

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

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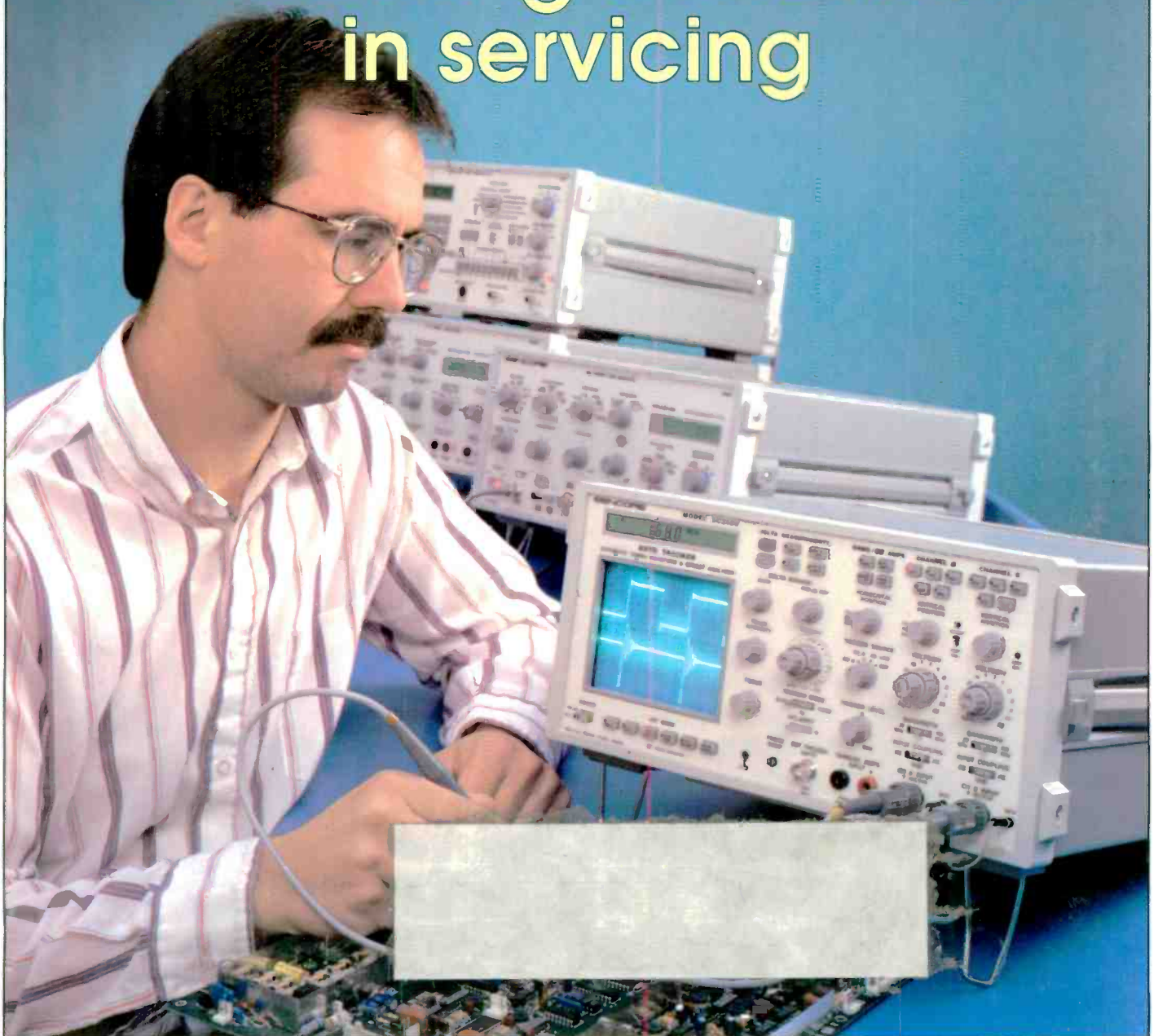
Servicing & Technology

August 1994/\$3.00

Replacement parts showcase

Luminance and chrominance signals

Continuing education in servicing



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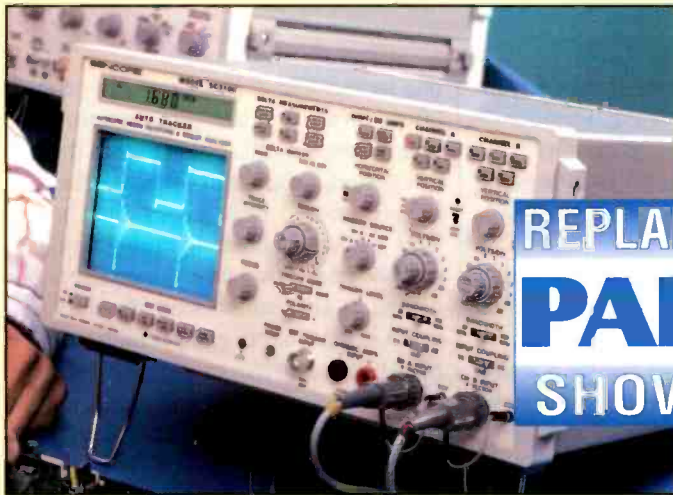
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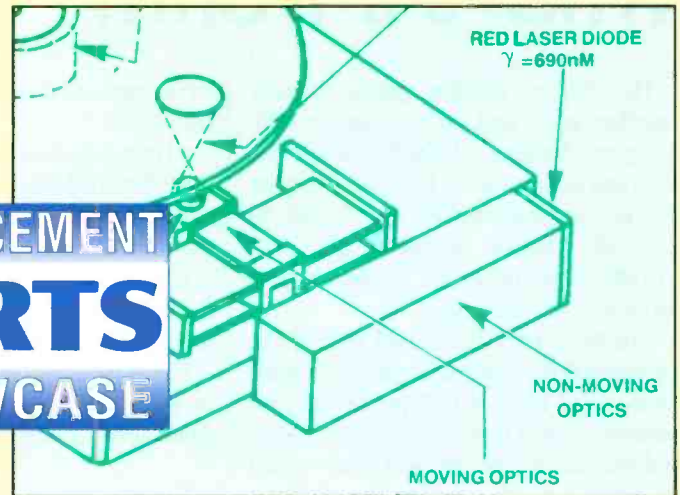
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REPLACEMENT PARTS SHOWCASE

FEATURES

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The ES&T staff continually remains tuned in to the educational opportunities available to technicians. We like to think that we're a valuable source of technical/servicing information, but we recognize that a 70-or-so-page magazine once a month can't begin to fulfill the information needs of servicing technicians, so we try to make you aware of every avenue of education that we can find.

14 Restoring connector conductivity *By Mark Lohkemper*

Considering the hundreds (maybe thousands) of connections in a piece of electronic equipment today, it is only a matter of time before they begin to fail. But how can we restore them?

16 NTSC Part II—Luminance and chrominance signals *By Arthur Flavell*

This is the second part in a series of three articles that examines the NTSC video signal and its characteristics.

ADVERTISING SUPPLEMENT

22 Replacement Parts Showcase

Many of today's consumer electronics products have names that no one has ever heard of. Many service centers have no idea where to go for parts and information on these units. Whether you're faced with this kind of situation, or the product is a long-familiar one, when you're ordering replacement parts or service literature it's important to deal with a good, reputable distributor. The entries in this Replacement Parts Showcase will help service centers evaluate these important suppliers, and give them an idea of the policies and attitudes that prevail at each of them.

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ON THE COVER

The definition of consumer electronics continues to evolve and expand. Once encompassing only radio, phonograph and TV, consumer electronics now includes video cassette recorders, camcorders, compact disc players, personal computers, fax, and more. Fortunately, manufacturers of the products and the test equipment are helping to provide training, literature and more to help technicians keep abreast of all of the changes. (Photo courtesy of Sencore)

What's it worth?

The Eagles singing group is back together again and on the concert tour. They're charging \$100.00 a ticket for reserved tickets. Bette Middle is on tour. Top prices for her tickets are \$75.00. As I recall, Barbra Streisand got over \$1,000.00 per ticket for her recent performances in Las Vegas.

Are these performers and others like them worth that kind of money just to hear them sing? I guess it depends on your point of view. If they had to depend on me and people like me, most of them would be arriving at the concerts in a compact car instead of a stretch limo and spending the night in a Motel 6 instead of a four-star hotel.

But a lot of fans are willing to pay these incredibly large sums of money for the experience of being entertained by a professional who produces beautiful music that enriches their lives in some, perhaps undefinable way.

So why is it that someone who will pop for \$200.00 for a pair of concert tickets to sit outside in the heat and humidity while being nibbled on by mosquitoes and gnats won't pay \$150.00 to have their TV fixed?

Most of you know the answer to that, or part of the answer, already: it's in large measure a matter of perceived value. But there are some other factors as well.

Lets take a look at that idea of perceived value. To some people it's worth almost any amount of money to listen to their favorite entertainer and be emotionally transported to a different plane of existence. But it isn't worth it to have that five-year old TV set or VCR serviced for \$100.00 when they can buy a newer one for \$300.00 or so.

It's the uncertainty

Another reason for that reluctance to spend the \$100.00 for service is partly due to the uncertainty of the entire procedure. Let's list a few questions that are probably floating around in the mind of any prospective service customer:

- Is this guy competent to fix my TV set, or is he going to make it worse?
- Is this guy one of those rip-off artists I've seen shows about on TV?
- Is that \$100.00 he wants to charge me

a fair price, or is he trying to take advantage of me?

- How long will he keep my set?
- Is \$100.00 the total cost, or is he going to call me with more costs once I've made the commitment?
- Will the set be as sharp and clear after the service, or will I have to settle for an inferior picture?
- Will the serviced set last for a while, or will I either have to have it serviced again soon, or replace it anyway?

I'm not giving away any state secrets by saying that those questions constitute the major reason why people, when faced with a service/replace decision when it come to a consumer product, often toss the faulty set in the trash, and go to the local discount store and get a new set.

Taking away the uncertainty

In order to convince a prospective service customer to service rather than replace, a service center has to, one way or another, provide answers to those questions, even if they're unasked.

One excellent way to remove the uncertainty of service is to do business on a flat rate basis. At least one of the major manufacturers does that in their service centers. That may not work for some service centers, but for those that can adopt a flat-rate pricing structure, much of the consumer's uncertainty goes away.

The other major cause of concern is that nagging question of whether the set will remain in operation for some reasonable amount of time after it has been serviced, or if it will fail again soon. The customer knows that if he buys a new set, it will most likely last for years without needing service, and if it doesn't, he at least has some security for whatever the warranty period is.

If you think about it, we all have those nagging doubts. Anyone who has ever owned an older car that is facing a major repair has had them. "If I have the transmission overhauled, will the engine need to be overhauled or repaired in a month? And how are the brakes?"

One way to overcome this type of uncertainty is to offer more than the usual 30-day warranty on your work. At least

one service center that I know of offers a 90-day warranty, and promises to make good if the set fails again within the 90-day period, regardless of whether the failure is related to the original failure or not. This excludes abuse, lightning damage, or other extraordinary occurrences, of course. It also excludes any product that is not in reasonably good condition at the time of the service, or any that are trouble prone.

Remember, a major part of the reason that consumer electronics service has fallen on hard times is the reliability of modern products. Providing this lengthy warranty merely takes advantage of that inherent reliability.

I asked this service center owner what percentage of the units warranted for this length of time come back within 90 days. He believes he has had a couple of VCRs returned because of dirty heads. The remedy was to run a cleaning tape (a good one) through, explain to the customer that the problem was probably caused by a bad tape, and to try to find out which tape caused the problem, and send them on their way with a working product, a free cleaning tape and a smile. What do you think that customer will do the next time he has a problem with a product?

Of course service centers that have a lot of units returned within 90 days shouldn't offer this kind of warranty. On the other hand, they probably should be in some other line of business.

You have to know your business

Of course if a service center doesn't have a pretty good idea how long an average service takes, or what the average amount for a particular type of service costs, or whether the products they service remain in operation for a while, they can't remove the customer's uncertainty because they're uncertain themselves. But if a service center can instill confidence in their customers that their products will be serviced properly, at a reasonable rate, and last a reasonable amount of time, they'll find that more people opt for service instead of replacement.

Nile Conrad Pearson

Management seminars stress how to know and control business and service costs and how to achieve Total Quality Management

This year's annual National Professional Electronics Conference (NPEC) offers management education seminars for all skill levels, from the newly positioned manager to the seasoned pro. This week-long conference will be held in Portland's Red Lion Hotel at Lloyd Center, August 8-13.

NPEC '94 will begin on Monday morning, August 8, with a customer-relations seminar on "Defusing Angry Customers," presented by the Electronic Industries Association's Consumer Electronics Group (EIA/CEG). That afternoon, Randy Whitehead, CSM, of Service West in Salt Lake City, UT, will conduct a course in basic business management philosophy. This will be a preparatory course to taking the Certified Service Manager (CSM) course.

On Tuesday afternoon, NESDA President Bob Masa, CSM of Electra Sound in Parma, OH, will cover the essentials of "Total Quality Management." On Wednesday afternoon, Don Hatton, Product Services Staff Vice President of EIA/CEG, will talk on "Working Together Today to Meet Tomorrow's Challenges." Then, on Thursday evening, Gerry McCann, CET/CSM of McCann Electronics in Metairie, LA, will serve as catalyst for eliciting best business ideas from sharing participants.

All day Friday, Fred Longworth, MBA of Longworth Consulting in San Diego, CA, will conduct two seminars, one on "Controlling Your Costs of Doing Business," and a follow-up session on "Managing Your Service Parts Inventory."

On Saturday morning, Gerry McCann will talk about "Business-to-Business Marketing and Diversification." On Saturday afternoon, Gary L. Benton, of Couderdt Bros., Attorneys at Law of San Francisco, will conduct a presentation on "How do the Kodak and MAI Legal Cases Affect You—and What Can You Do About It?" Also, on Saturday afternoon, Paul Ginther of 3M/Blackwatch will talk about "Street-Smart Advertising."

The annual NPEC also offers advanced-technology technical seminars.

This year's technical seminars are topped by instruction in servicing personal computers as well as laser faxes and printers. Additional presentations, including many hands-on seminars, show how to service video laserdisc players, CD players, high-resolution monitors, camcorders, VCR mechanisms, and TV convergence and shut-down circuits. Also covered are explanations of electronic circuits in appliances and how to desolder and rework surface mount assemblies.

In addition to a two-day, nine-hour Professional Electronics Trade Show, NPEC '94 will offer dealer/manufacturer information-sharing sessions, golf and tennis outings, product serviceability ratings, annual association membership meetings and elections, more than a dozen programmed meal functions, and opportunities for peer networking.

Registration for the week, including the trade show, and all programmed seminars, sports outings, and meal functions, is \$300 per person at the door. However, the prepaid registration fee prior to July 31 is only \$250. Each additional person from the same family or business may save an additional \$20 each if pre-registered by July 31. Also, a special package price is available for only the last three days of the convention (Thursday through Saturday) for per-person registration fees of \$180 (at the door, \$150 if by July 31). For children, ages 5-18, additional discounts apply for either the full convention or the 3-day special, and includes some special programs and meal functions.

For more information, contact NPEC at 2708 W. Berry St., Fort Worth, TX 76109-2397 or phone 817-921-9061; fax 817-921-3741.

NSCA begins search for education manager

The National Systems Contractors Association is searching for a qualified candidate with technical, educational and presentation skills, to fill the newly created position of Education Manager.

According to Jay Johnson, Central California Electronics, Fresno, CA, and NSCA Education Chairman, the new Education Manager's first assignment will be to develop seminars to prepare candidates for the National Institute For

Certification in Engineering Technologies Audio Technician Certification. The Audio Technician certification program is the first of a projected series to be developed by NSCA in conjunction with NICET. It represents a major step forward in NSCA's new program to enhance the professional image of NSCA members.

Development of the Certification examinations will be completed in early 1995, and the tests administered later in the year. The preparatory seminars will be offered in Indianapolis during the 1995 NSCA Expo, April 30 through May 2, for technicians planning to be in the first group certified.

The Education Manager will have responsibility for the total educational segments at future Expos, and for coordinating the development of educational and training textbooks, workbooks, video tapes and other audiovisual materials for use by NSCA members.

Candidates for this position should demonstrate a knowledge of the electronic systems contracting industry from having worked as a contractor, sales representative, or regional manager for a national supplier. The position will be based at NSCA in suburban Chicago.

NSCA is the trade association for the electronics systems industry, with membership open to qualified individuals or companies engaged in electronics systems contracting. NSCA also welcomes manufacturers/suppliers, sales representatives, consultants and others affiliated with the industry as sponsors.

For more information, or to send a resume for the Education Manager position, contact Mary Beth Rebedeau, General Manager, NSCA, 10400 S. Roberts Rd., Palos Hills, IL 60465. Telephone: 708-598-9777.

Paper and pencil assessments help high-tech industry measure workers' skills

With the recent release of the American Electronics Association's voluntary skills standards for front-line workers, the high-tech industry is moving forward with its goal to improve the quality of its work force.

This move toward improved workplace productivity and quality has made it in-

creasingly important that employers have the ability to measure job applicants' skill levels. Skills assessments can provide the information employers need regarding hiring decisions as well as help them determine training needs.

Recently, London House introduced, through its SRA product group, four new skill assessments, designed specifically for the selection of workers in industrial, electrical repair and maintenance positions. These multiple-choice assessments can be used to determine the skill level of job candidates or monitor the development of current employees.

The *Technician Electrical Test* can be used to measure knowledge of digital and analog electronics, test instruments, motors, schematics and print reading, power supplies, basic ac/dc theory, power distribution, and the use of hand and power tools.

Using the Electronics Test, individuals can be assessed for skills in many of the same areas covered by the Technician Electrical Test, with the addition of computers and PLCs, electronic equipment, regulators and radio theory.

Employers can use the Technician Mechanical Test to measure knowledge of hydraulics, pneumatics, print reading, welding, power transmission, lubrication, pumps, piping, rigging, mechanical maintenance, shop machines, tools and mechanical equipment.

With the Reading Prints and Drawings Test, employers can measure skills in the following areas—views and surfaces; simple, intermediate and complex drawings; dimensions; and finishes.

Assessments are completed by paper-and-pencil and require no outside assistance with scoring or results interpretation. Assessments are administered in-house and hand-scored with an answer key.

For more information on these technical assessments, contact London House, 9701 West Higgins Road, Rosemont, IL 60018; or call 1-800-221-8378, ext. 3347.

The company offers self-scoring assessments in the areas of basic skills, office and computer knowledge, as well as industrial, mechanical, sales, customer service, leadership and mental capabilities.

London House, a McGraw-Hill company, is a publisher of human resource assessments for business.

In-school program for mobile electronics installer training

The Electronic Industries Association's Consumer Electronics Group (EIA/CEG) launched its Mobile Installation Course (MIC) support program at a recent ceremony in Los Angeles. Officials from the Los Angeles Unified School District participated in a ceremony which took place May 3 at the East L.A. Skills Center and the North Valley Occupational Center. The MIC is a program initiated by the EIA/CEG Mobile Electronics Division and is implemented through the EIA/CEG Product Services Department's educational committee. The goal of the MIC program is to establish and support training of entry level installers of audio, security and cellular products for motor vehicles.

The MIC project will support three to five schools in 1994. Currently, three schools in Los Angeles are participating in the program: East L.A. Skills Center, North Valley Occupational Center and the Harbor Occupation Center. Schools will work with both the Product Services Department and the Mobile Electronics Division of CEG to develop and test a standardized curriculum that can be implemented in other schools across the country. The new curriculum will be designed to support the Mobile Electronics Certification Program (MECP), which issues certification through proficiency testing of installers. EIA endorses the three-year old MECP, which has certified over 5,000 industry installers to date.

"The MIC project is designed as an entry-level feeder program to bring installers into this industry in support of the enormous growth of automotive electronics products and to curtail the declining number of installers due to normal attrition," said Don Hatton, EIA/CEG Staff Vice President, Product Services.

Butch Miller, Vice President of Kenwood U.S.A. Corporation, presented the schools with several regulated power supplies and speakers for use in their training programs. Larry Tinkler of Pioneer, donated several hundred speakers, as well as some equalizers. Phil Horn of Sony Electronics was on-site to show support for the program. ■

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC

Servicing & Technology

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

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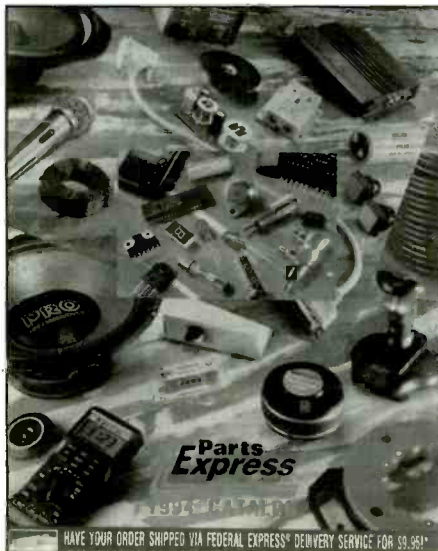
Technical supplies catalog

New from HMC is a detailed, fully-illustrated buying guide of electronic tools, test equipment and technical supplies for the assembly, testing and repairing of electronic products. This catalog contains a large selection of brand-name items including precision hand tools, test instruments, datacom/telecom equipment, tool kits, soldering/desoldering systems, lamps and magnifiers, static control products, industrial chemicals and adhesives, measurement and inspection instruments, and work stations.

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Electronic parts and accessories catalog

Parts Express announces the release of its 188-page, 1994 catalog of electronic parts and accessories geared toward the



consumer electronics industry and the technical hobbyist. An extensive line of electronic components includes speakers and audio accessories for home and car, architectural audio products, pro sound equipment, CATV and VCR repair parts and accessories, semiconductors, tools and technical aids, computer accessories, chemicals and solvents, telephone products, wire, connectors, instructional books and videotapes, and arcade game parts.

Circle (81) on Reply Card

Directory of IC manufacturers' data pages

Hearst Business Publishing/UTP Division, publishers of the IC Master catalog, announce publication of the 1994 directory of IC Manufacturers' Data Pages. The directory is a quick reference guide for identifying the manufacturers' most current data books and data sheets on specific integrated circuits.

The reference is based on the Part Number Index in the 1994 IC Master catalog. Users can look up specific ICs by complete part number or base number to find

out what product literature is available, then contact the manufacturer directly for a mailed or faxed copy of that information. Complete vendor contact information is included in the directory which indexes products from 723 different data books.

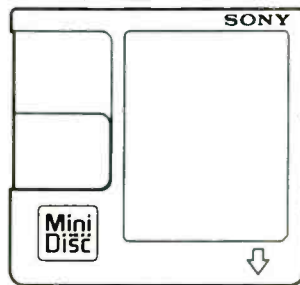
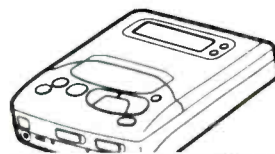
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Catalog of microwave oven parts

Global Micro-Parts Depot offers their catalog of microwave oven parts. The catalog includes "almost every part for every microwave," according to the company. Products listed in the catalog include magnetrons, fuses and fuse holders, diodes/rectifiers, triacs, switches, motors, relays, waveguide material, door liners, power cords, HV transformers, stirrer covers and waveguide covers, shelves, doors, door handles and more. Microwave ovens represented include Admiral, Amana, Caloric, Frigidaire, Magic Chef, Tappan, Panasonic and more. Also included are tools, test equipment and chemicals for performing microwave oven service.

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SONY

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Continuing education in servicing

By Conrad Persson

Do you remember the early days of television, circa 1950? The pictures were all black and white, and few screens were larger than about 13 inches. At that time there were few stations, no UHF, no cable TV and no satellite dishes. Sputnik, the first artificial satellite, wasn't placed in orbit until 1957.

