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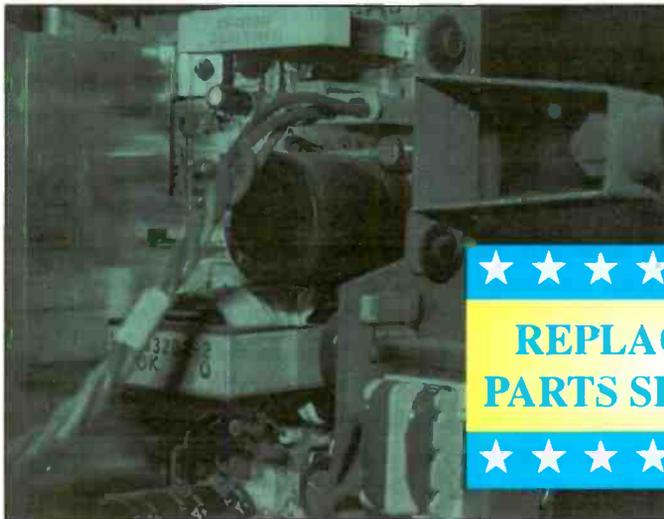
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**REPLACEMENT
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FEATURES

- 6 Troubleshooting technique**
By The ES&T Staff
Troubleshooting is the essence of the service process. Before you can replace a component, resolder a cold solder joint, or adjust a pot, you have to determine if that's where the problem lies. This article will give servicers tips on ways to be a more successful troubleshooter.

- 8 Continuing education in servicing**
By Conrad Persson
Keeping up to date when it comes to consumer electronics technology is vital to any servicer. In this issue of ES&T we will supply you with a number of correspondence schools, publishers, associations and test equipment manufacturers that will help you do just that.

- 13 Troubleshooting problems in pincushion circuits**
By Homer Davidson
Often in television sets when there

is distortion on the right side of the raster, it has something to do with pincushion circuits. This article will help servicers troubleshoot these kinds of problems effectively.

ADVERTISING SUPPLEMENT

- 26 Replacement parts showcase**
Consumer electronics today come from so many different manufacturers that it is often hard for a servicer to keep up to date with all of them. But, whether you are dealing with a well-known or relatively unknown company it is still vital that you deal with a reputable company. The company's featured in this month's showcase will help you make a decision about buying replacement parts that you can feel confident about.

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ON THE COVER

If you don't have the right replacement component to finish a service procedure you can't return the product to the client and get paid. If the parts distributor you deal with charges you too much, it cuts into your profit. For those and many other reasons, it pays to choose carefully the distributor you buy your replacement parts from. (Photo courtesy Herman Electronics)

The service information revolution

In the July issue we published an article in the Technology department on a CD-ROM-based software system that will allow consumer electronics servicing technicians to call up a service manual on the computer screen. This service "manual" will contain all of the important information that the service technician now receives in paper form: schematic diagrams, circuit board layouts, and component identification.

The Technology department in this month's issue describes another type of computer-based service manual. In this case, the program that allows the technician to access the service information will be distributed on floppy disk by the software manufacturer, and the individual disk-based manuals will be distributed on separate floppy disks by the manufacturers of the consumer electronics product.

This is a revolutionary concept. Back in the good old days of vacuum tubes, service manuals (frequently not very good) were published by the manufacturers. As time went on, the service literature improved, but it was still delivered on paper.

Then, a few years ago, the manufacturers came up with the idea of reducing the bulk of the service literature and publishing it in microfiche form. This was greeted with mixed feelings by the servicing community. Many service centers, especially those who service a large number of different brands, welcomed fiche. It allowed them to slow the steady increase in the amount of space that filing cabinets full of schematics and manuals would take up in their service centers. Many service centers, however, were less happy with microfiche. They didn't want to purchase a fiche reader. They wanted to have everything on paper.

If the computerization of service information works out as expected by the companies who have developed the technology, it's hard to imagine that there will be service centers that will not want to convert to it. The benefits are many. For example, instead of having to go to a filing cabinet and search for the desired manual, the technician would simply have to insert the required disk into the computer and begin looking up the information.

Actually, most of the servicing information could be placed on the hard drive of a central computer (file server), and then all manuals would be available to any technician at any terminal in the service center (or even a laptop computer in the hands of a technician at the customer site via telephone line or radio system).

But ease of access is only one advantage of the computerization of service literature. Ease of looking up the desired information is another important advantage. With paper or fiche service literature, the technician has to search through the material to find the subsystem that he suspects as being the cause of the problem. With a computer-based system, he will merely have to key in the name of the subsystem (say the low-voltage power supply), and the computer will find it and display it on the screen.

A look at the schematic diagram will allow the technician to see how the circuit is designed and begin to formulate some ideas about where the problem might lie. Now, when he's ready to have a look at the circuit board layout, the technician will merely have to tell the computer to bring up that information, rather than pore over the pages of an unwieldy service manual.

Once the technician has located the faulty component(s), instead of having to look through the manual to find the parts identification information, he merely tells the computer to locate the pertinent information on that component.

There are, of course, many service centers that still do not have a personal computer, in spite of its benefits. It is helpful for such routine tasks as word processing, or for running the entire service center with service center management software, for example. If service literature on computer becomes available for all or most consumer electronics manufacturers' products, the efficiencies of handling service literature in this manner will be such that no service center will want to be without it.

Nile Conrad Penner

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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Home video products post quarterly gains

Rebounding strongly in March, first-quarter sales of home video equipment increased in all product categories, the industry's trade association reported today.

Figures compiled and analyzed by the Electronic Industries Association's Consumer Electronics Group (EIA/CEG) indicate that after a mixed performance in January-February, products such as color TV receivers, VCRs, and camcorders regained momentum and resumed their upward sales trends.

Direct-view color TVs expanded 11 percent in March to nearly 2.2 million units. When added to the more than 2.8 million sets sold during January and February, the quarterly figure exceeds 5 million color TVs— an all-time first-quarter record. Last year, nearly 25 million color TVs were sold to U.S. dealers (not including projection and LCD models).

Even more remarkable is the fact that at 11 percent, color TV sales had the lowest percentage increase of any video hardware category in March. VCR decks, sales of which had slipped 8 percent during the first two months of 1995, surged 23 percent in March to achieve 4 percent quarterly growth. With a March jump of 21 percent, first-quarter sales of camcorders grew by 7 percent.

"To the extent that inventory adjustments produced a slow-down in dealer purchases early this year, that trend clearly has been replaced by a major re-stocking of inventories," said Gary J. Shapiro, group vice president of EIA/CEG. "By any standard, the March and quarterly numbers are very positive, suggesting both a mood of confidence at retail and a strong likelihood that we'll set some new sales records in 1995."

Projection televisions continued to set the pace among video product categories, jumping 50 percent in March to nearly 66,000 units. On a year-to-date basis, projection TVs are running more than 30 percent ahead of January-March 1994, further evidence of the growing popularity of home theater.

Within the VCR category, sales of hi-fi stereo models rose some 57 percent. More than 1.26 million VCR decks were sold to dealers in March, bringing the

quarterly total to nearly 2.7 million units.

Other categories reporting significant gains in March were color TV/VCR combinations, videocassette players and laserdisc players. TV/VCR combos rose 24 percent in March and are up 3.6 percent for the quarter. Videocassette players soared 76 percent in March and are currently up 19 percent year-to-date.

Finally, sales of laserdisc players expanded 15 percent in March to nearly 67,000 units. For the first three months of the year, laserdisc player sales were up 10 percent from 1994's first quarter.

NECA Show to feature Fiber U Conference

Fiber U, the fiber optic training conference, for the first time will be held in conjunction with the NECA (National Electrical Contractors Association) annual show in Anaheim, CA October 6-8, 1995.

Fiber U, which began in 1993, has become the premier fiber optic training event. Since the first conference in Nashville in 1993, Fiber U has received enthusiastic applause from both attendees and sponsors for its unique combination of classroom and hands-on training by the top instructors and vendors in fiber optics.

Fiber U at NECA will be held October 6-8 at the Anaheim Hilton Hotel and Towers in Anaheim, CA. The NECA Show will run October 8-10 at the adjacent Anaheim Convention Center. Fiber U will feature its standard format, a combination of classroom instruction by professional instructors and hands-on training by ten of the fiber optic vendors participating in the NECA Show. The attendance will be limited to 200 to insure that each attendee receives high quality instruction.

Topics covered in the Fiber U training will be the basics of fiber optics, cables, connectors, splices and tools, testing, networks and applications and planning and estimating the cable plant. Fiber optic exhibitors not participating in the hands-on training will be invited to exhibit in a tabletop exhibit/demonstration area in the Fiber U area at the Hilton. There will also be a special Fiber U attendee and vendor reception and luncheon on October 9.

For more information on either exhibiting at or attending Fiber U or the NECA Show, contact Beth Ellis, Exposition

Sales Manager, The NECA Show Office, 3 Bethesda Metro Center, Suite 1100, Bethesda, MD 20814. Phone 301-215-4507, Fax 301-215-4500. For more information on Fiber U, call 1-800-50-Fiber, fax to 1-617-241-8616, or send email to info@fotec.com.

ISCET receives White House recognition

The international Society of Certified Electronics Technicians (ISCET) has received congratulations from President Bill Clinton on its 25th Anniversary. ISCET, which was founded in July of 1970, celebrated its 25th Anniversary at the National Professional Electronics Convention, July 31-August 5, at the Hyatt Regency Crystal City, Arlington, VA.

In his letter, President Clinton stated, "For twenty-five years, ISCET has worked to educate its members and promote excellence within the field of electronics. The strength of your organization today exemplifies the ongoing commitment to professionalism that inspired your founders."

There are technicians certified by ISCET in all 50 states and 41 territories and foreign countries. Based on past statistics, the 40,000th technician will be certified before the end of 1995. The certification program has helped assure consumers that the technician entrusted to service their products possesses the knowledge, training, and experience to perform exacting technical work with distinction.

The White House letter closed with best wishes for many years of continued success. For more information about ISCET and the CET program, Contact ISCET, 2708 West Berry, Fort Worth, TX 76109, 817-921-9101, Fax 817-921-3741.

Electronics Representatives Association Interactive Television Association to co-sponsor CES Orlando...The Digital Destination

The Electronic Industries Association's Consumer Electronics Group (EIA/CEG) announces that the Electronics Representatives Association (ERA) and Interactive Television Association (ITA) will join the growing list of co-sponsors for CES Orlando...The Digital Destination.

The show, scheduled for May 23-25, 1996 in Orlando, FL, is a trade event dedicated to advancing digital products, services and technologies distributed in the retail consumer electronics market. A compilation of exhibits and conferences, CES Orlando is expected to become the most important mid-year gathering point for retailers, publishers and developers.

The Software Publishers Association has already announced sponsorship of CES Orlando. Also supporting the show are the industry's major consumer electronics retail publications including AudioVideo International, Computer Entertainment News, Computer Retail Week, Dealerscope, Discount Store Magazine, First of the Month, MMR, Satellite Retailer, SMART, TWICE, and Video Store Magazine.

The ERA is an electronics industry trade organization of professional manufacturers' representatives firms.

"With all of the products and our member reps in one location, CES Orlando is a great fit," said Bill Weiner, vice president of marketing groups. "This show is a great opportunity to involve manufacturers' reps in what promises to be the most exciting and informative and influential show of the year."

ITA, a relatively new organization, was formed 18 months ago to promote the interests of the broad-based interactive television industry.

"The most innovative, revolutionary interactive TV products have never been seen by many retailers or consumers. CES Orlando is going to be the unveiling of an amazing array of interactive products and services that will be available to the consumer for the first time," said Andrew Sernovitz, president, ITA.

Adding to the excitement of CES Orlando are several concurrent events and show specials. CES Habitech '96, a trade show co-located with CES Orlando, will focus on residential systems, integration, and automation products. Additional concurrent events include the announcement of the SPA Codie Award, an industry event that names the top PC-based software in each of 25 categories, and Innovations '96, an EIA-sponsored awards program honoring excellence in design, engineering, and programming of digital hardware and software. EIA has also

struck a deal with Disney and will be collaborating with the Orlando theme park on several special events.

CES Orlando...The digital Destination will be centered around Orlando's Orange County Convention Center and will showcase all of the "hot" on-line, multimedia, cable, satellite, home theater, home office, hardware and software products for 1996.

EIA/CEG owns, manages and sponsors several industry trade shows including the Mobile Electronics Show, CES Specialty Audio & Home Theater, CES Mexico and Winter CES.

Home theater video components gain sales momentum first quarter announces EIA/CEG

Factory sales of audio and video products that comprise a home theater system rose 12 percent in the first quarter of 1995 to \$1.7 billion compared with \$1.5 billion in 1994, according to the Consumer Electronics Group of the Electronic Industries Association (EIA/CEG). Complete surround sound speaker packages lead the increase with sales up 55 percent from 1994.

"These strong sales figures indicate that home theater components sales are off to an excellent start for 1995, and clearly demonstrates that consumer interest in home theater is continuing to grow," explained Gary J. Shapiro, EIA/CEG group vice president. "Sales of home theater video products remained strong and sales of home theater audio equipment posted impressive gains."

Home theater audio equipment sales totaled \$226 million in the first quarter of 1995, up 40 percent from 1994, while sales of home theater video products were up 10 percent in 1995 to \$1.5 billion.

First quarter results were strong for all home theater audio equipment. Surround sound processors including receivers, amps, and stand alone units were up 39 percent in 1995 to \$186 million. Subwoofer sales were up 44 percent to \$13 million, and center, satellite, and separate speakers were up 43 percent to \$10 million, and surround sound speaker packages totaled \$17 million in sales—an increase of \$6 million over last year.

"It is very exciting to see these huge sales gains," said Sandy Gross, president of Definitive Technology, a leading American manufacturer of high-end loud

speakers for music and home theater. "This is clear confirmation that the marriage of audio to video and the home theater market that has resulted, is the most significant development for the audio industry ever."

First quarter home theater video products sales were also strong. Large screen rear projection models shared sales of \$278 million in the first quarter, a gain of 28 percent from last year.

EIA/CEG's consumer tracking study found that nearly 20 percent of people buying a new TV in the first quarter were using, or planned to use, separate speakers. Of those, almost 30 percent purchased speakers with the TV.

Strong replacement sales helped hi-fi stereo VCR sales post 21 percent growth during the first quarter of 1995 to \$240 million. Sales of laserdisc players, which totaled \$28 million the first quarter of 1995, fell slightly in 1995.

April video sales to dealers remain solid overall

Despite a slowdown in sales from a record-setting March sales month, unit sales to dealers of video products remained solid overall in April, as reported by the Electronic Industries Association's Consumer Electronics Group (EIA/CEG).

TV sales were down 11 percent in April, however, most other categories recorded gains of no less than 11 percent. Laserdisc players and color TVs were the only products without double-figure sales increases last month.

"Capitalizing on the more positive sales momentum of March, video product sales look good for the balance of the year," said Michael Williamson, Vice President of sales and marketing of Sharp Electronics' audio and video division. "As consumers look to replacing their TVs and VCRs, they are seeking out new TV/VCR combination units. Americans also are appreciating the new camcorders hitting the market that have improved in weight, balance and clarity."

The video market was led by dealer sales of color TV/VCR combination units which surged 31 percent in April, shaking off an early year slump. Individual VCRs sales followed on that video trend with a 17 percent jump in April to a record

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Troubleshooting technique

By The ES&T Staff

Troubleshooting is the essence of the service process. Before you can replace a component, resolder a cold solder joint, or adjust a pot, you have to determine if that's where the problem lies. Some people seem to be better at troubleshooting than others. They almost seem to have a sixth sense, or seem to be more in tune with the workings of consumer electronics. Some people just seem to be naturally adept at certain skills. But, every service technician can sharpen his troubleshooting skills with training and practice.

Education is where it all starts

For starters, tackling a service project is made easier if the technician has a detailed knowledge of the normal operation of the product he's servicing, as well as a thorough grounding in the generalized theory of the principles on which the product is based. In other words, if you're going to set out to troubleshoot a TV, it is recommended that you understand not only TV theory, but that you have some background in electronics theory. The broader and deeper the theory you have access to, the better.

The need for technique

But the background in theory is only one of the attributes of a good troubleshooter. Troubleshooting also requires a troubleshooter's mindset and a methodical, meticulous approach to troubleshooting, not to mention patience as well as persistence. There are three broad steps to troubleshooting: observation of the symptoms, evaluation of the symptoms, and testing of the circuits/components.

Good troubleshooting technique begins with the careful observation of symptoms. It is important at this stage not to rush into the evaluation stage. How often have we read or heard an account of a technician who observes a symptom, hauls out a DMM or oscilloscope, goes directly to the suspect area of the circuitry and begins taking measurements, only to find that there's nothing wrong. The

technician then has to rethink his whole strategy. Only upon further reflection does it dawn on the technician that there are several symptoms, not only one, and when considered together they point to a completely different area of the product than the one he's working in.

For example, let's say that the problem is the absence of a picture. The technician might be tempted to jump right in and look at the circuitry that's related to the generation of the TV picture. A little further observation might help the technician localize the problem. Another symptom which, added to the no picture that might change the technician's thinking is the question of whether or not there is sound. For example, does he hear a rushing sound of high voltage coming up when he turns on the set.

Evaluating the symptom

Let's say that the technician has been diligent in observing the condition of the set and has only found one symptom; no picture. Where should his thoughts go next? Let's consider what components or circuits might be implicated when there's no picture, in other words, the screen is blank. Two possibilities here are a bad picture tube or no high voltage.

One way to begin narrowing down the problem is to measure the HV. If there is no HV, or if it is low, then a good step to take next is to turn off the set. Then, observing all standard precautions, such as first shorting out the HV lead, disconnect the HV lead, and turn the set back on. If the HV comes back up the problem is probably a gassy picture tube. If the HV doesn't come up, the problem is in the HV circuits somewhere, or somewhere in the circuits that supply the HV.

Be methodical

One of the tools that should be part of the technician's arsenal, is a pencil and paper. It's not uncommon in troubleshooting that a technician begins measuring resistances and voltages, but

doesn't find any obvious problems. It may be that a resistor here or a voltage there is pretty close to being out of tolerance, but not so much that it leaps out at him. After all possible measurements have been made, the technician is no closer to having an answer as to why the set isn't working, but he's pretty sure that he's in the right area.

Now the only thing to do is to go back over the same circuit and make the same measurements again, but this time look for subtle variances from the specified values. It would have been much easier to have recorded those measured values in the first place. And, no doubt, the information would have been more revealing, simply because the technician would be able to look at the information all at once, without worrying about whether the probe is in the right place.

Using all the information available

There will be times when you're trying to service a product but you don't have a schematic diagram for the product. If you've sharpened up your troubleshooting techniques, it may still be possible to service the unit. Look closely at the circuits. In many cases in modern consumer electronics products, the components are labeled so you can tell what they are without a schematic diagram.

And while you may not be able to determine directly what the function or the part number of a given component is, you may be able to identify the component using a semiconductor replacement guide. Semiconductor replacement guides are available from Philips ECG, NTE, RCA SK, Howard W. Sams, IC Master, and D.A.T.A. Many of these have diagrams, transistor and integrated circuit pin layouts, drawings of the components, layouts of ICs and transistors, and voltage and current ratings for transistors.

