THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

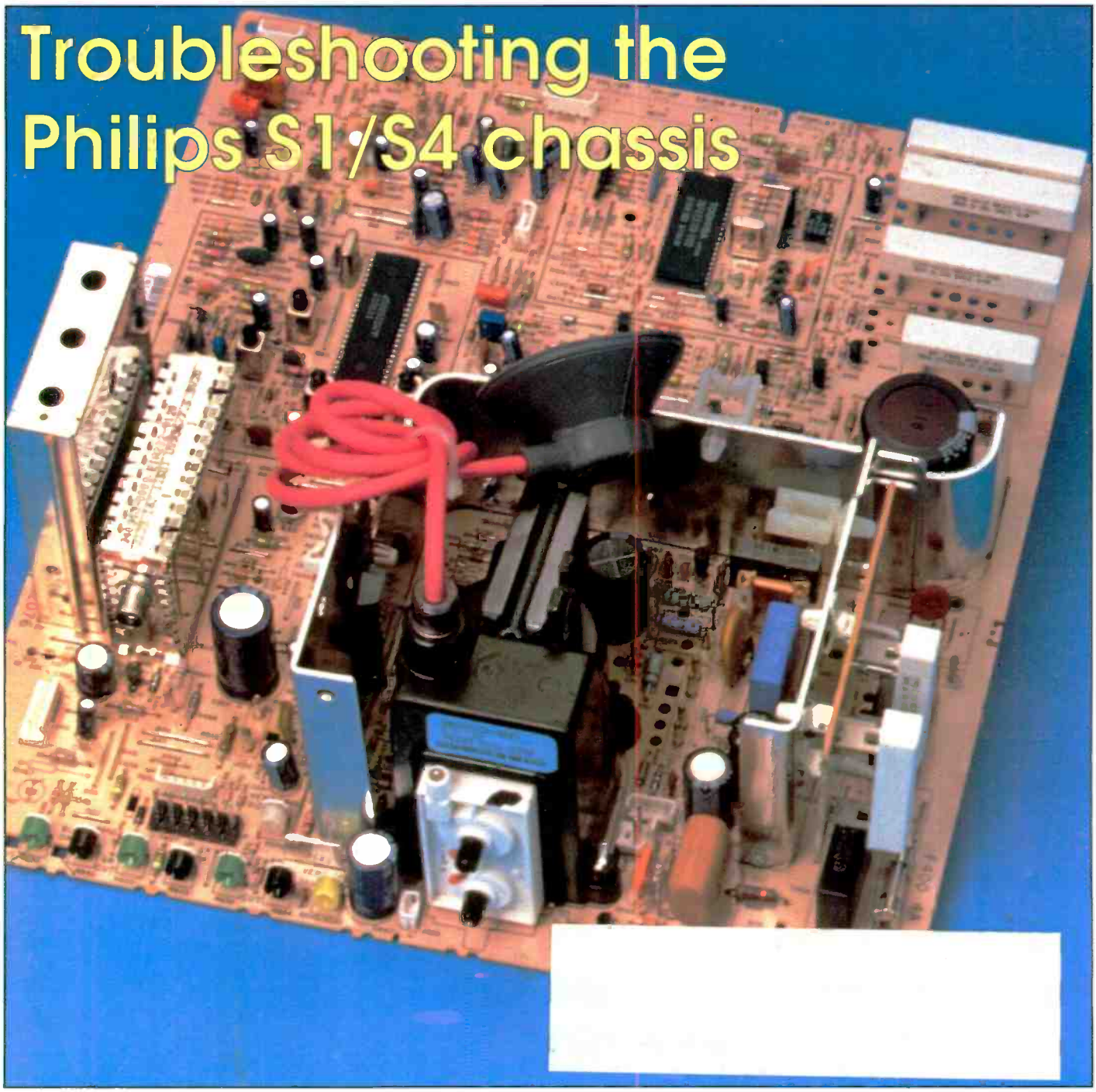
# ELECTRONIC™ Servicing & Technology

August 1993/$3.00

**Replacement parts showcase**

**Sources of schematics and technical information**

## Troubleshooting the Philips S1/S4 chassis



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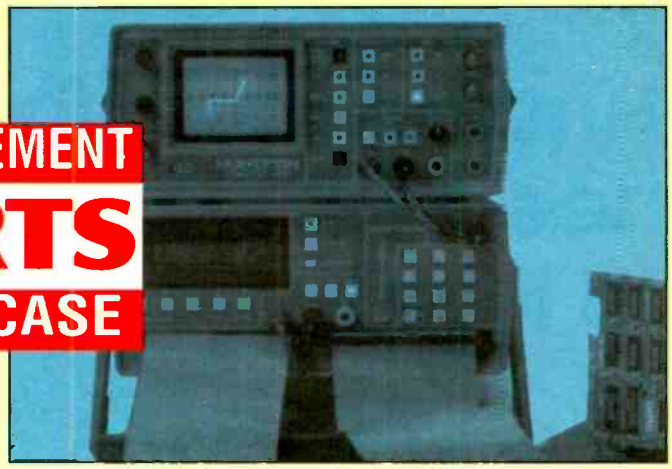

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## SPECIAL ADVERTISING SUPPLEMENT

### Replacement Parts Showcase



## FEATURES



## DEPARTMENTS



## ON THE COVER

The S1 and S4 chassis, manufactured by Philips Consumer Electronics, are an example of the same chassis used in a variety of models with different brand names. These chassis are used in no less than six different models. These sets may be serviced using Tech. Manual #7502, available from Philips. (Photo courtesy Philips Consumer Electronics.)

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING
ELECTRONIC Servicing & technology

# Finding the information you need—it's all in knowing where to look!

Information is one of the most valuable commodities in the world today. Countries have vast intelligence gathering facilities to attempt to find out what other countries are doing. Companies are constantly trying to find out what their competition is doing without letting anyone else know what they are doing.

Credit agencies keep files on anyone who has ever used or applied for credit, so that lending agencies can come to them to find out who is credit worthy and who is not. And those companies who need this information are willing to pay well to receive it.

Other kinds of information on people is also extremely valuable. If you subscribe to a magazine, buy something by mail order, or otherwise reveal your personal or professional interests (and possibly buying power) to a company or organization, your name will become part of a list that is so valuable that it will be sold to companies that offer similar products.

Still other types of information are so valuable that organizations publish newsletters that subscribers pay tens or even hundreds of dollars for each year in order to remain abreast of changes in that area. For example, investors in the stock market pay considerable monthly sums for advice on what the market is doing so they can buy and sell at the right times.

Of course this information is only as valuable as its accuracy. Some of these investment newsletters are very accurate and some are less so.

People who are involved in government activities, such as lobbyists and government contractors are glad to pay for newsletters that provide regular updates on what's going on in Washington.

In government and government related organizations, information is a very valuable commodity indeed.

Closer to home, consumer electronics servicing businesses generally are willing to spend some reasonable amount to receive useful information on the products that they service. Authorized service centers subscribe to the service literature published by the manufacturers for whom they're authorized.

Many service centers also buy individual service manuals or schematic diagrams for certain products they're called upon to service, and many others subscribe to other service information publications, such as Sams Photofact.

Frequently, however, especially in the case of unfamiliar brands, service information is hard to track down. First, you have to find either the company whose brand is on the product, or the company that actually manufactured the product. Second, you have to contact the company and try to get them to send you the service information you need.

Three articles in this issue are intended to help service centers locate technical or service information. Each article looks at a slightly different aspect of this same problem. In "Knowledge by the pount," the author suggests ways of finding information at a low cost, such as by frequenting garage sales, sales at electronics stores, and otherwise getting in contact with individuals who have the information you want that they no longer need.

In "Sources of schematics and technical information," the author suggests a number of places the technician can contact to locate technical information.

In "Using manufacturers' tech help lines," the author describes his experiences with using these very valuable sources of technical information and assistance, and suggests ways in which technicians can more fully utilize the help they offer.

Information is a valuable commodity; especially in this information intensive world in which we live. The servicing individual or organization that knows best how to fully mine the information that's available will usually be among the most successful in the business.

Nils Conrad Person

# News

## Video product unit sales up nine percent

Unit sales to dealers of video products totaled 2.7 million in April, up nine percent from the same period last year, despite sluggish U.S. consumer demand at the retail level, according to the Electronic Industries Association's Consumer Electronics Group (EIA/CEG).

*The Wall Street Journal* reported on May 6 that sales at the nation's retailers were up between two and three percent in April from the same period in 1992. The newspaper also noted that many analysts blamed April's lackluster retail performance on lower tax refunds, bad weather, and consumer uneasiness about the near-term future of the economy.

The Commerce Department recently reported that the U.S. economy grew at an annual rate of just 1.8 percent in the first quarter of this year. The video market has weathered the uneven outlook on the U.S. economy in the early part of this year, riding the success of color television and camcorder sales to record industry volumes. Overall, total sales of video products grew 11 percent in the first four months of this year.

The solid performance of mass merchants and specialty retailers, in the face of the overall uneven retail picture, has been a boon to video sales, and a clear indication that consumers are continuing to buy products based on quality and value.

Brighter times for the overall U.S. economy may be on the horizon, if a recent Federal Reserve report is any indication. The report, sometimes referred to as the "beige book," focuses on economic activity at many different state and regional levels, and showed that many sectors may have reached turning points, especially in some of the hardest hit areas of the nation, such as the Northeast.

Sales of color TVs were exceptionally strong the last week of April, coming in at more than double the amount of sales during the last week of April 1992. For the full month, sales to dealers were up 1.5 million units, or 14 percent from the same period last year. This surpassed the previous April high set in 1989.

Sales of 25 inch televisions did particularly well in April, rising 31 percent on volume of nearly 230,000 units. Projection television sales jumped 21 percent in April, the category's best year-to-year growth since last October.

"Consumers are recognizing that they can enjoy bigger screens and higher performance with more features at attractive price points," says Jim Palumbo, senior vice president/general manager, Sony consumer Television Products Company. "The value/feature/performance relationship has improved significantly in televisions versus five years ago. We are seeing heightened interest in home enter- tainment, resulting in the industry being fueled by larger screen sizes."

Palumbo notes that "with the addition of CaptionVision closed caption decoding to every television set 13 inches and above by every manufacturer beginning July 1, approximately one million new television sets will go on display in the nearly 5,000 television retail outlets in the United States."

VCR deck sales rebounded from slower sales experienced in the first half of April to end the month with a loss of only four percent. Total sales to dealers, through the first four months of 1993, remained three percent ahead of last year's record total, rising to an annual rate of 12.4 million units.

Camcorder sales exhibited the most consistent growth of any video category in the first three months of this year, as well as in April. Unit sales to dealers were up 18 percent over April 1992, and rose 16 percent in the year-to-date.

Also contributing to the solid April results for sales of video products were TV/VCR combinations, which rose 49 percent, and laserdisc players, which rose 29 percent, versus April 1992.

## FCC action clears way for new TV features

The Federal Communications Commission (FCC) has acted quickly in response to an electronic Industries Association petition by releasing an order which will create new and useful television services for consumers.

The FCC's order will, by 1994, allow many consumers with new TV sets to obtain information, such as the elapsed time and name of a program, as they switch TV channels.

Television manufacturers welcomed the FCC order. Joseph P. Clayton, Executive Vice President, Marketing and Sales-Americas, Thomson Consumer Electronics, and EIA Video Chairman, says, "This decision frees up television set manufacturers to develop TVs which will enhance consumer entertainment and provide a wide variety of new information and services such as automatic setting of VCR and TV clocks, and automatic delaying and extending of recording when program times change."

Some manufacturers have already introduced TV sets with extended capabilities. Mitsubishi announced that all of its TV sets manufactured in accordance with the Decoder Act of 1990 will be capable of decoding and displaying enhanced captioning and extended data services.

EIA's Television Data Systems Subcommittee (TDSS), which drafted the original petition that resulted in the FCC's Report and Order, is also developing EIA-608, the voluntary standard which details the use of the new bandwidth.

The FCC order, adopted on May 5 and released on May 10, describes an amendment of the FCC's rules to open, as of July 1, field two of line 21 for these new services. This will take effect concurrent with the implementation of the Decoder Act of 1990, which states that, as of July 1, all televisions 13 inches and larger manufactured for sale in the U.S. must have built-in captioning decoder circuitry.

The Television Data Systems Subcommittee will soon issue for approval EIA-608, a voluntary standard that acts as a technical guide for captioning service providers and programming providers wishing to offer enhanced captioning and extended data services.

EIA-608 is expected to be finalized in the third quarter of this year.

In the order, the FCC also adopted rules first proposed by the Advanced Television Systems Committee and supported by EIA, which reallocate line 19 of the VBI for transmission of the Philips ghost cancelling reference signal on an optional, but exclusive, basis.

The FCC stated in the order that both the EIA's and the ATSC's petitions were addressed ". . . because both are a matter of high priority, inasmuch as they would significantly enhance conventional NTSC television service." ■

# Literature

## Power quality survey suggestions

BMI's new Application Note #227 *How To Do A Power Quality Survey* provides five steps for understanding a power quality problem, gathering necessary information, and determining the best solution. The application note discusses the importance of using logical procedures, which will reveal the cause of the problem, appropriately assign responsibility, and help avoid conflict between concerned parties.

**Circle (12) on Reply Card**

## Semiconductors software enlarged

Philips ECG introduces the newly expanded version of ECG Semiconductors Instant Cross floppy disk program, now cross-referencing over 8,100 additional industry part numbers.

The entire data base from the recently published "Supplement 1 to the ECG-212Q Semiconductors Master Replacement Guide" has now been merged with that in the original release (version 1.0) of the replacement semiconductor software for IBM PCs and compatibles.

A new and helpful feature of the enlarged program is the addition of the complete ECG Product Index file selected from the Main menu. Entering an ECG part number will display that number and following numbers plus device description and case style. The Index file may also be scrolled or paged up and down to view other semiconductor types.

The software operates on IBM-PCs and compatibles that have 640K of RAM, a hard drive and $3^1/_2$-inch or $5^1/_4$-inch floppy disk drive. The program versions that are available will support 360K/1.2M and 720K/1.44M floppy disk drive; also supported are monochrome, CGA, EGA and VGA monitors.

Among the new devices added by Supplement 1 and contained in the new release of the software, include some 60 modules and ICs used in VCRs, TV, audio, PCs and industrial equipment applications. Functions include voltage regulators, motor drivers, signal processors, decoders, AFPOs, small signal subsystems, deflection circuits and electronic attenuators. Also added are a number of transistors, rectifiers and diodes.

**Circle (13) on Reply Card**

## New LAN catalog

A new 80-page LAN Catalog has been introduced by Jensen Tools with products for installation and maintenance of PCs and local area networks. The colorful slim-line catalog contains an additional 24-page LAN supplement featuring new tools, test instruments and LAN installation hardware from major manufacturers. Included are hubs and repeaters, wire/cable/connectors, testers, cable distribution products, scanners, technical manuals, diagnostic software, and more.

**Circle (14) on Reply Card**

## Product ordering guide on paper, disk

A new Product Ordering Guide for Electronic Specialty Markets (ESM) is now available from 3M. The guide is a valuable resource for engineers, assemblers and technicians who require a wide variety of electronic and electrical parts as well as static control products in small quantities. The 192-page catalog provides part numbers, descriptions, and drawings of more than 6,000 3M products.

The $8^1/_2$ x 11-inch catalog fits easily into a three-ring notebook or file folder for easy reference. An electronic version of the catalog is also available for $9.95. The electronic catalog, which also includes suggested retail prices, is available on DOS $3^1/_2$-inch diskettes and requires 4MB RAM.

The catalog includes information on the following types of products: adhesives, cleaners and compounds, breadboards and test clips, bumpons, cable handling products, connectors, IC sockets, IDC cables, static control products, tapes, terminals, vacuums, cleaning supplies, heat sink products, diagnostic and detection equipment, heat shrink insulating products and Hook 'N Loop products.

The catalog also includes detailed cross-reference charts and an index to assist in quickly locating specific products.

**Circle (15) on Reply Card**

## Training pull-out calendar now available

Learning Group International has announced the release of its semi-annual planning calendar. This planning aid is a grid based calendar listing Learning Group International course titles down one side and corresponding course dates across the top. The calendar is useful for planning training for the period January through December 1993 and is available free of charge.