The lead-in wire came in from the antenna on the roof, or sometimes from the "rabbit ears" on the top of the set. If the set received the signal from a rooftop antenna, and there were more than one station that could be received, there might be a DPDT switch on the back of the TV.

When it came time to change the channels, the viewer would change the channel, switch the switch to the other position to change the antenna element, then fiddle with the fine tuning knob to get the best possible picture.

It was all very technical, and the only people who knew how to change the channel and get a really good picture were the service technician who came regularly to change tubes, and any technically oriented kids in the house. Generally, the adult generation had a little difficulty grasping the idea, and grandma and grandpa were generally content to watch whatever channel happened to be on, or go back to listening to the radio, and had no desire to try to learn the complexities of such a thing as the TV set.

The more things change . . .

Things have changed a great deal since those days. TVs now offer dazzling color, and larger screen size. The number of channels available in a given area has increased dramatically. More often than not, the signal is now delivered via cable, and in any event, the switch is gone forever from the back of the set.

Unfortunately, that doesn't mean that the TV is necessarily easier to use, or better understood by the viewer.

The complexity of that switch at the back, and fiddling with the fine tuning

have been replaced by the complexities of the cable A-B switch, the routing of the lead-in or cable wire through the VCR to the TV, programming of the VCR, and even setting the time on the clock, and wiring of the sound through the stereo system.

It's all still very difficult to operate and many viewers just get uncle Ralph, the family handyman, to hook it up, and hope they never have to move anything, or disconnect anything.

And now many of those same homes have computers, cordless telephones, cellular telephones, fax machines, copiers, etc. that they can't understand.

More complex for technicians, too

All of the new products and new technology have presented a great deal of opportunity for servicing technicians. While TVs have become ultrareliable, they still do require service, and VCRs, camcorders and the host of office products now in homes offer service opportunities that never existed before.

Unfortunately for the service technician, if he plans to service all of the new home office products with their unfamiliar technology, and the traditional consumer electronics products with their new technology, he has to become a perpetual student. The minute the technician starts to become familiar with the theory of operation of a new product or technology, someone introduces two new ones.

There is help

Fortunately for service centers and technicians, everyone from the manufacturers and the manufacturers' associations, to service associations and technical schools, as well as publishers, have recognized that technicians need a lot of training for this new technology, and are making that training available.

And depending on the amount of money available to the technician, the amount of time he has for school, and the travel budget, the technician has a choice of resident schools, hands-on schools, self-

study courses, videotapes, books, test equipment manuals and user instructions, association meetings and seminars.

The ES&T staff continually remains tuned in to the educational opportunities available to technicians. We like to think that we're a valuable source of technical/servicing information, but we recognize that a 70-or-so-page magazine once a month can't begin to fulfill the information needs of electronics servicing technicians, so we try to make you aware of every other avenue of education that we can find.

Training from EIA/CEG

One of the best, and least expensive sources of training for servicing of consumer electronics products is the Electronics Industries Association/Consumer Electronics Group (EIA/CEG) Product Services Department. This organization offers free 2-day and 5-day on-site workshops for technicians actively working in consumer electronics servicing.

EIA is the association to which manufacturers of TVs, VCRs, stereo equipment, etc. belong. They are working very hard through this organization to attract and train technicians to service the products that they manufacture and sell. Every service center that can do so should take advantage of this superb training resource.

In addition to the workshops, EIA/CEG also offers video cassettes, manuals and the like on a wide range of subjects from "Troubleshooting with modern electronic test equipment (Parts I and II)," to high-tech soldering and microprocessor troubleshooting, and more. These tapes are priced very inexpensively, just enough to offset the cost of producing them.

If you, or someone in your service facility, is in need of training, you should at least explore what EIA has to offer. See their name and address in the listing in this article.

Currently available from EIA

For example, the EIA currently offers several courses in VCR, digital/micro-

Persson is editor of ES&T.

processor applications, PC servicing and video laser disc servicing, covering theory and hands-on training. All workshops, except video laser, are five days, 40 hours with an enrollment of 20 people; video laser disc is a three-day session. These courses will be presented in cities throughout the United States, throughout the current year.

Technician programs are co-sponsored by local chapters of the National Electronic Service Dealers Association and the International Society of Certified Electronics Technicians (NESDA/ISCET). Five-day workshops for electronics instructors in vocational education are co-sponsored by state departments of vocational education and local teaching institutions.

The workshops are provided at no cost to the attendee by EIA. Anyone interested in attending should contact EIA at 2001 Pennsylvania Avenue, NW, Washington, DC 20006; 202-457-4986.

Currently, the EIA also offers workshops on color television and VCR servicing throughout the year at five locations. These workshops are open to consumer electronics technicians and educators. While covering basic principles and practical troubleshooting on modern equipment, the courses are particularly suited for technicians who wish to be updated on their basic theory and troubleshooting abilities.

Considering the high quality and timeliness of these programs and the materials the attendees retain, EIA believes that the practical nature of these workshops will provide the attendees with new skills of immediate benefit.

These courses have an estimated \$500.00 value, but EIA/CEG offers them free to qualified technicians. Attendees must provide their own transportation and lodgings while at the workshops.

For more information write to:

EIA/CEG Product Services
Department 287
Washington, DC 20005
202-457-4986
202-457-4901

Identifying the need for education

For the technician, identifying the need to further his education usually isn't difficult. One day a customer brings in a TV set for service and when the technician

opens up the set to perform a technical evaluation of the nature of the problem he finds components and circuitry he's never seen before. Or one day a customer brings in a digital compact cassette or a CD-ROM drive, a product that the technician has only seen in photographs before.

Once the need to get further education has been established, it's important to pin down exactly what education is needed. There are two questions that the technician must answer: "What training do I need?" and "How do I get that training?"

It's important to examine these questions in detail to determine beforehand exactly what it is you need to study. It's not enough to just say "I need to learn about CD-ROM servicing," and then to look for a correspondence school or a local school that might offer a course on CD-ROM.

It's important to examine the situation precisely, and determine what aspects of the subject that need to be covered. Do you just want an overview on CD-ROM technology? Or do you really have a pretty good idea of how CD-ROM works and really need a course in digital equipment servicing?

Once the specific goals are set, the question becomes how to achieve them. One simple but effective method might be to contact other technicians in your area. If you have a skill that they lack and vice versa, you might be able to arrange a session in which you educate each other.

Find a good technical book

One way to learn about a new subject is to buy a technical book on the subject and study it. Many technicians are able to learn enough in this manner to enter into a whole new area of servicing. If the book is well written, and the technician has a lot of self discipline, this approach might prove very fruitful. If the book is poorly researched or written, or if the technician isn't one who can study on his own, the effort might prove useless and frustrating.

Home study courses

Home-study courses are a step up from simply studying from a book on one's own, and they generally make learning easier and lead to better results. In a home study course, the material is divided into logical study units, an instructor tells the student what is expected, and there is feedback through regular tests. Some

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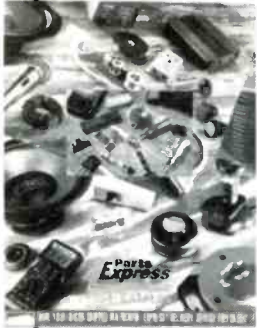
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TAMPA TECHNICAL INST TAMPA, FL	OCTOBER 18 - 20	
NEC DALLAS CAMPUS DALLAS, TX	OCTOBER 18 - 20	
NEC COMMERCE CAMPUS COMMERCE, CA		OCTOBER 24 - 28

schools also assign an instructor to the student with whom he can correspond by telephone and mail if there is a problem.

Schools and seminars

If the technician or service center can afford the time and money, structured class and lab courses provide a more effective way to learn. There are many options available for a technician who can attend such classes. Technical schools throughout the country offer anything from the most elementary introductory courses to detailed theory, design and servicing courses.

For anyone who has the time and the budget to travel, consumer electronics equipment manufacturers offer seminars on the operation and servicing of specific products to servicing technicians.

There are also many organizations, especially in the computer area, that offer seminars of a few days to a week or so, usually in a number of locations throughout the country.

In addition, manufacturers of test equipment and tools such as multimeters, oscilloscopes, soldering tools, etc. offer instruction in using their products. Some offer books and pamphlets, and some even have videotaped instructions, that help you understand how to most effectively use their products. Some companies offer formal courses for home study, and others offer courses and seminars that travel to different areas of the country so you can take a formal course taught by the experts near home. Some instruction is free, and some will cost a substantial amount, so check before you proceed.

Finding the knowledge

A complete list of all of the technical

educational resources available to technicians today would no doubt fill several thick volumes. There are local vocational technical schools, both public and private, a large handful of national technical correspondence schools, associations such as ETA, NESDA/ISCET, PSA, manufacturers' training, thousands of technical books. For anyone who wishes to stay abreast of modern electronics technology, an important activity is simply maintaining an awareness of what the educational resources are and how to take advantage of them.

Accompanying this article are several lists of companies and other organizations that offer some kind of training and/or training materials, but space doesn't permit a comprehensive list. There are a number of detailed lists available that will provide someone who is serious about training many avenues to explore. One such list is the **ES&T March Buyers' Guide**. That issue contains a large list of consumer electronics manufacturers, tool and test equipment manufacturers and associations including addresses and phone numbers.

Try experimentation

One of the best ways to get an education is to "learn by doing." There's nothing like taking a piece of equipment in your hands, pressing the buttons, watching what happens, poking and probing, and taking DMM and oscilloscope readings.

This approach may not be advisable in the case of a \$1,000.00 hi-fi VCR, but some of the low-end units cost in the neighborhood of \$200.00. If you take a look at the cost of books these days, or the cost of seminars, or even just the cost of travel, lodging and meals to attend a

seminar, \$200 is pretty cheap for a unit to take apart, observe, and check with DMM and oscilloscope. And you might get a pretty good education from it.

Try the product manufacturers

Many of the manufacturers of consumer electronics equipment provide training in a number of ways. Some of the manufacturers restrict the training they provide to technicians from their own authorized servicing facilities. Others not only offer courses to anyone who is both qualified and interested, they make it a point to make their courses universally applicable.

Test equipment manufacturers

Test equipment manufacturers not only know a great deal about the test equipment they sell, but they are familiar with applications of their products. They talk to the engineers and technicians who buy and use their products and learn what their problems and needs are.

The test equipment manufacturers also recognize one other important fact: the more their customer knows how to apply their products, the more likely they will be to buy their product in the first place, to be happy with it once they've bought it, to recommend the company's products to a friend, and to buy that same brand the next time they need a piece of test equipment. In order to enhance the customer's or potential customer's understanding of the testing/diagnosing function in general and the company's product in particular, many manufacturers of test equipment offer courses, manuals, videotape courses, and other training opportunities.

For example, B&K Precision offers booklets such as a "Guidebook to Function Generators," a "Guidebook to Test Instruments," and a "Guidebook to Oscilloscopes." Sencore offers seminars throughout the country as well as their "Tech Tips" binder, the periodical "Sencore News" and other training materials.

Tektronix Oscilloscope Division puts out booklets such as "The XYZs of using a scope" and "Basic Oscilloscope Operation." They even sell a training kit that allows a scope user who needs to learn more about use of an oscilloscope to practice on circuitry for which the scope traces are known. The Tektronix Television Business Division offers application notes such as "Basic NTSC Video Test-

ing" and "Checking VCR Performance."

Hewlett-Packard offers manuals such as "The fundamentals of signal analysis" and "Feeling comfortable with digitizing oscilloscopes," that provide in-depth information about the state of the art in circuits and signals, and the test equipment and techniques needed to study and understand it.

You should also check with any of the other well-known manufacturers of test equipment to determine what kinds of training materials they have.

Learning about office equipment

Personal computers have become consumer electronics products. According to recent reports, more personal computers were sold to private individuals in 1993 than were sold to businesses. Advancing technology and competition among manufacturers and sellers is causing the price of computers to continue to come down. And the increasing availability of useful, user-friendly low-cost software such as word processing, spread sheet, data base, desk-top publishing, accounting, on-line data bases, etc., is making them more and more attractive to more and more people.

The changing economy and the changing workplace are resulting in more people establishing offices at home. Along with fax machines and answering machines, personal computers are considered essential tools for the home office.

One result of this increasing population of personal computers in homes is that personal computers have become consumer products, and consumers are looking to their traditional service centers to service their computers. And while making the transition from servicing TVs and VCRs to servicing computers does take something of a mental adjustment, it's usually far easier than it first seems, especially for someone who has made a lifetime study and a business of understanding and servicing electronics circuits.

These days it becomes yet easier as the number of organizations that offer training in computers increases, and in most cases the level of training gets better. The companies that offer computer related service training include not only companies that are traditionally computer oriented such as American Institute, Heath/Zenith, Learning Tree, National Advancement Corp., but also some of the companies that you might not think of as

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United States Business Development Manager

If you have been working in national service and are looking for a refreshing career change, this could be the opportunity you have been looking for. You should be an inspired individual who knows the inside track of doing business in the consumer electronics industry. Your management and development responsibilities would include:

- **Manufacturer relations**
- **Content recruitment programs**
- **End user marketing programs**
- **Channel marketing programs**
- **Coordination of trade show and other educational events**
- **Development and maintenance of departmental sales tracking and order processing systems**
- **New market development**

Applicants should have 10+ yrs experience in the consumer electronics industry, with at least 5 years in management of service programs at the importer/manufacturing level.

United States Technical Production Manager

If you feel you have "Topped Out" working in all aspects of consumer electronics repair as a senior technician, manager and trainer—this could be your next career move. The key to this position is the ability to creatively communicate technical ideas.

You should be a technician or technical service manager at the peak of your skills, with the ability to repair or align any type of consumer or professional electronics equipment. Putting your skills to use in Vicom's state of the art CD-ROM production facility, you will be responsible for coordinating the daily production of TekDisc® CD-ROM service manuals. The ideal applicant should be extremely organized, a superior manager and communicator, and above all, a superior circuit analyst.

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Boston, MA 02215
Phone (617) 783-4901
FAX (617) 783-0359**

Circle (53) on Reply Card

We recently became aware of a technical college program that might be of interest to readers who are interested in becoming electronic music technicians, or service managers who are interested in recruiting someone to service electronic musical instruments.

The school is:

Red Wing Technical College

215 Pioneer Rd
Red Wing, MN 55066
1-612-388-8271
1-800-657-4849
Fax: 612-388-6368

Graduates can earn a diploma or Associate in Applied Science degree, in as few as two traditional school years.

The course includes technical writing, computers and basic electricity. Technical courses include circuitry, semiconductors, MIDI concepts, vacuum tube and solid-state amplifiers, electronic assembly and digital music devices.

Graduates can pursue careers as manufacturer's technicians, music store technicians, consumer electronics technicians, band roadies, amplifier design and sales, factory bench servicing, organ servicing, studio engineer for sound systems or sound system maintenance for entertainment complexes.

Some of the sources

The accompanying text lists a number of correspondence schools, book publishers, associations, and test equipment manufacturers whom you might want to contact for further information on what educational opportunities they have to offer.

Trade associations

*Electronic Industries Association/
Consumer Electronics Group*
2001 Pennsylvania Avenue, N.W.
Washington, DC 20006-1813
202-457-4919

*Electronics Representatives
Association*
20 E. Huron
Chicago, IL 60611
312-649-1333

Electronic Technicians Association
604 North Jackson St.
Greencastle, IN 46135
317-653-3849

*Musical Instrument Technicians
Association, International*
8216 Audrain Drive
St. Louis, MO 63121-4504
314-389-3290

*National Association of Business and
Educational Radio*
NABER
1501 Duke St, Suite 200
Alexandria, VA 22314
703-739-0300

*NARDA (National Association of
Retail Dealers of America)*
*NASD (National Association of
Service Dealers)*
10 East 22nd Street
Lombard, IL 60148
312-953-8950

*National Association of Service
Managers*
650 W. Algonquin Road, Suite 204
Des Plaines, IL 60016
708-640-8133

*National Electronic Distributors
Association*
35 East Wacker Drive
Suite 3202
Chicago, IL 60601
312-558-9114

*National Electronic Servicing Dealers
Association*
2708 W. Berry Street
Ft. Worth, TX 76109
817-921-9062

Professional Service Association
71 Columbia Street
Cohoes, NY 12047
518-237-2953

*United Servicers Association, Inc.
(USA)*
PO Box 626
Westmont, IL 60559
5630 Harnarc Place
Downers Grove, IL 60516
708-968-6752
800-432-0972

Technical book publishers

CRC Press, Inc.
2000 Corporate Blvd., N.W.
Boca Raton, FL 33431
407-994-0555

Hayden Book Company
Rochelle Park, NJ 07662

McGraw-Hill Book Company
1221 Avenue of the Americas
New York, NY 10020

MacMillan Publishing
Front and Brown Streets
Riverside, NJ 08075
800-257-5755

PCS Publications
PO Box 10492
Clearwater, FL 34617-8492
800-741-DATA
Fax: 813-446-3157

Prentice-Hall, Inc.
Rte. 9W
Englewood Cliffs, NJ 07632
201-592-2455

Howard W. Sams & Company
2647 Waterfront Parkway, East Drive
Suite 300
Indianapolis, IN 46214-2041
800-428-7267

Tab Books
PO Box 40
Blue Ridge Summit, PA 17214
717-794-2191

Van Nostrand Reinhold Company
135 W. 50th St.
New York, NY 10020

Publishers of schematic diagrams

Eagan Technical Services, Inc.
1380 Corporate Center Curve,
Suite 107
Eagan, MN 55121
612-688-0098

MI Technologies
3310 E. Peterson Rd
Troy OH, 45373
513-335-4560
Fax: 513-339-6344

Howard W. Sams & Company
2647 Waterfront Parkway East Drive
Indianapolis, IN 46214
317-298-5400

Schematic Solutions, Inc.
11120 Wurzbach Rd., Suite 206
San Antonio, TX 78230
512-696-0404
Fax: 512-696-7135

Service Tips programs

AnaTek Corporation
(Computer monitor tips)
PO Box 1200
Amherst, NH 03031
603-673-4342

Electronic Software Developers
826 South Main Street
South Farmingdale, NY 11735

FixFinder
TCE Publications
10003 Bunsen Way
Louisville, KY 40299

High Tech Electronics
1623 Aviation Blvd.
Redondo Beach, CA 90278
213-379-2026

Higher Intelligence Software
60 Farmington Lane
Melville, NY 11747
516-643-7740

Technical Information Procurement Service (TIPS)
PO Box 1681
Forest Park, GA 30051-1681
404-968-3715

Home study

Cleveland Institute of Electronics
1776 E. 17th St.
Cleveland, OH 44114
216-781-9400
Fax: 216-781-0331

Cook's Institute of Electronics Engineering
Desk 15
PO Box 20345
Jackson, MS 39209

Electronic Institute of Brooklyn
4823 Avenue N
Brooklyn, NY 11234

Grantham College of Engineering
2500 S. La Cienega Blvd.
Los Angeles, CA 90034

Heath/Zenith
PO Box 167
Hilltop Rd.
St. Joseph, MI 49085
616-982-3411

National Institute of Technology
1701 W. Euless Blvd.
Euless, TX 76039

National Technical Schools
456 W. Santa Barbara Ave
Los Angeles, CA 90037

NRI Training for Professionals
McGraw-Hill Continuing Education Center
3939 Wisconsin Ave.
Washington, DC 20016

Private trade schools

Accrediting Commission of Career Schools and Colleges of Technology ACCSCT
(Formerly NATTS)
750 First Street N.E.
Washington, DC 20002-4242
202-336-6850

This organization offers a booklet that contains the names and addresses of private career schools and colleges of technology, broken down by subjects of study offered and geographic location.

Computer training

American Institute Institute for International Research
437 Madison Ave., 23rd Floor
New York, NY 10022
212-826-3340

Learning Tree international
6053 West Century Boulevard
PO Box 45028
Los Angeles, CA 90045-0028
213-417-8888
Fax: 410-2952

National Advancement Corp.
2730-J South Harbor
Santa Ana, CA 92704
714-754-7110

Test equipment manufacturers

B&K Precision
Maxtec International Corp.
6470 West Cortland Street
Chicago, IL 60635
312-889-1448
Fax: 312-794-9740

John Fluke Mfg. Co., Inc.
PO Box C9090
Everett, WA 98206
206-347-6100

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

Sencore
3200 Sencore Drive
Sioux Falls, SD 57107
605-339-0100

Tektronix
Oscilloscope Division
PO Box 500, MS 39710
Beaverton, OR 97077
503-627-2010
Fax: 503-627-5593

Tentel
4475 Golden Foothill Parkway
El Dorado Hills, CA 95630
916-939-4005
800-538-6894

computer oriented, like the consumer electronics manufacturers.

Trade associations

Organizations such as ETA, NARDA/NASD and NESDA/ISCET (see the "Associations" listing below for the meaning of these abbreviations, and the addresses and telephone numbers of these associations) and their state and local affiliates offer many opportunities for education both technical and management oriented.

For example, state and local chapters of these associations frequently invite a technical training instructor from a consumer electronics manufacturer to their monthly meetings to lead seminars on servicing the company's new products.

Management seminars are offered to service center owners and service managers at monthly meetings of local/regional/state association affiliates as well as at the associations' annual meetings.

Some of the most successful service center owners and managers belong to these trade associations, and attend the meetings, seminars and annual conventions religiously. Most, if not all of them

attribute a great deal of their success to their membership in the organization and their participation in these training activities. If you don't belong to such an association, you should at least look into it.

Learning from service software

Finally, service oriented computer software provides a source of training: of sorts, at least. For example, there are several software programs that provide problem/solution type of assistance for servicing technicians. This is the type of program that you load up, then key in the make and model of product, and then select the symptom that most closely describes what you've observed. The program then offers a number of possible solutions, starting with the most common. Such programs are available from a number of suppliers.

Of course these programs are primarily designed to provide quick fixes for technicians who have a sick product on the bench that they want to get fixed quickly. But a fledgling technician, with a schematic diagram of a given electronic product in front of him could look at

the schematic while going through the various symptom/suggested cure units. This kind of exercise could be a powerful training exercise.

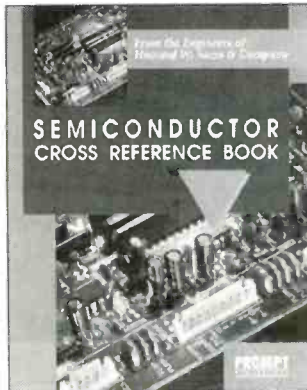
As another example, computer diagnostic software could also be used as a learning tool. A competent but still learning technician could sit down with a malfunctioning computer product, and compare his observation of the symptoms with the conclusions drawn by the software as it runs.

Just do it

If a technician hasn't taken a course, read a technical book, or otherwise made an attempt at learning about some of the new technology in some time, he most likely is lacking in some of the important skills required to diagnose and service today's sophisticated consumer electronics products. The education to develop those skills may be as near as the local library, the local association meeting place, or the mailbox. The information is there; it's just a matter of finding it.

The listings that accompany this article will help you get started in finding it. ■

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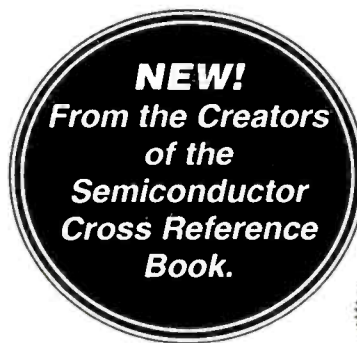


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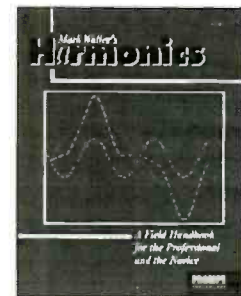


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Test Your Electronics Knowledge

Several calculations and a few definitions

By Sam Wilson

1. Refer to Figure 1. What is the resistance of R_2 ?

2. In Figure 1 what is the value of applied voltage (V)?

3. Which of the following is an example of a breakover diode?

- A. Light-activated diode
- B. Magnetron
- C. LED
- D. DIAC

4. Which of the following is sometimes used as a parasitic suppressor?

- A. Four-layer diode
- B. Bead ledge
- C. Thermistor
- D. Ferrite bead

5. What is the maximum voltage that can be applied across a 100Ω resistor rated at 1W?

6. If you know the resistance of a circuit is 90Ω , and the impedance of that circuit is 120Ω , what is the power factor of the circuit?

