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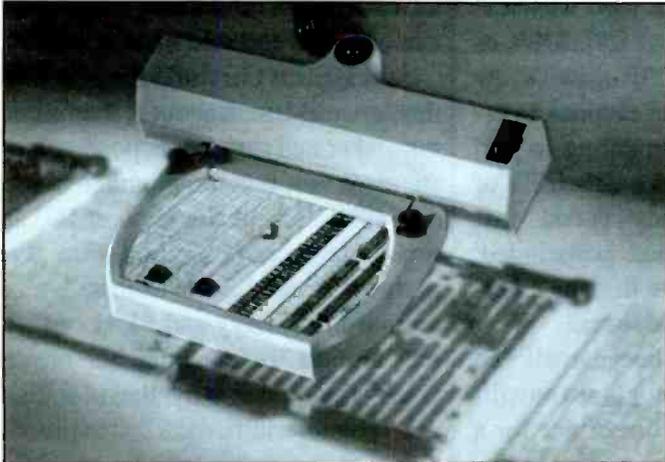


* The TVA92 is a companion unit to the VG91 Universal Video Generator.

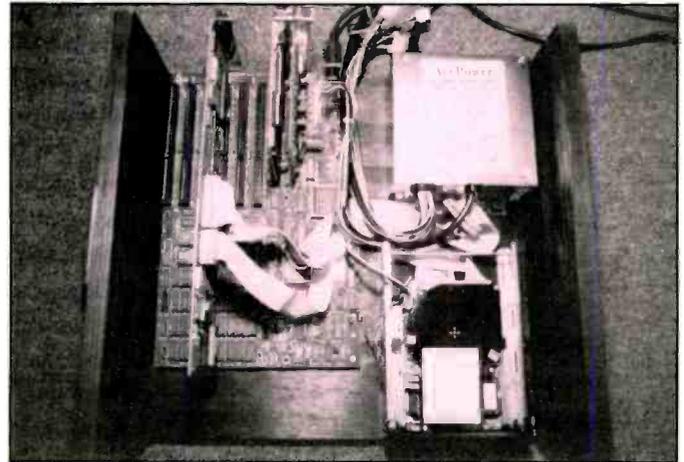
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Circle (32) on Reply Card



page 14



page 16

FEATURES

- 6 Computer software for service center management**
By The ES&T Staff
As computers and software become more powerful, and their prices stay the same or decline, it makes sense for more service centers to automate. Check out the capabilities of some of today's service center management software in this article.
- 11 Shedding light on productivity**
Many of today's service centers are still as dim and dingy as Bob Cratchit's office in Dickens' *A Christmas Carol*. Reading this article may give you some ideas on brightening your workplace.
- 14 Proper lighting for magnification**
Good lighting and magnifiers can make tiny components and circuit traces visible. But don't go out and buy the first magnifying lamp you see. First, read this article for some tips on selecting one.
- 16 Constructing a personal computer test fixture**
By John Kull
Technicians have been using TV test jigs for years. Now learn how to do

the same thing when you're servicing personal computers.

- 20 Electronic tuner theory and troubleshooting—Part 2**
By Steve Babbert
In a previous article, this author discussed electronic tuner theory. Read this article for some specific tips on servicing them.
- 22 Coping with hard drive problems—Part 3**
By Stephen J. Bigelow
Hard drive problems may be caused by hardware malfunctions or they may be the result of incorrect software operation. This article segment looks at hard disk problems that may be caused by software and suggests ways of dealing with them.

ADVERTISING SUPPLEMENT

- 28 Distributors' showcase**
A distributor is kind of like a specialized hardware store for service centers. It carries the tools, test equipment, supplies and replacement parts you need to diagnose a product and restore it to proper operation. This showcase features descriptions, written by the distributors, of what they offer. It's intended as an aid to help servicers who read **ES&T** decide which distributor is best for their particular needs.

DEPARTMENTS

- 2 Editorial**
- 4 News**
- 27 Test Your Electronics Knowledge**
- 33 Profax**
- 56 What Do You Know About Electronics?**
Boltzmann's constant
- 58 Computer Corner**
Making room on the hard disk
- 60 Books**
- 62 Business Corner**
Leadership: A rare and valuable commodity—Part 3
- 63 ES&T Calendar of Events**
- 64 Products**
- 67 Literature**
- 69 Photofacts**
- 70 Classified/Readers' Exchange**
- 72 Advertisers' Index**

ON THE COVER

More service centers are relying on service management software to track customers and products through the service process, print invoices, do billing and manage the accounting. The software continues to get more powerful and easier to use. (*Photo courtesy of Sencore.*)

What's it worth? The sequel

In an editorial in the August 1994 issue, I wondered out loud why it is that people will lay out \$50, \$100, or even more than \$1,000 to spend a few hours listening to their favorite entertainer sing, but be unwilling to part with a few dollars to have their TV or VCR serviced. They spend that money to be entertained, I concluded, because they perceive that the entertainment is worth it to them.

On reflection, it became all too obvious why many people are unwilling to spend money on service for a piece of consumer electronics equipment: the replacement cost of buying a new one. Why would anyone who is possessed of all his faculties choose to spend, say, \$150 to have a five-year-old TV set fixed when for another \$150 or so he can buy a brand new set with more features, a better picture and a new product warranty.

Here's another story that brings up the question of "what's it worth." I was talking to a friend the other day. Gary saw a trickle of water coming from under the kitchen sink. He investigated and found that his garbage disposer had rusted through and every time someone in the family turned on the kitchen faucet water leaked through it.

Gary's first thought was to call a plumber. He makes absolutely no pretense at being a handyman. Besides, plumbing is unpleasant work, can require special tools and techniques, and amateur work can often lead to worse leaks.

When he called the plumber, explained the situation, and asked for an estimate of the cost to install a standard-quality disposer, the person at the other end quickly responded with a quote of \$400. Gary had expected to hear a quote of around \$200, figuring that price to be somewhat inflated, but worth it not to get his hands dirty.

The \$400 quote almost knocked Gary off his feet, but he managed to maintain his composure enough to

ask how much he would be charged to install a premium unit. The reply came back without hesitation: \$600.

At that point Gary told the plumber that he would think about it, then went out and priced garbage disposers. The standard unit that the plumber wanted \$400 to install cost around \$50 at retail. The premium unit that the plumber wanted \$600 to install was around \$100. Gary and I kicked that one around for a while, but never could figure out why the plumber asked for an additional \$200 to install a unit that cost him maybe an additional \$50, especially when it seemed that the \$350 or so that the plumber asked for to install the standard unit was already exorbitant.

In this case, the plumber lost the business. Gary concluded that it wouldn't be very difficult for him to replace the unit and went ahead and did it himself with a little help from his son.

One must conclude, though, that many homeowners, not knowing the true cost of a garbage disposer, or being incapable of doing even the simplest of plumbing chores themselves, have no choice but to pay that exorbitant amount to get a simple installation performed.

I don't know of a single consumer electronics service company that would take advantage of customers by overcharging like that plumber (although we all know that there are a few unscrupulous servicers out there). But wouldn't it be nice if electronic servicers could at least charge what it's actually worth in terms of parts and labor to effect a repair, return a reasonable profit, and get the approval of the customer?

Maybe we all should have just become plumbers.

Mike Conrad Penner

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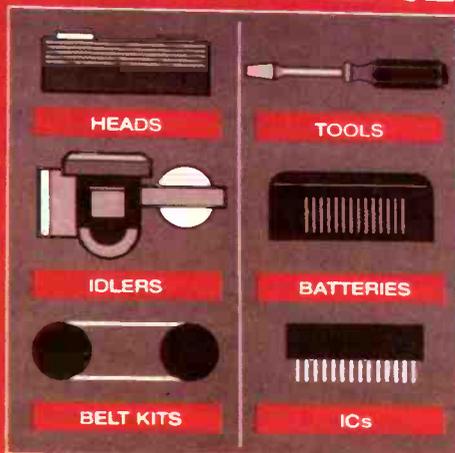
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Circle (93) on Reply Card

EIA applauds FCC on RBDS announcement

The Electronic Industries Association's Consumer Electronics Group (EIA) endorsed the announcement by the FCC that recommends FM radio broadcasters use Radio Broadcast Data Systems (RBDS/Smart Radio) technology to transmit Emergency Alert System (EAS) alerts in times of local or national emergencies. The EIA/CEG Executive Committee, which happened to be in Washington during the FCC announcement, immediately responded by providing up to \$500,000 in 1995 to promote RBDS to the American public.

The RBDS/Smart Radio technology, which was standardized under the aegis of EIA engineers in January 1993, allows broadcasters to transmit radio text and commands as digital data on an inaudible subcarrier. Individual radio stations purchase an RBDS/Smart Radio encoder for as little as just under \$2500.

This recommendation from the FCC should increase the likelihood that RBDS/Smart Radio's growth will accelerate by breaking the so-called "chicken-egg" circle (i.e., reluctance on the part of broadcasters to gear up for a new service because so little consumer hardware had been sold, and a corresponding reluctance on the part of consumers to buy new hardware in the absence of programming in the new media).

In addition to emergency alerting, RBDS/Smart Radio can also allow radio listeners to see the call letters of the station; tune by program format, for instance Top 40, Country, Sports, or Oldies; show song titles and artist names; switch to alternate frequencies for continuous reception of network programming or long trips, etc.; hear automatically announced traffic bulletins; obtain paging information and business and navigation data.

Broadcasters, for example, would be able to send, and consumers receive, text transmission, enabling radio stations to identify themselves by call letters and frequency. Broadcasters could also convey information about the recording artist and song/album title, and feed clock synchronization signals.

Moreover, broadcasters could interrupt in-car CD and cassette players with traf-

fic or emergency alerts. Another practical application would allow consumers to scan the car or home radio dial for a particular program format (e.g., "Soft-Rock"), which could be especially useful on road trips, but equally useful at home.

As the FCC has recognized, RBDS/Smart Radio will help to make possible the new-generation system that not only would transmit information when people are listening to their radios, but actually turn on radios to alert consumers to a potential disaster.

While many car radios will feature an eight-character digital display, some home RBDS/Smart Radio receivers will offer a 64-character display, making possible the transmission of stock quotes and other financial information, sports scores and statistics, weather reports, and even brief commercials.

A number of manufacturers and marketers, including Deco, Denon, Goldstar, Grundig, International Jensen, Panasonic, and Philips, already make or distribute RBDS/Smart Radio products.

RBDS/Smart Radio was developed for the United States and Canada by the National Radio Systems Committee (NRSC), an inter-industry panel including representatives of both EIA and the National Association of Broadcasters (NAB). The NRSC develops standards for technologies affecting both transmitting stations and radio receivers.

The RBDS effort is based on the Radio Data System (RDS), which has been in operation within the European Community since 1984.

Electronics installers association helps sell home systems to consumers

To educate consumers about custom installation of home theaters, multi-room entertainment systems, and other residential electronics, the Custom Electronic Design and Installation Association (CEDIA) has produced a full-color sales brochure for use by its members. Entitled, "Home Entertainment...At Your Fingertips," the new literature employs striking photography and easy-to-understand language to build excitement and demand for advanced home electronic systems. The brochure is available for immediate delivery, and CEDIA members can have their logo and address imprinted on the piece.

"Members will be able to use this as their company brochure, for direct mail solicitation, or as a complement to their existing sales materials," said Jeff Zemanek, president. "It will be especially useful to smaller companies which don't have the means to produce their own color sales literature."

Measuring 7" x 7" folded and opening to 28" x 7", the new brochure covers all aspects of home systems, including communications, security, lighting controls, and integrated systems. Media rooms and home theaters receive prominent attention, and consumers are reminded more than once that the selection of a professional, CEDIA-affiliated custom installer is their best guarantee of getting the system that meets their every expectation.

Further information, including pricing, can be obtained by contacting CEDIA at 1-800-CEDIA30.

Custom home theater installers expect business and customer satisfaction to grow

Home theater installation companies will continue to grow, possibly up to 20 percent, according to a recent survey of custom home theater installers. Respondents agreed that quality equipment and a quality custom installation combine to create the most satisfactory audio/video experience. The new study was commissioned by the Custom Electronic Design and Installation Association (CEDIA), a trade group of residential and commercial electronics contractors.

Conducted by National Marketing Research of California, the study revealed that the majority of custom installations are completed in homes with an average size of 5,600 square feet and an average number of 9.2 rooms. Usually, the systems are installed, in order of popularity, in the master bedroom, family room, living room/den, kitchen, master bath, dining room, and library.

Almost two-thirds of respondents reported that their largest custom installation job was \$50,000 or more; however, half the respondents reported that they would accept custom installation jobs totaling \$1,000 or less. Overall, respondents say that 75 percent of the billing

(Continued on page 72)

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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ES0495

Computer software for service center management

By Conrad Persson

Every type of work has its tedious aspects. No matter how interesting or fulfilling the job is during the best moments, at other times the person performing the work finds himself involved in the sheer drudgery of performing the supporting functions: usually the paperwork.

For example, people attend athletic functions, football, baseball, basketball, etc., to watch the athletes perform their magic. It's really entertaining to see a batter smack one out of the park, or to watch an outfielder make a dazzling play that robs the batter of the home run. It's fun to watch a great receiver make a difficult catch, or to watch a defender intercept it and race down the sidelines for a score.

What we don't see is the drudgery associated with these performances: the drills, studying the playbook hour after hour, working out with weights to increase strength and running to get in condition, and practice, practice, practice.

Every job is like that. The great musicians practice hour after tedious hour to become and stay great. Actors have to spend hours learning their lines and getting into costume before they ever mount the stage or walk in front of the camera.

Doctors, lawyers, police, congressmen, even the President of the United States, experience tedium in their jobs. So why should it be any different for a consumer electronics technician or manager.

For every minute spent hot on the trail of that elusive fault, and for every brief moment of exultation when the source of the problem has been located and the faulty unit fixed, there are hours spent researching part numbers, filling out warranty forms, and doing the paperwork necessary to avoid giving Mrs. Smith's TV to Mr. Jones.

Cutting down on the tedium

Those tedious tasks will always be there: someone has to fill out the invoice, order the paper towels, sweep the floor. But we live in an age of marvels, one in

Conrad Persson is editor of *ES&T*.



which a silent, ever-attentive servant can be called on to do some of the drudge work. That silent servant is called the computer. Anyone who is in an information-intensive profession, such as consumer electronics servicing, and who has applied a computer at work, knows that while it won't take away all the drudgery, it will handle a lot of it.

And it doesn't take a lot of thought to come to the conclusion that the drudge work is the part of the job that doesn't bring money into the service center. Restoring a TV to service, turning it over to the owner, and collecting the payment, either from the owner on a COD transaction or the manufacturer on a warranty transaction, pays the bills. The hours spent filling out warranty claim forms, product identification forms and claim checks, or writing up invoices doesn't directly bring a penny into the business.

Letting the software do the work

Thanks to the likes of IBM, DEC, Apple, Microsoft, and the hundreds of other computer hardware and software manufacturers, every service center can afford

to own a computer and the software to automate all of those tiresome, tedious tasks.

These days, a couple of thousand dollars, in the same ballpark as the cost of a good oscilloscope, buys a powerful computer with more than enough storage to take care of the data processing needs of any service center. A few hundred to a thousand or so dollars more buys software that will allow any service center to automate all of those paperwork tasks, from filling out the customer complaint form to generating the invoice.

Look around carefully

There is a lot of software available that can help in running a service center. Some of it is written specifically for the management of a service center by people who have managed such centers themselves. Some software is more general and can be used to track contacts of any kind.

Some programs are very general, but they are not for every one. For example, a highly motivated service manager with a good background in computers could write applications in database programs like dBase or Lotus, or even in one of the

programming languages like BASIC or C. Those applications could perform all the functions of the dedicated programs.

In fact, some of the programs listed at the end of this article are programs that were originally written for one service center and worked so well that they are now offered for sale to other centers. But the average service manager or technician who wishes to automate the service center really wants to buy a program, install it on the hard drive of the computer, and get started.

Finding the right program

For a technician or service manager who is thinking about automating, the best thing to do is to sit down, preferably in conference with everyone who has a stake in putting the operation of the center on a computer, and define what the computer must do. This requires an in-depth look at the service center operation, but it's a good idea to do this once in a while anyway. In many cases, businesses do many things that no one really thinks about, and it can be revealing to itemize every process.

Once the tasks to which the computer

is expected to be applied have been enumerated, someone needs to look at the budget to see how much can be earmarked for hardware and software.

Once the tasks and the budget have been established, it's time to contact one or several hardware and software suppliers and find out what's available. That's where an article like this comes in. At the end of the article is a list of companies that offer service center management and related software. Any of them would be delighted to provide interested service managers and technicians with information about their software, and many offer demonstration programs that the service center can experiment with to determine their usefulness.

Service center management

Software can vary considerably in its usefulness, depending on the particular needs and management style of the managers. So, before making a commitment to purchase a system, the buyer should compare the features and ease of operation of several packages.

Cost is another important consideration. The least expensive of these pro-

grams costs a few hundred dollars. The most expensive may cost several thousand dollars. As with any other product, the purchaser must weigh the product's features against the cost.

Many of the companies listed here offer demonstration programs, most of which will contain all the features of the actual software. This will enable you to determine if the product will meet your needs. The only limitation of demo packages is record storage. Typically, a demo will only let you store 10 or so transactions.

The following sections describe some of the tasks that a service center management software package will perform. Look at any package of interest carefully, not all of them will necessarily perform all of the tasks mentioned here.

Tracking/scheduling

As information is entered into the computer, the computer creates a job ticket and stores the information. This allows you to do several things:

- Easily handle customer phone inquiries. Just enter the customer's phone

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number or name and the job information appears on the screen.

- Instantly access a job's current status just by supplying the code number.
- Get detailed job status information.
- Maintain a complete history of each unit by serial number or by customer identification number.
- Call up a summary schedule that lets you see the whole day's schedule with a glance at the screen.
- Schedule on-site service by territory.
- Obtain a printout of both technician routing sheets and a management summary sheet.

Inventory management

The inventory program gives you indi-

vidual parts movement by month, cross reference data, prices, quantity, and a re-order report. By checking the movement record, you can adjust quantities ordered to make sure you have adequate inventory without accumulating an excess of slow-moving parts. By coupling this information with manufacturer's shipping time, a service center can order replacement parts early enough to cut down on back orders.

Invoicing

With some programs, you may enter repair descriptions and labor pricing ahead of time. The information is then on record, allowing the computer operator to automatically invoice by making number

selections for repair descriptions and labor prices. In addition, this program segment allows you to print both customer and NESDA or NARDA invoices and to automatically print post cards informing customers of the status of their unit.

Codes and tables

User-defined codes and parts pricing tables let you customize your system and speed up data entry. All the technician needs to do is press a special key to see the list of possible code entries. They include codes for unit types, brands, manufacturers, technicians, status of jobs (e.g., parts on order or estimate, customer approval, return shipping method, sales taxes, vendors).

Service management software companies

Active Software
1208 Apollo Way, Suite 507
Sunnyvale, CA 94086
408-732-1740
Fax: 408-732-1749

Advanced Technology Group
205 Regency Executive Park Dr., Ste. 306
Charlotte, NC 28217
704-521-8113
Fax: 704-521-9711

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

Astea International, Inc.
55 Middlesex Turnpike
Bedford, MA 01730
617-275-5440
Fax: 617-275-1910

Automated Systems, Inc.
4827 Pioneer Blvd.
Lincoln, NE 68506
402-489-2717
Fax: 402-489-2370

BGI Co.
50509 Hollyhock Rd.
South Bend, IN 46637
Phone/Fax: 219-277-8762

Cahill Electronics
160 Main Street, P.O. Box 568
Kingston, NH 03848
603-642-4292
Fax: 603-642-7941

Computer Transaction Systems
RepairWare
P.O. Box 56
North Weymouth, MA 02191
617-331-6968
800-332-6968
Fax: 617-331-6969

Core Software, Inc.
26303 Oak Ridge Drive
Spring, TX 77380
713-292-2177
Fax: 713-298-1492
713-298-1492

Creative Logics Corporation
17W755 Butterfield Road
Oakbrook Terrace, IL 60181
708-261-1833

Custom Data Associates
P.O. Box 10903
Baltimore, MD 21234
410-668-9594
Fax: 410-661-3942

DAYTACO
(Soft-Serve software)
757 North 22nd St.
Mesa, AZ 85213
Phone/Fax: 602-835-2243

Good-Lyddon Data Systems
6879 Sard Street
Rancho Cucamonga, CA 91701
714-980-4563

Great Atlantic Information Systems
P.O. Box 9132
Virginia Beach, VA 23450-9132
804-523-5501

Ideal Computer Systems
1320 Second Ave., SE
Cedar Rapids, IA 52403
319-362-2662
Fax: 319-362-4305

Magic Solutions, Inc.
180 Franklin Turnpike, 2nd Floor
Mahwah, NJ 07430
201-529-5533
Fax: 201-529-2955

Metrix, Inc.
20975 Swenson Drive
Waukesha, WI 53186
414-798-8560
Fax: 414-798-8573

Ogment Group
P.O. Box 781
Lafayette, CA 94549
510-284-7372
Message or Fax: 510-284-4142

Forms and reports

A service management software system can save time and money in several ways by doing much of the paperwork. First, a skilled technician will have to take less time away from repair work to do paperwork. Second, customer data only has to be entered once. After that, the computer will automatically generate the information in the proper format to match the different forms. Finally, the various computer-generated reports allow service center management to see where the money is going and how fast.

