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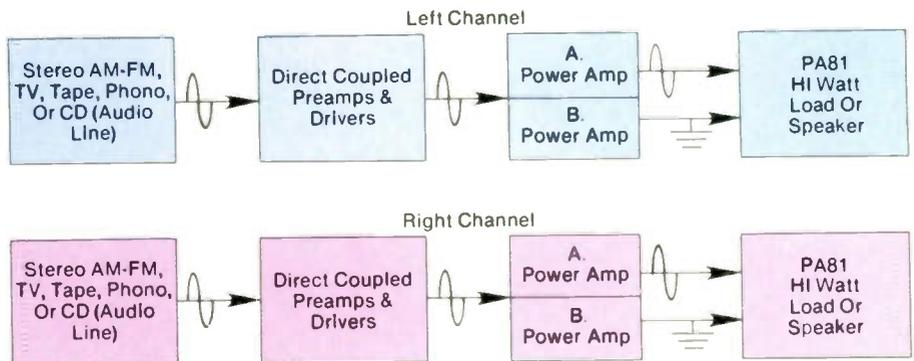
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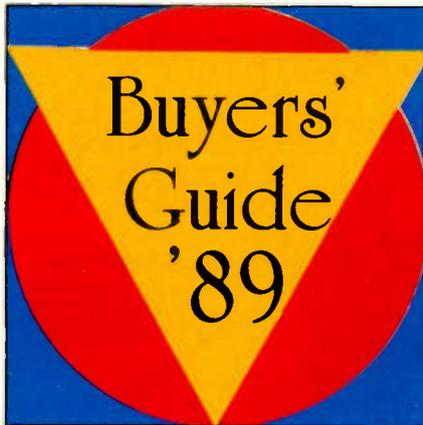
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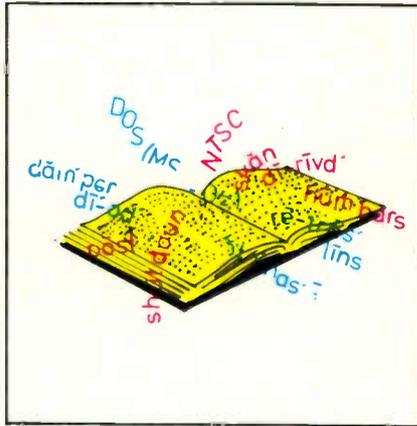
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You need to buy new equipment, locate replacement parts, update your education? Here's our third annual Buyers' Guide. The guide has five parts to help you find the products, replacement parts, services, associations, continuing education sources and addresses that might help you do your job better, faster and easier in 1989.

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The magazine for consumer electronics servicing professionals

ELECTRONIC
Servicing & Technology

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By Conrad Persson

Electronics terms and abbreviations are certainly necessary to electronics servicing — after all, who wants to say metal oxide semiconductor field effect transistor all the time?

However, if you don't know what the initials stand for or if the origin of the term is obscure, you'll always feel a little less sure of yourself than you should. If you've been pondering some of these terms, try out our dictionary. You may finally find the meanings to some of those irritating word puzzles.

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ON THE COVER

Even if you're not planning an electronics equipment shopping spree, buying that one piece of equipment you know will help you do your job better, faster or easier can be the highlight of your day — if not your year. (Photo courtesy of HMC, Canton, MA.)

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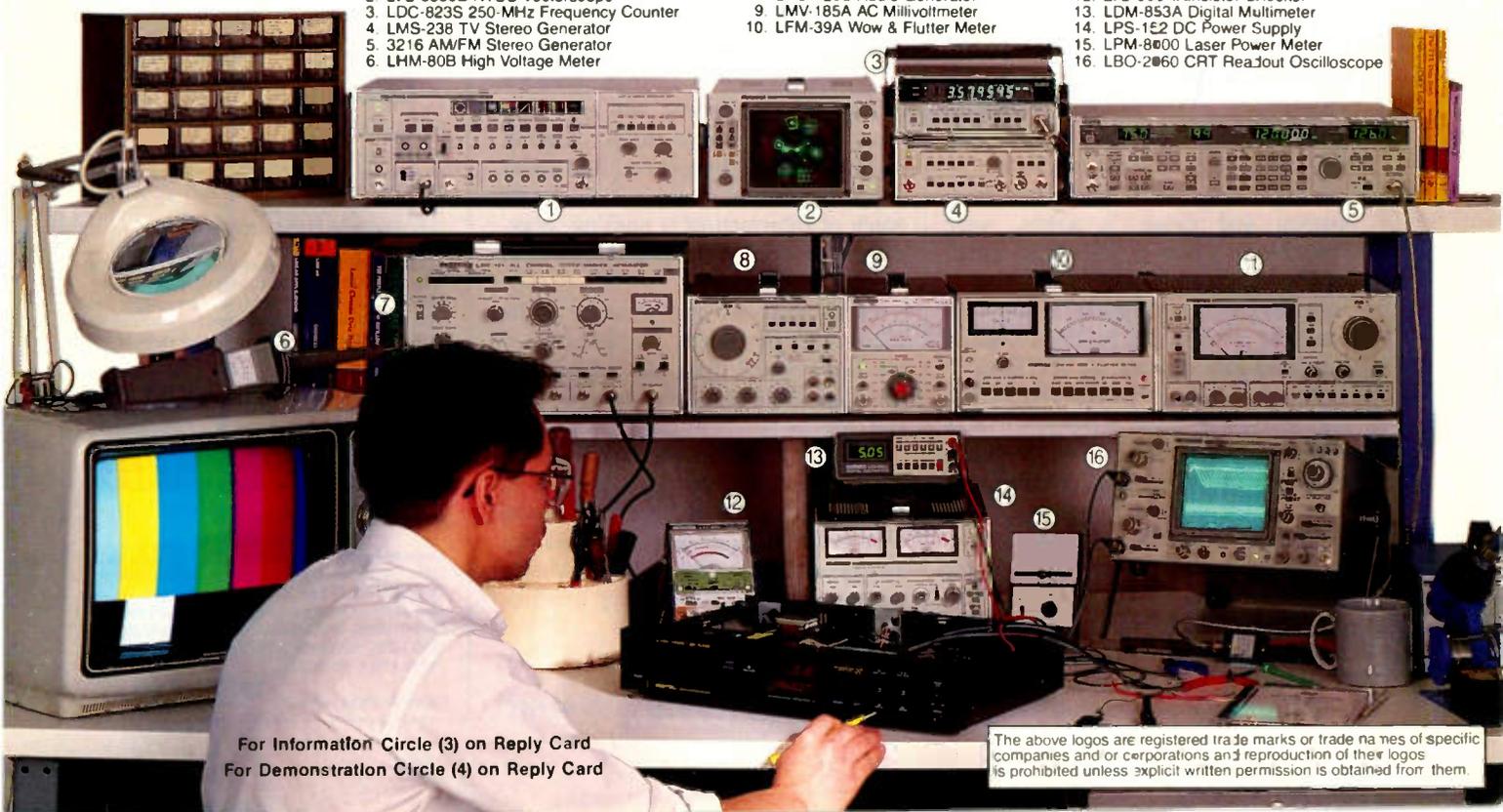
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A rose by any other name

Do you suppose the engineers and designers who have devised electronic components and circuits deliberately set out to make it confusing, or do you think it just happened that way? Take current, for example. When I was studying electronics back in the dark ages BIC (before integrated circuits), I learned that something called *conventional* current flowed from the positive terminal of a dc power source. Later, I found that people were using the idea of electron current flowing from the negative terminal of the dc power source. And of course, it doesn't matter which way you look at it, as long as you're consistent.

When I was studying vacuum tubes, things were bad enough with plate current and voltage and grid current and voltage and cathode current and voltage. Then we got into transistors and not only did we have three sets of voltages and currents, but now there were both NPN and PNP transistors with totally opposite polarities of biasing arrangements, either of which might be analyzed using either conventional current or electron current methods.

Then along came field-effect transistors, and those, it seems, were available in junction (JFET) or metal-oxide-semiconductor (MOSFET) varieties (and just for good measure you can also refer to the MOS devices as insulated-gate devices, or IGFETs).

But wait, there's more. The JFETS and MOSFETs come in n-channel or p-channel varieties, either of which can be operated in either the enhancement mode or the depletion mode.

Give me a break!

Making this situation even worse, the same engineers who came up with all of these wonderful and confusing critters are also responsible for coming up with some terms that may have made sense to them at the time, but have since

had their origins vanish into the mists of obscurity. We've discussed a few of them before, and through speculation and some help from our readers, we came up with explanations for them. One of my favorites is "aquadag," the black coating inside and out on the sides of a picture tube. Turns out that's actually a trademark for an aqueous solution of "deflocculated Acheson graphite" put out by the Acheson Graphite company.

Here's another one. Does anyone have any idea of the origin of the term "BNC connector," such as is used on oscilloscopes and other test equipment? I've heard somewhere in the neighborhood of half a dozen explanations, most of which are suspect. Here's one: It seems that there used to be a "Type N" connector, and when someone manufactured a smaller version of it, they called it a "baby Type N" connector or BNC. This explanation is even documented in a book published in 1945, but I'm skeptical.

Someone else suggested that because it's a Bayonet Connector, the name came from those three letters. That's the explanation I like best so far.

This kind of shenanigans with terminology is fun, but it has a serious side, too. Obscure references and terms for which no one knows the exact meaning or origin make what is supposed to be an exact technology less exact. They also become stumbling blocks. A term that's not familiar is something that a technician or engineer will trip over every time he comes to it, wasting precious time and attention. And when a term is obscure, sometimes a valuable piece of information is missing, making the solution of the problem at hand more difficult.

That's why we put together "The Electronics Servicer's Dictionary" — we hope you'll find the answers to some questions that have been troubling you, and at the least, maybe you won't get hung up on terminology as much when you read our articles in the future. If any of you have a favorite technical term or abbreviation that you would like an explanation for, let us know. Maybe the next time we do something like this, we can include it.

Nils Conrad Persson

The magazine for consumer electronics servicing professionals

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Servicing & Technology

Electronic Servicing & Technology is the "how-to" magazine for technicians 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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Electronic Servicing & Technology (ISSN 0278-9922) is published monthly for \$19.49 per year by Intertec Publishing Corp., 9221 Quivira Road, Overland Park, KS 66215. Second-class postage paid at Shawnee Mission, KS and additional mailing offices. POSTMASTER: Send address changes to ELECTRONIC SERVICING & TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66212.



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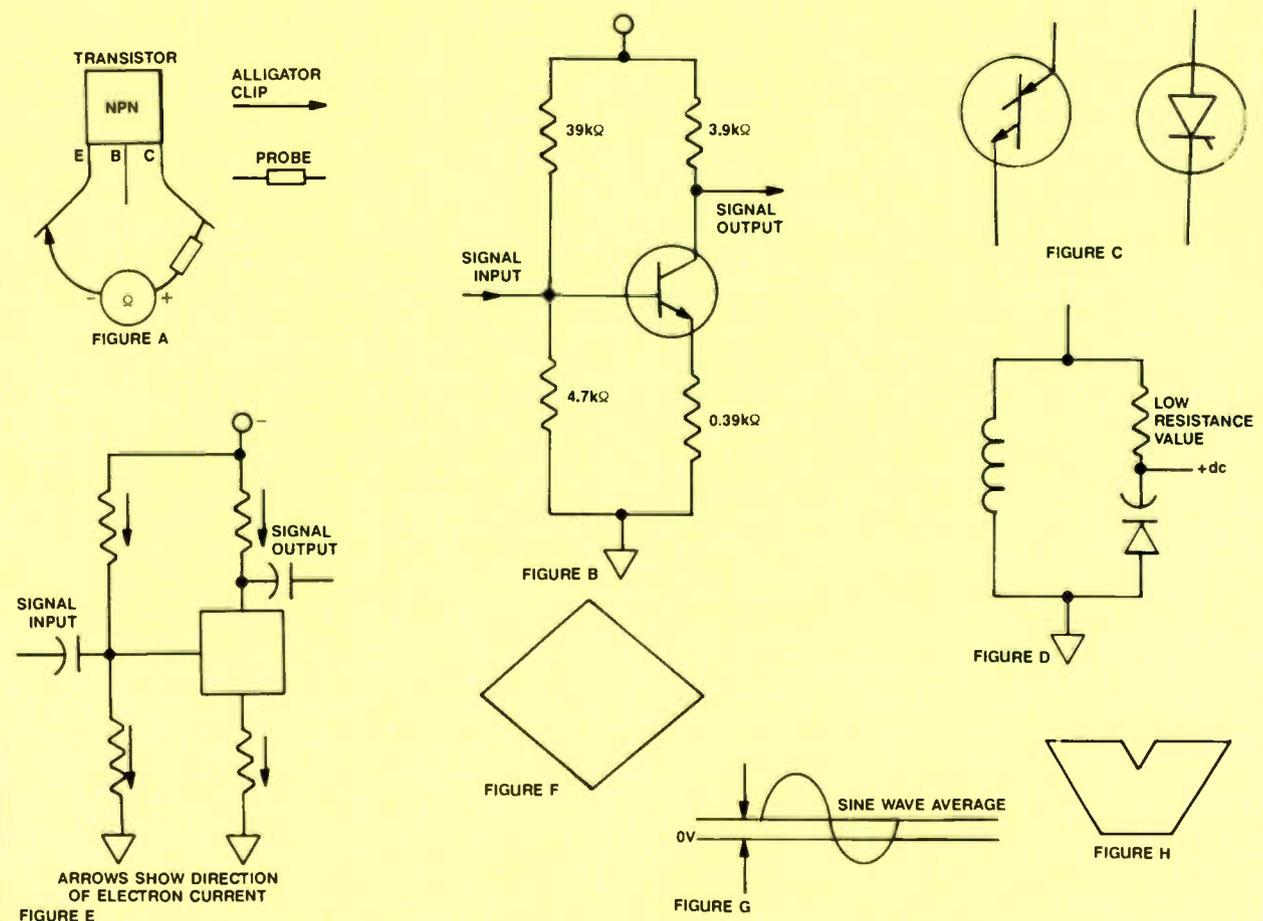
By Sam Wilson, CET

- An ohmmeter test is being conducted on an NPN transistor. As shown in Figure A, the positive lead of the ohmmeter output voltage goes to the collector, and the negative lead goes to the emitter. The ohmmeter should indicate a
 - high resistance.
 - low resistance.
- Refer again to the test in Figure A. A $6.8k\Omega$ resistor is momentarily connected between the base and collector leads. This will
 - destroy the transistor.
 - increase the resistance as indicated by the ohmmeter.
 - not affect the ohmmeter reading.
 - decrease the resistance as in-

- indicated by the ohmmeter.
- What is the approximate voltage gain of the amplifier in Figure B?
 - increased.
 - decreased.
- Both of the symbols in Figure C represent the same component. What is the component?
 - increased.
 - decreased.
- The tuned circuit in Figure D uses a varactor diode. To increase the resonant frequency, the +DC voltage should be
 - increased.
 - decreased.
- Which type of diode is used for sensing infrared?
 - increased.
 - decreased.
- Refer to Figure E. The symbol inside the box was supposed to be in-

- color but it never got printed. Which of the following is more likely for the missing symbol?
 - P-channel enhancement MOSFET.
 - N-channel depletion MOSFET.
- Figure F shows a symbol that is used with flow charts. It means to
 - go slow.
 - stop.
 - make a decision.
 - interchange data.
- Refer to the sine wave voltage in Figure G. What is the difference between 0V and the sine wave average called?
 - go slow.
 - stop.
 - make a decision.
 - interchange data.
- What does the symbol in Figure H stand for?