7. What is the wavelength (in meters) of an rf signal if the period of one cycle is 1.0 nanoseconds?

8. If a radio wave travels 186,000 miles per second, how many yards does it travel in one minute.

9. Refer to Figure 2. What value of resistance must be assigned to R_2 to get a circuit resistance of $10K\Omega$.

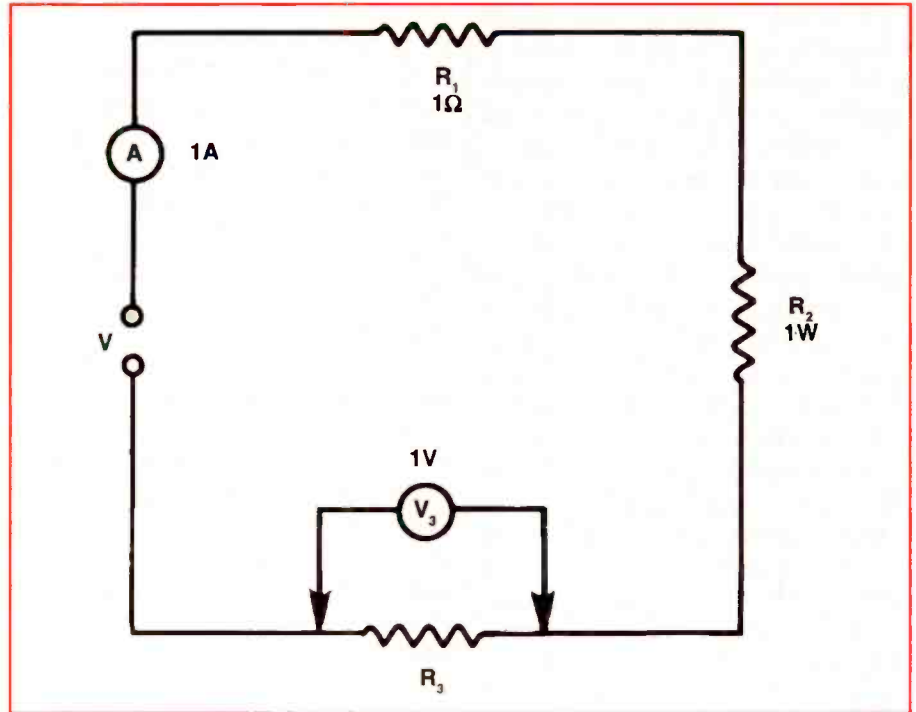


Figure 1. What is the resistance of R_1 ; What is the value of V?

10. An antenna that radiates equally well in all directions is called

- A. A hertz antenna.
- B. an isotropic antenna.

C. a marconi antenna.
D. a yagi antenna.

(Answers on page 65)

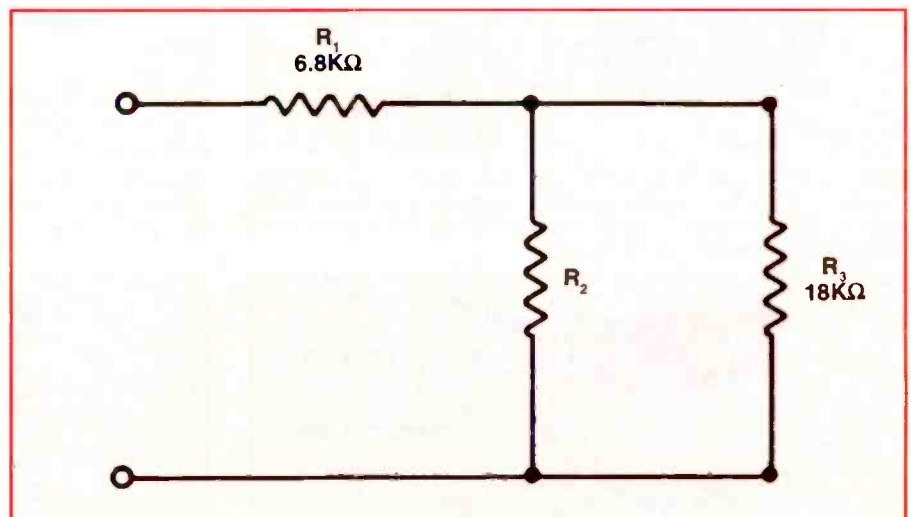


Figure 2. What resistance must R_2 have so that the circuit resistance is $10K\Omega$?

Wilson is the electronics theory consultant for ES&T.

Restoring connector conductivity

By Mark Lohkemper

Considering the hundreds (if not thousands) of connections in a piece of electronic equipment today, it is only a matter of time before they begin to fail; primarily due to oxidation and corrosion.

Normally we consider a connector to have failed when it interrupts or degrades signal flow. If a "good" connection is one with a reasonable amount of metal-to-metal contact, then many connections in electronic equipment are substandard.

The mating surfaces of connectors are typically unable to crunch through the nonconducting film of metal oxide that forms on them. Component and equipment manufacturers are aware of these problems. Consequently, they design into their switches and sockets a certain amount of wiping action. This is a polite way of saying abrasive contact.

Another popular countermeasure to connector problems is to carefully select materials to fit the intended application. The problem with this approach is that the really good contact materials, such as coin silver, deteriorate quickly, while the most durable substances, such as tungsten, have poor electrical characteristics.

Lohkemper is President of Caig Laboratories

Sometimes a combination of materials such as gold over silver or silver over copper is used, but in time this combination also causes problems.

Degradation of connector conductivity

Physical and chemical changes in surface conditions of electrical or electronic connectors are a primary cause of degraded performance in components and equipment. When contact surfaces are exposed to dust, smoke, gases, soot and other solids in the atmosphere, non-metallic films form, inhibiting conductivity.

Oxidation is the most common reaction, causing metal oxide formation. Salt-laden air in coastal areas corrodes most metals, forming chloride films. Humidity, condensation, salts, sulfur and acid fumes are also common causes of rust, corrosion and oxidation. Added resistance and friction between metal surfaces can cause abrasion, noise, freeze-up and in some cases increased power consumption.

Plated surfaces

A common problem with plated surfaces, especially gold, is the "whiskering" (dendrite corrosion) of base metals to the

surface due to gold's soft and porous nature. Once exposed, the base metals oxidize, causing a "blistering" of the surfaces, adding unwanted resistance that impedes electrical performance. The contact surfaces are actually separated by this blister, thereby reducing the effective contact area. Since gold plated surfaces are thinly coated, they are susceptible to scratching and abrasion, further exposing the base metals.

While the household user of electrical and electronic equipment may be able to live with such problems for short periods of time, one can realize the critical nature of even minor trouble in industrial, high-tech or aerospace applications.

Abrasion

Contact technology has improved with the advent of specialized alloys, bimetallic contacts and innovative plating techniques. Whether contacts are machined or plated, it is impossible to achieve a perfectly smooth contact surface. Contact surfaces appear smooth to the unaided eye, but examined under the microscope the peaks and valleys on the surface become evident.

When the contact surfaces are brought

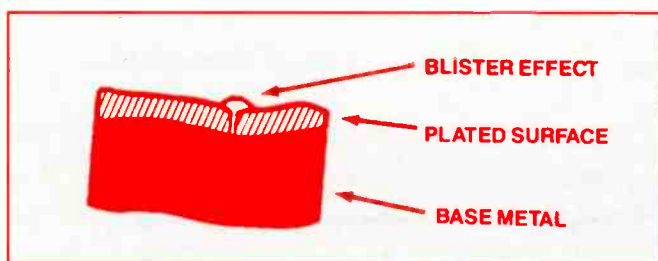


Figure 1. A common problem with gold plated surfaces is dendrite corrosion of base metals to the surface because the gold is soft. Once exposed, the base metals oxidize, causing a "blistering" of the surface which reduces the effective contact area.

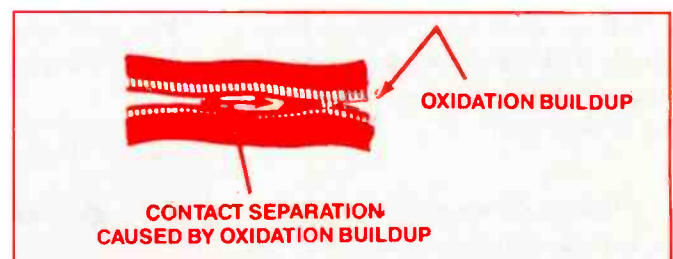


Figure 2. In some cases, noble metal (gold, silver) plating on contacts wears away, exposing the base metal. The base metal then oxidizes, increasing resistance and reducing contact efficiency.

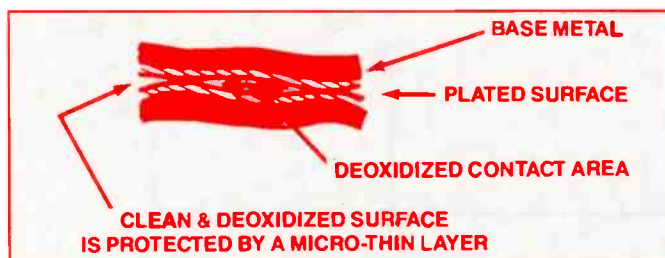


Figure 3. Chemicals exist that can form a protective film over the contact surface, prevent contaminants from coming in contact with the metal.



Figure 4. When contacts are separated, the protective chemical migrates to cover the exposed surfaces.

together, only the peaks are actually in contact with the other surface, causing increased contact resistance, higher operating temperatures, increased wear of contacts, and further exposure of base metals.

A common practice in the manufacture of contacts is to apply a thin layer of expensive gold or silver onto a cheaper base metal, usually copper. In time, the softer metal gets worn away by the harder one and exposes the base metal. The exposed surfaces then oxidize, increasing resistance and reducing contact efficiency. In some cases this will actually separate the contact surfaces.

Arcing

As contacts open and close, an arc will occur between the high and low points of the contact surfaces. This causes heat to be generated and contaminants to react with the metal contacts, creating an insulating oxidized film. This film increases contact resistance and generates more heat. Arcing also causes electrochemical reactions in the air between the contact surfaces resulting in nitric acid formation, which can form a high resistance insulated layer.

Air contamination

Although gold plated contacts do not oxidize, they are subject to other contamination problems. Exposed metals tend to oxidize and corrode due to the contaminants in the atmosphere, resulting in a very high contact resistance. Tarnishing can also occur and is generally present on contact surfaces.

These problems are common on many plated surfaces, especially edge connectors, where the plating is generally very thin and porous, vulnerable to moisture and metal salts. The corrosion tends to separate the plated surfaces from the base metal. The affected surfaces are easily worn or broken away, leaving holes that invite further oxidation and corrosion.

RF interference, distortion and signal loss

When contacts are contaminated, they can act like an antenna and become susceptible to RFI. When operated they can cause RFI as they vibrate or chatter through the contamination.

Dealing with contact degradation

As anyone who has ever worked with metal surfaces in mechanical, electromechanical or electronics systems will attest, Murphy's law is always at work, frequently in the form of one of its corollaries: "If anything can corrode, it will." The actions of oxidation, and other assaults to metal surfaces mentioned in this article will occur. After some period of time, most metal to metal contacts that are not soldered will fail in some way.

In the case of mechanical failure, the solution is normally to scrape away the corrosion or other compounds that have formed and to use a layer of lubricant, oil or grease, to try to coat the affected area and keep the contaminants from forming again. This even works in the case of some electronic connections, where the idea is simply to coat the connection with a chemical resistant barrier.

(continued on page 65)

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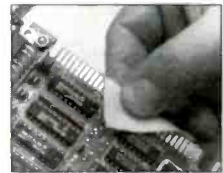
Even the finest equipment cannot guarantee noise-free operation. One "dirty" connection anywhere in the signal path can cause unwanted noise, distortion and signal loss. Considering the hundreds (if not thousands) of connections in electronic equipment today, it is only a matter of time before they begin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

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How Does ProGold Actually Work?

ProGold fills the gaps in the contact surfaces, increasing the effective surface area and current flow (conductivity). ProGold penetrates the plated surface and molecularly bonds to the base metal to seal and protect it. Conduction through a ProGold coated surface occurs in three ways. First, ProGold can be displaced by electrical arc, shock wave or simple mechanical pressure and will redistribute itself along the surface when the disturbance is removed. Second, a thin insulating film of ProGold can be dispersed by an electrical field. Finally, conduction takes place through very thin films of ProGold by means of a quantum-mechanical phenomenon called "tunneling." To avoid delving into a discussion in physics, simply stated, electrons travel from one side of a thin film of ProGold to the other without passing through (this is the same effect that gave the tunnel diode its name).



Why Use ProGold?

ProGold increases the performance and reliability of electrical components and equipment. It provides long-lasting protection (1-10 years), reducing the expense of repeated cleaning with expensive ozone-depleting solvents. ProGold will not gum-up, evaporate, varnish, char or breakdown. Use on plated connectors and contacts for maximum performance and protection.



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NTSC Part II -Luminance and chrominance signals

By Arthur Flavell

This is the second in a series of three articles that examines the NTSC video signal and its characteristics. Part I described sync signals and their role in circuit control and timing. This part, part II, looks at the other elements of the composite sig-

nal—luminance and chrominance. Part III will discuss how baseband video and audio signals are used to modulate RF carriers for use in VCRs, broadcast, cable and MATV applications.

Luminance signal

The luminance signal contains the monochrome or black and white picture

information and is designated by the letter "Y." In a monochrome application, the luminance signal provides all the video information. In color applications, luminance and chrominance signals are both used to produce the final picture. Much of the detail information in color video is contained in the luminance signal.

The luminance signal exhibits electri-

Flavell is owner of an independent consumer electronics service center in Alaska

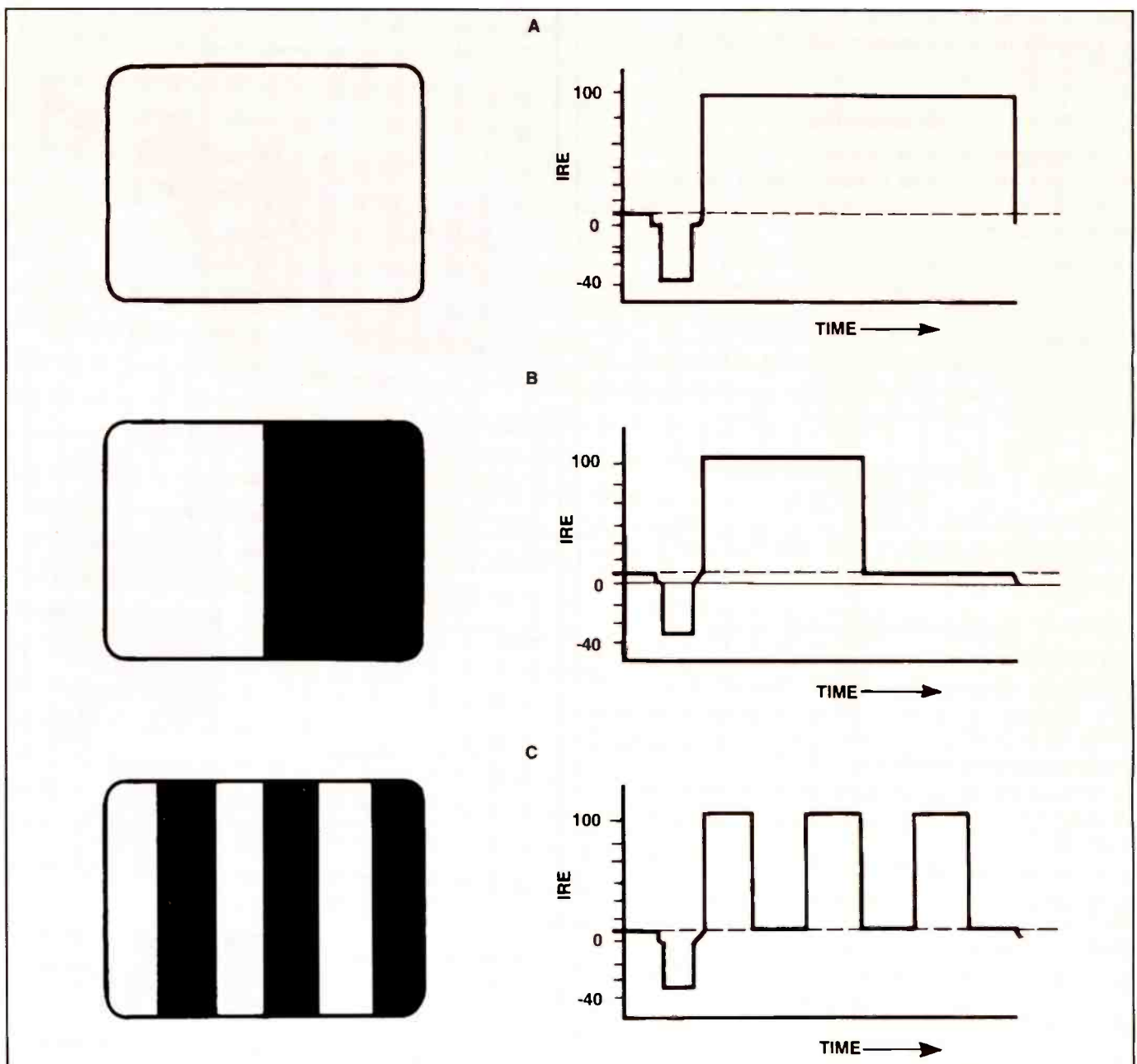


Figure 1.

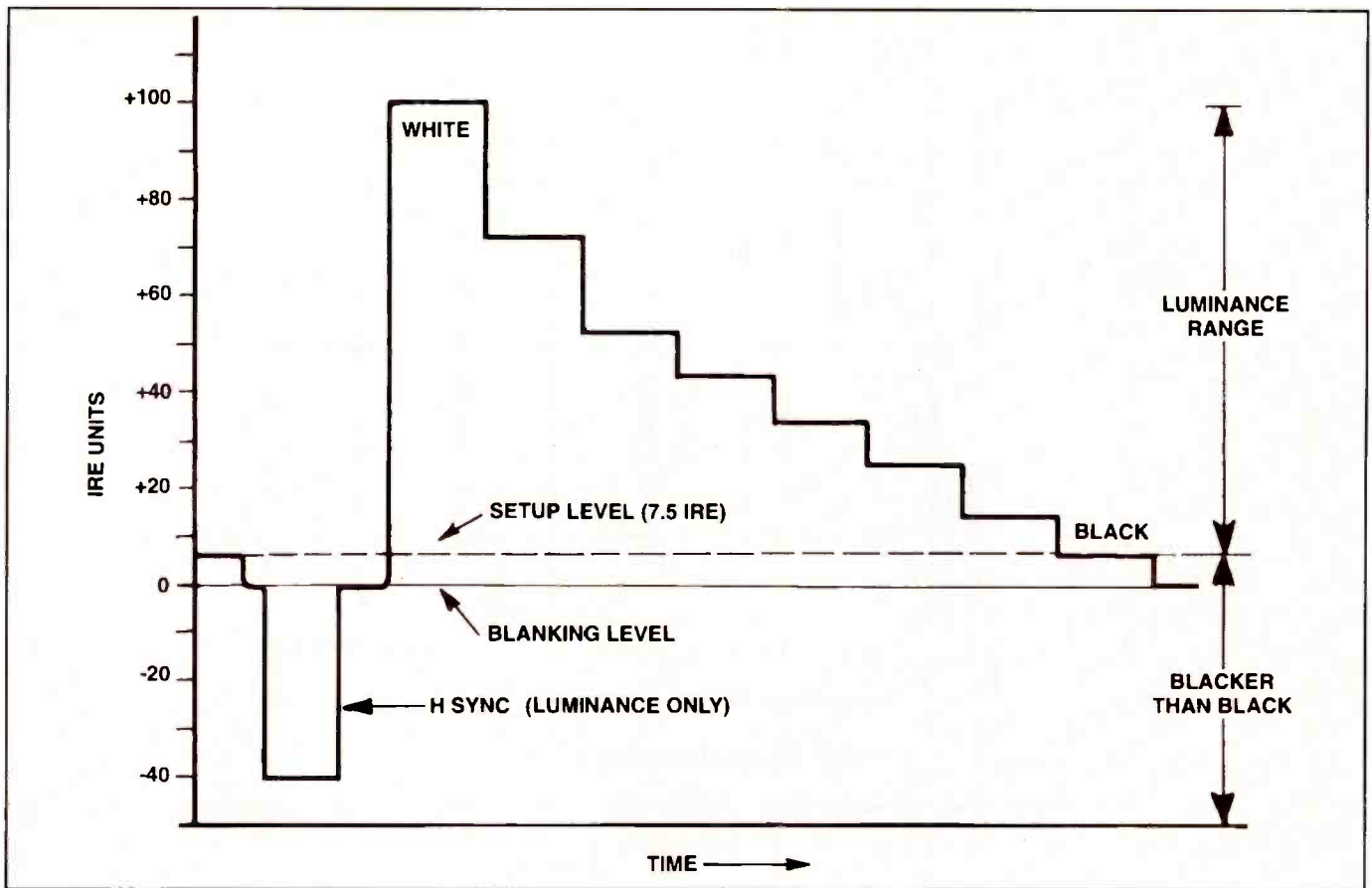


Figure 2.

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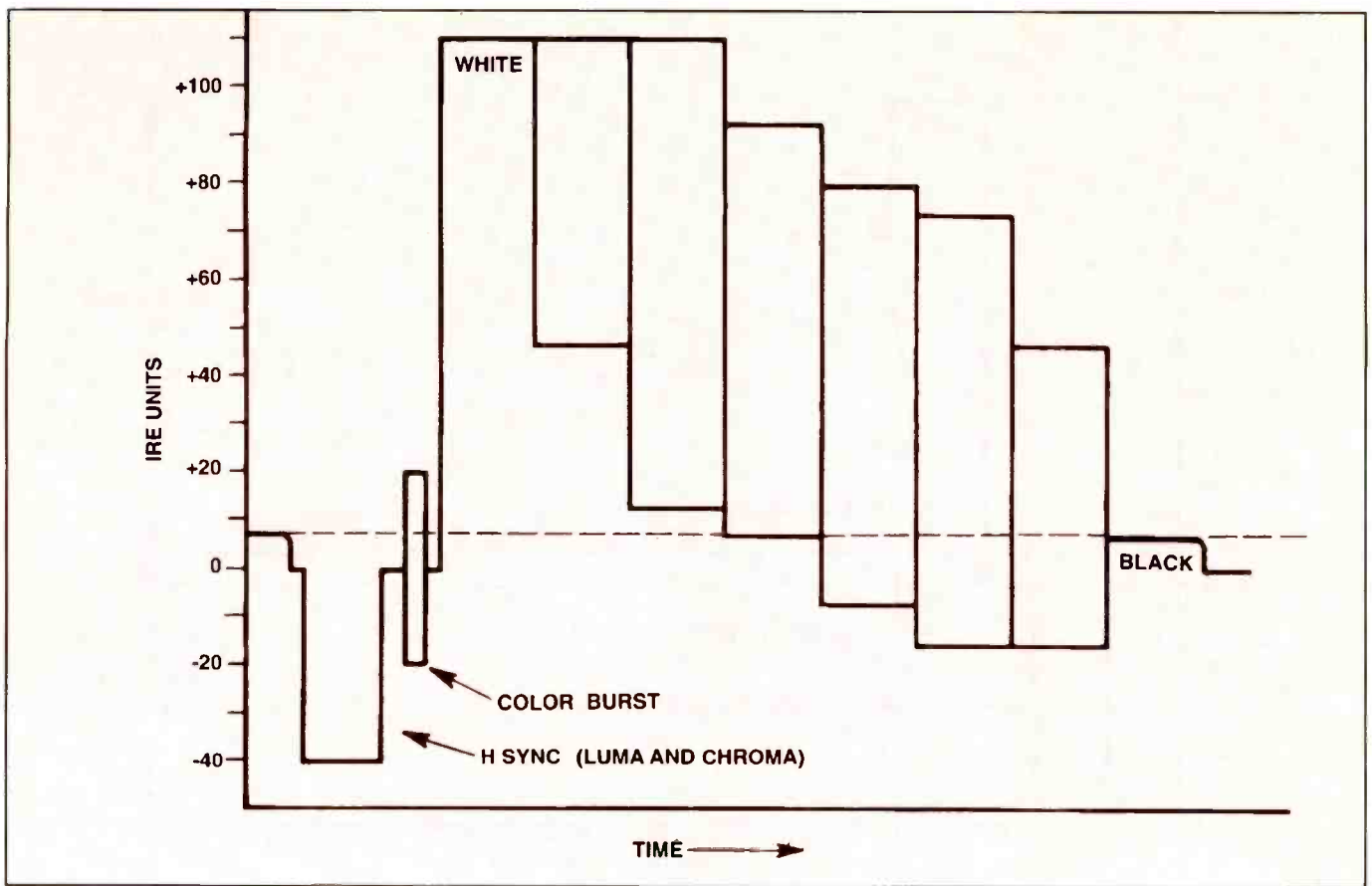


Figure 3.

cal characteristics that are readily defined in conventional terms. From a servicing standpoint, frequency and amplitude are perhaps the two most important.