The following are some of the forms and reports available: management reports, such as daily work in process report, work completed not picked up, technician unit

report, technician productivity report, production detailing report, and job tracking/scheduling. Also available are invoicing reports, warranty and service literature information and inventory management.

Integrated software

Some service center software packages include more than one of these functions. For example, at least one software package includes modules for service center management, a symptom/cure module, a daily cash drawer module, and a time card module to keep track of technicians' time.

A caveat

A service management system won't make your business run any smoother all

by itself, any more than an oscilloscope will diagnose a problem in a product. It's a tool. You have to learn how to use it and teach other people in your business to use it. And you have to use the computer system consistently and correctly.

One other comment: These systems are probably not for every servicing facility. A low-end system, say, software that runs on your own PC, may cost several hundred to over a thousand dollars. A high-end software system for a large shop, or a software and hardware combination, may cost several thousand dollars. On the other hand, if a service center is large enough to use one of these systems, and the people who will use it are dedicated to making it work, the benefits may far outweigh the cost.

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

Plaza Electronics
RUSH Software
8800 Merrimoor Blvd.
Largo, FL 34647
813-392-9168

Premium Parts +
P.O. Box 28
Whitewater, WI 53190
800-558-9572
Fax: 414-473-4727

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

Rezteck
23342 Madero "D"
Mission Viejo, CA 90630
714-454-9204

Sencore
Service Center Manager
3200 Sencore Drive
Sioux Falls, SD 57107
800-736-2673 Ext. 238
Fax: 605-339-9374

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National Electronic Servicing Dealers
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Fax: 913-661-0220

ServiceWare Inc.
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ServiceWare Corporation
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Ottawa, Ontario
Canada K1G 4K1
613-521-7391
Fax: 613-521-5595

Servicing Systems
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Fax: 203-647-9124

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Fax: 714-553-1133

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Other software products

Contact management

TeleMagic
TeleMagic, Inc.
17950 Preston Rd., Suite 800
Dallas, TX 75252

This product is actually designed as a telemarketing tool. It allows the user to enter all actual company customers as well as prospects and to call up their records in a number of ways. When a record is on the screen, a push of a button dials the telephone. The program can be customized by the user to handle a number of types of forms, print labels, print lists of customers, and prospects in any of a number of categories.

Help desk software

Intellisystems
5250 Neil Road, Suite 110
Reno, NV 89502-6546
800-637-8400

This company manufactures a software product that doesn't fit into any of the categories discussed in the article, but it may be of interest to some service centers. It allows a service center to set up a com-

puter system so callers can get answers to many of their questions directly from a computer, without tying up a human.

Claims filing help system

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

This company doesn't fit any of the categories in this article, either. It acts as a data input for many manufacturers and for a number of functions. Once a manufacturer subscribes to this system, a specific data base can be created and continually maintained. Service centers can access this data and obtain information, as authorized by the subscribing manufacturer, on claims, parts availability and pricing, technical bulletins and more. A service center that wishes to access this system needs only a PC and the appropriate communications software. When the user connects with the central source mainframe, he instantly has access to all authorized information. According to the company, the screens are all menu-driven and easy to use, and on-line help is available. ■



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Shedding light on productivity

The key concern of any business, large or small, is productivity. We work at improving productivity by hiring the best people for the job, making certain those people are well-trained, and providing them with the best tools available within budget restrictions.

Nothing should be too difficult or expensive if it helps us get more work done faster by fewer people. If you agree, then look up at the ceiling. Is the lighting in your facility helping your workers do their jobs? In fact, careful scrutiny may show that the lighting now in place might actually be *hindering* their ability to produce high quality work in less time.

Taking lighting for granted is common in business, and that's unfortunate. An investment in better lighting is often rewarded tenfold by higher productivity, lower error rates, less absenteeism, and higher employee morale. Other benefits can accrue as well. Consider service areas that experience a high number of accidents. A close look at the lighting might reveal that many of those accidents could have been avoided had the lighting provided better visibility. An added bonus: Preventing accidents with high-quality lighting might qualify the company for reduced insurance premiums.

A case in point

To illustrate just how much productivity can influence the bottom line and how much lighting can influence productivity, take the case of Superior Pipe Specialties Company in Cicero, Illinois. Management knew the company could save money by installing more efficient lighting, so it called in a lighting designer to help. The company spent \$40,000 on a new high-pressure sodium lighting system and management kept close records of worker productivity before and after the change.

Productivity increased throughout the plant, in some areas more than in others. The average conservative estimate of productivity increase was 2%, but, when weighed against employee's salaries and fringe benefits, that increase translated into a productivity saving worth \$32,000 per year. The number of rejects plummeted, saving time and money on rework for an additional \$48,200 saving per year.

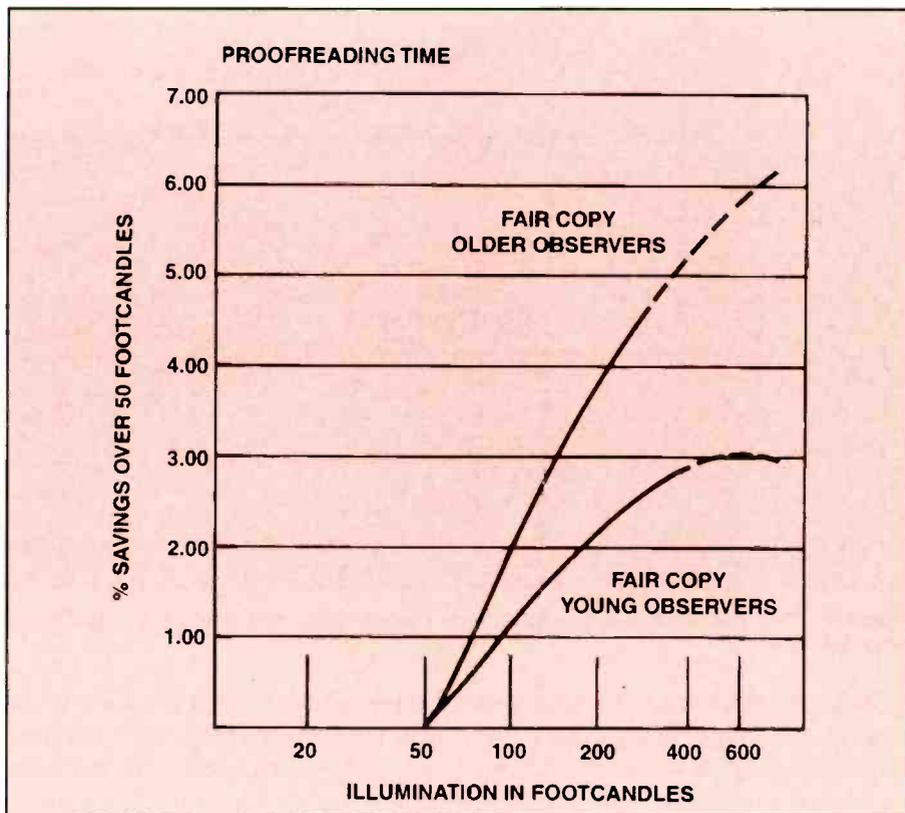


Figure 1. A proofreading experiment showed that productivity increased with increases in lighting levels, especially for older workers.

The original intent of the new lighting system was to save on operating and maintenance costs. That saving added another \$3,361 to the pot, for an overall saving of \$83,561 per year. Superior Pipe, therefore, experienced a simple payback on its investment in 25 weeks and a simple return on investment of 210% per year.

While your business may not be as large as Superior Pipe's or engaged in the same type of work, the fact is that lighting can help a company reap big rewards for any activity requiring employees to use their eyes to perform a job. Remember that lighting is for people, and a lighting system works most efficiently when it is designed for the particular tasks and people involved. For example, a proofreading experiment showed that productivity climbed with increases in footcandles, especially for older workers (Figure 1).

Evaluating your equipment

Lamps (bulbs) are available in six categories, including incandescent, fluorescent, metal halide, mercury vapor, high-pressure sodium (HPS), and low-pressure

sodium (LPS). The commercial/industrial environment is more flexible as to lamp type, because of the large spaces involved and a lesser emphasis on aesthetics.

For instance, high-pressure sodium lamps give off a "golden white" color, as opposed to a fluorescent or incandescent "white" color. HPS lamps cause some color-shifting (e.g., reds take on a brownish hue) but they provide decent light efficiency in huge spaces.

When evaluating lamps, the user must consider lamp lumen depreciation (LLD). This is the rate at which a lamp's light output diminishes with time (Figure 2). LLD, an essential selection criterion, determines the frequency with which lamps must be replaced in order to maintain the lighting levels needed to attain high levels of worker productivity and safety, quality control, and other objectives. As the lamp lumens depreciate, energy consumption remains constant, thereby making the lamp less efficient as time goes by.

Improving a lighting system can be as easy as replacing a lamp. Many lamp

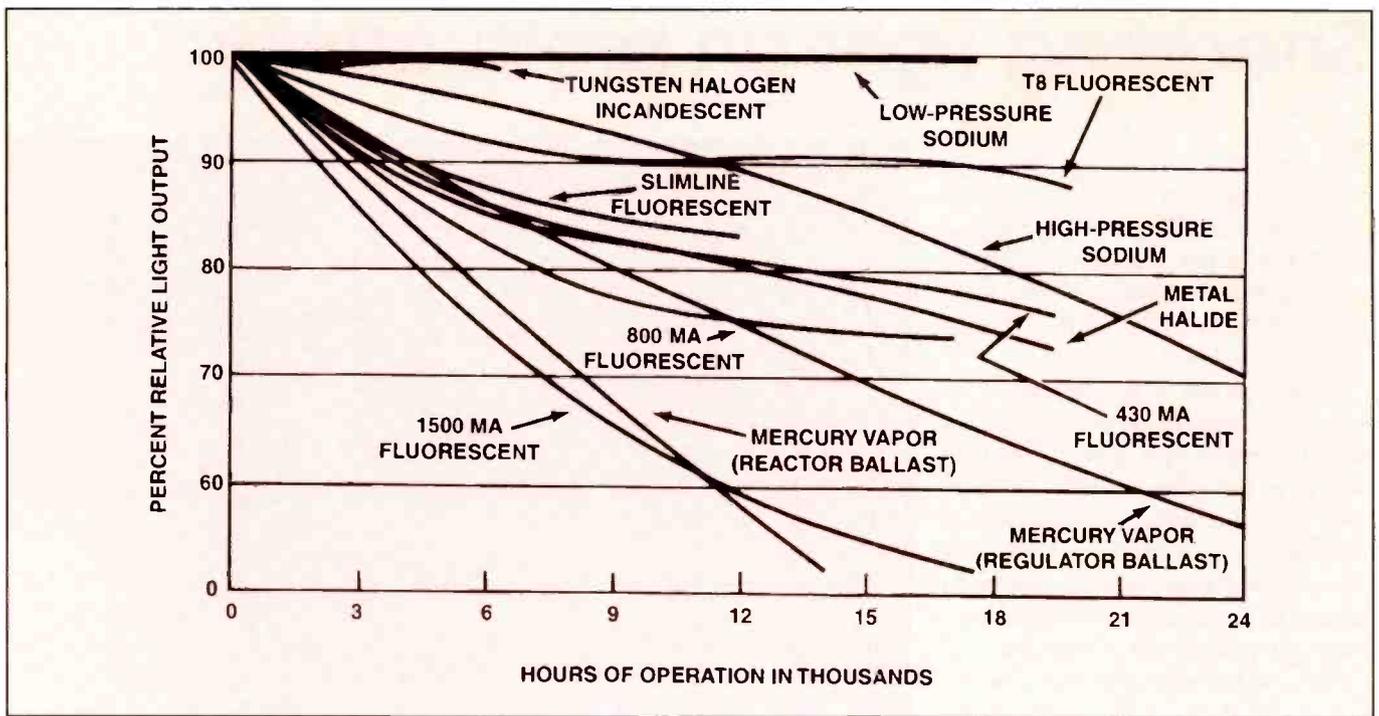


Figure 2. When evaluating lamps, the user must consider lamp lumen depreciation (LLD). This is the rate at which a lamp's light output diminishes with time.

types in use today are carryovers from times past, while the lighting industry has made great strides in lamp efficiency. By replacing one lamp type with a more efficient version, or another lamp type altogether, managers can see some significant savings with little change in overall lighting quality resulting.

Luminaires

Luminaires can be efficient or inefficient, just as lamps are. Manufacturers rate luminaires on the basis of several factors, including efficiency and the amount of glare they produce. Overall luminaire efficiency can be determined by dividing lumens from the luminaire by lumens from bare lamps. Given the ratio, a luminaire that is 90% efficient traps about 10% of the lamp's light.

Manufacturers can report luminaire efficiency this way, or employ a more significant measure called coefficient of utilization (CU). CU is basically the same as efficiency, except that the luminaire's output is based on the amount of light distributed to the workplace where it is used. For this measure, divide luminaire lumens distributed to the workplace by lumens from a bare lamp.

Two other factors to consider are luminaire dirt depreciation and luminaire surface depreciation. The luminaire dirt depreciation rating indicates the lighting

fixture's ability to resist dirt build-up on light-reflecting surfaces, light transmission surfaces and lamps. The luminaire surface depreciation rating indicates how well a luminaire resists deterioration of interior and exterior surfaces.

Faced with a poorly performing luminaire, managers have two options: retrofit or replacement. Retrofitting can be a cost effective option when modifying the luminaire for new lamps, ballasts, or shielding and diffusing media to bring it up to contemporary standards. If too much work must be performed on a luminaire to make it more effective, it might be wiser to look at replacement, since the cost of a new luminaire might not be much more than the cost of a complete retrofit, and new luminaires that use state-of-the-art materials and design.

Ballasts

Ballasts are necessary to the working of all lamps except incandescents. Since many workplace installations are illuminated with ballasted lamps, ballasts are an important consideration in the overall lighting scheme. Manufacturers have made great strides in fluorescent ballast efficiency, versatility, and longevity. A fluorescent lighting system that is more than five years old is a good candidate for a ballast upgrade.

For instance, electronic ballasts reduce

the overall energy consumption of four-lamp fluorescent luminaires by some 20% to 26% compared to conventional electromagnetic ballasts. In addition, new electronic ballasts have been developed for use with some metal halide lamps that extend lamp life by almost 20% while improving lumen maintenance and reducing color variations over time.

Other fluorescent ballast types include energy-saving electromagnetic ballasts, the new industry standard unit offering a 10% energy savings over conventional ballasts, hybrid low-frequency electronic energy-saving ballasts, which can save energy at a rate of 17% to 26% over conventional magnetic ballasts, reduced light-output ballasts, which reduce energy consumption and light output but work well in areas already over-lighted, and dual-level ballasts, which permit lamps to operate at two levels of light output via an external switch.

Controls

The array of control options available for the workplace setting seems to get wider each year. High technology is important in this area, because controls allow the user to adjust lighting to particular tasks in particular areas by increasing or decreasing light output or switching them on or off altogether.

In workplace settings, controls are ap-

plied almost exclusively to reduce energy consumption, and they can be cost justified based on the value of savings. These savings can be particularly pronounced when controls are installed to reduce utility demand charges by helping to reduce system peaks.

Everyone has used manual controls by flicking a switch up or down. Many businesses employ automatic controls, such as time clocks, photocells, or occupancy sensors. The new wave of controls include such high-technology implements as ultrasonic devices, which detect occupancy by movement, and passive infrared devices, which detect the infrared energy of people in the vicinity.

Maintenance

Without spending a dime on brand-new equipment, managers can make changes in their lighting systems. Maintenance is an often overlooked element of lighting management that has the potential to pay big dividends. Planned lighting maintenance involves two key strategies: regu-

lar cleaning and timely replacement.

Lamps and luminaires, like all surfaces in a work environment, collect dust and dirt over time. As this grime accumulates, the light intended for work surfaces is absorbed, which degrades the work area. This causes several problems, among them lowered productivity due to poor lighting conditions, and wasted energy because luminaires are working at full output despite the fact that the light they produce is of poor quality. A regular cleaning schedule keeps lighting equipment working at peak efficiency.

Timely replacement is important due to LLD, as discussed earlier. As lamps age, the lumens delivered to the work area decrease slowly. If lamps are replaced only at burn-out, they are not working as efficiently during the latter stages of their lives. Group relamping involves replacing all the lamps in a building or large area at the same time after a defined number of hours of use. In this way, light levels remain at a consistently high level, avoiding the problem of compensatory lighting

that uses more energy. If good maintenance practices are used consistently it may even be possible to eliminate some lighting for even greater energy savings.

Help is on the way

Locally, consulting illuminating engineers are available through the Yellow Pages. A good start, however, would be to contact the National Lighting Bureau. The Bureau offers a series of publications intended to guide the nontechnical reader through the maze of decisions involved in upgrading lighting systems, and how they can improve a company's bottom line. The Bureau has recently updated its popular *NLB Guide to Industrial Lighting* and also offers *The NLB Guide to Energy-Efficient Lighting Systems*. All books are \$10.00 plus shipping and handling. To order, or obtain a free publications directory, contact the National Lighting Bureau 2101 L St N.W., Suite 300, Washington, DC 20037; 202-457-8437.

This article was based upon information provided by the National Lighting Bureau.

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Proper lighting for magnification work

As the circuitry in consumer electronics products becomes smaller, it becomes more difficult for technicians to see the tiny components and hair-thin circuit traces. For troubleshooting, and for component removal and replacement, proper magnification task lighting is essential. When used alone, traditional overhead lighting is not appropriate for tasks that require detailed work, and if there is too much light, glare on the work area will interfere with the inspection process.

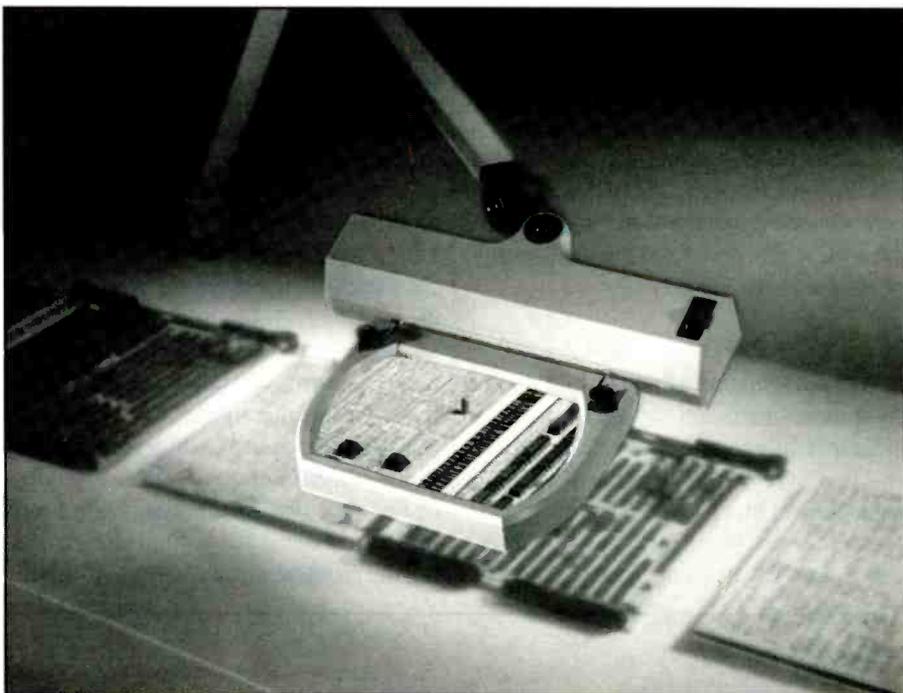
It is important to use the proper level of overhead lighting and supplement the work area with adjustable magnification task lighting. If overhead lighting in the service area is too bright, removing some of the overhead light may be an economical and energy saving solution. Articulated arm task lighting can then be used to provide higher levels of light where it is needed; on the dedicated task at hand.

