THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC Servicing & Technology

T.M.

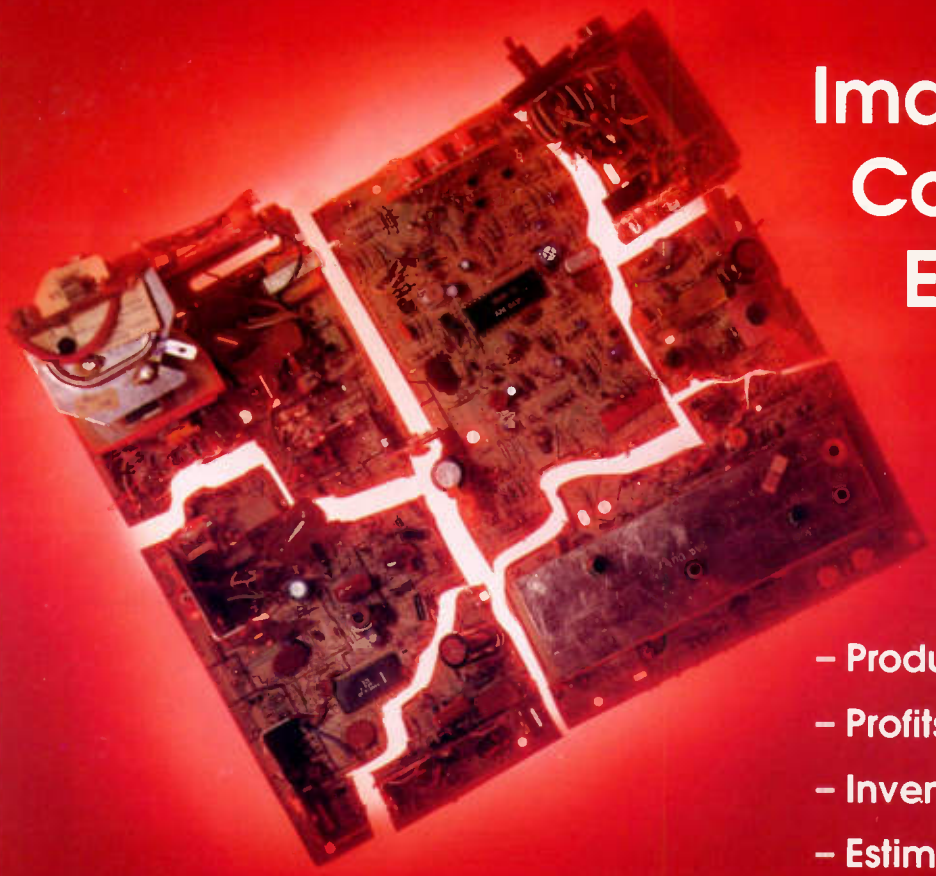
MARCH 1993/$3.00

Replacement parts/Components directory

Product directory • Services directory • Mailing addresses

1993

Electronic Servicer's Buyer's Guide



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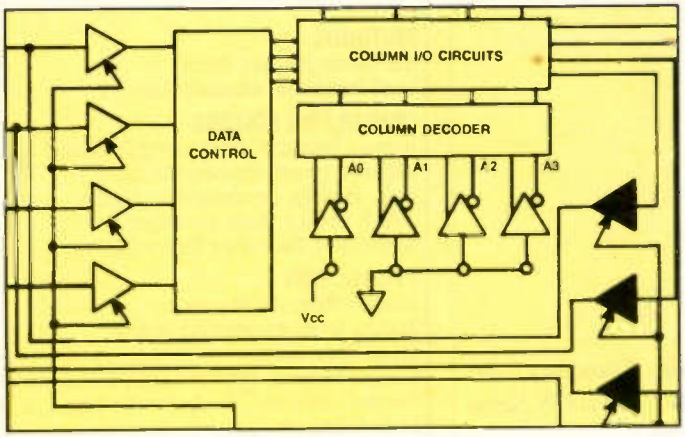
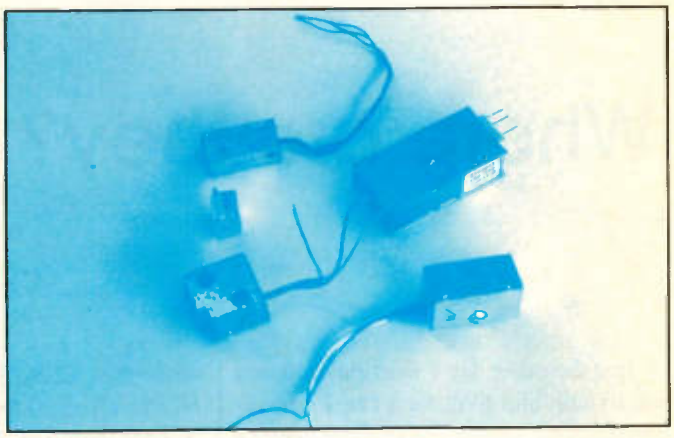
Contents

Volume 13, No. 3 March 1993



page 50



page 58

1993 BUYER'S GUIDE

Once you've diagnosed the cause of a fault in a product down to the component level, where do you go to find the replacement component? Where should you go to buy a new multimeter or oscilloscope? If you're servicing a computer and you find that the hard drive is faulty, but you think it might be able to be refurbished, where do you send it? This Seventh Annual Buyers' Guide will help you find the sources of supply for tools, test equipment, replacement components, services and associations to help you keep your service business operating smoothly.

DEPARTMENTS

ON THE COVER

The products shown here are but a small handful belonging to the rapidly growing family of consumer electronics products. As these products become more numerous and complex, the people who service them need more and better information to help them find the replacement parts, tools and test equipment, and education needed. This 1993 Buyers' Guide is designed to help service managers and technicians find everything they need to provide their customers with the best service possible.

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING
ELECTRONIC Servicing & Technology

Editorial

Where are they?

Just the other day I went out with my son to help him look for a car. I remembered having visited one specific dealer a few years back who I wanted to visit again this time. When we got there I found that the building was empty. I don't know where the company has gone, but I have to do some looking to find them. Companies seem to come and go, and it sometimes seems hard to keep track of them.

Here's another example, of more immediate interest to readers of **ES&T**. I received a call from a reader who has recently made a move into computer servicing. He had taken in a monitor for servicing but couldn't locate any information that would let him get started locating service literature or replacement components for this unit.

He had called the last listed number he could find for the company, but that didn't get him anywhere. In desperation he called me.

He gave me all the information he could find, including the three letter prefix of the FCC ID number. I told him I'd see what I could find out.

Armed with the FCC ID number I called up the FCC Public Access system, confident that I'd soon have the address and telephone number of the company. I did get the address and phone number; unfortunately it wasn't current.

Next, I called directory assistance in the city where the company's last known address was to see if I could get an up-to-date listing. They had no record of the company.

Next I decided to try my luck with the Electronics Industry Telephone Directory (EITD). That reference has helped me many times in the past when I was trying to locate an address and telephone number. This time I struck out. I drew a blank with the CES Show Directory, the NESDA Annual and the Howard W. Sams Annual Photofact Index.

I decided to play my ace in the hole and called the reference department of the Johnson County Kansas library system. They have always proved to be helpful to me. I gave the reference librarian all of the information that I had and she told me she'd look it up and call me back. A short while later the librarian called back and gave me an address in a different city, and a new telephone number. I have called the library many times when I couldn't find the information anywhere else, and usually they are able to find it.

I felt it would be a good idea if I confirmed the information, so I called the number. I got a message that the number had been changed, so I called the new number. I was gratified to find that the telephone receptionist answered with the name of the company I was looking for. When I asked her to confirm the address I had, she gave me a different address. During our subsequent conversation I found that the company had moved twice during the last two years. But at least I had tracked them down.

Companies move, merge, shut down at a rapid rate these days. It's really hard to keep up. That's why every year we publish this buyer's guide: so that the readers of **ES&T** can have available to them the most up to date information available on companies of interest.

Nils Conrad Persson

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING
ELECTRONIC
Servicing & Technology

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Circle 101 For Product Information & Demonstration

Product directory

Note: An entry followed by *D means that this company is a distributor, not a manufacturer.

A line listing that is in color indicates that the company listed has an ad in this issue. The number following the listing is the number of the page on which the ad is located.

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Schlumberger Technologies Instruments Div.
Sony Service Co. 21
3M Private Network Products
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MCM Electronics*D
Mouser Electronics*D 61
Omega Engineering Inc.
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See Adv. Page

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Datel, Inc.
East Coast Transistor*D
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Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Fox International*D 19
Global Specialties A Div. of Interplex
GoldStar Precision Co. Ltd.
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Heath Co.
Hitachi Denshi America, Ltd.
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Joseph Electronics*D
Keithley Instruments
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marconi Instruments
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Mercer Electronics
Mouser Electronics*D 61
Orion Instruments, Inc.
Print Products International *D
Racal-Dana Instruments Inc.
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See Adv. Page

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Sprague Magnetics, Inc.*D
Techni-Tool Inc.*D
Tentel Corp. 59
Wholesale Electronics Inc.*D

See Adv. Page

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See Adv. Page

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Leader Instruments Corp. 3
Marshall Industries*D
MCM Electronics*D
NCM Electronics
Network Technologies, Inc.
Orion Instruments, Inc.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Sirius Technologies
Techni-Tool Inc.*D
Tektronix TV Products Div.
Tri State Electronics*D
Tucker Electronics Co.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

HV PROBES

Accutest Instruments*D
Alfa Electronics
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
B-B&W Electronics*D
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Design Specialists
Electronics Warehouse Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
PanSon Electronics*D
Polaris Div. of UXL Corp.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Simpson Electric Co.

See Adv. Page

Specialized Products Co.*D
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix TV Products Div.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wavetek Corp. An Affiliate of Emerson Electric Co.
Wholesale Electronics Inc.*D

LOGIC ANALYZERS: SIGNATURE/STATE

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
BitWise Designs, Inc
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Electronics Warehouse Corp.*D
Electronix Express*D
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex
GMB/dba Fox International*D
Heath Co.
Hitachi Denshi America, Ltd.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Leader Instruments Corp. 3
Marshall Industries*D
MetraByte Corp.
Orion Instruments, Inc.
Pacific Electro Data, Inc.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Schlumberger Technologies Instruments Div.
Specialized Products Co.*D
Tektronix Test & Measurement Group
Total Power International
Vance Baldwin Inc.*D

LOGIC PROBES

Accutest Instruments*D
Alfa Electronics
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
American Reliance Inc.
Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
B-B&W Electronics*D
Bel Merit
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
Fieldpiece Instruments
Fordham Radio Supply Co.*D
Fox International*D 19
Global Specialties A Div. of Interplex
GMB/dba Fox International*D
GoldStar Precision Co. Ltd.
Heath Co.
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Kobetron Inc.
Lil' Bitty Tester, Inc.

See Adv. Page

MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mercer Electronics
Mouser Electronics*D 61
O.K. Industries Inc.
PanSon Electronics*D
Philips ECG
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Speco Div.
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Universal Enterprises
Vance Baldwin Inc.*D
Wavetek Corp. An Affiliate of Emerson Electric Co.
Wholesale Electronics Inc.*D

LOGIC PULSERS

Accutest Instruments*D
American Reliance Inc.
Brunelle Instruments Inc.
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
Fox International*D 19
GMB/dba Fox International*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kelvin Electronics*D
Kobetron Inc.
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mercer Electronics
Philips ECG
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Vance Baldwin Inc.*D
Wavetek Corp. An Affiliate of Emerson Electric Co.
Wholesale Electronics Inc.*D

MAGNETRON TESTERS

Computer Componet Source *D
Diversified Parts*D
Electronic Design Specialists
GMB/dba Fox International*D
W.S. Jenks & Son*D

METERS, CAPACITANCE/INDUCTANCE

Accutest Instruments*D
Alfa Electronics
All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
American Reliance Inc.
AT&T Capital Corporation Instrument Services Instrument Services Div.
AVO Biddle Instruments
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Creative Electronics
C&S Sales*D

See Adv. Page

Daetron
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electromatic Controls/ Soar Instruments
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
Extech Instruments Corp.
Fieldpiece Instruments
Fordham Radio Supply Co.*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
IET Labs, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Keithley Instruments
Kelvin Electronics*D
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Mercer Electronics
Omega Engineering Inc.
Philips ECG
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Specialized Products Co.*D
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
TIF Instruments, Inc.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Total Power International
Tri State Electronics*D
Universal Enterprises
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wavetek Corp. An Affiliate of Emerson Electric Co.
Wholesale Electronics Inc.*D

METERS, CLAMP ON

Accutest Instruments*D
AEMC Corp.
Alfa Electronics
American Reliance Inc.
Amprobe Instrument
AT&T Capital Corporation Instrument Services Instrument Services Div.
AVO Biddle Instruments
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Diversified Parts*D
Dranetz Technologies
East Coast Transistor*D
Electromatic Controls/ Soar Instruments
Electronics Warehouse Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
Extech Instruments Corp.
Fieldpiece Instruments
Fox International*D 19
Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
ITT Pomona Electronics
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mercer Electronics

See Adv. Page

Mouser Electronics*D 61
Omega Engineering Inc.
PanSon Electronics*D
Philips ECG
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Simpson Electric Co.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Start International*D
Techni-Tool Inc.*D
TIF Instruments, Inc.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Universal Enterprises
Vance Baldwin Inc.*D
Wavetek Corp. An Affiliate of Emerson Electric Co.
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

METERS, FIELD STRENGTH

Accutest Instruments*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Bird Electronic Corp.
BMI-Basic Measuring Instruments
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Computer Componet Source *D
Contact East, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Electro-Metrics, Inc. A Penril Corp.
Electron Processing
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Herman Electronics*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Leader Instruments Corp. 3
MCM Electronics*D
Plastic Systems, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Techni-Tool Inc.*D
Tri State Electronics*D
Tucker Electronics Co.*D
Vance Baldwin Inc.*D

METERS, SIGNAL LEVEL

Accutest Instruments*D
American Reliance Inc.
AT&T Capital Corporation Instrument Services Instrument Services Div.
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Computer Componet Source *D
Conway Engineering, Inc.
Diversified Parts*D
East Coast Transistor*D
Electronics Warehouse Corp.*D
Electronix Express*D
GMB/dba Fox International*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Leader Instruments Corp. 3
Marshall Industries*D
MCM Electronics*D
Omega Engineering Inc.
Print Products International *D
Racal-Dana Instruments Inc.
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Specialized Products Co.*D
Techni-Tool Inc.*D
Tri State Electronics*D
Triplett Corp.

METERS, SOUND LEVEL

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D

See Adv. Page

AT&T Capital Corporation Instrument Services Instrument Services Div.
Brunelle Instruments Inc.
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Diversified Parts*D
Electronics Warehouse Corp.*D
Extech Instruments Corp.
GMB/dba Fox International*D
HMC-Hub Material Co.*D
Hunter Products, Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Marshall Industries*D
MCM Electronics*D
Pacer Industries, Inc.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Simpson Electric Co.
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D
Time Motion Tools
Triplett Corp.
Universal Enterprises
Vance Baldwin Inc.*D
Yokogawa Corp. of America

METERS, VOLTMETERS, AC

Accutest Instruments*D
AEMC Corp.
Alfa Electronics
All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
American Reliance Inc.
Amprobe Instrument
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
AVO Biddle Instruments
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
BMI-Basic Measuring Instruments
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Cooper Associates*D
Datel, Inc.
Diversified Parts*D
East Coast Transistor*D
Electromatic Controls/ Soar Instruments
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Extech Instruments Corp.
Fieldpiece Instruments
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
Herman Electronics*D
HMC-Hub Material Co.*D
IET Labs, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Keithley Instruments
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marconi Instruments
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
MetraByte Corp.
Omega Engineering Inc.
PanSon Electronics*D

See Adv. Page

Philips ECG
Print Products International *D
Racal-Dana Instruments Inc.
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Schlumberger Technologies Instruments Div.
Sencore Electronics ..... IFC
Simpson Electric Co.
Snap-On Tools Corp.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Start International*D
Techni-Tool Inc.*D
Tegam, Inc.
TIF Instruments, Inc.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Total Power International
Triplett Corp.
Truminco*D
Tucker Electronics Co.*D
Universal Enterprises
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wavetek Corp. An Affiliate of Emerson Electric Co.
WestCon Div. of Sycon Corp.
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

METERS, WOW AND FLUTTER

Accutest Instruments*D
Arrow Electronics Inc. Catalog Sales Div.*D
Brunelle Instruments Inc.
Computer Componet Source *D
Contact East, Inc.*D
Cooper Associates*D
Electronics Warehouse Corp.*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Techni-Tool Inc.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

MICROWAVE LEAKAGE TESTERS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Diversified Parts*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Simpson Electric Co.
Specialized Products Co.*D
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
Universal Enterprises
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

MULTIMETERS: ANALOG/DIGITAL

Accutest Instruments*D
AEMC Corp.
Alfa Electronics

See Adv. Page

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc.
Amprobe Instrument
Analogic Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Avex Probes Inc.
AVO Biddle Instruments
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
Brunelle Instruments Inc.
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Daetron
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electromatic Controls/ Soar Instruments
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Extech Instruments Corp.
Fieldpiece Instruments
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex
GoldStar Precision Co. Ltd.
Hameg, Inc.
Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Keithley Instruments
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mercer Electronics
MetraByte Corp.
Mouser Electronics*D 61
Omega Engineering Inc.
PanSon Electronics*D
Philips ECG
Print Products International *D
Racal-Dana Instruments Inc.
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Schlumberger Technologies Instruments Div.
Simpson Electric Co.
Solder Absorbing Technology, Inc.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Start International*D
Techni-Tool Inc.*D
Tegam, Inc.
Tektronix Test & Measurement Group
3M Private Network Products
TIF Instruments, Inc.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Total Power International
Tri State Electronics*D
Triplett Corp.
Truminco*D
Tucker Electronics Co.*D
Universal Enterprises
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wavetek Corp. An Affillate of Emerson Electric Co.
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

OSCILLOSCOPES

Accutest Instruments*D
Alfa Electronics
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc.
Analogic Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electro-Metrics, Inc. A Penril Corp.
Electro Tool, Inc. *D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex
GoldStar Precision Co. Ltd.
Gould Inc. Test & Measurement Group
Hameg, Inc.
Heath Co.
Herman Electronics*D
Hitachi Denshi America, Ltd.
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Kikusui International Corp.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
MetraByte Corp.
Mouser Electronics*D 61
Nicolet Test Instruments
O.K. Industries Inc.
Omega Engineering Inc.
Orion Instruments, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Print Products International *D
RAG Electronics Inc.*D
Rapid Systems
Republic Packaging Corp.
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Snap-On Tools Corp.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix TV Products Div.
Time Motion Tools
Tri State Electronics*D
Tucker Electronics Co.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

PERSONAL COMPUTER REPAIR/TEST EQUIPMENT

American Design Components*D
American Reliance Inc.
Aristo Computers, Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.

See Adv. Page

B&B Electronics Mfg., Co.
B&K-Precision Maxtec International Corp.
Computer Componet Source *D
Computer Doctors
Contact East, Inc.*D
Datatran Corp.
Eagan Technical Services, Inc.
Electronics Warehouse Corp.*D
Hy-Tronix Instruments, Inc.
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Jonard Industries Corp.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MetraByte Corp.
Orion Instruments, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Time Motion Tools
Total Power International
Vu-Data Corp.
Warrantech Corp.

RECEPTACLE CIRCUIT TESTERS

Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Computer Componet Source *D
Contact East, Inc.*D
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
3M Private Network Products
Tool Kit Specialists, Inc.*D
Vance Baldwin Inc.*D

SEMICONDUCTOR TESTERS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
B-B&W Electronics*D
Bird Electronic Corp.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electronic Design Specialists
Electronics Warehouse Corp.*D
Electronix Express*D
Hy-Tronix Instruments, Inc.
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Keithley Instruments
KeyTek Instrument Corp.
Lil' Bitty Tester, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Omega Engineering Inc.
PanSon Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Techni-Tool Inc.*D
3M Electronic Products Div.
Tool Kit Specialists, Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SPECTRUM ANALYZERS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Analogic Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
B&K-Precision Maxtec International Corp.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Electro-Metrics, Inc. A Penril Corp.
Electronics Warehouse Corp.*D
Electronix Express*D
Hameg, Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Marconi Instruments
Marshall Industries*D
National Instruments
Print Products International *D
RAG Electronics Inc.*D
Ramsey Electronics Inc.
Rapid Systems
RNJ Electronics Inc.*D
Schlumberger Technologies Instruments Div.
Specialized Products Co.*D
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix TV Products Div.
Tri State Electronics*D
Triplett Corp.
Tucker Electronics Co.*D

TELEPHONE ANALYZERS/TESTERS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc.
AT&T Capital Corporation Instrument Services Instrument Services Div.
B&K-Precision Maxtec International Corp.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Conway Engineering, Inc.
C&S Sales*D
Digitech Industries Inc.
Electronic Design Specialists
Electronics Warehouse Corp.*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Simpson Electric Co.
Specialized Products Co.*D
Techni-Tool Inc.*D
3M Private Network Products
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Triplett Corp.
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

TEMPERATURE SENSORS

Acculex Corp. A MetraByte Co.
Accutest Instruments*D
Alfa Electronics
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Anritsu Meter Co. of America
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Bel Merit
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Dranetz Technologies
Electromatic Controls/ Soar Instruments
Electronics Warehouse Corp.*D
Electronix Express*D
Fieldpiece Instruments
John Fluke Mfg. Co. Inc. ..... BC
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
MetraByte Corp.
Multicore Solder
Omega Engineering Inc.
Pacer Industries, Inc.
Philips ECG
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Solder Absorbing Technology, Inc.
Solomat Neotronics
Start International*D
Tektronix Test & Measurement Group
TIF Instruments, Inc.
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Universal Enterprises
Wholesale Electronics Inc.*D

TRANSISTOR TESTERS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bel Merit
B&K-Precision Maxtec International Corp.
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Electronic Design Specialists
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
HMC-Hub Material Co.*D
Hosfelt Electronics*D
Hy-Tronix Instruments, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kelvin Electronics*D
Lil' Bitty Tester, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Omega Engineering Inc.
PanSon Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Specialized Products Co.*D
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wavetek Corp. An Affillate of Emerson Electric Co.
Wholesale Electronics Inc.*D

VECTORSCOPES

Accutest Instruments*D
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Contact East, Inc.*D
C&S Sales*D
Electronics Warehouse Corp.*D
Hitachi Denshi America, Ltd.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix TV Products Div.
Tucker Electronics Co.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

WAVEFORM MONITORS

Accutest Instruments*D
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
Contact East, Inc.*D
C&S Sales*D
Dranetz Technologies
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
Hitachi Denshi America, Ltd.
Hi-Techniques Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
Rapid Systems
RNJ Electronics Inc.*D
Snap-On Tools Corp.
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix TV Products Div.
Tucker Electronics Co.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

OTHER TEST EQUIPMENT

Accutest Instruments*D
ACL
AEMC Corp.
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Amprobe Instrument
Analogic Corp.
Anritsu Meter Co. of America
AT&T Capital Corporation Instrument Services Instrument Services Div.
AVO Biddle Instruments
B&B Electronics Mfg., Co.
Behlman Electronics
Bird Electronic Corp.
B&K-Precision Maxtec International Corp.
Bursma Electronic Distributing*D
Computer Doctors
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
CSTS Inc.
Daetron
Datacom Technologies, Inc.
Digitech Industries Inc.
Dranetz Technologies
Electron Processing
Electronic Design Specialists
Electronics Warehouse Corp.*D
Electronix Corp.*D
Elenco Electronics, Inc.
Extech Instruments Corp.
John Fluke Mfg. Co. Inc. ..... BC
Hameg, Inc.
HMC-Hub Material Co.*D
Hy-Tronix Instruments, Inc.
IET Labs, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D

See Adv. Page

W.S. Jenks & Son*D
Jensen Tools Inc.*D
Jit Resources
Jonard Industries Corp.
Joseph Electronics*D
Kenwood U.S.A. Corp.
Kestor Solder
KeyTek Instrument Corp.
Kikusui International Corp.
Klein Tools, Inc.
Kobetron Inc.
L-Com Inc.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marconi Instruments
Marshall Industries*D
MCM Electronics*D
Mouser Electronics*D 61
M-Test Equipment
Multicore Solder
Nutronix Inc.
Omega Engineering Inc.
ORA Electronics
Orion Instruments, Inc.
Pacer Industries, Inc.
Pacific Electro Data, Inc.
Pacific Power Source
Panasonic Industrial Co.
Print Products International *D
Prorachl Electronics Corp.
Racal-Dana Instruments Inc.
RAG Electronics Inc.*D
Ramsey Electronics Inc.
Republic Packaging Corp.
RNJ Electronics Inc.*D
Schurter, Inc.
Sencore Electronics ..... IFC
Sirius Technologies
Snap-On Tools Corp.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Start International*D
Static Control Services, Inc.
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Tektronix Redmond Div.
Tektronix TV Products Div.
Temptronic Corp.
Tentel Corp. 59
3M Private Network Products
Time Motion Tools
Total Power International
Wavetek Corp. An Affiliate of Emerson Electric Co.
Yokogawa Corp. of America

Test equipment accessories

AUDIO DUMMY LOADS

Accutest Instruments*D
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
The Instrument Mart, Inc.*D
Joseph Electronics*D
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RNJ Electronics Inc.*D
Sencore Electronics ..... IFC
Vance Baldwin Inc.*D

DECADE BOXES: CAPACITANCE/INDUCTANCE/ RESISTANCE

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
Daetron

See Adv. Page

Electromatic Controls/ Soar Instruments
Electronix Express*D
Elenco Electronics, Inc.
Fordham Radio Supply Co.*D
GMB/dba Fox International*D
HMC-Hub Material Co.*D
IET Labs, Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kenwood U.S.A. Corp.
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Speco Div.
Techni-Tool Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Yokogawa Corp. of America

IC TEST CLIPS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electronics Warehouse Corp.*D
Electronix Express*D
Emulation Technology Inc.
E-Z Hook
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
Global Specialties A Div. of Interplex
GMB/dba Fox International*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
Hy-Tronix Instruments, Inc.
The Instrument Mart, Inc.*D
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mouser Electronics*D 61
O.K. Industries Inc.
PanSon Electronics*D
Print Products International *D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Tektronix Test & Measurement Group
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

POWER SUPPLIES, BENCH

Accutest Instruments*D
Alfa Electronics
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
B-B&W Electronics*D
Behlman Electronics
Bel Merit
Brunelle Instruments Inc.
Bursma Electronic Distributing*D

See Adv. Page

Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
East Coast Transistor*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Elenco Electronics, Inc.
Elgar Corp.
John Fluke Mfg. Co. Inc. ..... BC
Fordham Radio Supply Co.*D
Hameg, Inc.
Heath Co.
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Kikusui International Corp.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
O.K. Industries Inc.
Omega Engineering Inc.
PanSon Electronics*D
Plastic Capacitors Inc.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Salen Enterprises*D
Sola
Specialized Products Co.*D
Speco Div.
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wholesale Electronics Inc.*D

TEST JIGS AND FIXTURES

American Reliance Inc.
B-B&W Electronics*D
Brian Instruments, Inc.
Bursma Electronic Distributing*D
Diversified Parts*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Emulation Technology Inc.
E-Z Hook
Fordham Radio Supply Co.*D
GMB/dba Fox International*D
Hy-Tronix Instruments, Inc.
W.S. Jenks & Son*D
Philips CEC Technical Training Service Co.*D ..... IBC
Polaris Div. of UXL Corp.
RNJ Electronics Inc.*D
Sony Service Co. 21
Tentel Corp. 59

TEST LEADS AND PROBES

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
American Reliance Inc.
Amprobe Instrument
Anritsu Meter Co. of America
Atrix, Inc.*D
Avex Probes Inc.
B-B&W Electronics*D
Bel Merit
Brian Instruments, Inc.
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
C&S Sales*D
CUI Stack, Inc.
Diversified Parts*D
East Coast Transistor*D
Electro Standards Lab, Inc. Data Communications Products Div.
Electromatic Controls/ Soar Instruments
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.

See Adv. Page

Emulation Technology Inc.
Extech Instruments Corp.
E-Z Hook
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
Hameg, Inc.
Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
Interconnect Devices, Inc.
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Keystone Electronics Corp.
Kikusui International Corp.
Klein Tools, Inc.
Leader Instruments Corp. 3
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mercer Electronics
MetraByte Corp.
Oldaker Corp.
Omega Engineering Inc.
PanSon Electronics*D
Philips ECG
Print Products International *D
Probe Master
RAG Electronics Inc.*D
Ramsey Electronics Inc.
RNJ Electronics Inc.*D
Schurter, Inc.
Sencore Electronics ..... IFC
Simpson Electric Co.
Specialized Products Co.*D
Speco Div.
Techni-Tool Inc.*D
Tegam, Inc.
Tektronix TV Products Div.
Test Probes, Inc.
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Universal Enterprises
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wholesale Electronics Inc.*D
Yokogawa Corp. of America

TRANSFORMERS: ISOLATION/VARIABLE

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
Contact East, Inc.*D
C&S Sales*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mouser Electronics*D 61
PanSon Electronics*D
Plastic Capacitors Inc.
Print Products International *D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
SHOGYO International Corp.
Specialized Products Co.*D
Tri State Electronics*D

See Adv. Page

Universal Enterprises
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wholesale Electronics Inc.*D

VCR TEST JIG KITS

B-B&W Electronics*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Joseph Electronics*D
Marshall Industries*D
MCM Electronics*D
Nippon Shokuhin Sangyo USA Ltd.
Philips CEC Technical Training Service Co.*D ..... IBC
Phillips ECG
Premium Parts + Electronics Co.*D 14
RNJ Electronics Inc.*D
Sony Service Co. 21
Tentel Corp. 59
Truminco*D

OTHER TEST EQUIPMENT ACCESSORIES

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Amprobe Instrument
Brian Instruments, Inc.
Bursma Electronic Distributing*D
Computer Componet Source *D
Contact East, Inc.*D
C&S Sales*D
Dandy Mfg. Co.
Diversified Parts*D
East Coast Transistor*D
Electro Standards Lab, Inc. Data Communications Products Div.
Electron Processing
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
C.H. Ellis Co., Inc.
Emulation Technology Inc.
E-Z Hook
John Fluke Mfg. Co. Inc. ..... BC
Fox International*D 19
Gemini Inc.
GlobeTech International, Inc.
GMB/dba Fox International*D
Hameg, Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
Hy-Tronix Instruments, Inc.
The Instrument Mart, Inc.*D
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Johnson Electronic Technologies
Joseph Electronics*D
Kenwood U.S.A. Corp.
Kestor Solder
Kikusui International Corp.
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mouser Electronics*D 61
National Instruments
Oldaker Corp.
Pacific Electro Data, Inc.
Philips CEC Technical Training Service Co.*D ..... IBC
Print Products International *D
Probe Master
Prorachi Electronics Corp.
RAG Electronics Inc.*D
Ramsey Electronics Inc.
Republic Packaging Corp.
RNJ Electronics Inc.*D
Schurter, Inc.
Simpson Electric Co.
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
Tektronix TV Products Div.

See Adv. Page

Tentel Corp. 59
Truminco*D
Vance Baldwin Inc.*D

Circuit damage protective equipment/supplies

POWER CONDITIONING EQUIPMENT

GROUNDING SYSTEMS

Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
AVO Biddle Instruments
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
MAI/Prime Parts*D
Plastic Systems, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Static Prevention Inc.
Verite
Wescorp

POWER LINE MONITORS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
AT&T Capital Corporation Instrument Services Instrument Services Div.
BMI-Basic Measuring Instruments
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Contact East, Inc.*D
Dranetz Technologies
Eastern Time Designs, Inc.
Electronics Warehouse Corp.*D
Elgar Corp.
Extech Instruments Corp.
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
MAI/Prime Parts*D
Mendon Electronics Corp.
Perma Power Electronics, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Safe Power Systems Div. of Acme Electric Corp.
SL Waber, Inc.
Sola
Specialized Products Co.*D
The Superior Electric Co.
Techni-Tool Inc.*D
Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Wholesale Electronics Inc.*D

STANDBY POWER SYSTEMS

AESI/Stedi Watt
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
Best Power Technology
Bursma Electronic Distributing*D
Computer Power, Inc.
Contact East, Inc.*D
Controlled Power Co.
Electronic Specialists, Inc.
Electronics Warehouse Corp.*D
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D

See Adv. Page

JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kalglo Electronics Co. Inc.
MAI/Prime Parts*D
Meirick, Inc.
Minuteman
Perma Power Electronics, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Safe Power Systems Div. of Acme Electric Corp.
SL Waber, Inc.
Sola
Specialized Products Co.*D
Sutton Designs, Inc. Computer Power Div.
Tri State Electronics*D
Tripp Lite
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SURGE/SPIKE PROTECTORS

AESI/Stedi Watt
All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Best Power Technology
Bursma Electronic Distributing*D
Computer Componet Source *D
Computer Power, Inc.
Contact East, Inc.*D
Datatran Corp.
East Coast Transistor*D
Elger Electronics*D
Electro Standards Lab, Inc. Data Communications Products Div.
Electron Processing
Electronic Parts Supply*D
Electronic Specialists, Inc.
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
Geist Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Joseph Electronics*D
Kalglo Electronics Co. Inc.
L-Com Inc.
MAI/Prime Parts*D
Marshall Industries*D
MCG Electronics, Inc.
MCM Electronics*D
Minuteman
Mouser Electronics*D 61
Omega Engineering Inc.
ORA Electronics
Panamax
Perma Power Electronics, Inc.
Philips ECG
Plastic Systems, Inc.
Premium Parts + Electronics Co.*D 14
Print Products International *D
RNJ Electronics Inc.*D
Safe Power Systems Div. of Acme Electric Corp.
Schurter, Inc.
Shape Electronics
SL Waber, Inc.
Sola
Specialized Products Co.*D
The Superior Electric Co.
Sutton Designs, Inc. Computer Power Div.
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Tripp Lite
Vance Baldwin Inc.*D
Verite

See Adv. Page

Wholesale Electronics Inc.*D

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
AVO Biddle Instruments
B-B&W Electronics*D
Behlman Electronics
Best Power Technology
Bursma Electronic Distributing*D
Clary Corp.
Computer Power, Inc.
Contact East, Inc.*D
Controlled Power Co.
Deltron, Inc.
Electronics Warehouse Corp.*D
Electronix Express*D
Elgar Corp.
General Power Corp.
Herman Electronics*D
HMC-Hub Material Co.*D
Horizon Technology, Inc.*D
Hosfelt Electronics*D
ICS, Inc. Electro-Pac Div.
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kalglo Electronics Co. Inc.
MAI/Prime Parts*D
Melrick, Inc.
Minuteman
Pacific Power Source
Panamax
Perma Power Electronics, Inc.
Philtek Power Corp.
Print Products International *D
RNJ Electronics Inc.*D
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
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Tripp Lite
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

VOLTAGE REGULATORS

Accutest Instruments*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Power Conversion Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
AVO Biddle Instruments
Bursma Electronic Distributing*D
Computer Power, Inc.
Contact East, Inc.*D
Controlled Power Co.
Datel, Inc.
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronic Specialists, Inc.
Electronics Warehouse Corp.*D
Electronix Express*D
Elgar Corp.
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kalglo Electronics Co. Inc.
Kelvin Electronics*D
MAI/Prime Parts*D
Minuteman
Mouser Electronics*D 61
Perma Power Electronics, Inc.
Print Products International *D
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
Tripp Lite
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

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. 65
Chapman Corp.
Charleswater, Div. of Desco Industries Inc.
Chemtronics Inc.
Com-Kyl Inc.*D
Computer Componet Source *D
Diversified Parts*D
Dow U.S.A.
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Four Star Chemical
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
HMC-Hub Material Co.*D
Hosfelt Electronics*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jit Resources
Joseph Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
Master Bond
Micro Care Corp.
Miller-Stephenson Chemical Co.
PanSon Electronics*D
Philips ECG
Plastic Systems, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Rogers Anti-Static Chemicals
Specialized Products Co.*D
Start International*D
Static Prevention Inc.
Tech Spray, Inc.
Techni-Tool Inc.*D
Gregory Thomas, Inc.
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wescorp
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

ANTISTATIC IONIZATION DEVICES

Atrix, Inc.*D
Chapman Corp.
Charleswater, Div. of Desco Industries Inc.
Com-Kyl Inc.*D
Desco Industries
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Marshall Industries*D
Plastic Systems, Inc.
Print Products International *D
RNJ Electronics Inc.*D
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.
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*D
Vortec Corp.
Wescorp

ANTISTATIC MATS/BENCHTOPS/WRIST STRAPS/OTHERS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Charleswater, Div. of Desco Industries Inc.
Clauss Cutlery Co.
Com-Kyl Inc.*D
Computer Componet Source *D
Contact East, Inc.*D
Cooper Associates*D
Desco Industries
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
C.H. Ellis Co., Inc.
GC Electronics Div. of GC Thorsen Co.
Geist Inc.
Global Kitting
The Granite Corp.
Hexacon Electric Co.
HMC-Hub Material Co.*D
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Jit Resources
Joseph Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Melmat Inc.
Mouser Electronics*D 61
Nu-Concept Systems, Inc.
Oak Technical Inc.
O.K. Industries Inc.
Parts Express International Inc.*D 57
Philips ECG
Plastic Systems, Inc.
Print Products International *D
The Rex Co.
RNJ Electronics Inc.*D
Seco Industries
Semtronics Corp.
Sentinel Products Corp. Subsidiary of PI, Inc.
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
Teclab/Kalamazoo Technical Furniture, Inc.
Gregory Thomas, Inc.
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*D
Tool Tron Industries
Trace Racks
Tri State Electronics*D
Vance Baldwin Inc.*D
Wescorp
Wholesale Electronics Inc.*D

ESD FLEXIBLE PACKAGING

Armand Mfg. Inc.
Atrix, Inc.*D
Charleswater, Div. of Desco Industries Inc.
Com-Kyl Inc.*D
Desco Industries
Electronics Warehouse Corp.*D
Global Kitting
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Jit Resources
Joseph Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Plastic Systems, Inc.
Print Products International *D
Republic Packaging Corp.
Seco Industries
Semtronics Corp.
Sentinel Products Corp. Subsidiary of PI, Inc.
The Simco Co., Inc.
Specialized Products Co.*D
Tech Spray, Inc.
Techni-Tool Inc.*D
Gregory Thomas, Inc.
Wescorp

STATIC DETECTION METERS

ACL
AEMC Corp.
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Atrix, Inc.*D
Chapman Corp.
Charleswater, Div. of Desco Industries 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
Jit Resources
Joseph Electronics*D
Marshall Industries*D
Monroe Electronics, Inc.
Plastic Systems, Inc.
Print Products International *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
Gregory Thomas, Inc.
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*D
Vortec Corp.
Wescorp

Supplies/accessories equipment

BATTERIES

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Ambico
American Design Components*D
American Power Conversion Corp.
Amprobe Instrument
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*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
Contact East, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
Omega Engineering Inc.
ORA Electronics
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Philips ECG
Rayovac Corp.
RNJ Electronics Inc.*D
Russell Industries
Sanyo Energy Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Universal Enterprises
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

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
East Coast Transistor*D
GMB/dba Fox International*D
HMC-Hub Material Co.*D
Hosfelt Electronics*D
W.S. Jenks & Son*D
Joseph Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Parts Express International Inc.*D 57
Print Products International *D
The Rex Co.
RNJ Electronics Inc.*D
Specialized Products Co.*D
Start International*D
Teclab/Kalamazoo Technical Furniture, Inc.
Tri State Electronics*D
Workplace Systems
Zero Corp., East Div.

CARTS/CASES, EQUIPMENT

Clipper Products
Melmat Inc.

CHEMICALS

ACL
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Caig Labs, Inc. 65
Chemtronics Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
CRC Industries, Inc.
Diversified Parts*D
Dow U.S.A.
East Coast Transistor*D
Echelon Industries*D
Eiger Electronics*D

See Adv. Page

Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Four Star Chemical
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Micro Care Corp.
Mouser Electronics*D 61
Multicore Solder
P.K. Neuses Inc.*D
Omega Engineering Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Print Products International *D
Prorachi Electronics Corp.
Rawn Co. Inc., (Subsidiary of the Triangle Corp.)
RNJ Electronics Inc.*D
Rogers Anti-Static Chemicals
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Tech Spray, Inc.
Techni-Tool Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

CLEANING SUPPLIES

ACL
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Atrix, Inc.*D
Bursma Electronic Distributing*D
Caig Labs, Inc. 65
Chemtronics Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
CRC Industries, Inc.
Diversified Parts*D
East Coast Transistor*D
Echelon Industries*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Falcon Safety Products, Inc.
Fordham Radio Supply Co.*D
Four Star Chemical
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Metro Data Vac
Micro Care Corp.
Multicore Solder
P.K. Neuses Inc.*D
ORA Electronics
Parts Express International Inc.*D 57
Philips ECG
Print Products International *D
RNJ Electronics Inc.*D
Rogers Anti-Static Chemicals
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Tech Spray, Inc.
Techni-Tool Inc.*D
The Texwipe Co.

See Adv. Page

Thomson Consumer Electronics, Inc. Distributor & Special Products*D
3M Consumer & Pro Video & Audio Markets Div.
Time Motion Tools
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

LAMPS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Moody Tools, Inc.
Mouser Electronics*D 61
PanSon Electronics*D
Parts Express International Inc.*D 57
Premium Parts + Electronics Co.*D 15
Print Products International *D
RNJ Electronics Inc.*D
SHOGYO International Corp.
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D
Teclab/Kalamazoo Technical Furniture, Inc.
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

MAGNIFIERS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Dazor Mfg. Corp.
Edroy Products
Electro Tool, Inc. *D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Luxo Corp.
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Print Products International *D
RNJ Electronics Inc.*D
Solder Absorbing Technology, Inc.
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D
Teclab/Kalamazoo Technical Furniture, Inc.
Tool Kit Specialists, Inc.*D
Tri State Electronics*D

See Adv. Page

Vance Baldwin Inc.*D
Vector-Viz Instrument Div. a Vector Group Co.
Brian R. White Co., Inc.*D

SHELVES/RACKS/BINS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
Com-Kyl Inc.*D
Contact East, Inc.*D
East Coast Transistor*D
Fordham Radio Supply Co.*D
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Joseph Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Melmat Inc.
Print Products International *D
The Rex Co.
Techni-Tool Inc.*D
Teclab/Kalamazoo Technical Furniture, Inc.
Time Motion Tools
Trace Racks

SOLDER/DESOLDERING BRAID/FLUX

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Chemtronics Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
ESP, Inc.
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
Hexacon Electric Co.
HMC-Hub Material Co.*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Kestor Solder
MAI/Prime Parts*D
Marshall Industries*D
MCM Electronics*D
Mouser Electronics*D 61
Multicore Solder
Nu-Concept Systems, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Print Products International *D
RNJ Electronics Inc.*D
Solder Absorbing Technology, Inc.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Tech Spray, Inc.
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Brian R. White Co., Inc.*D
Wholesale Electronics Inc.*D

TUBING

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D

See Adv. Page

Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
W.S. Jenks & Son*D
Joseph Electronics*D
MAI/Prime Parts*D
MCM Electronics*D
M.M. Newman Corp.
Omega Engineering Inc.
Russell Industries
Techni-Tool Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

WIRE, CABLE AND ACCESSORIES

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Cooper Associates*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
ITT Pomona Electronics
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
MCM Electronics*D
Mouser Electronics*D 61
Oldaker Corp.
Omega Engineering Inc.
ORA Electronics
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
RNJ Electronics Inc.*D
SHOGYO International Corp.
Support Systems International Cables & Accessories Div.
3M Electronic Products Div.
Time Motion Tools
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

Audio/video accessories

A/B SWITCHES

All Electronics Corp.*D
Ambico
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Computer Componet Source *D
Consolidated Electronics, Inc.*D
East Coast Transistor*D
Eiger Electronics*D

See Adv. Page

Electro Standards Lab, Inc. Data Communications Products Div.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
International Components Corp.*D 68
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
L-Com Inc.
MAI/Prime Parts*D
M.A.T. Electronics*D
MCM Electronics*D
ORA Electronics
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Philips ECG
RNJ Electronics Inc.*D
SHOGYO International Corp.
Sony Service Co. National Parts Div.*D
Support Systems International Cables & Accessories Div.
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

COUPLERS/SPLITTERS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Computer Componet Source *D
Consolidated Electronics, Inc.*D
East Coast Transistor*D
Elger Electronics*D
Electro Standards Lab, Inc. Data Communications Products Div.
Electron Processing
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
International Components Corp.*D 68
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
MCM Electronics*D
Microwave Filter Co., Inc.
Multiplex Technology, Inc.
ORA Electronics
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Philips ECG
RNJ Electronics Inc.*D
SHOGYO International Corp.
Sony Service Co. National Parts Div.*D
Support Systems International Cables & Accessories Div.
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

FILTERS

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
Channel Master Div. of Avnet, Inc.
East Coast Transistor*D
Eiger Electronics*D
Electron Processing
Electronic Specialists, Inc.
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Joseph Electronics*D
MAI/Prime Parts*D
MCM Electronics*D
Microwave Filter Co., Inc.
Mouser Electronics*D 61
Multiplex Technology, Inc.
Pfanstiehl Corp.
RNJ Electronics Inc.*D
Schurter, Inc.
Sony Service Co. National Parts Div.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

RF SWITCHERS

Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
East Coast Transistor*D
Elger Electronics*D
Electro Standards Lab, Inc. Data Communications Products Div.
Electron Processing
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Kelvin Electronics*D
MAI/Prime Parts*D
MCM Electronics*D
Multiplex Technology, Inc.
Pfanstiehl Corp.
Philips ECG
RNJ Electronics Inc.*D
Schurter, Inc.
Sony Service Co. National Parts Div.*D
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SIGNAL MIXERS

Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Joseph Electronics*D
MCM Electronics*D
Multiplex Technology, Inc.
Pfanstiehl Corp.
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Tri State Electronics*D
Wholesale Electronics Inc.*D

Tools

HEAT GUNS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Contact East, Inc.*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Mouser Electronics*D 61
Parts Express International Inc.*D 57
Philips ECG
Portasol, Inc.
Print Products International *D
Russell Industries
Snap-On Tools Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Ungar, A Rubbermaid Co.
Vance Baldwin Inc.*D
Brian R. White Co., Inc.*D
Wholesale Electronics Inc.*D

JIGS/FIXTURES/VISES

Andrews Electronics *D
B-B&W Electronics*D
Consolidated Electronics, Inc.*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Eraser Co., Inc. Wybar Div.
Fox International*D 19
GMB/dba Fox International*D
HMC-Hub Material Co.*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
MCM Electronics*D
Mouser Electronics*D 61
PanaVise Products, Inc.
Parts Express International Inc.*D 57
Print Products International *D
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Tri State Electronics*D

SOLDERING/DESOLDERING EQUIPMENT

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
A.P.E. Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Calg Labs, Inc. 65
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
CooperTools
C&S Sales*D
Den-On Instruments, Inc. 20
Digi-Key Corp.*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Elvo Div. of Zumbach Electronics Corp.
Eraser Co., Inc. Wybar Div.
ESP, Inc.
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Heath Co.
Herman Electronics*D
Hexacon Electric Co.
HMC-Hub Material Co.*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Leads Metal Products, Inc. (ENDECO)
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Mouser Electronics*D 61
Multicore Solder
P.K. Neuses Inc.*D
M.M. Newman Corp.
Nu-Concept Systems, Inc.
O.K. Industries Inc.
Omega Engineering Inc.
ORA Electronics
PACE, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Portasol, Inc.
Print Products International *D
RNJ Electronics Inc.*D
Royel Soldering Systems, Inc.
Snap-On Tools Corp.
Solder Absorbing Technology, Inc.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Tech Spray, Inc.
Techni-Tool Inc.*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Ungar, A Rubbermaid Co.
Vance Baldwin Inc.*D
Virtual Industries
Weidmuller, Paladin Tools
Brian R. White Co., Inc.*D
Wholesale Electronics Inc.*D

TOOL CASES

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Amprobe Instrument
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Chicago Case Co.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
CooperTools
Diversified Case Co. Inc.
East Coast Transistor*D
Eiger Electronics*D
Electro Tool, Inc. *D
Electronics Warehouse Corp.*D
Electronix Express*D
C.H. Ellis Co., Inc.
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
Highland Products, Inc.
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D

See Adv. Page

M.A.T. Electronics*D
MCM Electronics*D
P.K. Neuses Inc.*D
Omega Engineering Inc.
PanSon Electronics*D
Platt Luggage
Print Products International *D
R & K Supply Co.
RNJ Electronics Inc.*D
Snap-On Tools Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Spencer Industries
Techni-Tool Inc.*D
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Zero Corp., East Div.

TOOL KITS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
Bursma Electronic Distributing*D
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
CooperTools
CUI Stack, Inc.
Dremel
East Coast Transistor*D
Elger Electronics*D
Electro Tool, Inc. *D

See Adv. Page

Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Eraser Co., Inc. Wybar Div.
ESP, Inc.
Fieldpiece Instruments
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Moody Tools, Inc.
P.K. Neuses Inc.*D
O.K. Industries Inc.
Omega Engineering Inc.
PACE, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Print Products International *D
The Rex Co.
R & K Supply Co.
RNJ Electronics Inc.*D
Snap-On Tools Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Spencer Industries
Techni-Tool Inc.*D
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tool Tron Industries
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Weidmuller, Paladin Tools
Brian R. White Co., Inc.*D
Wholesale Electronics Inc.*D

TOOLS, MISCELLANEOUS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
AMP Inc.
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
B-B&W Electronics*D
Bondhus Corp.
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Clauss Cutlery Co.
Com-Kyl Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
Cooper Associates*D
CooperTools
CUI Stack, Inc.
Dremel
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Eraser Co., Inc. Wybar Div.
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
The Granite Corp.
Herman Electronics*D
HMC-Hub Material Co.*D
JDR Micro*D
W.S. Jenks & Son*D
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Moody Tools, Inc.
Mouser Electronics*D 61
P.K. Neuses Inc.*D
O.K. Industries Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Planned Products
Portasol, Inc.
Premium Parts + Electronics Co.*D 14
Print Products International *D
Prorachi Electronics Corp.
The Rex Co.
R & K Supply Co.
RNJ Electronics Inc.*D
Snap-On Tools Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D
Tentel Corp. 59
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Time Motion Tools
Tool Kit Specialists, Inc.*D
Tool Tron Industries
Tri State Electronics*D
Ungar, A Rubbermaid Co.
Vance Baldwin Inc.*D
Virtual Industries
Weidmuller, Paladin Tools

Replacement parts/ components directory

Note: An entry followed by *D means that this company is a distributor, not a manufacturer.

A line listing that is in color indicates that the company listed has an ad in this issue. The number following the listing is the number of the page on which the ad is located.