Luminance frequencies

NTSC video systems must create and reproduce a wide range of frequencies to produce a picture with adequate detail. Luminance frequencies can range from dc to 4.5MHz. The specification is 30Hz to 4.5MHz (+1dB, -3 dB) in the NTSC composite video system.

The range of luminance frequencies is produced by brightness transitions in the scene as it is scanned. Figure 1 shows how frequency variations occur.

Figure 1A shows a completely white background. As seen in the accompanying waveform display, the video signal is at a constant level and will produce a dc signal.

In 1B, there is one transition from white to black as the picture is scanned from left to right. This produces a square wave signal with a duration of 1H (one horizontal scan). The luminance frequency in this case is 15.734264kHz, the same as the horizontal scanning frequency.

Figure 1C has three transitions from white to black, producing a luminance frequency of 47.202kHz. In live-action video, the rate of brightness transitions and resulting luminance frequency will vary widely with picture content.

Picture resolution

Horizontal resolution is one measure of picture quality in NTSC video. Resolution is a measure of the number of light to dark transitions that are discernible in a single horizontal scan. The higher the resolution, the more fine detail is visible and the sharper the reproduced image.

Resolution test charts display a pattern of converging lines to measure horizontal resolution. The test result is obtained by viewing the segment of the chart where the highest number of lines can be clearly distinguished.

Resolution is a function of luminance circuit bandwidth, whether in a camera, VCR or distribution system. Particular care should be taken in following the manufacturer's instructions and specifications when performing camera alignment. The camera is the beginning of the video chain, and poor performance here

will be noticeable, regardless of the condition of other components downstream.

Luminance amplitudes

To ensure proper signal performance in all NTSC video applications, stringent specifications have been established for luminance signal amplitudes. Luma amplitude variations are the result of brightness variations in the scene. The brighter the area being scanned, the higher the luminance amplitude.

The amplitude specification for the composite NTSC video signal is 1V_{pp} into a 75Ω load. Only a portion of this total is reserved for luminance, however. The 1V overall signal is divided into 140 intervals known as IRE units. Blanking occurs at 0 IRE units and sync occupies the area from 0 to -40 IRE units (Figure 2).

Make note of the dashed line at 7.5 IRE units. It is marked on the graticule of video waveform monitors and some oscilloscopes and is called the setup level. The term is derived from the fact that the luminance signal is "set up" 7.5 IRE units above blanking.

Setup level may also be referred to as pedestal or picture black level (while the

region below 7.5 IRE units may be referred to as blacker than black). Setup level represents the lowest amplitude the luminance signal should reach under any picture brightness condition. Setup is established to clearly differentiate between video and sync signals.

Misalignment of the setup level in camera or processing equipment can cause problems in the reproduced video. If the setup is too low and the luminance signal reaches below the blanking level, dark segments of the scene may be mistaken for sync signals. This can result in picture jitter or tearing. If the setup is too high, reduced picture contrast range will result.

The upper limit of luminance is 100 IRE units. This represents the highest level the luminance signal should reach in the brightest picture segments. Exceeding the upper limit can cause picture blooming and problems with the audio in rf systems this will be discussed in Part III). Setting the luminance level of bright areas much below 100 IRE units results in reduced picture contrast range.

Figure 2 depicts the luminance signal produced by a SMPTE (Society of Motion Picture and Television Engineers) color

bar test signal. SMPTE bars are a good choice for alignment purposes because they contain a 100 IRE unit white flag and a block of picture black, the extreme limits of the luminance signal amplitude.

Chrominance signal

The chrominance signal contains the color information of NTSC video and is designated by the letter "C." In monochrome systems, the chrominance signal is filtered out and not used. In color systems, the chrominance signal supplements the luminance signal to produce a complete color picture. The electrical characteristics of the chrominance signal are defined in a manner similar to those of the luminance signal.

Chrominance frequencies

The bandwidth of chrominance frequencies in composite systems is somewhat narrower than that of luminance. This is true because of the way the human eye responds to color. The eye is much less responsive to small variations in color information than to small variations in brightness level. An adequate range of color parameters can be provided by a rel-

atively narrow bandwidth of frequencies in the chrominance circuits. Bandwidth is from 30Hz to 500kHz (+0.5dB, -3 dB) in composite systems.

Chrominance amplitude

The amplitude of the chrominance signal is determined by the intensity of the color in the scene. The brighter or more saturated the color, the higher the amplitude. Less intense or pastel colors produce lower amplitudes.

Chrominance amplitude limits are not as restrictive as those for luminance. Highly saturated colors in a scene may produce chroma amplitudes that exceed 100 IRE units. Some video test generators offer a choice of 75% or 100% amplitude levels for the color bar pattern. Because 100% bars can cause over-modulation of an RF system, 75% bars are typically used. At the 75% level, no chroma signal exceeds 100 IRE units.

Making the composite

The bandwidth of chroma signals occupies some of the same frequency spectrum as luma signals. To minimize interference between the two signals, chromi-

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nance signals are shifted in frequency. When the NTSC standard was being developed, the question of where to place the color information caused concern.

Examination of the luminance bandwidth revealed that the monochrome video signal did not produce much output in some frequency segments. A segment in the upper portion was selected and a chroma subcarrier frequency of 3.579545 MHz was chosen. The chrominance signal is used to modulate the subcarrier and the color information is contained in the subcarrier's sidebands.

The subcarrier approach is a compromise solution which produced color broadcast signals which were compatible with the existing monochrome system. As such, it is not perfect and some trade-offs exist.

One of the most noticeable byproducts of the compromise is the moire effect. If a scene contains rapid brightness variations which produce a signal in the fre-

quency range of the chroma passband, the chroma circuits detect the signal as color information. Pinstripes or herringbone patterns in clothing often cause this phenomenon and appear on screen as a vary-ing-color moire pattern.

The effect cannot be eliminated with the present system technology. The industry has generally adapted by eliminating visual elements that might produce the moire effect.

Hue

Overall color lightness or darkness is controlled by the luminance signal. Color intensity or saturation is indicated by the amplitude of the chrominance signal. One other important color parameter must also be accounted for: hue, or tint. Hue information is represented by the instantaneous phase of the chroma signal.

To accurately measure phase, a stable reference must be available for compari-

son. This role is filled by the chroma subcarrier. When a color video signal is produced, a small sample of unmodulated chroma subcarrier, known as the color burst or simply burst, is included in each horizontal interval (except for the equalizing area of the vertical interval).

The color burst consists of 8 to 11 cycles of subcarrier on the back porch of the horizontal blanking interval (Figure 4). The amplitude of the color burst is specified at 40 IRE units peak-to-peak, centered on the blanking level.

Because the color burst is positioned in the horizontal blanking interval, it is not normally visible on the screen. It may be viewed on a video monitor with cross-pulse capability, where it appears as a greenish bar to the right of the horizontal sync pulse.

Burst serves to lock the chroma subcarrier oscillator in the reproduction equipment to the frequency and phase of the oscillator in the originating equipment. This provides a stable reference for phase comparison. Alignment of hue control circuits in cameras and other production equipment requires the use of a specialized oscilloscope called a vectorscope.

Composite vs component

Ultimately, the sync signals (vertical and horizontal), the luminance signal and the chrominance signal (on its subcarrier) are all mixed together to form the NTSC composite video signal. The composite signal is most commonly used to transfer video information between different pieces of equipment, such as from camera to recorder or playback machine to monitor. It may also be used to modulate an RF carrier for distribution systems.

However, inside the equipment, the individual components of the composite signal are generally separated and processed individually. To minimize noise and distortion introduced by the mixing process, some video systems use the component signals even between pieces of equipment when editing and during signal processing. Super VHS, U-Matic, Beta and M-II are some examples. Only at the end of the processing chain is the signal converted to composite.

Understanding the nature of the NTSC composite video signal and the components involved in its creation makes troubleshooting and repairing these complex circuits a simpler task. ■

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Will Total Quality Management work for you?—Part 11

By John A. Ross

TQM Point 11a

Eliminate work standards (quotas) on the factory floor. Substitute leadership.

TQM Point 11b

Eliminate management by objectives. Eliminate management by numbers, numerical goals. Substitute leadership.

With the two parts of TQM point 11 Deming makes several interesting suggestions about management practices. First, point 11 asks for the elimination of targets for zero defects, work and production quotas, and numerical goals. The choice to eliminate targets and quotas refutes traditional methods used to make people work faster and to produce more goods. Looking back at point ten, introduced in the last issue, we see that it combines with point 11 to identify the problems that can occur when organizations place high priorities on organizational needs with very little concern about human needs.

Incentives can backfire

Criticisms aimed at individuals because the business or department did not achieve its organizational goals can damage morale. Low morale in one section can spread through the organization. In addition, if the organizational goals include cost saving measures, the resulting lack of resources and the increasing expectations of each individual may not only affect morale but may also significantly harm organizational performance.

Wrongly used, some management techniques reward employees who "get by for less" and have no need to provide quality workmanship. Consequently, the

elimination of employee/organizational bonds also eliminates motivation for quality and improvement. Although the use of goals or quotas has the intent of making the organization more efficient and more effective, the overemphasis on goals and quotas actually makes these characteristics less attainable.

Deming targets the oft-used management by objectives approach with TQM point 11 because it concentrates on quotas, numerical goals, and results.

Emphasizing the process as well as results

Rather than focus on results, Total Quality Management addresses both the process and results. As we have seen, TQM seeks to both add quality workmanship to every process of the production process and to continuously improve the process. Furthermore, like MBO, the application of TQM seeks to ensure that the process retains quality through careful monitoring and statistical feedback.

Most important, point 11 accentuates the need for leadership throughout the management process. At this point, it is especially important to remind everyone that leadership is a form of power.

What is leadership?

Before we look at the style of leadership espoused by TQM, let's take a quick look at some definitions of leadership. In his book *Leadership*, James McGregor Burns tells us: "Leadership over human beings is exercised when persons with certain motives and purposes mobilize, in competition or conflict with others, institutional, political, psychological, and other resources so as to arouse, engage, and satisfy the motives of followers."

In addition, Burns says that leaders induce followers to work toward certain

goals that reflect the values of both the leader and the followers.

James Champy, co-author of *Re-engineering the Corporation: A Manifesto for Business Revolution*, builds on Burns' definitions by saying that leadership is a process of getting others to share your vision so that everyone's goals are the same. Still others define leadership as the exercise of influence rather than power.

The TQM philosophy of leadership

Obviously, many types of leadership—such as transactional, social, political, moral, reform, executive, and intellectual—exist. The concepts that make up each one of those types become evident when we look at the total philosophy of Total Quality Management. Like the definitions that we have just seen, the TQM philosophy of leadership speaks in terms of taking the power provided by leadership and spreading it throughout the organization. Thus, leadership evolves from the giving of authority and power to everyone in the organization.

Benefits of the TQM philosophy of leadership

How does the TQM philosophy of leadership and empowerment benefit your organization? We can answer this question in terms of health and humanity. Organizations that rely on the talents and capabilities of all their employees experience less turnover, less "finger-pointing," and less micro-management. It becomes evident, then, that the TQM philosophy seeks to strike a balance between the organizational and human needs. Employees who have a role in decision-making processes of an organization have a tendency to remain with the organization for a longer period of time and have a higher sense of job satisfaction. ■

Ross is a technical writer and microcomputer consultant for Ft. Hays State University, Hays, KS.

Choosing a replacement parts supplier

Consumer electronics servicing, never an easy occupation, continues to get more difficult. Service technicians and service managers are continually faced with products with malfunctions that are difficult to diagnose. Keeping up with rapidly changing technology consumes a considerable amount of the time and energy of service organizations.

In today's rapidly changing world of consumer electronics, two of the most common problems facing service technicians and managers are locating replacement parts and finding service literature.

Many of the consumer electronics products being sold today have brand names that no one has ever heard of. Many service centers have no idea where to go for parts and information on these units. Much of the circuitry in these products is highly sophisticated, featuring unique components for which no one but the manufacturer has the replacement, which compounds the problem. What can a service center do when faced with this increasingly common problem?

One part of the answer is to deal with a good replacement parts distributor, the kind who is responsive to the service center's needs

Products are complex, varied

Many modern consumer electronic products are far more than products; they are intricate systems. Consider a camcorder. The electromechanical portion of the system loads the tape and records or plays it. The optical system captures the image and converts it into an electronic signal that can be manipulated by the camcorder's electronic circuitry.

The electronic portion of the camcorder manipulates the video signal. The control section makes sure that all the other sections work properly together, and in addition senses conditions like the presence of moisture or end of tape and shuts down the system if there's danger of damage.

Electronics engineers and scientists continue to create an ever broadening variety of components with unique characteristics. With this increasing variety of available components and characteris-

tics, designers of today's sophisticated consumer electronics products have increasing freedom in the way in which they design the circuits for the product they want to build.

If the designers should want to achieve a function but don't want to do it with the components available, they can go to an integrated circuit manufacturer, or in some cases the IC division of their own company, and have a new, proprietary IC designed and fabricated.

All of this leads to a huge variety of components that the service technician will encounter any time he services a product. The problem is compounded by the fact that manufacturers' part numbering systems are all different.

In some cases, when a technician has identified a particular faulty component, he can find a cross reference that will allow him to determine if he has an equivalent in stock. Unfortunately, in many cases, there is no cross reference, and even if the service center has a needed part on hand, no one is aware of it. And, in the case of complex ICs, there probably is no equivalent anyway.

Identifying components

Service centers can do a number of things to make obtaining replacement components easier. One step is to obtain copies of every available cross reference and become familiar with them so that when a part is needed it can be identified.

Some cross references are available free from manufacturers through distributors. Other cross references cost a considerable amount of money. However, if a service center adds up all the long distance calls, and all the time spent on the phone, to say nothing of the toll charges for those long distance calls, any cost for cross references might be found to be money well spent.

Working with a distributor

Once the faulty component that caused the malfunction has been identified, the next step is obtaining a part from the distributor. Distributors differ in their commitment and ability to help you identify a com-

ponent and obtain it for you, just as is the case with any other supplier.

The advertisers who are represented in this special advertising supplement have taken this opportunity to tell you a little more about themselves than they can in an ad. They want service centers to be aware of what kind of facilities they have, what kinds of people work for the company, the efforts they are making at customer satisfaction, and how to contact them when you need a replacement component.

Here are some of the questions we asked the manufacturers and distributors to address in their articles:

- How many locations do they have?
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- What payment options do they offer - open order account, credit card?
- How soon after receipt of an order to they ship?
- Do they add a shipping surcharge?
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- What ordering options do they offer?
- What is their return policy?
- Do they offer a warranty?
- Is there a minimum order amount?
- What shipping options do they offer?
- What special services do they offer?
- Do they have a research department to help technicians find a specific part?

Some things to think about

When you're searching for a replacement part supplier you can count on for reliability, convenience and service, keep some of those questions in mind. Just finding someone who stocks the part isn't the only consideration. If you have to wait until you fill a large minimum order amount before you order, or if you have to wait weeks for the part to arrive, you're stuck with a defective television and probably an irate customer.

The impulse to order from the first name in the book might be high, but take the time to ask some questions. It could save time, money and aggravation. The following section will give you a head start in answering some of those questions.

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We have heard repeatedly of the need for a computer program that would give instant access to part numbers, substitute numbers, dealer cost, dud prices, descriptions, and availability. We developed that program. Today, the Parts Pricing and Cross Reference Program is available, and includes over 260,000 part numbers. It includes generic and Philips part numbers, as well as all the other requested information listed above.

We went one step further and created the PartSeeker program. With this program, you look up a model or chassis and find your part number quickly. Just enter your component number and there it is. It even interacts with the Parts Pricing and Cross Reference Program to provide the price.

And now the final step. The program that will display the schematics from our service manuals is almost finished. We have shrunk our manuals down to the size of one high density floppy disk. This program, SmartMan, provides fast access to boards, circuits, components, and faults. Training information is included to view signal flow and operation on the screen at the same time you are looking at the schematic. This program links with all the rest of our software and allows any technician to

input his own notes and print his circuits out.

Video Tapes

As a result of requests for more videotapes covering electronics repair, we are offering videos covering VCR mechanics, CD repair, switching mode power supply service, and cameras. In fact, the demand was so high we decided to expand our video production facilities to triple our output of videos by the end of 1993!

Highest Quality

Philips Technical Training is committed to providing total customer satisfaction. We are also committed to producing the highest quality of training in the industry. Our Hands-On classes, training books, tapes, and software are all accompanied by a quality survey card. This survey is used to constantly check the quality of our products as seen by the technician. Quality and effective training are very important to us.

Order your new catalog

A free catalog, containing descriptions of all products and training materials available, is published annually by Philips. You can get your catalog by calling the Technical Training department at 615-475-0044 or faxing us at 615-475-0221. ■

Matsushita Original Replacement Parts and Accessories

Let's Keep the Promise!

Nothing less than total satisfaction is expected by today's customers. Their hard earned dollars and your reputation are on the line. When a customer chooses a Panasonic, Technics or Quasar product, MSC makes them a promise. Simply stated, when service is required, our Factory Service Centers, Authorized Servicers and Parts Distributors will work together to repair their units the first time, every time!

The only way to live up to this promise is by using Matsushita Original Replacement Parts and Accessories. You've worked hard over the years to gain their trust. Let's build on this by using the best components from the

only source, your Authorized Parts Distributor and MSC.

A Promise Kept! Here's How:

Locate your nearest Authorized Replacement Parts Distributor by consulting the list included inside.

As an Authorized Matsushita Servicer, you can have direct access to all parts, accessories and service literature. Sign up for Parts-Link today! See the sign-up sheet inside.

Give your customers the only accessories that really work, and earn profits as well! Contact the Parts Accessory Representative in your area.

Matsushita Services Company
50 Meadowland Parkway, Secaucus, NJ 07094

Panasonic®

Technics™

Quasar®

MATSUSHITA

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Panasonic®

Technics™

Quasar®

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Cass Electronics (C/V/M/A) • 801 Seventh Ave., Oakland 94606 • 510-839-2277 • FAX 510-465-5927

E and K Parts, Inc. (C/V/M/A) • 2115 Westwood Blvd., Los Angeles 90025 • 310-475-6848 • FAX 310-474-0846

Pacific Coast Parts (C/V/M/A) • 15024 Staff Court, Gardena 92048 • 310-515-0207 • FAX 800-782-5747

Star for Parts (V) • 10727 Commerce Way, Suite B, Fontana, CA 92335 • 909-428-1404 • FAX 909-428-3213

Blakeman Wholesale/Tacony (V) • 1800 E. Walnut Street, Fullerton, CA 92631 • 714-680-6800 • FAX 714-680-8700

COLORADO

Denver Walker Wintronic (C/M) • 1001 W. Arizona Ave., Denver 80223 • 303-744-9505 • FAX 303-777-9357

Star for Parts (V) • 2350 Arapahoe St., Denver 80205 • 303-296-2117 • FAX 303-296-2120

CONNECTICUT

Signal Electronics Supply, Inc. (C/M/A) • 589 New Park Ave., West Hartford 06110 • 203-233-8551 • FAX 203-233-8554

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Herman Electronics (C/V/M/A) • 1365 N.W. 23rd St., Miami 33142 • 305-634-6591 • FAX 305-634-6247

Layco, Inc. (C/V/M/A) • 501 South Main St., Crestview 32536 • 904-682-0321 • FAX 904-682-8820

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Vance Baldwin (C/M/A) • 1801 NE 2nd Ave., Miami 33132 • 305-379-4794 • FAX 305-373-8855

Vance Baldwin (C/V/M/A) • 1007 N. Himes Ave., Tampa 33607 • 800-443-2606 • FAX 813-870-1088

Vance Baldwin (C/V/M) • 500 Clematis St., West Palm Beach 33401 • 407-832-5671 • FAX 407-833-8191

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Wholesale Industrial (C/M/A) • 5925 Peachtree Corners East, Norcross 30071 • 404-447-8436 • FAX 404-447-1078

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B-B & W, Inc. (C/V/M) • 2137 S. Euclid Ave., Berwyn 60402 • 708-749-1710 • FAX 708-749-0325

Hesco, Inc. (V) • 6633 North Milwaukee Ave., Niles 60648 • 708-647-6700 • FAX 708-647-0534

Joseph Electronics, Inc. (C/M/A) • 8830 N. Milwaukee Ave., Niles 60648 • 708-297-4208 • FAX 708-297-6923

Union Electronic Dist. (C/V/M/A) • 16012 S. Cottage Grove, South Holland 60473 • 708-333-4100 • FAX 708-339-2777

INDIANA

Electronic Service Parts (C/V/M) • 2901 E. Washington St., Indianapolis 46201 • 317-269-1527 • FAX 800-899-1220

KANSAS

G & A Distributors, Inc. (C/V/M/A) • 635 N. Hydraulic St., Wichita 67214 • 316-262-3707 • FAX 316-262-6494

Manhattan Electronics, Inc. (C/V/M) • 9086 Bond St., Overland Park 66214 • 913-888-1115 or 800-821-3114 • FAX 800-255-6239

MARYLAND

Fairway Electronics (C/V/M) • 3040 Waterview Drive, Baltimore 21230 • 410-576-8555 • FAX 800-955-2119

Fairway Electronics (C/V/M/A) • 4210 Howard Ave., Kensington 20895 • 301-564-1440 • FAX 800-955-1358

Tritronics, Inc. (C/V/M/A) • 1306 Continental Dr., Abingdon 21009-2334 • 410-676-7300 • FAX 800-888-FAXD

MASSACHUSETTS

Signal Electronics Supply, Inc. (C) • 484 Worthington St., Springfield 01105 • 413-739-3893 • FAX 203-233-8554

Tee Vee Supply Co. (C/V/M/A) • 407 R. Mystic Avenue, P.O. Box 649, Medford 02155 • 617-395-9440 • FAX 617-391-8020

MICHIGAN

G.M. Popkey Co. (C/V/M/A) • 5000 W. Greenbrooke Dr. S.E., Grand Rapids 49512 • 616-698-2390 or 800-444-3920 • FAX 616-698-0794

Remcor Electronics (C/V/M/A) • 10670 Nine Mile Rd., Oak Park 48237 • 313-541-5666 • FAX 313-398-1016

MINNESOTA

Ness Electronics, Inc. (C/V/M/A) • 441 Stinson Blvd. NE, Minneapolis 55413 • 612-623-9505 • FAX 612-623-9540

