

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

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Servicing & Technology

March 1995/\$3.00

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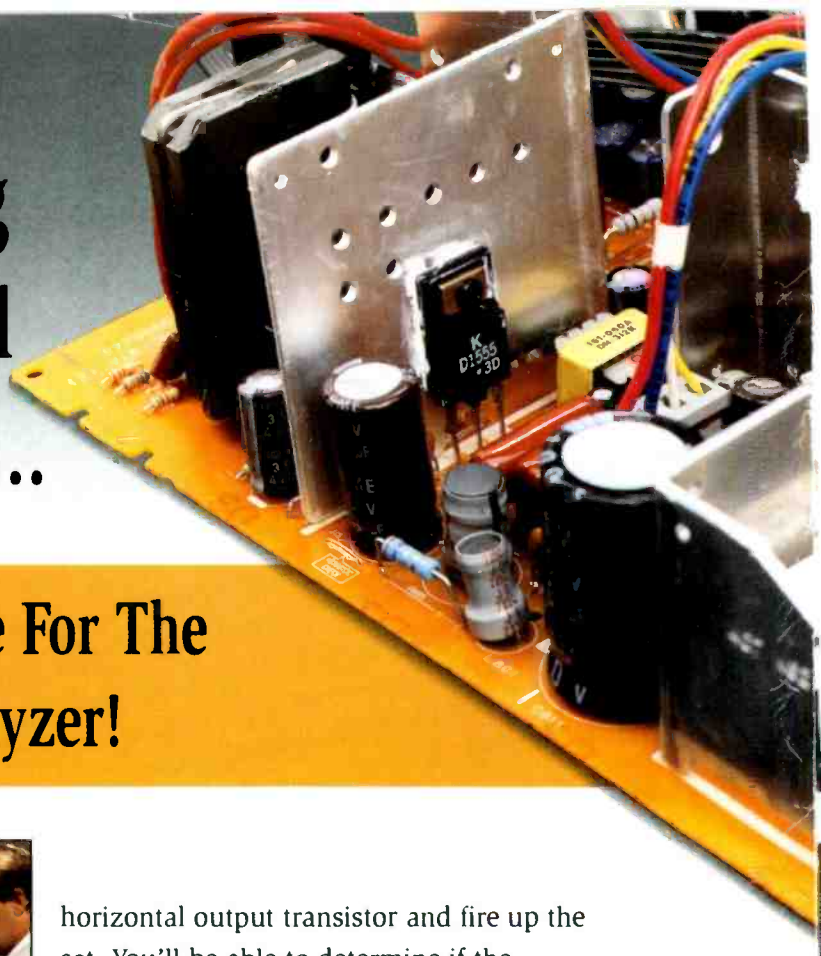
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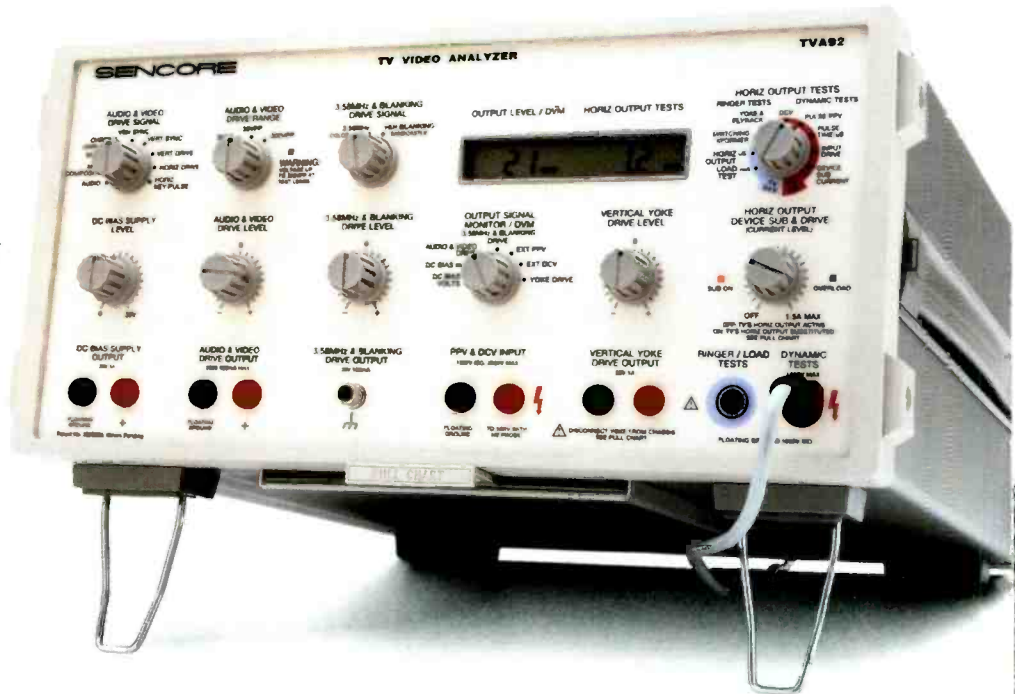
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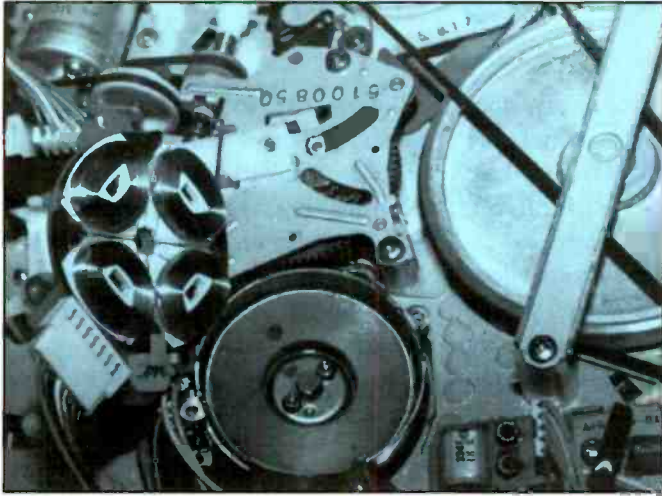


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FEATURES

6 Electric motors for consumer electronics

By Ron C. Johnson

Most of the new products that are being introduced into the consumer electronics market have motors in them: VCRs, camcorders, CD players, personal computers with their fixed and floppy drives. A practical approach to diagnosing and servicing these motors, such as the methods suggested in this article by Ron Johnson, will help technicians who are beginning to venture into this unfamiliar territory.

12 A technician's glossary

By Dale C. Shackelford

One of the challenges of keeping up to date with any technology-driven business is simply learning what the words mean. This article defines a number of terms that servicing technicians should be familiar with in order to stay abreast of the latest in consumer electronics.

1995 BUYERS' GUIDE

Running a service center today takes technical skills, management ability, a comprehensive library of

technical literature, and a broad array of tools, test equipment, accessories and replacement parts. Because the definition of "consumer electronics" is continually broadening, and the technology that goes into consumer electronics is continually changing and becoming more sophisticated, it requires that practitioners remain abreast of all of that growth and all of those changes. The **Electronic Servicing & Technology Buyers' Guide** is published annually to help readers keep up with the growth and changes in the field. It contains information on hundreds of manufacturers and distributors who make and sell thousands of products. This year's edition of the **Buyers' Guide** is considerably larger and more comprehensive than past years' guides. We have scanned the literature and attended trade shows that have to do with new areas of interest to **ES&T** readers, such as personal computers and other office products, and have identified many companies that we have never listed before.

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ON THE COVER

We live in an era when change happens so fast that it's impossible to keep up with it. Products are introduced that change the way we live, communicate with each other, and get our news and entertainment. Companies start in business, then close their doors. Companies buy or merge with other companies. Companies move from one location to another, seemingly overnight. This type of change happens in all parts of the economy, but it profoundly affects the consumer electronics service industry. This **Buyers' Guide** is published annually to help our readers keep up with the companies that are responsible for the changes. (Cover art designed by the **ES&T** Art Staff.)

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC

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ES&T on the information highway

There has been much talk of late about the "internet," a worldwide system of computer networks that allows communications among computer users across the globe. As seems to be the case with just about any aspect of computer and communications technology, it has no doubt been overly hyped in the news. And because the internet has been called the "information highway," writers, reporters and editors everywhere have had a lot of fun coming up with names that are clever analogies to the idea of a highway. Who hasn't heard of the "infobahn," or heard of someone getting a set of "wheels" to ride the "infohighway."

But as with so many aspects of modern technology, in spite of the fact that too much is said about it, the internet is a wonderfully useful communications network. And, as we'll explain later, **ES&T** now has a connection to the internet where readers will be able to communicate with us.

The internet was set up originally by the U.S. military to ensure communications and the availability of information in case of all-out nuclear war. Researchers at colleges and universities found that they were able to use the internet to gain access to the information on computers at colleges in distant locations and to communicate with other academics at those locations. Those computers at those colleges added to the internet.

The internet is available to anyone who wishes to make use of it. To access the internet, all it takes is a computer with a modem connected to a telephone line. Many on-line and computer communications services provide access to the internet. Some of those providers are CompuServe, GENIE, America On-Line and MCI Mail.

The internet is an attractive way to communicate between computers across long distances because it's so inexpensive (usually) to the end user.

It's also possible to send or receive documents of any length, from a brief note to a book-length document from almost anywhere on earth. And it's a local call; no toll charge.

Of course, access to the internet does require a monthly subscription to one of those services mentioned earlier, but that's generally nominal; around \$10.00, more or less. (Although if you're a student or faculty member at a college or university, it might be possible to gain access to the internet at no charge.) But if any of you are seriously thinking about getting onto the internet, you should look around carefully. Some of those services charge a per-message fee for every message you receive. If you receive a lot of messages, it could be costly.

All of this is very interesting, but there are a couple of good reasons we're talking about the internet here. One is that, as mentioned previously, readers can now correspond with **ES&T** via the internet. The other reason is that a group has been set up, the Electronic Servicers Information Group (ESIG), which can be reached via the internet.

We'll be providing you more information in future issues about these internet addresses, but for now, here's information on how you can reach **ES&T** and ESIG on line.

If you have a computer and modem, you can talk back to us or get an advance look at what's coming up in future issues by checking into the **ES&T** feedback area on the GENIE information service. If you're a GENIE member, look for us in the RADIO & ELECTRONICS ROUNDTABLE (Pg. 345), under "Commercial Vendors—Books, Magazines, Videos, etc." (Category 16; Topic 5. If you're using a Windows or Mac-based program to access GENIE, just go to Keyword RADIO, click on "Radio/Electronics Bulletin Board," then open folder 16 and go to topic 5, **ES&T**. It's even easier with a text-based program:

just type "M345:16:5" (without the quotes) and press "enter." If you're not a GENIE member, you can take care of that by calling them at 1-800-638-9636. And if you're on another on-line service, or have direct Internet access, you can send us mail addressed to "CQ@genie.geis.com."

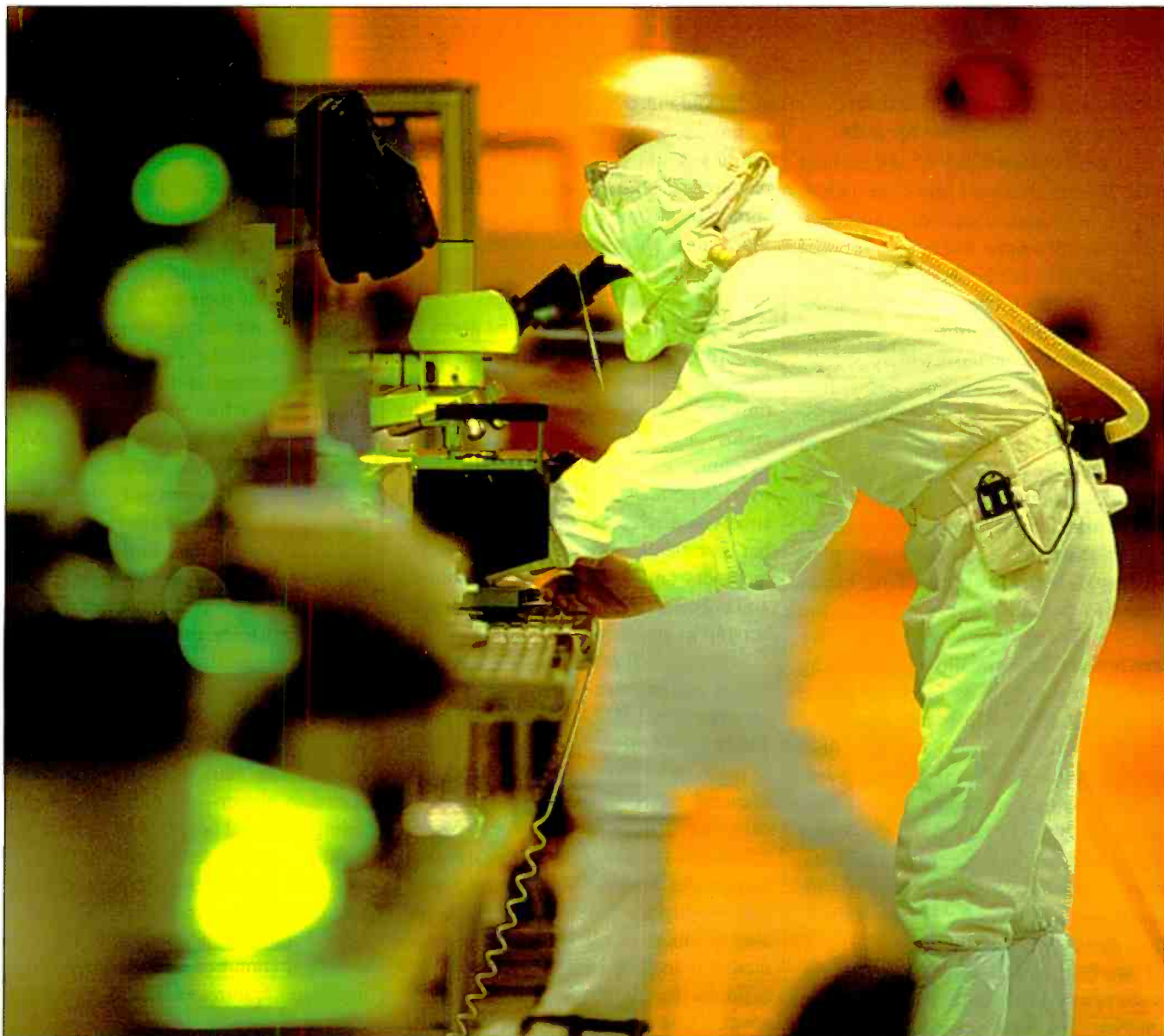
If you'd like to gain access to ESIG, the on-line address for sending e-mail is esig-list-request@frick.com. If you would like to get more information about ESIG, you can call Susan Frick at 816-461-6230.

Currently, the primary focus of ESIG seems to be checking on the availability of older, out of stock parts and general industry communication (something many servicers would like to see their industry groups do better at). Sending out information on the internet allows for the transfer of information on industry trends, news bulletins, or other sorts of customer service information with tremendous time savings.

ESIG is administered by NESDA (the National Electronic Servicing Dealers Association) and is not a free service. It is offered at an annual cost of \$25.00 to members and \$50.00 to non-members. At the moment, if you sign on you will be allowed to use it at no cost for around 30 days to see if it is of use to you. You'll then be asked to send a check to NESDA if you wish to continue to have access. After that trial period, if your check has not been received, you will be denied access.

No doubt there are other internet addresses that **ES&T** readers would find useful. In the future we'll publish more information about the addresses mentioned here, and we'll fill you in on any other useful internet information we turn up.

Nile Conrad Penem



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Fiber optic installers' training conference scheduled for July

The third annual Fiber U will be held in the Boston area next July 7 through 9. Fiber U is an annual training conference sponsored by a large number of vendors and distributors of fiber optic components which offers both classroom and hands-on training in fiber optics.

Fiber optics is the most widely accepted communications medium today. It is already the most widely used medium for telephony and is rapidly replacing wire in the backbones of CATV and computer networks. Fiber to the home and desktop are the next stages of fiber optic growth.

At this time, there are not enough qualified installers of fiber optics. Fiber U was started to provide basic training to the installers. The two previous Fiber U's have been praised for the quality of the training and the opportunity of meeting all the sponsoring vendors. Fiber U trainees have installed millions of dollars worth of fiber optic systems since their training and several are now training others. sw

Fiber U '95 will be held at the Royal Plaza Hotel in Marlboro, Massachusetts, on Boston's outer loop highway, 1-495. The conference will be Friday, July 7, through Sunday, July 9.