See Adv. Page

ANTENNAS/ROTORS/SATELLITE SYSTEMS

Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Cooper Associates*D
Diversified Parts*D
Elger Electronics*D
Electro-Metrics, Inc. A Penril Corp.
Electron Processing
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
Joseph Electronics*D
M.A.T. Electronics*D
MCM Electronics*D
Parts Express International Inc.*D 57
Philips ECG
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Winegard Co.
Zenith Sales Co. A Div. of Zenith Electronics Corp.

AUDIO HEADS

Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Joseph Electronics*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Premium Parts + Electronics Co.*D 14
Quasar
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Sprague Magnetics, Inc.*D
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D

BELTS/DRIVE WHEELS

Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
E.M.T. Parts Inc.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Joseph Electronics*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Philips ECG
Premium Parts + Electronics Co.*D 14
Quasar
RNJ Electronics Inc.*D
Russell Industries
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Warrantech Corp.
Wholesale Electronics Inc.*D

CAPACITORS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
International Components Corp.*D 68
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NTE Electronics, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Plastic Capacitors Inc.
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Russell Industries
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Universal Enterprises
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

CIRCUIT BREAKERS

All Electronics Corp.*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
Classic Components Supply Inc.*D
Cooper Associates*D
Digi-Key Corp.*D
East Coast Transistor*D
Elger Electronics*D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
Hurley Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Quasar
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

CONNECTORS/TERMINALS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
AMP Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
CUI Stack, Inc.
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
International Components Corp.*D 68
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
MCM Electronics*D
Mouser Electronics*D 61
ORA Electronics
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Quasar
RNJ Electronics Inc.*D
Schurter, Inc.
SHOGYO International Corp.
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
3M Electronic Products Div.
Time Motion Tools
Tri State Electronics*D
Vance Baldwin Inc.*D
Weidmuller, Paladin Tools
Wholesale Electronics Inc.*D

FLYBACKS

American Design Components*D
Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
E.M.T. Parts Inc.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Joseph Electronics*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Premium Parts + Electronics Co.*D 14

See Adv. Page

Quasar
RNJ Electronics Inc.*D
Russell Industries
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Technics
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

FUSES

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
International Components Corp.*D 68
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
ORA Electronics
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Premium Parts + Electronics Co.*D 14
Quasar
RNJ Electronics Inc.*D
Russell Industries
Schurter, Inc.
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

HARDWARE

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Cooper Associates*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GlobeTech International, Inc.
GMB/dba Fox International*D
Hitachi Home Electronics
Horizon Technology, Inc.*D
Hosfelt Electronics*D
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
Keystone Electronics Corp.
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
PanSon Electronics*D
Parts Express International Inc.*D 57
Quasar
Russell Industries
Schurter, Inc.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
Technics
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

HOLDERS/CLIPS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Consolidated Electronics, Inc.*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
E-Z Hook
GMB/dba Fox International*D
Hitachi Home Electronics
Hosfelt Electronics*D
Hurley Electronics*D
Joseph Electronics*D
Kelvin Electronics*D
Keystone Electronics Corp.
Klein Tools, Inc.
MAI/Prime Parts*D
M.A.T. Electronics*D
MCM Electronics*D
Mouser Electronics*D 61
PanSon Electronics*D
Parts Express International Inc.*D 57
Quasar
Schurter, Inc.
SHOGYO International Corp.
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
Technics
Tri State Electronics*D
Wholesale Electronics Inc.*D

INDUCTORS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Digi-Key Corp.*D
Elger Electronics*D
Electronix Express*D
GMB/dba Fox International*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
IET Labs, Inc.
JDR Micro*D
MAI/Prime Parts*D
MCM Electronics*D
Mouser Electronics*D 61
Panasonic Industrial Co.
Quasar
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
Technics
Wholesale Electronics Inc.*D

LAMPS/LEDs/INDICATORS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Datel, Inc.
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Industrial Devices, Inc.
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NTE Electronics, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Quasar
Schurter, Inc.
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Time Motion Tools
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

MAGNETRONS

Andrews Electronics *D
ARS Electronics*D
B-B&W Electronics*D
Consolidated Electronics, Inc.*D
Delta Warranty
Diversified Parts*D
Eiger Electronics*D
Electronix Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
PanSon Electronics*D
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
Sony Service Co. National Parts Div.*D
Truminco*D

MODULES

Andrews Electronics *D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electrodyn, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
MCM Electronics*D
Module Exchange
PanSon Electronics*D
PTS Electronics Corp.
Quasar
Richardson Electronics*D
Schurter, Inc.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Time Motion Tools
Tri State Electronics*D
Tritronics Inc.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

MOTORS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Premium Parts + Electronics Co.*D 14
Quasar
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Technics
Tritronics Inc.*D
Truminco*D
Universal Enterprises

PHONO CARTRIDGES/STYLI

Andrews Electronics *D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D

See Adv. Page

Fordham Radio Supply Co.*D
GMB/dba Fox International*D
Herman Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
Premium Parts + Electronics Co.*D 14
Richardson Electronics*D
RNJ Electronics Inc.*D
Russell Industries
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
A.G. Tannenbaum*D
Tri State Electronics*D
Tritronics Inc.*D
Wholesale Electronics Inc.*D

PICTURE TUBES/CRTs

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Clinton Electronics Corp.
Delta Warranty
Diversified Parts*D
Eiger Electronics*D
Electronic Parts Supply*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Horizon Technology, Inc.*D
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Joseph Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Vance Baldwin Inc.*D
Video Dispaly Corp.
Warrantech Corp.
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

POTENTIOMETERS

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Consolidated Electronics, Inc.*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Hitachi Home Electronics
Hosfelt Electronics*D
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
Panasonic Industrial Co.
Parts Express International Inc.*D 57
Quasar
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

RECTIFIERS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Computer Power, Inc.
Consolidated Electronics, Inc.*D
Cooper Associates*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
NTE Electronics, Inc.
Parts Express International Inc.*D 57
Philips ECG
Quasar
Richardson Electronics*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

RELAYS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Digi-Key Corp.*D
Diversified Parts*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NTE Electronics, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Quasar
Richardson Electronics*D
Schurter, Inc.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

RESISTORS

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NEC Technologies*D
NTE Electronics, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SEMICONDUCTORS, DIODES

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Delta Warranty
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
International Components Corp.*D 68
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NEC Technologies*D
NTE Electronics, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Power Technology Components
Microsemi Co.
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SEMICONDUCTORS, ICs

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D

See Adv. Page

Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Delta Warranty
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Easy Tech*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Module Exchange
Mouser Electronics*D 61
NCM Electronics
NEC Technologies*D
NTE Electronics, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SEMICONDUCTORS, SCRs/TRIACS

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Delta Warranty
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
NEC Technologies*D
NTE Electronics, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SEMICONDUCTORS, TRANSISTORS

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
C&S Sales*D
Delta Warranty
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Electronix Express*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
Marshall Industries*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
NEC Technologies*D
NTE Electronics, Inc.
PanSon Electronics*D
Parts Express International Inc.*D 57
Philips ECG
Power Technology Components Microsemi Co.
Premium Parts + Electronics Co.*D 14
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

SOCKETS

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
AMP Inc.
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Electronix Express*D
Emulation Technology Inc.
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Kelvin Electronics*D
Keystone Electronics Corp.
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
NTE Electronics, Inc.
PanSon Electronics*D
Philips ECG
Quasar
Richardson Electronics*D
RNJ Electronics Inc.*D
Schurter, Inc.
Snap-On Tools Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Tri State Electronics*D
Wholesale Electronics Inc.*D

SPEAKERS

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
International Components Corp.*D 68
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
RNJ Electronics Inc.*D
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tri State Electronics*D
Tritronics Inc.*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D
Zenith Sales Co. A Div. of Zenith Electronics Corp.

SWITCHES

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Cooper Associates*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Elger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mouser Electronics*D 61
MultiFlex Seals, Inc. Viziflex Keyboard Seels Div.
ORA Electronics
Panasonic Industrial Co.
PanSon Electronics*D
Parts Express International Inc.*D 57
Pfanstiehl Corp.
RNJ Electronics Inc.*D
Schurter, Inc.
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Tri State Electronics*D
Truminco*D
Universal Enterprises
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

TRANSFORMERS

See Adv. Page

All Electronics Corp.*D
Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Design Components*D
Andrews Electronics *D
Arrow Electronics Inc. Catalog Sales Div.*D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Computer Componet Source *D
Computer Power, Inc.
Consolidated Electronics, Inc.*D
C&S Sales*D
Digi-Key Corp.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D

See Adv. Page

Electronics Warehouse Corp.*D
Electronix Express*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
JDR Micro*D
Joseph Electronics*D
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
PanSon Electronics*D
Parts Express International Inc.*D 57
Plastic Capacitors Inc.
Quasar
RNJ Electronics Inc.*D
SHOGYO International Corp.
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Tandy Electronics National Parts Div.
A.G. Tannenbaum*D
Technics
Thordarson/Meissner
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Universal Enterprises
Video Dispaly Corp.
Wholesale Electronics Inc.*D

VACUUM TUBES

Allied Electronics, Inc. Subsidiary of Hall-Mark*D
Andrews Electronics *D
ARS Electronics*D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D
Diversified Parts*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
GMB/dba Fox International*D
Herman Electronics*D
International Components Corp.*D 68
Kelvin Electronics*D
MAI/Prime Parts*D
M.A.T. Electronics*D
MCM Electronics*D
Philips ECG
Richardson Electronics*D
Sony Service Co. National Parts Div.*D
Tri State Electronics*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

VIDEO HEADS

Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Diversified Parts*D
East Coast Transistor*D
Eiger Electronics*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics
HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Joseph Electronics*D
M.A.T. Electronics*D
Matsushita Services Co.
MCM Electronics*D
Mitsubishi Electronics America, Inc.
PanSon Electronics*D

See Adv. Page

Philips ECG
Premium Parts + Electronics Co.*D 14
Quasar
RNJ Electronics Inc.*D
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
Technics
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tri State Electronics*D
Tritronics Inc.*D
Truminco*D
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

YOKES

Andrews Electronics *D
B-B&W Electronics*D
Bursma Electronic Distributing*D
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Diversified Parts*D
Eiger Electronics*D
Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D
Fox International*D 19
GMB/dba Fox International*D
Herman Electronics*D
Hitachi Home Electronics

See Adv. Page

HSC Service Co. Div. of Hitachi Sales Corp. of America
Hurley Electronics*D
Matsushita Services Co.
Mitsubishi Electronics America, Inc.
Panasonic Industrial Co.
PanSon Electronics*D
Quasar
Sony Service Co. 21
Sony Service Co. National Parts Div.*D
A.G. Tannenbaum*D
Technics
Vance Baldwin Inc.*D
Wholesale Electronics Inc.*D

Software/services directory

Note: An entry followed by *D means that this company is a distributor, not a manufacturer.

A line listing that is in color indicates that the company listed has an ad in this issue. The number following the listing is the number of the page on which the ad is located.

COMPUTER DIAGNOSTIC SOFTWARE

See Adv. Page

Anatek Corp. 51
B&B Electronics Mfg., Co.
CSTS Inc.
Eagan Technical Services, Inc.
Electro-Metrics, Inc. A Penril Corp.
Fessenden Technologies
Gibson Research Corp.
Hy-Tronix Instruments, Inc.
JDR Micro*D
MAI/Prime Parts*D
M-Test Equipment
Omega Engineering Inc.
Pacific Electro Data, Inc.
Print Products International *D
Sony Service Co. 21
Warrantech Corp.
Windsor Technologies, Inc.

CONSULTANTS

CSTS Inc.
JDR Micro*D
W.J. Lynott, Associates
Marshall Industries*D
MaxServ
Research Specialists Inc.
Soft-Serve
TEKSERV

DISC DRIVE/HEAD REFURBISHMENT

Fessenden Technologies
Gibson Research Corp.
Sprague Magnetics, Inc.*D
Warrantech Corp.

ONLINE SERVICES

Cahill Electronics
JDR Micro*D
KeyPrestige, Inc.
MaxServ
PanSon Electronics*D

PC BOARD REPAIR/REWORK

Circuit Repair Corp.
CSTS Inc.
Eagan Technical Services, Inc.
Eiger Electronics*D
Electronics Warehouse Corp.*D
Fessenden Technologies
JDR Micro*D
W.S. Jenks & Son*D
La Guardia Enterprises
Monitech
Orion Instruments, Inc.
PACE, Inc.
The Rex Co.
Sprague Magnetics, Inc.*D
WRC Inc.

RENTAL/LEASING EQUIPMENT

AT&T Capital Corporation Instrument Services Instrument Services Div.
GlobeTech International, Inc.
The Instrument Mart, Inc.*D
Soft-Serve
TEKSERV
Tucker Electronics Co.*D

SERVICE BULLETIN SOFTWARE

Cahill Electronics
GMB/dba Fox International*D
High Tech Electronic Services
KeyPrestige, Inc.
PanSon Electronics*D
Philips CEC Technical Training Service Co.*D ..... IBC
Soft-Serve

SERVICE MANAGEMENT SOFTWARE

Anatek Corp. 51
Automated Systems
AutoTech, BGI Co. Inc. 68
Cahill Electronics
Magic Solutions, Inc.
MaxServ
Metrix Customer Support Systems, Inc.
NESDA 14,20
Sage Data Systems Div. America West C&E, Inc.
Sencore Electronics ..... IFC
Service Systems International
Soft-Serve
Static Control Services, Inc.
Warrantech Corp.

TEST EQUIPMENT REPAIR/CALIBRATION

AT&T Capital Corporation Instrument Services Instrument Services Div.
Bel Merit
Brunelle Instruments Inc.
Digitech Industries Inc.
Electro-Metrics, Inc. A Penril Corp.
Electromatic Controls/ Soar Instruments
Electronics Warehouse Corp.*D
IET Labs, Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
National Instruments
Orion Instruments, Inc.
Print Products International *D
Sencore Electronics ..... IFC
TEKSERV
Tucker Electronics Co.*D
Wavetek Corp. An Affiliate of Emerson Electric Co.
Yokogawa Corp. of America

TUNER/MODULE REPAIR

B-B&W Electronics*D
Bursma Electronic Distributing*D
Eiger Electronics*D
Electrodyn, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Module Exchange
PTS Electronics Corp.
Tri State Electronics*D

Association/educational sources directory

Note: An entry followed by *D means that this company is a distributor, not a manufacturer.

A line listing that is in color indicates that the company listed has an ad in this issue. The number following the listing is the number of the page on which the ad is located.

BOOKS/MANUALS

See Adv. Page

All Electronics Corp.*D
American Power Conversion Corp.
Antique Radio Classified
ARS Electronics*D
Banner Technical Books
B&B Electronics Mfg., Co.
B-B&W Electronics*D
B&K-Precision Maxtec International Corp.
BMI-Basic Measuring Instruments
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Consolidated Electronics, Inc.*D
Contact East, Inc.*D
D.A.T.A. Business Publishing
Dranetz Technologies
East Coast Transistor*D
Eiger Electronics*D
Electron Processing
Electronic Industries Association Consumer Electronics Group
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
GMB/dba Fox International*D
Heath Co.
Hosfelt Electronics*D
IC Master Hearst Business Communications
Interconnect Devices, Inc.
ISCET 57
JDR Micro*D
W.S. Jenks & Son*D
W.J. Lynott, Associates
MAI/Prime Parts*D
Matsushita Services Co. 60
Mitsubishi Electronics America, Inc.
Mouser Electronics*D 61
National Instruments
NESDA 14,20
PACE, Inc.
Parts Express International Inc.*D 57
Philips CEC Technical Training Service Co.*D ..... IBC
Print Products International *D
Howard W. Sams & Co. 57
Sencore Electronics ..... IFC
Sony Service Co. 21
Sperry Tech Inc. 68
TAB Books Inc.
A.G. Tannenbaum*D
Tektronix TV Products Div.
Tri State Electronics*D
United Techbook Co.
Viejo Publications
WEKA Publishing, Inc.

EDUCATIONAL/TRAINING SEMINARS/VIDEOS

See Adv. Page

The American Institute
Bergwall Productions, Inc.
BMI-Basic Measuring Instruments
Cleveland Institute of Electronics
Dranetz Technologies
Eagan Technical Services, Inc.
Electronic Industries Association Consumer Electronics Group
Electronix Corp.*D
ETA-Electronics Technicians Association
GlobeTech International, Inc.
Hosfelt Electronics*D
Industrial Training, Inc.
ISCET 57
W.S. Jenks & Son*D
Jit Resources
Joseph Electronics*D
KeyTek Instrument Corp.
Learning Group International
W.J. Lynott, Associates
Matsushita Services Co. 60
Mitsubishi Electronics America, Inc.
National Advancement Corp. 51
National Association of Service Dealers (NASD)
National Instruments
NESDA 14,20
PACE, Inc.
Philips CEC Technical Training Service Co.*D ..... IBC
Print Products International *D
SDA
Sencore Electronics ..... IFC
Sharp Electronics, Corp.
Sony Service Co. 21
Static Control Services, Inc.
Techni-Tool Inc.*D
Tektronix TV Products Div.
Ucando VCR Educational Products
Warrantech Corp.

MANAGEMENT SOFTWARE SYSTEMS

See Adv. Page

AutoTech, BGI Co. Inc. 68
Cahill Electronics
NESDA 14,20
Sencore Electronics ..... IFC

SCHOOLS: CORRESPONDENCE/ RESIDENT

Cleveland Institute of Electronics
Cook's Institute of Electronics Engineering
NRI School of Electronics
Philips CEC Technical Training Service Co.*D ..... IBC

SERVICE LITERATURE/SCHEMATICS

Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Computer Componet Source *D
Consolidated Electronics, Inc.*D
Diversified Parts*D
Eagan Technical Services, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Electronix Corp.*D
Fox International*D 19
Hitachi Home Electronics
Hosfelt Electronics*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
MAI/Prime Parts*D
Matsushita Services Co. 60
Mitsubishi Electronics America, Inc.
Parts Express International Inc.*D 57
Print Products International *D
Quasar
Howard W. Sams & Co. 57
Sony Service Co. 21
A.G. Tannenbaum*D
Technics
Vance Baldwin Inc.*D

Company mailing addresses

A

Acculex Corp.
A MetraByte Co.
440 Myles Standish Blvd.
Taunton, MA 02780
508-880-3660
Fax 508-880-0179

Accutest Instruments*D
P.O. Box 130
Clarksburg, NJ 08510
609-259-0460
800-524-0747

ACL
1960 E. Devon Ave.
Elk Grove Village, IL 60007
708-981-9212
800-782-8420
Fax 708-981-9278

AEMC Corp.
99 Chauncy St.
Boston, MA 02111
617-451-0227
800-343-1391
Fax 617-423-2952

AESI/Stedi Watt
2005 Lincoln Way E.
Chambersburg, PA 17201
717-263-5681
800-733-3155
Fax 717-263-1040

Alfa Electronics
P.O. Box 8089
Princeton, NJ 08543
609-275-0220
800-526-ALFA
Fax 609-275-9536

All Electronics Corp.*D
P.O. Box 567
Van Nuys, CA 91408
800-826-5432
Fax 818-781-2653

Allied Electronics, Inc.
Subsidiary of Hall-Mark*D
7410 Pebble
Fort Worth, TX 76118
817-595-3500
800-433-5700
Fax 817-595-6470

Ambico
P.O. Box 427
Norwood, NJ 07648-0427
201-767-4100
Fax 201-767-4109

American Design Components*D
P.O. Box 520
Fairview, NJ 07022
201-941-5000
800-776-3800
Fax 201-941-7480

The American Institute
437 Madison Ave., 23rd Floor
New York, NY 10022
212-826-3340
800-345-8016
Fax 212-826-6411

American Power Conversion Corp.
132 Fairgrounds Road
West Kingston, RI 02892
401-789-5735
800-800-4APC
Fax 401-789-3710

American Reliance Inc.
9952 E. Baldwin Place
El Monte, CA 91731
818-575-5110
800-654-9838

AMP Inc.
P.O. Box 3608
Harrisburg, PA 17105-3608
800-522-6752
Fax 717-986-7575

Amprobe Instrument
P.O. Box 329
Lynbrook, NY 11563
516-593-5600
Fax 516-593-5682

Analogic Corp.
8 Centennial Drive
Peabody, MA 01960
508-977-3000
Fax 508-531-1266

Anatek Corp.
P.O. Box 1200
Amherst, NH 03031
603-673-4342
Fax 603-673-5374

Andrews Electronics *D
P.O. Box 914
Santa Clarita, CA 91380
805-257-7700
800-289-0300
Fax 805-295-5162

Anritsu Meter Co. of America
P.O. Box 193
Franklin Lakes, NJ 07417
201-848-0033
800-457-2999
Fax 201-848-1845

Antique Radio Classified
P.O. Box 802-C12
Carlisle, MA 01741
508-371-0512

A.P.E. Corp.
142 Peconic Ave.
Medford, NY 11763
516-654-1197
Fax 516-289-4735

Apollo Wholesale
1944 W. Shady Grove
Irving, TX 75060

Aristo Computers, Inc.
6700 S.W. 105th Ave., Suite 307
Beaverton, OR 97005
503-626-6333
800-327-4786
Fax 503-626-6492

Armand Mfg. Inc.
5020 Rivergrade Road
Baldwin Park, CA 91706
818-960-4081
Fax 818-338-5393

Arrow Electronics Inc.
Catalog Sales Div.*D
1860 Smithtown Ave.
Ronkonkoma, NY 11779
516-467-1000
800-932-7769
Fax 516-585-0878

ARS Electronics*D
P.O. Box 7323
Van Nuys, CA 91409
818-997-6200
800-422-4250
Fax 818-997-6158

Atrix, Inc.*D
14301 Ewing Ave. S.
Burnsville, MN 55337
612-894-6154
800-222-6154
Fax 612-894-6256

AT&T Capital Corporation
Instrument Services
Instrument Services Div.
P.O. Box 619260
D/FW Airport, TX 75261-9260
214-456-4000
800-874-7123
Fax 214-456-4002

Automated Systems
4827 Pioneer Blvd., Suite 100
Lincoln, NE 68506
402-489-2717
800-279-7312
Fax 402-489-2370

AutoTech, BGI Co. Inc.
50509 Hollyhock Road
South Bend, IN 46637
219-277-8762
Fax 219-277-8762

AVA Instrumentation, Inc.
8010 Highway 9
Ben Lomond, CA 95005
408-336-2281
Fax 408-336-5049

Avex Probes Inc.
P.O. Box 1026
Bensalem, PA 19020
215-638-3300
800-877-7623
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ES&T Manufacturers' schematics **PROFAX**

MARCH 1993

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SHARP

Color TV Chassis No. A10, Model 20C-S200 3099

BLOCK DIAGRAM

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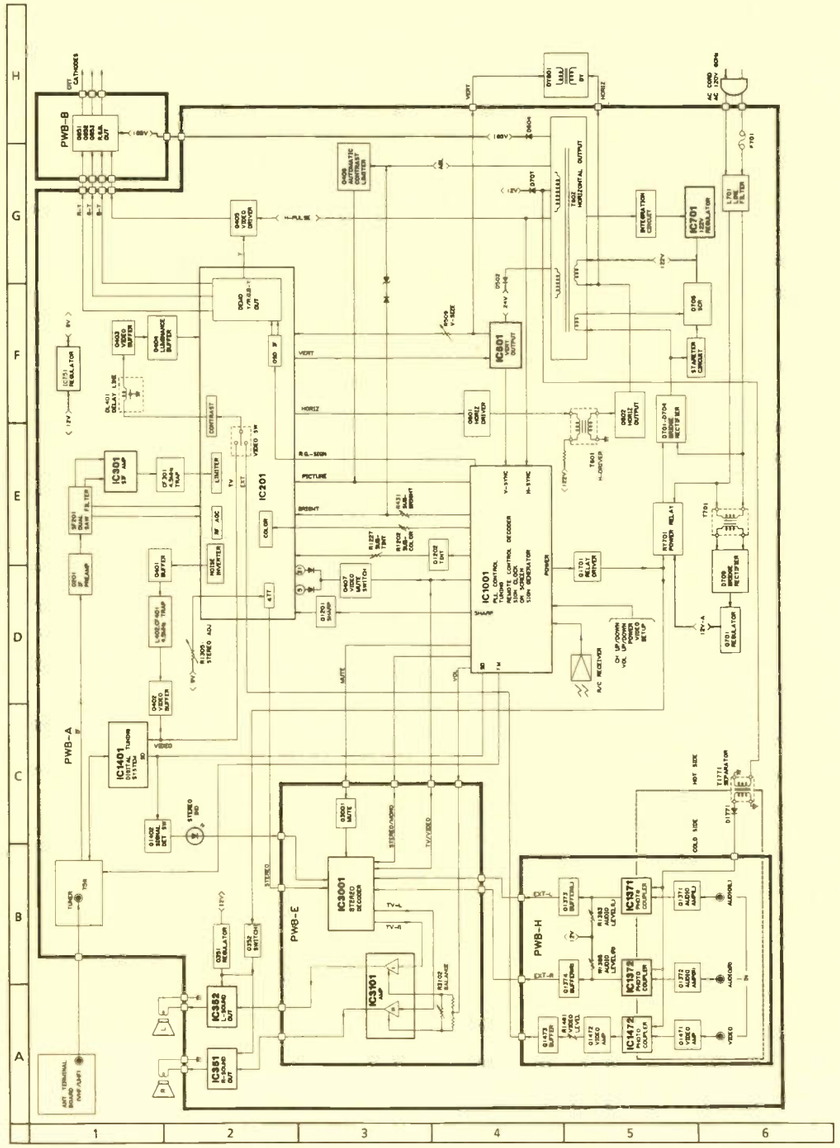
Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

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.



SCHEMATIC DIAGRAM: CRT SOCKET, V/A MODULE UNIT

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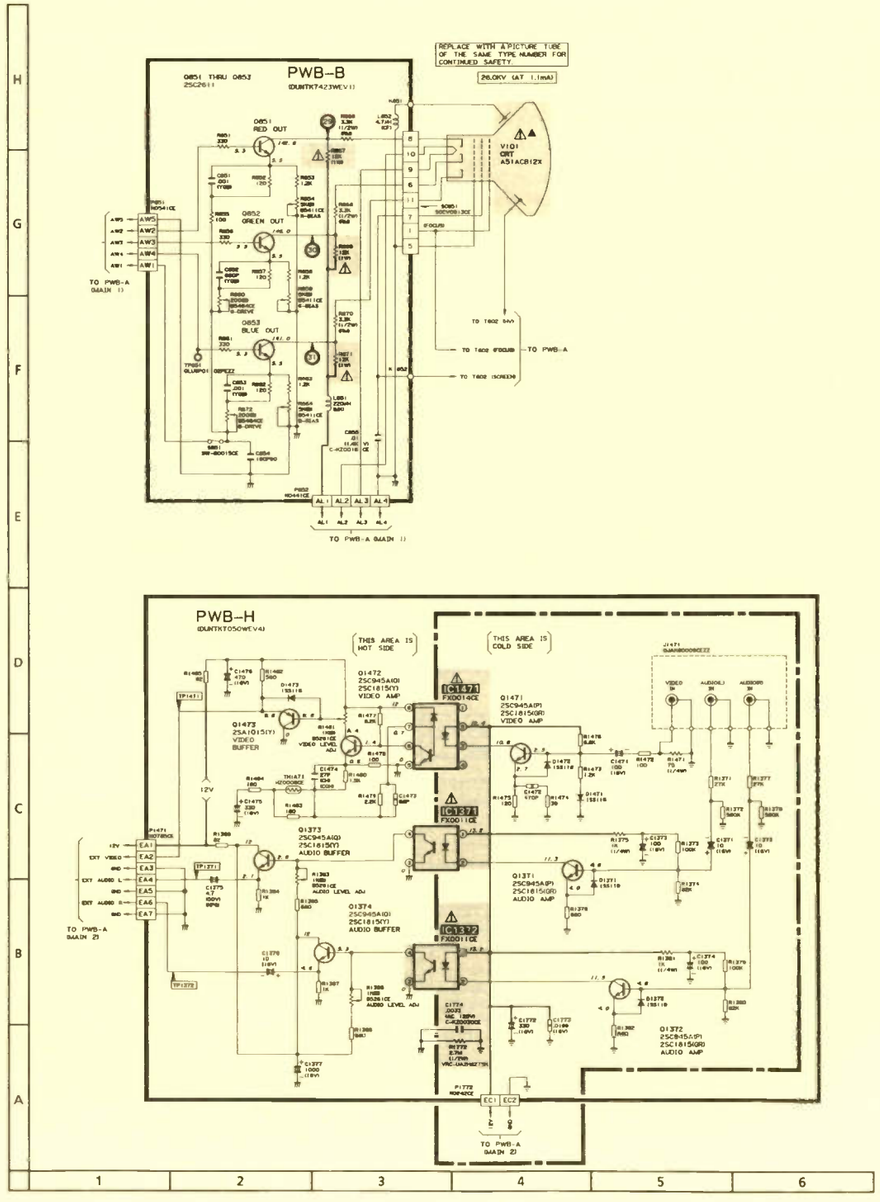
All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.



SCHEMATIC DIAGRAM: MAIN-2

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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3099 PROFAX Manufacturers' schematics

SCHEMATIC DIAGRAM: MAIN-2

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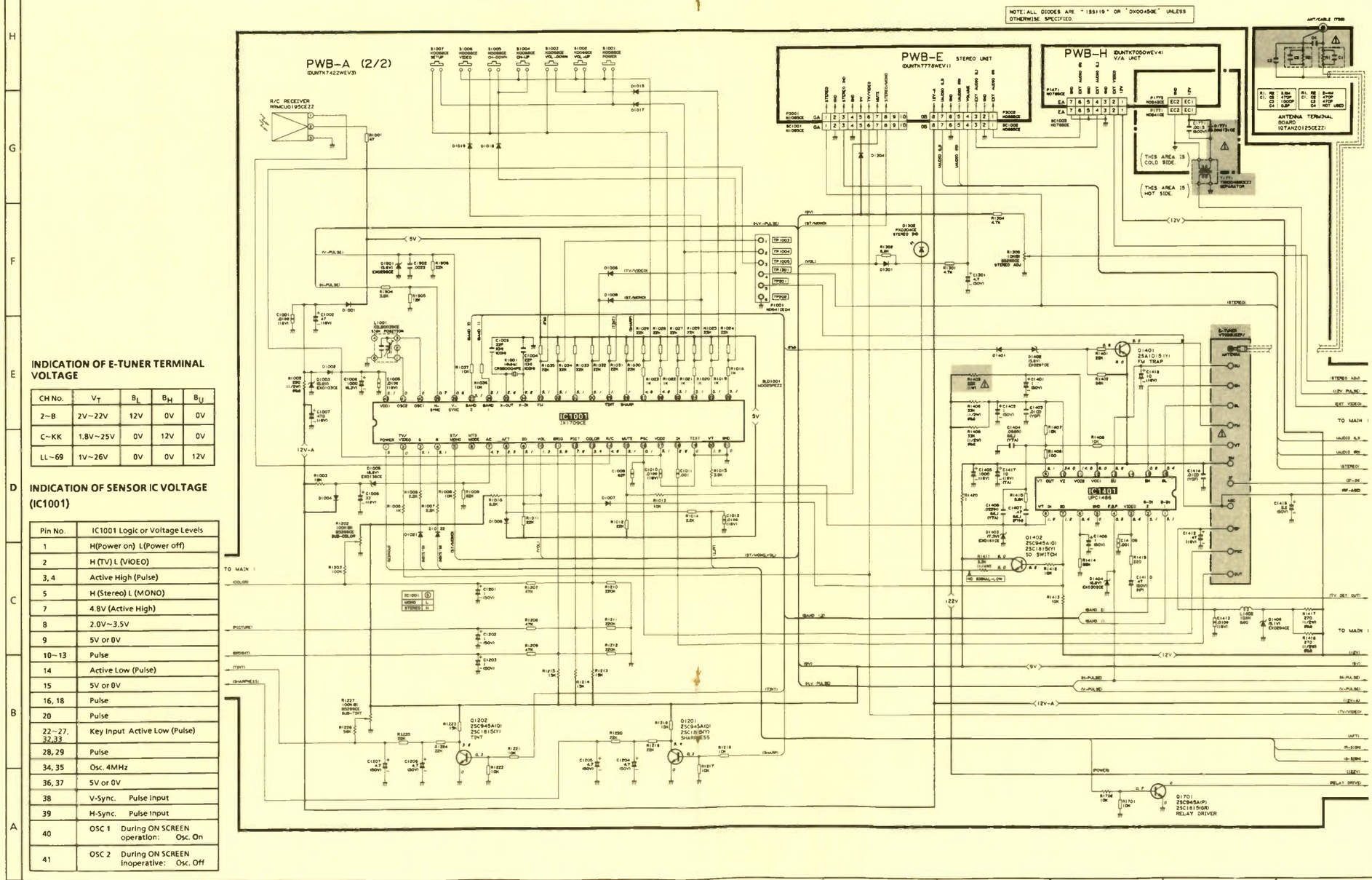

INDICATION OF E-TUNER TERMINAL VOLTAGE

CH No.	V_T	B_L	B_H	B_U
2~B	2V~22V	12V	0V	0V
C~KK	1.8V~25V	0V	12V	0V
LL~69	1V~26V	0V	0V	12V

INDICATION OF SENSOR IC VOLTAGE (IC1001)

Pin No.	IC1001 Logic or Voltage Levels
1	H(Power on) L(Power off)
2	H (TV) L (VIDEO)
3, 4	Active High (Pulse)
5	H (Stereo) L (MONO)
7	4.8V (Active High)
8	2.0V~3.5V
9	5V or 0V
10~13	Pulse
14	Active Low (Pulse)
15	5V or 0V
16, 18	Pulse
20	Pulse
22~27, 32,33	Key Input Active Low (Pulse)
28, 29	Pulse
34, 35	Osc. 4MHz
36, 37	5V or 0V
38	V-Sync. Pulse Input
39	H-Sync. Pulse Input
40	OSC 1 During ON SCREEN operation: Osc. On
41	OSC 2 During ON SCREEN Inoperative: Osc. Off

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SCHEMATIC DIAGRAM: MAIN-1

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B&K Manufacturers schematics PROFAX 3099

SCHEMATIC DIAGRAM: MAIN-1

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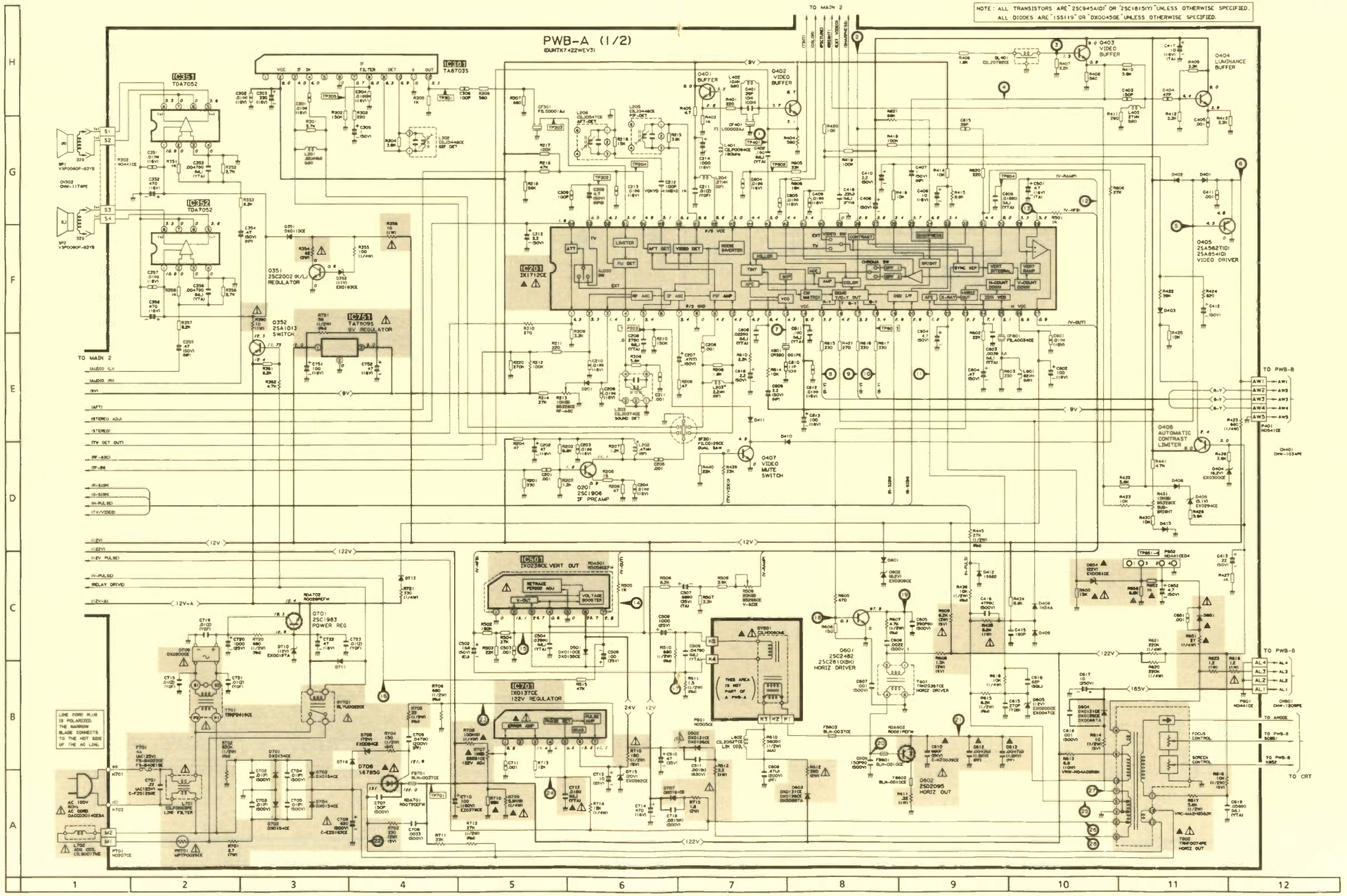

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SCHEMATIC DIAGRAM: STEREO MODULE UNIT

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SCHEMATIC DIAGRAM: STEREO MODULE UNIT

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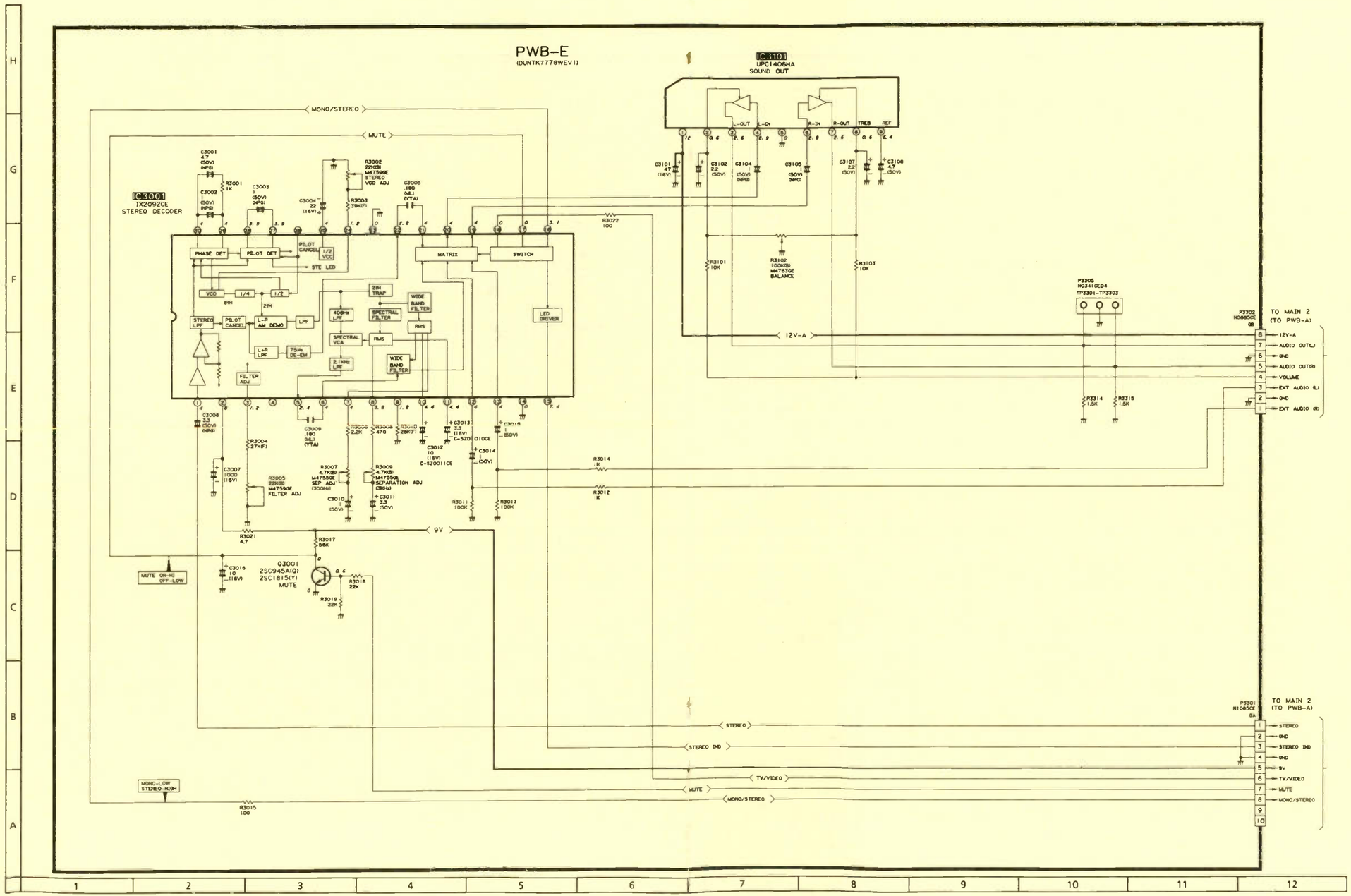
All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.

PROFAX Manufacturers' schematics 3099



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ES&T Manufacturers' schematics **PROFAX**

MARCH 1993

Profax Number

SHARP

VCR Models VC-H86U/C.....3100

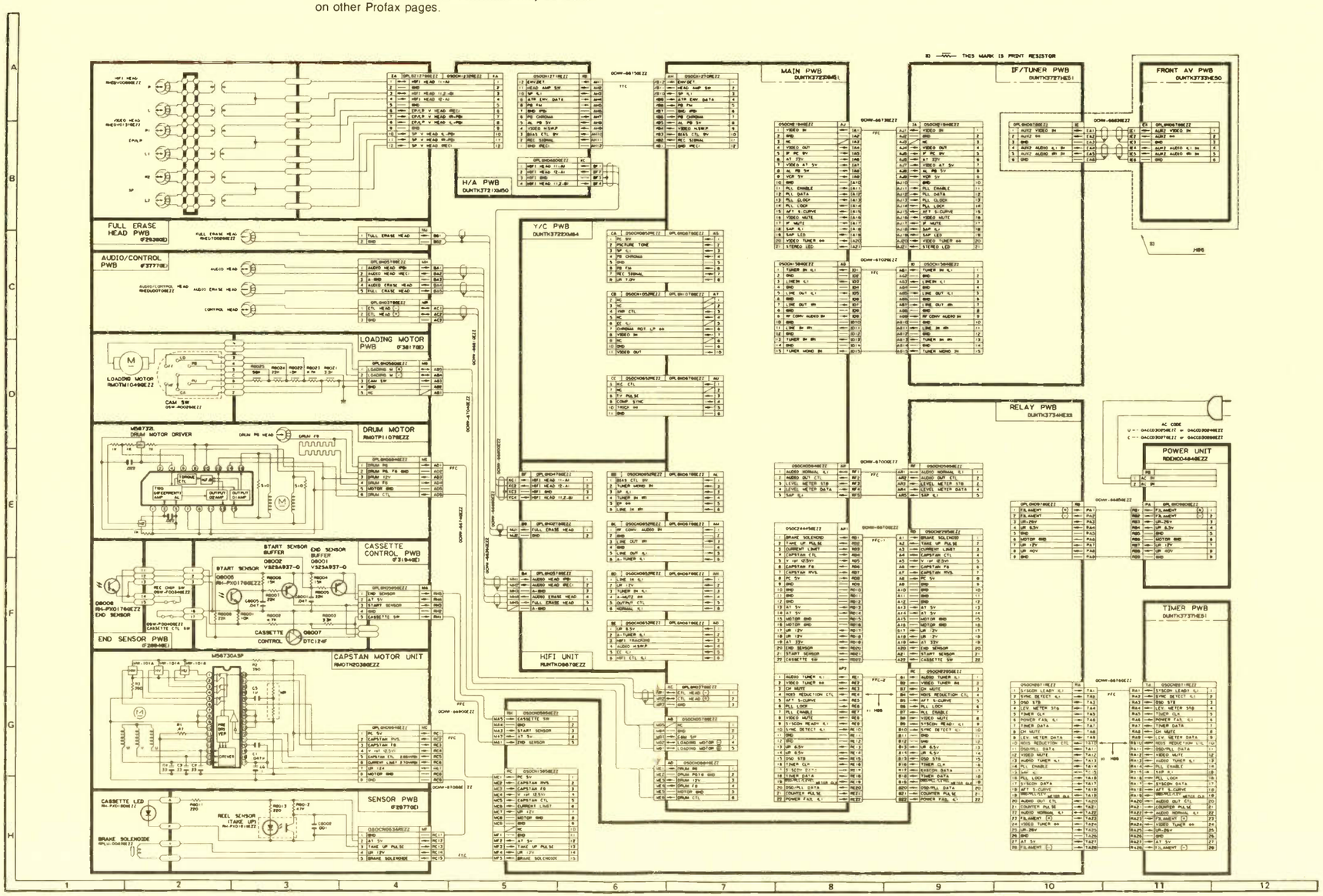
CIRCUIT DIAGRAM AND PWB FOIL PATTERN OVERALL DIAGRAM

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.

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.



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

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MAIN (1) CIRCUIT

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

es&t Manufacturers' schematics PROFAX 3100

MAIN (1) CIRCUIT

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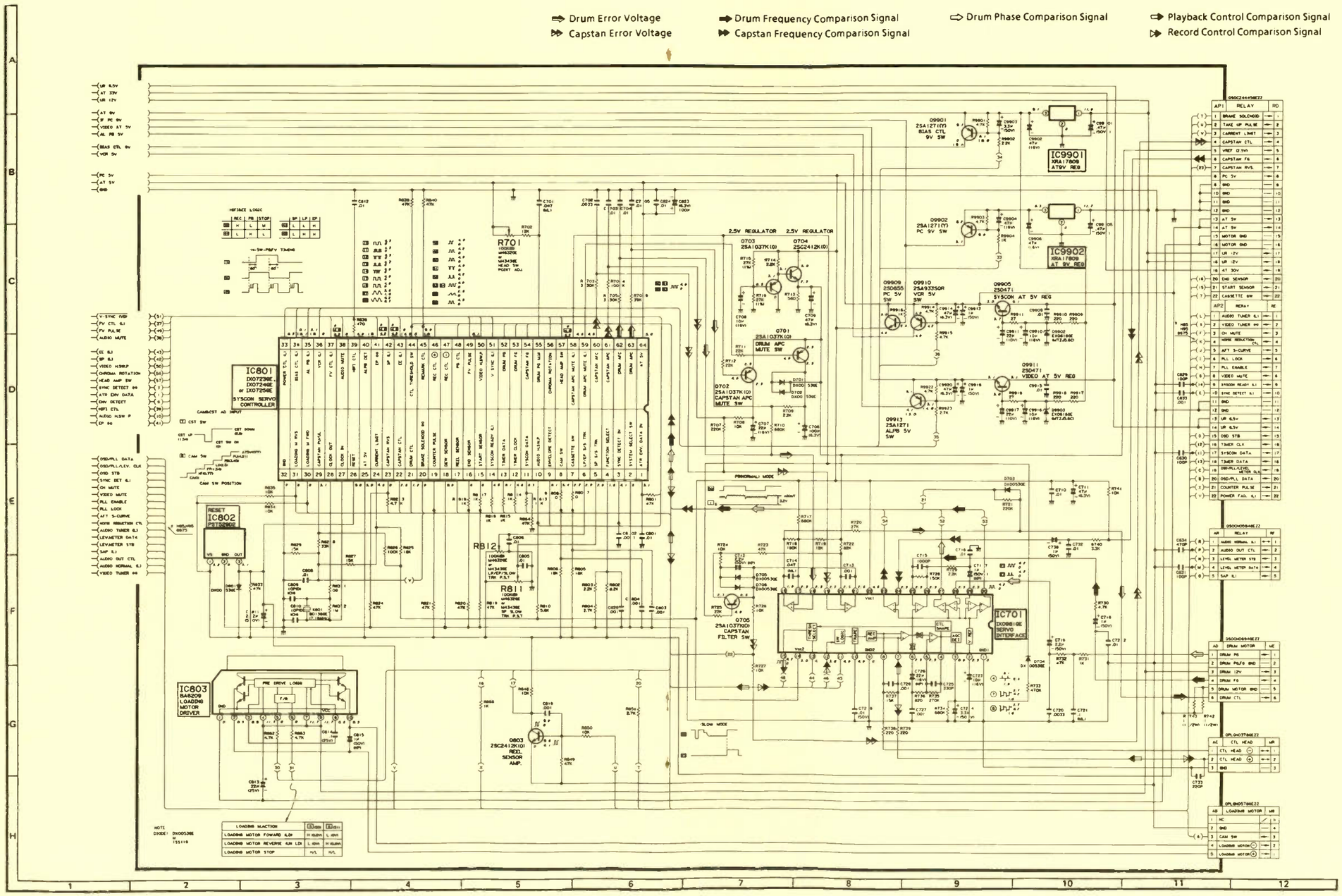

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Y/C CIRCUIT AND HEAD AMP. CIRCUIT

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

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

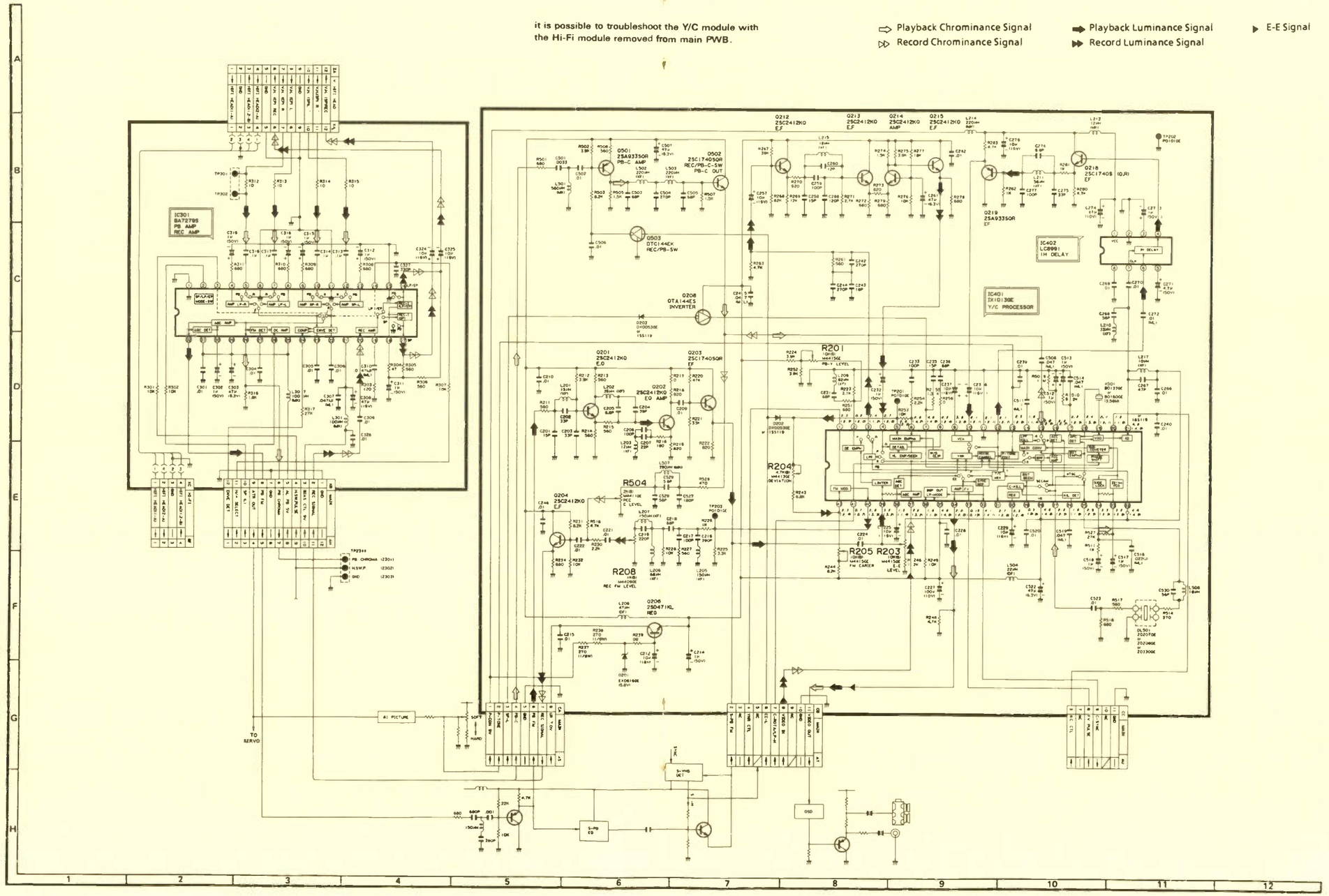
This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

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

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

it is possible to troubleshoot the Y/C module with the Hi-Fi module removed from main PWB.