**Circle (16) on Reply Card**


THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC Servicing & Technology

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

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**SALES OFFICE**
Electronic Servicing & Technology
76 N. Broadway, Hicksville, NY 11801
516-681-2922; FAX 516-681-2926

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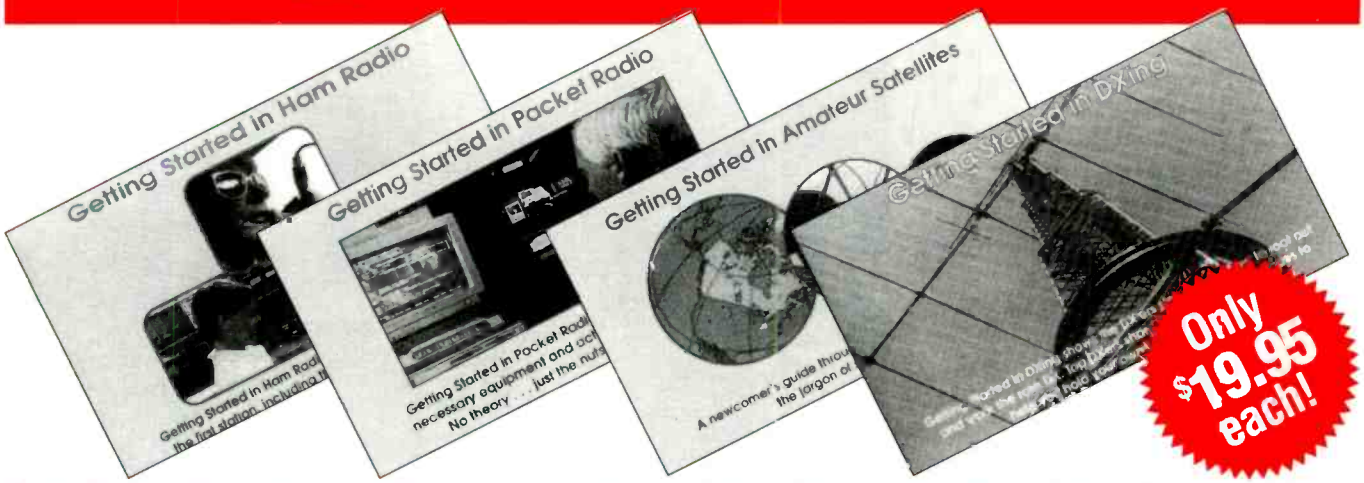
The Authority on Amateur Radio

# CQ's new videos bring the exciting world of amateur radio into your living room!




**Getting Started in Ham Radio.** The authoritative fast paced video introduction to the fascinating world of ham radio. Shows how to select equipment and antennas. How to use repeater stations for improved VHF coverage. The importance of grounding and the basics of soldering. How to get the most out of your station, whether it's home-based, mobile or hand held!

**Getting Started in Packet Radio.** This video will help de-mystify the exciting but sometimes confusing world of packet radio. Shows you how to get started in using your computer on the radio. Includes step-by-step instructions on making packet contacts and using packet bulletin boards, networks and satellites.

**Getting Started in Amateur Satellites.** Shows you how veterar operators set up their satellite stations and how to find and track ham satellites with ease. How to access current satellites and contact far ranging countries around the world. This video is filled with easy to understand advice and tips that can't be found anywhere else.

**Getting Started in DXing.** Top DXers share their experience on equipment, antennas, operating skills and QSL-ing. See hams work rare DX around the world. If you're new to DXing this video is for you. All the valuable information presented here may well give you the competitive edge you need to master the exciting world of DXing.

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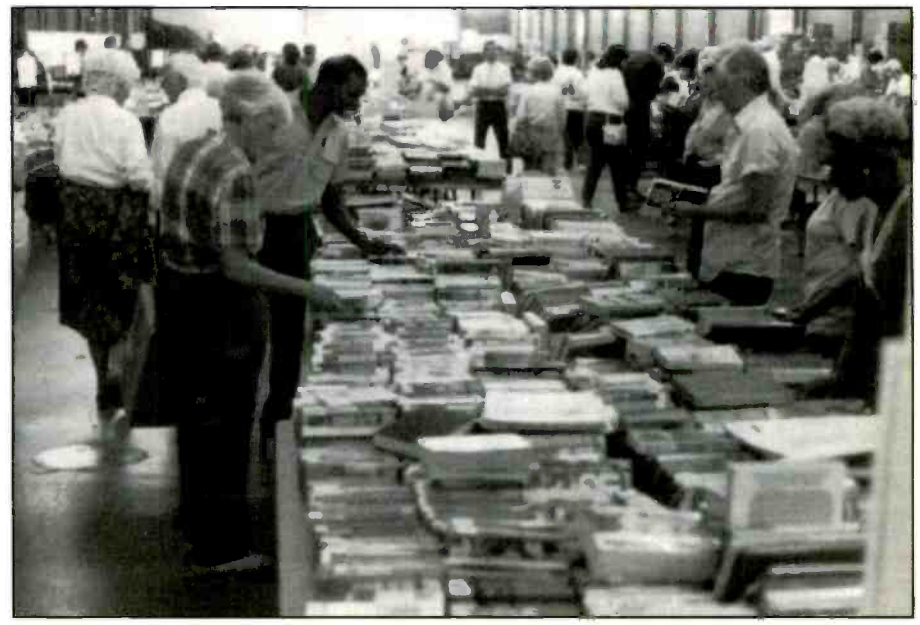
# Knowledge by the Pound

By Matt J. McCullar

Whether you are a novice technician still in school or a journeyman with a generation of experience, a problem all of us share is collecting information about electronics for our work. Technicians must keep up to date with the latest advances in electronics.

You wouldn't want to go to a doctor who doesn't read about the latest advances in medicine, would you? With so many topics to cover (and more arriving every day), it is practically impossible to buy at face value every book and magazine that hits the market.

So how would you like to purchase many of the books and magazines on electronics, computers, amateur radio, lasers, fiber optics, troubleshooting, vacuum tubes, transistors, computer graphics, and television you want for incredibly low prices? Experience says that when someone offers something for nothing, you'd better duck; but getting something for next to nothing is a different story.



Somewhere in this picture are books you can use.

## Locating used books

The secret is looking for used books and periodicals. There are plenty of them out there, patiently waiting for you to find them. They lie quietly in dusty bins, lonely shelves, and dark storage rooms. Many of the secrets they contain about electronics never go out of date. And you won't even get sticker shock when you see their prices.

## Gold mines

Garage sales are the technician's answer to El Dorado. You can find anything if you look long enough. There are broken televisions, orphaned computers (great for parts), old video game systems, audio/visual equipment, and more books than a high-school library. People who hold garage sales do so because they are cleaning out the attic, moving away, or just trying to earn some money. Regardless of the reason, they want to get rid of it all, and they price it accordingly.

Back issues of magazines for a dime apiece are not uncommon. Neither are hardcover books for a quarter. Among the treasures I've found over the years at these grabfests include:

- 50 data books on EPROMs, RAMs, microprocessors, TTL chips, CMOS chips, op-amps, and LEDs for only $15; including a nice wooden shelf to hold them all. An engineer was cleaning out his study.
- An entire Cleveland Institute of Electronics (CIE) course, over two dozen workbooks covering all the fundamentals of electronics, for only $5.
- A stack of hobby books written by Forrest Mims III for Radio Shack during the '70s for a quarter apiece. These cover transistors, digital gates, linear power supplies, and more.
- A stack of Schaum's Outline Series books on electronic communication, digital fundamentals, circuit analysis, and other science courses; free. A retiring teacher just didn't have room for them. If you are in college, or have been, you realize how much these cost in the stores.
- A car-trunkful of textbooks on energy conversion, solar power, and power systems for only $20.

## Other treasures

If the books don't interest you, you can find "broken" radios, televisions, computers, etc., for rock-bottom prices and determine all that may be needed is cleaning, readjustment, or just new batteries.

No kidding. I find TVs for sale simply because someone fiddled with the controls on the back of the set. Children leave their toys on, draining the batteries. Even if it can't be fixed, at least you can stock up on your store of salvaged parts.

Flea markets fall in the same category as garage sales—they offer super deals.

## Libraries

Public libraries often hold discard sales to clear out books that are too old, tat-

McCullar is an independent computer and electronics servicing technician.

tered, water-logged, or for some other reason not to their liking. Since no money is earned by heaving these books into the trash, the public is invited to nose around and name their own price.

I bought a hardcover 1981 ARRL Handbook for only 25 cents. It had "DISCARD" stamped on it a few times, but there was nothing obviously wrong with it. If you don't mind occasional flaws such as pages missing or two chapters stuck together, you can possibly get yourself a real bargain.

Why not make a trip to the library in the first place? You may be surprised at the books and magazines available to borrow. What you're looking for may not be in plain sight, so feel free to ask the librarian for assistance. Your taxes pay for it, anyway. Besides, some libraries stock Sams Photofacts. They can get back issues of almost any magazine you want.

None of these books cost more than $5.

## Radio Shack

Radio Shack managers periodically hold their own personal sales to get rid of damaged stock, and books are usually a part of said merchandise. New books from Tandy come out every year, and the old ones have to go somewhere, for less than half the cover price. Get to know your local Radio Shack managers and you can get some super deals besides free batteries every month.

I bought a compact disc player for $50 because it was assumed to have been broken after a burglar knocked it off the shelf during a robbery (it turned out to work fine). A tornado took the roof off of the same store a few years later and technicians came from miles around for the resulting "Gone With the Wind" sale.

Amidst the pile of items I bought was a copy of Rodnay Zaks' best-seller "Programming the Z-80" for 50 cents; it cost $12 brand-new. No two Radio Shacks offer exactly the same stuff at these sales, so visit as many of them as you can.

## Used bookstores

No doubt you can find something you can use at any used bookstore. They often buy used reading material as well as sell it, so you can earn some cash for superfluous technical literature if your library fills up.

I've often found Sams Photofacts and other technical manuals at these shops. Some also sell software at discount prices. (I discovered ES&T at a used bookstore.)

## Public booksales

Local clubs often hold public booksales to raise money. Figure 1 shows their general format: thousands of books scattered across plywood sheets set up on sawhorses, in some semblance of general order. You have to hunt for what you want, but the results are well worth it. You can waddle out of these sales with shopping bags full of tech lit for less than $10.

## Ask around

If you just put the word out that you're looking for books, pretty soon you'll find yourself inundated with them. While I was on my lunch hour at work one day, my supervisor walked in and dumped a cardboard box full of electronics books and manuals on the floor.

He said his wife wanted him to clean out the garage, so he rounded up his old workbooks from his days at technical school and offered them to me. I loaded up my car with them, and all it cost me was a lunch. From that experience I found out that it pays to ask your friends.

If your friends have books you want but they aren't willing to part with them, why not borrow? I hosted a party at my house for members of a computer bulletin board to which I belong, and a friend began thumbing through an architecture book I had landed in a previous deal.

She was studying drafting at the time (and I wasn't), so when she asked to borrow it, I said yes. She saved $20, I got some valuable shelf space back, and everyone is happy. More recently I borrowed a book on the General Radiotelephone Operator's License exam after someone else hosted the party.

If you know someone in the military, they may have some government manuals on electronic troubleshooting, or can get them for you. I learned a lot about antennas and transmission lines from the workbooks my father kept during his days in the Air Force.

Recently a ham radio friend of mine asked me to fix his scanner radio, so I drove to his house and was astonished to find dozens of books on radar. He had been a radar expert during World War II and was part of its development, and had actually written some of the books on it. He eagerly let me read them, which I was pleased to do.

Another ham friend showed me several manuals his professor had given him. They were the original training manuals NASA used to teach the Apollo astronauts how to fly and control the Saturn V rocket. Every switch, every gauge, every wire is shown clearly on the schematic diagrams and pictures. Study these manuals, and you can fly to the moon.

## Bargain bins

If you're still in school, check the bargain table in the campus bookstore. They have discard sales once in a while. At

these sales, math and science books are a dime a dozen. If the assigned textbook in your course doesn't explain a concept clearly, reach into your private stock of other books and read one that does.

Working the extra problems pays off, too. And you don't have to stagger over to the library to do it. I've saved hours of time on research projects because I knew I already had a certain schematic stashed away somewhere at home. The price for this valuable database easily falls within a student's budget; but you have to look for it.

Ask your instructors for books. Professors are encouraged to read dozens of new textbooks that publishers want to sell, and are asked for their review. At the end of one semester I asked my physics teacher what he was going to do with all the books stacked up in his tiny office that publishers had sent him. He said he was throwing them away. You can guess who has them now.





## Now what?

"Where am I going to put all of these books?" you may be asking yourself. "And when will I ever get the time to read them?" These are excellent questions. The Library of Congress would be absolutely useless if the staff had no method of cataloging everything. That's why it's important to know what you've got and know exactly where it is.

I keep several important reference books on the shelf at work so I can look up something when the need arises. Albert Einstein once said, "Never bother remembering something that's already written down." And I can't possibly remember the pinouts for a VGA connector. That's why I keep information like that within reach of the bench. Everyone else in the service center knows where it is as well, so the entire staff benefits.

Other technicians find important data and store it in the collective library, too. Sharing the fruits of the hunt is part of the fun. Supervisors are pleased when they see technicians keeping up with new technology by reading about it. It impresses the customers, as well.

At home, use a sturdy shelf made of metal or wood. Figures 2, 3, and 4 show some examples. One night one of my homemade shelves came apart and the resulting avalanche of paper woke up the whole house.

Whenever a free moment shows up, read a few pages from a book and highlight passages of interest. Keep a textbook or two in the car in case you get caught in a traffic jam. Read for a few minutes during lunch. Try to find out something new every day. It can only help your career.

It doesn't take much to get started, so start shopping. Undoubtedly, you'll also find some books that the rest of the family will enjoy. The finest things in print are waiting to be read. ■

# Sources of schematics and technical information

By Victor Meeldijk

Often the hardest step in troubleshooting any piece of equipment is getting the technical data you need. This article is written to provide some suggestions on locating sources of that most precious commodity: information.

### The manufacturer

To get manufacturer addresses consult the "Consumer Electronics Replacement Parts Source Book" issued by the EIA/CEG (Electronic Industries Association/Consumer Electronics Group). If the unit has no nationally-recognized brand name on it, call the distributor/store where it was purchased to try to trace the manufacturer or the importer.

Meeldijk is Reliability/Maintainability Engineering Manager for Diagnostic/Retrieval Systems, Inc., Oakland, NJ 07436

### Dealing with microfiche

If the manufacturer supplies a microfiche copy of the technical manual and schematics, and you have no way of reading it, you can do one of three things:

- Ask if the manufacturer will provide paper copies of the schematic diagrams;
- Try your local library to see if a microfiche reader/printer is available or;
- Find out if someone you know works for a company with a library that can make a copy of the schematic.

If, however, there is no manual available, you can always place an item in the

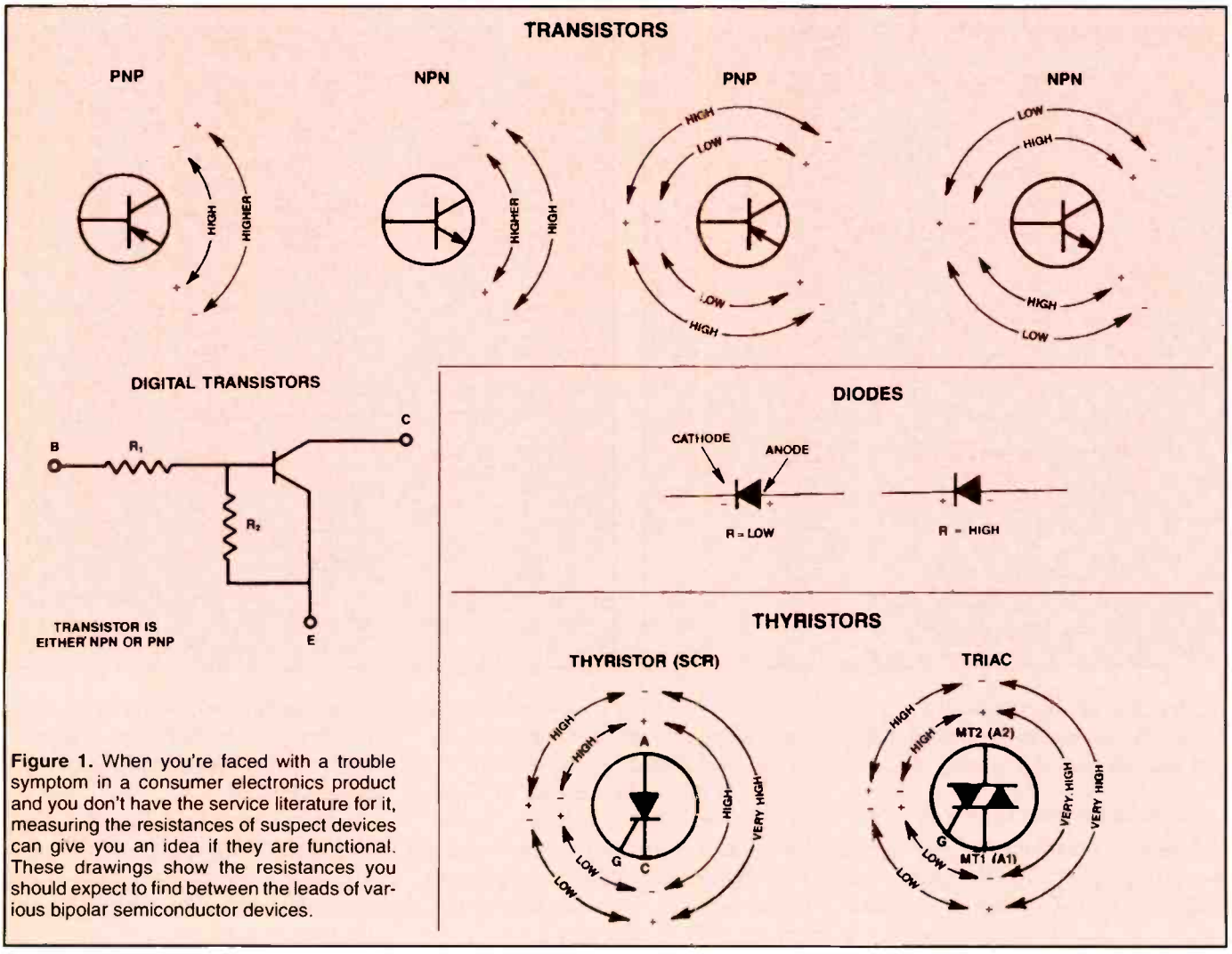



**Figure 1.** When you're faced with a trouble symptom in a consumer electronics product and you don't have the service literature for it, measuring the resistances of suspect devices can give you an idea if they are functional. These drawings show the resistances you should expect to find between the leads of various bipolar semiconductor devices.