Fiber U is managed by Fotec, Inc., the Boston-based fiber optic test equipment company. For more information, call 1-800-50-FIBER, fax to 1-617-241-8616, or email to info@fotec.com.

Home Theater Industries Association to merge with EIA/CEG

The Electronic Industries Association's Consumer Electronics Group (EIA/CEG) recently announced that the Home Theater Industries Association would merge into the EIA's Consumer Electronics Group.

"We're very pleased to have HTIA joining the Consumer Electronics Group of EIA," says Gary Shapiro, group vice president of EIA/CEG. "We have created a Home Theater subdivision which will greatly enhance the profile of home theater. For years, we have been promoting the home theater market, but HTIA brings a new dimension to EIA. We will be representing virtually all of the home theater

audio and video manufacturers, accessory providers, service providers, and furniture manufacturers. We can pool our resources to help this segment of the consumer electronics market maintain its momentum and continue to provide consumers the latest in technology and lifestyle enhancements."

Most HTIA members will be given the opportunity to join the EIA as full members, while others will be given the opportunity to join as associate members. The audio and video divisions of the Consumer Electronics Group will jointly oversee policies and activities of the new subdivision. Several of the HTIA member companies are already EIA/CEG members and this joining of resources will not affect their participation or membership in any way.

Serving as chairman of the new subdivision will be Peter Tribeman, who was a member of the HTIA Board of Directors and is president of Atlantic Technology. "This is more than an alliance of convenience," stated Tribeman. "This is an excellent strategic move for both organizations, as the newly combined membership works together towards the goal of maximizing the potential for home theater products of all kinds. The HTIA's members included manufacturers of furnishings for home theater, periodicals specializing in the home theater arena, and service providers and technology licensing companies along with the traditional manufacturers of accessories and audio video products. When combined with the strength and breadth of the EIA's membership and their 70-year tradition of serving the consumer and manufacturer alike, we certainly have a winning combination," concluded Tribeman.

Quality and reliability are key factors in video product purchases

Quality and reliability top the list of factors influencing consumer purchases of color televisions, VCRs, camcorders, and TV/VCR combinations, according to a survey of purchasing patterns of video products conducted by the Marketing Services Department of the Electronic Industries Association (EIA).

In addition to quality and reliability,

survey respondents rated price and features as key factors influencing their purchasing decisions. Additionally, those surveyed felt ease of use was one of the most important facets of their color TVs, VCRs, and camcorders.

According to the survey, consumers are satisfied with their video products—35 percent of the survey respondents said they have owned a VCR for six or more years, 24 percent said they have owned a camcorder for four to five years, and 45 percent said they have owned a TV/VCR combination for three years or more.

Thirty-five percent of the survey respondents said they have two color televisions in their homes. Forty-five percent said that they have one TV that is 25 inches or larger; 88 percent revealed that their large screen televisions are not projection models, suggesting that a large market exists for projection sets for an industry placing increased importance on home theater (additionally, 96 percent of survey respondents said they did not own a laserdisc player—another signpost signaling potential home theater growth).

Survey respondents rated, in descending order, remote control, picture-in-picture capability, screen size, stereo capability, on-screen programming and surround sound capability as important television features or facets, in addition to ease of use.

Sixty-six percent of those surveyed said that at least one of their VCRs has built-in automatic programming as a feature. Survey respondents may be bucking the overplayed notion that programming a VCR is a difficult task—the average difficulty rating given by respondents for setting or changing timed recordings was 2.5 on a scale of one to five (five being very difficult). And, as to that *other* VCR-related chestnut—setting the VCR clock—the average difficulty rating was 2.1 on the same scale.

Forty-seven percent of survey respondents said they own a full-size VHS camcorder, well ahead of 8mm (36 percent) and VHS-C (27 percent). An overwhelming percentage of respondents said that they purchased their camcorders to record family events such as birthdays,

(Continued on page 68)

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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Electric motors for consumer electronics

By Ron C. Johnson

Over the last year or so you've probably seen several articles in this magazine on the servo systems used in tape decks, VCRs and CD players. Servos are closed loop systems consisting of an electric motor and the electronic circuitry required to control it. There are a couple of different types of servo systems found in consumer electronics: ones that control the speed and/or synchronization of a capstan or drum, and ones used to position a mechanism (as in the laser head on a CD player). Another position control system (used in computer printers and other equipment where precise mechanical movement is required) is the stepper motor and its associated circuitry.

We'll assume for now that you're already familiar with servo systems and how to troubleshoot them, so we'll just talk about the motors themselves. You may not have seen as much information on the motors used in these systems, but that isn't because they never fail. Motors can become intermittent, run slow or erratically, or quit completely. They are both mechanical and electrical devices and can fail either mechanically or electrically. Obviously, the cure is normally just to replace a faulty motor, but, because they are part of a larger system, the trick is to be sure the motor is the culprit.

The theory of how motors work, how they are controlled, and how they fail is interesting, but, more important to you, this is information that should help you in servicing the equipment that comes across your bench. So we'll try to make it as useful as possible by looking at some practical ways to bench test motors and some suggestions on how you can try to repair one in a pinch.

Motor basics

Motor theory can get pretty complex if you delve into it, but a lot of that complexity relates to the problems inherent in designing practical motors. The basic fact

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

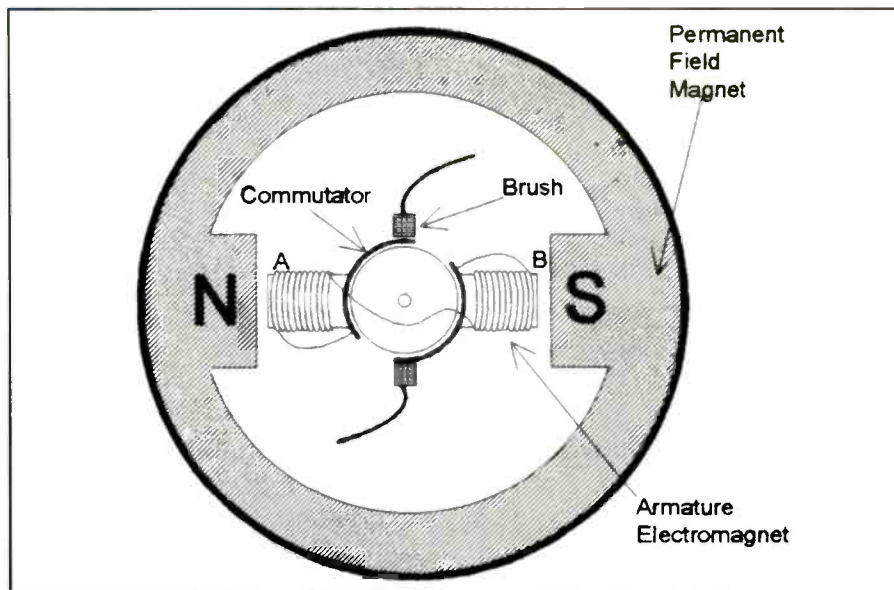


Figure 1. Simplified diagram of a permanent magnet dc motor.

is that, to get rotary motion out of a mechanism, you have to create a rotating magnetic field. The complexity is further reduced by knowing that, for our purposes, we'll be talking about dc motors.

Every motor has two essential parts: the stationary part, called the stator, or field, and the rotating part, called the rotor, or armature. The idea here is to create magnetic fields in both parts in such a way as

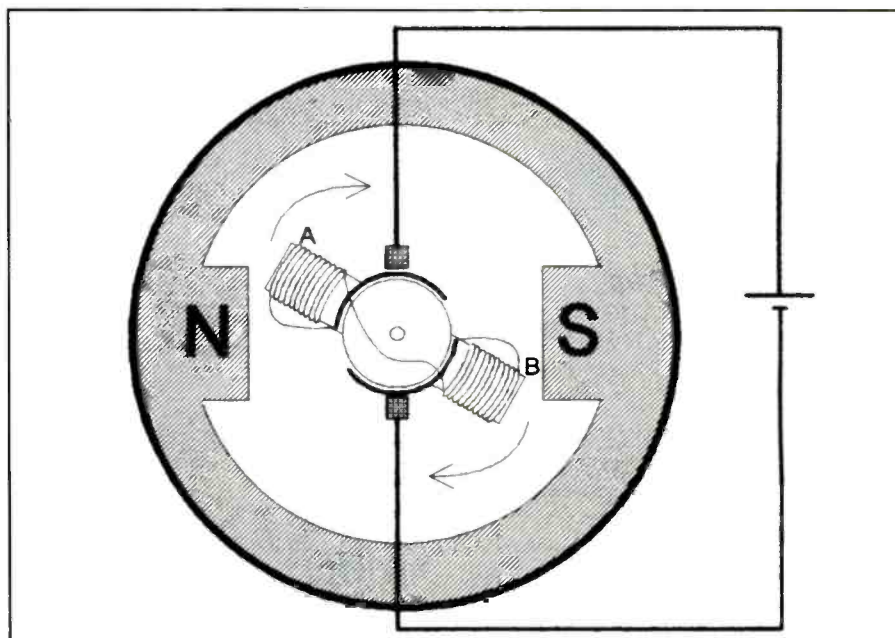


Figure 2. When voltage is applied to the armature, through the brushes and commutator as shown here, magnetic attraction and repulsion cause the armature to rotate. The reversal of the magnetic field caused by the commutator causes the rotation to be continuous as long as power is applied to the motor.



Figure 3. In real motors, the armature is made up of at least three windings, which facilitates the rotation. This is a simplified three-pole motor.

to pull the armature around in a circle. This is accomplished in a number of different ways depending upon the motor requirements, such as size, speed, torque and application.

Permanent magnet dc motors

The simplest dc motors used in consumer electronics are permanent magnet dc motors. These kinds of motors are used in the loading mechanisms of VCRs and for a main drive motor in the inexpensive cassette players. Take a look at the simplified diagram of the permanent magnet dc motor shown in Figure 1. The field,

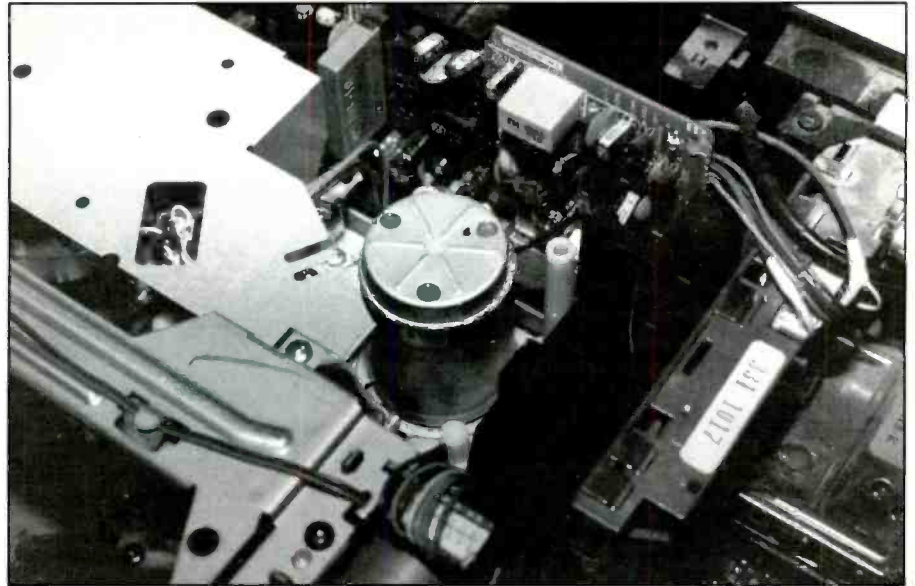


Figure 4. The servo motor used for capstan and tape take-up in a VCR.

produced by the permanent magnet (shown shaded around the outside), has two poles: north and south. The armature is essentially an electromagnet mounted on a shaft. Let's assume that, initially, the armature is at rest, with no current flowing through its winding.

The trick to getting the motor to turn is in the commutator. As shown, the com-

mutator is a pair of contacts embedded in each side of the armature shaft. These contacts are isolated from each other and connected to each end of the armature winding. The brushes are carbon or copper contacts which slide on the commutator contacts. The voltage supplied to the armature is connected to the winding through the two brushes.

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When voltage is applied to the armature, through the brushes and commutator as in Figure 2, a magnetic field is set up such that point A is the north magnetic pole and point B is the south pole. Since similar poles repel and opposites attract, the armature will be forced away from the position shown in Figure 1. As shown in Figure 2, as the armature turns, the brushes slide on the commutator. The armature will eventually be pulled around so that opposite poles can line up.

When that position is reached, however, the brushes will make contact with the opposite sides of the commutator, reversing the flow of current. This creates the rotating magnetic field we mentioned earlier. As the armature turns, the changing direction of current through the armature creates a shifting magnetic field which pulls the armature around in a circle.

The higher the voltage applied, the greater the magnetic field strength and, consequently, the faster the motor turns. These motors respond to the average dc value so speed can be controlled by changing the dc level or by varying the duty cycle of a fixed amplitude pulse waveform (pulse width modulation).

Practical considerations

In real motors the armature is made up of at least three windings, which facilitates the rotation much better than the simple example shown here. (See the miniature 3-pole motor shown in Figure 3.) Other motors use electromagnets instead of permanent magnets to produce the field's magnetic field. There are several variations on this type of motor, including series, shunt, and compound field windings.

Series motors have the field windings in series with the armature circuit. Their advantage is fast starts, even under load, but their disadvantage is that the heavier the load, the slower they run.

Shunt windings have many more turns of fine wire and are connected in parallel with the armature. They don't start as easily, but keep a constant speed under load.

Compound motors are a combination of the first two and exhibit good starting and constant speed.

In some cases the field winding is connected separately. In these motors speed is a function of controlling the current through the field winding while a constant voltage is applied to the armature. In-

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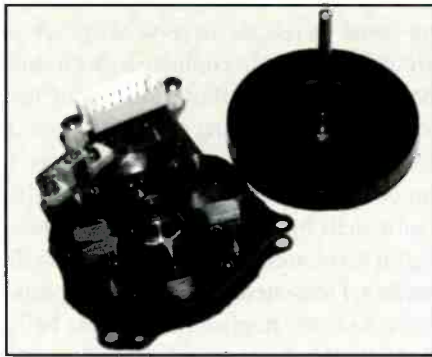


Figure 5. A brushless dc motor used as a capstan motor in a VCR.

creasing the strength of the magnetic field around the armature causes it to turn faster. The motor can also be reversed by switching the polarity of the field current.

It may be interesting to know what type of motor has been used in a piece of equipment, and sometimes it is important for troubleshooting. (For example, if the speed is controlled by varying current to the field winding). For the most part, however, the kind of motor used is a design consideration. One consideration that is important to us relates to the problems with commutators.

Motor wear factors

As the commutator turns under the brushes, sparking occurs at the point where the brushes disconnect from one contact and reconnect with the next one. (Remember, the armature is effectively an inductor that tries to maintain current through itself. When that current is interrupted, the inductor induces relatively large voltages as its magnetic field collapses. This causes sparks.) Sparking can cause a variety of problems such as electrical noise and burning and pitting of the brushes and commutator.

In addition to the electrical problems, these motors are subject to physical wear. The physical abrasion of the brushes on the commutator will eventually wear them out. These kinds of motors can also wear out the bearings or bushings in which the armature shaft runs.

Testing motors

Testing these motors is pretty simple. First, if the motor isn't turning at all, check the resistance across the terminals. Rotate the motor slightly just to make sure the brushes are not between commutator contacts. If the meter shows an open circuit, the motor must be replaced. If the

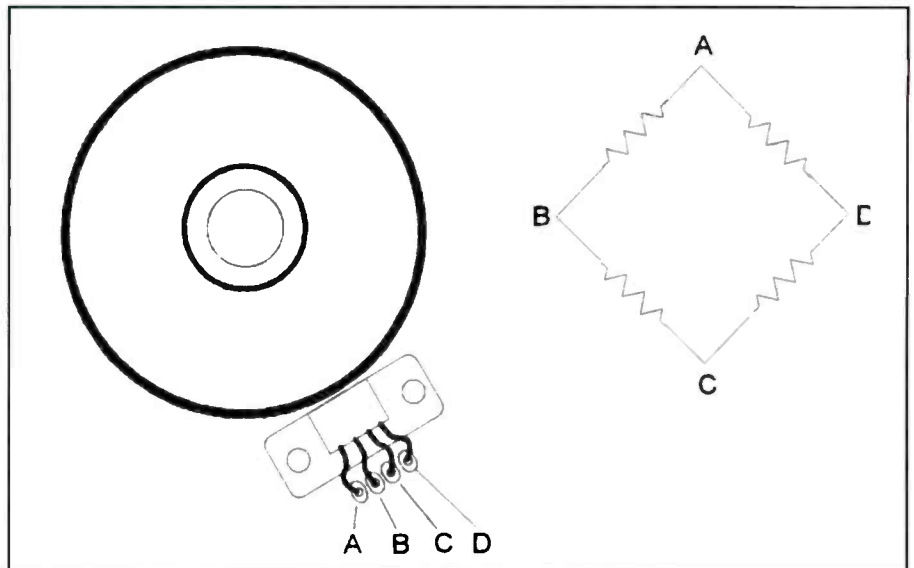


Figure 6. The Hall-effect sensor on a brushless dc motor.

meter reads a very low resistance (5Ω to 50Ω , depending on the motor), that winding is okay. Be sure to turn the motor, though, and check the other windings. You'll probably see the resistance reading jump around as the brushes move from one commutator contact to the next. If one of the windings is open you still have to replace the motor, but at least you know where the problem is.