⇨ Playback Chrominance Signal
⇨⇨ Record Chrominance Signal
➡ Playback Luminance Signal
➡➡ Record Luminance Signal
▶ E-E Signal



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SHARP
VCR
Models VC-H86U/C

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MAIN (2) CIRCUIT

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

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

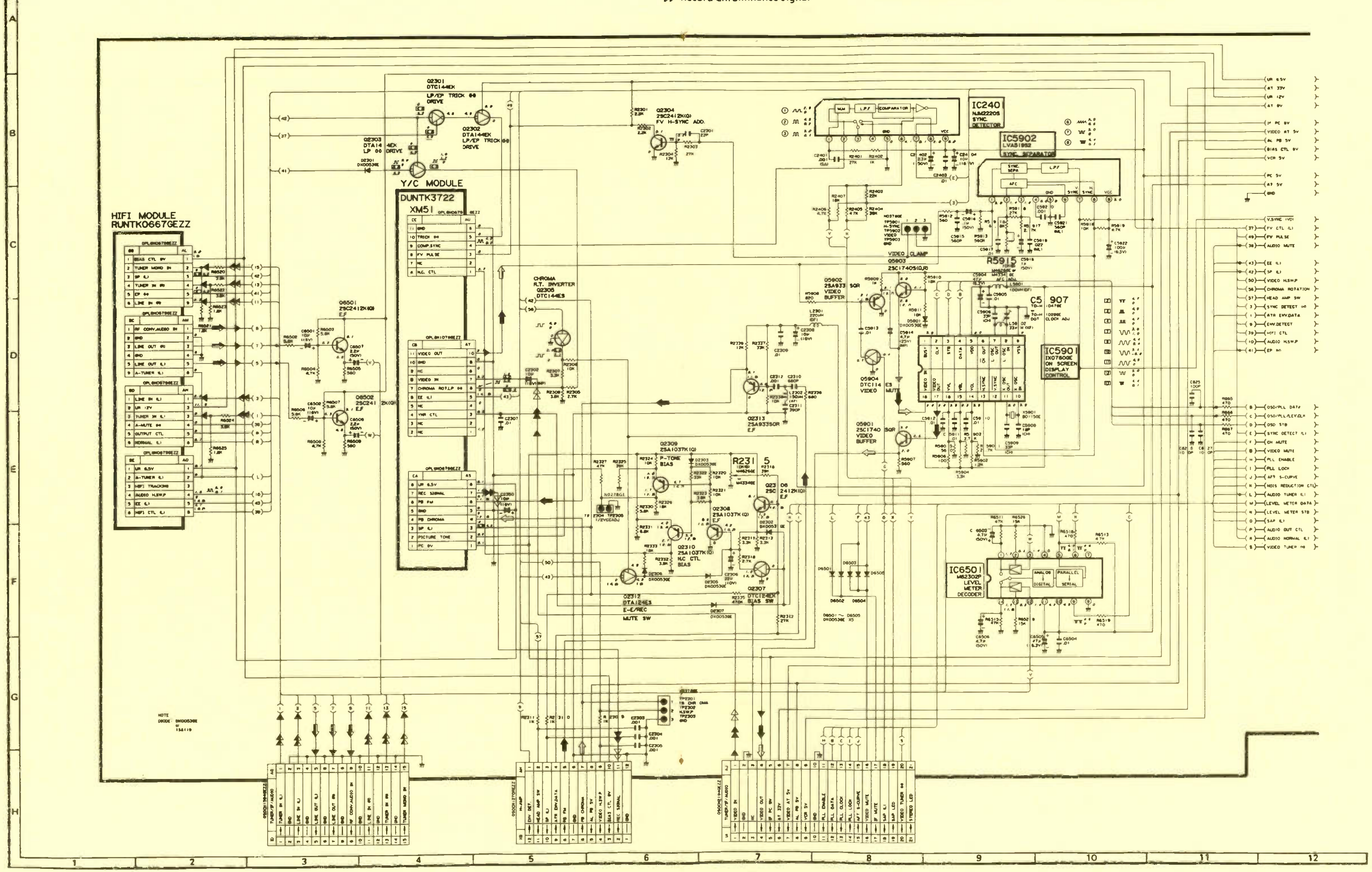
MAIN (2) CIRCUIT

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.

- Playback Chrominance Signal
- Record Chrominance Signal
- Playback Luminance Signal
- Record Luminance Signal
- Audio Playback Signal
- Audio Record Signal
- E-E Signal (Video)/(Audio)



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What do you know about electronics?

Constructing A Microcomputer-Part II

By J.A. Sam Wilson, CET

I have received several letters from a technician regarding the circuit of Figure 1. He insists that an emitter-base short circuit on Q_1, will "cool down transistor Q_2." I thought it might be a good idea to discuss what happens when that short circuit is in place.

One of the troubleshooting techniques used by technicians is shown in Figure 2. When the emitter is shorted to the base there is no longer a forward bias on the transistor. That, in turn, shuts off the transistor and prevents it from conducting

Wilson is the electronics theory consultant for **ES&T**.

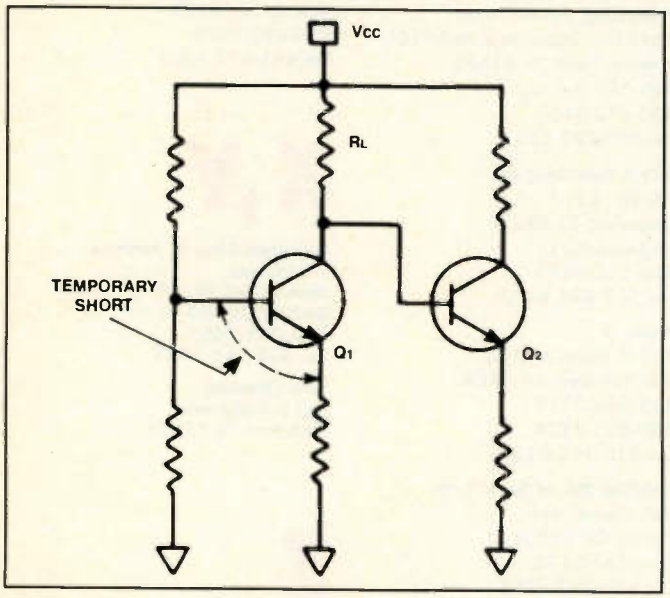


Figure 1.

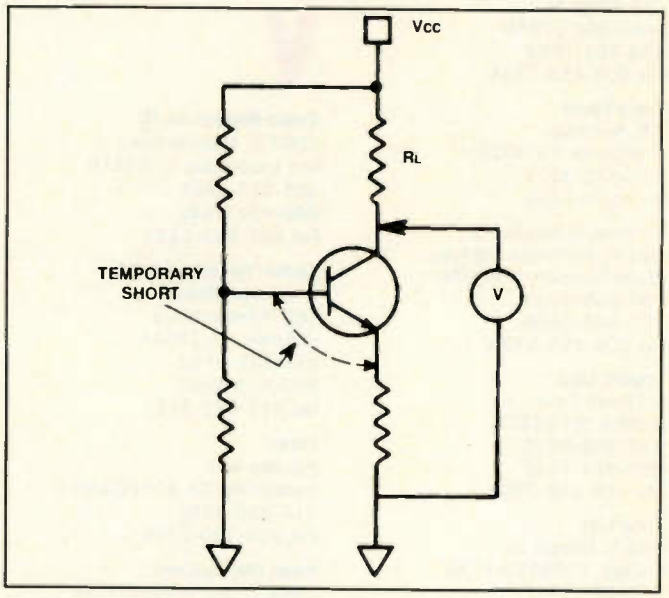


Figure 2.

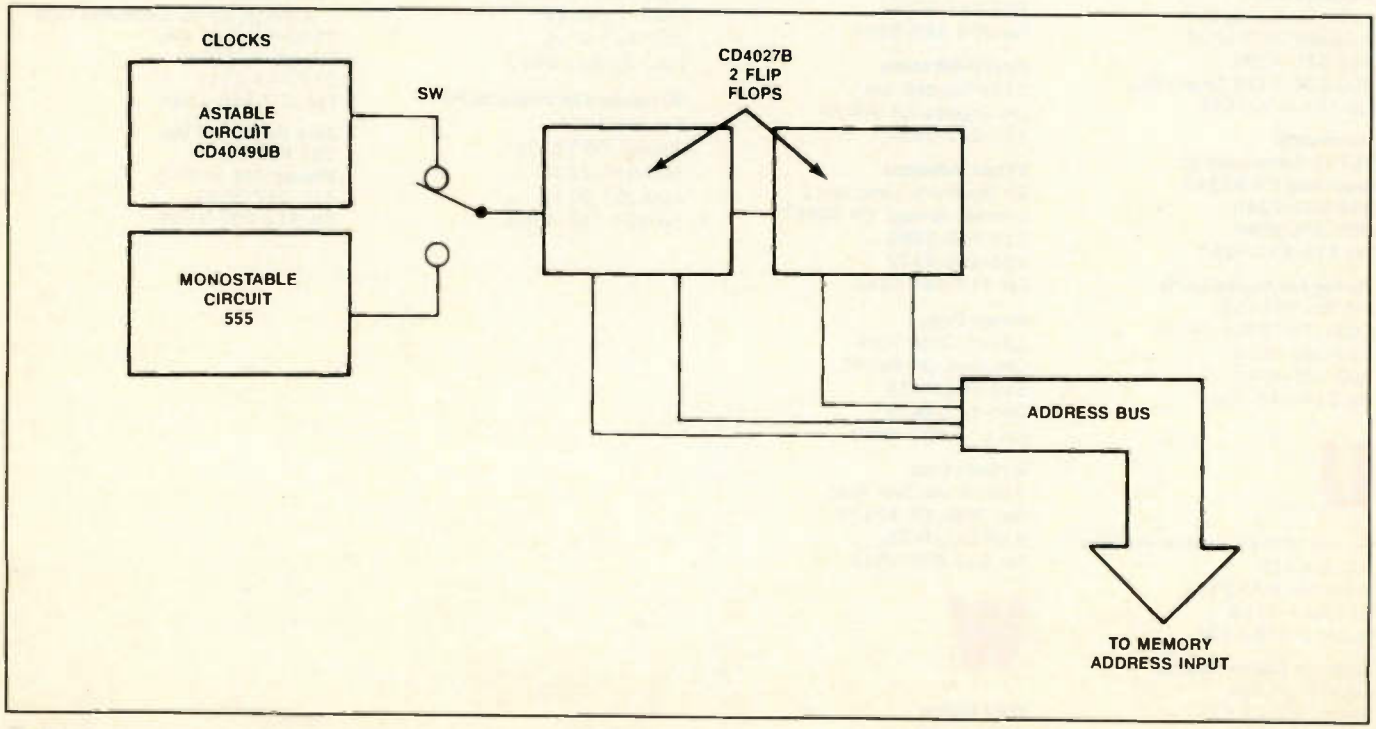


Figure 3.

through the load resistor (R_L). The voltmeter reading should swing to about the V_{cc} value and that indicates the transistor base has some control over the collector current. It also indicates that the transistor is not shorted between the emitter and collector and that it does not have excessive leakage.

In the circuit of Figure 1, the emitter-base short circuit of Q_1, stops current flow through R_L and causes the collector voltage to closely approach V_{cc}. With that much voltage on the base of Q_2 its base current rises to a destructive value.

I pointed this out to the reader/technician, but, he insists he has performed that short circuit test on direct-coupled transistors many times and the effect has always been to "cool down Q_2." He tells me his brother has also performed the same test many times with the same result.

After the third letter I decided to double, double check. Using 2N3909 transistors I connected the circuit of Figure 1. Then, I proceeded to destroy the second transistor, Q_2, by shorting the emitter and base of Q_1. Do you think this job is easy?

Constructing a microprocessor circuit by circuit continued

The object of this series of construction projects is to show how the circuits in a microprocessor system operate. Before this series is finished a complete microprocessor system will have been breadboarded. Our first job is to show how a microprocessor puts information into and takes information out of memory.

Any new readers who didn't get the previous issue and want the complete series can send a self-addressed (stamped) envelope to me in care of this magazine and I will send a photocopy of the previous material.

So far, the input circuits to the Random Access Memory (RAM) have been constructed. They are reviewed in Figure 3. A four-bit binary counter was constructed with the four J-K flip flops in two CD4017B CMOS integrated circuits. The counter is needed because the inputs to our RAM to be used must be in the form of a binary count. Inside the memory that count is converted to a 1-of-64 decoder that is used to select the rows of memory. An example of a similar decoder was discussed in a previous issue.

Although 64 rows of 4-bit memory can be selected with the address inputs, we will only use 16 of those rows for the experiment. That is accomplished with the 4-bit binary count out of the flip-flops ($2^4 = 16$).

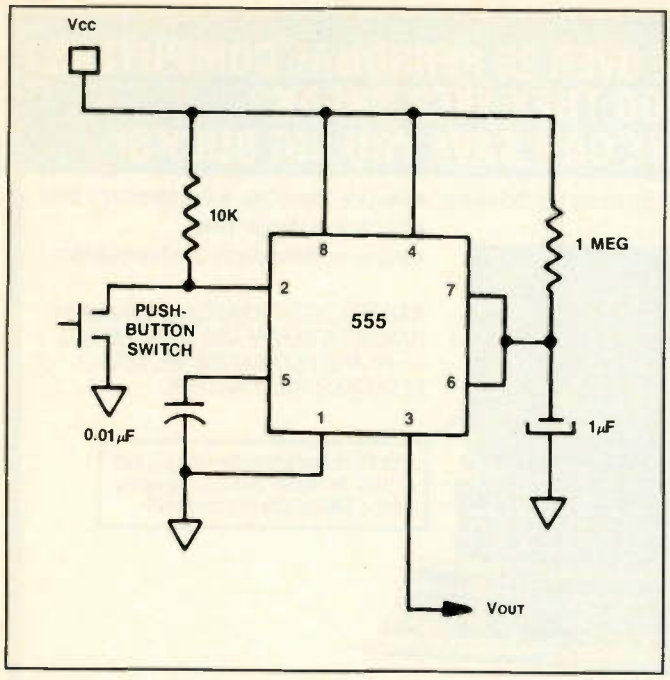
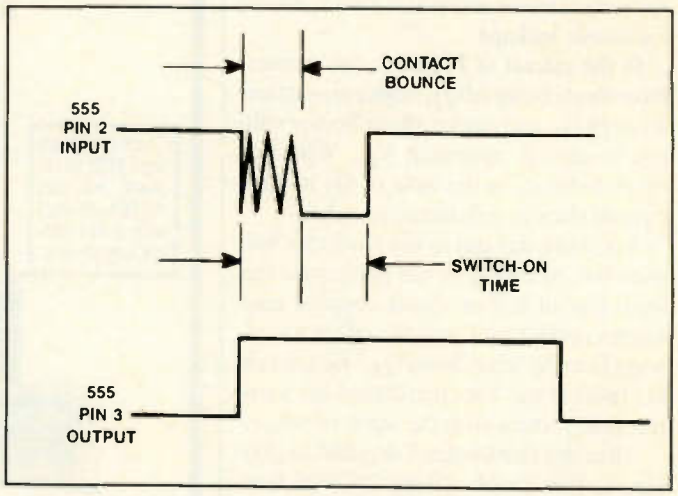


Figure 4A.

Figure 4B.



The *monostable circuit* of Figure 4 is also known as a one-shot circuit. It will be used to select the memory rows one-at-a-time. So, each memory row can be selected and held for data input or data output. A momentary mechanical switch is used for the single-stepping procedure.

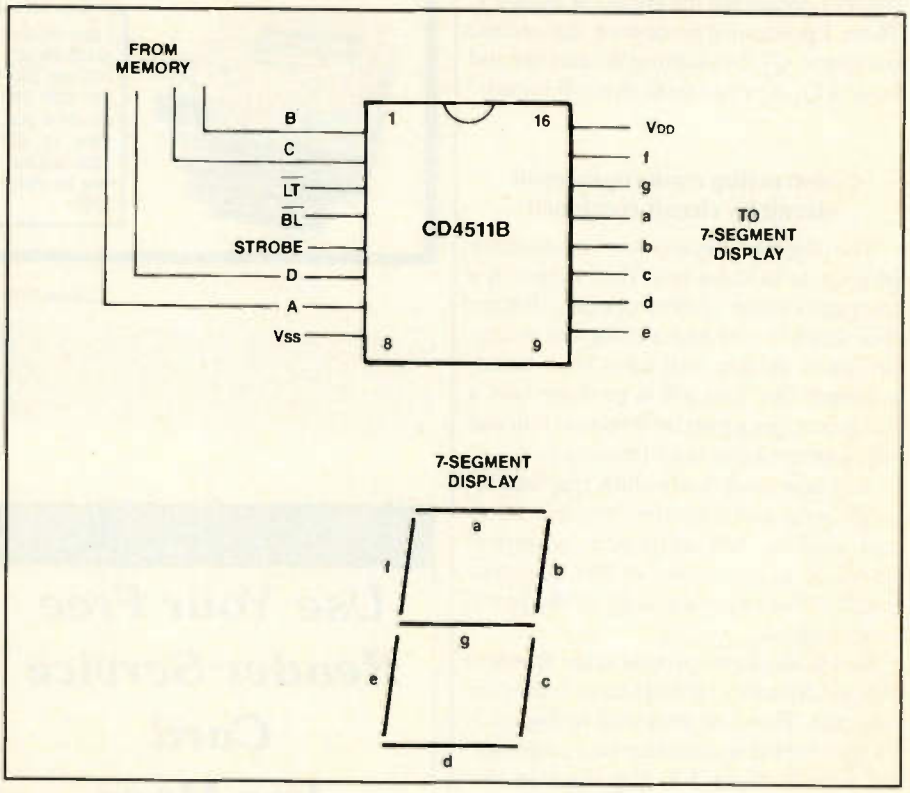


Figure 5.

Since the contacts of a mechanical switch have a bad habit of bouncing, the one-shot circuit is needed to hold the output high during the bounce period. That is illustrated in Figure 4.

A *bounceless switch* circuit could be used for the same purpose as the monostable. As with the one-shot circuit it prevents the contact bounce from delivering a series of bounce pulses that could be misinterpreted by the memory decoder.

There is also an astable (free-running) oscillator made with inverters in a CD-4049UB integrated circuit. It permits the RAM internal decoder to automatically step through the sixteen lines of stored information. A switch (SW) allows you to go from one-step to free-running output.

Memory output circuit

Having constructed the memory input circuit, the next step is to build the output

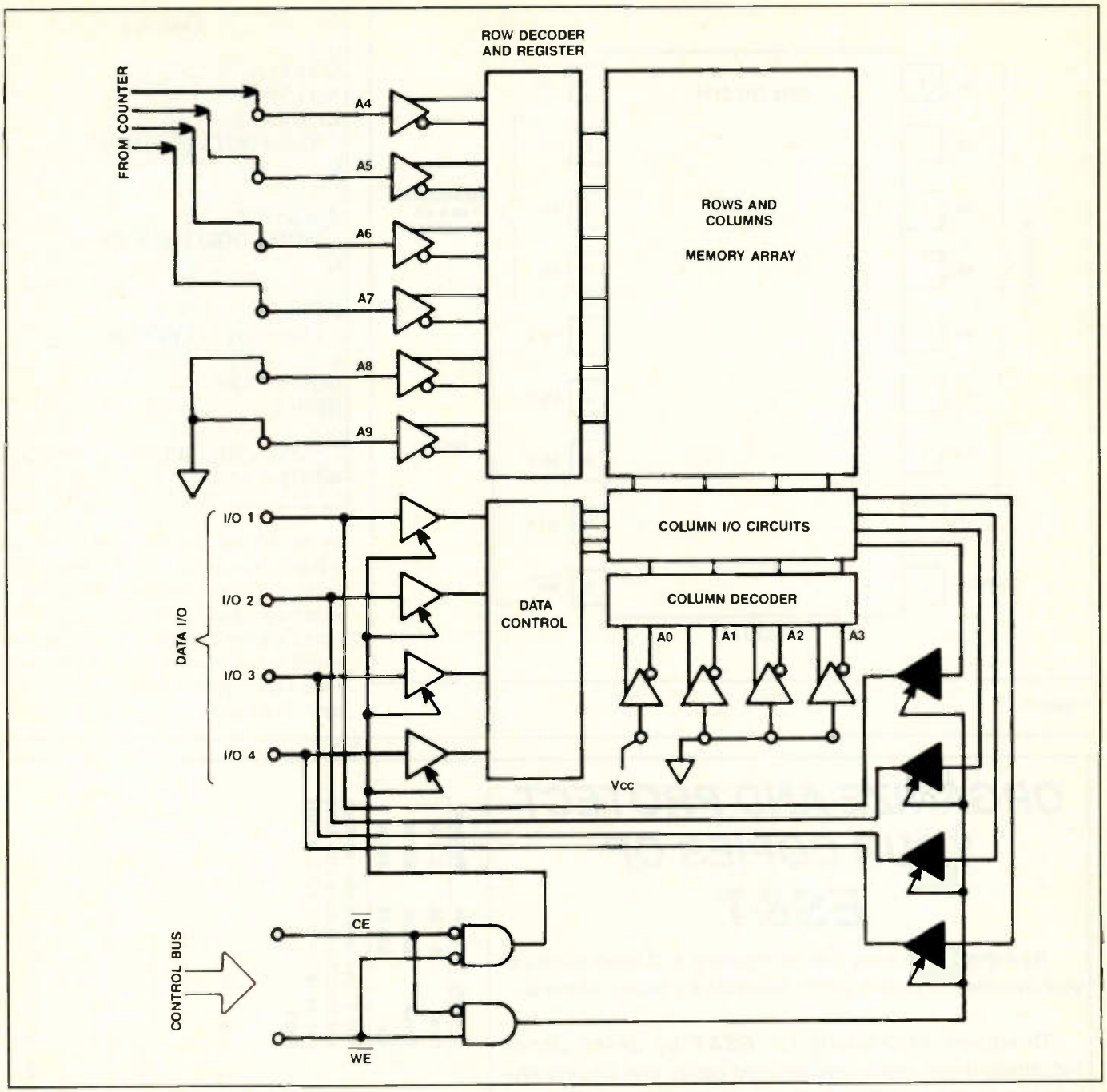


Figure 6.

circuit. A CMOS CD4511B binary-to-seven-segment decoder is used to convert the stored binary signals from the RAM output to signals needed for energizing the 7-segment display. This is shown in Figure 5.

When the circuit construction is completed you will put your telephone number into the memory one row at a time. Each memory row will hold a digit or a space. The single-stepping procedure will be used to advance row-by-row when writing the phone number into memory.

When the stored information is read from the memory, the input to the J-K flip flops will be switched to the astable oscillator. The RAM output is delivered to the decoder. The output from the decoder will be the signals needed to display each digit. So, the decoder will "convert" each binary number from the memory into a display on the seven-segment *common-cathode* LEDs.

The S5614 memory (same pinout as 2114)

Figure 6 shows a block diagram of the memory chosen for this project. I used an S6514 that is similar to the 2114 and other 1024-word X 4-bit static RAM memories. It is a *volatile memory,* meaning that your program will be lost if the power supply is disconnected.

There are many other 4-bit RAMS that will do just as well. What I am saying is that the memory you use is the memory you can get, but, you may have to slightly modify the circuit for this experiment. Use the manufacturer's specifications.

There are 10 address lines (A0 through A9) for accessing the rows and columns of memory. Four of those lines are used

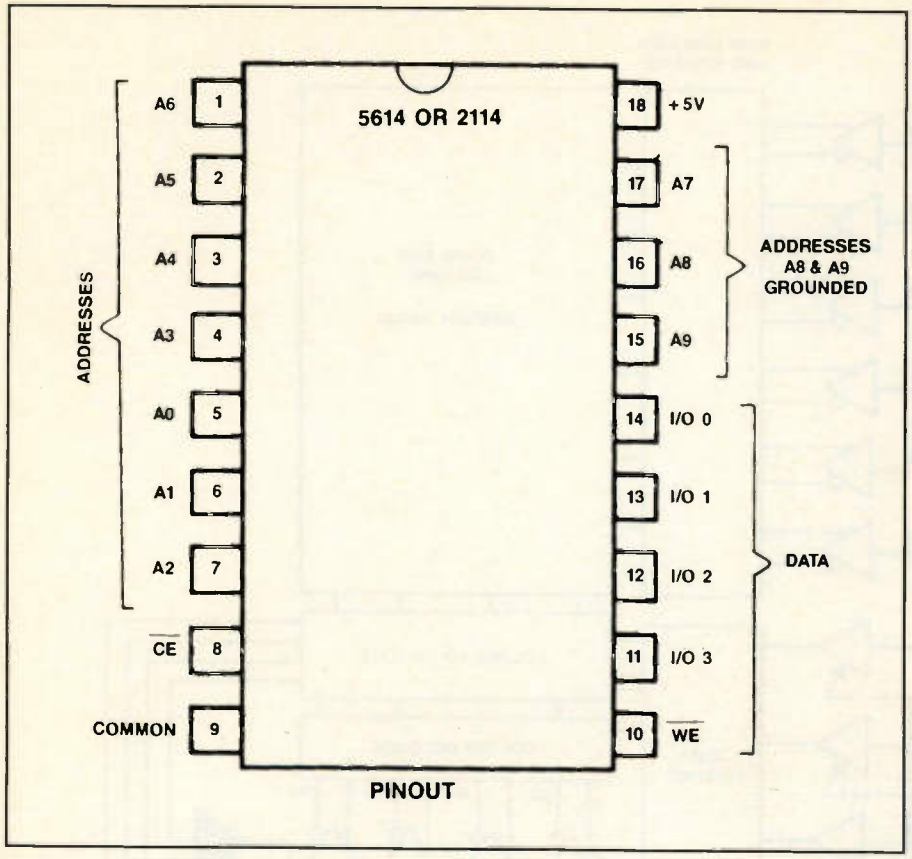


Figure 7.

TABLE I

NOT CS*	NOT WE**	REMARKS
		READ OUT OF MEMORY
0		
1		
		DATA OUT
		WRITE INTO MEMORY
0		
0		
		DATA IN
		CHIP NOT SELECTED
1		
		DON'T CARE
HIGH 2		

*NOT CHIP SELECT **NOT WRITE ENABLE

for the column decoder. They are shown in Figure 6 as A0 through A3. We will be working with only one column which is addressed with binary 0001. That means there are three column address lines connected to common, or logic 0. The positive power supply is used for that logic 1 input. See Figure 6.

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There are six additional address inputs for the rows but we will use only four of those inputs (A4 through A7) for this project. As shown in Figure 6, those inputs come from the J-K flip flop counter.

Delivering data to the RAM

We are going to use only 16 four-bit words for data input and data output; that is, binary inputs and outputs to I/O. Four switches are used for the logic 1 and logic 0 bits. The input/output (I/O) terminals are on pins numbered 11 through 14 on the RAM IC (see Figure 7).

What determines whether the data is going in or coming out of the memory is the binary-numbered code on the NOT CS and NOT WE terminals. Those codes are given in Table 1. You can see that when NOT CS is at logic 1 the data terminals are at a high impedance so there can be no input or output data.

Figure 8 shows the completed circuit for entering and retrieving a telephone number. The unused rows and columns of memory are connected to common. Bounceless switches are not needed for data input because the switch selection will be held long enough to get past the bounce pulses.

The light-emitting diodes on the address terminals permit you to know which memory line is being delivered to or delivered from. The 7-segment display will show which digit you are entering.

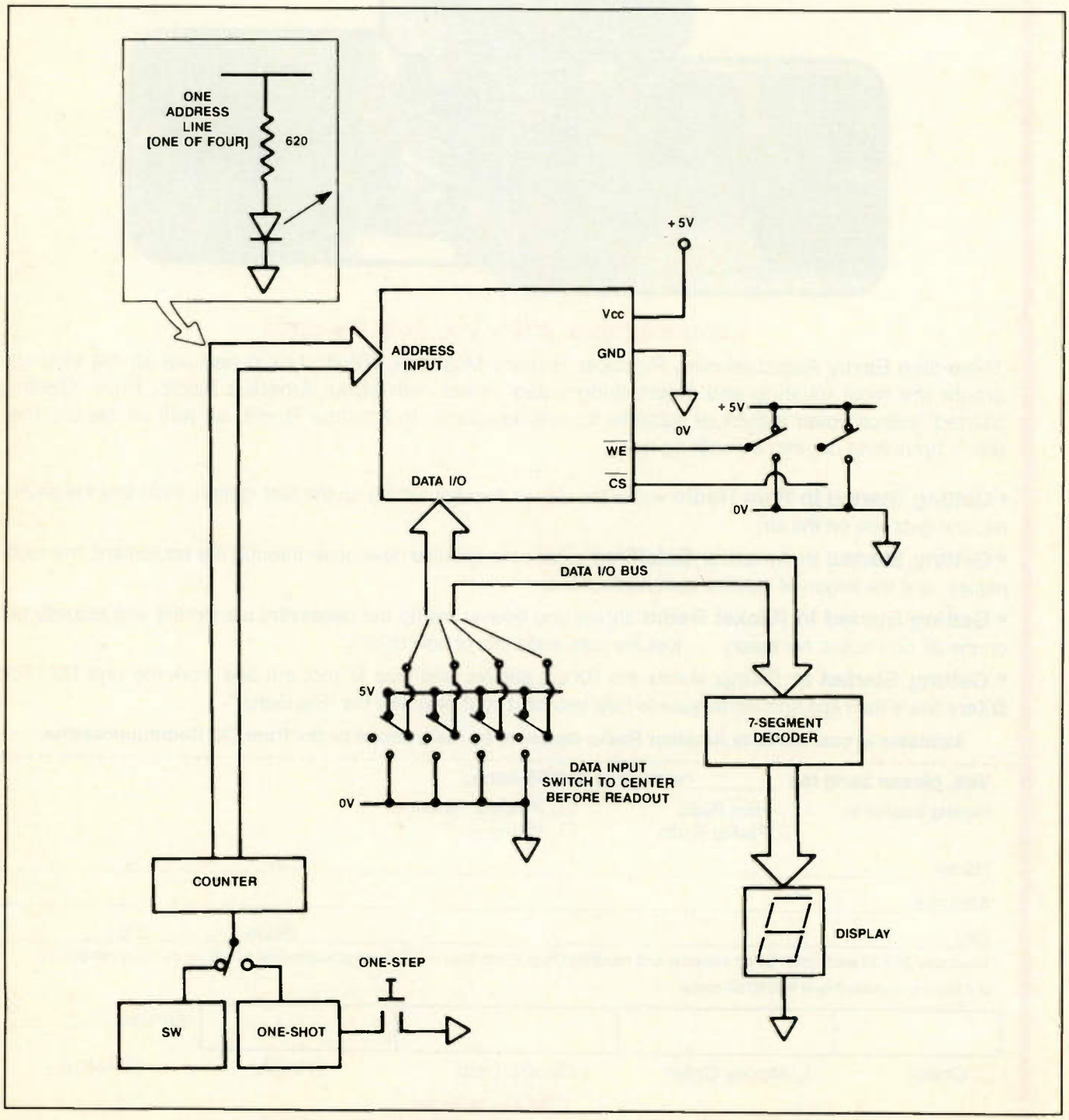


Figure 8.

TABLE II

Program For Loading Phone Number Into Memory

ADDRESS INPUT				DATA INPUT	REMARKS
A0	A1	A2	A3	I/O	
1	I/O 2	I/O 3	I/O 4		
0	0	0	0	0	
0	0	1	1		
0	0	0	1	1	
1	1	1	BLANK		
0	0	1	0	1	
0	0	1	9		
0	0	1	1	1	
0	0	1	9		
0	1	0	0	1	
0	0	1	9		
0	1	0	1	1	
1	1	1	BLANK		
0	1	1	0	0	
1	0	1	5		
0	1	1	1	0	
1	0	1	5		
1	0	0	0	0	
1	0	1	5		
1	0	0	1	1	
1	1	1	BLANK		
1	0	1	0	0	
0	0	1	1		
1	0	1	1	0	
0	0	0	0		
1	1	0	0	0	
1	0	0	4		
1	1	0	1	0	
1	0	1	5		
1	1	1	0	1	
1	1	1	BLANK		
1	1	1	1	1	
1	1	1	BLANK		

Procedure

Make a chart like Table II to show the addresses and corresponding data for each row of memory needed for your phone number. Set NOT CS to logic 1 to disable the memory I/O. Connect the four counter outputs to the address terminals as shown in Figure 6. Remember that two of the data lines and address lines on the memory are connected to logic 0 because they are not used for this setup.

The monostable output is switched to the flip flop counter so you can step through the rows one at a time.

Connect the data switches to the I/O lines. Then, set NOT CS to logic 0 (The NOT WRITE is also at logic 0).

You will select the addresses one-at-a-time as you load the memory. Use the momentary switch on the one-shot circuit to go from address-to-address. Set the address input to 0000 (no LED lighted). That puts you on the first row of memory. Set the data switches for the first number you are loading into memory—that's 0001 in the program of Table II.

Continue to load data into each line. When I performed this experiment I changed NOT CS to the logic 1 high-impedance condition each time I moved to a new address line. That's just an optional precaution.

After the memory is loaded *you must switch the data input switches to their no-connection positions before you go to the next step!!!* Switch the input of the J-K counter to the astable oscillator. Then, set the NOT CS and NOT WE inputs to read data out as shown in TABLE I.

The 7-segment display should show your phone number one digit at a time.

In the next issue we will compare the lab setup with a microprocessor system.

Build this tester for infrared remote controls

By Ricky Hall

Most technicians use a credit-card-size tester to test infrared remote control transmitters. This is a small white card that gives off a dim reddish light when it is illuminated with infrared light. In order to test a remote control unit, the user aims the remote transmitter at the card and presses a button. The user must be in subdued light, and must hold the remote close to the card in order to see the light it emits.

The light from these cards is difficult to see. This, coupled with the fact that these cards are small and easy to misplace, prompted me to find another method of testing remote transmitters.

Using a remote VCR controller as a tester

Some time ago I hit upon the idea of using a store bought device to do this job. This unit, called XTRA Link, allows the user to control a VCR from another room. The box at which the user aims the remote transmitter has an LED that flashes when the IR signal is being received from the remote unit.

With this tester I can get an indication of IR transmitter function from across the room, under normal light. This unit cost about $70.00. I used it for several years and wondered how other TV techs could do without one.

Building a remote control transmitter tester from reclaimed parts

Several times while I was troubleshooting the infrared remote control transmitter of a TV or VCR, I wondered if it might be possible to use the IR receiver from a remotely controlled product to make a tester. Every consumer electronics service center, including mine, has discarded TVs and VCRs in storage. Many of these units are remote control. Most of them have a small IR receiver with connections as shown in Figure 1: +dcV, output and ground.

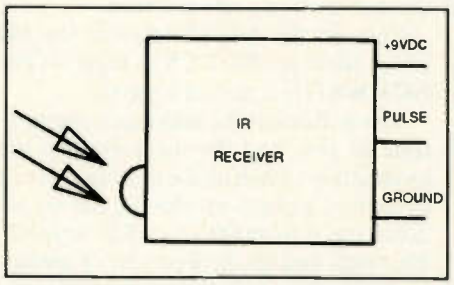


Figure 1. If you have a discarded TV or VCR waiting to be scrapped, you may be able to reclaim the IR receiver. Many of them have connections as shown here. IR receivers are also available inexpensively at stores that sell electronics components.

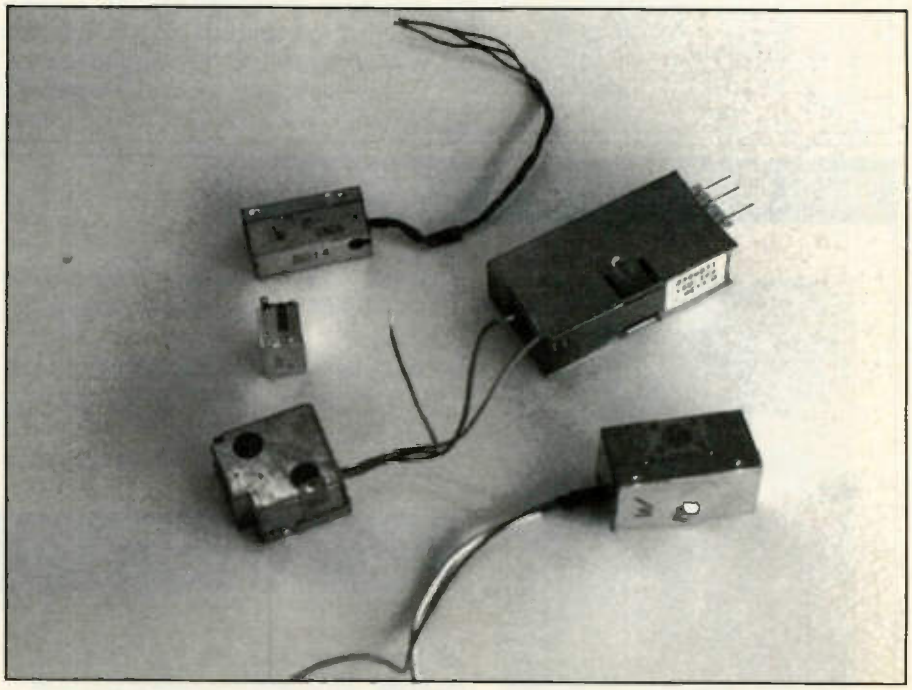
One day while doing some experimenting with an IR receiver from a TV, I hooked the cathode of an LED to the output, and the anode to the +9Vdc, and it worked. The LED was bright and it lit up or flashed depending on the output from the transmitter under test.

This tester works even better than the XTRA Link as a tester. That device would occasionally give false indications under certain light conditions.

Table 1

IR Receive	276-137	$3.49
High brightness LED	276-066	$1.19
Case (Box)	270-293	$3.99
9V Battery Clip	270-325	$0.26
SPST Toggle Switch	275-624	$2.29

Table 1. You can build the IR tester circuit in Figure 2 using the bill of materials shown here. The case has a compartment with a door that you remove to insert a 9V battery; a nice feature.



Many otherwise worthless TVs and VCRs may yield infrared receivers such as these that you may use to build an IR remote transmitter tester.

Hall is owner and chief technician at Hall's TV in Prentiss, MS

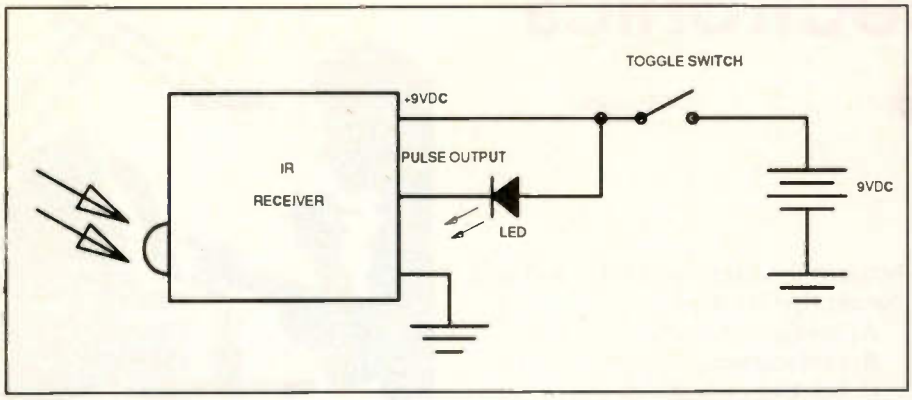


Figure 2. A simple circuit, as shown here, can put an IR receiver to work as an IR remote transmitter tester.

Technicians can find all the parts to build such a tester (except a box to put it in, and the 9V supply) inside old TVs and VCRs. I used an old TV antenna power supply box to put mine in. I built two units for my service center.

One of these units is powered with a 9V battery so I can take it on calls. The other unit is supplied by a 9Vdc power adapter from an old Atari video game. I put the unit that's powered by the adapter on a shelf and it stays on all the time. Whenever I want to check and see if an IR remote transmitter has an output, I just shoot it at the IR tester on the shelf.

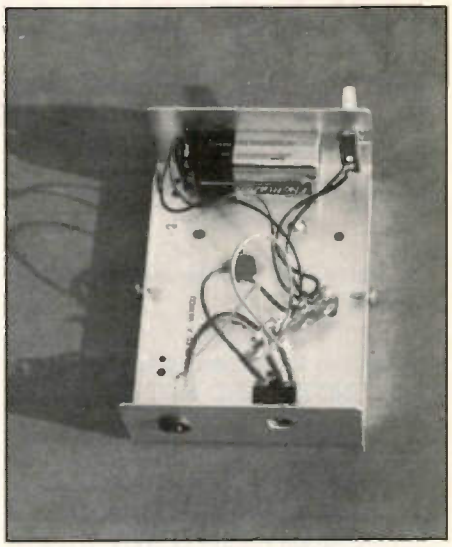
Building a tester from store-bought parts

You could also do what I did and build yourself a nice unit with parts from Radio Shack. I gave the one that I built to my brother, who is also a technician, for Christmas. It looked store bought, and I used one of those super bright red LEDs.

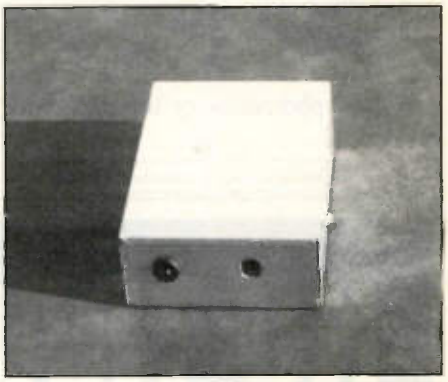
Table 1 is the list of parts I used from Radio Shack.

Evaluating the testers

I find that the IR receivers from TVs work best and are much brighter than the ones used from VCRs. The IR receiver that I built from the Radio Shack parts works super. ■



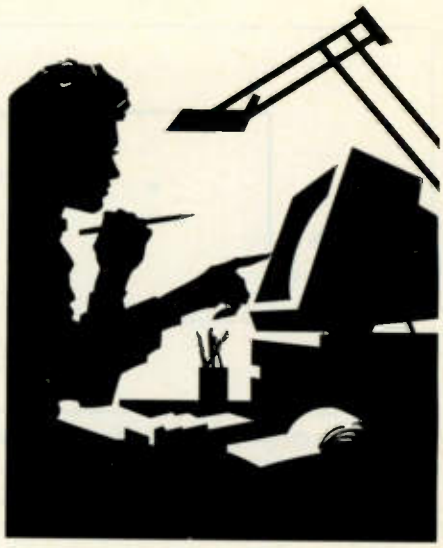
An infrared receiver from a TV or VCR can be combined with a dc voltage source, a switch and an LED to construct an IR remote transmitter tester such as this



This IR remote transmitter tester, constructed using a reclaimed IR receiver, in an antenna power supply box makes a professional-looking unit.

Test your electronics knowledge

By Sam Wilson, CET



1. Solve this simple math problem: $3 + 9 - 2 \times 4 \div 2$

2. Identify the theorem given by the following: NOT A AND NOT B = NOT A OR B

3. A certain N-channel MOSFET is operated in an amplifier circuit with a source-to-drain voltage of 300V. It is a/an _____MOSFET.

4. For the binary number 101010 the MSB is
   A. logic 1.
   B. logic 0.

5. In a photodetector the difference between the light current (I_L) and dark current (I_D) is called
   A. storage current.
   B. photocurrent.
   C. blanking current.
   D. (None of these choices is correct.)

6. A superheterodyne AM table-model radio has
   A. one detector.
   B. two detectors.
   C. no detectors.

7. Can you determine the fourth harmonic frequency of a 9.26 kilohertz pure sine wave signal?
   A. Yes
   B. No

8. How many radians are there in 72 degrees?

9. The DC collector current of a certain transistor is 150 milliamps and its DC emitter current is 160 milliamps.

   Calculate the value of beta.

10. In a resonant circuit the equation f_r/Q is the formula used to calculate the _____. ■

(Answers on page 63)

Wilson is the electronics theory consultant for **ES&T.**

The "Super Tuner"

By John Shepler

There is a new tuner on the market that has some unique features and an interesting history. Its unassuming designation is the Denon TU-680NAB. The NAB stands for National Association of Broadcasters and that's what makes it especially interesting.

The NAB is an association of AM and FM radio broadcasters that sets standards and helps to lobby for legislation favorable to station owners and radio listeners. Broadcasters have been feeling the financial pinch recently and fear that at least some of their woes are due to the degradation of receiving equipment, especially for the AM band. The NAB decided to fund a new receiver design to prove that radio broadcasting is up to the challenge of digitally recorded music and satellite delivered programming.

The new Denon tuner is a high performance AM/FM stereo tuner with remote control, selection for wide and narrow signal bandwidths to block interfering signals, and noise reduction circuitry. While the FM performance is impressive, what really sets this tuner apart from others is the advanced AM receiver section.

Shortcomings of AM

The AM band has been snubbed by most home stereo designers since FM became popular. While nearly every tuner permits tuning of both bands, the AM section has seldom been more than a copy of a small transistor radio design. With narrow bandwidth and high distortion, it is no wonder few people listen to their home stereos on AM.

The Denon tuner meets the new AMAX standard described in the February 1992 Audio Corner department. These include operation on the expanded AM band from 520kHz to 1710 kHz, AM Stereo, noise blanking, ability to use an external antenna, and frequency response out to 7.5kHz or more. In fact, the Denon tuner's response exceeds 9kHz, which requires close listening to distinguish from FM.

Why is AM band performance important? The AM band is capable of sounding just as good as FM. It offers the advantage of long distance reception and can work its way around tall buildings that are densely packed in downtown areas. However, due to poor quality receivers and lack of AM stereo standards, AM stations have seen their audiences for music programming deserting the band for FM. Now, the FM band is filled to overflowing while AM stations shut down for lack of listenership.

The AM band is capable of sounding just as good as FM

New AM standards

The crisis for AM broadcasters is what prompted the NAB to join forces with the Electronic Industries Association (EIA) to set new standards, including AMAX, and create a high performance "Super Tuner" to demonstrate how good both AM and FM can sound. The NAB funded design is expected to be produced by manufacturers other than Denon. It is hoped that this will be just the start of a movement toward higher performance radio receivers that can maintain FM listenership when satellite digital direct broadcast services begin, and revive the ailing AM band which now hosts mostly sports and talk show broadcasts.

Clear Channel AM stations may again be heard

While new receivers like the "Super Tuner" are needed to put the quality back in AM reception, much more is also needed. One of the problems that drove listeners from AM to FM was overcrowding on the band. This is being fixed by doubling the AM band and spreading out the stations, which will occur in the coming years. Clear Channel AM stations may again be heard all over the country at night.

Is digital the answer?

The FM band, though, is now nearly fully occupied with nowhere to expand. One answer may be adding digital broadcasting on the same channels. Current demonstrations show that digital and FM transmissions can co-exist on the same carrier, as long as the digital transmissions are reduced in power so they don't confuse the existing FM receivers. Another scheme uses every other channel for digital broadcasts in a given geographical area.

Perhaps the next "Super Tuner" we see will have more modes of operation. Instead of simply AM, FM, mono and stereo, the tuner of the future will have to accommodate AM analog and digital, FM analog and digital, mono and stereo, and even satellite and fiber optic cable. Now, if only the programmers can give us something new to listen to on all those channels. ■

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

Books

Prentice Hall's Illustrated Dictionary of Computing, By Jonar C. Nader, Prentice Hall, 540 pages, $24.95, paper.