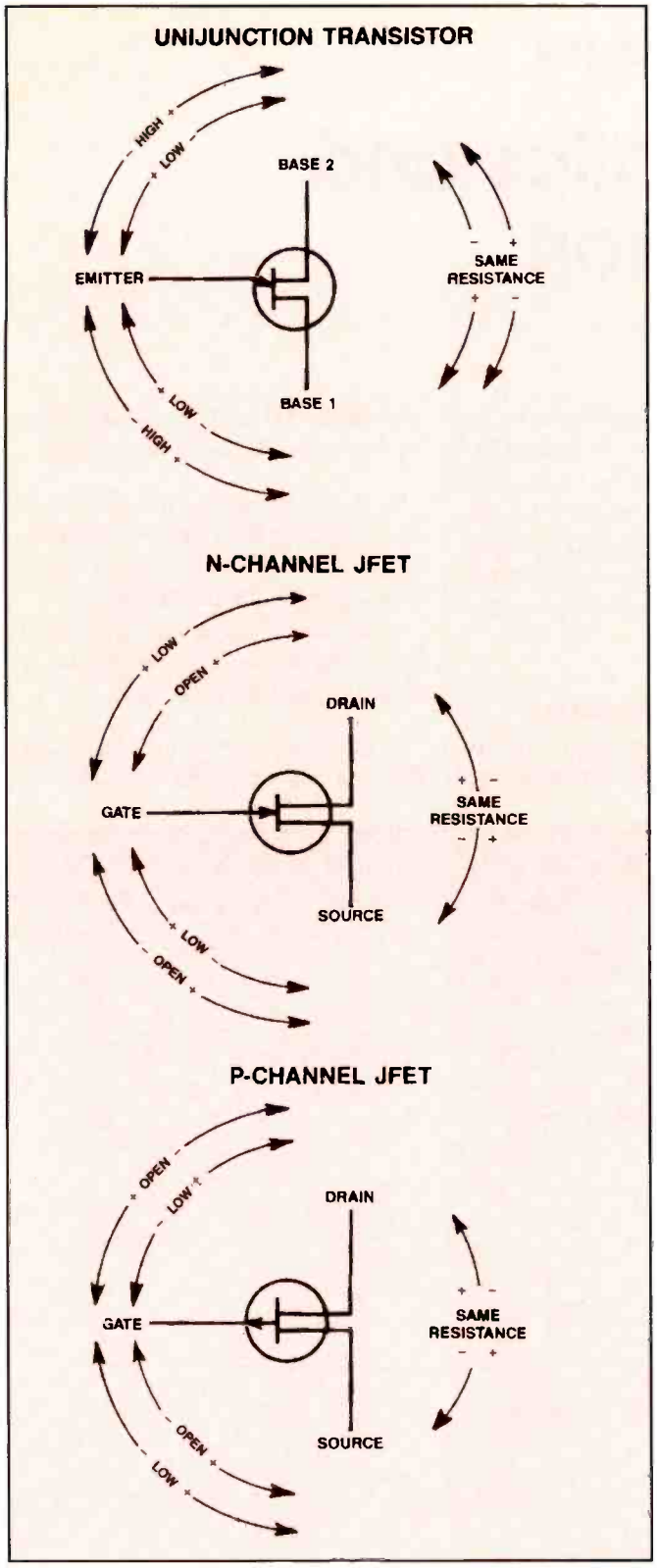
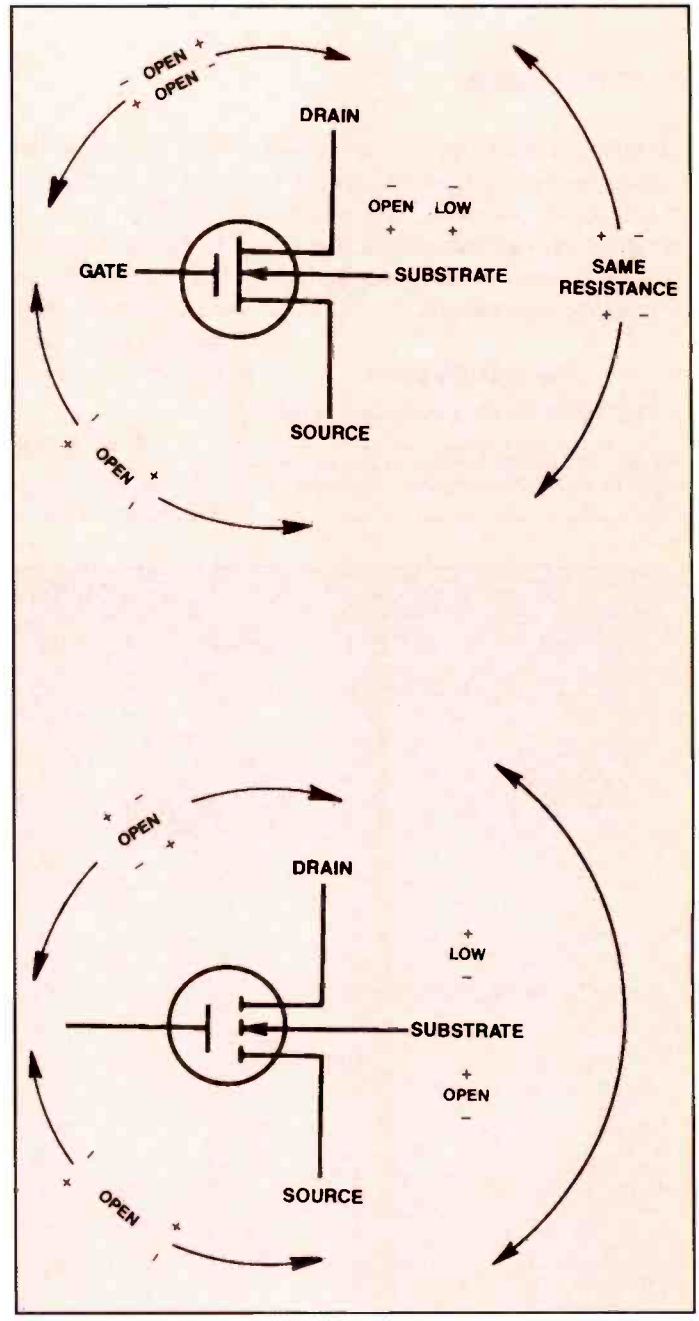



**Figure 2.** You can get an idea if a unijunction transistor or JFET is operational by measuring resistances between elements. These drawings show the resistances that you will measure if the unit is functioning properly.

**Figure 3.** You should expect to measure these resistances between elements of MOS devices if the devices are not damaged.




Readers' Exchange column of this magazine asking if another reader can supply you with the manual you need.

### Use a manual for a similar product

Another alternative is to use a service manual from a similar product. Textbooks frequently reproduce sections of schematics, so check your local library. For VCRs, as an example, while there are many brand name units around, many are owned by the same parent company.

As examples; Matsushita of Japan owns the Panasonic, Technics, Quasar, Prism and National Brands. It also makes VCRs for Grundig. Thompson Consumer Electronics of France owns GE and RCA, and some RCA recorders are made by Hitachi. North American Philips, whose parent company is the Philips Company of the Netherlands, owns Magnavox, Sylvania and Philco.

Zenith, the only American owned company, has had VCRs made by Hitachi and JVC. Fisher is owned by the Sanyo Corporation. Sony owns the Aiwa brand and is the only manufacturer left that builds

the Beta format machines. It used to supply units to Aiwa, Sanyo, Sears, Zenith and Pioneer.

Sony's initial VHS machines were built by Hitachi. Samsung makes products under the Samsung brand and under the Astra name. Other parent companies or controlling companies include Mitsubishi, which has operating control of Akai and Nippon Gakki which owns Yamaha.

### A publisher

Schematic diagrams and other troubleshooting aids are contained in Photofact folders on computer, TV, radio, hi-fi and VCR equipment, sold by Howard W. Sams. This publisher also has various troubleshooting and repair guidebooks.

### The FCC (Federal Communications Commission)

The FCC has to approve the design of many electronic products, including VCRs, portable telephones and computer equipment, to verify that the product meets their electromagnetic interference radiation standards. Every product that has been given FCC approval must carry an FCC ID number. Even though TV sets no longer have to be FCC approved, many TVs still bear an FCC ID number.

The Equipment Authorization Branch of the FCC, in Columbia, MD, 301-725-1585, can tell you the name of the company that manufactured a given product once you have provided them with the FCC ID number on the back of the unit. There is also a computer line, 301-725-1072, 1200 baud, which you can access to determine which company manufactured a particular product.

If the file exists, you can request photocopies of sections of the file, such as circuit diagrams, through the printing contractor: ITS.

This should be done as a last resort however, as this service costs $22/hour labor and 8 cents per page reproduction costs. A typical charge is about $25. A check for $50 must be included with your request if you do not have an account with the FCC.

### Underwriters' Laboratories (UL)/ETL Testing Laboratories

To determine the manufacturer of a UL listed device, you can contact UL and ask them to identify the manufacturer's code (file) number that appears on the listing or recognition label.

The safety testing organization is headquartered in Northbrook, IL, 708-272-8800. Unfortunately, test records and files, which may contain design information and schematics are confidential, and are not available.

If the device has an ETL mark, you can contact that organization.

### U.S. Patent Office

When an item is patented, design information has to be disclosed. If you have a patent number for a product, you can research the patent at the library. There are various libraries designated as Patent Depository Libraries that receive current issues of U.S. Patents and maintain collections of earlier patents. Some collections go back as far as 1790.

If your local library does not have patent information on file, you can request a copy of the patent paperwork by sending a check for $1.50 to the patent office.

The copy of the patent application you will receive will contain information on the design of the item and may even contain a schematic diagram.

### The British Patent Office

If the unit has a UK Registration Number on it, you can identify the manufacturer by contacting the Patent Office.

### Military Parts Control Advisory Group (MPCAG)

If you have a National Stock Number, or a Contract Number, of an item or assembly, you can contact MPCAG to look up the last known manufacturer of the item. This information can be used, for example, to trace a component part that's used in an assembly.

For example, if you could not identify a jack connector on a headset, but had the NSN of the headset, you could call MPCAG for assistance. They would tell you the last known manufacturer of the headset. You would then contact the headset manufacturer to find out if he will sell you the jack or tell you who supplied it.

### Servicing without schematics

Servicing without schematics, while not easy, is possible. However, when you attempt to service a product without the documentation, do not overlook the manufacturer's service department. In many cases you will find that the technical service people are very helpful, even giving advice on how to troubleshoot a unit based upon symptoms described to them (they will even tell you where not to bother looking). Use the listings in the "Consumer Electronics Replacement Parts Sourcebook" to contact the manufacturer if you do not have their phone number.

### Dealing with intermittents

Intermittent conditions and faults can sometimes be isolated by heating or cooling the circuit. You can alternately cool components with freeze spray and heat them with a heat gun, or by cutting off the air flow in the unit to let it self heat.

If you deliberately close off ventilation to a product to cause it to become excessively warm, be careful not to allow it to become so hot that the unit is damaged. Heating and cooling parts can help you find the cause of thermal intermittents.

Problems can also be found by gently flexing the circuit board, or by vibrating the system. Manipulation of the board often reveals faulty connections or poor solder joints. Be careful not to flex the boards very much or you can break parts or cause intermittent connections, especially if surface mounted components are used. Look for cracks in the connections to surface mounted components.

Be especially careful when manipulating assemblies that have surface mount components. You can easily crack the part or the connection to the part. Often just touching or tapping the parts with a nonconductive stick or pencil can locate faulty (open) connections and cold solder joints. Tapping a relay, for example, may release stuck contacts and suddenly result in normal system operation.

When you mechanically probe a circuit board, do it in a darkened room so you can see any arcing that may occur when the contact is made or broken.

### Monitor the power line

Faults can also be located by monitoring the power supply to see if any random spikes occur, or if the power supply voltages are within specification. Supply voltage spikes, or out of tolerance conditions can cause strange problems if digital logic levels are caused to fall below/above the logic "1" and "0" levels. Alignments may also be compromised if the voltages are not what they should be.

### Taking the product's temperature

Failures can also be isolated by the tem-

perature of the part. For example, if a part is cold, it may not be receiving any power, may not have a load to drive, or it may be open circuited. If a part is hot, it may be shorted, may be operating with a supply voltage at the upper limit of the part, or it may be trying to drive a circuit with a short in it.

### Service tips

Servicing tips for various pieces of electronic equipment are also contained in magazines, such as this one. As reported in the February 1987 issue, a ten year index of articles, symptoms/cures, and tough repair articles is maintained by a reader, Larry Gribbin. His address is listed in the sidebar.

### Obtaining product design information

If the above methods fail to allow you to isolate the defective component, but after signal tracing and voltage measurements you suspect a circuit area that has a microprocessor or IC's, the next best thing to having a schematic is to get design information on these component parts.

To obtain design information, you will need to be able to either identify the manufacturer's logo or recognize the part number. In addition to looking at the logos in the EIA/CEG Consumer Electronics Replacement Parts Sourcebook, you may be able to locate other source materials, such as those described in the following portions of this article.

### Schematic diagrams of related products

In many cases, the same part is used in other models of the equipment by the same manufacturer. The part may also show up in other brands of the same product. This is especially true if the units were made by the same company but marked with different manufacturer trade names.

Sometimes similar designs are used by different manufacturers and you may be able to use a schematic from a different manufacturer to help you troubleshoot a failed unit. In one case, an IC used in a Panasonic VCR was found in an NEC VCR schematic. I was able to use this portion of the NEC schematic to troubleshoot the similar portion of a Panasonic unit.

In another case, I found the horizontal output section of a failed XAM television to be almost identical to the design used in a Zenith television for which a schematic diagram was available.

### Distributor catalogs

When you have isolated a problem to failure of a component, check the part number against listings in distributor catalogs. An unknown manufacturer's diode bridge, for example, might be listed in the semiconductor section of a parts catalog.

### Unmarked parts/semiconductor part numbers

Sometimes manufacturers will deliberately erase part markings so that products have to be returned either to the factory, or to an authorized service center. Most of the time replacements for the defaced parts are common, readily available off the shelf items that can be bought for a few dollars.

In the case of integrated circuits; custom parts, or programed PAL's or PROM's are generally marked with a custom manufacturers part number.

If you encounter a failed component whose part number has been erased, remove the IC from the circuit and look for a number on the bottom of the device. If you don't find a part number there, rub light oil on the erased area or look at the part under a UV light. Sometimes this allows you to make out the part number that the manufacturer tried to obliterate.

If you can't find any useful identification on the part, it is time to try to analyze the circuit. Is the circuit analog or digital? Look in the owners manual, or in a sales catalog, for information. What are the power and ground pins? Which pins appear to be inputs, which are outputs. In a hand held temperature meter, I identified a component by the following method:

- According to the description in the catalog, the meter used a modified Wheatstone bridge circuit.
- The meter circuit was analog, so this was an analog IC, not a digital IC.
- With 14 pins, the IC is probably not a single amplifier, or even a dual amplifier as those are usually in 8-pin packages. Being in a Wheatstone circuit meant that it was most likely a quad op amp.
- The relatively low cost of the meter, coupled with the fact that the part number was erased, indicated that it was a common part.
- $V_{cc}$ was connected to pin 14 of the IC. Pin 7 was connected to ground. Some of the quad op amps that seemed to come close to being replacements, such as the LM148 and LM348, have power on pin 4 and ground on pin 11. The LM3900, however, had the power and ground on pins that matched the IC in this meter.
- In order to determine if the voltages at the pins of the IC in my meter were the same as those specified for the LM3900, I measured the voltages on the meter IC pins in a functioning unit. I found the following (with the meter fully on, battery measuring 8.44V):

| PIN | VOLTAGE | Function |
|---|---|---|
| 1 | 0.68 | in1+ |
| 2 | 0.62 | in2- |
| 3 | 0.217 | in2- |
| 4 | 6.6 | output2 |
| 5 | 6.6 | output1 |
| 6 | 100.3mV | in1- |
| 7 | 0.4mV GND | GND |
| 8 | ≈ 120mV | in3- |
| 9 | 6.55 | output3 |
| 10 | 3.47 | output4 |
| 11 | 0.508 | in4- |
| 12 | 0.3mV | in4+ |
| 13 | ≈ 96mV | in3+ |
| 14 | 7.3V Vcc | Vcc |

The higher voltages were all identical to those specified for the outputs on the LM3900 IC. All the other low voltages were identical to those specified for the inputs on the LM3900. The two pins that had varying voltages were the inputs to a single amplifier. It looked like the LM3900 would work. When I installed an LM3900 as a replacement for the unidentified IC, the meter operated perfectly.

Ohmmeter testing of unmarked discrete parts can verify if they are operational (see Figures 1-3). For semiconductor parts marked with a registered part number, the Electronic Industries Association (EIA) and the Joint Electronic Devices Engineering Council (JEDEC) in the United States and the Electronic Industries Association of Japan (EIAJ) have standards that regulate device interchangeability and marking.

### The component numbering system

Japanese transistors that follow the EIAJ coding system (Electronic Industries Association of Japan), in the Japan Industrial Standard JIS-C-7012 Designation System for Discrete Semiconductor Devices, are marked with the following type of code:

2 S A 675 B

The first number is the number of active leads, minus 1. The second letter, "S," indicates that the device is registered with the EIAJ. The third letter indicates the type of part it is, per the following:

A - high-frequency PNP device
B - low-frequency PNP device
C - high-frequency NPN device
D - low-frequency NPN device
E - P-gate thryistor
F - SCR (silicon controlled rectifier)
G - N-gate thyristor
H - N-base unijunction transistor
J - P-channel FET (field effect transistor)
K - N-channel FET
M - bi-directional triode thyristor

The next number is the serial number of the device. This number is assigned sequentially by the EIAJ. The alpha character following the number indicates revisions to the design of the device.