Wilson is the electronics theory consultant for ES&T.



Answers

1. A — high resistance. The base of the transistor is open, so the transistor is cut off.

2. D — decrease the resistance as indicated by the ohmmeter. This is a better test. It shows that the base has control over the collector current. The resistor forward-biases the base. That in turn increases the collector current, as indicated by the reduced resistance.

3. 10V. When the emitter resistor is not bypassed, as in the case of the amplifier in Figure B, the approximate gain is equal to the collector resistance divided by the emitter resistance.

4. Shockley diode. It is also known as a 4-layer diode. This is a breakover device that does not conduct until its forward bias reaches a predetermined value.

5. A — increased. Increasing the positive voltage increases the diode reverse bias. Increasing the reverse bias of a varactor diode decreases its capacity. Decreasing the capacity in a tuned circuit increases the resonant frequency.

6. PIN diodes are used for sensing infrared energy.

7. A — P-channel enhancement MOSFET. The voltage divider is used to forward-bias the device. The negative supply and the direction of electron current are clues to the type of device. There are other devices that would work but they weren't choices in the question.

8. C — make a decision. Of course, if you're going to make a decision, you probably should go slow.

9. Offset. You will see this as an adjustment on some function generators. It permits you to adjust the dc level in relationship to the signal.

10. ALU. It is the symbol for the arithmetic logic unit inside a microprocessor. The ALU is the number cruncher. It performs arithmetic and logic functions on stored data.

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Diversify, and keep good records

The thrill of victory, the agony of defeat. There is probably no better real-world illustration of that shop-worn phrase than is contained in the history of the electronics servicing industry.

If we regard the end of World War II as the beginning of the modern electronics servicing industry, we have certainly seen both the thrill of victory and the agony of defeat compressed into those forty years or so. When all of those GIs returned from WWII with their newly acquired electronics skills, new radio and TV service companies were launched at a mind-boggling pace. And the business climate couldn't have been better. A new phenomenon called *television* was being hailed as the most fascinating form of entertainment since motion pictures. TV sets were selling as fast as manufacturers (all of them American) could turn out the product. The industry's appetite for people who knew how to install and repair these new gadgets was insatiable. It was almost impossible to fail in the TV service business in those days.

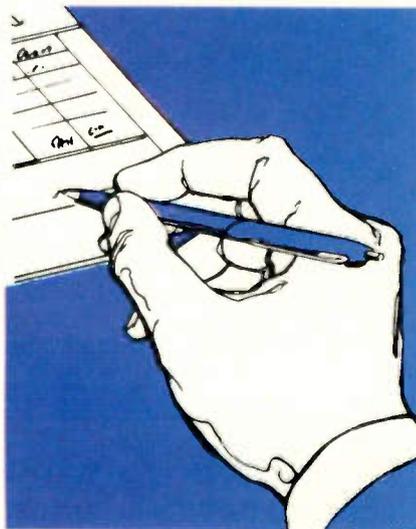
Rapid improvements in electronic technology kept the service profit pot at a rapid boil. As soon as things showed signs of dying down a little, color television made its debut. If B&W TV required a lot of service, color sets required even more. Breakdowns were so common in those days that jokes about live-in service technicians became a staple for network comedians.

There were so many success stories in the service industry that "experts" on successful service business operations began to give seminars and write books on how easy it was. The thrill of victory.

But a strange thing happened as technology continued its dizzying escalation. Solid-state electronics was introduced and then improved. Dependability in TV and other electronic products increased on a geometric basis. Work became scarce, competition hungry. Thousands of small service businesses died. Some are still dying. Slowly. The agony of defeat.

With the perspective that comes with the passage of time, we can look back now and see more clearly what happened. Many of the industry's "experts" weren't so expert after all. The business climate had been so favorable that business success was almost unavoidable — until the going got tough.

But there was an important lesson to be learned in all this. There really were some experts out there. And they're still around today, with businesses that are



bigger, better and more successful than ever.

In my travels around the country, I meet and work with many of the industry's most successful service dealers. Analyzing the differences between their businesses and the ones that fail is part of my job. Passing some of those observations along to you is one of the purposes of this column.

It's easy to see now that a willingness and the ability to diversify has been a major factor in long-term success for electronic service dealers. Anyone who has been in the service industry for a while remembers the old-timer who was unwilling or unable to advance beyond television. His business is long gone now. A successful service dealer whom

I admire recently told me that 60% of his revenue today comes from servicing products that did not exist when he founded the business 30 years ago.

So, diversification is one of the obvious keys to longevity in this business. Your ability to diversify, in turn, depends on your ability to keep up with advancing technology — that's part of the purpose of *ES&T* magazine.

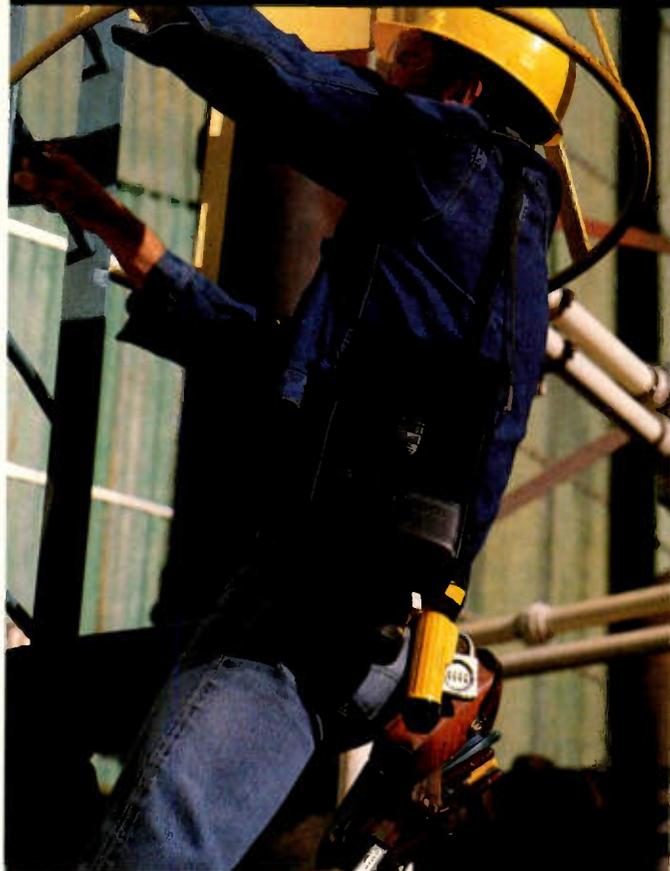
The other major characteristic that I have seen in successful electronics servicing dealers is their recognition that service is, above all, a **BUSINESS**. If a service business is to be successful, its owners and managers must be skilled business managers. We hope that Business Corner will help you in that objective.

One of the most obvious signs of pending trouble that I see in my work in the field is a service dealer's failure to maintain adequate records. Keeping and using good records is not at all difficult. More imperative, it is a vitally important responsibility. Business records are a signpost of where you have been, where you are now and, most imperative, where you may be heading.

Among the business records that I feel are most imperative are monthly operating statements that adhere to standard formats, operating budgets, servicing technician productivity records, and the tracking of advertising results (even if Yellow Pages are the only advertising being used). From time to time, we'll discuss each of these records and how to put them to use effectively.

I want to emphasize to you that a failure to keep adequate business records is one of the most common of all reasons for the failure of small businesses. The good news is that there is no reason to avoid the job. Done properly, it's easy. And once you come to depend on your records, you'll wonder how you ever survived without them. If you are among those who already maintain a good set of business records, congratulations. That's one of the reasons you're still alive and kicking. **ES&T**

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Introducing Tek's new 222 Digital Oscilloscope. Weighing in at under 4.5 pounds, the new Tek 222 is an ultra-portable, 10-MHz digital storage scope that's perfect for service applications. So tough, rugged, and totally self-contained, it can go just about anywhere. And it's incredibly easy to use—even in extreme conditions.

Extraordinary capability and reliability at a great price. The 222 is a dual-channel scope that can measure a wide variety of electronic instrumentation and circuitry. It has rechargeable on-board batteries with a floating ground to 400 volts, and meets tough environmental standards.

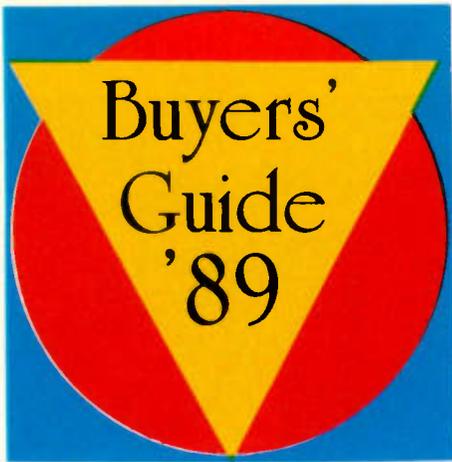
Plus, the 222 lets you pre-define front-panel setups, and call them up with a single button in the field. You can also save waveforms in the scope's memory, then transfer them to a PC for analysis and hard-copy output when you get back to the shop.

Best of all, the 222 is yours for only \$2350. And that includes Tek's remarkable three-year warranty on parts, labor, and CRT.

Get one to go! Pack a handful of power with you wherever you go. To order your 222, or for a free brochure, contact your local Tek representative or authorized distributor.

In a hurry? Call
1-800-426-2200.





Electronic servicers are constantly searching for the newest technology — test equipment to make their jobs easier, special services to increase their efficiency, associations and schools to keep them on top of new information, and of course those elusive replacement parts to get that TV off the bench and back in the hands of its owner. To help you in your search for what's new, here's the third **ES&T Buyers' Guide**. Keep this reference on hand year-round — after all, who knows when you might need to find a source for that one particular capacitor you just can't find anywhere?

Using the Buyers' Guide

You want to buy a new oscilloscope, but you're not sure what new features are available, and you don't have a phone number on hand to help you find it. That's one of the reasons we publish the **Buyers' Guide**. Every month we hear about new test equipment, new continuing education courses, even brand new companies. In this issue, we'll pull all that information together into one handy reference, cross-referenced to the issue's advertisements to give you an idea of some specific products you can choose from. The **Buyers' Guide** is

divided into five categories:

- product directory page 11.
- replacement parts/components directory page 45.
- services directory page 51.
- association/educational sources directory page 52.
- company address directory page 53.

Finding a product

The product directory is subdivided by the type of product: test equipment, test equipment accessories, circuit damage protective equipment/supplies, supplies/accessories equipment, audio/video accessories and tools. If you need a breakout box, for example, just turn to "Test equipment." You'll notice two things in the listings: some companies are highlighted in blue, and some company names are followed by a *D. The *D indicates that the company distributes, not manufactures, a particular product. The blue listings point out companies that have advertised in this issue. If you want to know a little bit more about what a company has to offer, turn to the page number indicated to the right — a small feature, but one

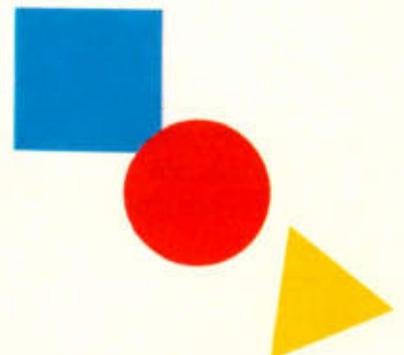
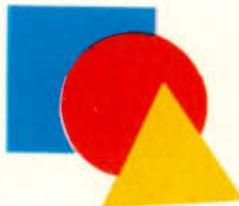
that we hope will make this **Buyers' Guide** just a little more informative.

Making your contact

So, you know what company you're interested in, what next? Turn to the company mailing address section. Here you'll find the addresses and telephone numbers for more than 460 companies that offer products or services for your industry. No matter what you're looking for, this directory, tailored for the electronics servicer, should point you in the right direction.

We've also included the replacement parts/components directory to help you locate those hard-to-find items, and the services directory should help you find consultants, rental equipment and repair or calibration services. If you're looking for a book, seminar or class to continue your electronics education or enhance your business acumen, check out the association/educational sources directory.

We hope we've included all the equipment, parts and manufacturers you need, but we're not holding our breath. New companies and products are launched every day, so if we've left out information you need, drop us a line.



Product directory

See Adv. Page

See Adv. Page

See Adv. Page

See Adv. Page

Test equipment

AC LEAKAGE TESTERS

Abatron Electronics*
Accutest Instruments*
AEMC Corp.
Allied Electronics, A Div. of Hall-Mark Electronics*
Amprobe Instrument
Biddle Instruments
E.I.L. Instruments, Inc.
Electro Rent Corp.*
Electronics Warehouse Corp.* 73
Fordham Radio Supply Co.*
HSC Electronic Supply*
The Instrument Mart, Inc.*
Joseph Electronics*D 71
Kelvin Electronics*
Kikusui International Corp.
RAG Electronics Inc.*D 57
Sencore Electronics IFC
Simpson Electric Co.*D 53
Specialized Products Co.*
A.W. Sperry Instruments, Inc.
Sutton Designs, Inc. Computer Security Div.
Tekserv*
TIF Instruments, Inc.
Transcat*
Verite
Video Midwest & AVC Divs. of Vaughn Communications*
VIZ Test Equipment Div. of Kappa Networks Inc.

AUTOMATED TEST EQUIPMENT

Abatron Electronics*
American Reliance Inc.
Analogic Corp.
Anasco Corp.*
Arium Corp.
Biddle Instruments
Cabletest Products Co. (Formerly Hollex Inc.)
Colorado Data Systems
Convex Corp.
CSTS Inc.
Electro Rent Corp.*
Electronics Warehouse Corp.*D 73
Fiskars Electronics Corp. AC Power Div.
John Fluke Mfg. Co. Inc. 5
GenRad, Inc.
GlobeTech International, Inc.
Greenbrier Electronics Div. Temco Instruments, Inc.
Heath Co.
Hilevel Technology, Inc.
Hi-Techniques Inc.
HSC Electronic Supply*
Huntron Inc.
Hy-Tronix Instruments, Inc.
IET Labs, Inc.
The Instrument Mart, Inc.*
Interconnect Devices, Inc.
IQ Technologies, Inc.
W.S. Jenks & Son*
Joseph Electronics*D 71
Keytek Instrument Corp.
Kobatron Inc.
Marconi Instruments
MarKerich Corp.
Pacific Power Source
PanSon Electronics*
PAXR Corp.
Pioneer-Standard Electronics*
Racal-Dana Instruments Inc.
Rapid Systems
Schlumberger Instruments

Sencore Electronics IFC
Tektronix, Inc. 8A-B,9,
16A-B,17
Temco Instruments Inc.
Triplett Corp.
United States Instrument Rentals*D 55
Verite
Video Midwest & AVC Divs. of Vaughn Communications*
D.S. Walker & Associates, Inc.
Wandel & Goltermann, Inc.
Wavetek Corp.

