

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

# ELECTRONIC<sup>TM</sup>

Servicing & Technology

December 1997

Troubleshooting Techniques

Replacement parts/Servicing Information

## Test Equipment Showcase



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# ELECTRONIC

## Servicing & Technology

Volume 17, No. 12 December, 1997

### Contents

#### FEATURES

##### 8 Troubleshooting techniques: Testing and troubleshooting the VCR

By Stanely J. Nawrocki

Once the basic principles of the VCR are mastered the technician can apply that information in the testing, troubleshooting and repair of the unit. A logical approach should be developed to insure that the problem is resolved efficiently. In this article the author recommends an approach to help you do this.

##### 10 Replacement parts/servicing information sourcebook

By The ES&T Staff

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 tools to help them overcome these kinds of servicing problems.

#### Special Advertising Supplement

##### 18 Test Equipment Showcase

By The ES&T Staff

This special advertising section was

conceived as a way to help bring more information about test equipment providers to readers. Every advertiser in this section has been given additional space to tell readers something about their company, or to help readers understand the value and use of the company's products. We invite you to read what these companies that sell test equipment have to say about themselves and their products.

#### DEPARTMENTS

2 Editorial

4 News

6 Literature

27 Profax

50 Electronics Quiz

52 Products

53 Photofact

53 Books

54 About Electronics

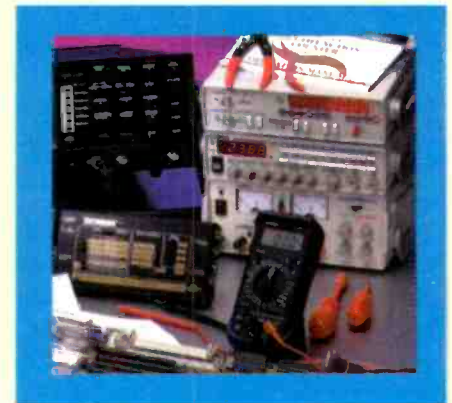
57 Calendar of events

58 Classified/Reader's Exchange

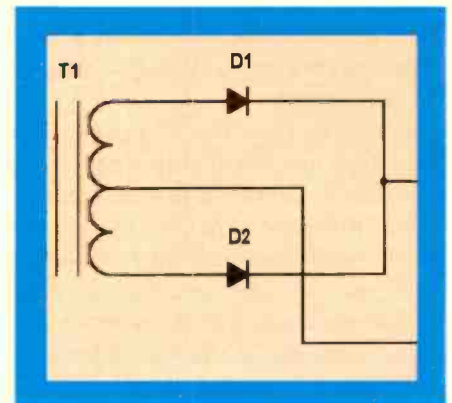
60 Advertiser's Index



page 8



page 18



page 50

#### ON THE COVER

Most of the activity that takes place within an electronics product has no visible effect on the outside world. For that reason, technicians require a variety of test devices to determine what's going on in the circuitry, and what's going wrong. Test equipment manufacturers tell you a little more about themselves and their products in this Test Equipment Showcase. (Photo courtesy Tenma)

# Quizzes

What is it about taking a test that causes an emotional reaction in us humans? If it's a test that's going to be graded and considered as part of a grade in a course, or a test that will determine our eligibility to hold a particular job, or to enter a particular school, the emotion is one of dread. On the other hand, if it's a test that's just done for fun, to see how much we know, or don't know, the emotion is one (generally) of eagerness to face the intellectual challenge. Or why are trivia questions so popular?

For most of us, the fun of taking such a quiz depends on the degree to which we're interested in the subject matter, and our familiarity with it. For example, if most of us adults who are involved in consumer electronics servicing ran across a trivia quiz that had to do with alternative music, or the denizens of Melrose Place, our reaction would probably be "who cares?" But faced with a quiz on the subject of electronics and related subjects, we're ready to challenge ourselves, and to compare our knowledge with our colleagues.

That's the kind of feedback we generally get about the quiz "What Do You Know About Electronics?," which appears regularly in this magazine. A number of readers have told me that whenever the latest issue of **ES&T** is delivered, they make copies of the quiz for everyone in the service center, even the front desk people who are not technically oriented. Everyone takes the quiz, then they compare answers, then check their answers against the answers given in the magazine.

It's really great that so many people find those quizzes so interesting.

In this issue of **ES&T**, there's a somewhat different kind of quiz. Oh, the subject matter is the usual, but there are a lot more questions. As described in the text of the brief article that describes the quiz, these questions are extracted from the official list of questions that was presented to the participants in the Electronic Product Servicing Competition segment

of the VICA (Vocational Industrial Clubs of America) Skill Championships that were held in Kansas City in 1996.

The young men and women who took this test as part of those championships had a great deal at stake. The winners of the championships (which included actual hands-on product servicing and electronics construction as well as the written quiz) would go on to represent the United States in international competition. Not only that, but they were also eligible to win prizes, including a full scholarship to a prestigious technical college, gifts of test equipment or tools, and even a year's subscription to this magazine.

We have included the quiz so that current electronics technicians can see the kind of information that up and coming technicians are expected to know. I suspect that most of you will be pleasantly surprised to find that you know a lot of this stuff. It's pretty basic information, and in spite of all the gee-whiz new technology, the basics still apply.

As I point out in that article, I was given the questions for the quiz, but not the answers. So the answers given at the end of the quiz (no fair peeking) are the answers I came up with by dredging up information from the dim recesses of my memory, and by dusting off some old (and referring to some newer) textbooks. I think most of them are correct, but if your answers differ from mine, you're probably right. Hey, I don't deal with this stuff every day like you do.

If you have serious differences with my answers, and can support your argument with facts, write to me. We'll carry a discussion of those differences, and your names (if you'd care to give me permission to publish your name) in a future issue. We won't publish your name if you don't want us to.

And by the way, we'd like to apologize for any errors in the answers to this or any other quizzes that we've committed in the past. We know how frustrating it is to get an answer right, then to have the person

who wrote, or edited, the quiz publish the wrong answer. Even if you know that your answer is right and the published answer is wrong, it kind of detracts from the pleasure of having aced the quiz.

## A couple of errors in October

We had a couple of goofs in the answers to TYEK in the October issue.

In one case, question number 3 asked "How many picofarads are there in a microfarad." The answer, incorrect, stated  $10^6/10^9 = 10^3$ . It's amazing that we managed to get that so incorrect. The correct answer, of course, is  $10^{-6}/10^{-12} = 10^6$ .

Question number 4 asked, "If ten and a half pieces of candy cost four and a half cents, how much would one piece of candy cost?" The erroneous answer stated, "Divide ten and a half by four and a half and get 2.33333 cents." Actually that would give you 2.33333 pieces of candy per penny, not the number of cents per piece of candy.

To find the price per piece, divide 4.5 cents by 10.5 pieces of candy and get 0.4285 cents per piece. The part of the answer that states, "By multiplying the numerator and denominator by 2, you find that 21 pieces cost 9 cents exactly and you avoid paying the fractional cent," is correct, because if you bought, say, two pieces of candy, it would cost 0.857 cents, but you would have to pay a penny for the two pieces anyway.

Maybe part of the problem here is that those problems were so simple that we just charged ahead without really thinking about them. Anyway, we're sorry about the incorrect answers. We will redouble our efforts to get all quiz answers right in the future. But you can bet that we'll keep those quizzes coming.

Thanks to those sharp eyed readers for pointing out the errors.

*Nile Conrad Penner*

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71	SKHD6508	SKID1104	SKKIT078	SKTI
72	SKHD6509	SKID1105	SKKIT105	SKT
73	SKHD6510	SKID1106	SKKIT109	SKT
74	SKHD6511	SKID1108	SKKIT110	SKT
75	SKHD6513	SKID112	SKKIT111	SKT
76	SKHD6514	SKID1150	SKKIT71525	SKT
77	SKHD6515	SKID1152	SKKIT71526	SKT
78	SKHD6516	SKID118	SKKIT71527	SKT
79	SKHD6517	SKID120	SKKIT71528	SKT
80	SKHD6518	SKID1200	SKKIT71529	SKT
81	SKHD6519	SKID1201	SKKIT71530	SKT
82	SKHD6520	SKID1202	SKKIT71531	SKT
83	SKHD6521	SKID1203	SKKIT71532	SKT
84	SKHD6522	SKID1204	SKKIT71533	SKT
85	SKHD6524	SKID121	SKKIT71534	SKT
86	SKHD6525	SKID1215	SKKIT71535	SKT
87	SKHD6528	SKID122	SKKIT71536	SKT
88	SKHD6536	SKID123	SKKIT7848	SKT
89	SKHD6537	SKID125	SKMK0001	SKT
90	SKHD6540	SKID126	SKMS22	SKT
91	SKHD6541	SKID127	SKMS23	SKT
92	SKHD6545	SKID128	SKMS24	SKT
93	SKHD6547	SKID129	SKMS25	SKT
94	SKHD6549	SKID1752	SKMS9101	SKL
95	SKHD6573	SKID1756	SKPL104	SKL
96	SKHD6587	SKID1756	SKPL104	SKL
97	SKHD6603	SKID1756	SKPL104	SKL
98	SKHD6606	SKID1756	SKPL104	SKL
99	SKHD6619	SKID1756	SKPL104	SKL
100	SKHD6619	SKID1756	SKPL104	SKL
101	SKHD6619	SKID1756	SKPL104	SKL
102	SKHD6619	SKID1756	SKPL104	SKL
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108	SKHD6619	SKID1756	SKPL104	SKL
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111	SKHD6619	SKID1756	SKPL104	SKL
112	SKHD6619	SKID1756	SKPL104	SKL
113	SKHD6619	SKID1756	SKPL104	SKL
114	SKHD6619	SKID1756	SKPL104	SKL
115	SKHD6619	SKID1756	SKPL104	SKL
116	SKHD6619	SKID1756	SKPL104	SKL
117	SKHD6619	SKID1756	SKPL104	SKL
118	SKHD6619	SKID1756	SKPL104	SKL
119	SKHD6619	SKID1756	SKPL104	SKL
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129	SKHD6619	SKID1756	SKPL104	SKL
130	SKHD6619	SKID1756	SKPL104	SKL
131	SKHD6619	SKID1756	SKPL104	SKL
132	SKHD6619	SKID1756	SKPL104	SKL
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134	SKHD6619	SKID1756	SKPL104	SKL
135	SKHD6619	SKID1756	SKPL104	SKL
136	SKHD6619	SKID1756	SKPL104	SKL
137	SKHD6619	SKID1756	SKPL104	SKL
138	SKHD6619	SKID1756	SKPL104	SKL
139	SKHD6619	SKID1756	SKPL104	SKL
140	SKHD6619	SKID1756	SKPL104	SKL
141	SKHD6619	SKID1756	SKPL104	SKL
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147	SKHD6619	SKID1756	SKPL104	SKL
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## Notebook PC owners may look to hand-held PCs for next computer purchase new CEMA survey reveals notebook PC usage preferences and hand-held market potential

The battle for the lucrative mobile computing market is starting to heat up, as hand-held personal computers (HPC) show signs of challenging the supremacy of the notebook PC in the consumer marketplace. A new survey released today by the Arlington, Virginia-based Consumer Electronics Manufacturers Association (CEMA) reveals that 58 percent of notebook PC owners would consider purchasing a hand-held PC instead of another notebook PC. "The maturation of hand-held computing products has really expanded the range of choices now available to mobile consumers," said Gary Shapiro, CEMA president. "This survey shows that expanded memory and increased functionality have turned today's hand-held PCs into powerful devices capable of performing many essential computing tasks."

Based on a random sample of 500 notebook PC owners, the CEMA survey reveals various mobile computing preferences that may dictate future purchasing decisions between notebook and hand-held PC products. Fifty-three percent of the respondents classified their notebook PC as a "secondary" computer, while 38 percent said it serves as their "primary" PC - that is, one used on a day-to-day basis. People often take their notebook PC on the go, with half of the survey respondents indicating they use their notebook PC away from the home or office at least 20 percent of the time. Meanwhile, 23 percent log on to the Internet every day from their notebook PC, and another 14 percent connect every week. Forty-two percent have no Internet access from their notebooks.

Notebook personal computer users show an overall high level of satisfaction - 76 percent say they are either "very" or "mostly" satisfied with their notebook PC. Short battery life tops the list of biggest complaints, chosen by 25 percent of the respondents, followed by touchpad/mouse pointer control (14 percent) and small screen size (11 percent).

Many of the most desired features for mobile computing consumers can be

found in today's hand-held products. What aspect of a mobile computing product is most important to you, assuming you already own a desktop PC?

45% Word processing, spreadsheets, presentations, 17% Price, 12% Internet/E-mail; 12% Size and Weight.

### Hand-held computer preferences

Awareness of hand-held computers is relatively high among notebook PC owners - 68 percent say they are familiar with the products. The respondents were not, however, as familiar or concerned with the HPC operating system (OS). Sixty-one percent said they were not familiar with Microsoft's Windows CE operating system, while 69 percent indicated that having a Windows 95-like OS on a hand-held computing device would not increase the likelihood of buying one. For those who would be influenced by a Windows 95-like OS, familiarity (39 percent), file compatibility (33 percent), and software availability (17 percent) were the biggest factors.

At \$500, the price is right for a hand-held PC, according to notebook PC users. Thirty-eight percent say \$500 is "about right," and another 42 percent say it's less than they would expect to pay.

The survey respondents were generally favorable in their assessments of the functionality of hand-held computing products as revealed below.

How strongly do you agree or disagree with the following statements: It would be easy to synchronize files between a hand-held and a desktop computer?

44% agree strongly  
32% somewhat agree  
8% disagree

It would be easy to connect peripherals like a printer to a hand-held computer?

37% agree strongly  
35% somewhat agree  
10% disagree

### DVD players post impressive sales

With 200,000 players sold to U.S. dealers in just six months on the market, consumer acceptance of Digital Video Disc (DVD) technology has been more rapid than initial sales of either the videocassette recorder (VCR) or the CD player, the Consumer Electronics Manufacturers Association (CEMA) says.

Although first-generation home VCRs

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

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were introduced in 1975, CEMA statistics indicate that it was not until 1977 that sales topped the 200,000-unit mark, and not until 1981 that the industry experienced its first million-unit sales year (1.36 million). compact disc players, which debuted in 1983 with estimated sales of 35,000 units, sold 208,000 in their second year and topped one million units annually in 1986 (1.69 million).