The popular "ring magnifier" (which includes a 22W fluorescent circline lamp surrounding a round magnifying lens) may be fine for certain types of simple inspection work, but the round shape of the magnifying lens leads to aberration (distortion) around the edges of the glass. Another downside of these products is that the magnifier cannot be positioned independently of the light source. It becomes difficult to keep the magnifier's light source from causing bounce back glare through the lens and into the user's eyes. Unfortunately, the user perceives this glare as "more light," and feels that it is beneficial. It actually makes the inspection task more difficult, however.

There are many models of illuminated magnifiers that offer "ergonomic" features and provide users with individual control such as the ability to position the light source and lens independently to meet specific worker requirements. It is important to have this type of flexibility because worker needs and work applications vary so greatly.

Getting the most from your magnifier

For optimum work area lighting and



The tiny components and vanishingly thin circuit traces in today's consumer electronics products make it essential that service centers have a good magnifier for diagnosis, rework and final inspection.

magnification, here are several features to look for in an illuminated magnifier:

- a "distortion-free" optical quality glass magnifier that is able to tilt independently of the lighting system. Models with rectangular "stadium shaped" lenses offer the largest viewing area. It is important that the grade of glass used does not have a green tint to it. This green tint can lead to problems identifying colors on the items you are inspecting. A lens can be checked for green tint by tilting the magnifier at an angle and looking for depth of color in the lens. This green tint may be acceptable on magnifiers used for a consumer task, but it is not advisable for commercial types of applications.
- an energy efficient compact fluorescent light source for maximum light output and long lamp life. New generation compact fluorescents offer better lamp life (10,000 hours) and color rendering than conventional bi-pin fluorescents.
- a highly polished metal reflector to ensure that light is being directed to the

work surface. White plastic and foil reflectors do not offer maximum light reflective capabilities.

- the ability to compound (stack) lenses to increase magnification power.
- positionable head joints that let the user place the light in the most effective position for the particular application.
- articulated arms that allow sturdy vibration-proof positioning and easy adjustment. Internal spring mechanisms are generally longer lasting and safer than exposed spring systems.
- a louver or grid system that covers the lamps so light can be redirected and does not reflect in areas not requiring light.
- different base options that allow the light to be positioned both vertically and horizontally.

Understanding magnification terminology

When using illuminated magnifiers, it is helpful to understand specific terms such as "power," "diopters," and "focal

distance." Workers can apply this information to their specific application needs.

Magnification

Also called power, magnification is the degree to which the viewed object is enlarged. Magnification is expressed by a number followed by X (e.g., 4X).

Diopter

Diopter is a term used to identify the light bending (refractive) capacity of a lens. More important, it relates magnification to focal distance. This is the traditional method that is used by magnifier manufacturers to identify the viewing power of their lenses. See chart for diopter to power ratios.

Magnification (X)	Diopter (D)	Focal Distance (Inches)
1.63	2.5	16
1.75	3	13.3
2	4	10
2.75	7	5.7
3	8	5
4	12	3.3
5	16	2.5

Focal distance

Focal distance is the maximum distance that the center of the magnifying lens may be from the object being viewed without causing distortion. Remember this basic rule: as magnification increases, focal distance decreases and the size of the lens increases.

System magnification explained

The most often used measurement of magnification is "system magnification." This formula measures not only the "power" of the lens, but also takes the seeing ability of the operator into consideration. This means that the operator is using the lens and therefore the refractive power of the eye, which is "one," is added to the formula.

Since we refer to magnification in diopters, it is useful to know how to equate diopters to power (X).

The formula that is given in this article is an easy way to calculate system magnification.

How to best view through your magnifier

The most common misconception of viewing through a magnifier is that you

Magnification power (X) = Diopter of lens/4 + 1(X) Operator

Example 1

$$X = 3 \text{ diopters}/4d + 1(X) = 1.75X$$

Example 2

$$X = 4 \text{ diopters}/4d + 1(X) = 2X$$

Formula: The numerical value of "system magnification" includes the magnification power of the lens plus the refractive power of the observer's eye, which has the value of 1.

need to almost press your nose up against the glass to inspect the subject area. In reality, each person has a "comfort zone" where they can view objects under the magnifier with ease. This comfort zone is called nodal or "near" point.

To find your near point, hold your thumb at arm's length away from your nose. Look at your thumb with both of your eyes. Bring your thumb slowly toward your nose. When your eyes see two thumbs instead of one, stop. That is your near point. For most people it will be about ten inches away.

This exercise doesn't work for everyone. If you never saw two thumbs don't worry about it. Just use ten inches as a guide. This is the distance you should keep between your eyes and the magnifying glass whenever you inspect. It makes no difference how strong the magnifying glass actually is. The near point will remain the same. If you keep your eyes at this distance, you will be able to view your work with the least distortion and fatigue.

If you have used a magnifier differently before it will take a while to adapt to this method. Keep practicing. The result will be easier viewing with less fatigue.

What is the focal distance of my magnifier?

How do you determine the focal distance from an object being viewed through your magnifier to the lens? It can be measured with a process called inversion. Inversion will let you measure the focal distance of the glass which in turn will allow you to define the diopter of the lens. You will need a light colored wall facing a window, and preferably a sunny day.

Place the magnifier against the wall at your face height. Slow move it away from

the wall. When the image formed on the wall by the magnifier becomes clear and upside down, stop. Measure the distance between the wall and the magnifier. This is your focal distance. Now take the focal distance and compare it to the accompanying chart. This will give you both your diopter and power measurements.

Summary

Think of magnifiers not as lights but as work station accessories. They should be selected with the same care given to purchasing servicing tools, soldering irons, test equipment, chairs and the workstation furniture itself. A little investigation before purchase will reap benefits for two important items you bring to work every day: your eyes. ■

This article was provided by Waldmann Lighting Company, a worldwide designer and manufacturer of ergonomic task lighting.

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Circle (39) on Reply Card

Constructing a computer test fixture

By John Kull

When servicing computers, you are often systematically exchanging various peripheral cards or accessories until you have found the defective component. But what do you do when you don't have a card to exchange? Wouldn't it make things easy to be able to install the suspect board in a dedicated known-good system? Sure, you may already have access to other PCs, but that requires removing the cover, finding an empty slot, and possibly reconfiguring the system (and your secretary's getting tired of your disassembling her PC). What you need is a customized test fixture. One that can easily be reconfigured to test what you need it to test. Sounds like a good job for a PC test fixture. Why not use a PC to fix a PC?

This test fixture allows testing of any individual computer component quickly and easily. The open design allows easy access to the power supply and expansion bus connections, allowing easy removal and insertion of peripheral cards and accessories to be tested. A top can be added as a place to put a monitor, and you can add a handle for portability (Figures 1 and 2). A computer test fixture can be as simple or as complex as you want to make it. That's the beauty of this project; simplicity and versatility.

Materials

To construct the fixture you will need the following items:

- 80286 or higher motherboard with 1MB RAM, minimum
- 200W or greater power supply
- hard disk and/or floppy disk drive
- keyboard
- hard/floppy controller
- additional expansion cards as needed (video, I/O)
- plywood or particle board
- miscellaneous hardware

With the success of the 80486 processor, 286 and 386 motherboards can be ob-

Kull is a medical technician servicing consultant at the St. Louis Regional Medical Center.



Figure 1. A test fixture allows testing of any individual computer component quickly and easily.

tained for around \$100.00 or less. Other computer hardware prices are continuing to drop as well. Chances are, you may even have some parts laying around your shop. If not, then check your local yellow pages for used computer parts. In my city there are several businesses that sell used computer parts, software, and complete computer systems.

As people upgrade their systems, they trade in or sell their old equipment. Most businesses that sell new computers also sell used computers and parts. If no parts can be obtained locally, then check mail-order companies. Mail-order companies

usually offer a wide range of new and used parts at reduced prices. Ask about warranty and exchange policies before buying.

Once all the parts are obtained, it's time to begin construction.

Construction

To construct the fixture start by cutting a 16" X 18" piece of 1/2-inch or 3/4-inch plywood or particle board. If you plan on adding a top and sides, cut another piece 16" X 18" and two pieces 5-1/2" X 16" (Figure 3). Attach sides, if desired, by securing with wood screws to the base, then attach handle and hinges for the top.



Figure 2. Adding a top provides a place to put a monitor and a handle makes the fixture portable.

****AUTOEXEC.BAT FILE****

```
@ECHO OFF
PROMPT $p$g
PATH C:\DOS
SET TEMP=C:\DOS
**ADD A LINE HERE TO CALL
YOUR DIAGNOSTIC PROGRAM**
```

****CONFIG.SYS FILE****

```
DEVICE=C:\DOS\SETVER.EXE
DEVICE=C:\DOS\HIMEM.SYS
DOS=HIGH
FILES=30
BUFFERS=10
```

TABLE 1. Basic AUTOEXEC.BAT and CONFIG.SYS files

Attach the top after the fixture is completed and checked out.

Lay the motherboard, power supply and hard/floppy drives on the base. Arrange these components to allow space between each one (Figure 4). Using the motherboard as a template, mark holes for mounting. Next, mark holes to mount the power supply and hard/floppy drives. These holes will vary depending on the style of power supply and floppy or hard drives used. Most power supplies have a mounting flange with holes or cutouts that can be used to secure them to the board. Hard and floppy drives should be installed in a conventional mounting bracket that can be used to secure the unit to the base of the fixture.

After all holes have been drilled on the base, begin mounting the components. Before installing the motherboard, check jumper settings to be sure they are set correctly for your application. Secure the motherboard with conventional stand-offs, or construct your own from six screws and nuts (Figure 5), then install the power supply and hard/floppy drives. If installing both a hard and floppy drive, first mount the lower drive bracket to the base and then secure the upper drive bracket to the lower one.

Next, connect the power supply to the motherboard and hard/floppy drives. (CAUTION: With enough determination and brute force the disk drive and mother-

board connections can be installed backward!) The power supply connects to the motherboard with two six-pin connectors that are installed so the black wires in each plug face each other. The hard and floppy drives are connected with four-pin plugs that are keyed for proper installation.

Install the hard/floppy controller and video card. Remember, pin one on the ribbon cables is marked with a solid color, usually blue or red. Connect this end to pin one on the drives and on the controller. Pin one is usually marked with a square, PCB silk screen, or a notch in the printed circuit board.

Before adding any additional cards, it's a good idea to check things out. Double check all connections from the power supply and controller cards. Connect a video card, keyboard and monitor and power up the system (Figure 6).

Operational checks

If the monitor remains blank, remove power and check all connections. Check the motherboard video jumper to be sure it's set properly for the type of monitor you are using, color or monochrome. Try powering up the system with just the motherboard and video card. In some cases this may not provide an adequate load for the power supply to start up. If this is the case with your system, connect a hard drive or two floppy drives to provide an additional load for the power sup-

ply, but do not connect the controller cards at this time.

If the motherboard begins the Power Up Self Test (POST), the problem is in the hard/floppy controller card. Recheck your ribbon cables to be sure they are not reversed. Once the problem is resolved the test fixture is ready to customize.

Invoke the CMOS system setup program and enter the system setup information as needed. Information on calling the setup routine is usually contained in the motherboard documentation. On a new configuration, however, the motherboard should detect the new equipment and prompt you to enter the setup routine.

If the fixture has a hard drive, its configuration must be entered in the CMOS setup. Enter the hard drive, floppy drive, and other system information as directed. Format the hard drive if needed and add diagnostic software.

Booting up the system

If the fixture contains only a floppy drive, you must use a DOS disk to boot the system the first time. Insert the disk in the drive and power up the system. When the DOS prompt appears, prepare a floppy disk for "booting" by inserting a formatted disk in the drive and typing SYS A: (or B:) or format a blank disk with the FORMAT/S command.

Follow the instructions on screen. Create a DOS directory on the disk and copy any additional DOS files to it. Your "boot disk" may also be created on another computer system, saving the time and

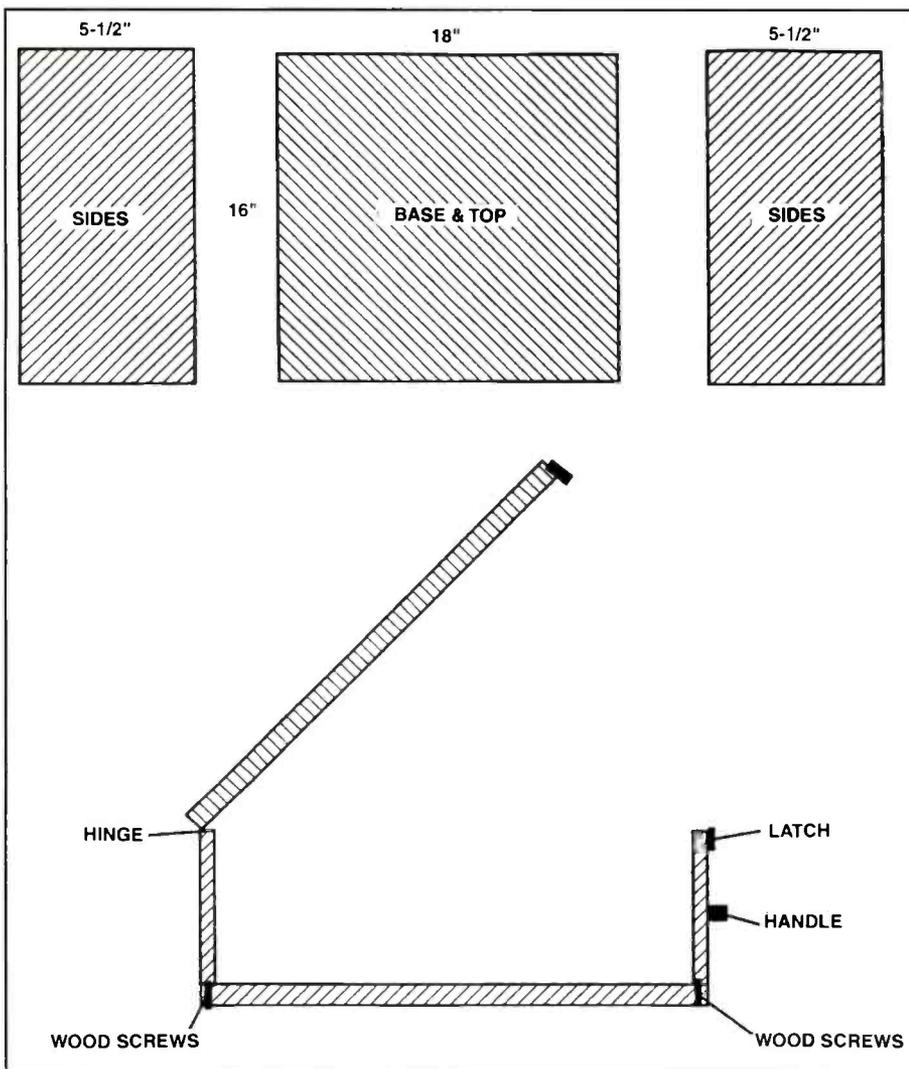


Figure 3. To construct the fixture, use three pieces of 1/2-inch or 3/4-inch plywood or particle board as shown.

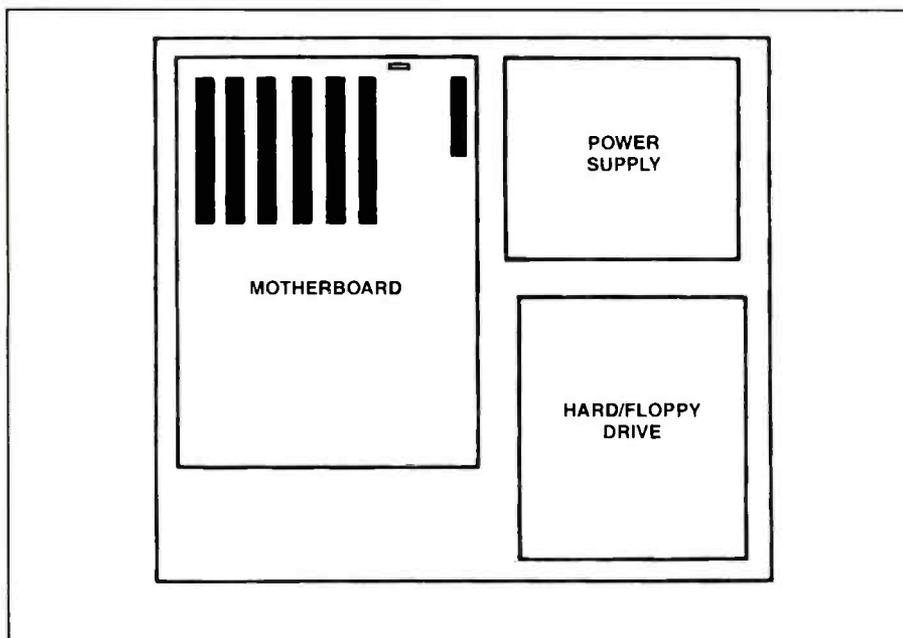


Figure 4. Lay the motherboard, power supply and hard/floppy drives on the base. Arrange these components to allow space between each one.

```
CLS
:START
@ECHO
@ECHO OFF
GOTO START
```

TABLE 2. Batch file to fill the monitor screen

hassle of swapping disks in and out of the floppy drive.

Now create AUTOEXEC.BAT and CONFIG.SYS files using a text editor or word processor (Table 1). These files are used by DOS to execute commands after boot up and provide additional system information. For more information on AUTOEXEC.BAT and CONFIG.SYS files consult a DOS reference manual.

Now add any diagnostic or other software as needed. Call the diagnostic software from the AUTOEXEC.BAT file. Now you have a customized boot disk for your fixture. If you have several applications in mind, create a boot disk for each one. Load the appropriate disk and apply power to the system.

You have just created a customized test fixture. The test fixture can be configured and used as needed to check out any individual system component. Following are some ideas and uses.

On-site checkout and testing

Often when troubleshooting a computer system, you are exchanging a known-good board for a suspect board. This is usually not a concern since some peripheral cards are inexpensive and stocking a spare is not a problem. However, some cards are specialized and expensive and it would not be cost effective to stock a spare for testing. It would be convenient to install a suspect card in a known-good system to see if the problem follows the card or stays with the system. With the portable fixture, this is a quick and easy test to perform.

Hard drive setup and checkout

A customer has called complaining of problems with a hard drive. After discussing the problem, you determine that the old hard drive may need replacement. You then use the fixture to check out and format a new or used drive. In addition you "burn in" the replacement drive for several hours and then arrive on-site with the replacement ready to install. Format-

ting and performing diagnostics can be time consuming. The fixture allows you to do this in the shop before you arrive at the customer's site.

Computer-monitor signal source

If you work on computer monitors, you need a signal source to drive the monitor. A simple fixture with a floppy drive can be configured to test monitors. Prepare a floppy disk for "booting" (described earlier). Next add a diagnostic program or write a simple batch file to fill the screen with characters (Table 2). Most diagnostic programs also contain routines for generating test patterns for monitors. Call the program or batch file from the AUTO-EXEC.BAT file on the floppy. Load the floppy and turn on the system. Now you have a customized pattern generator for checking monitors.

Motherboard setup and checkout

Before installing a new motherboard, jumpers must be set for system clock speed, cache memory size, monitor type, and other optional features. In most cases the jumpers are set properly for your application. However, it is not a good idea to assume that this is always the case. The fixture allows you to set up and test a new motherboard before installing it in a system. This saves the frustration of yanking a newly installed motherboard out of a system you thought was fixed.