BREAKOUT BOXES

American Reliance Inc.
Anasco Corp.*
Arrow Electronics Inc. Catalog Sales Div.*
Atrix, Inc.*
B&B Electronics Mfg., Co.
Beckman Industrial Corp. Instrumentation Products Div. IBC
Black Box Corp.*
Com-Kyl Inc.
Consolidated Electronics, Inc.*D 73
Contact East, Inc.*D 74
Convex Corp.
Datacom Technologies, Inc.
Datatran Corp.
E.I.L. Instruments, Inc.
Electro Standards Lab, Inc.
Electronics Warehouse Corp.*D 73
Fordham Radio Supply Co.*
Frederick Engineering, Inc.
G.C. Electronics Co. Div. of GC Thorsen Co.
Global Specialties A Div. of Interplex Hall-ComSec, Inc.
Hand Tool Industries, Inc.
HMC-Hub Material Co.*
HSC Electronic Supply*
IAM
International Data Sciences
IQ Technologies, Inc.
JDR Microdevices*
W.S. Jenks & Son*
Jensen Tools Inc.*
Joseph Electronics*D 71
Kelvin Electronics*
Kobatron Inc.
Marconi Instruments
MCM Electronics*D 61
Milo Associates, Inc.*
M-Test Equipment
P.K. Neuses Inc.*
Nu-Data Inc.
ORA Electronics
Patton Electronics Co.
Pioneer-Standard Electronics*
RAG Electronics Inc.*D 57
RNJ Electronics Inc.*
Scooter Products Ohm Electrics, Inc.*
Sintec Co.*
Specialized Products Co.*
Sutton Designs, Inc. Computer Security Div.
Techni-Tool Inc.*D 72
Tektronix Communications Network Analyzers Div.
Telecommunications Techniques Corp.
Tool Kit Specialists, Inc. 68
Transcat*
Tucker Electronics Co.*
United States Instrument Rentals*D 55
Video Midwest & AVC Divs. of Vaughn Communications*
Wandel & Goltermann, Inc.

CELLULAR TELEPHONE TEST EQUIPMENT

Consolidated Electronics, Inc.*D 73
Electro Rent Corp.*
Hand Tool Industries, Inc.
The Instrument Mart, Inc.*
Joseph Electronics*D 71
Marconi Instruments
Ramsey Electronics Inc.
Sony Service Co. 23,29

COMPUTER DIAGNOSTIC SOFTWARE

Designer Technology
International Data Sciences
Jensen Tools Inc.*
Joseph Electronics*D 71
Sony Service Co. 23,29
Specialized Products Co.*
Video Midwest & AVC Divs. of Vaughn Communications*
Windsor Technologies, Inc. 31

CONTINUITY TESTERS

Accutest Instruments*
Allied Electronics, A Div. of Hall-Mark Electronics*
Amprobe Instrument
Arrow Electronics Inc. Catalog Sales Div.*
Atrix, Inc.*
Biddle Instruments
Brunelle Instruments Inc.
Bursma Electronic Distributing*
Cabletest Products Co. (Formerly Hollex Inc.)
CG Instruments Inc.
Charleswater Products, Inc.
Com-Kyl Inc.
Consolidated Electronics, Inc.*D 73
Contact East, Inc.*D 74
Datacom Technologies, Inc.
Desco Industries
EDS, Inc.
E.I.L. Instruments, Inc.
Electro Standards Lab, Inc.
Electronics Warehouse Corp.*D 73
EM Corp.
EMCO Electronics
Fordham Radio Supply Co.*
G.C. Electronics Co. Div. of GC Thorsen Co.
Global Specialties A Div. of Interplex HMC-Hub Material Co.*
HSC Electronic Supply*
The Instrument Mart, Inc.*
JDR Microdevices*
W.S. Jenks & Son*
Jensen Tools Inc.*
Joseph Electronics*D 71
Kelvin Electronics*
Wayne Kerr Inc.
Klein Tools, Inc.
L-Com Inc.
Li'l Bitty Tester, Inc.
MCM Electronics*D 61
Microtest, Inc.
Milo Associates, Inc.*
Mitrex Supply Corp.*
MiniTool Inc.
Nu-Data Inc.
O.K. Industries Inc.
OmniTron Electronics*
ORA Electronics
Patton Electronics Co.
RAG Electronics Inc.*D 57
RNJ Electronics Inc.*
Scooter Products Ohm Electrics, Inc.*

Simpson Electric Co. 53
Sintec Co.*
Specialized Products Co.*
Speco Div.
A.W. Sperry Instruments, Inc.
Synchronicity Research Co.
Techni-Tool Inc.*D 72
Tekserv*
TIF Instruments, Inc.
Tool Kit Specialists, Inc. 68
Tool-Tronics, Inc.*
The Triangle Tool Group, Inc.
Vaco Products 61
Video Midwest & AVC Divs. of Vaughn Communications*
Yokogawa Corp. of America

CRT TESTERS/RESTORERS

Accutest Instruments*
B&K-Precision Maxtec International Corp.
Bursma Electronic Distributing*
Consolidated Electronics, Inc.*D 73
Dandy Mfg. Co.
Electronic Parts Supply*
Electronics Warehouse Corp.*D 73
Fordham Radio Supply Co.*
HMC-Hub Material Co.*
Joseph Electronics*D 71
Kelvin Electronics*
OmniTron Electronics*
PanSon Electronics*
RAG Electronics Inc.*D 57
RNJ Electronics Inc.*
Sencore Electronics IFC
Sony Service Co. 23,29
Video Midwest & AVC Divs. of Vaughn Communications*
D.S. Walker & Associates, Inc.

CURVE TRACERS

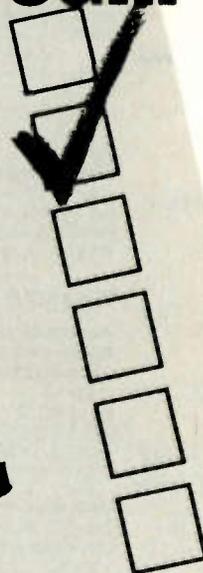
Accutest Instruments*
Brunelle Instruments Inc.
Consolidated Electronics, Inc.*D 73
Electro Rent Corp.*
Electronic Design Specialists
Electronics Warehouse Corp.*D 73
Genstar Rental Electronics Inc.
Hameg, Inc.
HSC Electronic Supply*
Huntron Inc.
The Instrument Mart, Inc.*
Joseph Electronics*D 71
Kelvin Electronics*
Leader Instruments Corp. 3
Leasametric IRD*
OmniTron Electronics*
PanSon Electronics*
Polaris Div. of UXL Corp.
RAG Electronics Inc.*D 57
RNJ Electronics Inc.*
Synchronicity Research Co.
Tekserv*
Tektronix, Inc. 8A-B,9,
16A-B,17
Video Midwest & AVC Divs. of Vaughn Communications*

DATA COMMUNICATION ANALYZERS/MONITORS/TESTERS

Abatron Electronics*
Anritsu Meter Co. of America
B&B Electronics Mfg., Co.
Beckman Industrial Corp. Instrumentation Products Div. IBC
Black Box Corp.*
Colorado Data Systems

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RELIABILITY
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ELECTRONIC PARTS CO. (C/V/M) • 4021 N. 31st Ave., Phoenix 85017 • 602-227-7281

ARKANSAS

AMERICAN ELECTRONICS (C/V/M) • 101 W. Rock St., Fayetteville 72701 • 501-442-8070

CALIFORNIA

ANDREWS ELECTRONICS (C/V/M) • 905 Allen Ave., Glendale 91201 • 818-845-3536
AUDIO VIDEO PARTS, INC. (C/M) • 1071 South La Brea Ave., Los Angeles 90019 • 213-933-8141
CASS ELECTRONICS (C/V/M) • 801 Seventh Ave., Oakland 94606 • 415-839-2277
CHUCK HURLEY ELECTRONICS (C/V/M) • 2557 Albatross Way, Sacramento 95815 • 916-927-5891
E AND K PARTS, INC. (C/V/M) • 2115 Westwood Blvd., Los Angeles 90025 • 213-475-6848
HURLEY ELECTRONICS (C/M) • 10712 Inglewood Ave., Inglewood 90304 • 213-678-7644
HURLEY ELECTRONICS (C/M) • 730 W. Spruce, San Bernardino 92410 • 714-885-0721
HURLEY ELECTRONICS (C/M) • 318 16th St., San Diego 92101 • 619-235-6245
HURLEY ELECTRONICS (C/M) • 2101 N. Fairview, Santa Ana 92706 • 714-971-2992
PACIFIC COAST PARTS (C/V/M) • 15024 Staff Court, Gardena 92048 • 213-515-0207
WHOLESALE VACUUM (V) • 5811 Rose Ave., Long Beach 90813 • 213-428-6411

COLORADO

DENVER-WALKER ELECTRONICS (C/V/M) • 299 Bryant St., Denver 80219 • 303-935-2405

CONNECTICUT

SIGNAL ELECTRONICS SUPPLY, INC. (C) • 589 New Park Ave., West Hartford 06110 • 203-233-8551

FLORIDA

HERMAN ELECTRONICS (C/V/M) • 1365 N.W. 23rd St., Miami 33142 • 305-634-6591
LAYCO, INC. (C/V/M) • 501 South Main St., Crestview 32536 • 904-682-0321
VANCE BALDWIN (C) • 2207 S. Andrews Ave., Fort Lauderdale 33316 • 305-523-3461
VANCE BALDWIN (C/M) • 11629 N.W. 7th Ave., Miami 33168 • 305-769-0225
VANCE BALDWIN (C/V/M) • 1307 N. Himes Ave., Tampa 33607 • 813-870-2606
VANCE BALDWIN (C/V/M) • 500 Clematis St., West Palm Beach 33401 • 305-832-5671
WALDER ELECTRONICS (C/V/M) • 1801 N.E. 2nd Ave., Miami 33132 • 305-379-4794

GEORGIA

BUCKEYE VACUUM CLEANER (V) • 2870 Plant Atkinson Rd., Smyrna 30080 • 404-351-7300
CLIMATIC CORPORATION (C/V/M) • 650 Old Norcross, Lawrenceville 30246 • 404-962-0737
WHOLESALE INDUSTRIAL (C/M) • 5925 Peachtree Corners East, Norcross 30071 • 404-447-8436

HAWAII

PANASONIC HAWAII, INC. (C/V/M) • 91-238 Kauhii St., Ewa Beach 96808-0774 • 808-682-2851

ILLINOIS

B-B & W, INC. (C/V/M) • 2137 S. Euclid Ave., Berwyn 60402 • 312-242-1533
HESCO, INC. (V) • 6633 North Milwaukee Ave., Niles 60648 • 312-647-6700
HOWARD ELECTRONIC SALES (C/V/M) • 4573 Archer Ave., Chicago 60632 • 312-254-1777
JOSEPH ELECTRONICS, INC. (C/M) • 8830 N. Milwaukee Ave., Niles 60648 • 312-297-4200
UNION ELECTRONIC DIST. (C/V/M) • 16012 S. Cottage Grove, South Holland 60473 • 312-333-4100
YEOMANS DISTRIBUTING CO. (C/V/M) • 1503 W. Altorfer Dr., Peoria 61614 • 309-691-0050

INDIANA

ELECTRONIC SERVICE PARTS (C/V/M) • 2901 E. Washington St., Indianapolis 46201 • 317-269-1527

IOWA

JONES DISTRIBUTING CO. (C/V/M) • 2650 Bridgeport Dr., Sioux City 51102 • 712-277-8600
UNION SUPPLY COMPANY, INC. (C/V/M) • 231 S. 3rd St., Burlington 52601 • 319-754-5745
YEOMANS DISTRIBUTING CO. (C/M) • 616 New York St., Des Moines 50313 • 515-280-8179

KANSAS

G & A DISTRIBUTORS, INC. (C/V/M) • 635 N. Hydraulic St., Wichita 67201 • 316-262-3707

KENTUCKY

MAJOR DISTRIBUTING COMPANY (C/M) • 449 S. 16th St., Paducah 42001 • 502-443-5345
SERVICE ELECTRONICS SUPPLY (C) • 1046A New Circle Rd., NE, Lexington 40505 • 606-254-5786

MARYLAND

FAIRWAY ELECTRONICS (C/V/M) • 3040 Waterview Drive, Baltimore 21230 • 301-576-8555
FAIRWAY ELECTRONICS (C/V/M) • 4210 Howard Ave., Kensington 20795 • 301-564-1440
TRITRONICS, INC. (C/V/M) • 1306 Continental Dr., Abingdon 21009-2334 • 301-676-7300

MASSACHUSETTS

MIL ELECTRONICS (C/V/M) • 27-33 Jones Rd., Waltham 02154 • 617-891-6730
SIGNAL ELECTRONICS SUPPLY, INC. (C) • 484 Worthington St., Springfield 01105 • 413-739-3893
TEE VEE SUPPLY CO. (C/V/M) • 3211 Washington St., Boston 02130 • 617-522-9330

MICHIGAN

POTTER DISTRIBUTORS (C/M) • 4037 Roger Chaffee Dr., S.E., Grand Rapids 49508 • 616-531-6860
REMCOR ELECTRONICS (C/M) • 10670 Nine Mile Rd., Oak Park 48237 • 313-541-5624

MINNESOTA

NESS ELECTRONICS, INC. (C/V/M) • 441 Stinson Blvd. NE, Minneapolis 55413 • 612-623-9505
MID AMERICA VACUUM CLEANER SUPPLY CO. (V) • 666 University Ave., St. Paul 55104 • 612-222-0763

MISSISSIPPI

TRI-STATE ELECTRONICS (C/V/M) • 605 W. Fortification St., Jackson 39203 • 601-355-3431

MISSOURI

CITITRONIX, INC. (C/V/M) • 1641 Dielman Rd., St. Louis 63132 • 314-427-3420
MANHATTAN ELECTRONICS, INC. (C/V/M) • 1101 C E. 76th Terrace, Kansas City 64131 • 816-361-9440
TACONY CORP. (V) • 1760 Gilsinn Lane, Fenton 63036 • 314-349-3000