With its vastly improved picture quality and six-channel surround sound, DVD offers consumers a host of advantages over existing analog video playback systems. DVD technology uses up to 500 lines of horizontal resolution, as compared with VHS' 240 lines, and can store up to 133 minutes of full-motion video on a single-layer, CD-size disc (more than four hours on dual-layer software).

In addition to its superb images and sound, DVD gives consumers the ability to adjust the aspect ratio between the squarish (4:3) measurements of today's TV sets and the widescreen (16:9) dimensions of a theater screen. Capable of storing, on one side of the disc, more digital information than seven audio CDs, DVD's unequaled flexibility allows the consumer to select from as many as eight different soundtracks and 32 subtitle tracks, choose preferred camera angles, and access background information on the actors and director.

At a time of rising concern over whether certain movies are suitable for children to a version edited for younger audiences. Last but not least, DVD players have the welcome advantage of being fully compatible with today's music CDs.

For more information on today's digital video products, turn to the product trend section of CEMA's Web site at [www.cemacity.org/mall/](http://www.cemacity.org/mall/).

### Consumer information technology to star at 1998 International CES

Bringing together the world's top Information technology (IT) executives, exhibits of the latest digital technologies, and a comprehensive array of conference sessions, the 1998 International Consumer Electronics Show (CES) promises to fulfill its role as the world's premier event for the consumer information technology industry. Over 90,000

attendees are expected at the trade-only show, January 8-11, 1998 Las Vegas.

Already at near capacity, the 1998 International CES exhibit floor is packed with the top manufacturers of digital television, Internet box/network computer, DVD, digital imaging, wireless data products, TV/PC, satellite transmission, digital camcorders, handheld computers and PDAs, smart phones, remote access devices, home automation, and the latest home office products and PC accessories.

CES Show management says that momentum is sky high for the 1998 CES featuring such industry stalwarts as AMD, Casio, Hitachi, IBM, Intel, Micron, Microsoft, Motorola, Network Computer Inc. (Oracle), Panasonic, Philips, Sharp, Sony, Sun Microsystems, Texas Instruments, Toshiba, Thomson, and Zenith.

"The industry buzz already surrounding this show is phenomenal," said Robbi Lycett, CES Vice President. "With such a strong lineup of speakers and educational seminars, and a bustling floor featuring cutting-edge consumer digital products, the 1998 CES will play an integral role in defining where the consumer marketplace is headed for digital and IT products."

One of the CES highlights will be a showcase of digital television (DTV), including the world's commercial debut of digital high-definition television (HDTV). Joel Brinkley from the New York Times will moderate a distinguished panel to discuss the impact of DTV and how best to bring digital entertainment to the consumer. The session, January 9, 8:30am-10:00am, will include top executives from CBS, Microsoft, Harris Corp., Thomson, and USA Networks.

Where will consumer technology be in the next millennium? A host of today's leading decision makers look ahead to tomorrow:

CES Keynote: Barry Diller, Chairman and CEO, HSN, Inc. (Jan 8, 8:30am-10:00am)

CES Economic Outlook: Steve Forbes, President and CEO, Forbes, Inc. (Jan. 8, 4:00pm-5:00pm)

CES Technology Keynote: Scott McNealy, Chairman, President and CEO, Sun Microsystems (Jan. 9, 4:00pm-5:00pm)

CES Executive Perspective: Bill Gates,

Chairman and CEO, Microsoft Corp. (Jan. 10, 8:30am-10:00am)

Among the more than 1,500 exhibits on the show floor, attendees will find several pavilions showcasing special product areas. The 1998 CES pavilions include: The Digital Imaging pavilion, Network Computer Inc. (NCI) pavilion, Emerging Technologies pavilion, DVD Video Group pavilion, Microsoft Windows CE pavilion, Forbes Business pavilion, and the Intelligent Transportation System (ITS) pavilion.

An extensive program of CES conference sessions will cover the latest trends in the high-tech marketplace. Attendees will choose such topics as:

- Sight and Sound Innovations for the Computer
- Understanding Low-Cost Computers and Internet Devices
- Beyond the Modem - Selling Speed
- PC Peripherals - Tapping Into Profits
- Home Networking Solutions
- Gaming's Cutting Edge - A Look at the Technology of Computer Gaming
- Content Distribution: It's More than Software!
- How to Sell Convergence Products
- DVD ROM - Where's the Software?
- Digital Imaging: New Profits Beyond the Camera
- Notebooks Versus Hand-helds: The Battle for Dominance
- Video Conferencing for Consumers - New Retail Opportunities
- Mobile Computing: Is it Ready for Mass Market?
- The Latest Breakthroughs in In-Car Computing
- The Emerging Deployment of Java in Consumer Electronics
- Remote Access Products: New Profit Opportunities
- Buying Off-the-Shelf: IT Buyers meet the Retail Channel
- Future Trends in Home Computing
- Web Products at the Starting Gate
- TV vs. Web Advertising

The complete conference program, along with show news, online registration, housing/travel information, and an updated exhibitor list can be found at [www.cemacity.org](http://www.cemacity.org), home of the Consumer Electronics Manufacturers Association (CEMA), sponsor of CES.

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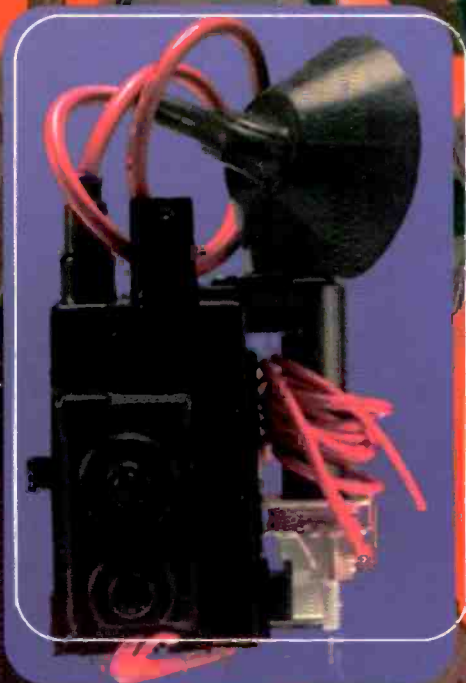
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## LITERATURE

### Replacement parts/ accessories catalog

M-Tronics offers a catalog of replacement parts and accessories, including parts for VCRs, TVs, and audio, as well as batteries, and exact replacements for manufacturers' IC's, transistors and diodes.

VCR parts listed include idlers, tires, gears, belts, belt kits, pinch rollers, guide posts and more. TV parts listed include EPROMS for RCA and GE sets, rebuilt CRTs, tuners, switches and over 250 different flybacks.

The 52-page catalog also includes the company's own 17 kits of high-use replacement parts. For example, kit number #TK150 contains 150 VCR tires: to each of 15 popular tires; kit number #ZDKIT-1 contains 75 zener diodes rated at from 3.3V to 18V at 1W. Other kits contain assortments of fuses, IC protectors, EPROMS, switches, belts and capacitors. All kits come in a sturdy plastic storage box.

Circle (90) on Reply Card

### Components website

Mouser Electronics has recently updated its website at <http://www.mouser.com>.

New features include: a user-friendly interface, product pricing, product availability, and excellent search engines. This allows searches by part number, manufacturer, product type, keyword, or catalog page. There are also links to Mouser's manufacturers' websites.

In addition, there are complete manufacturer and product indexes with drill down capabilities. At any time in the drill down, you may view the catalog page, or check the price or availability for any product on a page. Catalog pages are viewable with Adobe Acrobat Reader 3.0, which can be downloaded from their website.

The complete Mouser catalog can also be downloaded and is text searchable.

Circle (91) on Reply Card

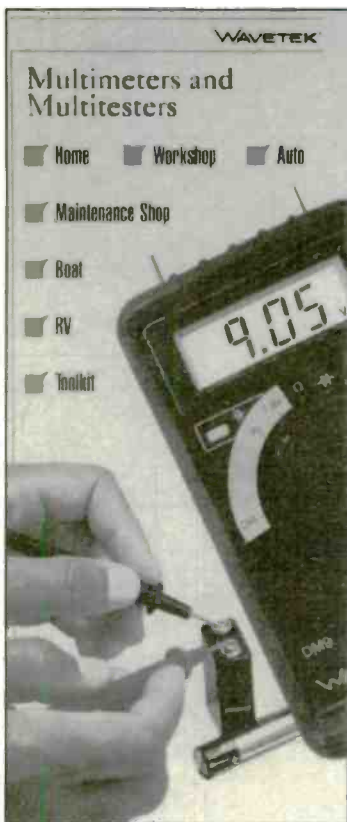
### Tester brochure

Wavetek has made available a four-color glossy brochure of the company's line of multimeters and multitesters — the AM8, DM7 and DM9. The brochure outlines the features and benefits of these new compact, yet rugged meters that are ideal for basic electronic and electrical troubleshooting, test and measurement. Measurement capabilities include ac, dc, resistance and special

### Correction from the October issue

In the article entitled "Company e-mail and website addresses," which appeared in the October issue of *Electronic Servicing & Technology*, there was an error in the information for Herman Electronics. The correct fax number, e-mail and website information for Herman are: Fax: 800-938-4377, e-mail: [Info@hermanelectronics.com](mailto:Info@hermanelectronics.com), website: <http://hermanelectronics.com>.





1.5 and 9V battery testing. All meters come standard with safety test leads and protective holsters.

The AM8, with an analog readout, is the smallest and lowest cost of the three meters. It is designed for appliance repair and lighting tests around the house and shop. The DM7 is an all-trade, general purpose digital readout meter with measuring functions that include ac/dc to 600V, four resistance ranges and diode test. Finally, the DM9 is a high performance, autoranging meter for field service and top-of-the-line testing. Features of the DM9 include a higher resolution 4000 count display, ac/dc measurement to 600V, diode test and continuity.

Circle (92) on Reply Card

### Master tool catalog

Jensen's newly released Master Catalog for 1997/1998 features 300 pages filled with items essential to the electronics and other related industries. Several newly developed kits are introduced in the latest catalog, including the JTK-2001 PC Workstation Plus Kit and the JTK-2900 Network Support Kit. An innovation described in the catalog is a Quick-Clip design incorporated into many of the kits that makes pallet removal quicker and easier.

Among the products offered for the first time are a number of test instruments, specialty tools, testers, probes and other devices new to the marketplace. Standard product lines have also been expanded and strengthened to offer customers the widest range of items available.

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**International Fax: 516-496-4166**

# Troubleshooting techniques: Testing and troubleshooting the VCR

by Stanley J. Nawrocki, CET

Once the basic principles of the VCR are mastered and the knowledge of the use of test instruments is achieved, the technician can apply that information in the testing, troubleshooting and repair of the unit. A logical diagnostic approach should be developed in order to insure that the problem can be resolved in the shortest time possible. The recommended troubleshooting approach is as follows.

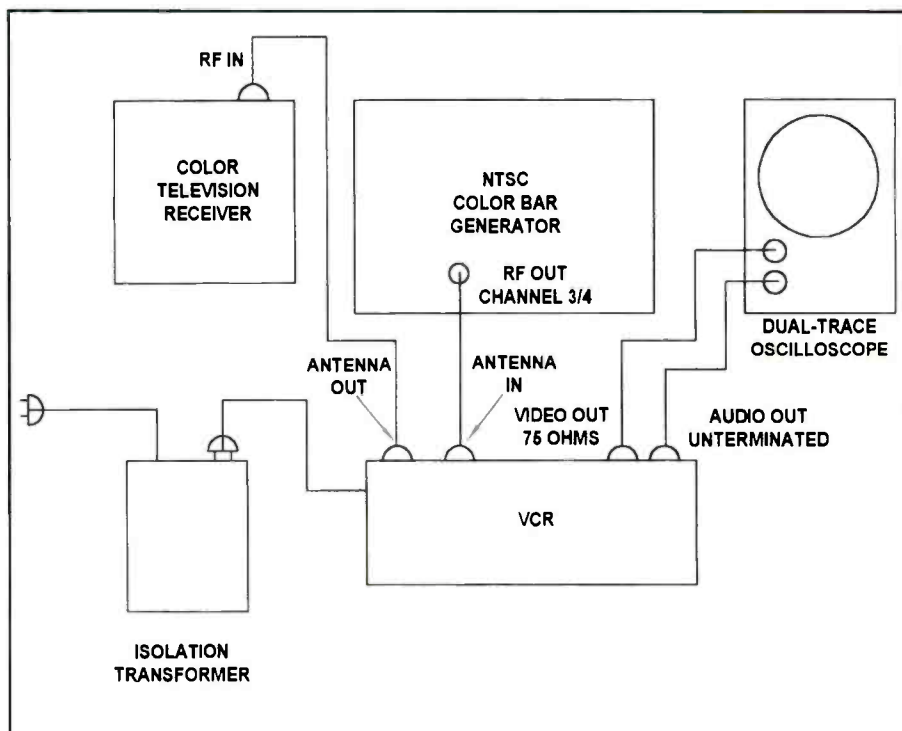
## Listen to the customer

The customer may not be able to explain the problem in our technical jargon, but he/she should be listened to very carefully in order to uncover any clue that will help you in repairing the unit.

## Initial observation

Connect all of the proper cabling and attach an NTSC color-bar generator to the RF input jack. Plug the VCR into an isolation transformer, but do not turn the power on. Take notice of the function indicator panel (FIP) to insure that it is operating properly. Check the receiver monitor for the proper rendition of color bars and to ascertain that audio is present.

Apply power to the VCR and take notice of any abnormal activity such as the absence of power indication, non-working switches, strange noises, failure to update information on the FIP, and whether the machine cycles to the off position. While observing the receiver/monitor, flip between the TV/VCR modes, taking note of any perceptible difference between the color bars and the audio in the two modes. This step checks the record and standby electronics-to-electronics (E-E) paths for the NTSC video and audio signals.



Use this test setup for diagnosing and troubleshooting a defective VCR.

If there is a significant difference in the video signal, attach a cable to the video output jack of the VCR, which is terminated in a 75 $\Omega$  unbalanced load. Place a scope across the load, it should give a reading of 1Vpp on its graticule. If there is a significant difference in the audio, place a cable in the audio output jack of the VCR which is left unterminated. Place the scope across it. It should give a reading of 1.2Vpp. Make any required repairs to this section before you continue.

