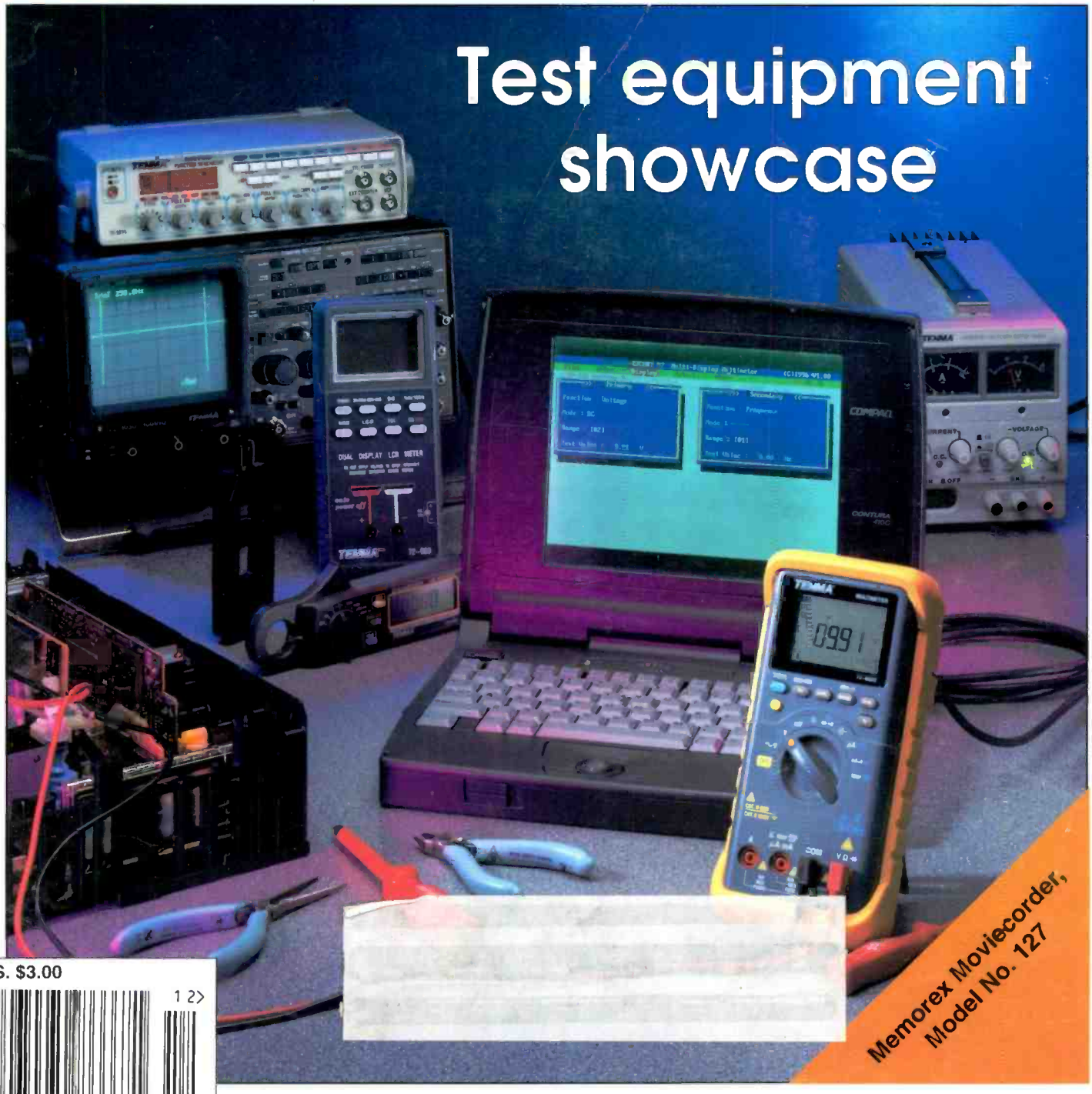
THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC Servicing & Technology

December 1996

Replacement parts/servicing sourcebook

Audio signal injection tests



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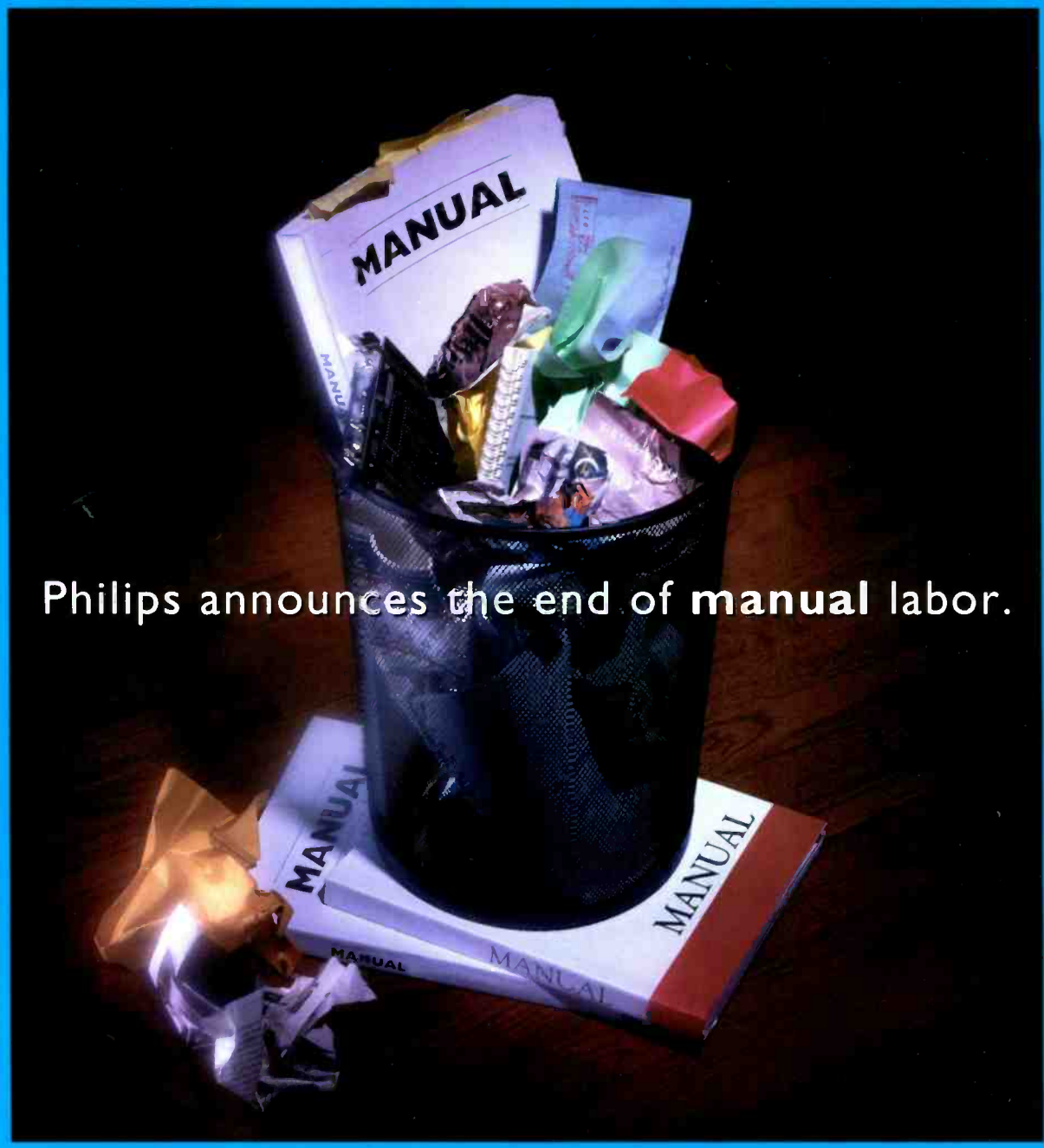

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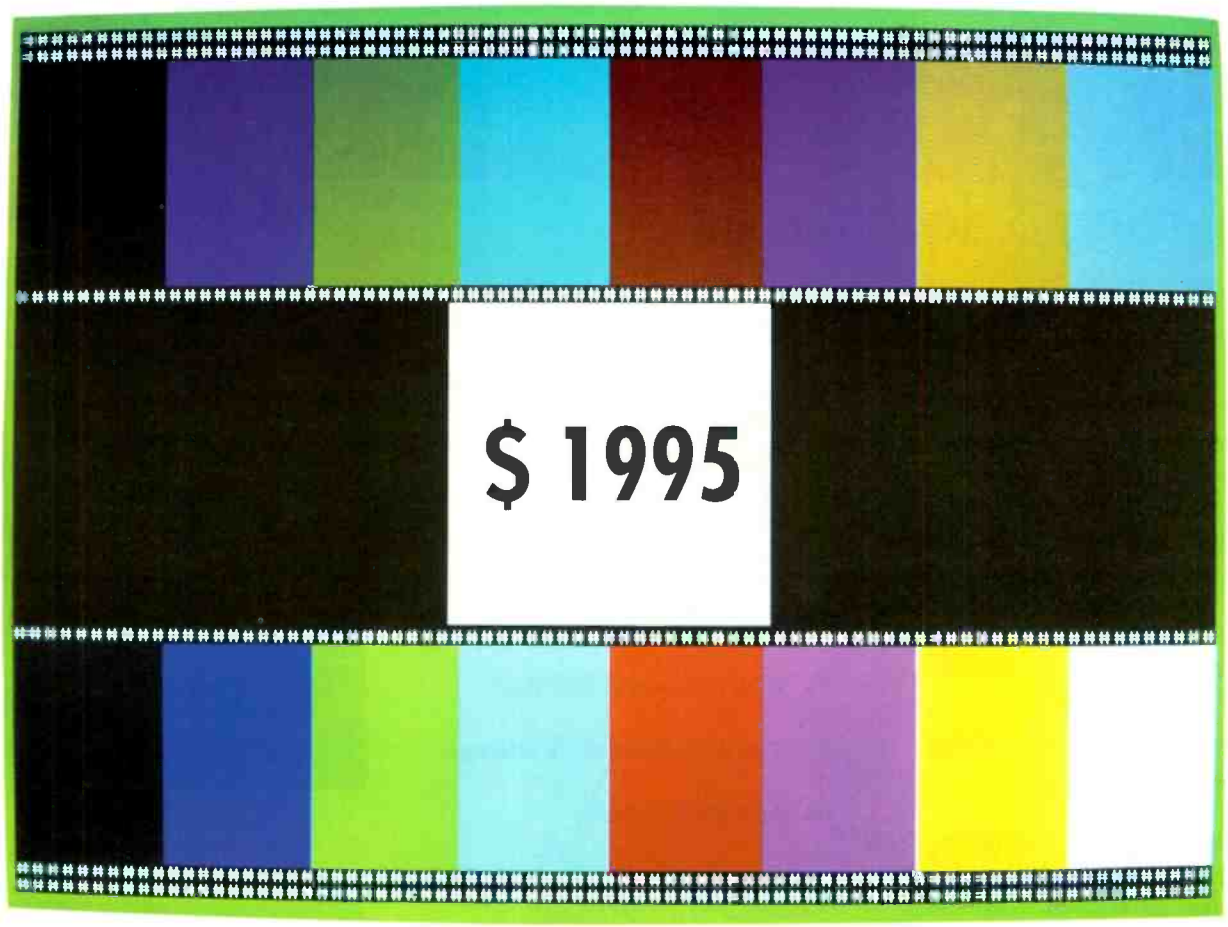

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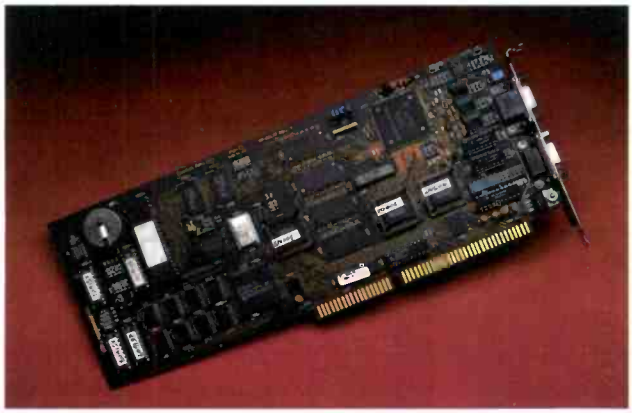

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ELECTRONIC Servicing & Technology

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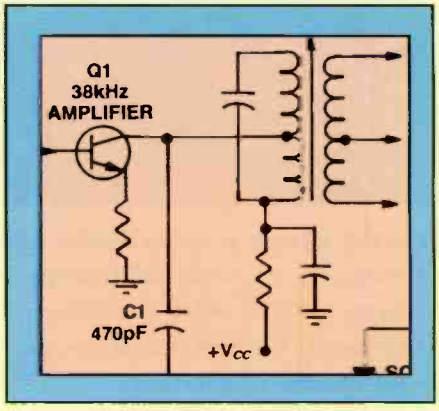

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ON THE COVER

Existing test equipment continues to become more fully featured and easier to use. Moreover, as the universe of consumer electronics products continues to evolve and expand, manufacturers introduce new test equipment to aid technicians in their diagnosis. Setting out to choose a piece of test equipment becomes more complex and difficult every year. For that reason, every year **ES&T** presents a Test Equipment Showcase to allow test equipment manufacturers to tell readers a little more about themselves and their products. (Photo courtesy Tenma)

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

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How do you keep current?

I recently received a call from a service center regarding a well-known manufacturer of consumer electronics products. He has a number of products made by that company that need service, and he needs to contact the company to obtain service literature and parts.

This service manager has called the telephone numbers, regular and toll free, that we published in a recent issue of this magazine. At one number he reached a service station. Dialing the toll-free number resulted in a message that it is no longer in service.

This problem points out the perishability of information about manufacturers these days. Those numbers were verified about eight months ago. I knew that the company was still in business because we have received press releases from them within the past three months. It's even possible that those releases included new information concerning the company's telephone numbers, but because they didn't call attention to the changes we assumed that they hadn't changed.

Everywhere in consumer electronics companies are changing, starting up, going out of business, being sold to other companies, moving. It's very difficult to keep up. That's why we publish issues such as this one in which we list companies with addresses, phone numbers and other vital information. Unfortunately, we can't call and verify every listing, so occasionally you'll find that a telephone number is wrong or out of date, but that doesn't happen very often. Based on the volume of calls and mail we get concerning the accuracy of the information we publish, it would seem to be relatively rare. But it does happen.

Interestingly, in this case we tried to use one of the very modern methods of looking up the correct information. I logged onto the Internet and connected with an international telephone directory. They have listings, including addresses and telephone numbers, for individuals and businesses in every country in the world. After scrolling past other countries, I got to the United States. There I entered in the name of the company and the state where I was pretty sure that they were still doing business. I got several hits, but only one of them had the word "Company" as part of the name, so I dialed that number. It was no longer in service. I guess the lesson here is that even the most modern, up-to-date type of technology can contain incorrect or out-of-date information.

I then reverted to a lower technology approach, but one that has brought success in the past. I dialed one plus the area code of the incorrect number for the company and 555-1212, for long-distance directory assistance. The directory assistance operator gave me a number for the company I was looking for.

I then called the number, and voila, I was connected with the company I was looking for. The operator at the company verified that the address I had in my database was correct, and provided me with the new fax number, and told me that they no longer had a toll-free number. The telephone and fax numbers for that company have been corrected and are listed correctly in this issue.

We do try to make sure that all of the company addresses and telephone numbers we publish are accurate and up to date, but we occasionally get one wrong. When that happens, please let us know. And if you have the correct information, please provide that to us. It will be helping thousands of other servicers.

Enter the contest

By now you should have received the **ES&T** Annual Schematics Special Issue. If you have overlooked the contest entry blank in that issue, please go back and find it. Give the additional form to a coworker, because if you send in two with your name on them, we'll toss them both away.

Just by filling out an entry blank you could win one of several prizes: a DSS system from Thomson, service management software from Sencore, a service tips program from Electronic Software Developers, a technical videocassette library from EIA/CEMA, cleaner/degreaser from Chemtronics, a monitor service tips database from Anatek, one of three monitor stands from Datacomm, or one of three sets of four books from the Howard W. Sams Prompt Technical Library.

You might also win one of two additional prizes, a dial torque gauge from Tentel, or a LeakSeeker from Electronic Design Specialists.

But, you can't win if you don't send in your entry blank, so send it in.

Nils Conrad Persson

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Troubleshooting techniques

Audio signal injection tests

By Homer L.Davidson

Audio signal injection is a good way to test a stereo audio amplifier of a TV chassis or an AM/FM/MPX receiver in order to locate a weak or dead circuit, or one that's causing distortion. A weak audio stage may be caused by a defective coupling capacitor, a transistor, an IC or a change in the resistance of a resistor in the audio circuits. A dead audio circuit can result from an open or leaky transistor or IC, or improper voltages from the low voltage sources.

A defect in just about any component in the audio circuits can produce a weak signal, or complete absence of signal output. Extreme distortion is usually the result of a leaky transistor or IC, improper supply voltages, or a change in resistance of the bias resistors.

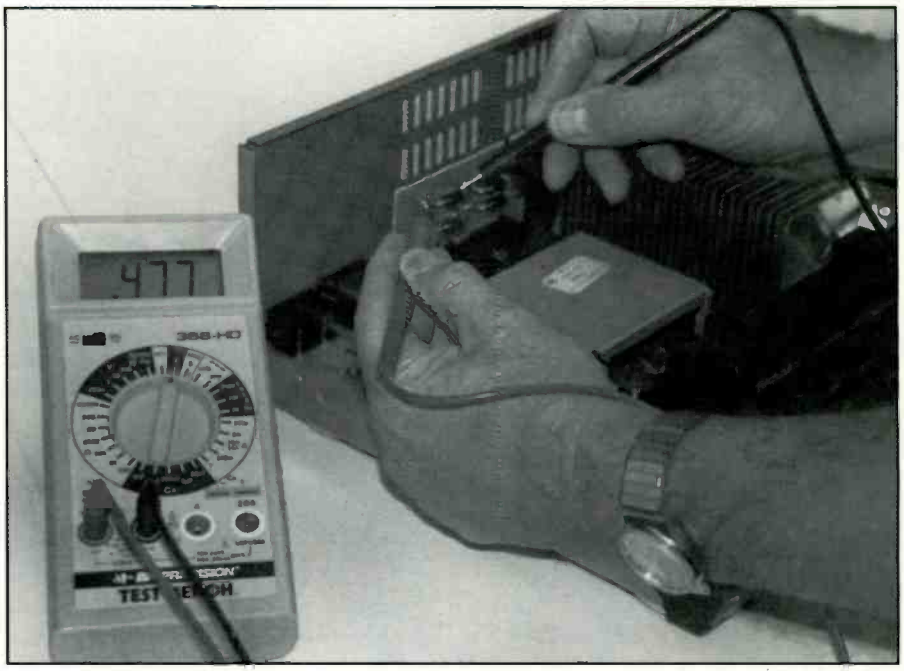

Figure 1. When you encounter a chassis with weak or no sound, check the dc voltage sources. If the source voltages are zero, check the low voltage power supply and test each diode for leakage.