NEW HAMPSHIRE

TEE-VEE SUPPLY CO. (C/V/M) • 58 Elm St., Nashua 03060 • 603-889-4171

NEW JERSEY

NIDISCO ELECTRONICS (C/V/M) • 284-294 Passaic St., Passaic 07055 • 201-779-5520

NEW MEXICO

ELECTRONIC PARTS CO. (C/V/M) • 2620 Rhode Island NE, Albuquerque 87110 • 505-293-6161

NEW YORK

A & P ELECTRONICS (C/V/M) • 4144 Sunrise Highway, Massapequa 11758 • 516-541-4200
DALE ELECTRONICS (C/V/M) • 7 E. 20th St., New York City 10003 • 212-475-1124
GREEN TELE-RADIO DIST. (C) • 84-00 73rd Avenue, Glendale 11385 • 718-821-1114
GMB SALES (C/M) • 2700 Middle Country Rd., Centereach 11720 • 516-585-8111
MILL ELECTRONIC SUPPLY (C/V/M) • 2026 McDonald Ave., Brooklyn 11223 • 718-336-4575
PAGO APPLIANCE PARTS (C/M) • 700 Broadway, Buffalo 14212 • 716-856-8133
PANSON ELECTRONICS (C/V/M) • 268 Norman Avenue, Greenpoint 11222 • 718-383-3400
RADIO EQUIPMENT CORP. (C) • 196 Vulcan St., Buffalo 14207 • 716-874-2690
STAR FOR PARTS (V) • 250 Rabro Drive East, Hauppauge 11788-0255 • 800-525-6046 (Except CO)
UNITED TELETRONIC PARTS (C/M) • 3860 10th Ave., New York 10034 • 212-LO9-2330

NORTH CAROLINA

ALLISON-ERWIN CO. (C/V/M) • 2920 N. Tryon St., Charlotte 28232 • 704-334-8621

NORTH DAKOTA

WESTECH DISTRIBUTING (C/V) • 1345 Main Ave., Fargo 58103 • 701-237-4885

OHIO

FOX INTERNATIONAL, INC. (C/V/M) • 23600 Aurora Rd., Bedford Heights 44146 • 216-439-8500
LARRICKS, INC. (C/V/M) • 23 Mackoll St., Dayton 45403 • 513-258-1211

OKLAHOMA

AMERICAN ELECTRONICS (C/V/M) • 730 South Utica, Tulsa 74104 • 918-599-8866

OREGON

DIVERSIFIED PARTS (C/V/M) • 2104 S.E. 9th Ave., Portland 97214 • 503-236-6140
THE MOORE CO. (C/V/M) • 333 SE 2nd, Portland 97214 • 503-234-5000

PENNSYLVANIA

AMERICAN VAC DISTRIBUTORS (V) • 3132 E. Thompson St., Philadelphia 19134 • 215-423-4522
CRS ELECTRONICS (C/M) • 818 Brownsville Rd., Pittsburgh 15210 • 412-431-7700
LINWOOD WHOLESALE, INC. (C/M) • 1139 Sumner Ave., Whitehall 18052 • 215-820-0357
STEINBERG ELECTRONICS (C/V/M) • 2520 N. Broad St., Philadelphia 19132 • 215-BA3-9400

RHODE ISLAND

JABBOUR ELECTRONICS (C/V/M) • 1744 Cranston St., Cranston 02920 • 401-944-2570

SOUTH CAROLINA

WHOLESALE INDUSTRIAL (C/V/M) • 515 E. Bay St., Charleston 29403 • 803-722-2634

TENNESSEE

CURREY'S, INC. (C/V) • 923-8th Ave. S., Nashville 37203 • 615-242-4223
MILLS MORRIS CO. (C/V/M) • 677 Phelan Ave., Memphis 38101 • 901-774-9810
SHIELDS ELECTRONICS SUPPLY, INC. (C/V/M) • 4722 Middlebrook Pike, Knoxville 37921 • 615-588-2421

TEXAS

ELECTRONIC COMPONENT (C/V/M) • 2401 Blissonnet, Houston 77005 • 713-528-1543
FOX INTERNATIONAL (C/V/M) • 752 So. Sherman, Richardson 75081 • 214-231-1826
M-TRONICS (C/V/M) • 3201 West Ave., San Antonio 78213 • 512-340-4069
PORTER BURGESS CO. (C/V/M) • 1233 Levee St., Dallas 75207 • 214-741-5161
VCP INTERNATIONAL, INC. (V) • 2285 Merritt Dr., Garland 75040 • 214-271-7474

VIRGINIA

AVEC ELECTRONICS CORP. (M) • 711 Granby St., Norfolk 23510 • 804-627-3502
AVEC ELECTRONICS CORP. (M) • 2002 Staples Mill Rd., Richmond 23230 • 804-359-6071
FAIRWAY ELECTRONICS, INC. (C/V/M) • 2304 Chamberlayne Ave., Richmond 23222 • 804-321-7255

WASHINGTON

P-E DISTRIBUTING (C/V/M) • P.O. Box 19315, Seattle 98109-1315 • 206-624-3112

WISCONSIN

DYKRO, INC. (C/V/M) • N90 W14401 Commerce Dr., Menomonee Falls 53051 • 414-255-1900
G.M. POPKEY COMPANY (C/V/M) • 2035 Larsen Rd., Green Bay 54307-2237 • 414-497-0400

CODING:

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

* ... Full Line
** ... Panasonic Only
*** ... Quasar Only
**** ... Vacuum Only
† ... For Dealers Only

(as of 6/17/88)

Parts Division

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

Circle (8) on Reply Card



See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
Com-Kyl Inc. Contact East, Inc.*D 74	RAG Electronics Inc.*D 57	FUNCTION GENERATORS	Joseph Electronics*D 71
Convex Corp.	Tekserv*D	Accutest Instruments*D	P.K. Neuses Inc.*D
Datacom Technologies, Inc.	United States Instrument	Allied Electronics, A Div. of Hall-Mark	Omega Engineering Inc.*D
Datatron Corp.	Rentals*D 55	Electronics*D	Techni-Tool Inc.*D 72
Digitech Industries Inc.	Video Midwest & AVC Divs. of Vaughn	Anasco Corp.*D	Tentel Corp. 70
Electro Rent Corp.*D	Communications*D	Arrow Electronics Inc. Catalog Sales	Video Midwest & AVC Divs. of Vaughn
Electro Standards Lab, Inc.		Div.*D	Communications*D
Frederick Engineering, Inc.	FREQUENCY COUNTERS	Ballantine Labs, Inc.	GENERATORS, AUDIO
Genstar Rental Electronics Inc.	Acculex Corp. (A MetraByte Co.)	Beckman Industrial Corp.	Abatron Electronics*D
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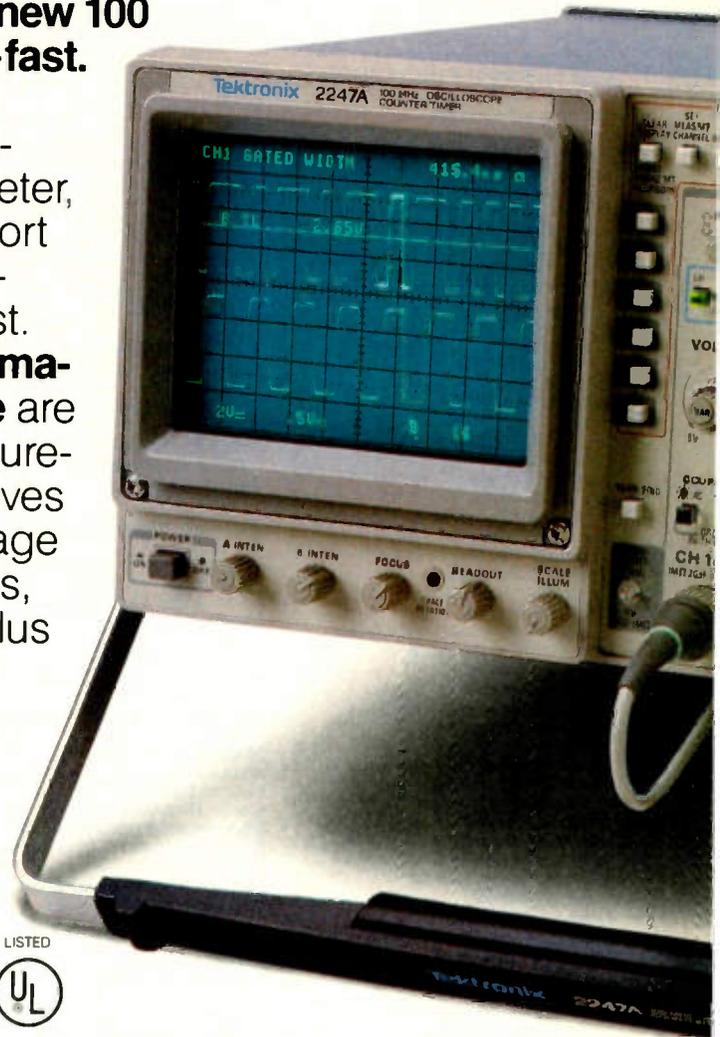
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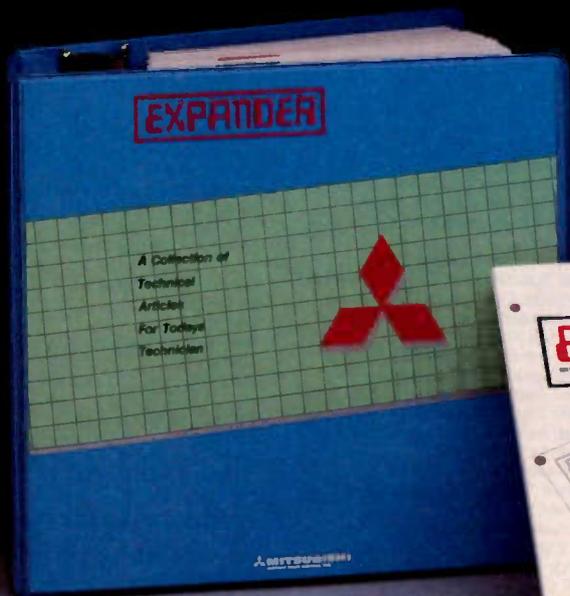
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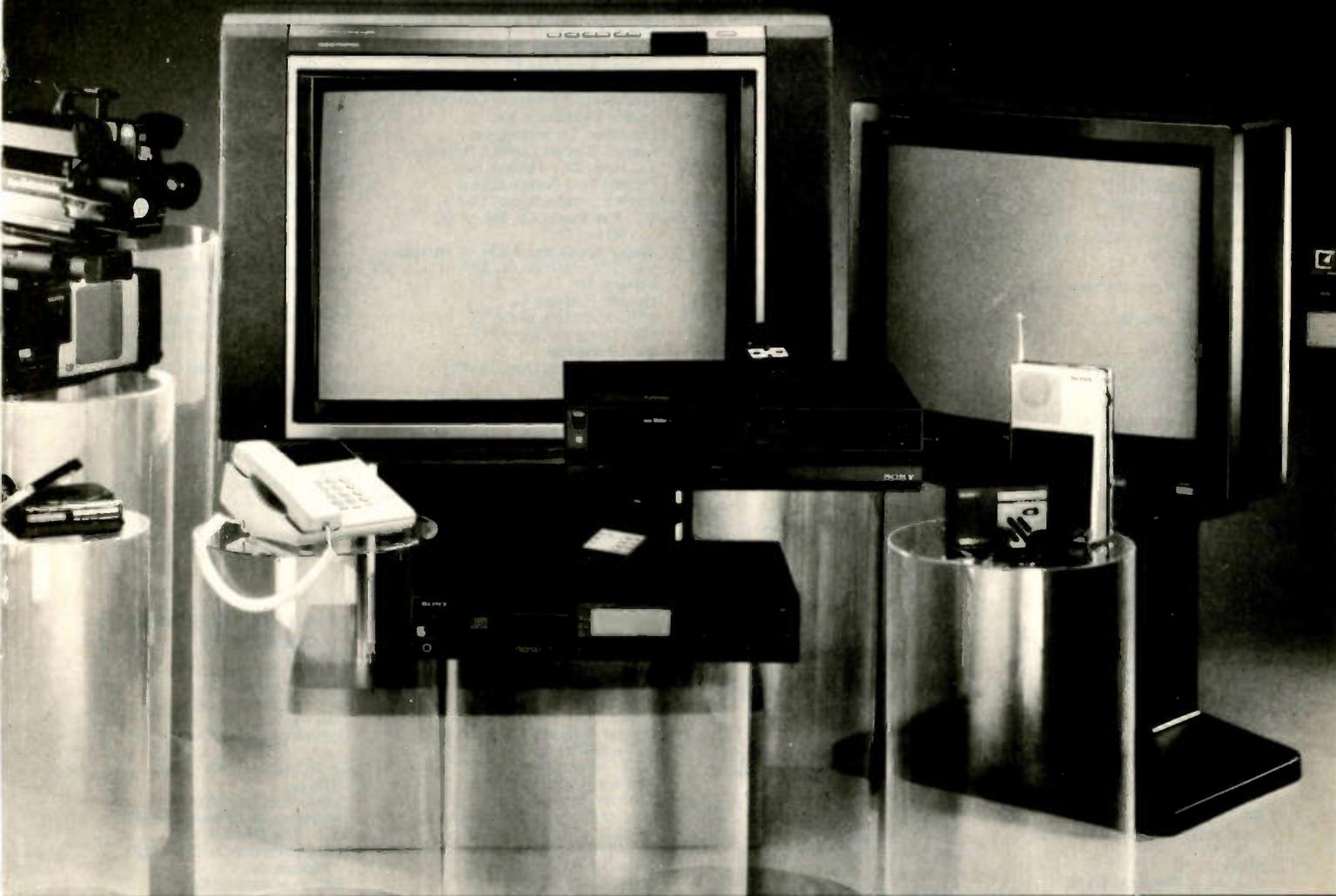
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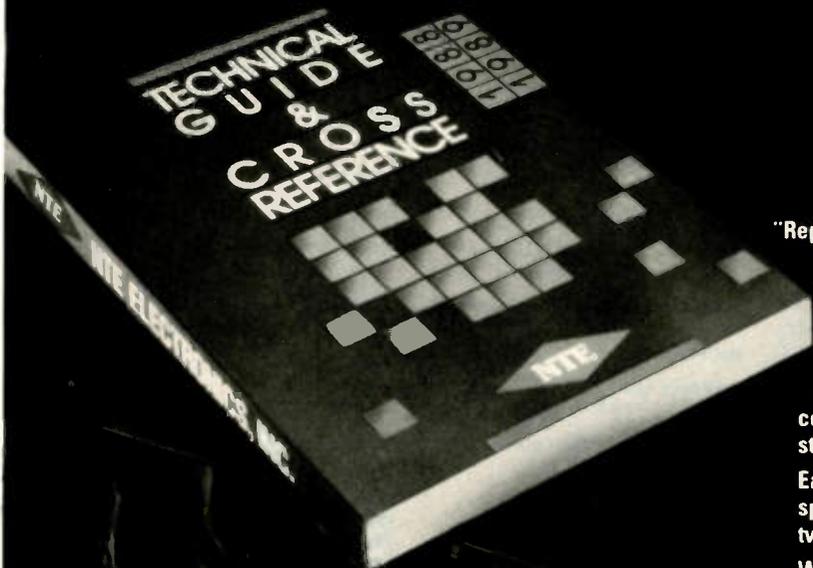
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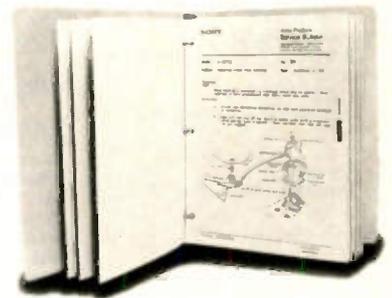
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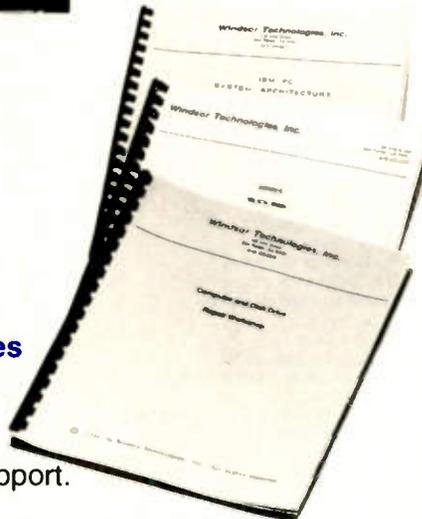