## Inserting a tape

Insert a prerecorded work tape with NTSC color bars and audio which have been recorded at the various speeds used. As you are placing the tape into the cassette holder, feel to see if more pressure than normal is required for the tape to be seated properly. Press the eject button to

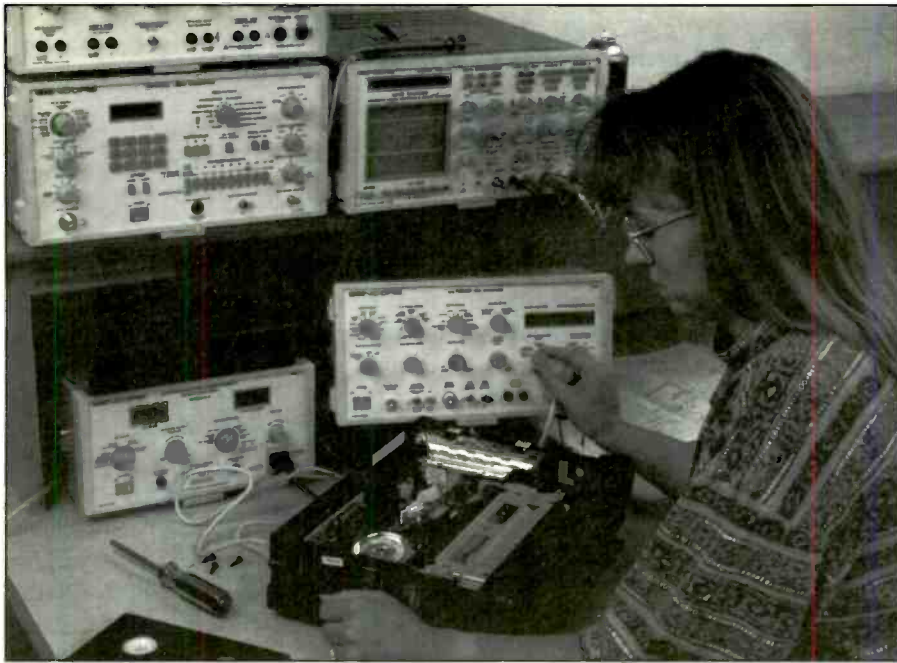
make sure that it is working properly. Reinsert the tape into the machine and check the FIP for the proper indication.

Now place the machine in the fast forward mode to insure that tape movement will take place. If the machine were first placed into the playback mode and there was no tape movement, the tape could spill out into the VCR where tape and machine damage could take place. Rewind the tape.

## Playback a tape

Since many of the circuits in the VCR are used for both recording and playback, the first thing to do is to *sectionalize* the problem to a particular board or section. It is much easier to diagnose common record/playback path problems in the playback mode, so it should be done first. With the tape rolling, carefully examine

Nawrocki is a Test Writer for IS CET, a Consultant for EIA/CEMA, and a former member of the faculty of Milwaukee Technical College and a former RCA Engineer



Diagnosis of a VCR using the test setup of the figure on the previous page. (Photo courtesy Sencore.)

the picture and listen to the audio from the monitor receiver. Adjust the control track and watch for normal activity. If the video and audio are proper, and the customer has not indicated any intermittent problems or delay in the time that the problem appears, this mode is operating properly.

The following are some of the problems that may generally be encountered in the playback mode.

- No audio or video. Audio but no video. Video but no audio.
- Dropouts in the picture, audio normal. Dropouts are white flashes or particles that appear in the picture which are caused by loose magnetic material from the tape. This is usually caused by dirty video heads or a badly worn tape.
- Heavy noise in the picture is generally caused by a defective head, although the heads should be cleaned first and other tests should be performed before you make a final diagnosis.
- Picture rolling vertically and horizontally is generally traced to the capstan servo system. The audio may also vary in pitch when the tape is rolling normally. If you are in the pause or still mode and the picture continues to roll, the cause of the problem would generally be located in the drum servo system.
- When the tape is rolling, the picture may be sharp and well defined and then go into noise, then back to a good picture. This cycling is caused by the loss of the

control track signal, which causes the capstan servo system to "hunt." When the drum servo and the capstan servo operate properly in the playback mode, it can be considered as operating properly in the record mode as well.

#### Make a recording

Using an NTSC color bar generator, make short segment recordings at the speeds provided by the machine. Check the FIP for proper operation. Rewind the tape. Play back the tape and view the results on a monitor/receiver. Examine the video and audio to see if any problems exist in the VCR.

#### Final comments

One of the preceding tests should have indicated a defect in either the record or playback mode. It should have also detected if there was a problem with the audio, video, color, synchronizing system, mechanical system, or any combination of the group. These tests can be used as a basis for giving the customer an estimate required for repair. Once the equipment is set up, it only takes about five minutes to go through the complete testing procedure without taking any covers off of the machine. The author recommends that a nominal charge be made for this service because the technician is deserving of compensation for his time and knowledge. ■



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# Replacement parts/servicing information sourcebook

by the ES&T Staff

Service manuals can cost a great deal of money; \$25.00, \$45.00, \$60.00 or more. And that's when you have enough information to identify the company that made the product so you can order the manuals. There are cases in which the brand name of a TV, VCR, or other consumer electronics product is meaningless to most people. Without some other information, a service center faced with trying to service such a product has no way to identify the manufacturer, and therefore, no way to obtain service literature.

Faced with such a dilemma, a service center can take one of several approaches. They may attempt to locate the company that claims parentage for the mystery unit. In some cases this may be an importer, not a manufacturer, that has had those sets made to their specification. That company may possess service literature on the unit. On the other hand, that company may not possess service literature. In fact, they may no longer be doing business in the country.

Alternatively, possessing any of several other clues, the service center may be able to determine the identity of the company that actually built the product. That company may or may not be able to provide service literature on the unit in question. If the product is identical to one sold by the company under their own brand name, the company may be willing to furnish service literature for the similar brand product. On the other hand, they

may not make a product anything like that orphan brand, and may have left it up to the company that bought the product to generate service literature.

In the first instance, you're in luck and will be able to fix the product. In the second instance, unless you can locate the company that imported the sets, and they have service literature to sell, you'll have to service the product without a manual, or return it to its owners.

## 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 certain amount of time has elapsed the post office doesn't forward mail.
- Some companies are small and have a very low profile in the marketplace, so they're just hard to locate.
- Many private brands of consumer electronics products have little or no technical 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.

## What are some of the clues?

If you encounter a product that has an unfamiliar name and no other information such as an address or phone number to help you determine its origins, you may still be to locate its manufacturer or distributor. Two pieces of information that can help make such an identification are the FCC (Federal Communications Commission) ID number and the UL (Underwriters Laboratories) code number.

## 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 pre-

1998 International

## CES

THE SOURCE FOR CONSUMER TECHNOLOGIES

Please send me a copy of the  
1998 International CES Directory,  
as mentioned in **ES&T**.

Enclosed is a check for \$25.00,  
Payable to the Consumer  
Electronics Show.  
(For **ES&T** readers only.  
Regular value is \$100.00.)

Print Copy     CD Rom

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

Email \_\_\_\_\_

Mail to: CES, Attn: CES Registration  
2500 Wilson Boulevard, Arlington, VA 22201-3824

## FCC ID numbers

Code Prefix	Manufacturer	Code Prefix	Manufacturer
A26	Alpine	ATP	Advent Corporation
A6R	Yamaha	BBO	Cobra
A3D	NEC	BCG	Apple Computer
A3L	Samsung	BEJ	Goldstar
A7R	Orion	BGB	Mitsubishi
AAL	Phone Mate	BO7	Sanyo Fisher
AAO	Radio Shack	BOU	Philips
AAZ	Midland International Corporation	C3K	Microsoft
ABL	Hitachi	C5F	Daewoo
ABW	JC Penney	CKL	Hyundai Electronics
ABY	Motorola	CNT	Compaq Computers
ACA	Yorx Electronics	E0Z	Shintom
ACB	Phonotronics	E2K	Dell Computer
ACJ	Matsushita	F67	Ampex
ADF	Carterfone	FOD	Packard Bell
ADT	Funai	GBU	3M
AES	Uniden	GQ8	Acer
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		

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.

fixes that identify 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

- 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

This document costs \$8.00, including shipping and handling

## The FCC public-access information system

Every VCR, personal computer, microwave oven and cordless phone sold in the United States must bear a 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 **ES&T** dialed up the bulletin board in October, the following screen information appeared:

10/22/97 13:20 You have 8 minutes

### "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 (7/96)
  - b - Processing Speed of Service
  - c - Test Sites on File per Sec 2.948 (10/97)
- 0 - Exit PAL

Enter your selection:

When I pressed the number 1, the following information appeared on the screen:

Welcome to the Lab PAL Application Status program

The following functions are available. Grantee code refers to the first 3 characters of the FCCID.

- 1 - Application status (requires EXACT FCCID)
- 2 - List GRANTED FCCIDs with just a Grantee code
- 3 - Grantee name and address from Grantee code
- 0 - Exit PAL status system

Enter your selection :

Pressing the number three brought up this instruction:

Enter Grantee code (CR to end) :

Then, just to enter a series of three letters such as appear at the beginning of the FCC ID number, I entered aaa, which brought up this bit of information:

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

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 hard disk drive for your 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.

### Electronic Industry Telephone Directory (Or some equivalent)

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

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.

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

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

### Consumer Electronics Show (CES) Directory

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

The Consumer Electronics Show 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 8 through January 11 1998. The directory 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, limited numbers of copies of the directory will be available from the above address.

## 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	API	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	AAV		

**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.

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. Quantities are limited, 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 Eighth Edition of the VCR Cross Reference Manual is avail-

able in both paper and software editions from ISCET.

The software allows the user to search by manufacturer for 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 on screen all the possible substitutes for the part entered.

The cross reference, which lists equivalent model numbers among brands and equivalent part numbers among brands is now available from ISCET. This three-hole punched, 144-page, expanded edi-

tion includes more than 7810 parts and 1992 models. About 50 brands are covered in the manual, including RCA, GE, Panasonic, Quasar, JC Penney, Canon, Magnavox, Philco, Sylvania and others. Typically, this manual would enable a user to repair say, a Canon VCR with a Panasonic part, using RCA service data. The price is \$29.95, plus \$3.00 shipping. The software version on 3-1/2 inch floppy diskette is \$39.95 plus \$3.00 shipping.

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

## 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	ampo	
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.

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 identical, 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 consumer electronics products that might generate electromagnetic interference. Armed with this number, a technician may call or write the FCC:

### 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 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 available 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/Data\\_bases/eadf.dat](ftp://ftp.fcc.gov/pub/Bureaus/Engineering_Technology/Data_bases/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 this information and makes it available in the form of a compact disc. The address and telephone number for this company are:

### M.I. Technologies

3310 E. Peterson Road  
Troy, OH 45373  
937-335-4560

### Identification using the UL manufacturer's code number

Another source of manufacturer identification 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 that these numbers 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.

### 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." 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 help you find the information you need. To find information on a company this way, just use whatever browser you ordinarily use, and 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," or "Inc."

And 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.

**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 1997 Consumer Electronics Replacement Parts Sourcebook published by EIA/CEG, the 1997 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)

(Now owned by Recoton)  
527 Stone Rd  
Benicia, CA 94510  
707-748-5930

### Action TV

(American Action TV)  
100 Exchange Place  
Pomona, CA 91768  
909-869-6600  
909-869-5545  
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 90501  
310-326-8000  
800-421-2284  
Fax: 310-533-0369

### 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  
800-556-7733  
Fax: 617-932-8756

### AOC International

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

### Apple Computer

1 Infinite Loop  
Cupertino, CA 95014  
408-996-1010  
Fax: 408-996-0275  
Customer Service: 800-776-2333  
Technical Assistance: 800-500-7078

### Aristo Computers Inc.

6700 SW 105th Ave., Suite 300  
Beaverton, OR 97008  
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  
847-395-6321

### Audiovox Corp.

150 Marcus Drive  
Hauppauge, NY 11788  
516-231-7750  
Fax: 516-273-5939

### Barcus-Berry, Inc

5381 Production Drive  
Huntington Beach, CA 92649  
714-897-6766  
800-854-6481  
Fax: 714-895-6728

### Blaupunkt

2800 South 25 Ave.  
Broadview, IL 60153  
800-266-2528  
Fax: 708-678-8111

**Canton Electronics Corporation, 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  
919-989-2212  
Fax: 919-989-2215

**Chinon America, Inc.**

615 Hawaii Ave.  
Torrance, CA 90503-5141  
310-533-0274  
Fax: 310-533-1727

**CIE America, Inc.**

2515 McCabe Way  
PO Box 19663  
Irvine, CA 92614-6243  
714-833-8445  
Fax: 714-757-4488

**Citizen America Corp.**

2450 Broadway, Suite 600  
Santa Monica, CA 90404  
310-453-0614  
Fax: 310-453-2814

**Clarion Corporation of America**

661 W. Redondo Beach Blvd.  
Gardena, CA 90247  
310-327-9100  
Fax: 310-327-9337

**Columbia Data Products**

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

**COMPAQ Computer Corp.**

PO Box 692000  
Houston, TX 77269-2000  
281-370-0670  
Fax: 281-514-1740

**Connecticut Microcomputer**

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

**Craig Consumer Electronics**

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: 214-503-5586

**Daewoo Electronics Corp. of America**

120 Chubb St.  
Lyndhurst, NJ 07071  
201-460-2500  
800-323-9668  
Fax: 201-935-5284

**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 07054  
201-575-7810  
Fax: 201-808-1608

**Design Acoustics**

Division of Audiosphere Technologies  
25 Esna Park Drive  
Markham, Ontario LCR 139  
Canada  
905-474-9130  
Fax: 905-474-9812

**Eastman Kodak**

901 Elmgrove Rd.  
Rochester, NY 14653-5245  
716-726-3525  
Fax: 716-726-0818

**Emerson Radio Corp.**

9 Entin Road  
Parsippany, NJ 07054  
201-884-5800  
Fax: 201-428-2019

**Epson America, Inc.**

20770 Madrona Ave.  
Torrance, CA 90503  
310-782-0770  
Fax: 310-782-5220

**Fujitsu Ten Corp. of America**

National Service Headquarters  
19600 South Vermont St.  
Torrance, CA 90502  
310-327-2151  
800-423-8161  
Fax: 310-515-6718