Mid America Vacuum Cleaner Supply Co. (V) • 666 University Ave., St. Paul 55104 • 612-222-0763 • FAX 612-224-2674

MISSOURI

Cititronix, Inc. (C.V.M.A) • 1641 Dielman Rd., St. Louis 63132 • 314-427-3420 or 800-846-2484 • FAX 314-427-3360

Tacony Corp. (V) • 1760 Gilsinn Lane, Fenton 63026 • 314-349-3000 • FAX 314-349-2333

NEW JERSEY

Panson Electronics (C/V/M/A) • I-80 and New Maple Avenue, P.O. Box 2003, Pine Brook, NJ 07058 • 201-244-2400 • FAX 800-332-3922

NEW YORK

Dale Electronics (C/V/M/A) • 7 E. 20th St., New York City 10003 • 212-475-1124 • FAX 212-475-1963

GMB Sales (C/V/M/A) • 140 N. Belle Mead, Setauket 11733 • 516-589-3400 or 800-874-1765 • FAX 800-635-0596

Radio Equipment Corp. (C/A) • 196 Vulcan St., Buffalo 14207 • 716-874-2690 • FAX 716-874-2698

Star for Parts (V) • 250 Rabro Drive East, Hauppauge 11788-0255 • 800-525-6046 • FAX 516-348-7160

OHIO

Fox International, Inc. (C/V/M/A) • 23600 Aurora Rd., Bedford Heights 44146 • 216-439-8500 • FAX 800-445-7991

OREGON

Diversified Parts (C/V/M/A) • 2104 S.E. 9th Ave., Portland 97214 • 800-338-6342 • FAX 800-962-0602

Northwest Wholesale (V) • 426 N.E. Davis St., Portland 97232 • 503-232-7114 or 800-234-8227 • FAX 503-232-7115

The Moore Co. (C/V/M) • 333 SE 2nd, Portland 97214 • 503-731-0100 or 452-0500 • FAX 503-731-0105

PENNSYLVANIA

CRS Electronics (C/M) • 818 Brownsville Rd., Pittsburgh 15210 • 412-431-7700 • FAX 412-431-5666

Steel City Vacuum Co., Inc. (V) • 919 Penn Ave., Pittsburgh 15221 • 412-731-0300 or 800-822-1199 • FAX 412-731-3205

SOUTH CAROLINA

Wholesale Industrial (C/V/M) • 515 E. Bay St., Charleston 29403 • 803-722-2634 • FAX 803-723-8182

TENNESSEE

Shields Electronics Supply, Inc. (C/V/M/A) • 4722 Middlebrook Pike, Knoxville 37921 • 615-588-2421 • FAX 615-588-3431

TEXAS

Fox International (C/V/M) • 752 So. Sherman, Richardson 75081 • 214-231-1826 • FAX 214-231-0177

Interstate Electric Co. (C/V/M/A) • 11292 Leo Lane, Dallas 75229 • 214-247-1567 or 800-527-4029 • FAX 214-247-2137

M-Tronics (C/V/M/A) • 3201 West Ave., San Antonio 78213 • 512-340-4069 • FAX 512-340-4569

VCP International Inc. (V) • 2285 Merritt Dr., Garland 75040 • 214-271-7474 • FAX 214-278-5981

VIRGINIA

Avec Electronics Corp. (C/M) • 711 Granby St., Norfolk 23510 • 804-627-3502 • FAX 804-627-1710

Avec Electronics Corp. (C/M) • 2002 Staples Mill Rd., Richmond 23230 • 804-359-6071 • FAX 804-359-5609

Avec Electronics Corp. (C/M) • 2009 Williamson Rd., Roanoke 24012 • 703-344-6288 • FAX 703-344-0081

WISCONSIN

G.M. Popkey Company (C/V/M/A) • 2035 Larsen Ave., Green Bay 54307-2237 • 414-497-0400 • FAX 414-497-4891

G.M. Popkey Company (C/V/M/A) • 2355 So. Calhoun Rd., New Berlin 53151 • 414-786-5887 • FAX 414-786-9031

CODING:
(C)...Consumer Electronic Parts
(V)...Vacuum Parts
(M)...Major Appliance Parts
(A)...Accessories

(as of 6/15/94)

Matsushita Services Company

**500 Meadowland Parkway
Secaucus, NJ 07094
Phone: 201-348-7589
FAX: 201-348-7527**

For 30 years, the Panasonic brand name has appeared throughout American homes and industries. In that time, our company's commitment to total customer satisfaction has manifested itself in many ways. Including the Technics, and Quasar lines of consumer electronic products, a multi-pronged approach to post sales support has evolved to include programs that encompass qualitative, human resource training as well as ones that stress the development of automated processes that allow us to offer timely, accurate solutions to our end users' service needs.

The engine behind MCS's ability to ensure timely repairs is our ability to deliver parts and service literature to our network of factory service centers, and independent servicers and dealers in a timely manner. We are now seeing the results of over a decade of continued investment in the modernization of our facilities. The primary point of support for all replacement parts and service literature is The National Parts Center in Kent, WA. From here, and with further support from sales & marketing staff located at Matsushita headquarters in Secaucus, NJ and field staff throughout our U.S. regions, we handle a wide variety of inquiries and fill just about any request made of us.

Customer Contact

Generally, the first line of customer support is provided by our order offices located in Kent and in Norcross, GA. These offices handle a wide variety of customer calls ranging from simple parts orders to requests to do research on unique model numbers. Currently, the order offices handle an average of 1,400 calls a day just for taking orders, as well as take an average of 250 calls from customers requesting such things as estimated shipping time, return authorizations, processing credits, and special orders. Also, the offices receive over 500 faxes daily. In addition to all this, MSC maintains an office in Elgin, IL where retail customers can place a toll-free call and order any of

our comprehensive line of accessories.

One of our improvements that was made recently was being able to consistently maintain a 24-hour turnaround for research requests. In order to further improve our level of service, we've made significant investments in phone management systems. Such systems allow management to see, in real time, how many customers are in the queue waiting for a representative to help them. Data gathered from these systems will graphically depict workload volume, peak times, and average call length on a daily basis and give management a true picture of where additional improvements are needed.

Our staff includes representatives which reach out to the field as well. Regional parts accessory representatives call on distributors, independent servicers, dealers, and even end users, to assess their needs. With a comprehensive portfolio of sales programs and promotional items, they are able to offer profitable opportunities to small and large businesses alike. Along the way, they are able to keep in touch with the ever changing needs of all, and make the necessary recommendations to market development personnel.

Parts and Service Literature Distribution

Once we've established what our customer needs, we have to get it to them. That's the job of over 60 employees that staff our parts and service literature warehouse in Kent. The building is the length of three football fields, and encompasses nearly a quarter million square feet! There are nearly 125,000 line items in stock.

The shipping day begins at 7:00 am. There are nearly 2,000 parts orders being processed at any given time. In order to manage such an overwhelming task, processes have been created that allow us to meet our goal of having all orders received by 3:00 pm out that day, and no order taking more than 24 hours to be shipped. One simple way to do this is by color coding the invoices. Each day, a new

color is used. This is a constant reminder to the staff, to be aware of our 24-hour goal. By the end of the day, the facility will have shipped approximately 3,000 parts and pieces of service literature orders, which consist of over 10,000 line items, and over 40,000 parts!

There is no better indicator of MSC's investment in automation than here. Recently, we've implemented the use of bar coding on pick tickets. The use of this is an example of how we're using technology to cut minutes and/or hours from the time a unit is brought in for service, up to when the customer has it satisfactorily repaired.

Finally, in our effort to be earth friendly, the warehouse has led our industry in the effort to recycle. It all began two years ago when we began to use biodegradable packing material. Today, we have a comprehensive program to sort, and through the use of outside experts and handlers, dispose of any potentially hazardous waste.

The Future

MSC is excited about the near future. If the past is any indication there will continue to be marked improvements in our methods of serving customers. There will be a continued expansion of our customers' ability to go "on line" with MSC, not just for order entry, as is currently available to all servicers with Parts-Link, but with far more comprehensive research and product information systems such as Panasonic Advanced Support System (PASS). PASS allows users to directly tie into our vast library of service literature, bulletins, product literature, and technical information. This is an on-line system. All your questions are answered right away. (See our display at this year's NESDA show in Portland, OR).

Internally, with systems that our customers don't directly see, we move further into the information age. Our purchasing agents now employ CD-ROMs to access any of the vast bits of information they need to see to know that we have the right inventory. The use of bar coding will continue to expand.

The future is an ever expanding vista for MSC. It's one that we continue to explore in an ever increasing way. We expect nothing less from our authorized distributors and servicers. The customer is always number one with MSC. Our dollars go toward hardware, software, training and promotion. The payback is customer satisfaction! ■

Twenty-four MSC factory servicenters (FSCs) are strategically located throughout the country.

Distributors of:

Panasonic

Technics

Quasar



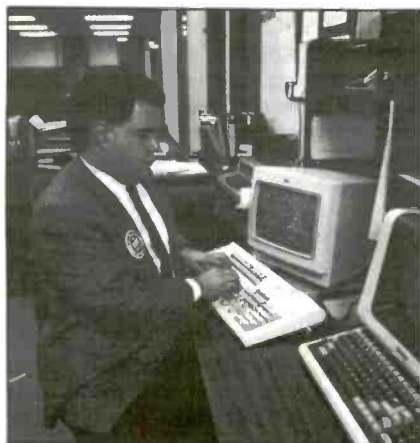
Factory servicenters at convenient locations throughout the United States provide repair services and replacement parts.



Owners of Panasonic, Quasar and Technic products are never far from factory-trained service technicians.



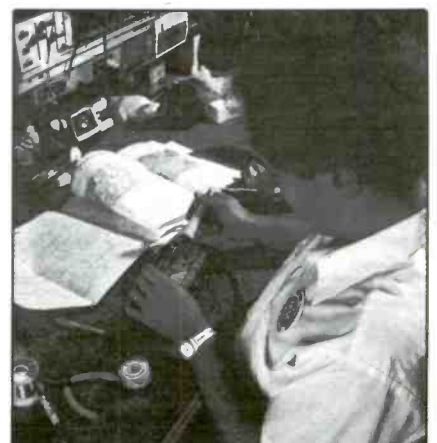
Trained parts and service personnel provide a telephone link to customers seeking product and service information.



The MSC Parts-Link computer system quickly locates the nearest source of original equipment parts needed to service products.



Highly trained technicians use sophisticated instrumentation to speed and improve the quality of customer service.



In thousands of service departments, service procedures developed by MSC speed product repair.

Andrews Electronics

P.O. Box 914, Santa Clarita, CA 91380-9014
800-289-0300 Fax: 800-289-0301

What is the most important quality that you as a servicer look for in a distributor? An extraordinary supply of parts on hand or superior service? By itself, either would be practically useless. Welcome to Andrews Electronics, the best of both worlds! We are the most well-stocked wholesale distributor of our kind, with over 250,000 line items in our warehouse and an average fill-rate of

over 90%! Over an acre of floor space filled with parts, all in one location, makes us the largest supplier in America for the majority of the manufacturers that we represent. And now, Andrews is proud to announce the addition of yet another major manufacturer to our growing family of O.E.M.'s—JVC! This is just one more reason to make us your "one-stop shopping" distributor. Another

outstanding reason is our service. Our dealer order desk has recently been expanded to an unbelievable 30 available sales representatives! You now have a 99.9% chance of speaking to them rather than voice mail during office hours. We've built our reputation on a very simple philosophy...service. Not very fancy, but pretty effective. Our constant growth attests to it. You see, all of our policies that have been developed over the years have been based on that one simple thought: "How may we better serve the industry?" How about:

16 major brands to save you time, frustration, and money with "one-stop shopping."

Orders placed before 2:30 PST are routinely shipped the same day

A freight program that offers free or discounted shipping

No minimum orders and no handling charges

Automatic backorder reports with ETA's mailed biweekly

A fast, highly-efficient research department, second to none.

A program that converts make/model/descriptions to part numbers instantly for the majority of research requests

24-hour toll-free phone and fax order lines

Over 80 full-time employees waiting to serve your needs

Beware of programs that charge a flat rate (usually around \$4 or \$5) for shipping ground and a seemingly lower than normal rate for air. The average ground shipment costs about \$2.50 to \$3.00! What, no shipping charges on any backorders (which you'll likely have more of than you thought)? Of course not, either you paid for it up front with your \$4.95 flat rate shipping charge or it'll be shipped with your next order—which you will pay for! At Andrews we only bill you for the actual UPS charges, not a penny more! Or under our freight program, you'll pay less than that or nothing at all!

In case you've heard this elsewhere before, now's the time to let us prove it to you. By investing a mere two minutes of your time, you can discover what thousands of others have: that there is a difference. When you place your next order with your local supplier, check the availability of all the items. Then call or fax Andrews and check our stock levels. We believe you'll be pleasantly surprised! Wouldn't getting those extra units repaired a week or two sooner be good for your reputation? Sure it would! And we can help! After all is said and done, it is performance that counts. We know that your ability to perform your job depends on how well we perform ours. Our regular office hours are from 8:15 to 4:45 PST and we're closed for lunch between 12:00 and 12:30. When you think of electronic parts think of Andrews.

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 Phone: 800-844-7871 FAX: 800-844-3291

PTS Electronics has been the electronics service dealers best friend by providing fast dependable service to thousands of service dealers for more than 25 years.

PTS is the nation's largest single source for all major brands of television tuners and TV main boards. Brands such as RCA, Zenith, GE, and NAP are available at substantial savings of up to 60% when compared to OEM direct replacements.

Recently, PTS has updated and expanded our offering of PC boards for Sharp Microwave ovens. Since 1979 PTS has been involved in the repair of Microwave PC boards. In the coming months, we will be adding other manufacturers to our line of Microwave PC boards.

Rebuilding is what we do best

PTS began in 1967 remanufacturing television tuners, and now remanufactures television main boards, satellite receivers, complete chassis, projection set boards, computer monitors and microwave oven panels.

Specialization has made PTS the largest and most efficient independent electronics rebuilder in the world. Maximum use of available resources and skill has made PTS the leader in

electronics rebuilding, with the ability to adapt to new technologies and advance into new markets according to customer needs.

PTS specializes in rebuilding/remanufacturing electronic timing devices, modular circuits, and electronic tuners and main boards. PTS currently maintains contracts with major manufacturers in a variety of industries including white goods, television, computer, automotive, medical and various government agencies.

Currently, PTS rebuilds over a million analog and digital products, components and sub-assemblies each year.

Dedicated to customer satisfaction

At PTS, just providing our customers with high quality products and services is not enough. Our goal is total, unconditional customer satisfaction. Since 1967, PTS has been the world's leading independent electronics rebuilder and parts supplier. We provide the electronics industry with quality repair services and parts. We have worked with leading manufacturers to develop service programs for emerging technologies. We've seen a lot of changes over the years, but there's one thing that hasn't changed. That's the value and qual-

ity of our products and service programs.

You don't just become an industry leader overnight. It takes several years of experience and dedication to achieve excellence. It also takes a real commitment to training as well as state-of-the-art diagnostic and service equipment. PTS has the commitment.

Our staff are seasoned veterans who put themselves in the customer's shoes. They know how to listen and respond to a customer's needs. Each call is evaluated very carefully, and the response is always supportive and helpful. When you use PTS products and services, you become a part of our family. We'll go that extra mile to make sure you're happy and satisfied. When you call PTS, we really mean it when we say "PTS Electronics, how may we help you?"

PTS maintains a state-of-the-art computer system that allows instant response to your order inquiries. Our staff of customer service representatives are very knowledgeable of our products and services, and can help ensure that you get the part you really need.

PTS carries thousands of different parts for virtually every major manufacturer, and has more than 3 million parts in stock.

With a 40,000 square foot corporate facility, PTS employs more than 175 technical personnel and support staff. Branch operations are located in Longview, TX, Tustin, CA, and Arvada, CO. There are over 300 individual test positions for live testing of television tuners and mainboards. PTS keeps thousands of tuners and mainboards in stock for immediate shipment and also services all major brands.

So, call today to place your order and ask for our free price guide or for more information.



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PTS Electronics

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 1-800-264-5082

15042 PARKWAY LOOP, SUITE D
 TUSTIN, CA 92680

Local: 714-258-0313
 Fax: 714-258-0315
 1-800-380-2521

Philips Service Company

112 Polk Street, P.O. Box 967
Greenville, TN 37744
Phone: 800-851-8885
Fax: 800-535-3715

Philips Consumer Electronics Service Company is commanding national attention as the industry's Number 1 OEM replacement parts supplier across the board.

The company's continuing efforts to become the "one-stop-shop" for all servicer needs is consistently supported by the ability of the replacement parts division to hold our competitive standing as first in quality and service—quite impressive with a line of over 45,000 parts.

"Philips Consumer Electronics Com-

pany has demonstrated a tremendous commitment to total customer satisfaction across the board in product and service," said Travis Kelton, Marketing Manager, Replacement Parts. "I'm happy to say that that commitment is evidenced in the reliability of our OEM replacement parts and the timeliness of our service.

"Our customers want results. They deserve every product to deliver on its promise, and we refuse to fall short of that expectation," Kelton continued.

"Our OEM replacement parts are

not designed to be a short-term solution," Kelton explained, "rather, they are a long-term investment on the part of the customer."

And a long-term investment is how Philips Service Company views our relationship with each and every customer. Philips' customer-first approach is evidenced in our ability to remain at the top, a position demanding an intensive investment of our time, people and money.

"We don't just sell parts, service aids, or service contracts; instead it is a team effort around here to customize service and technical support—all according to an individual's needs," Kelton added.

Rob Whorley, National Sales Manager for Philips echoes that same opinion—"We want our customers to be customers for life," said Whorley, "that is exactly why we have a tradition of making total customer satisfaction priority Number 1 in every case."

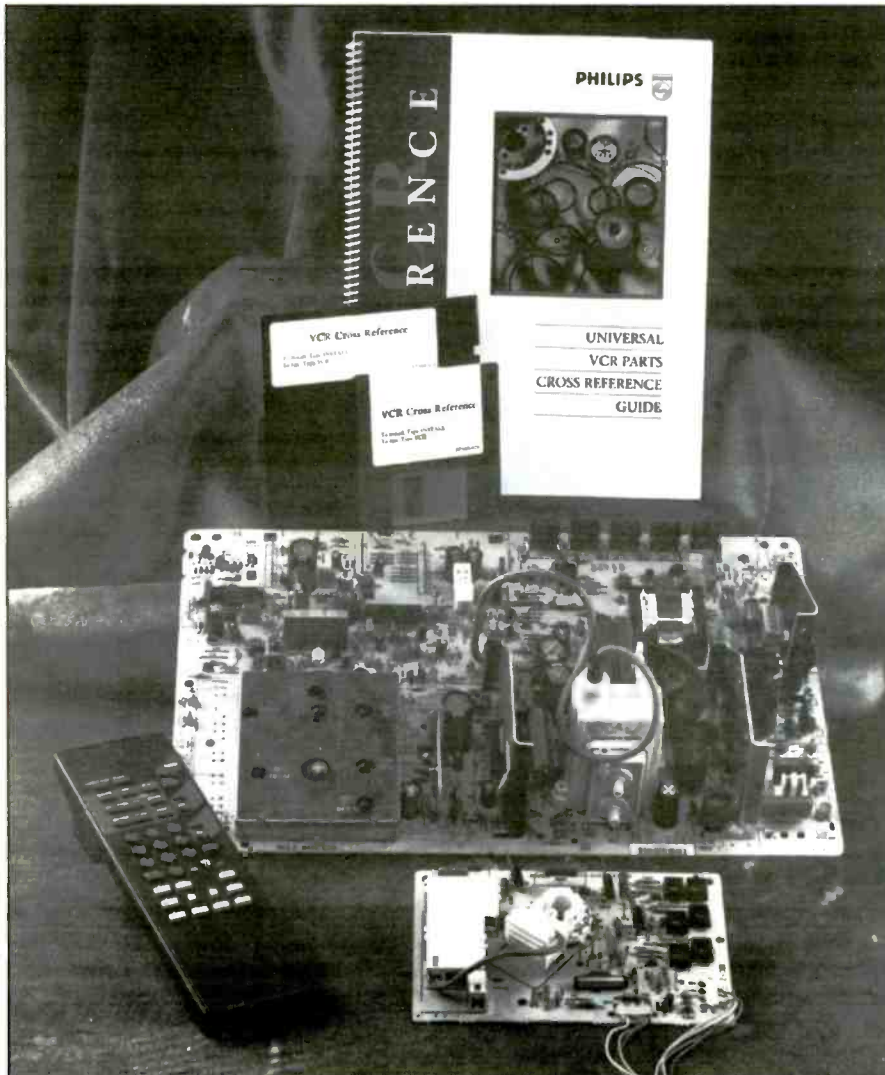
"Providing total customer satisfaction is the key to success in this industry," said Whorley.

"This philosophy of doing business is very beneficial to every division at Philips, not only to replacement parts, and without it we would not have seen the success we've seen in recent years.

"Our movement toward becoming the highest quality, most reliable and affordable 'one-stop-shop' in the industry is critically supported by this approach," Whorley added.

This same approach has already led Philips to create a variety of new programs and services, including a computerized parts cross-reference program, a specific VCR parts-reference guide and Smart Access, an on-line order entry and status review service.

In addition, Philips Service Company sells a complete line of test equipment and service aids. The Service Company provides a wide variety of products and services designed to enhance and protect all brands of consumer electronics products, including Philips and Magnavox brands. These after-market solutions include not only OEM replacement parts, but accessories, service contracts, technical training and systems support, all established to support Philips standing as the Number 1 "one-stop-shop" for all servicer needs.



One word best describes an industry leader who can provide a complete line of the highest-quality, reliable OEM replacement parts at competitive prices.

Intelligent.

SmartParts.

The intelligent Philips replacement-part line from your one-stop-shop for quality, service and technical support.



Philips Service Company Parts Department
112 Polk Street, P.O. Box 967, Greeneville, TN 37744
800-851-8885 FAX: 800-535-3715

PHILIPS



OUR COMMITMENT TO EXCELLENCE IS TOTAL CUSTOMER SATISFACTION.

Circle (44) on Reply Card

Dalbani Corporation

**4225 N.W. 72nd Ave.
Miami, FL 33166
Phone: 1-800-325-2264
Fax: 305-594-6588**

Dalbani Corporation is a national and international distributor of high quality electronics components and parts, servicing the wholesale, retail and manufacturing industry.

Since finding the parts you need should not be a major task, Dalbani Corporation maintains a huge stock of the most popular parts as well as those parts that are hard to find. Our extensive inventory of over 22,000 different items reflects our commitment to our customers, anticipating their needs and offering the lowest prices available for the best quality merchandise.

Dalbani Corporation keeps customers informed of the latest introductions of new items by publishing two full-line catalogs per year including catalog supplements, seasonal brochures, and notifications of sales promotions and specials. The multi-lingual sales department, coupled with the state-of-the-art computerized order processing, enables Dalbani Corporation to offer prompt and efficient service to benefit the customers: Monday through Friday 9:00 a.m. to 7:00 p.m. East Coast Time. A toll-free number (1-800-DALBANI/1-800-325-2264) for the U.S.A. and Canada is available, in addition

to a 24-hour fax line (Fax: 305-594-6588).

Dalbani Corporation offers many shipping options (UPS Red, Blue, Orange & Ground, FEDEX, etc.). Orders received by 2:00 p.m. Pacific Time are air freighted the same day, and most other orders are shipped within 24 hours. CODs, company checks and cash, and most major credit cards (Visa, Mastercard, Amex & Discover) are accepted. There is a \$20.00 minimum order.

Our Customer Service Department is available to help answer customers' product related questions during our normal business hours.