This comprehensive, illustrated computing dictionary, includes official international standards, illustrations, tables and a style manual for correct usage of computer terminology. Over 150 people and 95 companies helped the author compile thousands of computer terms. Each entry describes the meaning behind the words, phrases, acronyms and abbreviations used in present day technology in a wide cross-section of business and industry. The book also highlights the history of the computer industry so that you can learn about the products, events, discoveries, inventions, and people behind the computer industry. The book looks to the future by covering new directions in database management, microchip technology, robotics, fiber optics and the use of satellites in information technology. The book covers a comprehensive cross-section of the computer industry: artificial intelligence, benchmarking, communications, desktop publishing, expert systems, fiber optics, graphic arts, hardware, information technology, JCL, keyboards, languages, memory, networking, operating systems, printers, query languages, robotics, software, typography, UNIX, virtual reality, and windows.

Prentice Hall, Simon & Schuster Education Group, Englewood Cliffs, NJ, 07632

Camera Maintenance & Repair, By Thomas Tomosy, Amherst Media, Inc., 176 pages, $24.95.

Camera Maintenance & Repair offers immediate, practical guidance aimed at readers, with or without experience, who want to repair their own cameras.

This book is a how-to for people who want to repair their cameras without learning the trade. It can also be used as an introduction by those who want to eventually become full-time camera technicians.

The author leads the reader through general chapters concerned with rules and precautions, design configurations and their characteristics, mechanical, optical and cosmetic cleaning, dos and don'ts and more. Instructions are made easy with 130 detailed photos and diagrams.

Section two gives a more detailed description of the examples given in the first section. Specific camera models are grouped into chapters based on the design configurations. The author covers mechanically controlled single-lens reflexes, mechanically controlled rangefinder cameras, electronically controlled single-lens reflexes, electronic lens-shutter cameras and medium format cameras.

Successful camera repair is possible using a few inexpensive hand-tools. Chapter 13 is dedicated to "Test Instruments You can Build." Using very little effort and spending only a few dollars, instruments frequently needed during camera repair can be built. The chapter on "Where to Find Parts and Supplies" leads the reader to possible sources for parts and supplies when they cannot be built or repaired.

This book includes special instructions for more than 175 camera models—from Agfa to Zeiss—which show the reader how to "get inside" and get working.

Amherst Media, Inc., Buffalo, NY 14207

Peter Norton's PC Problem Solver, Second Edition, By Peter Norton, Prentice Hall, 720 pages, $29.95.

Peter Norton is known for authoritative information written in an easy-to-read style. His *PC Problem Solver,* offers PC users answers to frequently asked questions and guides them to quick and direct solutions to everyday tasks and problems.

In only a few pages, nearly 200 discussions teach users what they need to know—how to use essential DOS commands, the DOS Shell, and Microsoft Windows to get complicated jobs done quickly and accurately. They also learn about configuring hardware, software, DOS, and Windows to all work together. Whole chapters are devoted to disk drives, printers, and communications. Users learn how to make their machines run faster and work more smoothly by using batch files, utility software, and optimization techniques. Plus, readers are shown how to avoid calamities like hard disk crashes, lost files, or computer viruses, and recover from misfortune when it does come their way.

This expanded edition has been updated to include the latest features in MS-DOS 5.0 and Windows 3.1. New material on memory management, laser printers, and networking through Windows are all highlighted.

Each of the book's 25 chapters begins with a short mini-tutorial that lets users understand how things work. A detailed index, extensive cross-referencing, and a comprehensive, plain English glossary help users find the information they need.

Prentice Hall, Simon & Schuster Business and Professional Group, Carmel, IN, 46032

Managing the Computer Power Environment: A Guide to Clean Power for Electronic Systems, By Mark Waller, Prompt Publications, 192 pages, $19.95 paper.

Prompt Publications, an imprint of Howard W. Sams & Company, presents Mark Waller's *Managing the Computer Power Environment: A Guide to Clean Power for Electronic Systems.*

This book provides background in electrical technology and computers to data processing specialists, field engineers, technicians, and computer network professionals. The author prepares you to manage the demons of electrical destruction by ensuring clean power for electronic systems with the coverage of the following subjects:

- Basic electricity—an elementary lesson on electrical power and its physics
- Quality power—the differences between what your computer needs and what the power company provides
- Utility power—variances and how to control them
- Buildings—the effects that a structure has on power and your computer
- Lightning, static, and noise—explanations and effective solutions for your computer problems
- Surge suppression devices and grounding—practical protection
- Standby power systems—ways to keep current flowing to your computer
- Personal computers and other office equipment—how to apply your knowledge of power to smaller systems
- Full glossary and index

Prompt Publications, Howard W. Sams & Company, Indianapolis, IN, 46214

Surges, Sags and Spikes, By Mark Waller, Prompt Publications, 240 pages, $19.95, paper.

Prompt Publications, an imprint of Howard W. Sams & Company, presents Mark Waller's *Surges, Sags and Spikes.*

Surges, sags, spikes, brownouts, blackouts, lightning, and other damaging electrical power disturbances can render a personal computer system and its data useless in a few milliseconds.

This book is written for all personal

computer users concerned about protecting their computer systems against a hostile electrical environment. In easy-to-understand, nontechnical language, it takes a comprehensive approach to solving computer power problems. Helpful diagrams and photographs are included to document computer power needs and solutions. Subjects covered in Waller's book include:

•Large and small computers—differences and similarities

•Basic electricity—an elementary lesson on electrical power and its physics

•Power problems—definitions and troubleshooting tips

•Quality power—the differences between what your computer needs and what the power company provides

•Lightning—how to protect your computer from the deadly phenomenon

•Static and noise—explanations and effective solutions for your computer problems

•Surge suppression devices and grounding—practical ways to insure protection

•Power-line conditioners—how to get clean power for the best computer performance

•Standby power systems and UPS—ways to keep the current flowing to your computer

•Full glossary and index

Prompt Publications, Howard W. Sams & Company, Indianapolis, IN 46214

The Right Antenna, By Alvis J. Evans, Prompt Publications, 112 pages, $10.95, paper.

Communication signals fill the air and are available to anyone, but it takes a properly selected and installed antenna to make use of them.

Television, FM, CB, cellular phone, satellite, and shortwave signals are all around you. *The Right Antenna* will show you that with the proper information and equipment you can access these bits of information to compete in an age where technology is the key. With easy to understand text and clearly illustrated examples, *The Right Antenna* will give you the confidence to select and install the antenna that will meet your needs.

The contents include: How antennas work, Selection of antennas for specific devices and applications, Complete installation instructions, Fringe area and MATV antennas, How to identify and eliminate interference, and Complete glossary and index.

The author of *The Right Antenna*, Alvis J. Evans, is an associate professor of electronics at Tarrant County Junior College in Ft. Worth, Texas. The author of many books on the subjects of electricity and electronics for both beginning hobbyists and advanced technicians, Mr. Evans teaches seminars and workshops nationwide to members of the trade. ■

Prompt Publications, Howard W. Sams & Company, Indianapolis, IN 46214

Test your electronics knowledge

Answers to the quiz *(from page 60)*

1. 8 – If you got the wrong answer you probably forgot the following rule in basic arithmetic: "Multiply first, then divide, then add, then subtract."

2. DeMorgan's theorem: Write it as

$$\overline{A}\,\overline{B} = \overline{A + B}$$

Remember the rule: "Break the bar and change the sign."

3. It is an enhancement MOSFET. So much for the idea that you can't get shocked in a transistor circuit!

4. A – The letters MSB stand for Most Significant Bit. It is the first bit starting from the left.

5. B – (By definition)

6. B – There are two places where heterodyning takes place: The first detector (converter or mixer) and the second detector (diode detector). That is why it is a superheterodyne receiver.

7. B – No - Pure sinewaves have no harmonics.

8. 1.2566 radians. There are π radians in 180 degrees, so,

$$72 \text{ DEGREES} \times \frac{\pi \text{ RADIANS}}{180 \text{ DEGREES}} = 1.2566$$

9. Beta = 15. The base current is equal to the emitter current minus the collector current. So,

$$\text{Beta} = \frac{150}{10} = 15$$

10. Bandwidth (f_2-f_1) by definition. ■

Products

Pocket fiber tester

Jensen Tools Inc. offers a pocket-size fiber optic cable tester that is simple and effective. The ST pocket Fiber Tester quickly checks continuity and attenuation of a signal to indicate proper or improper fiber optic cable assembly/termination, and is especially useful when terminating fiber cable in the field. The lightweight (5 oz.), 4.5 x 2.3 x 1", battery powered unit outputs a precise 800nm (nonlaser) test light, and reads out the signal strength at the other end of the cable on a graduated scale from -22dBm to -40dBm. Two ST connectors attach to like connector cables.

Circle (10) on Reply Card

Hand-held NTSC color generator

The Model 1221 portable television/video signal generator from *B&K Precision* generates fourteen patterns of stable video signals for comprehensive testing, servicing and adjustment of virtually all types of television and video equipment. Applications include video monitors (color or monochrome), CGA computer monitors, videocassette recorders, television receivers, closed circuit television systems and components and cable television systems. Suitable for field or shop use, it is small enough to fit into a field service kit.

Circle (11) on Reply Card

Digital storage interface

Huntron Instruments, Inc. announces the DSI (Digital Storage Interafce) 700, which brings digital storage capabilities to Huntron's Tracker 2000, an analog signature analysis instrument for troubleshooting electronic equipment. Based on the comapny's 5100DS technology, this unit scans electronic components to determine their analog signature, and then digitizes the signature and stores them on disk. This storage capability eliminates

the need for a physical reference board inventory and speeds the troubleshooting process. This allows Tracker 2000 customers to add digital storage capabilities to their existing instruments.

Circle (12) on Reply Card

Static eliminating air gun

The first self-balancing static eliminating air gun, the Silencer SE includes *Chapman's* patented self-balancing circuitry. The air gun is useful for cleaning and neutralizing static on objects of any shape. Designed for heavy duty industrial use, the gun is rugged cast aluminum with a reinforced ionizing point assembly. Suitable for ESD applications such as PC board assembly, the product maintains ±10V balance automatically, even when subjected to input power fluctuations. When tested in accordance with EOS/ESD standard 3.1, the Silencer's decay rate from 1000V to 100V is less than 1/2 second.

Circle (13) on Reply Card

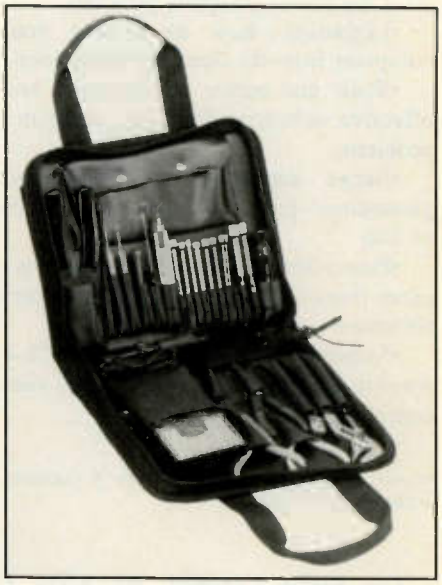
DMMs with bar graphs

Auto-ranging, auto data hold DMMs, with high LCD readouts and one-year warranties are featured in four new models from *American Reliance, Inc.* Model 33 is a 3-1/2 digit, 0.5% model with a 0.75" high LCD readout. It is fused at 20A with ranges of 200mV to 1000Vdc, 2V to 750Vac, 20mA to 20A and 200Ω to 20MΩ resistance. This also provides a diode and audible continuity check. Models 35 and 37 are 3-3/4 digit meters with 0.3% basic accuracy. They have a 0.67" high display with bargraph. Their frequency measurements are 100HZ to 600KHz, 400mV to 1000Vdc, 400mV to 750Vac, 40mA to 20A ac/dc and 400Ω to 40MΩ resistance.

Circle (14) on Reply Card

Electronic tool tote

Model CD-29, from *Chicago Case* is one of the Custom Designed Series featuring long-wearing Cordura. This look alike for soft-sided bags is really a Tool Tote. This case is for the supervisor or technician who uses a wide assortment of tools in various sizes. This case's overall dimensions are 13" x 10" x 2 1/2"; holds 29 tools, including a test meter. The outside pocket is expandable, the dimensions of the pocket are 11" x 10" x 2 1/2". The tote comes in either water resistant black or brown Cordura, with sturdy web handles and a heavy duty zipper.



Circle (15) on Reply Card

Diversified TechniGraphics, Inc. releases SX fusing assembly master repair kit

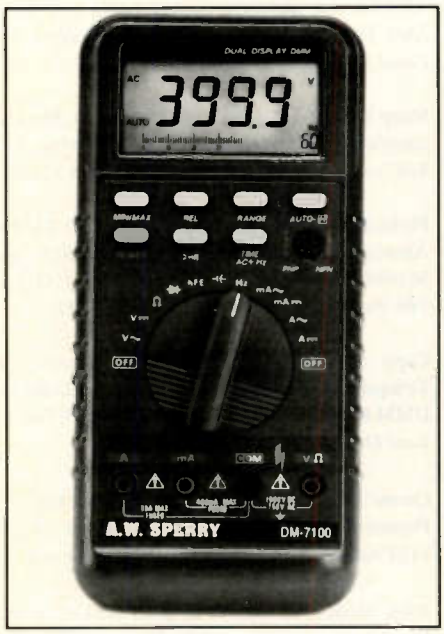
Diversified TechniGraphics, Inc. (DTI) has released a fusing assembly master rebuild kit for printer repair facilities. The kit contains all needed parts, tools, supplies, and a two-hour video with accompanying manual to accurately show how to repair the Canon SX fusing assembly.

About 60% of all laser printers on the market use the Canon SX engine. DTI also conducts laser printer repair classes at its facilities. On-site training can be arranged for corporations.

Circle (16) on Reply Card

Digital multimeter

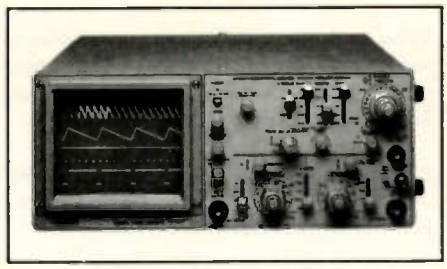
A.W. Sperry Instruments, Inc. announces the introduction of the 3 3/4 digit, Dual Display Digital Multimeter, DM-7100. This DMM, with dual display, offers 29 functions on 29 ranges including capacitance, frequency, continuity, analog bar graph display, min/max function, timer, auto\-hold, diode test, transistor HFE, simultaneous display of volts and frequency, plus auto off. Ranges include: 400mv/4v/40v/400v/1000vdc, 4v/40v/400v/750vac, 400mA/10Adc, 400mA/10Adc, 400mA/10Adc, 400Ω/4KΩ/40KΩ/400KΩ/4MΩ/40MΩ, 10-200KHz, frequency, 4nF-40μF capacitance.



Circle (17) on Reply Card

100-MHz oscilloscope

Leader Instruments Corporation announces a new addition to its oscilloscope family with Model 8100, a 100-MHz dual-channel unit featuring alternate sweep and 4-trace capability. Vertical sensitivity is 1mV to 5V per division in twelve ranges (bandlimited to 20MHz at the 1 and 2mV per division ranges). Triggering choices include separate TV H and V coupling for solid video observations, and a new VERT trigger-source selection that automatically selects the trigger source from the channel in use or sets up alternate trigger if the V mode is set to ALT. Trigger mode selections include AUTO, NORM and FIX. The latter tracks the trigger point within the peak-to-peak value of the signal to maintain stable triggering during large amplitude excursions. Single-sweep triggering is also offered to view single-shot events and for photo-capture purposes. Variable delayed sweep is offered with viewing options of the main or delayed sweep or both (ALT sweep), and a X10 MAGnifier extends the fastest sweep speed to 5 ns/div. X-Y operation is standard, and a CH-1 output jack on the rear panel facilitates the use of frequency counters and other instruments. Z-axis (intensity) modulation is accessible through a rear panel jack. ■



Circle (18) on Reply Card

Readers Exchange

Reader's Exchange has been reinstated as a free service.

The following restrictions apply to Reader's Exchange:

• Only individual readers may use Reader's Exchange, and items must be restricted to those that are ordinarily associated with consumer electronics as a business or hobby. If you're in business to sell the item(s) you want to offer for sale, the appropriate place for your messsage is in paid advertisement, not Reader's Exchange.

• Readers Exchange items must be restricted to no more than three items each for wanted and for sale, and may be no more than approximately four magazine column lines in length (about 20 words).

Send your Reader's Exchange submissions to:

Reader's Exchange
Electronic Servicing & Technology
76 N. Broadway
Hicksville, NY 11801

FOR SALE

Sencore SR68 100 watt stereo TV audio checker, like new, with leads and instruction book $200.00 Also, Sencore LC53 Z-Meter capacitor, inductor meter and analyzer with SER 224 checker, new leads with instruction book like new, $300.00 *Call 517-893-1354 for particulars.*

Sencore VC93 VCR analyzer with leads, instructions and original packaging worth $300.00 Asking $250.00 *Call Jill at 207-628-4701.*

New training tapes, "Ten Most Common VCR Electronics Problems," $20. Also, Nintendo repair $15, new books on CD & microwave repair. *Call 303-686-7250.*

Sencore TF-26 in or out of circuit transistor and FET tester. Touch tone. $65.00. *Dennis Soucy, 416 Belmont St., Manchester, NH 03103. 603-641-5793.*

Sams Photofacts 1 thru 1751—some missing. 476 in all, 20 new binders. Also, complete set of Riders 1-16, all in binders. All **Electronic Servicing & Technology** from 1967 to date—$499.00 or offer. *Al Nikora, 5298 Argyle Ct., Sterling Hts., MI 48310. 313-268-6938.*

Sencore VC-93, all cables. manuals, never used. $2200.00 or best offer. *Call Art 707-226-6235.*

Sams Photofacts 381—1400, best offer. Sams 2572-2577 never used $50.00 *Steve Mack, 1335 Ave., F, Billings, MT 59102. 406-245-0799.*

Sencore equipment, good condition. Best offer. Send an S.A.S.E. (legal size) to *Fred Ingersoll, G.I. Electronics, 6845 Lathers St., Garden City, MI 48135.*

Sencore SC61 with probes $1500.00; VA62 video analyzer with VCR test accessory, test pattern generator and stereo/SAP tester, all just $1200.00! 10 years of accumulated audio and VCR service manuals $500.00. Misc. test gear. *Call Paul at 805-995-2046.*

Video heads, upper & lower drum assemblies for Samsung VR-2640, Funai FLC 1100, and Magnovox VR9720A. Also, complete LLoyds L838 unit for sale. *Call Jackson VCR at 205-643-5906.*

Singer-Gertsch FM10Cs, excellent, $300.00. Will consider trade. Seeking old-time radios and test gear. *Al Pratt, 114 Lakeview, Milwaukee, 53217.*

Heath 40MHz dual trace scope. 1 yr. old, like new. Includes 2 switchable probes—not a kit. $400.00 plus shipping. *619-949-1435. Ken after 5 PM. PST.*

Almost new Sencore SG165—AM/FM stereo tuner analyzer, and power amplifier analyzer. Includes manuals, box, and test leads. All in one unit—designed to make your audio troubleshooting easy. List $2495.00—offer price $1450.00 or best offer. *Jim, 1199 Partrick Rd., Napa, CA 94558. 707-224-4566.*

Just like new Leader LBO-515B-30MHz dual trace, delayed time base oscilloscope. Includes manuals and probes. Use in lab or field service. Very sensitive and stable. List $3495.00 Offer price $2,200.00 or best offer. *Jim, 1199 Partrick Rd., Napa, CA 94558. 707-224-4566.*

Sencore SC-61, SG165. B&K 1822—other. Best offer. *Call Vance Knight at 912-764-4866 anytime. 300 Mobley Dr., Statesboro, GA 30458.*

Many 'Rider' manuals incl. TV. Also, collection of reel-to-reel tape recorders, VM, Sony, Utter Martel, etc. Motorola Model 7V TV. *Robert Christie, 2885 E. Beltline N.E., Grand Rapids, MI 49505.*

Sencore VA62 with cover, VC63, NT64, TP212 for $2500.00 Sencore SG165 AM/FM stereo analyzer $1000.00 All in excellent condition, used only once. *Call John 201-432-7635.*

Sencore SC61 excellent condition. $895.00 or best offer. Photofacts and VCR facts for sale. Closing shop, must sell everything. Also have 35MHz scope and some meters. *Call Marc, 603-434-0041.*

Approximately 300 tubes, new and used, from 1930s to 1960s. Specify era, etc., all for $160.00, or send SASE for list and details to *O. Sellers, 7308 Franklin Dr., Bessemer, AL 35023.*

Sencore VC93—$2400.00, LC76-$1,000.00. Both like new with original leads, instructions and packaging, both $3200.00. Call *513-842-9909—Larry.*

WANTED

Midland VCR schematic or service literature, model #15-938, copy O.K. *Dwain Close, 223 Cooper St., Cato, NY 13033. 315-626-2508.*

Old wooden tube table model radios—tubes—literature on early radio—TVs—predicta Philco TVs, transistor radios, *Maurer TV, 29 South 4th St., Lebanon, PA 17042.*

Sencore CM2000 computer monitor analyzer. *All-Tronix & TV Svc., 1364 S. 33, Lincoln, NE 68510. 402-476-8164.*

RF Mod for Sears VCR 934.53130250. Also crosses to RCA VJT250 or Hitachi VT11A. *Anchor VCR service, 2219 Reo Dr., San Diego, CA 92139. 619-267-9001.*

NEC Bipolar analog IC data manual that has UPC1701 in it. Pay $30. *Mr. Chou. 714-669-4114.*

Power Transformer for Eico 950B Cap/Res Comparator P/N 30005, manual set for Tandy model 16B Xenix 15mb HD system, Jensen Car Stereo ATZ500 vol, seek/scan control panel (left-side). *LMS Electronics, 11241 Northwest Seventh St., Coral Springs, FL 33071.*

Sharp DX-620 CD player: working or not. Must be complete. *Call Chris at 619-479-8401 or write: S.C. VonTersch, 2219 Reo Dr., San Diego, CA 92139.*

Flyback transformer part no. 79D 200-1A for Admiral TV, flyback transformer part no. 3619690001 for Philco TV. *Brown's TV, P.O. Box 146, Peterstown, WV 24963.* 304-753-9549.

Copy of service manual and schematic for Telequipment oscilloscope #S-54A, Datatech DMM #30L—will pay. *Fred DiMasi, 4179 Timber Lane Dr., Allison Park, PA 15101.*

Owner's manual for Castle Master Subber Mark V. Photocopies are OK. *Carlos Urbina, Calle 14 No. 1128 Norte, Torreon, Coahuila 27000, Mexico.*

B&K Model 177 VTVM in good working order. User and/or service manual for Leader 1021 Scope, Xerox OK. *Lee, 202-686-1620.*

Need service manual for JC Penney stereo amplifier model 683-3835-8903. Will pay for copy or original. *Main TV, 615 9th Ave., Longmont, CO 80501. 303-776-6955.*

Need tuner for Akai model AR-R30 stereo AM/FM receiver and varactor tuner for Quasar model WL 9578RP tuner #77-13851A01. Call 517-893-1354 or write *Sea & Shore Electronic's Service, 1045 Heavenridge, Essexville, MI 48732.*

Horizontal centering pot for GE KE chassis, GE part #EU49X486; Centrarlab part #WT-10, WSK-104, Clarostat part #NPW-10; Mallory part #MR10T, MRS1250, MRS1563. *Mr. William Suhy, 309 Terrace Ave., #12, West Haven, CT 06516. 203-933-8386.*

Photofacts and specialized books: AR, CB, HTP, MHF, SD, TR, TSM, VCR. A.G. *Tannenbaum, P.O. Box 110, E. Rockaway, NY 11518. 516-887-0057.*

Schematics for a color TV Sears model 564.4260050 and for a color TV Wards model JSA-1229. *James Gregorich, 117 Second St. No., Virginia, MN 55792.* ■

Classified

Classified advertising is available by the word or per column inch.

By-the word. $1.65 per word, per insertion, pre-paid Minimum charge is $35 per insertion. Initials and abbreviations count as full words. Indicate free category heading (For Sale, Business Opportunities, Miscellaneous, Wanted). Blind ads (replies sent to ES&T for forwarding) are $40 additional. No agency discounts are allowed for classified advertising by the word. Contact Emily Kreutz at 516-681-2922 to place your classified ad (by-the-word). Mastercard, VISA, American Express are accepted for phone or mail orders. Or send your order, materials and payment to **Emily Kreutz, 76 North Broadway, Hicksville, NY 11801.**

Per column inch (classified Display): $235 per column inch, per insertion, with frequency discounts available, 1" minimum, billed at 1/4" increments after that 10" maximum per ad. Blind ads are $40 addition. Reader Service Number $25 additional to cover processing and handling costs. (Free to 4-inch or larger ads.) For more information regarding classified display advertising please contact Jonathan C. Kummer at 516-681-2922. Optional color (determined by magazine) $150 additional per insertion.

FOR SALE

REDUCED 85%. Diehl Mark III $69, Diehl Mark V Horizontal circuit tester $179. New. Conductive coating for remote control keypads $9.99 ppd. WEEC, 2805 University Ave., Madison, WI 53705. 608-238-4629, 608-233-9741.

LARGEST SELECTION of original TV & VCR IC's and transistors. Lowest Prices. Call or write for free catalog. **PRELCO ELECTRONICS**, 605 Chestnut Street, Union, NJ 07083, 908-851-8600.

TV CASE HISTORIES: Booklet with 1,750+ histories. Satisfaction assured. Only $35 (first-class shipping add $1.50). Mike's Repair Service, P.O. Box 217 Aberdeen Proving Ground, MD 21005. Same mailing address 29 years. Send SASE for samples.

THE ONLY ANSWER TO REPAIRING ELECTRONICS PROFITABLY (this should have been done years ago) **GET SMART!** Someone somewhere has already repaired your next repair **YOUR TOP TECHNICIAN,** who's training you have paid for **JUST LEFT TODAY! YOU'RE THE BOSS** and now you have to put on your old rusty technician's cap. **TODAY YOUR BANK** sent you three NSF checks your customers so graciously gave you, and you don't have time to chase them down to collect, **THEY LEFT TOWN. IT'S TAKING YOU LONGER** to assess the repairs and your customers are now coming to collect their units. You promised to give them a **FREE** estimate, but you just realized you don't have a schematic or time to do it. **NOW YOU ARE DOING NIGHT REPAIRS** because during store hours the phone rings off the hook with nuisance questions about setting VCR clocks and you have parts to order, bills to pay and service literature to file. **CIRCUIT CITY JUST MOVED IN** and your wife say's there's no money in repairs **FRIEND!! YOU DEFINITELY HAVE AN EMERGENCY!!** 10,000 repairs 1987 through 1992 with annual updates. References available on request. **I CAN ASSURE YOU THESE TECH-TIPS ARE NOT DUSTY OLD REPAIRS YOU'LL NEVER SEE.** Other programs don't even come close to comparing. **CALL NOW (305) 474-2677 FOR A "FREE" DEMONSTRATION DISK OR PAPER FORMAT** or mail request to **TV-MAN SALES & SERVICE, 8614 SR-84, FT. LAUDERDALE, FL 33324**

ZENITH 9-516/517 MODULE CURE: Repair easily yourself and save! For instructions send $15.00: TEK ENTERPRISES, 702 Overland Avenue, Wilmington, Delaware 19804

FOR SALE: SENCORE OSCILLOSCOPE, Model SC61 with probe. Approximately 4 years old. Excellent condition. Asking $1995.00. Call 1-800-825-4641 9am to 5pm EST M-F

ATTENTION CONSUMER ELECTRONICS TECHNICIANS! "The Dog Catcher" is a new program which gives instant access to the largest repair tips from a network of America's finest technicians. Monthly updates, and your own tips can be added to the database of VCR, Camcorder, TV and Stereo repairs. Take advantage of the introductory price now! $99.95 DataBasic 1-800-967-5924.

COMPUTER AIDED TV/VCR REPAIR SOLUTIONS: 5 1/4" IBM compatible disks, 1,000 VCR, Printout $83, Disks $72. 5,400 TV, Printout $135, Disks $113 (Harddrive). Add to or quick scan by chassis, model and stage. Two solutions pays for it. Electronic Solutions, 407 W. Ave. "N", San Angelo, TX 76903.

VHS-VCR Repair Solution Sets I, II, III IV, V, VI, VII. Each contains 150 symptoms and cures, updated cross reference chart, free assistance, $11.95 each, all seven $69.95. Schematics available. Visa/MC. Eagle Electronics, 52053 Locks Lane, Granger, IN 46530.

TV-VCR SHOPS: Now fix those tough dogs! A package of over 2800 fixes on disk. ASCII or data for popular data bases. (PFS, QA, etc.) One fix could pay for all. Only $99.95. TECHDAT, 212 Earth Row, Waynesville, MO 65583. To order call 1-800-280-2100. VISA & Mastercard Accepted.

BUSINESS OPPORTUNITIES

SUNNY WEST COAST FLORIDA: Busy TV, VCR, stereo repair. Major warranties. Repair all brands. Before 5:00 pm, 813-823-5415, after 6:00 pm, 813-528-0375

ESTABLISHED SERVICE SHOP, good reputation, great potential. Will sell all or possibly partner with the right person. Central WV 304-269-7850

SOUTH FLORIDA SERVICE BUSINESS: 20 years established. Sencore equipped. Sams and factory manuals, parts, etc. Must sell. $20,000. 305-652-8700.

MOVE TO SUNNY SOUTH FLORIDA: Owner retiring. Fully staffed in largest growth area of Ft. Lauderdale. Established 12 years, no competition. Authorized 15 major brands. 100 percent computerized. Simple to operate business. Owner financing available. Call for details 305-474-3588.

VCR CLINIC IN COLORFUL COLORADO: Near I25 and Rocky Mountain National Park. $37,900 includes building with small apartment, parts, equipment and training tapes. Will train. Call 303-686-7250. Video Master Company, 509 Main Street, Windsor, CO 80550. ■

Manufacturers Parts and Literature Directory

This monthly section is sponsored by manufacturers to help you find the parts and technical literature needed to service their equipment. Call them for replacement parts or for the name of their nearest distibutor.

Hitachi Home Electronics 401 W. Artesia Blvd. Compton, CA 90220 800-HITACHI	**Mitsubishi Electronics America** 5757 Plaza Drive Cypress, CA 90630 800-553-7278 fax 800-825-6655	**NEC Tehcnologies** 1255 Michael Drive Wood Dale, IL 60191 800-366-3632
Panasonic 50 Meadowlands Parkway Secaucus, NJ 07094 800 545-2672	**Philips ECG** 1025 Westminister Drive Williamsport, PA 17701 800-526-9354 fax 800-346-6621	**Quasar** 50 Meadowlands Parkway Secaucus, NJ 07094 800-545-2672
Technics 50 Meadowlands Parkway Secaucus, NJ 07094 800-545-2672	**Thomson Consumer Electronics** 2000 Clements Bridge Road Deptford, NJ 08096 800-257-7946 fax 800-524-1498	**Zenith Electronics Corp.** 1900 N. Austin Avenue Chicago, IL 60634 312-745-2000

Call Jonathan Kummer at 516-681-2922 to reserve space in this special section.

MOVING?

If you're planning a move in the near future, don't risk missing an issue of *Electronic Servicing & Technology*. Please give us 6-8 weeks notice if you're planning on changing your address. Just write in your new address below and mail this coupon, WITH YOUR SUBSCRIPTION MAILING LABEL, to:

Electronic Servicing & Technology
Subscriber Services
76 North Broadway
Hicksville, NY 11801

Name _____
Address _____
City _____
State _____ Zip ____

Advertiser's Index

We'd like to see your company listed here too. Contact Jonathan C. Kummer to work out an advertising program tailored to suit your needs.

SALES OFFICE

Phone: (516) 681-2922
FAX: (516) 681-2926

Jonathan C. Kummer
Advertising Manager

Emily Kreutz
Sales Assistant

PHILIPS TECHNICAL TRAINING

Leading Supplier of Hi-Tech Training

software training packages

Philips is working hard to make your job efficient through software that helps you quickly access part numbers, service tips, service procedures, service training adjustments, and schematics.

PART #	DESCRIPTION/PRICE
*(ST1439)	**Parts Pricing and Cross Reference** *order now* **$49.95**
*(ST1443)	**SmarTips** *order now* **$99.95**
*(ST1488)	**VCR Cross Reference** *order now* **$9.95**
*(ST1442)	**Update #1 for FixFinder Program** *order now* **$49.95**
*(ST1498)	**Update #2 for FixFinder Program** *order now* **$49.95**
*(ST1499)	**PartSeeker Complete Parts Lookup** *order now* **$89.95**

5.25HD	5.25DD	3.5HD	3.5DD
-0120	-0360	-0144	-0720

*Add the appropriate four-digit number to indicate disc size.

Hands-On Troubleshooting Training Classes

Philips Technical Training has many generic hands-on courses to choose from. We cover a wide variety of consumer electronics technical training topics. Included are courses in the repair of VCRs, CDs, Cameras, and Switch Mode Power Supplies. Our training classes are offered in major cities throughout the United States.

video tape training packages

Improve servicing techniques at your own pace with Philips Technical Training Video Tape Packages. Valuable troubleshooting and service information are there when you need them.

PART #	DESCRIPTION/PRICE
VT-129	**What's New for 1990/1991 TV** *(67 min.)* **$34.95**
VT-131	**What's New for 1991/1992 TV** *(73 min.)* **$34.95**
VT-140	**What's New for 1992/1993 TV** *(60 min.)* **$34.95**
VT-119	**Magnavox VR9668 VCR Drive Mechanism "G" Chassis Service Tape** *(51 min.)* **$44.95**
VT-135	**8mm Mechanical Maintenance and Electrical Alignment (CVM710, 720)** *Available soon* *(51 min.)* **$35.00**
VT-137	**H2 Mechanical Maintenance** *(32 min.)* **$34.95**

Servicing Tools

Philips Technical Training can upgrade your VCR workbench. We offer the tools necessary for economical camera service.

- Light Box with Four Transparencies ..... $625.00/*$499.00
- Greentron Vectorscope Generator ..... $425.00/*$390.00
- Blue Filter $9.95

*Price break for those who attend training.

To order your Catalog or to receive the latest Training Flyer, Call, Fax, or Write

615-475-0044 FAX: 615-475-0221

Philips Technical Training
401 East Old Andrew Johnson Hwy.,
Box 555, Jefferson City, TN 37760

PHILIPS

Circle (76) on Reply Card

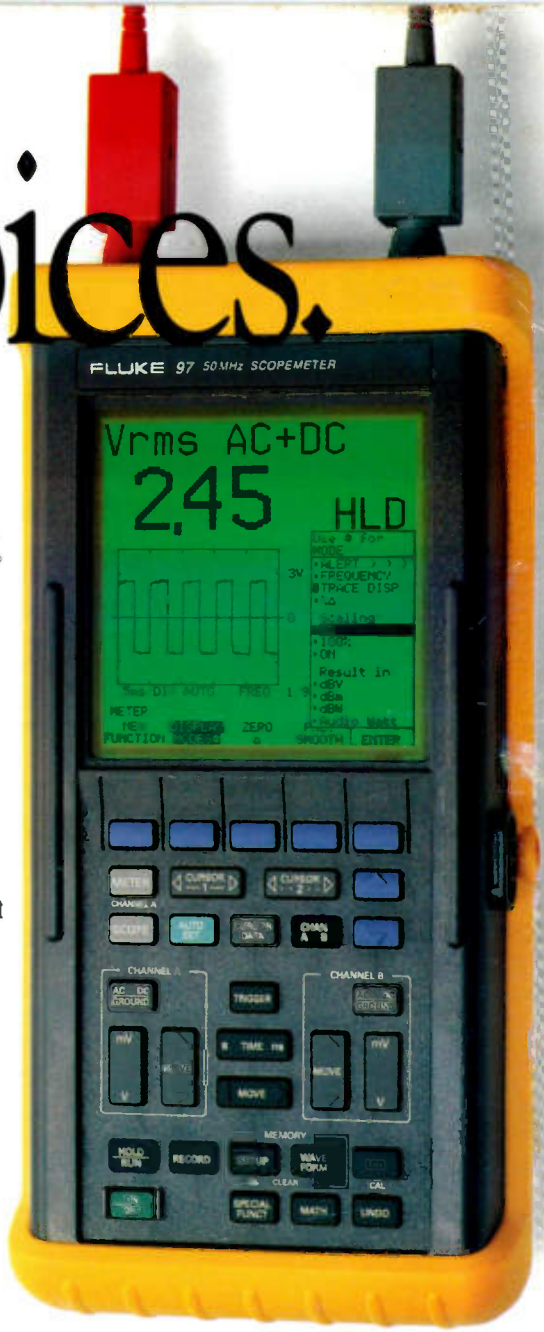
Top Choices.

Fluke meters are your top choice for accuracy, reliability, and performance. They offer more combinations of features and functions than any other meters on the market. Features like true-rms measurements, high resolution, Smoothing™ and Peak Hold. Or simultaneous scope and meter functions in one portable package. Whichever Fluke meter you choose you can count on benchtop accuracy, test lab versatility, and handheld convenience.

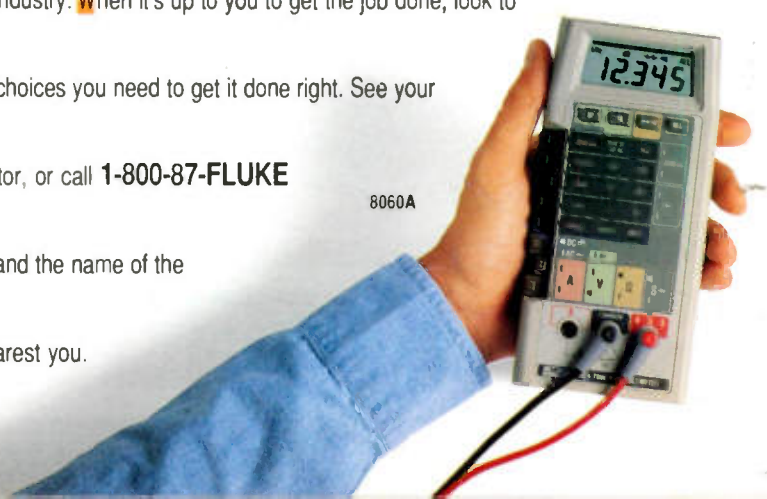
Plus, Fluke keeps you covered with a full line of quality accessories, strong customer support, and product warranties that measure up to any in the industry. When it's up to you to get the job done, look to Fluke for the choices you need to get it done right. See your Fluke distributor, or call **1-800-87-FLUKE** for a catalog and the name of the distributor nearest you.

Fluke 87

Fluke 79



Fluke 97 ScopeMeter®



8060A

FLUKE 79	FLUKE 87	8060A	FLUKE 97
The Fluke meters listed above feature diode test, auto and manual range, continuity, and frequency measurements.			
Lo-Ohms measurements	True-rms	True-rms	True-rms ac, or dc & ac
Capacitance measurements	Capacitance measurements	Resistance measurements to 300 MΩ	Scope, Meter or simultaneous meter and scope display
Smoothing™	Duty Cycle measurements	High-impedence DC voltage function	Dual Trace 50 MHz bandwidth
4000 count display	20,000 count high resolution display	20,000 count display	40 nanosecond glitch capture
Basic accuracy 0.3%	Offset/Relative reference	Offset/Relative reference	Store waveforms and setups
	1 millisecond Peak Hold	dB measurements	dBm, dBV, dB Relative and Audio Watt calculations
	Basic accuracy 0.1%	Basic accuracy 0.04%	Basic accuracy 0.5%

John Fluke Mfg. Co., Inc.
P. O. Box 9090, Everett, WA 98206
For more information call:
(416) 890-7600 from Canada
(206) 356-5500 from other countries

Ad No. 00282

FLUKE®

Circle (21) on Reply Card

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

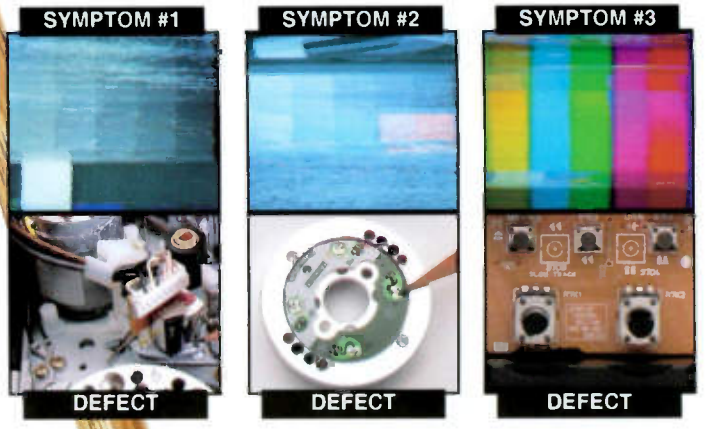
ELECTRONIC Servicing & Technology™

FEBRUARY 1993/$3.00

Computer software for service center management

Where are they now? • On site servicing

Frustrated With Servicing The "Tough Dog" VCRs?



Are You Ready For Today's VCR Challenges?

You know the scenario all too well. A customer brings in a VCR for service with the simple complaint that the picture is noisy. But down deep in the pit of your stomach you wish it would be something else, maybe "It won't load a tape, or it won't rewind". You'd even wish the customer would have said "it plays for a few seconds and then stops".

But a noisy picture, that could be anything from a problem in the servos to bad video heads, or a tape path alignment problem, to a defect almost anywhere in the luminance circuits.

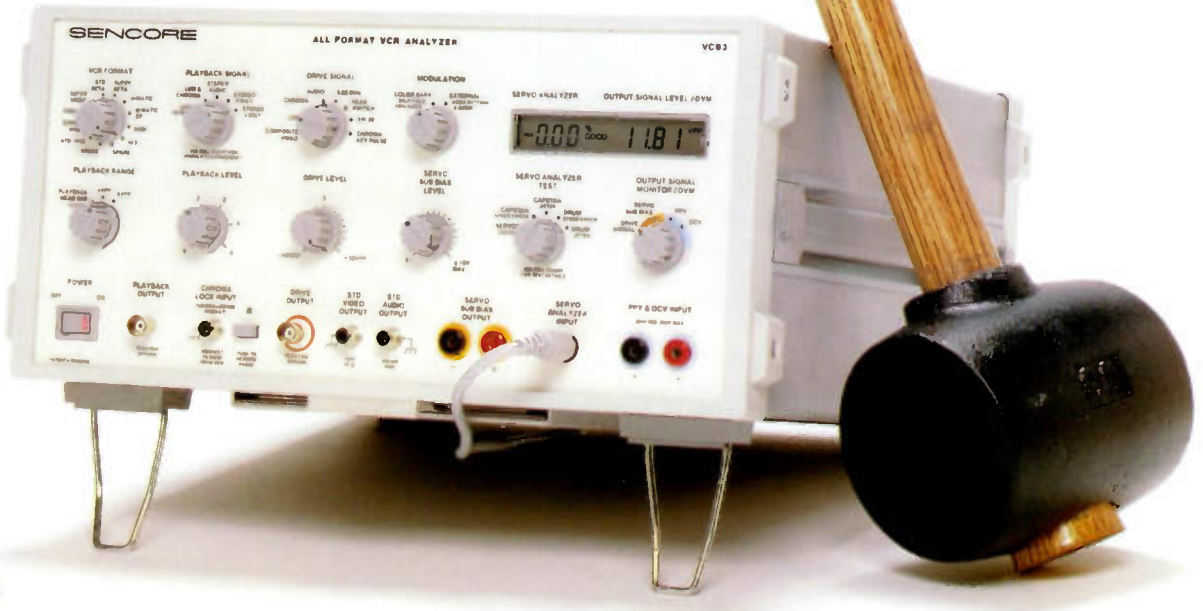
What do you do after you've carefully and thoroughly cleaned the heads - several times – only to find that the same symptom has not gone away?

What would you do next if you had one of these VCRs in your shop?

- Inspect the heads further?
- Check the servos?
- Give the customer a high estimate?
- Order new heads?
- Suspect a mechanical problem?
- Other?

Are you equipped to profitably service today's VCRs and camcorders? Sencore's new VC93 All Format VCR Analyzer answers the technical troubleshooting challenges you face when servicing VCR/camcorder playback and record circuits.

If you'd like to see exactly how the VC93 can help you troubleshoot the three symptoms above, call 1-800-SENCORE and ask for your FREE video tape demonstration.



VC93 All Format VCR Analyzer

TECH CHOICE SYSTEM

With the VC93 All Format VCR Analyzer...

Now, You Can Isolate Any Playback Or Record Problem In All VCRs, In Less Than Half The Time It Presently Takes!

- Equip your bench for servicing all consumer VCRs with the only all-format VCR analyzer.
- Eliminate guesswork with dynamic VCR head signal substitution for all consumer formats.
- Quickly isolate Hi-Fi stereo audio problems with exclusive Hi-Fi stereo head signal substitution.
- Pinpoint any luminance, chrominance, or audio problem with phase-locked analyzing signals.

Circle (95) on Reply Card

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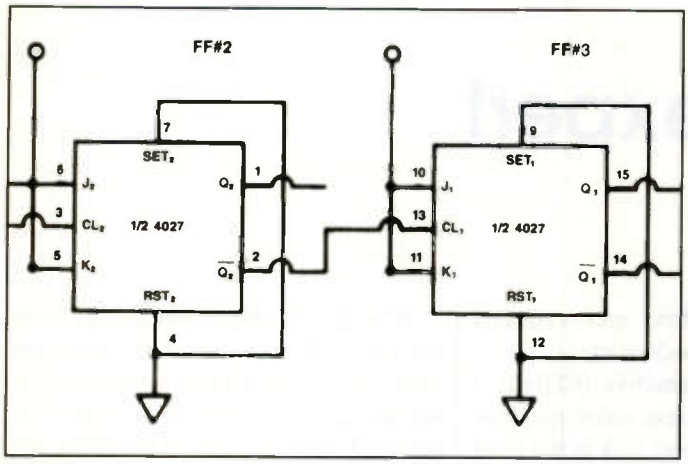
Contents

Volume 13, No. 2 February 1993



page 56

page 63

FEATURES

DEPARTMENTS

ON THE COVER

Every consumer electronics service center has a great deal of administrative work: filling out forms, preparing claim checks, keeping track of the status of each product being serviced, making out the bills. An inexpensive personal computer with the right software can perform most of these tasks, freeing technicians and managers to perform their tasks more efficiently. *(Photo courtesy Sencore).*

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING
ELECTRONIC
Servicing & Technology

The computer as expert

The first computer built in the United States was used to compute trajectories for artillery. This information was computed, then arranged in tables so that the U.S. military knew how to aim its guns in order to hit a distant target.

This computer, ENIAC, for electronic numeric integrator and calculator, was programmed by expert mathematicians and their helpers, as the computations were being done, by rearranging wires that connected parts of the computer.

The computer was a huge affair, made up of vacuum tubes, consumed a great deal of electrical power, and because of the low reliability of tubes, it failed regularly.

But it did its job and it did assist the war effort.

Today, no doubt, a microcomputer could do the entire job much faster. And, in fact, no doubt, a microcomputer built into an artillery piece could instantaneously compute or look up a trajectory based on input data and set its own angle of fire. But then that would probably still be less sophisticated than the military weapons that currently exist.

As computers, which are now tiny, and which can now store their programs internally, increase in power, and memories continue to shrink in size and grow in capacity, computers and the software written for them, continue to become, increasingly, a part of our lives; frequently in ways in which their existence is not evident.

For example, most high end TVs, VCRs and camcorders have a microprocessor or two in them. The fax machines that over the past three or four years seem to have appeared everywhere would not be possible without microcomputers. The entire concept of compact disk requires computers to convert the music information to digital bits that are recorded on the disks, and to convert the bits on the disk back to music.

Compact disk interactive (CDI) is a method of recording text, voice, graphics and music on a compact disk in the form of digital bits. In some of these cases, the idea of software gets a bit murky. For example, in the case of CD there's software in ROM (read only memory) that directs the operation of the player, then there's the "software" on the disk that is converted to music in the case of CD, or text, music, etc., in the case of CDI.

Another place you'll find tiny computers and their software is in the cellular telephone.

And of course, all of those video games: Nintendo, Sega, Genesis, are nothing more than tiny computers that use the software contained in those game cartridges to create the pictures and sound that keep the kids entertained for hours on end.

As the power of computers continues to increase, the memory capacity continues to expand, the price of the hardware continues to decrease, and the sophistication of the software continues to increase, more and more tasks can be performed by computer.

We have reached the point where, in many cases, the cost of the computer hardware is no longer an issue. The cost of the computer is so low that it is an insignificant part of the overall cost of the product, and in many cases it's even less costly than the less versatile, less functional, hardware it replaces. The cost of much of the software is also becoming less.

Technology is at a point now that nearly every process that can be economically realized by a computer and the appropriate software is either being done by a computer or being studied for possible computerization.

With this level of computerization, there is hardly a consumer electronic service center that couldn't benefit from automating their operations. A powerful personal computer such as the 386 or 486 along with, say, 4 megabytes of memory and a hard disk drive capable of storing 100 megabytes or more of memory can be purchased for around $2,000. The software can be purchased for anywhere between a few hundred and a few thousand dollars.

And for the most part, the software has been written either by people who are service technicians or managers, or by software experts working closely with service technicians and managers. Because of this, much of the software is intuitive, and so requires little training to make it work.

And one thing that most users find out is that, on balance, using a computer to manage the business doesn't cost; it pays: in reduced paperwork, more efficient tracking of products through the service process, readily availability of service information such as technical tips.

In essence, computerization allows a company to benefit in several ways: applying a good software package, or a combination of software programs, is like hiring an expert manager, a file clerk, an experienced technician and more.

Today's computers are everything that first computer was not: small, energy efficient, reliable, affordable, simple to operate. And while that first computer required that the programmers be there at the site to do the programming, today's stored program computers allow that programming expertise to be recorded on a floppy disk and made available to anyone who wants to buy it.

Nils Conrad Persson

News

Field test of long distance HDTV broadcast

Zenith and AT&T demonstrated that digital high-definition television (HDTV) broadcasting can bring high-quality, snow-free, interference-free TV pictures to a broader service area than conventional TV broadcasts. In the first long-distance over-the-air field test of an all-digital HDTV signal, Zenith and AT&T conducted a broadcast from a TV station in Milwaukee 75 miles to Zenith's technical center in Glenview, Ill.

The late-night field test of the "Digital Spectrum Compatible" HDTV system, broadcast on Milwaukee Public Television Station WMVT Channel 36, was the first ever terrestrial broadcast of digital TV signals using low power over long distances. The test also showed that digital HDTV can provide high-quality, noise-free pictures even in the presence of interference from conventional TV signals on the same channel.

The primary broadcast service area (Grade B contour) for conventional analog TV signals on WMVT is 48 miles from the transmitter. The Glenview receiving site is on the far fringe reception area of the Milwaukee station, and even with an antenna tower atop the seven-story building, the conventional analog signals are very noisy or snowy.