**Funai USA Corporation**

(Also Symphonic)  
100 North Street  
Teterboro, NJ 07608  
201-288-2666

**GE Appliances/  
Microwave Products Dept.**

Appliance Park  
Bldg. 4106  
Louisville, KY 40225  
502-452-4311

**Gemini, Inc.**

103 Mensing Way  
Cannon Falls, MN 55009  
507-263-3957  
Fax: 507-263-4887

**GoldStar Electronics Int'l, Inc.**

See LG Electronics

**GoVideo**

7835 East McClain Drive  
Scottsdale, AZ 85260  
602-988-3400  
Fax: 602-998-0381

**Grundig/Lextronix Inc.**

3520 Haven Ave., Unit L  
Redwood City, CA 94063  
800-872-2228  
Fax: 415-361-1724

**Harmon Kardon, Inc. - JBL**

80 Crossways Park West  
Woodbury, NY 11797  
516-496-3400  
516-496-4868

**Hitachi Home Electronics (America), Inc.**

3890 Steve Reynolds Rd.  
Norcross, GA 30093  
770-279-5600  
Fax: 770-279-5692

**International Jensen/Recoton**

2950 Lake Emma Rd  
Lake Mary, FL 32746  
407-333-8900  
Fax: 407-333-8903

**JVC Service & Engineering Co. of  
America**

Division of U.S. JVC Corp.  
107 Little Falls Rd.  
Fairfield, NJ 07004-2105  
800-882-2345  
Fax: 800-446-0085

**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)  
7 Oser Avenue  
Hauppauge, NY 11788  
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.**  
National Parts Department  
PO Box 22745  
Long Beach, Ca 90801-5745  
310-549-7810  
800-367-7514  
Fax: 310-609-2127 (Parts Information)  
Fax: 800-437-7255 (Orders Only)

**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.  
PO Box 6727  
Somerset, NJ 08875  
908-560-3400/ Fax: 908-560-8380

**LG Electronics**  
(Formerly Goldstar Electronics)  
201 James Record Rd.  
PO Box 6166  
Huntsville, AL 35824-0166  
205-772-0623  
Fax: 205-772-0628

**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**  
440 Medinah Rd.  
Roselle, IL 60172  
630-307-3100/ Fax: 630-307-2687

**Matsushita Services Co. (Panasonic)**  
20421 84th Avenue South  
Kent, WA 98032  
800-833-9626  
Fax: 800-237-9080  
800-545-2672 (For the location of nearest distributor)

**Mattel, Inc.** - See INTV

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

**Midland Consumer Radio**  
1690 North Topping  
Kansas City, MO 64120  
816-241-8500

**Mitsubishi Electronics**  
Parts Department  
6100 Atlantic Boulevard  
Norcross, GA 30071-1305  
800-553-7278  
Fax: 800-825-6655  
404-734-5460

**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  
Parts  
800-366-3632  
Fax: 800-356-2415  
Technical assistance  
708-860-9500

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

(Continued on page 56)

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## ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

An electronics product is a mysterious device. Take for example, a television set. When it's working properly, there's a picture on the screen, and sound is coming out of the speaker. Look inside, however, and nothing at all appears to be going on. In today's sets, the only sign that there's action of any kind is the warm glow of the heaters in the CRT. All of those electrons racing back and forth, being rectified, clipped, clamped, amplified and transformed do so without making any kind of impact on the outside world, except for the rushing sound when the HV comes up, and the slight increase in temperature that takes place within the set.

The only way you can tell that anything is going on at all is through the use of test equipment. Hook up the DMM to a few points in the set and you see that there are voltages there. Hook up the oscilloscope, and all becomes visible. With the oscilloscope, you can observe the various waveforms at the various test points, and see that a great deal of activity is indeed going on in there. If you compare the waveforms that you observe to the waveform that the manufacturer's service literature says should be there, you can determine if that circuit in the product is working properly or not.

### **The test equipment**

As consumer electronics products evolve and improve, and as more and more products are added to the mix, the service center has to change and grow to keep up with those changes. On the other hand, the basic principles of electronics don't change, and some of the test equipment in use by service centers today will still be in use for years to come. 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 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 test meters 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 that the technicians face are so much more sophisticated than they once were, the test equipment must also be more sophisticated.

### **Some things to consider**

The value of a piece of test equipment to the technician depends on a number of factors:

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

### **Guidance is important**

The more features that a product offers, the more difficult it becomes to compare features in order 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.

Fortunately, a consumer electronics service center has access to a number of resources that can help them 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 the company's line. Not only that, but many of the manufacturers have 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. They list products that are offered by a number of manufacturers within each price level, and so makes comparison somewhat easier.

### **The test equipment purchase decision**

When a service center buys a piece of test equipment, it would be best if the purchase was considered in detail before the purchase decision is made. Unfortunately, that doesn't always happen. For example, when it's decided that the service center needs a new oscilloscope, the service

manager may perform some research on the products and prices, and then send out a purchase order for an oscilloscope.

Most purchases done in this manner turn out fine, but sometimes the organization learns too late that the unit isn't quite what they need. For example, it may not have the required features to service some new consumer product that they will soon begin servicing. In other cases the service center realizes that the expensive new piece of test equipment has far more features than they'll ever need, and the money tied up in it could be used elsewhere. You occasionally see some of those items listed in Readers' Exchange in this magazine.

Just as with any purchase, the use to which the test equipment will be put should be carefully studied.

### **The checklist**

Before a service center buys a piece of test equipment, it might be useful to check the candidates against a list such as this:

- What products will this equipment be used to test (now and in the near future)?
- What bandwidth is needed?
- Single-channel, or multichannel?
- 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 additional space to tell readers something about their company, or to help readers understand the value and use of that company's products.

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

## Philips Service Solutions Group

PO Box 555  
401 E. Old Andrew Johnson Highway  
Jefferson City, TN 37760  
Phone: 800-851-8885  
Fax: 800-535-3715

PHILIPS SERVICE COMPANY has a new name: PHILIPS SERVICE SOLUTIONS GROUP. We chose this name because it better describes who we are and what we offer. We offer TIMELY SOLUTIONS to all of your parts, accessories, and servicing needs. For example, we carry a complete line of B&K Precision test equipment, everything from Oscilloscopes to Multimeters and Test Probes - We have the SOLUTION you are looking for, AND we will deliver it in a TIMELY manner. We also carry a wide range of Network Technologies monitor testing equipment under the MON-TEST brand. So, there is really no reason you shouldn't consider us for your test equipment needs. Some other benefits of shopping with PHILIPS include: 30/60/90 day terms on most test equipment, we will match any advertised price on B&K test equipment (same model ONLY), and IF we don't have the piece of test equipment you are looking for from B&K - we'll gladly order it for you and have it within 7-10 working days.

### Rated #1 in the Industry

Philips Service Solutions Group surveys its Authorized Servicers throughout the country to ask them to rate our service among the service of the top ten consumer electronic manufacturers. All manufacturers are rated in seven service-related categories as well as an overall rating. The Philips Service Solutions Group has consistently achieved a #1 rating in all categories, including the category of Service Parts Support.

**Easy to Do Business With**  
Toll Free Order Line - 800-851-8885  
Toll Free Fax Line - 800-535-3715

Courteous and knowledgeable phone representatives are available Monday through Friday, 8:00 a.m. - 8:00 p.m. EST and Saturdays from 8:00 a.m. to 5:00 p.m. EST and are ready to take your order or assist you with on-line pricing and availability information. A toll free fax is also available 24-hours a day, 7 days a week for customers to fax their orders. A confirmation of your order can be returned upon request indicating the order number and item availability.

### No Hassle Return Policy

In our continued effort to be easy to do business with, Philips offers a 30-day No Hassle Return policy. The details of this policy are provided on the back of your packing slip, and enable the servicer to minimize this turnaround



time of customer repairs and estimates by allowing the return of new parts within 30-days of purchase with *No Hassle*.

### Customer Service Department

Servicers are encouraged to contact our Customer Service Department if they experience any problems with their orders, parts returns, or account. Associates are trained to resolve most problems while you are on the phone. The Customer Service Department can be reached through the Parts and Accessories ordering number 1-800-851-8885.

### Teleserve Department

Our Teleserve Department consists of knowledgeable representatives working to keep you informed of new items and special promotions that are available for you to offer to your customers. Representatives are continuously finding new avenues of reaching our customer base such as outbound calling and group faxing.

### Making Things Better Reduced Pricing

In our effort to continually *make things better*, Philips Service Company reduced its parts pricing in late 1996. This represented a reduction in price from 2%-23% for many of our popular items, such as tuners, remotes, and transformers.

### Same Day Shipping - Two-day Delivery

Philips continues to achieve same day shipment of orders received by 6:00 p.m. EST. Your orders should be delivered within 2 working days anywhere within the United States. Free shipping for all set warranty replacement parts.

### Inventory Availability

Philips prides itself on inventory availability, measuring its orderfill percentage to ensure that it consistently meets 95% or better. All of this is to allow our servicer to provide the best service support to their customer. ■

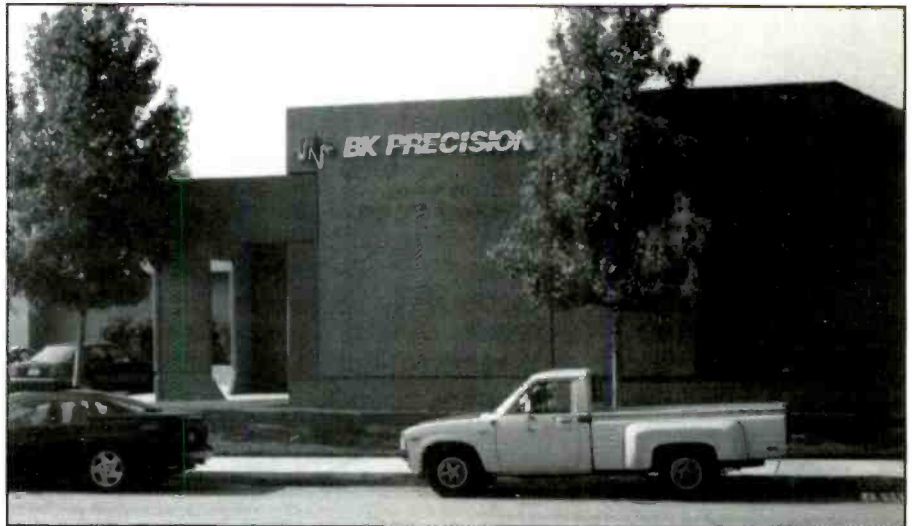
## B+K Precision

4353 W. Lawrence Avenue  
Chicago, IL 60630  
Phone: 773-725-9252  
Fax: 773-725-9385

During the early years of the television industry there were many manufacturers of television sets, but few manufacturers of test instruments to diagnose and repair them. Central Service, later to become one of the largest service centers in the country, began developing their own test equipment to service and repair sets. Other service organizations became aware of the availability of this test equipment and began ordering from Central Service, and B + K Precision was created in 1954. Today B + K is the first choice for many of the most discriminating electronic test equipment buyers.

In November of 1996, GMME of France acquired B + K Precision. GMME also owns a number of other test and measurement manufacturers in Europe and has an interest in Boonton Electronics in New Jersey, a manufacturer of RF and microwave equipment. B + K Precision, in partnership with their European counterparts under the GMME corporate umbrella, has recently developed new products which meet the demanding safety and performance standards of the European test instrument markets. The design expertise of GMME's test and measurement subsidiaries who have manufactured for the European test market for many years, has assisted B + K with some of the most dramatic new product developments in the company's history.

Advances in electronic circuitry and increased dependence upon electronic controls have brought about dramatic changes in test instrument design. Higher resolution measurement, improved accuracy and multi-function capability are required in everyday test environments, and B + K Precision has responded to these requirements with the appropriate new products.



B + K Precision's new west coast office is located in Placentia, California.

Even as the pace of technology has quickened and the urgency to perform critical test functions has accelerated dramatically, safety and reliability considerations for technicians have not diminished. Ease of operation and price/performance characteristics are still two of the most important test equipment selection criteria, but speed and accuracy in diagnosing problems are key to sustaining profitability and lowering the cost of design and maintenance. B + K Precision has been a leading supplier of superior performance, competitively-priced test equipment for many years, available through a well-established worldwide distribution network.

In September, 1997, B + K Precision launched a nationwide expansion program with the opening of new facilities in New Jersey and California. Headquartered in Chicago, IL for more than 44 years, B + K has strategically decentralized their operations to provide improved customer service, inven-

tory and service centers to support the company's growing business through distributor sales in the U.S. while contributing to its growth in global markets.

The Sales, Customer Service, Technical Support and Accounting Departments are located at 4353 W. Lawrence Ave., Chicago, IL 60630, (773) 725-9252, Fax: (773) 725-9385. The Research & Development, Engineering and Manufacturing Departments have been joined with those of Boonton Electronics, an affiliated company with a highly-respected reputation as a manufacturer of state-of-the-art instrumentation for the microwave, RF and other technical markets, in a modern, leading edge facility (ISO 9000 certification is expected in 1998) in New Jersey.

Marketing, Administration and a Factory Service and Calibration Center is now based at the west coast office located at 1031 Segovia Circle, Placentia, CA 92870, (714) 237-9220, Fax: (714) 237-9214. ■

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You can record measurements on a PC or printer, or recalibrate the instrument without opening the case, with B+K hardware & software kits (optional). You'll even be able to have full ISO9000 documentation of calibration results.



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for dB and resistive power measurements is easy. Just tell the meter the impedance and it calculates dB or resistive power automatically. Select from 600Ω, or any value from 1Ω to 9999Ω.



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Howard W. Sams & Company is proud to be celebrating over 50 years as the nation's leading technical publisher. Since its inception in 1946, Sams has seen its product offerings expand and diversify, so that today, Sams boasts the most complete lineup of technical documentation, services, and publications found anywhere.

Over 50 years ago, Howard Sams was the first company to recognize that the increasing popularity of home entertainment electronics meant a corresponding demand for reliable service documentation. This insight gave birth to the first PHOTOFACT® which presented concise technical information to help service technicians repair specific makes and models of radios. Televisions soon were added to the product line, followed by computer equipment and then VCRs, further enhancing Sams' ability to provide complete, consistent, high-quality repair information to service technicians.

Today, Howard Sams is the nation's largest provider of aftermarket service data for the television and VCR repair industry in the form of the PHOTOFACT® and VCRfacts®, through subscription services, as well as through electronics distributors. Research shows that 95 percent of the companies providing aftermarket repair service for color televisions use Sams technical data.

While PHOTOFACT® provided the foundation for Howard Sams' rise to the top of the technical publishing industry, it is only a portion of what the company publishes today. Sams currently offers a complete line of service products, distributor catalogs, technical books, copy service, and custom manuals for a wide range of clients.