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NAP E34-11 SCHEMATIC DIAGRAM

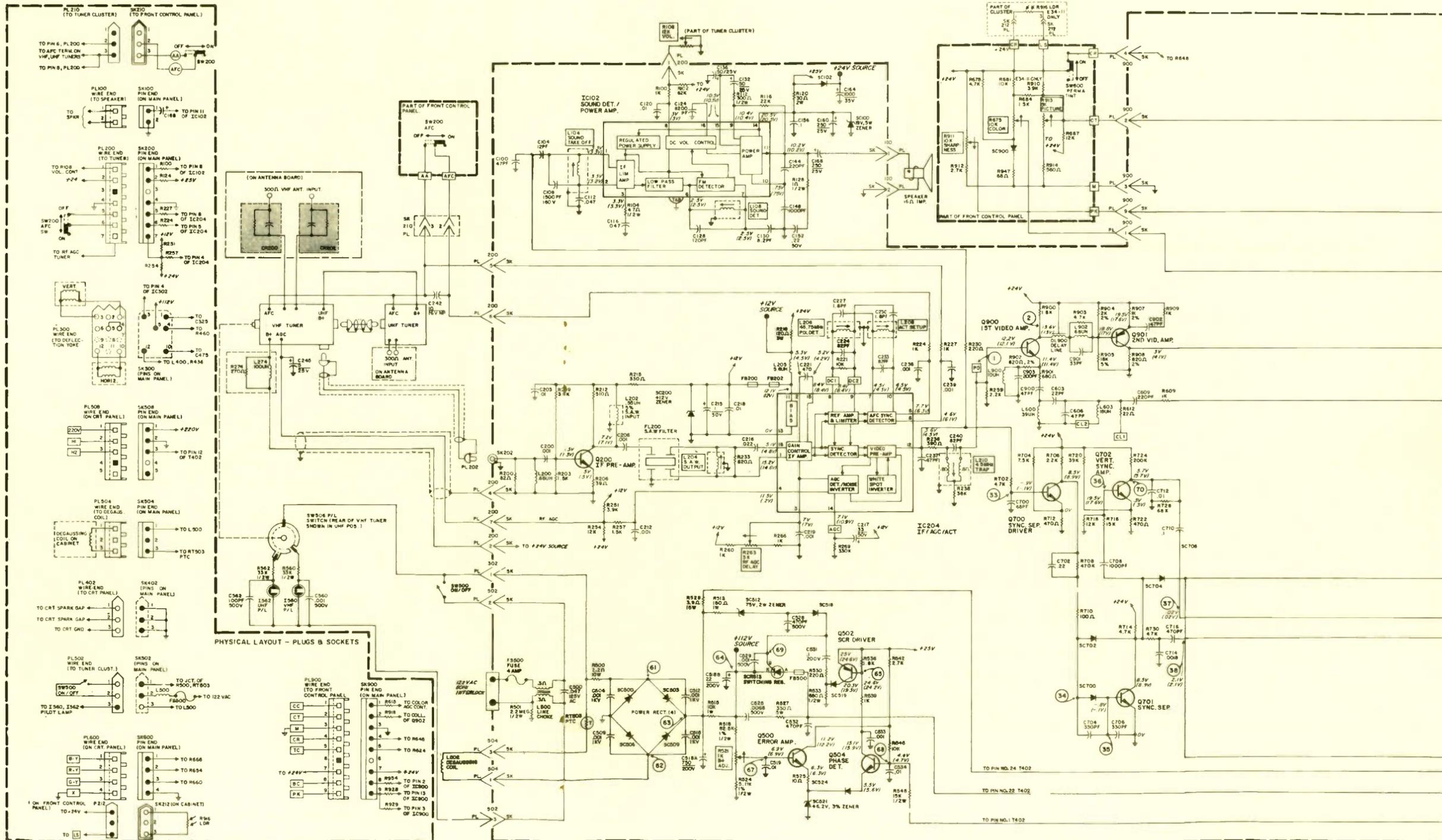
NAP E34-11 SCHEMATIC DIAGRAM

Product safety should be considered when component replacement is made in any area of a receiver. Shaded areas of the schematic diagram designate sites where safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

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

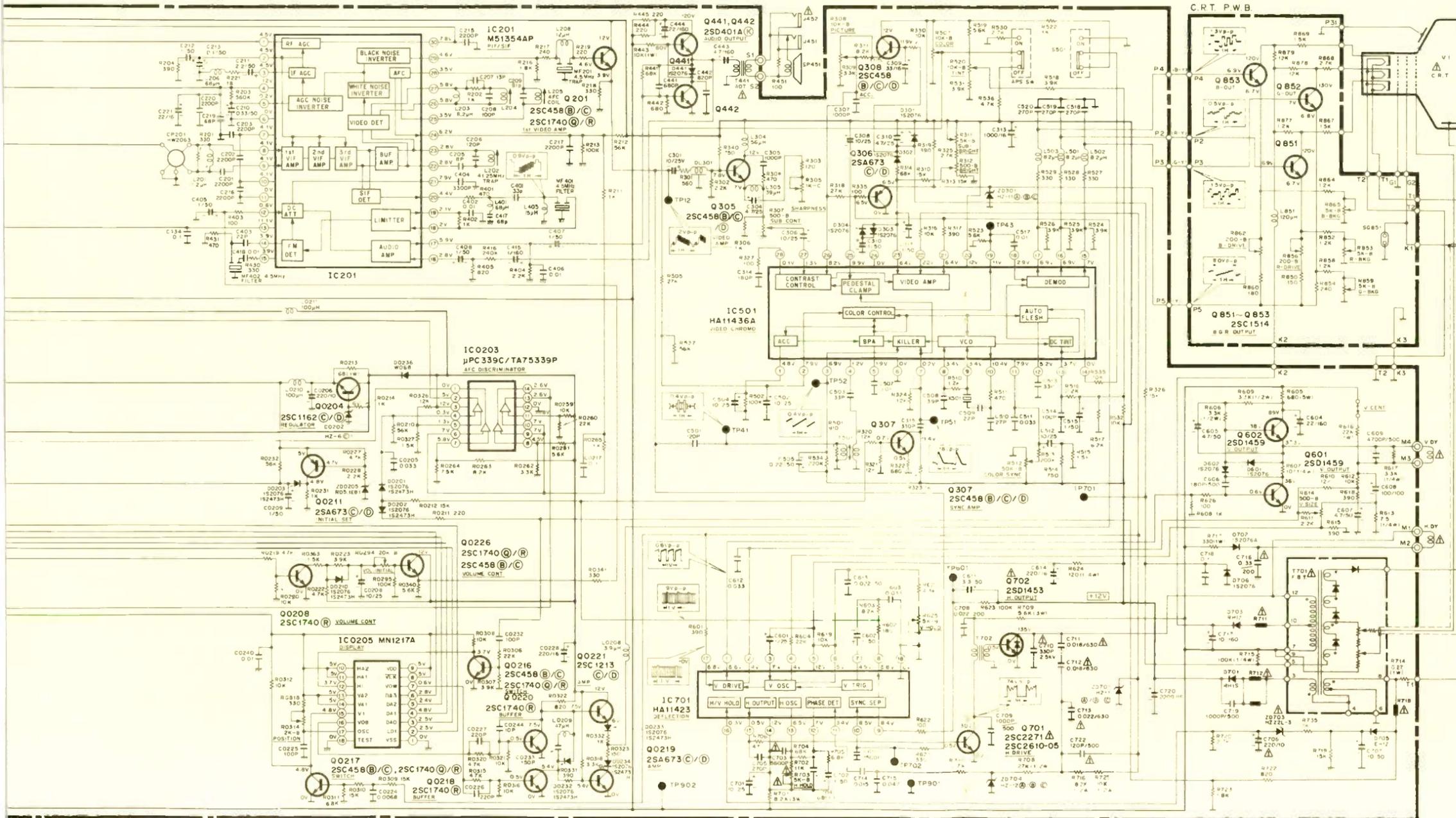
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The other portions of this schematic may be found on other Profax pages.



HITACHI CT1942/CT19A2 BASIC CIRCUIT DIAGRAM

HITACHI CT1942/CT19A2 BASIC CIRCUIT DIAGRAM



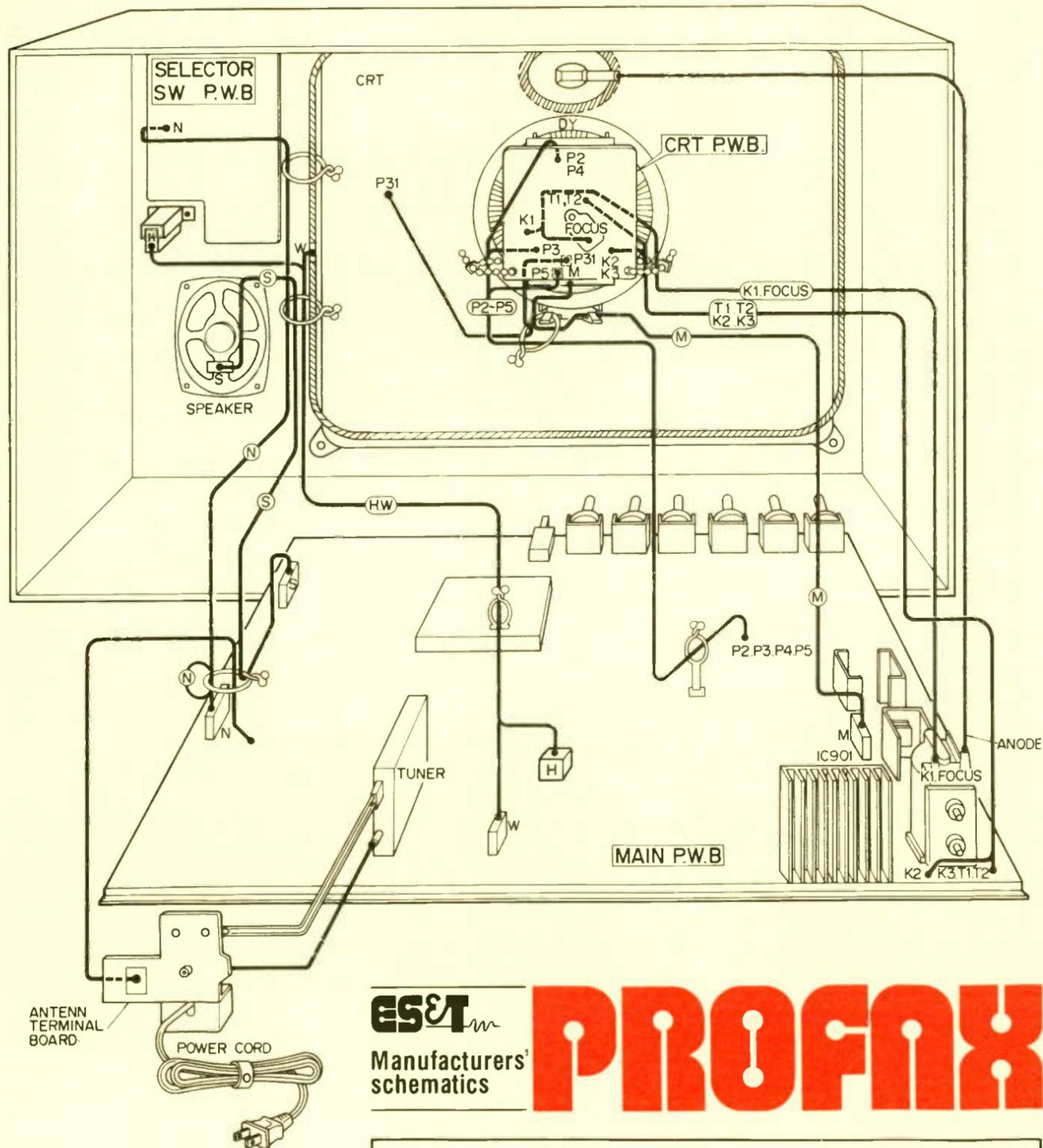
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WIRING DIAGRAM



MARCH 1989
NAP
Chassis E34-11 color TV 3042

HITACHI
CT1941/CT19A2, NP83X chassis color TV 3043

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HITACHI CT1942/CT19A2 BASIC CIRCUIT DIAGRAM