Keeping notes

Another good troubleshooting technique is to keep a notebook, or other type

of file of the products you service, listing the symptoms encountered, the cause that was discovered, and the cure. Make a note of every repair, especially the difficult troubleshooting ones, by make and model number. These records will prove to be very valuable any time you encounter a problem that's similar to one you've already run into.

Using basic principles

If you keep the basic operating principles of the product being serviced in mind, you can use them to help you troubleshoot, even if service literature is not available. As an example, the vertical output circuit in a TV must produce a sawtooth waveform to drive the vertical deflection yoke. It's the same with any TV set. If you can locate this waveform, you know where you are in the set. This concept is true in many areas of many consumer electronics products.

Use service information from similar products

Many consumer electronics products manufactured today may bear the name of one manufacturer, department store or

discount store, but are actually made by another company. If you're not able to find a schematic diagram or other service information for the product being serviced, it may be possible to find service literature for a similar product. Some cross-reference information exists that can help you identify the similar products. One such cross-reference is a VCR cross-reference available from the National Electronic Service Dealers Association (NESDA), Fort Worth, TX.

It's like solving a puzzle or a mystery

Troubleshooting, whether it's a TV, a VCR, or even a car or a furnace, provides a fine sense of satisfaction to those who do it for a living. You're faced with a product that doesn't work. It's often a problem whose solution may be far from obvious. You have to search for clues, assemble the clues, interpret them, and then come up with an answer. Once you've found your answer, you then restore the product to operation.

Troubleshooting consists of solving a problem, and bringing otherwise useless products back to life. What could be more satisfying than that? ■

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Continuing education in servicing

By Conrad Persson

Has there ever been a period in the history of electronics when so much training was needed? Has there ever been a period when so much training was available? Has there ever been a period when so many kinds of certification were required or offered? The answer to all of these questions would seem to be "no."

The reach of electronics into every aspect of modern life goes deeper with every passing day. Not long ago, electronics encompassed radio, TV, hi-fi audio, and little more. Today, in every area where sight and sound are created and amplified, there's electronics. Everywhere information (data) is stored and manipulated, electronics is there. Everywhere control is exercised over some kind of process, electronics is there, too.

There are electronic devices not only in our consumer electronics products and our computers, but also in our automobiles, our airplanes, our telephones, our appliances, everywhere. Even in our greeting cards (those cute little ones that play a tune).

More complex, sensitive, smaller

But not only are electronics circuits showing up everywhere, they're constantly becoming more complex and more sensitive to environmental phenomena such as electrostatic discharge (ESD) damage and overvoltage. And they continue to get tinier and more devilishly difficult to remove and replace.

Because of all these factors, education and training becomes more and more important for technicians. Increasingly, technicians find themselves scratching their heads trying to determine how to troubleshoot a 100-pin IC to make absolutely sure that it's faulty before they replace it. And once they've done the troubleshooting and determined that 100-pin monster is indeed the problem, they need to know how to remove the faulty IC and install a replacement. And they have to do it without damaging any of the PC-board traces, or destroying the new IC by zapping it with a crackling electrosta-

tic discharge or cooking it with the wrong soldering equipment.

Managers need training, too

There's another aspect of training that's needed in the consumer electronics area: management training. In these days of inexpensive consumer electronics products that many people would rather throw away than fix, management training for service centers is every bit as important as technician training.

The service manager of today, whether he's the owner of a solely-operated service center or the manager of a service center that employs 20 technicians, has to know how to maximize efficiency. He has to know how to determine the company's cost of doing business so he can price servicing so as to make a profit without driving away customers. He has to know how to attract business to the service center in the first place, keep customers coming back, and insure the quality of service that the customers (and the manufacturers) demand. Many, if not most, service managers have never had any formal education or training in management, but there are places where they can get electronic servicing management training.

The resources

Fortunately, as suggested at the outset, there's plenty of training available to anyone who cares to make the time and effort it. Fortunately for service centers and technicians, everyone from manufacturers and manufacturers' associations, to service associations and technical schools, as well as publishers, have recognized that technicians need a lot of training for this new technology. And all are making that training available.

And depending on the amount of money and time available for school, the technician has a choice of resident schools, hands-on schools, self-study courses, videotapes, books, test equipment manuals and user instructions, association meetings and seminars.

The ES&T staff continually remains tuned into the educational opportunities available to technicians. We like to think

that we're a valuable source of technical/servicing information, but we recognize that a 70-or-so-page magazine once a month can't begin to fulfill the information needs of electronics servicing technicians. So we try to make you aware of every other avenue of education that we can find. For example, both NESDA and ETA offer training for the Certified Service Manager certificate. These programs provide a great deal of information on the management aspects of consumer electronics service.

Training from EIA/CEG

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

EIA is the association to which manufacturers of TVs, VCRs, stereo equipment, etc. belong. These manufacturers work very hard through this organization to attract and train technicians to service all of their. Every service center that can do so should take advantage of this superb training resource.

In addition to the workshops, EIA/CEG also offers video cassettes, manuals, and the like on a wide range of subjects, including "Troubleshooting with modern electronic test equipment (Parts I and II)," and "High-tech soldering and microprocessor troubleshooting." These tapes are priced very inexpensively, just enough to offset the cost of producing them. If you, or someone in your service facility needs training, you should at least explore what EIA has to offer. See their name and address in the listing in this article.

Identifying the need for education

For the technician, identifying the need to further his education usually isn't difficult. One day a customer brings in a TV set for service and when the technician opens up the set to perform a technical evaluation of the problem, he finds com-

Persson is editor of EST.

ponents and circuitry he's never seen before. Or one day a customer brings in a digital compact cassette or a CD-ROM drive, a product that the technician has previously seen only in photographs.

Once the need for further education has been established, it's important to pin down exactly what education is needed. There are usually two questions that the technician must answer: "What training do I need?" and "How do I get that training?" It's important to examine these questions in detail to determine beforehand exactly what it is you need to study. It's not enough to just say "I need to learn about CD-ROM servicing," and then look for a correspondence school or a local school that offers a course on CD-ROM.

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

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

Find a good technical book

One way to learn about a new subject is to buy a technical book on it and start studying. Many technicians are able to learn enough in this manner to enter into a whole new area of servicing.

If the book is well written, and the technician has a lot of self-discipline, this approach might prove very fruitful. If the book is poorly researched or written, or if the technician isn't one who can study on his own, the effort might prove both useless and frustrating.

Home study courses

Home study courses are a step up from simply studying a book on one's own, and they generally make learning easier and yield better results. In a home study course, the material is divided into logical study units, an instructor tells the student what is expected, and there is feedback through regular tests. Some schools also assign an instructor to the student with whom he can correspond by telephone and mail when there is a problem.

Schools and seminars

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

For anyone who has the time and the budget to travel, consumer electronics equipment manufacturers offer technicians seminars on the operation and servicing of specific products. There are also many organizations, especially in the computer area, that offer seminars of a few days to a week or so, usually in a number of locations throughout the country.

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

Finding the knowledge

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

Accompanying this article are several lists of companies and other organizations that offer some kind of training and/or training materials, but space doesn't permit a comprehensive list. There are a number of detailed lists available that will provide those serious about training

with many avenues to explore. One such list is the **ES&T** March Buyers' Guide. That issue contains a large list of consumer electronics manufacturers, tool and test equipment manufacturers, and associations with addresses and phone numbers.

Try the product manufacturers

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

Test equipment manufacturers

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

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

Learning about office equipment

Personal computers have become consumer electronics products. According to recent reports, more personal computers were sold to private individuals in 1993 than were sold to businesses. Advancing technology and competition among manufacturers and sellers continues to lower the price of computers. And the increasing availability of useful, user-friendly, low-cost software like word processing, spread sheet, data base, desk-top publishing, accounting, and on-line databases makes computers even more attractive to more people.



Some of the sources

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

Trade associations

Computing Technology Ind. Association (CTIA)
450 E 22nd St.
Lombard, IL 60148-6158
800-333-9532
Fax: 708-268-1384
Offers A+ Certification for computer technicians

Electronic Industries Association/
Consumer Electronics Group
2500 Wilson Blvd
Arlington, VA 22201
703-907-75
Fax: 703-907-7601

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

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

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

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

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

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

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

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

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

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

Technical book publishers

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

Hayden Book Company
Rochelle Park, NJ 07662

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

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

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

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

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

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

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

Publishers of schematic diagrams

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

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

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

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

Software sources

Training Software

Interactive Image Technologies
111 Peter St., Suite 801
Toronto, Ontario M5V2H1

Canada

Software that simulates electronic circuits and allows students to understand circuits and troubleshoot problems in them.

Service Tips programs

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

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

FixFinder
TCE Publications
10003 Bunsen Way
Louisville, KY 40299

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

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

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

Home study

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

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

Electronic Institute of Brooklyn
4823 Avenue N
Brooklyn, NY 11234

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

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

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

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

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

Private trade and technical schools

Accrediting Commission of Career
Schools and Colleges of Technology
ACCSCCT
(Formerly NATTS)

750 First Street N.E.
Washington, DC 20002-4242
202-336-6850

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

Red Wing Technical College
215 Pioneer Rd
Red Wing, MN 55066
1-612-388-8271
1-800-657-4849
Fax: 612-388-6368
Offers courses in music instrument
technology

Other Training Programs

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

Computer Maintenance Training
241 Boston Post Road W
Marlboro, MA 01752
508-624-7708
Fax: 508-624-4179
#Learning Tree international
6053 West Century Boulevard
PO Box 45028
Los Angeles, CA 90045-0028
213-417-8888
Fax: 410-2952

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

Sony Technician Development Center
390 University Ave.
Westwood, MA 02090
617-329-8308

UCANDO VCR Educational Products
Company
PO Box 928
Greenville, OH 45331
513-548-6113
Fax: 513-548-6124

Test Equipment Manufacturers

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

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

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

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

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

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

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

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

These days, as the number of organizations offering computer training increases and the level of training itself gets better, the task is easier still. The companies that offer computer-related service training include not only traditionally computer-oriented companies, such as American Institute, Heath/Zenith, Learning Tree,

and National Advancement Corp., but also some companies you might not think of at first, like the consumer electronics product manufacturers.

Trade associations

Organizations such as ETA, NARDA/NASD and NESDA/ISCET (see "Associations" listing below) and their state and local affiliates offer many opportunities for technical and management-oriented education throughout the year.

For example, state and local chapters of these associations frequently invite a technical training instructor from a consumer electronics manufacturer to their monthly meetings to lead seminars on servicing the company's new products. Management seminars are offered to service center owners and service managers at monthly meetings of local/regional/state association affiliates as well as at the associations' annual meetings.

Some of the most successful service center owners and managers belong to these trade associations and attend the meetings, seminars and annual conven-

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

Learning from service software

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

Of course these programs are primarily designed to provide quick fixes for technicians who have a sick product on the bench that they want to get fixed quickly. But they can also be used for training. For instance, a fledgling technician could follow through the various symptoms/cure suggestions with a schematic diagram of a given electronic product. This exercise could make for a powerful training device.

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

Just do it

If a technician hasn't recently taken a course, read a technical book, or made other attempts to learn about new technology, he probably lacks certain skills required to diagnose and service today's sophisticated consumer electronics products. The education to develop those skills may be as near as the local library, the local association meeting place, or even the mailbox. The information is there: it's just a matter of finding it.

The listings that accompany this article will help you get started on your search. Many of these addresses have been published in the past, but several are brand new listings, and some contain updated information about the organization. ■

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Hicksville, NY 11801

Troubleshooting problems in pincushion circuits

By Homer Davidson

The pincushion circuits in a TV set prevent the type of distortion where the sides of the raster pull in toward the center of the screen. Usually a large area of distortion appears to the right side of the raster (Figure 1). Any time you encounter a symptom such as this, check out the pincushion circuits.

Sometimes it is difficult to see pincushion problems in an otherwise normal picture. Pincushion problems become more evident when a building or door frame appears at either edge of the picture; the perpendicular wall will appear to be bowed inward. The best way to check for pincushion distortion is to carefully check the picture for bowing with a color dot-bar generator connected to the TV antenna terminals. Set the generator to the crosshatch lines.

A pincushion-correction generator circuit provides a deflection signal to correct pincushion distortion. A form of pincushion correction used in some sets consists of a parabola generator and op-amp differentiator. Pincushion problems are corrected by processing a vertical parabola waveform through various stages in the pincushion circuits, and applying vertical modulation to the horizontal output stage.

Pincushion problems

Most pincushion problems are caused by a defective pincushion transformer or poorly soldered transformer connections on the PC board. The pincushion transformer's primary winding may short out resulting in lowered resistance in the winding, or the winding may open up. A narrow picture may be the result of a shorted winding of the pincushion transformer. Intermittent bowing of the picture in older sets may be caused by poorly soldered transformer connections. Replace any pincushion transformer that constantly emits a high pitched squeal.

In the latest TV chassis, a common

Davidson is a TV servicing consultant for ES&T.

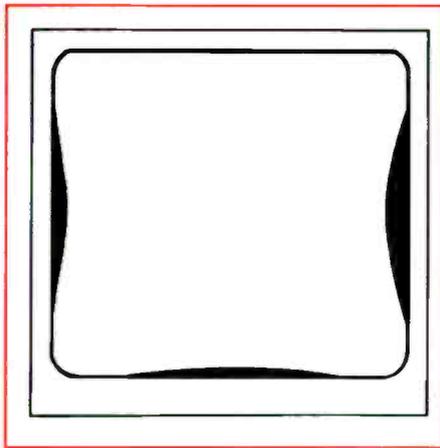


Figure 1. If you encounter a TV set with a picture that has sides that bow in, check out the pincushion circuits.

cause of picture bowing is a defective transistor in the pin amp, buffer, or pin output circuits. Always check the pin output transistor for leaky or open conditions. In-circuit transistor and voltage measurements can quickly identify a defective pin output transistor.

Intermittent leakage of an output tran-

sistor is more difficult to locate. If the problem is intermittent, monitor the waveform at the output transistor with an oscilloscope, or measure voltages with the DMM. Check the schematic and chassis to locate the pincushion transformer and output pin transistor (Figure 2).

Don't try to make resistance and pin-phase coil adjustments until you have identified and replaced the defective component. You could make the picture worse. These adjustments don't change by themselves and should not be touched until all repairs are made. In many cases, these adjustments will have little effect upon the picture if the pin output transistor is defective. You may find that the width control, when there is one in the pincushion circuits, has little effect if the pin output transistor is defective.

Sharp 19D72 pincushion problem

Pincushion circuits in early sets may consist of a pincushion transformer with coils, and resistance and capacitance coupling of the horizontal and vertical cir-

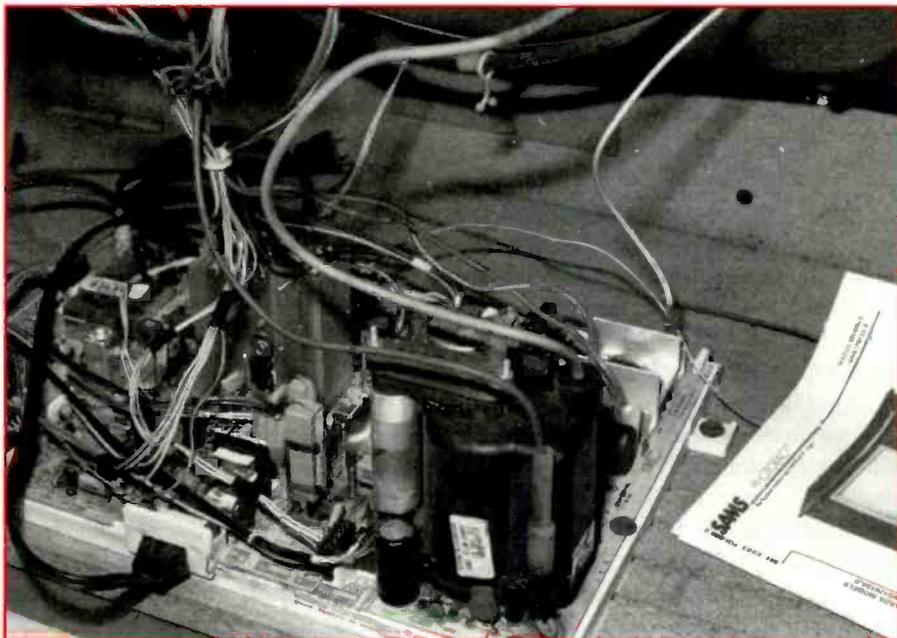


Figure 2. If you suspect pincushion circuit problems, check the schematic and locate the pincushion transformer on the chassis.

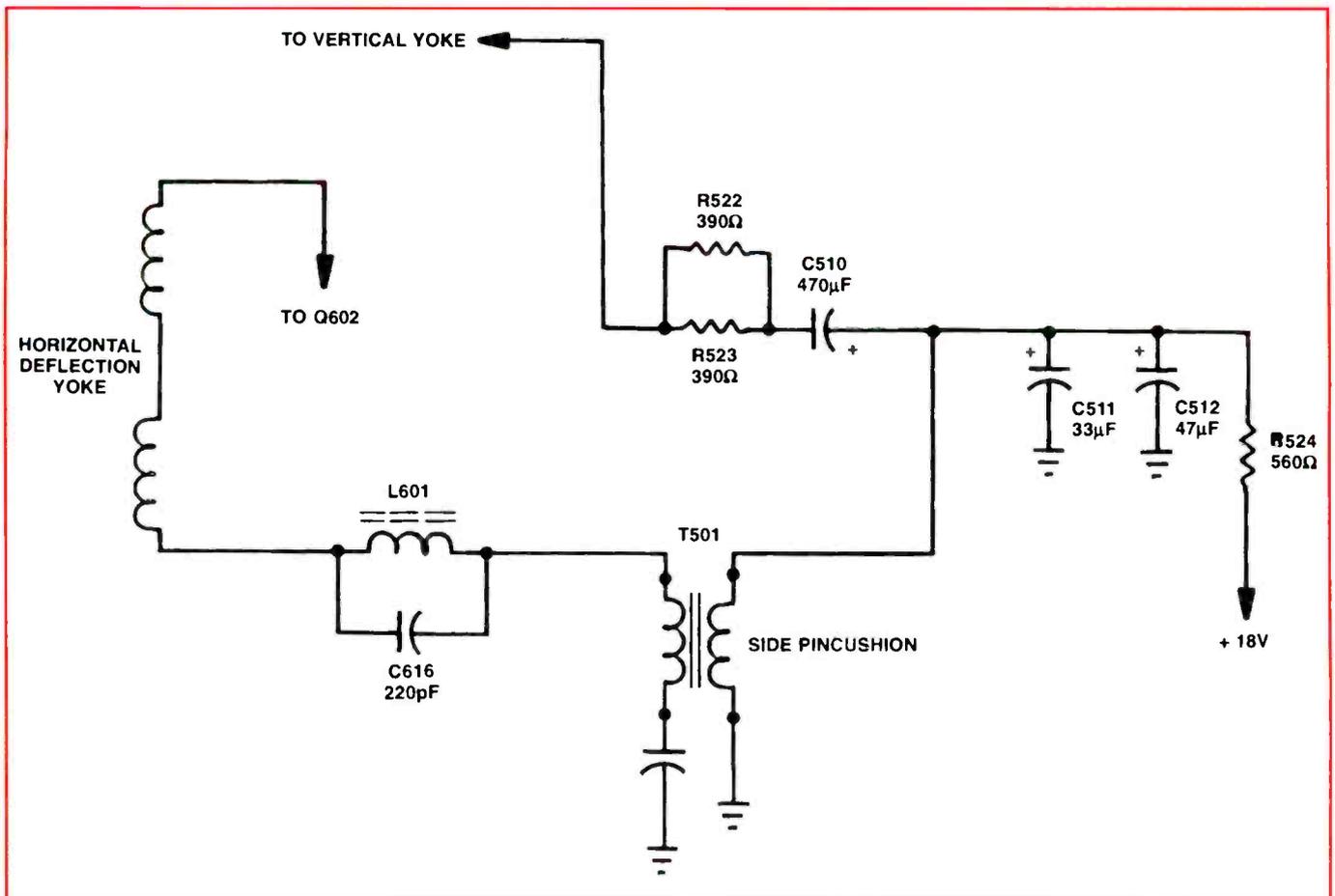


Figure 3. A bowed picture on a Sharp 19D72 chassis was corrected by soldering all connections on pincushion transformer (T501).

cuits. Usually, the pincushion transformer is connected to the horizontal yoke winding with the secondary side pincushion winding tied to the vertical yoke winding with capacitor and resistance coupling. These side pin circuits are easily serviced since the pincushion transformers cause the most problems.