Created in 1991, PROMPT® Publications has grown to become one of the top technical imprints in the nation and one of Sams' brightest stars. Concentrating its efforts on technical books designed both for the novice and the experienced electronics technician, PROMPT® published over 60 books in its first five years, with another 28 scheduled to go to press this year.

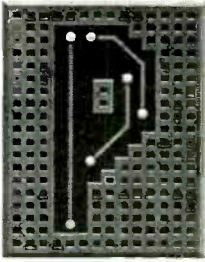
Each and every PROMPT® book provides a clear understanding of the principles involved in the installation, maintenance, and performance of electronic devices that have become such a large part of our everyday lives. Some of PROMPT's bestselling titles include *The Component Identifier and Source Book*, the *Semiconductor Cross Reference Book*, the *IC Cross Reference Book*, and the *Tube Substitution Handbook*. Each of these replacement and substitution part guides contain thousands of part numbers, type numbers, and other identifying numbers, and are backed by Sams' decades of research and data.

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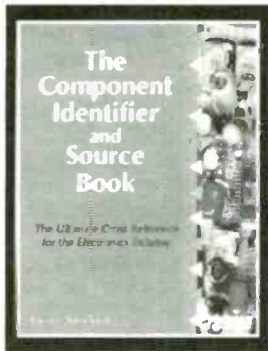


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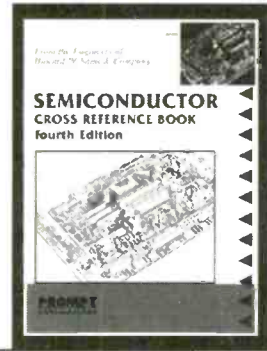
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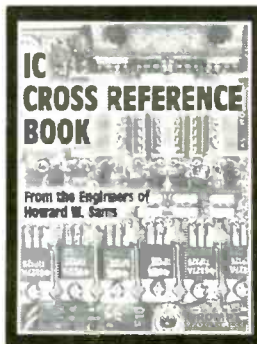
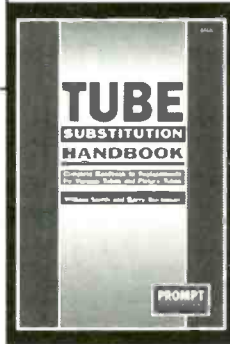


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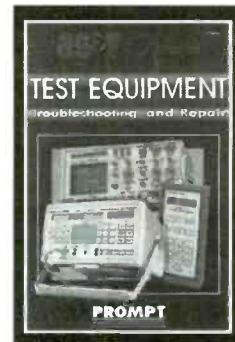
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## Herman Electronics

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Herman electronics, one of the country's largest original equipment parts distributors has just become a Premier distributor for Fluke products. Herman will be introducing the exciting new 70 and 20 series III multimeters with many advanced features for the service trade. The addition of Fluke makes Herman a complete source for all the requirements of the typical service organization. They supply test equipment, tools, soldering equipment and virtually every item found on the service bench.

If you need test equipment, Herman has it! Fluke, Goldstar, B & K, and Wavetek, as well as a complete assortment of test leads, probes and accessories. The company is quickly earning the reputation as stocking one of the largest and most diverse inventories in the industry. It has always been the company's philosophy that in order to maximize customer service, the item must be on the shelf when needed in order to facilitate immediate delivery - and Herman does just that!

Herman Electronics' new focus is to become a SINGLE SOURCE to all facets of the electronic service industry. As one of the nation's largest factory authorized OEM parts distributors for Sony, Panasonic, RCA, Toshiba, Samsung, Quasar, Kenwood, and most recently, Daewoo and Hitachi, there is no longer the need for busy service organizations to search multiple vendors for parts and related service accessories says Jeffrey A. Wolf, Vice President and son of the company's founder. "It is our goal to be a SINGLE-SOURCE to fill all of our customer's needs. What truly makes us different is that we really care about our customers and try to make their dealings with us as smooth and trouble free as possible. All of our employees are trained with that thought in mind."

Herman now publishes a quarterly catalog which shows the latest products available from their huge warehouse right near the Miami Airport. The catalog features a variety of specially priced items as well as a host of



recently released products available through Herman. Call for your free copy. They have also moved their web page to a new location, "hermanelectronics.com," with links to many major suppliers and services related to our industry.

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LG Precision, formerly Goldstar Precision was founded in Korea in 1976. Since its establishment, LG Precision has grown significantly in the Test & Measurement marketplace.

It has expanded with a wide selection of Analog and Digital Storage Oscilloscopes, Frequency Counters, DC Power Supplies, Digital Multimeters (Hand-Held, Bench-Top, Clamp-On), Function Generators, and Audio Oscillators.

New in this year is a complete upgrade and conversion of its family of Oscilloscopes. The new design has White Face Plate for a Cleaner Look with Blue CRT Screen for Higher Resolution.

The OS-3000 series of Digital Storage Oscilloscopes are compact and lightweight Digital Storage Oscilloscopes range from 20MHz to 60MHz.

The OS-5020G is the most unique model with its 20MHz bandwidth and Built-in 1MHz Function Generator makes it 2(two) in 1(one).

Real Time Oscilloscopes consists of: OS-5020, OS-9020, OS-5040A, OS-5060A, OS-5100, and OS-8100A are available in 20MHz to 100MHz at a lower cost, but still with high quality and performance that you expect!

New to the Family; OS-5100RA/RB, with 100MHz Bandwidth, Cursor-Readout and Autoset Function with 4CH 8 Trace (RA)/2CH 4Trace (RB).

All of the Oscilloscopes are designed to meet with IEC-1010 safety requirements as well as UL and c/UL approval.

To find out more about the products, you can visit the website at [www.oscilloscope.com](http://www.oscilloscope.com) and download spec. sheets and pictures. ■

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## ITT Pomona

1500 E. Ninth Street  
Pomona, CA 91766  
Phone: 909-623-3463  
Fax: 909-629-3317

Founded in 1948 as a radio and television service company, the Pomona® name became respected by early TV service technicians and engineers with the development of their first product, a vacuum tube adapter, which was offered in the early 1950s. Within a fairly short time a family of easy-to-use accessories emerged to answer a variety of commonly encountered testing problems. From the beginning, quality was as important as functionality.

Since then, rapid technological advances in electronics have created new testing challenges, which Pomona has responded to by developing innovative test accessories. Becoming part of ITT added financial strength and international access. Through periods of very accelerated growth, Pomona has continued to maintain its high standards of quality and market responsiveness.

Today, Pomona has the broadest line of test accessories in the world, for applications ranging from test labs to field service and plant maintenance. The Pomona line of test accessories is recommended by leading manufacturers of test equipment and instrumentation.

With the introduction of the new 1998 catalog, Pomona will offer nearly 8,000 products, designed to provide immediate solutions for thousands of everyday uses, as well as specialized testing needs. As a vital part of this growing family, Pomona expands their popular line of "Test Companion" Test Accessory Kits. These kits are specifically designed to compliment the most popular test instruments offered by FLUKE, HEWLETT PACKARD, TEKTRONIX and WAVETEK. The contents of each kit include carefully selected test accessories, including many new IEC1010-compliant prod-



ucts, with new kits specifically tailored for use with benchtop DMMs and heavy duty kits for electrical/plant service.

The Pomona product family includes banana plugs, coaxial cables, oscilloscope and digital multimeter (DMM) probe kits and accessories, IC test clips, boxes, connectors and test leads. Each is developed to address specific test or interconnection applications.

The importance of accurate testing cannot be overstated. The accessories used between the circuit or device under test and the test instrument have a great effect upon the reliability and accuracy of the test results. Pomona's products are designed and built to produce accurate results every time.

Electrical/electronic product design depends upon a continuing refinement of prototypes, verification of logic and

circuit design and integrity, and system diagnosis. Test accessories play a key role in this area, and their reliability and ease-of-use can significantly impact the test function and the time needed to bring a new product to market.

Design engineers and technicians have a number of requirements in common: They must be able to access and interface with the product, component or device. The electrical interface must be reliable. The connection must be strong and continuous, so that the signals received are accurate, not intermittent or partial. The job must be completed as rapidly as possible, and equipment must be accessible.

Technicians may need to connect a coaxial cable to an oscilloscope one moment, connect a terminal block to a voltmeter the next, and exercise a microcomputer's CPU chips through its diagnostics the next. Each task requires different tools. Unfortunately,



technicians often make do with what is on hand, "jury rigging" some temporary and often unrepeatable solution.

The test accessories offered by Pomona are much more than the relatively simple hardware they may appear to be. The materials involved, the design, the manufacturing and quality assurance, are all very carefully planned and executed. Each product begins as a solution to a test problem.

With the introduction of the industry's first lock-on 32-pin test clip for EPROM devices in new, miniaturized, surface-mount packages, Pomona continues its close alliance with IC manufacturers. These manufacturers depend on Pomona's innovative solutions for support in introducing new products to market quickly. Pomona's latest test clips for ICs include lock-on styles for industry's newest 64- to 196-pin PQFP (plastic quad flat pack) devices, enabling on-board test even when boards are installed vertically in active systems.

With the emergence of IC test clips for ultra-thin chips used on such confined surfaces as PCMCIA cards and Test Companion Kits specifically tailored for instrument user-specific needs, Pomona continues to lead the industry with test accessories that solve problems for engineers, designers and technicians. Pomona extends its support with the availability of technical information on their web site ([www.ittpomona.com](http://www.ittpomona.com)).

ITT Pomona is located at 1500 E. Ninth St., Pomona, CA 91766, Tel. 909-623-3463, Fax 909-629-3317. Due particularly to Pomona's on-site injection molding capability, the company prides itself in producing quality products, quickly and reliably for testing of industry's most popular devices. The same famous Pomona quality found in its standard products can also be extended to special designs and custom requirements. These may include special colors, private labeling, and custom configurations.

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Pomona's latest family of Test Companion™ Test Accessory Kits are designed to enhance your FLUKE, TEKTRONIX, HEWLETT PACKARD or WAVETEK hand-held or benchtop instruments. Each kit contains the newest Pomona test accessories for test reliability, versatility and longer service life.

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**ITT Pomona Electronics**  
AN ITT CANNON COMPANY

## HC Protek

154 Veterans Drive  
Northvale, NJ  
Phone: 201-767-7242  
Fax: 201-784-0611

The "HC" in HC Protek stands for Hung Chang, Protek's parent company. Hung Chang has been in the test equipment business for over thirty years. Hung Chang, based in Seoul Korea, is a major manufacturer of test and measurement equipment, satellite receivers, wireless communication amplifiers, and set top converter boxes. In the United States, Hung Chang manufactures oscilloscopes, analog and digital multimeters under private label to some major suppliers of equipment and components.

In 1989 Hung Chang made the decision to market its test equipment under the Protek brand name. Today the name is well established as a quality, budget priced line of state-of-the-art, T&M products.

Protek sees its market as defined by four broad areas: Service, Education, Production test, and Laboratory applications. To serve these markets, the company manufactures 14 models of oscilloscopes, 20 models of

Digital multimeters, 15 analog and clamp multimeters, 10 power supplies, 14 types of bench instruments, ranging from function generators to frequency counters, audio equipment, and video generators.

Protek Oscilloscopes range in bandwidth from 20 to 100 MHz. All are dual trace, three units are dual time base as well as dual trace. Two models are portable, battery operated, LCD display units that are the size of this page. Protek sees the RS-232 interface as becoming more and more important. The company makes four oscilloscopes with RS-232 interfaces for uploading wave forms and data to a PC. Protek's most popular DMM, its model 506, features the RD-232 interface. That interface, along with the proprietary software allows the unit to serve as a strip chart recorder, data logger, or glitch recorder for capturing intermittent problems.

The company's line of power supplies feature analog technology that is inherently

noise free, and allows the supplies to be used in pager, and other RF service where power supply noise (noise generated by switching power supplies for example) would interfere with the diagnosis and repair of the original problem. Supplies range in voltage from 30 to 60 volts and current up to 10 amps. Analog, and digital displays, with single, dual, and triple units are available.

Protek makes the only analog multimeter with an FET high impedance front end: the model A-450. The Model A-445 is a true RMS analog/digital multimeter with a dual display. Protek's line of analog meters range in price from \$10.95 to \$99.00.

The company's equipment has a two year warranty with all service performed in Northvale, NJ, where Protek is headquartered. All Protek equipment is available through a network of electronic Distributors. Contact Protek's web site at: [www.hcprotek.com](http://www.hcprotek.com).

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E-mail: [sales@quantumdata.com](mailto:sales@quantumdata.com)

Web site: <http://www.quantumdata.com>

If you are involved with designing, building, installing, testing or repairing video displays or video projectors, you should see what Quantum Data video test equipment has to offer.

One good way to check out the complete product line or download the latest software updates is to check out Quantum Data's website (<http://www.quantumdata.com>).

#### Find out fast by contacting Richardson Electronics.

To learn more about the products and see how little they cost for all that they can do for you, contact Richardson Electronics, LTD, the national distributor for Quantum Data products for the service industry. Richardson is the world's leading CRT distributor with over 60 locations and one of the most technically adept sales and support teams in the distribution industry.

You can get sales and technical support by contacting Richardson's Display Product Division directly by calling 1-800-222-2787 or by e-mailing [dpg@rell.com](mailto:dpg@rell.com).

#### Sophisticated testing made simple.

The Quantum Data 800 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.

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

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

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

#### Color convergence made fast.

In addition to products for generating and distributing video test signals, Quantum Data also makes equipment that lets you analyze the convergence of color CRT displays. The 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  $\pm 0.02$  mm), repeatable readings on the production line, or in the field. The CG-1 gauge is priced thousands below measurement systems of comparable accuracy.

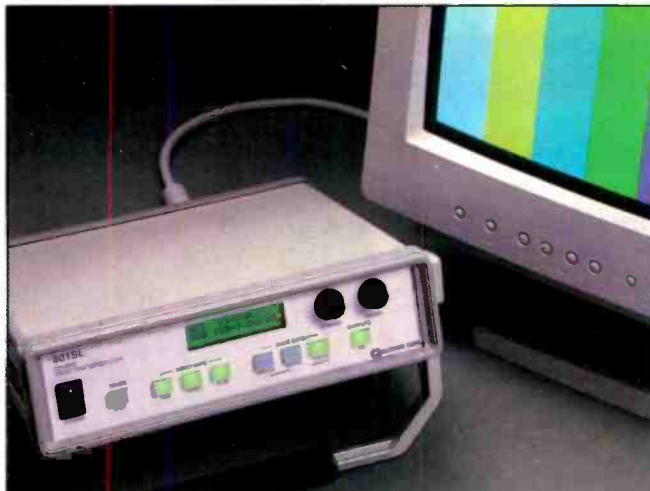
#### About Quantum Data.