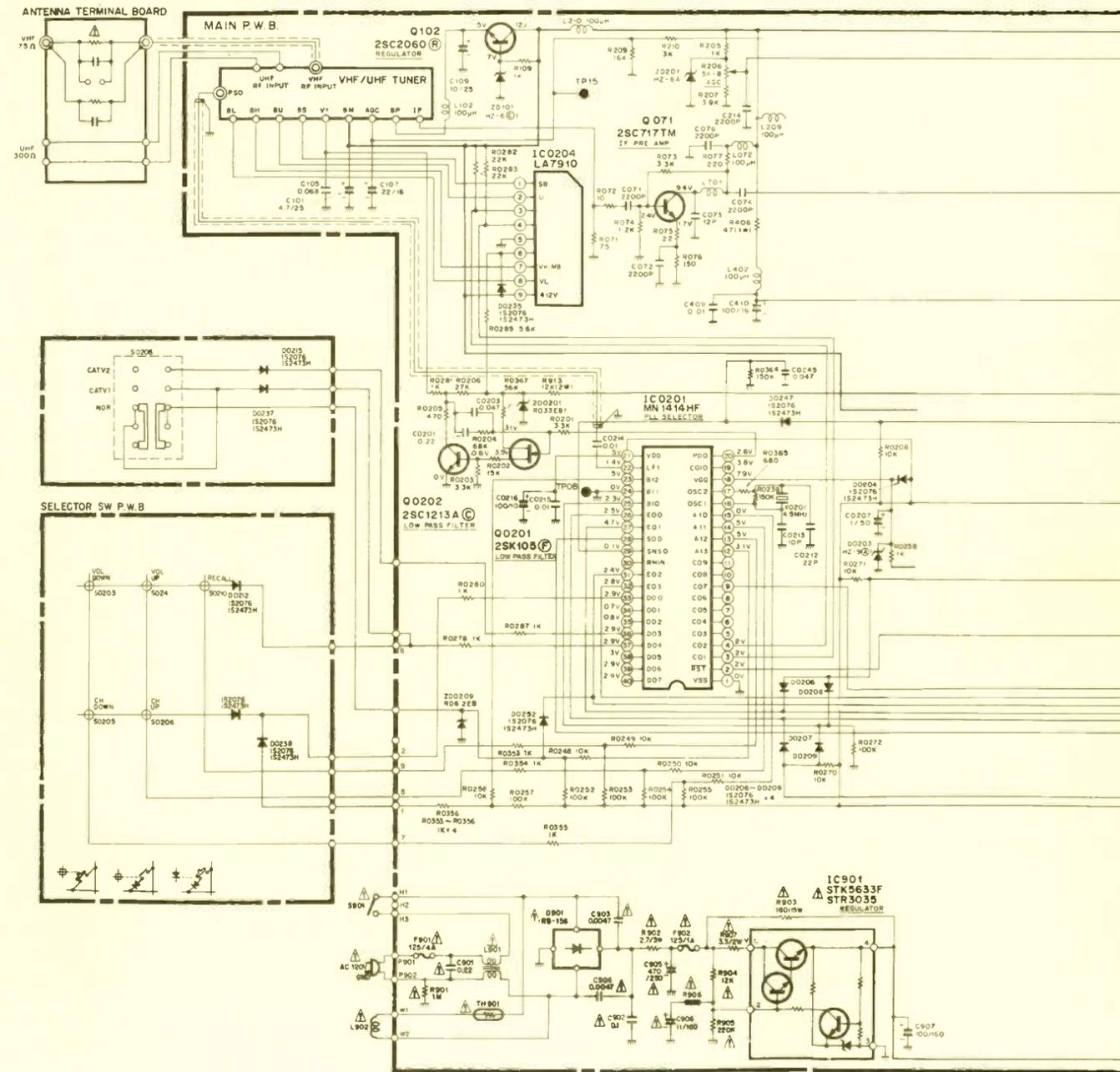
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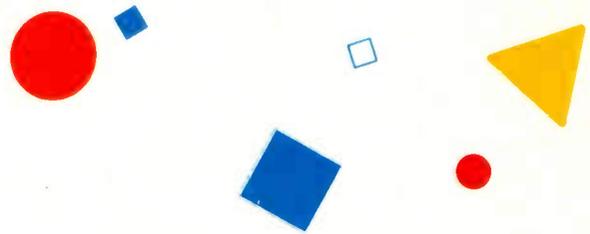
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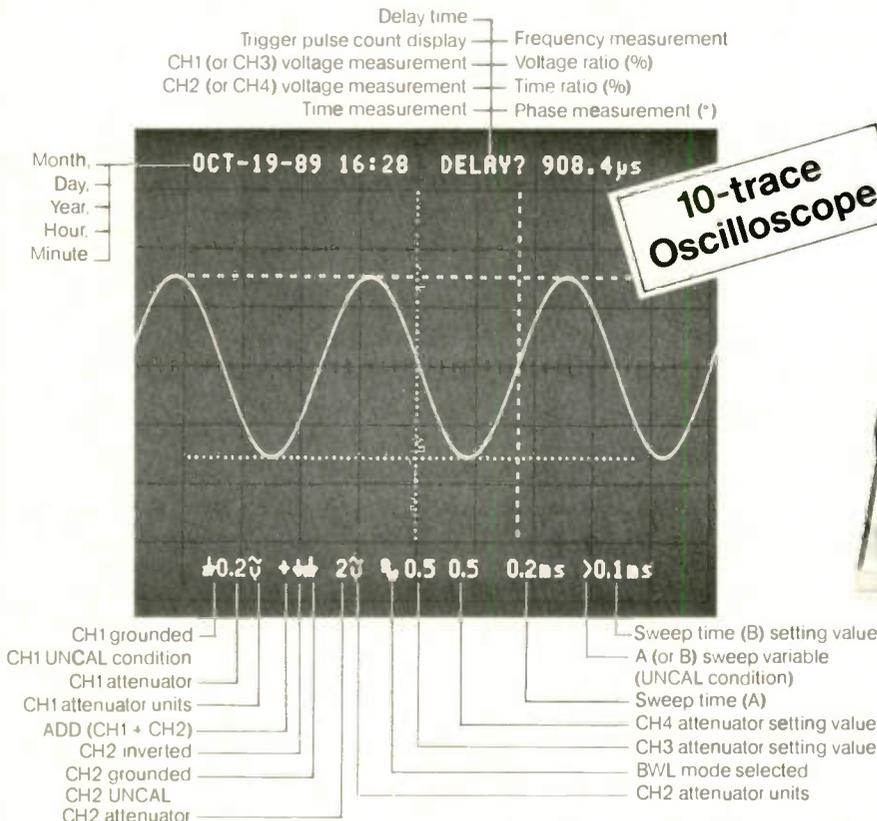
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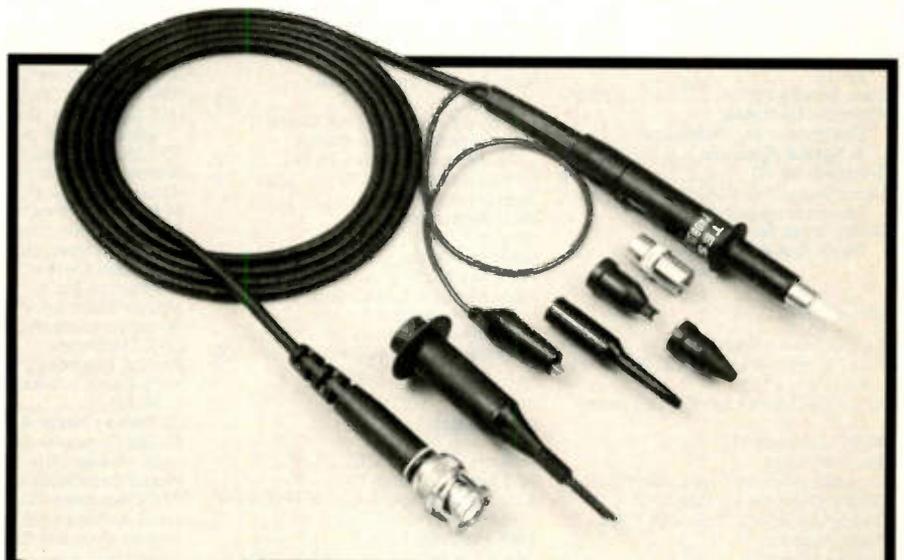
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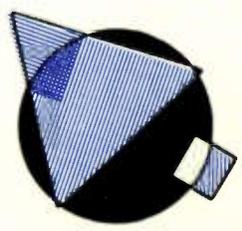
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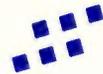
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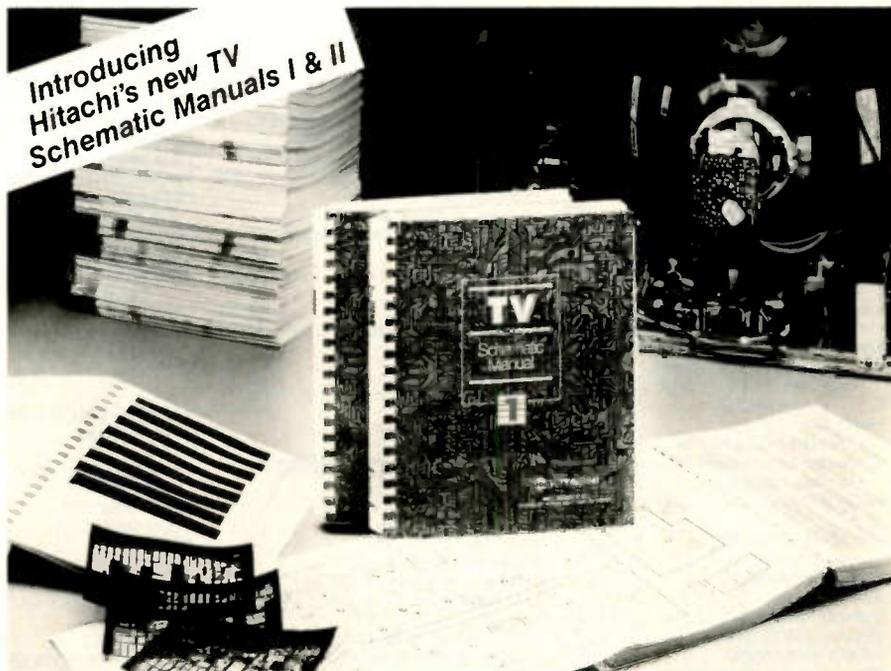
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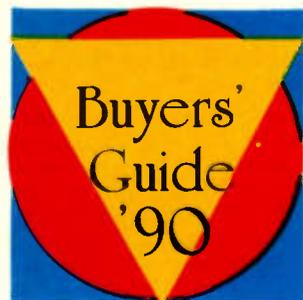
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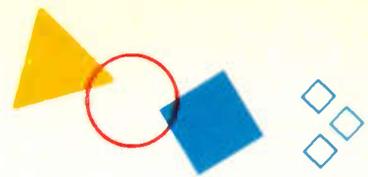


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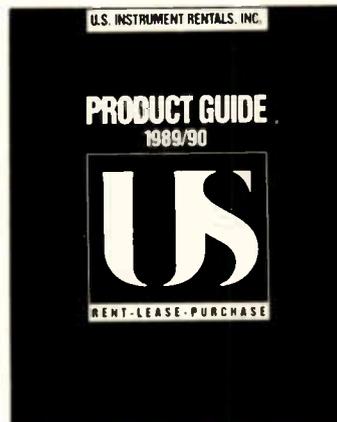
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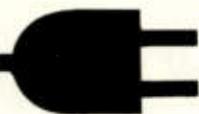
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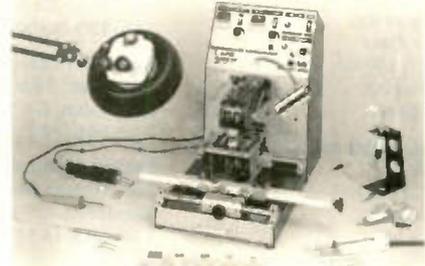
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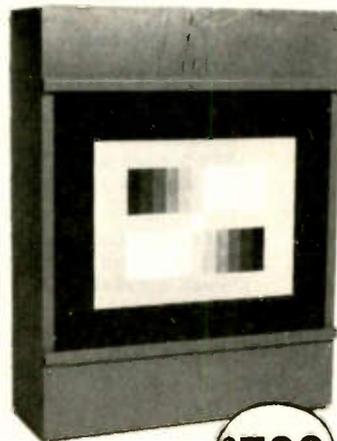
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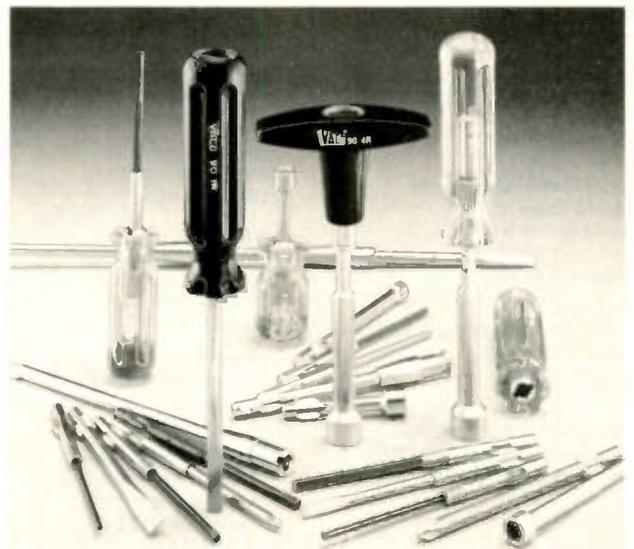


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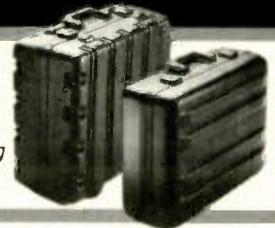


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Circle (30) on Reply Card

The electronics servicer's dictionary

By Conrad Persson

In *Electronic Servicing & Technology*, we regularly use a vocabulary of words that we assume everyone reading the magazine understands. After all, you have to start somewhere when you're publishing articles. However, there are at least two problems with this assumption.

For one thing, among the nearly 50,000 readers of *ES&T*, there is a wide variety of interests, products serviced and length of time the reader has spent in servicing. There are people interested in TV and VCR; others are primarily interested in audio; some are almost completely into servicing personal computers. And we have a variety of levels of expertise, from the technician who's just getting started to the expert who doesn't need this vocabulary.

There's another reason for this vocabulary as well. There are a lot of terms that "everyone knows what that means," but when you analyze the situation, everyone has a somewhat different understanding of the term and no one has ever really defined it. We're going to define some of those terms here, at least for the purposes of this magazine.

"The Illustrated Encyclopedic Dictionary of Electronics" by Prentice-Hall, which we used for one of our references, runs to almost 700 pages (soft cover). Obviously we can't begin to include that kind of vocabulary in a few magazine pages. We don't plan to try. The idea of this vocabulary is to present a few of the terms and concepts that we think are crucial to electronics servicing technicians and need definition.

We plan to include vocabulary words like this from time to time, so if we've left out your favorite electronics term, let us know. Perhaps we can include it next time. If there's some term we've used or that you've seen elsewhere and would like to see defined, let us know and we'll try to include it in a future

issue. And if you have the inside track on some electronics term — you know where and when it was coined and exactly what it means — please let us know so we can tell the world.

This vocabulary and future examples of it is for you. Let us hear what you'd like to see covered and what we can do to make it better.

After you've had a look at this vocabulary, if you have a moment, tell us what you think. If you think it was a waste of space, we'd like to know, but tell us why: wrong terms, definitions not good, too short, you know all of the terms and don't need stuff like this.