Using less than one-tenth of the power used to transmit a full-power conventional analog TV signal, the test successfully transmitted and received digital signals - without noise, snow or ghosts. The test showed that the system's unique digital compression and transmission technologies can eliminate the so-called "cliff effect" a total and abrupt loss of the TV picture and sound that could be caused by errors in transmitted digital data at long distances from the transmitter.

The companies plan to share the field test data with the Federal Communications Commission's Advisory Committee on Advanced television Service and its HDTV Field Test Task Force.

Summit meeting held

A third summit meeting among members of the three national service associations consisting of the National Association of Service Dealers (NASD) a division of NARDA, the Professional Service Association (PSA), the National Electronic Service Dealers Association (NESDA), and several state organizations including the California State Electronics Association (CSEA), the Television Electronics Service Association (ESDA) of IL, the Independent Warranty Servicers (IWS), and the Appliance Service Dealers (ASD), was held in Chicago on October 4, 1992.

The industry Summit decided to form a permanent group called the "Service Industry Council" for the purpose of collecting information, identifying industry problems and finding possible solutions for those problems. This group will continue to meet on a regular basis to address the needs of the service industry.

The environmental committee report stated that as a result of indecision on the part of governmental agencies the mandated technician certification program has been abandoned. The resulting controversy that continues to grow in the ser

(Continued on page 62)

Literature

Demonstration package available for virtual instrument software

National Instruments announced today that a free demonstration package is available for the new LabVIEW for Windows graphical programming software. The demonstration package includes software and a guide that gives the user a comprehensive look at the software but does not require previous knowledge of it.

Based on the full-function version of LabVIEW, the demonstration package describes fundamental concepts, gives an overview of the system, and guides the user through hands-on examples. In the first section, the user learns about the product and explores a completed virtual instrument (VI) program. In the second section, the user builds a VI from scratch. The third section contains a variety of examples demonstrating how the software addresses different application needs. The last section also describes the GPIB, VXI, and Instrument Driver VI libraries for controlling over 115 GPIB, VXI, ad RS-232 instruments using the company's interface hardware; the Data Acquisition VI Library for controlling the company's PC plug-in data acquisition and signal conditioning hardware, and the Data Analysis Library for processing acquired data.

The demonstration package is available now on 3.5 in. high-density diskettes and requires a 386/33 PC with a 387 coprocessor (486 recommended) running Microsoft Windows Version 3.1, 8M memory, and VGA or Super VGA video adapter.

Power Protection catalog on disk

Available from Best Power Technology, Inc. is a new hypertext catalog on a disk that is free of charge. The full-color, interactive disk is a virtual encyclopedia of information on protecting computers and other sensitive electronics from power problems. Featuring an easy-to-use, "point and click" user interface, the catalog instantly responds to each user's information needs with more than two megabytes of helpful information. In addition to a complete description of the company's line of power protection products, the catalog includes a number of innovative features.

Unlike many computer-based "catalogs" this one features actual on-screen color product photography, so users can see the devices being described.

Many of the photographs and diagrams in the presentation are interactive; users can click on anything they see in the graphic to get more information on it. By clicking on a button, users can invoke a UPS Sizer. The program asks questions about the computer system the user wishes to protect, calculates total VA load and system growth, and makes specific product recommendations based on the criticality of the user's application The UPS Sizer can also be run as a stand-alone DOS application.

Interface handbook

A new handbook, IPC/92, describes Interference Phase Cancellation, a practical method for suppressing interference which occurs at the same frequency as the desired signal or which occurs so close to it that application of conventional filters is impractical.

IPC/92 summarizes the phase cancellation theory, describing six most common interference problems, 15 different examples, solutions and product instructions. Some areas discussed are co-channel reception, ghosting due to relfection, in-channel harmonic reception, wideband noise across low band channels, undesired adjacent FM carriers and microwave inband interference. The handbook also explains methods applicable to CATV and other broadband cable systems, interference to VHF-microwave receivers, interference to TVRO installations and interference to UHF/cellular paging.

Fume extractor brochure

Pace Inc. announces the release of the new Arm-Evac Fume Extraction brochure illustrating a wide variety of fume extraction systems to remove hazardous fumes from solder operations and other electronic assembly processes. This brochure also explains the benefits of local exhaust by removing harmful particulates and gases of the extraction system before they reach the worker's breathing zone. ■

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

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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Computer software for service center management

By Conrad Persson

In just a few short years, the personal computer has revolutionized the operations of every kind of business. Not many years ago, if you went into your doctor's office, or any of a number of small businesses, when you gave them your name they went to a file cabinet and pulled out your records. Today they ask you for your telephone number, punch a few buttons on a computer keyboard and your record appears on a monitor screen.

Just a few years ago, a few visionary consumer electronics service centers revolutionized their administrative procedures by computerizing. They recognized that a personal computer, or a network of personal computers, would be perfect for taking care of all of the administrative tasks that are required in a service center. Since that time, more and more service centers have converted from the old cumbersome paper approach to entering information, tracking products through the servicing process, preparing parts orders, preparing invoices and billing, to a computerized system that does all these things but has the added advantage of allowing instant access to any of this information at any time from any place in the service center.

More than just service center management

Now service centers are turning over even more and more tasks to the computer. One example is the filing of service tips. Traditionally, many service centers have file drawers full of service tips. The personnel at the service center carefully document every service procedure they perform; the symptoms of a problem on a particular set and the nature of the trouble found. They file this information, along with tips they receive from manufacturers and other sources.

In the exceptionally well-managed service center, this information is properly filed and accessible when a product is being serviced. In the less well managed service center, sometimes the information desired can be found, and sometimes not. Even in the well managed service center, however, the process is cumbersome, and if one service technician has a particular tips file, it might not be available to another technician who needs it.

There are programs available now not only for storing and retrieving these tech tips, but they have hundreds or even thousands of symptoms and cures already in a data base. A service center that buys one of these programs can then add the problems they have encountered, along with the solutions, to this existing data base. By filing all of these service tips in a computer data base on a networked computer system, all the service tips, those developed in house as well as those provided by the program, are available readily to any technician at any time, using just a few keystrokes.

Diagnostics, too

While computers are helping service centers file and retrieve information, computers that require servicing are also providing service centers with a source of revenue. Many service centers have added personal computers to the list of products that they service. Unlike products such as TVs, VCRs, CD players, etc., computers can tell the servicer what's wrong, to a certain extent at least.

When a personal computer is exhibiting a problem, but some of the vital portions are still functioning, it's possible to put a disk into the computer that contains a software program that was written so that it exercises certain portions of the computer, and reports back if everything is working properly, or provides a report of the nature of the problem if a problem exists.

Here's a rundown of the software as we know it

Whether you've been computerized for the past five years, or plan to computerize next year, whether you have all your service tips on a computer or have been thinking about doing it, or whether you've been servicing computers for years or think you might get into it one of these days, this article is published here to provide you with some useful information. What follows is a description of some of the features of some of the software mentioned above, accompanied by a list of companies who offer this software for sale.

Service center management

Service center management software provides support for the servicing facility in just about every aspect of the business. With one of these packages, when a product is brought in for service you enter the customer's information and the nature of the complaint. If this is a repeat customer you may just have to type in his phone number, and the rest of the information is brought up automatically from the computer database.

Here's a rundown of some of the features of a software product that provides a broad range of service center management capability. Because software such as this can vary considerably in its usefulness, depending on the particular needs and management style of the managers, we recommend that before making a commitment to purchase such a system that you compare the features and ease of operation of several packages. Another important consideration, of course, is cost. The least expensive of these programs cost a few hundred dollars. The most expensive may cost several thousand dollars. As with any other product, the purchaser must weigh the product's features against the cost and determine which is best for a particular application.

To help you decide which one of these software packages would be best for you, many of the companies listed here offer a demonstration program that you can try out before you buy. Most of these demos contain all the features of the software product so you can determine if it will meet your needs. The only limitation of a demo package is in the record storage fea-

Persson is editor of ES&T.

ture. Typically, a demo will only let you store 10 or so transactions.

One manufacturer, BGI, will send a fully featured package as a demo for $14.50, on the understanding that the person who orders it will pay the remainder of the full list price if satisfied.

Job tracking/scheduling

As the customer's job information is entered into the system, the computer automatically creates a job ticket and stores the information. Now you can do several things:

- Easily handle customer phone inquiries. Just enter the customer's phone number or name and the job information appears on the screen.
- Instantly access a job's current status just by supplying the appropriate code number.
- Get detailed job status information.
- Maintain a complete history of each unit by serial number or by customer number.
- Call up a summary schedule that lets you see the whole day's schedule at a glance.
- Schedule on-site service by territory.
- Obtain a printout of both technician routing sheets and a management summary sheet.

Inventory management

The inventory program gives you the individual parts movement by the month, cross reference data, prices, quantity and a reorder report. By checking the movement record, you can adjust quantities ordered to make sure you have adequate inventory of parts without accumulating a large inventory of slow-moving parts. By coupling this information with manufacturer's shipping time, you can order replacement parts early enough to cut down on back orders.

Invoicing

With some programs, you may enter repair descriptions and labor pricing ahead of time. The information is then on record allowing you to automatically invoice by making number selections for repair descriptions and labor prices. In addition, this program segment allows you to print both customer and standard NESDA or NARDA invoices and to automatically print post cards informing customers of the status of their unit.

Codes and tables

User-defined codes and part pricing tables let you customize your system and speed up data entry. All the technician needs to do is to press a special key to see the list of possible code entries. They include codes for unit types, brands, manufacturers, technicians, status of jobs; e.g., parts on order or estimate, customer approval, return shipping method, sales taxes, vendors.

Forms and reports

A service management software system can save you time and money in several ways by doing much of the paperwork for you. First, a valuable technician will have to take less time away from repair work to do paperwork. Second, you only have to enter the customer data once. After that, the computer will automatically generate the information in the proper format to match your different forms. Finally, the various computer generated reports allow you to see where your money is going and how fast.

Some of the forms and reports that are available are: management reports, such as daily work in process report, work completed not picked up, technician unit report, technician productivity report, production detailing report, job tracking/scheduling. Also available are invoicing reports, warranty and service literature information and inventory management.

Yet more computer help

As powerful as these computer programs are, one thing is absent from their capabilities: input from and communication with the manufacturers. At least one system now includes communication with the manufacturers as part of their features: OASIS by KeyPrestige.

OASIS provides information from subscribing manufacturers to service centers. Once a manufacturer subscribes to this system, a manufacturer's specific data base is created and continually maintained, service centers can access this data and obtain information on claims, parts availability and pricing, technical bulletins and more, as authorized by the subscribing manufacturer. A service center that wishes to access this system only needs to have a PC and the appropriate communications software.

When the user connects with the central source mainframe, they instantly have access to all authorized information. The screens are all menu driven and easy to use, and on-line help is available, according to the company.

Current menu options

A user can make as many or as few inquiries as desired with each dial-up session. Status can be checked with one or several subscribers on the following items:

Claims - A user can inquire about the status of warranty claims. Included in this screen is all the necessary claims information. A window at the bottom of the screen will display any additional information that is applicable, including any reason for rejection or non-payment.

Parts - This screen will display part numbers, descriptions, availability and applicable prices.

Bulletins - This feature offers users technical information to assist in repairs. Users can order bulletins or print them in-house while on-line.

Future options

According to the manufacturer, options that will be added to the software in the future are parts ordering, electronic transmission of warranty claims, special announcements, and more.

A caveat

A service management system won't make your business run any smoother all by itself, any more than an oscilloscope will diagnose a problem in a product. It's a tool. You have to learn how to use it and teach other people in your business how to use it. And you have to use it consistently and correctly.

One other comment: these systems are probably not for every servicing facility. A low-end system, software only to run on your own PC may cost several hundred to over a thousand dollars. A high end system for a large shop, software or software and hardware, may cost several thousand dollars. On the other hand, if a shop is large enough to use one of these systems, and the people who will use it are dedicated enough to making it work, the benefits may well far outweigh the cost.

NEW! Service Center Manager

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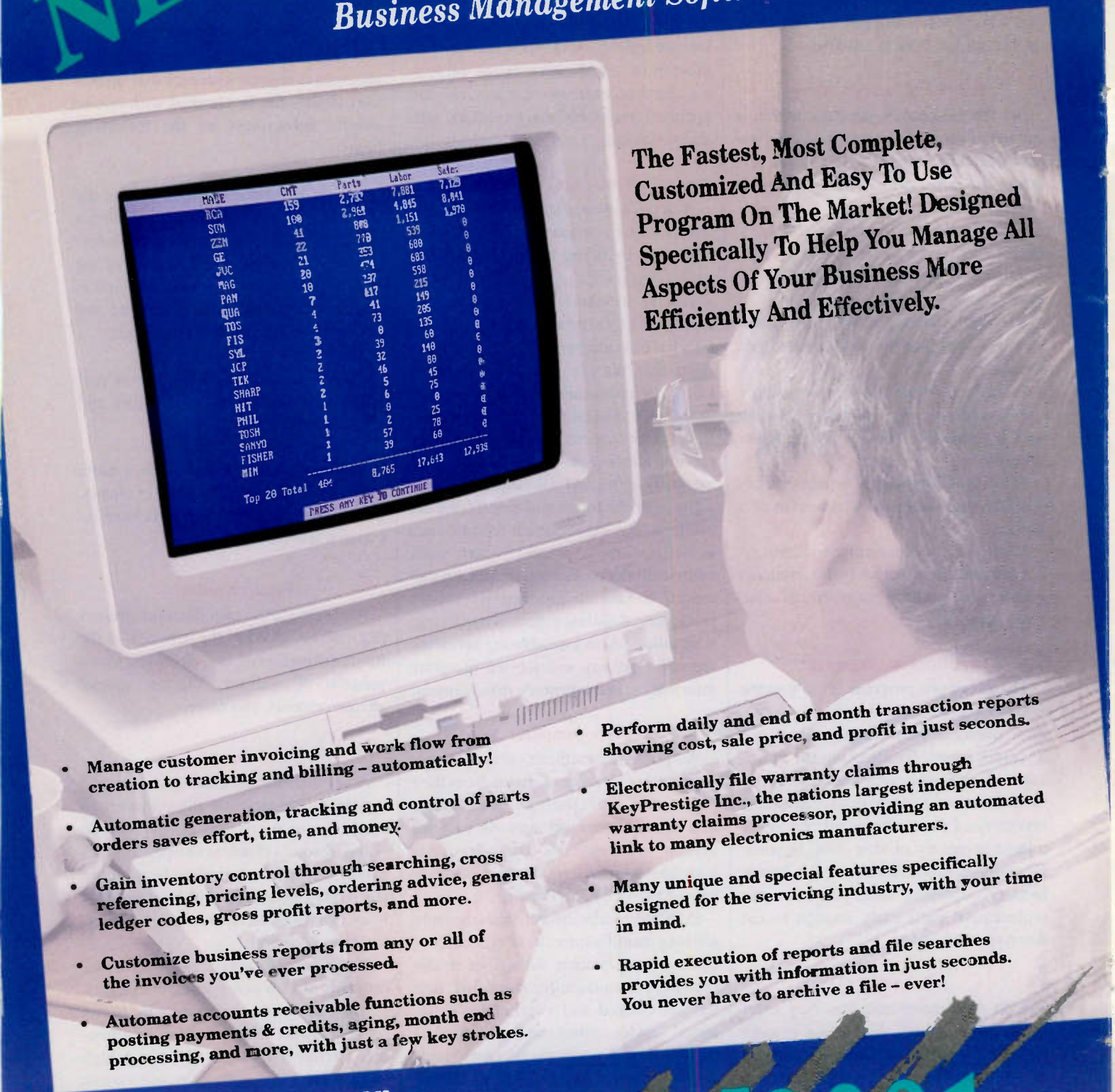

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Service Management Software
931 Sunset Blvd.
West Columbia, SC 29169
800-756-7035
Fax: 803-791-8521

Circle (22) on Reply Card

Service Systems International, Ltd.
8717 West 110th Street, Suite 600
Overland Park, KS 66210
913-661-0190
800-826-4351
Fax: 913-661-0220

Circle (23) on Reply Card

Sidon Data Systems
18007 South Mitchell
Irvine, CA 92714
714-553-1131
Fax: 714-553-1133

Circle (24) on Reply Card

Soft-Serve, Inc.
757 North 22nd St.
Mesa, AZ 85213
Phone/Fax: 602-835-2243

Circle (25) on Reply Card

Service Tips programs

AnaTek Corporation
(Computer monitors)
PO Box 1200
4 Limbo Lane
Amherst, NH 03031
800-999-0304
603-673-4342
Fax: 603-673-5374

Circle (26) on Reply Card

FixFinder
TCE Publications
10003 Bunsen Way
Louisville, KY 40299
502-491-8110

Circle (27) on Reply Card

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

Circle (28) on Reply Card

Higher Intelligence Software, Inc.
60 Farmington Lane
Melville, NY 11747
Phone/Fax: 516-643-7740
This company also offers custom software for the service industry.

Circle (29) on Reply Card

Diagnostics/utilities

Fessenden Technologies
116 N. 3rd Street
Ozark, MO 65721
417-485-2501
Fax: 417-485-3133

Circle (30) on Reply Card

Gibson Research Corp.
35 Journey
Aliso Viejo, CA 92656
714-362-8800
Fax: 714-362-8808

Circle (31) on Reply Card

Micro 2000, Inc.
1100 E. Broadway, Third Floor
Glendale, CA 91205
818-547-0125
Fax: 818-547-0397

Circle (32) on Reply Card

SyncPulse
7730 Foothill Blvd.
Tujunga, CA 91042
818-353-9595
Fax: 818-353-7016

Circle (33) on Reply Card

Track Mate
Diagnostics and disk drive maintenance
5305 East Shore Drive
Conyers, GA 30208
800-486-5707
Fax: 404-922-8044

Circle (34) on Reply Card

Windsor Technologies, Inc.
130 Alto Street
San Rafael, CA 94901
415-456-2200
Fax: 415-456-2244

Circle (35) on Reply Card

On-line systems

Technical Information Procurement System
(Online computer system for tech tips)
PO Box 1681
Forest Park, GA 30051-1681
Phone/Fax: 404-968-3715
System Phone: 404-968-6600 E-7-1

Circle (36) on Reply Card

Servicing consumer electronics on site

By Homer L. Davidson

Servicing of consumer electronics products in the home has become largely a thing of the past. Modern TV sets and other consumer electronics products are so sophisticated that most service procedures require tools, test equipment and information that are only available in the well-equipped service center. Moreover, a large proportion of those products are small enough and light enough that they can be brought into the service center by the customer.

However, some products can still be serviced economically on site if not more than two trips are required to finish the job, and payment is collected before the technician leaves the site. Payment arrangements should be made when the call is booked in. Of course, if the customer has been with you for years, it's another story.

Figure 1. Minor service can be completed on site. Here a technician is replacing defective diodes in an RCA CTC140 chassis.

Logging in the call

The service center employee who logs in calls for on site service should be trained to ask for specific information that will be helpful to the technician who will perform the on site service. What specific information to ask will be determined by the individual service manager, but the following represents some of the information that will be helpful to the technician for any on site service call:

- What is the brand and model and type of product?
- What is the screen size?
- Is it a console, table model, portable, projection set?
- What are the symptoms?
- How long has the problem existed?
- Has the set been moved or disconnected recently?
- Have you had any problems with the power system, or did the problem begin just after a thunderstorm?

If the questions reveal that it is a portable or other small product, the telephone person might be instructed to tell the customer that he or she can save a trip charge by bringing the unit in.

Scheduling on site service

In a small service center where a technician does both bench servicing and on site service, it should be determined what time of day is best for the technician to make on site calls. I prefer the afternoon, since the mind should be bright and clear in the morning to tackle those tough jobs. Larger service centers may have outside technicians who take calls all day long. A regular servicing route may take certain sections of town or country on given days.

How many house calls can be made in a day? Owners of some large service centers say 8 or 10 calls a day is necessary for a decent profit. But in the case of a small service center, the technician can only take the morning or afternoon for calls, while the other half is reserved for bench time.

I have made many on site service calls, each of them different from the others. In some cases I was able to perform the service on the spot. In other cases it was necessary to return the product to the service center so that it could be serviced on the bench. The following narratives of some

Davidson is a TV servicing consultant for **ES&T**.

of my experiences may give other readers some insights into on site servicing.

Call 1 - Old faithful

One RCA XL100 console TV that I was called out to service exhibited two unrelated symptoms. The main problem was that, intermittently, the set refused to operate. According to the owner, sometimes when the set was inoperative rapping on the side of the cabinet would cause it to begin working. The other symptom was that the remote worked sometimes, and refused to work on other occasions.

Mr. Jones had been giving the cabinet a rap with his cane or a swift kick for days. Now the TV set would remain silent for longer hours, and sometimes would not respond at all when rapped. After setting for several hours, it might start up again when either the switch on the set was pressed, or when the on/off button on the remote unit was pressed.

Our experience with this particular XL100 chassis was that this type of tuner control problem was fairly common on sets that were 10 or 12 years old. This chassis has a slanted push button assembly with tuner control module in one piece. In fact, "old faithful" (CTC92W) frequently developed symptoms caused by cold solder joints

I removed the back cover and dropped the tuner-control assembly down. Turning the assembly over provided easy access to the PC wiring and component contacts within the tuner. As I had done in the case of several other XL100 chassis in the past, I resoldered the outside and ground connections, as well as all the connections at the bottom half of the entire area.

After re soldering these joints with a soldering gun and rosin core solder, I turned the set on. It operated perfectly. I flexed and carefully tapped on the tuner assembly to see if I could make the symptom return. The chassis never missed a beat. I returned the intermittent remote control transmitter to the service center to be serviced at the bench.

Call 2 - A horizontal white line

This was one of those exceptions to the rule that a portable set should be brought into the shop by the customer. Mrs. Smith, the owner of this portable set, is confined to a wheelchair.

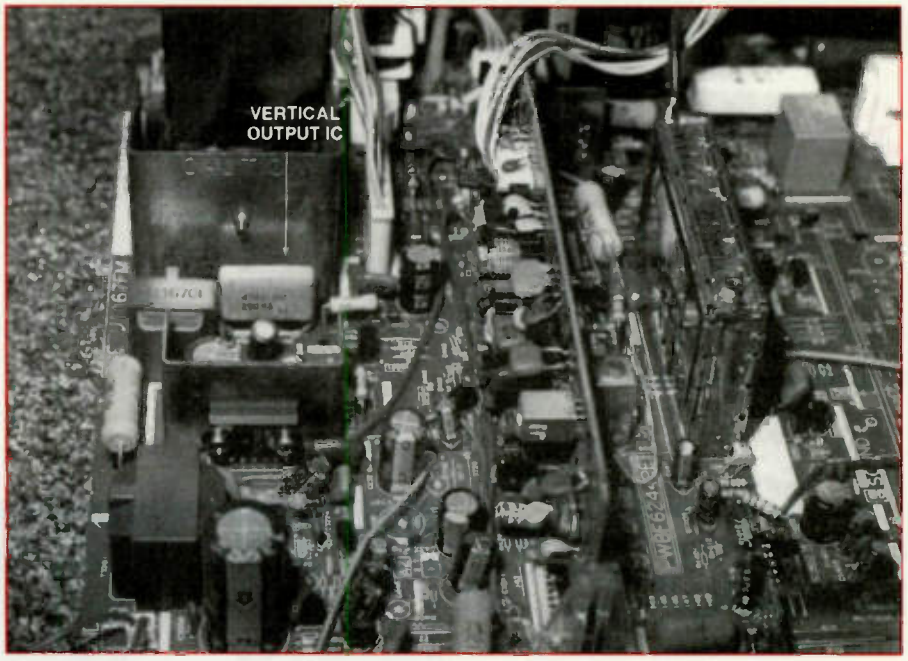

Figure 2. The defective vertical deflection IC (X0238CE) in a Sharp 19SB60R model was replaced with a TCE SK7653 universal replacement.

The only thing that showed on the screen of this Sharp 19SB60R portable was a horizontal white line. Mrs. Smith had been listening to the sound with no picture for several weeks.

Because the screen showed only a horizontal white line, I quickly concluded that the problem had to be a defect somewhere in the vertical section.

Rather than just picking up the set and bringing it into the service center, I decided that as long as I had made the trip to the house, I might as well attempt to service it on site. After removing the antenna cables and VCR connections, and pushing the pet dog aside, I removed the plastic back cover. I turned the set on and turned the brightness control up as far as it would go. There was only a white line. The sound was good, but there was no vertical sweep.

I examined the fairly new Sharp chassis, trying to locate the vertical output cir-

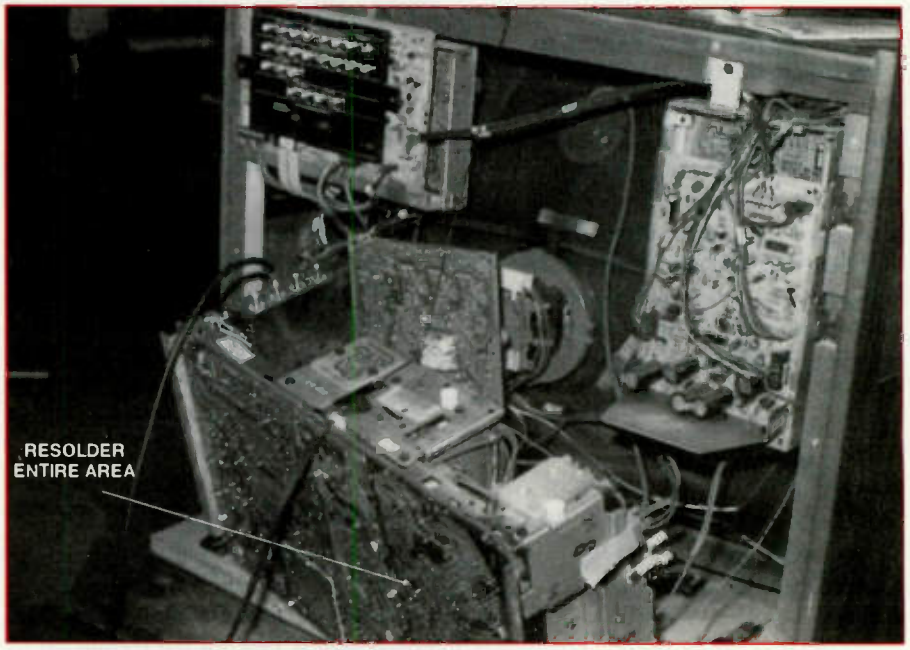

Figure 3 Soldering all terminal connections under the flyback area solved the intermittent condition in this RCA FM2722T model.

cuits. Since the chassis was only two or three years old, I assumed that the vertical oscillator or count down circuits must be in a large IC. No doubt the vertical output must be on a separate heat sink.

Sure enough, the vertical output component was located at the outside edge of the chassis on a separate heat sink (Figure 2). I was fairly confident that this IC must be defective and the cause of the symptom.

I looked up the X0238CE vertical IC in the TCE solid-state replacement guide. The SK7653 was listed as a replacement for the X0238CE vertical IC. When I called the service center and asked for this part, the parts clerk went to look for it. A short while later, the service center called back that this part was not in stock, but the local distributor had it in stock.

After picking up the replacement IC, I quickly installed it and turned on the set, holding my breath. I breathed a sigh of relief when the picture appeared. Adjusting a few controls placed the color picture back to normal. I sure lucked out on this one.

Call 3 - Intermittent RCA FM2722

I was having breakfast at a small restaurant when one of the regular waitresses told me that she was having trouble with her TV set. She was one of three sisters who worked here. She gave me their new home address and told me that her sister, Sarah, would be home all day. So I was able to make the call at my convenience.

Sarah complained that the set would go off, sometimes sound was there and sometimes not, with a black screen. At other times, the FM2722T table model would run all day and half the night.

When I first turned the set on, the picture and sound were normal. The TV set played perfectly for five minutes and then went out. When I turned the cabinet around to get at the back cover, the picture and sound reappeared. Loose connections, no doubt.

After removing the back cover I pushed around on the flyback's shield. the picture and sound would come and go. After removing two chassis end screws, I was able to turn the chassis up for easy viewing (Figure 3).

Flexing the PC board under the flyback caused the picture and sound to come and go. This naturally suggested cold solder joints or other connection problems. After I resoldered all the solder joints in that area and turned the set back on, the picture had returned to normal.

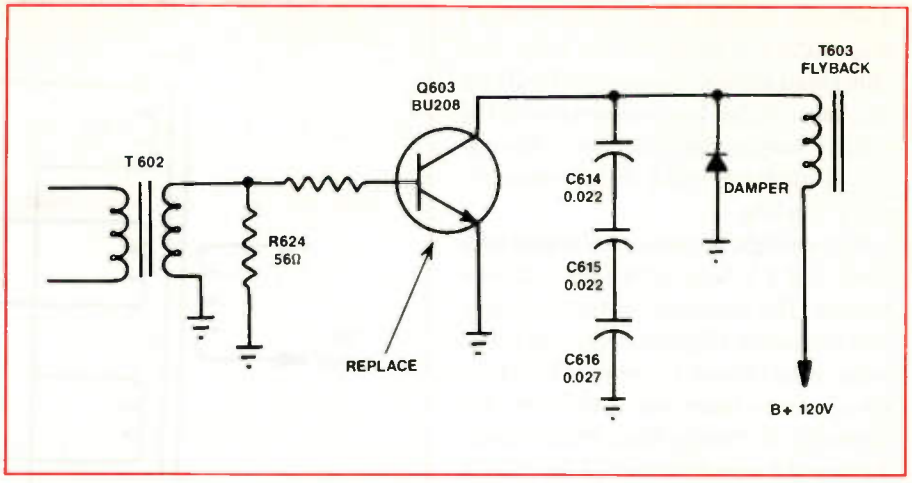

Figure 4. The leaky BU208 horizontal output transistor was replaced with a GE-38 universal replacement.

Call 4 - Dead set

The next call was on a KMart KS-1976 model. There was a great deal of dust gathered over each component. Because the set was completely dead, I suspected a blown fuse, or low voltage or horizontal output problems.

I replaced the 4A ac line fuse, but the chassis remained dead. I located another fuse in the B+ circuit (1.25A) and replaced it. The chassis still remained dead. This fuse was right alongside the flyback transformer.

A quick voltage test at the B+ fuse indicated no voltage at this point. No doubt a defective diode or switch was at fault. A continuity check from the line voltage fuse to the bridge rectifier circuits revealed an open circuit condition. When I closely examined the area around the fuse and bridge rectifier, I noted a large white 10W resistor standing upright. A resistance check showed that this resistor was open. I replaced R701 with a 5Ω, 10W resistor. When I turned the set on, the B+ fuse blew. I removed the spent fuse and made some resistance tests on the related circuitry.

A quick resistance check on one side of the B+ fuse clip indicated a voltage

Figure 5. Resoldering all three diode connections upon a SIP diode board solved the intermittent off/on problem in this RCA CTC140-SN chassis.

discharge through the DMM. When I placed the test probe on the other fuse clip, I read a low resistance, under 200Ω. The cause of this low resistance could be a leaky output transistor, since this circuit feeds the flyback transformer primary winding.

Sure enough, the horizontal output transistor had a leakage of 0.13Ω to chassis ground. The horizontal output transistor was located on a separate heat sink bolted to the metal chassis. I removed Q603 from the circuit to determine if the transistor was leaky, or if the problem was the diode. Testing the transistor out of the circuit, with the DMM, indicated leakage between collector (metal) and emitter terminal.

To determine if the damper diode and flyback winding were normal, I made a resistance check from the collector socket to ground. There was no leakage here (Figure 4). A quick continuity check from the base terminal to chassis read around 27Ω. A resistance test from the emitter terminal to chassis ground indicated a direct short. This was normal.

I called the service center and the parts clerk determined that the faulty transistor, Q603, could be replaced with a GE-38 replacement. As luck would have it, there were two on the truck. Replacing the horizontal output transistor, two fuses and a 10W resistor restored the set to operation. Just in time for lunch.

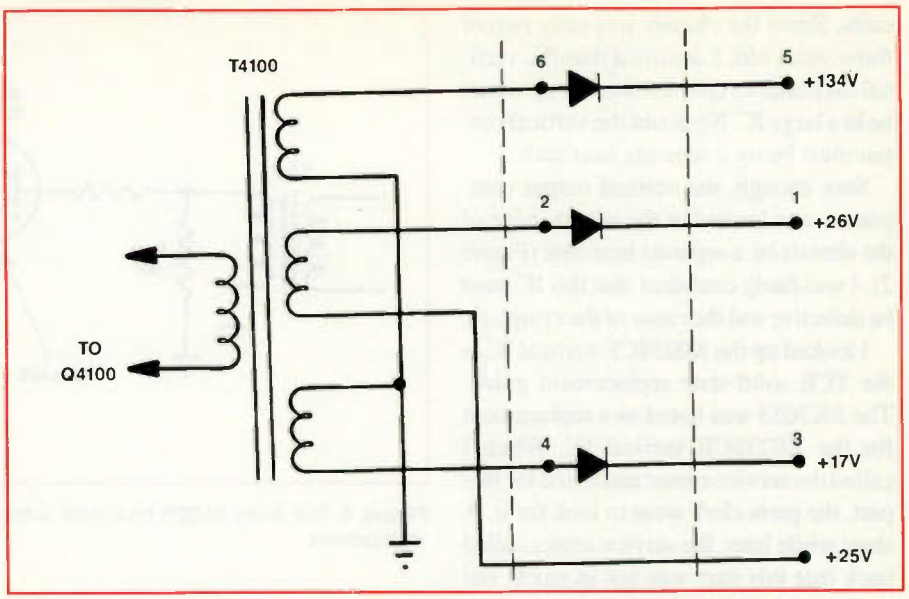

Figure 6. Solder each diode terminal to correct the intermittent off/on problem.

Call 5 - Intermittent off/on

In this 27-inch RCA console, the picture and sound would sometimes pop off and then back on, or the set would sometimes just quit. Sometimes the set would operate all night long. Usually, the CTC140-S2 chassis would always come on, with or without the remote control unit, and after running for several hours may pop off.

We had observed this problem in several of these same chassis in the past. In the first case we encountered, we brought the set into the service center. Careful diagnosis revealed that the problem was caused by bad solder joints on the SIP diode board. The problem was corrected by resoldering these joints. Now when we encounter these symptoms on one of these sets, we can go right to the circuitry that's causing the problem and correct the problem. No need to bring the set to the service center.

The CTC140 chassis must be pulled out to get at the SIP diode board (Figure 5). Six soldered pins under the chassis must be released to remove the small diode board. Carefully examine the soldered ends of each diode for cracks in the solder joint. Thoroughly solder each diode connection, by adding new solder to each terminal (Figure 6). But , don't let on to

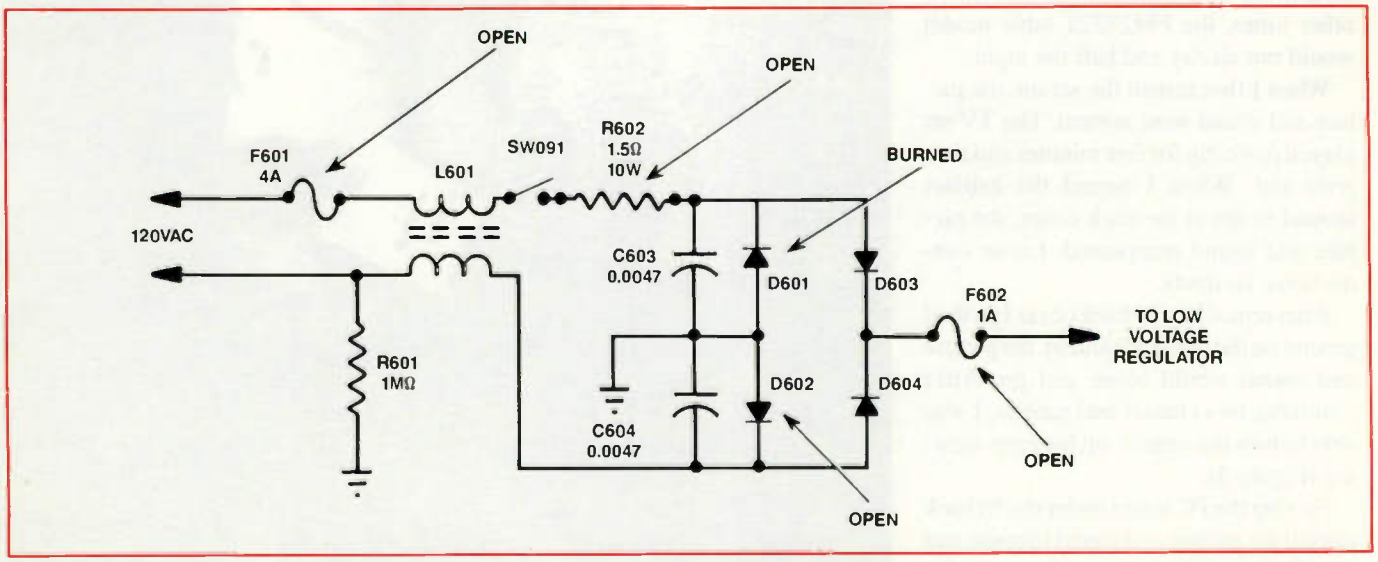

Figure 7. When this Curtis Mathes CM81 console was subjected to a higher than normal line voltage, several components in the low voltage circuit were damaged. In addition, several sections of the PC wiring were burned.

the customer how easy it was to fix the set; let him think you are a genius for repairing this large TV set in a total of 30 minutes.

Call 6 - AC line problems

Although the next call was only 1-1/2 miles north of town in the same area, the problem turned out to be quite different. Since yesterday's rain storm, every electrical appliance in the house was damaged. A large tree branch had fallen over the power lines to the house. Somehow this caused a higher than normal voltage to be placed upon all equipment that was operating at the time.

Mr. Smith, the homeowner was watching TV when the storm hit. When the tree came crashing down on the power line, the TV set flashed and went out, the VCR went up in smoke, and the ceiling fan started spinning faster than normal. It continued to race until it was turned off.

Mr. Smith called the electrician at once. After the electrician had restored normal power, he checked all the electrically operated products in the house. Not only were the TV and VCR inoperative, the refrigerator would not come on, the stereo player was dead, and two small radios did not work.

Because the radios, stereo player and VCR were not turned on when the power surge hit, the damage to them must have been caused because their small power transformers were connected directly into the circuit with the ac switch on the secondary side.

A cursory examination of the Curtis Mathes CMC81 console TV set gave the impression that little damage had been done, so I replaced only the line and B+ fuse and then turned the set on. When I did so, a puff of smoke rose from the set. My first thought was that this might indicate the bridge diodes were damaged. Even the voltage isolation resistor (1.5Ω) was open (Figure 7).

If I had only pulled the chassis up and looked at the bottom PC wiring, several minutes could have been saved. There were at least three different strips of PC wiring ripped from the board, tied to chassis ground. This set had to go in for a complete estimate. It looks as though this power surge may call for a total TV replacement.

Conclusion

In order to be profitable, on site service should be completed in less than one hour. The on site technician must work efficiently and with great determination. Evaluate the symptoms with the screen and speaker before tearing into the chassis. Look for those simple problems that occur most of the time. If handy, take along the correct schematic.

Be polite, courteous, and always admire the customer's plants, hobbies, children, house flowers and dog. Don't forget to smile before collecting the service bill. You may be asked personally to come back the next the TV refuses to function.

Troubleshooting microwave oven high voltage circuits

By Homer L. Davidson

Servicing microwave ovens can be dangerous. Extreme caution must be exercised any time the technician works around ac power line voltages and dc voltages up to 4.5kV. Always remember that the power transformer, capacitor, rectifier and magnetron tube have high voltages on them when the microwave oven is operating (Figure 1).

Some manufacturers warn against taking any voltage tests within the high-voltage section. Of course, the TV technician works around picture tube voltages up to or over 35KV. But remember, the high voltage in the microwave oven is capable of delivering high-current as well, while the current that a TV set can deliver is limited. Extreme care must be used while servicing a microwave oven.

Before taking off the back cover, remove your wrist watch. Make sure that the oven is unplugged at all times when checking continuity and resistance and replacing components. Before making any tests, discharge the HV capacitor with insulated handle screwdrivers. Remember, you can be severely shocked or killed if the high-voltage capacitor is not discharged.

WARNING! Before attempting any service, or any time the cabinet has been removed, the microwave oven should be unplugged and the high-voltage capacitor discharged. Sometimes you may have to use two well-insulated screwdrivers if you cannot get one blade across both terminals. Again, any time the oven has been plugged into the power line, once you again turn it off, before you work on it, discharge the HV capacitor.

Basic HV circuit

The high voltage circuit in a typical microwave oven operates on the voltage doubler principle. Ac voltage (120V) is applied to the primary winding of the HV transformer, which provides output of 2000V to 6000V peak voltage. The HV diode rectifies the high ac voltage to operate the magnetron tube from 1800Vdc to 4500Vdc (Figure 2).

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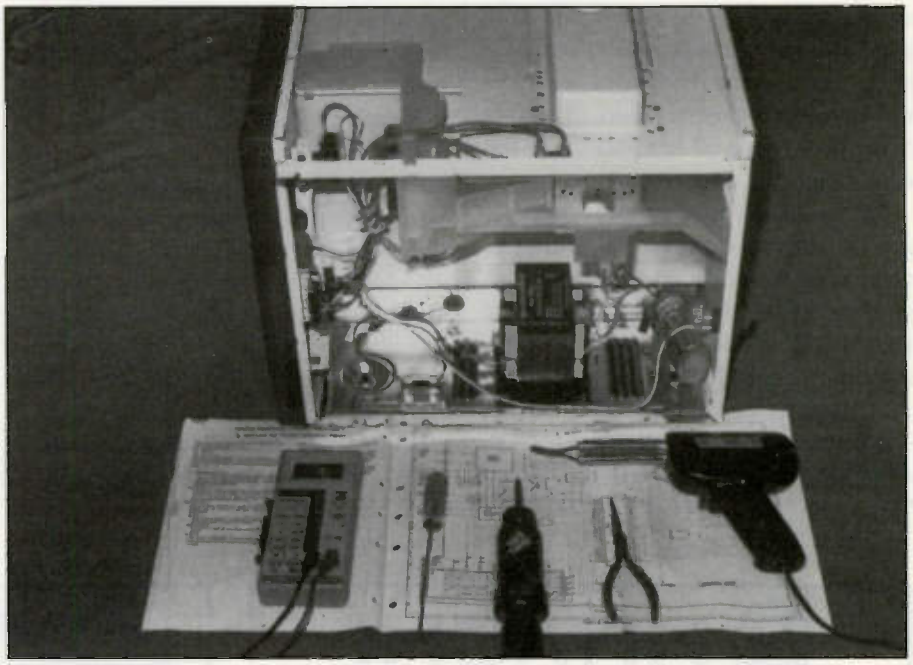

Figure 1. Do not touch anything: hands, tools, or test leads to the oven while operating.

The typical half cycle doubler circuit with capacitor and diode is connected in the secondary circuit of the HV transformer. Another transformer winding provides a filament voltage of 3.1Vac to

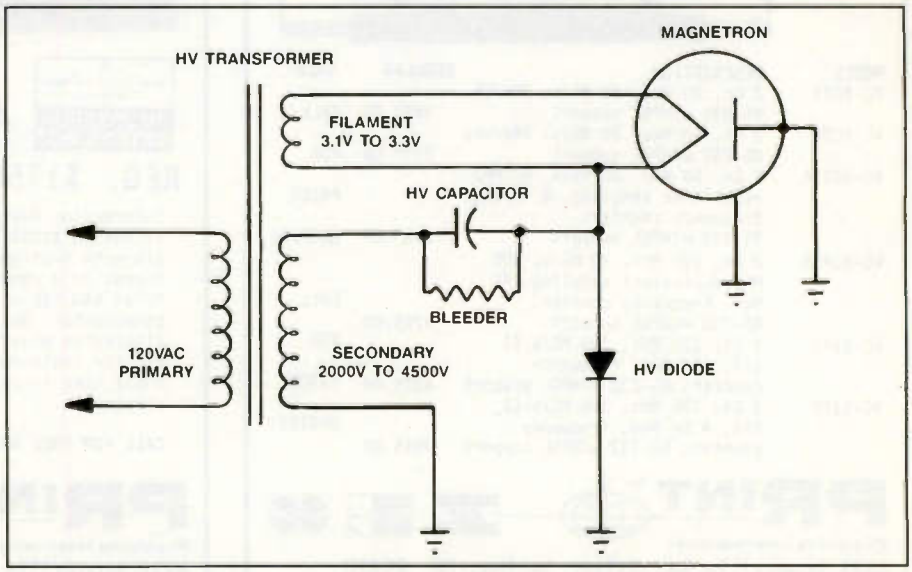

Figure 2. The basic high-voltage doubler circuit with transformer, high-voltage capacitor and diode.

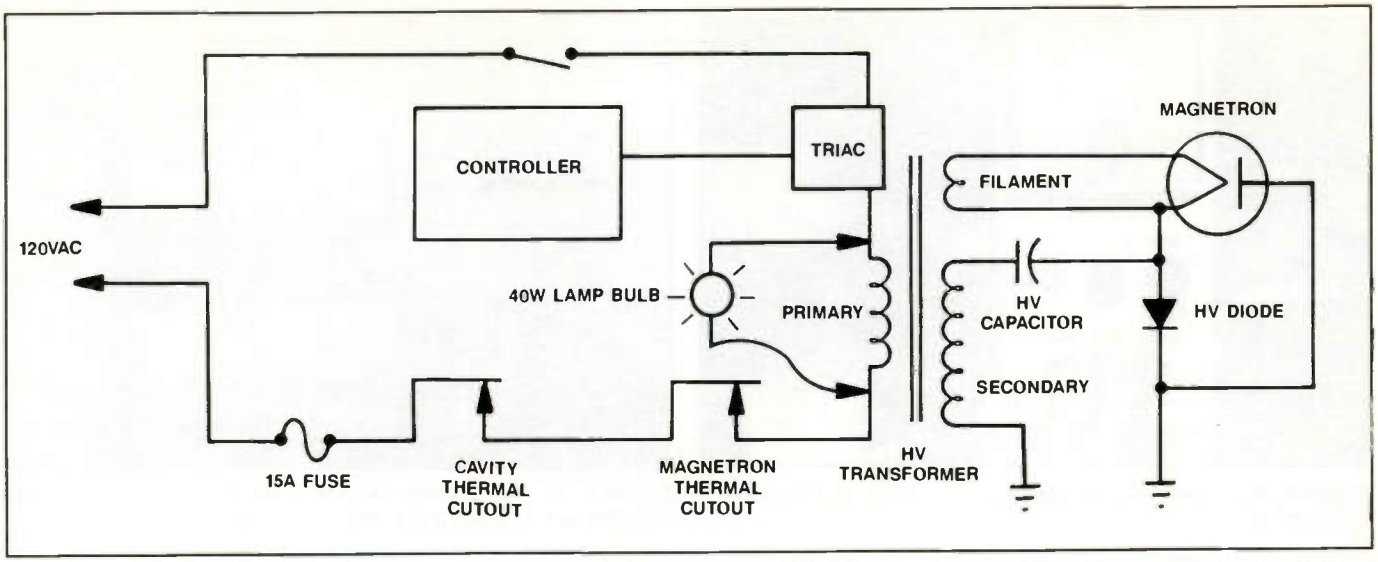

Figure 3. A 40W pigtail socket light bulb, or ac meter connected to the primary winding of the power transformer indicates if primary circuits are normal.

3.3Vac to the magnetron. Some ovens have suppression filter chokes and bypass capacitors to reduce radiated noise that would interfere with radios or TV sets. On most ovens you can tell if the magnetron is oscillating by looking for horizontal firing lines across the picture of the kitchen portable TV.

You may find a bleeder resistor of 9MΩ to 10MΩ across the high-voltage capacitor. When the oven is off, the HV capacitor is discharged in about 30 seconds. It's wise, however, to always discharge the capacitor by placing a short across it. Do not assume that the bleeder resistor will discharge the HV circuit.

HV circuit components

The HV circuit consists of the HV transformer, capacitor, diode and magnetron. A failure of any of these components may result in a blown fuse, no heat/no cooking, or intermittent cooking symptoms.

When 120Vac is applied to the primary winding of the HV transformer, high voltage developed by the secondary winding is applied to the voltage doubler circuit. The primary winding voltage may be applied via an oven or high voltage relay and triac assembly. You can monitor this primary voltage (120Vac) with a 40W pigtail light bulb socket or ac meter (Figure 3). If the meter registers 115Vac to 120Vac, or the light bulb is bright, you know the primary circuits of the oven are functioning.

Typical faults that cause the transformer to be defective are: an open primary or secondary winding, poor connections or shorted windings. When you suspect that the transformer is faulty, discharge the HV capacitor before checking continuity or resistance at the transformer terminals.

The primary resistance should be less than 2Ω (around 0.15Ω). The secondary winding may measure from 50Ω to 100Ω. The filament winding for the magnetron may read less than 1Ω (0.001Ω to 0.5Ω) with leads disconnected.

The high-voltage capacitor may open up or become leaky. A shorted high-voltage capacitor may blow the main fuse. To check this component, discharge the HV capacitor. Remove wires from both terminals. Set the ohmmeter to R X 10,000

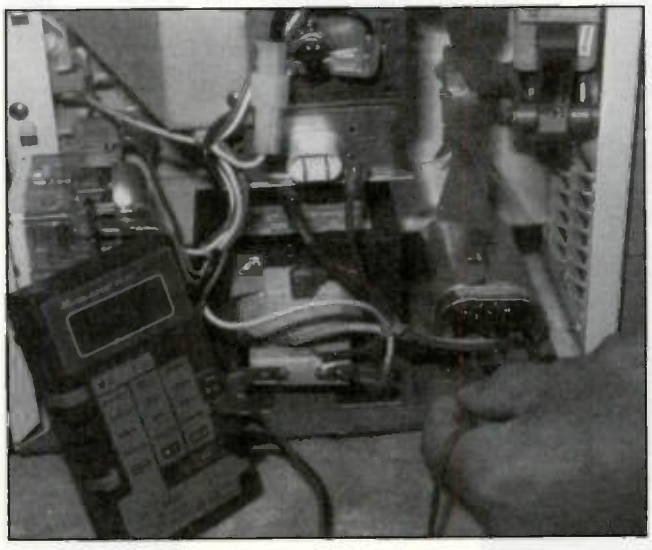

Figure 4. Checking the high-voltage capacitor resistance test with a small DMM.

Figure 5. Do not use a small DMM or VOM to measure high voltage in the microwave oven. Use the DMM only for continuity and resistance measurements.