In the example shown, B is the second revision to the basic device. An improved device is usable in place of a preceding device but not necessarily the other way around (a lower revision level device may not be able to replace a higher level revision part).

U.S. EIA marking is not as descriptive as the Japanese marking. The first letter indicates the number of active leads, minus one. The second alpha character, an "N" indicates the device is registered with the EIA. The next numbers are sequentially assigned and have no particular significance to the type of part.

Alpha characters following the device number indicate the revisions to the design of the part. As with the Japanese revision levels, lower revisions may not necessarily be suitable to replace higher revision level devices.

### Digital transistor marking

Digital transistors, transistors with resistors incorporated within the device, have the following identifications (the numbering scheme is controlled by the device manufacturer and not by a registered authority):

DT A 144 E F

This numbering scheme, developed by the Rohm Co., has the following meaning:

DT- Digital Transistor

The following alpha character:

A is PNP type, 100mA transistor (2N3606 type)

B is PNP type, 500mA transistor (2N4403/PN2907A type)

C is NPN type, 100mA transistor (2N3904 type)

D is NPN type, 500mA (2N4401/PN222A type)

(Note: "PN" is equivalent to EIA "2N".)

The next number is:

1 is a digital transistor die

The next two numbers are the R1 resistor value:

13 is 1 x $10^3$
24 is 1 x $10^4$
23 is 2 x $10^3$
24 is 2 x $10^4$
33 is 3 x $10^3$
43 is 4 x $10^3$
44 is 4 x $10^4$

The next letter is the ratio of R1/R2:

E - R2/R1 = 1/1
G - R2 only, no R1
T - R1 only, no R2
W - R2/R1 is 1/2
X - R2/R1 is 2/1
Y - R2/R1 is 5/1
Z - R2/R1 is 10/1

The last letter represents the device package style and will be A, F, K, L, N, S, V or U. Industry recognized packages are K, which is SOT-23, and N, which is a TO-92 package. SOT stands for "small-outline transistor," and TO is "transistor outline."

The other digital transistor series were developed by Panasonic Industrial Company. These devices are NPN and PNP digital transistors with the nomenclature: UNXXX series.

UNZ11X are PNP, 100mA devices
UNZ12X are PNP, 500mA devices
UNZ21X are PNP, 100mA devices
UNZ22X are NPN, 500mA devices
UNZ23X are NPN, 1.5A devices

"Z" are numbers 1 through 8 and indicate different package styles. "X" is 0 through 9 and letters D, E, F, H, H, L, X and Y (etc.) and indicate specific R1 and R2 values. ■

### Addresses of organizations mentioned in this article

**EIA/CEG**
(Electronic Industries Association/ Consumer Electronics Group)
2001 Pennsylvania Avenue, N.W.
Washington, DC 20006
Attn: Product Services.

**FCC**
Equipment Authorization Branch
Columbia, MD
301-725-1585
Computer access: 301-725-1072

**ITS**
2100 M Street North West
Suite 140
Washington, DC 20037
202-857-3800

**Panasonic Industrial Company**
Matsushita Electronics Corporation of America
Two Panasonic Way
Secaucus NJ 07094

**Rohm Electronics Division**
3034 Owen Drive
Antioch TN 37013
615-641-2020
Fax: 615-641-2022

**Howard W. Sams & Company**
2647 Waterfront Pkwy.
Indianapolis, IN 46214
800-428-SAMS

**Underwriters' Laboratories (UL)**
Northbrook, IL
708-272-8800.

**ETL**
Industrial Park
Cortland, NY 13045
607-753-6711
800-345-3851
Fax: 607-756-9891

**U.S. Department of Commerce**
Patent and Trademark Office
Washington DC 20231

**The British Patent Office**
The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH
United Kingdom
071-438-4724

**Larry Gribbin**
Farrell Electronics
127 Providence Avenue
South Portland, ME 04106

# Using manufacturers' tech help lines

By Sheldon Fingerman

What's the most valuable tool on your bench? Your scope? Your DVM? It might be your telephone.

Usually technicians go along at a pretty good clip, solving one problem and going on to the next. But there are those days when you just get stumped. After several hours, or in some cases days, of trying to find a leaky "something," you are ready to hit the aspirin bottle. Well, try reaching for the telephone instead.

Most manufacturers have their own service facilities (not to be confused with an authorized service center). Ninety percent of the time they will have a technician who has seen your problem; more then once. You'd be surprised how many factory techs have an answer before you can even finish the question.

## Factory modifications

You'd also be surprised how many problems can be solved, permanently, with a factory upgrade. Remember that unit that's been back three times for the same problem? It could very well be a design flaw. I had a CD player come back about every three months. Every time I called technical support they had another modification to solve the problem.

One manufacturer even had a complete kit to solve a CD problem. Even though I own an authorized service center, I never received any information on it. The phone call that made me aware of it saved me a lot of grief.

On another occasion, trying to find a short in a power amplifier was driving me nuts. Even a schematic wasn't helping. Tech support said that I was on the right track, but they had seen a "few" bad caps. They said it was a real longshot, but it wouldn't hurt to check. Five minutes after the call I found it. The problem turned out to be a shorted ceramic disc capacitor; not exactly the first thing I would normally be looking for.

I had to fix a TV on site that I was unfamiliar with. I figured a quick call to tech support might save me some time. Not only did they pinpoint the problem, but they told me how to modify the circuit so it wouldn't happen again. They even gave me some tips on getting the back of the set on and off. The technician informed me that it would probably take me longer to replace the back of the set, than to actually make the repair.

## Making contact

So, how do you get through to these gurus? To start with you'll need a phone number. If you belong to an organization like NESDA, you can consult the guide that they publish filled with phone numbers, fax numbers, and addresses. The EIA/CEG "Consumer Electronics Parts Replacement Sourcebook" also carries addresses and telephone numbers for many manufacturers' help lines.

You might try calling 800 directory assistance. You probably won't get a tech support number, but you may find someone who can give it to you. Other good sources of phone numbers are magazines like this one. For audio service, "Stereo Review's Annual Buyers Guide is a good source of information."

## Have the service manual ready

Before you call any support number, try to get your hands on the service literature, especially if it's inexpensive. You'll find that many techs won't even talk to you unless you have a schematic in front of you, though not always.

If the service literature is going to cost you a bundle, and you may not see another model like that in a year, try calling anyway. Sometimes a little guilt, mixed with a lot of sugar coating, can go a long way. After all, even though you are the one servicing the unit, your customer is still their customer as well. If they won't play ball with you, that customer may think twice before buying the same brand in the future.

Always have the unit ready to service when you make the call. For every "We'll get back to you," you'll get a tech who's ready to go. They are the ones doing you a favor, so don't waste their time, and yours. If someone tells you they will call back, try to leave things on your bench if you have the room, and try to stick around, even if it takes them two days to return your call. You may have to wait another two days if you're not ready when they are.

## Some suggestions

Make sure you've checked the obvious, and jot down any discrepancies you find on the schematic. Help line technicians will assume you've gotten at least this far. If you know that this service procedure requires a specialized piece of test equipment you don't have, they are probably going to tell you to use it. "Just measure it with your (you don't have it)," is an all too common response. And, be prepared to be on hold a lot, and deal with technicians who don't speak English very well. Your patience will usually be rewarded.

These help-line people are really good; that's why they work for the factory. Always thank them and don't abuse the system. Some of the smaller companies may only have one tech, and if you are ungrateful, or call all the time, you will

Fingerman is an electronics and computer consultant and servicing technician.

be treated accordingly. Even if you despise the product, remember, they are not the ones who built it.

### Small company help lines

Speaking of smaller companies, they can usually provide you with the best support. Especially those that manufacture high-end products. Their catalog of products is quite small, and their techs usually know them inside and out.

Also, since you are dealing with high-end products, they tend to be more reliable, and the technicians usually have more time on their hands. Sometimes I get the feeling they actually welcome phone calls because it gives them something to do. And believe it or not, the smaller the company, the better your chance of getting free service literature.

### Use the fax machine

Using a fax machine can work even better. Whenever you make contact with a technical support department, see if they have a fax number. If you transmit a description of the product, the trouble symptom, and the steps you have already taken to solve the problem, the technicians will get a chance to research the problem, and when they call back it's their dime. You can even fax drawings, and sections of the schematic to clarify a problem. They can do the same as well.

### If you strike out

On occasion you will find that the factory tech knows even less than you do. It happens. Don't think of the call as a waste. It could turn out to be a real ego boost when you finally do solve the problem. And if you've been working with someone who has been especially helpful, drop them a card (or a fax) and let them know how much you appreciated it.

Above all, technical support should be a last resort. Before you call, make sure you've covered all the basics: power supply, regulators, bad grounds, etc. Again, they will assume you have already checked the obvious. So don't waste their time, and embarrass yourself in the process.

Finally, use the system, don't abuse it, and start clearing some of those dogs off your bench. ■

# Troubleshooting the Philips S1/S4 chassis

**By Dale Shackelford**

It is not uncommon for a servicing technician to work on a TV set one week and the next week to see the exact same chassis, cabinet style and circuitry in another set, with a different brand name stenciled across the front. Sometimes several schematics have been purchased for a series of products that are exactly the same, yet have different model/manufacturers identification.

The S1 and S4 chassis manufactured by the Philips Consumer Electronics Company are a classic example of the same chassis used in a wide variety of models with different brand names. These chassis are used in no fewer than six different models, with screen sizes ranging from 13 inches to 27 inches (Table 1).

Every one of these sets may be serviced using Technical Manual No. 7502, available from Philips. This comprehensive manual has 72 pages of valuable schematics and information on various aspects of the S1/S4 chassis, including designs and options such as AVIO (audio/video input/output) jacks, picture in picture (PIP) modules and stereo sound. Figure 1 is the block diagram of this chassis, Figure 2 is the wiring diagram, and Figure 3 illustrates the component layout.

### The power supply

The power supply of the S1/S4 chassis is relatively straightforward, with a full-wave (diode) bridge rectifier, filtering capacitors, and a voltage regulator IC (IC-430) that injects 155Vdc into the system.

As with most modern television receivers, these chassis incorporate a "standby" circuit which is activated when the set is turned off. This circuit has an output of approximately 9Vdc, which is used to power the IR receiver circuitry for remote control power up, microcomputer reset and PIP control. Thus, whenever the set is plugged into a 120Vac source, the set is either in an on or standby condition.

One of the most important components for the servicing technician to be aware of when servicing these chassis is R407 (Figure 4). This 100Ω, 1/3W resistor is fusible, and when it fails it is due to a problem within the horizontal section.

When the set is turned on, 13.5Vdc is fed from the flyback transformer (T501) to the anode of D405, which ultimately reverse biases Q403. If D405 is open, or a problem develops within the horizontal section that results in the 13.5Vdc being absent from the emitter of Q403, R407 will be destroyed when the 129Vdc source comes up while Q403 is still in the on condition (Figure 4).

If you encounter a destroyed R407 in one of these chassis, connect an external 13.5Vdc source to the emitter of Q403 and ground the base of Q402 (power on/off transistor). Then connect the ac power cord to a variable transformer set to 0V, and a scope probe to pin 6 of T501.

Slowly increase the voltage output of the variable transformer. You should observe a horizontal pulse from pin 6 once you reach approximately 50Vac. If this pulse is not present, troubleshoot the horizontal while the set is powered from the reduced-voltage ac source. Once the problem is remedied, the pulse will be present.

On the opposite side of the coin, too high a voltage on the base of Q402 will keep the transistor from turning off, and the set will not operate. This excessive voltage is usually generated by a typical shut-down circuit.

### Microcomputer control

With the computerization of recent television receivers, it is not uncommon to find entire logic systems contained entirely within two or three integrated circuits. The S1/S4 chassis are no exception. For example, the tuning system is controlled by a microcomputer and a memory IC (IC350 and IC351 respectively) in addition to the U/V tuner. With this combination, this system is capable of receiving up to 178 channels, while providing an on-screen display for all consumer adjustable controls such as brightness, color, volume and sleep timer.

When problems develop in the tuning system or any of the on-screen displays, check the voltages both into and out of the microcomputer (IC350), the memory IC (IC351) and the U/V tuner (Figure 5).

The voltages on the U/V tuner can be informative, as this unit is powered from three separate supplies. The 5Vdc (tuner) voltage (pin 12) is derived from the emitter of Q461, a voltage regulation transistor which derives its voltage from the 13.5Vdc source previously discussed (T501). Pin 6 of the U/V tuner should measure 13.5Vdc, and as with the voltage at pin 12, the voltage is scan derived.

Unlike pins 6 and 12, however, the 33Vdc tuning voltage is taken from the 129Vdc source via R360, R361 and R366. If any one of these resistors opens, or the 33V zener diode (Z361) shorts, the 33Vdc needed to power the tuner would obviously not be present.

In the event that all voltages are correct, check the main tuning system oscillator to determine if the requisite 4MHz signal is present on pins 31 and 32 of IC350. Additionally, pins 28 and 29 are connected to the 6.5MHz tank circuit/oscillator necessary for on-screen display of various functions.

If the tuning system and adjacent circuitry, including voltages and frequencies check out, yet the system does not operate correctly, the microcomputer (IC350) may have to be replaced. Because of the various designs and options, this IC will be different in different sets. Look closely at the original chip. If the chip has TOSHIBA printed on it, and the particular set does not employ the PIP option, the part number of the IC is 4835-209-17352.

If the receiver does feature the PIP option, and IC350 is marked TOSHIBA, the part number of the IC is 4835-209-47111.

Shackelford is an independent electronic servicing technician.

NOTE: THE FOLLOWING ABBREVIATIONS AND NOTATIONS ARE USED IN THIS LIST.
LAT. AM. = BUILT FOR LATIN AMERICAN COUNTRIES
HOT.-MOT. = BUILT FOR HOTEL/MOTEL USE
P1920R C1XX = C1XX IS THE MODEL VERSION, XX ARE VARIABLES AND WILL CHANGE WITH REVISIONS TO THE CHASSIS. THE REASON THIS IS NOTED ON SOME MODELS IS THEY MAY HAVE TWO COMPLETELY DIFFERENT CHASSIS BUT HAVE THE SAME BASIC MODEL NUMBER.
CANADA = BUILT FOR CANADIAN MARKET
COMMERCIAL = FOR COMMERCIAL USE

## S1 MODEL TO CHASSIS LIST

| Model | Screen Size | Chassis Reference |
|---|---|---|
| **Magnavox** | | |
| HD1920 | 19" | 19S101 |
| CMX162 (HOT.-MOT.) | 19" | 19S101 |
| EMX162 (HOT.-MOT.) | 19" | 19S101 |
| XMX162 (CANADA HOT.-MOT.) | 19" | 19S101 |
| RR1930 | 19" | 19S102 |
| XR1930 (CANADA) | 19" | 19S102 |
| RR1936 | 19" | 19S102 |
| RR1937 | 19" | 19S102 |
| RR1938 | 19" | 19S102 |
| RR1940 | 19" | 19S104 |
| XR1940 (CANADA) | 19" | 19S104 |
| RR1944 | 19" | 19S104 |
| RS1960 | 19" | 19S105 |
| HD1925 | 19" | 19S107 |
| XD1925 (CANADA) | 19" | 19S107 |
| RS1965 | 19" | 19S108 |
| RS1970 | 19" | 19S109 |
| RP1945 | 19" | 19S112 |
| EM2019 (HOT.-MOT.) | 19" | 19S115 |
| GM2019 (HOT.-MOT.) | 19" | 19S115 |
| CMK172 (HOT.-MOT.) | 20" | 20S101 |
| EMK172 (HOT.-MOT.) | 20" | 20S101 |
| XMK172 (CANADA HOT.-MOT.) | 20" | 20S101 |
| RR2040 | 20" | 20S103 |
| RS2045 | 20" | 20S104 |
| HD2038 | 20" | 20S105 |
| RS2002 | 20" | 20S105 |
| RS2050 | 20" | 20S105 |
| RS2080 | 20" | 20S105 |
| XS2050 (CANADA) | 20" | 20S105 |
| XS2080 (CANADA) | 20" | 20S105 |
| XD2038 | 20" | 20S105 |
| RS2560 | 25" | 25S101 |
| RS2563 | 25" | 25S101 |
| RS2566 | 25" | 25S101 |
| XD2503 (CANADA) | 25" | 25S101 |
| XS2563 (CANADA) | 25" | 25S101 |
| XS2566 (CANADA) | 25" | 25S101 |
| HD2504 | 25" | 25S101 |
| CR4510 | 25" | 25S102 |
| CR4520 | 25" | 25S102 |
| CR4521 | 25" | 25S102 |
| CX9512 | 25" | 25S102 |
| CX9514 | 25" | 25S102 |
| CX9516 | 25" | 25S102 |
| HD2501 | 25" | 25S102 |
| RR2540 | 25" | 25S102 |
| HD2502 | 25" | 25S102 |
| RR2544 | 25" | 25S102 |
| CR4522 | 25" | 25S102 |
| RR2535 | 25" | 25S102 |
| RP2545 | 25" | 25S103 |
| CS4535 | 25" | 25S104 |
| CS4536 | 25" | 25S104 |
| CX9522 | 25" | 25S104 |
| CX9526 | 25" | 25S104 |
| RS2555 | 25" | 25S105 |
| CML192 (HOT.-MOT.) | 25" | 25S106 |
| EML192 (HOT.-MOT.) | 25" | 25S106 |
| RP2575 | 25" | 25S107 |
| RP2576-C1XX | 25" | 25S107 |
| CP4580 | 25" | 25S107 |
| RP2577 | 25" | 25S107 |
| **Magnavox (continued)** | | |
| CP4581 | 25" | 25S107 |
| XML192 (CANADA HOT.-MOT.) | 25" | 25S108 |
| XR2542 (CANADA) | 25" | 25S109 |
| XS2560 (CANADA) | 25" | 25S110 |
| XS2555 (CANADA) | 25" | 25S111 |
| RS2655 | 26" | 26S101 |
| HD2650 | 26" | 26S102 |
| RS2655 | 26" | 26S103 |
| HD2650 | 26" | 26S104 |
| HD2762 | 27" | 27S101 |
| RK5520 | 27" | 27S101 |
| RS2745 | 27" | 27S101 |
| RS2755 | 27" | 27S101 |
| RK5521 | 27" | 27S101 |
| RR2740 | 27" | 27S102 |
| XD2762 (CANADA) | 27" | 27S104 |
| XS2745 (CANADA) | 27" | 27S104 |
| **Sylvania** | | |
| SRC194 | 19" | 19S102 |
| SRW195 | 19" | 19S104 |
| SSB195 | 19" | 19S109 |
| SRW202 | 20" | 20S103 |
| SSB206 | 20" | 20S105 |
| SSW256 | 25" | 25S101 |
| SRA453 | 25" | 25S102 |
| SRP453 | 25" | 25S102 |
| SRW252 | 25" | 25S102 |
| SSA454 | 25" | 25S104 |
| SSP454 | 25" | 25S104 |
| SPP456-22XX | 25" | 25S107 |
| SPA456-12XX | 25" | 25S107 |
| SPC258 | 25" | 25S107 |
| SSC263 | 26" | 26S101 |
| SRW273 | 27" | 27S102 |
| **Crosley** | | |
| CT1911 | 19" | 19S102 |
| CT2031 | 20" | 20S103 |
| CT2051 | 20" | 20S105 |
| CT2511 | 25" | 25S102 |
| CC2533 | 25" | 25S102 |
| CC2534 | 25" | 25S102 |
| CC2535 | 25" | 25S102 |
| CC2557 | 25" | 25S104 |
| CC2558 | 25" | 25S104 |
| CC2545 | 25" | 25S104 |
| CT2521 | 25" | 25S110 |
| CT2725 | 27" | 27S102 |
| **Philco** | | |
| P2010R | 20" | 20S103 |
| P2510R | 25" | 25S102 |
| P2505R | 25" | 25S102 |
| P2702R | 27" | 27S102 |