On the other hand, if you found it useful, we'd like to know that, along with any suggestions you might have that will help us make it better.

Please notice that, after the word defined, we have included in parentheses the type of servicing the term is usually used in. The abbreviations are *TV* for television, *VCR* for videocassette recorder, *C* for computer, and *all* for electronics in general.

Barkhausen lines (*TV*) Definition from Webster's Third New International Dictionary: "Barkhausen-Kurz oscillation, or Barkhausen oscillation — (After H. Barkhausen and K. Kurz; 20th century German scientists). Ultrahigh-frequency oscillation produced in a triode oscillator by means of a positively biased grid that causes the cathode electrons passing through it to oscillate at a frequency characteristic of the tube and applied voltages."

Damper diode (*TV*) When the horizontal signal is applied to the horizontal windings of the yoke, the yoke is shock-excited into oscillation. The advantage of this oscillation over a half-cycle is that it causes the beam to return quickly to the viewer's left-hand side of the screen after a complete line of the picture has been drawn. The disadvantage is that continued oscillation of the yoke would

show up as vertical bars on the left side of the screen.

To eliminate this continued oscillation (ringing), a diode is connected from the output of the horizontal output transistor to ground so that when the magnetic flux around the yoke windings collapses, inducing a voltage in the windings, the diode shorts this voltage to ground, damping any continued oscillation — hence the term *damper diode*.

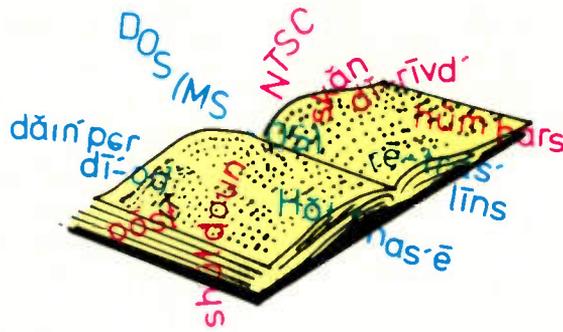
Database (*C*) A collection of information, most often used to describe information stored in a computer's mass storage devices. A database might consist of, say, a list of all of the customers of a particular electronics servicing facility including name, address, telephone number, sets owned, repair history, etc. In the most general sense, the local library is a database.

DOS (or MS-DOS) (*C*) This is the computer program that is used by IBM small computers to perform their functions. DOS is the abbreviation for *disk operating system*, and the MS is simply the abbreviation for the name of the software company (Microsoft) that devised the DOS program. DOS performs such basic functions as instructing the computer to respond to commands from the keyboard and telling it how to read from and write to the disk. It also contains other instructions such as how to copy from one disk to another or compare two disks.

A general understanding of the DOS commands is essential to technicians who want to service IBM personal computers and IBM-compatible computers.

Diagnostics (*C*) Much of the work of diagnosing a computer malfunction can be done by a computer program designed for that purpose. For example, let's say that a malfunction is caused by failure of some portion of a memory IC. One function of the diagnostic program is to write a predetermined data pattern

Persson is editor of *ES&T*.



to each memory location and then read the data back out. If the data pattern read out differs from the data pattern originally written, there is a problem in that IC or in the attendant circuitry.

Downstream/upstream (all) These are terms that some servicing technicians use to describe the location of portions of the circuit in relation to the point currently being considered, using the analogy of a river or stream. The source of the signal (upstream) is the antenna or other point at which the signal is introduced. The signal proceeds downstream until it reaches the end of its travel: the picture tube, the speakers, etc.

ESD (all) Electrostatic discharge is the spark that snaps from your finger when you walk across a rug in winter, then touch a grounded light switch or water pipe. Electrostatic discharges, which are generated by the ordinary motions of servicing a consumer-electronic product, crumpling up an empty cigarette pack or tossing away a foam coffee cup, can be so small that you can't even feel them, yet they can destroy a static-sensitive IC. Servicing technicians should *always* use a grounding wrist strap and take other precautions when working on today's consumer-electronic products.

Firing lines (TV) This term describes lines that are caused by amplitude-modulated noise (arcing, for example), such as noise caused by firing automobile spark plugs that are not properly suppressed.

Horizontal driver (TV) The horizontal oscillator, kept in step by the horizontal sync pulses of the NTSC signal, provides the signal that ultimately feeds current to the horizontal windings on the picture-tube yoke. This current (from the horizontal output transistor) generates the magnetic field that deter-

mines the horizontal position of the electron beam.

In some TVs, especially small sets, the oscillator output is fed directly to the horizontal output transistor. In most sets, though, there are one to three stages of amplification between the oscillator and the output transistor. Where these circuits are used, they serve two purposes: to ensure that the output stage is supplied with enough drive — voltage or power — to generate enough current, and to isolate the oscillator from the output device so that it isn't loaded down.

Horizontal-output transformer (TV) This transformer, which is also called a flyback, is fed with the voltage that is generated by the collapsing magnetic field in the yoke windings. It then steps the voltage up to the level required at the picture tube. In modern TV sets, other windings have been added to this transformer to provide some of the low-voltage dc power-supply power (see **scan derived**).

Horizontal-output transistor (TV) This is the device that generates the heavy current used by the horizontal windings of the yoke to create the magnetic field, which determines the horizontal position of the electron beam and consequently the position of the spot of light on the face of the picture tube. The horizontal-output transistor produces a sizable amount of current — in the range of 4A. Because this device carries such a heavy current, it is a frequent cause of failure.

Hot chassis (TV) Most modern TV sets use a rectifier consisting of four diodes connected in a bridge configuration, and do not use a line transformer in the power supply. Because of this configuration, at least a portion of the TV is at some voltage with reference to ground, and a technician touching the chassis and ground at the same time will receive

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a shock. This configuration is used because, without the transformer, the TV weighs less and the set's power efficiency is increased.

In addition, because of the orientation of the rectifier diodes with respect to ground, if a technician connects the ground probe of a piece of grounded test equipment to the hot chassis in order to make measurements, one diode of the bridge will become a direct short on one half-cycle of the ac waveform. The result will be a blown diode in the set's power supply at the least, and possibly damage to the test equipment as well.

The only safe way to connect test equipment to a set with a hot chassis is to connect the set to the line through an isolation transformer.

Hum bars (TV) Wide, dark, horizontal stripes appearing on the face of the picture tube, usually indicating poor filtering in the boost supply.

Isolation transformer (all) A transformer with a one-to-one turns ratio (ac output voltage will be the same as the input voltage), and with no common connection between the input windings and the output windings. When working on a TV set with a hot chassis, it is imperative for the safety of the technician, the TV and the test equipment to power the set through an isolation transformer.

NTSC (TV) When color television became a reality, existing B&Ws had to be able to receive color broadcasts in black and white. The complex TV waveform that made this compatibility possible was devised by a committee of broadcasters and electronics manufacturers: the National Television System Committee (NTSC). The waveform bears the name of this committee.

POST (C) Power-on self test. Every time an IBM personal computer or compatible is switched on, this computer program, stored in permanent memory, checks the function of every part of the computer to make sure it's working correctly.

If there's a malfunction, depending on the location and severity of the malfunction, an error message may appear on the screen or the monitor screen may remain blank, giving the appearance of a totally dead computer.

Retrace lines (TV) When the electron

beam is pulled back to the top of the screen to begin tracing out the next field of the picture, the signal voltage is at a level that is designed to turn off the electron beam and therefore blank the screen. Theoretically, then, the screen should be dark during the vertical retrace interval. In the case when the received signal is weak or the brightness is turned up high, the retrace action may be seen as a series of bright, widely spaced lines sloping diagonally upward to the right. Modern televisions have retrace blanking circuits to overcome this problem. Some malfunctions in TV sets will allow these lines to be seen.

Scan derived (TV) See explanation under **start-up**.

Scan rectification (TV) See explanation under **start-up**.

Shut-down (TV) Excessive high voltages can result from surges on the power line in modern TVs that use scan-derived dc power and don't have ac line transformers. Regulators gone awry can also cause excessive high voltages and X-ray emission. These and other problems in modern TVs can cause damage to components and can even pose fire hazards.

To minimize hazards to the set itself and to people and property, TV manufacturers now include circuits specifically designed to shut down operation in the event that a voltage or current exceeds a safe limit.

The shut-down circuit consists of some kind of sensor to detect the excessive voltage or current and some kind of circuit to cause the shut-down. The most common method of shutting down the circuits is to block the drive to the horizontal output circuits.

Start-up (TV) There are some problems with having highly educated engineers sitting around thinking up new ways of making consumer-electronics products work better and more efficiently. One problem is that their fertile minds frequently come up with solutions that work well but increase the complexity of the product and thus make troubleshooting more difficult. Start-up circuits are one example.

Back in the old days, when all of the low-voltage dc for a TV set was generated in the 60Hz-based power supply, sets worked just fine. However, there were inefficiencies: energy was

lost in the transformer and other components, a lot of filtering was required to eliminate the 60Hz ripple, and there was a need for filter chokes.

One day, some bright engineer looked at a schematic diagram and said to

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Alvin A. Liff
Prentice-Hall
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Walter H. Buchsbaum, Sc.D. (Revised by John P. Steiner)
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Television Servicing with Basic Electronics (soft cover)
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himself "Eureka! If I put a couple of extra secondary windings on the horizontal-output transformer to take a part of that output and rectify it, I can use that dc to power some of the TV's circuits, and because the ripple frequency is several kilohertz, I don't need

much filtering." So he did. And now most modern sets use this method of **scan rectification** to provide scan-derived dc for some or all of the power sources.

The only problem with this is that, among other things, the horizontal oscillator uses scan-derived dc power: until the horizontal-output circuit is operating, there's no scan-derived dc to power the horizontal oscillator; until there's scan-derived dc, there's no dc power to the horizontal oscillator and hence no signal to cause the horizontal-output circuits to operate. The thing needs a push.

The startup circuit provides the push that's needed. For example, in the circuit shown, the trickle starter provides a small amount of unregulated voltage as input to the horizontal oscillator. This voltage allows it to operate long enough to start the horizontal circuits, which can then provide the scan-derived dc voltage needed to keep the horizontal oscillator operating.

Vertical driver (TV) The vertical oscillator, kept in step by the vertical sync pulses of the NTSC signal, provides the signal that ultimately feeds current to the vertical windings on the picture tube yoke. It is this current (from the vertical output transistor) that generates the magnetic field which determines the vertical position of the electron beam.

In some TVs, especially small sets, the oscillator output is fed directly to the vertical output transistor. In most sets, though, there are one to three stages of amplification between the oscillator and the output transistor. Where these circuits are used, they serve two purposes: They make sure the output stage is supplied with enough drive — voltage or power — to generate enough current, and they isolate the oscillator from the output device so that it isn't loaded down.

Vertical output transistor (TV) This device generates the heavy current used by the vertical windings of the yoke to create the magnetic field that determines the vertical position of the electron beam and, consequently, the position of the spot of light on the face of the picture tube. The vertical output transistor produces a sizable amount of current — in the range of half an amp. This device carries a heavy current, so it is a frequent cause of failures. **ES&T**

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Computer Corner

Troubleshooting dot-matrix printer problems

By Conrad Persson

Dot-matrix printers are inexpensive, fast, reliable hard-copy output devices for personal computers. A good dot-matrix printer will print at speeds faster than 100 characters per minute in draft mode, can give good quality type that's adequate for all but the most important correspondence in near-letter-quality mode, and can even print graphics.

Not only do they perform fast and with good quality, they are highly reliable. Dot-matrix printers have relatively few moving parts: the platen; the sprockets, which turn to feed the paper; the system that winds the ribbon from one spool to the other; and the print head, which travels across the page and contains nine or more print wires that make the ink impressions on the page by striking the ribbon.

In addition to the electromechanical parts, there are also the electronics that collect and hold a number of characters from the computer until they can be printed (the buffer). Circuits translate the digital computer information into

alphabetic, numeric, or special characters through a sequence of strikes of the print wires as the print head moves across the paper. Other circuits translate computer signals into mechanical movement of the print head and the sprockets/platen.

There really isn't much to go wrong, but occasionally one of these units will need servicing, and they should be cleaned once in a while. Some dot-matrix printers may also need to be lubricated once in a while, but don't indiscriminately put grease and oil here and there. Lubricants put where the designer didn't intend for it to go can gum things up. Follow the manufacturer's instructions for lubing printers.

Taking care of routine problems

The print head in a dot-matrix printer can be expected to last a long time. According to the users manual that comes with the Star Micronics NX-10 printer, for example, the head in that unit will print perhaps 100,000,000 characters before you have to replace it.

Assuming that the print head operates, but print density isn't as dark as it should be, how do you determine if the head needs to be replaced? When you have replaced the ribbon and the letters on the page are still faint, it may be time to replace the print head. Hold on, though. Before you buy a new print head and put it on, check one more thing. On the Star NX-10 and on other printers, there's an adjustment for the print head to compensate for paper thickness. (See Figure 1.) If this adjustment was set up for heavy paper and the operator is using thinner paper, the result might be light printing. Check this adjustment before you install a new print head.

Replacing a print head is usually pretty simple. In some dot-matrix printers you just have to remove a couple of

Persson is editor of ES&T.

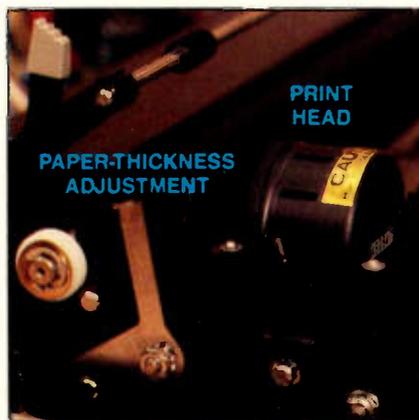


Figure 1. If the printer is printing light even after you have changed the ribbon, check the setting of the paper-thickness adjustment lever (to the left) before replacing the print head (to the right). This printer is the Star SG-10, similar in construction to the NX-10.

screws, unplug the ribbon cable connector and lift the print head away, then install the replacement in the reverse order.

Interlocks

If you're not familiar with a particular printer, you might find the interlocks a little frustrating. Some printers are constructed so that if you remove the cover, it won't operate. Also, most if not all dot-matrix printers have a paper-out detector that will stop printing if the printer runs out of paper. This saves the print head and the platen from being damaged by printing without paper. Of course, Murphy's law being what it is, it's entirely possible that one of these detectors might fail, leaving the printer inoperative. If you're faced with a dot-matrix printer that won't operate, it might be a good first step to check the interlocks for proper operation before performing any major surgery.

Self-test feature

Computers and peripherals tend to be complex and sometimes difficult to diagnose. On the other hand, sometimes they're wonderfully helpful. Let's say you have a problem in printing and you don't know if it's in the computer or in the printer. You could get involved in checking the computer, then the printer or vice versa, then checking the interconnections. Some and possibly all dot-matrix printers offer a self-test feature. Using this feature involves holding down one of the operating buttons while you turn on the printer.