Series field motors may have higher resistance readings than permanent magnet motors because the field windings are in series with the armature. Usually series field windings are relatively short and use larger gauge wire so the resistance should only be a few ohms higher, worst case.

Shunt motors could have an open field winding. The tricky part here is that it may not be obvious that you have a shunt type

motor. Since the winding is parallel with the armature, it is difficult to tell whether you are measuring the field winding without disconnecting the brushes from the armature. Fortunately, you probably won't find many of these kinds of motors in consumer equipment.

Correcting motor problems

I don't recommend trying to fix a customer's motor unless it is impossible to replace or substitute. In a pinch, though, you can open these motors up by bending back the metal tabs that hold the end cap on. The trick is in getting the brushes back in place when you put it back together. It might be worth a try if you are desperate, though. If you're lucky you might find a broken lead from one of the windings or a damaged brush that could be repaired.

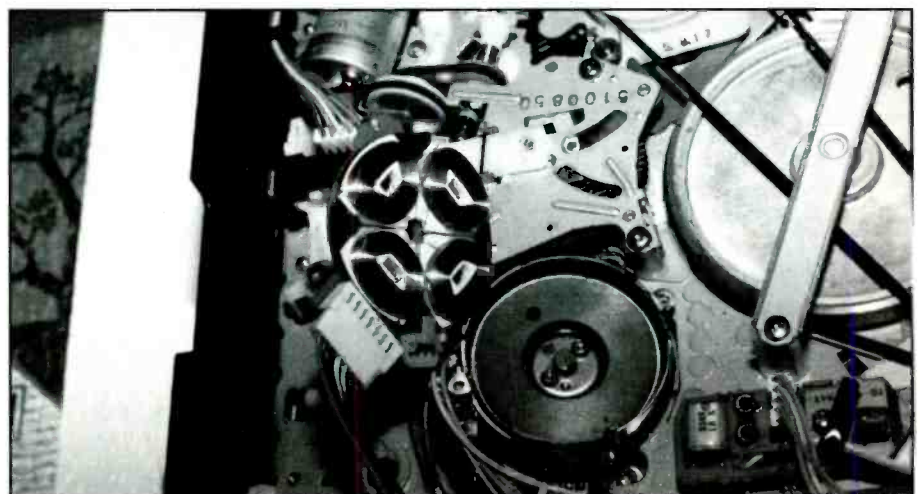


Figure 7. Another brushless dc motor used to drive the drum on a VCR.

Another situation that sometimes comes up is a motor that varies in speed. This isn't a problem with loading motors or most other positioning servos, but in the case of a capstan drive it will be obvious because of the pitch changes of the sound. Dirty commutator contacts or damaged brushes can cause this problem. Worn out bushings or bearings are another possible cause.

Again, normally you will just replace the motor, but it helps to know for sure that the motor is the source of the problem. Spraying the commutator (if you can get at it) with contact cleaner will usually show up a problem there. The motor will speed up, or at least even out in speed.

Depending on the motor, checking for worn bearings or bushings is difficult. Permanent magnet motors with several poles will "bump" as you turn the shaft (as the armature passes the poles of the field). If you suspect this kind of a problem, you'll just have to replace the motor and check to make sure the problem is gone.

Brushless dc motors

Obviously, one of the main drawbacks of the motors we've been talking about is the commutator. Brushless dc motors,

which are often used as capstan and drum motors in VCRs, avoid this problem by getting rid of the commutator. They are low profile and lend themselves well to servo control, especially using custom driver circuitry or microprocessor control. Figure 5 shows a brushless dc motor from a VCR.

These motors are set up with their elements in an arrangement opposite to the arrangement of the elements of the motors discussed earlier. In these motors, the armature is a special permanent magnet in a doughnut shape, but magnetized in sectors. When I moved a small steel screw driver around the face of the magnet, I could feel that there were eight poles in all. The field consists of six flat wound coils attached to a printed circuit board. The rotating field is produced by sequentially energizing the coils to pull the armature around in a circle. The sequencing is done in the servo circuitry and speed and phase control is facilitated by feedback from a Hall effect sensor that is mounted next to the armature to pick up magnetic pulses as the armature turns.

A worn out bearing

The problem with this motor happened

to be a worn out bearing which was causing speed variations (in spite of the servo circuit's attempts to compensate). I found the problem by marking the top of the armature and watching it turn. It slowed down regularly every eight revolutions. I turned the VCR off and tried turning the motor shaft by hand. Sure enough, every eighth revolution I could "feel" the shaft binding. I reasoned that this kind of problem could only happen if one of the balls in the shaft bearing was damaged.

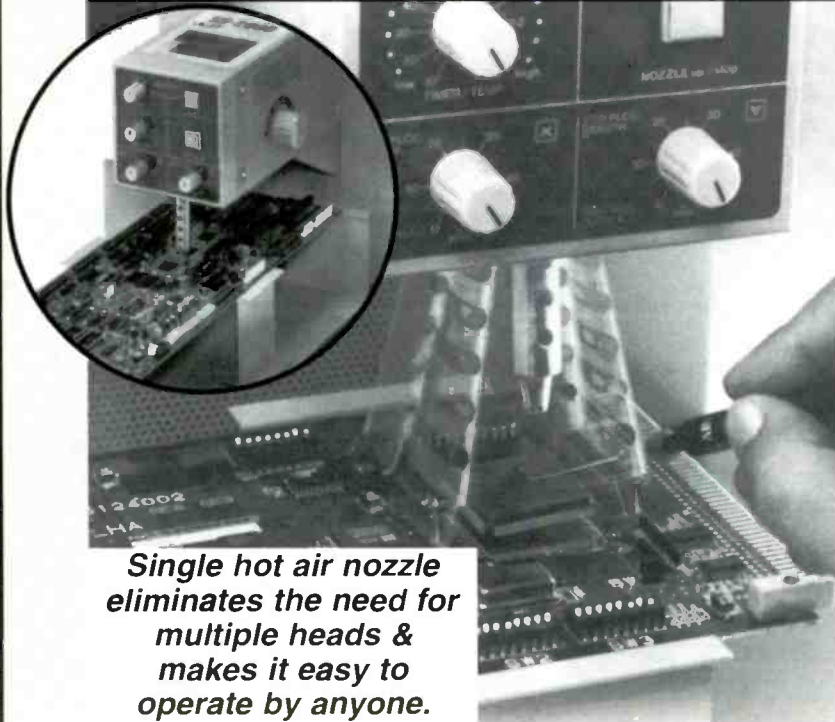
I removed the bearing and again turned it by hand. I got the same result. Since this one happened to be my own VCR, I considered replacing the bearing rather than the whole motor. Unfortunately, I couldn't get the bearing by itself and had to replace the whole motor anyway.

The motor drive signal

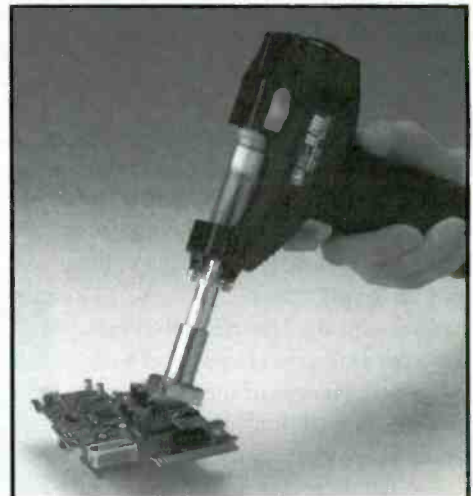
The operation of this motor depends entirely on receiving the proper driving pulses to the coils. You cannot just disconnect the motor and hook it up to an external voltage as you can with a permanent magnet dc motor. Moreover, control of the speed of these motors is accomplished by the closed loop servo feedback. Troubleshooting the servo circuit-

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ry is the subject of another article, but as far as testing the motor itself, there are a few simple checks. As before, check the windings for continuity. The windings on this measured about 2Ω each.

You can also do a quick check on the Hall-effect sensor. If you think of the Hall sensor as a Wheatstone bridge, the resistance readings make sense. Figure 6 shows a diagram of the Hall-effect sensor and shows how the connections relate to a resistive bridge. Measuring this sensor indicated that the resistances were all about 1800Ω. This can be determined by applying some basic electricity theory. The meter showed about 1800Ω from A to C and B to D and about 1400Ω from A to B, A to D, B to C and C to D. This makes sense based on the bridge diagram.

Stepper motors

Steppers work on a very similar principle to the brushless motor just described. Figure 8 shows a photograph of a larger (industrial) stepper that has the end caps removed. You can see the



Figure 8. A large stepper motor used in industrial applications.

field consists of eight electromagnet coils. The armature is a permanent magnet built with many "mini-poles." Rotation of the stepper motor is accomplished, as before, by sequentially energizing the field windings to pull the armature around the circle.

The difference here is that steppers are designed not only to rotate, but also to be positioned by moving the armature in small steps. Each time the sequence incre-

ments by one, the armature moves a very predictable angular distance to the next mini-pole. By reversing the sequence, the armature can be moved backwards. If the sequence is stopped, the armature remains in the last position.

Steppers are used in dot matrix printer applications (and many others) to move the print head across the paper. The advantage of the stepper motor is that, once a reference point has been established, the print head can be positioned with great precision without the need for a positional feedback signal as in a servo type position control.

Troubleshooting a stepper is much the same as the approaches we have already mentioned. You can check the resistance of the windings, check the mechanical condition of the armature and bearings, and that's about it. The only other way to narrow down the situation is to monitor the driving circuitry that sequences the field windings.

(Continued on page 69)



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A technician's glossary

By Dale C. Shackelford

In an effort to keep readers up to date with the latest terminology in the field of electronics, this magazine from time to time publishes a list of terms and definitions used in the field of consumer electronics service. These terms, some new, some old (and often forgotten), are important to the technician who needs to keep up with industry standards.

Architecture

The physical design of a system (computer), and the way in which the systems interrelate with one another. This term can be applied to the design of virtually any machine, circuit or network. Architecture refers to the logical structuring of a system, rather than the specifications or details of the individual components used to construct the system.

Aspect ratio

The physical proportions of a CRT, LCD or other viewing screen of a television receiver, computer monitor, or other such optical view screen. Aspect ratio is expressed as the ratio of width to height, which, in modern appliances, is typically four units wide by three units high. Thus a television CRT with a width of 4 inches would usually have a height of 3 inches.

Bidecal base

A 20-pin base of a standard cathode ray tube (CRT).

Diheptal base

A 14-pin base of a standard cathode ray tube (CRT).

Duodecal base

A 12-pin base of a standard cathode ray tube (CRT).

Header

A glass disk or wafer through which wires (leads) are passed into a glass envelope or other unit that needs to be completely sealed. Headers are often found at the bottom of miniature bulbs where the glass makes contact with the metal. Headers are also used as the terminal base of plug-in coils, filters and other such components where glass, ceramic or other materials must join with metal to form a seal.

I-demodulator

A demodulator that receives the chrominance and color (3.58MHz) oscillator signals in a color television receiver, and delivers a video output signal corresponding to a color picture. In many modern receivers, the I-demodulator circuit is contained within a single signal processing IC.

Judder

A condition in which there is a lack of uniformity in the scanning of a picture (or document) by a facsimile (fax) machine. Judder usually results in the overlapping or

smearing of the received picture. It can be caused by inaccurate scanning of the document/photo by either the transmitting or receiving machine, or by improper movement of the machine or document during the scanning process.

Magnal

An 11-pin base of a standard cathode ray tube (CRT)

Ondoscope

A device used to detect rf energy, consisting primarily of a neon bulb attached to an insulated rod. When the neon bulb is held near a relatively intense rf field, the gas in the bulb is ionized, and the bulb begins to glow. Electronics technicians often use pocket-size ac line testers (often carried by electricians) as an inexpensive alternative to an ondoscope since the line testers contain a small neon bulb, as does the ondoscope.

Note: both the pocket ac line tester and the ondoscope will detect the presence of an rf field, but neither device will measure the relative strength of the field.

VOGAD

VOGAD (voice operated gain adjusting device) is a type of automatic gain control used in audio amplifiers, modulators and radio transmitters. It will maintain (virtually) 100% modulation of the carrier signal while the carried signal (voice, music, etc.) levels may vary widely. ■

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1995 Buyers' Guide

The growing number of products that fall under the umbrella of "consumer electronics" has been a boon to servicing. Many traditional products have become cheaper and more reliable, thus making it less likely that they will require service or that their owners will choose to have them serviced. Products such as microwave ovens, personal computers and peripherals, home copiers, fax machines and other non-traditional products, however, offer new opportunities for service centers.

But this is not an unmixed blessing. When a consumer electronics service center takes in a computer monitor, microwave oven, or fax machine for service, the traditional channels for obtaining service literature parts, and even specialized test equipment, frequently do not provide the required support for these new products.

For that reason, **ES&T** has made great strides in the past few years in identifying manufacturers, distributors and other companies which can provide service centers with the service literature, replacement parts and test equipment to accommodate these new products.

By carefully examining books and periodicals in those related fields, attending trade shows where those companies exhibit, and performing other types of research, we have identified hundreds of suppliers that have never been listed before in the **ES&T Buyers' Guide**. Included are companies that supply replacement parts, service literature and test equipment for computers, computer peripherals, microwave ovens and more.

This ninth annual **ES&T Buyers' Guide** contains information on hundreds of manufacturers and distributors who make or sell thousands of products. The guide will tell you who sells what, and it will give you addresses and phone numbers to contact. Save this issue. We get long-distance calls every day from readers who need an address. One look in the **Buyers' Guide** is usually all it takes to help them. If the callers had looked for themselves, they could have saved time and a toll call.

Using the Buyers' Guide

If you're in the market for a new DMM this year, you probably know the names of some of the major DMM manufacturers, and you might have some of those

companies' addresses somewhere in your files. Or maybe you would like to learn how to service computer disk drives or compact disc players, but you have no idea who offers a course on that subject. If you figure the EIA is your source, you still have to figure out where to find that eternally misplaced address.

That's why we put together this **Buyers' Guide**—all the information you need is gathered together in one place. No need to search through stacks of papers. Here's your one-source alternative.

If you want a DMM, turn to the Product Directory and look up DMMs. Every company that responded to our questionnaire will be listed there, and every company's address will be listed in the Company Address Directory.

We've broken down this information into five categories:

- Product Directorypage 15.
- Replacement Parts/Components Directorypage 44.
- Services Directorypage 49.
- Association/Educational Sources Directorypage 50.
- Company Address Directorypage 53.

Finding a product or part

We have subdivided the product directory according to certain types of products:

- Test equipment.
- Test equipment accessories.
- Circuit damage protective equipment and supplies.
- Supplies/accessories equipment.
- Audio and video accessories.
- Tools.

For example, if you are looking for a VCR test jig kit, turn to the test equipment accessories section of the Product Directory. The companies listed there all say they offer test jig kits. If the company name is followed by a *D, that tells you this company is a distributor, not a manufacturer, of that product.

You will notice that certain company names are in color. Those companies have advertised in this issue. If you want to learn a little more about that company, turn to the page number listed to the far right. The ad alone might give you enough information to help you decide.

Once you know who you want to con-

tact for more information, turn to the Company Address Directory. The address, telephone number and fax number for each company are listed there. (Of course, if the company you are interested in has advertised in this issue, you can just pull out your Reader Service card on page 51 and circle the reply number listed under the advertisement.)

The Replacement Parts/Components Directory works the same way. Just look up the type of component you need, then turn to the Company Address Directory to find out how to contact a company that supplies that product. The Company Address Directory lists information on more than 450 companies and associations that offer products or services for the electronics servicer.