Start with these diagnostic steps

When you encounter a chassis with weak sound or no sound, check the dc voltage sources (Figure 1). A quick voltage measurement at the largest filter capacitor can determine if the working voltage is adequate. Check the transistor and zener diode voltage regulators providing voltage to the various audio circuits, to see if any of the transistors are open, or if any of the electrolytic capacitors have dried out.

The output voltage of a supply that contains an open transistor regulator will be at or near 0V, while a supply that contains a transistor that has leakage may have a dc voltage output that is higher or lower than the specified voltage. Test each silicon diode in the low voltage power supply if the symptom is an output of 0V.

Audio signal injection

When you encounter problems in an audio system and you wish to troubleshoot it by injecting an audio signal, choose either a 3KHz square or sine waveform from the audio or function generator. Apply ac power to the TV chassis or receiver through an isolation transformer for these tests.

For best results, connect 8Ω or 10Ω 10W resistors across the stereo speaker terminals. Of course you may prefer to connect the speakers to the audio output so that you will be able to hear the various audio signals. In some cases, however, the volume may be too loud.

In cases where a speaker voice coil has been damaged because raw voltage has been applied to it, use power resistors as loads connected to the speaker terminals. In the case of high wattage amplifiers,

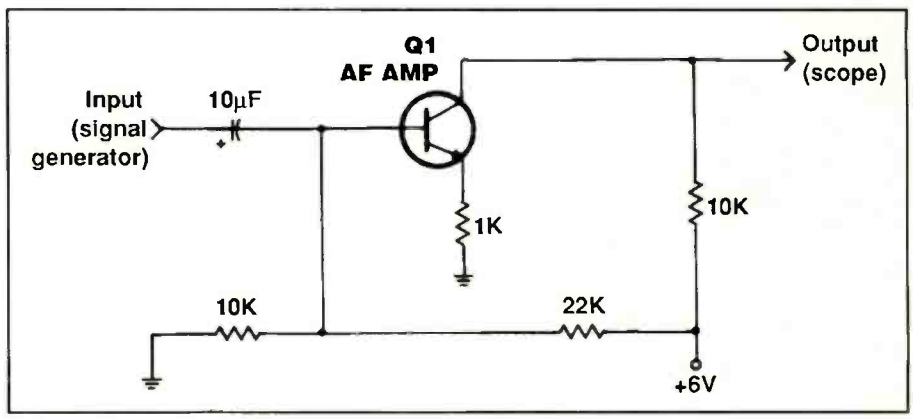

Figure 2. Inject a 3KHz (audio frequency) signal from the signal generator at the base and use the oscilloscope to observe the waveform at the collector terminal of the audio transistor to locate the defective stage.

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

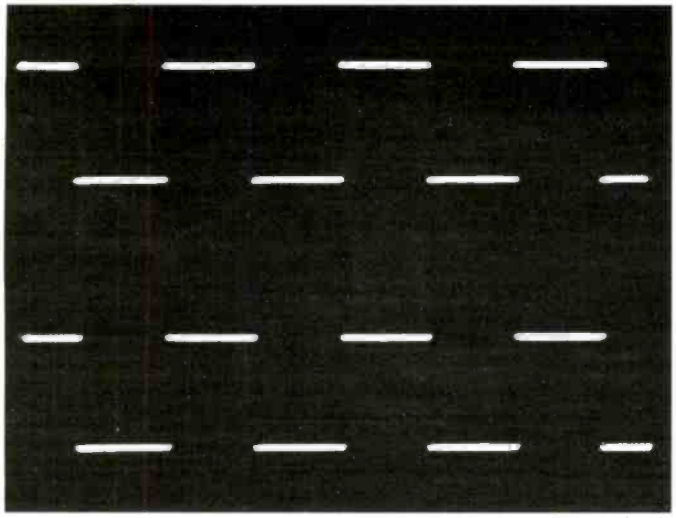

Figure 3. Set the oscilloscope's variable sweep control for a steady waveform with either a sine or square wave input signal. Both input signals should be adjusted, one above the other, so each waveform can easily be seen. Here both square waveforms are adjusted to the same height and width.

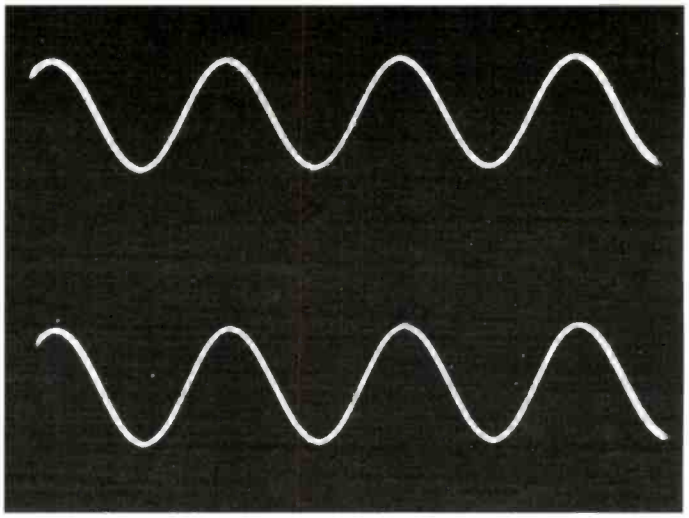

Figure 4. The normal audio sine wave with equal signals upon the scope.

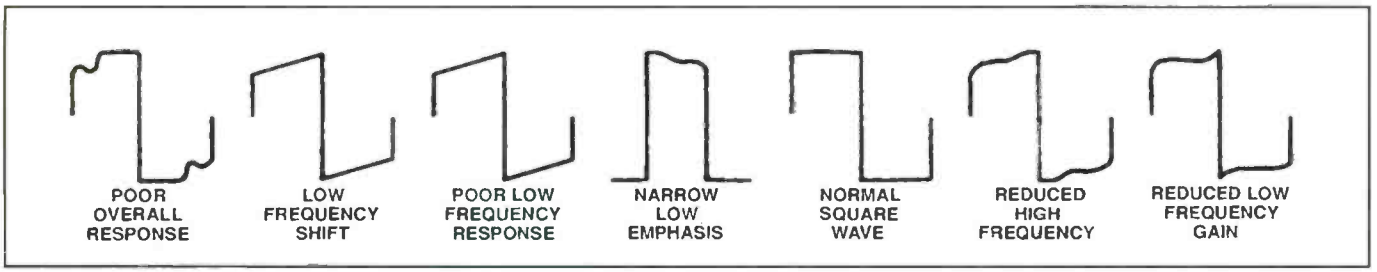

Figure 5. When you inject a square wave into an amplifier stage and observe the output, you can determine a great deal about the frequency response of the amplifier.

connect 50W or 100W resistors as loads in place of the speakers.

Testing the overall performance of the audio amplifier

For overall audio amplifier tests of a TV or stereo receiver, connect the signal generator at the first audio transistor or IC preamp circuits (Figure 2). Clip a test lead from generator probe to both stereo input channels. Some audio circuits can be tested by injecting the audio signal into the auxiliary stereo audio input jacks.

By using a dual-channel oscilloscope, you can compare the performance of the audio channels with each other. If there's a balance control in the circuit, be sure to adjust it for even balance of both stereo channels. Set the scope gain controls at the same level or numbers for equal measurement. Adjust the mode switch of the

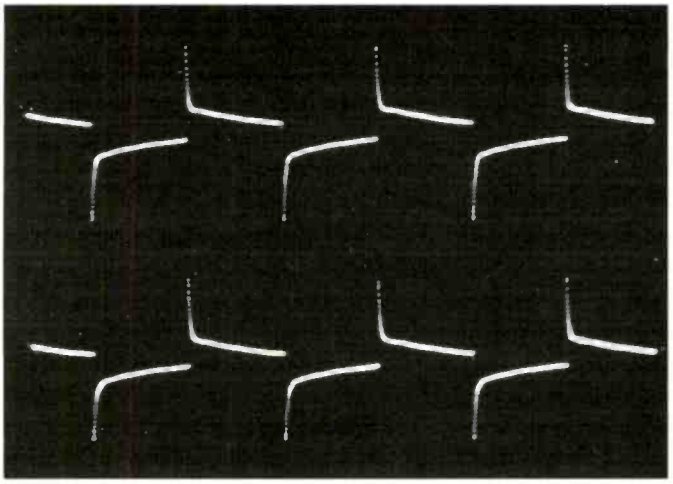

Figure 6. These square waves are the outputs of a known-good dual-input IC with equal signals at the inputs. The oscilloscope was connected to the speaker output terminals with speakers connected to a 15W amplifier. Notice the square waveform is not a perfect square wave. This is normal.

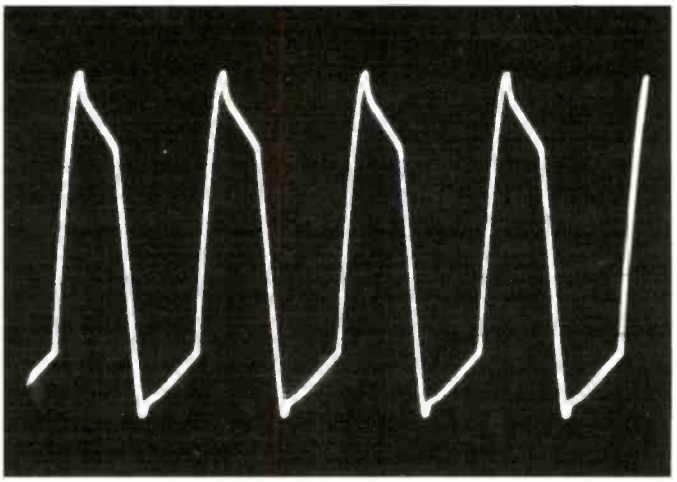

Figure 7. If the amplitude of the signal from the signal generator is too great, you will over drive the amplifier, causing the output signal to be distorted. This is a distorted output of an amplifier over driven by a sine wave.

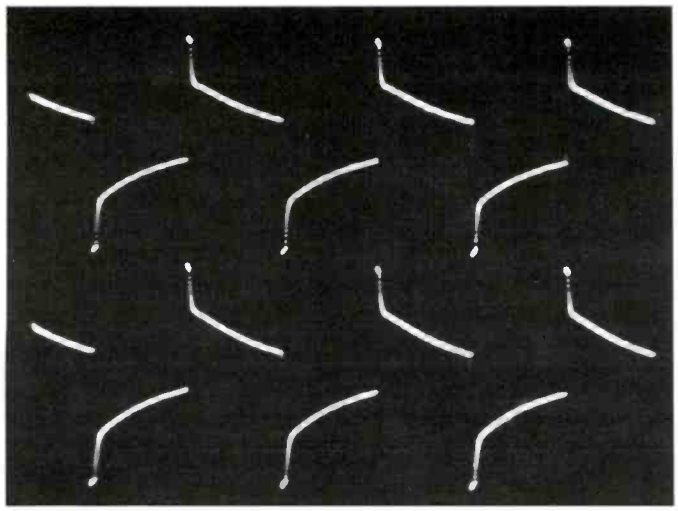

Figure 8. This is the distorted output of an amplifier that is over driven by a square wave signal output from the signal generator that is too great in amplitude.

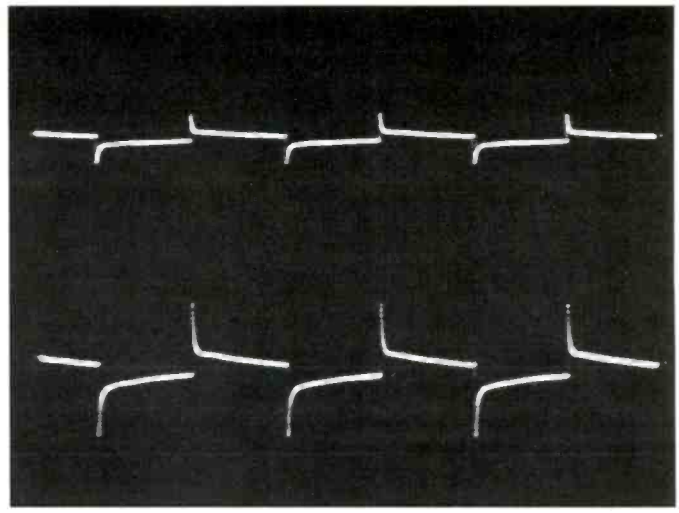

Figure 9. The amplitude of the square wave signal output of the left channel of the stereo amplifier being tested here (top), is less than half the amplitude of the square wave signal at the output of the right channel.

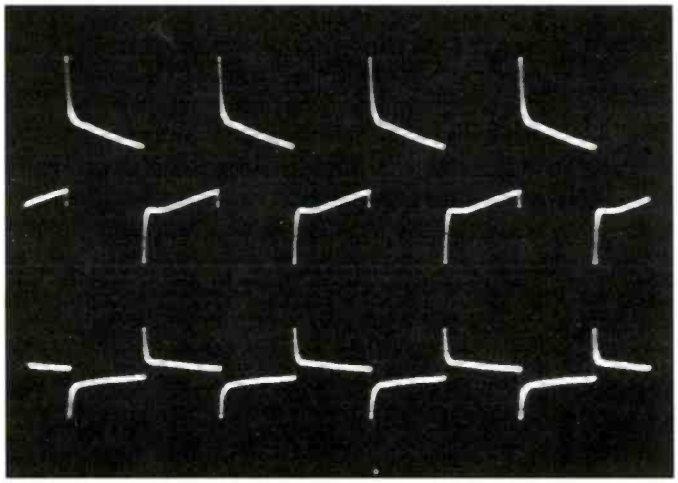

Figure 10. In this case, the amplitude of the signal at the output of the stereo amplifier's right channel (bottom), is much lower than the amplitude of the signal at the output of the left channel, although the amplitude of the input signals is the same for both channels.

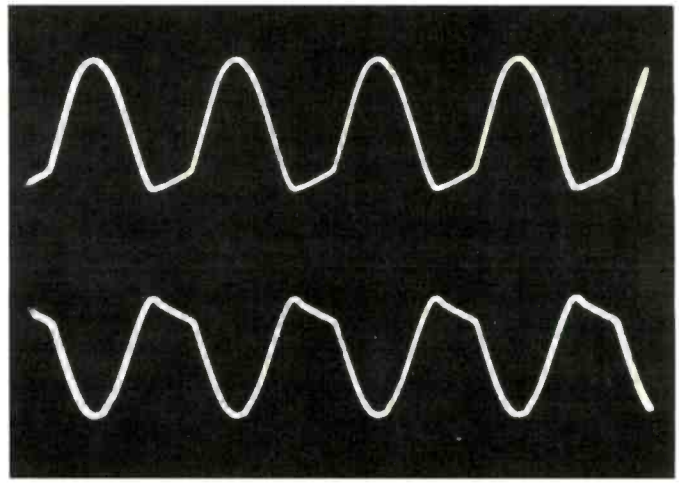

Figure 11. This oscilloscope photo indicates that a problem in the right channel of the amplifier is causing distortion of the output signal.

scope so that both input signals can be seen at the same time.

Set the oscilloscope's variable sweep control for a steady waveform with either a sine or square wave input signal. Both input signals should be adjusted, one above the other, so each waveform can easily be seen. In Figure 3, both square waveforms are adjusted to the same height and width.

Inject the sine wave to show weak or distorted sound throughout the amplifier circuits (Figure 4). The shape of the sine wave should be the same coming out of the output of the audio system as it was going in. Now readjust the bass and treble controls to obtain a normal sine wave on the scope with just enough signal. You may find the bass control has very little effect upon the sine wave. It is best to rotate the bass and treble controls fully on when you're using a sine waveform for audio signal injection tests.

The response of the amplifier to the square waveform can indicate distortion, low frequency response, reduced high and low frequency, and poor low frequency response (Figure 5). If the amplifier response shows distortion, move the signal generator leads downstream a stage at a time until the distortion disappears. When the output of the oscilloscope is undistorted, the stage upstream is the one where the problem lies.

Adjust the squarewave signal the same way as the sine wave to test for distortion, loss of signal and poor frequency response. The square waves of Figure 6 are the outputs of a dual-input IC with equal signals at the inputs. The oscilloscope was connected to the speaker output terminals with speakers connected to a 15W amplifier. Notice the square waveform is not a perfect square wave. This is normal.

Input signal adjustment

If the signals are injected downstream from the volume control, use the controls of the signal generator to adjust for correct signal level; that is, keep the volume control of the TV or receiver at the middle of its range and adjust the controls of the signal generator for correct waveform amplitude. Of course, if you're trouble-

Dead left channel—Pioneer SX-950

The symptom in a Pioneer SX-950 amplifier was a dead left channel at turn on, followed by shutdown. When I injected a 1KHz audio signal at the input terminals, there was no output at the speaker terminals, and the amplifier quickly shut down. Each time I applied power to the amplifier the protection circuits would shut it down in seconds.

Resistance tests showed that both output transistors were leaky. I replaced both the 2SD427 transistor and the 2SB557 with universal replacement transistors. While the defective transistors were out of the circuit, I checked the emitter bias resistors, R56 and R58, and found them to be open. I replaced these 0.5Ω resistors with 5W units.

Before performing any further tests, I disconnected the speakers and connected an 8Ω 10W resistor across each speaker terminal. When I again applied power to the amplifier, it shut down at once. After disconnecting power I checked the replacement components that I had installed. Resistors R56 and R58 had opened again, but both output transistors were still good (Figure 12).

I measured the resistance from the left speaker output to ground. It measured 14.1KΩ. The normal right channel showed infinite resistance to ground.

The SX-950 power amplifier contains all direct-coupled transistors in a complementary audio circuit. The output circuits have a balanced positive and negative power supply with a dc center point potential at 0V. There should be no dc voltage at the speaker terminals in this balanced audio circuit.

I measured the resistance from the base of each transistor in the circuit to common ground and compared them to the resistances I measured in the normal channel. Lowered resistances at the bases of transistors Q2 and Q4 indicated leakage (Figure 13). The resistance across R26, a 1KΩ resistor, measured only 91Ω. This led me to check capacitor C12, a 330µF electrolytic capacitor. This capacitor was leaky, so I replaced it. Transistor Q4 was leaky as well, so I replaced it with a universal replacement transistor.

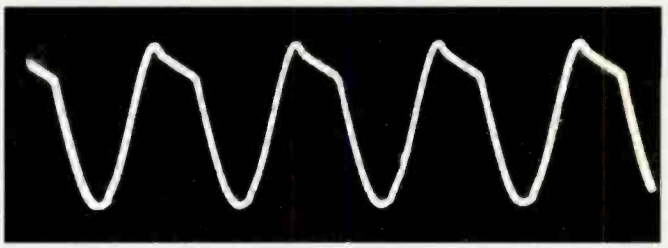

Figure 12. The clipped top of this output signal, in response to a clean sinewave input from the signal generator, reveals that there's distortion in this amplifier channel.

Again a resistance test was made from the base to the collector of Q2 (2SA7265), which indicated a 1.6KΩ leakage. I replaced Q2 with another universal replacement. After both Q2 and Q3 were replaced, resistance measurements to ground compared to the good channel showed a difference of only a few ohms.