In a Sharp 19D72 chassis, the sides were slightly bowed inward. By soldering all four pincushion connections or terminals, the sides of the picture were restored. To make sure both windings of the transformer were normal, I made a resistance check of each winding and compared them to the values on the schematic diagram (Figure 3).

Some manufacturers do not list these winding resistances. These values can usually be found in Howard W. Sams Photofact schematic diagrams, however. Sometimes either winding can overheat and short out between turns of the winding. This results in a bowed picture. Notice that this type of pincushion circuit has no adjustments. The only way to correct

problems in these circuits is to replace the defective components or resolder the transformer terminals.

Montgomery Ward GGV-12974A pincushion circuits

The pincushion circuits in a Montgomery Ward GGV-12974A TV chassis connect to the emitter terminal of the horizontal output transistor and are capacitively coupled to the vertical output (Q2609) circuits through coupling capacitor C619. In one of the sets that I encountered, the sides were bowed in, indicating problems within the pincushion circuits (Figure 4).

I resoldered all four pincushion transformer connections, but the problem remained. Next, I checked the resistance of both windings. The primary winding was open. This primary winding should measure around 20Ω. I ordered a replacement pincushion transformer (T1810) and installed it. This corrected the problem. Whenever you encounter poor horizontal linearity and bowed picture problems in

one of these sets, check C1800 (330pf), C1707 (0.47μf), and T1810 (Figure 5).

RCA CTC157 and 159 pincushion circuits

In the RCA CTC157 and CTC159 chassis, the pincushion correction circuit modulates the horizontal yoke current at a vertical rate to correct distortion in the picture. The smaller screen size with the same chassis contains the conventional linearity coil and pincushion corrected yoke circuits. You will find complicated pincushion circuits only in the 27 inch screen TV's.

In early RCA sets, pincushion circuits only consisted of a transformer, coil, resistance and capacitor components. The pincushion transformer may be found on the rear or top side of chassis (Figure 6).

The primary winding of the pincushion transformer is in series with the horizontal winding, which is tied to the collector terminal of horizontal output transistor Q4401. The regulated B+, 126V, is applied through the flyback,

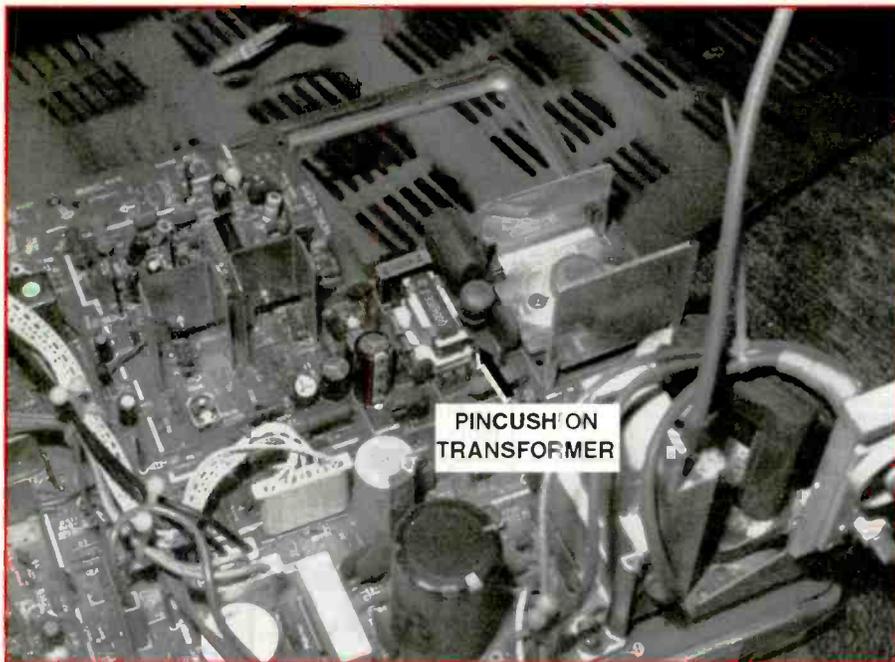


Figure 4. Bowed in sides in the picture on a Montgomery Ward GGV 129724A indicated a problem with the pincushion circuit. The resistance of the primary winding of the pincushion transformer T1810 (20 Ω) confirmed that the problem was caused by a defective pincushion transformer.

yoke and primary winding of pin transformer T4801 (Figure 7). When modulating the current through the pin transformer, the B+ across the yoke winding changes the width of picture. The width increases with more of the regulated B+, 126V appearing across the yoke winding.

The correction circuit develops a parabolic waveform that is applied to the pincushion transformer and circuits. The input parabola control signal is applied to the base of the error amp (Q4801). R4803 determines how much of the input signal is applied to Q4801. The width control (R4805) adjusts the level of the dc voltage that is applied to the error amp. The beam current input to Q4801 and Q4802 allows the pin correction circuit to compensate for changes in width with variations in the beam current.

Pin output transistor Q4804 is turned off and on by the input signal of Q4801 and Q4806. Q4804 is turned on when Q4801 is off. The on time of the error amp (Q4802) determines the average current through the pin transformer.

Most problems within this pincushion circuit are caused by the pin output transistor (Q4804). If the yoke has shorted turns, the pin output transistor will run quite hot. If the output transistor runs hot with the width control turned down, remove the red yoke lead wire and notice if the transistor cools down.

Sometimes the pin output transistor will fail when the horizontal output transistor is leaky or shorted, so it's a good idea to check the raster for bowing any time you replace the horizontal output transistor. Usually a bowed picture is caused by a shorted or leaky pin output transistor (Q4804).

First check the pin output transistor for leakage. Next, solder all terminals on pincushion transformer T4801. Measure the resistance of both windings and compare them to the schematics. Test each transistor in the circuit. And finally, take waveform and voltage measurements at the collector terminal of Q4804 (test point TP4303).

Sanyo AVM 255 pincushion circuits

I was asked to make a house call to service a Sanyo AVM 255 set. Examination of the set revealed that the horizontal output transistor was leaky and had caused the fuse to blow. I replaced the defective components in the horizontal section, which returned the picture to normal. To complete the repair I checked all adjustments and put the rear cover back on.

When the owner watched the picture he said that the set was not the same. (Have you heard that before?) Something was wrong with the picture. It was not as good as before the TV quit.

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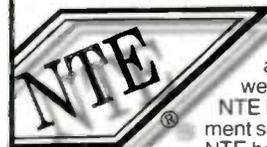
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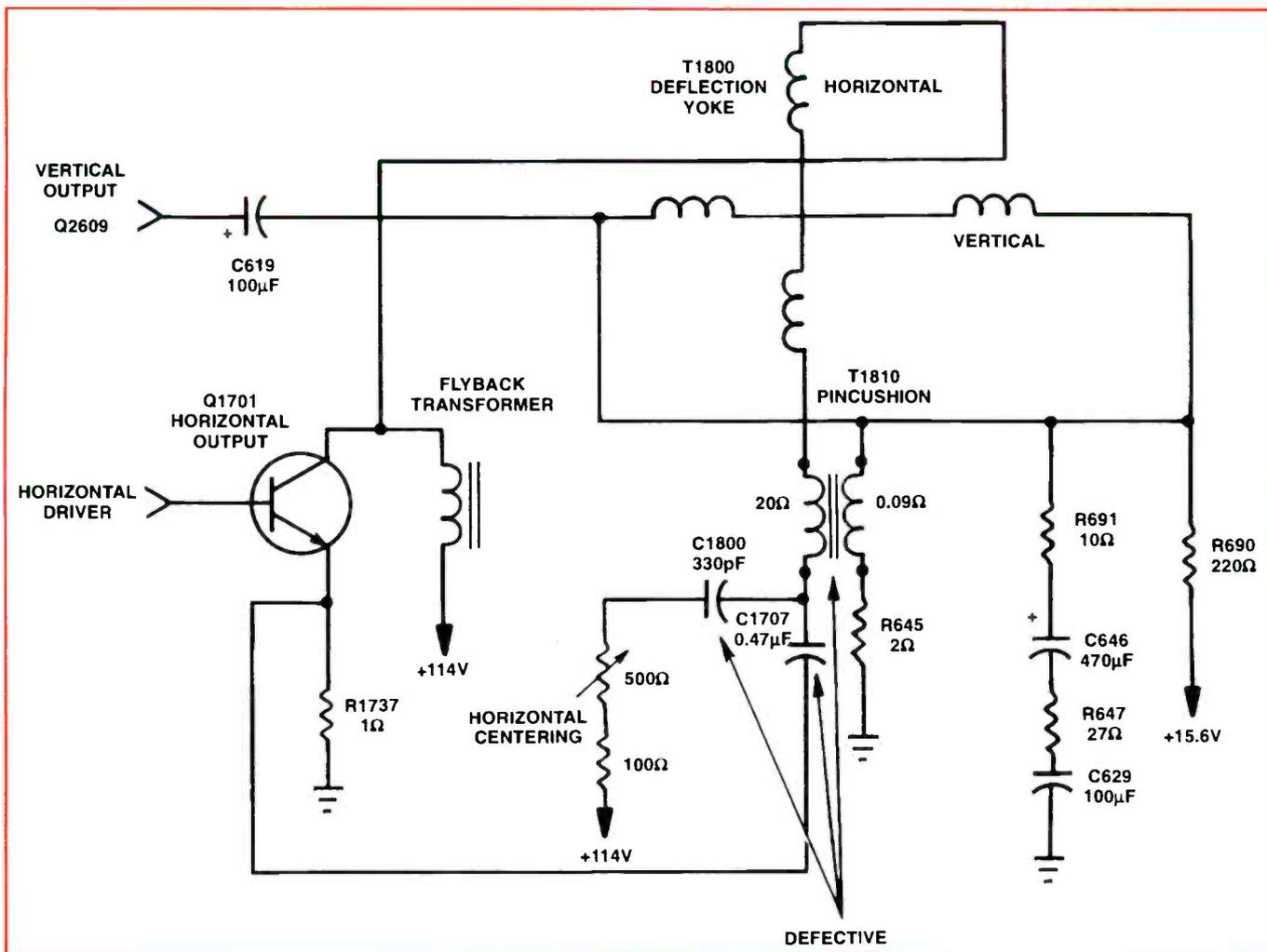


Figure 5. Other possible causes of poor picture linearity and bowed picture in a Montgomery Ward 129724A are capacitors C1800 (330pf) and C1707 (0.47uF).

certain scenes appeared bowed. I connected a crosshatch signal from the color dot-bar generator and examined the pattern on the screen. The vertical lines were bowed inward at both sides. Since it was difficult to gain access to the pincushion circuits with the set in the cabinet, I brought the set to the service center for further work.

The schematic diagram showed that the pincushion circuits were tied to the horizontal yoke circuits with Q491 as pin amplifier (Figure 8). The emitter terminal of pin transistor Q493 was connected to the +14.5V winding of the pincushion transformer (T491). The secondary winding of the pin transformer was coupled through C492 to the vertical return electrolytic capacitor (2200μF) and the 2.2Ω return resistor.

I measured the voltage at all terminals of all the transistors in the pincushion circuits. These voltages were way off, indicating either leaky transistors or an im-

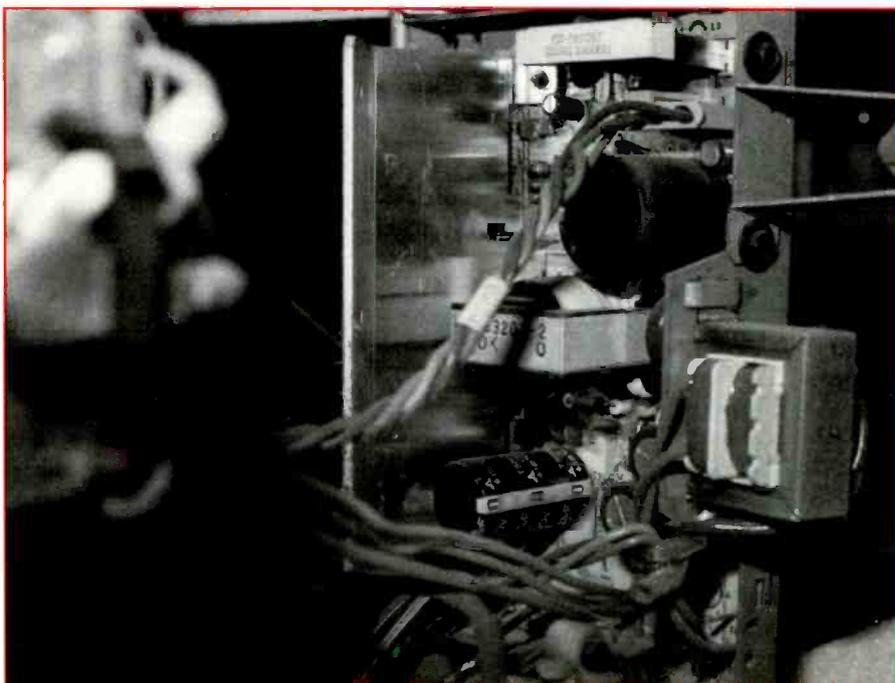


Figure 6. When you're working on a TV set with pincushion problems and don't have a schematic diagram, locate the pincushion transformer and associated circuitry on the chassis.

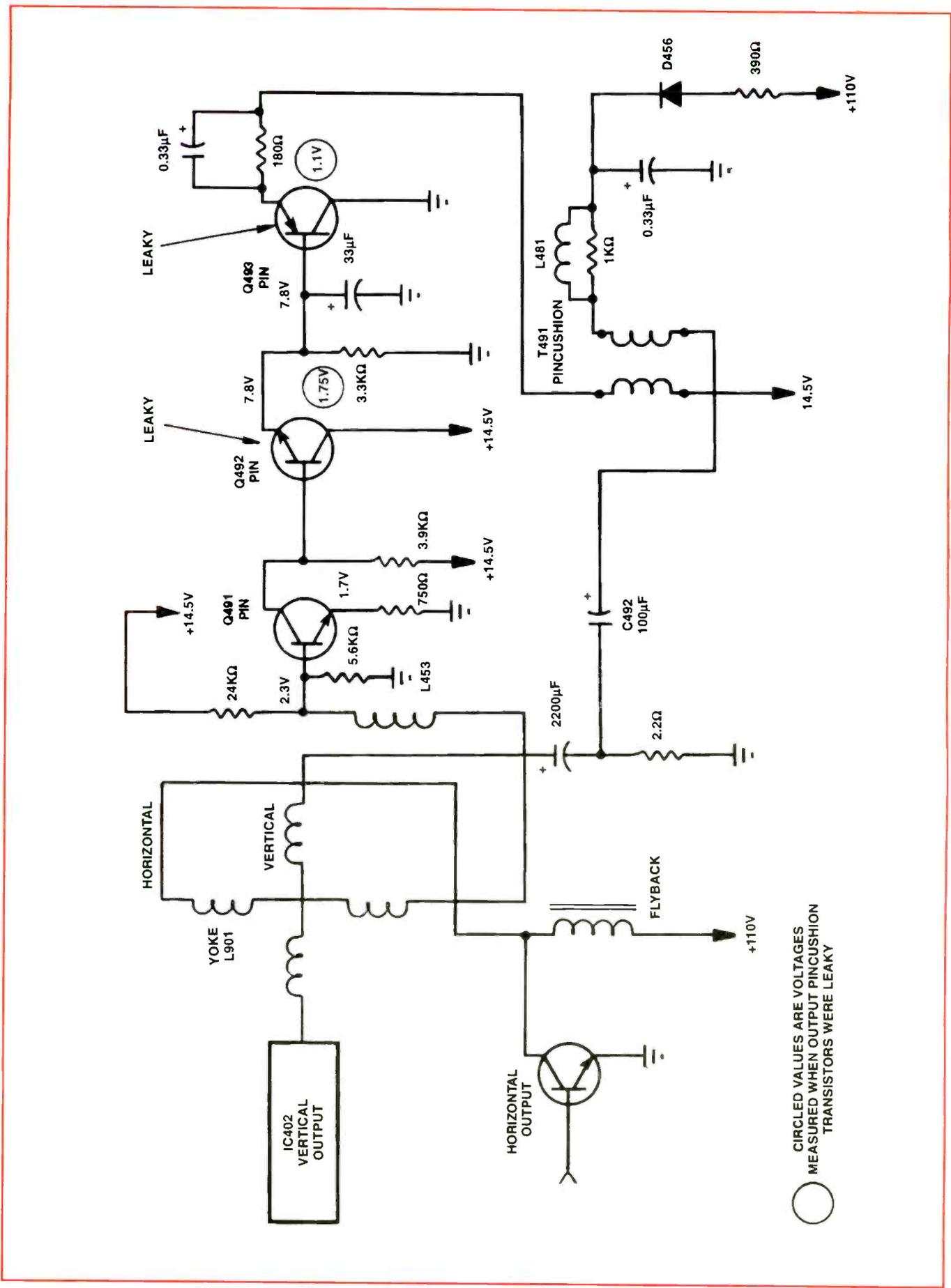


Figure 8. Leaky transistors (Q492 and Q493) were replaced in the pincushion circuits of a Sanyo AVM255 TV set.