**Table 1.** The S1 and S4 chassis are used in a wide variety of models with different brand names. These chassis are used in no less than six different models, with screen sizes ranging from 13 inches to 27 inches.

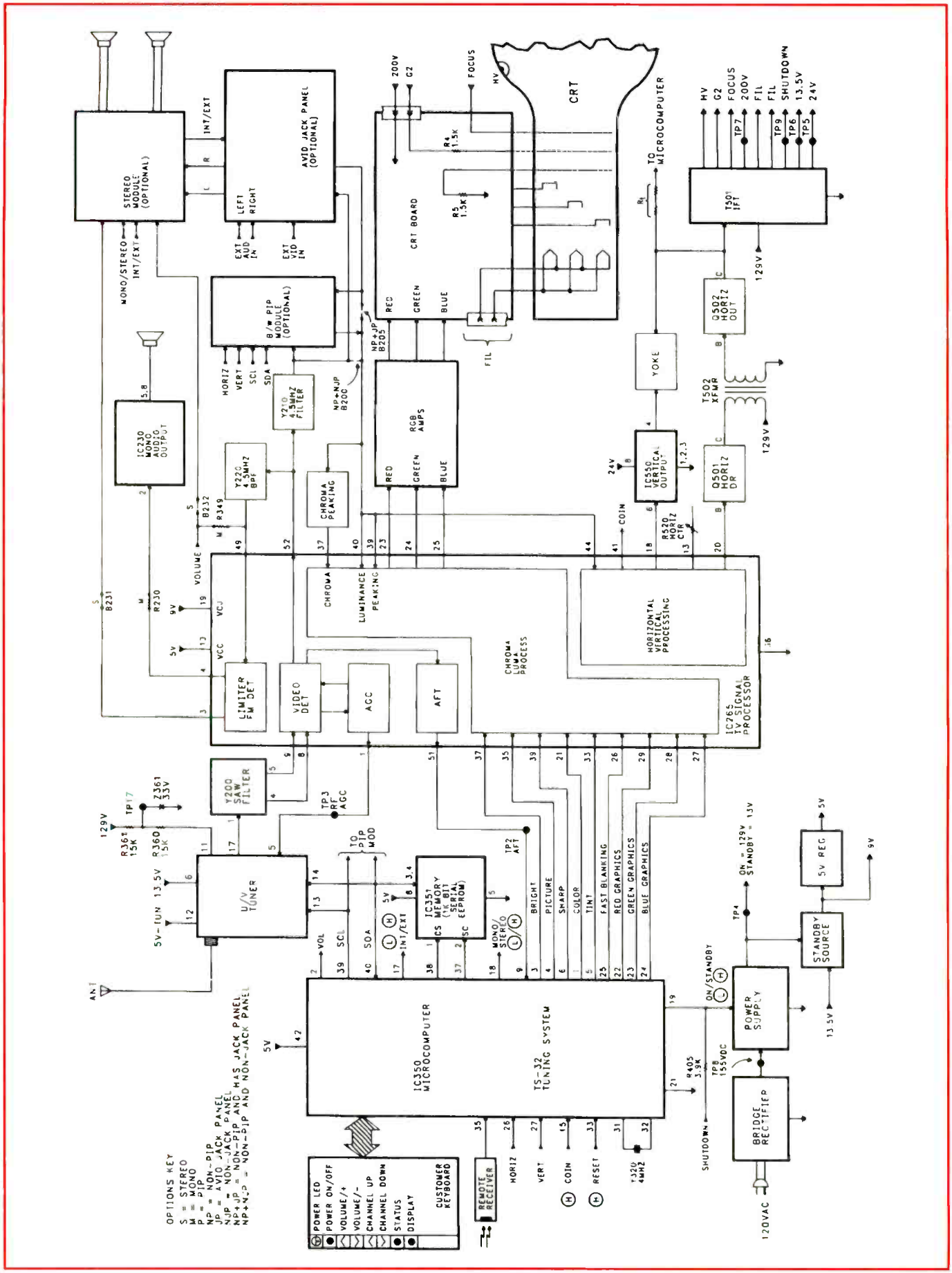



**Figure 1.** This block diagram of the Philips S1/ S4 chassis provides a good illustration of the many features that can be provided with just a few ICs.

If the original IC350 is printed with the name SIGNETICS, contact Philips' Technical Department for assistance:

Philips Service Company
Parts Order Department
112 Polk Street
PO Box 967
Greeneville, TN 37744
800-851-8885
Fax: 800-535-3715

If a loss of stored data occurs, it is likely that the memory chip (IC351) will have to be replaced. If IC351 has TOSHIBA printed on it, the part number is 4835-209-17315. If the name SIGNETICS appears, the part number is 4835-209-47106. In either case, take precautions when handling these ICs, and protect them from electrostatic discharge damage.

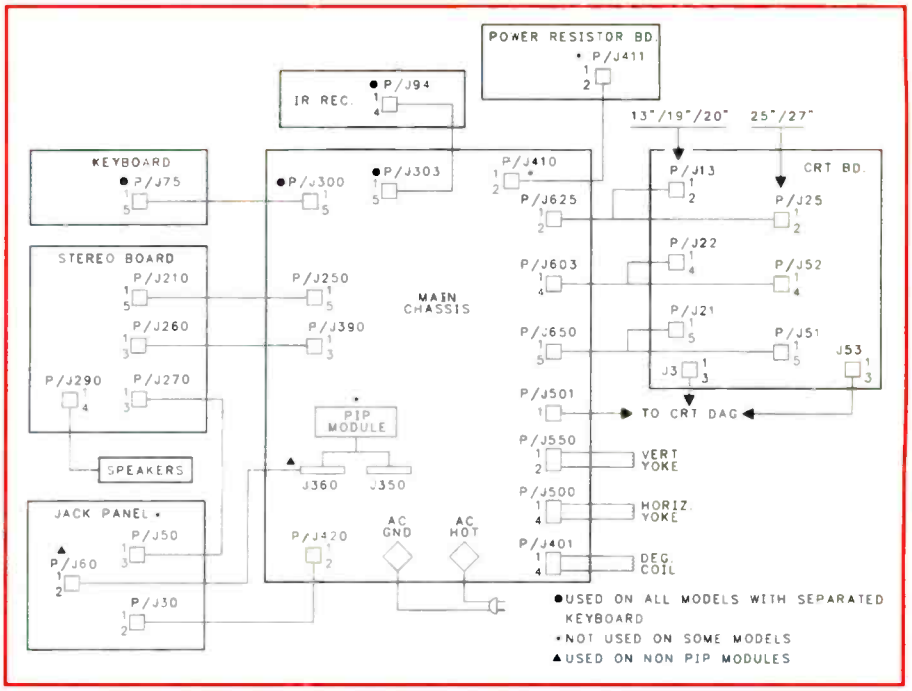



**Figure 2.** This simplified wiring diagram shows how the various portions of the S1/S4 sets are connected together.

### Using the test mode

One of the advanced features of this microcomputer/memory system is the test mode. This test mode allows servicing technicians to make various adjustments, via the remote control, to the brightness, picture, color tint and sharpness parameters. Thus, you can set-up the set without even opening up the cabinet.

To enter the test mode, use an appropriate remote control unit that features a numerical input pad, and enter the following sequence: 0-6-2-5-9-6-MENU. This sequence must be entered fast enough that the on-screen display of the numbers does not time out between entries, although the display will register only one or two of the digit entries at a time. Once you have successfully done this, you should see a display at the bot-

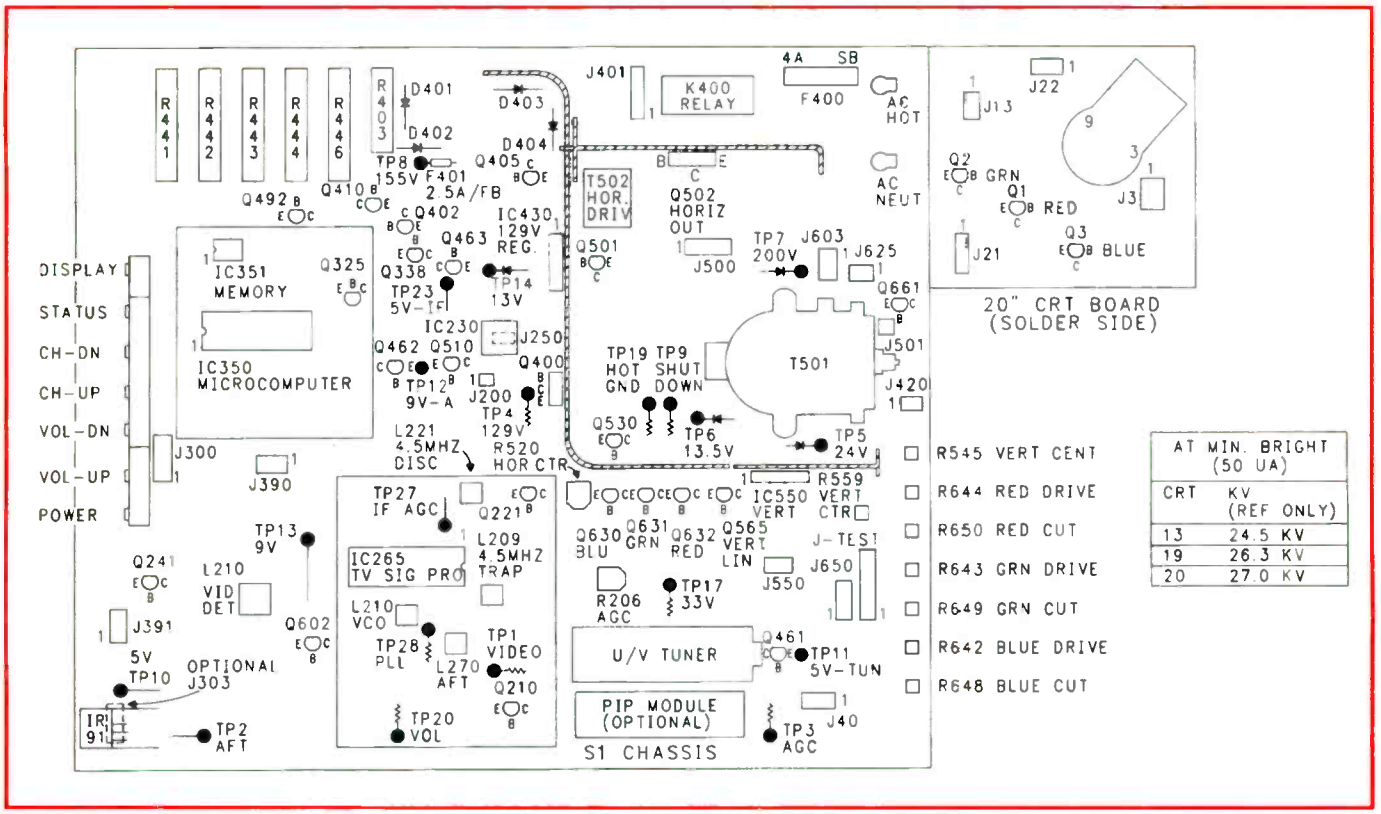



**Figure 3.** This layout shows where the various components are located on the S1/S4 chassis.

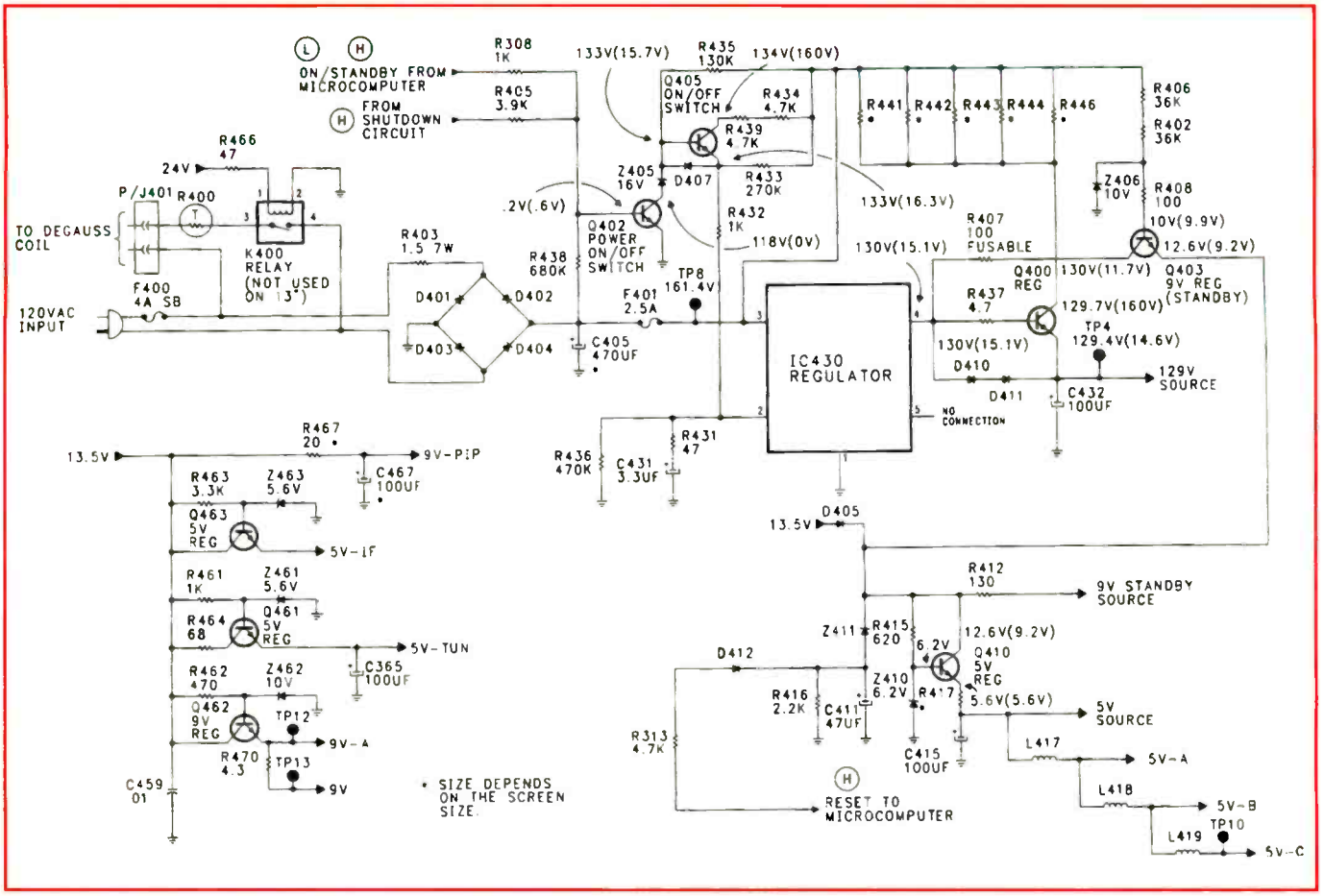



**Figure 4.** The power supply of the S1/S4 chassis employs a full-wave bridge rectifier, filtering capacitors, and a voltage regulator IC (IC430) which injects 155Vdc into the system. These chassis incorporate a "standby" circuit which is activated when the set is turned off.

tom of the screen that looks like this:

| TS32-C2 | | B300 |
|---|---|---|
| 5 | C 11 | 1F |

The TS32 on the display denotes the identification of the tuning system which is currently used in all receivers using the S1/S4 chassis configuration; from the 13-inch to the 27-inch models. The TS32 system, in addition to providing an excellent quality picture, is also capable of controlling PIP functions and stereo sound if these options are present within the set.