Checking out services

Refer to the Services Directory if you need to contact a consultant, get a disk drive or head refurbished, plug into an on-line service, find a company to repair or rework a PC board, rent or lease equipment, calibrate your older test equipment, or repair a tuner.

Your source for continuing education

The Association/Educational Sources Directory helps you find books, schools and training seminars for continuing your electronics servicing education. It also points you toward sources for service literature and schematics for the products you service. Finally, it lists those companies that produce management software systems that can help you run your business.

Keep in touch

Although the annual **Buyers' Guide** is a year in the making, we realize it can't be absolutely complete—companies are always starting up, going out of business, or moving. And technology keeps adding new products to track. If you know of a company that you think other readers should be aware of, or if you would like us to extend our coverage to new product areas, drop us a line. If you become aware that a company listed has changed its address or telephone number, please let us know. Of course, if you find a mistake, please contact us immediately. We'll publish a correction in the first issue that we can get it into. ■

Product Directory

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

A line listing that is in color indicates that the company has an ad in this issue. The number following the listing is the number of the page on which the ad is located. BC means Back Cover. IBC means Inside Back Cover, and IFC means Inside front cover.

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 Contact East*D
 E.I.L. Instruments, Inc.*D
 Electro-Metrics, Inc.
 Electronics Warehouse Corp.*D
 Electronix Express*D
 Hameg Instruments, Inc.

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 Joseph Electronics*D
 Leader Instruments Corp.
 Marconi Instruments
 Marshall Industries*D
 MCM Electronics*D
 National Instruments
 Omnitron Electronics*D
 Philips ECG13
 Print Products International
 H.C. Protek
 RAG Electronics Inc.
 Ramsey Electronics Inc.
 RNJ Electronics Inc.*D24
 Schlumberger Technologies
 Smith Design
 Tandy National Parts*D
 Techni-Tool, Inc.*D
 Technology Programs
 TEKSERV
 Tektronix, Inc.
 Tenma Test Equipment
 TTC
 Tucker Electronics Co.*D

TELEPHONE ANALYZERS/TESTERS

Allied Electronics, Inc.
 American Reliance
 AT&T Capital Corporation
 Vance Baldwin Inc.
 B&K Precision
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
 Computer Component Source*D
 Consolidated Electronics*D
 Contact East*D
 CSTS Inc.
 CUI Stack, Inc.
 East Coast Transistor*D
 E.I.L. Instruments, Inc.*D
 Electronic Design Specialists
 Electronics Warehouse Corp.*D
 Elenco Electronics, Inc.
 Herman Electronics*D25
 HMC - Hub Material Co.*D
 JDR Micro*D
 Joseph Electronics*D
 Marshall Industries*D
 Omnitron Electronics*D
 Philips ECG13
 Print Products International
 RAG Electronics Inc.
 RNJ Electronics Inc.*D24
 Simpson Electronic Company
 Specialized Products Company
 Tandy National Parts*D
 Techni-Tool, Inc.*D
 3M Telecom Systems Division
 Time Motion Tools
 Triplett Corp.
 TTC
 Wavetek Corporation5
 Wholesale Electronics Inc.*D65

TEMPERATURE SENSORS

AEMC Corp.
 Alfa Electronics*D
 Allied Electronics, Inc.
 Amprobe Instrument
 Anritsu Meter Co. of America
 Arrow Electronics Inc.
 AT&T Capital Corporation
 Vance Baldwin Inc.
 Bel Merit Corporation
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
 Computer Component Source*D

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 Consolidated Electronics*D
 Contact East*D
 Dranetz Technologies, Inc.
 E.I.L. Instruments, Inc.*D
 Electromatic Controls/Soar
 Instruments
 Electronics Warehouse Corp.*D
 Electronix Express*D
 Exttech Instruments Corporation
 HMC - Hub Material Co.*D
 JDR Micro*D
 Joseph Electronics*D
 MAI/Prime Parts*D
 Marshall Industries*D
 Multicore Solder
 Omega Engineering, Inc.
 Omnitron Electronics*D
 Pacer Industries, Inc.
 Philips ECG13
 Print Products International
 RAG Electronics Inc.
 RNJ Electronics Inc.*D24
 RS Electronics
 Simpson Electronic Company
 Solder Absorbing Technology
 Solomat Neotronics
 Start International*D
 Techni-Tool, Inc.*D
 Technology Programs
 TEKSERV
 TIF Instruments, Inc.
 Time Motion Tools
 Universal Enterprises (UEI)
 Wavetek Corporation5
 Wholesale Electronics Inc.*D65

TRANSISTOR TESTERS

Allied Electronics, Inc.
 Arrow Electronics Inc.
 Vance Baldwin Inc.
 B-B&W Electronics*D
 B&K Precision
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
 Computer Component Source*D
 Consolidated Electronics*D
 East Coast Transistor*D
 E.I.L. Instruments, Inc.*D
 Electronic Design Specialists
 Electronics Warehouse Corp.*D
 Elenco Electronics, Inc.
 Hi-Techniques, Inc.
 HMC - Hub Material Co.*D
 IET Labs, Inc.
 JDR Micro*D
 Joseph Electronics*D
 Kelvin Electronics*D
 Lil' Bitty Tester, Inc.
 MAI/Prime Parts*D
 Marshall Industries*D
 Omega Engineering, Inc.
 Omnitron Electronics*D
 Philips ECG13
 Print Products International
 H.C. Protek
 RAG Electronics Inc.
 RNJ Electronics Inc.*D24
 RS Electronics
 Salen Enterprises*D
 Sencore ElectronicsIFC, 7
 Techni-Tool, Inc.*D
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VECTORSCOPES

Arrow Electronics Inc.
 AT&T Capital Corporation
 Vance Baldwin Inc.
 Bursma Electronic Distrib.*D

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 C&S Sales*D
 Computer Component Source*D
 Compuvideo
 East Coast Transistor*D
 E.I.L. Instruments, Inc.*D
 Electronics Warehouse Corp.*D
 Herman Electronics*D25
 Hitachi Denshi America Ltd.
 Joseph Electronics*D
 Kenwood U.S.A. Corp.
 Leader Instruments Corp.
 Marshall Industries*D
 Omnitron Electronics*D
 Philips ECG13
 Print Products International
 RAG Electronics Inc.
 RNJ Electronics Inc.*D24
 Salen Enterprises*D
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 Tandy National Parts*D
 Techni-Tool, Inc.*D
 Tektronix, Inc.
 Tucker Electronics Co.*D
 Wholesale Electronics Inc.*D65

WAVEFORM MONITORS

Analogic Corp.
 Arrow Electronics Inc.
 AT&T Capital Corporation
 Vance Baldwin Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
 Computer Component Source*D
 Compuvideo
 Dranetz Technologies, Inc.
 East Coast Transistor*D
 E.I.L. Instruments, Inc.*D
 Electronics Warehouse Corp.*D
 Gould Instrument Systems Inc.
 Herman Electronics*D25
 Hitachi Denshi America Ltd.
 Hi-Techniques, Inc.
 Joseph Electronics*D
 Kenwood U.S.A. Corp.
 Leader Instruments Corp.
 Marshall Industries*D
 Omnitron Electronics*D
 Print Products International
 RAG Electronics Inc.
 RNJ Electronics Inc.*D24
 RS Electronics
 Sencore ElectronicsIFC, 7
 Snap-On Incorporated3
 Tandy National Parts*D
 Techni-Tool, Inc.*D
 TEKSERV
 Tektronix, Inc.
 3M Telecom Systems Division
 TTC
 Tucker Electronics Co.*D
 Ultech Corp
 Wavetek Corporation5

OTHER TEST EQUIPMENT

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 Allied Electronics, Inc.
 Analogic Corp.
 Anritsu Meter Co. of America
 Aristo Computers, Inc.*D
 AT&T Capital Corporation
 AVO International
 Vance Baldwin Inc.
 Behlman Electronics
 Bel Merit Corporation
 Bird Electronics Corp.
 B&K Precision
 BMI-Basic Measuring Instrument
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D

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 Computer Component Source*D
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 Computer & Monitor Maintenance
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 Consolidated Electronics*D
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 Digitech Industries Inc.
 Diversified Parts*D
 Dranetz Technologies, Inc.
 East Coast Transistor*D
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 E.I.L. Instruments, Inc.*D
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 Fotec Inc
 GlobeTech International, Inc.
 Gould Instrument Systems Inc.
 Hameg Instruments, Inc.
 IET Labs, Inc.
 Instek Corp.
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 JDR Micro*D
 Jensen Tools, Inc.*D
 JIT Resources, Inc.
 Jonard Industries Corp.
 Joseph Electronics*D
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 Keithley Instruments
 Kenwood U.S.A. Corp.
 Kester Solder
 Key Tek Instrument Corp.
 Klein Tools, Inc.
 Kobetron, Inc.
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 TTC
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 Universal Enterprises (UEI)
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 Yokogawa Corp. of America

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 Brunelle Instruments, Inc.
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 C&S Sales*D
 Computer Component Source*D
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 E.I.L. Instruments, Inc.*D
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 Joseph Electronics*D
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 C&S Sales*D
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 Innovative Solutions
 ITT Pomona Electronics
 Jameco Electronics Components
 JDR Micro*D
 Jim-Pak
 Joseph Electronics*D
 Kelvin Electronics*D
 MAI/Prime Parts*D
 Marshall Industries*D
 MCM Electronics*D
 Mouser Electronics*D
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 Omnitron Electronics*D
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 Behlman Electronics
 B&K Precision
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
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 Consolidated Electronics*D
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 Deltron, Inc.
 East Coast Transistor*D
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 Electronic Parts Supply*D
 Electronics Warehouse Corp.*D
 Electronix Corp.*D
 Electronix Express*D
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 Extetch Instruments Corporation
Fluke Corporation.....BC
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 Goldstar Precision Co., Ltd.
 Hameg Instruments, Inc.
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 Sun Equipment Corporation
 Tandy National Parts*D
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 Tenma Test Equipment
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TEST JIGS AND FIXTURES

Vance Baldwin Inc.
 B-B&W Electronics*D
 Brian Instruments, Inc.
 Bursma Electronic Distrib.*D
 Computer Component Source*D
 CSTS Inc.
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 Electronics Warehouse Corp.*D
 Emulation Technology, Inc.
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 Polaris Div. of UXL Corp.
RNJ Electronics Inc.*D.....24
 RS Electronics
 Schurter, Inc.
 Sony Service Co.
 Techni-Tool, Inc.*D
 3M Electronic Products Div

TEST LEADS AND PROBES

AEMC Corp.
 Alfa Electronics*D
 Allied Electronics, Inc.
 American Design Components*D
 Amprobe Instrument
 Anritsu Meter Co. of America
 Atrix, Inc.*D
 Avex Probes, Inc. (API)
 Vance Baldwin Inc.
 B-B&W Electronics*D
 Bel Merit Corporation
 B&K Precision
 Brian Instruments, Inc.
 Brunelle Instruments, Inc.
 Bursma Electronic Distrib.*D
 C&S Sales*D
 Computer Component Source*D
 Consolidated Electronics*D
 Contact East*D
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 East Coast Transistor*D
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 Electromatic Controls/Soar Instruments
 Electro Standards Lab, Inc.
 Electronics Warehouse Corp.*D
 Elenco Electronics, Inc.
 Emulation Technology, Inc.
 E-Z Hook
Fluke Corporation.....BC
 GC Electronics
 Hameg Instruments, Inc.
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Herman Electronics*D.....25
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 Salen Enterprises*D
 Schurter, Inc.
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 Simpson Electronic Company
 Smith Design
 Speco/EMCO Electronics
 A.W. Sperry Instruments, Inc.
 Tandy National Parts*D
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 Computer Component Source*D
 Dalbani Corporation*D
 Diversified Parts*D
 East Coast Transistor*D
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 Amphenol Corporation
 Amprobe Instrument
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 Brian Instruments, Inc.
 Brunelle Instruments, Inc.
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RNJ Electronics Inc.*^D24
RS Electronics
Salen Enterprises*^D
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Simpson Electronic Company
A.W. Sperry Instruments, Inc.
Techni-Tool, Inc.*^D
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3M Electrical Specialties Div
3M Electronic Products Div
Time Motion Tools
Ultech Corp
Universal Enterprises (UEI)
The Vector Group, Inc.
Wavetek Corporation5

Circuit damage protective equipment/supplies

GROUNDING SYSTEMS

Arrow Electronics Inc.
Atrix, Inc.*^D
Computer Component Source*^D

Contact East*^D
HMC - Hub Material Co.*^D
Jameco Electronics Components
MAI/Prime Parts*^D
RNJ Electronics Inc.*^D24
Specialized Products Company
Static Prevention Inc.
Techni-Tool, Inc.*^D
3M Electrical Specialties Div
Time Motion Tools
Verite
Wescorp
Xentek, Inc.

POWER LINE MONITORS

Allied Electronics, Inc.
American Power Conversion Corp
Arrow Electronics Inc.
Atrix, Inc.*^D
AT&T Capital Corporation
Vance Baldwin Inc.
B&K Precision
BMI-Basic Measuring Instrument
Brunelle Instruments, Inc.
Bursma Electronic Distrib.*^D
Computer Component Source*^D
Consolidated Electronics*^D
Contact East*^D
Conway Engineering, Inc.
Dranetz Technologies, Inc.
EFI Electronics Corporation
E.I.L. Instruments, Inc.*^D
Electronics Warehouse Corp.*^D
HMC - Hub Material Co.*^D
Hosfelt Electronics, Inc.*^D
Integrity Design & Research
Jameco Electronics Components
JDR Micro*^D
Joseph Electronics*^D

MAI/Prime Parts*^D
M.A.T. Electronics*^D67
Mendon Electronics Corp.
On-Line Power
Perma Power Electronics, Inc.
PowerTronics
Print Products International
RNJ Electronics Inc.*^D24
RS Electronics
SL Waber, Inc.
Sola Electric
Specialized Products Company
The Superior Electric Company
Techni-Tool, Inc.*^D
Time Motion Tools
Tripp Lite
The Vector Group, Inc.

STANDBY POWER SYSTEMS

Acme Electric Corporation
AESI/Stedi Watt
Allied Electronics, Inc.
Alpha Technologies
American Design Components*^D
American Power Conversion Corp
Arrow Electronics Inc.
Vance Baldwin Inc.
Best Power Technology, Inc.
Bursma Electronic Distrib.*^D
Computer Component Source*^D
Computer Power Inc.
Consolidated Electronics*^D
Controlled Power Co.
Electronic Specialists, Inc.
Electronics Warehouse Corp.*^D
Fox International*^D49
Galco Industrial Electronics*^D
Herman Electronics*^D25
HMC - Hub Material Co.*^D

Hosfelt Electronics, Inc.*^D
Jameco Electronics Components
JDR Micro*^D
Joseph Electronics*^D
Kalglo Electronics Co., Inc.
MAI/Prime Parts*^D
Meirick, Inc.
Minuteman UPS
Perma Power Electronics, Inc.
Philtek Power Corp.
Print Products International
RNJ Electronics Inc.*^D24
RS Electronics
SL Waber, Inc.
Sola Electric
Specialized Products Company
The Superior Electric Company
Sutton Designs, Inc.
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Allied Electronics, Inc.
Alpha Technologies
American Design Components*^D
American Power Conversion Corp
Arrow Electronics Inc.
Atrix, Inc.*^D
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- American Design Components*D
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- On-Line Power
- Perma Power Electronics, Inc.
- Philtex Power Corp.
- Print Products International
- RNJ Electronics Inc.*D24
- RS Electronics
- SL Waber, Inc.
- Sola Electric
- Specialized Products Company
- Staco Energy Products
- The Superior Electric Company
- Sutton Designs, Inc.
- Techni-Tool, Inc.*D
- Tripp Lite
- Tucker Electronics Co.*D
- Wholesale Electronics Inc.*D65

VOLTAGE REGULATORS

- Acme Electric Corporation
- Allied Electronics, Inc.
- American Power Conversion Corp
- Arrow Electronics Inc.
- Vance Baldwin Inc.
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- Computer Component Source*D
- Compuvideo
- Contact East*D
- Controlled Power Co.
- East Coast Transistor*D
- E.I.L. Instruments, Inc.*D
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- Hosfelt Electronics, Inc.*D
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- Kalgeo Electronics Co., Inc.
- Kelvin Electronics*D
- MAI/Prime Parts*D
- M.A.T. Electronics*D67
- MCM Electronics*D
- Minuteman UPS
- Mouser Electronics*D
- Omnitron Electronics*D
- On-Line Power
- Parts Express Int'l Inc.*D65
- Perma Power Electronics, Inc.
- Print Products International
- RNJ Electronics Inc.*D24
- RS Electronics

- Salen Enterprises*D
- Shape Electronics
- SL Waber, Inc.
- Sola Electric
- Specialized Products Company
- Staco Energy Products
- The Superior Electric Company
- Tandy National Parts*D
- Techni-Tool, Inc.*D
- Time Motion Tools
- Tripp Lite
- Wholesale Electronics Inc.*D65
- Xentek, Inc.