Burn-in fixture

Use the fixture to check out and burn-in motherboards, hard and floppy drives and power supplies. An excellent program for this is called "Burn-in." It will test individual or a complete system of components for an indefinite period of time and offers an error log to list failures. The error log is useful in tracking intermittent problems.

Demonstration and teaching

The fixture can be beneficial as a teaching aid when training new technicians on various aspects of computer repair and theory. With a little imagination and thought you will undoubtedly come up with other uses as well. No matter what your particular application is, the test fixture will prove to be a useful piece of test equipment for troubleshooting and repairing personal computers. ■

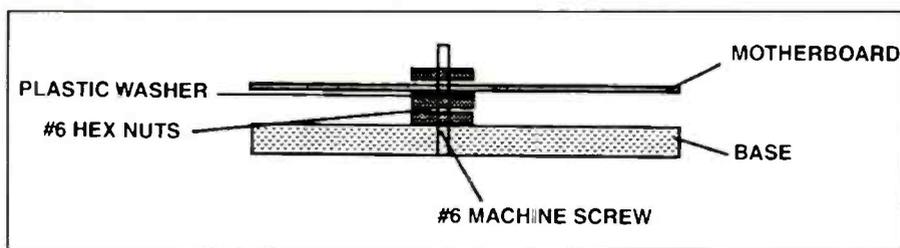


Figure 5. Secure the motherboard with conventional standoffs, or construct your own from #6 screws and nuts as shown here.

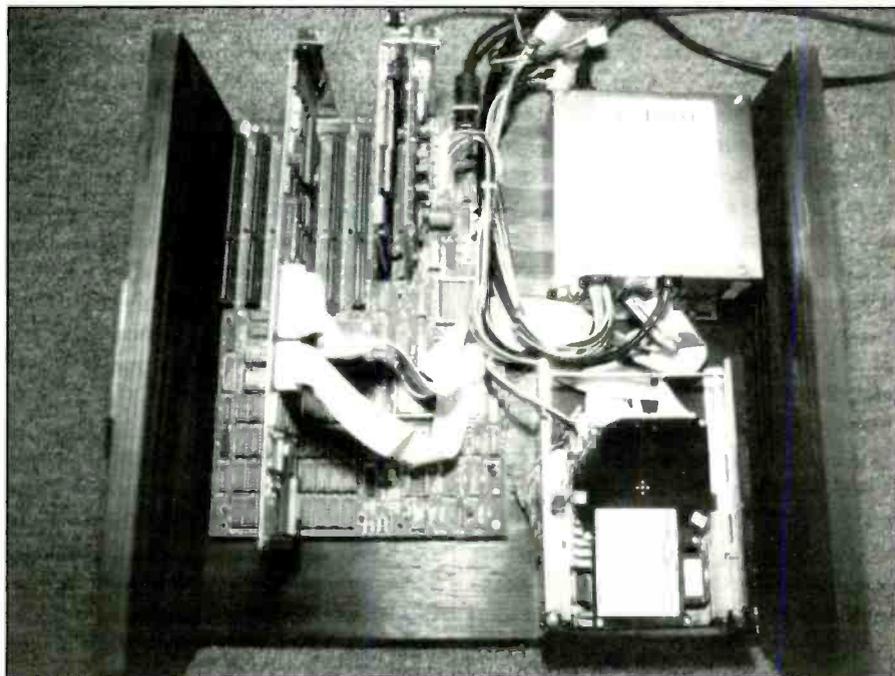


Figure 6. Before adding any additional cards, it's a good idea to check things out. Double check all connections from the power supply and controller cards. Connect a video card, keyboard and monitor and power up the system.

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Electronic tuner theory and troubleshooting—Part II

Troubleshooting

By Steve Babbert

The tuner of the Sanyo set that was referred to in part I of this article (Figure 1) had an odd symptom. When I would attempt to tune a channel, the desired channel number would be locked in on the LED display but the video and sound would snap in and out several times per second as if the tuner was sweeping back and forth across the desired frequency. The fact that the display held a correct channel number only shows that the microprocessor is attempting to tune the channel; it doesn't reflect the actual tuned frequency of the tuner.

When certain active channels were entered on the keypad, there was no video or audio present. When other channels that are inactive in this area were selected, the tuner was tuning upper or lower adjacent channels (still with the sweeping action). There were, however, certain

channels randomly distributed throughout the VHF and UHF bands that would be properly tuned when selected. This led me to believe that the problem was probably outside of the tuner.

Since the tuner appeared to be sweeping back and forth across the desired frequency, I decided to check the tune voltage. Measuring this voltage while watching the analog bar graph display of a DMM showed that it was fluctuating in step with the tuner variations. At this point I decided to open the loop.

Opening the loop

In this chassis there is a connector in the line that routes VT from the output of the LPF to the tuner. This is a convenient place to open the loop. When this plug is disconnected, the PLL has no control over the tuner. However, the feedback from the LO in the tuner still affects the PLL. Monitoring this signal will provide valuable

information when manually controlling the tuner with an adjustable voltage source. The band selector switch, however, still can control the tuner's band selection.

I used a 0V to 30V adjustable power supply as the voltage source for the diagnostic device that I have used to troubleshoot VCR servo systems, instead of the 4.8V battery I normally use for servo troubleshooting. This way I could set the output for as high as 24V as needed when tuning the higher channels. I connected the positive lead of the diagnostic device to the line leading to the tuner, and the negative lead to ground. I could have used the adjustable power supply by itself for this test but the diagnostic device gives more precise control.

When trying to tune a channel with an adjustable voltage source, only channels within the selected band can be tuned. After entering channel 2 on the keypad, which placed the tuner in the VL mode via the band selector switch, I set both of the

Babbert is an independent consumer electronics servicing technician.

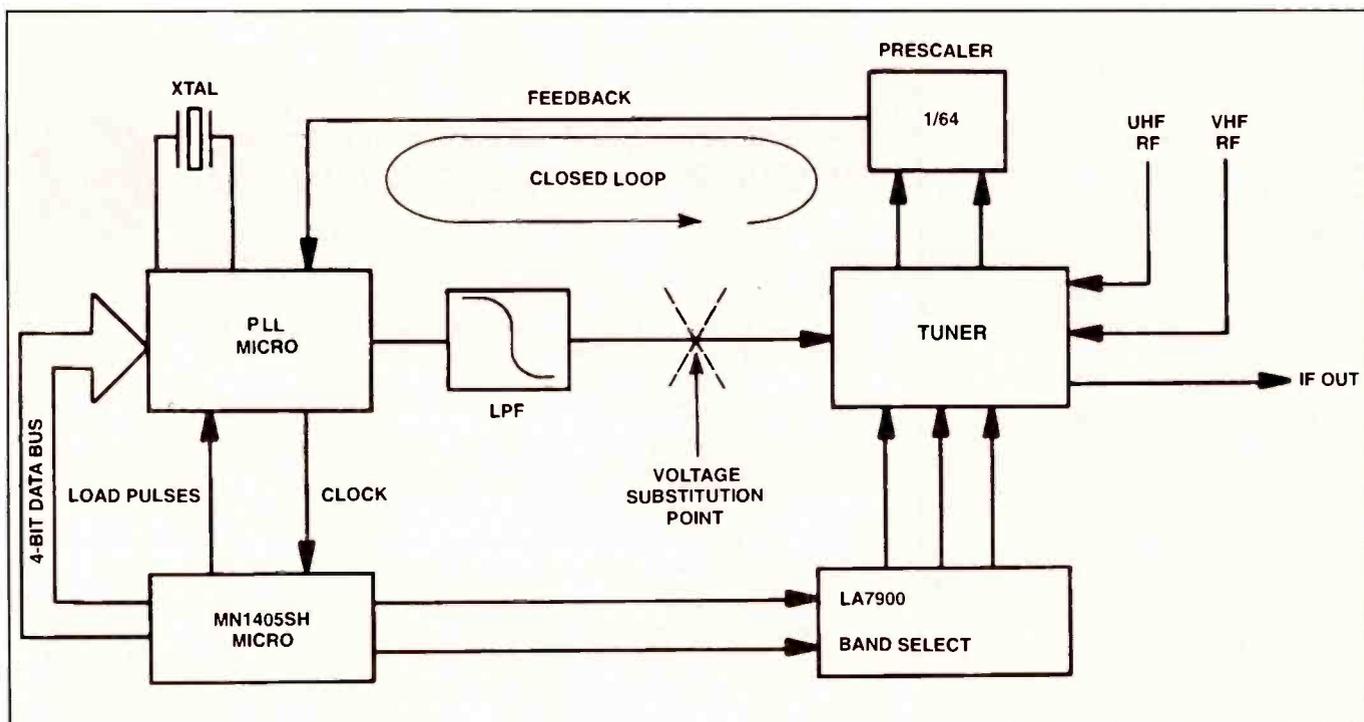


Figure 1. Tuning circuitry in the Sanyo Model 91C94N.

potentiometers on the diagnostic device to their centers.

Next, beginning at 0V, I raised the voltage on the power supply while watching for an active channel to appear on the screen. When one would appear, I used the controls on the diagnostic device for fine tuning. I found that I could tune all channels in the VL band that were active in this area. Any channel in the VL band could have been entered on the keypad with the same results.

Next I entered channel 7 on the keypad to place the tuner in the VH band. I found that all active VH channels could be tuned by adjusting the voltage. Finally I entered channel 14 on the keypad placing the tuner in the UHF mode. Again, the tests showed that the active channels could be tuned. This verified that the tuner and band selector switch were normal.

Testing the prescaler

The next step was to check the output of the prescaler. The tuner's LO frequency for a given channel can be calculated or looked up in a chart. The LO frequency should be 44MHz above the center of the selected channel frequency. Since the prescaler divides by 64, its output for any channel can be determined.

The LO frequency for channel 4 is 113MHz. Dividing by 64 gives 1.77MHz. Measuring the prescaler's output with a frequency counter while the tuner was tuned to channel 4 showed that it was normal. Performing this test on other channels in the VHF and UHF bands also gave normal results.

When manually controlling an electronic tuner, if the output of the phase detector is monitored, it will change state from high to low (or vice versa) as the tuned frequency is swept above and below the channel's center frequency. In this particular case, tuning through some channels showed normal results while when tuning through other channels, the transitions were erratic and in some cases didn't occur at the center frequency. By taking notes I saw that the channels that resulted in abnormal PLL outputs were the same channels that wouldn't tune properly when the tuner was connected to the PLL.

The cure

At this point it looked like the PLL was defective. All of its inputs were normal but apparently the divider could divide by

some numbers and not by others. This could be caused by one or more "stuck" bits at one of the latches or at the divider itself. If the stuck bit (high or low) was consistent with the 13 bit word for a particular channel, proper tuning would result. This is only one possible explanation but it seems reasonable.

After I replaced the PLL IC and reconnected the VT line the tuner worked normally again.

For my future reference I once again disconnected the VT line and connected the diagnostic device. I wanted to see how the various sections of the properly working voltage synthesizer circuit behaved while being manually controlled. I scoped the two inputs of the phase detector with the scope synchronized to the stable reference. At the same time I viewed the phase detector's output with the analog bargraph of the DMM. The test provided some interesting results.

After manually tuning the tuner to the center frequency of an active channel, I turned the fine adjustment slowly back and forth in order to slightly raise and lower the tune voltage causing the tuner to sweep back and forth across the center frequency. While watching the pulses from the divider on the oscilloscope and the output on the analog bargraph, I noticed that at the center frequency the pulses were stable with respect to the reference signal.

As I raised the frequency, the pulses began drifting to the left. As I lowered the frequency, they drifted to the right. When the pulses began drifting from the center frequency, as soon as they were out of phase by one cycle with respect to the reference, which in effect causes one of the comparator inputs to change state with respect to the other, the output of the phase detector would change state.

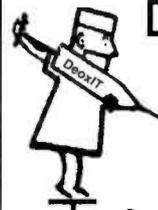
When I caused the divider pulses to drift in the other direction by adjusting the diagnostic device, once the pulses were out of phase by one cycle, the output of the phase detector would assume the opposite state. In the output of a normally working circuit, this back and forth action is constantly taking place at a high frequency. This way the tuned frequency is nudged alternately from both sides to keep it centered. The ratio of high to low time in the PWM output determines the average dc value of VT.

Summary

All sections in the television have un-

dergone major changes since its beginning. Most sections have evolved from vacuum tubes to transistors and in some cases to integrated circuits. Sections of the tuner which were electronic to begin with, such as the RF amp, the mixer, and the oscillator, have followed this course.

While all of these achievements are impressive, none seem to compare with the elimination of the tuner's mechanical parts. The downside of this enormous achievement is the enormous complexity which now must be dealt with by the technician. Just bear in mind that though the entire system might seem impossible to comprehend at a glance, if the individual sections are examined one at a time, the overall picture will become clear, making the troubleshooting task manageable. ■



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Circle (8) on Reply Card

Coping with Hard Drive Problems— Part III

Software troubleshooting

By Stephen J. Bigelow

Part I of this three-part article, published in the January 95 issue, described the various parts of a hard drive system and detailed the similarities and differences among the different types of hard disk drives. Part II, published in February, listed some of the hard drive hardware error messages that a technician may encounter and suggested a course of action to take when they are encountered.

This segment will describe software-related hard-disk problems and suggest ways of coping with them.

The hard disk format

When a hard drive is manufactured, its platters contain no useful information. Even if the drive and its controller are installed properly, the computer cannot use the drive since a computer must access boot sectors and file allocation information. When a new drive is installed, it must undergo a low-level format and it must be partitioned. The procedures outlined here can help you overcome some of the problems encountered in low-level drive preparation.

Please keep in mind that IDE drives should not be low-level formatted since they contain special servo tracking information that is encoded at the drive factory. A low-level format can overwrite and destroy that information, leaving the drive useless. IDE drive users can go directly to creating a DOS partition.

Low-level format problems

The symptom of one type of low level format problems is that the low-level format operation is taking too long, or it hangs up the system. You probably see a large number of errors such as code 20 or 80. You may also see "Unsuccessful format" error messages.

Bigelow is a technical author and computer consultant at Dynamic Learning Systems in Marlboro, MA.

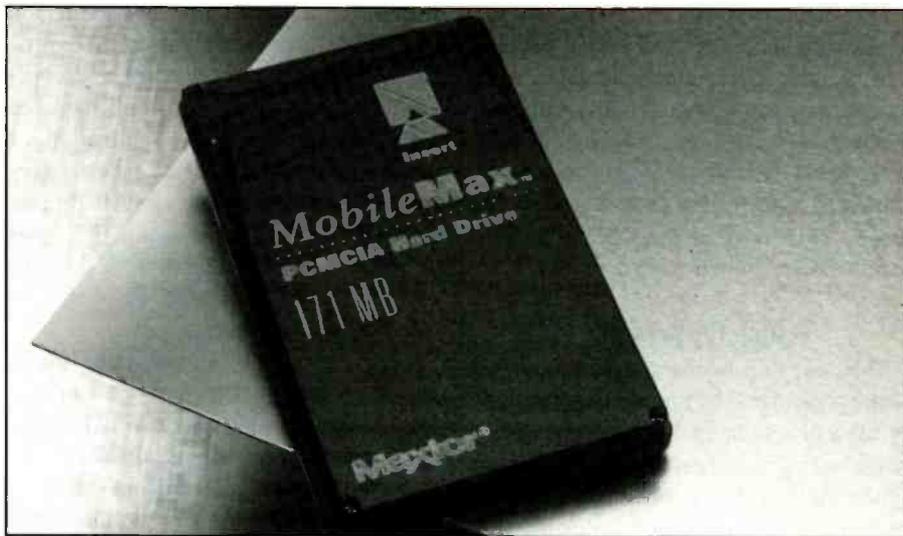


Figure 1. Hard disk drives may suffer from software faults as well as hardware faults.

To troubleshoot this problem, start your investigation by checking the drive parameters used in the low-level format command string, as well as the drive parameters shown in the CMOS system setup. One or more incorrect parameters can prevent a successful format. If you are working with an older PC/XT which does not use a CMOS setup, check that the system's dynamic configuration is correct.

If the system setup and drive parameters are all in order, you should suspect a communications fault between the drive and controller. Replace the signal cable(s) between the drive and controller and try the system again. Make sure that your cable(s) are inserted into their proper receptacles in the correct orientation.

Finally, make sure that the performance of your drive and controller are suitable with your system. For example, an older expansion board in a new system may not be able to keep pace with the system.

Problems accessing the low-level format window

Occasionally a technician will find that he can't access the low-level format win-

dow from the DEBUG address. Some systems will not low-level format a drive while its parameters are entered in the CMOS setup. If you run into this problem, enter your CMOS setup menu and remove the drive type entries. Make sure to write down the entries so you can restore them later. If that fails to clear the problem, return to the CMOS setup again and restore the drive parameters.

Refer to the documentation for the drive controller board and check that the controller's on-board BIOS ROM is enabled. If the controller's BIOS is partially or fully disabled, the DEBUG command may not be interpreted properly. Also check the base address of the controller against the address used in your DEBUG command.

If you are referring DEBUG to the wrong address, the controller will not respond and allow the low-level format to initiate. You will need the documentation for your drive controller to check address settings.

There may be a hardware conflict between the drive controller and one or more other expansion boards in the sys-

tem (although most conflicts will manifest themselves in a more substantial fault). Remove one board at a time from the system and recheck the system after each board is removed.

If DEBUG access is granted after a board is removed, that board is probably experiencing a peculiar conflict with the drive controller. Try changing the drive controller's address to correct the trouble.

If you still cannot initiate a low-level format through DEBUG, contact the controller manufacturer. The manufacturer may have specialized low-level formatting software designed for use with your particular controller card.

Finally, check your original DEBUG command against one of the following commands. Try using one of the following commands to initiate the DEBUG low-level format menu:

G=C800:5 or
 G=CC00:5 or
 G=C800:CCC or
 G=C800:6 or
 G=D800:5 or
 G=DC00:5

The low-level format process hangs up

If the low-level format process regularly hangs up on a specific head/cylinder/sector, there may be defects in the surface of the drive. Not all portions of a manufactured drive are usable. These are called "hard errors," and the low-level format procedure must recognize and avoid these hard errors.

Some low-level format procedures require you to enter these hard errors manually. In this case, if you forget to enter a hard error (or enter the wrong location), the format process will stop when the hard error is encountered.

If you encounter a problem that sounds like this one, try low-level formatting the drive again, but make sure to enter the proper hard error locations. Also, check the CMOS setup parameters to be sure the drive type is correct. Even if the hard error table is entered properly, incorrect drive parameters may cause the drive to look for its errors in the wrong places.

FDISK problems

If the FDISK procedure hangs up or fails to create or save partition record for the drive(s), begin by checking the drive parameters entered into your system's

CMOS setup. If the drive parameters are incorrect, FDISK may not be able to produce the proper partition. If you are using an IDE drive and the drive parameters seem correct, you may wish to contact the drive manufacturer and see if there is another appropriate translation geometry (entries for tracks, sectors, cylinders, and so on) that you can use for the drive parameters. When using the FDISK utility, try a different partition size. For large drives, try breaking the drive into two or more smaller partitions.

If you are still encountering FDISK trouble, try a different DOS version or a non-MS-DOS partitioning utility. Also try running a surface scan utility such as the utility in Central Point's PC Tools to check for physical defects at the beginning of the drive.

Physical damage to the boot sector, file allocation tables, or the partition table can render the drive useless—it must be replaced. There is a slight possibility that the signal cable(s) may be intermittent or defective. Try replacing the cable(s).

Hard disk controller problems

If you see a "Hard Disk Controller Failure" or a large number of defects in the last logical partition, immediately check the hard drive parameters listed in the CMOS setup. Make sure that the parameters used do not define a drive larger than the one actually installed. If a larger drive is specified, the system will try to format areas that don't exist—creating a significant number of errors. Try low-level formatting the drive again using the correct drive parameters.

High-level (DOS) format takes too long

If this problem occurs on a computer you're servicing which uses MS-DOS, check the DOS version in use. Version 4.x tries to recover hard errors which can consume quite a bit of extra time. You will probably see a number of "Attempting to recover allocation units" messages. Your best course is to upgrade the MS-DOS version to 6.2 or higher. Later versions of DOS abandon hard error retries, so formatting should take place faster.