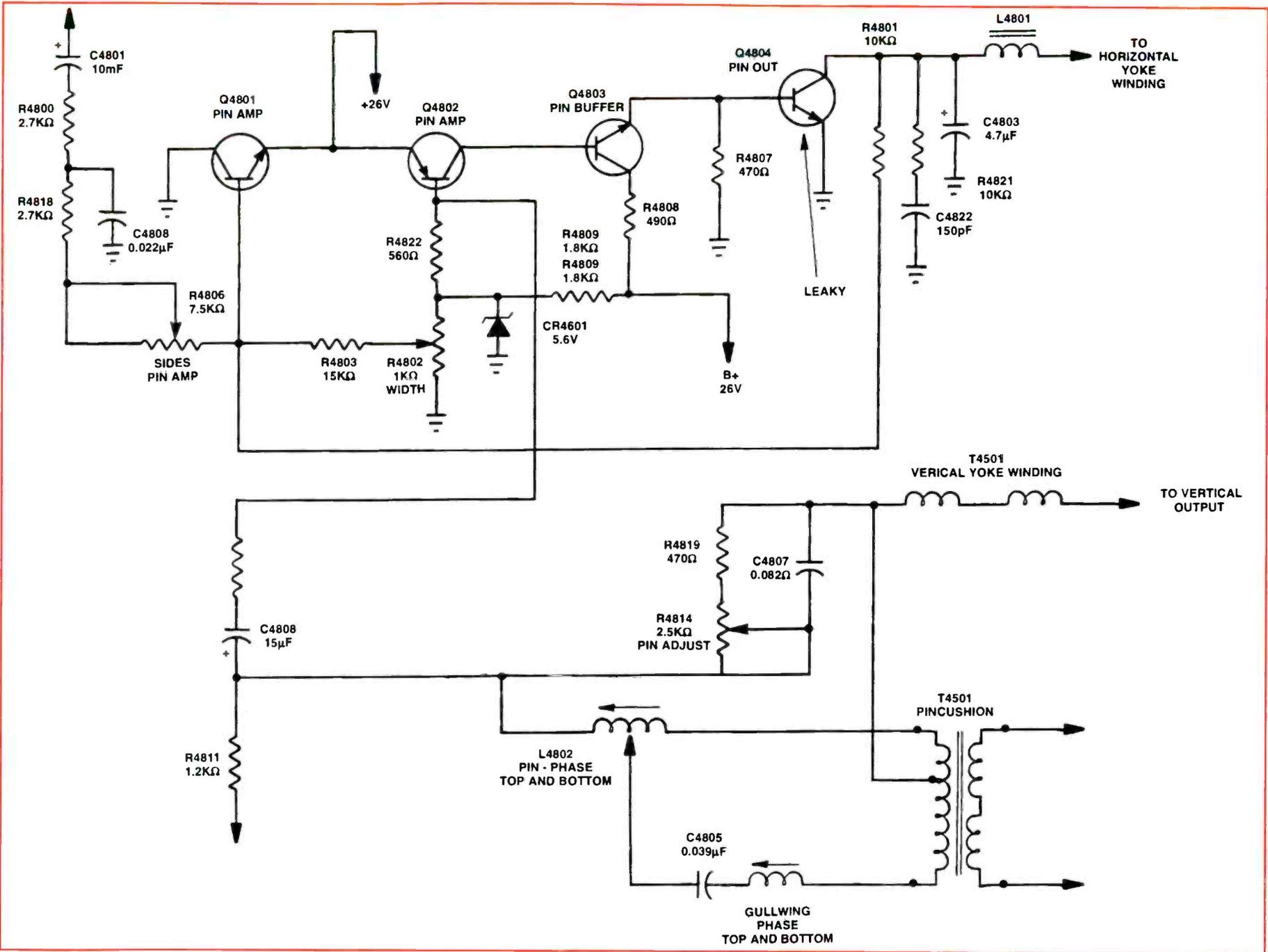
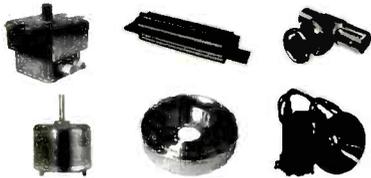


Figure 9. Pin output transistor (Q4804) was found to be leaky in an RCA CTC140 chassis after the horizontal output transistor (Q4400) had shorted out and was replaced.

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proper source voltage. The voltage at the emitter of Q493 was low, 1.1V, and the voltage at the base was 1.75V. Since the pin amp (Q492) emitter terminal was connected directly to the base of Q493, I suspected both transistors.

I tested transistors Q492 and Q493 in the circuit. Q493, with a reverse resistance of 79Ω was leaky. When I tested Q493 out of circuit, the leakage resistance was the same. I removed pin transistor Q492 from the circuit and tested it. It appeared to be normal. Since these two transistors work so closely together, even though only one was proven to be defective by testing, I felt that it would be prudent to replace them both with universal replacements.

I checked the resistances of both windings of T491 against the resistance values listed in the service literature. They seemed to be within specifications. To be on the safe side, I resoldered all four transformer terminals. I then turned the set on and checked the voltages at the terminals of the transistors I had just installed. These voltages were quite close to those on the schematic. I connected the cross-hatch generator and observed the pattern on the screen. The lines were straight, both vertically and horizontally.

Bowed picture in an RCA 27-inch set

A customer called into the service center with the complaint that his RCA CTC140 set was exhibiting an intermittent no-raster, no-picture symptom. At times leaving the set off for an hour or so temporarily corrected the problem. The set, a 27-inch console, was brought to the shop for service.

After a day or two, the problem really acted up. When the chassis was completely dead and would not start up, I made several tests. Since the SIP board diodes have been known to cause problems, I tested them in the circuit. All diodes were normal. I resoldered all diode terminals before remounting the SIP board. When I turned the set on, I found that fuse F4001 (5A) was open and there were no VIPUR voltages at the SIP diodes.

Often, the VIPUR output transistor (Q4400) or SIP diodes are leaky causing the main fuse to open. Since the diodes were normal, I looked for the horizontal output transistor, Q4400. An in-circuit test of this transistor indicated that it was leaky. I tested this transistor out of circuit and measured a leakage of 0.17Ω be-

tween collector and emitter terminals. I measured the resistance from the collector of damper diode CR4400 to the heat sink. This component was fine.

I replaced Q4400 with the exact RCA replacement, part number 179743. When the chassis was fired up, the +130V source voltage appeared normal and there was a raster on the screen. The only problem was that the picture was bowed inward. Bowing of the picture is a common side effect when the horizontal output transistors in these 27 inch TV sets are leaky.

Pincushion correction is accomplished in these RCA 27 inch sets by a vertical parabola waveform, through Q4801, Q4802, Q4803, and Q4804 on the pin SIP circuit board (PW4800). The application of vertical modulation to the horizontal output circuits corrects any bowing of the 27 inch picture.

Since the width control, centering, and pin adjustments had little effect on bowing of the raster, I checked Q4804 for leakage (Figure 9). Sure enough, the leakage resistance of the pin output transistor from collector to emitter ground was 144.1Ω . Replacement of Q4804 solved the bowing picture problem. Before making pincushion adjustments, check the horizontal centering and width adjustments. Adjust the width control (R4802) for 1/4 inch overscan at the left and right sides of the raster. Check the vertical linearity for normal raster or picture display.

Connect the crosshatch generator to the antenna terminals. Adjust pin control (R4814) fully clockwise. Adjust the pin-phase coil (L4802) for symmetrical barrel pattern distortion at the top horizontal lines. Then, adjust the Gullwing coil (L4803) for Gullwing distortion at top and bottom horizontal lines. Now, adjust pin control (R4814) for straight horizontal lines top and bottom. Make sure the vertical lines at the sides of the picture and horizontal lines at the top and bottom of the picture have no humps or curves in them.

A distinctive problem

In TV service, one type of problem frequently masquerades as another, making servicing more difficult. In the case of a symptom of bowing in the picture on the screen, the problem has something to do with the pincushion circuits. So, now you know just where to start your troubleshooting procedures. ■

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Using the Internet

By David F. Norman

Here's a simple riddle. What is 25 years old but as new as tomorrow? Answer. The Internet! A quarter of a century ago, the U. S. government and several universities started a project called ARPANET. The idea was to provide communications between strategic sites which would remain basically intact even in the event of a nuclear attack. By connecting the various sites via several physical paths, the system would allow remaining facilities to communicate in real time over a network of computers. Since there was no central site which could be knocked out by either direct damage or electromagnetic bursts, the system would be invulnerable.

As the cold war ended, visionaries began to realize that this basic concept would allow communication between computers and those who operated them on a scale never imagined before. For the first time ever, laboratories engaged in research that could coordinate projects with private or public institutions anywhere in the world.

Getting computers to talk to each other

Protocols which allowed very different types of computers to "talk" to each other were developed and refined and used to transmit huge amounts of data error free within minutes. Security protocols were added so that any information which might be intercepted would be very difficult or impossible to decode and steal.

[As a sidenote, this is as good a place as any to add that if someone can encrypt data, someone else can decipher it unless many levels of encoding are used.]

As time went on, the idea expanded and soon mere students were using the system to exchange information between themselves, and to gather data for projects. More and more information was made available to anyone with access to what became known as the Internet. As the network of fiber optic cables became

larger, service became available to smaller colleges, businesses and individuals. Much of what we have today has been available for years, but the Internet club remained pretty exclusive.

Improving the interface

If you think DOS is unfriendly, you've never tried UNIX, the operating system used by most of the computers on the Internet. In most cases, after you were logged onto a computer attached to the Internet, you were sitting in front of a screen with only a cursor blinking at you. Figuring out where to begin looking for the information you needed took a lot of study, and that was the easy part.

If you ever sat down in front of someone else's computer and tried to find a particular file using programs you had never used before with little or no help or documentation available, you have the idea. Then some really bright people decided that the Internet would be much more useful to a lot more people if it could be made friendlier and prettier.

It's about information

You see, the Internet isn't about computers any more than the long distance services are about telephones, repeaters and fiber optics. The Internet is about information. If you had to navigate manually through the telephone system to the person on the other end—and had no operators to assist—you would have a hard time calling Aunt Harriet; forget about calling your brother in Japan.

The same type of situation existed on the Internet. To find out something about a particular disease and its latest treatment, not only did you have to be a doctor and know the questions to ask, you had to be—or hire—a computer freak just to begin searching for the data you needed.

These geniuses changed that. They developed a graphical browser that could navigate the wilds of the Internet and allow quick searches of any server available to the user. As most of the software

code was released into the public domain, a bunch of little developers jumped onto the bandwagon and began to refine and polish the quirky programs and make them available to the general public.

Constant revision of software

It would be nice to say that now everything is working perfectly, and completely reliable Internet connections are a reality. It would also be untrue. While things are better than ever, and these later programs are easier to use with a point and shoot interface, they are still quirky and undergoing constant revision.

Some of the programs in common usage on the Internet are in their tenth or higher release version and are still referred to as "beta versions" by their producers. Even when a program gets designated as a "final release," you can expect a revision every few months or weeks as new bugs are discovered and fixed.

Congestion on the net

Then there are the problems on the Internet itself. Assuming your computer and operating system are fully compatible with the software you are using to access the Internet and you have a clean telephone line used for no other purpose than dialing out to online services, the problems don't end there.

Not only do you need a clean, noise-free telephone line (and a fast reliable modem of 14.4KBaud), so does the provider on the other end of the phone line. If he has a system that is running near saturation, you may have to wait until someone else logs off before you can log on.

Once you are on the system, you may have some delay trying to squeeze your computer's request out through the traffic and onto the Internet. Many small local providers have only a 56KBaud connection to the Internet "backbone," and if several users on the system are busy downloading or uploading files at the same time, they each get to share this bandwidth a few bytes at a time.

Norman is an independent servicing technician and a computer and security consultant.

Congestion at the off ramp

But, let's assume that you just happen to be the only person logged on since it is after midnight and everyone with enough sense to get in out of the rain is asleep. Even if your connection to the local provider is fast and clean and you happen to be the only person in the world accessing the provider's computer system (incoming traffic from somewhere else gets a piece of the bandwidth too), your troubles ain't necessarily over.

Let's say that you are trying to find some information about a new product that you would like to sell from your shop. The manufacturer proudly informed you in a brochure that his company now has a presence on the World Wide Web (the WWW is only the pretty face of the old Internet). All you have to do is type the rather cryptic URL (Uniform Resource Locator) "http://www.gadgets.com" into the location box on your Internet browser and off you go, right? Well maybe. If a number of other people happen to be accessing his site at the same time you reach out, you are once again sharing band-

width with a lot of people. You may even get a message to the effect that the server is too busy now and you should try later.

If the person taking care of the manufacturer's web server is addicted to pictures, you might have to wait for several minutes while the pictures download to your machine. (Internet Tip of the Day: you can speed things up considerably by setting your browser to not automatically load graphics. Load only those images you want to see.)

Persistence pays

At this point many things can go wrong with the connection and you might have to start over, but hang in there. Persistence always pays off on the Internet. When you eventually reach the information you want and discover that the product is of interest to you, you can send e-mail requesting more information.

A strange way to run a railroad or a superhighway, no doubt, but the rewards are worth the trouble. So much information is available on the Internet that you had better write down exactly what you

are looking for and stick to the subject. It is so easy to get sidetracked and start looking up something else, that you might not get to bed at all.

A whole new industry

The Internet is all about information. There is a whole new industry springing up offering this information to the public and trying to find new ways to turn a buck. As you explore the Internet, you will see many goods and services offered for sale. If you decide that you have a product, service or idea that could be marketed over the Internet, there are many ways you can bring this to pass.

The most sophisticated and most expensive way is to start your own Web server. What does it cost? The best answer is the old saw: "If you have to ask, you can't afford it!" But there are many alternatives. Part of this new industry—including myself—is busy offering alternatives to those who want a Web presence.

(Continued on page 68)

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Choosing a replacement parts supplier

The most difficult part of servicing one of today's consumer electronics products depends on the manufacturer. Sometimes the toughest part of the service process is finding the service literature. Sometimes it's diagnosing the cause of the problem. Sometimes it's removing a component from the PC board without causing any damage to the hair-thin traces. And, sometimes it's finding a replacement for the defective part. It's almost never easy.

The mail we receive, the reader service cards readers fill out, and the telephone calls we get tell us that two of the most common problems facing service technicians and managers are locating replacement parts and finding service literature.

Many of the consumer electronics products being sold today are made by companies that are not well known. So, many service centers have no idea where to go for parts and information on these units. Much of the circuitry in these products is highly sophisticated, featuring unique components for which no one but the manufacturer has the replacement parts, which compounds the problem. What can a service center do when faced with this problem?

Part of the answer is to deal with a good replacement parts distributor, the kind that will make an extra effort to meet the service center's needs.

Technologically advanced products

Many consumer electronic products today are actually intricate systems. In a camcorder, for example, the electro-mechanical portion of the system loads the tape and records or plays it. The optical system captures the image and converts it into an electronic signal that can be manipulated by the electronics.

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

Electronics engineers and scientists continue to create an ever broadening variety

of components with unique characteristics. With this increasing variety of available components and characteristics, designers of today's sophisticated consumer electronics products have increasing freedom in the way they design the circuits for the product they want to build.

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

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

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

Identifying components

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

Some cross references are available free of charge from the manufacturers through the distributors. Other cross references cost a considerable amount of money. However, if a service center adds up all the long distance calls, and all the time spent on the phone, any cost for cross references might be found to be money well spent.

The role of the distributor

Once the faulty component has been identified, the next step is obtaining a replacement part. Some distributors offer the service technician a variety of aids in finding the

needed replacement. Others are less helpful.

The distributors who have advertised in this special advertising supplement have done so because they would like to tell you more about themselves than they can in an ad. They want service centers to know what kind of facilities they have, what kinds of people work for their company, the efforts they are making for customer satisfaction, and how to contact them when you need a replacement component.

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

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- Is there a minimum order amount?
- What shipping options do they offer?
- What special services do they offer?
- Do they have a research department to help technicians find a specific part?

Some things to think about

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

The impulse to order from the first name in the book might be high, but take the time to ask some questions. It could save time, money and aggravation. The following section will give you a head start in answering some of the questions you may have when it comes to ordering replacement parts. ■

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Travis Kelton, Marketing Manager for Philips' replacement parts, cites these types of programs, as well as the variety and availability of their parts as the key to Smart Parts' success. "Philips Service Company maintains a strong commitment to total customer satisfaction across the board in product and service. The reliability of our OEM replacement parts, the quality of our service and the responsiveness of our entire staff testify to that commitment," said Kelton. "We want our customers to be customers for life," he continued. "They deserve every product to deliver on its promise, and we refuse to fall short of that expectation."

Larry Coughlin, Marketing Manager for service aids and accessories, reminds servicers that Philips also distributes a broad line of the industry's most popular test equipment and service aids. These products include soldering and desoldering tools, chemicals, lubricants and microfiche readers - each designed to support the servicing of all consumer electronics products.

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Two of the most recognizable trademarks in the consumer electronics business are RCA and GE. Both represent a long and proud tradition of customer satisfaction and leading-edge technology. That tradition is carried on today at the Thomson Consumer Electronics Accessory and Components Business in Deptford, NJ. They offer exact replacement parts for RCA and GE consumer electronics products. The Accessory and Components business provides parts support to more than 4,000 authorized RCA and GE Servicenters plus thousands of after-warranty servicers located throughout the United States through its distributor network.

Authorized distributors stock and maintain inventory levels based on Thomson's quarterly efficiency program. The efficiency program identifies the most commonly used parts and recommends an adequate stocking level to meet demands. Distributor orders for all items can be placed via toll-free telephone, fax or by using a direct computer link to Thomson. Distributors may place orders directly into the system and check stock, pricing and delivery status. Distributors can request a blue ribbon or emergency order and have their orders shipped overnight. Thomson's Premier Distributors also have the ability to place "Direct Drop Ship" orders for TCE Authorized Servicenters.

The Thomson Accessory and Components Business also offers both the SK replacement semiconductor line and a series of JEDEC exact industry number semiconductors. The SK replacement semiconductor line includes transistors, rectifiers, triacs, integrated circuits, and optoelectronic devices and cover a variety of devices for both consumer and industrial applications. The SK Cross Reference Guide which gives the SK replacement number for over 210,000 original semiconductor numbers is available in both printed form and DOS based floppy disk program.

Another important reference book produced by the TCE Accessory and



Components Business is the VCR/Camcorder Source Book. This comprehensive 320 page guide provides the servicer with a quick reference source for key items such as belts, motors, rollers and headwheels for many different VCR brands including: GE, RCA, Hitachi, Magnavox, Panasonic, Philco, Philips, Quasar and Sylvania. The Source Book provides the servicer with the Thomson stock number as well as a reference number corresponding to the number shown on the service data parts list and on the exploded view. This reference is also available on 3 1/2" disk.

Another publication that the Accessory and Components Business offers servicers is the TCE Remote Control catalog. This catalog contains all available direct replacement remote controls for RCA, GE and PROSCAN televisions, video recorders, camcorders and audio components. The catalog is divided into three sections. One section contains more than 320 photos to aid in identifying the correct remote. The two

other sections contain cross-reference materials in model number sequence and in remote type number sequence.

Thomson Consumer Electronics Accessory and Components Business provides service from a 358,000 square foot facility with all aspects of the business located in Deptford, New Jersey - customer service, sales and marketing, quality assurance, product analysis, administrative departments, and warehousing. Some parts are also stocked in a satellite warehouse in El Paso, TX. Technical support is available, as is identification for distributors who cannot locate this information in the company's technical literature.

Other product lines at Accessory and Components Business include a full line of RCA and GE accessories and videotape. Picture tubes, surge suppressors, anti-static kits, and service aids are also marketed from this operation. The business is managed by Larry R. McKinney, General Manager. Thomson Consumer Electronics corporate headquarters is in Indianapolis.