Electrostatic discharge protection

ANTISTATIC CHEMICALS

- Aervo-Pacific Co.
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- Bursma Electronic Distrib.*D
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- Eiger Electronics*D
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- Marshall Industries*D
- MCM Electronics*D
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- Omnitron Electronics*D
- Parts Express Int'l Inc.*D65
- Philips ECG13
- Print Products International
- RNJ Electronics Inc.*D24
- Rogers Anti-Static Chemicals
- RS Electronics
- Specialized Products Company
- Static Prevention Inc.
- Tandy National Parts*D
- Tech Spray Inc.
- Techni-Tool, Inc.*D
- Gregory Thomas Inc.
- Time Motion Tools
- Wescorp
- Wholesale Electronics Inc.*D65

ANTISTATIC IONIZATION DEVICES

- Atrix, Inc.*D
- Vance Baldwin Inc.
- Bursma Electronic Distrib.*D
- Chapman Corporation

- Charleswater
- Computer Component Source*D
- Contact East*D
- Desco Industries
- E.I.L. Instruments, Inc.*D
- HMC - Hub Material Co.*D
- JIT Resources, Inc.
- Joseph Electronics*D
- Marshall Industries*D
- Omnitron Electronics*D
- Print Products International
- Richmond Static Control Svcs
- RS Electronics
- Semtronics Corp.
- The Simco Co., Inc.
- Specialized Products Company
- Static Prevention Inc.
- Techni-Tool, Inc.*D
- Gregory Thomas Inc.
- 3M Electrical Specialties Div
- Time Motion Tools
- Vortec Corp.
- Wescorp

ANTISTATIC MATS/ BENCHTOPS/WRIST STRAPS/OTHERS

- Allied Electronics, Inc.
- Atrix, Inc.*D
- Vance Baldwin Inc.
- B-B&W Electronics*D
- Bursma Electronic Distrib.*D
- Charleswater
- Clauss Electronics Div.
- Computer Component Source*D
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- C.H. Ellis Company, Inc.
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- Global Kitting
- The Granite Corp.
- Herman Electronics*D25
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- Hosfelt Electronics, Inc.*D
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- Jameco Electronics Components
- JDR Micro*D
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- Joseph Electronics*D
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- MAI/Prime Parts*D
- Marshall Industries*D
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- Print Products International
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- Richmond Static Control Svcs
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- Semtronics Corp.
- The Simco Co., Inc.
- Solder Absorbing Technology
- Specialized Products Company
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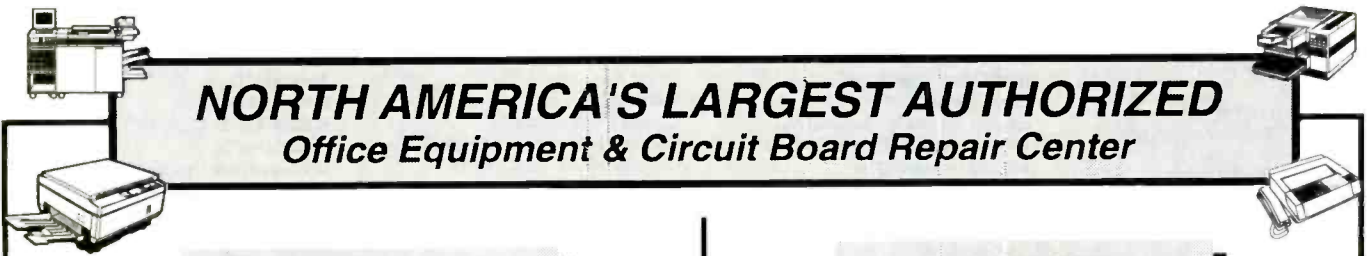
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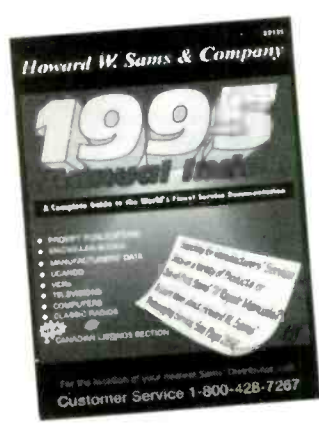
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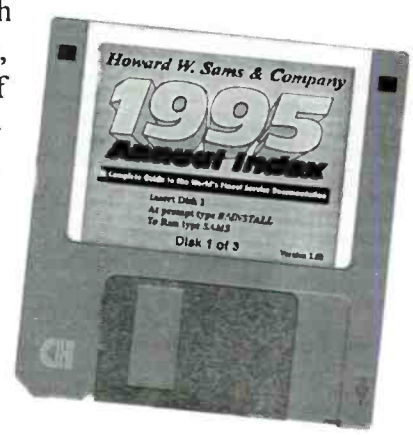
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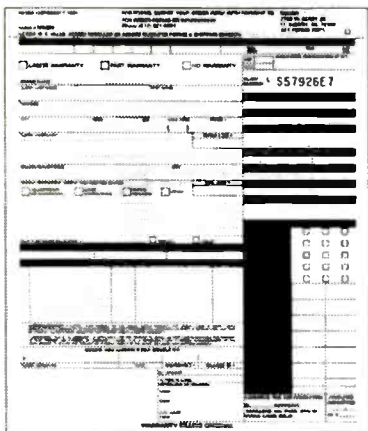
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| Sony Service Co. | |
| A.G. Tannenbaum*D | |
| Tech Assist, Inc. | |
| Technics | |
| TV Man Tech Tips Inc.72 | |
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Abbot, Langer & Associates

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Accutest Instruments*D

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Acme Electric Corporation

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Adaptive Research

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Addison-Wesley Publishing Co.

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Advanced Software Karyonics

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Lancaster, CA 93534
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Advanced Technology Group, Inc

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AEMC Corp.

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Fax: 617-423-2952

Aervo-Pacific Co.

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AESI/Stedi Watt

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Aiwa America, Inc.

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Alfa Electronics*D

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Allied Electronics, Inc.

An Avnet Co.
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Fort Worth, TX 76118
800-433-5700
Fax: 817-595-6470

All Micro Inc.

18820 US Hwy 19N Suite 215
Clearwater, FL 34624
813-539-0200
Fax: 813-531-0200

All-Spec Static Control Inc.

PO Box 28
Maspeth, NY 11378-0028
800-537-0351
Fax: 718-457-2811

Alpha Technologies

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Bellingham, WA 98226
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800-421-8089
Fax: 206-671-4936

Alternative Technical Serv.*M/D

2242 East Trenton Avenue
Orange, CA 92667
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800-343-3530
Fax: 714-744-3870

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Fax: 201-575-8469

America West Communications

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American Design Components*D

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American Hakko Products

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American Megatrends, Inc.

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American Micronics, Inc.

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Fax: 714-573-9008

American Power Conversion Corp

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West Kingston, RI 02892
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800-800-4APC
Fax: 401-789-3710

American Reliance

11801 Goldring Road
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Fax: 818-358-3838

Amherst Media, Inc.

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Fax: 716-874-4508

AMP

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Amprobe Instrument

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Andrews Electronics*D

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Fax: 201-848-1845

Antique Automobile Radio

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Palm Harbor, FL 34683
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Fax: 813-789-0283

Antique Electronic Supply

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Fax: 602-706-6789

Antique Radio Classified

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Fax: 508-371-7129

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Armand Mfg. Inc.

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Arrow Electronics Inc.

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Instrument Services**
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Fax: 605-326-5138

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815-434-0846
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- Cleveland Inst. of Electronics**
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Cleveland, OH 44114
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800-243-6446
Fax: 216-781-0331
- Clipper Products**
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- Colorado Spectrum, Inc.**
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- The Component Exchange**
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- Computer Maintenance Training**
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Fax: 508-624-4179
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818-879-1100
Fax: 818-879-1199
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124 W. High St.
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908-638-8000
800-526-5088
Fax: 908-638-4931
- Computer Service Supply Corp.**
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- Computer Transaction Systems**
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- Cook's Inst. of Elec. Engrg.**
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- Corporate Systems Center**
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- CRC Components**
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- CRC Industries, Inc.**
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- CRC Press, Inc.**
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2336 Lu Field Road
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214-241-2662
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- CSTS Inc.**
1480 N. Lakewood Ave.
Anaheim, CA 92807
714-777-2707
Fax: 714-777-2360
- CUI Stack, Inc.**
9640 S.W. Sunshine Ct Ste 700
Beaverton, OR 97005
503-643-4899
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- Curtis Mathes Parts & Service*D**
10911 Petal St.
Dallas, TX 75238
800-657-1979
Fax: 214-503-8515
- Custom Components Corporation**
W224 S8445 Industrial Drive
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Fax: 414-662-3781
- Custom Data Associates**
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Baltimore, MD 21234
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- Daetron**
935 The Queensway
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Toronto, ON CANADA M8Z 5Y9
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- Dalbani Corporation**
4225 NW 72nd Avenue
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- DataBasic**
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800-967-5924
Fax: 203-584-5370
- Data Depot, Inc.**
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Clearwater, FL 34615-6213
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800-275-1913
Fax: 813-443-4377
- Dataproducts Corporation**
528 Route 13 South
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603-673-9100
603-673-3091
- Datatech Depot, Inc.**
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R.L. Drake Company
P.O. Box 112
Miamisburg, OH 45342
513-866-2421

Dranetz Technologies, Inc.
1000 New Durham Road
PO Box 4019
Edison, NJ 08818-4019
908-287-3680
800-DRANETZ
Fax: 908-248-9240

Dremel
4915 21st Street
Racine, WI 53406
414-554-1390
800-437-3635
Fax: 414-554-7654

Dynaloy, Inc.
7 Great Meadow Lane
Hanover, NJ 07936
201-887-9270
Fax: 201-887-3678

Dynamic Learning Systems
PO Box 805
Marlboro, MA 01752
508-366-9487
Fax: 508-898-9995

E

Eagan Technical Services, Inc.
1380 Corporate Center Curve
Suite 115
Eagan, MN 55121
612-688-0098
800-285-1873
Fax: 612-688-7829

East Coast Transistor*D
2 Marlborough Road
West Hempstead, NY 11552
516-483-5742
800-645-3516
Fax: 800-733-5904

Echelon Industries*D
20681 E. Truss Court
Walnut, CA 91789
714-594-1891
Fax: 714-598-3810

Edroy Products
P.O. Box 988
Nyack, NY 10960
914-358-6600
800-223-8803

EFI Electronics Corporation
2415 South 2300 West
Salt Lake City, UT 84119
801-977-0009
800-877-1174
Fax: 801-977-0200

EIA/CEG Product Services
2500 Wilson Blvd
Arlington, VA 22201
703-907-7500

Eico Electronics
363 Merit Road
Lynbrook, NY 11563
516-599-5744

Eiger Electronics*D
70A E. Jefry Blvd.
Deer Park, NY 11729
516-242-2583
800-835-8316
Fax: 516-242-2586

E.I.L. Instruments, Inc.*D
10946A Golden West Drive
Hunt Valley, MD 21031-1320
410-584-7400
Fax: 410-584-7561

Electrodyn, Inc.
501 E. Temperance St.
Ellettsville, IN 47429
812-876-2522
800-937-1023
Fax: 812-876-2533

Electro Dynamics, Inc. (EDI)
135 Eileen Way
Syosset, NY 11791-9022
516-496-4000
800-426-6423
Fax: 800-873-2948

Electro Insulation Corporation
3921 Ventura Drive
Arlington Heights, IL 60004
708-632-1020
800-247-2114
Fax: 708-632-1089

**Electromatic Controls/
Soar Instruments**
2495 Pembroke Ave.
Hoffman Estates, IL 60195
708-882-5757
800-222-2659
Fax: 708-882-7234

**Electro-Metrics, Inc.
A Penril Corp.**
100 Church St.
Amsterdam, NY 12010-4299
518-843-2600
Fax: 518-843-2812

Electron Processing
P.O. Box 68
Cedar, MI 49621
616-228-7020

Electronic Design Specialists
4647 Appalachian St
Boca Raton, FL 33428
407-487-6103

Electronic Production Specialist
W 140 N 5084 Lilly Road
Menomonee Falls, WI 53051
414-783-6300
800-783-3337
Fax: 414-783-6707

Electronic Parts Supply*D
4071 Emery Street
Emeryville, CA 94608
510-420-1040

Electronic Software Developers
826 South Main Street
South Farmingdale, NY 11735
800-621-8477

Electronic Specialists, Inc.
171 South Main Street
Natick, MA 01760
508-655-1532
800-225-4876
Fax: 508-653-0268

Electronic Technicians Assn.
602 N. Jackson
Greencastle, IN 46135
317-653-8262
Fax: 317-653-8262

Electronic Warehouse Corp.
1910 Coney Island Ave.
Brooklyn, NY 11230
718-375-2700
800-221-0424
Fax: 718-375-2796

Electronix Corp.*D
313 West Main Street
Fairborn, OH 45324-5036
513-878-1828
800-223-3205
Fax: 513-878-1972

Electronix Express*D
365 Blair Road
Avenel, NJ 07001
908-381-8020
800-972-2225
Fax: 908-381-1572

**Electro Standards Lab, Inc.
Data Comm Prods Div**
36 Western Industrial Drive
Cranston, RI 02921
401-943-1164

Electro-Tech Systems, Inc.
115 East Glenside Avenue
Glenside, PA 19038
215-887-2196

Elenco Electronics, Inc.
150 West Carpenter Avenue
Wheeler, IL 60090
708-541-3800
Fax: 708-520-0085

Elgar Corp.
9250 Brown Deer Road
San Diego, CA 92121
619-450-0085
800-733-5427
Fax: 619-458-0267

C.H. Ellis Company, Inc.
2432 Southeastern Ave.
Indianapolis, IN 46201
317-636-3351
800-466-3351
Fax: 317-635-5140

Eltrex Industries Inc.
65 Sullivan St.
Rochester, NY 14605
716-454-6100
Fax: 716-263-7766

**Elvo Division of
Zumbach Electronics Corp.**
140 Kisco Ave.
Mount Kisco, NY 10549-1407
914-241-1008
Fax: 914-241-7096

Company mailing addresses

Emerson Radio Corp.

9 Entin Road
PO Box 430
Parsippany, NJ 07054-0430
201-952-0077
800-388-8333
Fax: 201-428-2128

E.M.T. Parts, Inc.*D

2031 East Via Burton St.
Suite J
Anaheim, CA 92806
714-758-8769
800-448-7892
Fax: 714-758-8768

Emulation Technology, Inc.

2344 Walsh Ave., Building F
Santa Clara, CA 95051
408-982-0660
800-995-4381
Fax: 408-982-0664

Entech Corp

2486 Dunwin Drive
Mississauga, ON CANADA L5E 1J9
905-820-3030

Equus C/O Unistar

13562 Pawnee
Tustin, CA 92680
714-730-7936

The Eraser Company, Wybar Div.

Oliva Drive
PO Box 4961
Syracuse, NY 13221
315-454-3237
800-724-0594
Fax: 315-454-3090

E.S.I. Inc.

3171 Hempstead Turnpike
Levittown, NY 11756

ESP Inc.

14 Blackstone Valley Place
Lincoln, RI 02865
401-333-3800
800-338-4353
Fax: 401-333-4954

Essential Seminars

297-101 Kinderkamack Road
Suite 122
Oradell, NJ 07649
201-986-1678
Fax: 201-986-1679

EURAS USA, Inc.

501 Sycamore Suite 300
Waterloo, IA 50703-4634
319-236-2000
800-453-8727
Fax: 319-236-2020

Excel Distributing*D

1819 Mentor Ave
Cincinnati, OH 45212
513-531-9989
Fax: 513-531-4115

Extech Instruments Corporation

335 Bear Hill Road
Waltham, MA 02154
617-890-7440
Fax: 617-890-7864

E-Z Hook

225 North Second Avenue
PO Box 450
Arcadia, CA 91066
818-446-6175
Fax: 818-466-0972

F

Falcon Safety Products, Inc.

25 Chubb Way
Branchburg, NJ 08876
908-707-4900
Fax: 908-707-8855

Fedco Electronics, Inc.