Drive does not format to full capacity

If the drive will not format to its full capacity, check the drive parameters used

[Continued from page 21]

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in the low-level format. If the parameters specify a drive that is smaller than the one actually installed, some portion of the drive will not be used. Moreover, DOS has a 1024 cylinder limitation. If the drive has more than 1024 cylinders, see if there is an alternate translation geometry that can be used.

If an alternate translation geometry is not available, third-party or manufacturer-specific partitioning software may have to be used. Confirm that the drive parameters reported by FDISK match those of the drive. Check that the drive controller is appropriate for the drive interface being used. Check the DOS version being used.

Older DOS versions had a limit of 32MB per partition. If older DOS is in use, upgrade to MS-DOS 6.2 or later. Some drive controllers use disk space to handle drive defect management. Check the controller manual to see if drive space is being allocated for defect management.

Drive delivers less than full capacity

If you do not get full capacity from a large-capacity drive when using partitioning software, chances are very good

that you have entered the wrong drive parameters in the system CMOS. Make sure that the correct parameters are entered. Also, check to see if there are other translation geometries that can be entered instead. Test those alternate geometries to see if you can coax more space from the drive.

Interpreting and correcting error messages

If you see "Disk Boot Failure," "non system disk," or "No ROM Basic - SYSTEM HALTED" error messages, check the drive for computer viruses. Remove any viruses or infected files as required. Make sure that the necessary system files have been transferred to the hard drive (format the hard drive as a "system disk").

When using FDISK to partition a drive, make sure that the created partition is made active. Check the drive parameters entered in the system CMOS. Enter the proper parameters. If the system will not save those parameters, try replacing the CMOS backup battery. Make sure that the floppy drive door is opened. Check to see that all cables are connected properly.

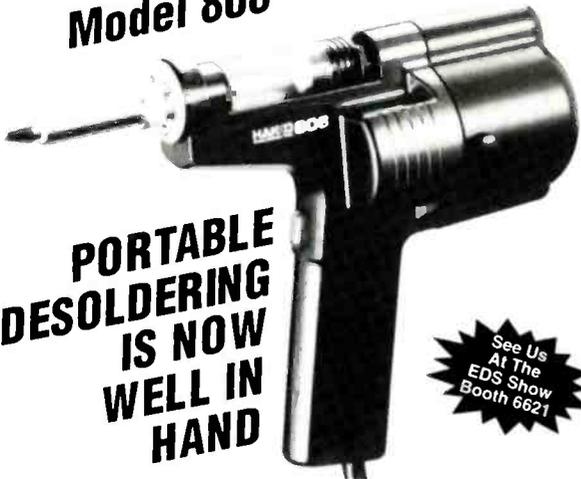
Conclusion

Whether you are installing or upgrading a drive, or dealing with the faults and failures that eventually plague every drive system, hard drives often require quite a bit of troubleshooting. With some advance information, however, most problems can be identified and corrected without much difficulty. This series of articles was intended to give a broad overview of the incompatibilities and problems that technicians will have to deal with when working on PC drives.

About the Author

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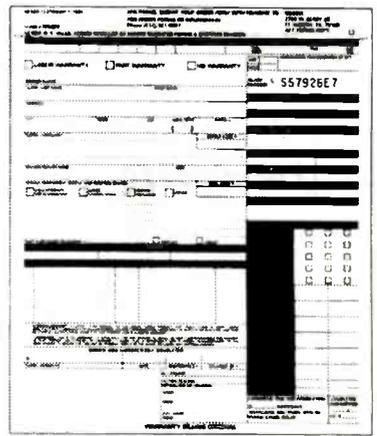
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Test Your Electronics Knowledge

Component and signal characteristics

By J.A. Sam Wilson

1. Two capacitors are connected in series. Their reactances are 30Ω and 40Ω . What is the reactance of the series combination? _____.

2. The equivalent circuit of a certain dc motor is 0.8Ω in series with a 120mH inductor. What is the time constant of the equivalent circuit?

3. The bandwidth of a certain series resonant circuit is 10kHz and it has a Q of 50. What is the resonant frequency of the circuit?

4. Another name for a Schottky Barrier Diode is _____.

5. To improve the signal-to-noise ratio in a receiver, a technician adds an rf pre-amplifier that has a gain of 55. The signal-to-noise was 30 to 1 before the addition. What is the ratio after the addition?

6. Increasing the bandwidth of an rf circuit will

- A. decrease the signal-to-noise ratio.
- B. not change the signal-to-noise ratio.
- C. increase the signal-to-noise ratio.

7. The inductance of a single-layer coil is directly proportional to

- A. the square root of the number of turns.
- B. the number of turns.
- C. the square of the number of turns.

8. A radio wave is made of a magnetic field at right angles to an electric field. If the radio wave is horizontally polarized

- A. the electric field is horizontal.
- B. the magnetic field is horizontal.

9. Adding a coil to the base of a whip antenna will

- A. make it resonant to a lower frequency.
- B. make it resonant to a higher frequency.

10. Angstrom is a unit of

- A. angular measurement.
- B. length.
- C. volume.
- D. time.

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

(Answers on page 66)

Coming Next Month . . .

Servicing projection TV sets

The May 1995 issue of **ES&T** will feature an article entitled "Servicing projection TV sets," covering both front and rear projection sets. This article will discuss the similarities between projection sets and direct view sets, special precautions that must be followed in servicing a projection TV, handling of the fresnel lens, focus and convergence adjustments. This article will also describe some specific projection TV service procedures performed by the author.

Troubleshooting techniques

Everyone knows a few troubleshooting techniques, tips and shortcuts that can help a technician get a servicing job done a little more quickly. For example, there's the old trick of connecting a light bulb between the power line and the set as a means of limiting the current and judging

the amount of current being consumed by the set. Another trick is using an external power supply as a source of voltage for a suspected oscillator to see if the problem is in the oscillator or in the power supply. This article will review some of the tried and true tricks and techniques, as well as some of the newer ideas for troubleshooting products like personal computers and peripherals.

Tool & tool case showcase

A technician can't get much done without the right tools, no matter how good he is. But with the proper tools, test equipment, service literature and supplies, a competent technician can get the job done in a minimal amount of time. The May 1995 issue of **ES&T** will provide a showcase of suppliers of tools and tool cases that will help technicians know where the tool suppliers are and what kinds of tools and cases they offer.

When a service technician sits down to perform a diagnosis on a set that has malfunctioned, in many instances it becomes a major effort to locate service information. When a technician completes a diagnosis and determines the cause of a problem in a TV, VCR or other consumer electronics product, often that's merely the prelude to the serious problem of locating a replacement part that will restore the product to proper operation.

In years past, finding service information and replacement parts was not as much of a problem as it is today. There was only a relative handful of products and manufacturers, and most service information and replacement components were readily identifiable and obtainable. Nowadays, obscure products from hard-to-find manufacturers are increasingly likely to be brought in for service, and locating service information and parts may require detective ability and tenacity.

Fortunately, there are a number of organizations that can assist a technician in the search. A well-organized, well-stocked distributor is one agency that can provide a great deal of assistance in finding the necessary information and products. Because a good distributor can provide important help, whether you do almost all of your business with a local distributor or a mail order firm, or some combination of the two, it is prudent to choose carefully the distributor(s) with whom you do business.

Similar but different

Just as with any other kind of selling organization, you'll find many similarities and many differences among distributors. Most distributors are well-organized and well-stocked, can help you with special requirements, and have a research department to help you find the part you need; some are not. Some mail-order distributors can accept your orders in a variety of ways, including mail, telephone (some with 800 numbers), fax, etc.; some cannot. Some distributors will charge you a reasonable fee for shipping and handling; some will charge you what you will conclude is an exorbitant amount. Some distributors will send your order right

away even before your check clears, some will wait until your check clears, and some others will keep your order well beyond the point when they should have shipped it to you.

Some variables to consider

Most people are careful shoppers when it comes to buying consumer goods. It pays to shop just as carefully when choosing a distributor.

Here are some of the factors you should consider when settling on a distributor. Some apply only to the local distributor, and some apply only to mail order, but it would be a good idea to keep them in mind any time you're thinking about doing business with a new firm.

- Do the facilities and/or literature give the impression of competence and order?
- Do prices seem reasonable and in line with what other companies charge?
- Are most items in stock, or will many have to be back ordered?
- Does the distributor offer a broad line of products, or will you have to find other sources of supply for many of your needs?
- Does the distributor specialize in any particular kinds of products that you typically order?
- What kind of payment options are available: open order account, credit card, COD, check, etc.?
- How soon after receipt will your order ship?
- Is there a shipping surcharge, or a handling charge?
- Does the company list a toll-free number?
- Are such ordering options as fax and telex available? How about such computer ordering options as MCI Mail, Compuserve, and EasyLink?
- What is the return policy?
- Are all policies well-documented, or do you have to guess at them? Or do they seem to differ depending on whom?
- What kind of warranty, if any, does the distributor offer?
- Does the distributor publish a catalog? If so, is it clear and easy to understand?
- Is there a minimum order amount? If so, is it reasonable?
- What kind of shipping is available: mail, UPS, Federal Express, etc.?

- What kind of special services, such as assembling cables, are offered?
- What research services are available to help you to find the part you need?

These questions can be important

Some of these questions may not seem important at first glance, but from what we have learned from some of our readers, they may be very important. For example, we learned from one of our readers that one mail order company made a regular practice of charging unnecessarily high shipping charges.

Another practice that some distributors indulge in is to hold the shipment of products for some time after the purchaser's check has cleared. This gives the distributor a nice little interest-free loan between the time the check clears and the time he decides to ship the merchandise. This is not necessary. Some companies will even ship the product immediately after receiving an order.

Don't forget to ask about restocking fees. Some distributors charge a restocking fee even when they were responsible for shipping the incorrect product in the first place.

Let the buyer beware

Most replacement parts distributors are hard-working, well-organized, ethical companies, who will make every effort to help you obtain the correct replacement for a faulty component. Some are less ethical in their practices. It's not always easy to locate the good ones and avoid the ones that will give you problems.

When you're considering ordering products from a new distributor, it might be a wise idea to start out with just a small order and see what kind of treatment you get. If the service is good, you might gradually increase the size of your orders and gradually start building up a close working relationship.

If the service you receive is not what you'd like, go ahead and try someone else. It's your business that will suffer if you don't get what you order when you need it, or if you're hit with exorbitant freight charges that you will have to pass along to your customer.

Philips Technical Training

401 East Old Andrew Johnson Highway

Jefferson City, TN 37760

Phone: 615-475-0044

FAX: 615-475-0221

Philips Technical Training is one of the many departments that make up Philips Service Company. Our primary responsibility is to provide for the training needs of all servicers, including Philips Authorized Servicers. We produce various forms of training materials, such as hands-on technical training books, and conduct training classes all over the country. The locations of these classes are specifically chosen for easy access of service companies.

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Our hands-on training is the most comprehensive service training available today, teaching both circuit operation and troubleshooting! Philips Technical Training has been voted "Number One in Technical Training" for nine years running by servicers attending these classes.

Communication with servicers is the key to our success. Servicers attending our classes keep us informed of problems being faced on a daily basis, as well as subject material that is of interest to them. We take this information and structure our training materials to better fit their needs. If there is a product servicers would like made available to them, to help them in their profitability and efficiency, we do our best to make it available.

Computer Software

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

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

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

input his own notes and print his circuits out.

Video Tapes

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

Highest Quality

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

Order your new catalog

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

PTS Corporation

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PTS Electronics was established in 1967 with corporate headquarters located in Bloomington, IN. PTS is the nation's largest single source for all major brands of replacement Television Tuners, Mainboards, Projection Set Modules and Complete Chassis. Brands such as RCA, Zenith, Philips and GE are available at substantial savings when compared to manufacturers pricing. PTS employs over 175 technical personnel and support staff with a 65,000 square foot facility and branch locations in California, Texas and Colorado.

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Our primary objectives

PTS has been supporting the independent service dealer since 1967. If you're a one man operation, multiple location

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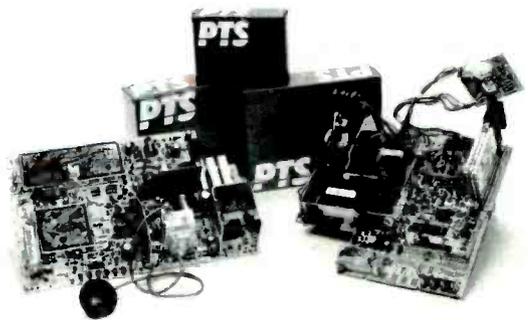
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Dalbani Corporation offers many shipping options (UPS Red, Blue, Orange & Ground, Fed Ex, etc.). Orders received by 3:00 p.m. Eastern Standard Time are air freighted the same day, and most other orders are shipped within 24-hours. CODs, company checks and cash, and most major credit cards (Visa, Mastercard, Amex & Discover) are accepted. There is a \$20.00 minimum order.

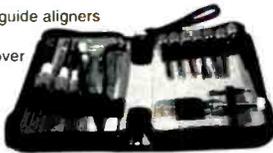
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 Warehouse Grand Opening: 5/1/95

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

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

The company publishes an easy-to-read

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

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

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

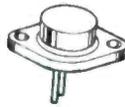
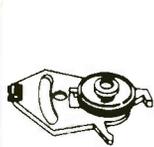
service is also available to ensure even faster delivery service if necessary.

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

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

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

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164113	ACA Idler Original \$2.99ea (10 min)	2SD869	\$2.50ea (10 min)	154-074E	\$19.95ea	4.7M/250V	Radial \$3.55ea (10 min)
NPLY0111	GEZZ Idler Original \$7.95ea (10 min)	2SD1397	\$1.99ea (10 min)	2434391	\$24.95ea	4.7M/350V	Radial \$6.55ea (10 min)
613-022-2534	Sony/Fisher Gear \$6.69ea (10 min)	2SD1398	\$1.99ea (10 min)	2434651	\$24.95ea	10M/160V	Radial \$5.55ea (10 min)
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157061	ACA Belt \$.85ea (10 min)	JU0069	\$11.95ea	F0016	\$19.95ea	100M/200V	Snap-in \$1.00ea (10 min)
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RTU006GEZZ	Sharp RF Mod \$14.95ea	TDA4505A	\$8.95ea	TLF14561F	\$26.95ea		
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Founded in 1945, *Howard W. Sams & Company* was one of the first companies in the publishing business to recognize that the increasing popularity of home entertainment electronics meant a corresponding demand for reliable service documentation. This insight gave birth to the first PHOTOFACT[®], which presented concise technical information to help service technicians repair specific makes and models of radios. Televisions soon were added to the product line, followed by computer equipment, and then *VCRfacts*, further enhancing Sams' ability to provide complete, consistent, high-quality repair information to service technicians.

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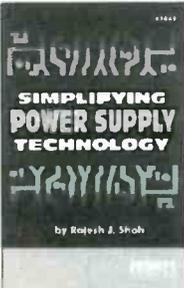
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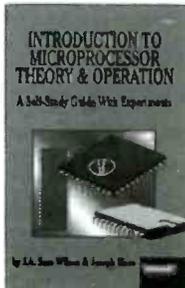
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Fax: 800-RNJ-FAX 1

RNJ Electronics, Inc. is now entering its 15th year as a full-line discount distributor, servicing the TV, VCR, computer, stereo, and microwave repair industries. In addition, RNJ Electronics is a leading supplier of background sound products including PA amplifiers, microphones, speakers, wire, etc. The company has also become a leading distributor in an industry experiencing tremendous growth: The security industry, stocking products such as cameras, moni-

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

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

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

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

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

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

Tritronics, Inc. is a family owned and operated parts distributor, which has been in business since 1975. Our specialty has been supplying exact replacement parts to the electronic service industry. In the past year, we have branched out, and now offer several quality lines of general replacement parts through a catalog and monthly special fliers.

Tritronics' goal is to provide timely and efficient service for their customers. To achieve this, they provide the following services:

1. Orders received by 3:00 p.m. E.S.T. are shipped that day.
2. Stock over 45,000 line items, over 3,000,000 parts.
3. Initial shipments are 85% filled.
4. Price and availability is provided on

toll-free numbers for common parts by description and by part number. In Maryland call 1-800-638-3328 or FAX 1-800-888-3293 and in Florida call 1-800-365-8030 or FAX 1-800-999-3293.

5. As of April 1, 1993, Tritronics, Inc. is a Premier distributor for RCA, GE, and Proscan, offering prompt shipments and "DDS" to help improve your "QOS!"

6. Dagnet, an on-line ordering system, allows easy access to information on over 1.5 million parts, prices, inventory, substitutions and common parts by model and description.

Tritronics is committed to supporting the independent electronic service industry. Our support has included being a founding member of NESDA affiliate Chesapeake Electronics Association; cosponsoring a

membership drive with NESDA; and supporting various local organizations by advertising in trade journals, sponsoring and participating in special events.

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

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

In our travels to the various industry meetings, Tritronics' officers often have the pleasure of meeting other people who work their business with family members. The Tritronics family looks forward to serving your business now and in the future. Our customers say that we are: LARGE ENOUGH TO SERVE YOU, SMALL ENOUGH TO KNOW YOU!



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MCM Electronics is dedicated to providing the best service and value available to the consumer electronics service industry. In stock and available for immediate shipment is an extensive inventory of over 21,000 items including semiconductors, repair parts and test equipment. This includes a large assortment of quality generic parts and accessories offering the ultimate in price value. In addition, we stock some of the best brand names available, throughout all categories, giving the customer additional performance comfort.

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MCM services the industry through two full size catalogs per year. Each issue contains MCM's complete assortment of parts and equipment. Extensive selections are available in test equipment, wire and cable, connectors, tools, computer products, audio/video and appliance parts. You will also find one of the most complete lines of semiconductors and repair parts. Hundreds of new items are included in each MCM catalog, and supplemental flyers go out regularly offering specialty priced items and hot new arrivals.

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The sales staff at MCM is trained to

answer calls quickly, efficiently, and in a friendly manner. These professionals are available on toll-free lines to provide current information on stock availability and pricing. Extended hours make the sales staff available Monday—Friday, 7:00 AM—9:00 PM, and Saturday 9:00 AM—6:00 PM (EST). After-hours orders can also be placed through these lines ensuring 24-hour service. MCM also provides toll-free technical support through highly-trained electronics technicians to answer any questions customers may have. The "Techline" is a valued service to MCM customers and is available toll-free by calling 1-800-824-TECH (8324).

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An extension of MCM's dedication to customer service is its distribution facilities. In February 1995, MCM moved into a new facility in Springboro, Ohio. This increased warehouse space and improved distribution capabilities and was the second expansion in two years to better service MCM customers. In 1993, MCM opened a second distribution facility near Reno, NV, to more efficiently serve our customers in the western U.S. The new facility in Springboro and the one in Reno have combined to continually improve MCM's already superior distribution efforts. For more information and a free 324-page catalog, call 1-800-543-4330. In the Dayton, OH area, call 513-434-0031.

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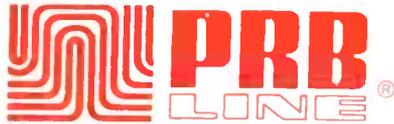
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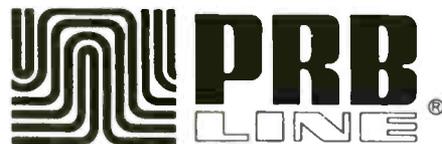
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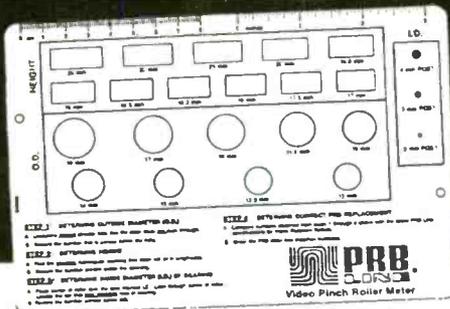
To help our customers save time and be more profitable, PRB began publishing a Cross Reference Belt Guide in

1970. Currently, in addition to belts, it contains replacement information on Idler Assemblies, Tires, Pinch Rollers, Video Heads, RF Modulators, and Sensing Lamps for various electronic equipment. The 1995 PRB Line Cross Guide features detailed information on replacement parts for VCRs, Camcorders, Cassette Players, Compact Discs, Answering Machines, Car Stereos and Replacement Belts for Turntables, Audio/Visual Equipment and Office Machines. The Cross Guide lists a majority of the mechanical parts, by manufacturer make and model and is crossed to the recommended PRB Line Replacement Part. The Guide is also available on a computer diskette. If the model number is unknown, the program allows the user to merely enter the specifications of their original belt and instantly obtain all the PRB belts that fit within those specs. We feel our customers deserve the time, energy, and money we have invested every year to improve this excellent resource.