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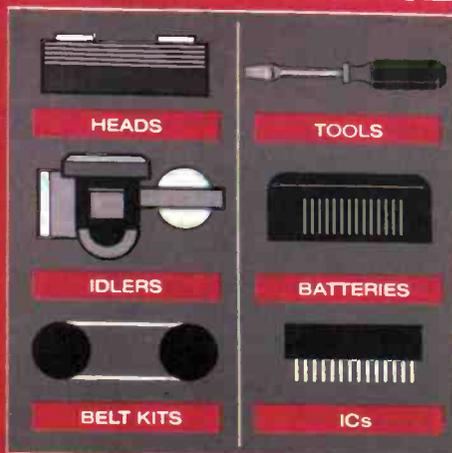
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- Flameproof Resistors
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MAT Electronics proudly celebrates its 10 year anniversary serving the electronic repair industry. Over the past ten years, MAT electronics has strived to constantly improve their product lines, customer service and competitive pricing. MAT Electronics 10 year anniversary also marks the addition of their west coast distribution center located in Las Vegas, Nevada. 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

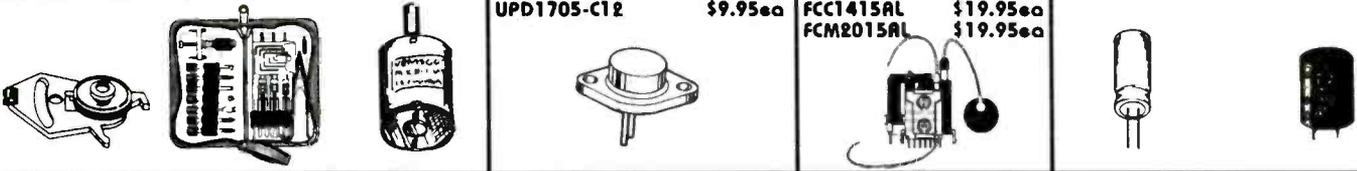
receipt of your order, but UPS red and blue label service is also available to ensure even faster delivery service if necessary.

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 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 toll-free FAX number is available 24 hours a day. ■

VCR REPLACEMENT PARTS		POPULAR SEMICONDUCTORS		POPULAR FLYBACK REPLACEMENTS		CAPACITORS	
VXP0521 Panasonic Idler	\$2.99ea (10 min)	BU208A	\$2.50ea (10 min)	154-040A	\$19.95ea	4.7M/160V Radial	\$.45ea (10 min)
164113 RCA Idler Original	\$2.99ea (10 min)	25D869	\$2.50ea (10 min)	154-074E	\$19.95ea	4.7M/250V Radial	\$.55ea (10 min)
NPLY0111GEZZ Idler Original	\$7.95ea (10 min)	25D1397	\$1.99ea (10 min)	2434391	\$24.95ea	4.7M/350V Radial	\$.65ea (10 min)
613-022-2534 Sanyo/Fisher Gear	\$.69ea (10 min)	25D1398	\$1.99ea (10 min)	2434651	\$24.95ea	10M/160V Radial	\$.55ea (10 min)
199347 RCA Belt Kit	\$1.99ea	25D1426	\$1.99ea (10 min)	3214003	\$24.50ea	10M/250V Radial	\$.65ea (10 min)
VTK-1 Video Tool Kit	\$39.95ea	25D1427	\$2.50ea (10 min)	043220011	\$27.95ea	10M/350V Radial	\$.75ea (10 min)
198522 Audio Bias Oscillator	\$2.25ea	25D1650	\$1.99ea (10 min)	79A307-1	\$24.95ea	100M/50V Radial	\$.50ea (10 min)
VJSJ0018 Orig. Panasonic Solenoid	\$5.95ea	25D1651	\$2.50ea (10 min)	1-439-357-11	\$26.95ea	100M/63V Radial	\$.50ea (10 min)
VEM50099 Panasonic Motor	\$8.95ea	25D1879	\$2.50ea (10 min)	F0014	\$19.95ea	100M/100V Radial	\$1.00ea (10 min)
143-0-7504-01000 Fisher Belt	\$.85ea (10 min)	JU0017	\$11.95ea	F0015	\$19.95ea	100M/160V Radial	\$1.00ea (10 min)
157061 RCA Belt	\$.85ea (10 min)	JU0069	\$11.95ea	F0016	\$19.95ea	100M/200V Snap-in	\$1.00ea (10 min)
157062 RCA Belt	\$.85ea (10 min)	SDA-3202-3	\$6.50ea (10 min)	F1588	\$27.95ea	100M/250V Radial	\$1.25ea (10 min)
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RTU006GEZZ Sharp RF Mod	\$14.95ea	TDA4505A	\$8.95ea	TLF14561F	\$26.95ea		
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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, Phillips and GE are available at substantial savings when compared to manufacturers pricing. PTS employs over 175 technical staff with a 65,000 square foot facility and branch locations in California, Texas and Colorado.

Thousands in stock

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tory on most major brands of Television Replacement Tuners and Mainboards. Thousands of tuners and mainboards are readily available - just call in your order. If the item you need is not currently in stock, PTS has a service support system to rebuild your non-working tuner or mainboard.

In recent years, PTS has expanded its available service to include Computer Products such as Monitors, Printers and Motherboards.

Our primary objectives

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

turer, PTS can help increase profits utilizing four primary objectives. **REDUCE PARTS INVENTORY.** There is no need to stock expensive, unnecessary parts for repair when you can rely on PTS for thousands of rebuilt tuners and mainboards. **PROVIDE FASTER SERVICE.** You'll minimize having to wait for backordered parts, schematics or technical information including high failure history of individual components. In most cases we'll process your order long before you could have obtained special ordered parts or schematics. **MINIMIZE LABOR COST.** Knowing that PTS provides an excellent source for repair assistance, you technicians will no longer have to agonize over "dog" units which results in a high labor cost per unit. Your output per man hour and work flow will improve dramatically. **INCREASE PROFITS.** PTS stocks and services major brands of replacement TV Tuners and Mainboards. In most cases you will save up to 60% when compared to OEM replacements. ■

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Matsushita Services Company

50 Meadowlands Parkway
Secaucus, NJ 07094

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

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

Customer Contact

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

One of our improvements that was

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

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

Parts and Service Literature Distribution

Once we've established what our customer needs, we have to get it to them. That's the job of over 80 employees that staff our parts and service literature warehouse in Kent. The building is the length of three football fields, and encompasses nearly a quarter million square feet! There are nearly 125,000 line items in stock.

The shipping day begins at 7:00 am. There are nearly 2,000 parts orders being processed at any given time. In order to manage such an overwhelming task, processes have been created that allow us to meet our goal of having all orders shipped in 24 hours. One simple way to do this is by color coding the invoices. Each day, a new color is used. This is a constant reminder to the staff, to be aware of our 24-hour goal. By the end of the day, the facility will have shipped approximately 3,000 parts and pieces of service literature orders, which consist of over 10,000 line items, and over 40,000 pieces!

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

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

The Future

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

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

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

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Nothing less than total satisfaction is expected by today's customers. The only way to live up to this standard is by using Matsushita Original Replacement Parts and Accessories. The source of this quality is The Matsushita Services Company and your Authorized Replacement Parts Distributor. Consult the list below, or call **1-800-545-2672** for the location nearest you.

CALIFORNIA

Andrews Electronics * 25258 Avenue Stanford, Valencia 91355 * 800-289-0300 * FAX 800-289-0301
Cass Electronics * 801 Seventh Ave., Oakland 94606 * 510-839-2277 * FAX 510-465-5927
E and K Parts * 2115 Westwood Blvd., Los Angeles 90025 * 800-331-8263 * FAX 800-826-0890
Pacific Coast Parts * 15024 Staff Curt, Gardena 92048 * 310-515-0207 * FAX 800-782-5747
Star For Parts (V) * 10727 Commerce Way., Fontana, CA 92335 * 909-428-1404 * FAX 909-428-3213
Blakeman Wholesale (V) * 1800 E. Walnut St., Fullerton, CA 92631 * 714-680-6800 * FAX 714-680-8700

COLORADO

Denver Walker Wintronics * 1001 W. Arizona Ave., Denver 80223 * 303-744-9505 * FAX 303-777-9357
Star For Parts (V) * 2350 Arapahoe St., Denver 80205 * 303-296-2117 * FAX 303-296-2120

CONNECTICUT

Signal Electronics * 589 New Park Ave., West Hartford 06110 * 203-233-8551 * FAX 203-233-8554

FLORIDA

Herman Electronics * 1365 N.W. 23rd St., Miami 33142 * 305-634-6591 * FAX 305-634-6247
Layco, Inc. * 501 South Main St., Crestview 32536 * 904-682-0321 * FAX 904-682-8820
Vance Baldwin * 2207 S. Andrews Ave., Fort Lauderdale 33316 * 305-523-3461 * FAX 305-523-3464
Vance Baldwin * 1801 NE 2nd Ave., Miami 33132 * 305-379-4794 * FAX 305-373-8855
Vance Baldwin * 1007 N. Himes Ave., Tampa 33607 * 800-299-1007 * FAX 813-870-1088
Vance Baldwin * 500 Clematis St., West Palm Beach 33401 * 407-832-5671 * FAX 407-833-8191

GEORGIA

Buckeye Vacuum Cleaner (V) * 2870 Plant Atkinson Rd., Smyrna 30080 * 404-351-7300 * FAX 404-351-7307
Wholesale Industrial * 5925 Peachtree Corners East, Norcross 30071 * 404-447-8436 * FAX 404-447-1078

ILLINOIS

B-B & W * 2137 S. Euclid Ave., Berwyn 60402 708-749-1710 * FAX 708-749-0325
Hesco (V) * 6633 North Milwaukee Ave., Niles 60714 * 708-647-6700 * FAX 708-647-0534
Joseph Electronics * 8830 N. Milwaukee Ave., Niles 60648 * 708-297-4208 * FAX 708-297-6923
Union Electronic Dist. * 16012 S. Cottage Grove, South Holland 60473 * 708-333-4100 * FAX 708-339-2777

INDIANA

Electronic Service Parts * 2901 E. Washington St., Indianapolis 46201 * 317-269-1527 * FAX 800-899-1220

KANSAS

G & A Distributors * 635 N. Hydraulic St., Wichita 67214 * 316-262-3707 * FAX 316-262-6494
Manhattan Electronics * 9086 Bond St., Overland Park 66214 * 800-821-3114 * FAX 800-255-6239

MARYLAND

Fairway Electronics * 3040 Waterview Drive, Baltimore 21230 * 410-576-8555 * FAX 800-955-2119
Fairway Electronics * 4210 Howard Ave., Kensington 20895 * 301-564-1440 * FAX 800-955-1358
Tritronics * 1306 Continental Dr., Abingdon 21009-2334 * 410-676-7300 * FAX 800-888-FAXD

MASSACHUSETTS

Signal Electronics * 484 Worthington St., Springfield 011105 * 413-739-3893 * FAX 203-233-8554
Tea Vee Supply * 407 R Mystic Avenue, P.O. Box 649, Medford 02155 * 617-395-9440 * FAX 617-391-8020

MICHIGAN

G. M. Popkey * 5000 W. Greenbrooke Dr. S.E., Grand Rapids 49512 * 800-444-3920 * FAX 616-698-0794
Remcor Electronics * 10670 Nine Mile Rd., Oak Park 48237 * 810-541-5666 * FAX 810-398-1016

MINNESOTA

Ness Electronics * 441 Stinson Blvd. NE, Minneapolis 55413 * 612-623-9505 * FAX 612-623-9540
Mid America Vacuum (V) * 666 University Ave., St. Paul 55104 * 612-222-0763 * FAX 612-224-2674

MISSOURI

Clitronix * 1641 Dielman Rd., St. Louis 63132 * 314-427-3420 or 800-846-2484 * FAX 314-427-3360
Tacony Corp. (V) * 1760 Gilsinn Lane, Fenton 63026 * 314-349-3000 * FAX 314-349-2333

NEW JERSEY

Panson Electronics, 1-80 and New Maple Ave. Pine Brook, NJ 07058 * 800-255-5229 * FAX 800-332-3922

NEW YORK

Dale Electronics * 7 E. 20th St., New York City 10003 * 212-475-1124 * FAX 212-475-1963
Fox International, Inc. * 241-A Central Ave., Farmingdale 11735 * 516-694-1354 or 800-321-6994 * FAX 516-694-0595

Radio Equipment * 196 Vulcan St., Buffalo 14207 * 716-874-2690 * FAX 716-874-2698

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Northwest Wholesale (V) * 426 NE Davis St., Portland 97232 * 800-234-8227 * FAX 503-232-7115
The Moore Co. * 333 SE 2nd, Portland 97214 * 503-731-0100 or 452-0500 * FAX 503-731-0105

PENNSYLVANIA

CRS Electronics * 818 Brownsville Rd., Pittsburgh 15210 * 412-431-7700 * FAX 412-431-5666
Steel City Vacuum (V) * 919 Penn Ave., Pittsburgh 15221 * 800-822-1199 * FAX 412-731-3205

SOUTH CAROLINA

Wholesale Industrial * 515 E. Bay St., Charleston 29403 * 803-722-2634 * FAX 803-723-8182

TENNESSEE

Shields Electronics Supply * 4722 Middlebrook Pike, Knoxville 37921 * 615-588-2421 * FAX 615-588-3431

TEXAS

Fox International * 752 So. Sherman, Richardson 75081 * 800-321-6993 * FAX 800-445-7991
Interstate Electric Co. * 11292 Leo Lane, Dallas 75229 * 214-247-1567 or 800-527-4029 * FAX 214-247-2137

M-Tronics * 3201 West Ave., San Antonio 78213 * 210-340-4069 * FAX 210-340-4569

VCP Intentional (V) * 2285 Merritt Dr., Garland 75040 * 214-271-7474 * FAX 214-278-5981

VIRGINIA

Avec Electronics * 711 Granby St., Norfolk 23510 * 804-627-3502 * FAX 804-627-1710
Avec Electronics * 2002 Staples Mill Rd., Richmond 23230 * 804-359-6071 * FAX 804-359-5609
Avec Electronics * 2009 Williamson Rd., Roanoke 24012 * 703-344-6288 * FAX 703-344-0081

WISCONSIN

G. M. Popkey * 2035 Larsen Ave., Green Bay 54307-2237 * 414-497-0400 * FAX 414-497-4894
G. M. Popkey * 2355 So. Calhoun Rd., New Berlin 53151 * 414-786-5887 * FAX 414-786-9031

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What is the most important quality that you as a servicer look for in a distributor? An extraordinary supply of parts on hand or superior service? By itself, either would be practically useless. Welcome to Andrews Electronics, the best of both worlds! We are the most well-stocked wholesale distributor of our kind, with over 250,000 line items in our warehouse and an average fill-rate of over 90%! Over an acre of floor space filled with parts, all in one location, makes us the largest supplier in America for the majority of the manufacturers that we represent. Another outstanding reason is our service. Our dealer order desk has recently been expanded to an unbelievable 30 available sales representatives! You now have a 99.9% chance of speaking to them rather than voice mail during office hours. We've built our reputation on a very simple philosophy.....service. Not very fancy, but very effective. Our constant growth attests to it. You see, all of our policies that have been developed over the years have been based on that one simple thought: "How may we better serve the industry?" How about:

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- A freight program that offers free or

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- No minimum orders or handling charges.
- Automatic backorder reports with ETA's mailed bi-weekly.
- A fast, highly-efficient research department, second to none.
- A program that converts make/model/descriptions to part numbers instantly for the majority of research requests.
- 24-hour toll-free phone and fax order lines.
- Over 80 full-time employees waiting to serve your needs.

Our newest feature is an online system that allows select customers to directly access our computer! This program offers the widest possible range of servicing including:

Placing orders that are automatically prioritized and will accept multiple purchase order numbers, research, etc., viewing previous orders, access to our model file, enabling customers to perform the majority of their research immediately.

Viewing backorders with eta's, part inquiry for pricing and availability that also provides information on substitutes and allows partial part numbers to be entered.

This is just one more reason to make us your "one-stop shopping" distributor.

Beware of programs that charge a flat rate (usually around \$4 or \$5) for ship-

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

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



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America's one call source for brand name electronic parts and accessories.®

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

America's one call source for brand name electronic parts and accessories.

A new affiliation based on 89 years of combined parts distribution experience is the CitiTronix/Panson alliance. Serving North America's servicers and customers by distributing high quality exact placement parts and accessories for most major consumer electronic manufacturers.

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

Several outstanding benefits for you are:

- More product lines - by combining resources the alliance offers more lines than ever.
- More inventory - with multiple warehouse facilities the "in-stock" parts inventories are larger than ever.
- Faster shipping - multiple warehouse facilities allows your order to be filled and shipped from the most efficient location.
- More Phone Lines - greater access to the alliance via phone, fax and computer will help you to obtain information and place orders.

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

The company maintains a state of the art telephone system, FAX, and on-line computer system for communicating with you. The remote customer on-line access systems have been updated and provides research capabilities and access to the complete combined company inventories.

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

Illinois and Missouri.

In 1994 the combined expertise in parts distribution convinced JC Penney to name CitiTronix/Panson as the exclusive authorized repair parts distributor for JC Penney.

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

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

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

A dramatic change came to CitiTronix in 1977 when the first electronic lines, Sylvania and Philco, were added to the existing appliance lines. The following exact replacement parts additions occurred shortly thereafter:

- Sony
- Magnavox
- Matsushita (Panasonic, Quasar, Technics)
- General Electric
- Sanyo & Fisher
- Thomson Consumer Electronics (RCA Premier, GE, ProScan)
- Kenwood

On January 8, 1988, the name of City Refrigeration Co., Inc. was changed to CitiTronix, Inc. and a 13,800 sq. ft. facility was established.

CitiTronix, Inc. has received several prestigious awards including:

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

Panson Electronics was established in 1965 as a supplier of electronic repair parts distributor in the U.S.

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

- Sharp

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

Panson Electronics has received several prestigious awards including:

- Matsushita Regional Distributor of the year for: 1984 through 1988.
- Sony Innovation Achievement for the years: 1986 through 1988.
- Sony Sales Incentive: 1990.

In August 1993, Panson relocated from Greenpoint, N.Y. to the present 20,000 sq.ft. facility in Pine Brook, N.J. location in order to provide the fastest parts delivery available.

CitiTronix/Panson features:

- A consistent high level of service with a goal exceeding industry standards.
- A strong telemarketing staff, congenial customer service.
- No freight on back orders.
- On-line remote access system with extensive data base, parts price/availability, model number to part number research, open order status and order entry.
- Open line of credit available.
- In - and - out handling of non-stocking parts.
- Daily open order and shipped order reporting.
- Outside sales - calling on regional accounts.
- Monthly specials.
- One stop shopping for major and secondary brand parts support.
- Line item ID to servicer's work order number.
- Exact replacement parts, kits and accessories.
- Warranty pricing.
- Same day Shipping on orders placed by 3:00 PM EST on in stock parts.
- Toll-Free ordering numbers.

The CitiTronix/Panson alliance will provide to you a total service which is greater than the sum of the services provided by the individual companies. They are America's one call source for brand name electronic parts and accessories.

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Fax Toll Free 1-800-397-8587

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Panson • I-80 & New Maple Ave. • P.O. Box 2003 • Pine Brook, NJ 07058 • Office: 201-244-2440

Circle (29) on Reply Card

Herman Electronics

**7350 N.W. 35th Terrace
Miami, FL 33122
Phone: 800-938-4376
Fax: 800-938-4377**

Herman Electronics is a diverse, full-line distributor of everything in electronics, committed to offering only the best in original replacement parts, tools, test equipment, and most importantly, customer service to their 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.