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.

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 and servicing environments.

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The 100MHz CRT Readout Oscilloscope is just one example of Tenma's commitment to providing accurate, reliable test equipment, for a reasonable price. From oscilloscopes to DMMs, function generators and counters to power supplies, Tenma can supply your needs.

The complete Tenma Test Equipment line can be found at MCM Electronics. MCM is the undisputed leader in supplying the consumer electronics service industry. Stocked are over 36,000 items including original repair parts, semiconductors, technicians aids, chemicals, tools and Tenma Test Equipment.



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## Sencore, Inc.

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

### Real people answering your servicing needs!

Time is money. Lost or wasted time is money right out of your pocket. Every time you have to fiddle with a knob, connect and reconnect leads, or remeasure a test point because you just aren't sure, it costs you dearly.

Saving time is our business. Sencore test equipment is specially designed to help servicers save time. As you look at the Sencore product line, you'll notice that each instrument has a fresh, uncluttered, easy-to-use look. Our design engineers put the complicated electronics on the inside, but keep your operation simplified on the outside.

Each member of Sencore's exclusive instrument line is packed with time-saving, money-making features not available anywhere else. Sencore products are widely known for their quality, innovation, and outstanding value. And each instrument is all American-made, right here in the heartland of the U.S.A.

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—mak-

ing 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 spe-

cially 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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(736-2673)

**Fax**  
1-605-339-0317

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Sioux Falls, SD 57107  
(605)339-0100  
Call 1-800-SENCORE (736-2673)

## I.C.M. Components

1545 Sawtelle Blvd. Suite 21

Los Angeles, CA 90025

Phone: 310-268-1005

Fax: 310-445-5003

Web Address: <http://home.att.net/~ICMSTEVE>

E-mail: [ICMSTEVE@worldnet.att.net](mailto:ICMSTEVE@worldnet.att.net)

I.C.M. Components is an importer and distributor of high quality computer monitor flybacks, computer monitor testers, schematics and service manuals. Flybacks for televisions are also available.

Offering the highest level of service, I.C.M. processes and ships most orders the same day from an inventory of over 600 different types of flybacks and 860 different types of schematics/service manuals. There are no minimum orders and most major credit cards are accepted.

Helping the repair technician is I.C.M.'s top priority. In addition to schematics and service manuals, we offer several types of software designed to assist the tech. One such software program is our Tech-Tip Repair Program for Windows that we

sell for \$199.95 plus S&H; the program contains over 1,600 Monitor, CPU, and Power Supply failures listed by symptom and solution. The program is updated once a month and upgrades can be purchased for a small charge plus S&H. As a bonus, the FCC-ID Database program described below is included at no extra charge with the new WINDOWS Tech Tips program (a \$50.00 value if purchased separately).

To help identify who made the different brands of monitors, I.C.M. offers a FCC-ID software program for \$50.00. The FCC-ID database contains over 60 pages of monitor manufacturers names and addresses. The software is easy to install and operate; no long instruction texts are

ever required. With so many off-brands of monitors being sold now, this program is a must to easily identify the O.E.M.

Our line of Computer Monitor Testers are affordable and easy to operate. Starting at only \$129.00 plus S&H our testers can test most of the IBM compatible monitors including MDA, CGA, EGA, VGA, SVGA. There is no need to use a computer or to change video cards; the ease of operation, reliability and low price has made our testers a very popular choice with repair depots that already own the top names in testing equipment. Recently, we have introduced three new testers that will test Apple Mac monitors in addition to the IBM compatibles; one of the new models is also capable to test up to five different IBM compatible monitors simultaneously for long term burn-in. A new TV tester is now also available; price and specifications on all testers are available upon request.

I.C.M. sales people are dedicated to complete customer satisfaction. Our staff is knowledgeable, dependable and friendly. To obtain the latest availability and pricing call us between 8:00AM - 5:00 PM (Pacific) Monday through Friday. Fax or e-mail us at anytime and we'll respond promptly. ■

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### MT802 MONITOR TESTER

Can be used to quickly and easily trouble-shoot, test and align IBM compatible and Macintosh computer monitors.



### MT803 MONITOR TESTER

Same functions as the MT802, plus can test up to 5 IBM compatible monitors simultaneously.



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On 1.44 disk to help you identify who manufactured the monitor you are trying to repair. Program contains over 60 pages of manufacturers names and addresses.

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# Electronic Design Specialists

4647 Appalachian Street  
Boca Raton, FL 33428  
Phone: 561-487-6103

Electronic Design Specialists is a maker of specialty test equipment designed specifically to help electronic technicians troubleshoot electrical problems as quickly as possible. All test equipment is designed by David T. Miga, CET, who is both an electronic engineer and a servicing technician.

Dave started EDS ten years ago with the now-famous SemiAnalyzer 59C, which he designed originally for himself to increase his output as a service technician. After other technicians saw the amount of help the SemiAnalyzer was providing and asking Dave to custom-build them their own units, EDS was born. Used by the military, fortune 500 companies, individual service technicians, and many technical trade schools and colleges, the SemiAnalyzer was just the first

in a series of unique test solutions to aid various technical specialties.

Following the SemiAnalyzer was the Bus Line Tracer, which located shorted and leaky components to their exact location on the PC board, the Teletester series, which simulated two telephone lines for repairing answering machines and faxes, and the MicroAnalyzer, which was designed to help microwave oven technicians check all parts in-circuit under high-voltage load.

At the St. Louis convention last year, EDS introduced the LeakSeeker 82A, which like the Bus Line Tracer, locates the exact location of shorted or leaky components, although the LeakSeeker is a digital, automatic version of the Bus Line Tracer, with many more capabilities. For 1997, EDS introduced the world's best

and fastest in-circuit electrolytic capacitor checker, the CapAnalyzer 88.

Dave uses the basic idea that a service technician simply needs to know if a component is good or bad, and doesn't need to be confused by electrical statistics that only an engineer could care about. (Look in the "used test equipment" section to see evidence of "purchase overkill"). Therefore, all EDS equipment is reasonable priced, designed to check components quickly in circuit, with calibrations to determine component condition as good or bad, based on Dave's 25 year service experience. The CapAnalyzer 88 reflects this approach by automatically discharging the capacitor, checking for shorts or DC leakage, then checking high-frequency ESR, quickly alerting the technician by both beeping and indicating the condition of the capacitor....all within three seconds.

As the electronic service repair industry heads into the twenty-first century, Dave will keep on thinking of new products that make it easier for the consumer electronics technician to make a profitable living in repairing today's and tomorrow's complex electronics. Dave invites all technicians to call or write to him regarding their ideas for test solutions they would like to see in the EDS test equipment lineup. ■

**CHECK CAPACITORS IN-CIRCUIT WITH 100% ACCURACY IN 3 SECONDS---GUARANTEED\***

Automatically discharges capacitor, checks for DC leakage (DCR) and beeps below your preset value, measures ESR on LED bar and beeps from 1 to 5 beeps for values from good to bad.

- ONE-HANDED GOLD-PLATED TWEEZER PROBE
- HANDY 3-COLOR CHART SHOWS TYPICAL READINGS
- 20 SEGMENT LED METER DISPLAYS ESR FROM 0.1 TO 20 OHMS
- PORTABLE, RUNS ON AAA BATTERIES



**CapAnalyzer 88 \$169**

**FIND THE EXACT LOCATION OF ANY SHORTED OR LEAKY COMPONENT IN SECONDS---GUARANTEED\***



Stop cutting up the PCB and unsoldering each suspicious part to check out of circuit because your ohmmeter can't handle the job. Simply touch LeakSeeker's probe to any solder pad along the trace showing the short, and listen for the highest beep, 'cause that's exactly where the bad part is!

LeakSeeker can find components that other equipment can't, because it has a range from zero to 150 ohms, with a resolution of 0.001 ohms. You would need a six-digit DVM to do what LeakSeeker 82A can do.

**LeakSeeker 82A \$169**

**\* 60 DAY TRIAL PERIOD WITH MONEY-BACK GUARANTEE ON ALL EDS EQUIPMENT. THREE YEAR WARRANTY PARTS & LABOR. FREE TELEPHONE SUPPORT.**

**ELECTRONIC DESIGN SPECIALISTS (561) 487-6103**

we make test equipment designed to make you money.



## Leader Instruments Corporation

380 Oser Avenue

Hauppauge, NY 11788-3694

Phone: toll-free 1 800-645-5104, NY State 516-231-6900

Fax: 516-231-5295

### MEMORANDUM

Leader Instruments, DTV, HDTV and more...

There is a new dawn out there. Possibly the greatest evolution of television technology since the introduction of color television, DTV is promising to bring video communications to a higher level. Over 130 television broadcast stations have already contracted to install DTV transmitters and major television set manufacturers will be introducing sets and set-top converters by the end of 1998. Service opportunities abound in this new era. New DTV technology will increase television set prices over 300% to help combat the throw-away society syndrome. These larger

sets will increase opportunities for more lucrative field service work while the availability of HDTV signals from broadcasters will increase antenna usage - providing opportunities for antenna installation and maintenance work. The change to DTV will also effect hospital and hotel/motel equipment maintenance contracts - with the more expensive DTV set in place, the same contract will be worth a lot more income. There is no doubt about it - DTV will boost the value of consumer electronics equipment and service income per repair will definitely increase as well. A bright new dawn for the service industry and those who chose to serve it.

Recognizing the opportunities in this new lucrative market, Leader



The first HDTV combination waveform monitor/vectorscope provides both serial digital (1.5GHz) and analog HDTV inputs.

Instruments, has dedicated their resources to the development of DTV and HDTV instrumentation initially for use in broadcast and post production

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**Price vs Performance**  
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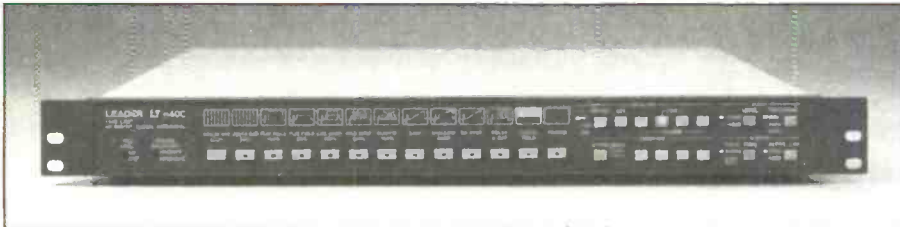
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# ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★



The first HDTV generator providing 1.5GHz uncompressed serial digital outputs.

operations. Our newest introduction of HDTV instruments include the **LT 440D Digital High Definition Generator** and the **LV 5150D Combination Digital/Analog HDTV Waveform Monitor/Vectorscope**. To satisfy the broadcast industry's needs for experimenting with the various resolutions allowed by the ATSC standard, we have also introduced the **LT 1608 Video Encoder**. The LT 1608 works in conjunction with our **LT 1610 Programmable RGB Generator** to provide the signal generation flexibility needed for experimenting with various HDTV resolution standards. We find it interesting that the very product

(LT1610) that is used to troubleshoot and align computer monitors in the service industry is now being used to evaluate broadcast standards. In addition to the above, we also provide a line of standard video products that complement and work in tandem with the newly introduced HDTV products. We are proud to claim that our digital video and HDTV products are presently being used by two major television networks and we are looking forward to making a similar claim about the service industry in the years ahead. From standard NTSC to digital video to HDTV Leader provides a comprehensive solution to all of your testing needs. And, as DT

and HDTV become wide spread, Leader will be there - ready as always - to provide comprehensive solutions to your service needs. In the mean time, we appreciate your support and your business for our standard NTSC video equipment as well as our standard test instruments (oscilloscopes, frequency counters, function generators and power supplies as advertised below). If you have any questions or require additional information on our digital video and/or HDTV instrumentation please feel free to call us at 1 (800) 645-5104.

Sincerely,

George Gonos  
Director of Marketing

PS. Did you know that Leader is presently marketing portable field strength meters for CATV/MATV and satellite work for under \$900? Call 1 (800) 645-5104 for details. ■

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# CMM

## Monitor Test Equipment



### Checker 12e

Now you can repair and test Computer monitors with ease. With sweep rates up to 64Khz., eight step gray scale, white screen, single color mode, Mac II, EGA, CGA support, you can run almost ANY PC monitor. And it is EASY to use. Color front panel displays show just what you should see. Don't let its' small size fool you. It is the most powerful handheld available, and it supports ALL basic VGA modes (some don't). It is suitable for bench or field operations. Battery or AC operation.

**PRICE: \$295**



### Checker Jr.

Looking for a SMALL battery operated monitor test pattern generator that will fit in your pocket? The Checker Jr. is it. It displays a very useful 64 color pattern. You can evaluate size, focus, linearity, color tracking, and balance. It operates in the 640 x 480 mode (31.5Khz x 60Hz.), and is very easy to use. Use it anywhere.

**PRICE: \$99.95**



**NEW!**  
**Checker  
TV Pro  
& TV Jr.**

The TV Pro is just the tool for your repair bench. It provides Video, S-Video, and RF outputs. It also has the most important pattern, GRAY SCALE! You can't set up a color TV without it. All with NTSC standards and COMPLEX sync. The RF output also includes an audio tone and STEREO signaling. With colorbars, gray scale, crosshatch, with dots, you can set and test quickly.

**Checker TV Pro.....PRICE: \$599.95**

The TV Jr. is a small NTSC video generator, with colorbars, cross-hatch with dots, white, red, blue, green, and black screens. Small enough to fit in your pocket, powerful enough to drive the largest projection TV!

**Checker TV Jr.....PRICE: \$149.95**

**Computer & Monitor Maintenance, Inc.**

**1-800-466-4411 • 770-662-5633**

<http://www.computermonitor.com>



## ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

## Computer & Monitor Maintenance (CMM)

6649-N Peachtree Industrial Blvd.  
Norcross, GA 30092

Phone: 1-800-466-4411

Web site: <http://www.computermonitor.com>.

CMM was established in 1990 as a computer and monitor repair company. The computer portion of the business lasted less than 60 days. Once our customers found out that we could repair monitors, that was all we did.