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

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

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

(premier), QUASAR, GE, KENWOOD, TECHNICS, SAMSUNG and TOSHIBA. Stocking one of the largest and most comprehensive inventories enables the company to fill over 80% of our orders from over 40,000 stocking items and guarantees Two-Day service (at no additional charge) to you on all in-stock orders placed before 2:00 p.m. (EST).

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

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

result, the company is quickly establishing itself as stocking one of the largest and most diverse inventories of tools, test equipment, and soldering supplies in the U.S. Huge inventories of XCELITE tools, CHEMTRONICS chemicals, WELLER & HAKKO soldering equipment, and virtually every meter & scope from WAVETEK, FLUKE, B & K, GOLDSTAR, LEADER, KENWOOD, and HITACHI are on hand to provide same day shipments of your orders.

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

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

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Hytec Dealer Services began operation in 1981 as a division of one of the largest office equipment dealers in the southeast U.S. After becoming an independent corporation in 1985, Hytec quickly established itself as the preeminent repair center in North America for office equipment circuit board repair on copiers, facsimiles, typewriters and laser printers.

Office equipment dealers and OEMs around the world recognize Hytec for its consistently high-quality repair work and its expertise in a variety of areas. Customer service has been a major focus since the earliest

days of Hytec. The business of circuit board repair requires quick response by the vendor and Hytec has maintained an adequate and attentive customer service staff to solve dealer problems that otherwise might have resulted in lost accounts.

Board repair services offered have expanded through the years to include CANON, SHARP, MINOLTA, RICOH, SAMSUNG and BROTHER office equipment, among many others. Many of Hytec's repair lines are offered through direct authorization by the OEM. Hytec remains the exclusive OEM authorized facility for sev-

eral equipment lines, including CANON MICROGRAPHICS, SHARP COPIERS, BROTHER TYPEWRITERS AND FACSIMILE and SAMSUNG FACSIMILE. New repair services are always being added and, for 1995, Hytec is pleased to announce the addition of board repair services for the Ricoh/Savin copier line.

Other services offered include a complete variety of technician tools and accessories. Complete tool kits and cases from Platt Case Co. and Howe Industries, meters from Wavetek and Fluke, service vacuums from 3M and assorted other accessories allow individual technicians and service departments to utilize Hytec as a true "one-stop" shop for their service needs.

A complete catalog featuring all of Hytec's products and services is available free of charge by calling a Hytec account rep at 800-883-1001.



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What Do You Know About Electronics?

Boltzmann's constant

By Sam Wilson

By way of review, I pointed out in a previous WDYK? that a carbon-composition resistor, sitting on a table with no connections, has a voltage across its terminals. It is called a noise voltage, or Johnson noise voltage, or thermal agitation noise voltage. Take your pick.

What causes noise voltage?

Noise voltage is caused by the random motion of charge carriers (electrons) in the resistor. It occurs at any temperature above absolute zero (about -273C or -460F).

Every resistor, semiconductor diode, bipolar transistor, FET and every other component made with semiconductor material is guilty of generating the noise voltage. The value of the voltage is given by the equation in Figure 1.

The temperature is given on the Kelvin scale for a good reason. At absolute zero it is assumed that all random motion of charge carriers stops. So the noise voltage must be 0V at that temperature. Well, that's the prevailing theory. No one has been able to produce a temperature of absolute zero up to now.

Boltzmann's Constant

As for Boltzmann's Constant (k), (1.374 x 10⁻²³ joule per Kelvin degree), in that equation, it is easy to find the numeric value in books. It is another thing to try to find out what Boltzmann's Constant means and how it can be derived; unless you read WDYK?

Boltzmann used some sophisticated mathematics of statistics to arrive at the constant. However, you don't need to take a graduate course in math to understand it.

If you had the time, money for expensive lab equipment, and the inclination you could set up an experiment to determine which things affect the noise voltage. You would find that the noise is directly affected by the resistance of the resistor, the bandwidth over which the measurements

Wilson is the electronics theory consultant for ES&T.

BOLTZMANN'S CONSTANT
(1.374 x 10⁻²³ JOULE PER °K)

$$V_n^2 = 4kTBR$$

WHERE: B IS THE BANDWIDTH OVER WHICH THE NOISE IS MEASURED, R IS THE RESISTANCE, T IS THE TEMPERATURE IN DEGREES KELVIN, AND k IS BOLTZMANN'S CONSTANT

Figure 1

are made, and the temperature at which the measurements are made.

You could make a graph of the values. After plotting measured values and using basic reasoning you would see that it is the square of V_n that is affected by those things. The technique used is called "curve fitting" and when you plotted the values on graph paper you would see that the curve is part of a parabola.

Armed with that information you would write the relationship between the values in symbolic form. That relationship is given in Figure 2.

It isn't necessary to go through every step of that process. I am describing it to show how it can be done. The lab setup must be done very carefully. If you insist on doing it you will have to quit your job.

The symbols in Figure 2 should be read as follows: "The square of the noise voltage is directly proportional to (T)(R)(B)."

Constant of proportionality

I have mentioned before that any time you have values that can be written as a proportion you can make them equal by introducing a constant of proportionality. Let's call that constant "Boltzmann's Constant" and give it the symbol "k." Those are good choices.

Figure 3 shows the equation with the

$$V_n^2 \propto (T) (B) (R)$$

Figure 2

$$V_n^2 = k(R) (T) (B)$$

$$k = \frac{V_n^2}{(R) (T) (B)}$$

$$k = \left(\frac{V_n^2}{R}\right) \left(\frac{1}{T}\right) \left(\frac{1}{B}\right)$$

Figure 3

$$k = (WATT) \left(\frac{1}{\circ K}\right) \left(\frac{1}{CYCLES/SEC}\right)$$

$$k = \frac{WATT - SEC}{\circ K}$$

$$k = \frac{Joule}{\circ K}$$

Figure 4

$$V_n = \sqrt{(4) (1.374 \times 10^{-23}) (300) (1 \times 10^6) (6 \times 10^6)} = 3.145 \text{ mV}$$

Figure 5

constant of proportionality, and what you get when you solve that equation for k. I took out the number 4. It comes from measuring the distance to the focus of the parabola. The omission will not affect the development of k. So, we can put it back in after that constant is properly defined.

The scientific world will not accept the equation for noise unless we can give k a value and a unit of measurement. The first step in establishing a value for k is to solve the equation for k. That equation is given in Figure 3.

I rewrote the equation for k in Figure 3, so in the last equation in Figure 3 the constant k is shown to be equal to the product of three fractions.

Entering the data

For every combination of T, R, B, and calculated value of noise voltage (using the data that you obtained in your experiments) you would get 1.374×10^{-23} for the value of k. In the history of technology there have been experts who specialized in doing this kind of thing. Michael Faraday was one of the greatest.

So far so good. Now for the units. Refer to Figure 4.

This time we poke the units of measurement for T (degrees K), and B (cycles per second) into the equation for k that was given in Figure C. Remember that the power in watts is equal to V^2/R so we substituted watt for that fraction.

In the first equation for k in Figure 4 you see 1 divided by CYCLES/SEC. When you divide by a fraction you invert and multiply. That's how the SEC got into the numerator of the equation for k. Now we have a value for k and a unit of measurement.

To summarize—Boltzmann's constant is a constant of proportionality. When you plug the value into an equation you find you can rationalize units as was shown in the previous issue.

Calculating a noise voltage

Here is an example of the calculation of noise voltage: What is the value of noise voltage for a $1M\Omega$ resistor when the temperature is 300K and the bandwidth is 6MHz?

For the solution, see Figure 5.

Curing noise problems

Thermal agitation noise in the tuner of television receivers and communications

receivers causes snow in the picture and a hissing noise in the sound. If you want to get rid of it you don't have many ways to go. Squelch is used effectively in communications receivers. Or a strong signal can override the noise.

You're stuck with the bandwidth so you can't do anything with that.

The designers know the importance of a low-input resistance. So, use an exact replacement for resistors, for transistors, and other semiconductor components in the front end. Some resistors are noisier than others. Carbon-composition types are among the noisiest.

Forced-air cooling is sometimes helpful, but, it is costly and it can add noise if it isn't done right.

Controlling noise usually boils down to a better antenna or cable signal.

Control of dc motor output power

This is a discussion of motor output power, not a discussion of speed control!

I have said many times that technicians do not usually use math equations in their work. The importance of equations, however (and the reason I put them in WDYK?), is that they show important relationships between parameters. For example, when you learned Ohm's law you learned the relationships between voltage, current and resistance.

The "Basic Motor Equation" is an example of a learning tool for dc motors. It has been called "the fundamental motor equation" as well as other names. It is shown in Figure 7.

The equation tells you that the voltage delivered to a motor is dropped across the armature and armature resistance.

Figure 6 also shows that multiplying both sides of the equation gives you information about motor power. It tells you that the power delivered to a dc motor is used in two ways. Some of the power is wasted in the armature resistance. The useful power is delivered to the armature.

DC motors are sometimes rated by the amount of horsepower the motor can deliver through its shaft. That is the useful power in the equation.

When you were in school you may have memorized the following relationship: one horsepower = 746W. The next time you have a minute to kill, calculate the amount of electric power it would take to replace the motor in your car or truck. That will give you a good idea of the prob-

$$V_t = V_g + I_a R_a$$

Figure 6

$$(V_t)(I_a) = (V_g)(I_a) + (I_a^2)(R_a)$$

Figure 7

lem of making an electric car. Example: A manufacturer rates its dc motor as being able to deliver one-half horsepower. It requires one ampere of current when it is operating with that output. Its armature resistance is 1.1Ω . How much input power is required when it is delivering its rated output?

The solution is shown in Figure 7. Example: A 1929 Hypolux 8 had an engine rated at 200 horsepower. How many watts of power would be needed if you replace with a dc motor?

Solution:

$$1HP = 746W$$

$$So: 200HP = 200 \times 746W = 149,200W$$

In the next issue we will look at some power controls for motors. ■

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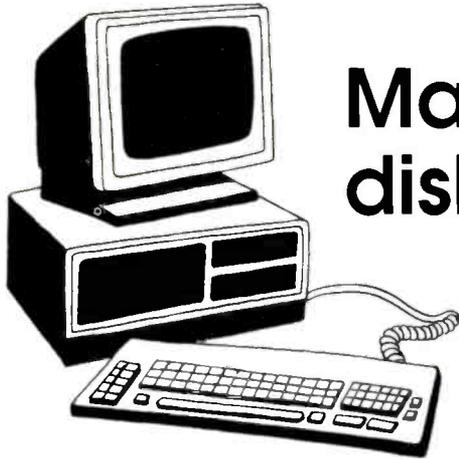


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Making room on the hard disk

By David F. Norman

Personal computers have come a long way from the early days (just a few years ago, really). They have increased in speed, power and storage capacity. Unfortunately, software programs are increasing in their requirements for storage and operating space as fast as, or faster than, the improvements and enhancements in hardware are occurring.

When I first began messing with computers about 12 years ago, I bought about the last Timex/Sinclair computer that sold for full retail price. Frankly, I don't know why that experience did not sour me forever on computers. The documentation was terrible, the equipment balky and unreliable, and I managed to come away from the experience learning very little.

For some reason, I tried again. This time I bought a Franklin; you remember the Apple "compatible" that became an orphan after a lawsuit won by Apple. I actually learned to do a little word processing on that computer.

A year or so later, I graduated to a Tandy TL 1000 with its proprietary quirks. As I began to learn more about using the little Tandy, which I still use in my computer network "lab," something clicked and I fell in love with computers. I even figured out how to export all the wordprocessing files I had stored on the Franklin to the Tandy using a null modem. I wish I could remember how I did it at this late date.

Into the world of IBM compatibles

When I graduated to a 20MHz 80386, which had no proprietary quirks, I finally had a real machine. Since then I have moved up a couple of notches; and aren't those Pentiums getting reasonable?

Along the way, I managed to experience just about every difficulty that can occur. Resolving those problems has made me what I am today.

Years ago, we used to cuss the documentation as lousy and had to figure things out for ourselves. The documentation has improved a lot, but who has time to read all that junk? We still tend to figure things out for ourselves.

When I worked for a computer store, we had a saying that often came to our lips (behind the customer's back) when a customer began to require excessive after-sale support: we would say RTM, or "read the manual!"

Excellent advice. Unfortunately, sometimes it still doesn't work. One of these days, I will install a new piece of hardware or software and everything will work just right the first time. One of these days, but it hasn't happened yet. I guess the point is that no matter how much experience you get, there is still more to learn. Lately I have been learning a few things which might help some of you.

Eliminate unnecessary files

One of the recurring ways I get in trouble is by trying to keep unnecessary files off my hard disks. Sure, I can accept the default installation and end up with lots of extra files and wasted hard disk capacity. I can, but I don't. It is a point of pride with me that I don't have a single file on my hard disk that I don't expect to use. Of course, it is a delusion. But I try, and that is where I get in trouble.

If I got paid \$10 an hour for every hour I spent reinstalling programs after deleting just one unnecessary file too many, I

could take a great vacation. In all honesty, it isn't always my fault.

Wouldn't it be nice if software and hardware manufacturers would add to all documentation a short description of what every file does? WordPerfect, Microsoft, and others have gotten much better in that department. However, there is still room for improvement.

While we are on the subject of room for improvement, my biggest peeve is the massive size of so many "programs." Real programmers can do amazing things with a small amount of code. The other guys hang things together and do amazing things with code which requires a 486 or better with 8 megabytes of RAM.

If the trend continues, the average program will require 100 megabytes or more of hard disk space and \$2,000 worth of memory just to run. Give us a break.

Back to the problem of saving space on a hard disk. There are a few suggestions I can make to ease "disk cram."

Back up before you delete

Before you do anything, back up the directories you intend to clean up. Restoring from a backup is usually quicker, if not easier, than a full reinstallation.

Delete the unnecessary files; conditionally. This includes drivers for hardware you don't and never will have. Get rid of "readme" and text files after you have perused or printed them. Unused macros can also waste a lot of disk space. Sample files are usually unnecessary after you have messed about with the program.

Write down the name of each file you delete. Then if you attempt to run the program and it does not function properly,

use an "Undelete" utility to recover the missing files as necessary.

Compress files

Another way to get more disk space is to upgrade to DOS 6.22 and use the "DRVSPACE" utility to compress your hard disks. This gives me a compression ratio of 1.7:1 with my mix of files. In plain language, that means you can expect effective storage from a 100 megabyte drive of nearly 170 megabytes; just about as close to something for nothing as you will ever find. The difference in speed is negligible and reliability seems to be unaffected by the compression.

Further compress old documents, graphics, and sound files you seldom use with a compression utility such as Pkware's excellent PKZIP. This is an example of excellent programming which others would do well to emulate.

Finding a single file in a zipped file

PKZIP can compress a number of files into a single zipped file, but there are several ways to look for a particular file in a "zipped" file. A simple, elegant way to do this is to use a single-line batch file.

Assuming that PKUNZIP.EXE and the DOS utility MORE.COM are in your path, go to any directory in your path and type the following lines, pressing "Enter" after each line:

```
COPY CON ZIPDIR.BAT
PKUNZIP %1 -vb | MORE <F6>
<Enter>
```

When you press the F6 key, "AZ" will appear at the end of the line. When you press <Enter>, you will get a message, "1 file(s) copied."

To run the batch file, enter the directory where the zip file is stored and type "ZIPDIR (filename) <Enter>." Your screen will display a list of the files inside the zip file, one screen at a time.

Using a replaceable parameter (%1) tells the batch file to replace the parameter with the next keyboard entry. (filename). The pipe symbol (|) tells the program to send its output through the DOS program MORE which stops the display as the screen fills and pauses until a key is pressed.

That is the lesson for today. Do any of you have any one line batch files to make our lives simpler? If so, send us your suggestions, ideas, and questions. ■

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Test Procedures for Basic Electronics, By Irving M. Gottlieb, PROMPT Publications, 376 pages, illus., \$16.95 paperback.

This book is designed to train the novice and to better inform the professional technician about testing equipment, its uses, and the appropriate translation of readings into practical repair information.

Author Irving M. Gottlieb details numerous test and measurement procedures, with an emphasis on the use of commonly available instruments. Illustrations and diagrams of setups offer examples of common connections.

Some of the subjects covered include: dc resistance, voltage and current, impedance concepts, semiconductor devices, and digital circuit testing.

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PROMPT Publications, Howard W. Sams & Company, Indianapolis, IN 46214

Old-Time Telephones. By Ralph O. Meyer, TAB Books, 304 pages, 200 illus., \$19.95 paperback, \$4.95 hardcover.

Few inventions have had the far-reaching impact of the telephone. All kinds of telephones—from Gray's and Bell's earliest patents to state-of-the-art models continue to fascinate. Now, there is a book that will satisfy information-hungry enthusiasts, be they casual hobbyists, serious collectors, or students of history.

This book is filled with intriguing historical information on telephones of the past 120 years. Gleaned from author Ralph O. Meyer's painstaking research of patents and journal articles, and his numerous precision electrical measurements, much of this material has never before been widely published.

In addition to providing a comprehensive guide to the restoration and repair of antique telephones, the book contains many high-quality photographs, drawings of antique telephones, and unique

schematic diagrams that will prove valuable to collectors and technicians.

The book is divided into four sections covering the development of the telephone, types of telephones used in commercial service, electrical circuits used throughout the telephone's history, and repair and restoration. There is also an appendix of electronics fundamentals, conventions, and related physical principles.

A member of the Antique Telephone Collectors Association and Telephone Collectors International, Ralph O. Meyer has had a career in science and engineering and a lifelong interest in telecommunications. He holds a Ph.D. in physics.

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

Power Supply Cookbook, By Marty Brown, Butterworth-Heinemann, 248 pages, hardcover, \$39.95.

Written to serve as a practical reference on power supplies during the design process, the *Power Supply Cookbook* provides easy-to-follow, step-by-step design procedures for power supplies. It offers common industry approaches along with relevant explanations that facilitate implementation. The publisher claims that by using this book, any technician or engineer will be able to complete a complicated power supply schematic in less than one day.

Marty Brown's latest book covers linear, PWM switching, and resonant-mode switching power supplies, both dc-to-dc and off-line types. It presents each section of the power supply, organized into functional subcircuits, along with explanations of each function and typical design approaches.

This volume addresses every phase of power supply design, from magnetics and feedback loop compensation to RFI/EMI control. Many easily modified design examples are provided as design templates to help the reader.

Contents include Role of the Power Supply Within the System and the Design Program; Basic Linear Regulator Design; Pulsewidth Modulated Switching Power Supplies; Quasi-resonant Switching Power Supplies; and appendices.

Marty Brown is a power supply design specialist and a Senior Field Applications

Engineer at Motorola Semiconductor Product Sector. He is the author of *Practical Switching Power Supply Design*, a popular volume on switching power supply design used by engineers worldwide.

Butterworth-Heinemann, Newton, MA 02158-1626

Operational Amplifier Circuits: Analysis and Design, By John C.C. Nelson, Butterworth-Heinemann, 175 pages, \$22.95, hardcover.

The widespread availability of operational amplifiers in the form of low-cost integrated circuits means that today a modular approach to analog circuit design is possible. In many cases, a single operational amplifier in conjunction with a small number of passive components may be all that is required for a particular function.

This book, a revised and updated version of the author's *Basic Operational Amplifiers* (Butterworths 1986), enables the non-specialist to make effective use of readily available integrated circuit operational amplifiers for a range of applications, including instrumentation, signal generation and processing. It is assumed the reader has a background in the basic techniques of circuit analysis, particularly the use of *j* notation for reactive circuits, with a corresponding level of mathematical ability. The underlying theory is explained with sufficient, but not excessive, detail. A range of computer programs provides assistance with the required calculations.

Contents include Preface; Introduction to Operational Amplifier Circuits; Frequency Response; Offset Errors; Waveform Generation; Introduction to Active Filters; Nonlinear Circuits; Appendix-Computer Programs.

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Electronic Circuit Design Ideas, By Venkataraman Lakshminarayanan, Butterworth-Heinemann, 288 pages, \$29.95, paperback.