1995 is a very special year for Herman Electronics. After 35 years, they have just completed relocating to their new state of the art distribution facility in order to prepare to meet the demands of the 21st century. Herman Electronics is also proud to announce that they have just published the **FIRST edition of the Herman Catalog**. This 350 page buyers guide has everything to fill your every need. Call for your free copy today.

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 them to provide more efficient and cost effective service to you, their 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), SAMSUNG, QUASAR, KENWOOD, GE, TECHNICS, SAMSUNG, and TOSHIBA. Stocking one of the largest and most comprehensive inventories enables the company to fill over 80% of their orders from their 35000 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. They have several customer service representatives to serve all of your needs from 8:30 A.M. to 5:30 P.M. Monday thru Friday. Whether your request is for pricing, availability, or even parts research, the company's toll free lines are at your disposal to assist in fulfilling all of your requests. The company further prides itself in guaranteeing prompt and accurate answers to your research requests and provides computerized backorder reports with ETAs to keep their customers abreast of their backordered items.

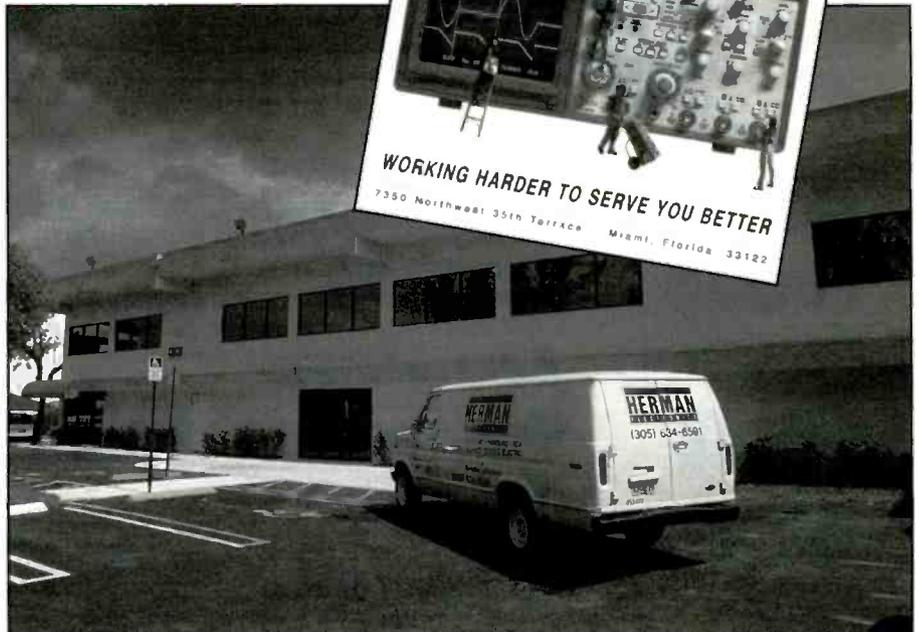
The focus of Herman Electronics is to be a single source provider of everything in electronic supplies to the service industry. As a result, the company has established itself as stocking one of the largest and most diverse inventories of tools, test equipment, and soldering supplies in the U.S. Huge inventories of Xcelite tools, Chemtronics chemicals, Weller & Hakko soldering equipment, and virtually every meter & scope from Wavetek, Fluke, B&K, Goldstar, Leader, 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 realize 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 insure 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 hours requests and orders, Herman Electronics has an electronic telephone and fax ordering system to insure service 24 hours a day, seven days a week.

If you haven't given Herman Electronics a try, please do so now - you'll be glad you did! Herman Electronics the ONE source for ALL your service needs. ■



HERMAN ELECTRONICS

7350 N.W. 35th Terrace
Miami, Florida 33122



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PO Box 245495
Brooklyn, NY 11224
Phone: 1-800-242-5556
Fax: 1-800-239-6349

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

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

to suit every servicer's requirement.

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

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

Most orders are shipped the same day. There is never a handling charge at Neptune Electronics. You pay only actual shipping charges. There is no shipping charge on back-ordered items.

We ship via UPS - either Brown Label (ground), Orange Label (3 day), Blue Label (2nd day air), or Red Label (next day air). For those who desire, we also ship USPS Priority Mail (2 day) and USPS Express Mail (next day). We also ship via Airborne - select (economical next afternoon delivery).

Neptune Electronics provides FREE SHIPPING on Visa or Mastercard orders over \$50.00. There is FREE SHIPPING on C.O.D. and Open Account orders over \$50.00, also there is FREE C.O.D. on orders over \$100.00. For those who choose to prepay, SHIPPING is FREE on orders over \$50.00—orders of less than \$50.00 pay a nominal \$2.00 shipping charge.

When you call Neptune Electronics you will receive prompt, courteous, professional attention, high quality products, and low, low prices. ■

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47uf/35v	.13	100uf/63v	.29	1uf/250v	.30
100uf/35v	.18	47uf/100v	.36	4.7uf/250v	.35
1uf/50v	.09	100uf/100v	.51	10uf/250v	.47
4.7uf/50v	.12	1uf/160v	.27	47uf/250v	1.05
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The **RIGHT CHOICE** for your electronic replacement parts, supplies and information. PREMIUM PARTS+ Electronics Company supplies over 10,000 popular items in their free catalog. And if you buy in quantity, you'll save even more off our already low, competitive prices.

Our product lines have expanded to include audio and video accessories; camcorder, and telephone batteries and accessories; belts and belt kits; fuses and lamps; a wide variety of repair kits; microwave accessories; motors; Nintendo® accessories; phonograph needles and accessories; reference materials including instructional books and video tapes; soldering accessories; speakers; television accessories; tools and test equipment; transistors; and VCR parts and accessories.

PREMIUM PARTS+ offers the technician an assortment of helpful tools such

as the PRB Line **Measur-A-Belt Guide**, which allows you to measure the customer's old belt by placing it on the Guide. With the information provided by the Measur-A-Belt Guide, use the unique PRB Line Replacement Belt System to order the correct replacement belt.

Measure the dimensions of your pinch rollers using the PRB Line **Video Pinch Roller Meter**. You'll wonder how you lived without this handy, easy to use VPR Meter.

Every technician needs the PRB Line **Cross Guide**. Available as a manual or an exciting automated PC version. Both offer years of highly researched cross reference information on replacement parts and/or belts for: VCRs, camcorders, compact disc and cassette players, answering machines, and car stereos.

Our successful PREMIUM DELIVERY service guarantees that PREMIUM PARTS+ will get your parts delivered to

your door within 48 hours via UPS 2nd Day Air Service anywhere in the 48 states for just a \$6.00 charge, regardless of its weight.* For many customers this is faster than UPS Ground Service. Or we'll send your order via UPS Overnight Air with a guaranteed noon delivery anywhere in the 48 states for just a \$15.25 charge, regardless of its weight.* For PREMIUM DELIVERY service just place your order before 2:00pm Central Time on any week day, and specify if you want 2nd Day Air or Overnight Air delivery.

You have a 100% guarantee on any item** purchased from PREMIUM PARTS+. If you are not completely satisfied, just return the product, in saleable condition, for an account credit.

PREMIUM PARTS+ strives to be your one source for high quality electronic replacement products. Call us today toll free at 800-558-9572 or call our 24-hour toll free fax line at 800-887-2727 for your FREE copy of our catalog.

*Plus the regular handling charge. Based on UPS 1# rate. Subject to change if UPS raises rate. Excluded from this offer are: shipments to Alaska and Hawaii; chemicals; camcorder batteries; literature including Tech Library; reference books; and all back orders.

** Note: Unless defective, reference materials and video tapes are non-returnable. ■



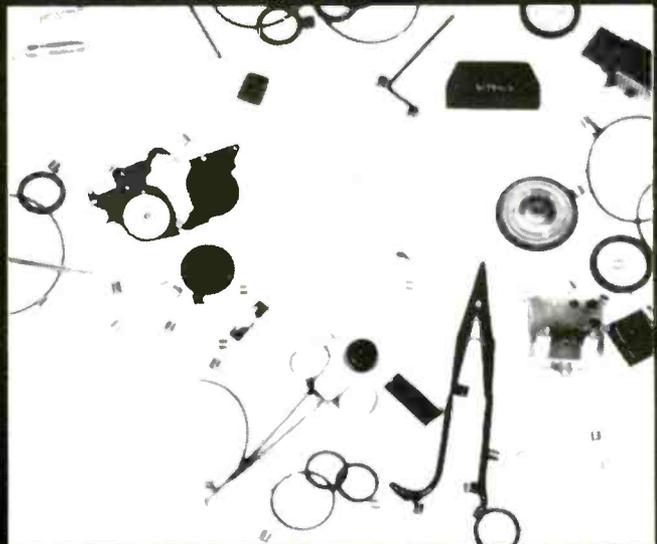
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RNJ Electronics, Inc.

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Fax: 800-RNJ-FAX1

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, monitors, 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 semi-conductors, 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 shipping via UPS. The company has added additional phone lines as well as an 800 fax line.



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

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Tritronics Incorporated

1306 Continental Drive
Abingdon, MD 21009-2334

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

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

Tritronics, Inc. has much to celebrate as they approach their twentieth anniversary this fall. In order to maintain it's high level of service, they will have upgraded their computer hardware and have relocated their southern branch to Miami, Florida.

Tritronics International of Florida, Inc. is now located at 1952 NW 93rd Ave., Miami, Florida 33172. They have more than doubled their warehouse space in Florida and expanded the inventory to cover more product lines. This branch is conveniently located near the Miami International Airport. "Se habla espanol."

By upgrading their computer, Tritronics can now offer an even faster and more efficient parts identification system. Manufacturers we represented and Tritronics' staff are adding model to part number cross reference information on a daily basis.

This information can be readily accessed by their customers who sign up on Dragnet,

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

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

- Orders received by 4:00 P.M. EST are shipped that day.
- An inventory of over 3,000,000 parts.
- One of the highest initial fill ratios in the industry.
- 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.

•Tritronics, Inc. is a Premier distributor for RCA, GE and Proscan, offering prompt shipments and "DDS" to help improve your "QOS!"

•Their minimum order of \$10.00 is the same as it was 20 years ago and is easy to meet. Just ask their sales rep about their weekly specials.

•All backorders ride freight free unlike those who will penalize you for their lack of inventory.

Tritronics is committed to supporting the independent electronic service industry. Their support has included being a founding member of NESDA affiliate Chesapeake Electronics Association; co-sponsoring a membership drive with NESDA, and supporting various local organizations by advertising in trade journals, sponsoring and participating in special events.

Tritronics has a full staff in both their 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.

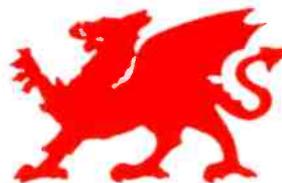
In their travels to the various industry meetings, Tritronics' officers often have the pleasure of meeting other people who work their business with family members. The Tritronics family looks forward to serving your business now and in the future. Their customers say that we are: LARGE ENOUGH TO SERVE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

aiwa CASIO DENON QSS Emerson FISHER

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Circle (52) on Reply Card

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.

Hands-On Training

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 ten 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, description, 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 creat-

ed 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 schematic from our service manuals is 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 the 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.

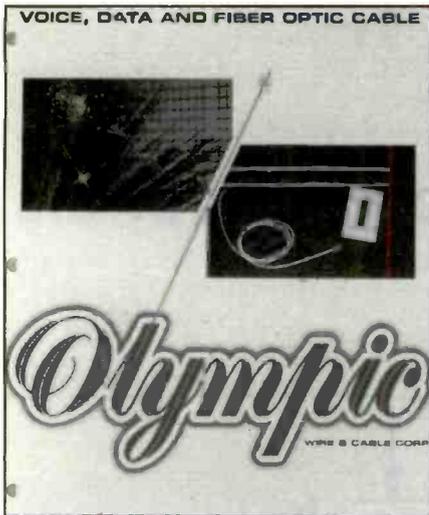
Highest Quality

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.

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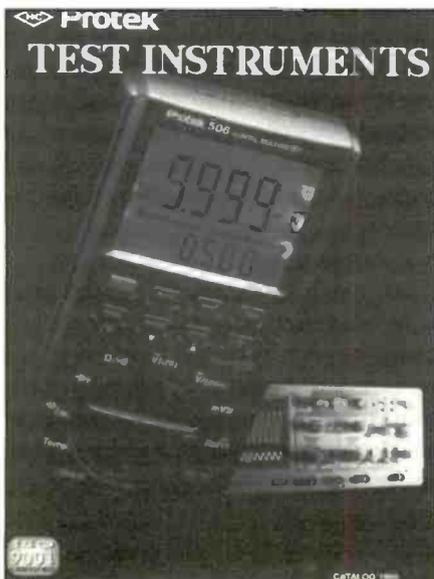
Cable catalog

Olympic wire and Cable Corporation offers its new full line catalog. Included in the 98 page, 2-color catalog are over 2,000 items including over 70 types of wires, cables and cords plus connectors, tools, jacks, panels and tubing. Alarm, audio, coaxial, control, data, fiber optic, IBM compatible, LAN, telephone, TV and CCTV cables are among those offered. Types of wires include motor, high temperature and test lead, silicone rubber, switchboard and teflon hook-up.

Circle (60) on Reply Card

Test instrument catalog

A new selection of digital storage scopes, function generators, multifunctional DMM's and analog meters are among more than 70 test instruments and accessories featured in the latest HC Protek catalog.



This 44 page publication also features easy reference selection guides for choosing the proper DSO, bench use and portable oscilloscopes, as well as digital and analog multimeters.

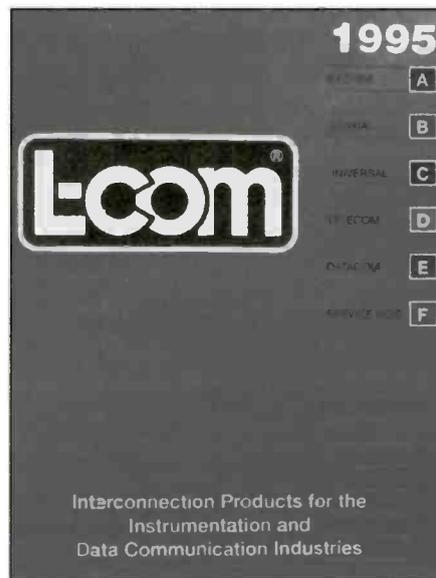
With its wide selection of state-of-the-art test instruments, this latest edition incorporates expanded specifications data for all products and an updated index, cross referencing page location to items.

Circle (61) on Reply Card

Computer/instrumentation interconnect catalog

L-com has released its new 1995 catalog containing computer and instrumentation related interconnect products.

Many new and unusual items are included in keeping with the latest technology.



Product categories include a wide variety of ready made coaxial and data cables; along with components to build your own. Adaptors of all types are available to satisfy many unusual applications.

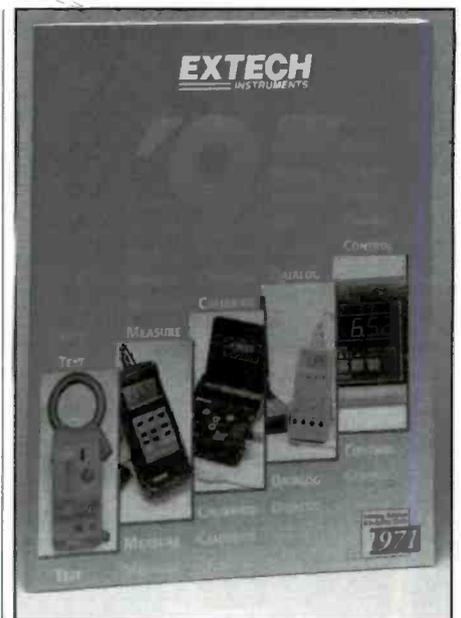
This issue also contains the broadest listing of IEEE-488 interconnect products covering 13 cable families and 20 adaptors with many other accessory products.

A full complement of Category 5 and LAN interconnection products are listed in an understandable, easy to follow format.

Circle (62) on Reply Card

Instrumentation catalog

Extech Instruments has released its 1995 44-page Instrumentation Catalog. Over 150 products are divided into 5 application categories: test, measurement,



calibration, datalogging, and control. This year's highlights include a series of heavy duty portable instruments for measuring light, airflow, temperature, and humidity which feature built-in RS232 capabilities. Optional datalogging and multiplexing hardware allow for later transfer and monitoring. Other products include the "NoBat" DMM which operates without battery, and an analog dc power supply. Traditional products include multifunction multimeters and clamp-on multimeters.

Circle (63) on Reply Card

Catalog features components, test equipment, tools, and books

Electronix Express announces a new full-line catalog that features semiconductors and other components, test equipment, tools, training books and tapes, chemicals, hardware and more.

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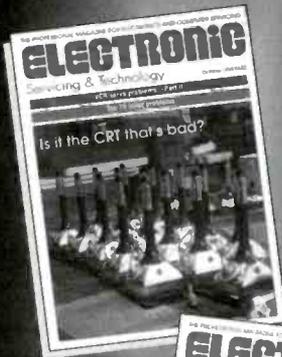
Computer products catalog

Milgray Electronics, Inc. has just released its 1995 Computer Products Catalog, an easy-to-use reference that features the company's portfolio of hard disk drives, magneto optical storage, motherboards, monitors, CCD cameras, and other peripheral products.

The catalog includes a quick index by the manufacturer, which allows buyers to locate preferred brand names quickly, and without hassle.

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Test Your Electronics Knowledge

Calculation of percent errors

By Sam Wilson

In the April '95 issue of ES&T there was an error in TYEK. Please turn to What Do You Know About Electronics? in this issue for an explanation.

The questions this month deal with calculation of percent errors. In WDYKAE? I give a simple way of solving some of these problems. If you have any trouble answering these questions, please turn to that column.

1. You have just about finished building your transistorized humane mouse-trap. All you have to do is solder in R216. According to the kit plans it is a $33\text{K}\Omega$ resistor with a tolerance of plus or minus 20% (its an old kit). All you have is a $27\text{K}\Omega$ resistor with a 20% tolerance. Can you use it?

2. You have a $6.8\text{M}\Omega$ resistor that actually measures $6.9\text{M}\Omega$. What is the percent error?

3. You have a $47\text{K}\Omega$ resistor with a $\pm 2\%$ tolerance. What is the highest resistance value that this resistor might be expected to have?

4. Your brute-force power supply delivers a no-load output voltage of 24V. Under full load its output voltage is 22.6V. What is the percent regulation?

5. Calculate the percent ripple for the following power supply: the dc output voltage is 24V and the RMS value of ripple voltage is 1.2V.

6. Determine the percent modulation for the AM signal having the trapezoid pattern shown in Figure 1.

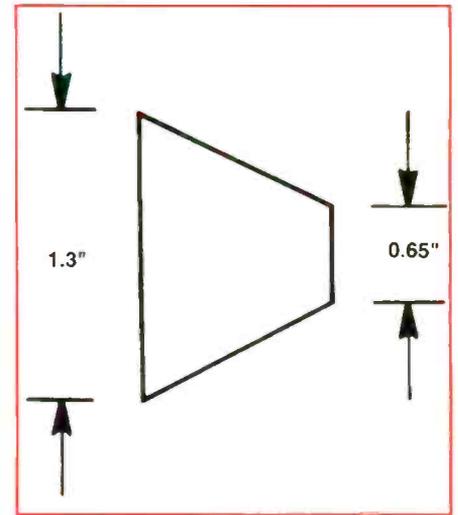


Figure 1.