The C immediately following TS32 indicates that the particular receiver is designed for consumer use. If the letter M or H were to be displayed (rather than the C) it would indicate that the receiver contained a special Motel or Hospital package. The 2 following the consumer designation indicates the version of the software used in this particular set.

If a letter appears immediately after the software version, it indicates that there is an error in one of the subsystems. For example, if the display were to read: TS32-C2M, an error in the memory subsystem is indicated. If the letter T or P were displayed, the error would be found in the tuner or PIP subsystems respectively.

The B300 shown to the far right is the internal timer, showing minutes in hexadecimal form. This number will most likely be a different value when you view it, but that is what was displayed at the time of preparation of this article.

This timer is used primarily for the sleep timer function, which allows the consumer to program the set to turn off automatically after up to 120 minutes, in 30-minute increments. The on-screen display even wishes the viewer a "Good Night" during the last 15 seconds of operation, during which time a second by second countdown is displayed.

On the next line, at the extreme left, is the channel to which the receiver is currently tuned. The C on the second line indicates that the set is currently in the SERVICE mode. The letter A or B would indicate that the receiver is in a factory set-up mode.

In the SERVICE mode, unlike either of the factory modes, the registers (adjustments) may be set in small increments, from minimum to maximum. In the factory modes, the registers can only be set at minimum, medium or maximum, with no incremental values possible. To go from the service setting to either of the factory modes (A or B), press menu or ↑/↓ on the remote control unit.

When the display is changed to Factory (A), the receiver will default to channel 2. Factory setting (B) will default the receiver to channel 3, and Service setting (C) will default the receiver to the channel to which it was tuned prior to entering the test mode. In all settings, the channels may be changed via the remote control unit by using the ↑/↓ function keys, as the numerical keys will only change the register values.

The next number in the series, in this instance 11, indicates the register current-

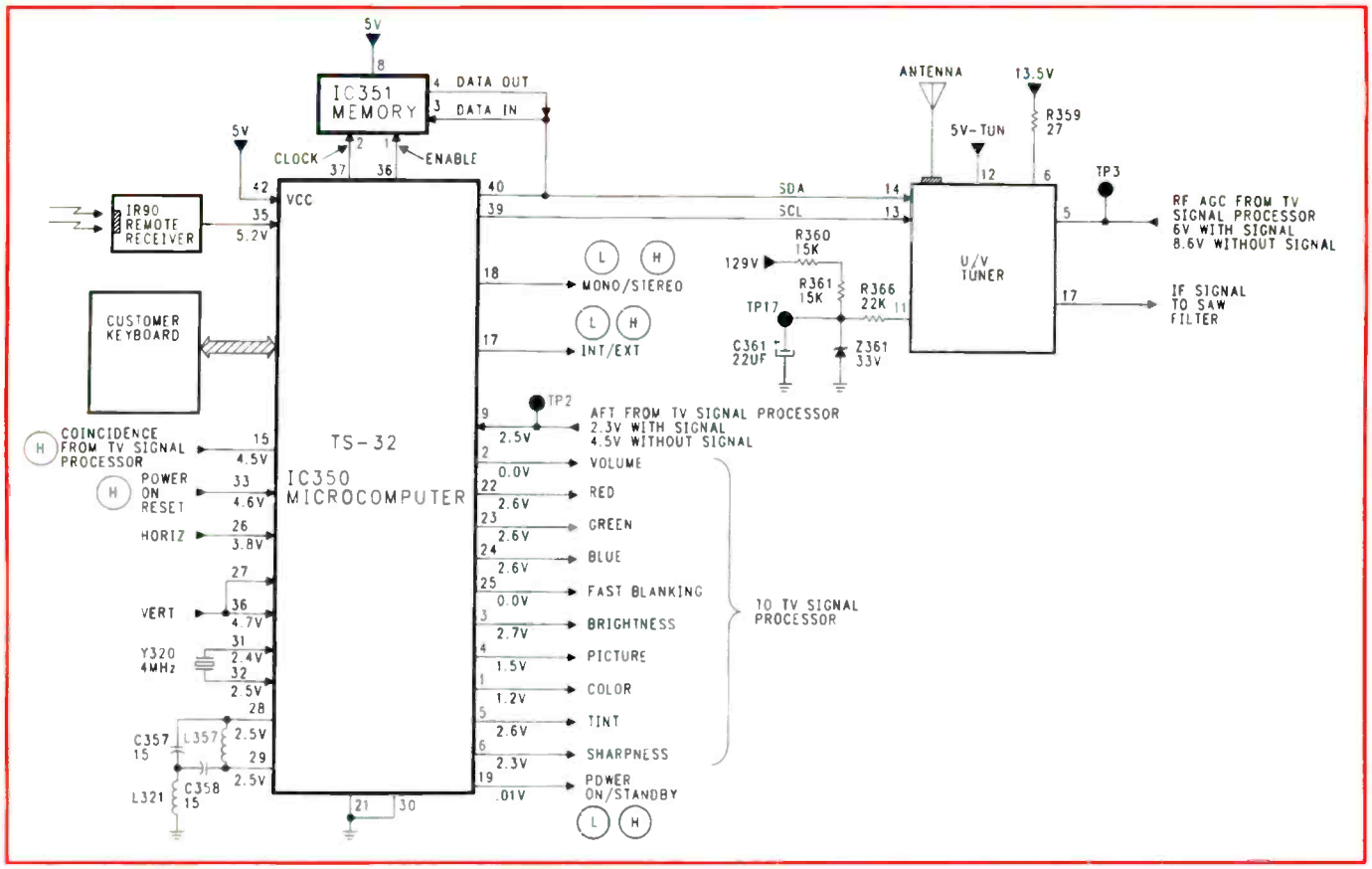



**Figure 5.** The tuning system in this TV set, as in many modern products, contains a microcomputer, with its attendant memory, to provide a wealth of functions electronically.

ly engaged. The set of numbers, or number/letter combination to the far right denotes the current value of the register displayed at the immediate left, in hexadecimal notation.

Thus, if the register number is 15, sharpness, and the value is 1F, the value of the sharpness register is set to factory specifications or mid-level. If the value of register 15 were to indicate 0, the sharpness register would be at a minimum.

To select a particular register, press 9 and the last number of the register desired, or simply press Reset (or ↑/↓) on the remote until the desired register appears.

To change the value of the register, press + or - (→ or ←) in the Service mode (C), as previously mentioned, the register values may be changed in small increments. In Factory (A or B) modes, the same keys will move the register values from MIN-MID-MAX only.

To save any changes made in any of the register values, the television receiver must be turned off at the set. If the receiver is turned off with the remote control, no changes will be saved.

### This set has a hot chassis

As with all appliances that utilize a hot chassis, an isolation transformer must be used when servicing these chassis.

With a little time invested in the understanding of the S1/S4 family of chassis, you will become familiar with several different models and brands which you may never have heard of, much less repaired. While this article is not comprehensive enough to cover any problem which may be encountered with sets containing these chassis, it will give you a place to start. The rest, as they say, is up to you. ■

# Analog signature analyzers—Part III

By Vaughn D. Martin

Part I of this article described analog signature analyzers and discussed the use of this device for testing resistors. Part II described the use of an analog signature analyzer to test active components: both regular transistors and phototransistor-based optoelectronic devices.

This concluding part, Part III, will examine more analog signature analyzer hardware, such as a switcher, and a prober. Component examination will conclude with more advanced component checking.

Up to this point you may have thought, "all of this looks impressive, but since I'm limited to testing components in the power-off state I'll have to remove them from the PC board because most components are interconnected."

This is a logical concern, but one that will not defeat the analog signature analyzer. Let's start with a diode in parallel with a resistor since we've already examined each separately.

### The signature of a parallel resistor/diode

First, refer to Table 3 for an overview of what each component should look like. The best signatures on the analog signature analyzer are obtained when you have a few details:

- whether the diode is in series or in parallel with the resistor,
- the value of the resistor,
- the selected range you use on the analog signature analyzer.

Refer to Figure 48 and note that a 1N4001 diode in parallel with various value resistors yields different results. In brief, when the resistor is over 1kΩ it contributes very little to the signature. The analog signal analyzer mainly shows the effect of the diode.

Conversely, when the resistor's value is less than 5Ω, the resistor's contribution

Martin is Chief Engineer in the Automatic Test system Division at Kelly Air Force Base.

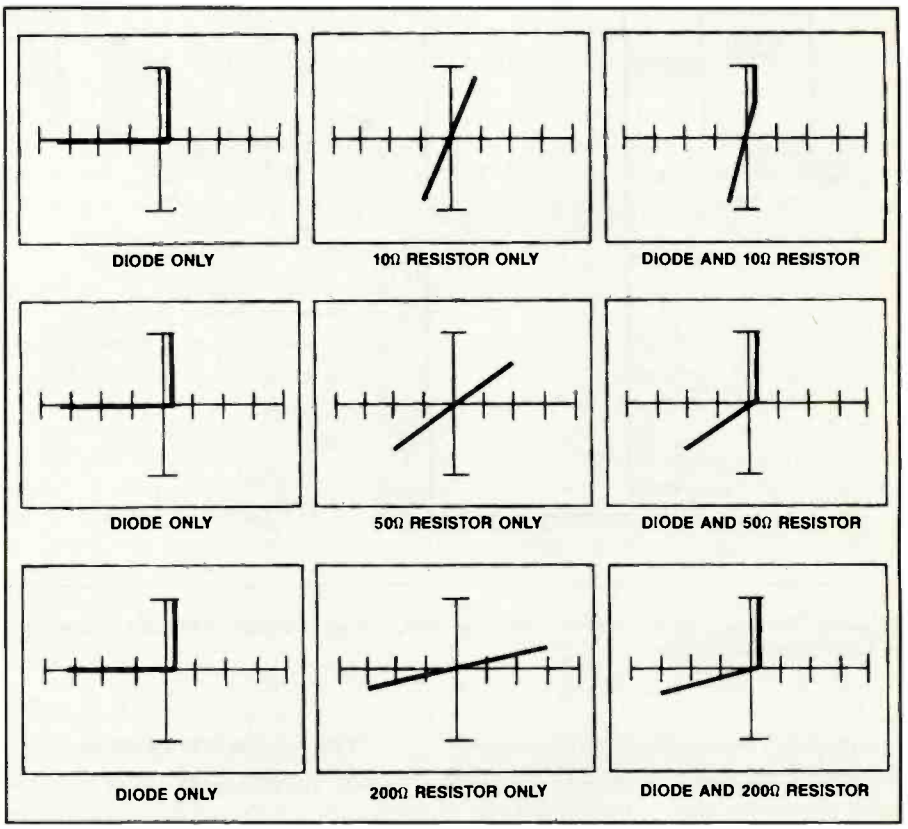



**Figure 48.** A 1N4001 diode in parallel with various value resistors yields different signatures. When the resistor is over 1kΩ it contributes very little to the signature: the signature mainly shows the effect of the diode.

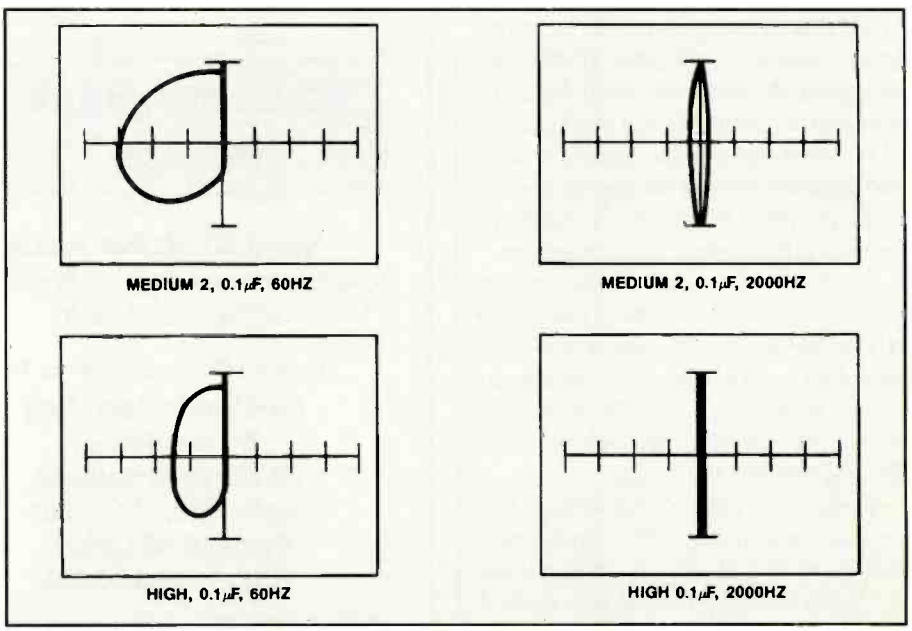



**Figure 49.** A 50kΩ resistor in parallel with a 0.1μF capacitor yields this signature.

| RANGE | TEST FREQUENCY | | |
|---|---|---|---|
| | 50/60 | 400 Hz | 2000 Hz |
| HIGH | .001μF-1μF | 500pF-.1μF | 100pF-.02μF |
| MEDIUM 2 | .01μF-2μF | .001μF-.5μF | 200pF-.05μF |
| MEDIUM 1 | .2μF-50μF | .02μF-5μF | .005μF-1μF |
| LOW | 5μF-2000μF | .5μF-100μF | .2μF-25μF |

Table 1.

**Terminal Characteristics**

| Range | $V_s$ (peak volts) | $Z_s$ |
|---|---|---|
| High | 60 | 74kΩ |
| Medium 2 | 20 | 27kΩ |
| Medium 1 | 15 | 1.2kΩ |
| Low | 10 | 54Ω |

Table 2.

| COMPONENTS | RANGE | SIGNATURES DESCRIPTION |
|---|---|---|
| Open circuit | All | Horizontal line |
| Short circuit | All | Vertical line |
| Resistor | All | Straight diagonal line |
| Diode | All | "L" shape |
| Capacitor | All | Ellipse or circle |
| Inductor | All | Ellipse or circle |

Table 3.

dominates the overall resultant signature. This set of signatures was obtained while in the LOW range. But what happens when you change ranges?

If you use the MED 1 range for the same diode, the 1N4001, resistance in parallel with the diode will have to be 50kΩ or greater to have an insignificant effect on the signature and have the diode dominate the signature. If the resistor is less than about 500Ω, the resistor starts to dominate the signature. If you go to the MED 2 range these two resistance values will, of course, be greater.

### Resistor/capacitor parallel combination

Resistors and capacitors in parallel with each other present another characterization challenge. As Table 1 showed, a capacitor produces an ellipse, and a resistor produces a straight line which is subject to rotation. The resistor tends to reduce the capacitor's ellipse and causes its major axis to rotate.

The magnitude of the rotation angle is determined again by the size of the resistor and the range selected on the analog signature analyzer. Refer to Figures 49 and 50 and note that in the first figure, when in the HIGH range, each component is by itself. It is in composite form on the far right. This is with a 50kΩ resistor in parallel with a 0.1μF capacitor. The second figure shows the effects of a 1kΩ resistor in parallel with a 1μF capacitor.

This is on the MED 1 range at 60Hz. Note the similarities in the two signatures to the right in Figures 49 and 50 but the ellipse on the left has signatures which are first slightly more vertical, then more horizontal. This is expected since capacitors below 0.1μF tend to appear as shorts and larger capacitors tend to more closely resemble open circuits.

### Testing digital TTL integrated circuits

If you examine a data book of a typical TTL (transistor-transistor logic) gate, such as the one in Figure 51, you will note they all are similar in that they have an input gate, phase shifter, (Q2) with emitter and collector load resistors, a pull-up mechanism (Q3/Q4) and a pull-down transistor (Q5).

In all TTL circuits, except LS (Low-power Schottky), the AND function is formed by a multi-emitter transistor in which the emitter-base junctions serve to isolate the input signal sources from one another. The inputs to these gates contain input protection diodes.

To test a digital IC, you need to examine four factors as follows:

- Inputs with respect to ground to determine if the input diode and transistor are damaged.
- Output pin with respect to ground to see if the C-E junction of Q5 is damaged.
- Output pin with respect to $V_{cc}$ to determine if Q4 is damaged.
- $V_{cc}$ with respect to ground. Generally this instrument can display flaws caused by overloading.

Refer to Figure 52 which is the signature between the input pin and ground of a 7410 TTL triple three-input NAND gate at 60Hz. Now refer to Figure 53 which is the signature between the $V_{cc}$ pin and ground of this same gate under these same conditions.

### Testing bus architectures and memories

Bus related problems are generally troubleshot on an individual basis; however, there are certain general troubleshooting techniques which do apply. Occasionally an IC develops an internal short on a lead connected to a common bus. This causes a portion of the bus to remain fixed at some voltage level.