Another resistance test from speaker terminals to ground now showed that this resistance was infinite.

As this procedure demonstrates, making accurate resistance measurements from transistor terminals to ground in a defective stereo channel, and comparing them to measurements of the same points in the normal channel can quickly locate a defective audio circuit.

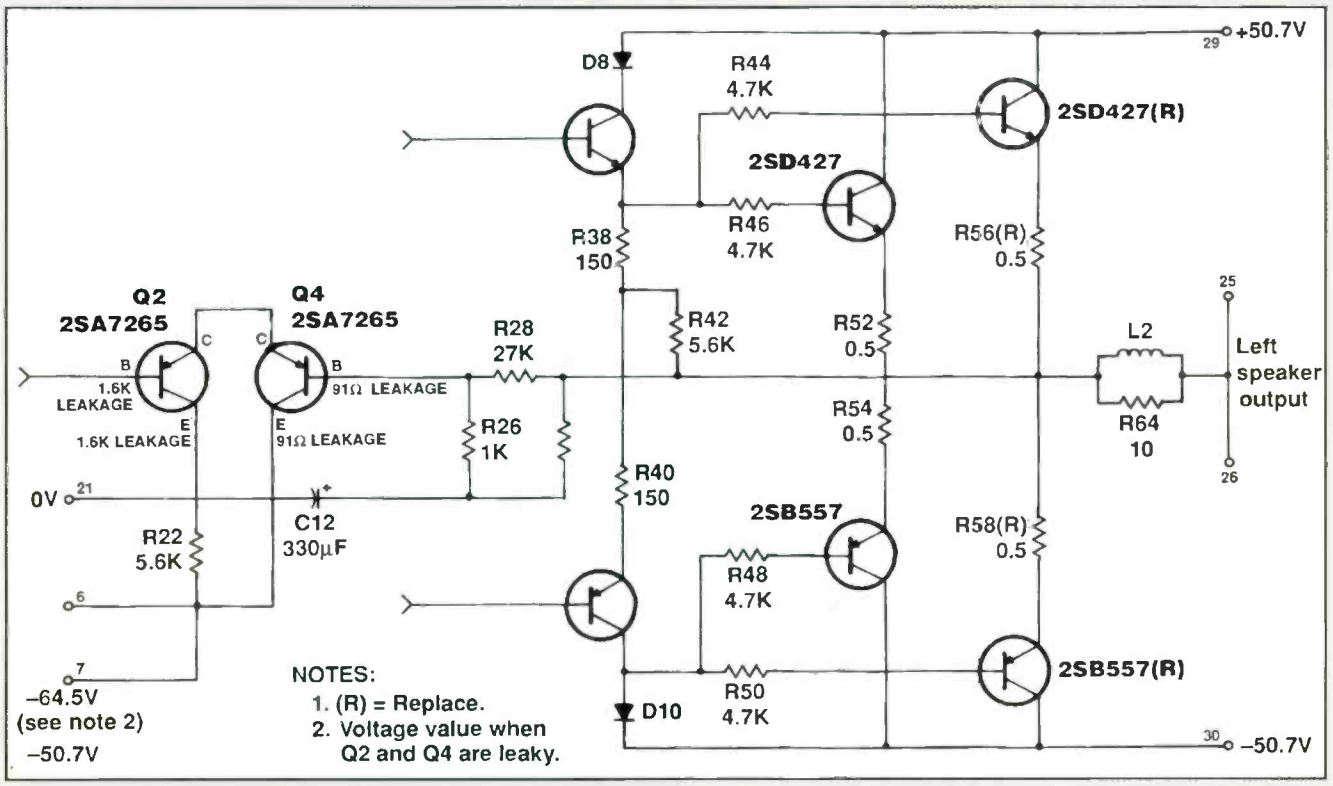

Figure 13. Leaky transistors Q2 and Q4 destroyed both output transistors and emitter resistors in this Pioneer amplifier.

shooting a high-power amplifier the volume control should be adjusted for adequate volume.

Figures 7 and 8 show the output of the amplifier when the amplitude of the signal generator was turned up too high with the sine wave input and square wave, respectively. Keep the signal generator signal as low as possible for a normal input signal. Do not over-drive the amplifier stages with a signal of excessive amplitude, as this will produce a distorted waveform output.

A weak audio stage

Inject the sine or square wave signal at the input terminals of both stereo circuits to locate a weak audio stage. Connect the oscilloscope across an 8Ω or 10Ω load resistor at the speaker terminals. Notice if one waveform is weaker than the other with both scope gain controls adjusted at the same settings.

In Figure 9, the amplitude of the square wave signal output of the left channel is less than half the amplitude of the square wave signal at the output of the right channel. In Figure 10, the square wave output of the right channel signal (bottom) is much weaker than the output of the left channel (top).

After determining that the signal output of one channel is weak, inject the generator signal into the amplifier a stage at a time until the weak stage is located. A good way to do this is to check the schematic diagram and find the approximate midpoint of the amplifier circuit.

If the amplitude of the output signal is reasonably strong when you inject the signal generator signal at the midpoint, work back toward the volume control until you find a point where the output signal drops off dramatically. If the amplitude of the signal output is weak when you inject the signal generator signal at the midpoint, work forward toward the speaker outputs with the signal generator probes until you find the correct signal level. In either case, the stage between the point where the signal level was weak, and the point at which the signal was correct, is the defective stage. Check voltages and component condition at that stage to pinpoint where the problem lies.

Remember, the amplitude of the output signal will decrease as you move the signal generator inputs toward the speaker terminals. This makes sense because each time you move forward a stage, the number of stages of amplification is reduced. When the audio signal drops off dramatically or disappears, you have located the weak stage. Check a suspected electrolytic capacitor by injecting signal on both sides of the capacitor and notice the height or loss of the waveforms.

The distorted channel

Extreme distortion occurs in the audio output circuits if the transistors or ICs have leakage. Lower levels of distortion may occur if bias resistors have burned or otherwise changed in resistance, or if coupling or bypass capacitors have become leaky. Improper voltages can cause distorted sound.

If you encounter distorted audio, first determine which channel the distortion is occurring in, and then signal trace the audio circuits of that channel with injected signal from the function generator.

After determining the channel where the audio is distorted, inject the signal generator audio signal, stage by stage, to pinpoint the stage in which the distortion

(Continued on page 60)

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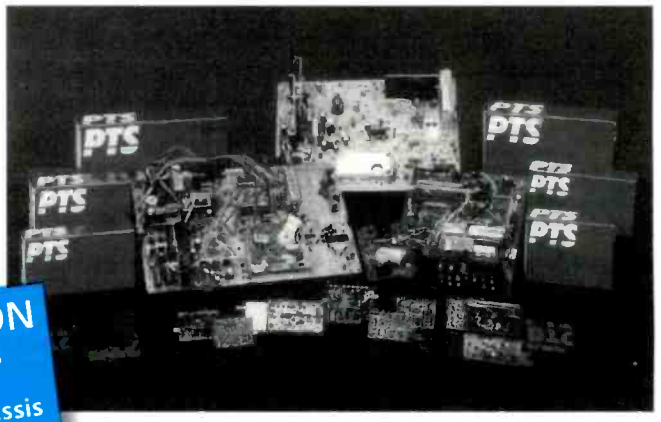

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Circle (69) on Reply Card

Replacement parts/servicing information sourcebook

By The ES&T Staff

A number of factors make the inherently difficult task of servicing consumer electronics products more difficult still. One obstacle that servicers frequently face is the large number of relatively obscure manufacturers. If you can't find an address and/or telephone number for the manufacturer of the product you're working on, how are you going to order replacement parts or service literature?

Exacerbating this problem for servicers is the increasing number of proprietary parts (that is, parts that you can only obtain from the manufacturer) and parts that are difficult to identify because they're identified using the manufacturer's private code, or not marked at all.

Still another factor increasing the difficulty of servicers is the mutability of brand names. There was a time when a TV or radio that proudly bore a manufacturer's logo was made by that manufacturer. Not any more. These days it's no novelty to find that company A makes sets that bear the brand names of companies B, C D and Z. Generally this is not a bad thing, as generally, the reputable manufacturer maintains the quality of the product, and maintains stocks of replacement parts and service literature for the product during its useful life.

However, many brand names today have become commodities, and it has happened that a manufacturer with a venerable old name sells the brand to a company that then sells shoddy merchandise to unsuspecting consumers, who may then find it difficult, or not worth the bother and cost, to get the product serviced.

Other factors that make service difficult

These are only a few of the factors that make it difficult for the average service center to locate and obtain service literature and replacement parts for some products. Some of the other reasons are:

- Companies move, and after a set amount of time the post office doesn't forward mail to them.
- Some companies are small and have a very low profile in the marketplace, so they're hard to locate.
- Many manufacturers of private brands of consumer electronics products offer little or no support.
- An offshore manufacturer may sell and support products in the U.S. for a period of time and then leave the market. In some cases these companies will have sold their stocks of replacement parts to a distributor in the U.S., but how do you know to whom?
- Some companies don't wish to have independent service companies service their products, so they refuse to provide service literature and replacement parts to the independent.

Here's some help

Because consumer electronics servicing presents so many difficulties in simply locating replacement parts and service information, each year in the December issue, we publish a replacement parts and servicing information sourcebook that provides service companies with several tools to help them overcome these problems. This sourcebook is published annually because so many changes take place within a twelve month period that the list is largely out of date by the time a year has gone by.

This sourcebook contains the following sections:

- A list of suggested references.
- A list of FCC (Federal Communications Commission) ID number prefixes that identifies the manufacturer of any product that bears an FCC ID number.
- A sidebar that describes how to use the FCC public access system to look up the manufacturer of a product on which you have found an FCC ID number.
- *New for 1996*: an identification for the website for the FCC. At this site you can browse, or download records that contain FCC ID numbers vs. company name, address, etc.
- An updated list of UL (Underwriters' Laboratories) ID numbers.
- An updated list of manufacturers with addresses and telephone numbers.

Finding replacement parts

Here's a list of references that are useful in tracking down the manufacturer, or parts distributors. We think that every electronics servicing facility should have them:

Consumer Electronics Replacement Parts Source Book

Consumer Electronics Manufacturers Association,
Electronic Industries Association
2500 Wilson Boulevard
Arlington, VA 22201
Include $1.00 for postage and handling

Electronic Industry Telephone Directory (Or some equivalent)

Harris Publishing Company
2057-2 Aurora Rd.
Twinsburg, OH 44087-1999
216-425-9000

Please send me a copy of the Consumer Electronics Show Directory, as mentioned in **ES&T**. Enclosed is a check for $15.00, payable to the Consumer Electronics Show. (For **ES&T** readers only. Regular value is $100.00.)

Name _____ Occupation/Title _____

Address _____

City _____ State _____ Zip _____

Mail to: CES, Attn: Bernie Hawkins
2500 Wilson Blvd.
Arlington VA 22201

FCC ID numbers

Code Prefix	Manufacturer
A26	Alpine
A6R	Yamaha
A3D	NEC
A3L	Samsung
A7R	Orion
AAL	Phone Mate
AAO	Radio Shack
AAY	Midland International Corporation
ABL	Hitachi
ABW	JC Penney
ABY	Motorola
ACA	Yorx Electronics
ACB	Phonotronics
ACJ	Matsushita
ADF	Carterfone
ADT	Funai
AES	Uniden
AEZ	Sanyo
AFA	Fisher
AFL	Sharp
AFR	Curtis Mathes
AGI	Toshiba
AGV	Montgomery Ward
AHA	RCA
AIH	Litton Microwave Cooking Products
AIX	Sylvania
AJD	Pioneer Electronics Corp.
AJU	GE
AK8	Sony
AKC	Superscope Inc
AKE	Marantz Co Inc
ALA	Wells Gardner Electronics Corporation
ALI	Kenwood USA Corporation
ANV	Capetronic Int'l Corporation
API	Harman Kardon Inc
ARS	AOC Int'l of America Inc
ASH	Akai
ASI	Victor Company of Japan
ATA	Sharp
ATO	Zenith Electronics Corporation
ATP	Advent Corporation
BBO	Cobra
BCG	Apple Computer
BEJ	Goldstar
BGB	Mitsubishi
BO7	Sanyo Fisher
BOU	Philips
C3K	Microsoft
C5F	Daewoo
CKL	Hyundai Electronics
CNT	Compaq Computers
E0Z	Shintom
E2K	Dell Computer
F67	Ampex
FOD	Packard Bell
GBU	3M
GQ8	Acer

This is a FCC and UL guide to original VCR manufacturer that was published in the Taiko replacement video head guide July 6, 1994.

Original Manufacturer	UL listed code	FCC listed code
Akai	186Z	ASH
Fisher/Sanyo	403Y	AFA
Funai	333Z, 51K8	ADT, EOZ, BFY
Goldstar	86BO	BEJ
Hitachi	238Z	ABL, AHA
JVC	439F	ASI
Matsushita	679F	ACJ, AIX, AJU
Mitsubishi	536Y	BGB
NEC	781Y	A3D, E74
Orion-Emerson	44L6, 722	A7R
Philips	645Y	BOU
Samsung	16M4, 414K	A3L
Sharp	504F	ATA
Sony	570F	AK8
Toshiba	174Y, 84X7	AGI, G95

Figure 1. Every VCR, personal computer, cordless telephone and microwave oven must carry an FCC ID number. The first three characters of that ID uniquely identify the manufacturer of the product. This is a listing of manufacturer vs. FCC ID number prefix, alphanumerically by code.

This will cost around $50.00 (Or you might be able to get a copy free from your distributor.)

The Howard W. Sams and Company Annual Photofact Index

Available from your distributor, or directly from:

Howard W. Sams & Company
2647 Waterfront Parkway East Drive
Indianapolis, IN 46214-2041
800-428-7267

(This document is available in printed form and on computer floppy disk)

Consumer Electronics Show (CES) Directory

Electronic Industries Association
Consumer Electronics Group
2500 Wilson Blvd.
Arlington, VA 22201
703-907-7500

The CES directory includes over 1,000 manufacturers, brand names, products and key personnel. The best way to get a copy of this directory is to attend the Consumer Electronics Show in Las Vegas, January 9 through January 12 1997. It comes with the price of attendance. For further information about CES, write to the address above, or call the listed number and ask for CES Registration.

If you can't get to the show the directory may be available from the above address. Limited quantities of the CES Show directory will be available at a reduced price to **ES&T** readers who send in the coupon in this issue. But the EIA/CEMA will fill as many orders as possible.

A VCR model number and parts reference

Another invaluable reference is published by the International Society of Certified Electronics Technicians (ISCET): a VCR model number and parts cross reference. The Seventh Edition of the VCR Model Number and Parts Cross Reference is available in both paper and software editions from ISCET.

The cross-reference software allows the user to search by manufacturer for

The FCC public-access information system

Every VCR, personal computer, microwave oven and cordless phone sold in the United States must bear an FCC identification number because they may possibly generate radio-frequency interference. Some products outside of this category, such as TV sets may also bear FCC ID numbers. This number identifies which company manufactured the unit. If you have one of these products in your shop for service and can't identify the manufacturer, you can contact the FCC through its public-access system and find out who made it.

There are two ways to get this information: via voice telephone or via computer and modem by contacting the public-access bulletin board. The FCC prefers to have people use direct computer-to-computer contact.

To contact the FCC bulletin board, you must have a computer and a modem capable of 300 baud or 1200 baud. The number to call, in Maryland (just outside of Washington, D.C.), is 301-725-1072. This is a toll call. Dialing this number at any time should get you in direct contact with the bulletin board.

Once you have made contact, the computer screen will tell you how much time you have and provide you with a menu of items to choose from. When the **ES&T** staff dialed up the bulletin board in October of this year, the following screen information appeared:

"P A L"
1 - Access Equipment Authorization Database
2 - Definitions - Terms/Codes used in Application Records
3 - Applying for an Equipment Authorization (1/92)
4 - Other Commission Activities and Procedures (8/92)
5 - Laboratory Operational Information
6 - Public Notices (7/96)
7 - Bulletins/Measurement Procedures (3/93)
8 - Rulemakings (7/94)
9 - Help
a - Information Hotline (9/96)
b - Processing Speed of Service
d - Test Sites on File per Sec 2.948 (10/96)

0 - Exit PAL

Enter your selection:

Pressing the number 1 on the keyboard brought up the following information on the screen:

Equipment Authorization Database

NOTICE: We now have two phone lines for PAL. Use the same number. It will automatically connect to the new line if the original line is busy.

1 - Equipment Authorization Application Status
2 - Applicant/grantee Names and Addresses by Code

0 - Exit this Menu

Enter your selection:

Enter Grantee Code (CR to end): ...

At this point, it was only necessary to enter the three character alpha or alphanumeric code, and the name, address and telephone number of the manufacturer identified by that code appeared. For example, entering the three letter ID aaa and pressing the ENTER key brought up this information on the screen:

AAA Code A Phone Corporation
PO Box 5656
Portland, OR, 97228 USA

The system gives you eight minutes at a time, and you can enter as many codes and gather as much information as you can in that time period. If your software allows you to download information, you can download all of this information to your computer's disk for future reference.

The other method of obtaining this information is to call 301-725-1585, Monday through Thursday between 2:00 and 4:30 p.m. and ask to be connected to the status desk. The individual who answers will relay your question to the bulletin board via a computer terminal and will then relay the information it provides to you.

Obviously, if you have a computer and a modem, it makes far more sense to contact the computer directly. You'll cut out the middle man and, of course, you can contact the computer any time.

Information sources close to home

Those of you who are located in a city that has a good library system have a ready source of information available free. For example, the **ES&T** staff regularly call the local library for information. References that they have available include the Thomas Catalog, a book called "Companies and their brands", and one called "Brands and their companies." And they're always pleased to receive a call for this kind of information. It's what they're there for. Try giving the reference librarian in your local library a call next time you have a question about who makes what brand of TV or VCR, or similar questions.

Look on the internet

Nowadays, another good way to find information on a company is to search for it on the worldwide web. It's pretty much hit-or-miss, but this approach might just help you find the information you need. To find information on a company this way, just use whatever browser you ordinarily use, enter the name of the company that you want to search for, in quotes. Start by using the simplest search string, for example just the name of the company, without the word "Company."

If you don't find any information at first, see if there are any other names that you might search under. For example, if you don't find anything under "Philips," try "Magnavox," or vice versa.

Is there a long lasting solution for improving the performance and reliability of switches and connectors?

See **CAIG** ad on page 17

Circle (75) on Reply Card

model numbers and description for part numbers, and a sub-search by manufacturer and part description is also a feature of the program. The editing sequence for parts shows all of the substitutes for the part entered on the screen.

There are 1,746 models and 6,000 parts with all updated prices in the 144-page laser-printed book. The book sells for $29.95 plus $3.00 shipping. The software version, which comes on one 3-1/2" disk, or two 5-1/4" disks, is priced at $69.95 plus $3.00 shipping. Registered previous purchasers of the original program can purchase the upgrade for $29.95 plus shipping.

The Cross Reference book or disk can be ordered from ISCET, 2708 West Berry, Fort Worth, TX 76109; Telephone: 817-921-9101.