Dalbani Corporation will meet your company's needs: Wholesale, retail and manufacturing. For more information and to receive a free full-line catalog, call toll-free 1-800-325-2264. ■

DALBANI CORPORATION

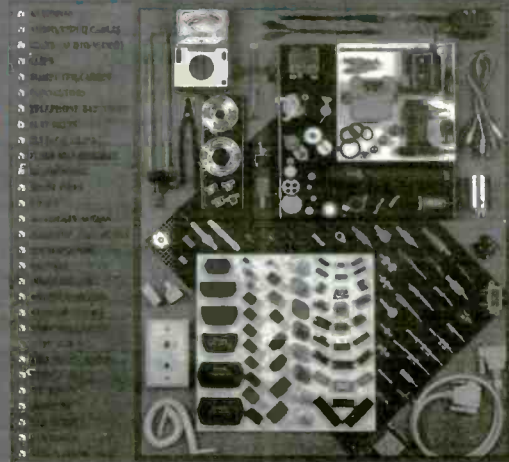
THE LEADER IN ELECTRONIC PARTS

**4225 N.W. 72nd Ave. Miami, FL 33166
Tel: (305) 716-1016 Fax (305) 594-6588**

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Telephone Accessories
Computer Accessories
Audio/Video cables
Semiconductors
Cleaning Kits
Connectors
VCR Heads
Antennas
Flybacks
Batteries
Switches
Motors
Belts
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Circle (25) on Reply Card

Herman Electronics

**1365 N.W. 23rd St.
Miami, FL 33142
Phone: 800-938-4376
FAX: 305-634-6247**

Herman Electronics is a diverse, full-line distributor of everything in electronics, committed to offering only the best in original replacement parts, tools, test equipment, and most importantly, customer service to our customers. In business for over 40 years, Herman Electronics has clearly established itself as one of the leaders in the industry by providing only quality products and superb customer service to all facets of the electronics industry.

Herman Electronics' product base varies from original replacement parts and accessories to test equipment and everything in between, including tools, soldering & desoldering equipment, chemicals, cable, connectors, microphones, line conditioners and virtually everything to fulfill a servicer/technician's needs.

The heartbeat of the company lies in the OEM parts department. While servicing the industry for over three decades, Herman Electronics has many of the major OEM parts lines, enabling us to provide more efficient and cost effective service to you, our valued customers. Herman is one of the largest original replacement parts and accessory distributors in the country and is factory authorized for Sony, Panasonic, RCA (pre-

mier), Samsung, Quasar, GE, Technics, Samsung, and Toshiba. Stocking one of the largest and most comprehensive inventories enables the company to fill over 80% of our orders from over 35,000 stocking items and guarantees Two-Day service (at no additional charge) to you on all in-stock orders placed before 2:00 p.m. (EST).

Herman Electronics is able to provide a variety of customer support services as a result of the company's commitment to customer service excellence. We have several customer service representatives to serve all of your needs from 8:30am to 5:30pm Monday through Friday. Whether your request is for pricing, availability, or even parts research, the company's toll-free lines are at your disposal to assist in fulfilling all of your requests. The company further prides itself in guaranteeing prompt and accurate answers to your research requests and provides computerized backorder reports with ETAs to keep our customers abreast of their backordered items.

The focus of Herman Electronics is to be a single source provider of everything in electronic supplies to the service industry. As a

result, the company is quickly establishing itself as stocking one of the largest and most diverse inventories of tools, test equipment, and soldering supplies in the U.S. Huge inventories of XCellite tools, Chemtronics chemicals, Weller & Hakko soldering equipment, and virtually every meter & scope from Beckman, Fluke, B & K, Goldstar, Leader, and Hitachi are on hand to provide same day shipments on your orders.

The company prides itself on being accommodating to its customers in order to deliver total customer satisfaction. "We realized there are many good distributors throughout the country" says Jeffrey A. Wolf, Vice-President and son of one of the company's founders. "It is our job to be better by taking that extra step in giving our customers professional personalized service. This industry has quickly become service driven. Therefore, we are dedicated to maintaining a standard of excellence in customer service."

Herman Electronics makes ordering easy and provides several benefits to ensure customer satisfaction. All out-of-state orders are shipped UPS 2nd Day Air at no additional charge. Several methods of payment are available including a net 30 day open account, COD, MasterCard/Visa or American Express. To accommodate the west coast and after hour requests and orders, Herman Electronics has a sophisticated telephone and fax ordering system to ensure service 24-hours a day, seven days a week.

If you haven't given Herman Electronics a try, please do so now — you'll be glad you did! Herman Electronics—experience, reliability, and service excellence. ■



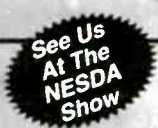
The ONE reliable source for ALL your electronic needs. We have huge inventories of original replacement parts, tools and test equipment...all available for immediate delivery to you!

- Stocking one of the largest and most comprehensive parts and accessory inventories in the nation
- All in-stock orders shipped same day if placed before 2:00 PM (E.S.T.) Guaranteed!
- No minimum order
- Two-day delivery at NO additional cost to you

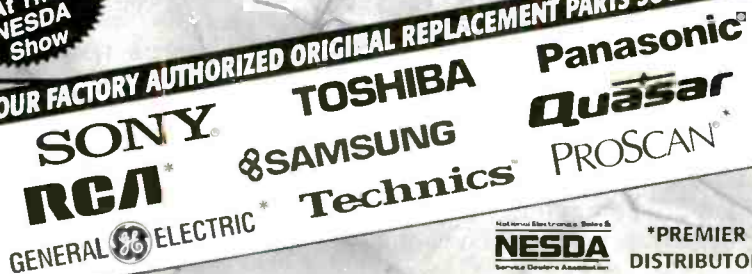
- Rapid response to all research requests
- Personal, efficient and experienced customer service representatives standing by to serve your every need.
- Now stocking one of the largest inventories of tools and test equipment in the United States. Your source for Hitachi, Weller, Goldstar, B&K, Xcelite, Hakko, Wavetek, & Leader.

SERVING THE INDUSTRY FOR OVER 30 YEARS!

**Nation Wide: (800) 938-4376
Fax Orderline: (305) 634-6247**



YOUR FACTORY AUTHORIZED ORIGINAL REPLACEMENT PARTS SOURCE FOR:



1365 N.W. 23RD STREET • MIAMI, FLORIDA 33142



***PREMIER DISTRIBUTOR**

Circle (31) on Reply Card

Philips ECG

1025 Westminster Drive
 Williamsport, PA 17701
 Phone: 800-526-9354



Since our introduction almost three decades ago, the ECG® brand name has been synonymous with outstanding quality, positioning Philips ECG as the nation's leading replacement semiconductor supplier, with a reputation for excellent customer service and technical support. Our concept of universal replacement has enabled us to establish a select range of components and parts that replaces more industry part numbers than other lines. This means distributors and repair facilities can enjoy the benefits of stocking fewer devices yet providing extensive replacement parts coverage, thus realizing a substantial savings.

Geared toward the needs of the commercial, industrial/ MRO, computer, home entertainment and communications markets, Philips ECG offers the widest range of universal replacement semiconductors available, including transistors, integrated circuits, SCRs, TRIACs, rectifiers, diodes, optoelectronic devices, and others. The current ECG Semiconductor Master Replacement guide

cross references over 270,000 industry part numbers to their equivalent ECG replacements and additionally features data for about 4,000 total ECG devices.

Also offered is a floppy disk version of the same semiconductors cross reference section contained in the ECG Master Guide. Called the "ECG Semiconductors INSTANT CROSS Master Guide," the software enables users to instantly access the full replacement semiconductors base of over 270,000 industry numbers on their personal computers. The program displays the best ECG device replacement, description, case style and a reference to any note that applies. INSTANT CROSS software runs on IBM PCs and compatibles having MS-DOS, 640K RAM, hard drive and 3 1/2 or 5 1/4-inch floppy disk drive. Several versions are available to support 360K/1.2M and 720K/1.44M disk drives.

Among the some 20 product lines offered by Philips ECG is the most comprehensive family of replacement electromechanical and solid state

relays and accessories on the market together with a brand new 352-page 7th edition product line catalog, which cross references over 58,700 industry part numbers and 210 different brands to 705 ECG relay types (86 styles).

A new line of Advanced Chemicals for the electronic and electrical industries is among the most recent additions to the ECG family of products. The line features reliable, precision cleaners, flux removers, lubricants and circuit refrigerants formulated with state-of-the-art chemistries to meet the latest federal environmental protection rules and regulations. AC series aerosols are also application tailored with a broad range of material compatibility and are manufactured to industrial quality standards. In addition, distinctive, color-coded packaging provides quick, positive product identification.

Other Philips ECG product lines include digital multimeters and analog multimeters, logic and oscilloscope probes, proximity switches, I/O modules, cube timers, surge suppression devices, audio-video VCR parts and accessories, flameproof resistors, capacitors, connectors, TV converters, circuit designers, flyback transformers, rechargeable camcorder and telephone batteries, solder wire, desoldering braid, antenna rotators and wiring accessories. All lines are continuously monitored and updated to ensure that Philips ECG customers receive the latest in state-of-the-art technology.

Philips ECG products are sold only through authorized distributors. More than 500 distributors in over 900 locations throughout the U.S. and Canada maintain sufficient inventories to generally provide off-the-shelf service. For special situations, "Hot-Line" service is available to provide product delivery within 24 hours.

Philips ECG is a division of Philips Electronics North America Corporation. To locate the nearest Philips ECG distributor, consult "Electronic Equipment and Supplies" in the telephone directory yellow pages or call toll-free: 1-800-526-9354. ■

28 Ways To Get Good Readings At A Great Price: ECG® Test Equipment.



Products include full-function digital and analog multimeters, AC clamp-on current meters, capacitance meters, digital thermometers, logic and oscilloscope probes, infrared RC testers. The value leader in performance, dependability and extra features. Ask for a catalog at 900 Philips ECG distributor locations or call 1-800-526-9354.



Philips ECG



PHILIPS

Circle (39) on Reply Card

Introducing ECG® Advanced Chemicals For The Electronic/ Electrical Industries.



An all new line of reliable, precision cleaners, flux removers, circuit refrigerants and lubricants formulated with state-of-the-art chemistry and agents to meet latest federal environmental protection rules and regulations. At 900 Philips ECG distributor locations or call 1-800-526-9354.



Philips ECG



PHILIPS

Circle (40) on Reply Card

ECG® Camcorder & Phone Batteries Replace 100 Top Brands.



From camcorders and cordless phones to memory backup, we supply replacement rechargeable batteries. In fact, we carry direct replacements for over 100 brands and 2400 part numbers, including Panasonic, RCA, Sharp, Sony, Cobra and Uniden equipment. 900 Philips ECG distributors have the new catalogs you need, or call 1-800-526-9354.



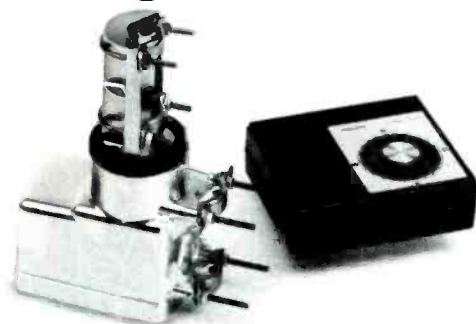
Philips ECG



PHILIPS

Circle (41) on Reply Card

ECG® antenna rotator: high torque plus long service life!



High-torque ECG® U-105 Rotator turns even largest TV/FM antenna array. Manufactured and tested exclusively to our specifications. Precision cut, hardened steel drive train, rugged cast aluminum housing and reinforced mast support for long service life. At 900 Philips ECG distributor locations or call 1-800-526-9354.



Philips ECG



PHILIPS

Circle (42) on Reply Card

Dalco Electronics

275 Pioneer Boulevard
Springboro, OH 45066-1180
Phone: 800-445-5342
Fax: 513-743-9251

Expanded Product Selection

Dalco recently incorporated repair and replacement parts to complement our current selection of computer components and accessories. We now offer a 100-page catalog with over 2000 items; five pages of tools including soldering equipment, three pages of testers, and six pages of repair/replacement parts. The repair and replacement parts section offers a selection of monitor repair kits, computer monitor flybacks, power supply repair kits, fuses, resistors, capacitors, ICs, transistors, and semiconductors. Other offerings of interest are computer maintenance books, static/power protection, cleaning supplies, cables (custom too), connectors, switches, PC components, and accessories.

To request a FREE catalog, call 800-445-5342.

Superior Service

In business since 1986, Dalco Electronics is set apart from other computer components distributors by our superior service. We pride ourselves on fast turn around time—all orders for in-stock items are shipped within 24 hours and orders received before 3pm (eastern time) are shipped out the same day. UPS ground service and overnight options are available.

Knowledgeable sales and technical support representatives are available Monday through Friday 8:00 am to 6:30 pm and Saturday 9:00 am to 5:00 pm.

There is never a minimum order requirement—a great feature when all you need is a single part to complete a job.

To leave a message after hours, you can send a fax to 513-743-9251 or contact Dalco on-line through CompuServe

(GO DA). For modem users, Dalco has a NEW Bulletin Board Service that offers technical support and sales, as well as forums and software drivers.

New Products On The Horizon

Dalco Electronics continually adds new and innovative products to our expanding quarterly catalog. Periodically, special flyers are inserted with orders offering customers the opportunity to purchase merchandise and product samples at heavily discounted prices.

Always Within Easy Reach

Customer satisfaction and customer contact are high on Dalco's list of priorities and this is evident in the way we treat our customers and what our customers have to say about us. To maintain good customer contact, Dalco has direct toll-free phone lines for each of our departments:

Sales	800-445-5342
Dealer Sales	800-228-9859
Technical Support	800-543-2526
Customer Service	800-449-8487

24-HOUR FAX 513-743-9251

Dalco welcomes Visa, MasterCard, Discover, American Express, Checks, COD orders. Credit terms are available for qualified business accounts. ■

- Replacement Parts
- Repair Parts
- Soldering Supplies
- Testers
- Monitor Repair Kits
- Computer Monitor Flybacks
- Power Supply Repair Kits
- Computer Maintenance Books
- Static/Power Protection
- Cleaning Supplies
- Cables
- Connectors
- Switches
- and more!

SUPER-TEMP SOLDERING STATION

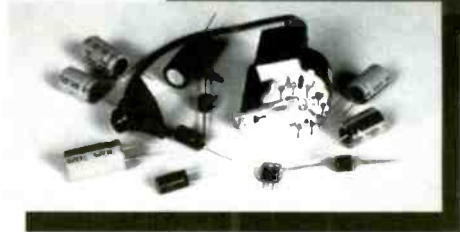
Electronic temperature controlled station with highly insulated ceramic heating unit. Features digital temperature display, lock-out feature to prevent temperature adjustments, 300-850 degree temperature range.

#49155 **\$126.20**



MONITOR REPAIR KITS

\$13.25 to \$29.80



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Reseller Pricing Available 800-228-9859



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Springboro, OH 45066

DALCO
ELECTRONICS

MAT Electronics

**400 Pike Road
Huntingdon Valley, PA 19006
Phone: 800-628-1118
FAX: 800-628-1005**

MAT Electronics has expanded into a full-line parts distribution center, gearing its inventory to the TV, VCR, computer monitor, and stereo repair industries. The growth of MAT Electronics has been due to the following: quality products, competitive prices and fast reliable shipping. The company's products are used by manufacturers, engineers, technicians, trade schools and hobbyists.

MAT Electronics stocks an extensive line of flybacks (TV and monitor), Japa-nese semiconductors, capacitors and MATV accessories. In the past year, MAT Electronics has started to distribute original parts from Hitachi, NEC, Panasonic and Sony at competitive pricing.

The company publishes an easy-to-read

80-page catalog filled with thousands of inventoried items, which can be accessed immediately on their state-of-the-art computer system.

MAT Electronics is always current with market trends in the repair industry-always emphasizing what is new in electronic parts and components-for VCRs, TVs, computer monitors and stereos. MAT Electronics sources its products from around the world as well as domestically to give the best product at a true savings.

MAT Electronics takes great pride in its ability to accommodate the various needs of all its valued customers. The company normally ships orders within 24-hours of receipt of your order, but UPS red and blue label

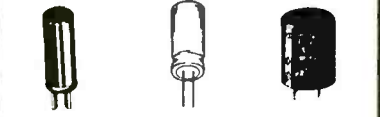
service is also available to ensure even faster delivery service if necessary.

The company takes pride that it has friendly and knowledgeable telephone operators waiting to take your phone call, and deal courteously with any questions you may have about any electronic part. And, if you don't see it in the catalog, just ask for it.

MAT Electronics takes the risk out of ordering from a catalog, offering a 90-day, 100% guarantee on all purchases.

Large volume discounts are available. Orders from foreign countries are no problem. The company's toll-free lines are open weekdays 8:30 a.m. to 7 p.m., and Saturdays from 8:30 to 2:00 p.m., and a toll-free FAX number is available 24 hours a day.

VCR REPLACEMENT PARTS		POPULAR SEMICONDUCTORS		POPULAR FLYBACK REPLACEMENTS		CAPACITORS	
VXP0521 Panasonic Idler Orig.	\$2.99ea (10 min)	BU208A	\$2.50ea (10 min)	154-040A	Goldstar \$19.95ea	4.7M/160V	Radial \$.45ea (10 min)
164113 RCA Idler Original	\$2.99ea (10 min)	2SD869	\$2.50ea (10 min)	154-074E	Goldstar \$19.95ea	4.7M/250V	Radial \$.55ea (10 min)
NPLY0111GEZZ Idler Original	\$8.95ea	2SD1397	\$1.99ea (10 min)	2434391	Hitachi \$24.95ea	4.7M/350V	Radial \$.65ea (10 min)
613-022-2534 Sanyo/Fisher Gear	\$.69ea (10 min)	2SD1398	\$1.99ea (10 min)	2434651	Hitachi \$24.95ea	10M/160V	Radial \$.55ea (10 min)
199347 RCA Replacement Belt Kit	\$.99ea	2SD1426	\$1.99ea (10 min)	3214003	Emerson \$24.50ea	10M/250V	Radial \$.65ea (10 min)
VTK-1 Video Tool Kit (15 Pc) w/case	\$39.95ea	2SD1427	\$2.50ea (10 min)	043220011	Emerson \$29.95ea	10M/350V	Radial \$.75ea (10 min)
198522 Audio Bias Oscillator	\$2.25ea	2SD1650	\$1.99ea (10 min)	79A307-1	AOC \$24.95ea	100M/50V	Radial \$.50ea (10 min)
VSJS0018 Original Panasonic Solenoid	\$5.95ea	2SD1651	\$2.50ea (10 min)	1-439-357-11	Sony \$26.95ea	100M/63V	Radial \$.50ea (10 min)
VEMS0099 Panasonic Motor	\$8.95ea	2SD1879	\$2.50ea (10 min)	F0014	Sharp \$19.95ea	100M/100V	Radial \$1.00ea (10 min)
143-0-7504-01000 Fisher Belt	\$.85ea (10 min)	JU0017	\$11.95ea	F0015	Sharp \$19.95ea	100M/160V	Radial \$1.00ea (10 min)
157061 RCA Belt	\$.85ea (10 min)	JU0069	\$11.95ea	F0016	Sharp \$19.95ea	100M/200V	Snap-in \$1.00ea (10 min)
157062 RCA Belt	\$.85ea (10 min)	SDA-3202-3	\$6.50ea	F1588	Sharp \$29.95ea	100M/250V	Radial \$1.25ea (10 min)
MSU911 Toshiba RF Mod	\$14.95ea	STK4273	\$7.95ea (10 min)	TLF14401F	Panasonic \$29.95ea	330M/200V	Snap in \$1.00for \$5.00
MSU951 Toshiba RF Mod	\$14.95ea	STK0080	\$14.95ea	TLF14423F	Panasonic \$29.95ea	470M/200V	Snap in \$1.99ea (10 min)
VA3409 Emerson RF Mod	\$14.95ea	STK5481	\$12.50ea	TLF14530	Panasonic \$26.95ea	680M/200V	Snap in \$2.99ea (10 min)
VA3422 Emerson RF Mod	\$14.95ea	TA7777	\$9.50ea (10 min)	TLF14515F	Panasonic \$26.95ea	800M/200V	Snap in \$1.99ea (10 min)
RTU006GEZZ Sharp RF Mod	\$14.95ea	TDA4505A	\$8.95ea	TLF14561F	Panasonic \$26.95ea	153671	RCA Replacement \$5.95ea
RTU0035GEZZ Sharp RF Mod	\$14.95ea	TDA8305	\$9.50ea (10 min)	TLF14801F	Panasonic \$22.50ea	270172-1	NAP Replacement \$5.95ea
		UPD1705C12	\$9.95ea	FCC1415AL	Samsung \$19.95ea		
				FCM2015AL	Samsung \$19.95ea		



MAT ELECTRONICS
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HUNTINGDON VALLEY, PA 19006-1610

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1-800-628-1118
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CALL OR WRITE FOR YOUR
FREE CATALOG!!

CitiTronix, Inc. / Panson Electronics

1641 Dielman Rd.
St. Louis, MO 63132

I-80 & New Maple Ave.
Pine Brook, NJ 07058

Phone: 800-846-2484 Fax: 800-397-8587

New on the horizon but old in the saddle is the CitiTronix/Panson alliance serving North America's servicers and customers by distributing high quality exact replacement parts and accessories for all major consumer electronic manufacturers.

In January, 1994 CitiTronix, Inc. and Panson Electronics formed an alliance which operates under the names of CitiTronix, Inc. and Panson Electronics. This move was precipitated by the fact that there is some ownership-in-common between the companies and that the lines carried by the "sister" companies complement each other very nicely. All major manufacturers and brands are thus represented.

Several outstanding benefits to customers are:

More product lines—by combining resources the alliance offers more lines than ever.

More Inventory—With multiple warehouse facilities the "in-stock" parts inventories are larger than ever.

Faster Shipping—Multiple warehouse facilities means that the customers orders can be filled and shipped from the most efficient location.

More Phone Lines—Greater access to the alliance via phone, fax and computer will aid the customer in obtaining information and placing orders.

CitiTronix/Panson maintains an experienced staff dedicated to serving the customer to provide correct parts for their servicing needs in the quickest time practical. Replacement parts research is provided. This research includes helping the customer determine the correct parts and recommending alternates when parts are no longer available. A large collection of manufacturer's literature is maintained for this purpose.

CitiTronix/Panson is an equal opportunity employer with 70 full-time employees. The company maintains a semiautomatic telephone system, FAX, and CitiLink/PARTS Link for communicating with the customer.

The headquarters for the alliance is located in St. Louis, MO where Jeffrey A. Daniels, Sr. serves as the president of both CitiTronix and Panson.

Warehouses are located in New Jersey, Illinois and Missouri.

Further expansion is planned when CitiTronix/Panson becomes the exclusive JC Penney repair parts distributor for North America on August 1, 1994.

The remote customer access systems (CitiLink/PARTS link) have been updated and provide research capabilities and access to the complete combined company inventories.

The TQM (Total Quality Management) Program adopted by the alliance is intended to provide the customer with the best service possible and Jeff Daniels' policy is to personally ensure customer satisfaction.

Both CitiTronix, Inc. and Panson Electronics are long-time parts distributors and have interesting histories.

CitiTronix was founded on June 1, 1936 by Mr. James A. Daniels, Sr. and was called City Refrigeration Service Company. It initially began as a service company servicing washers, dryers, ranges and refrigeration products.

On October 29, 1949, CitiTronix was incorporated as "City Refrigeration Company, Inc." and at that time the company began distributing appliance parts wholesale to other dealers and servicers in the area. The company was then located at 4739 McPherson in St. Louis' Central West End.

On November 29, 1971 the company moved to its current location at 1641 Dielman Road in West St. Louis County.