If you check this stuck bus line to ground or the positive voltage supply with the analog signature analyzer on the LOW range, the signature will usually be a diag-

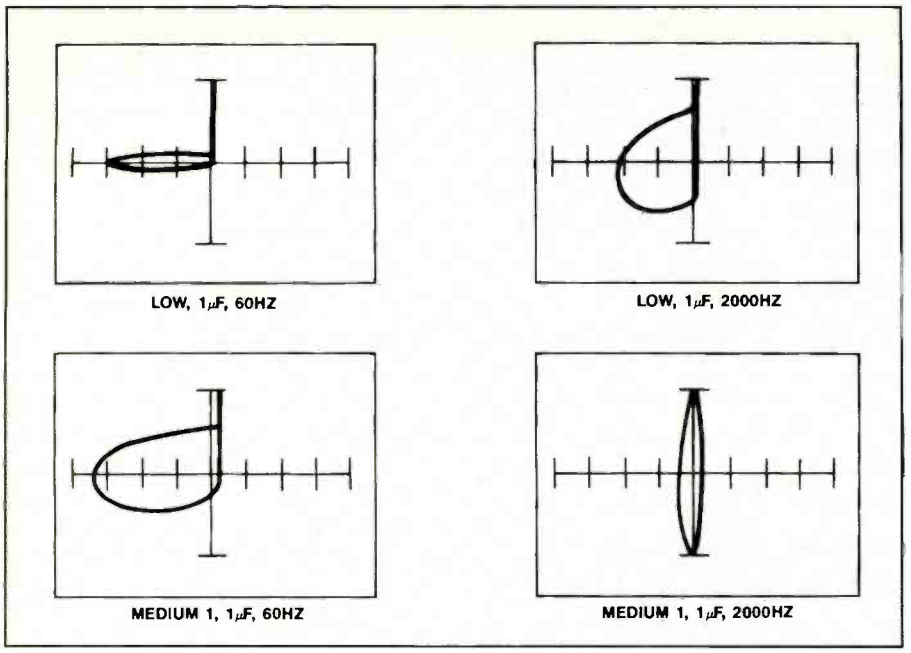



**Figure 50.** The signature of a 1kΩ resistor in parallel with a 1μF capacitor.

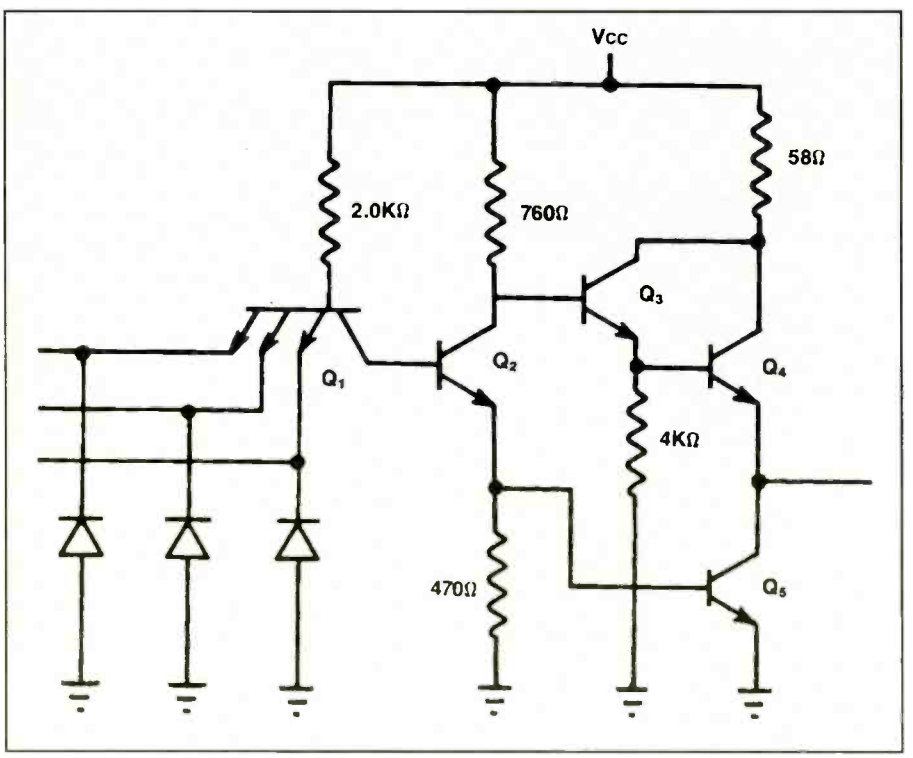



**Figure 51.** A typical TTL (transistor-transistor logic) gate. These gates are similar in that they have an input gate, phase shifter, (Q2) with emitter and collector load resistors, a pull- up mechanism (Q3/Q4) and a pull-down transistor (Q5).

onal line indicating a short of from 4Ω to 10Ω (although some IC's short as high as 50Ω). A 0Ω short (a vertical line) indicates a mechanical (non-IC related) short.

### Less sophisticated instruments to aid analog signature analyzers

A shorted capacitor, a solder bridge or a bad trace can make troubleshooting a board very difficult. Since signature analyzers work best detecting component failures, you may need to use a different piece of test equipment here. There are current tracers, (covered by this author in a previous article) and then there is the Huntron Shortrack 90 (Figure 54).

Using this test device, the first step is to calibrate the trace you're investigating. Use the signature analyzer as a current source. The short circuit tracker reads the current going through the trace. After you have set the LCD display to 100%, this will be your reference point at which current is at full strength. Probe around the board to see where the current falls off.

As an example, an electrolytic capacitor can fail when the dielectric fails and the plates become shorted (touch one another). The shorted capacitor of the four paralleled capacitors in Figure 55 will draw the most current, more than the other three non-shorted capacitors. The frequency response of the tester is from 50Hz to 2,000Hz.

If you have an unstuck wired-OR bus it is troubleshot in much the same manner as the stuck wired-OR problem just discussed. The analog signature analyzer does not indicate a short, but may show serious leakage current problems in the MED 2 range.

This type of problem usually has the defective device with more than one pin showing the internal defect. If there are no IC's with multiple pin failures, try alternately heating and cooling each IC with a soldering iron and coolant spray.

Since leakage is highly temperature dependent, the defective IC should cause the signature to change when you change its temperature, whereas good ICs exhibit no substantial changes.

### Memory boards

Memory boards can be difficult to troubleshoot if the system does not have built-in diagnostics to identify the section of memory where data cannot be retrieved or stored. Also, memory devices have most of their pins connected in parallel.

Most failures on memory boards occur in devices that access and control the memory and not in the memory itself. If the memory ICs are soldered in, find a pin that is not connected in common (parallel) with other memory devices.

This can be a chip select line (CS or CE on many memories). There will always be at least one such memory pin. Check this non-bussed pin using the ALT (alternate) mode, with one common lead tied to the defective bus line.

Connect the Channel A test lead to one non-bussed pin of one memory IC, and the Channel B test lead to the same non-

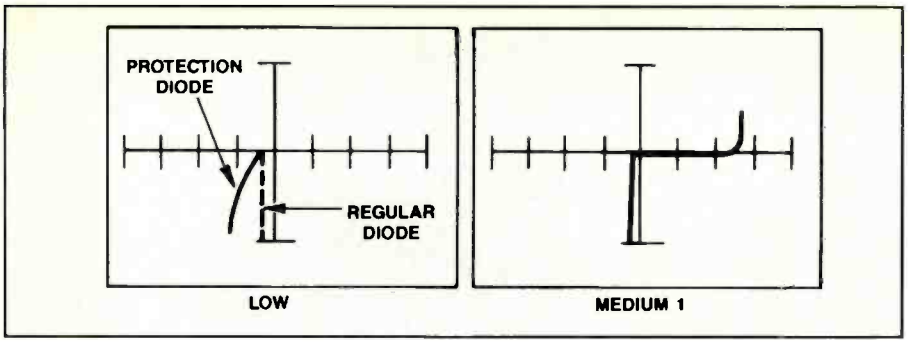



**Figure 52.** The signature between the input pin and ground of a 7410 TTL triple three-input NAND gate at 60Hz.

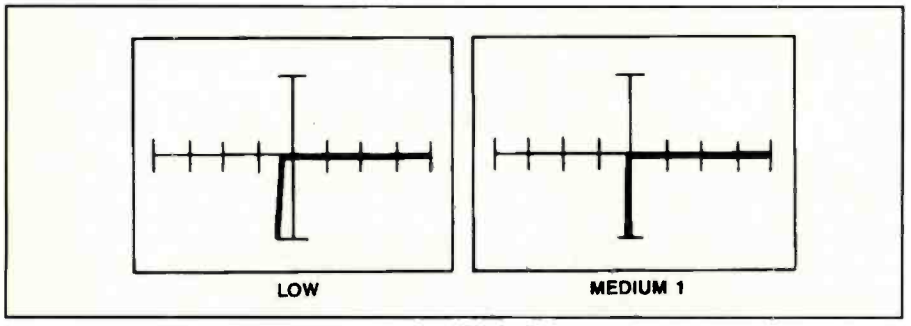



**Figure 53.** The signature between the $V_{CC}$ pin and ground of a 7410 TTL triple three-input NAND gate at 60HZ.


**Figure 54.** The Shortrack allows the user to probe a PC board to determine where current falls off, and therefore where there is a short circuit.

bussed pin of an adjacent memory IC. Compare the two signatures, looking for substantial differences in the shapes of the signatures.

These changes may be accompanied by a dc shift (the signature shifts to the left or right as it alternates between channels). If there is only a shift and no actual change in signature shape, this only indicates manufacturing differences from IC to IC.

### General troubleshooting tips

Almost all testing should be performed on the MED 2, MED 1, or LOW ranges. The HIGH range should only be used if testing at a high impedance point, or if higher test voltage is required. This is the case when examining the zener region of a 40V device.

As previously indicated, when testing a single bipolar junction, such as a diode, a base-emitter junction, or a base-collector junction, the LOW range should be used. If you want to check for reverse leakage, then a higher range can be used.

Try to relate the failure mode of the circuit under test to the type of defect indicated by the instrument. For example, a catastrophic PC board failure can be expected to be caused by a failed device with a dramatic signature difference from that of a normal device of the same type. A marginally operating or intermittent board may have a failed component indicating only a slight pattern difference from that of the normal indication.

Devices from different manufacturers, especially digital IC's, are likely to produce different signatures; however, this does not indicate a failed component.

If a specific area of a large PC board cannot be fault isolated, go to the edge connector. This will identify all of the inputs and outputs. Leakage current doubles with each 10C rise in temperature.

Leakage current shows up as a rounded transition (where the signature shows change from zero current flow to current flow). Never begin testing an IC in the LOW range. Confusion results from the inability to display various junctions. Starting on a higher range, then switching to the LOW range reveals an IC's defective input protection diodes.

After a little practice in determining what a horizontal versus a vertical line indicates and what the "fullness" of an ellipse indicates, you will be able to intelligently interpret these signatures.

If, however, you want to have a standard against which to compare an acceptable component, there is a device called a Switcher, (refer to Figure 56A for a photo of this manual switcher), which allows you to compare the signature of a device against that of a known-good device of the same type. An automated switcher is shown in Figure 56B, below an analog signature analyzer.

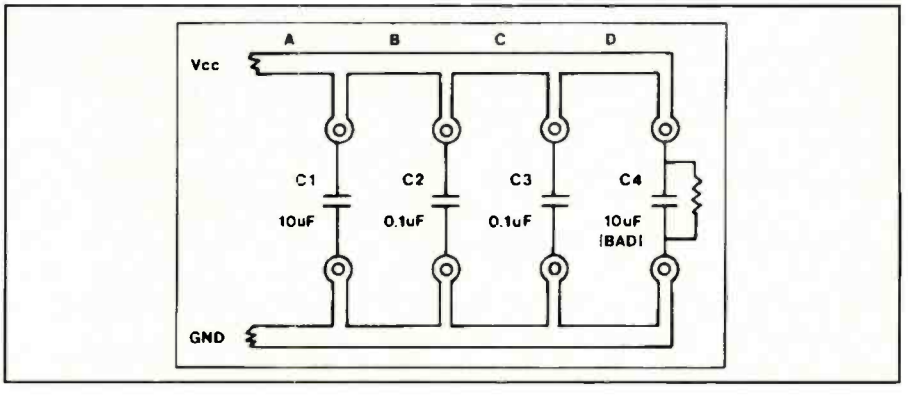
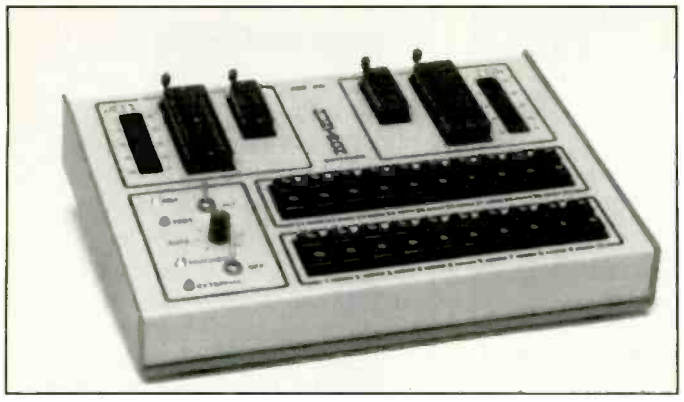



**Figure 55.** The shorted capacitor of these four paralleled capacitors will draw the most current, more than the other three non-shorted capacitors, thus allowing the user of the short circuit tracker to find the bad capacitor.



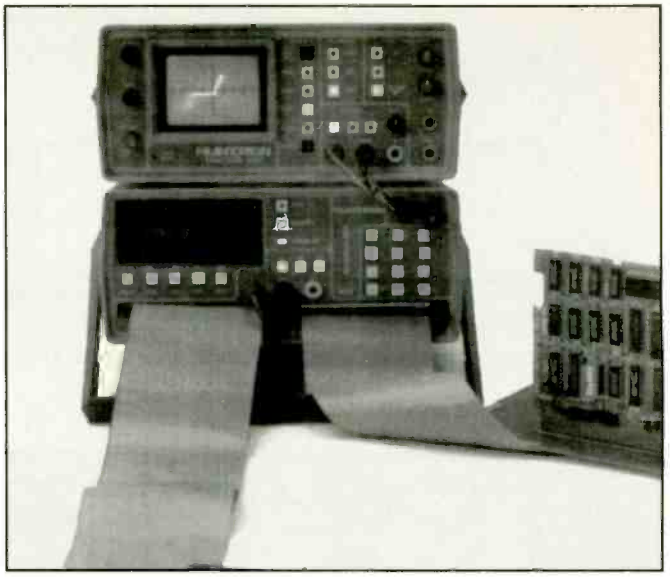


**Figure 56.** A. A switcher allows a technician to compare the signature of a device against that of a known-good device of the same type. This is a manual switcher. B. An automated switcher, shown here below an analog signature analyzer, allows the switching to be done automatically.

This device has dual inputs so it routes signals from a known good part and the suspected bad part to a signature analyzer. All you do is attach a clip to the IC being tested and use the switcher's 40 push buttons to display the signature at each of up to 40 pins. You can even customize the cable with special edge connectors or interface devices.

### A computer-driven troubleshooting system

If you are in a highly automated high production environment, you may prefer to set up a computer driven troubleshooting system. Provisions exist to expand these manual test capabilities. More specifically, refer to Figure 57.

This is the family of trackers, which, in combination with an IBM or compatible computer, can digitally store device signatures for future troubleshooting.

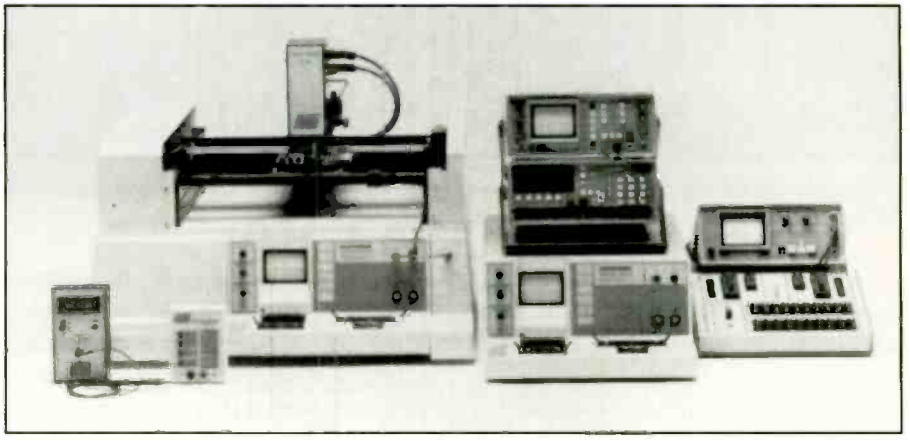


**Figure 57.** This family of trackers, in combination with an IBM or compatible computer, can digitally store device signatures for future troubleshooting.

### The hardware

The unit shown in Figure 58 (the instrument on the far right), adds the capability to handle 64-, 40-, and 20-pin IDC connector sockets. It has a 40-pin ZIF (zero insertion force) socket built in, and an IEEE-488 interface.

System requirements are as follows:

**Figure 58.** The instrument on the far right provides the capability to handle 64-, 40-, and 20-pin IDC connector sockets. It has a 40-pin ZIF (zero insertion force) socket built in, and an IEEE-488 interface.

- IBM PC/AT or equivalent with 8MHz or faster clock.
- MS/DOS 3.0 or later, a math coprocessor chip (8MHz) minimum.
- One 40MB hard disk with 28-ms access time and a self-parking head.
- One expansion slot, a parallel printer port and a Compaq Video Graphics controller board or equivalent with Zenith ZCM-1402 VGA (640 x 480 resolution) monitor or equivalent.