PO Box 1403
Fond Du Lac, WI 54936
414-922-6490
Fax: 414-922-6750

Federal Warranty Service Corp.

919 North Michigan Avenue
Suite 3202
Chicago, IL 60611
312-944-6161
Fax: 312-944-8966

Fessenden Technologies

116 3rd Street
Ozark, MO 65721
417-485-2501
Fax: 417-485-3133

Fiber Options, Inc.

80 Orville Drive
Bohemia, NY 11716-2506
516-567-8320

Fieldpiece Instruments

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Suite 250
Fullerton, CA 92635
714-992-1239
Fax: 714-992-6541

Fifth Generation Systems

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Baton Rouge, LA 70809-4562
504-291-7221

Fluke Corporation

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Everett, WA 98206-9090
206-347-6100
800-44-FLUKE
Fax: 206-356-5116

Foley-Belsaw

6301 Equitable Road
Kansas City, MO 64141
816-483-6400

Foresight Resources

10725 Ambassador Drive
Kansas City, MO 64153-1216
816-891-1040
800-231-8574
Fax: 816-891-8018

Fotec Inc

529 Main Street
Boston, MA 02129
617-241-7810
800-537-8254
Fax: 617-241-8616

Fotronic Corp.

PO Box 708
Medford, MA 02155
617-665-1400
Fax: 617-665-0780

Four Star Chemical

5701 South Compton Avenue
Los Angeles, CA 90011
213-588-7166
800-243-6264
Fax: 213-582-6226

Fox International*D

23600 Aurora Road
Bedford Heights, OH 44146
216-439-8500
800-321-6993
Fax: 800-445-7991

Franks Electronics

PO Box 357
Glen, MS 38846
601-287-1594

R. Frazier Inc.

1300 Intervale Drive
Salem, VA 24153
703-387-3799
Fax: 703-387-1180

Frederick Engineering, Inc.

10200 Old Columbia Rd.
Columbia, MD 21046
410-290-9000
Fax: 410-381-7180

G

Galco Industrial Electronics*D

26010 Pinehurst Drive
Madison Heights, MI 48071-4189
810-542-3090
800-521-1615
Fax: 810-542-8031

GC Electronics

A Division of GC Thorsen Co.
1801 Morgan Street
Rockford, IL 61105-1209
815-968-9661
800-435-2931
Fax: 815-968-9731

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2912 Pacific Dr
Norcross, GA 30071
404-263-5984
800-431-7671
Fax: 404-263-5780

GE Consumer Service

4421 Bishop Lane
Louisville, KY 40218
800-572-2455

Geist Inc

P.O. Box 83088
Lincoln, NE 68501
402-474-3400
800-432-3219

Gemini Inc.

103 Mensing Way
Cannon Falls, MN 55009
800-533-3631
Fax: 507-263-4887

General Power Systems, Inc.

17881 Cartwright Road
Irvine, CA 92714
714-851-0800
Fax: 714-851-1181

Genstar/Electro Rent

6060 Sepulveda Blvd
Van Nuys, CA 91411
818-787-2100
Fax: 818-786-4354

Gibson Research Corp.

35 Journey
Aliso Viejo, CA 92653
714-362-8800
800-736-0637
Fax: 714-830-0300

Global Communications, Inc.

Global One Center
472 Capital Circle NW
Tallahassee, FL 32304
904-574-6633
800-659-8659
Fax: 904-574-6663

Global Kitting

P.O. Box 1757
Roseburg, OR 97470
503-672-5332
Fax: 503-672-0614

Global Micro-Parts Depot*D

11151 Denton Drive
Dallas, TX 75229
800-325-8488
Fax: 800-433-2060

Global Specialties

A Division of Interplex
PO Box 1942
New Haven, CT 06509
203-624-3103
800-345-6251
Fax: 203-468-0060

GlobeTech International, Inc.

1684 S. Research Loop
Tucson, AZ 85710
602-298-6900
800-654-7314
Fax: 602-298-1913

Goldstar Precision Co., Ltd.

13013 East 166th Street
Cerritos, CA 90701-2226
310-404-0101
Fax: 310-921-6227

Goldstar U.S.A. Inc.

1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
201-816-2033
Fax: 201-816-0913

Goldstar Products Company

14555 N Hayden Rd Suite 101
Scottsdale, AZ 85260
602-922-3922
800-541-6808

Good-Lyddon Data Systems

6879 Sard Street
Rancho Cucamonga, CA 91701
909-980-4563

Gore Laboratories, Inc.

3 Northern Blvd
Amherst, NH 03031
606-672-4673
Fax: 603-672-5652

Gould Instrument Systems Inc.

8333 Rockside Road
Valley View, OH 44125-6100
216-328-7000
Fax: 216-328-7400

Gower Publishing Company

Old Post Road
Brookfield, VT 05036
802-276-3162
802-276-3837

The Granite Corp.

24200 Burbank Blvd.
Woodland Hills, CA 91367
818-887-5533
Fax: 818-883-5188

Company mailing addresses

Great Atlantic Info Systems
PO Box 9132
Virginia Beach, VA 23450-9132
804-523-5501

Greenlee Textron, Inc.
4455 Boeing Drive
Rockford, IL 61109
815-397-7070
Fax: 815-397-8289

Guardian Computer Support, Inc
1177 Quarry Lane, Suite F
Pleasanton, CA 94566
510-846-3649
800-752-8733

H

Willi Hahn Corp U.S.A.
1400 East Broadway
PO Box 960
Monticello, MN 55362
612-295-2162
800-328-8310
Fax: 612-295-4440

Hameg Instruments, Inc.
266 East Meadow Avenue
East Meadow, NY 11554-2437
516-794-4080
800-247-1241
Fax: 516-794-1855

Harco Electronics
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Aberdeen, MD 21001
410-838-7990
800-638-7616
Fax: 410-734-7288

Harris Publishing
2057 Aurora Road
Twinsburg, OH 44087-1999
216-425-9000
800-888-5900
Fax: 216-425-4328

Heath Company
455 Riverview Drive
Benton Harbor, MI 49022
800-444-3284 Catal
800-253-0570 Order
Fax: 616-982-5577

Herman Electronics*^D
1365 N.W. 23rd St.
Miami, FL 33142
305-634-6591
800-938-4376
Fax: 800-938-4377

Hewlett-Packard Company
Personal Measurements Operation
1900 Garden of the Gods Road
Colorado Springs, CO 80907
719-590-2053
719-590-1900
Fax: 719-590-2193

Hexacon Electric Co.
161 W. Clay Ave.
P.O. Box 36
Roselle Park, NJ 07024
908-245-6200
Fax: 908-245-6176

High Tech Electronic Services
1623 Aviation Boulevard
Redondo Beach, CA 90278
310-379-2026
800-289-3001
Fax: 310-379-9608

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

Highland Products, Inc.
P.O. Box 794
Dover, NJ 07801
201-366-0156
Fax: 201-366-6665

High Tech Electronics
203 Highway 79N
Henderson, TX 75652
903-657-6320
Fax: 903-655-0280

Richard Hirschmann of America
Industrial Row Box 229
Riverdale, NJ 07457
201-835-5002
Fax: 201-835-8354

Hitachi Denshi America Ltd.
150 Crossways Park Drive
Woodbury, NY 11797
516-921-7200
Fax: 516-921-0993

Hitachi Service Company
401 West Artesia Boulevard
Compton, CA 90220
213-537-8383

Hi-Techniques, Inc.
152 Owen Road
Madison, WI 53716
608-221-7500
800-248-1633
Fax: 608-221-7509

HMC—Hub Material Co.*^D
33 Springdale Avenue
Canton, MA 02021
617-821-1870
Fax: 617-821-4133

Hosfelt Electronics, Inc.*^D
2700 Sunset Boulevard
Steubenville, OH 43952-1158
614-264-6464
800-524-6464
Fax: 614-264-5414

Houston Computer Services, Inc
3207 Ashfield Drive
Houston, TX 77082-2205
713-493-9900
Fax: 713-558-1880

Howard Electronic Insts Inc.*^D
6222 North Oliver
Wichita, KS 67220
316-744-1984
800-394-1984
Fax: 316-744-1994

HSC Service Co.
Div of Hitachi SIs Corp of Am
401 W. Artesia Blvd.
Compton, CA 90220
800-447-2882

Hunter Products, Inc.
792 Partridge Drive
PO Box 6795
Bridgewater, NJ 08807
908-526-8440
800-524-0692
Fax: 908-526-8348

Huntron Instruments, Inc.
15720 Mill Creek Rd.
Mill Creek, WA 98012
206-743-3171
800-426-9265
Fax: 206-743-1360

Hytec Dealer Service
4548 Parkbreeze Ct
Orlando, FL 32801
407-297-1001
800-883-1001
Fax: 407-297-4310

I.A.C. Industries
895 Beacon Street
Brea, CA 92621
714-990-8997
800-229-1422
Fax: 714-990-0557

IBM Education
1500 Riveredge Parkway
Marietta, GA 30067
404-644-4059

IC Master
Hearst Business Comm. Inc.
645 Stewart Avenue
Garden City, NY 11530
516-227-1300
Fax: 516-227-1453

ICS Inc., Electro-Pac Div.
520 Interstate Road
Addison, IL 60101
708-543-6244
Fax: 708-543-6244

Ideal Computer Systems
206 Collins Road, N.E.
Cedar Rapids, IA 52402
319-373-2001

Ideal Industries, Inc.
117 Fern St.
Santa Cruz, CA 95060
408-427-3122
Fax: 408-427-3134

IET Labs, Inc.
534 W. Main St.
Westbury, NY 11590
516-334-5959
800-899-8438
Fax: 516-334-5988

Impact Printhead Services
10435 Burnet Road, Suite 114
Austin, TX 78758-4450
512-832-9151
800-777-4323
Fax: 512-832-9321

Industrial Devices, Inc.
260 Railroad Ave.
Hackensack, NJ 07601
201-489-8989
Fax: 201-489-6911

Industrial Electronic Supplies
2101 N. Fairview St.
Santa Ana, CA 92706
714-971-2292
800-4-HURLEY
Fax: 714-971-5033

Industrial Training, Inc.
5376 52nd St. S.E.
Grand Rapids, MI 49512
616-698-8688
800-253-4623
Fax: 616-698-9080

Innovative Solutions
416 Stewart Hollow Road
Portsmouth, OH 45662
614-574-4304
Fax: 614-574-4304

Instek Corp.
1205 John Reed Court
City of Industry, CA 91745
818-336-6537
Fax: 818-369-1748

Integrity Design & Research
296 West Ferry Street
Buffalo, NY 14213
716-882-9699
Fax: 716-882-9699

Intelligent Business Solutions
1720 Jane Ave S
Minneapolis, MN 55403-2825
612-377-4819

Intellisystems
10930 Fullbright
Chatsworth, CA 91311
818-341-1634

Interactive Image Technologies
111 Peter St Suite 801
Toronto, ON M5V2H1 Canada
416-977-5550
Fax: 416-977-1818

Interconnect Devices, Inc.
5101 Richland Ave.
Kansas City, KS 66106
913-342-5544
Fax: 913-342-7043

Intermatic Incorporated
Intermatic Plaza
Spring Grove, IL 60081-9698
815-675-2321
312-282-7300

Intn'l Correspondence Schools
925 Oak Street
Scranton, PA 18515
717-347-1625
Fax: 717-343-8172

International Components Corp.
105 Maxess Road
Melville, NY 11747
516-293-1500
800-645-9154
Fax: 516-293-4983

International Disk Svcs, Inc.
1530 Montague Expwy
San Jose, CA 95131
408-432-0537
Fax: 408-434-1015

International Power Tchnlgies
538 South 1400 West
Orem, UT 84058
801-224-4828

Interplex Electronics, Inc.
70 Fulton Terrace
New Haven, CT 06512
203-466-6103
Fax: 203-468-0060

ISCET
2708 W. Berry
Fort Worth, TX 76109
817-921-9101
Fax: 817-921-3741

Isles Industries
895 Beacon Street
Brea, CA
714-990-8997

ITT Pomona Electronics
1500 East Ninth Street
PO Box 2767
Pomona, CA 91766
909-623-3463
Fax: 909-629-3317

Company mailing addresses

ITT Power Systems Corporation
3400 East Britannia, Suite 122
Tucson, AZ 85706
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Fax: 602-294-1808

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Jameco Electronics Components & Computer Products
1355 Shoreway Rd.
Belmont, CA 94002
415-592-8097
800-831-4242
Fax: 800-237-6948

Javelin Electronics
ATAPCO Security & Comm. Group
19831 Magellan Drive
Torrance, CA 90502-2033
310-327-7440
800-421-2716
Fax: 310-327-5405

JDR Micro*D
2233 Branham Lane
San Jose, CA 95124
408-559-1200
800-538-5000
Fax: 408-559-0250

JDV Engineering Company
2-05 Banta Place
Fair Lawn, NJ 07410
201-796-1720
Fax: 201-796-9399

W.S. Jenks & Son*D
1933 Montana Ave. N.E.
Washington, DC 20002
202-529-6020
Fax: 202-832-3411

Jensen Tools, Inc.*D
7815 South 46th Street
Phoenix, AZ 85044-5399
602-968-6241
800-426-1194
Fax: 800-366-9662

Jim-Pak
1355 Shoreway Rd
Belmont, CA 94002
415-595-5936
Fax: 415-592-2503

JIT Resources, Inc.
300 S. Walnut, Unit 403
San Dimas, CA 91773
909-599-6090
Fax: 909-592-9960

Jonard Industries Corp.
134 Marbledale Rd.
Tuckahoe, NY 10707
914-793-0700
Fax: 914-793-4527

Joseph Electronics*D
8830 N. Milwaukee Avenue
Niles, IL 60714
708-297-4200
800-323-5925
Fax: 708-297-6923

K

Kalglo Electronics Co., Inc.
Colony Drive Industrial Park
6584 Ruch Rd., E. Allen Twp.
Bethlehem, PA 18017-9359
610-837-0700
800-524-0400
Fax: 610-837-7978

Kasco Distributing
12336 Martin Alexander Rd
Sardinia, OH 45171
513-446-2562
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Fax: 513-446-2609

KDM Associates
20 W 345-D 101 Street
Lemont, IL 60439
708-739-3337
800-536-6168
Fax: 708-739-9169

Keithley Instruments
28775 Aurora Road
Cleveland, OH 44139
216-248-0400
800-552-1115
Fax: 216-248-6168

Kelvin Electronics*D
10 Hub Drive
Melville, NY 11747
516-756-1750
800-535-8469
Fax: 516-756-1763

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2201 E. Dominguez St.
Long Beach, CA 90810-5745
213-639-4200

Kester Solder
515 E. Touhy Ave.
Des Plaines, IL 60018
708-297-1600
800-2-KESTER
Fax: 708-390-9338

KeyPrestige
11065 Knott Ave., Suite B
Cypress, CA 90630
714-893-1111
Fax: 714-893-7997

Keystone Electronics Corp.
31-07 20th Road
Astoria, NY 11105-2017
718-956-8900
Fax: 718-956-9040

Key Tek Instrument Corp.
260 Fordham Road
Wilmington, MA 01887
617-658-0880
Fax: 508-657-4803

Kikusui International/Marconi
See Marconi Instruments

Klein Tools, Inc.
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Chicago, IL 60659-9033
708-677-9500

Knight Business Systems, Ltd.
266 Middle Island Road
Bldg. 2-13
Medford, NY 11763
516-736-4440
Fax: 800-333-5642

Kobetron, Inc.
2271 Arbor Blvd.
Dayton, OH 45439
513-298-8244

L

La Guardia Enterprises
5882 Rich Hill Way
Yorba Linda, CA 92686
714-579-1276

Landmark Research Intl Corp
703 Grand Central St.
Clearwater, FL 34616
813-443-1331
800-683-6696
Fax: 813-443-6603

Laser Products Company
1821 Macon Street
Kansas City, MO 64116
816-421-7830
800-786-8897
Fax: 816-421-8053

L-Com Inc.
1755 Osgood Street
North Andover, MA 01845
508-682-6936
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Fax: 508-689-9484

Leader Instruments Corp.
380 Oser Avenue
Hauppauge, NY 11788
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800-645-5104
Fax: 516-231-5295

Leads Metal Products (ENDECO)
P.O. Box 441186
Indianapolis, IN 46244-1186
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Fax: 317-261-1208

Learning Group International
1805 Library Street
Reston, VA 22090
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Fax: 703-709-6405

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6053 West Century Boulevard
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Los Angeles, CA 90045-0028
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800-843-8733
Fax: 310-410-2952

LeCroy Corporation
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Chestnut Ridge, NY 10977-6499
914-578-6020
914-425-2000
Fax: 914-425-8967