Butterworth-Heinemann announced the publication of *Electronic Circuit Design Ideas*. With 14 chapters, and using over 170 circuits, this compendium contains a wide range of interesting and illus-

trative circuit design ideas. Each idea consists of a circuit diagram, waveforms (where applicable), and a simple explanation of how each circuit works. In many cases relevant design equations and formulas are also shown, so that the full lesson offered by each can be appreciated.

This collection provides a valuable ready reference for design engineers, consisting of many circuits that provide the building blocks of larger system design. Each component used is fully described, and data sheets are provided where appropriate. These designs work, according to the publisher, and all information necessary to make them work is provided.

Contents include Digital Circuits; Interface Circuits; Timer Circuits; Op-Amp Circuits; Amplifier Circuits; Waveform Generators and Oscillators; Phase-locked Loop Circuits; Power Supply Circuits; Voltage Regulator Circuits; Battery Circuits; Motor Control Circuits; Encoders/Decoders; Tester Circuits; Miscellaneous Circuits; Bibliography; Circuits Index.

Butterworth Heinemann, Newton, MA
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Computer Interfacing: A practical approach to data acquisition and control, By William H. Rigby and Terry Dalby, Prentice-Hall Inc., 232 pages, hardcover.

According to the authors, the two disciplines of electronics and computers have become so intertwined that it is difficult to differentiate between them. The emergence of the personal computer (PC) in the late 1970s changed forever any separation that existed between these two fields of study.

Now in one volume, Rigby and Dalby's class-tested text/laboratory manual will provide a resource for students who apply personal computers to applications in electronics: from interfacing, digital input/output, analog input/output, to data acquisition and computer control of external devices.

Elementary program examples, called program kernels, are provided in both BASIC and C languages. These examples have been kept reasonably straightforward to avoid obscure programming techniques and "tricks."

The use of personal computers in elec-

tronics and mechanical technology is a fascinating field that provides a high level of satisfaction to students.

Prentice Hall, Simon & Schuster Education Group, Englewood, NJ 07632

Introduction to Microprocessor Theory & Operation, PROMPT Publications, paper/232 pages, 6" x 9"/illus., \$16.95

PROMPT Publications announced the release of *Introduction to Microprocessor Theory & Operation*, a book that explores the heart and soul of computerized equipment, the microprocessor.

This book reveals the inner workings of computerized electronic equipment, but more important, it explains how microprocessors work with their associated circuitry to provide basic core energy to the entire system.

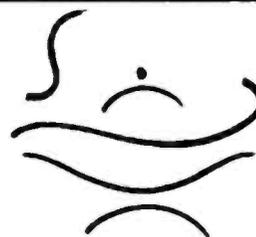
Since the introduction of microprocessor theory, a great gap has existed between its principles of operation and those attributed to the more universally accepted ideas revealed in digital electronics theory. In *Introduction to Microprocessor Theory & Operation*, authors J.A Sam Wilson and Joseph Risse set out to eliminate the myths and inform the reader on the circuits, specifications, and general ins-and-outs of microprocessor systems.

Subjects covered include Features of the Microprocessor, Basic Microprocessor Systems, ALU, Mass Memories, Binary Components, and Transducers as Data Sources.

Introduction to Microprocessor Theory & Operation is fully illustrated and includes 15 easy-to-build, inexpensive experiments that illustrate the various individual sections in a microprocessor. These range from construction of a bounceless switch to more advanced ROM, RAM, and interfacing experiments. This book is appropriate for the beginner just breaking into the field of microprocessors, while still providing experienced technicians with a valuable reference and refresher tool.

It is available at electronic parts distributors and book-stores nationwide. For the name of your nearest PROMPT Publications distributor, call Howard W. Sams toll free at 1-800-428-7267.

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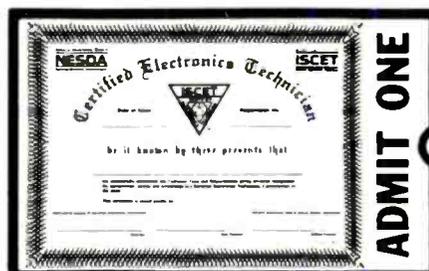
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Leadership: A Rare and Valuable Commodity—Part 3

By John A. Ross

A previous article explored one of the most basic leadership types: transactional leadership. Transactional leadership can push all involved parties into "higher" forms of leadership. In short, the situations created by the transactions create an environment in which a different level of decision-making is required. This environment tests the balance discussed in the first article of the leadership series and places additional pressure on the person or persons in the leadership position.

What causes this added pressure? The added pressure occurs because the balance between organizational and individual needs becomes internalized within the leader. As it becomes internalized, no definite line between organization and individual can be discerned. The success of one depends on the other, and the dominance of one weakens the other. It is at this "gray area" that decision-making takes on a delicate and important nature.

Externalities

In purely theoretical and economic terms, a concept called an "externality" can twist and turn any decision so that no answer seems correct. Here's an economist's somewhat confusing definition of the term: "An externality is a situation where consumption benefits cannot be limited and charged to any particular consumer. Economic activity results in social costs which need not be paid for by the producer or by the consumer who causes them. No fixed relationship between production, consumption, and externalities exists. As an example, an individual inoculated against the flu benefits both the individual and society in general. The person benefits from the inoculation. Society benefits by having one less flu carrier."

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

That definition may help to clarify the problems with decision-making and leadership. The first part of that definition refers to the consumption of social goods. It can also apply to the transactions that occur between a supervisor and a subordinate on a daily basis. As with the definition of externality, no clear winner or loser emerges concerning the costs and benefits of the transaction.

Here's an extreme example: if the transaction causes the superior to terminate the subordinate, the subordinate may find a better job. Because there is no clear winner or loser here, it becomes more difficult to assign those costs or benefits to any one source.

When we progress to decision making and on to moral or ethical leadership, the concept of "externalities" takes on a fuller meaning. As daily problems arise, the leader faces a wide range of decisions that may affect both the organization and the individual in positive and negative ways. Each consequence of one decision also causes a "ripple effect" of other problems and decisions. Going back to the externality concept, each decision that is made will result in certain short- and long-term costs and benefits for the organization and the individual.

While the short-term costs and benefits are relatively easy to identify, the long-term costs and benefits may be hidden from view. Finally, as the costs and benefits unfold, no one may be able to pinpoint their source. If the first decision is poor and yields costs, other decisions that branch or ripple from the first may be good and yield benefits.

A basis for decisions

Because of all of the possible consequences of leadership decisions, the leader finds that some type of "bedrock" is necessary for decision-making and for

maintaining the balance between the organization and individual. Within the balance, both togetherness and conflict make up the relationship between the person who has the leadership position and the person in the follower position. Even with this bedrock in place, every satisfied want creates another need. In turn, each want or need may involve survival, self-esteem, or other motives. Thus, the bedrock becomes difficult to define.

For many, the bedrock has its roots in the behaviors of everyone in the organization. Yet, I would suggest that the bedrock spreads from the moral or ethical behavior of the leader. Because of their positional power, charisma, or other characteristics, leaders create patterns for their followers. As an example, the pattern may be that "hard work provides excellence." Yet, even though the leader establishes those patterns and works to maintain the leader-follower relationship with each of his followers, he or she must recognize that the organization cannot satisfy all of the individual needs presented by the followers.

Moral and ethical leadership

With that last remark, the need for moral or ethical leadership becomes most important. Moral leadership makes the needs, motives, and values of the followers a priority for the leader. Ethical leadership and, thus, ethical decision-making hinge on three principles: stewardship, self-constraining responsibility, and equity.

While some may argue that stewardship implies the domination over people or property by one individual, the ethical context of stewardship is the responsible exercise of trust. For example, a public steward acts in behalf of a citizen or citizens. As management expert Peter Drucker points out, "...managers of institutions are collectively the leadership groups of the

society of organizations." In other words, the leader must be the "boundary-crosser" or the bridgework of the organization.

Working as a member of a leadership group, the individual manager has the responsibilities of cultivating and exercising trust, and of acting as a professional. Within Drucker's definition, a professional has the responsibility of maintaining autonomy with no obligation to political or ideological controls and the responsibility of remembering that the welfare of his clients or employees "sets limits to his deeds and words."

Equity

The last of the principles, equity, builds on the ideals of stewardship and self-constraining responsibility and fills out the wholeness of ethical leadership. Equity in the ethical context means that the leader has an obligation to everyone in the orga-

nization. If the managers in the Total Quality Management (TQM) system begin to represent only a portion of their organizations, they are not exercising the right kind of leadership.

Going back to Drucker's admonition about professional responsibilities, an understanding of the simple definition of equity precludes a managerial obligation to any one group or ideology. When the manager becomes a leader, he or she must serve both the organization and the common good.

Furthermore, this sense of equity demands that "when we do unto others as we would have them do unto us" the "others" should include everyone. When we transfer this sense of equity to the organization and to the TQM approach, then we find that a leader/manager should treat all co-workers, employees, and customers as he or she would like to be treated.

Creating a cooperative atmosphere

Becoming the ethical leader required by TQM means that the leader figure must maintain consistency, firmness and honesty throughout the decision-making and planning processes. As theory moves into practice and the ideal becomes muddled with personal conflict, a principled consistency that recognizes honor, benevolence, justice and honesty lends legitimacy to the actions of the manager.

From there, the bridging of personal ethics with organizational ethics encourages employees to seek their own sense of personal responsibility. This sense of responsibility allows employees to become more sensitive to the implications of their actions. When this happens, the organization becomes an environment where individual values and organizational values mesh rather than clash. ■

ES&T Calendar

April 7-9, 1995

SDA Annual Convention and SAM School
Westin Plaza, Elkhart, IN
SDA (Satellite Dealers Association) and IESA (Indiana Electronic Service Association)
303-390-3252
800-288-3824

April 19-21, 1995

Electronic Distribution Show and Conference
Hilton Hotel, Las Vegas, NV
312-648-1140
Fax: 312-648-4282

April 26-27, 1995

CEDIA Regional Training
CEDIA (Custom Electronic Design & Installation Assn.)
Charlotte, NC
1-800-CEDIA30

April 30-May 2, 1995

NSCA Contractors Conference and Expo
Indianapolis Convention Center
NSCA (National Systems Contractors Association)
708-598-9777
800-446-NSCA

May 7-8, 1995

CEDIA Regional Training
CEDIA (Custom Electronic Design & Installation Assn.)
San Francisco, CA
1-800-CEDIA30

May 17-18, 1995

Systems Support Expo
World Trade Center
Boston, MA
10:00 am to 5:00 pm daily
Fax: 207-846-0657

May 19-20, 1995

ETA Annual Convention
Philadelphia Wireless Technical Institute
Philadelphia, PA
Electronics Technicians Association
317-653-8262

June 17-19, 1995

CES Specialty Audio & Home Theater Trade Show
EIA/CEG
Chicago, IL
703-907-7600

July 31-August 5, 1995

National Professional Electronics Conference
Arlington, VA
National Electronics Service Dealers Association
817-921-9062

October 26-27, 1995

Systems Support Expo
Moscone Center
San Francisco, CA
10:00 am to 5:00 pm daily
Fax: 207-846-0657

Zipper kit holds test equipment, tools, computer and paper

Jensen Tools, Inc., introduces the JTK-19 three-sided tool kit for the electronics industry, and other service. The JTK-19 is designed for technicians who service a broad range of systems and must carry spares and test equipment.

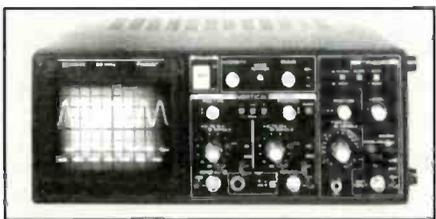


The three-sided Cordura Plus case has separate compartments for tools, test equipment, notebook computer and paperwork. It measures 18 x 12½ x 8½ inches outside.

Circle (80) on Reply Card

Scope test components

The Model P-3502C oscilloscope from *HC Protek* is a full-featured 20MHz dual trace plus component test functions with new unitized, single PC board construction for high stability measurements.



In addition to standard capabilities, this dual-channel instrument will measure resistors, capacitors, coils, zeners, diodes, zener-capacitor parallel, and resistor-zener series—in and out of circuit. Other key features include a bright, six inch CRT with 2kV acceleration; X5 magnification for all time/div settings; 5 vertical mode selections and a 20-step horizontal sweep speed from 0.5 sec/div to 0.2 µsec/div; and trigger coupling including "TV" "AC-LF" to attenuate frequencies that are above 50kHz.

Circle (81) on Reply Card

Handheld milligauss meters

Omega's HHG-10 Series handheld ELF/VLF milligauss meters are available in a choice of three different models for basic and advanced magnetic field measurements.



The HHG-14 is a low-cost model with a range of 0.2 to 199.9mG, while the HHG-15 includes an autoranging function which allows accurate measurements from 0.1 to 1999mG. Both models are for measuring 60Hz magnetic emissions. The HHG-16 adds a built-in ability to measure both Extremely Low Frequency (ELF) and Very Low Frequency (VLF) emissions. Both the HHG-15 and HHG-16 offer an optional dc analog output for continuous recording.

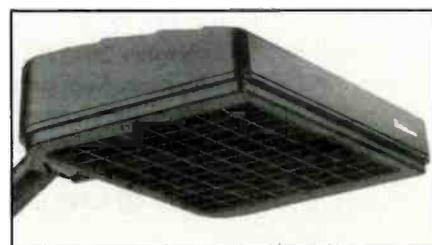
Circle (82) on Reply Card

Light features black parabolic louver

Waldmann Lighting Company announces the introduction of their ergonomic "Computer/CAD" workstation task light that is specifically designed to meet the most significant challenge to the design of computer workstation task lighting—to keep overall illumination levels low enough to maintain VDT contrasts but have enough light for reading reference documents.

The light features an ergonomic black built-in parabolic louver that focuses light on the work area, preventing stray light from creating glare on VDT's or irritating other persons nearby, providing glare-free illumination for the VDT user.

Another ergonomic feature of the CAD-LITE is a 5-axis, articulated, ad-

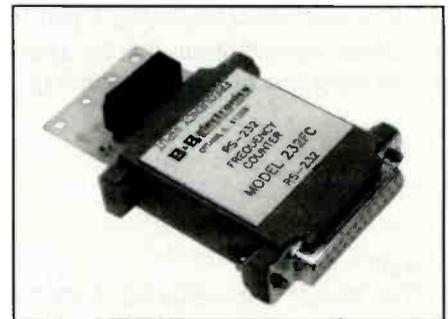


justable arm, affording users precise positioning and light control. The light is available in black, grey, cream, and chocolate, and can be mounted by clamp, table base, wall bracket or panel brackets that fit over 50 office furniture systems.

Circle (83) on Reply Card

RS-232 frequency counter

B&B Electronics Manufacturing Company announces its new RS-232 Frequency Counter, Model 232FC. Powered from the RS-232 port handshake lines, the counter allows you to make frequency measurements of TTL level signals. If the handshake lines are not available, a 12-Vdc external supply can be used to power the converter.



The unit makes frequency measurements from 5Hz to 2MHz and duty cycle measurements from 5Hz to 50KHz. Simple commands will allow the user to make measurements with his own program. The product is shipped with software that logs and plots frequency and duty cycle information, as well as display histograms.

Circle (84) on Reply Card

Oscilloscope probes

ITT Pomona Electronics introduces its SL-Series of passive voltage oscilloscope probes. These compact monolithic probes feature bandwidths up to 450MHz and input capacitance as low as 7pF (X10).

Accurate, laser-trimmed, surface-mount devices replace the discrete circuitry of conventional probes. The result is an ergonomically easy-to-handle product offering very high performance, according to the manufacturer. When used with instruments with 1MΩ input resistance, the probes can handle high (up to 450-MHz) frequencies with low input capacitance (7pF in an X10 probe) to minimize signal distortion. The new series also fea-



tures a wide compensation range (10 to 30pF) to maintain signal integrity during use. Popular switchable attenuation (1X/10X) versions are also available.

The new probes are all constructed of engineering-grade thermoplastic for durability and are compliant to IEC1010 safety standards. They come with a replaceable gold-plated test tip and a 1.2-meter (48-inch) cable. All standard accessories are included.

Circle (85) on Reply Card

DMM service kits

Fluke Corporation now has available two digital multimeter (DMM) service kits that provide customers with a convenient solution to their measurement needs. The Models 23 and 87 Service Kits include a rugged, handheld DMM, accessories and training materials necessary to perform electrical measurements.



The Model 23 Service Kit provides the industrial, electrical and HVAC technician with a Model 23 Analog/Digital Display Multimeter, a 80i-400 clamp-on ac current probe, a TL20 test lead set, and a C17Y case. The kit also includes electrical and HVAC/R application notes and training materials for DMM users.

The Model 87 Service Kit provides the user with a Model 87 analog/digital mul-

timer, a 80i-400 clamp-on ac current probe, a TL20 test lead set, a C28Y case, and the video "Understanding Harmonics." Additional training materials that are in the kit include the "High Performance Guide to DMMs" application booklet and electrical, harmonic and HVAC/R application notes.

Circle (86) on Reply Card

Dual time-base 60MHz scope

The new Model 2260 oscilloscope from B&K Precision offers a wide range of high-end features, including cursors and readouts. The oscilloscope has 60-MHz bandwidth, 1mV per division vertical sensitivity, V-mode triggering for viewing two signals unrelated in frequency, main and delayed time bases and a built-in component tester that is used for testing resistors, capacitors, coils diodes, and a wide variety of other semiconductors and components.



Digital readouts display the volts per division (either channel), seconds per division, and other important operating mode information such as ADD, UN-CALibrated, Probe Attenuation, MAG-nification, Delay Mode, Delay Time, Component Test, and XY Mode. Cursors can measure voltage differences, time differences, and frequency.

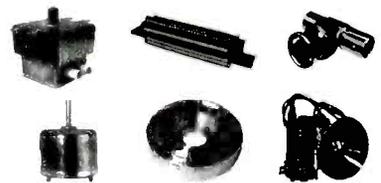
The user can select from 23 calibrated sweep time ranges on the main time base and 19 calibrated ranges on the delayed-sweep time base. Each sweep time range is fully adjustable between calibrated ranges. A X10 magnifier is provided to allow closer examination of waveforms, while maintaining display calibration.

Other features include front panel x-y operation, z-axis input, variable holdoff, channel 1 output on the rear panel (e.g., for input to a frequency counter), signal delay line, beam finder, single sweep operation, and a bright CRT with illuminated internal graticule.

The unit comes complete with two new

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Circle (47) on Reply Card

Test Your Electronics Knowledge

Answers to the quiz

(from page 27)

1. 70Ω (Reactances in series add like resistances in series.)
2. $Q = L/R = 120 \text{ mH}/0.8 = 0.15$ (not very high)
3. $Q = f r/BW$, so, $BW = f r/Q = 200$ kilohertz
4. HOT-CARRIER DIODE
5. The ratio is the same because the signal AND noise are both amplified the same amount.
6. C (See this month's WDYKAE?)
7. C
8. A (by definition)
9. A (Think of the coil as being part of an LC resonant circuit.)
10. LENGTH (it is a very small unit useful for measuring the wavelength of light.)

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10:1 probes, instruction manual and schematic diagram.

Circle (87) on Reply Card

Air-operated production system

The A.P.E. EX-675 is an economical desoldering system for high volume production touch-up and repair. The unit is a pneumatically powered station which converts 60 psi to 120 psi into a high vac-



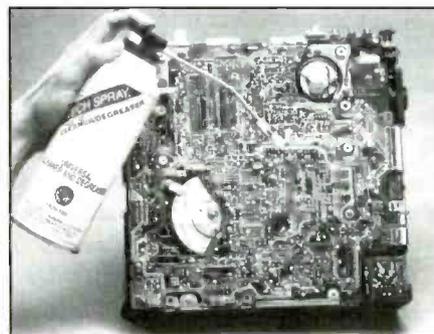
uum flow. Continuous vacuum is achieved through a pneu-vac foot pedal activating a venturi system for an instant vacuum force of 20 to 23 inches of Hg. The station also features an integral temperature control panel. The system requires an in-house air supply filtered and regulated from 60 psi to 120 psi.

Circle (88) on Reply Card

Hydrocarbon-based cleaner/degreaser

Tech Spray announces a new hydrocarbon-based cleaner/degreaser which is a blend of isopropanol and ethanol.