A dramatic change came to CitiTronix in 1977 when the first electronic lines, Sylvania and Philco, were added to the existing appliance lines. This was only the beginning, the following additions occurred shortly thereafter:

April	1981	Sony
July	1982	Magnavox
July	1984	Matsushita (Panasonic, Quasar, Technics)
October	1985	General Electric
September	1986	Sanyo & Fisher
October	1987	RCA
April	1990	RCA Premier Parts Distributor
August	1992	Kenwood

On January 8, 1988, the name of City Refrigeration Co., Inc. was changed to CitiTronix, Inc.

CitiTronix, Inc. has received several prestigious awards including:

1985	Matsushita Regional Distributor of the Year
1986	Innovation Achievement from the Sony National Parts Center
1991	Sony Sales Incentive Award
1991-92	Matsushita Special Achievement Award

In 1990, CitiLink, a computerized remote customer access system was installed for the convenience of customers. The use of this system has steadily grown since its inception.

Panson Electronics was established in 1965

as a supplier of electronic repair parts when its affiliate corporation, S.L. Jack Electronics, was authorized as the first Panasonic repair parts distributor in the United States.

Responding to the ongoing changes and needs of the consumer and repair industry, Panson began expanding its services so that today it distributes exact replacement parts for such well-known electronic products as:

- Sharp
- Hitachi
- JVC
- Zenith
- Thomson Consumer Electronics (RCA, GE, ProScan)
- Matsushita (Panasonic, Technics, Quasar)

Since Panson's inception, the company has been dedicated to providing an unparalleled level of service to the electronics repair industry through continuous innovations and improvement of:

- Customer assistance
- Parts Research
- Warranty Pricing
- Same Day Shipping on orders placed by 3:00 PM
- Toll-Free ordering numbers
- Fast and dependable deliveries
- PARTS Link/On-line communications systems

Panson Electronics has received several prestigious awards including:
Matsushita Regional Distributor of the year for:

1984 1985 1986 1987 1988

Sony Innovation Achievement for the years:

1986 1987 1988

Sony Sales Incentive:

1990

In August, 1993, Panson relocated from Greenpoint, NY to the present Pine Brook, NJ location in order to provide the fastest parts delivery available. As a vital and growing business, Panson will continue to focus on the future and anticipate how to best serve and fulfill the needs of the customer today—and in the years ahead.

The CitiTronix/Panson alliance will provide to you a total service which is greater than the sum of the services provided by the individual companies. We are America's one call source for brand name electronic parts and accessories. Call toll free for any reason 1-800-846-2484.

Exclusive
Authorized



America's
One Call
Source For
Brand Name
Electronic Parts
And Accessories



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Neptune Electronics

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Fax: 1-800-239-6349

Neptune Electronics is a wholesale supplier of replacement parts to the TV, video, and audio service trade. We stock a wide variety of original IC's and transistors, and other semiconductors, together with flybacks, resistors, capacitors, fuses, belts, idler tires and assemblies, MATV/CATV hardware and components, and other replacement parts.

We supply belt kits for virtually every VCR, along with a complete line of replacement video heads and camcorder batteries. We also have a line of kits or dealer-assortments of capacitors, resistors, fuses, diodes, square belts, flat

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All calls to Neptune Electronics are toll-free — both phone calls and fax. Out phone hours are 8am to 6pm Eastern Time, Monday through Friday. Our fax line is open 24-hours a day, 7 days a week.

For your convenience we accept Visa and MasterCard, ship C.O.D., have open accounts, and accept prepayment, if you should so desire.

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Phone: 1-800-638-3328, Fax: 1-800-888-3293 (Maryland)

Phone: 1-800-365-8030, Fax: 1-800-999-3293 (Florida)

Tritronics, Inc. is a family owned and operated parts distributor that is committed to serving the independent service industry. Our "specialty" has been supplying exact replacement parts to the electronic service industry. In the past year, we have branched out, and now offer several quality lines of general replacement parts through a catalog and monthly special fliers.

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1. Orders received by 3:00 pm Eastern Time are shipped that day.
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3. Initial shipments are 85% filled.
4. Price and availability is provided on toll-free numbers for common parts by description and by part number. In Maryland call 1-800-638-3328 or by fax 1-800-888-3293 and in Florida call 1-800-365-8030 or fax 1-800-999-3293.
5. Tritronics, Inc. is a Premier Distributor for RCA, GE, and Proscan, offering prompt shipments and "DDS" to help improve your "QOS!"
6. Dagnet, an on-line ordering system, allows easy access to information on over 1.5 million parts, prices, inventory, substitutions and common parts by model and description.

To encourage their customers to use Dagnet, Tritronics is offering the software

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Setting their goals high has paid off for Tritronics' customers as well: two of the three Sharp Servicars who won vans in 1992 and two of three Sharp Servicars who won trips to Japan in 1993, purchased their parts from Tritronics. The CEO, Roger Williams, won NESDA's regional Friend of Service Award in 1991, and the company also garnered several performance awards from Matsushita Service Company and Sharp Electronics Corp.

Tritronics' has a full staff in both our parts research and sales departments who are knowledgeable, efficient and have been with the company for several years. The use of advanced telephone and computer equipment insures the quick handling of your order with personal service.

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Premium Parts+

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PREMIUM PARTS+ Electronics Company is a leading distributor of electronic replacement parts, supplies and information. PREMIUM PARTS+ offers a free catalog, listing over 10,000 popular items, available at economical prices and volume discounts.

The products featured in the 1994 PREMIUM PARTS+ catalog include: antennas and accessories; audio, cable and camcorder accessories; belts; capacitors; chemicals; compact disk and computer accessories; flashlights; fuses; a wide selection of repair kits; lamps; microwave accessories; motors; resistors; needles; phonograph accessories; reference materials; resistors; rollers and wheels; needles; semiconductors; soldering accessories; speakers; tapes; telephone and television accessories; test equipment; tools; VCR parts and accessories; and video accessories.

At PREMIUM PARTS+ we're always looking for new aids for the technician. As a result, the VPR Meter is something we liked and trust you will too. The VPR Meter is a device for measuring the video pinch rollers (see the ad below for details).

The PREMIUM PARTS+ catalog is also the source for the complete and unique PRB LINE

REPLACEMENT BELT SYSTEM. It contains all the information you need to order the right replacement belt for most electronic equipment. In addition to the PRB replacement belts and parts, PREMIUM PARTS+ also can provide you with valuable PRB resource materials, including the 1994 edition of the PRB COMPREHENSIVE BELT AND VCR PARTS CROSS GUIDE and InnerWorks™ VCR Mechanical Replacement booklets.

The PRB CROSS GUIDE is available both as a manual and the exciting, new and automated PC version*. Both versions of the CROSS GUIDE have been updated to feature the latest comprehensive information on replacement parts and/or belts for: VCRs; camcorders; answering machines; CDs; cassettes; and car stereos.

InnerWorks . . . VCR MECHANICAL REPLACEMENT BOOKLETS provide mechanical information for a wide variety of VCR makes and models. Each booklet includes detailed, easy-to-follow mechanical drawings, and complete listings of all mechanical parts and assemblies for each model included.

Our successful PREMIUM DELIVERY service guarantees that PREMIUM PARTS+ will

get your parts delivered to your door within 48 hours via UPS 2nd Day Air Service anywhere in the 48 states for just a \$6.00 charge, regardless of its weight.** For many customers this is faster than UPS Ground Service. Of course, since UPS does not make regular deliveries on weekends, Thursday orders will be delivered on Monday, and Friday orders will be delivered on Tuesday of the following week. Or we'll send your order via UPS Overnight Air with a guaranteed noon delivery anywhere in the 48 states for just a \$15.25 charge, regardless of its weight. For PREMIUM DELIVERY service just place your order before 3:00pm Central Time on any week day, and specify if you want 2nd Day Air or Overnight Air delivery.

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(* The PC CROSS GUIDE is available on 3 1/2 inch and 5 1/4 inch High Density disks. It runs in MS-DOS on any IBM PC or compatible with 640K of RAM, a hard drive, and a 5 1/4 inch or 3 1/2 inch floppy drive. The PRB database occupies only 1 Mbyte of hard disk space installed. Network compatible.)

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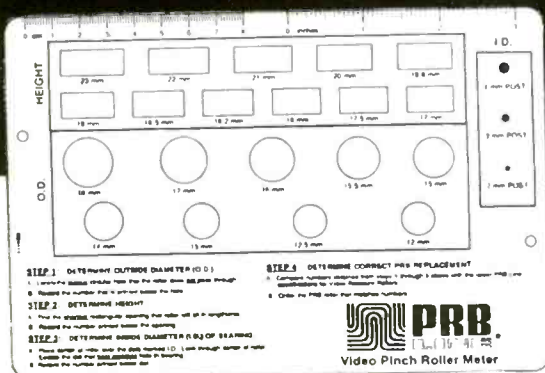
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RNJ Electronics, Inc.

**805 Albany, Ave., PO Box 528
Lindenhurst, NY 11757
Phone: 800-645-5833
Fax: 800-RNJ-FAXI**

RNJ Electronics, Inc. is now entering its 14th year as a full-line discount distributor, servicing the TV, VCR, computer, stereo, and microwave repair industries. In addition, RNJ Electronics is a leading supplier of background sound products including PA amplifiers, microphones, speakers, wire, etc. The company has also become a leading distributor in an industry experiencing tremendous growth: The security industry, stocking products such as cameras, moni-

tors, sequential switchers, quad splitters, lenses, etc.

The company publishes a bi-annual, 128-page catalog containing thousands of items all at discounted prices. Product categories in our catalog include test equipment by B&K Precision, EMCO, Vector, American Reliance, Global Specialties, Fluke, Wavetek, and AVCOM. In addition, the company also stocks a full line of audio video and antenna accessories, universal remotes, TV and VCR wall

mounts, mobile carts, service chemicals, an extensive line of VCR parts, camcorder accessories, TV and monitor flybacks, Japanese semiconductors, microwave oven parts, educational kits, tools and soldering equipment and computer accessories.

RNJ Electronics prides itself on its ability to stay current with the ever changing needs of its customers. Customer service is a top priority for the company. All orders are processed in a timely manner with shipping via UPS. The company has added additional phone lines as well as an 800 fax line.

The company offers volume discounts for large orders. It also ships all over the world. RNJ Electronics, Inc. can meet all of your needs. Call toll free and see.

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Print Products International

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Phone: 800-638-2020
FAX: 800-545-0058

Print Products International is a premier distributor of Pace Replacement Parts, test equipment, tools and supplies for electronic maintenance and service. Print carries such lines as Pace desoldering, soldering and surface mount systems, Leader, Hitachi, B&K, Kenwood, Simpson, Beckman, Triplett, Global Specialties, and Hameg test equipment, as well as brand name tools for field service and depot repair.

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A toll-free phone: 800-638-2020, and toll-free fax: 800-545-0058, are available for your convenience. Please contact Print for our free catalog. ■



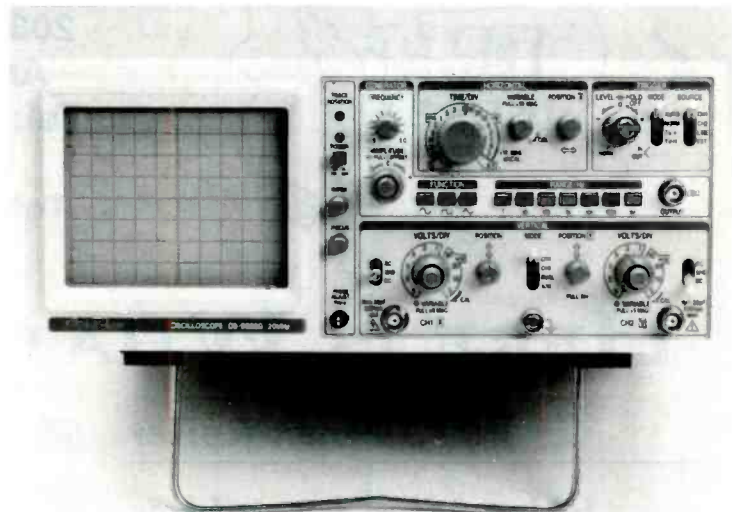
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EMT Parts, Inc.

2031 E. Via Burton St. Unit J
 Anaheim, CA 92806
 Phone: 800-448-7892
 714-758-8769/8602
 Fax: 714-758-8768

EMT has serviced the TV and VCR replacement parts industry since 1986. We search for the best qualified product sources worldwide and provide them to you. We only stock the best quality parts that we have faith in. Nothing else.

EMT supplies most brands of VCR heads, idler assemblies, belts, pinch rollers, idler tires and flybacks for TVs and monitors. Those products can be found in our 72-page, easy-to-read catalog just one phone call away. All parts are referenced by model number and manufacturer's number. Also they

can be crossed by suppliers number.

The EMT sales department has been trained to answer your call promptly and efficiently. They are available Monday through Friday 8:30am to 5:30pm Pacific Time. Orders received before 3pm are usually shipped the same day. After that, they are shipped the following day. Or, you may place your order by fax. No waiting on the phone. No confusion. And no digital sound asking you stupid questions.

Our minimum order is \$40. All orders are shipped by UPS ground

service unless otherwise requested. Express delivery is also available on request. We recommend UPS next day air or UPS 2nd day air. To serve our customers better, EMT has a three-month, money-back guaranty for any of our products. But no warranty will apply if our products are in any way altered or modified after use by a customer.

EMT always keeps our customers informed with market trends, new products, new designs or highlight promotions by regularly mailed sales flyers. Our goal is to be your warehouse for the above mentioned parts. To achieve that goal, EMT developed a state-of-the-art computerized inventory and customer reference system. All you have to do is dial this toll-free number, 1-800-448-7892, and you will find out how easy it is to locate certain replacement parts.

So, call now to experience our effective service and ask for our free catalog. ■



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HERE IS WHAT WE HAVE...

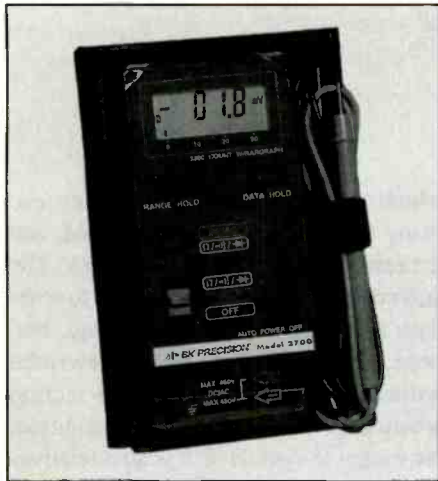
Video Pinch Roller ✓ *Toolkits*

Video Idler Assemblies ✓ *Beltkit*

Square Belt ✓ *Television Flybacks*

Flat Belt ✓ *Monitor & Terminal Flybacks*

Rubber Tires ✓ *Video Head*



Pocket DMM with bargraph

B&K Precision has introduced their first pocket DMM. Model 2700 measures ac and dc volts and resistance. The unit features data hold, range hold, audible continuity test, diode test, bargraph and 3200 count LCD display.

Data hold freezes the display to hold a reading. Range hold allows users to defeat autoranging and select one specific voltage or resistance range for making all their measurements.

The meter measures up to 450Vdc in 5 ranges. DCV accuracy is 1.3% (0.7% on the 3V range). It measures acV to 450V in 4 ranges, and resistance to 30M Ω in 6 ranges. Diode and audible continuity tests are included, and the meter is backed by a one-year warranty. It comes complete with test leads, which store conveniently in its shirt pocket carrying case. An instruction manual and two 1.5V button-type batteries are both included with the DMM.

Circle (70) on Reply Card

PC diagnostic software

Ultra-X introduces QuickTech-PRO, PC diagnostic and troubleshooting software for technicians, MIS professionals, and end users. This program comes on one 3 1/2 inch disk and can be used on any PC/XT, AT, 286, 386, 586 or Pentium system. The program's small size eliminates the need for hard disk installation to execute tests.

This diagnostic program is simple to run and use according to the manufac-

turer. The Main Menu provides quick access to all test groups. Once a test group is selected, a sub-menu is displayed which allows a particular test to be selected and run. The software also comes with on-line help that can be accessed from almost anywhere within the program.

The product allows the user to test all memory, and floppy and hard drives, and in addition includes an IDE drive low-level format function.

Users can perform system burn-in, test serial and parallel ports to pin-level, and do full functionality testing of Interrupts, DMAs, keyboards and mouse operations. The program also performs CPU speed, system, video and hard drive benchmark testing.

Circle (71) on Reply Card

HV AC/R DMM

Wavetek Corporation introduces a DMM with features that are specifically designed for the HV AC/R industry. It has the ability to measure temperature, capacitance, and frequency.

Called the DM28XT, the new meter is one of four high-performing handheld DMMs that the manufacturer offers in the XT Series. This family of DMMs comes standard with features such as acV to 750V, dcV to 1000V, fused ac current to 10A, fused dc current to 10A, resistance to 2000M Ω , diode test, continuity beeper, large LCD, and a pair of safety test leads. Each meter in the series is fully fused in both current jacks to protect the user and meter from unsafe current and has safety features such as an incorrect-input warning beeper that alerts the user when the test lead is in the current jack while the meter is switched to make a voltage measurement.

In addition to these standard features, this DMM measures and displays temperature in either Fahrenheit or Centigrade up to 2000F (1300C). The meter can be used to measure superheat, to monitor the ambient temperature of a computer room, or to check temperature rise on a heat sink. The unit can also measure capacitance from a few pF to 2000 μ F. This wide capacitance range lets the HV AC/R professional check the

accuracy of run and start capacitors that are suspect, determine the value of capacitors that are illegibly marked, or verify that a capacitor fits within a circuit's tolerance requirements. The unit also measures signal or line frequency up to 2kHz.

Circle (72) on Reply Card

Non-contact hot air tool

The Malcom Company introduces a compact 460W hot air tool for the non-contact removal and replacement of surface mount and thru-hole components.

The Leister Hotjet "S" hot air tool can rapidly desolder and solder sensitive surface mount devices without contact or



touching and damaging surrounding parts. Featuring electronic temperature and air controls which can maintain the desired heat, regardless of air flow, temperature can be infinitely adjusted from 70F to 1,100F (\pm 5F) and the airflow from 0.35 CFM to 2 CFM.

For precisely directing heat and air to a targeted device, the product is available with more than 100 stainless steel nozzles which push-fit onto the tapered sleeve. Constructed from thermoset plastic and double insulated, it has a built-in ESD lead connector, requires 110Vac, and heats up in 1.5 minutes.

Circle (73) on Reply Card

Overwritable optical disk

By The ES&T Staff

Toshiba Corporation announces that it has developed the world's first high capacity 3.5-inch overwritable optical disk drive. Data can be simply written to the phase-change optical disk that the system uses, and can also be rewritten by overwriting, and partially or totally deleted. The new drive is an improvement over conventional rewritable magneto-optical disk systems, where data can't be changed without erasing the whole section to which amended data are to be rewritten.

Development of the prototype drive system gives a new impetus to the realization of storage systems for sophisticated next-generation multimedia systems built around personal computers. The disk can store and retrieve large volumes of data at high speed, and is the first

storage system for personal computers with the capability to record up to 20 minutes of moving pictures in the MPEG2 format on a single disk. Such recorded images have a resolution superior to that of NTSC television broadcast signals, and can be played back in real time.

The promise offered by optical disks has long made them a favorite medium for future data storage systems: they offer a better combination of simple structure, cost, high density and high speed read and write rates than other candidates. However, developing a disk drive system that allows data to be changed and overwritten once recorded, as it is by conventional floppy and hard disk drives, has proved to be elusive.

Efforts so far have produced disks

which can be written to once and then read many times, such as the CD-ROM, and the rewritable magneto-optical disk. The latter device uses a magnetic field to write data and a laser beam for reading, but, once written, data cannot be rewritten without first erasing the whole section where data is to be rewritten. In addition, the magneto-optical disk is also relatively slow, and its storage density does not approach the level required for a multimedia-use optical system that can handle moving pictures.

In this prototype system, a double-sided phase-change optical disk is formed by bonding two disks back-to-back. With a combined capacity of 606Mbytes, the double-sided disk offers storage levels similar to that of the largest capacity CD-

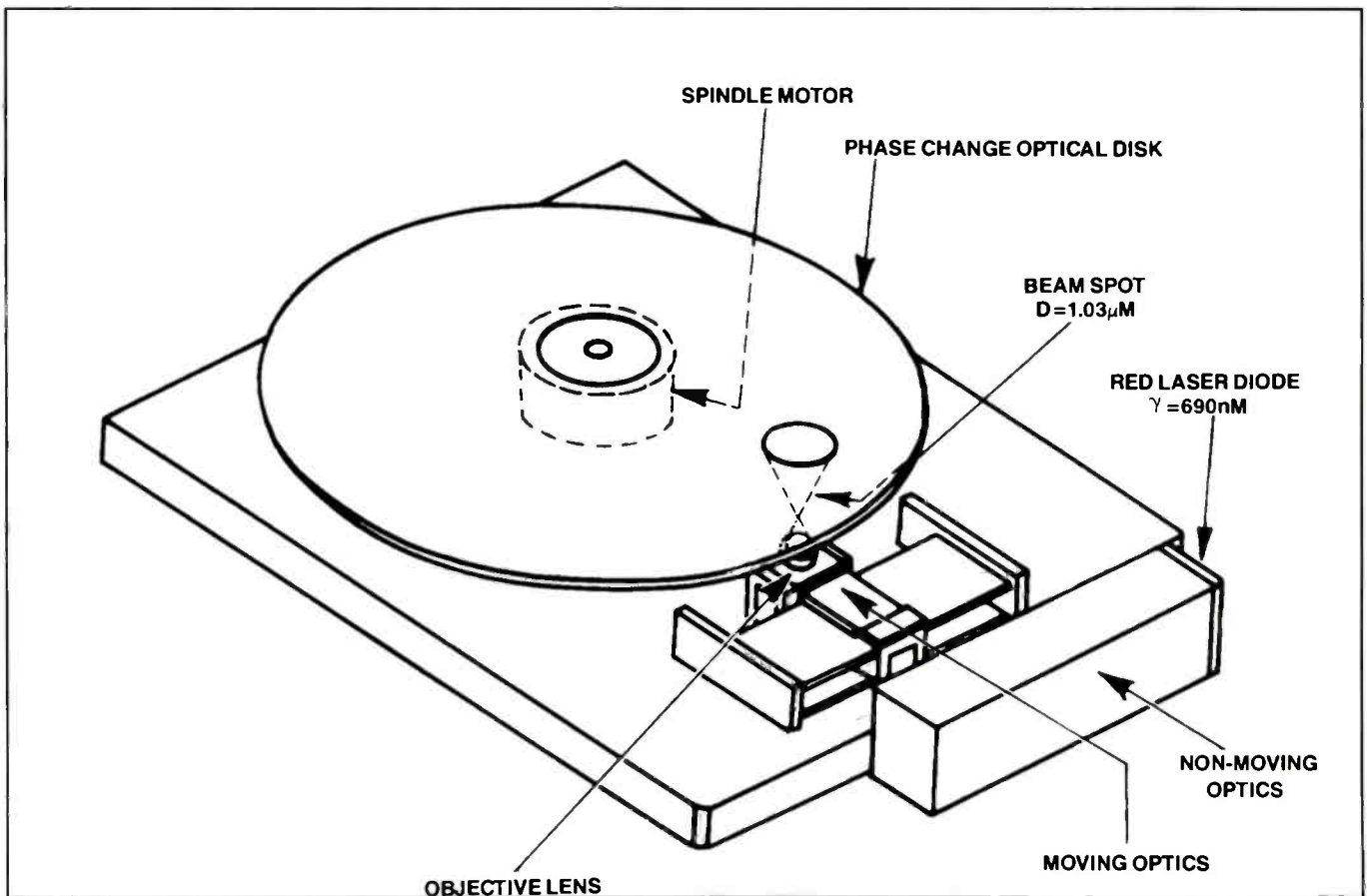


Figure 1. Data written to this optical disk can be changed by simply overwriting it, in contrast to existing rewritable optical disks, which require erasing of the entire section to which amended data are to be rewritten. The technology on which the disk is based is called "phase change." In this system, reading and writing data are done by converting the recording layer of the disk from an amorphous to a crystalline state, and vice versa.