LEM U.S.A., Inc.
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Milwaukee, WI 53218
414-353-0711
Fax: 414-353-0733

Lil' Bitty Tester, Inc.
3154 Main St.
Chula Vista, CA 91911
619-425-1472
Fax: 619-284-4567

L.J. Enterprises
An Elec-Cetera Inc. Company
68 Railroad Ave
Valley Stream, NY 11580
516-872-5000
800-296-5536
Fax: 516-872-5000

Luxo Corp.
36 Midland Ave.
Port Chester, NY 10573
914-937-4433
800-222-5896

M

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

Magic Solutions, Inc.
180 Franklin Turnpike
Mahwah, NJ 07430
201-529-5533
Fax: 201-529-2955

MAI/Prime Parts*D
5736 N. Michigan Rd.
Indianapolis, IN 46208-1729
317-257-1590
Fax: 317-257-1590

The Malcom Company
25 Abbot St.
Andover, MA 01801
800-289-7505
Fax: 508-475-7242

Marconi Instruments
3 Pearl Court
Allendale, NJ 07401
201-934-9050
800-233-2955
Fax: 201-934-9229

Marketing Concepts, Inc.
A Div. of Ind. Dir. Svcs.
2600 Washington
St. Louis, MO 63188
314-727-2901
Fax: 314-727-2046

Marshall Industries*D
9320 Telstar Ave.
El Monte, CA 91731
818-307-6000

M.A.T. Electronics*D
400 Pike Road
Huntingdon, PA 19061
215-364-7667
800-628-1118
Fax: 800-628-1005

Matrix Components
13581 Pond Springs Rd Ste 315
Austin, TX 78729
512-258-7590
800-726-1503
Fax: 512-219-0021

Matshushita Services Co.
Parts Division
50 Meadowlands Pkwy.
Secaucus, NJ 07094
201-348-7000
800-447-4700

MaxServ
8317 Cross Park Drive
Suite 350
Austin, TX 78754
512-328-3939
Fax: 512-328-3625

McAfee Associates, Inc.
2710 Walsh Avenue, Suite 200
Santa Clara, CA 95051
408-988-3832

MCG Electronics, Inc.
12 Burt Drive
Deer Park, NY 11729
516-586-5125
800-851-1508
Fax: 516-586-5125

Company mailing addresses

McGraw Hill Publishing Company
Professional and General Books
11 West 19th Street
New York, NY 10011
212-337-5945
212-337-5951

MCM Electronics*D
650 Congress Park Drive
Dayton, OH 45459-4072
513-434-0031
800-543-4330
Fax: 513-433-6959

Meirick, Inc.
420 South Hickory
Mount Vernon, MO 65712
417-466-3941
Fax: 417-466-4207

Melmat Inc.
5333 Industrial Drive
Huntington Beach, CA 92649
714-379-4555
800-MELMAT-9
Fax: 714-379-4554

Mendon Electronics Corp.
3800 Monroe Ave.
Pittsford, NY 14534
716-248-8480
800-227-6937
Fax: 716-248-3021

Mercer Electronics
859 Dundee Avenue
Elgin, IL 60120-3090
708-697-2260
708-697-2272
Fax: 708-697-2272

Merlin Software
15735 Barranca Pkwy Ste B108
Irvine, CA 92718
714-453-9563
Fax: 714-753-0501

METCAL
1530 O'Brien Drive
Menlo Park, CA 94025
415-325-3291
800-776-1778
Fax: 415-325-5932

Metric Supply
21029 Itasca Street, Unit C
Chatsworth, CA 91311-4924
818-701-7518
800-289-8953
Fax: 818-701-6011

Metrix Inc.
20975 Swenson Drive, Suite 160
Waukesha, WI 53186
414-798-8560
800-543-2130
Fax: 414-798-8573

Metrotek Industries, Inc.
33 West Main Street
Elmsford, NY 10523-2413
914-347-4112
Fax: 914-347-4203

Micro Care Corp.
34 Ronzo Road
Bristol, CT 06010
203-585-7912
800-638-0125
Fax: 203-585-7378

Microcode Engineering
1943 N 205 West
Orem, UT 84057
801-226-4470
Fax: 801-226-6532

Micro Data
1370 58th St West Bldg 202
Clearwater, FL 34620
813-539-8600
800-539-0123
Fax: 813-531-0977

Micro Dimensions, Inc.
89K Washington Ave.
Natick, MA 01760
508-650-9008
Fax: 508-650-9207

Microdoc
2635 Capitol
Eugene, OR 97403
503-344-5335

Micro Electronic Systems, Inc.
3 Quarry Road
Brookfield, CT 06804
203-775-1440
800-243-7254

Micro Mart, Inc.
159 State Road
Buzzard's Bay, MA 02532
508-833-2225
Fax: 508-888-2157

Micro Medics
6625 Jarvis
Niles, IL 60714
708-647-1010
800-678-5300

Micron Meters
4509 Runway Street
Simi Valley, CA 93063
805-522-0683
800-638-3770
Fax: 805-522-1568

Micro Semi
Power Technology Components
2830 S Fairview Street
Santa Ana, CA 92704-5948
714-979-8220
Fax: 714-557-5989

Micro 2000
1100 East Broadway 3rd Floor
Glendale, CA 91205
818-547-0125
800-864-8008
Fax: 818-547-0397

Microwave Filter Company, Inc.
6743 Kinney Street E.
East Syracuse, NY 13057
800-448-1666
Fax: 315-463-1467

Mid America Company
2309 South Archer
Chicago, IL 60616

Miller-Stephenson Chemical Co.
George Washington Highway
Danbury, CT 06810
203-743-4447
800-992-2424
Fax: 203-791-8702

Mindshare, Inc.
2202 Buttercup Drive
Richardson, TX 75082
214-231-2216
Fax: 214-783-4715

Minitool, Inc.
634 University Ave.
Los Gatos, CA 95030-4416
408-374-1585

Minuteman UPS
P.O. Box 815-188
Dallas, TX 75381
214-446-7363
800-238-7272
Fax: 214-446-9011

M.I. Technologies
3310 E. Peterson Road
Troy, OH 45373
513-335-4560
Fax: 513-339-6344

Mitsubishi Electronics America
5665 Plaza Drive
PO Box 6007
Cypress, CA 90630-0007
714-220-2500
800-553-7278
Fax: 800-825-6655

Module Exchange
706 Space Way
Duncanville, TX 75137
214-298-1212
800-632-6637
Fax: 214-283-1778

Monitech
46 Graphic Place
Moonachie, NJ 07074
800-332-9349
Fax: 201-933-5301

Monroe Electronics, Inc.
100 Housel Ave.
Lyndonville, NY 14098
716-765-2254
800-821-6001
Fax: 716-765-9330

Montgomery Ward
1 Montgomery Ward Plaza
Location 4S
Chicago, IL 60671
312-467-3248
Fax: 312-467-2731

Montgomery Ward
National Parts Center
5750 McDermott Ave.
Berkeley, IL 60163
800-323-1965
Fax: 800-215-3767

Moody Tools, Inc.
42-60 Crompton Ave.
East Greenwich, RI 02818-0230
401-885-0911
800-TOOL-INC
Fax: 401-885-4565

Moore Business Products
3901 Morse
Denton, TX 76205
817-566-8646

Mouser Electronics*D
2401 Highway 287 N.
Mansfield, TX 76063
817-483-4422
800-346-6873
Fax: 817-483-0931

M-Test Equipment
P.O. Box 460220
San Francisco, CA 94146-0220
415-882-4100
800-334-4293
Fax: 415-882-1988

Mueller Electric Company
1583 E. 31st St.
Cleveland, OH 44114-4354
216-771-5225
800-955-2629
Fax: 216-771-3068

Multicore Solder
1751 Jay Ell Drive
Richardson, TX 75081
214-238-1224
Fax: 214-437-0288

Multidyne
191 Forest Ave
Locust Valley, NY 11560
516-671-7278
800-488-8378
Fax: 516-671-3362

Multiplex Technology, Inc.
3200 East Birch Street
Brea, CA 92621-6258
714-996-4100
800-999-5225
Fax: 714-996-4900

Multiverse Communications
148 West 77th Street, Suite 3A
New York, NY 10024
704-522-6183

M-USA Business Systems, Inc.
15806 Midway Road
Dallas, TX 75244
214-386-6100
Fax: 214-404-1957

N

National Advancement Corp.
2730-J South Harbor
Santa Ana, CA 92704
714-754-7110
800-832-4787
Fax: 714-754-7166

Nat'l Assoc. of Svc Dealers
Division of NARDA
10 E 22nd St
Lombard, IL 60148
708-953-8950
800-621-0298
Fax: 708-953-8957

National Parts Depot
31 Elkay Drive
Chester, NY 10918
914-469-4800
Fax: 914-469-4855

National Instruments
6504 Bridge Point Parkway
Austin, TX 78730-5039
512-794-0100
800-433-3488
Fax: 512-794-8411

NATM
1 Penn Plaza
New York, NY 10119
212-239-7222

NCM Electronics
1500 Wyatt Drive, Suite 9
Santa Clara, CA 95054
408-496-0290
Fax: 408-496-0388

NEC Technologies, Inc.*D
1255 Michael Drive
Wood Dale, IL 60191
708-860-9500
800-366-3632

Nederman, Inc.
6100 Hix Road
Westland, MI 48185
313-729-3344

Company mailing addresses

Neptune Electronics
PO Box 245495
Brooklyn, NY 11224
800-242-5556
Fax: 800-239-6349

NESDA
2708 W. Berry
Fort Worth, TX 76109
817-921-9061
Fax: 817-921-3741

Network Technologies Inc.
1275 Danner Drive
Aurora, OH 44202
216-562-7070
800-742-8324
Fax: 216-562-1999

P.K. Neuses, Inc.*D
1401 Rohlwing Rd.
Rolling Meadows, IL 60008
708-253-6555
Fax: 708-253-6652

M.M. Newman Corp.
24 Tioga Way
PO Box 615
Marblehead, MA 01945
617-631-7100
Fax: 617-631-8887

Newport Electronics, Inc.
2229 South Yale Street
Santa Ana, CA 92704-4426
714-540-4914
800-639-7678
Fax: 714-546-3022

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

Nintendo America
4820 150th Avenue NE
Redmond, WA 98052
206-882-2040

Nippon Shokuhin Sangyo USA Ltd
861 Hinkley Rd
Burlingame, CA 94010
415-697-1558
800-366-4677
Fax: 415-697-2890

Northeast Electronics Inc.
6 Wilkins Drive #207
Plainville, MA 02762
508-699-6935
Fax: 508-695-9654

Northstar Matrix: Serv
7101 31st Avenue N
Minneapolis, MN 55427
612-591-0009
800-969-0009
Fax: 692-591-0029

NRI Training for Professionals
McGraw-Hill Continuing Ed Ctr
4401 Connecticut Avenue NW
Washington, DC 20008

NRI School of Electronics
4401 Connecticut Ave., N.W.
Washington, DC 20008
202-244-1600
Fax: 202-244-2047

NTE Electronics, Inc.
44 Farrand Street
Bloomfield, NJ 07003
201-748-5089
800-631-1250
Fax: 201-748-6224

Nu-Concept Systems
P.O. Box 587
Colmar, PA 18915
215-822-8400
800-762-4278
Fax: 215-822-1427

Nutronix Inc.
P.O. Box 77103
Sterling Heights, MI 48077
313-726-1278
Fax: 313-726-9150



Odem, Inc.
Instrumentation Division
PO Box 666
Ephrata, PA 17522
717-738-2330

The Ogment Group
PO Box 781
Lafayette, CA 94549
415-284-7372
415-284-4142

O.K. Industries, Inc.
4 Executive Plaza
Yonkers, NY 10701
914-969-6800
800-523-0667
Fax: 914-969-6650

Oldaker Corp.
301 N. Main St.
Dunkirk, OH 45836
419-759-3551
Fax: 419-759-3312

Omega Engineering, Inc.
One Omega Drive
PO Box 4047
Stamford, CT 06907-4047
203-359-1660
800-826-6342
Fax: 203-359-7990

Omnitron Electronics*D
280 North Midland Ave.
Saddle Brook, NJ 07662
201-703-9800
800-379-6664
Fax: 201-703-9804

On-Line Power
5701 Smithway St.
Commerce, CA 90040
213-721-5017
800-227-8899
Fax: 213-721-3929

Ontrack Computer Systems
6321 Bury Drive
Eden Prairie, MN 55346
612-937-1107
800-752-1333
Fax: 612-937-5815

Ontrack Data Recovery
6321 Bury Drive
Eden Prairie, MN 55346
612-937-5161
800-872-2599
Fax: 612-937-5815

OPTOelectronics Inc.
5821 NE 14th Avenue
Fort Lauderdale, FL 33334
305-771-2050
800-327-5912
Fax: 305-771-2052

ORA Electronics
9410 Owensmouth Ave.
Chatsworth, CA 91311
818-772-2700
Fax: 818-718-8626

Orion Instruments, Inc.
1376 Borregas Ave
Sunnyvale, CA 94089-1004
408-747-0440
800-729-7700
Fax: 408-747-0688

OTI International
319 North Main Street
PO Box 194
West Point, NE 68788
402-372-5650



PACE, Inc.
9893 Brewers Court
Laurel, MD 20723-1990
301-490-9860
Fax: 301-498-3252

Pacer Industries, Inc.
1450 First Ave.
Chippewa Falls, WI 54729
715-723-1141
800-283-1141
Fax: 715-723-7890

Panamax, Inc.
150 Mitchell Blvd.
San Rafael, CA 94903
415-499-3900
800-472-5555
Fax: 415-472-5540

Panasonic Industrial Co.
Two Panasonic Way
Secaucus, NJ 07094
201-348-7000

PanaVise Products
1485 Southern Way
Sparks, NV 89431
702-353-2900 EXT 19
800-759-7535
Fax: 702-353-2929

Panson*D
180 & Maple Ave.
PO Box 2003
Pinebrook, NJ 07058
800-225-5229
Fax: 800-332-3922

Parts Express Int'l Inc.
340 East First Street
Dayton, OH 45402
513-222-0173
800-338-0531
Fax: 513-222-4644

Parts Port
230 Bollingbrook St.
Petersburg, VA 23803
804-733-0591
800-253-0515
Fax: 800-253-5640

Patco Service, Inc.
2515 Glencoe Road
Baltimore, MD 21234
301-444-4010

PC Instruments Incorporated
9261 Ravenna Road, Bldg B11
Twinsburg, OH 44087
216-963-0800
Fax: 216-425-1590

PC Service Source*D
1221 Champion Circle, Ste 105
Carrollton, TX 75006
214-406-8583
800-727-2787
Fax: 214-406-9081

PD Software
7320 Louetta Rd
Spring, TX 77379
713-370-0600

The Peak Technologies Group
8990 Old Annapolis Road
Columbia, MD 21045
410-992-9922 X5410
800-950-6372

JC Penney
National Parts Center
6840 Barton Road
Morrow, GA 30260
404-961-8400

PerfectData Corporation
110 West Easy Street
Simi Valley, CA 93065
805-581-4000
Fax: 805-522-5788

Peripheral Parts Support
219 Bear Hill Road
Waltham, MA 02154
617-890-9191
Fax: 617-890-7767

Perma Power Electronics, Inc.
5601 Howard Ave.
Niles, IL 60714
312-763-0763
Fax: 312-763-8330

Pfanstiehl Corp.
3300 Washington St.
Waukegan, IL 60085
708-623-1360
800-323-9446
Fax: 708-623-9107

Philips Consumer Electronics
Service Parts
907 Snapp Ferry Rd.
Greeneville, TN 37744-0967
800-851-8885
Fax: 800-535-3715

Philips ECG
2001 West Blue Heron Blvd
Riviera Beach, FL 33404
407-881-3308
Fax: 206-332-7253

Philips ECG
Baldwin Green Common #109
Woburn, MA 01801
617-932-9070

Philips ECG
1025 Westminster Drive
Williamsport, PA 17701
717-323-4691
800-526-9354
Fax: 717-323-4691

Philips ECG Company
38 State Street, Room 213
PO Box 730
Seneca Falls, NY 13148
315-568-5875
Fax: 315-568-4492

Philips Service Company
Old Andrew Johnson Highway
PO Box 555
Jefferson City, TN 37760
615-475-0329
Fax: 615-475-0258

Company mailing addresses

Philips Technical Training
Service Co.
P.O. Box 555
Jefferson City, TN 37760
615-475-0044
Fax: 615-475-0221