This two-part reference will help any servicing organization that services VCRs to cross reference among different brands made by the same manufacturer. Part 1 of this reference will allow the user to determine when he has a product in for servicing, if it's possible that it's identical, or almost, to a product for which he already has a service manual. Part 2 of the reference cross references parts, so that if you can't find a particular part number for a product you are servicing, you may find that you have it on hand under a different part number for another manufacturer's product.

The FCC ID number can help you find a manufacturer

Most consumer electronics products carry clues as to who the manufacturer is. An FCC ID number, for example, appears on every VCR and computer, and any other product that might generate electromagnetic interference. Armed with this number, a technician may call or write the FCC for information:

Federal Communications Commission
1919 M Street, NW
Washington, D.C. 20463,

give the ID number and ask for the name and address of the manufacturer. An updated partial cross-reference list of manufacturer name vs. FCC ID numbers is provided in Figure 1. Figure 2 is the

FCC ID numbers

Manufacturer	First 3 Characters of FCC ID	Manufacturer	First 3 Characters of FCC ID
3M	GBU	Mitsubishi	BGB
Acer	GQ8	Montgomery Ward	AGV
Advent Corporation	ATP	Motorola	ABY
Akai	ASH	NEC	A3D
Alpine	A26	Orion	A7R
Ampex	F67	Packard Bell	FOD
AOC Int'l of America Inc	ARS	Philips	BOU
Apple Computer	BCG	Phone Mate	AAL
Capetronic Int'l Corporation	ANV	Phonotronics	ACB
Carterfone	ADF	Pioneer Electronics	AJD
Cobra	BBO	Radio Shack	AAO
Compaq Computer	CNT	RCA	AHA
Curtis Mathes	AFR	Samsung	A3L
Daewoo	C5F	Sanyo	AEZ
Dell Computer	E2K	Sanyo Fisher	BO7
Fisher	AFA	Sharp	AFL
Funai	ADT	Sharp	ATA
GE	AJU	Shintom	E0Z
Goldstar	BEJ	Sony	AK8
Harman Kardon Inc	PI	Superscope Inc	AKC
Hitachi	ABL	Sylvania	AIX
Hyundai Electronics	CKL	Toshiba	AGI
JC Penney	ABW	Uniden	AES
Kenwood USA Corporation	ALI	Victor Company of Japan	ASI
Litton Microwave Cooking Products	AIH	Wells Gardner Electronics Corporation	ALA
Marantz Co Inc	AKE	Yamaha	A6R
Matsushita	ACJ	Yorx Electronics	ACA
Microsoft	C3K	Zenith Electronics Corporation	ATO
Midland International Corporation	AAY		

Figure 2. To make it easier for readers who may be interested in locating the FCC ID prefix of a particular manufacturer, here is the same information presented in Figure 1, alphabetically by manufacturer name.

UL listing number to VCR manufacturer (Unofficial)

UL Number	Manufacturer	Brand Names
146C	Goldstar	
153L	NEC	
16M4	Samsung	Supra, Multitech, Unitech, Tote Vision, Cybrex, GE, RCA, Sears
174Y	Toshiba	Sears
238Z	Hitachi	RCA, GE, Penny, Pentax
270C	Sony	
277C	JVC	
282B	Sharp	
289X	Emerson	
333Z	Symphonic	Teac, KTO, Realistic, Multitech, Funai, Porta Video, Dynatech, TMK
336H	RCA	
347H	NAP	
43K3	Kawasho	
403Y	Fisher/Sanyo	Realistic, Sears
436L	Quasar	
439F	JVC	Zenith, Kenwood, Sansui
444H	Zenith	
44L6	TMK	Emerson, Lloyds, Broksonic
504F	Sharp	Wards, KMC
51K8	Portavideo	
536Y	Mitsubishi	Emerson, Video Concepts, MGA
540B	GE	
570F	Sony	Zenith
623J	Sampo	
628E	Samsung	MTC, ToteVision
679F	Panasonic	RCA, GE, Magnavox, Quasar, Canon, Philco
723L	Sanyo	
727H	Hitachi	
74K6	Funai	
781Y	NEC	Dumont, Video Concepts, Vector, Sears
828B	Panasonic	Olympus
843T	Magnavox	
86B0	Goldstar	Realistic, JC Penny, Tote Vision, Shinton, Sears, Memorex
873G	Mitsubishi	
41K4	Portland	

Figure 3. The UL listing number on a consumer electronics product identifies the manufacturer who made it. Here's a partial listing of UL numbers vs. manufacturer.

same information in alphabetical order by manufacturer name.

The sidebar that accompanies this article explains how you can contact the FCC Public Access system to obtain information about the manufacturer of a product that bears an FCC ID number. The same information is avialable in a different form via the Internet. The FCC has a website at http://www.fcc.gov. That's their home page. from there, you can access a huge amount of information, including such things as what's taking place at the FCC, communications problems of concern to consumers and more. You can also access FCC ID number databases.

From the internet, you can download FCC ID information wholesale and examine it at your leisure. You can get to their databases via the home page, or you can go directly to their file transfer protocol site at: ftp://ftp.fcc.gov/pub/ Bureaus/ Engineering_Technology/Databases/eadf .dat. At this location you can download their databases directly. These will be in the form of compressed files with the extension .zip. you will need a decompression program such as WINZIP to decompress (unzip) them.

A private company has downloaded

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- Reduces RFI, Wear & Abrasion

Even the finest equipment cannot guarantee noise-free operation. One "dirty" connection anywhere in the signal path can cause unwanted noise, distortion and signal loss. Considering the hundreds (if not thousands) of connections in electronic equipment today, it's only a matter of time before they begin to fail.

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DeoxIT dissolves oxides and sulfides that form on metal surfaces, removing these sources of resistance. This restores the contact's integrity and leaves a thin (organic) layer that coats and protects the metal.

DeoxIT's advanced formula contains deoxidizers, preservatives, conductivity enhancers, arcing and RFI inhibitors and anti-tarnishing compounds that significantly increase the performance and reliability of electrical components and equipment.

DeoxIT provides long-lasting protection, reducing the expense of repeated cleaning with expensive and aggressive ozone-depleting solvents.

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San Diego, CA 92127-1904
TEL: 619 / 451-1799
FAX: 619 / 451-2799
E-Mail: caig123@aol.com
URL: http://www.caig.com

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this information and makes it available on a floppy disc. The address and telephone number for this company are:

M.I. Technologies
3310 E. Peterson Road
Troy, OH45373
513-335-4560

Identification using the UL manufacturer's code number

Another source of manufacturer information is the Underwriters Laboratories code number. The manufacturer of every product that is submitted to UL for certification is assigned a unique code number that identifies who the manufacturer is. Figure 3 is a partial list of UL numbers and the manufacturers they represent.

Locating the manufacturers

It's not unusual for a servicing organization to have some difficulty finding the address and telephone number of a manufacturer of a product for which they need to order parts, even when the manufacturer is well known. Figure 4 is a listing of manufacturers, gleaned from the Consumer Electronics Replacement Parts Sourcebook, the NESDA Professional Electronics Yearbook, **ES&T** reader correspondence, many telephone calls by the **ES&T** staff, and other sources. ■

Figure 4. Sometimes it's difficult to find parts or servicing information for a product, even if you know who the manufacturer is. This listing, gleaned from the 1991 Consumer Electronics Replacement Parts Sourcebook published by EIA/CEG, the 1991 Professional Electronics Yearbook & Directory published by NESDA/ISCET, and information otherwise developed by the **ES&T** staff, will provide you with some parts and technical literature sources for some products.

Replacement Parts Source

Acoustic Research (AR)
330 Turnpike Street
Canton, MA 02021
617-821-2300
Fax: 617-784-4102

Action TV
(American Action TV)
100 Exchange Place
Pomona, CA 91768
909-869-6600
This company sells through truck stops and discount stores.

Adcom Service Corporation
11 Elkins Road
East Brunswick, NJ 08816
908-390-1130
Fax: 908-390-9152

AIWA America Inc.
800 Corporate Drive
Mahwah, NJ 07430-2048
201-512-3600
Fax: 201-512-3705

Akai American, Ltd. - See Mitsubishi

Alpine Electronics of America, Inc.
19145 Gramercy Place
Torrance, CA 90509
310-326-8000
800-421-2284
Fax: 310-782-0726

Altec Lansing Consumer Products
PO Box 277
Milford, PA 18337
717-296-4434
800-258-3288

AmPro Corporation
(Replacement parts for Kloss Novabeam and Videobeam)
5 Wheeling Ave.
Woburn, MA 01801
Sales: 617-932-4800
Fax: 617-932-8756

AOC International
311 Sinclair Frontage Rd.
Milpitas, CA 95035
408-956-1070
Fax: 408-956-1516

Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
408-996-1010
Fax: 408-996-0275

Aristo Computers Inc.
6700 SW 105th Ave., Suite 307
Beaverton, OR 97005
503-626-6333

Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
Parts: 408-745-5501
Tech: 408-745-2098
Warr: 408-745-2051

Audio Technica U.S., Inc.
1221 Commerce Drive
Stow, OH 44224
216-686-2600
Fax: 216-688-3752

Audio Video Technologies Inc.
60 E. Ida
Antioch, IL 60002
708-395-6321

Audiovox Corp.
150 Marcus Drive
Hauppauge, NY 11788
516-231-7750
Fax: 516-434-3995

Barcus-Berry, Inc
5381 Production Drive
Huntington Beach, CA 92649
714-898-9211
800-854-6481

Blaupunkt
2800 South 25 Ave.
Broadview, IL 60153
708-865-5200
Fax: 708-450-8554

Canton North America, Inc.
915 Washington Avenue South
Minneapolis, MN 55415-1245
612-333-1150
Fax: 612-338-8129

Casio Inc.
570 Mt. Pleasant Ave.
Dover, NJ 07801-1620
201-361-5400
Fax: 201-361-3819

Channel Master
PO Box 1416; Industrial Park Drive
Smithfield, NC 27577
919-989-2205
Fax: 919-989-2200

Chinon America, Inc.
615 Hawaii Ave.
Torrance, CA 90503-9747
310-533-0274
Fax: 310-533-0274

CIE American, Inc.
2515 McCabe Way
PO Box 19663
Irvine, CA 93713-9663
714-833-8445
Fax: 714-757-4488

Citizen American Corp.
Subsidiary of Citizen Watch Co.
2450 Broadway, Suite 600
Santa Monica, CA 90404
310-453-0614
Fax: 310-453-2814

Clarion Sales Corp.
661 W. Redondo Beach Blvd.
Gardena, CA 90247
310-327-9100
Fax: 310-327-1999

Columbia Data Products
PO Box 142584
Altamonte Springs, FL 32714-0584
407-869-6700

COMPAQ Computer Corp.
PO Box 692000
Houston, TX 77269-2000
713-370-0670
Fax: 713-378-6020

Connecticut Microcomputer
PO Box 186
Brookfield, CT 06804
203-740-9890
Fax: 203-775-4595
800-426-2872

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13845 Artesia Blvd.
Cerritos, CA 90703
310-926-9944
Fax: 310-926-9269

Curtis Mathes Corp.
100911 Petal St.
Dallas, TX 75238
214-503-8880
Fax: 214-503-8515

Daewoo Electronics Corp. of America
120 Chubb St.
Lyndhurst, NJ 07071
201-460-2571
Fax: 201-935-5004

Dell Computer Corp.
2214 Braker Lane
Austin, TX 78758-4063
Sales, Parts and Warranties:
800-426-5150
Service: 800-624-9896

Denon Electronics
222 New Road
Parsippany, NJ 1213
201-882-7490
Fax: 201-575-2532

Design Acoustics
An Audio-Technica Company
1225 Commerce Drive
Stow, OH 44224
216-686-2600
Fax: 216-688-3752

Eastman Kodak
343 State St.
Rochester, NY 14650
716-724-4000

Emerson Radio Corp.
9 Entin Road
Parsippany, NJ 070454
201-854-5800

Epson America, Inc.
20770 Madrona Ave.
Torrance, CA 90509-2842
310-782-0770
Fax: 310-782-5220

Fujitsu Ten Corp. of America
National Service Headquarters
19600 South Vermont St.
Torrance, CA 90502
800-423-8161

Funai USA Corporation
(Also Symphonic)
100 North Street
Teterboro, NJ 07608
201-288-2606

GE Appliances/Microwave Products Dept.
Appliance Park
Bldg. 4106
Louisville, KY 40225
502-452-4244

Gemini, Inc.
103 Mensing Way
Cannon Falls, MN 55009
507-263-3957

GoldStar Electronics Int'l, Inc.
201 James Record Rd.
Huntsville, AL 35824-0166
205-772-8860
Fax: 205-772-8987

Grundig/Lextronix Inc.
3520 Haven Ave., Unit L
Redwood City, CA 94063
415-361-1611
Fax: 415-361-1724

Harmon Kardon, Inc. - JBL
240 Crossways Park West
Woodbury, NY 11797
516-496-3400

Heath Company/ Heath-Zenith Consumer Products Group
PO Box 1288
455 Riverview Dr.
Benton Harbor, MI 49022
616-925-6000
Fax: 616-925-2898

Hewlett-Packard
3000 Hanover St.
Palo Alto, CA 94304
415-694-2000

Hitachi Home Electronics (America), Inc.
675 Old Peachtree Rd.
Suwanee, GA 30174
404-279-5600
Fax: 404-279-5692
Parts Center
401 West Artesia Blvd.
Compton, CA 90220
310-537-8383

INTV Corp.
3541 B Lomita Blvd.
Torrance, CA 90505
310-539-1940

International Jensen Inc.
25 Tri-State Int'l Ofc. Ctr., Ste 400
Lincolnshire, IL 60069
800-323-0221
Fax: 708-317-3826

JVC Service & Engineering Co. of America
Division of U.S. JVC Corp.
107 Little Falls Rd.
Fairfield, NJ 07004-2105
201-808-2100

Kawasho International
(Kawasho is no longer importing TV sets into the U.S., but some parts and service information is available from:)
Factory Service
PO Box 747
Buffalo, NY 14240
716-856-1612
Kawasho flybacks are also available from:
Electro Dynamics (General line distributor)
135 Eileen Way
Syosset, NY 11791
800-426-6423

Kaypro Corporation
4174 Sorrento Valley Blvd.
San Diego, CA 92121-1407
619-535-2155
Fax: 619-535-2170

Kenwood U.S.A., Corp.
PO Box 22745
Long Beach, Ca 90810-5745
310-639-9000
Fax: 310-609-2127

Kloss Video Corp.
See Ampro Corp.

KTV Inc.
205 Moonachie Road
Moonachie, NJ 07074
201-440-9090
Fax: 201-440-6557

Kyocera Electronics, Inc.
100 Randolph Rd.
Somerset, NJ 08875
908-560-0060

Lloyd's Electronics, Inc.
National Parts
6500 West Cortland St.
Chicago, IL 60635
312-889-8870
Fax: 312-889-6797

Luxman
Division of Alpine
19145 Gramercy Place
PO Box 2859
Torrance, CA 90509
310-326-8000
For non-account customers
Pacific Coast Parts Distributor
15024 Staff Court
Gardena, CA 90248
310-515-0207
Fax: 800-782-5747

Marantz USA
A Division of Bang & Olufsen of America, Inc.
1150 Feehanville Dr.
Mount Prospect, IL 60056
708-299-4000
Fax: 708-299-4004

Matsushita Services Co.
50 Meadowland Parkway
Secaucus, NJ 07094
201-348-7000
Fax: 201-348-7527

Mattel, Inc.
See INTV

Micro Palm Computers
13773-500 ICOT Blvd.
Clearwater, FL 34620
813-530-0128
Fax: 813-530-0738

Midland International Corporation
1690 North Topping
Kansas City, MO 64120
816-241-8500
800-MIDLAND

Mitsubishi Electronics America, Inc.
National Service Department
5757 Plaza Drive
PO Box 6007
Cypress, CA 90630-0007
714-220-2500

NAD (USA) Inc.
633 Granite Court
Pickering, Ontario
Canada L1W 3K1
416-831-6333
Fax: 416-831-6936
800-263-4641

NEC Technologies Inc.
Consumer Electronics and Computer Products Divisions
1255 Michael Drive
Wood Dale, IL 60191-1094
708-860-9500
Fax: 800-356-2415

Nikko
AVS Technologies
2100 Trans-Canada Highway South
Montreal, Quebec
Canada H9P-2N4
514-683-1771
Fax: 514-683-5307

Okidata
532 Fellowship Road
Mount Laurel, NJ 08054
609-235-2600
800-OKIDATA

Onkyo U.S.A. Corp.
200 Williams Drive
Ramsey, NJ 07446
201-825-7950
Fax: 201-934-1845

Orion Sales Inc.
11 Union Drive
PO Box 10
Olney, IL 62450
618-392-7000
Fax: 618-392-7100
Service manager is Roy See

Ortofon, Inc.
65 East Bethpage Rd.
Plainview, NY 11803
516-454-6570
Fax: 516-454-6515

Penney, J.C.
National Parts Center
6840 Barton Road
Morrow, GA 30260
404-961-8408
800-933-7115

Philips Consumer Electronics Company
Philips Service Company
PO Box 555
401 Old Andrew Johnson Highway
Jefferson City, TN 37760
615-475-8869
Replacement Parts/Service Literature
800-851-8885
Fax: 800-535-3715

Pilot Audio Video Systems
Information available on this company is that it went out of business in about 1989. For a while some parts were available through Curtis Mathes, but now there is no source of parts or service literature for Pilot. If any readers have other information, please let us know.
(See Electrophonic).