For example, in the case of the Star NX-10, there are two self tests: a long test and a short one. If the printer is either not printing or not printing some characters properly, you can check the printer to see if it's the source of the problem with a simple procedure. Turn the printer off, then, while you hold down the PAPER FEED key, turn the printer on. The printer will begin printing every character it can print in four different print styles. The printer will continue printing until you turn it off.

If you only want to test the printer to see if it will print letters (both upper and lower case), numbers and a few other characters, simply hold down the ON LINE key while you turn the printer on. Unlike the long self-test, this test will stop after the printer prints six lines.

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Troubleshooting VCR front loading systems—Part III

This series of Video Corner describes procedures for servicing the front loading system on a specific brand and specific models of VCRs. However, the methods discussed, the operation of the device and the precautions mentioned should have applications to almost any brand or model of VCR. Last month's installment described the actions that take place when a cassette is loading. This month, we'll discuss mode-switch replacement.

One of the more difficult repairs in the loading mechanism is the replacement of the mode switch assembly. Therefore, before you attempt to replace the switch assembly, make sure it is actually at fault.

The mode switch has five terminals. Four are status lines and are directed to the mechanical control circuitry, and the remaining terminal is connected to the STBY 9V supply. Depending on the

position of the mode switch at a particular instant, STBY 9V is directed to the appropriate output line, which enables the microprocessor (IC 5A0) to determine the status of the loading mechanism by the digital data on the four status lines.

Needless to say, a defective or misadjusted mode switch will result in improper cassette and tape loading or unloading. Symptoms that occur when

an individual pin is open on the mode switch (the most common occurrence) are listed in Table 1.

Once you have determined that the mode switch is defective, a new switch must be installed. The installation and adjustment of the switch is critical, and a small error results in malfunction of the VCR, so the mode switch should be replaced as described in the following procedure.

Table 1	
Open-pin symptoms	
open pin	symptom
pin 1 (brown)	The capstan motor does not start and the VCR will not accept a cassette.
pin 2 (red)	The capstan motor does not start and the VCR will not accept a cassette.
pin 4 (yellow)	The capstan motor does not start and the VCR will not accept a cassette.
pin 3 (orange)	Accepts the cassette but the loading motor continually oscillates forward and reverse.
pin 5 (green)	Accepts the cassette but when play or record is activated, the tape is continually loaded and unloaded.

This information was adapted with permission from the article "VCR Front Loading Troubleshooting," which appeared in Volume I of The Best of the Expander, published by Mitsubishi.

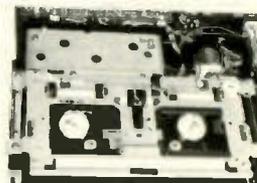
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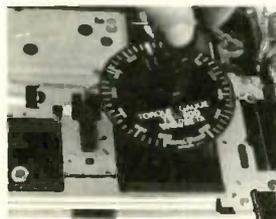
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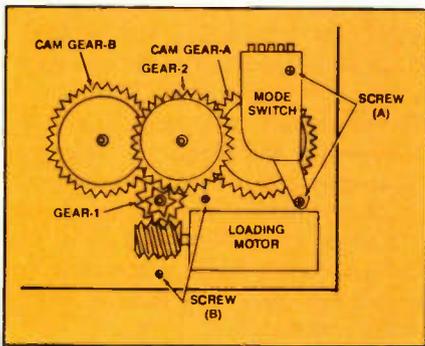


Figure 1. To remove the mode switch assembly, first disconnect the DS and DQ plugs from the assembly. Then remove the two mounting screws (A), and the mode switch.

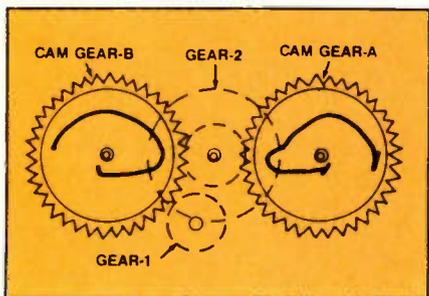


Figure 2. To set the loading mechanism to the eject position, you need to remove the two loading motor mounting screws (B in Figure 1), then move the loading motor away from gear 1. Manually rotate gear 2 counterclockwise until a stop is reached. Finally, reposition the loading motor and install mounting screws (B). This figure illustrates the position of the cam gears in the eject position.

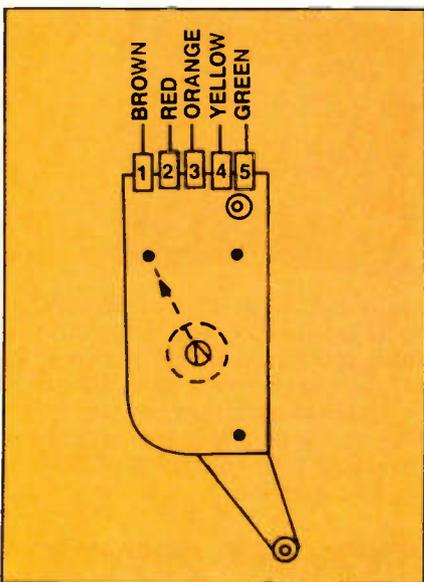


Figure 3. One of the first steps in installing the mode switch assembly is to manually rotate the gear on the mode switch until the pointer on the bottom of the gear shaft points to the black plastic guide.

Preliminaries:

1. Disconnect the VCR from the ac wall outlet.
2. Remove the bottom cover.
3. Turn the VCR upside down on a padded surface.

Removing the assembly:

1. Disconnect the DS and DQ plugs from the mode switch assembly.
2. Referring to Figure 1, remove the two mounting screws (A).
3. Remove the mode switch from the VCR.

Setting the loading mechanism to the eject position:

1. Referring to Figure 1: Remove the two loading motor mounting screws (B).
2. Move the loading motor away from gear 1.
3. Referring to Figure 2: Manually rotate gear 2 counterclockwise (from the bottom of the VCR) until a stop is reached.
4. Reposition the loading motor and install mounting screws (B). Figure 2 illustrates the position of the cam gears in the eject position.

Installation

1. Manually rotate the gear on the mode switch until the pointer on the bottom of the gear shaft points to the black plastic guide, as illustrated in Figure 3.
2. Use an ohmmeter on the R X 1000 scale (if you use a lower scale than R X 1000, you might cause damage to the contacts on the mode switch) and confirm that an open condition exists between pin 4 and pin 3 (yellow and orange wires) of the mode switch.
3. Mount the mode switch on the VCR with the two mounting screws (A), as shown in Figure 1.
4. Perform the following continuity checks before applying power to the VCR:
 - pin 4 to pin 3 (yellow to orange wires): OPEN.
 - pin 4 to pin 1 (yellow to brown wires): SHORT. If this check shows an OPEN condition, rotate the mode switch gear one tooth counterclockwise.
 - pin 4 to pin 5 (yellow to green wires): SHORT. If this check shows an OPEN condition, the mode switch must be rotated one tooth clockwise.
5. Connect the DQ and DS plugs from the mode switch assembly.

Continued

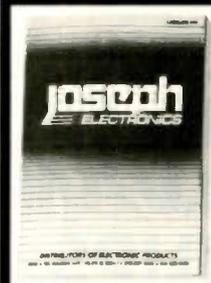
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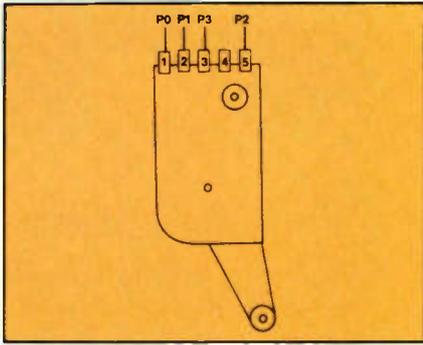


Figure 4. The mode switch on the HS-430UR is a 6-position rotary switch that informs the mechanical control microprocessor as to the current status of the tape-transport mechanism.

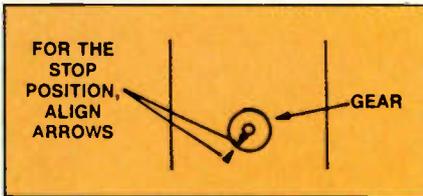


Figure 5. To set the mode switch to the STOP position, turn the switch over and align the arrow on the gear to the arrow on the body of the mode switch.

The mode switch on the HS-430UR is a 6-position rotary switch that informs the mechanical control microprocessor as to the current status of the tape-transport mechanism. Its operation is similar to that of the HS400UR, but there is no eject-mode switch position. The mode switch remains in the STOP position independent of whether there is a cassette in the VCR.

Figure 4 illustrates the physical appearance of the mode switch, along with the designations for each of its terminals.

On occasion, it may be necessary to remove the mode switch to replace a defective gear or to replace the mode switch itself.

The correct logic from the mode switch in the STOP position is high at each output terminal. To set the mode switch to the STOP position, turn the switch over and align the arrow on the gear to the arrow on the body of the mode switch, as shown in Figure 5. Next, carefully secure the mode switch into position. Check the continuity from

pin 4 of the mode switch to each of the output pins (pins 1, 2, 3 and 5). Continuity should exist from pin 4 to each of the output pins in the STOP position. If continuity does not exist, remove the mode switch and reposition the mode switch gear until continuity is present on all output pins. Once again, make sure to use the R X 1000 scale of the ohmmeter when checking continuity to be sure you don't cause damage to the switch contacts.

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Audio Corner

Servicing the compact disc player—Part VI

By Martin Clifford

This is the sixth part in a series on servicing compact disc players, based on *The Complete Compact Disc Player* by Martin Clifford (published by Prentice-Hall). This part is a continuation of last month's discussion on how flowcharts can streamline diagnosis.

As we said last month, a flowchart is only valuable if it is thoroughly thought out and contains a detailed

Clifford, a freelance writer, has published more than 75 books on electronics.

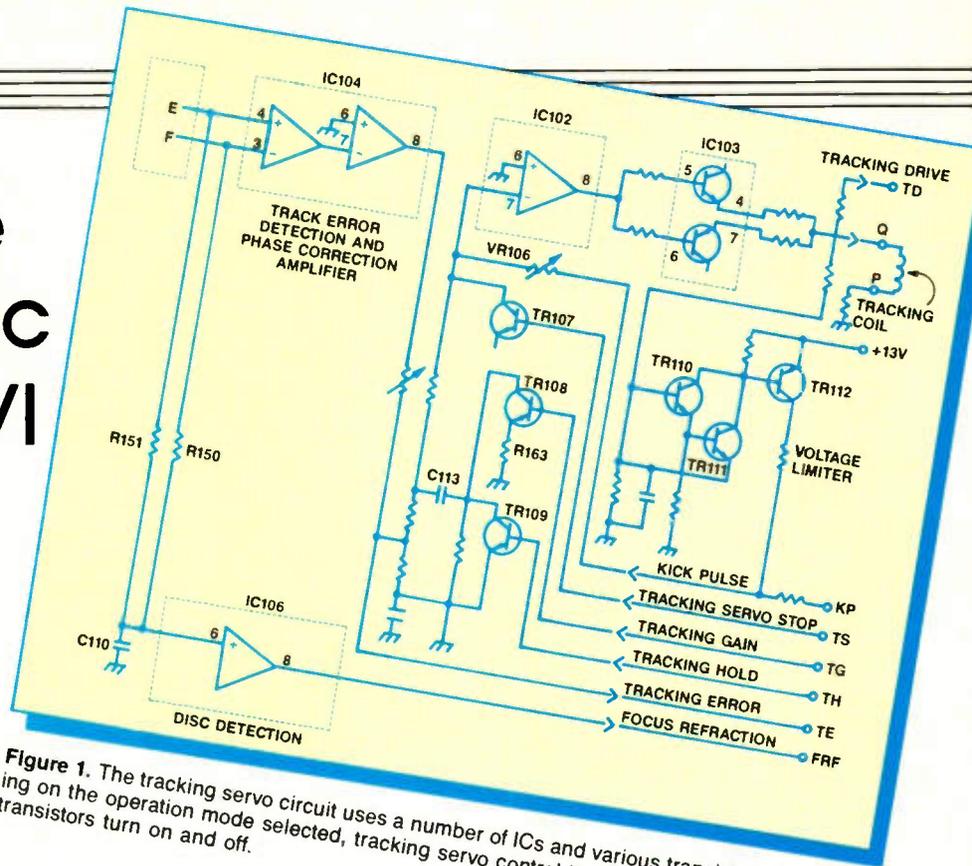


Figure 1. The tracking servo circuit uses a number of ICs and various transistors. Depending on the operation mode selected, tracking servo control is achieved by making certain transistors turn on and off.

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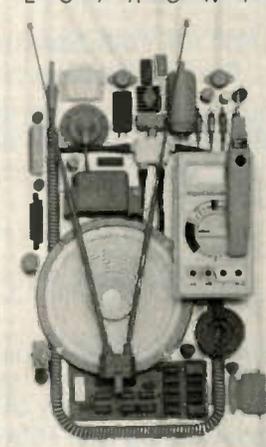
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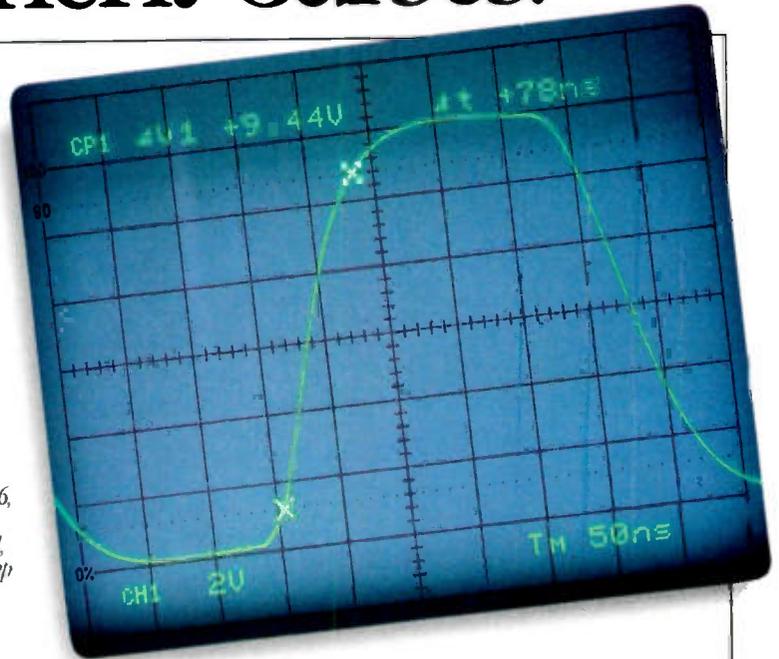
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