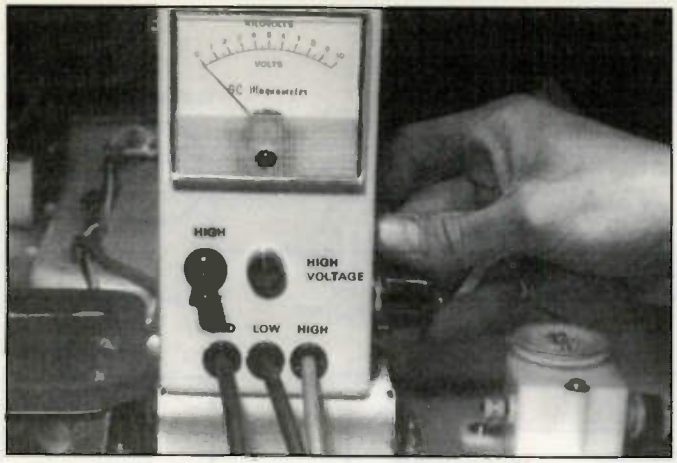

Figure 6. The original Magnameter was invented by Nick Parnello of Rockford, IL.

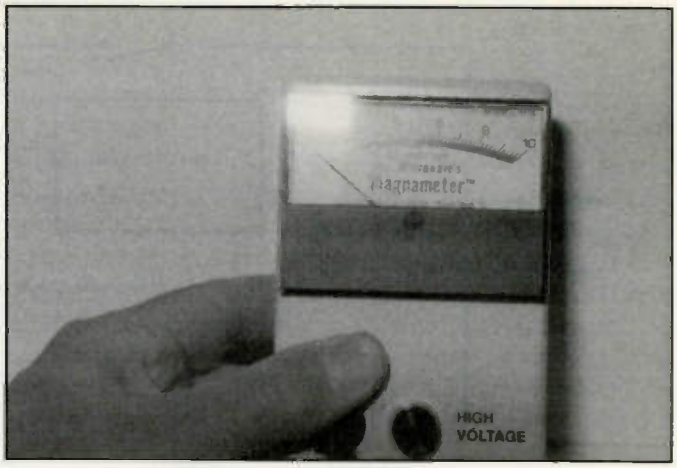

Figure 7. The Magnameter has a yellow area up to 2kV, a green area from 2kV to 4.5kV, and a red area from 4.5kV to 10kV.

scale (Figure 4). The meter needle should go up and slowly downward, then settle at infinite ohms. Now reverse the test leads. If the capacitor is normal, the meter indicator should go up and down as before. The meter should read infinite resistance for each terminal. Replace the capacitor if its resistance is below 10KΩ, or if the body becomes warm.

Usually, if the HV diode is defective, it becomes warm or leaky. Sometimes the HV diode becomes open. To evaluate the condition of the diode, start by discharging the HV capacitor. Set the ohmmeter to R X 10,000 scale. Apply test leads across the diode terminals. A normal HV diode should read infinite in one direction, and with test leads reversed, above 10KΩ. If the diode has a lower resistance or runs warm after the oven operates, it is defective. Replace it.

Magnetron tests

Typical magnetron defects are weak operation, or shorted, leaky or open filaments. Intermittent cooking may be caused by burned or poor filament connections, intermittent internal filaments, or a defective magnetron. An overloaded magnetron may operate intermittently because the thermal cutout alternately opens and closes the circuit. The defective magnetron may arc internally, around the metal gasket or between the antenna and the adjacent chassis, caused by a cracked glass antenna tube.

The defective magnetron may be checked by observing the symptoms when water is heated in the oven, or by

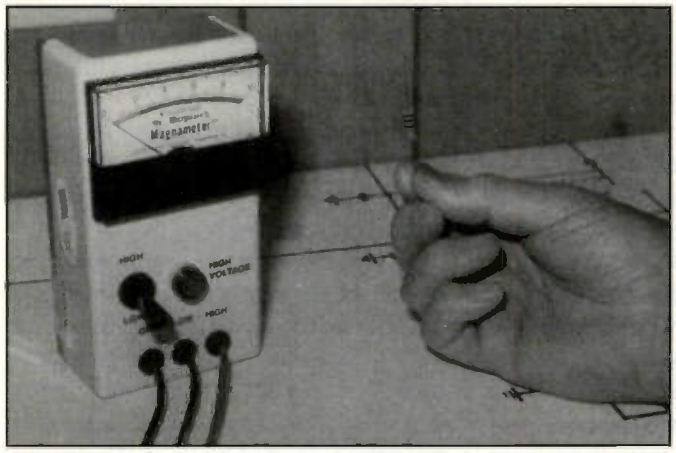

Figure 8. Disconnect the cathode terminal (+) of the HV diode in the oven and place the 10Ω resistor (furnished with tester) in series to chassis ground. You may find a 10Ω resistor in some ovens.

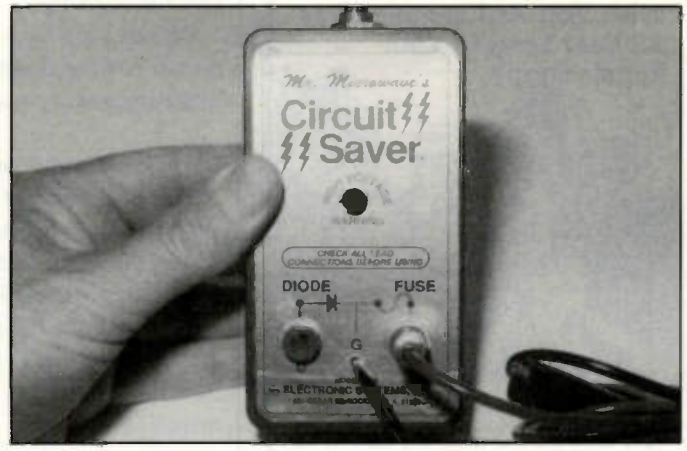

Figure 9. When the microwave oven keeps blowing the fuse, clip the Circuit Saver across the fuse holder and just reset the circuit breaker, instead of replacing those expensive chemical fuses each time.

making resistance and HV checks. Discharge the HV capacitor. Remove the HV terminal wires. Set the ohmmeter to R X 1. Place meter probes across the filament terminals with the filament wires disconnected. The meter should read less than 1Ω (0.02Ω to 0.035Ω).

Now set the meter to R X 10,000 and measure the resistance between each filament terminal and common ground. The meter should show infinite ohms at each terminal. If any lower resistance is measured, the magnetron or HV diode may be leaky. Disconnect one end of the HV diode and test again. A shorted diode may blow the 15A chemical fuse.

Dividing the circuits

The primary or low voltage circuits are found ahead of the primary winding of the power transformer. The HV circuits are known as the secondary circuits. Monitor the low voltage circuits with a pigtail 40W light bulb or ac voltmeter across the primary winding of the transformer. You may assume the low voltage circuits are working if the power line voltage is found at this point. Usually, ac voltage is applied to the winding through an oven relay contacts or triac component.

Resistance measurements

Critical resistance measurements of the HV components may reveal a defective component. Discharge the HV capacitor before making resistance measurements. A low resistance measurement from the filament of the magnetron or the top of the HV diode to chassis ground may indicate a leaky magnetron or diode. Disconnect one end of the diode and check the resistance of each component. A normal circuit will read infinite here, except in cases where the circuit features a 10MΩ resistor across the diode terminals.

Measure resistance or check continuity of the power transformer windings. If the HV winding is shorted, this resistance will be less than 50Ω and the transformer will run warm or red hot. Completely disconnect the HV winding. If the transformer runs too warm without a load, replace it.

A leaky or shorted magnetron may keep blowing the fuse or overheating. Higher than normal HV at the filament terminals may indicate open filaments within the tube. If you suspect this to be the case, discharge the HV capacitor, disconnect the filament from the circuit, and place test probes across the filament terminals. If the filament is intact, you should measure less than 1Ω.

Checking the high voltage

BE VERY CAREFUL IN TAKING HV TESTS WITHIN THE MICROWAVE OVEN. DO NOT ATTACH ANY TEST PROBES, OR TOUCH ANY CONNECTED TEST PROBES, WHILE THE OVEN IS OPERATING.

First, discharge the HV capacitor. Connect the test lead to the top side of the HV diode or magnetron filament terminals. Correct high-voltage measurement at the filament terminals of the magnetron may indicate the voltage-doubler circuits are normal. Remember, the positive side of the HV diode is at ground potential.

The high-voltage within the oven may be checked with a HV dc meter, high-voltage probe, or a Magnameter. The regular VTVM (found upon most TV service benches) with the high voltage probe will indicate if high voltage is present.

Do not hold the probe in your hands. Make sure that the probe is well insulated from the oven metal base, and that the ground wire is clipped to metal chassis. The Magnameter is a useful tester to check high voltage and current within the HV circuits.Do not attempt to use a small DMM or VOM to measure HV in the microwave ovens (Figure 5).

Meter damage

Since the second edition of my book, "Microwave Oven Repair" has been published, I have received letters from four different technicians with damaged test instruments. The first two instruments were a small VOM and DMM that were destroyed, while taking HV measurements. Most small VOMs or DMMs will not measure over 1000Vdc, and the lowest HV found in the microwave oven is above 1.5KV.

One technician had used a 3kVdc voltmeter in testing out several microwave ovens without any problems. The meter was damaged beyond repair when the HV diode was open, placing raw 3800Vac directly upon the dc meter terminals.

The fourth technician used an expensive bench DMM with a maximum 3000Vdc voltage measurement. He forgot to reconnect the ground end of the HV diode that he was testing earlier while making continuity tests. When the tester was connected for HV test, the meter went up in smoke. He returned the meter for factory repairs but in the end, had to replace it. The damage was just too exten-

sive for economical repair.

Be safe, use only a VTVM with HV probe or a Magnameter for HV tests within the microwave oven.

Magnameter tests

The Magnameter was primarily designed to check high voltage and current within the HV circuits. A correct negative voltage at the HV diode indicates that the HV circuits are normal. Simply flip the toggle switch to the low reading and measure the current pulled by the magnetron. No current measurement indicates the magnetron is open. Lower current than normal may indicate a low emission tube. Higher than normal current may indicate a leaky magnetron.

The new meter

The Magnameter is a specialized test instrument to speed up and simplify microwave oven repair. The new meter is a lot smaller in size and has a colored meter assembly (Figure 7). The shorting lever is not found upon the present meter.

The unit enables both high voltage and plate current measurement with one set up. When high voltage is present, on either "High" or "Low" position, the neon warning light is on. The test instrument has high-voltage test leads, with no metal knobs or switching actuators on the exterior unit.

All precautions for making measurements in microwave HV circuits still apply when you use any specialized meter. Don't get careless.

To test for high-voltage, connect ac power, set the toggle switch to high and insert a water load (usually 16 oz of water). Turn the oven on high setting and read the meter. If the meter only moves into the yellow area, suspect a shorted magnetron, shorted diode or HV capacitor, shorted or open high-voltage transformer, or open HV fuse.

Check for an open magnetron, open filament, defective filament transformer or open HV wire if the meter goes into the red area. The microwave is normal if the meter indicator is in the green area.

Turn the switch to Low to test the plate current. Most home type ovens should measure between 1.6V and 4.5V (160mA to 450mA). Commercial ovens register from 2.0V to 7.0V (200mA to 700mA) (Figure 8). Correct plate current, plate voltage and oven wattage for typical domestic and commercial ovens can be found in the instruction manual.

The Circuit Saver

The Circuit Saver is manufactured by the same firm to prevent replacing the chemical fuse when the oven keeps knocking out the fuse (Figure 9). To use this device, remove the blown fuse and plug the red banana plug into the fuse jack on the meter, and clip the meter across the fuse holder. The Circuit Saver can be reset each time if overload occurs.

The saver can save a lot of money in blown fuses while making microwave tests. The Circuit Saver also has an internal HV diode that can be clipped into the circuit, when you suspect that the problem is the HV diode.

Simply remove HV wire (anode end) from HV diode and connect the saver. If high voltage is present, the red HV light will come on.

The Magnameter and the Circuit Saver are available from:

Electronic Systems, Inc.
Microwave Division
624 Cedar Street
Rockford, IL 61102 ■

Where are they now?

By Victor Meeldijk

Many companies seemed to have disappeared due to mergers, acquisitions, name changes and bankruptcies. In this article we will tell you what happened to some of the companies you may be familiar with.

In the 1980's and 1990's, many companies merged, were acquired or went bankrupt, sometimes with the assets sold to other companies. According to industry statistics in 1992, in one typical month 1080 firms closed and 26,620 new businesses were incorporated. In this process, many original supplier names disappeared (remember when Datsun took the parent company name Nissan) making it hard to locate the company that might still make the parts.

(Electronic industry facts on companies, including assets and mergers, are compiled in the Electronic Industry Financial Directory, formerly called the Electronic News (EN) Fact Book and Directory, published yearly by Fairchild Books, 7 West 34th St., New York, N.Y.10001, 1-800-247-6622, 212-630-3880, Fax: 212-630-3868). Some of the changes that have occurred are:

ACUMOS was acquired by Cirrus Logic Inc.

The variable resistor lines manufactured by **Allen Bradley Company** were acquired by Clarostat Manufacturing Company. See Clarostat, below, for details on their merger.

American Switch Corporation, was bought by Mors Components, Inc., and is now known as MORS/ASC, Wakefield, MA.

AMI or American Microsystems was known as Gould-AMI up to the late 1980's when Gould Inc. sold AMI to Nippon Mining Company Ltd. of Japan.

Amperex and Mepco/Centralab merged on April 3, 1989 and on September 4, 1989 this company became known as Philips Components.

AT&T Microelectronics,DC wound capacitor line was purchased by Aerovox, Inc.

Ballentine Laboratories, a test equipment manufacturer, ceased operations in 1991.

Bowmar and NES meters are now manufactured by Weschler Instruments of Cleveland Ohio.

Cambridge Thermonics Corporation (CAMBION), and Hollingsworth, were part of Midland Ross which became part of Interconnection Products, Inc.(IPI). While the American IPI is no longer in business (since late 1991), the United Kingdom division of the company, Interconnection Products, LTD., Castleton, Sheffield England S30-2WR, is still operating. Their distributor in the U.S. is Pyttronic Industries, Inc. 1-800-251-2617, Fax: 1-215-855-5120. The Integrated Electronics Corporation in Denver CO is also dealing directly with the English company. Some of the IPI commercial connector lines may be available from Wearnes Technology Private, Ltd. which bought the assets of IPI (IPI was a subsidiary of Wearnes Technology, a unit of Singapore based Wearnes Brothers Ltd.). The Cinch Connector Division of Labinal Inc., in Elk Grove IL, purchased the MIL-C-5015FR, MIL-C-5015RR and MIL-C-28840 lines from IPI.. Interstate Connecting Components, Inc. in Moorestown NJ is still selling their remaining inventory of MIL-C-5015 and MIL-C-28840 connectors. Hollingsworth, the manufacturer of terminals is still operating in Florida.

Carol Touch Technologies is now Carol Touch, part of Amp. Inc. They are located at P.O. Box 1309, Round Rock, TX 78680.

Centralab, the manufacturer of pushbuttons, toggle switches, rocker switches, keyswitches and potentiometers was known as CRL Components, Inc. for a while and then closed on August 31, 1992. The rotary switch line was sold to Electroswitch, Weymouth MA, in January 1992. The illuminated pushbutton switches was transferred to a sister company, Dialight Corporation of Manasquan, N.J.. ITT Shadow, Eden Prairie MN, offers switches that may be compatible with CRL units.

Clairex Electronics of Mount Vernon N.Y. was acquired by OptoSwitch/Skan-A-Matic of McKinney Texas in 1992.

Clarostat Manufacturing Company and Senisys (Sensor Integrated Systems) were purchased from Hawker Siddeley Group by British Tire and Rubber Industries N.A. and were merged together in September 1992. Clarostat/Senisys distributor orders can be placed through the 1600 W.Plano Texas office, 800-448-2900, 214-422-1844, Fax: 214-423-4661. OEM. (Original Equipment Manufacturer) orders can be placed in the El Paso, Texas office.

CODI Semiconductor, Inc. ceased operations in 1991.

Cornell-Dubilier AC capacitor line and power products and filters were purchased, in late 1991, by Aerovox, Inc., North Dartmouth, MA.

Corning Electronics Resistors became Bradford Electronics, Inc. and is now part of Vishay.

Crystal Semiconductor was acquired by Cirrus Logic Inc.

Meeldijk is the Reliability/Maintainability Engineering Manager Diagnostic/Retrieval Systems, Inc. Oakland, N.J.

Custom Arrays Corporation of Sunnyvale CA has adopted the name Interdesign. This company manufacturers the linear arrays in a technical alliance with Ferranti Interdesign before it was acquired by Plessy Semiconductors.

Edmac, a subsidiary of Rospatch became Flightline Electronics, and is still located in Fishers, NY.

EMC (Electronic Molding Corporation) sockets, test jacks and panel systems was acquired by Advanced Interconnections, 5 Energy Way, W. Warwick, RI 02893, 401-823-5200, FAX: 401-823- 8723.

Erie became part of MuRata and is now known as MuRata/Erie. In April 1992, MuRata Manufacturing Company of Japan sold its EMI filter line, manufactured in Canada, to Spectrum Control in Fairview Pa. MuRata continues to sell surface mount filters and ferrite products for computer, consumer and telecommunications applications in Smyrna GA.

Fairchild Semiconductor became part of the National Semiconductor.

Ferranti Interdesign. See Custom Arrays Corporation.

Gazelle Semiconductor, Gigabit Logic and TriQuint Semiconductor merged together and are now called TriQuint Semiconductor, Santa Clara CA.

GE, RCA and Intersil microcircuits, and MOV's (metal oxide varistors), for the OEM market are now available, from Harris Semiconductors, part of the Harris Corporation, Melbourne, Florida. The use of the Harris name superseded the other logos in December 1989.

GE and RCA semiconductors, for the consumer service market, are now Thompson Consumer Electronics.

General Instruments Microelectronics Division is now called Microchip Technology.

General Semiconductor, was sold by its parent company Square D, to General Instrument Corporation in 1992.

GenRad (formerly General Radio) test equipment line (consisting of standards, measurement bridges, noise meters, stroboscopes) is now Quadtech, Inc., Bolton Mass.

Groupe Bull sold two printer lines, the series 4000 and 5000 high speed printers, to Delphax Systems in Canton, MA in late 1991. Groupe Bull continues to service the printers for Delphax Systems (the manufacturer of the print engines used in the machines).

Hamlin, a manufacturer of LCD's is now known as Standish Industries, Hamlin LCD Division.

H.H. Smith Company is now part of NT-T (National Tel-Tronics) Inc., 632 Atch Street, Meadville, PA 16335, 814-724-6440, Fax: 814-333-1912 .

Honeywell Semiconductors are now available from SPT, Signal Processing Technologies (a member of the TOKO Group), 1510 Quail Lake Loop, Colorado Springs, CO 80906, 719-540-3900, Fax: 719-540-3970.

Hughes Aircraft Microelectronic Circuit Division sold the crystal filters and oscillators to Piezo technology, Inc. in Orlando Florida.

Hybrid Systems Corporation is now known as Sipex Corporation, and is still located in Billerica MA (508-667-8700).

The **IBM** laser printer line is now an independent company known as Lexmark International, Lexington KY.

INMOS was bought by what is now SGS Thompson, although it still exists as a separate company.

Inova, a manufacturer of static RAMs, declared Chapter 11 bankruptcy in 1991 and ceased production of microcircuits.

Integrated CMOS Systems, Inc. in San Jose, CA, changed its name to Vertex Semiconductor Corporation in 1990.

International CMOS Technology, Inc. was acquired by a group of creditors, after filing Chapter 11 of the Federal Bankruptcy Act in August 1991, and was renamed ICT Inc.

ITT sold their computer line and the ITT XTRA Computers are serviced by Alcatel Business Products, located in AZ, 800-528-1400, Technical Service: 800-528-6457, Sales/Accessories/Technical Manuals: 1-800-231-4075.

Keithly sold their hand held meter and temperature instrument line to Tegam, Inc., Madison OH.

In 1991, **Kodak** sold its line of 9V Ultralife Lithium batteries and the new company is now known as Ultralife Batteries, Inc. Kodak continues to sell their other lithium batteries.

Kulka, a manufacturer of terminal blocks/strips, formerly a North American Philips Company, in Mount Vernon N.Y,, is now part of Marathon Special Products, Marathon Electric, 13300 Van Camp Road, Bowling Green, OH 43402, 419-352-8441, TWX: 810-499-2988, Fax: 419-352-0875.

Lambda Semiconductor parts are available from Semtech Corporation, Corpus Christi Facility, 121 International Blvd., Corpus Christi, TX 78406, 512-289-0403, Fax: 512-289-0472.

LSI, Avionics Systems Corporation of Lear Siegler, Inc. became SLI, Smiths Lear, Inc. part of Smiths Industries, 7-11 Vreeland Road, Florham Park, N.J. 07932, 201-822-1300.

In October 1992, **M/A-COM** sold their Radar Products Operation, microwave based high power control components military family, to Varian Associates, Inc. in Palo Alto CA.

Mallory Capacitors assets were purchased by North American Capacitor Co. 4760 Kentucky Ave., P.O. Box 1284, Indianapolis, IN 46206, 317-856-2430, Fax: 317-856-2500 .

Mepco became Mepco/Electra then Mepco/Centralab and then merged with Amperex on April 3, 1989 and became Philips Components, Airport Road, Mineral Wells, TX 76067.

MMI, Monolithic Memories, Inc, became part of AMD, Advanced Micro Devices, Inc. in August 1987.

Mostek Semiconductors was sold to United Technologies in 1979 and was later sold to Thompson-CSF. It is now part of SGS/Thompson Microelectronics, Inc (parts now have an "ST" logo). 1000 East Bell Road, Phoenix, AZ 85022, 602-867-6100.

Moxon Inc, manufacturer of Time Code Generators, became Kode, Inc. a division of Odetics, Inc. and is now known as Precision Time, a division of Odetics, Inc., 1515 South Manchester Avenue, Anaheim CA, 92802-2907, 714-730-6901.

Nova Devices, in 1969, became the Analog Devices Semiconductor division.

Nytronics inductor line is being distributed by Vishay Electronic Components (and is called Nytron). (Vishay Electronic Components is the parent company of TTI Inc., Angstrom Precision, Dale Electronics, Jeffers, Ohmtek, Techno, Ultronix and Vishay Resistors. The military relay lines of Struthers-Dunn and HiG were purchased by Schneider S.A of France (and can still be contacted through the pitman NJ location), who also purchased Square D. Struthers- Dunn commercial relays was acquired from the Nytronics Components Group by Magenecraft Electric Company in Northbrook, IL.

Optical Fiber Technologies (OFTI), of Westford MA was purchased by AMP in June 1992 and was merged into the AMP Electro-Optics Division.

Optima Division of Scientific Atlanta (manufacturer of enclosures) is now part of the Gichner Systems Group, is still located in Tucker GA.

Pixel Semiconductor was acquired by Cirrus Logic Inc. but still operates as a separate company.

Plessey, the division that manufactured special purpose computer boards is now Radstone Technology Corporation, 20 Craig Road, Montvale, N.J. 07645-1737, 201-391-2700, Fax: 201-391-2899

Plus Logic, a manufacturer of PLD's (programmable logic devices) was purchased by Xilinx.

PMI, Precision Monolithics Inc., a manufacturer of operational amplifiers, voltage followers, buffers, converters, multiplexers, etc., was acquired in 1990 by Analog Devices.

Power Control Devices, a manufacturer of oscillators/choppers, quartz crystals and amplifiers, discontinued operations in 1992. This company was formerly American Time Products a Division of Frequency Control Products, and prior to this a Bulova Electronics Division.

Prairie Tek, a disk drive manufacturer founded in 1986, closed in August 1991.

RCA test equipment was first sold to VIZ Instruments, which was later acquired by Kappa Networks, Inc. In 1990 they were again sold, to the Vector Group and are now called Vector-VIZ. They are located in Newburgh N.Y.

Renaissance GRX. See ZyMOS Corporation.

Rogers Corporation Circuit Components Division (best known for PGA and rail capacitors) was sold in April 1992 and is now known as CCI, Circuit Components, Inc., the company is still located in Arizona.

SFE Technologies ceased its San Fernando Capacitor Operations in 1991 and the EMI/RFI filter line was sold to Wems Electronics. The company is now called Wems Electronic Filter Group and is in Hawthorne CA.

Solid State Scientific, a semiconductor manufacturer, was acquired by Sprague Electric in 1984.

Souriau, Inc was puchased by Burndy Corporation. In Europe these connectors are marketed under the Framatome Connectors International (FCI) name. Framatome Connectors is the parent organization of Burndy, Jupiter, Souriau and Connectral.

Sprague Semiconductor is now Allegro Microsystems Inc., in MA.

Sprague Technologies solid tantalum capacitor line and the U.S. thick film network business was sold to Vishay Intertechnology in 1992. The 192P film/foil capacitor line was sold in 1992 to SB Electronics of Barre Vermont. Also in late 1992, United Chemi-Con Inc. acquired the Sprague aluminum capacitor facility in Lansing, North Carolina. The manufacturing location of the aluminum capacitors remains unchanged and the original Sprague part numbers have been retained. Capacitors as of December 1992 are marked Nippon Chemi-Con.

Standard Grigsby, a manufacturer of rotary switches, was acquired by Oak Switch (parent Oak Industries) in 1991. The new company is called Oak Grigsby, located in Sugar Grove, Ilinois.

The **Tecktherm** thermally conductive insulation product line (series 1601 to 1605) was sold in 1992 and is now available from Bergquist (Minneapolis, MN) as part of their Sil-Pad product line.

Teledyne Philbrick Division of Teledyne Inc. is now known as Teledyne Components Division of Teledyne Inc..

Texas Instruments sold its business computer line (the 1500 family) to Hewlett Packard in June 1992. Hewlett Packard will continue to sell the 1500 line and can even use the TI logo. TI will continue to manufacture the line for Hewlett Packard at a

(Continued on page 45)

MAIN (1) CIRCUIT

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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.

es&t Manufacturers' schematics PROFAX 3098

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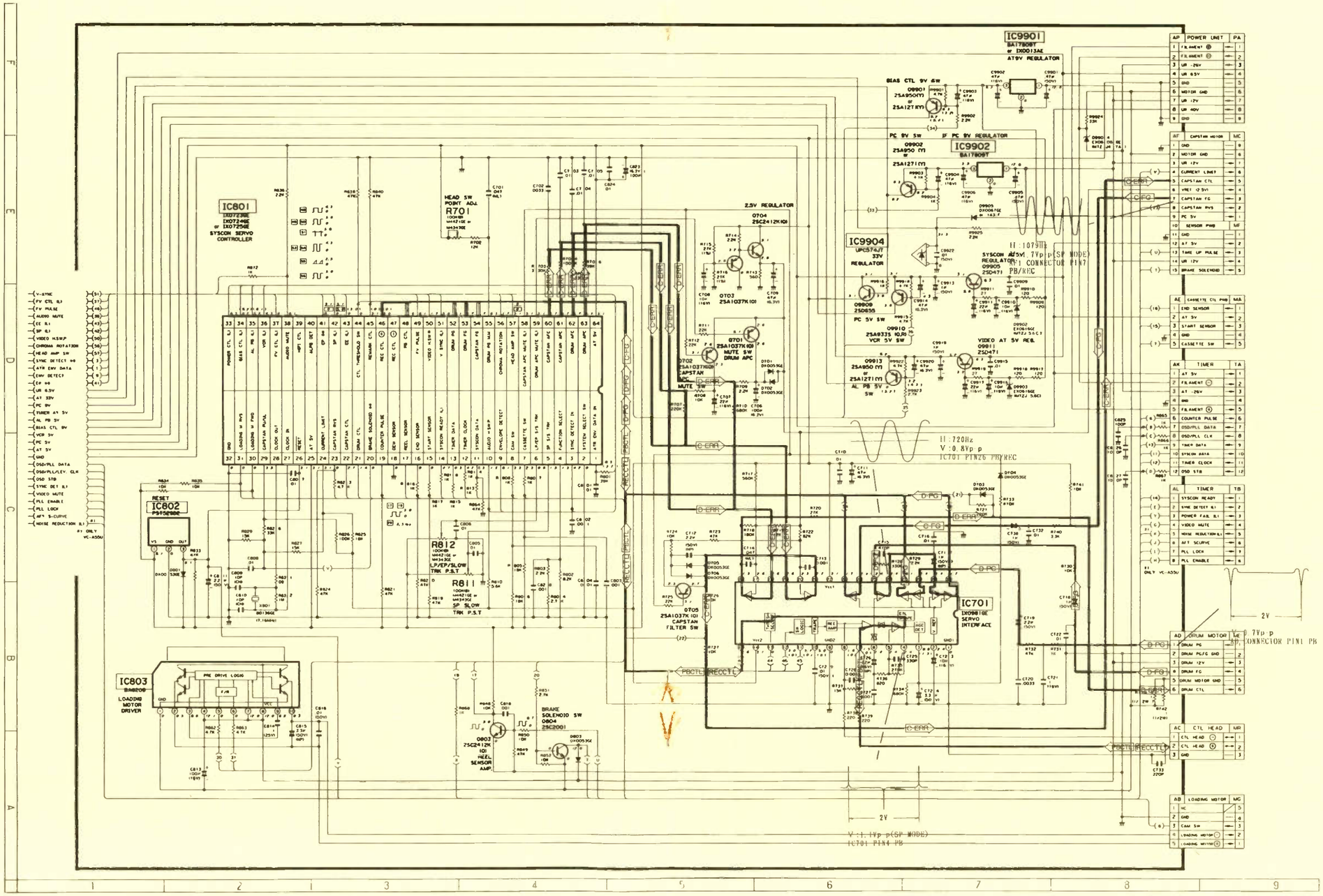

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ES&T Manufacturers' schematics **PROFAX**

FEBRUARY 1993

Profax Number

SHARP
VCR Model VC-A45U **3098**

MAIN (2) CIRCUIT AND IF/TUNER/AUDIO CIRCUIT

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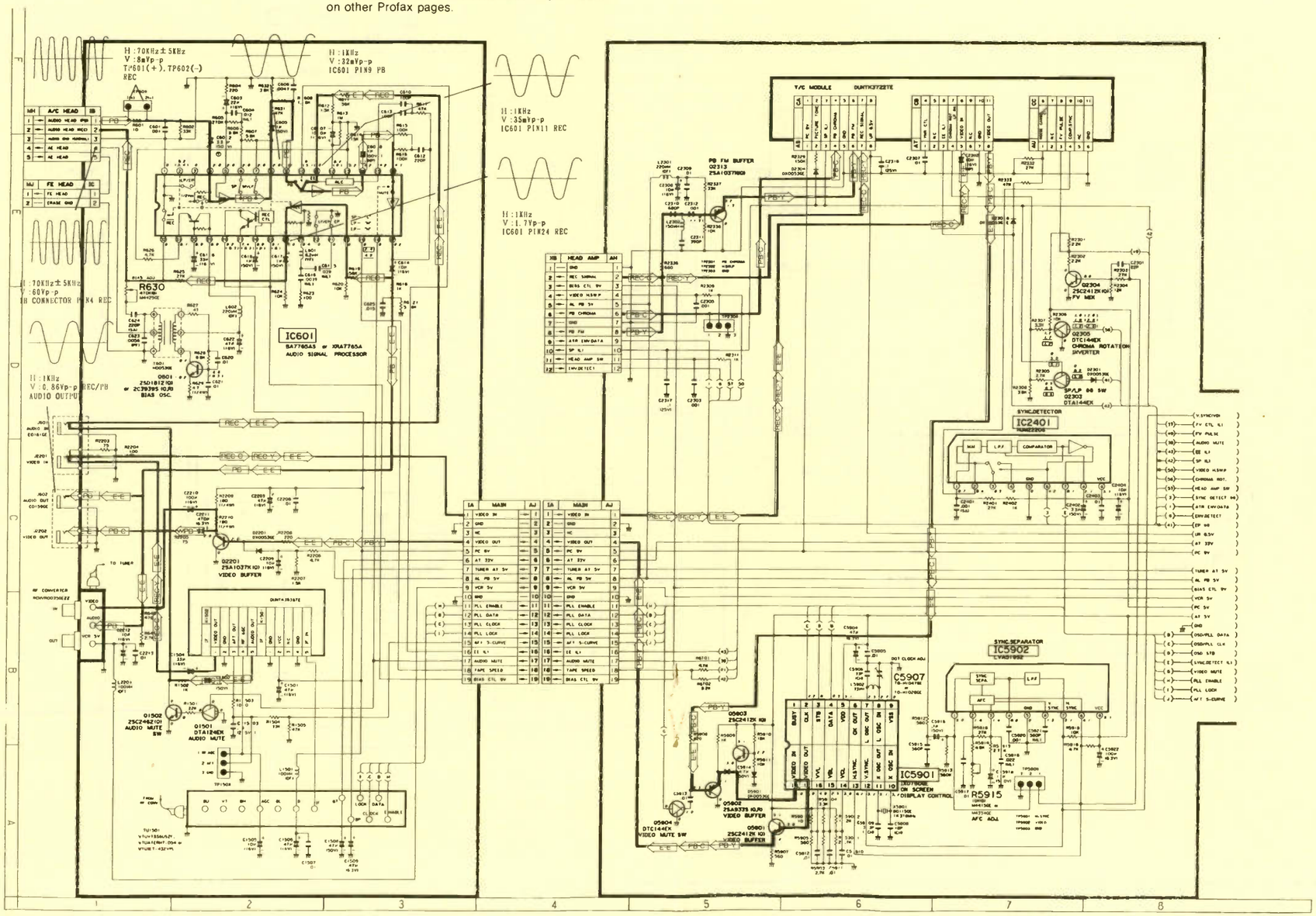

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Y/C CIRCUIT AND 4 HEAD AMP. CIRCUIT

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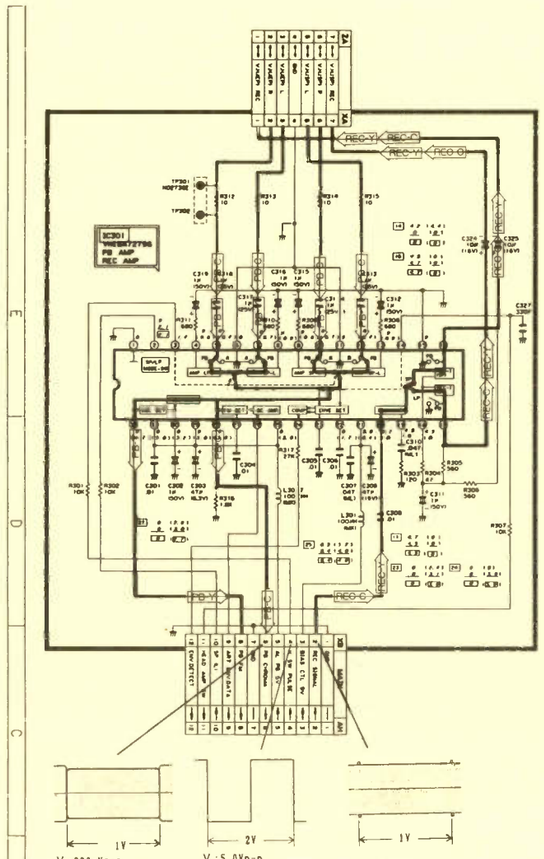

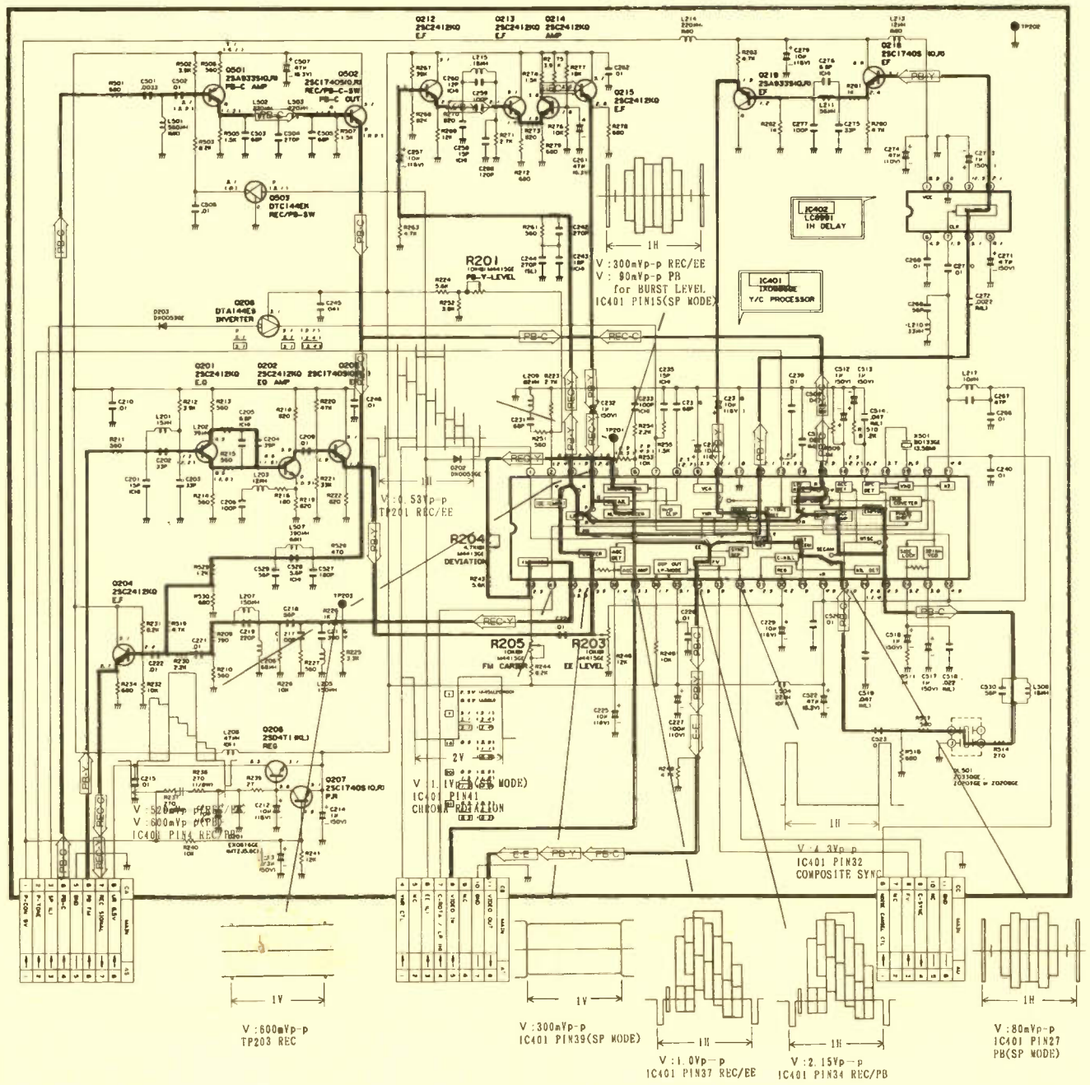

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LUMINANCE/CHROMINANCE BLOCK DIAGRAM

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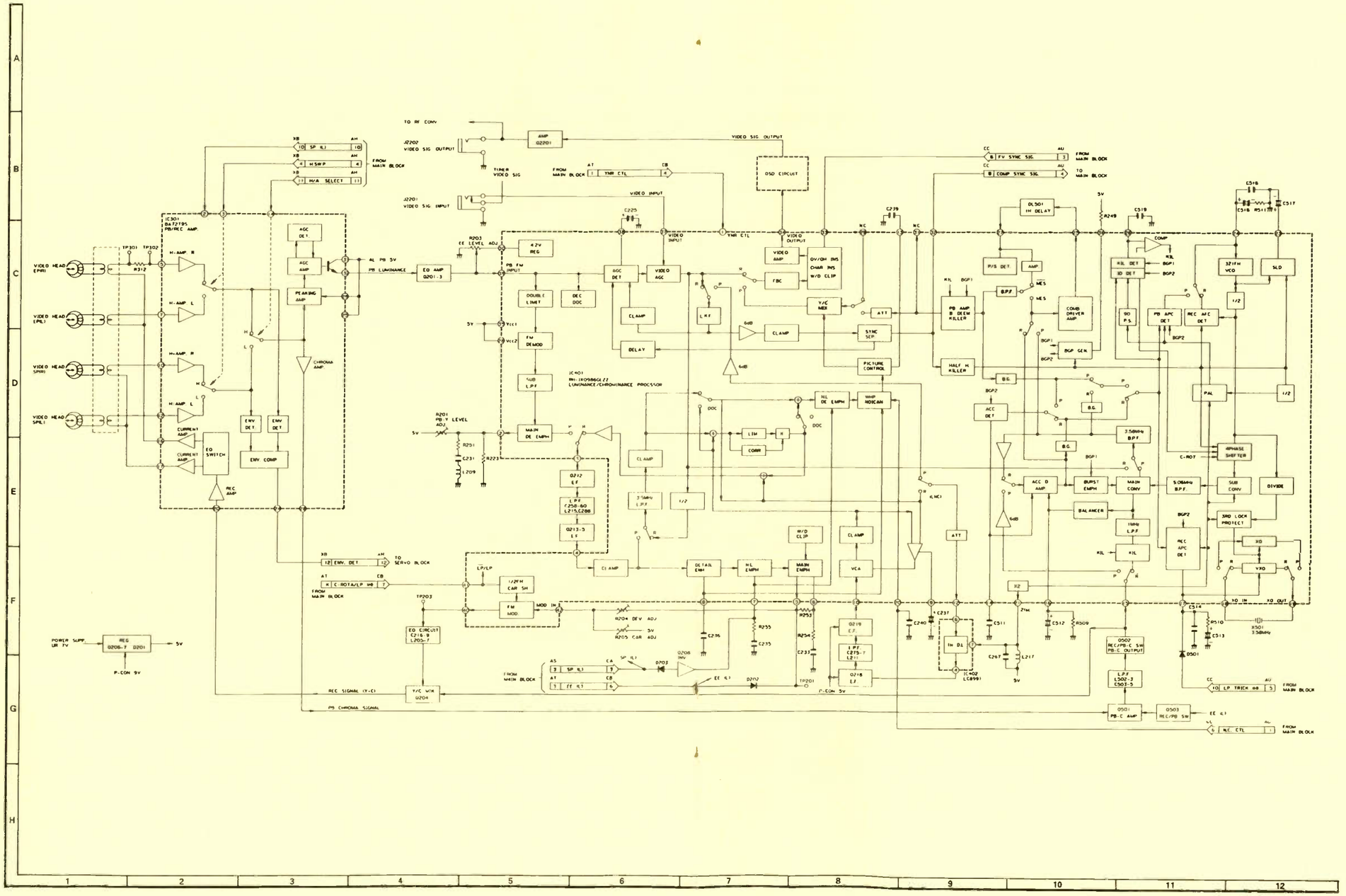
Manufacturers' schematics PROFAX 3098



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ES&T Manufacturers' schematics **PROFAX**

FEBRUARY 1993

Profax Number

SHARP

Color TV Chassis No. 25S1, Models 25SB60B, 25SB620B, 25SB640B **3097**

PRINTED WIRING BOARD ASSEMBLIES

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ES&T Manufacturers' schematics **PROFAX** 3097

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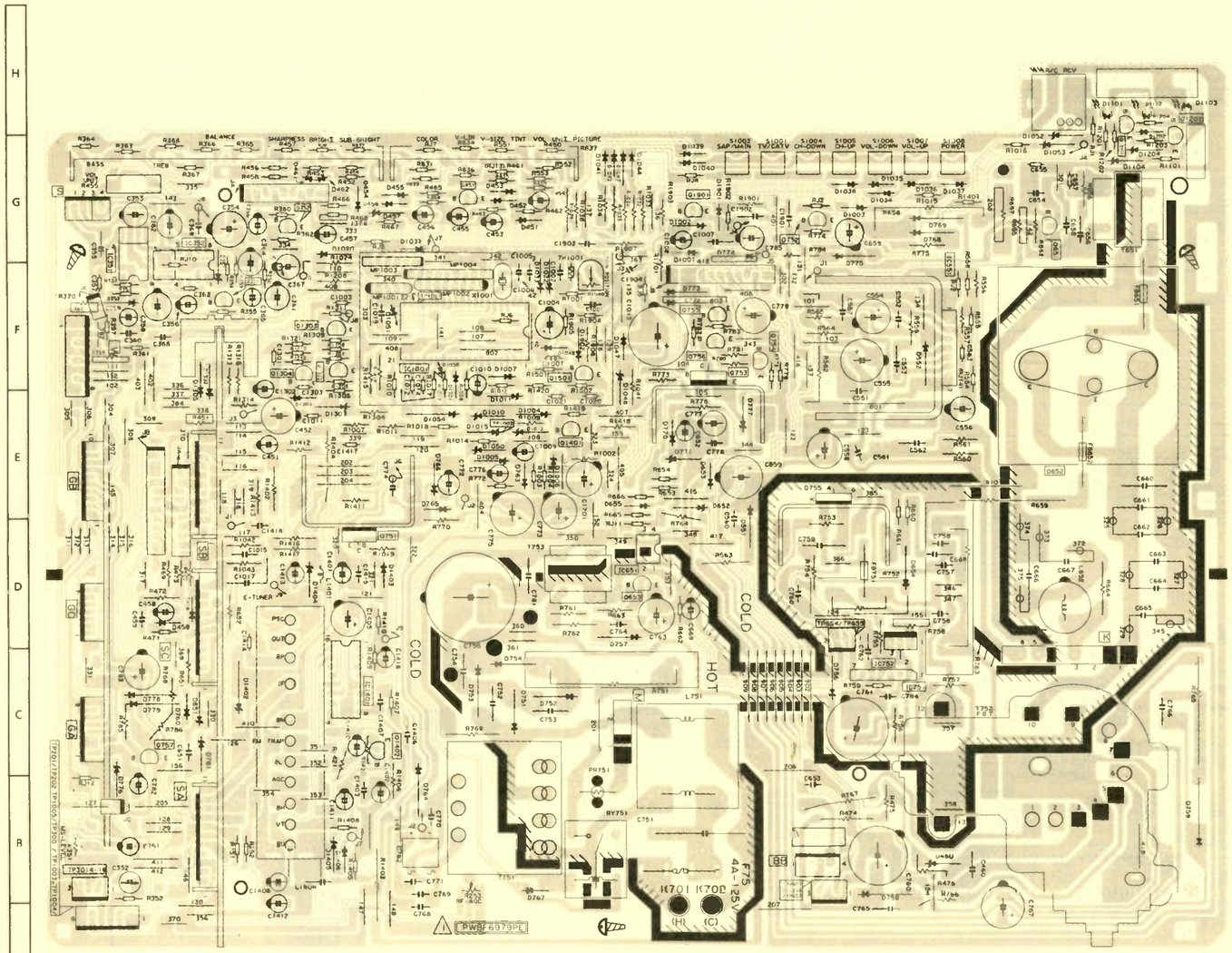
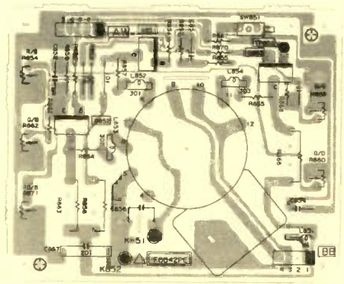


PWB-A Wiring Side



PWB-B Wiring Side

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SCHEMATIC DIAGRAM: MAIN-1

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ES&T Manufacturers' schematics PROFAX 3097

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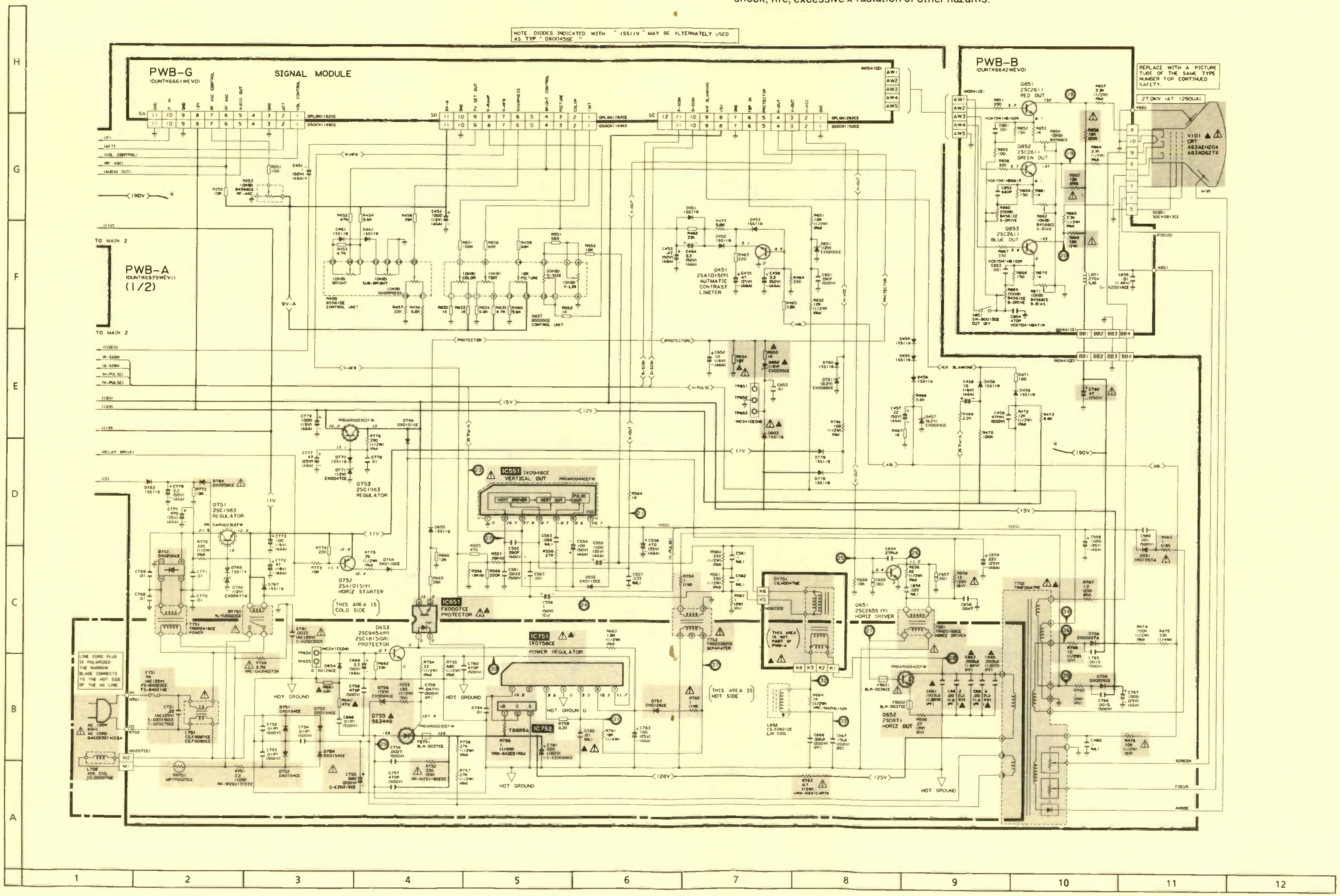

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SCHEMATIC DIAGRAM: MAIN-2

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SCHEMATIC DIAGRAM: MAIN-2

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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.