7. Calculate the percent modulation for an FM broadcast signal having a frequency swing of 50KHz.

8. You need to raise the price of your product by 12% to maintain the same profit as for last year. If you are now charging \$6.95 for one hamster feeder, what will be your new charge?

9. Correct the following. "A certain farmer finds that his brown cows eat more than his black cows. His advisor tells him it is because he has more brown cows. Actually, the percentage of black cows is 15%."

10. Your price on hamster double beds is now \$18.50 per bed. You have just raised the price by 18.5%. What was your previous price per bed? (Note: carry out your answer to as many decimal places as your calculator allows if you want the answer to be exact.)

Wilson is the electronics theory consultant for ES&T

(Answers on page 68)

What Do You Know About Electronics?

The calculating technician

By Sam Wilson

There was an incorrect answer in the TYEK quiz for the April 1995 issue. Not one reader caught the error and wrote to me about it. I think that was the month I had decided to give away a new Buick to the reader with the best letter. Anyway, that contest is closed!!!

Here is the question as it appeared:

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.

The answer given was 'C'. That is NOT the correct answer!

I dug out the original question and here is the way it was supposed to go:

6. Increasing the bandwidth of an rf amplifier circuit will

- A. decrease noise.
- B. not change the noise.
- C. increase the noise.

The answer was 'C'.

Anyway, let me say this once again - *equations are important to technicians and technologists because they express the relationship between parameters.* That, in turn, gives you a better understanding of how components, circuits and systems work.

Going back to the question the way it was asked in the April '95 issue, it should be obvious that when you increase the noise you *decrease* the signal-to-noise ratio! Refer to Figure 1. with noise voltage in the denominator, any increase in the noise—that is, in the denominator—will decrease the value of the fraction.

In the April '95 issue I told you where Boltzmann's constant came from. I gave the example of noise voltage. It is repeated here in Figure 2. As you can see from that equation the noise will increase when the bandwidth is increased.

Calculating those pesky percent values

What is the difference between percent and percentage? My technical writing

Wilson is the electronics theory consultant for ES&T

$$\text{Signal/Noise Ratio} = \frac{\text{Signal Voltage}}{\text{Noise Voltage}}$$

Figure 1. This equation for signal-to-noise ratio shows that when you increase the noise you decrease the signal-to-noise ratio! With noise voltage in the denominator, any increase in the noise—that is, in the denominator—will decrease the value of the fraction.

$$V_N^2 = (T) (B) (R)$$

Where V_N is the noise voltage
T is the temperature in absolute zero units
B is the bandwidth in Hertz
R is the resistance in Ohms

Figure 2. As shown by this equation for noise voltage, the noise will increase when the bandwidth is increased.

book explains the difference between the words this way: if it is a number it is a *percent* and if it is not a number it is a *percentage*. Examples:

- Calculate the percent decrease in sales this way.
- There is a low percentage of people that do not need money.

I use one simple equation for determining all percent values. I give that equation in Figure 3. If you get a positive value it is a percent increase. If you get a negative answer it is a percent decrease.

For example, you have a 6.8K resistor that actually measures 6.9K. How do you calculate the percent error? For the solution, see Figure 4.

Here's another example. You have a 33K resistor with a $\pm 2\%$ rating. What is the highest resistance the resistor can have and still be within tolerance? For the solution to this one, see Figure 5. Observe that I use the same equation to get the answer to this problem.

The equation in Figure 3 can be used to determine the percent regulation of a power supply if you remember that what you want is the no-load voltage (Figure 6).

A long time ago, a very wise teacher

The percent error (%) is given by the equation:

$$\% = \frac{\text{What You Have} - \text{What You Want}}{\text{What You Want}} \times 100$$

Figure 3. You can use this simple equation for determining all percentage change values. If you get a positive value it is a percent increase. A negative answer is a percent decrease.

The percent error is:

$$\% = \frac{6.9 - 6.8}{6.8} \times 100 = 1.47\%$$

Figure 4. Here's a specific example of finding the percent error in the case when you have a 6.8K resistor that actually measures 6.9 K.

gave me some very good advice: "Don't clutter up your mind with a lot of equations when one equation will solve all of the problems of a kind." It works for me.

Graphical solutions

Wilson's Math Theorems (I'll get my name in the history books some way!)

• *Every problem in a college trigonometry text book can be solved graphically. All you need are the following "tools": a ruler, a protractor, a compass (the kind used for drawing circles), a pencil, a good supply of graph paper, and a rule book!*

• *Every problem in a college calculus text book can be solved graphically using only the following things: a ruler, a protractor, a compass, a pencil, a good supply of graph paper, and a new rule book!*

Throw in a scientific calculator (about \$15) and you are ready for graduate school.

Well, I know that I will not go down in history for those statements because they are just common sense. Unfortunately, they seldom tell you those things in school. You are supposed to figure them out after you go through a lot of unnecessary, mind-numbing "proofs".

There are two different kinds of mathematics in the world. One kind is called

$$0.02 = \frac{R - 33K}{33K}$$

Solve for R
 R = 33,660Ω

Figure 5. Another example of calculating percent error when you have a 33K resistor with a ±2% rating. Here's how to determine the highest resistance the resistor can have and still be within tolerance.

The percent regulation (%) is given by the equation:

$$\% = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100$$

Where: V_{FL} is the full-load voltage
 V_{NL} is the no-load voltage

Figure 6. The equation in Figure 3 can be used to determine percent regulation of a power supply if you remember that you want a no-load voltage. This is how to perform that calculation.

“Pure Mathematics.” Pure mathematicians actually believe that mathematics is beautiful. Its value is in the beautiful way mathematics evolves and in the beautiful methods of proofs. If you don't believe that, try to explain why if you want to major in mathematics in college you are entered into the College of Liberal Arts!

One way of describing all of that math beauty is in the expression “the rigor of mathematics.” A mathematician who wants to prove something is required to use a rigorous step-by-step procedure that starts from unproved basic ideas. Unless those rules are followed to the letter, a pure mathematician would say “you ain't proved nuthin”.

The pure mathematicians have a strangle-hold on our school system. Did you ever have any of the following experiences in school?

- You worked a problem on a test. You are given a certain number of points for the right answer, and, a certain number of points for the right “procedure”. Read the word “procedure” as “having the correct beautiful way of writing your answer in a pre-decided format”. That format—called the rigor of mathematics is, to the mathematician, beautiful.

- You work a problem and you are given 5 points off for failing to box your answer.

- You have to sit through an agonizing step-by-step proof that “the shortest distance between two points is a straight line”. That proof is beautiful to a mathematician. It is boring to anyone with com-

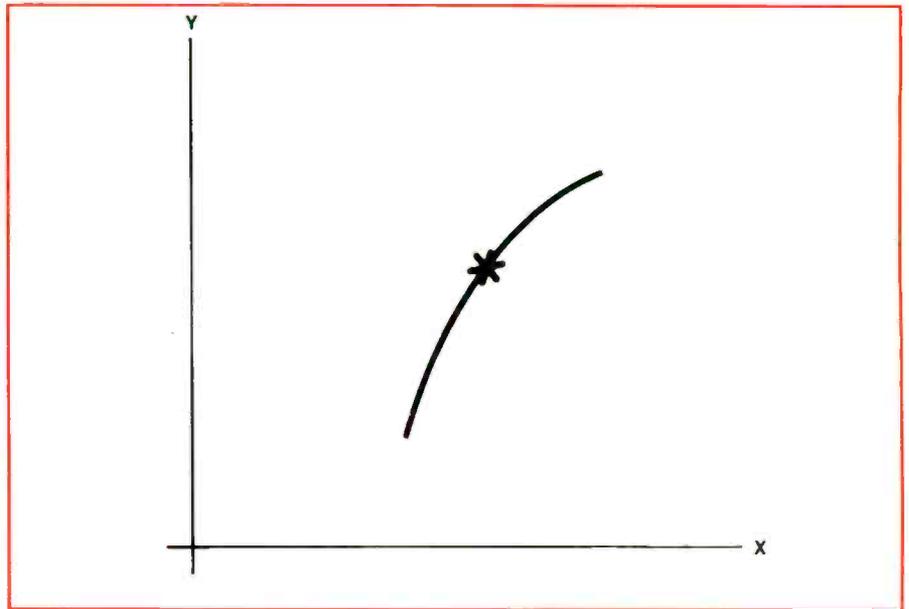


Figure 7. This is a portion of a curve for the equation $Y = +/\ - \sqrt{x}$. If you want to determine how fast y is changing with respect to x at the compass point, you'll need to use calculus. The problem can, however, be solved graphically.

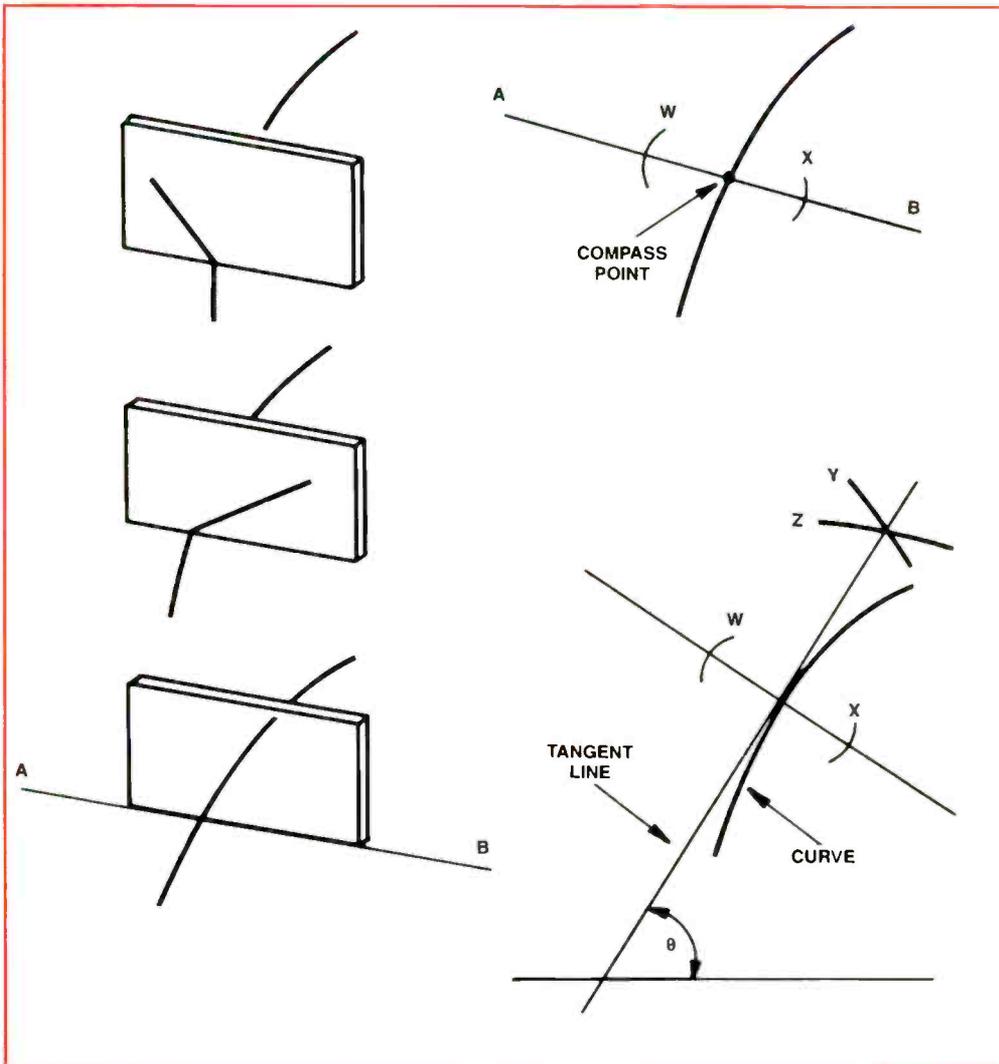


Figure 8. The rate of change of x with respect to y of the equation represented by the curve in the problem of Figure 7 is the value of the tangent to the curve at any point. To determine the value of the tangent, measure the angle that the curve makes with any horizontal line on the graph, and find the tangent of that angle. See the text for a step by step method of finding the angle.

mon sense. It is a lie to someone who builds roads. (The shortest distance between a given point in New York City and a given point in Los Angeles is a tunnel. It is NOT the line you draw on a map.)

To a pure mathematician the graphical solutions are nasty. They are given no space in the writings of pure mathematics. However, before going on with this discussion I must try to defend the accuracy of pure mathematical computations. Using the rules of pure, non-graphical solutions of a pure mathematician you can show that the resistance of a resistor in a certain network must be 67.3134339Ω . Don't ask me where you go to buy that resistor. An applied mathematician may use the rules of pure mathematics, or, any other rules that will get the answer needed for a practical problem. That includes graphical solutions.

At this point you may wonder if my

tirade against pure mathematicians has any merit among brilliant people. Let me tell you two examples.

A little girl sent her homework problem to Einstein and asked for help (nothing like going to the top). Einstein was more than a genius. He was a nice person. So, he worked the problem and sent it to the girl. Listen to this: a high school algebra teacher criticized Einstein because he used a graphical solution! (Wherever you find a top you will also find a bottom!)

Stephen Hawking is considered by many to be the greatest genius since Einstein. You may have seen him in television news sitting in a wheel chair. He is dying of Lou Gehrig's disease.

In a book called Stephen Hawking's "A Brief History of Time: A Reader's Companion" edited by Stephen Hawking—you will find this quotation: "As Stephen gradually lost the use of his hands,

he had to start developing geometrical arguments that he could do pictorially in his head. He developed a very powerful set of tools that nobody else really had".

I could write a book on the cases where brilliant people went to graphical solutions to avoid the rigors of pure mathematics. I have accumulated enough graphical solutions to fill a book.

An example

I will now give an example of the solution of a calculus problem solved graphically. Here is the problem:

"Figure 7 shows a portion of a curve for the equation Y equals plus or minus the square root of X. How fast is the parameter Y changing with respect to X at the compass point?"

The mathematical solution of this problem using calculus is simple, but, I want to prove to you that it can be solved graphically as well.

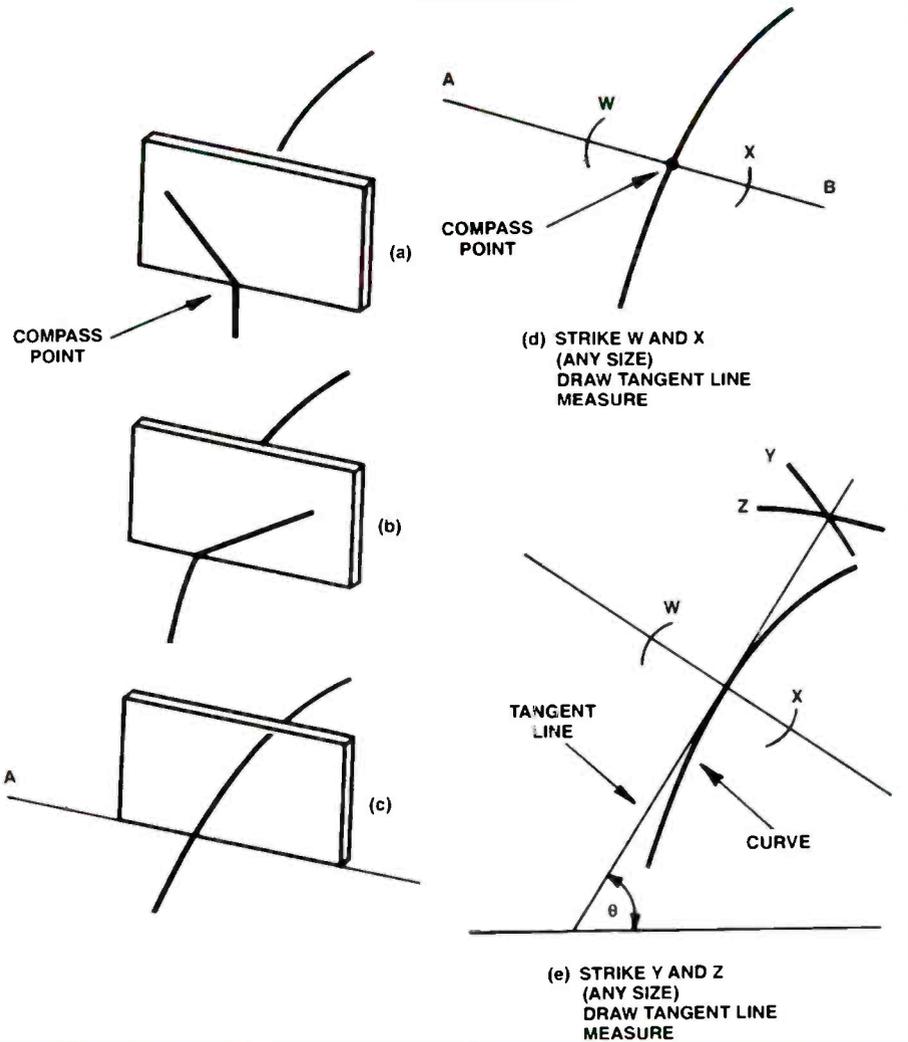
The rate at which Y changes with respect to X is called "the derivative of Y with respect to X". In symbols it is written dY/dX . After boiling down an exhaustive step-by-step proof you learn that if a tangent line is drawn to the curve at that point the tangent of the angle that line makes with the X axis (or any horizontal line) is the derivative dY/dX . Boiling it down even more: draw a tangent to the curve at that point.

Measure the angle it makes with any horizontal line on the graph, and find its tangent. That tangent is the answer to the problem. Let me show you how to draw the tangent to any curve. See Figure 8. You place the mirror against the curve at the point in question. See Figures 8(a, b and c). Turn the mirror so that it shows a continuation of the curve.

Draw a line along the base of the mirror. That line is vertical to the desired tangent. Construct a vertical to that line. See Figures 8(d) and 8(e). Extend that tangent line until it reaches a horizontal line on the graph paper. Use a protractor to measure the angle θ .

Use your calculator to find the tangent of that angle. That is the rate of change of Y with respect to X (dY/dX). By the way, the tangent can be found graphically. You don't really need a calculator, but, it makes the solution easier.

In the next issue of **ES&T** I will show how the derivative is used to make it easier to understand some important basic ideas in electronics. ■



SmartMan

A service manual is the road map for a service technician who is trying to navigate through the complex circuitry of a consumer electronics product trying to locate the cause of a malfunction and correct it. Like a road map, however, service manuals can be cumbersome, they take up a great deal of space, they are at times awkwardly folded, and it's often difficult to find the spot on the map that you're looking for.

Service information on computer

Personal computers have become so powerful and so fast that it's now possible to put large maps on disc and use the computer to view them. Because of the nature of computer data, finding a specific location on the map is as simple as entering its name and telling the computer to find it. Now service literature is becoming available in computer disk form. Having service data available in this form will provide technicians with a number of advantages.

One such program is SmartMan (for Smart Manual) from Philips, a Windows program that allows the servicer to call up a list of service manuals, select one, and display the schematics on the screen. In order to operate this program, a technician must have a computer with the following features: a VGA resolution or better monitor (640 X 480), 256 colors or more, a 386SX (or faster) with Windows 3.1, and at least 4 MBytes of RAM in the computer. The more RAM available, the faster the graphics will refresh and the more schematic windows that can be open at the same time. The software manufacturer recommends that it be at least a 486 33MHz with 12MBytes of memory.