Pioneer Electronics Service, Inc.
1925 East Dominguez St.
PO Box 1760
Long Beach, CA 90801
310-746-6337
Fax: 310-816-0412

Proton
Proton Parts Department
5630 Cerritos Ave.
Cypress, CA 90630
714-952-6900
Fax: 714-952-4600

Radio Shack
Business Products Support Services
1600 One Tandy Center
Fort Worth, TX 76102
817-390-3011
Radio Shack Business Products Parts
812 E. Northside Dr.
Fort Worth, TX 76102
817-870-5695

Ricoh Corp.
3001 Orchard Pkwy.
San Jose, CA 95134
408-432-8800

Rotel of America
290 Larkin Street
Buffalo, NY 14220-8089
800-543-0471

Sampo Corporation of America
5550 Peachtree Industrial Blvd.
Norcross, GA 30071
404-449-6220
Fax: 404-447-1109

Samsung Electronics America, Inc.
Service Division
One Samsung Place
Ledgewood, NJ 07852
201-691-6200
Fax: 201-347-8650

Sansui Electronics Corp.
Parts Department
17150 South Margay Avenue
PO Box 4687
Carson, CA 90746
310-604-7300

Sanyo-Fisher (USA) Corp.
Consumer Electronics Sales Div.
21350 Lassen St.
Chatsworth, CA 91311
818-998-7322
For Service: SFS Corporation
1200 West Artesia Blvd.
Compton, CA 90220
310-537-5830
Fax: 310-605-6699

Scott, H.H. Inc.
5601 Westside Ave.
North Bergen, NJ 07047
201-662-2000
Parts/Technical Literature:
H.H. Scott, Inc.
State Route 41 & County Rd. 100W
Princeton, IN 47670
800-695-0095
Fax: 812-386-6502
Tech. Serv.: 800-922-0738

Sears
Sears Tower
Chicago, IL 60684
312-875-5222

Sharp Electronics Corp.
Sharp Plaza
PO Box 650
Mahwah, NJ 07430-2135
201-512-0055
Fax: 201-512-3456

Sherwood/Inkel Corporation
14830 Alondra Blvd.
La Mirada, CA 90638-5730
714-521-6100

Shintom West Corp. of America
20435 S. Western Ave.
Torrance, CA 90501
310-328-7200

Shure Brothers, Inc.
222 Hartrey Avenue
Evanston, IL 60202-3696
Service: 708-866-5732
Customer Service: 708-866-2553
Fax: 708-866-2279

Signet
4701 Hudson Drive
Stow, OH 44224
216-688-9400

Sony Corp. of America/ Sony Service Company
Sony Drive (T1-12)
Park Ridge, NJ 07656
201-930-1000

Sony National Parts Center
8281 N.W. 107th Terrace
PO Box 20407
Kansas City, MO 64153
816-891-7550

Soundcraftsmen, Inc.
2200 S. Ritchey St.
Santa Ana, CA 92705
714-556-6191
Fax: 714-662-0750

SDI Technologies
(Formerly Soundesign Corporation)
800 Federal Blvd.
Carteret, NJ 07008
908-855-0220
Fax: 908-855-0224

Sparkomatic Corporation
Routes 6 & 209
Milford, PA 18337
717-296-6444
800-233-8831 (Nationwide)
800-592-8891 (In PA)

Studer Revox America, Inc.
1425 Elm Hill Pike
Nashville, TN 37210
615-254-5651
Fax: 615-256-7619

Symphonic Corp.
(Also Funai)
100 North St.
Teterboro, NJ 07608
201-288-2606

Tandberg
Tandberg was a manufacturer of audio equipment. Latest information available is that they are out of business both in the U.S. and in Europe.

Tandy Consumer Service Parts
7439 Airport Freeway
Ft. Worth, TX 76118
817-284-8691
800-243-1311
Fax: 817-284-1961

Tandy National Parts
900 East Northside Dr.
Ft. Worth, TX 76102
817-870-5600
800-442-2425

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203-367-7767
203-367-7040 Fax
http://webmail.net/datacom/

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Tatung Company of America, Inc.
2850 El Presidio St.
Long Beach, CA 90810
310-637-2105
310-979-7055
Fax: 310-637-8484

TEAC Corporation of America
7733 Telegraph Rd.
Montebello, CA 90640
213-726-0303
Fax: 213-727-7656
Parts Orders: 213-726-0303
Fax for Parts Orders: 800-366-8868

Technics
See Matsushita

Teknika Electronics Corp.
A subsidiary of Fujitsu, Ltd.
Parts Department
353 Route 46 West
Fairfield, NJ 07004
201-575-0380
Fax: 201-575-7311

Teledyne
See Acoustic Research

Thomson Consumer Electronics
600 N. Sherman Drive
Indianapolis, IN 46201
317-267-5000

Thomson Consumer Electronics
Distributor and Special Products Division
2000 Clements Bridge Rd.
Deptford, NJ 08096
609-853-2241
For Servicing Literature:
TCE Publications
10003 Bunsen Way
Louisville, KY 40299
502-491-8110

Toshiba America Consumer Products Inc.
National Parts Center
1420 Toshiba Dr.
Lebanon, TN 37087
615-449-2360
Fax: 615-444-7520
800-345-9785

Tote Vision
969 Thomas St.
Seattle, WA 98109
206-623-6000
Fax: 206-623-6609
Parts Fax: 206-343-9029

Unisonic Products Corp.
16 West 25th Street
New York, NY 10010
212-255-5400

Videonics
1370 Dell Ave.
Campbell, CA 95008
408-866-8300

V-M Corporation
The Voice of Music
305 Territorial
PO Box 426
Benton Harbor, MI 49023
616-925-8841
This company no longer manufactures product, but manufactured large numbers of turntables under their own name, and for use in audio products of other manufacturers. If you ever need parts for a turntable that has 857 for the first three digits of the serial number, this is the company to contact. If you have any parts for these turntables, V-M corporation would like to talk to you about buying them.

Wells-Gardner Electronics Corp.
2701 North Kildare Avenue
Chicago, IL 60639
312-252-8220

Yamaha Electronics Corp. USA
Parts Department
6660 Orangethorpe Ave.
Buena Park, CA 90620
714-522-9105
Fax Orders: 800-634-0355

Yorx Electronics Corp
405 Minnisink Rd.
Totowa, NJ 07512
201-256-0500

Zenith Data Systems
2150 East Lake Cook Road
Buffalo Grove, IL 60089
708-808-4584

Zenith Electronics Corp./ Videotech Corp.
1900 North Austin Ave.
Chicago, IL 69639
312-745-2000
Service: 312-745-5151

★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

Consumer electronics technology continues to evolve, constantly adding new products for consumers to enjoy and to marvel at, while at the same time issuing new challenges to the technicians who service them. For example, the camcorder gives consumers a new way to record baby's first steps, or the wedding of a beloved family member, but the existence of this new consumer electronics product forces the technician who wants to stay abreast of the technology to go out and buy a light box, and perhaps a waveform monitor and vectorscope.

Standard test equipment still needed

The requirement of a service center to invest in newer test equipment in order to meet the challenges in consumer electronics doesn't change the need for them to use the more familiar test equipment. The DMM and the oscilloscope, and other test instruments and accessories such as the variable transformer, the isolation transformer and the bench power supply are just as necessary as they ever were to the serious consumer electronics servicing technician. In other words, the arsenal of test equipment required by the technician gradually and continually grows.

But even as the requirements for newer test equipment are arising, the old standby items of test equipment are evolving and being improved.

For example, while today's technicians require oscilloscopes and DMMs and other old standbys just as much as they did 10 or 20 years ago, in many cases the test equipment they require has to be more sophisticated than before. In other words, because the products the technicians face are so much more sophisticated then they once were, the test equipment must also be more sophisticated.

The oscilloscope may need to have a wider bandwidth and more automated front panel features. The digital multimeters may need to have more functions and greater accuracy.

Some things to consider

The value of a piece of test equipment to the technician depends, then, on a number of factors. Here are a few:

- Ease of use
- Capability
- Accuracy
- Cost
- Support by the manufacturer
- Versatility

Guidance becomes more important

The more feature rich a product becomes, the more difficult it is to compare features and to know what product to buy. Anyone who has ever agonized over making a wise purchase in today's environment knows how true that is.

For example, trying to compare the features of modern appliances or cars to try to make an informed decision becomes ever more difficult. Each manufacturer has a range of products. Each level of the product within the range offers a set of features. But levels of product features differ from one manufacturer to another. Even when the features are more or less the same, different manufacturers may use different terms for the same feature, making the choice still more difficult.

This type of problem is less pronounced when it comes to test equipment, but it does exist. Choosing a piece of test equipment from among the various levels of features and prices from a variety of manufacturers is a challenge.

Fortunately, a consumer electronics technician has access to a number of resources that can help him choose from among the many test products offered by the many manufacturers. There are, for example, the catalogs offered by the test equipment manufacturers themselves. Most of these provide details of the features offered by each of the products in that company's line. Not only that, but many of the manufacturers are a treasure trove of information on how to connect the equipment, and how best to use it to achieve accurate results.

Even better in some cases are the catalogs offered by distributors and by companies that rent or lease test equipment. Their listings list products offered by a number of manufacturers within each price level, and so make comparison somewhat easier.

Buying a piece of test equipment

When a service center buys a piece of test equipment, the purchase may not be completely thought through. For example, when it's decided that the service center needs a new oscilloscope, some research is performed on the products and prices, and an oscilloscope is purchased.

Most purchases done in this manner turn out fine, but sometimes the organization learns that the unit doesn't have the required features to do the job. In other cases the organization learns too late that the unit is far more than they'll ever need, and the money tied up in it could be used elsewhere. You see some of those items listed in Readers' Exchange.

Just as with any purchase, the use to which the test equipment will be put should be thoroughly studied. The best approach would be to put together a checklist, and give every technician who is likely to use the unit an opportunity to participate in the decision. The following example checklist questions are for an oscilloscope, but a similar checklist would be useful forother test equipment.

The checklist

- What products will this equipment be used to test?
- What bandwidth is needed?
- Single-channel or two-channel?
- Is waveform storage needed?
- Will this be used at the bench only, or on site as well?
- Does this scope need to have on-screen readout of waveform parameters?
- Can this purchase be cost justified as a time and effort saver?

Getting to know the suppliers

Because the decision to purchase a piece of test equipment is so important, the more you know about the manufacturers or suppliers, the better informed your decision will be.

This special advertising section, "Test Equipment Showcase," was conceived as a way to help bring more information about test equipment providers to readers. Every advertiser in this section has been given space to tell readers something about that company, or to help readers understand the value and use of that company's products.

We invite you to read what these companies have to say about themselves and their products. ■

Sencore, Inc.

3200 Sencore Dr.
Sioux Falls, SD 57107
Phone: 605-339-0100
1-800-SENCORE (736-2673)
Fax: 1-605-339-0317

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Plus, your investment in Sencore instruments is backed by the best support in the business. Starting with the Sencore News, you get informative articles and tips on how to use your equipment in modern circuits. You also get helpful Tech Tips, Tech Tapes, and field workshops guaranteeing you get the most from your investment. Our obligation and support is just beginning, instead of ending, when you say "yes" to Sencore test equipment.

Start the road to success right now. Call us toll-free at 1-800-SENCORE and we'll get your service center equipped to handle even the toughest troubleshooting challenges.

About Sencore . . .

Sencore was started in 1951, in downtown Chicago, Illinois by R.H. ("Herb") Bowden. As the business grew, Sencore moved west to Sioux Falls, South Dakota. The now second generation business remains in Sioux Falls where Sencore is proud to be actively involved in community events and charities.

Sencore designs and manufactures test instruments that provide the highest quality and reliability in the entire service industry. Every Sencore instrument is engineered to provide you with exclusive tests and capabilities that will make your troubleshooting easier and more efficient. When you invest in Sencore instruments, you also receive the best after-the-sale support available in the service industry.

During the past 40-plus years, Sencore has remained dedicated to one goal—making you more successful in electronic servicing. And since our success depends on your success, we're working even harder to be your test equipment company.

Toll-free access to an entire company

Dial us now. One toll-free number, 1-800-SENCORE (736-2673), connects you to a factory full of "real" people (not a computer) dedicated to making you and your business more successful. We'll answer any questions you have concerning a new product, application of a Sencore instrument, ordering information, or technical service. We're waiting for your call!

One stop shop

We'd like you to make Sencore your "One Stop Shop" for all your test equipment needs. When you invest in Sencore equipment, you invest in an entire company devoted to saving you time and making your job easier. This dedication assures you of the best customer support in the industry from people who care.

Technical Sales Representatives: It all starts with answering your needs as a servicer. Our Technical Sales Representatives will listen to your needs, and work with you to come up with a solution. You'll be talking to a technically-trained person (not just an order taker) experienced with the operation and benefits of the entire Sencore instrument line. Your Technical Sales Representative will become your "friend at the factory" to assist you before, during, and after the sale.

Financing: We'll get you started with flexible investment terms to make your purchase easier, plus we can finance your investment at low rates with payments you can afford. Sencore's own financial division also serves as a highly reputable reference with other creditors.

Application Engineering: Once you've made your investment in Sencore test equipment, our job has just begun. If you need assistance using any of Sencore's instruments, our Application Engineers are just a toll-free phone call away. They're specially trained on the operation and uses of every item in the Sencore line. Our Application Engineers are dedicated to customers and helping solve problems—both before and after the sale.

Service: If your instrument should ever need service or recalibration, Sencore also services what we sell. Our factory service center backs your purchase with quality service that brings your instrument back to the same (or better) specifications as when new. Our top notch Service Department backs your equipment with three-day service, instrument loaners, and toll-free access for help servicing your own Sencore instruments if you choose.

Parts: Genuine original parts ensure your equipment is safe, accurate, and reliable. Our parts department ships orders within 48 hours guaranteeing maximum up-time and productivity from your Sencore test equipment.

Product Delivery: Most Sencore products are in stock and are shipped within 48 hours of receipt of your order-guaranteeing you maximum productivity right from the start. Overnight delivery is available for more immediate needs.

Buyer protection

30-Day Money Back Guarantee: Sencore's no-nonsense 30-day money-back guarantee assures you that you've made the right choice. Every Sencore instrument and accessory is covered by this guarantee of satisfaction. Simply stated:

"If you are not completely satisfied with any Sencore instrument, you may return it during the first 30 days and we'll give you a full refund, including freight, no questions asked."

You're always sure you've made the right decision when you say "yes" to a Sencore investment.

Product Warranty: Every Sencore instrument is warranted for one year against defects of any cause except acts of God and abusive use. During this warranty period, Sencore will correct any covered defect without charge for parts, labor, or recalibration.

Made Right Guarantee: We guarantee your Sencore instrument was "Made Right" or we will make it right without charge for parts and labor for as long as you own the instrument. This lifetime guarantee covers any defects caused by faulty design or workmanship errors. All parts and labor necessary to correct a workmanship defect covered by this guarantee will be at no charge to you. There will be a recalibration and handling charge if the instrument is no longer covered by Sencore's one year warranty.

Easy Ordering—Three Ways To Contact Us

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1-800-SENCORE (736-2673)	1-605-339-0317	Sencore, Inc. 3200 Sencore Dr. Sioux Falls, SD 57107 (605)339-0100 Call 1-800-SENCORE (736-2673)

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- CM2220 – 220 MHz Analyzer
- CM2220 PC – 220 MHz PC Based Analyzer
- CP215 – Color Analyzer

Waveform Analyzing:
- SC3100 – 100 MHz Waveform & Circuit Analyzer

Training:
- TC100 – Self Study Course
- TC100T – Tech Training Programs

Service Support Instruments:
- CR70 – CRT Tester & Restorer
- PR570 – Variable Isolated AC Supply
- LC102 – Cap/Coil Analyzer

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** Based on information from Sencore instrument-users.*

★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

MCM Electronics
650 Congress Park Drive
Centerville, OH 45459
Phone: 800-543-4330
Fax: 513-434-6959

MCM is dedicated to delivering the finest test equipment values in the market today. Names like Fluke, Leader, Hitachi and B&K are recognized leaders in the consumer electronics service industry, and available from MCM.

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MCM publishes two full-sized catalogs annually. The latest issue boasts over 6,500 new products, and features over 67 pages devoted solely to test equipment. In addition, MCM stocks over 30,000 of the most commonly used repair parts, components, semiconductors and tools in the electronics industry. Sales flyers are mailed regularly featuring specially priced items and new product additions keeping the customers up-to-date on the latest available products.

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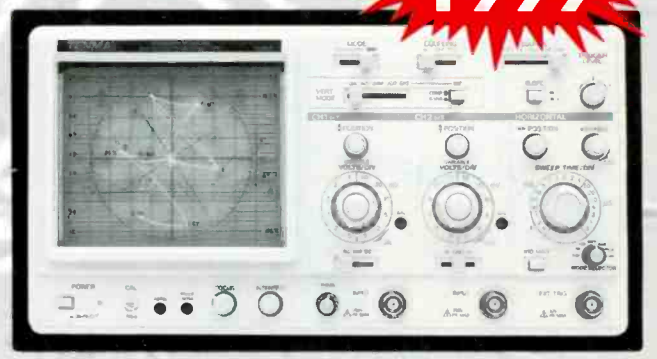

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Wavetek

9145 Balboa Avenue
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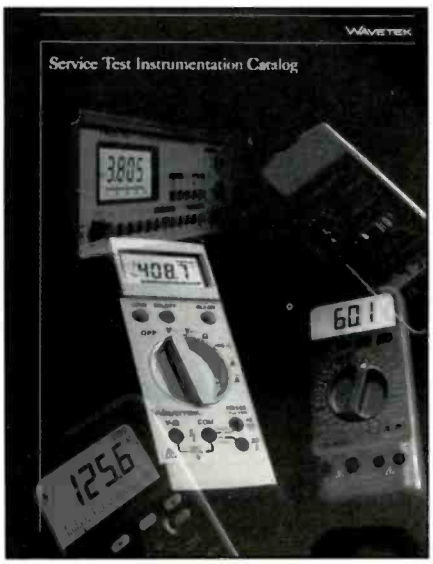
For over thirty years, Wavetek Corporation has been designing, manufacturing and distributing a broad range of electronic test and measurement instruments that are used for the design, service, evaluation, production and maintenance of electronic and electrical devices and systems. With four manufacturing facilities and 17 sales offices worldwide, Wavetek is one of the ten largest test and measurement instrumentation companies in the world.

Wavetek's **Test Tools** division has an enviable reputation for quality and reliability. This comprehensive product line offers meter selections to test a wide range of applications and features for all job requirements. During the past year, Wavetek has introduced several innovative products, demonstrating the company's commitment to the measurement, testing, troubleshooting and servicing of electronic, electrical and HV AC/R systems at reasonable pricing.

The new **XT Series**, six new handheld digital multimeters (DMMs) include five multitesters and one LCR component tester. Two of these meters are brand-new models (85XT and LCR55) and four are newly-enhanced models (23XT, 25XT, 27XT and 28XT). Each XT model is optimized with a unique combination of measuring features; component checking functions such as capacitance, inductance, frequency and temperature are combined with standard DMM features. Additional technician-preferred™ features include easy-to-read oversized characters, auto-off, wide measuring ranges, fully-fused current inputs and input warning beepers.

Also recently introduced are the **2005 & 2015**, two autoranging DMMs. Valuable measuring functions of these new professional class meters include AC and DC volts and amps, resistance, diode test and continuity check with beeper. In addition, the 2015 measures AC in True-RMS mode. The 2005 and 2015 offer to engineers, technicians and plant service professionals superior features such as 4000 count digital plus 42 segment analog bargraph display, manual mode range lock, Max/Min Data Hold and relative compare (Δ) mode.



In addition to its many new and innovative products, is Wavetek's comprehensive line of existing products. The **XL** line of testers is a series of seven DMMs including the CR50, a unique full range capacitance/resistance meter with dual zero adjust. **Models 2030, RMS225**, and heavy-duty models, **HD110, HD110T** and **HD160** all provide engineers and technicians with the highest performance in professional-grade handheld digital multimeters. These meters offer a variety of standard DMM functions, in addition to combinations of frequency counting, capacitance, and intermittent and pulse detection.