We soon found out that the available tools were limited and the few that were available were VERY expensive. Based on years of video repair and microprocessor design experience, we set out to design a line of "test equipment tools" to help us. The result was our patented "Checker". It had only three modes, but was extremely well received. First marketed in 1992, it was the first portable, inexpensive computer monitor tester. As the monitors grew in size and capability, we found that additional modes were required. The most important feature we wanted was a Gray Scale. As you know, a Gray Scale is required to properly set-up and evaluate VGA monitors. Additionally, we felt that ALL basic VGA modes should be supported, along with the correct "VESA" standard timings. The "Checker 12" was the result. With modes that extended to the "Super VGA NI", it was the most versatile handheld monitor tester available. Later we enhanced it to increase its max. scan rate to 64Khz., and released the "Checker 12E". Further, we released a modification for all of our "Checker 12 and 12E" products, to drive most "Apple Mac" 14"-17" monitors. You asked for it and we delivered.

Along the way we introduced three additional "tools". The "Checker II", a monochrome (TTL) tester. "The Checker Jr.", the smallest (1"x2"x3") 64 color VGA test pattern generator. And the "Checker VI", the first six port VGA self-contained (no computer required) test pattern generator. This test equipment has been sold all over the world.

We have just announced our latest line of test equipment for the television industry. The "Checker TV Pro" and the "Checker TV Jr.". They are based on the same patented technology found in our other "Checker" products. With Gray scale, colorbars, cross hatch, stereo, S-video, and RF outputs, the "Checker TV Pro" is a very versatile "tool", both in the shop and in the field. The "Checker TV Jr." is the smallest NTSC color pattern generator available. With colorbars, cross hatch, Red, Blue, Green, White, and Black screens, it is a powerful "tool" in a small, pocket-sized (1"x2"x3"), package.

For additional information, just give us a call at 1-800-466-4411, or you can visit us at our web site, <http://www.computermonitor.com>.

## Telematic

108-02 Otis Avenue  
 Corona, NY 11368  
 Phone: 718-271-5200  
 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 multi-set 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.

The test jig allows the service center to bypass the set's own picture tube, yoke and related components, thus giving an indication of their condition. It also allows the field technician to remove the chassis from a large set in the home, leaving the cabinet and picture tube/yoke assembly in

place. The service center no longer has to send two men and a van to haul in the complete set with picture tube, cabinet, etc., and repeat the same cumbersome and costly procedure to return the completed job with the possibility of damage to the set and injury to the men.

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

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## TELEMATIC'S TEST JIG SYSTEM

*Quick to hookup...Easy to use...For all popular makes and models*

The TeleMatic Test Jig System is designed to facilitate TV chassis troubleshooting without the need for bringing the cabinet and picture tube to the shop. With the trend toward larger—27-, 30- and 35-inch—picture tubes and projection sets, a test jig is needed more than ever!

**Telematic** DESIGNERS & MANUFACTURERS OF COLOR T.V. TEST JIGS AND ADAPTORS

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# Electronics quiz

by the ES&T Staff

As we have reported in the past, every year, the Vocational/Industrial Clubs of America (VICA) hold a skills championship. A number of skills training groups take part in these championships, including such diverse groups as electricians, hairdressers, jet-engine mechanics and food preparation specialists.

Individuals who are studying to be service technicians are represented at these championships. The competition that these individuals enter is called the Electronic Product Servicing Contest. It's a pretty stiff competition. It includes a written multiple choice test, a requirement to construct an electronic kit, and diagnosis and repair of several electronics products that have been rigged with problems.

At the most recent competition, I asked a member of the Consumer Electronics Manufacturers Association if **ES&T** could obtain a copy of one of these tests for publication in a future issue of the magazine. He obtained permission to provide me with a copy of the test. It's a pretty lengthy test, so we're only going to present a portion of it here.

Actually, CEMA gave me the test, but not the answers, so the answers are the ones that I came up with. I'll confess, though, I referred to several texts to get some of these answers. The students who took the test at the competition did so without the books, relying only on the knowledge they retained from the course work they did in school.

Take a shot at it and see how you do. If your answers are different from mine, you're probably right. I'd like to hear from you if you have any serious dis-

agreements. Let me know how you arrived at your answers.

1. What is the relationship between the frequency and wavelength of radio waves?

- a. no direct relationship
- b. directly proportional
- c. inversely proportional
- d. wavelength varies inversely according to the square of the frequency

2. The rate of energy consumption in a circuit is the:

- a. reactance
- b. power
- c. resistance
- d. phase angle

3. The opposition to current resulting in energy dissipation is:

- a. reactance
- b. resistance
- c. inductive reactance
- d. impedance

4. If the period of a sine wave is 0.5ms, the frequency is:

- a. 100Hz
- b. 500Hz
- c. 1000Hz
- d. 2000Hz

5. Some circuit components have opposition to ac currents, but do not dissipate heat (use energy) in the process. This opposition is:

- a. reactance
- b. XL but not XC

- c. XC but not XL
- d. impedance

6. Which of the following best describes the term "decibels?"

- a. the power dissipated at the input of a device
- b. the power dissipated at the output of a device
- c. the ratio of the input and output powers
- d. a reference for sound

7. A resistor that has a color code *red, red, silver*, has a value of:

- a. 222 at 10%
- b. 2200 at 10%
- c. 220 at 5%
- d. 2200 at 5%

8. A circuit has a 68,000Ω resistor and a 0.01μF capacitor. The time constant is:

- a. 68.0μSec
- b. 6.8mSec
- c. 680.0μSec
- d. 0.068mSec

9. The three electrodes of a JFET are called:

- a. emitter, base, collector
- b. source, drain, collector
- c. drain, source, gate
- d. source, gate, collector

10. To design a common-collector transistor amplifier circuit:

- a. put the collector at ac ground
- b. apply the input to the base
- c. take the output from the emitter
- d. all of the above must be done

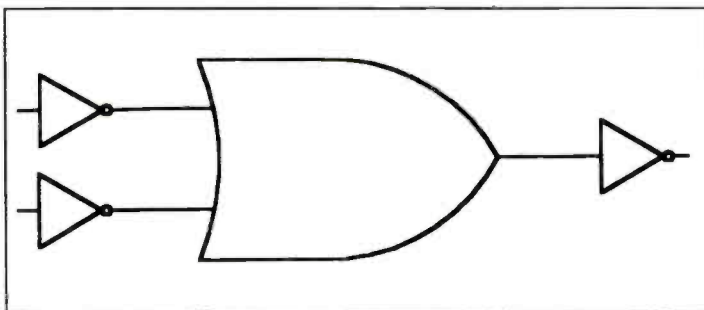


Figure 1. An OR gate with inverters at the inputs and at the output is the equivalent of one of the standard logic gates. Which one?

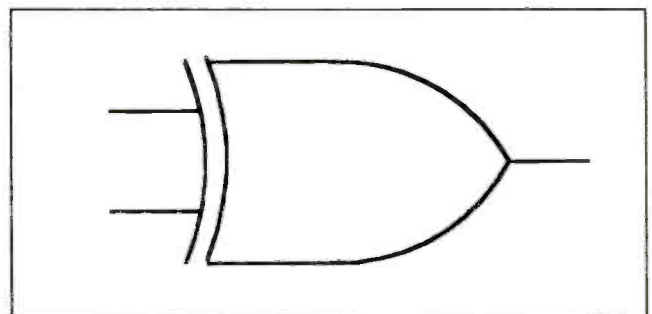


Figure 2. This is the symbol of which logic gate?



A	B	Out
0	0	0
0	1	0
1	0	1
1	1	0

Figure 3. Which gate has this truth table?

11. Which amplifier configuration has the best power gain?

- a. common emitter
- b. common base
- c. common collector
- d. emitter follower

12. Which of the following is not a flip-flop?

- a. J-K
- b. R-S
- c. T
- d. one-shot

13. A clocked R-S flip-flop:

- a. cannot be used in a synchronous circuit
- b. has a gated input
- c. cannot be used in an asynchronous circuit
- d. has a built-in clock

14. As shown in Figure 1, an OR gate with inverters at the inputs and at the output is the equivalent of a(n):

- a. NOR gate

- b. NAND gate
- c. AND gate
- d. XOR gate

15. The logic symbol in Figure 2 represents a(n):

- a. XOR gate
- b. AND gate
- c. NOR gate
- d. NAND gate

16. The truth table of Figure 3 describes the behavior of a(n):

- a. exclusive NOR gate
- b. AND gate
- c. NAND gate
- d. exclusive OR gate

17. A device that is used to eliminate or minimize ripple in a power supply is a:

- a. resistor
- b. filter
- c. diode
- d. coil

18. Audio generators have selective output waveforms. A primary use of the "square-wave" mode is to:

- a. determine the capacitance of a capacitor or the input circuit of a solid-state amplifier.
- b. Adjust the delay time of the variable delay line in the sync separators of a TV monitor
- c. determine the audio response in amplifiers
- d. determine if both the left and right channels are balanced in a stereo amplifier

19. The main purpose(s) for including

the Dolby system in audio equipment is (are):

- a. reduce wow and flutter
- b. avoid unwanted oscillations
- c. reduce noise
- d. all of the above

20. In a class B amplifier, the operating point on the load-line is:

- a. at saturation
- b. at cutoff
- c. in the middle of the load line
- d. below cutoff

21. When servicing a product with a "hot" chassis, what are the recommended bench connections?

- a. connect all the test equipment to grounded ac outlets and the product under test to an isolated output
- b. connect the product to a non-isolated outlet and the test equipment to isolated outlets
- c. connect everything to isolated outlets
- d. none of the above

22. Which color guns in a TV CRT are conducting when the screen color is yellow?

- a. green and blue
- b. green and red
- c. blue and red
- d. green and white

23. The position of the yoke in a color TV affects:

- a. contrast
- b. high voltage
- c. purity
- d. gray scale

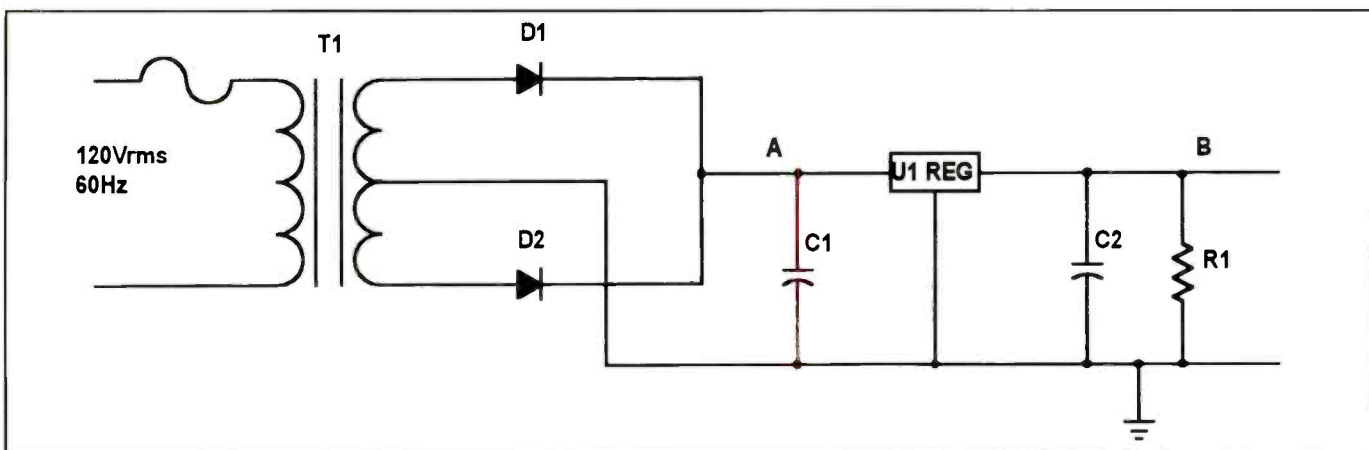


Figure 4. If D2 in this circuit opens, what happens to the no-load voltage at point A?

# PRODUCTS



## Oscilloscope benchtop kits

ITT Pomona introduces a series of Benchtop Test Companion Kits for Hewlett-Packard 54600 Series oscilloscopes. Each kit offers the technician all of the compatible test accessories needed in a pouch of Cordura material, ready to mount to the instrument. These kits include either two or four sets of switchable probes. The number of probes matches the number of channels of the particular HP scope. The switchable probes feature either zero or x10 signal attenuation by means of a switch. Most kits include additional accessories for external trigger requirements.

There are four kit models available for the various oscilloscope models.

Circle (50) on Reply Card

## Isolated ac power sources

The *Global Specialties* Models 1505 and 1506 are continuously variable, triple isolated dual output ac power sources. Each model features two outputs of 0Vac to 150Vac and 4A and 0Vac to 260Vac at 2A. The model 1505 is designed to be used with a 115Vac to 120Vac at 60Hz input and the model 1506 is designed to be used with a 220Vac to 240Vac at 50Hz input.

Both models are designed for circuit



design and development by modern electronic laboratories as well as production line testing and repair facilities, hospitals, vocational-technical schools and universities and any other application where a clean, electrostatically and galvanically isolated variable line supply is needed. The super isolation transformer output voltage is continuously adjustable throughout its entire range and is triple isolated from the input line to protect against shock hazard. Power line leakage can be measured on the digital output panel meter by means of a selectable range probe. These units are fully protected by fuses in the primary and secondary.

Circle (51) on Reply Card



## Bench DMM

*B&K Precision* has introduced the Model 5490 Bench DMM, a 50,000 count, 0.025% accuracy unit.

The meter features full DMM measuring capabilities including dcV to 1,000V at 0.025% accuracy, acV with true rms (ac or ac + dc), and overvoltage protection (1100Vdc + ac peak, dc and ac current measuring ranges are from 500mA to 10A, resistance 0.01Ω to 50MΩ), capacitance at 10pF to 50,000uF. The unit provides 600Vdc capacitance/resistance protection, and frequency measurement ranging from 0.5Hz to 500kHz. A 50,000-count resolution LCD provides easy readings, supported by a 34-segment analog bargraph.

Circle (52) on Reply Card

## DMM

*Oldaker* offers a meter that fits on the hand or wrist while the lead fits over the finger, which allows the user freedom to probe the equipment and read the meter with one finger.