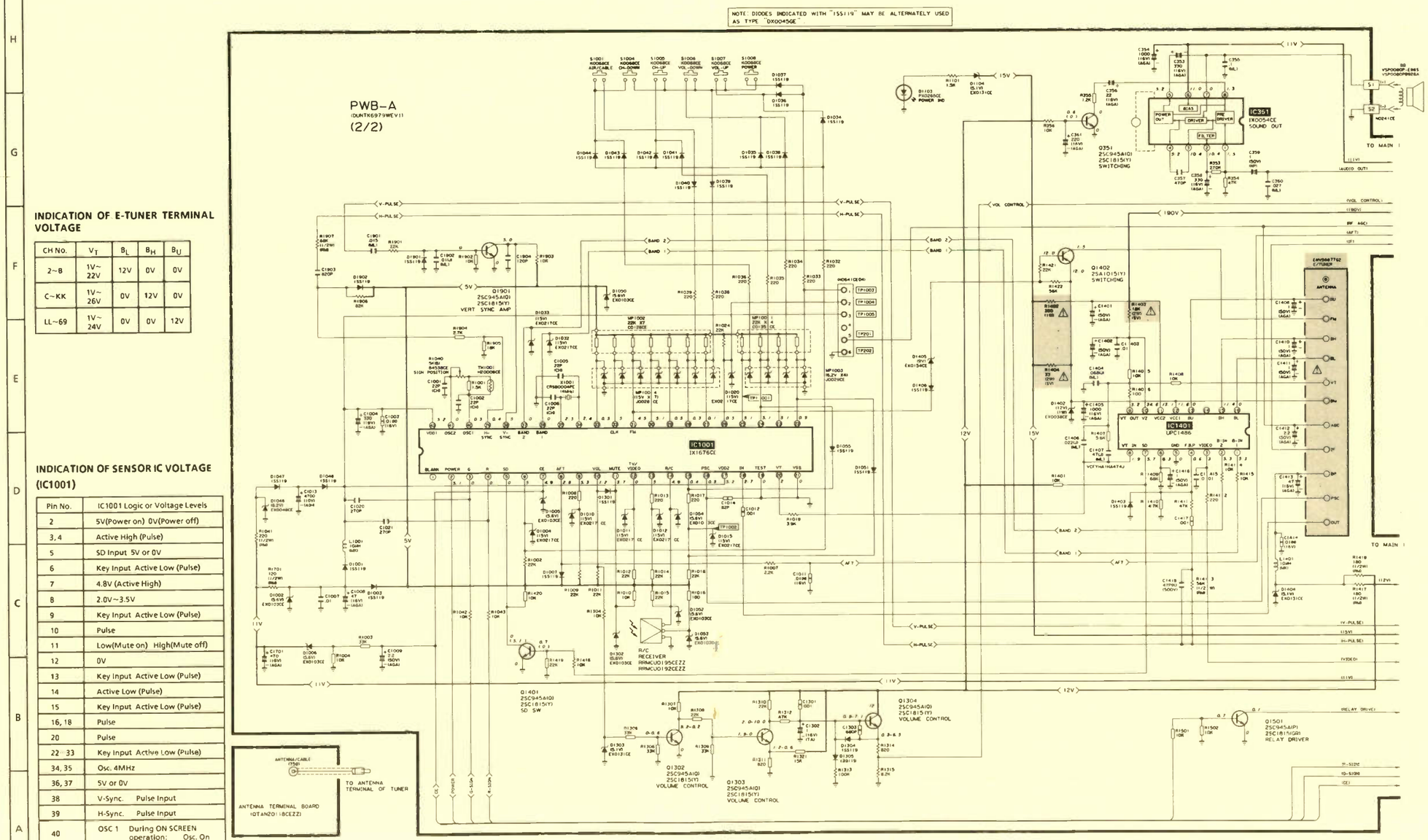
All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.

INDICATION OF E-TUNER TERMINAL VOLTAGE

CH No.	V_T	B_L	B_H	B_U
2~B	1V~ 22V	12V	0V	0V
C~KK	1V~ 26V	0V	12V	0V
LL~69	1V~ 24V	0V	0V	12V

INDICATION OF SENSOR IC VOLTAGE (IC1001)

Pin No.	IC1001 Logic or Voltage Levels
2	5V(Power on) 0V(Power off)
3, 4	Active High (Pulse)
5	SD Input 5V or 0V
6	Key Input Active Low (Pulse)
7	4.8V (Active High)
8	2.0V~3.5V
9	Key Input Active Low (Pulse)
10	Pulse
11	Low(Mute on) High(Mute off)
12	0V
13	Key Input Active Low (Pulse)
14	Active Low (Pulse)
15	Key Input Active Low (Pulse)
16, 18	Pulse
20	Pulse
22~33	Key Input Active Low (Pulse)
34, 35	Osc. 4MHz
36, 37	5V or 0V
38	V-Sync. Pulse Input
39	H-Sync. Pulse Input
40	OSC 1 During ON SCREEN operation: Osc. On
41	OSC 2 During ON SCREEN Inoperative: Osc. Off



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3097

SHARP
Color Television
Chassis No. 25S1
Models 25SB60B,
25SB620B,
25SB640B

PROFAX
BS&T Manufacturers schematics

FEBRUARY 1993

SCHEMATIC DIAGRAM: SIGNAL MODULE

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SCHEMATIC DIAGRAM: SIGNAL MODULE

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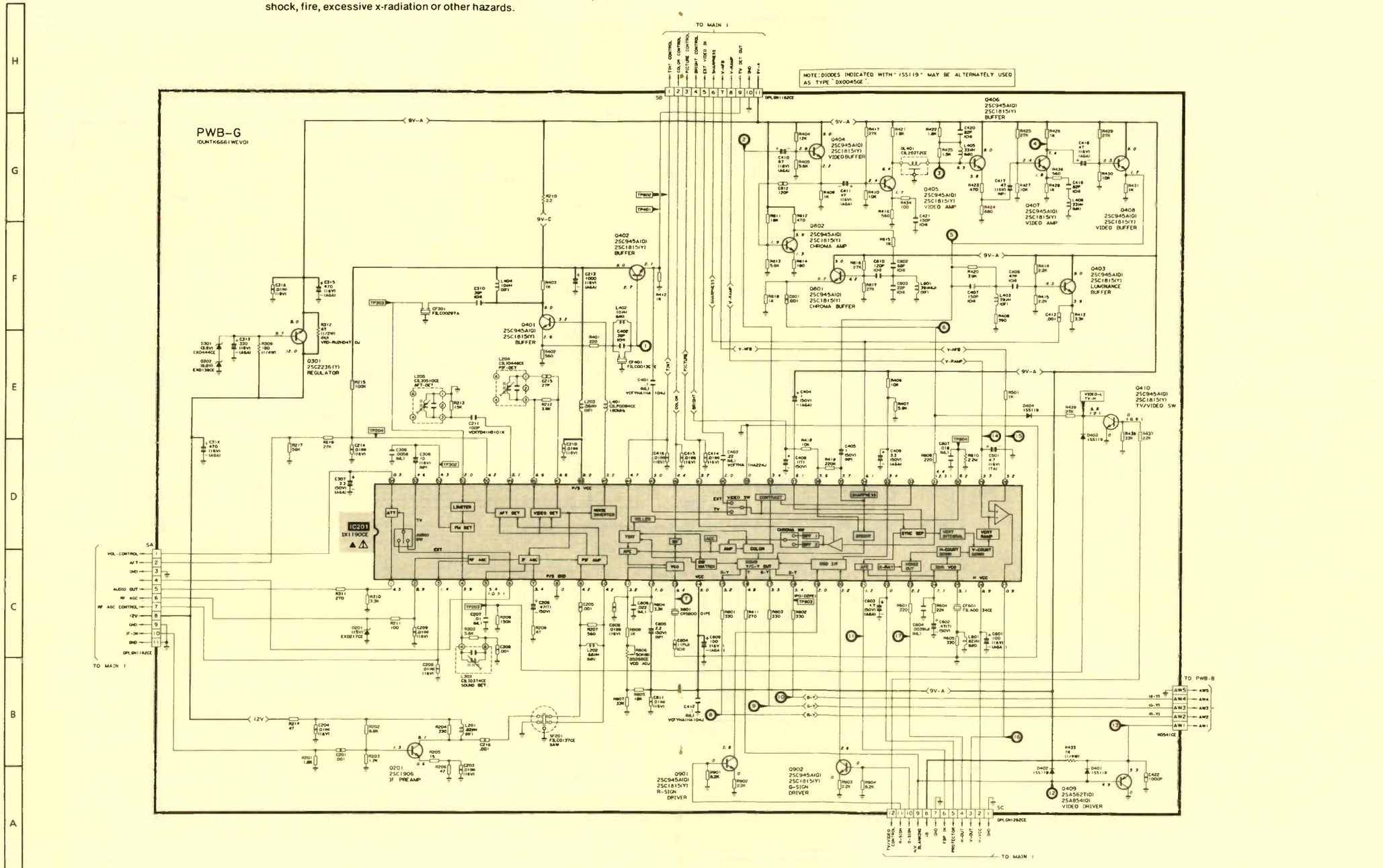
BS&T Manufacturers' schematics PROFAX 3097



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contract manufacturing plant in Austin. TI continues to manufacture a laptop line made by its peripherals group.

Times Fiber Communications, Inc., a manufacturer of coaxial cable and related products was acquired by Amphenol Corp. in late 1992.

TRW/UTC (United Transformer Corp.) Transformer became OPT/UTC, part of OPT Industries, Inc.. 300 Red School Lane, Phillipsburg, N.J. 08865, 201-454-2600, Fax: 201-454-3172.

Unimax Switch is now C&K Unimax Unisys Defense Systems, Mclean VA (Unisys is the company formed after Sperry and Burroughs merged), was renamed Paramax Systems Corporation (the name of the Sperry organization in Canada).

Unisys Defense Systems, Mclean VA (Unisys is the company formed after Sperry and Burroughs merged), was renamed Paramax Systems Corporation (the name of the Sperry organization in Canada).

Unitrode sold its semiconductor products division (which makes discrete power semiconductors for industry and the military) to Microsemi Corporation in 1992. This division was renamed to Microsemi Watertown.

U.S. Elco Inc. in Santa Clara CA, a power supply manufacturer, changed its name to Cosel U.S.A. in May 1992.

Vitelec Corporation was acquired by Mosel Corporation. The new company is called Mosel-Vitelic Corp., San Jose, CA.

Ward Leonard Resistors was acquired by Charles T. Gamble Industries, Delanco NJ.

Ward Leonard Industrial Controls (Relays, Contactors, Rheostats) was acquired by Joslyn Clark Controls, Lancaster SC.

The **WCI Major Appliance Group**, which manufacturers such brands as Frigidaire, Tappan, White-Westinghouse, Gibson and Kelvinator, changed its name to the Frigidaire Company in 1991.

West-Cap Arizona, an inductor manufacturer, was purchased by Vishay Intertechnology, Inc. in 1990.

The **Xceed** line of add-in computer video boards, cache cards and SIMM modules (for Macintosh and HP Laserjet printers) was sold by Micron Technology in 1992 to P.G. Design Electronics. This business which was operated as Micron's Enhancement products division is a division of P.G. Design based in Richmond Michigan and operating under the name Xceed Technologies.

ZyMOS Corporation, a manufacturer of PC Chip Sets, Graphics Chips and ASIC (application specific IC's) and Renaissance GRX, a manufacturer of graphics cards for PC workstations merged in 1991 and the new company is known as Appian Technology, Inc. in Sunnyvale CA.

Power supply mergers

The power supply industry saw many mergers and consolidations, including:

AC/DC, PowerTec, Semiconductor Circuits, Inc., and Brandenburg Power Supplies and ASTEC are now ASTEC America, Inc. 401 Jones Road (the old AC/DC address), Oceanside, CA 92054, 619-757-1880, Fax: 619-439-4243.

CEAG Power Supplies became CEA Power Supplies, same location in LI, New York.

Cherokee International, Inc, was purchased by Core Industries, Inc.

Fincor, division of INCOM International, Inc. became Mid-Eastern Industries, Inc. and later became a division of Technology Dynamics, Inc., 100 School Street, Bergenfield, NJ, 201-385-0500.

Gould Power Supplies became Advance Power Supplies, Inc. and is now known as Farnell Advance Power, 426 S. Hanover St, Baltimore, MD 21202, 301-528-9120, Fax: 301-528-9116.

Jetta Power Systems, Inc. changed their name to ETA Power Systems, Inc. 2675 Junipero Ave., Signal Hill, CA 90806, 213-427-0095.

Magnapower, Inc, the power supply manufacturer, was purchased by Lambda, Inc.

Modupower Inc. of Santa Clara CA (a manufacturer of dc/dc converters, power supply modules and voltage regulators) assets were bought by Semtech Corp., Corpus Christi, TX in September 1992.

MPSI, Modular Power Systems, Inc assets were purchased by EG&G Almond Inc.

NJE Power Supplies are available from Electronic Measurements, Inc. in Neptune N.J., this company bought NJE in 1990.

Novatronics, the power supply manufacturer is now part of the Lambda Group, Lambda Novatronics, Inc., 305-942-5200, Fax: 305-783-4963.

Computer Products Inc., Power Products Division, which included Boschert, Stevens-Arnold and Asia-Pacific, Ltd. sold the switching power supply lines to Unipower, Pompano Beach FL. Technetics, Inc, a military power supply manufacturer, was also sold to a group of its senior managers.

Powertec Inc., the power supply manufacturer was purchased by Low and Bonar, of Scotland

Venus Scientific, Inc., a manufacturer of high voltage power supplies, is now known as Ferranti Venus. ■

Successful Servicing
Diversification in servicing

By Ron C. Johnson

In an economy where businesses are struggling to find new ways to turn services into profits, diversification is one of the most viable options. This is certainly true in the field of electronics service. Technologies which used to be the domain of specialty service organizations are now fair game for more aggressive consumer electronics service centers.

Computers, printers, monitors and copiers are no longer considered the private realm of business service companies. Individuals use this kind of equipment as personal productivity tools, often working from home or out of a small office. If service is required, and they know their local consumer service center can do the job, the equipment finds its way there.

Aggressive business people would then ask, "What other areas of service can we move into?" As an electronic service technician, in business myself for several years, I asked myself that question innumerable times. Some of the areas I tried were quite successful while others were dismal failures, but each one was a learning experience. This article will list and describe some of those areas, their pros and cons, and give some ideas on how to approach them.

First considerations

Before listing some areas where service work could be obtained some consideration should be given to whether the investment of time, effort and money is worth the return. We all know that keeping busy doesn't always translate into making profits. Even large cash flows don't guarantee black ink, instead of red, in your bank account. It's the bottom line, after the expenses are deducted, that tells the story. Obviously, some careful study is required.

Look for service areas where the population of serviceable equipment is high.

Ron C. Johnson is a journeyman electronics servicing technician and an instructor of technology at the Northern Alberta Institute of Technology in Edmonton, Alberta, Canada.

Becoming a specialist in specific circuitry and equipment costs money in training, test equipment and experience. As technology is improved, equipment failures become less frequent. If there aren't enough units around to support the investment there will never be profits. More importantly, for long term growth, the population should be expanding.

Consider the level of training and the investment in test equipment required. Will you or your technicians need to travel somewhere for specialized training? Are your existing equipment and shop facilities adequate to the task? Is on-site service required as well as shop repairs? How large is the service region?

Profit potential also depends on related factors. Does this kind of work lend itself to service contracts or extended warranties? What will the average repair bill be? Are the sales of parts and supplies

a significant part of the picture? If so, what level of investment in parts is required? Who are your competitors and what is their status in the field?

If your analysis indicates a good opportunity for profits you may have a winner.

Some potential service opportunities

You are in business because you have the ability to provide certain services in your current field. Taking on new areas means transferring those skills and abilities to a new area. The following list and description may be helpful in determining if that transfer is workable.

Personal computer servicing

This is no surprise to anyone. Many service shops which have traditionally repaired home entertainment electronics, microwaves, etc. are already moving into this field. Personal computers have become a fixture in many households and the home office is very common. Fax machines, photocopiers, printers and PC's are becoming so closely integrated that they all fall into this category. In addition to the potential for sales of service contracts, supplies such as printer ribbons, paper, diskettes and laser printer refills can increase profitability.

Automotive test equipment

The automotive service industry has become highly dependent on sophisticated test equipment for battery testing, wheel balancing and alignment, and engine analysis. Since the environment is less than friendly to the test equipment, service on a regular basis is required.

This field, like many others, has moved steadily toward specialized computer equipment, which is quite reliable in itself. Much of this area's profitability comes from basic repairs to lead sets and connections between the vehicle and the analyzer.

For instance, a typical engine analyzer uses five or six sets of special cable harnesses with clips on one end and connectors on the other. In the shop environment these harnesses fail regularly. Sometimes they are cut or worn by moving parts under the hood of the vehicles, sometimes abused by the service mechanics who use them. Repair and/or replacement of cable sets is easy and profitable.

Engine analyzers also use sophisticated gas analyzers to analyze the vehicles' exhaust. Periodic cleaning, servicing and calibration of this equipment can bring in regular work.

Both engine analyzers and wheel alignment machines use software designed for specific automobiles. Every year new models come out with new requirements. The service shop representing the test equipment manufacturer has yearly opportunities to sell updated hardware and software needed to service the latest models.

While automotive test equipment is fairly specialized and requires extra training, some test equipment and a significant investment in parts, it can be very profitable. Moreover, it opens doors for related repair business such as timing lights, battery chargers and other small electronics related to the automotive field.

Supplies for the equipment, as well as supplies for the automotive shop (tools, materials, etc.) add to the total business. Representing specific brands can lead to the opportunity to branch out in non-related areas such as hoist installation and operational training, as well.

Industrial controls

There are countless small to medium sized businesses, manufacturers and industrial suppliers who struggle with electronic equipment failures. These companies cannot justify their own electronic service personnel on staff but could use the services of one on a periodic basis.

This also applies to small electrical maintenance companies. Their main function is to service the electrical equipment in commercial and small industrial plants. Often they are confronted with electronics equipment that they are not equipped to handle. An ongoing working relationship with companies such as these can create in-shop work.

While this kind of work can be varied and, consequently, difficult to effect repairs quickly, high charges can be justified. Who else will do it for them? Unfortunately, this kind of work can also be sporadic, but in some situations good profits are possible.

Agricultural electronics

It might be easy to overlook this area unless you have some contacts or a background in farming. Agriculture is no longer a simple folksy way of life. Successful farming involves the use of complicated machinery that uses electronics to monitor its operational status and to maximize its efficiency.

While this area is very specialized and requires a good understanding of the field, there is a vast market of seeder monitors, grain loss monitors, shaft monitors, etc., which need repairs regularly. The company that can set up an efficient system for receiving, repairing and shipping agricultural monitors can build a profitable sideline.

Agricultural applications are expanding and, for the company with the ability to design and manufacture original equipment, the possibilities are endless. Many times these applications are not 'high-tech' as much as they are very application specific.

Manufacturing a simple but practical item, (and marketing it through the same agri-dealerships that you are doing service for), can be lucrative.

Sound contracting

Sound contracting is a multi-faceted area of electronics. It can include sales, (bidding, quoting, in-store, etc.), service, (on-site and in-shop), and installation. The field ranges from small intercom, paging, background music, drive-through systems in restaurants, stores and offices, on up through public address systems in churches and schools, and even into large auditorium and sports field systems.

Since these are all largely contracted, the difficulties here lie in being able to accurately bid each project and then tightly control the costs when the job is done. Large cash flows are often associated with this kind of business and it can be a 'boom-and-bust' situation, with 'dry' periods interspersed with frantic efforts to complete all work on schedule.

My experience in this area led me to believe that several small contracts, with reasonable profit margins, were far superior to one or two large systems installations. Usually the large jobs attracted much more interest from competitors and the profit margins were 'shaved' to almost nothing (even less than nothing if a mistake in estimating occurred).

In addition, designing larger sound systems is difficult due to the variations in room acoustics and other factors. Ensuring customer satisfaction is equally difficult. The positive side is that smaller systems can be easily installed with a minimum of tools and expertise, for rea-

sonable profits. Working relationships with restaurant and retail chains can result in repeat work.

Security systems

Some similarities exist between sound system contracting and security system contracting. Some installation techniques and equipment are similar and often bidding for jobs is required. Both an advantage and disadvantage of security system contracting is that monitoring is required.

Security system monitoring involves the relatively high, up- front cost of setting up a system to monitor the security systems installed, but once it is in place, the customer pays regular monthly fees to have their system monitored. As with sound systems, a high degree of expertise is required to design reliable and effective systems.

Print shops and newspapers

As the use of personal computers continues to grow the distinction between desktop publishing and professional publishing becomes blurred. Still, the larger print shops and newspapers use more sophisticated systems for typesetting, printing and other applications.

Some manufacturers of this equipment will contract a local company to do service rather than keep a local service representative in the area. I also have had some success with providing 'third party' service when the manufacturers' service rates and response time were unsatisfactory to the customer.

Teaching

One side benefit of making yourself knowledgeable about a subject is that you can communicate the same information to others. It's not only who you know, but what you know. If you are able to stand up and talk to a group of people who are interested in a particular subject there will often be money to be made.

One way in which this occurs is when you sell a piece of equipment that requires specialized knowledge to operate it. Automotive test equipment is one example. The mechanics using the equipment need to know how to use it to make money for themselves. I have known a few trainers who make their living traveling around doing seminars on a single piece of equipment.

Community college evening courses are another opportunity. In addition to being paid to teach a course you can develop good public relations for your company in the process.

Full time work as an instructor at a technical school (as I do) is another, albeit full-time, way of making money from your technical knowledge and expertise. It isn't uncommon for instructors to make their living in the classroom while operating a business during their evenings, weekends and holidays.

Writing

As I said, it's often what you know that can produce a profit. Writing for technical and trade magazines and journals, newspapers, advertisers and for educational publications are all valid ways of using your expertise.

Your experience is unique. You have undoubtedly unraveled technical problems which are different than those that have been faced by anyone else. Why not use those experiences to help out others in your field of work? They'll gladly buy a magazine to share your knowledge. Again, sharing this kind of information not only benefits you personally but is good public relations for your company.

The key to making money writing technical articles is to write clearly and simply. Write letters to the magazines you think would be interested in your material and ask for writers' guidelines. You can also suggest some topics you could write about. They will usually be glad to respond with information on their requirements. Above all, follow these guidelines as closely as possible. This will maximize your chances of selling your material.

Even during good economic times business can be a challenge. But economies change, markets change, and technologies change. We have to take a dynamic approach to long range planning. The business that determines to stick with the success formula it used in "the good old days" may be writing its own death certificate. After considering the alternatives—only a few of which I've mentioned here—the business that broadens its income base may be the one that is still around in years to come. ■

Test your electronics knowledge

By Sam Wilson

1. The highest decimal number that can be represented by eight binary bits is

A. 256
B. 257

2. An integrated circuit has a pin designated as NOT CS. The signal to this pin is delivered on the

A. data bus
B. address bus
C. control bus

3. Evaluate the following

192_{10} = _____ 16

4. In a non-regulated power supply, better regulation occurs with

A. a capacitor input filter
B. a choke input filter

5. In the equation for magnetism, $\mu = B/H$, μ is the permeability, B is the flux density in lines/in^2, and H is the magnetizing force in ampere turns per inch. The unit of measurement for μ is

A. Gauss per square inch
B. Maxwells
C. Games
D. (none of the above choices is correct.)

6. An unregulated power supply has an M-derived LC filter. Is it is replaced by a constant-k filter the cutoff curve will

A. be sharper (that is, steeper).
B. not be as sharp (that is, not as steep).

7. An SCR is turned on by a

A. gate voltage
B. gate current

8. Is the following statement correct?

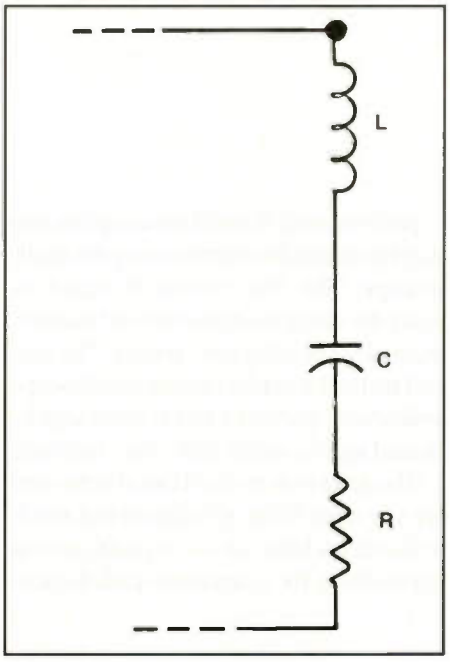


Figure A

"In the series-tuned circuit of Figure A the resistance has some effect on the resonant frequency."

A. The statement is correct
B. The statement is NOT correct

9. A VU meter measures

A. the average voltage value of a waveform
B. the RMS current value of a waveform
C. the peak voltage value of a waveform

10. A certain publication lists an h_{FE} of 110 for a transistor. Which of the following is correct?

A. The value must be wrong because h_{FE} cannot exceed 100.
B. Because of the value given it should be called h_{FB}
C. (Both choices are correct).
D. (Neither choice is correct).

(Answers on page 62)

Wilson is the electronics theory consultant for **ES&T.**

Video Update: Setting VCR head switching

By the ES&T Staff

This article is based on Tech Tip 108 from Sencore. All artwork is courtesy of Sencore.

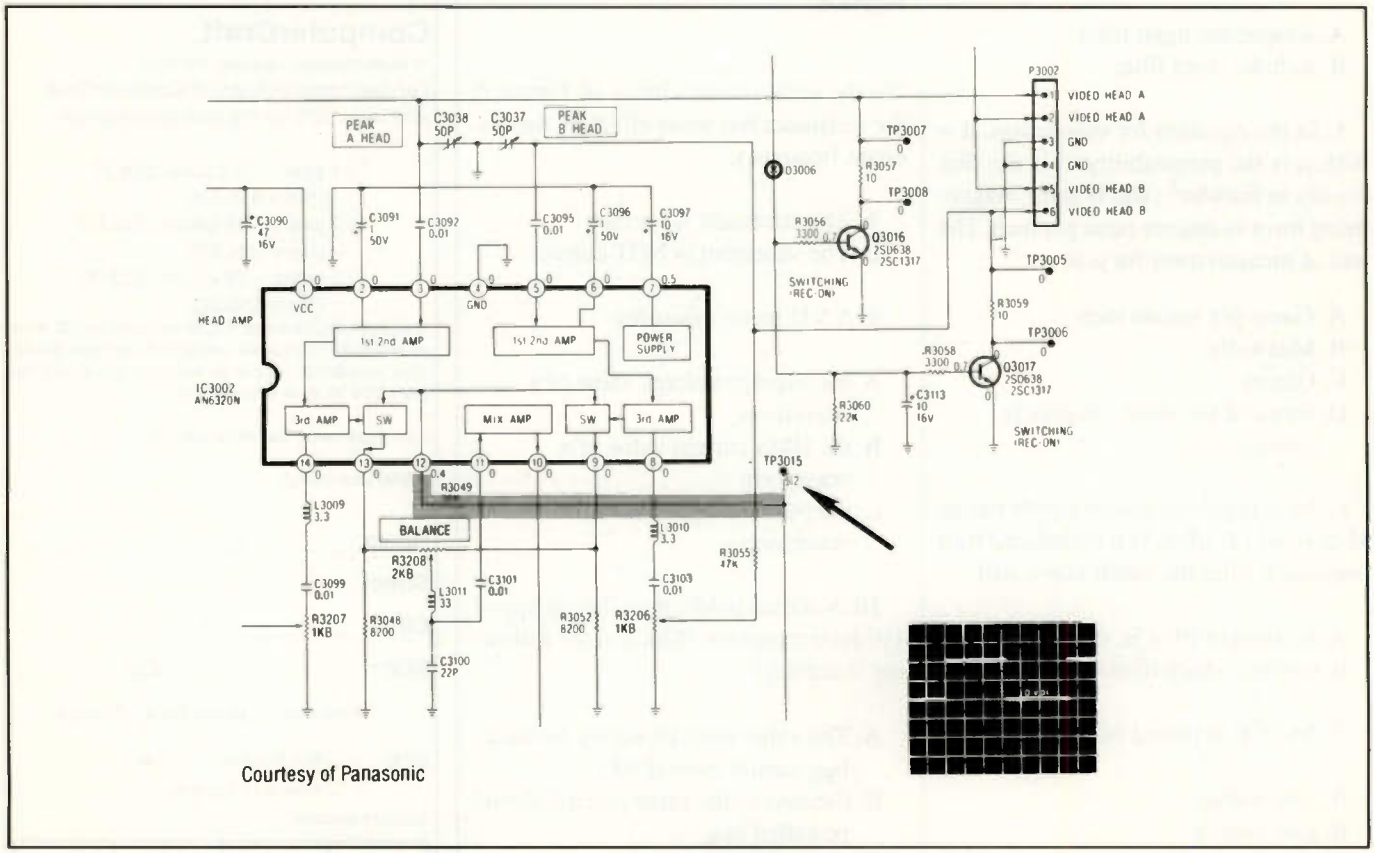
VCR technicians have a need to know how to set the head- switching signals in VCRs. Another name for this adjustment is the "PG Shifter" control. This article, based on Sencore Tech Tip 108, explains this adjustment in detail.

We will start by explaining how the head switching adjustment affects VCR performance. We will then explain two ways to adjust the circuits using the oscilloscope. The first method is based on using the scope in a conventional manner, manually counting sync pulses. The second method assumes that the oscilloscope available is one of the newer more sophisticated scopes with a delta time function.

The delta time method can also be used for any other VCR adjustment that needs a time delay between two signals, such as the tracking-fix (sometimes called tracking preset) adjustment and the timing of the hi-fi heads in VHS tape decks.

Why head switching needs adjustment

Before we explore how to set the head-switching signal, lets consider what it does. Every VCR uses a pair of video heads when playing a tape at normal speed. Even decks with 3, 4 or 5 video heads use the heads two at a time. (See Figure 1.).



Courtesy of Panasonic

Figure 1. The head switcher uses a 30Hz square wave from the servo circuits to turn off the amplifiers of the head which is not contacting the tape.

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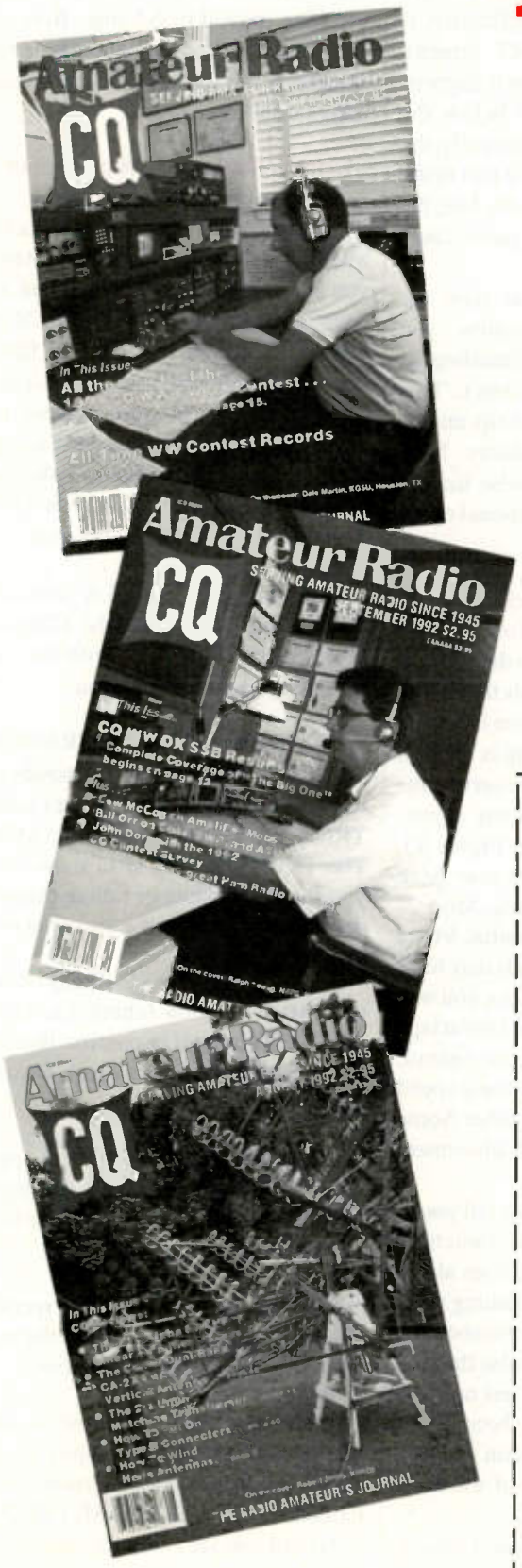

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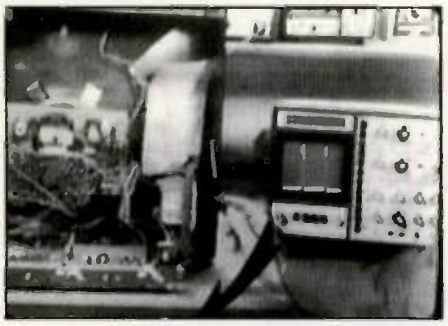


Figure 2. Noise appears in the picture at the point where the VCR switches from one video head to the other. The switching adjustment keeps this noise close to the bottom of the screen, so that it is not annoying.

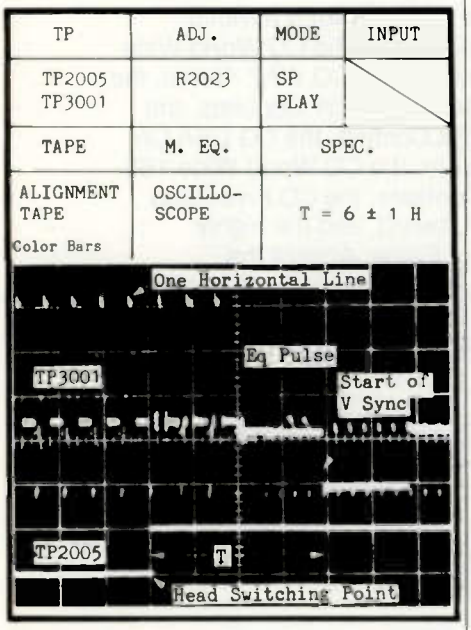


Figure 3. This is a typical manufacturer's head-switching instruction. Use the service literature to determine the test points and adjustments to use for the adjustment.

A 30Hz square wave from the servo circuits controls an electronic switch at the head amplifier output. The switch selects the amplifier for the head which is in contact with the tape and turns off the channel for the head which is on the opposite side of the drum. If the second head was not turned off it would add noise to the playback signal.

Noise appears in the video signal when the switching takes place.(See Figure 2.). You can see this noise by adjusting the vertical hold control to display the sync interval on a TV connected to the VCR. The switching noise is a horizontal tear in the picture a few horizontal lines above the black sync bar.

The head switching circuits change the timing of the switching signal with reference to vertical sync. Switching should take place a few lines before vertical blanking to place the noise in the bottom 3 lines of the picture. Since most TVs are overscanned (the vertical deflection is slightly larger than the CRT screen), switching is invisible, because it happens while the electron beam is below the screen. If the circuits switch too early, the noise moves up into the visible part of the picture. If the circuits switch too late, the noise occurs during the sync pulse, causing poor vertical stability.

Now that you understand how the adjustment affects the circuits, you should have a better understanding of why the timing must be correct. This understanding should also help understand the alignment procedures. Now let's see how to adjust the pulse timing. We will start with the conventional oscilloscope method.

Adjusting head switching by counting pulses

The first thing you need to do is locate the test points and the controls that affect the head switching. The service literature for the VCR you are servicing is the best source of this information. The service literature also tells you how many adjustments the VCR contains. (See FIgure 3.).

Depending on the VCR, it may have one, two, or three adjustments. Most 2-head VCRs have only one control. VCRs with four (or more) video heads may have two playback adjustments. If so, you will need a test tape recorded at the fastest tape speed (SP or Beta I) to adjust one control, and a tape recorded at the slowest speed (EP or Beta III) to adjust the other. Some early VCRs also have a third adjustment in the recording circuits.

The instructions will usually tell you to adjust the control until the switching square wave is 6.5 horizontal lines ahead of vertical sync. If you are counting pulses to make this adjustment, remember that you must count *every other* pulse through the blanking interval if your test tape has interlaced sync. This happens because the vertical blanking pulses contain equalizing pulses at twice the rate of the horizontal sync pulses.

If your tape has non-interlaced sync, it may not contain equalizing pulses, so you must count *every* pulse. You can avoid the question of whether to skip pulses by remembering that the blanking interval is always three horizontal lines wide. Count 3.5 horizontal lines from the start of blanking instead of 6.5 lines from sync. This lets you use the same procedure, whether or not your signal contains equalizing pulses.

Using a dual-trace scope with delta time capability

If your scope has two input channels and a delta time capability, you can use it to help you adjust the head switching, and avoid counting of pulses. Refer to the VCR manufacturer's service literature to find the needed test points and adjustment locations. Then, use the following procedures to make each head switching adjustment using the oscilloscope screen. Figure 4 shows the sequences of steps for this procedure for one manufacturer's waveform analyzer.

1. Connect the Channel A probe to the VCR video output and the Channel B probe to the test point with the head-switching square wave signal.

2. Set the scope's TRIGGER SOURCE switch to the "Channel B" position (to trigger from the square wave) and the TRIGGER MODE switch to "AUTO." The TRIGGER POLARITY switch lets you select the rising or falling transition, depending on which one you want to use.

3. Set the TIMEBASE-FREQ switch to the 1msec position (check the HORIZ POSITION control to confirm that it's in the correct position for a non-expanded trace).

4. Press the A&B (dual trace) selector button and adjust the inputs and triggering circuit until the two traces are locked in on the scope face.

5. Place the VCR into the record or playback mode, depending on the manufacturer's alignment instructions.

6. With the trace positioned to start at the left side of the CRT, adjust the horizontal vernier control (the small knob in the center of the TIMEBASE-FREQ control) until you see two vertical sync puls-

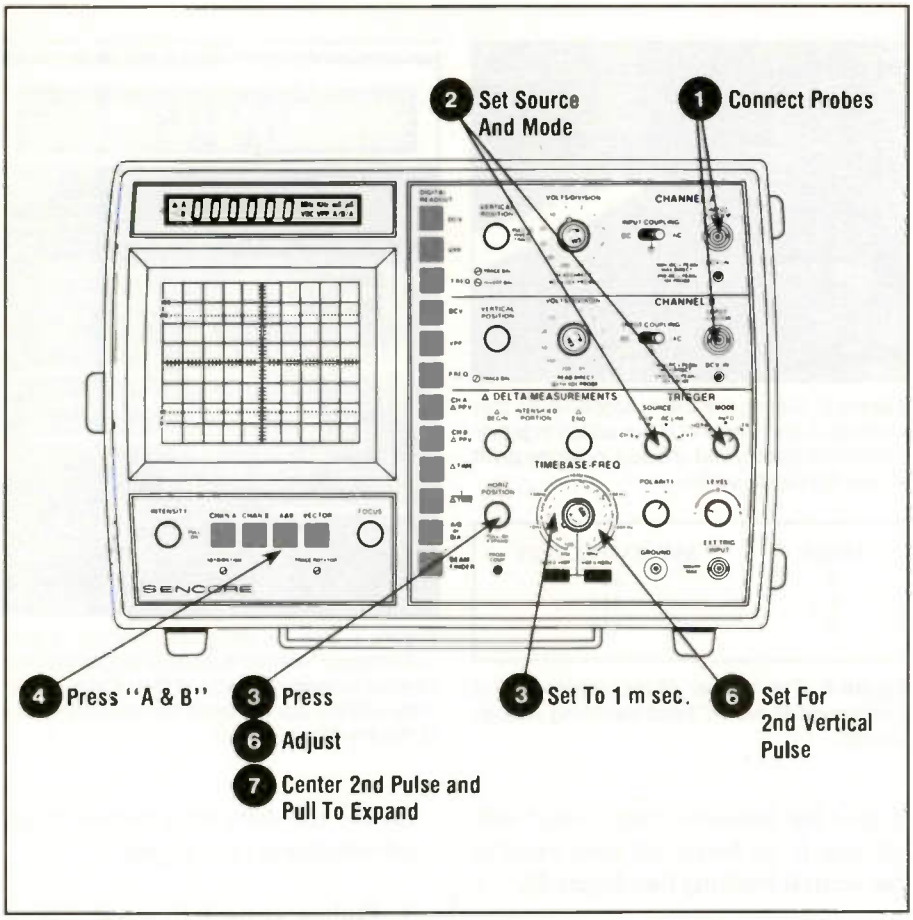


Figure 4. This drawing shows the sequence of steps that a technician would use to display the head-switching signal on the Sencore Waveform Analyzer.

es on the channel A trace - one at the left edge and the second one near the right edge of the screen. (Channel B should show a square wave transition near the second sync pulse.)

7. Adjust the HORIZONTAL POSITION control until the right hand vertical sync pulse (and square wave transition) is in the center of the screen. Set the HORIZ POSITION control to the correct position to expand the waveforms by ten times.

8. Carefully watch the trace as you adjust the control. Start by adjusting the timing until the square wave just touches the vertical sync pulse. Then move the transition to the beginning of vertical blanking. Finally, move the transitions 3.5 horizontal lines before blanking (which is the same as 6.5 lines ahead of vertical sync).

9. Some people prefer to add channel A to channel B by manipulating the appropriate controls. This makes it easier to compare the timing of the two signals. When added, the square wave causes a step to appear in the video waveform.

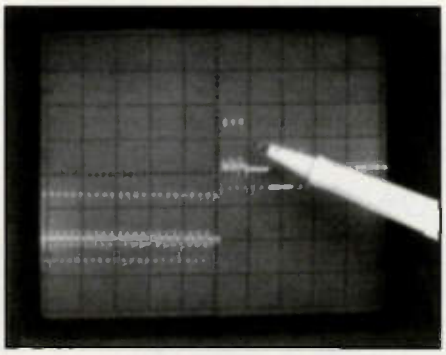


Figure 5. Setting the oscilloscope up so that Channel A and Channel B are added together results in a display that shows a jog at the point where the heads switch.

LINES	MICROSECONDS
6	381
6.5	413
7	444

Figure 6. The number of microseconds that correspond to typical head-switching specifications.

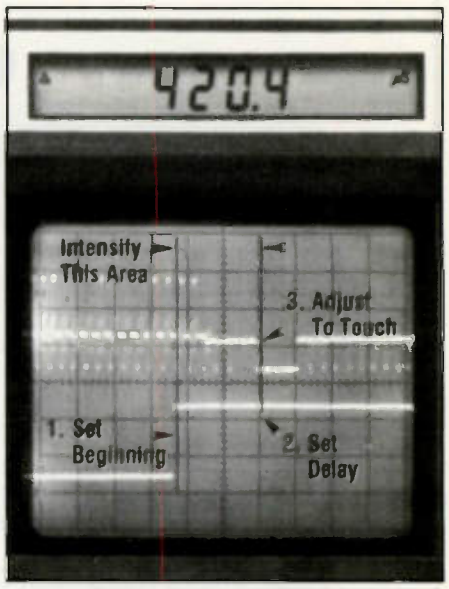


Figure 7. Use the delta time function, if your oscilloscope has this feature, to preset the time needed between signal, and then adjust the circuits until the signals touch the intensified area of the waveform.

Adjust the head-switching control until the step is 3.5 horizontal lines ahead of the vertical blanking (see Figure 5).

Using delta time to adjust head switching

If your oscilloscope has a delta time function, you can use it to eliminate the need to count pulses. You preset the delta begin and delta end controls until the digital readout shows the correct time, and then adjust the head switch control until the sync pulse touches the highlighted area of the waveform.

To use the delta time function, you need to know how many microseconds to leave between the square wave and the sync pulse. Simply multiply the lines specified by the time for one horizontal line: 63.5µsec. Your servicing instructions may use one of three delays: 6, 6.5 or 7 horizontal lines. Figure 6 shows the calculated values for each delay.

Lock the waveforms onto the CRT by following the previous steps 1 through 7. Then, choose the delta time function and set the interval so that the interval begins just to the left of the sync pulse, and ends to the right of the transition, such that the readout shows the correct time interval. Finally, adjust the head-switch control until the vertical sync pulse just touches the end of the time interval.

To use the delta time feature to set head switching: (See Figure 7.)

1. Follow steps 1 through 7 from above to display the two signals on the scope face.

2. Make whatever adjustments are necessary on the oscilloscope so that you can easily see the area of waveform that is of interest.

3. Select as the beginning of the time interval the square wave transition in channel B.

4. Select the end of the desired interval such that the digital or on-screen readout shows the correct time for the waveform (for example, 413µsec for a 6.5 line delay. Don't be too fussy in this setting since the circuits only need to be adjusted within 30µsec of the ideal amount.

5. Adjust the VCR head-switch control until the beginning of the vertical sync pulse just touches the end of the selected time interval.

You can use a similar procedure any time you need to set a time delay between the signals at two test points. ■

Troubleshooting Tip

Unit: JVC HRD-310U VCR

Submitted by:

Ken Dias
Service Manager
Videofix
Scarborough, Ontario, Canada

Symptom: The picture produced when a tape was played on this VCR was clear for about four inches at the top half of the screen, but there was nothing but noise on the rest of the screen. All functions of the VCR worked properly. The tracking control had no effect on the problem. The picture contained no color.

My first step in servicing this unit was to determine the extent of the problem. To determine if the tuner was ok, I selected VCR from the TV/VCR selector and changed channels. The picture was perfect, which showed that there was no problem in the tuner.

Because the problem occurred during playback, my first suspicion was that there might be some malfunction in the record/playback transport mechanism, so I performed a thorough inspection here. I noted that both the supply and playback rollers had seized. I replaced both rollers, and operated the unit, expecting to find that the problem had been eliminated. There was no noticeable improvement.

Next, suspecting that the problem was in the video circuit, I used the oscilloscope to observe waveforms at the pins of IC201, the video IC. The frequency of one waveform was erratic, so I checked the connections between the IC and the crystal. I found a cold solder joint and resoldered it, but the improvement was only slight.

Not knowing what else the problem could possibly be, I ordered a new upper video head drum assembly. After installing the new unit I played a known-good tape in the VCR. Again, no improvement.

I now started checking waveforms and taking voltage measurements at various points. It occurred to me during this procedure that I had omitted the preamp IC in my initial troubleshooting procedure. This time I observed waveforms at all pins of this IC. The waveforms at all pins of the IC were exactly according to the specifications, except for the waveform at pin 17, the 30Hz head switching signal. There seemed to be no question that the problem had to be in this IC. Replacing this IC cured the problem.

If I had thought this service procedure through more thoroughly as I went through my initial troubleshooting procedure, I would have realized that the problem couldn't have been caused by a video head problem. As has been mentioned before in a number of publications, including **ES&T**, if any part of the playback picture is clear, the problem is not the video heads. Also, hindsight reveals that the defect could have been narrowed down to the playback (and not the record) circuit, if I had simply recorded a tape on the defective VCR and played it back on a known good VCR.

In our January issue of ES&T, we ran a troubleshooting tip which was not given a name or make. The unit was a Mitsubishi TV model CS-1347R and was submitted by A. Camus, Queens, NY. ■

What do you know about electronics?

More on the AM radio detector for IR remotes

By Sam Wilson, CET

Here is some very valuable information from Paul R. Dedrick of North Carolina. He explains why the infrared remote control signal for consumer products can be picked up by an AM receiver.

Dear Sam: I am writing in response to your "What Do You Know About Electronics?" column in the July 1992 issue of **ES&T.** Until recently, I was employed as a Technical Writer/Trainer. I taught classes in all consumer products to authorized repair facility technicians. What follows is the reasoning behind the AM radio test to detect the presence of infrared remote control signals. An additional test will be given.

To begin, most infrared remotes operate by using a counted down fundamental frequency to generate a clock for data pulses which provide the different functions for the product to operate remotely. What is this fundamental frequency? Well, it usually is (you guessed it) 455KHz. Most remotes use a ceramic resonator to generate this frequency.

Often this delicate resonator has very thin leads which, when the remote is abused (i.e., dropped) the ceramic resonator becomes detached from the circuit. This can be determined by shaking the remote unit gently. If you hear a rattling sound, the resonator is usually loose! In this case, the remote can generally be repaired using a universal 455KHz resonator available from most Radio Shack stores.

If the resonator is not loose inside the remote, it may still be damaged, so you check it by operating the remote in close proximity to an AM radio. This tells if the remote is operating on frequency, by generating the buzz in the radio speaker.