This product is designed for cleaning electronic and electrical equipment, machinery and metal parts. Its rapid evaporation and compatibility with plastics makes it a choice for general cleaning.



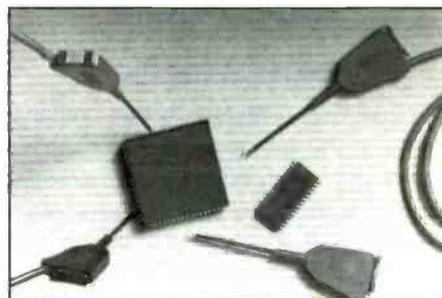
The cleaner/degreaser is packaged in a 10-ounce aerosol container and is compatible with the company's new brush attachment (1991).

Circle (89) on Reply Card

Test clips for small ICs

The latest test clips from ITT Pomona, the Ultra-Thin Micrograbber series, have been designed especially for testing today's fine-pitched, surface mount devices. The series can be used, for example, with J-lead (SOJ) and gull-wing (SOIC) small-outline packages on 1.27-mm (.050") centers.

The test clips have an extremely narrow body design measuring just 3mm/0.12". This ultra-thin body contour, combined with a 1.2mm/0.5" shaft maximizes the users' ability to stack the clips tightly onto fine-pitched devices with up to 50 mils spacing. The shaft is flexible (up to 36 degrees) for easy access from different angles. Additionally, to further facilitate the handling of these tiny clips, the company incorporates serrated surfaces on the plunger and finger tabs.



The new clips provide contact pincers which open to .6mm/.024" to securely grip the device leads, and which also rotate, for further positioning accessibility. Overall length is 54mm/2.13". The silicone-insulated connector wire measuring 2mm/.08" in diameter, is also highly flexible. Electrical specifications include 2A current, internal resistance levels of $\leq 15\text{m}\Omega$ and a temperature range of -20 to 80 degrees C.

Circle (90) on Reply Card

See Distributors Showcase Beginning On Page 28

Parts Catalog

Parts Express, a full-line distributor of electronic parts and accessories geared toward the consumer electronics industry and the technical hobbyist, announced the release of their 212-page 1995 catalog. They stock an extensive line of electronic components, including speakers and audio accessories for home and car, architectural audio products, pro sound equipment, CATV and VCR repair parts and accessories, semiconductors, tools and technical aids, computer accessories, chemicals and solvents, telephone products, wire, connectors, and instructional books and videotapes.

Circle (60) on Reply Card

Catalog of products for low-voltage installation and maintenance

The Jensen Connection, a new catalog from Jensen Tools, provides answers to questions about the installation and maintenance of low-voltage systems and equipment. This 52-page slim-line catalog offers a single source for tools, test instruments, cable, connectors, and installation hardware for CATV, security systems, PC LANs and other equipment.

No matter what equipment or cable type, there are assemblies, tools, testers, and technical guides to assist. Included among the products offered are network outlets, patch panels, wiring blocks, equipment racks, converters, boosters, adapters, gender changers, breakout boxes, cable testers, and fiber optic products, plus specialty tools and tool kits. Reference books offered include the Network Interface Guide, Technician's Guide to Fiber Optics, and the Novell Companion. The Novell Companion condenses years of experience in planning, configuration, installation, and maintenance of communications systems into a single reference for people of all experience levels.

Circle (61) on Reply Card

Industrial task lighting brochure

Dazor's new Industrial Task Lighting brochure presents its full line of task lights which includes a variety of light sources and adjustable-arm designs. A new light source for industrial applications is the energy-efficient compact fluorescent which replaces the "hot" incan-

descent with cooler operation and 10,000 hours bulb life. Other light sources are halogen, fluorescent, and incandescent. Arm types include rugged, all-steel friction arms designed to resist machine vibration and hold position, flexible goose-neck arms, and precision balanced arms that move with the touch of a finger. Applications include machine lighting, assembly, inspection, illuminated magnification, and all-purpose work lights.

Circle (62) on Reply Card

Application note explains importing harmonics data to the PC

BMI's Application Note #231, Importing BMI 155 Harmonics Meter data into your PC, describes how to transfer information from the BMI 155 Harmonics Meter to a PC, import data into spreadsheets, convert into graphs and analyze and write reports. Examples are provided using the data with Microsoft's Excel, Word, and Windows software.

Circle (63) on Reply Card

Test and measuring instrument catalog

Brunelle Instruments Inc., has released an updated instrumentation catalog. This new edition features many standard items along with many new models of test equipment. Products included are: oscilloscopes, function generators, frequency counters, power supplies, spectrum analyzers, multimeters, clamp-on ammeters, panel meters, stroboscopes, and more. A table of contents on the inside back cover makes for quick reference.

Circle (64) on Reply Card

Surge suppressor brochure

Information on the new line of Perma Power surge suppressors, applicable for all types of electronic equipment in the home or office, can now be found in a new brochure from Shape Electronics.

The brochure details the four grades of surge suppressor models. Premium-grade models protect PCs and workstations, and offer a lifetime product and equipment warranty. Heavy-duty, premium-grade units are applicable in test equipment, copy machines and laser printers. Computer-grade models protect personal computer systems, and standard-grade units provide surge and noise protection for

home computers, home entertainment and appliance applications.

As the brochure explains, communication surge suppressors are designed to protect various electronic equipment, such as fax machines and electric phone systems, from damaging surges that travel through phone and data lines. The surge suppressors use advanced SIDAC surge protection with fast-switching time to eliminate spikes.

Circle (65) on Reply Card

New parts catalog available

Parts Express announces the release of their 188-page, 1994 catalog, that describes the company's extensive line of electronic components including speakers and audio accessories for home and car, architectural audio products, pro sound equipment, CATV and VCR repair parts and accessories, semiconductors, tools and technical aids, computer accessories, chemicals and solvents, telephone products, wire, connectors, instructional books and videotapes, and arcade game parts.

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went toward equipment and 25 percent went toward labor. All respondents indicated that most of their jobs come from referrals, especially builders, contractors, and previous customers. Two-thirds of their jobs are new construction.

Respondents believe that the key factors in the future of the custom installation business are professionalism of installers, knowledgeable customers, easy-to-use systems and the integration of equipment in the home.

Expected growth areas include home theater, distributed systems, and systems integration. Almost all respondents agreed that the single most important factor in the growth of custom installation is educating the consumer about home theater.

Regional training dates announced by electronic installers association

The custom Electronic Design and Installation Association (CEDIA) announced regional training dates for 1995. According to Randy Wilson, chairman of the organization's Education Committee, training will be held in the following cities: Charlotte, NC, April 26-27; San Francisco, CA, May 7-8; Indianapolis, IN, June 4-5.

Training will cover all aspects of custom design and installation and will cost \$50 for CEDIA members and \$75 for non-members. For more information, call 1-800-CEDIA30.

Electronic installers association announces plans for 1995

Continuing its efforts to increase professionalism and promotion in the market for high-tech home electronic systems, the Custom Electronic Design and Installation Association (CEDIA) announced plans for the coming year. These include producing a set of instructional videotapes and establishing a test for home theater and audio installers.

According to Jeff Zemanek, president of the 700-member trade group, the video tapes will be a comprehensive guide for custom installers, and will cover several topics. The first videotape, scheduled to be ready by next summer, will cover home theater design and acoustics. A test will also be available on material in the videotape. Those who pass the test will be certified by CEDIA as professionals.

"We are very excited about our agenda for 1995. Our main goal has always been to educate members, and these plans will enable us to do that on a much broader scale than before," said Mr. Zemanek. CEDIA also plans international expansion for '95, with chapters in Europe and Australia anticipated.

Sites announced for annual meeting, SAM school

The Satellite Dealers Association (SDA) will hold its annual convention and meeting at the Westin Plaza in Elkhart, IN, April 7 through 9. Joining SDA in the affair will be the Indiana Electronic Service Association (IESA). The theme will be "Building America's Concourse."

Two days of satellite, antenna, and MATV school will be offered, with one day devoted entirely to topics required for DSS and Primestar installers. This includes rooftop antenna fundamentals, home wiring and safety, multiple source and multiple room distribution, as well as troubleshooting hints.

CSI, (Certified Satellite Installer) examinations will be available for those who want to demonstrate and help raise the level of professionalism in the industry.

For the first time, the SDA will test the industry skill and knowledge of dealers in fun ways and challenge their abilities in the form of SATGAMES. This will be light-hearted competition and will include programmer channel location trivia, IRD hook-up and programming, and blindfolded channel surfing.

The annual meeting will address vital industry issues as well as association business. Election of new officers and state coordinators will take place. All members are requested to attend.

Advanced registrations for the meeting are being accepted now at SDA headquarters by phone at 800-288-3824. Advance registration for members is \$35 and \$50 for non-members. Subscriber membership (SDA's basic level) is included for non-members.

The SAM School fee is additional. The eight hours (four hours each day) of class carry a fee of \$80. Graduates receive a school certificate with one hour semester credit from Central Community College of Nebraska. In addition to the school and fun events, a hands-on trade fair will take

place. Items such as no-concrete dish mounts and alignment equipment will be available on which attendees can get first hand information.

The grand banquet at the Westin Plaza will include presentation of the SDA-sponsored "Pat Porter—Friend of the Satellite Dealer" annual award. Keynote speaker is Mr. Dean Mock, CET, a member of Indiana's General Assembly, co-author of Indiana's TV Technician Licensing Law, and long-time consumer electronics sales and service dealer.

Plans are in the works for attendees at the SDA convention to visit an AM/FM radio station which will demonstrate modern radio broadcasting technology. Fred deFerbrache, SDA's Vice Chairman and host for the Elkhart convention has tagged the Railroad museum in South Bend and Lester Sumrall's TBN Uplink facility for additional field trips. Families may also want to tour the Amish Country exhibits near Elkhart, which are well known tourists attractions.

SDA has chosen the Grand Hotel in Minneapolis, MN, for its 1996 annual convention, now set for June 6 through 8. Tom Way and Pam Purenan of Satellite TV, Inc. of Anoka, MN, are the local co-chairpersons for the 1996 event.

Contact SDA Chairman R. Michael King, King Mt. Services, Ltd., Frisco, CO, at 303-390-3252, or Dick Glass, SDA President, at 800-288-3824 for further information.

Cordless phones in 40% of homes

A survey conducted by the Electronic Industries Association's Marketing Services Department (EIA) has found that more than 40 percent of respondents said they owned at least one cordless phone. Seven percent said they owned two cordless models, and two percent revealed they owned over two. In addition, the survey found that consumers own more stand-alone, cassette-based telephone answering machines than digitally-based models (45 percent said they had one cassette-based unit; only five percent said they had one that was digitally-based).

Perhaps more importantly, however, the survey revealed that corded and cordless phones, and both cassette-based telephone answering machines and units combined with a corded or cordless

phone, are used overwhelmingly for personal reasons. The percentage of respondents that reported they use these products for both personal and business reasons far outdistanced the percentage that said they use them only for business. For example 27 percent said they used corded phones for both personal and business reasons, whereas only one percent reported they use corded phones for business reasons only.

Interestingly, when asked about their use of personal computers and computer printers, survey respondents said they used them both primarily for personal reasons, and, secondarily, for both personal and business use. Only ten percent of respondents said they used their PCs and computer printers for business reasons only.

Significantly, 70 percent of the respondents said they had only one phone line in their household. Fifty-seven percent said they had one line for personal use; 13 percent said they use one line for personal and business reasons. Eighty-eight percent said they had no lines that were

used for business reasons only; only seven percent said they had one line for business use.

Although 46 percent of the survey respondents indicated that they do not have space set aside in their homes in which to perform work, a good percentage reported that they do have space set aside there to do work brought home from their jobs (24 percent), to operate a small business (16 percent), and to handle household business such as finances and budgeting (37 percent).

This survey was conducted by the Verity Group, Inc., using industry standard random-digit-dialing techniques from a representative random U.S. sample provided by Survey Sampling, Inc. One thousand households were contacted. Raw data from the completed survey was aggregated by Verity and supplied to the Marketing Services Staff.

The Electronic Industries Association will be relocated to 2500 Wilson Boulevard, Arlington, Virginia, 22201. Callers can reach the main switchboard by calling 703-907-7600. ■

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Simple to use and not complicated, it organizes 16,068 SERVICE TIPS in ALPHABETICAL ORDER by Brand Model/Chassis & Symptom with 3 lines for Symptom and 8 for Solution. **NOT ONLY CAN YOU REVISE and EDIT or PRINT** any service tip in our database, but **YOU CAN ADD YOUR OWN INFORMATION** and it will automatically be alphabetized and sorted. Our program contains information from **TECHNICIANS like YOURSELF** on TVs, Projection TVs, VCRs, Camcorders and other consumer electronic equipment. **UNLIKE SOME OTHER PROGRAMS, WE HAVE NO GIMMICKS.** SERVICE TIPS was designed and created by 2 CETs who are technicians/owners of their own service centers and a full-time programmer. **SERVICE TIPS is available for \$129.95 plus s&h.** For more information **CALL US at 1-800-621-TIPS (621-8477)** (from US & Canada). Demo Disk and Quarterly Updates available. **IF YOU USE WINDOWS, WE NOW HAVE AVAILABLE A SERVICE TIPS PROGRAM JUST FOR YOU. CALL US FOR MORE INFORMATION.**

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FOR SALE

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YES, WE ARE LIKE THE BUNNY RABBIT THAT JUST, "KEEPS ON GOING."

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INDUCTOR/CAPACITOR TESTER, SENCORE LC101, (40 HOURS)—\$1,700. VARIABLE ISOLATION TRANSFORMER, PERITE—\$375. TRANSISTOR/FET TESTER, CRICKET—\$350. OSCILLOSCOPE, BECKMAN, 20 MHz, DUAL TRACE, COMPONENT TRACER, TWO LOGIC PROBES—\$300. PACKAGE(<500 HOURS!)—\$2,500. 500-677-4686/717-545-5868.

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Sencore Service Center Manager Program SM2001 with manual, Version 4.3. Will ship C.O.D. \$800.00. Contact AI, 315-732-0177.

PHILIPS PM3216 25-MHz Scope with TV Trigger \$250. We also sell **NEW Tektronix and Fluke products. TEST EQUIPMENT SALES (603) 434-2544.**

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VCR service manuals for NEC N916U and Samsung VT311T. *Contact: Chris Anchor VCR & TV Repair, 4044 Shasta Way, Klamath Falls, OR 97603; (503) 884-5985.*

Schematic Profax @ 2090 9/86, will pay for copy or will copy and return. *Contact: J.V. Schember, 1017 West 24. St. Erie, PA 16502-2424.*

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.*

Early transistor radios (1954-1964) and Sams TSMs, volumes 1-23, will pay good prices. *Contact: Jon Hall, 39 Spring Oaks Lane, Ruckersville, VA 22968; (804) 984-4255 days or (804) 985-3827 evenings.*

Power transformer for RCA model WO-535A oscilloscope; part number 248113; new or used. *Contact: Harold Luehrs, R#1, Box 67, Frohna, MO 63748; (314) 824-5581.*

Sansui VCR model # S-V7, preferably in need of repair. *Contact: James Powell, 229 Charleston Road, Willingboro, NJ 08046; (609) 877-9143.*

Service manual for Hitachi VM3000A camcorder. *Contact: Anchor VCR & TV Repair, Klamath Falls, OR 97603; (503) 884-5985.*

Sams' VCR #208. *Contact: The Electronic Works, 6917 Moran Road, Lyles, TN 37098.*

KNIGHT KG-686 RF generator and B&K 606 Dyna jet tube tester. *Contact: Charles T. Huh, 229 Melmore Street, Tiffin, OH 44883; (419) 448-0007.*

Pay top dollar for Sam's Photofacts, over #2800. Please call collect anytime. *Contact: (818) 345-1974 or fax (818) 716-7445.*

Schematic or manual for an Tektronix type 503 oscilloscope. *Contact: Loyce Reid, 1501 So. Welch Circle, Lakewood, CO 80228; (303) 985-3084.*

FOR SALE

Sencore VA62A and VC63, both in excellent condition; \$2500.00. *Contact: Chuck at (615) 435-3389.*

ADCOM GFA-565, 450-watt, mono power amps (2); operational power supplies and output PCBs; toroidal transformers; only the pre-driver PCBs are missing. \$100 each plus shipping. *Contact: Craig at Gunnison Electronic Repair (303) 641-1669.*

Heath 25-MHz scope with component tester, \$250.00 (+S&H); Sencore VA62A video analyzer, \$1400.00 (+S&H); Sencore CR70 CRT Tester/Rejuvenator, \$600.00 (+S&H); Heath hand-held pattern generator, video/channel, 3 output, \$85.00 (+S&H). *Contact: Andrew Kusierick, PO Box 21, Millville, PA 17846.*

Sams Photofact folders (110), \$480.00 for all; Bell & Howell ABR-1060 microfiche reader, 20" X 13" screen, dual carriage and lens, 32X and 48X lenses, \$375.00 (plus shipping). *Contact: Sal Cribari, 1312 Well Drive, Camp Hill, PA 17011; (717) 763-1855.*

Sencore VC93, in original box with manuals, probes, tape; mint condition, \$1500.00. *Contact: Lee at (916) 698-1323.*

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Tektronix 491 spectrum analyzer, 10 MHz-40GHz, \$3800.00 or best offer; Tektronix 7633 100-MHz storage scope, w/7A13 diff comparator, 7A22 diff amp, 7A19 amp, 7B53 dual time base, \$3000.00 or best offer. *Contact: Harry at (201) 772-7443.*

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EICO VTUM model #232 with manual & test leads, good condition, \$40.00 plus shipping; Electronic Technician magazines, April 1965-June 1981 (some missing, all 75 magazines for \$25.00 plus shipping; Tab Books, TV service manuals (different makes) 1970-1972, \$3.00 each or all 13 for \$25.00 plus shipping. *Contact: John Brouzakakis, 247 Valley Circle, Charleroi, PA 15022; phone (412) 483-3072.*

Sencore SC61 waveform analyzer in excellent condition, \$800.00. *Contact: 515-295-9344.*

Must sell, Going out of business, New Sencore CR-70 CRT rejuvenator, \$900.00. Also Sencore SC-61 analyzer, very good condition with manuals/probes, \$750.00. *Contact: Bob, (506) 652-3146.*

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VCR, audio, microwave test equipment, schematics, parts, more than enough to start a repair business, \$3000.00 or best offer, includes UPS. *Contact: Mark (314) 897-4455 in central MO.*

Sencore SC61, LC102 Auto Z, SCR250 SCR & TRIAC test accessory, VC93. All equipment like new, in original boxes, \$3400.00. *Contact: (219) 627-5351.*

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Company	Page Number	Reader Service Number	Advertiser Hotline
American Hakko Products, Inc.	24	21	800/88-HAKKO
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Chemtronics	5	24	800/645-5244
Custom Data Associates	10	25	800/451-0137
Curtis Mathes	44	26	800/657-1979
Dalbani Corporation	43	27	800/325-2264
Electronic Technician Association	21	8	317-653-4301
Electronix Corporation	65	29	800/223-3205
Fluke Corporation	BC	28	800/59-FLUKE
Fox International	13	1	800/321-6993
GEnie Services	61	31	800/638-8369
Herman Electronics	54	2	800/938-4376
Hytec Dealer Services, Inc.	55	33	800/883-1001
ISCET	61		817/921-9101
International Components Corp.	72	34	800/645-9154
McGraw Hill	19		800/822-8158
MAT Electronics	45	36	800/628-1118
MCM Electronics	46	37	800/543-4330
NESDA	13,24		800/433-5557
PTS Electronics	30	50	800/844-7871
Parts Express	15	39	800/338-0531
Philips Technical Training	IBC	41	615/475-0044
Prelco	72	40	908/851-8600
Projector Recorder Belt Corp.	53	42	414/473-2151
RAM Software Enterprises	10	51	800/323-9654
RNJ Electronics	50	43	800/645-5833
Sams, Howard & Company	52	44	800/428-7267
Sencore	IFC,7	32,45	800/SENCORE
Sperry Tech	72	46	800/228-4338
Stoner, Inc.	65	47	800/227-5538
TV Man Tech Tips, Inc.	57	48	800/474-3588
Thomson Consumer Elec.	3	93	
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