Circle (53) on Reply Card

24. In Figure 4, if D2 opens, what happens to the no-load voltage at point A?

- it should double
- it should be cut to one-half
- it should remain about the same
- it should drop to zero

25. In testing the power supply of Figure 4, you observe a steady 60Hz ripple at point A. The most likely problem is:

- D1 is open
- D1 is shorted
- C1 is open
- this is normal

26. In Figure 4, which of the following defects will cause the fuse to open when power is applied?

- T1 primary is open
- D1 is shorted
- D2 is open
- C2 is open

27. What device would be used to interface a temperature sensor to a microprocessor?

- D/A converter
- A/D converter
- V/F converter
- Digital multiplexer

28. What logic level would be seen on a data line from a microprocessor in a normally operating system?

- high
- low
- pulsing
- it depends on the processor used

29. Which of the following memories is classified as volatile?

- EPROM
- RAM
- ROM
- EEROM

10. d.	20. b.
9. c.	19. c.
8. c.	18. c.
7. b.	17. b.
6. c.	16. d.
5. a.	15. a.
4. d.	14. a.
3. b.	13. c.
2. b.	12. d.
1. c.	11. a.

Answers to the quiz

# BOOKS

*The Video Hacker's Handbook*, by Carl Bergquist, PROMPT Publications, 336 pages, paperback \$24.95

Geared toward electronic hobbyists and technicians interested in experimenting with the multiple facets of video technology, *The Video Hacker's Handbook* features projects never seen before in book form. Video theory and project information is presented in a practical and easy-to-understand fashion, allowing you to not only learn how video technology came to be so important in today's world, but also how to incorporate this knowledge into projects of your own design. In addition to the hands-on construction projects, the text covers existing video devices useful in this area of technology plus a little history surrounding television and video relay systems.

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214

*Complete Guide to Video*, By John Adams, PROMPT Publications, 240 pages, paperback \$24.95

The TV has become the largest icon of modern society, but as new and better video components are coming to the market every year it is hard to know what to buy and what will work together to form the best video system ever. *The Complete Guide to Video* will explain video systems in easy-to-understand language, outlining the common components of modern video and audio technology and giving details and features of the newest gadgets on the market today. The ten chapters cover video and audio editing, an introduction to home video basics, mixed signals, magnetic and optical recording devices, camcorder basics, video games, and system troubleshooting and testing.

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214

*Radio Science Observing, Volume 1*, By Joseph J. Carr, PROMPT Publications, 336 pages, paperback \$29.95 includes CD-ROM

Among the hottest topics right now are those related to radio: radio astronomy, amateur radio, propagation studies, whistler and spheric hunting, searching for solar flares using Very Low Frequency (VLF) radio and related subjects. Author Joseph Carr lists all of these under the term "radio science observing" - a term he has coined to cover the entire field. In this book you will find chapters on all of these topics and more. The main focus of the book is for the amateur scientist who has a special interest in radio. It is also designed to appeal to amateur radio enthusiasts, short-wave listeners, scanner band receiver owners and other radio hobbyists.

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214

# PHOTOFACTS

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JSJ12023 Suffix C .....	3912

## GE

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27GC802KF1 .....	3919
27GC802KF2 .....	3919
27GC802MF1 .....	3919
27GC802MF2 .....	3919
27GC804MF1 .....	3919
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27GT612FE1 .....	3919
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CT-27G22CV .....	3910
CT-27G22UV .....	3910

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VRX360AT21 .....	VCR-292

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TP1319DV .....	3915

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TXD1973 .....	3920
TXD1973CX .....	3920

## SANYO

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DS25730 .....	3914
G5C-2507U0 .....	3914
G5C-2507U1 .....	3914
G5C-25070 .....	3914
G5C-25071 .....	3914
25730-00 .....	3914

## SHARP

CJ13M10 .....	3911
CJ13M15 .....	3911
CJ25S18 .....	3918
CJ25S20 .....	3918
CJ27S10 .....	3909
13J-M100 .....	3911
13J-M150 .....	3911
14MJ10 .....	3911
25J-S100 .....	3918
25J-S180 .....	3918
25J-S200 .....	3918
27J-S100 .....	3909
27J-S180 .....	3909

## SYLVANIA

L191G .....	3917
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## ZENITH

SY3572DT .....	3913
SY3572DTM .....	3913
Z25X22S .....	3916
Z25X22SM .....	3916

# About Electronics

## What's new in Fiber optics?

by the ES&T Staff

Fiber optics seems to be an aspect of technology that's constantly on the verge of being applied to consumer electronics in such a way that it will affect service centers, but so far it has not done so. It is, very likely, simply a matter of time, however, before outside technicians will have to concern themselves with disconnecting and reconnecting fiber optic cables from consumer electronics products. After all, some new home construction, in some areas, are having fiber optic cables installed for future use, and some distributors of television programming are accomplishing at least part of their distribution via fiber optics.

Moreover, many consumer electronic service centers are either involved in, or on the threshold of servicing computer networks, some of which use fiber optics for transmission of signals.

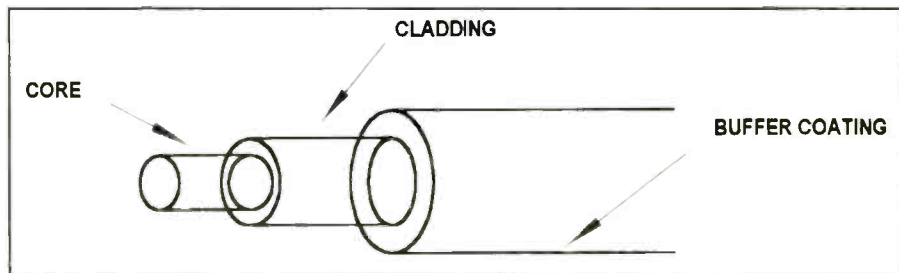
For these reasons, this article presents some information about fiber optics, in the form of a glossary. We hope it provides readers with a basic knowledge of the subject on which to build.

### Fiber optics

Fiber optics is the technology that consists of transmitting signals via light beams through hair thin strands of glass or plastic fiber (Figure 1). The light is guided through the fiber by reflecting off the outside of the center of the fiber, called the "core." The core is surrounded by optical material called "cladding," that causes the reflections. The core and cladding are usually made of ultra-pure glass, although some fibers are made from plastic. The fiber is coated with a plastic covering called the "buffer coating," which protects it from moisture and other damage. Further protection is provided by a "cable," which has an outer coating called a "jacket."

### Multimode fiber

There are two types of fiber in common use in fiber optics: multimode and single mode. Multimode has a larger core (almost always 62.5 microns [a micron is



**Figure 1.** The heart of a fiber optic cable essentially consists of three components: the core, the cladding that surrounds the core, and a buffer coating. An actual fiber optic cable will have additional coatings to protect it from damage.

one-millionth of a meter]) and is used with light emitting diode (LED) sources at wavelengths of 850 and 1300nm (see Figure 2) for local area networks (LANs).

### Single mode fiber

Single mode fiber has a much smaller core than does multimode fiber; only about 9 microns in diameter, and is used for telephony and CATV with laser sources of 1300 and 1550nm.

### Wavelength

You all know what wavelength is, but in the case of fiber optics, it actually describes the color of the light used to transmit the information. In plastic fiber applications, the light used is produced by a bright red LED. All fiber optics systems that use glass fiber, use light in the infrared region. Infrared light is invisible to the human eye. Wavelengths at these frequencies are reckoned in nanometers (nm), or billionths of a meter.

### Connectors

Just as with wire connectors, fiber optic connectors are used to mate two fibers, or a fiber to a piece of equipment. Connectors are used in cases where they may have to be disconnected occasionally for testing or rerouting.

### Splices

A fiber optic splice is a permanent connection between two fibers that is made by welding them in an electric arc, or

aligning them in a fixture and gluing them together. A splice that results from welding with an electric arc is called a "fusion splice." A splice that results from gluing the fibers together is called a "mechanical splice."

### Loss

The term loss as applied to fiber optics has a meaning that is very similar to the term as applied to electronic circuits. Loss in fiber optics describes the amount of light that is lost in a mated pair of connectors, a splice, or in a length of fiber. And just as in electronics loss in fiber optics is measured in decibels (dB).

Most connectors exhibit a loss of about 0.5dB. A splice has about 0.2dB loss. Multimode fiber losses are about 3dB per km, which is about equivalent to 5dB per mile, at 850nm, and 1dB per km (1.6dB per mile) at 1300nm. Single mode fiber losses are about 0.4dB per km at 1300nm and 0.3dB at 1550nm.

### Loss measurement

Loss is measured using a source of known strength, and a power meter, according to two standards set by the Electronic Industries Association (EIA). Standard FOTP 171 covers testing of short jumper cables, and OFSTP-14 covers installed cables. All loss tests work the same way; they test the loss of an unknown cable mated to a known good cable (launch reference cable) using a source and a power meter.

## Optical power

Optical power is measured in dBm, or decibels referenced to 1mW. While loss is relative (one power relative to another), optical power is an absolute measurement, referenced to standards.

## Fiber optic standards

Standards for fiber optic testing have been set by several groups, but most follow the fiber optic test procedures (FOTPs) developed by the EIA. Some of the EIA procedures are also called OFSTP (optical fiber system test procedures). Standards for optical power measurements are set by NIST (the US National Institute of Standards and Technology).

## Timeliness

Fiber optics is a relatively young, and quickly developing, technology. For that reason, much of what is written quickly becomes out of date. Experts in the field of fiber optics suggest that when someone reads about fiber optics, he keeps the following in mind:

- If it was written three or more years ago, it may not describe the current state of the art of fiber optics.
- Check to see if it applies to your appli-

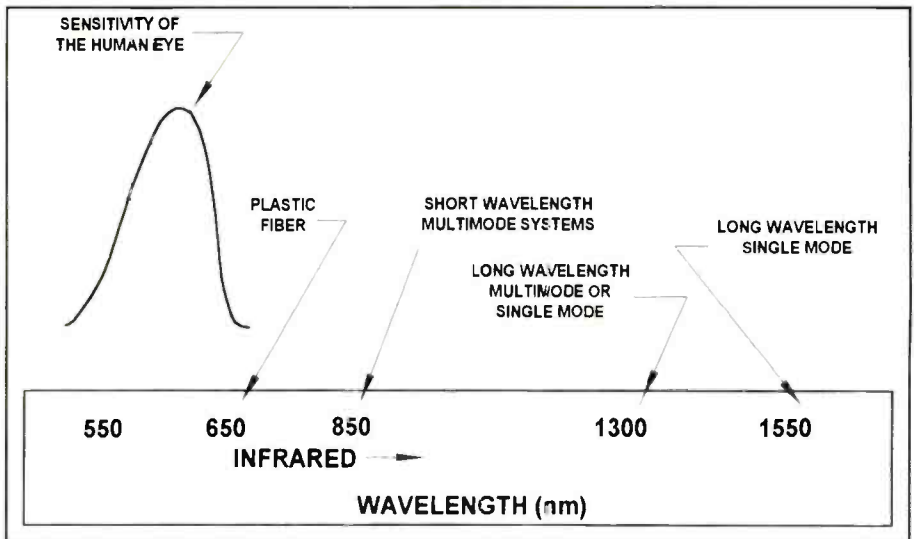


Figure 2. Except for plastic fiber, which uses a bright red LED light, fiber optic signal transmission uses light in the infrared region of the light spectrum.

cation. There are great differences in telephone, CATV and LAN applications, and differences between single mode and multimode applications as well.

- Check to see what the credentials of the author are. Look to see if he may have a hidden agenda.
- Check to see if the information you're

reading follows a current fiber optic industry standards.

*This article was based on information from the booklet "Lennie Lightwave's Guide to Fiber Optic Testing," by fotec, the fiber optic test instrument company, and fiber U.*



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## Replacement Parts (from page 18)

**Nintendo of America**  
4820 150th Avenue NE  
Redmond WA 98052  
800-447-8373

**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

**Panasonic Services Company**  
**formerly Matsushita**  
20421 84th Avenue South  
Kent, WA 98032  
800-833-9626/Fax: 800-237-9080  
800-545-2672 (For the location of nearest distributor)

**Penney, J.C.**  
National Parts Center  
6840 Barton Road  
Morrow, GA 30260  
800-933-7115  
Fax: 800-677-5025

**Philips Consumer Electronics Company**  
Philips Service Company  
PO Box 555  
401 Old Andrew Johnson Highway  
Jefferson City, TN 37760  
423-475-8869  
Replacement Parts/Service Literature  
800-851-8885  
Fax: 800-535-3715

**Pilot Audio Video Systems**  
Information available on this company:  
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/ 800-457-2881  
Fax: 310-816-0412

**Proton Corporation**  
13855 Struikman Road  
Cerritos, CA 90703  
310-404-2222/ Fax: 310-404-2322

**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.**  
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San Jose, CA 95134  
408-432-8800

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

**Runco International**  
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Hayward, CA 94545  
510-293-9154/ Fax: 510-293-0201

**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  
Fax: 310-604-1664

**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.  
PO Box 9038  
Compton, CA 90224-9038  
310-537-5830  
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Fax: 201-512-3456  
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La Mirada, CA 90638-5730  
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Evanston, IL 60202-3696  
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816-891-7550

**Soundcraftsmen, Inc.**  
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Santa Ana, CA 92705  
714-556-6191/ Fax: 714-662-0750

**Sparkomatic Corporation**  
Routes 6 & 209  
Milford, PA 18337  
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Parts: 800-338-5085

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

**Symphonic Corp.**  
(Also Funai)  
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**Technics** - See Matsushita

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Fax: 615-444-7481

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Fax: 206-623-6609  
Parts Fax: 206-343-9029

**Unisonic Products Corp.**  
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Campbell, CA 95008  
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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.

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Fax Orders: 800-634-0355

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VCR Plus, model VIP-18 or equivalent. *Contact: Donald Stevens, 1005 N. Brookfield, South Bend, IN 46628, 219-233-3746.*

Electronic technician magazines from January 1952 to December 1958 complete with Circuit Digest schematics no. 1 to 465. *Contact: Paul Williams, 717-786-2803.*

Panasonic reel to reel video recorder or replacement head. These machines were used in high schools in the 70's and 80's. *Contact: Ed McCullough, 708-361-5667 (call collect).*

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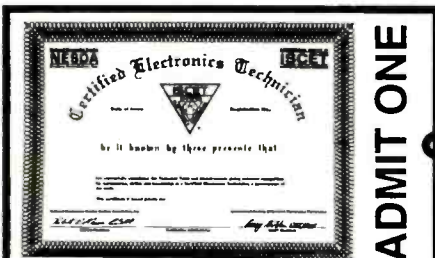
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