Wavetek's new line of Clamp-On DMMs, the **AC60, AC65** and **AD105** expand the company's line of instruments for modern electrical systems. This popular clamp method of meters, whether AC transformer in the models AC60 and AC65 or Hall-Effect transducer of the AC105 allows for both AC and DC measuring, and is non-invasive to allow for quicker and safer current measuring. Wavetek's **CDM600** is a digital multi-clamp for both AC and DC. Using advanced Hall-effect technology, it accurately measures AC and DC current up to 600 Amps without disturbing the electrical wiring. The **CPM Series** are clamp-on, true RMS power analysis meters that combine many electrical meters into one, easy-to-use handheld instrument. It is optimal for electrical technicians installing, maintaining and monitoring electrical systems with linear and nonlinear loads.

Beyond handheld DMMs and component testers is a broad line of additional instruments offered for the professional service technician. Included are bench-mount meters, portable function generators and frequency counters, as well as logic and pulse probes.

An extensive selection of function enhancing options and accessories are also available from Wavetek. The Model TC253 is a temperature converter that allows any brand of Multimeter to read temperatures from –50°C to 900°C (–32.4°F to 1652°F). A variety of temperature probes are available for the TC253 including immersion, surface, air/gas, piercing tip and more.

The **FPC850KIT** is a fiber optic power loss measurement converter. Combined with a Wavetek or any other brand of DMM with a DC millivolt range, the FPC850KIT becomes a low cost test tool for easily and conveniently qualifying fiber optic connections and cables.

Wavetek also offers current clamps, AC/DC, and high-voltage and radio frequency probes for use with multimeters. A large selection of replacement and application enhancing test leads are also available for various requirements.

Unique to the industry is Wavetek's **No Hassle™** warranty program. This warranty gives customers added assurance; any Wavetek DMM requiring warranty service will be replaced at any Wavetek dealer anywhere in the world instantly with an over-the-counter exchange.

With headquarters in San Diego, California, Wavetek sells its products through a worldwide network of representatives, distributors and dealers. For Wavetek's full line catalog of Test Tools products and/or the name of the Test Tools nearest you, call (800) 854-2708.

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If you are involved with designing, building, installing, testing or repairing video displays or video projectors, you should see what we have to offer.

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If you'd like to see how easy we make things, just download our latest VGM software from our website. Use it to create custom test images with the enhanced image editor. If you already have one of our 801G generators, you no longer need a bulky printed user manual. The software includes an on-line user manual, and can also be used as the interface for programming and operating our 801G generators.

Sophisticated testing made simple.

We currently offer two series of video signal generators. Our Model 801G series includes four compact standalone models and three ISA plug-in expansion board models. Over 100 built-in test images let you quickly test virtually every key aspect of a display's performance. The timing accuracy is precise to the pixel.

Our Model 903 features a built-in graphics user interface, disk drive, and expansion capabilities. It can provide pixel clock rates up to 250MHz.

Our generators can be set-up by the user to emulate the signal outputs of many video signal sources. Some of these sources include NTSC and PAL television, HDTV television, various personal computers, graphics workstations, medical imaging systems and military display systems.

We also make video distribution buffers which feature three analog video channels with 200MHz bandwidths and two TTL level sync channels. Our model DBV12-VGA distribution buffer features BNC connectors for the input and loop-through connections.

Color convergence made fast.

In addition to products for generating and distributing video test signals, we also make equipment that lets you analyze the convergence of color CRT displays. Our model CG-1 convergence gauge measures dot, stripe and slot CRTs, both small and large pitch. It "learns" the CRT type within five seconds, and will then measure various locations on the same monitor, or on different monitors of the same CRT type in just one second for each location. It is a standalone system and can be used with any video source that can display white lines on a black background.

The CG-1 system consists of two parts; a pistol-shaped probe and a separate control box. Measure convergence by simply placing the hand-held CG-1 probe on the screen and pulling the trigger. This ease-of-use means even first-time users will get accurate (to ± 0.02mm), repeatable readings on the production line, or in the field. The CG-1 gauge is priced thousands below measurement systems of comparable accuracy.

About Quantum Data.

Quantum Data was founded in 1979. Today its engineering, manufacturing and corporate headquarters are located on a spacious campus setting in Elgin, Illinois, about 40 miles northwest of Chicago. Our products are used, sold and supported throughout the world. For a list of sales and customer service locations just contact us via phone, e-mail or look up our website.

In the time since its founding Quantum Data has been at the leading edge of programmable video test generator technology. Our equipment is the benchmark reference tool for today's leading CRT manufacturers and system developers.

From the beginning, the overriding concern at Quantum Data has been to meet and try to exceed our customers' needs for quality. Our equipment has become the standard for use in many video testing environments because we understand our customers' needs from a variety of viewpoints, such as:

Evaluation Engineering

Establishing the highest quality video display, projector, or flat panel that meets price and performance standards can be difficult and time-consuming for original equipment manufacturers. Our 801 Series is one example of how many major companies are meeting this challenge by creating accurate, repeatable video signals that simplify selection through objective comparison. When you use Quantum Data equipment you are testing to the same rigorous standards and with precision equal to the originating factory.

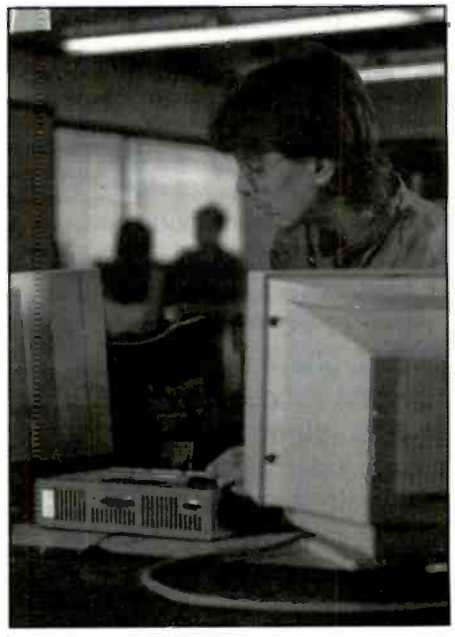
Design Engineering

Determining performance limits and specifications for a new display as well as repairing that display without a proper, reliable video signal is tedious and difficult. Our video generators quickly and easily create the necessary signals and display useful test images so you can immediately start isolating problems. Their usefulness extends to many manufacturer's early design stages where prototype monitors are simulated and evaluated long before the operating hardware is complete.

Applications Engineering

Because our generators are used by so many major manufacturers, you'll find our support team very helpful in assisting you with your needs in virtually any situation.

Quantum Data is ready and able to assist you in building your business with quality products that will help you achieve quality repairs. Just contact us for any further information. ■



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TENTEL Corp.

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More than 9 out of 10 VCR problems are due to mechanical malfunctions!

A VCR contains rubber belts, idlers, gears, brakes, clutches, and tension bands designed to maintain torques and tensions during the various modes; (loading, play, rewind, fast forward, and stop). All are subject to wear.

Each time a tape is played, these components stretch, wear, shift position, and are stressed. Contaminants and even oxygen cause many of these parts to age and break down even without wear.

By the time a VCR requires service, several of these components are often out of tolerance. It's recommended to perform a thorough check of the other mechanical components to determine their operating condition too.

If you merely correct the immediate problem and return the VCR to the customer without a thorough check, there's a high risk that one or more mechanical components will soon either fail or cause erratic operation. The result is a disgruntled and possibly lost customer, and either a callback that wastes time or, the customer just tosses the VCR in his closet and purchases a new one, carefully selecting a different VCR manufacturer (and servicer). It's the same for cars, if you get a "lemon" and the dealer can't fix it properly, the customer will typically change to a different brand.

Every VCR servicer should include a check, and adjustment if necessary, of tape guide heights, holdback tape tension, and numerous torques (including FF, REW, brakes and restoring torques). Each of these checks and adjustments is specified in the service manual for each transport. It is also valuable to check video head wear to see how many more hours of life the VCR owner can expect.

A thorough test and adjustment will allow service centers to do it 'right the first time', and possibly charge a little more money for performing all the tests that should be done anyway. You'll feel more confident with repairs, stop disappointing customers and avoid those dreaded callbacks.

Obtaining proper test equipment will save time in servicing VCRs, allowing higher quality repairs, and avoiding the high cost of callbacks. this provides the best VCR repair value for your hard earned test equipment dollar. ■

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Tucker Electronics

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For over 30 years Tucker Electronics has provided quality, reconditioned electronic test and measurement instruments and environmental chambers to its business customers. The company markets reconditioned products through a comprehensive catalog and guarantees customer satisfaction by offering a 30 Day Return Privilege along with a Standard 6 Month Warranty.

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Based in Garland, Texas, a suburb of Dallas, Tucker Electronics mails over 500,000 catalogs per year to customers around the world. Its catalog is widely recognized as the most comprehensive guide in the test and measurement industry for purchasing reconditioned instruments. The company expects that recognition to transfer to new instruments as it expands its distributor product line.

Tucker's Sales Engineers have extensive test equipment experience allowing them to recommend the right instrument for the customer's application. If the right instrument is not in-stock, Tucker's Broker Group can usually locate it in just a few hours. In addition, the Broker Group spends thousands of dollars daily purchasing surplus or "underutilized" equipment from end-users.

The company operates one of the largest laboratories in the country specifically designed to recondition instruments. The laboratory complies with the provisions of MILSTD 45662A and NCSL/ANSI Z540-1. Once an instrument passes a mechanical reconditioning process, a technician will make the necessary electrical repairs to calibrate the instrument to the OEM's specifications, and issue a Certificate of Calibration traceable to NIST.

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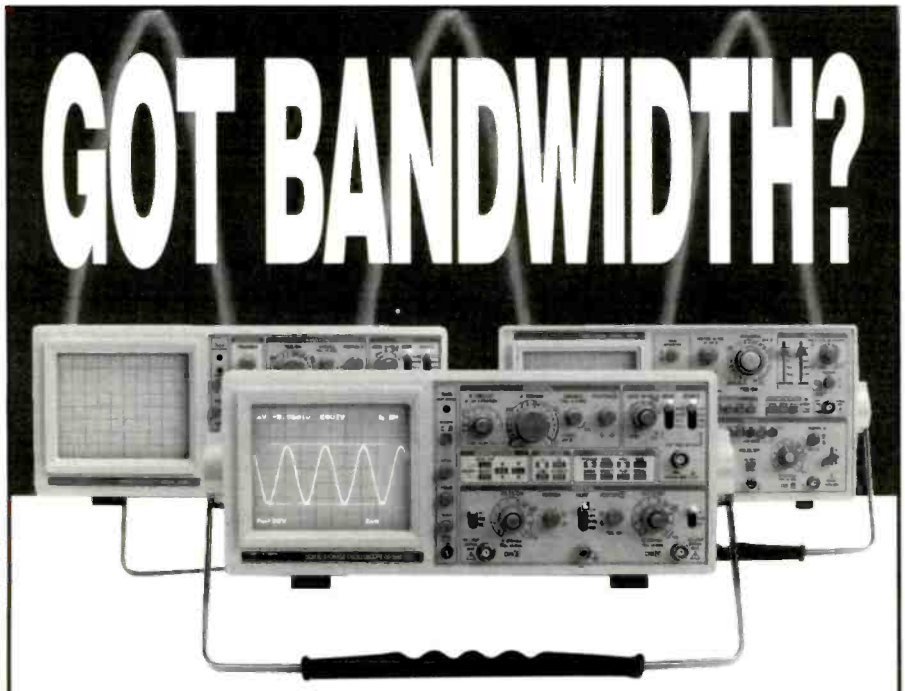

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LG Precision, internationally renowned for its electronic and electrical test products, was founded in Korea in 1976. Since its establishment, LG Precision has made significant progress in the field of test and measurement instrumentation.

In 1988, LG Precision established the marketing and sales of analog and digital storage oscilloscopes, electronic frequency and universal counters, function generators, and multifunction digital multimeters. All of LG Precision's products undergo stringent quality control procedures.

LG Precision can measure its growth and success by the large investment of year end profits that goes directly into their research and development laboratory. Their attention to producing the best product at a cost effective price has given LG Precision a steady growth rate since its inception, with their sales doubling in the last 4 years.

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Each year Parts Express produces a full line catalog, showcasing the complete product offering plus detailed descriptions and specifications. This catalog is supplemented with numerous sales flyers during the year, offering special bargains and hot deals. For more information or to request a free 228 page full line catalog, please call 1-800-338-0531. ■

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Telematic

108-02 Otis Avenue
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Fax: 718-271-5738

Telematic was founded shortly after World War II, at the inception of America's entry into the new technological era, and was a pioneer in television service products during the infancy of the television industry. The company dedicated itself to the design and manufacture of TV service aids and accessories to make servicing more efficient and productive. Telematic constantly added new items as the industry advanced.

The original products were television antennas and installation supplies. Telematic produced a pioneer quick-rig antenna that had all the elements and fasteners on the antenna and could be set up in minutes. The antenna proved to be the sturdiest in the industry. The antenna's sturdiness was proven during a few violent Florida hurricanes when they were the only ones to remain intact.

Other products that followed were multiset antenna couplers, antenna switches, interference filters, tuner subbers, pattern generators and more.

Madison Fielding, a division of Telematic, was the world's first producer of home stereo equipment. The line consisted of stereo tuners, multiplex adaptors, amplifiers and complete receivers.

The test jig

Telematic produced its first the TV test jig about forty years ago. These early jigs were designed to aid in servicing of black and white TV sets. As the industry progressed, the company constantly upgraded the line, adding first a color TV test jig, and then a solid-state version, which remained the standard for over 20 years.

Our present line of test jigs, the 10J106, series has proven to be very popular. There are approximately 25,000 of this version used by all the major brands, such as Sears, Montgomery Ward, Philips, RCA, Sony and others. These service centers find the test jig servicing method a great time and manpower saver.

The Telematic test jig operates on the same principle used by all of the leading TV manufacturers. When a chassis is tested on the production line or in their service facilities, they use a monitor that consists of a yoke/CRT and related equipment.

Telematic test jigs add a few important improvements. Our jigs have a switching system that, together with the recommended adaptor, makes it possible to check any make or size of TV with a single universal test jig. This versatility affords the service center productivity and efficiency similar to that achieved by the manufacturers.

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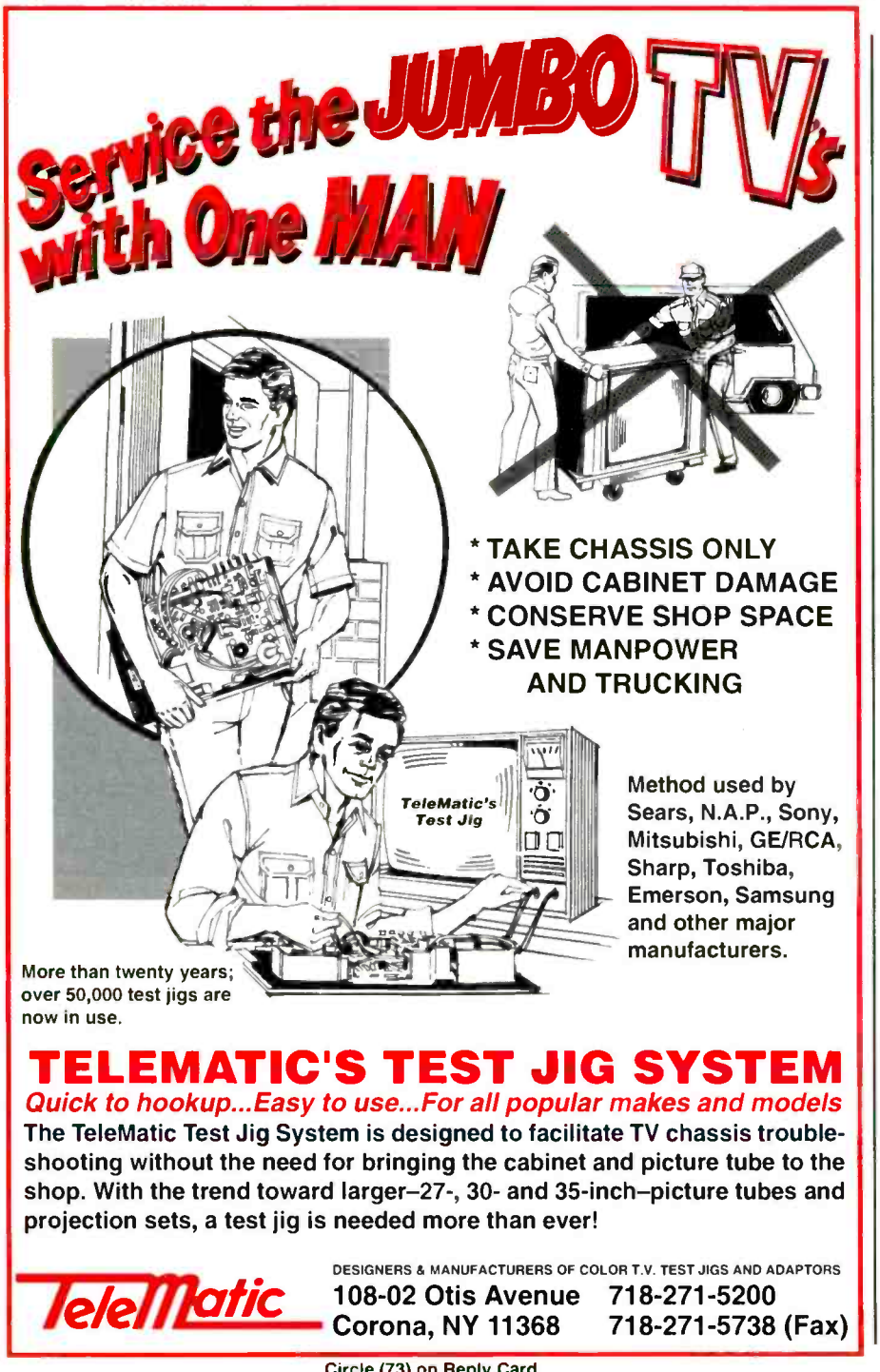
For further information, or if you have any questions, call 718-271-5200, or fax us at 718-271-5738. ■



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★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

Global Specialties

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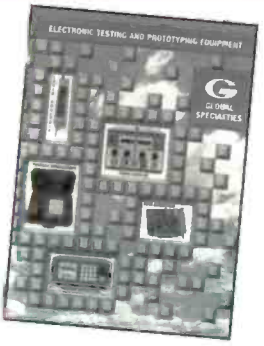
Fax: 203-468-0060



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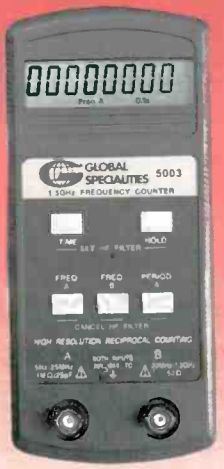

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RNJ Electronics, Inc.