Shrinking the data

The size of most schematics has been down-sized so that an entire service manual can fit on one of two floppy disks. All manuals can be loaded as needed onto the hard drive or left there for easy random access. Service literature from all manufacturers can be on the same or different drives in the computer. The subdirectory structure is: C:\Philips\7449. So under each manufacturer's name, the directory

structure is company name, then the manual numbers, 7449. All pertinent data is then in that directory.

Availability of service data

At the present time, the SmartMan system is expected to work as follows. Philips will sell the SmartMan software. The SmartMan program itself is simply an operating system. It does not contain any service literature so, Philips will also sell floppy disks containing their service manuals for use with SmartMan.

Philips is currently working with other consumer electronics manufacturers to help them convert their service literature into computer data that will be usable by SmartMan. These other manufacturers would then sell floppy disks containing their service literature to users of the SmartMan program.

Operation of the program

The flow of the program is as follows:

- Start program by clicking on icon
- Select manufacturer
- Select chassis or model unit to look at
- Select:
 - Board to see (multiple selects allowed)
 - Circuit to see
 - Component to see
 - Fault to see
 - Training to see

Selection opens window and comes in to view.

Program features

This program features zooming in/out, box zoom, panning around, entering your own fixes and service histories, changing brightness/contrast, and a display of all service adjustments. Simplified training information on each unit is also included with the signal flow shown.

Parts list

SmartMan comes with the parts list for that unit. If, for example, you begin typing a component number with "R," the parts list pops up and begins to display part numbers starting with "R" and if the company has a separate Parts Pricing pro-

gram, pricing and substitution information can show up too.

Previous fixes

Past fix information is available in three different ways. First, all known fault information for a given chassis is sent out to those that subscribe to SmartMan information. This comes with the locator information, so when a fault is selected the drawing appears on the screen. Second, fixes that are included in the company's external tips program (example: Ztips, FixFinder, etc.) can be checked. Third, fix information that has been input by the service center can be checked to help speed the repair.

Troubleshooting is one of the program's greatest strengths, according to the manufacturer. Troubleshooting procedures are done in a hypertext format, much as the HELP format is used by Windows itself.

Navigating in the schematic

SmartMan also includes a way for the service technician to move easily through the schematics that are linked by plugs, bus lines, arrows, or just spot indicators. Many of these spots will be "Hot Spotted." So the tech punches the "Find Hotspot" button and then tags the first Hot Spot. The screen then changes to the drawing where the Hot Spot is connected and that spot is marked with a red box.

"Red lining" is another function planned to be in the first version. Red lining provides the tech with the ability to draw a line across the schematic so that he can trace long circuit lines that may be grouped next to so many other circuit lines that it is hard to follow the one in the middle. This is similar to using a highlighter to trace a circuit path on a paper schematic diagram.

Improved versions

Philips is working toward improved versions of the program that have a target release for the end of 1995. One version will include a meter that allows the tech to have his reading show on the schematic where he took the measurement. For example, the technician would click on

"Meter Reading," then the base of a transistor on the schematic, then the point on the chassis where the base is found. The meter reading is displayed in a box near the base. When he is finished with that reading, the number stays there and he is ready to take another reading on the collector in the same fashion. This provides the technician with the ability to keep all of his readings on the schematic at the same time so that he doesn't forget them. He can then save the readings for tomorrow or allow another tech to look at them.

A variation on this upgrade would allow the technician to make meter readings with a standard DMM, and then to manually enter the readings.

Spot troubleshooting

A "Spot" troubleshooting procedure is planned for future releases of the program. This is primarily to help technicians who are troubleshooting on site, but can also be used in the service center. Using this system, a fault is selected, and a picture of the set appears with a spot over a plug pin or a transistor pin, showing that this is a frequent cause of failure. The reading that should be there is indi-

cated. The tech makes his reading and the results of that determines where the next Spot appears on the schematic.

With this process, troubleshooting that used to be text is changed into graphical procedures. This is similar to troubleshooting using a flow chart, except that the program/service literature follows the "flow chart" automatically.

The benefits of computerized service literature

Computerized service literature will provide fast access to the schematics and parts, but can also add features only dreamed of before, such as random access to all schematics, and all manufacturers, even when using a 5-pound Pen computer. Other benefits are the use of hot spots to locate points or trace wire through bus lines on schematics, troubleshooting spot procedures, voltage markup on the schematics, part pricing available at part look-up time, and the ability to update service information at the heart of your data. Finally, a technician can have all of the data (training, troubleshooting and fixes) for a given chassis in the same place with access from one source. ■



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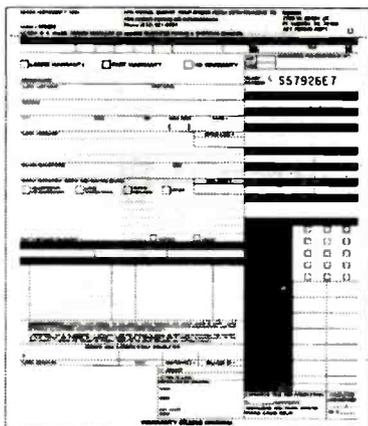
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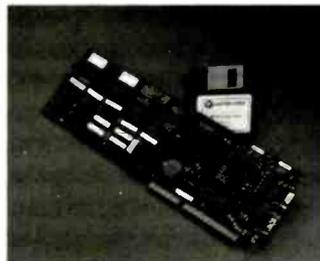
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***Radar for Technicians: Practical Installation, Maintenance, and Repair*, By Frederick L. Gould, 304pp, 232illus, \$45.00 hardcover**

The technology of radar, used for everything from weather forecasting and air traffic control to microwave ovens and X-ray equipment, is one of the more intriguing areas of electronics. Most books on radar-based technology have been oriented toward engineers, not technicians, and use advanced calculus and physics to explain many concepts.

In *Radar for Technicians*, long-time radar school instructor Frederick L. Gould covers virtually every aspect of radar theory and operation, but limits math to the algebraic formulas that professional electronics technicians are required to use and understand. After introducing basic radar concepts and the types of systems used today by civilian and military organizations, Gould uses a block diagram to illustrate signal flow within a typical system.

Then, he describes the major components and functions of radar transmitters; modulation techniques; how waveguides, antennas, and transmitters work; specialized radar receivers; how Moving Target Information (MTI) circuits function; the importance of radar system timing and location; various types of radar displays and their purposes; and the limitations of each type of radar.

This well-illustrated, practical resource also features handy maintenance hints for waveguides, antennas, receivers, and video displays, and a list of important safety procedures for radar system maintenance and repair.

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

***Buyer's Guide, a Map and Traveler's Advisory to the Internet*, By Willis Kreider, \$21.00**

More and more people are funneling to the on-ramps of the Internet, and all travelers are well advised to carry a map of the world's most developed information superhighway—whether they already have access to the system or not. Inquiring parties find out quickly that getting started can be confusing and difficult. And because this industry develops and takes

new shape almost daily—rules, standards, solutions and service offerings are in varying states of flux so even seasoned users need to track and consider new options that upgrade the speed and quality of their connections.

“Connecting to the internet” is a buyer's guide to the Internet system, leading readers to define their own wants and needs with an Internet connection considering: what to look for in a service provider, what questions to ask, what options and tradeoffs must be considered, what's involved in securing a connection to Cyberspace, and who can best help an individual get there for a price they can afford.

Willis Kreider, 2141 Champman Lake Drive, Warsaw, IN 46580

Ink jet cartridge reference guide, The Tech Press, \$39.50

The Tech Press announces the release of a reference publication focusing on the cartridges used in ink jet printers and their recycling methods. “The Ink Jet Cartridge Book” covers the in depth refilling methods of 28 different ink jet cartridges. Also included in the book is a detailed cross reference and resource guide. Mainly written for the entrepreneur seeking details on recycling methods, the book is also a valuable reference guide for anyone involved in the fast growing ink jet printer industry.

The Tech Press, 2725 Ore Mill Dr. C-24, Colorado Springs, CO 80904

Troubleshooting & Repairing VCRs, 3rd Edition, By Gordon McComb, TAB books, 384pp, 400 illus, \$22.95 paperback, \$34.95 hardcover

Since home video cassette recorders were introduced in 1976, more than 100 million VCRs have been sold. Eighty percent of households in the U.S. have one. Now in its third edition, *Troubleshooting & Repairing VCRs* has helped thousands of people keep their VCRs in top-notch condition and save on costly repair bills.

Most VCR problems are easily fixed, like dirty video heads, damaged tapes, broken wires, and old and worn rubber belts and rollers. This well illustrated, hands-on guide shows them how.

Author Gordon McComb covers all types of VCRs—VHS, Beta, and 8mm—providing specific maintenance and easy-to-follow repair instructions for dozens of different models. He includes updated or all-new material on beltless VCRs, linear and hi-fi audio heads, self-cleaning heads, built-in VCR plus, THX and surround sound audio systems, digital tracking, and more.

Readers will also find handy troubleshooting flowcharts for a variety of common VCR malfunctions, a tool and supply list, expert advice on how to clean VCR and camcorder heads without damaging them, and helpful tips on how to solder and desolder components and wires. In addition, McComb describes valuable emergency procedures for minimizing or eliminating damage caused by jammed, eaten, or broken tapes.

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

Operational Amplifier Circuits: Analysis and Design, Butterworth-Heinemann, 175pp, \$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 in order to create 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.

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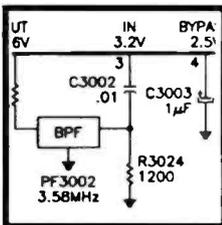
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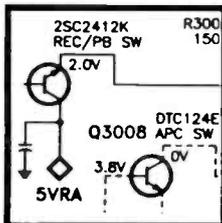


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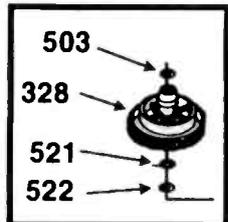
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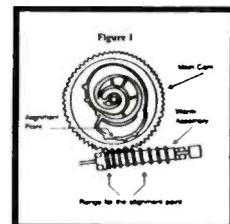
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volume of almost 930,000. Data from the EIA video tracking survey found that first-time purchases accounted for an estimated 17 percent of retail sales in April — up from 13 percent in 1994. Replacement sales made up 47 percent of the mix. Additional and replacement sales of models priced under \$200 at retail were particularly strong in April.

On the TV side of the market, direct-view sales to dealers were down 11 percent in April — their worst showing since a 14 percent slide in June 1991. The market saw sales rise on the low-end and high-end sides of the market with TVs under 19 inches up 4 percent and TVs 35 inches and larger up 4 percent as well; however, the middle range of TVs fell in April sales.

Softer retail replacement and additional set sales contributed to the decline although the TV market continues to grow over the last two years with a strong increase in first-time sales.

As home theater components expand their popularity with Americans, projection TVs are increasing their sales with a 14 percent gain in April and a 27 percent gain in year-to-date sales.

Camcorder sales were up 11 percent last month and 8 percent for the year to date. Fueling the camcorder boom are sales of models priced under \$500 which account for nearly one-quarter of total camcorder volume. The majority of first-time camcorder sales are made in the \$500 to \$899 price points. ■

Computer Corner (from page 25)

These alternatives range from a small classified ad for a few bucks a month to virtual servers operated as part of a larger system and appearing to those who access it as a complete, separate system. This can cost you anywhere from \$50 a month, to several thousand dollars a month, depending on what is involved.

While this may sound expensive, when you consider what it would cost to reach 30 to 50 million people worldwide by any other means, the price looks like a real bargain. Local Internet access is rapidly becoming universal in the United States and the price is coming down all the time. Virtually unlimited Internet access in most large cities and many small cities

costs less than \$30 a month, with limited access much less expensive.

Surfing the web

At your earliest opportunity, arrange to spend a couple of hours “surfing the web” with someone who has access and experience. What you will see will give you a lot of ideas and probably make you wonder why you never knew about this before.

Until I can get my own server up, you can check out my homepages at: <http://www.kern.com/dnorman/bakersfield.html>. Leave me e-mail and let me know what you think. Next month, we will discuss setting up your own BBS to provide service and support to your customers. ■

Test Your Electronics Knowledge

Answers to the quiz (from page 60)

1. You might be able to use it. Because the kit designer has specified a 20% 33KΩ resistor, the allowable range of resistance of the 33kΩ resistor is 26.4KΩ (33KΩ - 0.2 X 33KΩ) to 39.6KΩ (33KΩ + 0.2 X 33KΩ). The resistance of the 27KΩ resistor might be as high as: 27KΩ + [(0.2) X (27KΩ)] = 32.4KΩ. That is within the 20% range of a 33K, 20% resistor. But then the resistance of the 27KΩ resistor could have a low value of 27KΩ - 0.2 X 27KΩ = 21.6KΩ. So if the resistance of the 27KΩ resistor was on the low side its value would be outside the tolerance of the specified 33KΩ resistor.

So in a case like this, you should always measure to be sure that the resistance of any replacement resistor is within the tolerance of the specified resistor. Take no chances with fire!

2. $[(6.9 - 6.8)/6.8] \times 100 = +1.47\%$

3. $47K\Omega + [(0.02) \times 47K\Omega] = 47.94K\Omega$

4. $[(24 - 22.6)/22.6] \times 100 = 6.19\%$

5. $(1.2/24) \times 100 = 5\%$

6. $(1.3 - 0.65)/(1.3 + 0.65) = 33.3\%$

7. FM broadcast is given a range of ±75KHz. So:

$(50KHz/75KHz) \times 100 = 66.6\%$

8. $(X - 6.95)/6.95 = 0.12$

$X = 0.12 \times 6.95 + 6.95$

$X = \$7.79$

ALWAYS take the next higher cent. Actually, you will probably charge \$7.95.

9. “Actually, 15 percent of his cows are black.”

10. $X + (0.185X) = \$18.5$

$X = \$15.61181435$

Proof: $\$15.61181435 + (0.185 \times \$15.61181435) = \$18.50$

Obviously, there was some round-off of values. Using an original price of \$15.61: $\$15.61 + (0.185 \times \$15.61) = \$18.49785$.

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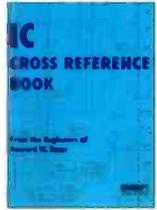


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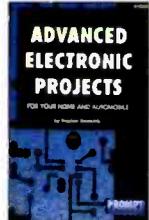


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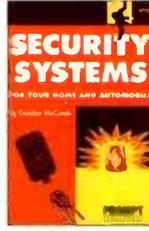
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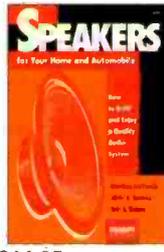


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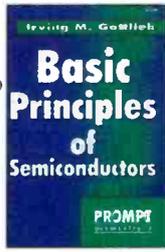
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2SC931E and 2SB474, two each transistors. *Contact: Mike's Repair Service, PO Box 217 Aberdeen Proving Ground, MD 21005. (410) 272-4984.*

Macadam digital audio analyzer 2000A need manual and/or schematic. Will pay well for copy, postage and phone call. *Contact: (403) 460-9540, Alberta, Canada. Leave message.*

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Text books, manufacturers manuals, Sam's, instruments, meters, parts, tuners, tubes, etc. Send large S.A.S.E. *Contact: Tony Fonseca, 24 Fernwood Court, Columbus, NJ 08022-1027.*

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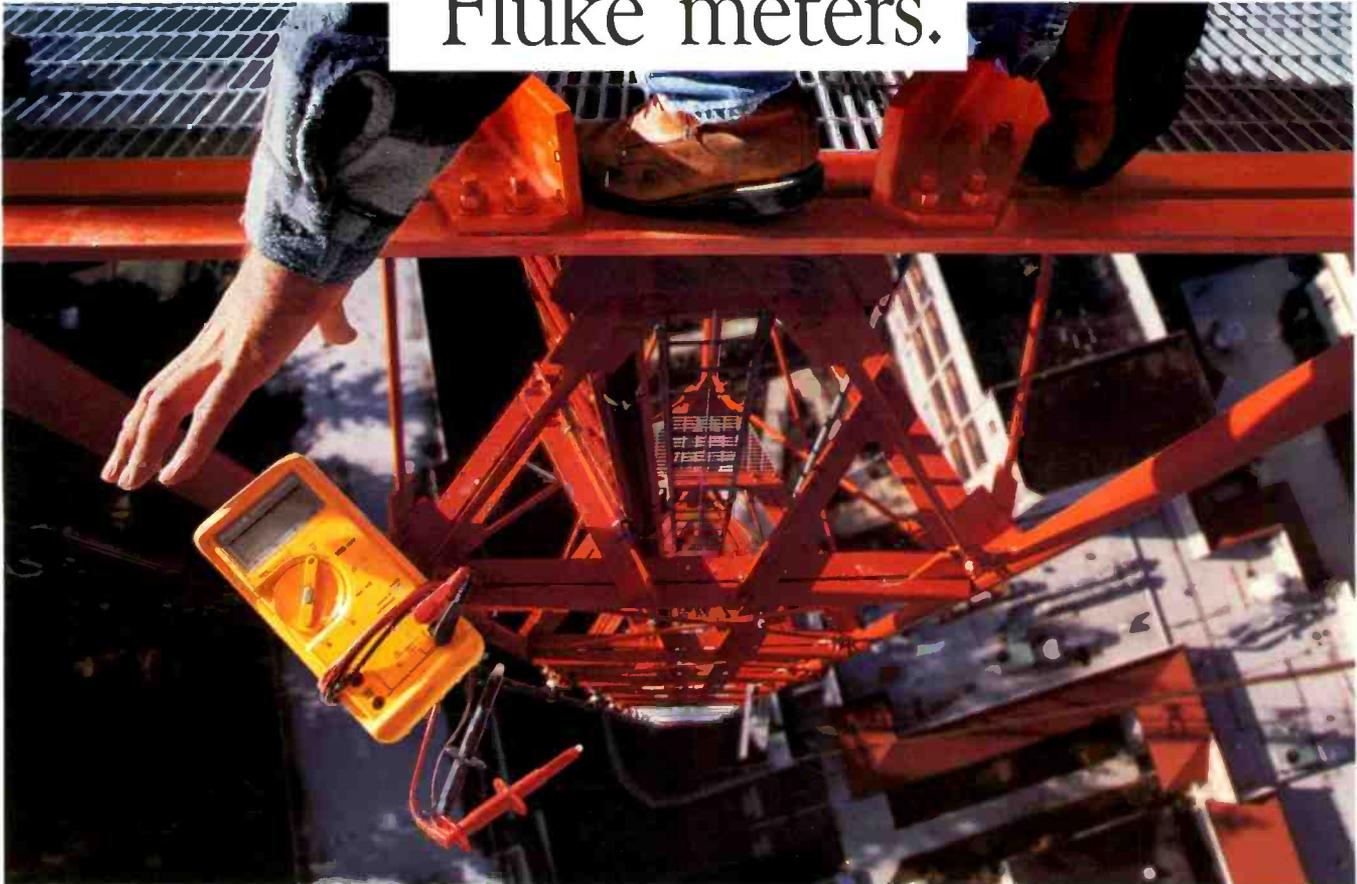
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