Wilson is the electronics theory consultant for **ES&T.**

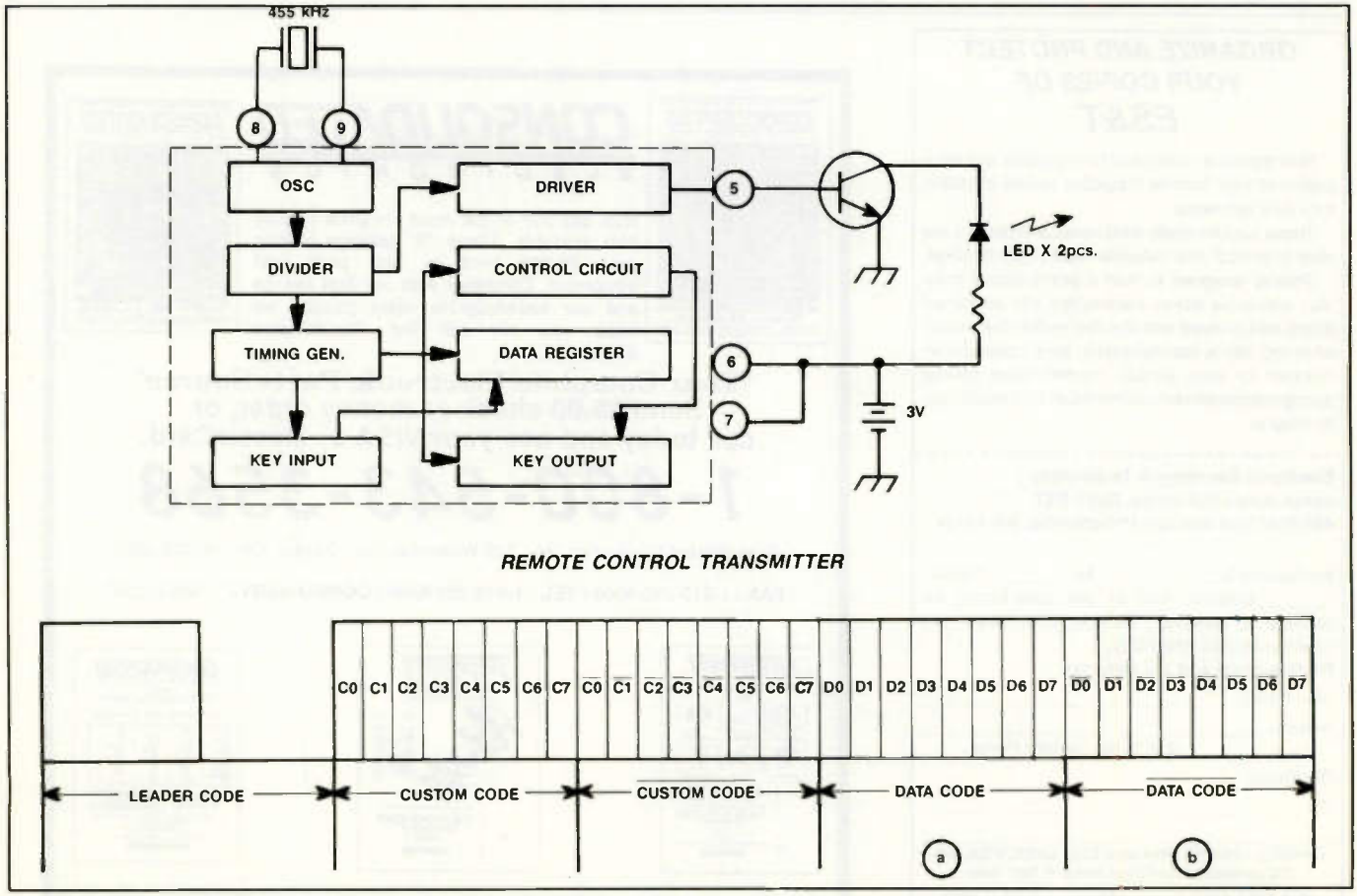
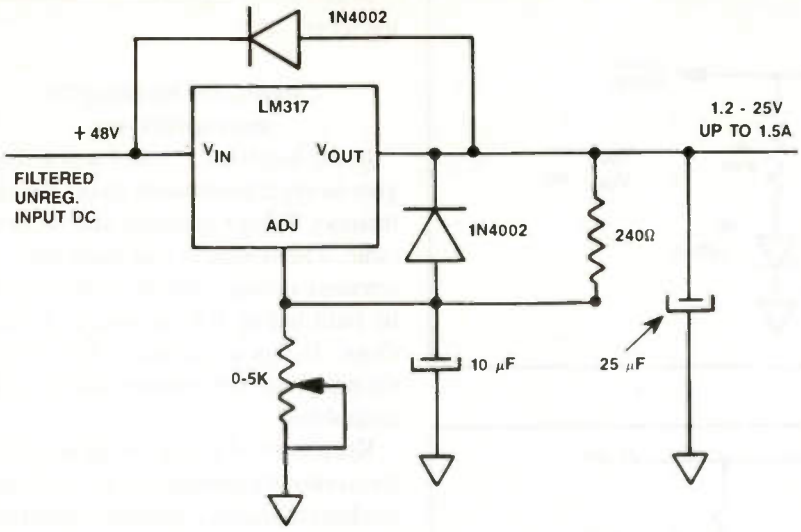


Figure 1.



THIS EXCELLENT REGULATOR IS A DESIGN SUGGESTED BY NATIONAL SEMICONDUCTOR. IT APPEARED IN THEIR VOLTAGE REGULATOR HANDBOOK.

Figure 2.

To fully test the remote for proper operation, use an infrared detector card, available from most mail-order parts sources, manufacturers, Sencore, or Radio Shack. If the remote is on frequency, and putting out infrared pulses, there is a 99% chance that it is a good remote!

Also, I would be interested in receiving an author package for writing articles for your fine publication."

Seven years ago, as a high school electronics teacher, I used articles from **ES&T** and your TYEK tests to enrich my curriculum in my classes. The magazine is an invaluable aid to the continuing educational needs of the industry. I find it very informative and helpful in my efforts to keep current.

Figure 1 shows a schematic diagram from one of the training manuals I wrote, which shows a typical remote control transmitter construction.

The transmitter is an infrared type, which offers up to 32 remote control functions. The transmitted signal is composed of four different codes, Custom Code, Inverse Custom Code, Data Code, and Inverse Data Code. Each code consists of eight bits. One single transmission consists of a combination of 32 bits.

Besides the four codes, there is a Leader code included in the transmission signal. It is made up of a 9ms carrier wave and 4.5ms off-wave. This is transmitted prior to the other codes. The Leader code is used to allow the microcomputer to differentiate the remote control signal from other control signals in terms of the time relation among them. The other four codes that follow the leader are applied to the microcomputer, which reduces them each to a 1 or 0 pulse. This is performed in accordance with PPM (Pulse Position Modulation) system. The pulses "a" and "b" are used in 32 different combinations of 1 and 0.

Sincerely,
Paul R. Dedrick, CET
Secretary, North Carolina Electronics Association

Sam Says - Observe from this information that the signal from the IR (infrared) remote control is pulsed. That is what makes it possible to inject the i-f signal into the AM radio and hear the signal in the radio speaker. A pulsed signal is rich in odd harmonics. As you know, a 455kHz sinewave signal could not produce any output sound in the receiver since it is the job of the "second" detector to remove a 455kHz carrier.

The AM radio signal tells you that the pulses are being generated but it doesn't tell you anything about the condition of the infrared LED.

The test with the infrared detector card - suggested by Mr. Dedrick sounds like it will give more reliable information.

I will be glad to consider any additional information on troubleshooting by our readers.

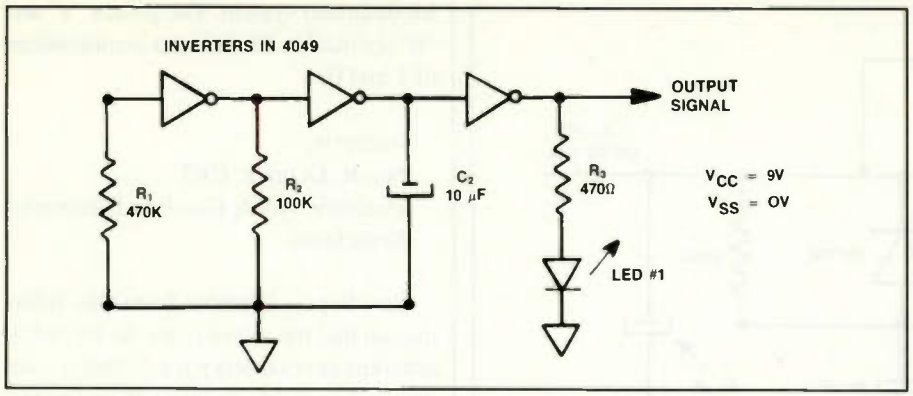


Figure 3A.

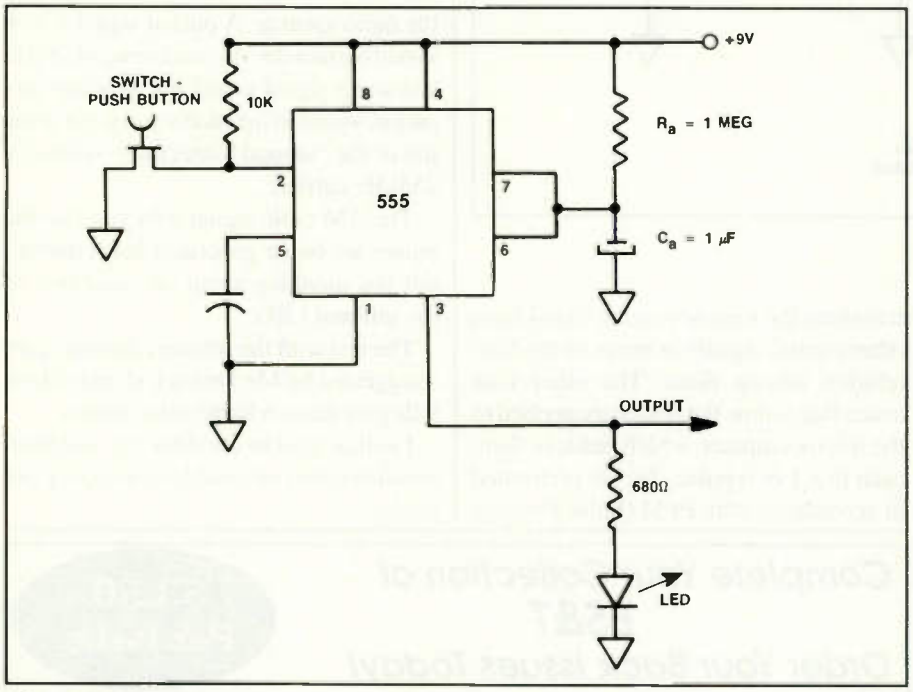


Figure 3B.

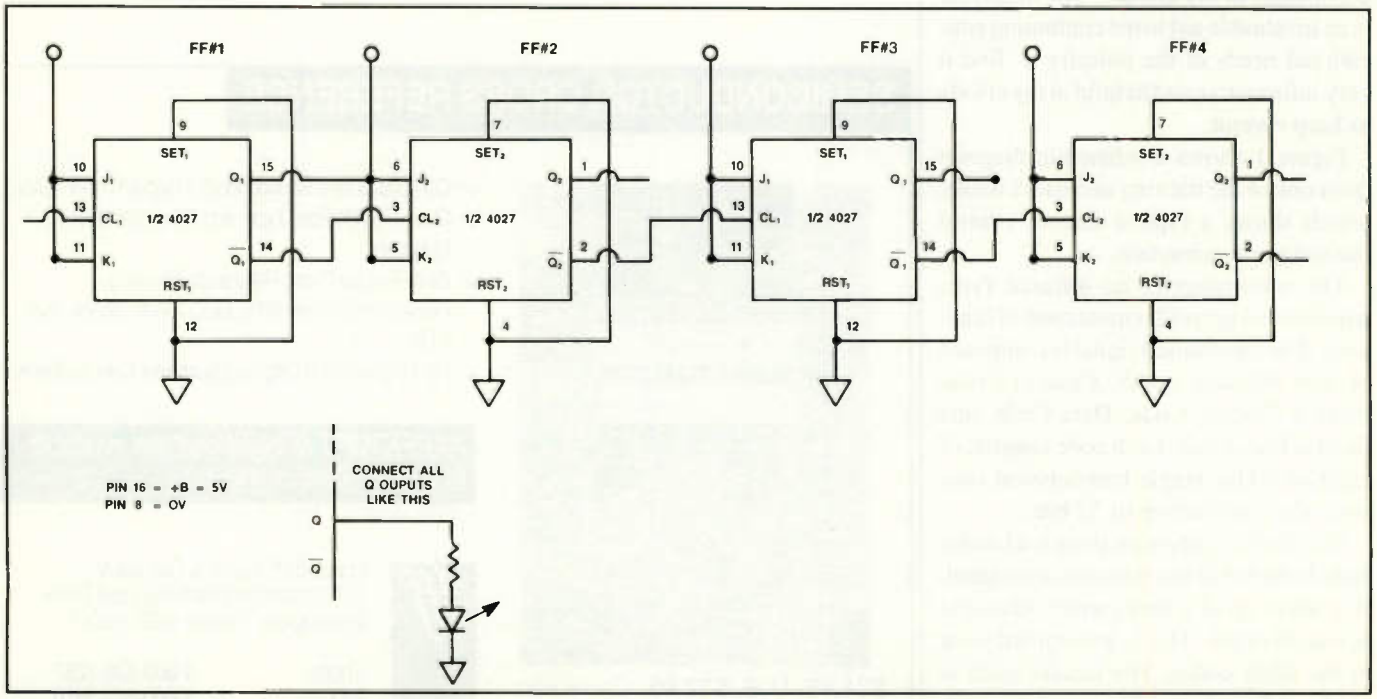


Figure 3C.

Many, many thanks to Mr. Dedrick for the letter.

Circuits for building the microprocessor

In the last issue I said I was going to give an experiment using an off-the-shelf memory. I don't quite get that far in this issue. The reason is that there are some circuits external to the memory that must be built before we can use it. Some of those circuits are given in this issue. In the next issue the memory circuit will be assembled.

Keep in mind where we are going with this series of experiments. My contention has been that a microprocessor and a computer are both memory controllers. That is why I have spent some space in previous issues on the most popular memories used in μP and computer systems. Starting with this issue I am going to give a series of experiments in which the major circuits in a microprocessor are built on plug-in boards. We will perform the same operations as the μP would do to get the same result.

Many technicians have told me they can best understand theory by hands-on work with devices. I have to admit I do not understand how that works. It doesn't work for me.

I have spent a lot of time doing hands-on experiments that didn't give me my time's worth. In other words, there was a lot of constructing, measuring and trou-

bleshooting just to "learn" one single piece of information that I could have read in a half page of typed material. I just don't understand trading 6 hours of wiring and pushing buttons for a minute of reading time.

Well, that's my concept. I know from experience that something can be true whether I understand it or not. So, to give those technicians the hands-on they need, I give μP experiments.

When a microprocessor is built with individual integrated circuits instead of on a single integrated circuit chip it is called a bit slice. So, basically, we are going to build a bit slice on plug-in boards. However, when we get all of the circuits assembled we will NOT be able to hook all of them together to get the bit slice.

The reason you can't put them together is that the timing of the various operations is very critical. So critical, in fact, that a microsecond difference in the arrival of pulses can make the system fail. However, when we have finished with the experiments we will have built the complete bit slice. If you are not into hands-on experimenting, read the experiments anyway. The basics of μP operation are explained in the theory writeups.

Memory experiment

To demonstrate how the μP operates a Random Access Memory (RAM) you will write a telephone number into the memory, then, read the memory to get the number back.

I chose CMOS integrated circuits because I thought it would be convenient for the reader to operate the circuits with a 9V battery. However, the memory I chose got hotter than a $2.00 pistol on 9V, so, I changed to a +5V regulated supply. If you don't have a regulated +5V, build the one shown in Figure 2. It is useful for many other things besides these experiments.

Figure 3 shows three circuits to be built to engage the memory.

Figure 3(a) shows the circuit for our clock generator. It produces the timing pulses for all of the μP experiments. Computers are often evaluated by their clock frequency. Ours will generate about one clock cycle each second, usually written as 1Hz. That is somewhat slower that the 25MHz frequency of some desk-top computers.

Mechanical switches and relay contacts have a habit of bouncing a few times when they are closed. Those bounces are interpreted by logic circuitry as being combinations of ones and zeros. That really messes up the operation. To get around that problem there are two circuits available to us. One is the bounceless switch (not shown). It is made with cross-coupled gates.

Instead of a bounceless switch, we will use the 555 one-shot circuit of Figure 3(b). It is usually called a monostable circuit. When a trigger is received from the switch, the output goes through a complete ON-OFF cycle before it can be triggered again. During that cycle the switch that provides the trigger can bounce and bounce but that will not affect the single-pulse output of the 555.

The monostable circuit (or, the bounceless switch) is needed so we can operate the system one step at a time. That is called single-stepping. More on that in the next issue.

The circuit of Figure 3(c) is sometime called "divide-by-16." It can be used as a binary counter to produce a binary count from 0000 to 1111. It will be needed to step our way through the program stored in our memory rows and to keep track of where we are in a program. So, it is our program counter.

Remember, the circuits of Figure 3 are used by the μP to operate the memory. To test the circuits, first connect the output of the monostable circuit to the input of the counter (CL1 of the first flip flop). Each time you momentarily switch the trigger input of the 555 monostable you get one output pulse. The output is shown by LED #1. It should be on for a short period of time after you operate the switch.

With each single step the counter should advance to a binary count from 0000 to 1111. The count may not start with 0000. You should advance the counts until the 0000 is displayed, then, start the count by single-stepping with the monostable circuit. Assuming the single stepping works, remove the 555 output to CL1 and connect the clock output to that point. The counter should automatically produce the complete range of counts when you single-step the clock pulses. ■

Books

The Winn L. Rosch Hardware Bible, Second Edition, By Winn L. Rosch, Prentice Hall Computer Publishing, 700 pages, $29.95.

With this newly revised and expanded edition, users gain hands-on expertise about mother boards and modems and everything in-between. This book puts users in the position to control processors, ports, peripherals, and more. This book also delivers the very latest developments in portables and laptops, as well as easy-to-follow instructions for PC, PC compatible, and PS/2 maintenance, expansion, and troubleshooting. Users also benefit from illustrations and diagrams that clarify how things work.

Prentice Hall Computer Publishing, 11711 N. College Ave., Suite 140 Carmel, IN 46032

Tube Substitution Handbook, By William Smith and Barry Buchanan, Howard W. Sams & Company, 154 pages, $16.95.

The Tube Substitution Handbook is a reference tool for antique radio buffs, ham operators, collectors of vintage ham radio equipment, marine operators, microwave repair technicians, TV and radio technicians, and any do-it-yourselfers with an interest in tubes and tube replacement.

The handbook features over 30,000 tubes and tube substitutions.

Howard W. Sams & Company 2647 Waterfront Parkway East Drive, Indianapolis, IN 46214

Hot ICs for the electronics hobbyist, By Stan Gibilisco, TAB Books, 464 pages, 400 illus, $19.95.

The hardest thing about building electronic circuits for fun is trying to find designs that are relatively simple and inexpensive, yet still useful for real working applications. Hot ICs for the Electronics Hobbyist solves that problem by bringing together, in one easy-to-use volume, the best low-cost circuit designs for experimenters. This collection of circuits ranges from simple power converters and function generators to practical ICs for video, audio, sound effects, alarm, timer and filter devices. Many of the circuits shown are new - straight from the drawing boards of major manufacturers - and have never been published anywhere before. Each includes a discussion of terms and parameters, a pinout diagram, suggested uses, and other important data, and the appendices contain a complete listing of distributors. Stan Gibilisco is an electronics engineer and a full-time science and technical writer. He is best known as the author of the International Encyclopedia of Integrated Circuits, 2nd Edition and co-author of the Encyclopedia of Electronics, 2nd Edition

TAB Books, Blue Ridge Summit, PA 17294

Power Supplies: Projects for the Hobbyist and Technician, By Kevin Etter, Howard W. Sams and Company, 96 pages, $10.95.

Power supplies, the sources of energy for all electronic equipment, are basic considerations in all electronic design and construction. This book guides you from the fundamentals of power supply components and their functions to the design and construction of power supply systems. Useful in many home workshop and technical construction projects, this book will prove invaluable to the interested do-it yourselfer or the seasoned technical professional. Contents include: basic sources of dc and ac power, unregulated power supply systems, linear power supply projects, switching power supply systems and projects, measurements, calibration, and troubleshooting and much more.

Howard W. Sams & Company, 2647 Waterfront Parkway East Drive, Indianapolis, IN 46214.

Speakers for Your Home and Automobile: How to Build and Enjoy a Quality Audio System, By Gordon McComb, Alvis J. Evans, and Eric J. Evans, Howard W. Sams & Company, 164 pages, $19.95.

This book will show any do-it-yourselfer or technician the hows and whys of building quality speaker systems for home and automobile. With easy-to-understand instructions and clearly illustrated examples, the authors explain the construction of home speaker systems and automotive speaker installations. Contents include: how speakers work, including the science behind the system, enclosures and their effects on sound quality, speaker types and design factors, construction of speakers for specific areas and purposes, finishing touches that add a professional look to your construction, project plans for both home and automobile installations, design equation and conversion charts, complete glossary to audio and speaker system terminology.

Howard W. Sams & Company, 2647 Waterfront Parkway East Drive, Indianapolis, IN 46214.

The Modern Converter Ciruit Encyclopedia, By Rudolf Graf, TAB Books, 192 pages, 300 illus, $12.95.

In this volume, readers will find 300 ready-to-use converter circuit designs reflecting the latest engineering principles and practices. The author includes only the best in converter technology, featuring unaltered circuits from the most respected electronics manufacturers and publications.

Analog-to-digital, ac-to-dc, frequency-to-voltage, capacitance-to-pulse width, triangle-to-sine wave - every kind of converter circuit is illustrated here, with explanations of how they work and how they can be used. Original sources are cited, for readers who want additional information on a particular circuit, and according to the publisher, all entries have been tested to ensure accuracy.

TAB Books, Blue Ridge Summit, PA 17294

Making Sense of Sound: The Basics of Audio Theory and Technology, By Alvis Evans, Howard W. Sams & Company, 112 pages, $10.95.

A lot of questions get answered in Making Sense of Sound: The Basics of Audio Theory and Technology. How is sound electronically reproduced? What are pitch, fidelity, and distortion? How do today's electronics components work together to produce quality sound? These are just some of the topics discussed in this clearly illustrated text that teaches you the basics of audio theory and their relationship to today's audio technology. Other topics include stereo components - how they function separately and as a system, distortion and system noise, recording and playback, combinations of video and audio technology, complete glossary and index plus much more.

Howard W. Sams & Compnay, 2647 Waterfront Parkway East Drive, Indianapolis, IN 46214.

Digital compact cassette

By John Shepler

Just when you thought digital audio tape was the medium of the future, here comes digital compact cassette (DCC). DCC is an invention of N.V. Philips, the company that also invented the audio cassette nearly 30 years ago. It doesn't replace the cassette the way CD's replaced vinyl discs. Instead, it extends the cassette into the digital age.

You may be surprised to know that the cassette was originally intended for low fidelity applications such as dictation. The small size and easy portability, however, made it just too attractive as a replacement for open reel tape to pass by. Over the decades, better quality transports, new tape formulations, and noise reduction techniques like Dolby and dbx have allowed audio cassettes to flourish as a music medium. Now, digital compact cassettes will allow consumers to keep playing their present stock of prerecorded cassettes while using much higher digital recordings for new material.

A digital compact cassette is about the same size as an analog cassette. It is flatter, though and has a metal shutter to protect the tape, much like a 3.5 inch floppy disk. Another difference is that the tape reels are accessible from only one side, so the tape deck must take care of reversing the tape movement.

DCC tape decks will play both digital and analog cassettes. They'll only record the new digital cassette, though. This dual playback is made possible by a new linear recording technique that uses 8 digital thin-film heads to record the audio bit stream lengthwise on the tape. Remember that DAT works like a VCR, using a rotating head to record in helical stripes across the tape.

Linear recording at the low speeds used by cassettes requires both the 8 channels of digital information plus a data compression technique called PASC or Precision Adaptive Sub-band Coding. This is a digital signal processing technique that compresses the data by taking into account which sounds are masked by other sounds and thus, don't need to be recorded anyway. PASC can reduce the required digital capacity by over 75%, with minimal impairment of the sound quality.

Sound quality of DCC decks will be similar to DAT and compact disc. Frequency response is 5Hz to 22kHz with a dynamic range of 108dB. In a sense, the consumer is getting the audio quality of CD with the recording capability of DAT, plus the ability to still play all those existing analog cassettes. It's an excellent compromise.

Philips is side-stepping lawsuits with the music industry by building the Serial Copy Management System or SCMS into the DCC chips. SCMS is a technique to prevent bootleggers from copying and recopying digital tapes, which lose none of their audio quality when copied.

In addition to the audio features already mentioned, DCC also has the ability to record digital data at 400 characters per second. This will enable recording studios to include song titles, artists, and even music lyrics or other information that can be displayed on the tape deck. The data can also be used as codes, so the consumer can program the deck to skip or repeat songs and even pick the order in which the songs play.

The first DCC units, like any new technology, are more expensive than traditional cassette decks. They're priced more like DAT recorders than CD players or cassette record/play decks. The new cassettes are also priced five to ten times the cost of standard cassettes.

This should change over the next few years. Philips is planning to introduce a variety of machines including smaller portable DCC record/play units and car stereo DCCs. Philips is also licensing the technology world-wide. This will help reduce costs by increasing manufacturing volumes. The stationary DCC head mechanism is also expected to be less expensive to produce than the rotating DAT and VCR mechanisms.

Recording companies have agreed to support the introduction of the new medium. Within the next year, hundreds of prerecorded digital compact cassettes should be available in music stores.

Since DCC is being promoted as a consumer electronics advance, warranty service and repair opportunities should start presenting themselves shortly. If DCC does flourish as anticipated, the service centers positioned to take advantage of this technology will surely benefit. ■

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

News (from page 3)

Field test of long distance HDTV broadcast

Zenith and AT&T demonstrated that digital high-definition television (HDTV) broadcasting can bring high-quality, snow-free, interference-free TV pictures to a broader service area than conventional TV broadcasts. In the first long-distance over-the-air field test of an all-digital HDTV signal, Zenith and AT&T conducted a broadcast from a TV station in Milwaukee 75 miles to Zenith's technical center in Glenview, Ill.

The late-night field test of the "Digital Spectrum Compatible" HDTV system, broadcast on Milwaukee Public Television Station WMVT Channel 36, was the first ever terrestrial broadcast of digital TV signals using low power over long distances. The test also showed that digital HDTV can provide high-quality, noise-free pictures even in the presence of interference from conventional TV signals on the same channel.

The primary broadcast service area (Grade B contour) for conventional analog TV signals on WMVT is 48 miles from the transmitter. The Glenview receiving site is on the far fringe reception area of the Milwaukee station, and even with an antenna tower atop the seven-story building, the conventional analog signals are very noisy or snowy.

Using less than one-tenth of the power used to transmit a full-power conventional analog TV signal, the test successfully transmitted and received digital signals - without noise, snow or ghosts. The test showed that the system's unique digital compression and transmission technologies can eliminate the so-called "cliff effect" a total and abrupt loss of the TV picture and sound that could be caused by errors in transmitted digital data at long distances from the transmitter.

The companies plan to share the field test data with the Federal Communications Commission's Advisory Committee on Advanced television Service and its HDTV Field Test Task Force.

Summit meeting held

A third summit meeting among members of the three national service associations consisting of the National Association of Service Dealers (NASD) a division of NARDA, the Professional Service Association (PSA), the National Electronic Service Dealers Association (NESDA), and several state organizations including the California State Electronics Association (CSEA), the Television Electronics Service Association (ESDA) of IL, the Independent Warranty Servicers (IWS), and the Appliance Service Dealers (ASD), was held in Chicago on October 4, 1992.

The industry Summit decided to form a permanent group called the "Service Industry Council" for the purpose of collecting information, identifying industry problems and finding possible solutions for those problems. This group will continue to meet on a regular basis to address the needs of the service industry.

The environmental committee report stated that as a result of indecision on the part of governmental agencies the mandated technician certification program has been abandoned. The resulting controversy that continues to grow in the ser

Test your electronics knowledge

ANSWERS TO TEST

(from page 49)

1. A - The value is computed by raising 2 to the eigth power. $2^8 = 256$

2. C - NOT CS means NOT CHIP SELECT. It measn that the integrated circuit is selected by a logic 0 on the control bus.

3. C - $192_{10} = CO_{16}$

4. B - The disadvantage of a choke-input filter is that its use results in a lower output voltage.

5. D - There are no units of measurement for permeability.

6. B - The M-derived filter has the sharper cutoff

7. B - It is the gate current that operates the SCR - even though a gate voltage is used to produce that voltage.

8. B - Although the effect is not great, the series resistance DOES influence the resonant frequency.

9. C - Compared to a dB meter, the VU meter has a higher degree of damping. It is used to monitor audio signals.

10. D - The parameter h_{FE} is sometimes called the dc Beta. It is equal to the collector current divided by the base current. A value of 110 is reasonable.

Z-axis adhesive film new concept in electronics interconnection

3M's new Z-axis adhesive film is an innovative concept for connecting flexible printed circuits and tape automated bonding (TAB) tape to printed circuit boards, glass substrates, and other flex type products. The 5303R Z-axis adhesive film (ZAF) has a thermoset adhesive that contains randomly dispersed, subminiature conductive particles. Conductivity can occur only in the Z axis (through the film) and not along the plane of the film.

The ZAF is heat tacked to the conductive pads of a flex or TAB circuit. The circuit with the applied ZAF is aligned with the conductive traces on a substrate (glass, printed circuit boards, or flex circuit). Heat and pressure is applied to the TAB or flex circuit, causing the ZAF to melt, flow, and cross link.

The thermoset adhesive has a higher coefficient of thermal expansion than the conductive particles. When cooled under pressure, the adhesive has little tendency to yield, so the conductive particles are forced onto the conductive pads of the circuits. This results in a stable electrical connection between the flex or TAB circuit and substrate pads.

The result is a long-term interconnect with environmental stability. The ZAF creates a repairable bond, which gives the user an opportunity to rework defective interconnects and thus extend component utilization. The ZAF also has excellent creep resistance over a wide range of temperatures allowing for stable electrical performance.

The ZAF has economic and environmental advantages. It has a lead-free formulation, so is an alternative to lead-based solder. Also, no flux is required, eliminating the cost of chemicals and disposal. The dry film construction avoids many volatile components associated with solder processes. ■

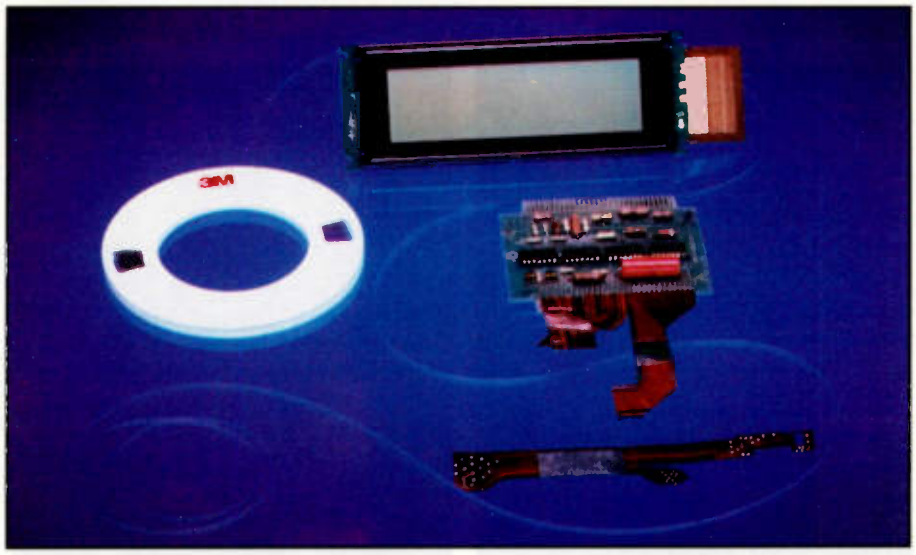
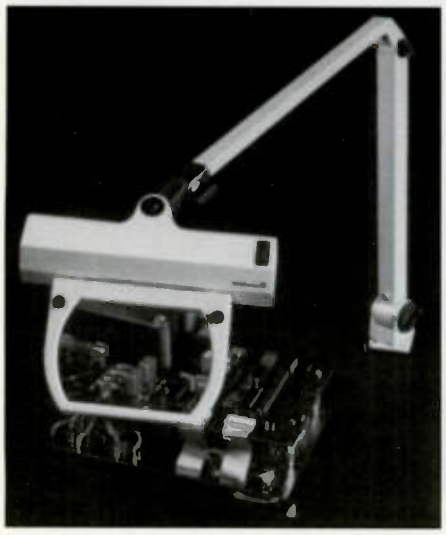


Figure 1. 3M's Z-Axis Adhesive Film (ZAF) is a new concept in connecting flexible printed circuits and Tape Automated Bonding (TAB) circuits to printed circuit boards, glass substrates, and other flex circuits.

Products



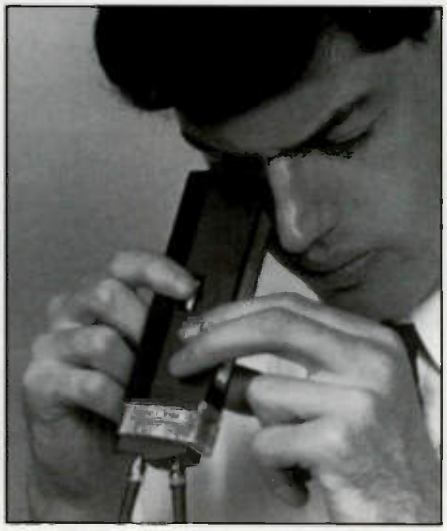
Magnification light for inspection work

Waldmann Lighting Co. announces its newest magnification light, the "Focus 7 Plus." This task light is designed to meet a wide range of close up inspection needs at any workstation. The (6.5" x 4.25") 3-diopter lens gives an undistorted, broad field of view, reducing eye fatigue and improving productivity. The thirteen inch focal distance makes assembly with soldering equipment or hand tool easy. To increase functionality, there are two optional "ADD-X" lenses to increase magnification up to 7 or 15 diopters. The light uses the new generation 13W compact fluorescent lamp which provides as much light as a 60W incandescent, but with 78% less energy consumption and heat. The lamp will last 10,000 hours.

Circle (80) on Reply Card

Fiber optic microscope

Fotec has introduced a new multipurpose fiber optic test tool that can be used to test fiber optic cables and connectors for common problems. The model V400 acts as a 3-way microscope and FOtracer. As a microscope, the unit can view fiber optic connectors three ways. In the direct mode, it allows seeing how well the fiber fits in the connector and if there are any large scratches in the polished surface. While in the direct mode, it can also illuminate the core of the fiber, an excellent way to find cracks in the fiber introduced during polishing. The third mode, angle



viewing, emphasizes polish irregularities, providing the best test to how well the connector has been polished. One can even confirm "PC" convex polishing in this mode. The device even offers zoom capability, with a 60X to 100X range. It is compatible with many common fiber optic connectors.

Circle (81) on Reply Card

Static control grounding cord extends reach

Employees wearing static control wrist bands can now have greater mobility with *3M's* new 2243 lightweight heavy-duty extension grounding cord. The cord plugs into any manufacturer's single conductor wrist strap grounding cord to provide an additional seven feet of reach. The grounding cord has a standard 0.175-inch banana jack on one end and a connection for a standard 0.175-inch banana plug on the other. It is constructed of a single bundle of tensile conductors and reinforced with strong synthetic fibers for durability without additional weight. The five-foot cord has an extended length of seven feet.

Circle (82) on Reply Card

Service business management software

Sencore claims that their new Service Center Manager software is the fastest, most complete customized, and easy-to-use business management program on the market. This program is designed specifically to help manage all aspects of a service industry and is flexible enough for a one person operation, and powerful enough to run 20-employee service center. The product is field-tested and market-proven to help service centers remain competitive in today's high technology and narrow margin environment. The product comes with a complete software package and configuration guide to help you get started. Each software package comes with toll-free support to answer questions anytime.

Circle (83) on Reply Card

Integrated service management software package

Developed by two service technicians for their own 7 man service shop, TECH SERVE is a comprehensive, fully integrated, Novell compatible, multi-station, user friendly software system, according to the selling company Premium Parts +. The software is an easy to understand and operate tool that will assist in maintaining a greater level of control over your business. It will increase profitability by making more efficient use of non productive time. A useful feature in this package is a secondary database that maintains the price that manufacturers are reimbursing the service technician for on the warranty work that is performed. The product tracks customers units, technician's productivity for the day and month, tracks cost and price of part installed for each claim and creates NARDA warranty claims, and allows you to create a summary report of claims submitted, and more.

Circle (84) on Reply Card

LAN physical layer tester

Beckman Industrial has introduced LANTech LT-10, a handheld LAN physical layer tester. The tester is designed for certifying all UTP and STP twisted pair, coaxial and telephone style wiring, 10BASE-T, Ethernet, ArcNet, and Token Ring networks. The unit is simple to operate for LAN technicians of any level according to the manufacturer, providing one-button access to commonly used test functions. In the Autotest Mode, a single keystroke starts an all-in-one, comprehensive series of tests that completes in less than 30 seconds. Test results can be stored internally, downloaded to a portable PC, or output to an optional portable printer. Up to 100 test results can be internally stored.

Circle (85) on Reply Card

Fume extraction kit

ARM-EVAC Fume Extractor kit from *Pace* removes hazardous and irrating fumes from the workplace. Fumes are extracted by way of a universal extractor arm into a self-contained air filtration system. An integral 3-stage filter collects hazardous particulates and gases. The cleaner air can be recirculated back into the work environment. The kit is fully portable, and the central unit is only 13"x13"x19". It features the central filtration unit, extraction arm, suction tube, flexible hose and an easy-to-assemble bench mounting bracket. An optional mobile stand is also available.

Circle (86) on Reply Card

Updated 1992 integrated circuits library

The revised 1992 D.A.T.A DIGEST Integrated Circuits library from *D.A.T.A. Business Publishing* has increased by 12%, or more than 32,200 components, over the earlier 1992 editions. Among the five product-specific digests - digital, interface, linear, memory and microprocessors - the most significant growth has been in Memory, with over 15,000 new devices, and Interface, with over 6,500 new devices. Sections included in each Integrated Circuits D.A.T.A. DIGEST are:

- Function, generic and part number indexes
- Technical sections
- Appendixes including package and pin drawings, device pinouts, suggested replacements, manufacturer directory, distributor/sales offices and electronics associations.

Circle (87) on Reply Card

Newest version diagnostic software

DiagSoft, Inc. announces the newest version of *QZPlus, 4.7*. New features include: Identification of the latest technologies, upgraded component tests, enhanced system information reporting, new and enhanced system utilities, new virus detection and remote control software included. In addition the software includes essential LAN features that simplify networked PC support and much more.

Circle (88) on Reply Card

Printer assembly repair video

Diversified TechniGraphics, Inc. (DTI) has released a fusing assembly repair video computer peripheral repair facilities. The video and accompanying manual, accurately show how to efficiently and effectively repair the Canon SX fusing assembly. Over half of all desktop laser printers on the market use the Canon SX engine, according to the company. This video shows time-saving repair techniques, guiding the viewer through the complex assembly leading to successful rebuilding the first try, says the company.

Circle (89) on Reply Card

Readers Exchange

FOR SALE

Camcorder repair. 500 page book. Troubleshooting and repairing camcorder topics by Homer L. Davidson. Also VHS tape Laymans guide to minor camcorder repair by electronix. Both hardly used, sell together or individually. Make offer. *Call Jackson VCR 205-643-5906.*

B&K oscilloscope 30MHz dual trace $300.00. Sencore VA48 make offer. *Rob Francella, 518-286-0710.*

Sencore VC-63, best offer over $275. Will take a Sencore SCR250, in partial trade. *Mike's Repair Service, 410-272-4984.*

Deviation meter $175.00, B&K CMOS IC tester $175.00, Cordless phone antennas. Leader Dot Generator $45.00. *Ask for Ralph Bianco at 215-446-4519.*

Heathkit RF signal generator model IG-102 with manual and test lead. Good condition. $50.00 plus shipping. RCA service manuals (1955-1961) (1967-1968) $7.50 each or all 3 for $20.00 plus shipping. *412-483 3072 ask for John.*

630 original TV service manuals. Hitachi, Panasonic, Sharp, Mitsubishi, NAP , Quasar, Teknica. $1.00 each, minimum 20, or $400 for all. Also 159 Sams books: 3 citizen band, 52 transistor radio, 6 tape recorder and 98 modular Hi-Fi books. $4.00 each, min 10, or $300.00 for all. List available. *Bob Neilson 602-855-5400.*

Sencore video test equipment. VA62 video analyzer, VC 93 VCR tester $1600.00 and SC 61 waveform analyzer $1750.00 or take all for $2900.00 *Cliff Deese 10497 Highway 17N. Myrtle Beach, SC 29572 or call (803) 272-2607.*

22 - YA + SYA + CO adapters. $20.00. Shipping 26 AR + Tekfax. 1 MHF $10.00 and shipping. *E. Andrews Jr. PO Box 91. Exeter, RI 02822.*

Sencore equipment VA62, SG165. Other brands also. Make offer Call *Ed Slagle at 615-926-1346.*

B&K model 490 CRT restorer/analyzer. Purchased new July 92. Adapters included. $750.00. Taking $300 loss. Sams Photofacts 2922-2977. 56 sets for $150. Will consider trading for computer. *Ernst Prater. PO Box 598, Hurley, VA 24620. 703-566-2265.*

Sams Photofacts, 2215-2305. New, in original (opened) mailing cartons. $225.00 plus shipping. Also looking for TSM's. *Robert Morrison, 231 Perkins St. Havelock, NC 28532 (919) 444-1660.*

WANTED

Need service manual or schematic for RCA VCR model VFT-650. Will buy outright or will copy and return. *Hugo Oliver 518-827-6138.*

Schematic and parts list for Simpson Models 260 and 260 series SP. Simpson company will not supply, as per request. These are VOMs. *Robert M. Dykeman, 912 Lock St., Phoenix, NY 13135.*

Jackson roll chart info for model 715 and 648A tube tester particularly old tubes. *Robert Christie, 2885 Beltine N.E., Grand Rapids, MI 49505.*

Hitachi monitor CM-1481 service manual, B&K #470 CRT checker adapter socket CR-42, Panasonic flyback #14712F. *Ed Herbert, 410 N. Third St., Minersville, PA 17954.*

Technical information on servicing a KLH model 510 portable Hi-Fi component system, specifically a capstan assy. Also info on an AKAI GX226-II reel-reel no control pnl functions. *Eugene Wolfe, 1855 S. Barton D., Augusta, GA 30906 or 706-560-0441.*

Flyback transformer, used but still good, for TV Sears model 14077 ch. C-984-20150. *G. Gautier 218 Ballantyne, Chicoutimi Quebec, Canada G7J 2L7.*

Photofacts and specialized books: AR, CB, HTP, MHF, SD, TR, TSM, VCR. *A.G. Tannenbaum, P.O. Box 110, E. Rockaway, NY 11518. 516-887-0057.*

Safety relay for Pioneer receiver SX-780. P/N ASR-020 or ASR-032. Power transformer or complete power supply for Samsung VCR model VR 4700L. *Parini VCR, John Parini 717-288-6141.*

Schematic and IC for Daytron VCR model VCR-42DBU IC# DBL 324 (DAE WOO). *Northern Technical Services, Joe, 715-356-6004.*

Tentel gauge, alignment tapes, Leader video generator, Sencore VC-93, VA62, etc, in good condition. *McGregor TV Service, 360, Jefferson Ave, Texarkana, AR 75502. 501-773-6488.*

Magnavox IC 612187-1. Quasar flyback TLF 6122F1. Samsung flyback KF 74525. *Blasig TV 203-242-4015.*

Variable isolated ac supply metered. Prefer Sencore Powerite. *Vance Payburn, 2718 Homestead Madison, WI 53711. 608-274-3002.*

Service/operation manual for Conn strobe tuner, tube type. *James Zikes, 9016 West 117 Terrace, O.P. KS 66210.*

Instruction manual and schematic for RCA RF signal generator model WR-50B. *Robert Blackwell, 2925 R1665 Ave, Baltimore, MD 21216. 410-362-6678.*

Schematic or service information for Apple disk drive model A2M0003. Will pay for copy. *W. Moulis P.O. Box 282, Poynette, WI 53955.*

Schematic for Silvertone Model - F- 31778. Audio output Xfmr and speaker for Zephyr model RN-7 radio. *John Phipps, 1412 Navaho Trail. St. Charles, MO, 63304.*

Cassette holding/loading tray assy for JVC VCR model HR-D200U. and for Llyod's VCR model L823. Service manuals or copies for JVC VCR's model HR-D670U and D680U. *J. Powell, 4237C FCN, McGuire AFB, NJ 08641. 609-723-1103.*

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Classified advertising is available by the word or per column inch.
By-the word. $1.65 per word, per insertion, pre-paid Minimum charge is $35 per insertion. Initials and abbreviations count as full words. Indicate free category heading (For Sale, Business Opportunities, Miscellaneous, Wanted). Blind ads (replies sent to ES&T for forwarding) are $40 additional. No agency discounts are allowed for classified advertising by the word. Contact Emily Kreutz at 516-681-2922 to place your classified ad (by-the-word). Mastercard, VISA, American Express are accepted for phone or mail orders. Or send your order, materials and payment to **Emily Kreutz, 76 North Broadway, Hicksville, NY 11801.**
Per column inch (classified Display): $235 per column inch, per insertion, with frequency discounts available, 1" minimum, billed at 1/4" increments after that 10" maximum per ad. Blind ads are $40 addition. Reader Service Number $25 additional to cover processing and handling costs. (Free to 4-inch or larger ads.) For more information regarding classified display advertising please contact Jonathan C. Kummer at 516-681-2922. Optional color (determined by magazine) $150 additional per insertion.

FOR SALE

TV CASE HISTORIES: Booklet with 1, 750+ histories. Satisfaction assured. Only $35 (first-class shipping add $1.50). Mike's Repair Service, P.O. Box 217 Aberdeen Proving Ground, MD 21005. Same mailing address 29 years. Send SASE for samples.

REPAIR MANAGEMENT SOFTWARE: for IBM PC's. Repair tracking, inventory, reports, billing, maillist, more. Demo disk $15. CAHILL ELECTRONICS, PO Box 568, Kingston, NH 03848. 603-642-4292

SENCORE TF46: Transistor Tester, $285.00; Sencore CG25, $50.00; Startek Frequency Counter, $50.00; Eico Flyback Tester, $50.00. Eico H.V. Probe, $25.00. 607-988-9000 Weekends and Nights.

COMPLETE SENCORE VIDEO TEST BENCH for sale. VA62A, VC93, SC61, CM2000, PR57, and CR70. New with all cables, manuals, and original cartons. Make Offer. *Chris Eichman, 215-270-5749.*

VHS-VCR Repair Solution Sets I, II, III IV, V, VI, VII. Each contains 150 symptoms and cures, updated cross reference chart, free assistance, $11.95 each, all seven $69.95. Schematics available. Visa/MC. Eagle Electronics, 52053 Locks Lane, Granger, IN 46530.

TELEPHONE LINE SIMULATORS. An absolute must for every repair shop. Two stamps for details. **JECTECH,** 13962 Olde Post, Pickerington, OH 34147.

THE ONLY ANSWER TO REPAIRING ELECTRONICS PROFITABLY (this should have been done years ago) **GET SMART!** Someone somewhere has already repaired your next repair **YOUR TOP TECHNICIAN,** who's training you have paid for **JUST LEFT TODAY! YOU'RE THE BOSS** and now you have to put on your old rusty technician's cap. **TODAY YOUR BANK** sent you three NSF checks your customers so graciously gave you, and you don't have time to chase them down to collect, **THEY LEFT TOWN. IT'S TAKING YOU LONGER** to assess the repairs and your customers are now coming to collect their units. You promised to give them a **FREE** estimate, but you just realized you don't have a schematic or time to do it. **NOW YOU ARE DOING NIGHT REPAIRS** because during store hours the phone rings off the hook with nuisance questions about setting VCR clocks and you have parts to order, bills to pay and service literature to file. **CIRCUIT CITY JUST MOVED IN** and your wife say's there's no money in repairs **FRIEND!! YOU DEFINITELY HAVE AN EMERGENCY!!** 10,000 repairs 1987 through 1992 with annual updates. References available on request. **I CAN ASSURE YOU THESE TECH-TIPS ARE NOT DUSTY OLD REPAIRS YOU'LL NEVER SEE.** Other programs don't even come close to comparing. **CALL NOW (305) 474-2677 FOR A "FREE" DEMONSTRATION DISK OR PAPER FORMAT** or mail request to **TV-MAN SALES & SERVICE, 8614 SR-84, FT. LAUDERDALE, FL 33324**

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TV–VCR SHOPS: Now fix those tough dogs! A package of over 2800 fixes on disk. ASCII or data for popular data bases. (PFS, QA, etc.) One fix could pay for all. Only $99.95. TECHDAT, 212 Earth Row, Waynesville, MO 65583. To order call 1-800-280-2100. VISA & Mastercard Accepted.

REDUCED 85%. Diehl Mark 111 $79, Diehl Mark V Horizontal circuit tester $199. New. Conductive coating for remote control keypads $8.99 ppd. WEEC, 2805 University Ave., Madison, WI 53705. 608-238-4629, 608-233-9741.

HELP WANTED

TECHNICIAN NEEDED: If you have long term experience in servicing all brands of projection TV's or camcorders. Please send your resume to: Service Manager, 6601 West Bethany Home Road, Suite 4, Glendale, AZ 85301. Experience required. Salary DOE.

WANTED

WANT TO BUY small electronic servicing business. Prefer Western or Southern United States. Call Mike 1-510-783-3648 or Joe 1-918-682-4781.

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Manufacturers Parts and Literature Directory

This monthly section is sponsored by manufacturers to help you find the parts and technical literature needed to service their equipment. Call them for replacement parts or for the name of their nearest distibutor.

Hitachi Home Electronics 401 W. Artesia Blvd. Compton, CA 90220 800-HITACHI	**Mitsubishi Electronics America** 5757 Plaza Drive Cypress, CA 90630 800-553-7278 fax 800-825-6655	**NEC Tehcnologies** 1255 Michael Drive Wood Dale, IL 60191 800-366-3632
Panasonic 50 Meadowlands Parkway Secaucus, NJ 07094 800 545-2672	**Philips ECG** 1025 Westminister Drive Williamsport, PA 17701 800-526-9354 fax 800-346-6621	**Quasar** 50 Meadowlands Parkway Secaucus, NJ 07094 800-545-2672
Technics 50 Meadowlands Parkway Secaucus, NJ 07094 800-545-2672	**Thomson Consumer Electronics** 2000 Clements Bridge Road Deptford, NJ 08096 800-257-7946 fax 800-524-1498	**Zenith Electronics Corp.** 1900 N. Austin Avenue Chicago, IL 60634 312-745-2000

Call Jonathan Kummer at 516-681-2922 to reserve space in this special section.

Advertiser's Index

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Multimeter
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To the advanced Fluke 83 with Min/Max/Average recording, Frequency, Duty Cycle and Input Alert™. Plus a full line of quality accessories to extend those capabilities even further. No matter which Fluke meter you choose, you can count on precise, reliable, consistent performance year in and year out. Plus, strong customer support and product warranties that measure up to any in the industry. Make the choice that gives you the most choices.

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Multimeter
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FLUKE 12	FLUKE 77	FLUKE 83
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V Chek™ (auto function)	Current measurements	Current measurements
Min/Max Record with Relative Time Stamp	Analog/Digital display	Analog/Digital display
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Continuity Capture™	Yellow holster with Flex Stand™	Yellow holster with Flex Stand™
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		Frequency and Duty Cycle
		Min/Max/Avg. Recording
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