ROMs available, and almost five times that of 3.5-inch magneto-optical disks.

Major breakthrough

A major breakthrough is the rate of data reading, writing and transfer. At 9.2Mbps this is more than twice that called for by the 4Mbps MPEG2 standard for compressed moving pictures that is steadily establishing itself as the de facto standard for moving image compression in advanced information systems. At a time when attention is increasingly focused on the promise of multimedia and the ability to manipulate moving images on PCs, the new drive and its 3.5 inch disk, only the size of a standard floppy disk, leads the way to the flexible and powerful data storage and retrieval capabilities required to make coming generations of multimedia PCs a reality. Toshiba is also developing the other enabling technologies for future systems, including a pioneering one-chip decoder for MPEG2 signals that allows computers to fully utilize the 20 minutes of moving pictures that the drive can save to a single disk.

Technical challenges

Toshiba overcame a series of technical challenges in the development of the prototype of this system:

- Warping in disks is a potential source of misread. A major cause is in the disk itself, which is susceptible to changes in temperature and humidity. Adoption of the back-to-back double disk brings together disks with the same characteristics but joined in opposition, warping in one direction in one disk is cancelled by the other disk's tendency to warp in much the same way.

- Problems occur with high density: the density of recording tracks and bits per track, and the thickness of the disk substrate. High storage capacity requires a high track/bit count, but increased density brings the danger of inaccuracies that can degrade data read and write. The thickness of the substrate determines the distance of the laser output source to the focal point on the disk, and a shorter distance is better.

The new disk has a substrate only 0.6mm thick, half that of conventional 3.5-inch magneto-optical disks on the

market. This allows use of a laser beam with a short wave length of only 690 nanometers, and an objective lens with a relatively wide numerical aperture of 0.6, providing a more accurate beam. With a laser beam diameter only 1/1.36 that of magneto-optical drives, accuracy of its reading and writing is greatly improved, making possible a track/bit density 2.4 times that of magneto-optical disks.

- Another problem occurs with noise interference in the signals, which largely results from laser beam reflections from the disk entering the semiconductor laser diode and changing the laser output power. To prevent this, it is necessary to closely monitor and control input current to the laser diode. A dedicated light sensor detects the beam reflected back to the laser diode, and the data it provides is used to control the laser beam's output power. This achieves a low signal-to-noise ratio.

Standardization

Standardization of phase-change optical disks is under way in Japan and elsewhere. The American National Standards Institute is considering a standard for 5.25-inch disks with a storage capacity of 2GB. ISO has a working group which is looking at magneto-optical disks and phase-change optical disks. Toshiba will propose a version of its phase-change disk with an increased capacity, and will further promote R&D in this area and cultivate the necessary technologies to produce disks to future standards.

What is phase-change optical disk

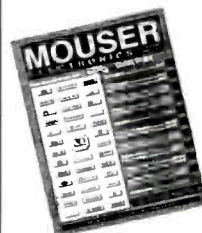
In a phase-change optical disk drive, reading and writing data are done by converting the recording layer of the disk from an amorphous to a crystalline state and vice versa, using the heat from a laser diode. Reading the data from the disk is done by using the laser in reduced power mode. Overwriting uses the beam at a higher power level to crystallize the spot where data is recorded, thereby erasing it. At its highest power level, the beam transforms the crystalline material to an amorphous state, allowing new data to be written. In this way, a phase-change disk can carry out selective writing, rewriting and erasing consecutively, a major advantage over magneto-optical disk systems, which must first erase the whole section to which amended data are to be rewritten.

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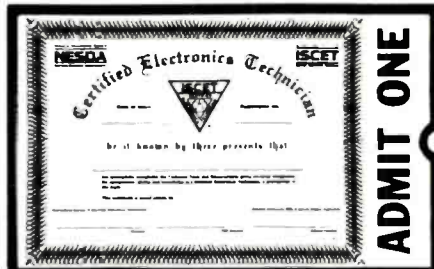
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What do you know about electronics?

More on servo systems

By Sam Wilson

This is a continuation of the series on servomechanisms. For years, technicians were able to ignore the many problems of electromechanical components.

The attitude was "If it moves it aint ours." Today the super techs are up to their middles in mechanical and electromechanical stuff. A good example is the servo systems in VCRs and compact disks.

You don't need to write and remind me of the record changer nightmares in your experience. I have been working (now and then) to find a way to represent cams, levers, motor shafts, gears, etc. with schematic symbols. That would allow a technician to pick up the schematic and follow those mechanical systems. It would work the same way that schematics of electronic systems tell a technician what is going on in an electronic system.

I now donate that idea to you. It is your million dollar idea for this month.

A closed-loop motor control

A reader wrote some time ago and criticized my closed-loop motor control. (See Figure 1.)

You will remember that a servo system is any negative feedback system. This is an example. A transducer senses the motor speed. The sense signal is amplified and compared with a reference signal. The output of the comparator is used to control a power amplifier that determines the speed of the motor.

If the sense signal and the reference signal are identical, there is no correction signal used to control the motor speed. If the speed is too high, the sense circuit provides a signal to the control circuitry to reduce the motor speed to the correct value. If the speed is too low, the closed loop provides a signal that increases the motor speed.

The automatic speed control in Figure 1 is an analog system because control is continuous. In other words, a continuous change in the input provides a continuous change in the output.

Wilson is the electronics theory consultant for ES&T.

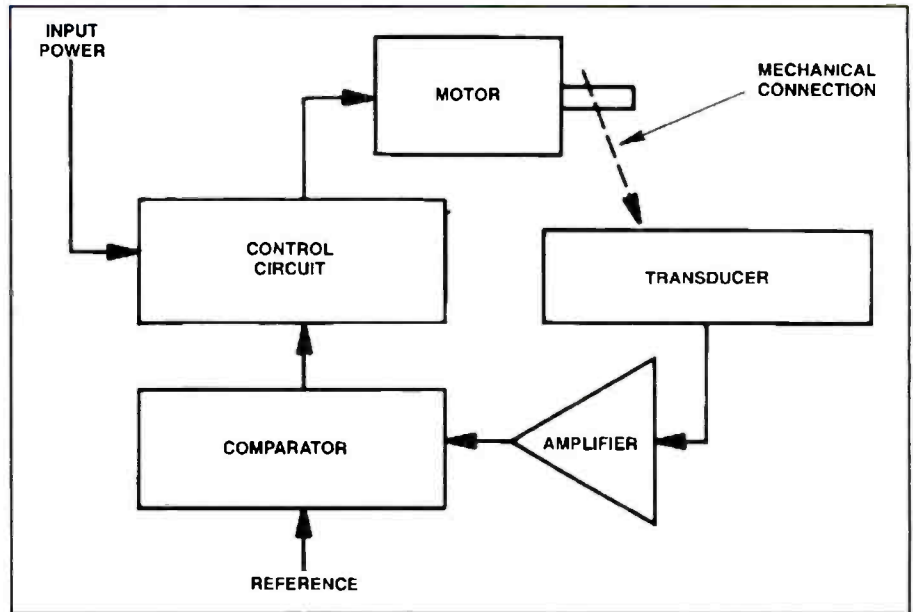


Figure 1.

As mentioned before, one place to start troubleshooting this system (after checking the power supply) is to open the loop at the transducer. That way you can manually control the motor speed by using a variable dc voltage. Then, you can check the response of each circuit to changes in the simulated transducer voltage.

The system shown in Figure 1 is not a universal all-inclusive motor speed control unit. One possible variation is in the amplifier. If a tachometer generator is used, the system may not have an amplifier. A tachometer generator is just what it sounds like. It is an electromechanical generator that is turned by the motor. The output of the generator is proportional to the speed. That type of transducer does not require an amplifier.

There are also tachometers that are not generators and do require amplifiers.

The criticism of the reader was that an amplifier following the transducer would produce excessive feedback. He was obviously thinking of a tachometer generator and assumed that was the transducer in Figure 1. The way he constructed his letter gave me the impression that he was a good-natured, fun-loving person. For that reason I answered with my own fun-

loving quips using my warped sense of humor. I probably mentioned something about steering the Queen Mary with a canoe paddle, and something about seeing the forest for the trees.

As often happens, my sense of humor went over like an iron dirigible. I honestly wish I had known he was serious.

If the tachometer is one like the strain gauge type in Figure 2, an amplifier is necessary. Another example where an amplifier is needed is the one that operates with a light shining through a hole in a disk onto a light-sensitive device. The light flashes onto the light-sensitive device twice for every revolution. (Two holes are used to maintain the balance of the wheel.)

Remember that the amplifier controlling the motor is a power amplifier. Power amplifiers require large signal inputs for their operation. If you bought my book on troubleshooting you know that power amplifiers get *hot* and any component that operates at a high temperature is a system that is a suspect in your first troubleshooting go around.

Feedback

The amount of feedback in a closed loop system is an important considera-

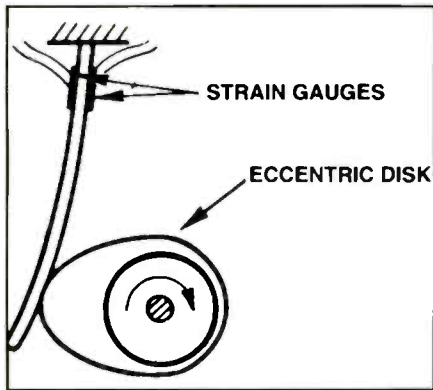


Figure 2.

tion. Too much feedback and the system will overshoot every time a correction is made. The result is like a damped wave. See Figure 3. The system oscillates and that is bad. While it is trying to make up its mind, other changes in the speed will go uncorrected. Also, energy is wasted with all of that hunting for the right value.

If there is not enough feedback, the system is too slow to respond to changes. That is also shown in Figure 3.

The correct amount of feedback is a subject we will have to look at for a complete understanding of closed loop systems. For now, if you replace any parts in a closed system make sure you use exact values. Otherwise you can change the loop gain and invite excessive or insufficient feedback troubles.

Another question on the closed-loop speed control

Another reader wants to know what the control circuit actually controls to get the motor speed changed.

For the answer to that question I refer to an excellent book on motor controls: *Electric Circuits and Machines* by Eugene Lister—6th edition. (McGraw-Hill Publishing company).

In that book Lister gives the following motor speed equation:

$$n = (V_t - I_a R_a) \div (K\phi)$$

where: n is the motor speed
 I_a is the armature current
 V_t is the motor terminal voltage
 ϕ is the field flux produced by the field current
 R_a is the armature resistance
 and: K is a constant related to the motor size

As I have said many times, equations

are not necessarily for designing. They are important because they tell how the parameters are related. For example, this equation tells you what you can use to control motor speed.

The armature current is determined primarily by the mechanical load placed on the motor. It is not a factor that can be easily controlled with an electrical input.

That leaves the following three things for controlling motor speed: field flux (by controlling the field current), armature resistance (by adding resistance in series) and the terminal voltage. The usual method of controlling dc motor speed electronically is to control the terminal voltage. Having said that, always be aware of the fact that either of the other two methods *can* be used.

If the motor speed is too low, the controller delivers a higher voltage to the motor terminals. If it is too high, the controller reduces the terminal voltage. The controller, in turn, gets its input from the closed loop. The subject of servo systems will be continued in another issue.

The very sensible metric system

I don't think there is anyone in the world who doesn't know that the very sensible metric system is replacing the British system that we have been using. After all, the metric system is based on scientific and mathematical reasoning.

Right?

Not!

The meter: If you drew a line from the north pole to the equator through Paris, France, then divided the line into ten million equal parts, each part would be one meter long. At least, that's how the meter was originally defined.

But, before you race out with a meter stick to check this, there is something you should know. The guy who figured it out thought that the world was round. So, he didn't get it right. As you know, the earth is shaped more like an apple. (Scientists call it an oblate spheroid.)

They didn't find this out until they had ground out a few million meter sticks, so, they decided not to worry about it. Now they say a meter is actually the distance between two scratches on a piece of metal. In the U. S. we keep our metal stick at the Bureau of Weights and Measures.

The Liter: We go from there to the very sensible metric unit of volume. Originally, a liter was supposed to be equal to 1000 cubic centimeters. But wait—don't memorize that! The nudnik who calculated that unit of volume had evidently been using his slide rule to prop up a window.

Anyway, after he carved out what he thought was a liter, and after they ground out a few million one-liter bottles, someone reciphered it.

It turns out that one liter is actually 1000.028 cubic centimeters. Now there's a handy unit of measurement! ■

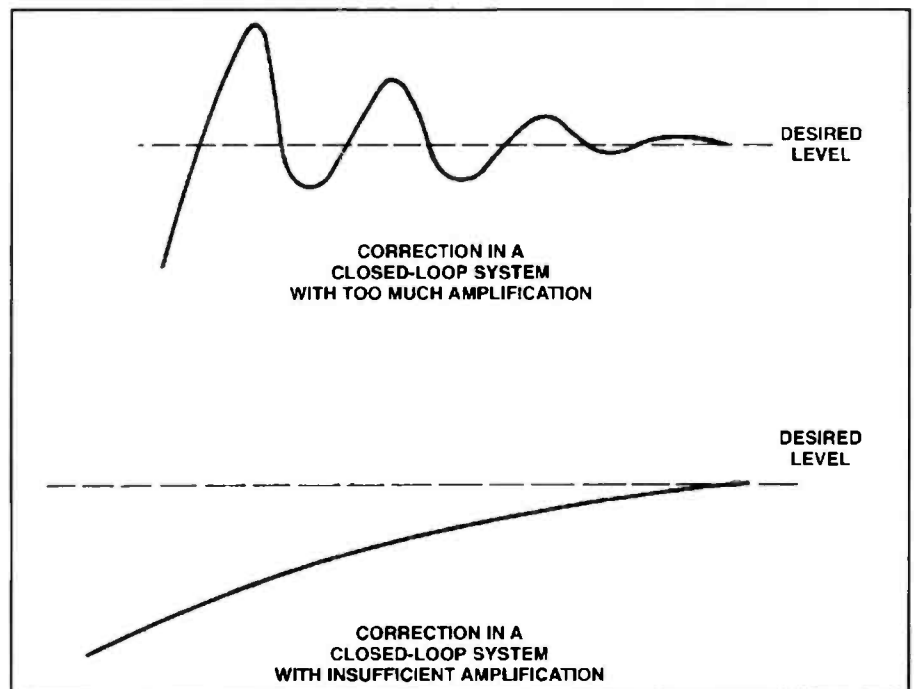


Figure 3.

Testing of compatibility of HDTV transmission technology with cable begins

By The ES&T Staff

CableLabs has begun field testing the transmission sub-system of the Grand Alliance High-Definition Television (HDTV) system over a group of cable networks in the Charlotte, NC area. The transmission sub-system is the portion of the system responsible for delivery of the digital bit stream to the home.

Field testing

The series of tests is scheduled to last approximately one month, and will test two modulation techniques (8-VSB and 16-VSB) which are part of the HDTV system presently under consideration by the FCC's Advisory Committee on Advanced Television Service. The field tests will evaluate both off-air reception at cable headend sites, and the subsequent transmission over cable plant of the digitally-modulated RF signal. The results of these field tests will be delivered to the Advisory Committee for its review, and are expected to confirm the results of the earlier laboratory-based tests which resulted in the selection by that body of these particular modulation techniques.

The test is expected to demonstrate that the digital vestigial sideband HDTV signals can be received off-air at cable system headends (the 8-VSB signal) and, after error correction processing, be combined with a second high definition signal for carriage to cable subscriber's homes within a single 6MHz channel (in the 16-VSB signal format).

Craig K. Tanner, CableLabs' vice president of advanced television projects noted, "We're particularly interested in the performance of the 16-VSB format on cable, because it will be carrying a payload data rate of about 38

megabits per second—sufficient to carry two HDTV programs in a single cable channel. This two-in-one functionality will be available only on cable systems, not over the air, due to the better channel characteristics on cable."

Eight cable systems participate

The tests will take place on eight cable systems in the Charlotte, NC, area and will involve about 50 test points within the systems. The cable systems are unmodified, and based on the indications of earlier laboratory tests, they are expected to carry the dual digital HDTV signals successfully.

The cable television HDTV transmission tests are being performed cooperatively with the Public Broadcasting Service (PBS) and the Association for Maximum Service Television (MSTV), which together are responsible for the over-the-air transmissions of the test signals and the evaluation of the off-air reception quality at homes within the transmitter's coverage area.

The transmission sub-system being tested is a portion of the complete HDTV system being developed by the Digital HDTV Grand Alliance, a consortium of seven companies: AT&T, the David Sarnoff Research Center, General Instrument Corporation, Massachusetts Institute of Technology, Philips Consumer Electronics, Thomson Consumer Electronics and Zenith Electronics Corporation.

Seven years of development

The system is the result of seven years of development and testing of proposed systems under the guidance of the FCC's Advisory Committee on

Advanced TV Service. The Grand Alliance members are combining parts of their formerly separate proposals in order to offer the best possible HDTV system. The complete HDTV system, to be tested in the laboratory this fall, will offer high resolution, interference-free pictures with a wide-screen aspect ratio and digital, CD-quality surround-sound audio.

The Charlotte, NC area was selected for the field tests because of its varied terrain, availability of a transmission tower and building, and the presence of a number of separate cable systems of varying design and size. Equipment for the transmission facility was provided by more than forty manufacturers and contractors. The cable tests are taking place in four Time Warner Cable-Charlotte Division systems and four Vision Cable Communications systems located in the Charlotte area. Cable system receive antennas were donated by Wade Antenna Ltd.

CableLabs is a research and development consortium of cable television system operators representing more than 85% of the cable subscribers in the United States, 70% of the subscribers in Canada, and 5 to 10% of cable subscribers in Mexico. CableLabs plans and funds research and development projects that will help cable companies take advantage of future opportunities and meet future challenges in the television industry. It also transfers relevant technologies to member companies and to the industry. In addition, CableLabs acts as a clearinghouse to provide information on current and prospective technological developments that are of interest to the cable industry. ■

Test Your Electronics Knowledge

Answers to the quiz

(continued from page 13)

1. The amount of current (1A) and the power dissipated (1W) are known.

$$P = I^2 R_2$$

$$\text{so: } R_2 = P/I^2 = 1/1^2 = 1\Omega$$

2. There is 1V across each of the following resistors: R_1 , R_2 and R_3 . That is a total of 3V for the applied voltage.

3. D. A breakover diode will not conduct until the voltage across it reaches a certain minimum voltage (V_{BO}). At that voltage, diode current flows and the voltage across the diode drops to a lower value.

4. D. A ferrite bead around a conductor acts like an inductor in series with the conductor. In some circuits the induc-

tance is needed to choke off undesired parasitic oscillations.

$$5. P = V^2/R$$

$$\text{so: } V^2 = P \times R = 1 \times 100$$

$$V = 100^{.2} = 10V$$

6. Power Factor = the cosine of the phase angle = $R/Z = 90/120$

Power factor = 0.75 (sometimes expressed as 75%)

7. The wavelength of an rf signal is the distance it travels during the time required for one cycle. (distance = rate x time) The Greek letter lambda (λ) is used to represent wavelength.

$$\lambda = (300,000,000 \text{ meters/second}) \times (1 \times 10^{-9} \text{ seconds})$$

(The seconds cancel)

$$\lambda = 0.3 \text{ meters}$$

$$8. 186,000 \text{ mi./sec.} \times 60 \text{ sec./min.} \times 5280 \text{ ft./mi.} \times 1 \text{ yd./3 ft. (cancel miles, seconds, and feet)}$$

$$= 1.9642 \times 10^{10} \text{ yards per minute}$$

$$9. R = R_1 + [(R_2)(R_3)/(R_2 + R_3)]$$

Substitute known values and solve for

R_2

$$R_2 = 3.892K\Omega$$

10. B. There is no isotropic antenna in the real world, but, this theoretical antenna is useful for making antenna calculations.

Restoring connector conductivity

(continued from page 15)

In the case of critical contacts in electronics products, especially where the voltage is measured in tens of volts and currents are in milliamps, other types of protective substances are called for.

Alternatives

There are materials that can be applied to contacts that consist of gold plated over a base metal that protect the gold or other precious metal and the base metal. Such materials deoxidize the contaminated contact, penetrate through the plated surface and bond to and protect both the precious metal plating and the base metal. If you or your customers experience intermittent problems that you suspect are caused by contamination of plug-in type contacts, consult a reputable chemical supplier for suggestions. ■

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Schematics for Fisher System 7780. Amplifier CA-78, Tuner FM-77. Stereo Cassette Deck AR-77. Will purchase or copy and return. Contact **W. P. Riggins, P.O. Box 197, Jesup, GA 31545.** (912) 427-3906.

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Job wanted: experienced technician, factory trained. Services TV/VCR/Stereo/Satellite/Microwave/Camcorders: \$17.00 - \$20.00/hr; 18 yrs. experience. Call **Mike (403) 462-1952, (403) 463-5446.**

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Pioneer Centrex PH 323 home 8 track player—no other will do! Does not have to be in working order. Will pay list price. Contact **Izzy, 1-(800) 877-1200 ext. 805.**

NEC Model N-966U Hi-Fi VCR. Give condition and asking price. Contact **David Klementovic, 24-hr. voice mail, (610) 648-3466.**

AF-PO HA 1338 or SK3372/1030 for Emerson stereo M30002; 10 pin ICs are discontinued. Contact **George Fogelman, 1201 Idlewilde, El Paso, TX 79925.** (915) 778-0997. AT&T collect.

Volume, Tuning, Bass, Treble and Blend knobs for harmon/kardon hk 350i receiver. Contact **Jeff Moser, 111 Nutbush Ct., Hillsborough, NC 27278,** (919) 732-0703.

Good oscilloscope in excellent working condition for reasonable price (no antiques please). Educational material, such as Heathkit TV or VCR course (nothing old or incomplete) also wanted. Contact **Sirelle Fogel, 87 Sandra Dr., Parsippany, NJ 07054,** (201) 316-8424.

Flyback transformer. Magnavox 50-30-171-34-3, no longer available from Magnavox. New or used serviceable. Contact **Len Wiechman, 3525, Jene Helene Ave., Billings, Montana 59101,** (406) 252-1550.

CRT Restorer. Belton preferred. will consider others. Contact **Tom, (510) 825-0300.**

FOR SALE

Sams Photofacts & Sams Radio Auto Service books. Contact **Ann Bichanich (Jays), 15 1/2 W. Lake St., Chisholm, MN 55719.** 1-(218) 254-4421.

TV/VCR test equipment (RCA, B&K, Tentel, etc.); Sams Photofacts thru 2676 (1100-2676 in file cabinets), \$95.00; brand name electronic repair parts-service data library free with purchase. Send SASE for complete list to **R. V. Alaniz, 307 S. Maiden Ln., Tecunseh, MI 49286.**

Sencore VCR test equipment, Model SC3080, 80 MHz waveform analyzer; model PR57 Powerite AC power supply; Model VC93 All-format VCR Analyzer; VR62A Universal Video Analyzer; NT64 NTSC Pattern Generator; VC63 VCR Test Accessory. Going out of business, must sell, low hours. Contact **Dan Myers, Dan VCR Repair, 122 Porter St. Marshall, WI 53559,** 1-(608) 655-3907.

Large inventory of old receiving tubes, 2600 in cartons, 200 loose without carton; loose tubes are free! Contact **Donald Ouellette 68 East Main Street, Fort Kent, ME 14743,** (207) 834-5742/2188; inventory list available.

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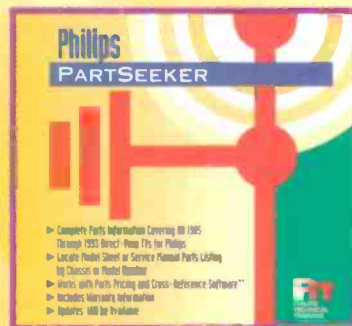
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