805 Albany, Ave., PO Box 528
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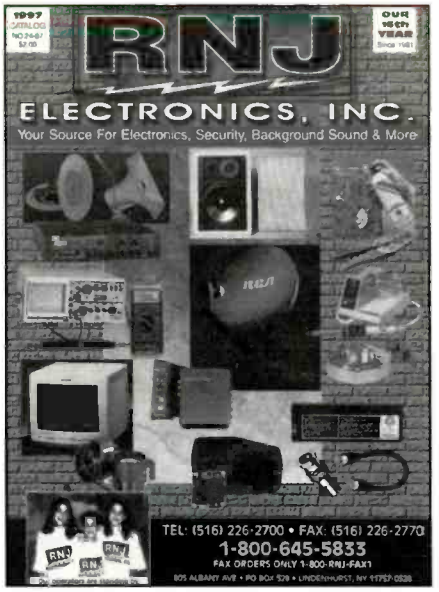

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Test Your Electronics Knowledge

A review

By Sam Wilson

Sam Wilson is currently busy with other urgent projects, and was therefore unable to prepare What Do You Know About Electronics/Test Your Electronics Knowlegde *for this issue. This is a reprise of an article that appeared in a previous issue.*

The questions in this TYEK are from articles that appeared in **ES&T** between January and October 1990. These are very easy questions so you will likely score high.

1. The letter I in PIN diode stands for
   A. Implied
   B. Inter
   C. Inner
   D. None of these choices are correct.

2. The circuit of Figure 1 was given in an article titled "Thyristors from A to Z" by Lambert C. Huneault. The article was in the February 1990 issue of **ES&T**. As explained in the article, if there is an internal (anode/cathode) short in the SCR the FM stereo lamp will be:
   A. ON all the time.
   B. OFF all the time.
   C. destroyed.

3. When a customer's radio, which glitches and distorts at home, works just fine in the shop, one of the first things to suspect is
   A. AGC
   B. RFI
   C. BFO
   D. AFC

4. The symbol in Figure 2 is for a _____.

5. The time rate of doing work is called _____.

6. Regarding frequency counters, time base stability and resolution determine _____.

7. Noise caused by the random movement of electrons across a potential barrier, such as a transistor or vacuum tube, is called _____.

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

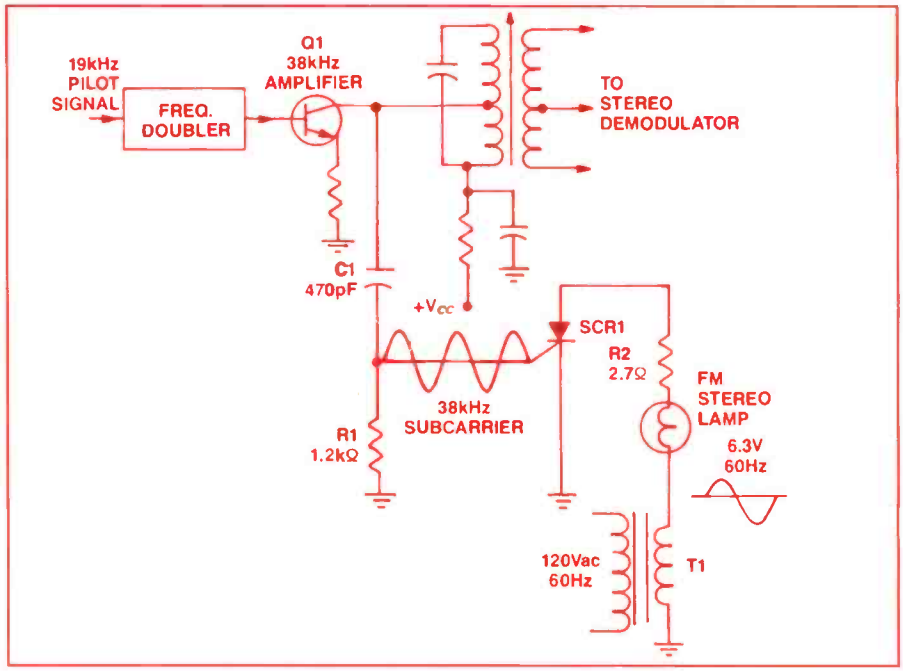

Figure 1. If there is an internal; (anode to cathode) short in the SCR, will the FM stereo lamp be on all the time, off all the time, or will it be destroyed?

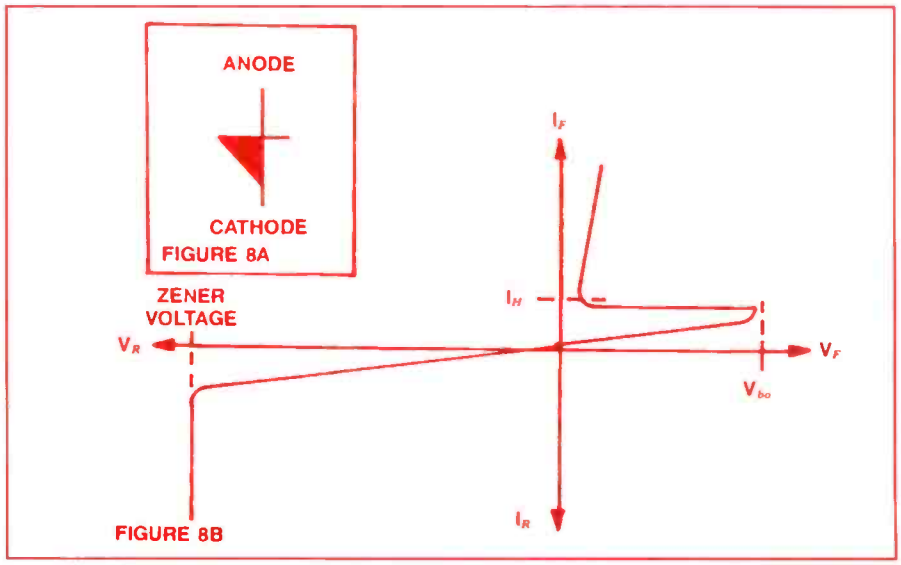

Figure 2. What electronic component does this symbol (8A), which has a characteristic curve as shown in 8B, represent?

8. A rapid variation in signal strength of a signal being received from a mobile 2-way radio unit is called_____fading.

9. From an article titled "Servicing Modems," by Glenn R. Patsch—if you cannot get a dial tone, but do see the RD (Receive Data) and SD (Send Data) lights flash, suspect the_____.

10. A bathtub curve is described in an article titled "10 Steps to Prevent Equipment Failure," by John Shepler. The curve shows that:
   A. Most failures occur right away when the equipment is first used.
   B. Failures approach 100% when age begins to take its toll.
   C. Both choices are correct.
   D. Neither choice is correct.

(Answers on page 59)

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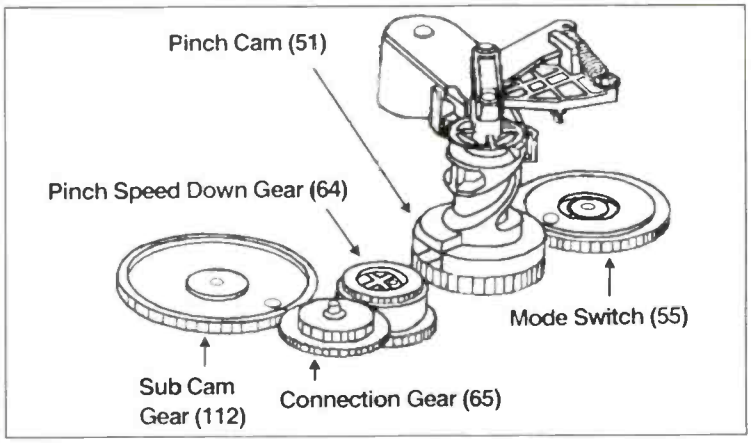

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Consumer electronics industry to experience 37% growth by new millennium

The Consumer Electronics Manufacturers Association (CEMA) projects that the consumer electronics industry will experience approximately 37 percent growth between 1995 and the year 2000. Communication information products, direct broadcasting systems (DBS), home theater, and digital video products will lead this impressive growth.

CEMA calculated that $63.2 billion of consumer electronics products were sold to dealers during 1995. By the year 2000 that number should escalate to $86.4 billion. Consumer electronics factory sales should reach $66 billion by year end.

"Digital video products such as digital versatile disc (DVD), high-definition television (HDTV) and digital camcorders will add another $5 billion in sales for this dynamic industry by the year 2000," commented Gary Shapiro, CEMA president. "Beyond digital video, expect to see converged Internet products such as WebTVs, new multimedia products like PC/TVs, flat-screen plasma TVs, and PCS (personal communications services) phones hitting the market in massive numbers as manufacturers develop evermore innovative products. By the new millennium, consumers will discover a host of new products to enhance their lives and their businesses."

"The U.S. consumer electronics market is one of the fastest growing sectors of our economy. We continue to keep factories humming at home and abroad. Of the $66 billion in sales projected for this year, more than $32 billion of that total will be produced or assembled in U.S. factories, employing some 180,000 people," said Shapiro. "Current trading statistics also show that American-made consumer electronics products are on the rise. Consumer electronics imports during the first half of 1996 fell nine percent compared to the same time period for 1995 ($8.396 billion compared to $9.205 billion). Exports, on the other hand, rose five percent from $1.955 billion in 1995 to $2.044 billion in 1996."

Sales of home information equipment will total $26.7 billion in 1996, up 14 percent from 1995. Already in 40 percent of American homes, PCs will continue their sizzling sales pattern this year, increasing by 12 percent to 9.4 million units. The 900MHz cordless phone market is exploding this year reaching 2.9 million units in 1996 and 4.4 million units in 1997.

Building on communication information products for the home, wireless communications products are also growing tremendously this year. In June of this year, household penetration of cellular phones reached 32 percent; cellular phone sales should jump 16 percent to $1.7 billion in 1996. Pagers also pushed past the one quarter mark in household penetration this past June and will rake in $370 million in sales by the end of the year.

The fastest selling consumer electronics product in the history of the industry is the Digital Satellite Systems (DSS) receiver. DBS sales will skyrocket this year to 25 percent above 1995 sales, totaling $1.6 billion by year-end.

Home theater continues to spur growth in both the audio and video markets. Home theater related video products will average eight percent annual dollar sales growth through the year 2000. Dollar sales of home theater audio products will grow nine percent each year through the end of the decade. During 1996, home theater audio products will be fueled by a 30 percent increase in home theater speaker sales and a 10 percent increase in surround sound receiver shipments. Overall, home and portable audio products are expected to see sales of just under $6 billion this year.

CEMA expects total TV unit sales to reach 26.7 million in 1997. In 1996, owing to the home theater craze, sales of sets 25 inches and larger will grow seven percent, including a 28 percent increase for models 30 inches and larger. Stereo TVs will account for 49 percent of total direct-view TVs sold, a three point share increase over 1995. Overall video equipment sales will total more that $19 billion by the year 2000, an increase of 28 percent above 1995 sales.

Aftermarket mobile electronics equipment sales will rise six percent in 1996 to $4.4 billion and 10 percent to $4.8 billion by 1997. As factory installed autosound sales drop to $2.5 billion for 1996 (from $3.1 billion in 1995) and more vehicle manufacturers offer cars with only optional mobile electronics products, retailers should be able to capitalize on the trend, boosting sales of autosound aftermarket in particular.

Accessories should also have a solid year-end for 1996 with $982 million in sales. Adding to those necessary extras for consumer electronics, battery sales should hit $2.7 billion and blank media sales should reach $1.4 billion.

HDTV, DAR, cable, computers and telecom capture the spotlight at digital engineering conference

Digital technology is rapidly changing consumer electronics, and this year's Digital Audio and Video Workshop demonstrated just how digital technologies such as high definition television (HDTV), digital audio radio (DAR), digital versatile disc (DVD) and others are affecting the traditional worlds of audio and video. Sponsored and managed by the Consumer Electronics Manufacturers Association (CEMA) with the participation of the Consumer Electronics Society of the Institute of Electrical and Electronics Engineers (IEEE), the four-day Workshop offered marketing and engineering managers an in-depth preview of future consumer electronics technologies and the way they intersect with service provider developments.

"Our Workshop brings some of the best minds in digital engineering together to discuss the latest developments in consumer electronics," said George Hanover, vice-president of engineering for CEMA and co-chairman of the Workshop. "More than 30 industry professionals examined how the industries of broadcasting, computers, telecommunications, consumer electronics and cable are converging on the digital audio and video engineering world for Workshop attendees."

Addressing the audio side of consumer electronics, a panel of three experts spoke on the state of DAR. Michel Tremblay of the Canadian Association of Broadcasters explained the Canadian launch of DAR at L-Band with the Eureka system in mid-1997. Established as an eventual

replacement for AM and FM service in Canada, DAR should rejuvenate radio as a communications medium and open up new revenue streams for broadcasters, according to Tremblay. By the year 2000, 350 million people will have access to DAR around the globe, due mainly to European, Asian and Canadian service implementations. Several DAR consumer receivers are available now, and a host of new receivers should be launched during Internationale Funkausstellung (IFA, Europe's bi-annual consumer electronics show in Berlin) in August 1997.

Tom Keller, a CEMA consultant, discussed the results of the two in-band on-channel (IBOC) DAR systems by the National Radio Systems Committee (NRSC). He demonstrated the problem of adjacent channel interference that may result from the energy generated by the IBOC systems out of band.

Scott Wright of Delco Electronics then explained how the Eureka system, now being implemented in Europe, could be optimized for the U.S. market through time division multiple access (TDMA) technology. Eureka can be implemented in any frequency band above 30MHz and does not need to be set at L-band only, according to Wright.

Following the DAR discussion, Dr. Richard Cabot of Audio Precision reviewed some basics of digital audio technology, including sampling theory and quantization, converter technologies, interface compatibility issues, the effects of sampling jitter, and the operation of low-bit-rate coders.

During the tutorial section of the Workshop, three members of the Interactive Media Technology Center at the Georgia Institute of Technology, Edward Price, John Guffey and Michael Sinclair, went online live to show state-of-the-art audio and motion video on the Web. Music from Web sites in various countries was demonstrated as well as interactive video and even virtual reality. Advantages and drawbacks were discussed.

Building on the tutorial, industry professionals discussed near-term applications of the Web for communications, transactions and entertainment and how the Internet will get to the consumer's home beyond the traditional telephone company line. Representatives from Comcast, Matsushita, Zenith, Arthur D. Little and the media shed new light on Web malls, Web appliances and cable Web services. In a lively session, moderated by Gary Arlen of Arlen Communications, the panel predicted a radical change in content of the Web with more audio and video online entertainment as well as faster response time.

James McKinney, a guest luncheon speaker, discussed WHD-TV, the model HDTV station sponsored by CEMA and the Association for Maximum Service Television. The following day, Robert Graves, chairman of the Advanced Television Systems Committee and the Workshop's keynote speaker, focused on the need for an HDTV standard and how HDTV will work with computers and telecommunications.

During the consumer electronics session, Jack Fuhrer of Hitachi discussed methods for implementing an all-format video decoder as the way to make standard TV sets viable; Mikhail Tsinberg of Toshiba talked of future DVD applications; Michael Isnardi of the David Sarnoff Research Center probed into compliance testing of MPEG decoders.

Cable and video engineers presented the differing digital cable standards now coming to market, discussing program supplier and headend requirements for digital video standards and the unique problems faced when transcoding material intended for computer display. David Wachob of WorldGate Communications noted that only 35 percent of U.S. households have PCs and only 11 percent are connected to the Web. He said that PC complexity and obsolescence are the main factors in slowing down PC acceptance in the home and offered solutions based on merging PC features with television receivers and using cable modems.

During the telecommunications session, representatives from Lucent Technologies, Next Level Communications and ABL Canada focused on the advantages fiber optics bring to digital video, especially its delivery into the home. The session also looked at current progress on deploying digital video services in public telephony networks, including applications for distance learning, teleconferencing and consumer broadband digital services. ■

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What do you know about electronics?

Did you know that the volt is a measure of work?

By Sam Wilson

Sam Wilson is currently busy with other urgent projects, and was therefore unable to prepare What Do You Know About Electronics/Test Your Electronics Knowledge *for this issue. This is a reprise of an article that appeared in a previous issue.*

In the past I have been a little careless about my definition of voltage. Alert readers have asked me to be more specific. The complaint is about my statement that *voltage is a unit of work*.

Actually, the statement should be *a volt is a unit* period. It is a difference of potential between two points. A volt is a unit just like an ampere and an ohm.

Voltage is not a force, nor is it an electromotive force. If it was any kind of force you would need to know how far a resistor is from the source of voltage before you could calculate the amount of current through that resistor.

Work

Before I go any further, I have to review the managing of the term *work* as it is used in science. In equation form:

$$WORK = W = Fs$$

Where F is the force exerted on some object and s is the distance the object moves as a result of that force. All of the entries in the equation have to be expressed in the same system of units such as the MKS (Meter-Kilogram-Second) system or the British system (Foot-Pound-Second). For example, if the force is in pounds and the distance is in feet, then, the work as expressed in pound-feet.

If you push a box across a floor, the work you do is easily calculated by multiplying the force you use by the distance you move it. However, if you carry the box horizontally between two points there is no work done because you are not exerting a force on the box. (This assumes you have already started the box. The two points are not the starting or ending points.) I know that will cause a lot of concern because you will probably feel like you have worked when you carry the box.

I am likely to get mail from readers on that subject. They will say that you have to get the box started with a force. However, in the scientific sense once you get it started it takes no force to keep it going.

According to Newton's second law of motion: *a body at rest remains at rest, and a body in motion continues to move at a constant speed along a straight line unless acted upon by an unbalanced force.* Of course, you did work when you lifted the box, but, you do not work in moving the box across the floor.

Unit charge

The second thing I want to review is the term *unit charge*. In science, the unit charge is a coulomb. If you squeeze 6.25×10^{18} electrons into a ball, the total negative charge of the ball will be one coulomb. In the following discussion you should think of the unit as being that negative ball.

Energy

The third thing I want to review is the term *energy*. In science *energy is the capacity to do work*. In some literature energy and work are represented by the same units of measurement. However, some authors make a valiant effort to avoid confusion by changing the names of the units a little bit. For example, they call the unit of work (in British System) "foot-pounds" and the unit of energy "pound-feet." I don't want to go into that any further—at least not at this time. Just remember the above definition of energy.

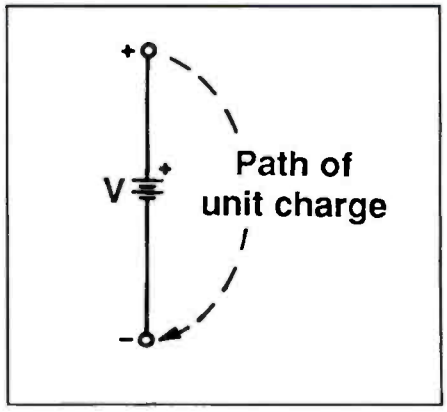

Figure 1. Work is required in order to move the unit charge shown here from a point of higher potential to a point of lower potential.

What is voltage?

Having reviewed those points, we can proceed with the true meaning of voltage. Consider the battery (shown schematically) in Figure 1. Assume you are going to move a unit charge from the positive terminal to the negative terminal along a path shown by the broken line.

You are going to have to exert a force on the unit (negative) charge to get it away from the positive terminal because unlike charges attract.