Phitek Power Corp.
4320 Sweet Rd., Unit B
Blaine, WA 98230-9110
360-332-7252
800-727-4877
Fax: 360-332-7253

Pioneer Research
1745 Berkeley St.
Santa Monica, CA 90404
310-829-6751
800-233-1745
Fax: 310-453-3929

Planned Products
303 Potrero Street, Suite 53
Santa Cruz, CA 95060
408-459-8088
Fax: 408-459-0426

Plato Products, Inc.
18371 Railroad Street
City of Industry, CA 91748
818-965-8044
800-423-4510
Fax: 818-965-8960

Platt Luggage, Inc.
4051 W. 51st St.
Chicago, IL 60632
312-838-2000
800-222-1555
Fax: 312-838-2010

Plaza Electronics
13268 66th Street N.
Largo, FL 34643
813-531-5484
800-531-5484
Fax: 813-530-1821

Polaris Div. of UXL Corp.
108-02 Otis Ave.
Corona, NY 11368
718-271-5200
Fax: 718-271-5738

J.S. Popper, Inc.
200 Liberty Street
PO Box 412
Little Ferry, NJ 07643
201-641-3252

Portasol, Inc.
3129 Chaucer Drive
Charlotte, NC 28210-4818
704-543-6239
Fax: 704-543-6839

Powercet Corporation
2700 Augustine Dr., Ste 178
Santa Clara, CA 95054
408-988-1346
Fax: 408-988-4869

PowerTronics
143 Raymond Road
PO Box 735
Candia, NH 03034
603-483-5876
800-746-9586
Fax: 603-483-5938

Prelco Electronics
605 Chestnut St.
Union, NJ 07083
908-851-8600
Fax: 908-686-4656

Premium Parts + Electronics Co
W9390 State Road 59
PO Box 28
Whitewater, WI 53190-0176
414-473-2151
800-558-9572
Fax: 800-887-2727

Prentice Hall, Inc.
113 Sylvan Avenue, Rte 9W
Englewood Cliffs, NJ 07632
201-592-2348

Prentice Hall Computer Publish
11711 N College Ave Suite 140
Carmel, IN 46032
317-571-3489
Fax: 317-573-2583

Prime Technology, Inc.
International Insts. Div.
Twin Lakes Rd PO Box 185
North Branford, CT 06471
203-481-5721
Fax: 203-481-8937

Princeton Computer Support
5 Crescent Avenue
PO Box 787
Rocky Hill, NJ 08553
609-921-8889
800-682-6158
Fax: 609-921-7693

Print Products International
8931 Brookville Rd.
Silver Spring, MD 20910
301-587-7824
800-638-2020
Fax: 800-545-0058

ProAmerica
959 E. Collins
Richardson, TX 75081
800-888-9600
Fax: 214-690-8648

Probe Master, Inc.
215 Denny Way
El Cajon, CA 92020
619-258-7412
800-772-1519
Fax: 619-258-7413

Production Devices
215 Denny Way
El Cajon, CA 92020
619-258-7303
800-824-4226
Fax: 619-258-1753

Professional Business Systems
490 W. Arrow Highway, Suite F
San Oiams, CA 91733

Progressive Electronics
325 South El Dorado
Mesa, AZ 85202
602-966-2931
800-528-8224
Fax: 602-967-8602

Projector Recorder Belt
P.O. Box 176
Whitewater, WI 53190-0176
414-473-2151
800-558-9572
Fax: 800-887-2727

Prostat Corporation
PO Box 1225
Elmhurst, IL 60126
708-530-8305
Fax: 708-530-8570

H.C. Protek
154 Veterans Drive
Northvale, NJ 07647
201-767-7242
Fax: 201-767-7242

PTS Corporation
5233 South Highway 37
PO Box 272
Bloomington, IN 47402
812-824-9331
800-844-7871
Fax: 812-824-2848



Quantum Data
2111 Big Timber Road
Elgin, IL 60123
708-888-0450
Fax: 708-888-2802

Quasar
50 Meadowlands Parkway
Secaucus, NJ 07094
800-447-4700



Racal Instruments Inc.
4 Goodyear Street
Irvine, CA 92718
714-859-8999
800-722-2528
Fax: 714-859-2505

RAG Electronics Inc.
Box 2450 Turquoise Circle
Newbury Park, CA 91320
805-498-9933
800-732-3457
Fax: 805-498-3733

RAM Software Enterprises
3434 Bren Lee Court
Indianapolis, IN 46227-7905
317-881-0690
800-323-9654

Ramsey Electronics Inc.
793 Caning Parkway
Victor, NY 14564
716-924-4560
Fax: 716-924-5555

Rawn Co. Inc.
Subsidiary of Triangle Corp.
P.O. Box 9
Spooner, WI 54801
715-635-8711
800-826-6791
Fax: 715-635-2200

Read/Right Products Division
The Texwipe Company
650 East Crescent Avenue
Upper Saddle River, NJ 07458
201-327-9100 X315
800-327-1237
Fax: 800-569-3600

Recoton Corporation
46-23 Crane Street
Long Island City, NY 11101
718-392-6442
800-223-6009
Fax: 718-784-1080

Resonance
5173 Waring Road, Suite 115
San Diego, CA 92120
619-287-3348

Research Specialists Inc.
1816 Settlers Reserve Oval
Westlake, OH 44145
216-871-8909

Reset, Inc.
49 Strathearn Place
Simi Valley, CA 93065
805-584-4900
Fax: 805-583-2900

The Rex Company
12311 Loraleen St.
Garden Grove, CA 92641
714-530-0330
Fax: 714-530-8577

RF Parts
435 S Pacific St
San Marcos, CA 92069
619-744-0700

RG Software, Inc.
6900 E. Camelback Rd, Suite630
Scottsdale, AZ 85251
602-423-8000

RGD Electronics
107 Trumbull St
Elizabeth, NJ 07206
908-354-2300

Richardson Electronics*M/D
40W267 Keslinger Road
LaFox, IL 60147
708-208-2200
800-348-5580
Fax: 708-208-2550

Richmond Static Control Svcs
3101 E. Alejo Rd.
Palm Springs, CA 92262
619-325-3211
800-538-0750
Fax: 619-322-2073

Ripley Company
Miller Tool Division
46 Nooks Hill Rd.
Cromwell, CT 06416
203-635-2220
800-528-8665
Fax: 203-635-3631

Rite Off
105 Park Ave.
Seaford Industrial Park
Seaford, DE 19973
302-628-2100
800-645-5863
Fax: 302-628-2110

R&K Supply Co.
1854 Hinkley Hills Rd.
Hinkley, OH 44233
216-278-7018
800-362-6780
Fax: 216-278-2434

RNJ Electronics Inc.*D
805 Albany Ave.
PO Box 528
Lindenhurst, NY 11757
516-226-2700
800-645-5833
Fax: 516-226-2770

Rogers Anti-Static Chemicals
120 W. Madison, Room 1118
Chicago, IL 60602
312-276-0665
Fax: 312-276-4371

RS Electronics*D
34443 Schoolcraft
Livonia, MI 48150
313-525-1155
800-366-7750
Fax: 313-525-1184

Company mailing addresses

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2130 Townline Road
Peoria, IL 61615-1560
800-662-0504
Fax: 309-691-2271

Russell Industries
3000 Lawson Ave.
Oceanside, NY 11572
516-536-5000
Fax: 516-674-5747



Sage Data Systems
Division of America West C&E
1900 Elk St.
Rock Springs, WY 82901-4005
307-382-5663
800-542-9378
Fax: 307-382-7323

Salen Enterprises*^D
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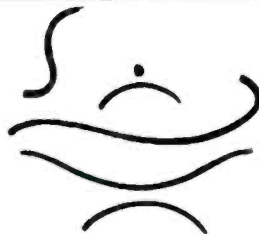
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Books

Personal Computer Interfaces, By Michael Hordeski, McGraw-Hill, 350 pages, 125 illus., \$34.95 paperback, \$55.00 hardcover.

With the ever-expanding array of products and peripherals available today from different manufacturers, computer interfacing often becomes a must for everyone from the electronics engineer to the more casual computer user.

Here is the first book that shows readers how to do it, regardless of the particular PC equipment or desired interface. Covering both hardware and software, this ready reference provides clean, step-by-step guidance for interfacing using easily obtained products—and gives a broad range of readers the necessary tools to solve any manner of PC interfacing problem.

Hordeski is an independent consultant specializing in computer and electronic systems. He is the author of many books on computers, microcomputers, and process control.

McGraw-Hill Inc.,
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The Alarm, Sensor, and Security Circuit Cookbook, By Thomas Petruzzellis, TAB Books, 304 pages, 232 illus., \$17.95 paperback, \$30.00 hardcover.

Useful for professionals in the field and an effective learning tool for students and experimenters, *The Alarm, Sensor, and Security Circuit Cookbook* contains complete circuit diagrams and building instructions for a wide range of creative sleuthing applications. All the designs are tested and proven effective in real-world alarm, sensor, and security equipment.

Among the circuits highlighted are a multi-purpose high-gain amplifier, temperature and pressure sensors, vibration and pyroelectric sensors, smoke and toxic gas detectors, tachometer/speed gauges, a remote audio/video security and surveillance system, door and window alarms, motion and impact detectors, and tone signaling sensors.

Petruzzellis, a professional electronics technician, designs, builds, and maintains many different types of electronic devices involving sensors.

TAB Books, McGraw-Hill Inc.,
Blue Ridge Summit, PA 17294-0850

Start Your Own Computer Repair Business, By Linda Rohrbough and Michael F. Hordeski, Windercrest, 304 pages, 10 illus., \$32.95 paperback.

The demand for PCs continues to zoom, and along with this increasing use comes the need for troubleshooting and repair technicians. In this nuts-and-bolts manual, technically oriented men and women will learn how to start their own personal computer repair business based on advice from those who have successfully accomplished just that.

Covering all aspects of setting up a home-based operation, this guide includes information on everything from computer parts and tools to pricing and advertising. It covers areas of specialization, profiles auxiliary services, and even predicts where future opportunities may lie. The bundled shareware disk includes a collection of diagnostic tools. The first book on starting a PC repair enterprise, this guide could help launch many successful PC servicing business ventures during the 90s.

Rohrbough is LA Bureau Chief for Newsbytes News Network. Hordeski is an author, lecturer and consultant.

Windercrest, McGraw-Hill Inc.,
Blue Ridge Summit, PA 17294-0850

Easy PC Maintenance and Repair Second Edition, By Phillip Laplante, Windercrest, 208 pages, 103 illus., \$17.95 paperback, \$27.95 hardcover.

For anyone who owns a computer, this guide puts at their fingertips simple strategies for the maintenance, troubleshooting, repair, and upgrading of their IBM PCs, XTs, ATs, and clones. Readers will be able to prolong the life of their computer, as well as save money on repairs, lost data, downtime and other problems, with the help of the book's step-by-step instructions.

Now covering Windows and DOS 6.0, this handbook contains new material on topics such as CD-ROM drives, tape backups, floptical disks, multimedia computing configurations, sound cards, scanners, local area network cards, hard disk technologies like ISA and EISA, 486 PCs, and Pentium technology.

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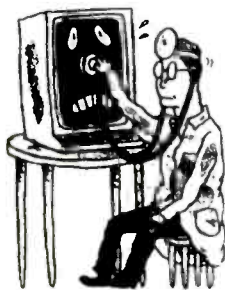
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News (from page 4)

holidays and weddings, vacations, and the growth of their children, confirming what the industry has known all along—camcorders are purchased primarily with family use in mind.

Although the majority of respondents said they did not own TV/VCR combinations, those that said they did noted that they purchased their units primarily because they wanted or needed an additional VCR and were looking for a unit that was portable.

EIA is the 70-year-old Washington, D.C.-based trade association representing all facets of electronics manufacturing. EIA's Consumer Electronics Group represents U.S. manufacturers of audio, video, home office, home automation, mobile electronics and accessory products, as well as assistive devices for people with disabilities.

CES Specialty Audio & Home Theater announces June 17-19 dates in Chicago

The Electronic Industries Association has announced that the premiere of the new CES Specialty Audio & Home Theater trade show will take place on Saturday, June 17, through Monday, June 19, at Chicago's Palmer House. Two major high-end audio associations have formally endorsed the Show.

The Show will be sponsored, managed and produced by the Electronic Industries Association's Consumer Electronics Group (EIA/CEG). Two other associations who have endorsed the launch of the new trade show are the Academy for the Advancement of High End Audio (AAHEA) and the Associazione per la Promozione dell'Alta Fedeltà (APAF), Italy's high-end distributors association.

AAHEA President Chris Browder says, "The Academy's Board of Governors voted to formally endorse this show, and I commend their action. As the 'voice of high end audio,' the Academy should take a positive and active role in creating the best possible arena for doing business and prospering as an industry and we think this CES-sponsored trade show is the best venue."

APAF President Giovanni Faccendini

adds, "A CES Show, such as proposed, will have a more beneficial effect on our industry since it will concentrate solely on quality audio and home theater products. Chicago is an ideal location, since it is very easy to travel to from most cities—including Milan and Rome—and a one-site location is very convenient."

Staged as a stand-alone trade show, CES Specialty Audio & Home Theater will provide a concentrated forum for the market with product-specific educational sessions and exhibits. The Palmer House location was chosen due to the nature of the exhibits, which require isolated listening rooms.

The grassroots campaign to develop the new show was headed by EIA/CEG Specialty Audio Subdivision chairperson Kathy Gornik of Thiel and Conrad-Johnson Design's Lew Johnson following the 1994 International Summer Consumer Electronics Show, the last-ever Summer CES. When originally announced the show was called *CES Specialty Audio & Video*, the new name was chosen to better reflect the full scope of the show's focus.

"Exhibitors in specialty audio had one of their best shows ever at the 1994 Summer Consumer Electronics Show, and that led us to believe that this group would benefit from a focused show dedicated to our segment of the industry," said Kathy Gornik, president of Thiel. "CES Specialty Audio & Home Theater will attract our buyers because it will have a different character without the distraction of a larger trade show, and we are certain the buyers will enjoy the relaxed atmosphere. We want to work with the EIA and the CES staff because they have consistently provided us with the buyers, international distributors and the media exposure that we can't find anywhere else."

Gornik added, "I think this is a great opportunity for everyone involved because right now we have the flexibility to make it into anything we want. I firmly believe the success and quality of the Show will be determined by the level of participation, and with more than 65 companies committed, we are off to a great start."

Electric Motors

(from page 11)

The bottom line

Lots more could be said about motors, how they are designed and built, and the details of how they work, but most of it is unnecessary for our purposes. And there are also lots of other types of motors we could talk about. The ones mentioned here are just some of the more common ones we see in consumer electronics.

If you have been doing consumer service for a while you probably know that when it comes right down to it, troubleshooting is just basically common sense. But, to apply that common sense, it helps to know as much as you can about the technology you're working on. This is true of motors, too. You may be able to get by without knowing exactly how motors work, but it's interesting and satisfying to be able to figure out just what a problem was in the first place. After all, isn't that what originally got us into this field, an interest in how technology works? ■



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[Continued from page 67]

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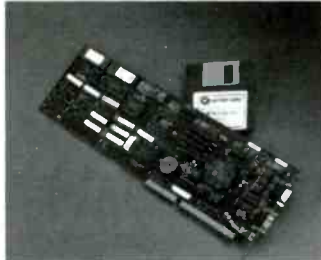
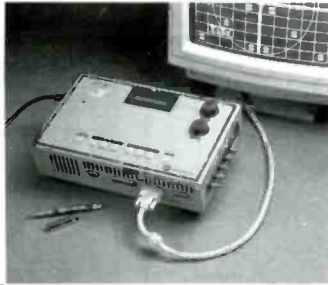
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Service manual or schematic for a 1985 TMK 19" color TV Model 1939CR1, will pay for copy or copy and return. **Contact: John**, 4190 Bonway Drive, Pensacola, FL 32504 or (904) 477-6736.

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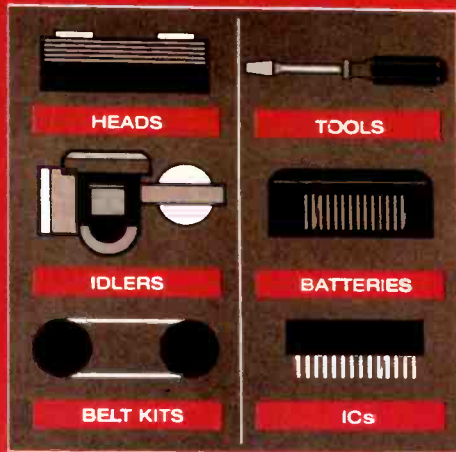
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