Likewise, you will have to do work on

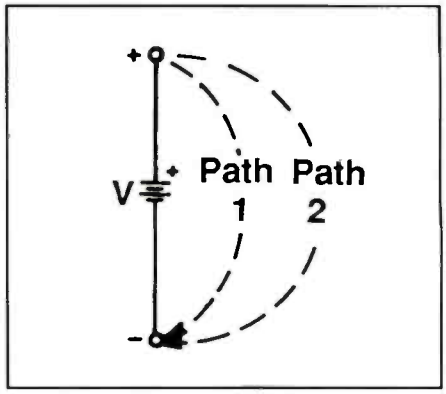

Figure 2. Even though one path in this case is different from the other path, the amount of work done in moving the unit charge is the same.

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

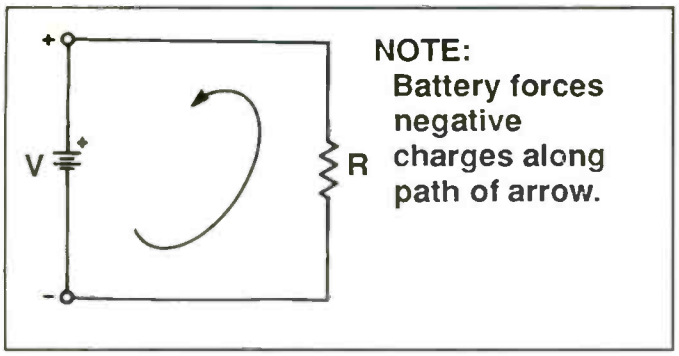

Figure 3. The battrey voltage causes negative charges to flow, as indicated by the arrow. The resistor, R, offers opposition to the motion of the charges.

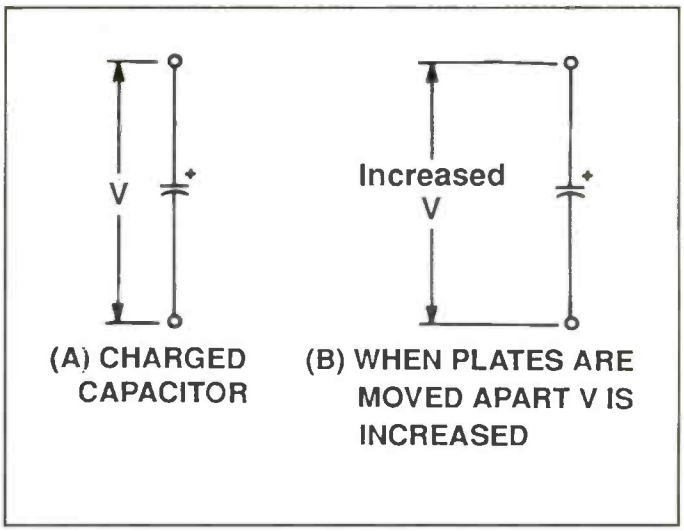

Figure 4. In order to move the plates of a charged capacitor apart, you have to do work ➔

the unit charge to force it to move to the negative terminal because like charges repel each other.

So, you have to exert a force on the unit charge to move it through the distance shown by the broken line. *Voltage is the amount of work done in moving a unit charge from a point of higher potential to a point of lower potential.*

The positive voltage is considered to be the point of higher potential and the negative terminal is assumed to be the point of lower potential. That is the true meaning of voltage.

Now, suppose you decide to move the unit charge along a different path as shown by the second broken line in Figure 2. The average amount of force will be lower along the way, but, the distance is greater. The work done (force times distance) in moving the unit charge along the two paths is the same.

Calculating work done

Let me give some arbitrary numbers to demonstrate that point. Suppose the average force is 10 units and the distance is 2 units for path #1. (See Figure 2.) Then:

$$W = Fs = 10 \times 2 = 20$$

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You do exactly the same amount of work in both cases, so, the voltage between the points is the same in both cases. This is a very important point:

The work done in moving a unit charge from a higher potential to a lower potential is the same for a voltage source regardless of which path you take. That is why voltage is expressed as the work done in moving a unit charge from one point to another.

Batteries and work

You have, no doubt, heard that a battery is a source of electric energy. That simply means it has the ability to do work. For example, the battery can move a negative charge from the negative terminal to the positive terminal. This is illustrated in Figure 3. In this case the resistor offers the opposition to the motion of the negative charge.

Charged capacitors and work

In the same way, a charged capacitor is a source of stored energy. It can also move a negative charge around a circuit.

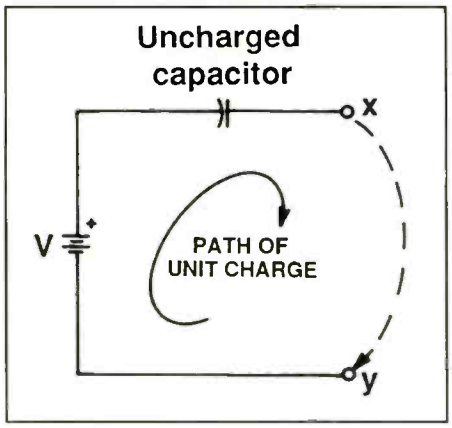

Figure 5. You have to do work to move a charge from terminal "x" to terminal "y" in this cicuit. Therefore all of the voltage drop in the external circuit is between those points.

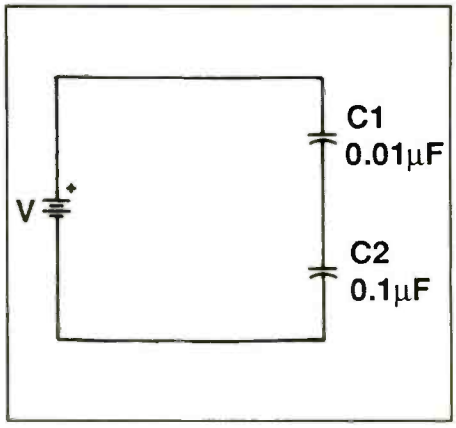

Figure 6. Why is the higher voltage in this circuit across the lower value of capacitor?

When you move the plates of a charged capacitor apart, as shown in Figure 4, you must do work. The plates are oppositely charged so they are attracted to each other. To move the plates apart you must overcome that attraction. So, you exert a force through a distance. You are doing work. That work shows up as an increase in the stored energy.

In other words, the voltage across the capacitor *increases*. Putting it another way, it would take a greater amount of work to move a unit charge from the positive plate to the negative plate after the plates have been moved apart.

Suppose you move a unit charge from the positive terminal of the capacitor to the negative terminal in the circuit of Figure 5. You do not need to exert a force to move the charge from one plate of the capacitor to the other. The capacitor is uncharged, so, the potential on both of its plates is the same.

You do, however, have to do work to move the charge from terminal 'x' to terminal 'y'. Therefore, all of the voltage drop in the external circuit is between those points.

Why is the higher voltage across the lowest value of capacitance in Figure 6?

Assume the capacitors have the same type of dielectric. Then, there are two ways to get a lower capacitance value for C_1. You can place the plates further apart, or, you can use plates that are smaller in the facing area.

If the plates are farther apart you have to go a longer distance to move a unit charge from one plate to the other.

$(W = F \times s)$

Saying it another way, an important equation for capacitors is Q=CV, where Q is the charge, C is the capacitance, and, V is the voltage across the capacitor. That can be written as:

$V = Q/C$

That means the voltage is inversely proportional to the capacitance. In other words, the lower the capacitance the higher the voltage.

Sharpening your concepts

You can call a camel that has one hump a Bactrian camel, but, that won't cause it to have two humps.

My point is that it is important to know the true meaning of technical terms (like volt and ampere) in order to really understand how some basic systems operate. That doesn't mean you have to give up your models. However, you should be willing to give them up when you find they don't work for specific cases.

For example, the idea that voltage is a force just doesn't work when you are trying to understand how a parametric amplifier works. The idea that a capacitor is charged by poking electrons into one plate and sucking them out of the other just doesn't help to explain how a capacitor can be charged by using an electret.

In these specific cases, be willing to recognize that the models we use to understand some facets of electronics are just that: models. They enhance, and make concrete our understanding of certain aspects of electronics, but electronics doesn't *really* work the way the models imply that it does. ■

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LITERATURE

Replacement semiconductor web site

NTE Electronics has established a supplier-based web site created exclusively to satisfy the increasing demand for small quantities of electronic components used in the MRO, OEM, and consumer repair markets. By accessing http://www.nteinc.com, electronic professionals, especially those working in small to mid-size companies, have a resource for products and information that is often hard for them to obtain because of allocation, discontinuance, or obsolescence.

The web site is owned and operated by NTE, which enables the company to provide continuous updates and timely information. The web site runs on a Sun Microsystems Netra Internet server with access via a high-speed T1 communications line, allowing information to be accessed and downloaded quickly.

The web site features include:

- Product information and selector guides on all of the company's product lines, with links planned to their product library of full data sheets.
- Location of the nearest distributor, with active links to those that also have web sites.
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Distributor announces web site

Herman Electronics, electronic parts distributor in Miami, announces Internet access to their web site. Customers may now view a huge assortment of broadcast and service parts and accessories, learn something about the company's 35 year history, and actually place orders, by secure credit card transactions or open an account directly.

The programming for this new web site, http://gateintl.com/hermanelec is the latest available, with moving images and the most sophisticated technology available to date.

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Test Your Electronics Knowledge

Answers to test *(from page 50)*

1. D—The I stands for Intrinsic. The total acronym stands for Positive-Intrinsic-Negative. It refers to the way the diode is constructed. (**ES&T** January 1990—"TYEK").

2. A - Draw a short circuit across the SCR. Observe that the lamp is directly across the secondary of T1.

3. B - In an article titled "Solving RFI Complaints - Part II, " by John Shepler one of the first things to suspect is Radio Frequency Interference. (**ES&T** March 1990 - "Solving RFI Complaints - Part II")

4. Shockley Diode. It is described in an article titled "Thyristors from A to Z—Part II" (**ES&T** April 1990). It is defined as a PNPN 2 - terminal thyristor. It is also called a Four-Layer Diode (FLD).

5. It is called power (by definition). (TYEK—May 1990).

6. Accuracy of measurement. ("Selecting a Low-Cost Counter," by Mark Mullins—June 1990).

7. Shot - This definition appeared in an article titled, "An Electronics Servicers Vocabulary," by Conrad Persson. (**ES&T** July 1990.)

8. Raleigh. It is a form of multipath distortion caused by varying lengths of signals as the signals bounce off various objects. A good example is when the mobile unit is on the move in downtown areas. (**ES&T** August 1990).

9. Phone line jack—(**ES&T**— October 1990).

10. C—(**ES&T** October 1990).

Extremely weak, distorted sound

The audio was weak and distorted in the left audio channel of an RCA CTC167CN TV set. I injected a 3kHz (audio frequency) signal from the signal generator into the left audio-in jack (J1403). I traced audio signal through the audio switch (IC1402) to the output pin 3 of the volume control IC (U1801) with the scope. Everything was normal up to that point. A check of the left channel showed that to be normal as well.

According to the schematic, both right and left output jacks were taken ahead of the sound IC (U1900). I checked the audio waveform at pin 8 of the sound output IC. This waveform appeared to be weak and distorted (Figure 14).

Sound was weak on output pin 8, but it was normal on the positive terminal of C1901. I replaced C1901, a 1µF electrolytic capacitor. This restored the distorted and weak left channel to normal.

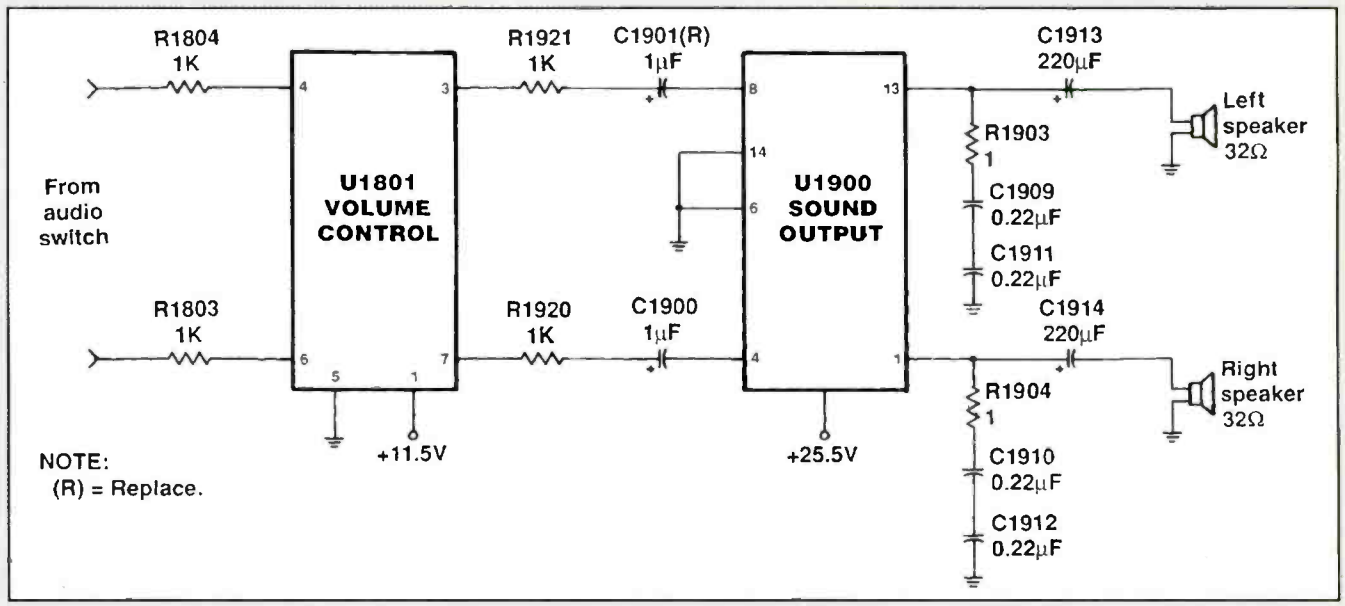

Figure 14. Open capacitor C1901 (1µF) coupling capacitor caused the output of the left channel to be weak and distorted.

occurs. When distortion is found at the output, or collector, of a transistor, but not at the base, or at the output of an IC, but not at the input, you have located the defective stage (Figure 11).

Once you have isolated the problem to a particular stage, carefully measure voltages at all transistor and IC terminals. A leaky transistor may have lower than normal collector and base voltages. Check the forward bias voltage between base and emitter terminals. Improper forward bias indicates a defective transistor. When a leaky transistor is located, check the base and emitter bias resistors for correct resistance. If in doubt, disconnect one end of each resistor from the circuit and test for correct resistance.

The defective audio IC

In the case of an IC-based audio system, after determining where channel distortion is occurring, signal trace the input and output pins of the suspected IC. If the injected signal is normal at the input and distorted at the output, suspect a defective IC. Measure voltages at all pins of the IC and compare them with the values specified on the schematic.

If you don't have a schematic of the product, locate the specifications for the IC in an IC catalog, and compare the measured values with those published in the catalog for that audio IC. Check each resistor and capacitor tied to each pin of the IC to determine if they are of the correct value and/or leakage before removing the existing IC and installing a replacement. Always use voltage and resistance tests to make sure the suspected IC is defective before going through the time-consuming process of desoldering it and installing a replacement. ■

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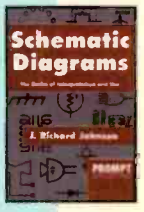

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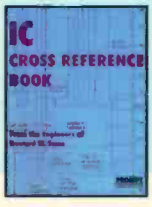

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RCA service data electronics books 1966 to 1978. RCA wireless phonograph, 6J. *Contact: Ann Bichanich (Jay's), 15 1/2 W Lake Street, Chisholm, MN 55719.*

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Sencore SC3100 Auto-Tracker, 100MHz waveform circuit analyzer, $2980.00. Sencore SG80 AM/FM stereo analyzer, $3350.00. Both brand new in box. *Contact: Jim Hunter, 707-224-4566 or Fax 707-259-8010.*

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Photofact 229 through 1854, most sets complete. Send for list. *Contact: Robert Weidman, 612 W. 7th Street, Hanford, CA 93230, 209-582-2083, Fax: 209-582-0748.*

Zenith service literature 1965 through 1985, $100.00. Other misc. service literature and some test equipment. *Contact: Paul's TV, 260 Main Cross, Charlestown, IN 47111, 812-256-3119.*

Commodore 64 SX computer. Zenith VR5100 portable stereo hi/fi VCR with color camera - two batteries, tuner/timer, charger, rain jackets. Old TV tubes and other parts. *Contact: Joseph Sanfilippo, PO Box 347, Arbor Vitae, WI 54568, 715-356-6004.*

Heath digital electronic course with trainer, parts and meter, cost $300.00, will sell for $110.00. *Contact: Daniel Seidler, 3721 W 80 Street, Chicago, IL 60652, 312-284-8221.*

Leader LBO-516 scope, 3-channel 100MHz $550.00, Leader LBO-518 scope, 4-channel 100MHz $600.00. Keithley 179A true RMS bench multimeter, 4.5 LED digits, manual ranging $150.00. All in good condition. *Contact: Frank, 516-669-0283.*

Sencore VA62A and VC63 video analyzers, boxed with all leads, $1200.00. Plus Heath 40MHz scope with leads, $400.00. *Contact: 718-829-9213.*

Sams Photofacts TV and radio service manuals, $7.00. Good originals. Send Sams or brand models. Can confirm and reserve the one you want. *Contact: William Miler, 2693 Fox Hill Drive, Camby, IN 46113, 317-831-0896, e-mail: eagle@trader.com.HTTP://www.trader.com/users/5010/5491/sams.htm.*

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Sony KV-32SXR10, need bezel (front escutcheon) *Contact: Wayne's TV, 4801 E. Judge Perez Drive, Suite B, Violet, CA 70092, 504-277-6735 (call or fax).*

Magnavox TV C85, need flyback transformer part 3618460003, or 361846-3 (new or used) *Contact: Harold James, 419-684-7622.*

Antenna switch for Heath 45 inch projection TV model GR-4600, part number GSZ-4600. *Contact: Carl's Electronics Service, 3710 "M" Avenue, Anacortes, WA 98221, 306-293-5386 (phone), 360-299-8297 (fax).*

Schematic service manual, and technical upgrades for Tanberg TIA3012 integrated amplifier. *Contact: Jack Williams, 5001 Edmonston Road, Hyattsville, MD 20781, 301-864-4164 (phone/fax).*

Panasonic VCR model PV-4760, need schematic. Photocopy OK. *Contact: Aby K. Paul, 111N Broadway, #A1, White Plains, NY 10603, 914-288-0675.*

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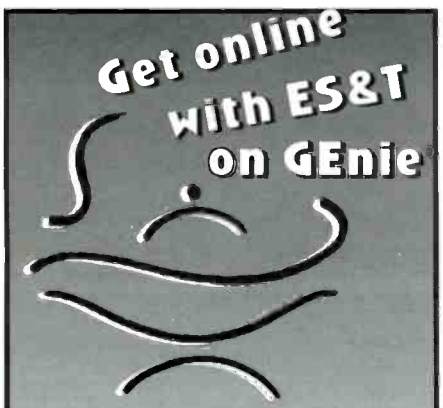

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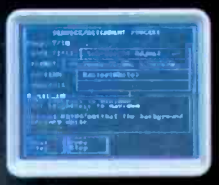

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