The 5100DS enables a technician to use their PCs to "learn" a board then store these signatures in a PC database. This is all done with simple data entry. Up to eight signatures can be called up and viewed at one time. A zoom capability enables $2^1/_2$ times size visual analysis.

No programming is required. The menu-driven, tree-structure operation enables testing to component level without

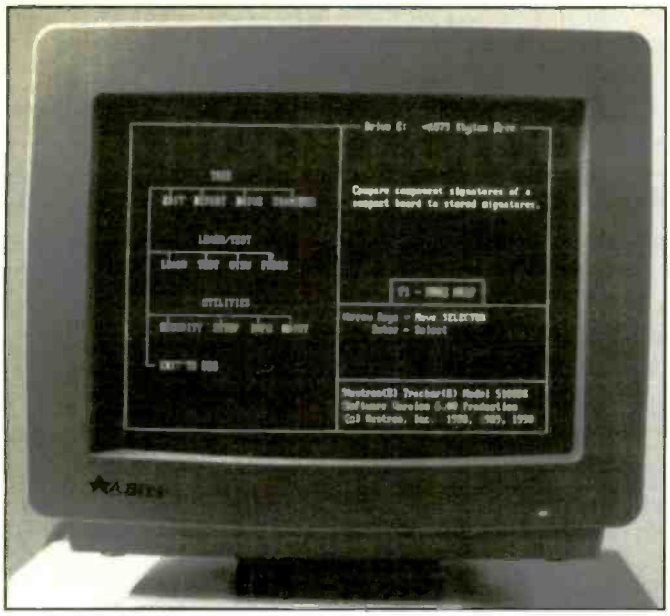


**Figure 59.** The main menu organizes system information into a tree structure.

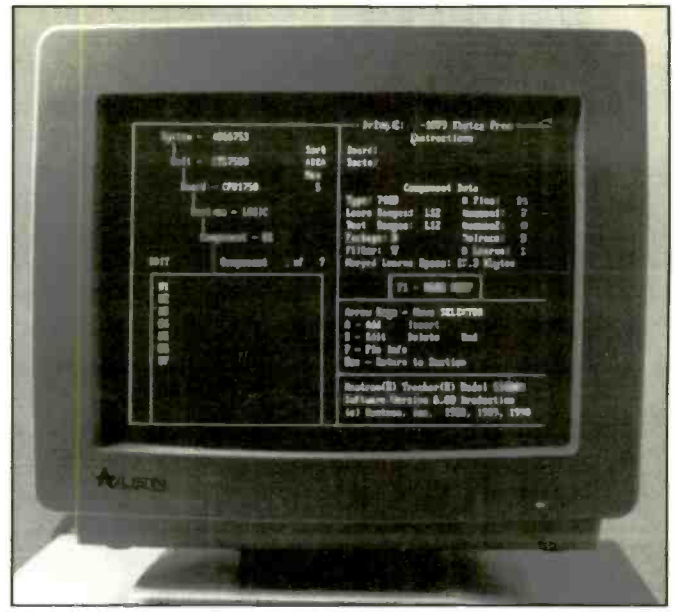


**Figure 60.** The learn screen.

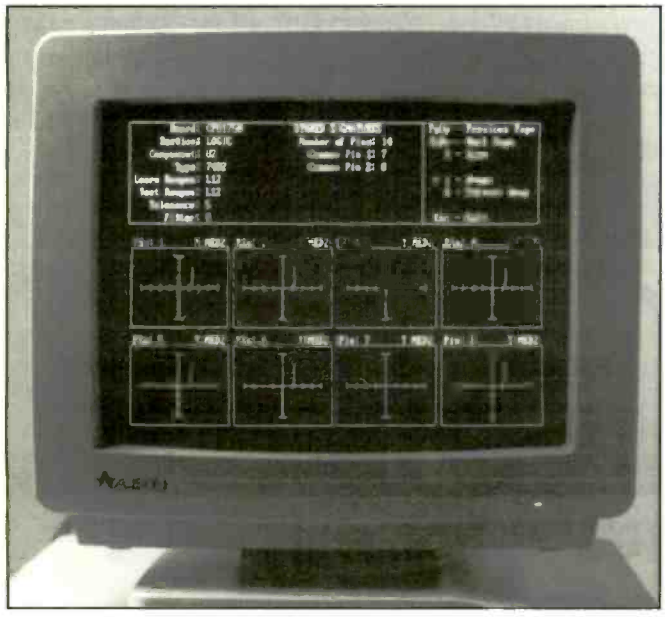


**Figure 61.** The signature screen.

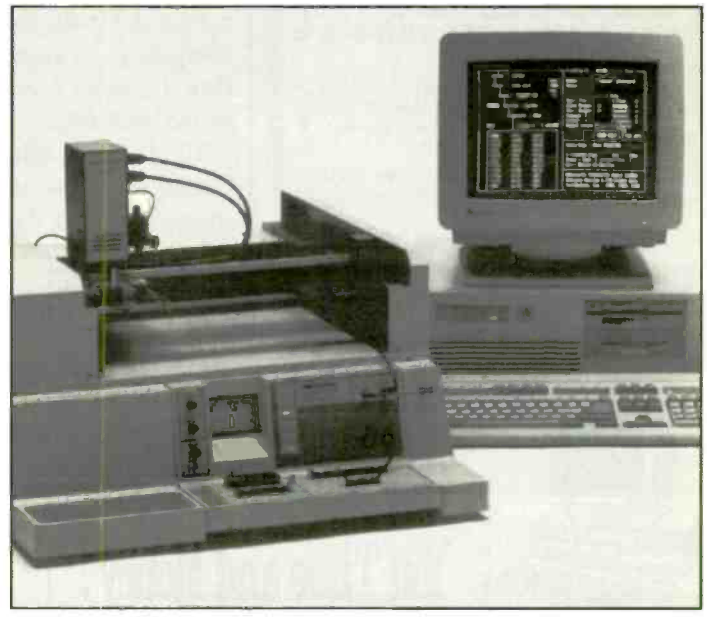


**Figure 62.** The prober allows automation of board testing.

programming, just data entry. The high level interface is divided into three logical blocks; TREE, LEARN/TEST, and UTILITIES.

The TREE creates trees with information such as the number of units in a system, boards in the unit, sections on the board, and components in a section.

The LEARN/TEST mode obtains and maintains learned signature information of known-good devices to be used later in the TEST mode. Monitor-displayed reports overlay learned signatures with suspect component signatures for quick visual comparison.

The UTILITIES mode allows the user to set and change the system security levels and change color settings. Utilities also deal with the management of system and data files.

### Some menus

Let's look at some actual menus. Figure 59 is the main menu and it organizes system information into a tree structure. The Edit branch allows data (board, section, and component data) to be entered, stored and recalled. The Learn/Test branch is where the learned signatures are created and the testing occurs. The Utilities branch has security, computer system information and setup and maintenance routines.

The Learn Screen in Figure 60 is for when you've identified all of a board's test points. Now it's time to learn their signatures, adjust tolerances acceptable, and refine your test routine for maximum accuracy. The more known good boards you learn, the tighter you can adjust the acceptable tolerances. The analyzer learns each IC's pins separately and automatically and stores this data.

The Signature screen in Figure 61 is where your PC monitor displays signa-

tures, up to eight of them. The color monitor allows you to overlay one signature over another in a different color for easier comparison.

### The Prober

Another, more sophisticated instrument supporting an analog signature analyzer, is the prober, model RP388, refer to Figure 62. This accessory accompanies the analyzer (shown in Figure 62) we've just discussed. This highly automates the testing of boards. The U. S. Navy uses one of these on board a ship with 5600 different boards to test and stores this massive data of each node or solder joint tested on 5 CD ROMs.

Testing is a three-step process. First, you teach the Prober where to go and each test point. Secondly, the Prober learns and stores these signatures of each good component and lastly, the Prober finds faulty components by automatically comparing their signatures with the signatures stored on the hard disk.

The Prober's software allows you to control the video imaging system which shows a detailed, display of the board on your PC monitor. A trackball (mouse) makes it simple to precisely move over test points and record their location.

The sensing tip has a spring loaded mechanism so if you come down on an obstruction on a board that isn't supposed to be there, you won't damage the Prober. Incidentally, the RP is the RP388 model number that stands for Robotic Prober, and once taught, if you observe it, you will agree that it is without a doubt an intelligent robot.

### Choosing the right instrument

This three-part article has provided a detailed exposition of a lesser known class of instruments: analog signal analyzers. They provide information about the condition of circuits and components in a different way than do oscilloscopes and DMMs.

Only experience and training can prepare a technician to know which instrument is best for troubleshooting a specific fault in a specific product, but the more information you have on the available test devices, the better informed your choice will be. ■

# Test your electronics knowledge

## Who needs tube theory?

**By Sam Wilson, CET**

Who needs tube theory these days? Well, for one answer, there are a lot of antique radio enthusiasts in this country. They even have a club and a newsletter.

Here is a test about tube theory—just for an interesting review. Who knows, tubes may come back.

1. A magnetron is an example of a
   A. diode tube.
   B. triode tube.
   C. tetrode tube.
   D. pentode tube.

2. Which of the following is a vacuum tube that is smaller than many of the transistors being sold today?
   A. tubistor
   B. thyristor
   C. nuvistor
   D. lovistor

3. Which of the following is most like a triode tube in operation?
   A. N-channel MOSFET
   B. JFET
   C. VFET
   D. P-channel MOSFET

4. Which of the following is correct when comparing a bipolar transistor with a triode vacuum tube?
   A. Both are current-operated devices.
   B. Both are voltage-operated devices.
   C. Unlike the triode, the transistor has no capacitance coupling between the input and output terminals.
   D. None of the choices is correct.

Wilson is the electronics theory consultant for ES&T.

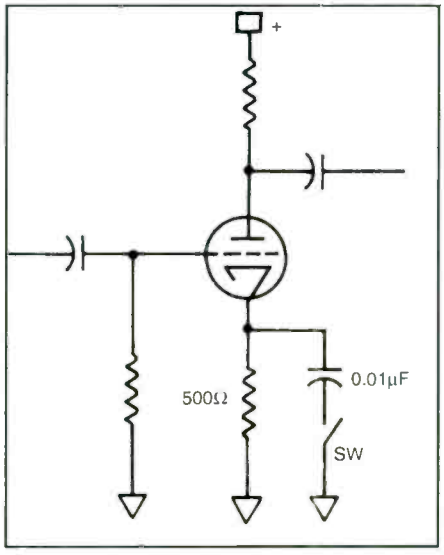



Figure 1.

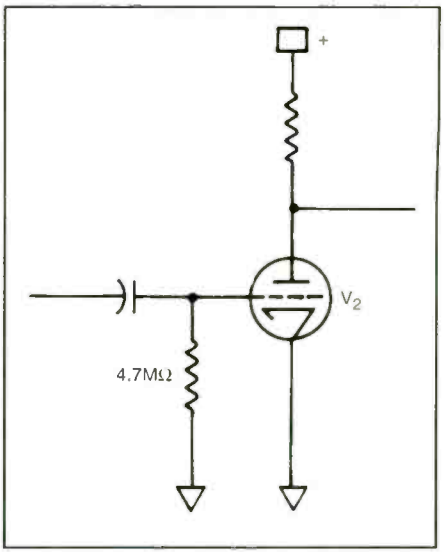



Figure 2.

5. A gas-filled triode is called a _____.

6. A gas-filled diode is called a _____.

7. An advantage of a triode over a pentode is that the triode
   A. has a better frequency response.
   B. introduces less distortion.

8. In the audio circuit of Figure 1, closing the switch
   A. will improve the low-frequency response of the amplifier.
   B. will not improve the low-frequency response of the amplifier.

9. Refer to Figure 2. What type of bias is being used in the circuit for $V_2$?

10. Figure 3(a) shows a triode tube using grid-leak bias. The equivalent MOSFET circuit is shown in Figure 3 (b). Which of the following is correct?
   A. The triode circuit won't work but the MOSFET circuit will.
   B. The MOSFET circuit won't work but the triode circuit will.
   C. Neither circuit will work.
   D. Both circuits will work.

*( Answers on page 65 )*

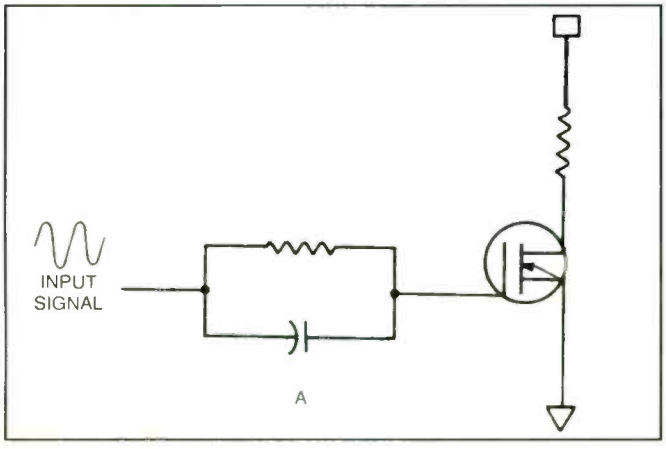
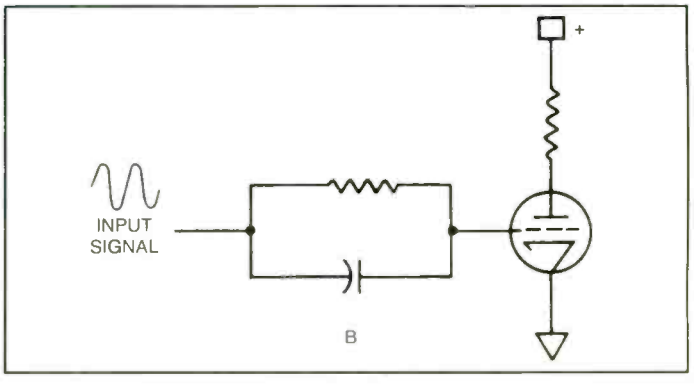



Figure 3A.

Figure 3B.



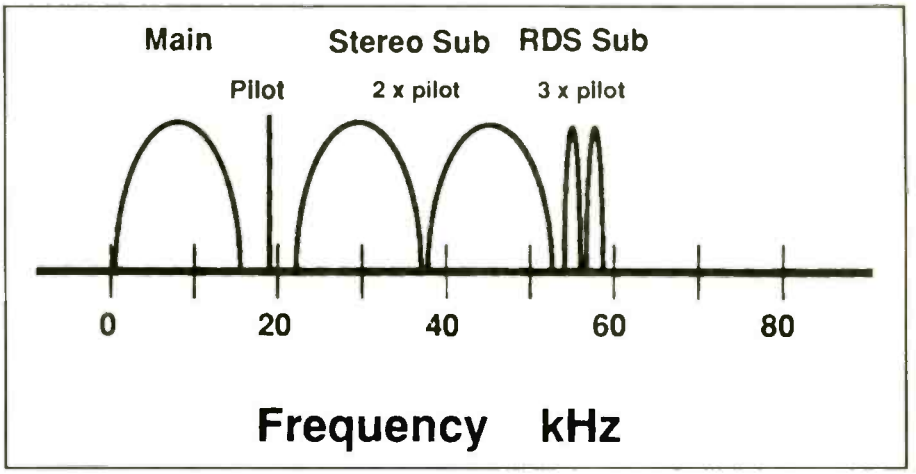
# Radio broadcast data is here

By John Shepler

The Radio Broadcast Data System (RBDS), described in the May 1992 *Audio Corner*, has been approved and is on the air. Soon, you'll be seeing car and home receivers that will have messages scrolling across their dials. Not far into the future, FM receivers will also offer paging, stock quotes, sports scores, weather forecasts, and, sorry to say, even scrolling commercials.

RBDS is a spinoff of an established European system called RDS or Radio Data System. The Americanized version has been carefully crafted so that foreign RDS radios will also work in this country. In fact, many of the early sets will probably be existing designs carrying the RDS name.

RBDS is a serial data transmission scheme that uses a 57kHz subcarrier piggybacked on an FM station's main carrier. The carrier also transmits the main channel or mono audio, the 19kHz stereo pilot signal, and the 38kHz stereo subcarrier. Some stations add other subcarrier frequencies to transmit background music, stock market and farm market data, and station remote control signals.




RDS audio spectrum

Most listeners are unaware of these subcarriers since they are filtered by the receiver's stereo decoder.

Special decoders are provided to subscribers of the background services. The decoders are usually phase locked loop detectors tuned to the desired subcarrier and driven directly by the receiver's IF section. Data services require a PC, or other dedicated serial to parallel data converter.

The RBDS standard has been two years in the making. It is a coordinated effort by the Electronics Industries Association (EIA) and the National Association of Broadcasters (NAB). Since subcarriers are already an established technology, no special rulings were required by the FCC.

RBDS is expected to take off quickly with the support of the major radio stan-

Shepler is an engineering manager and broadcast consultant. He has more than twenty years experience in all phases of electronics.

dards groups, the interest by radio stations in having their call letters and format displayed on the front of the receivers, and the opportunity for receiver manufacturers to charge a premium for the new sets.

A feature that will interest many listeners is the ability to find suitable signals by format rather than simply tuning up and down the dial. RBDS receivers will have format buttons. If you want to listen to country music, simply push the button marked COUNTRY. For rock & roll, push the button marked ROCK. The same is true for information, sports, jazz, and classical formats, to name a few. The system is assigned 22 specific format codes. The rest of the 31 available codes are reserved for spares or emergency broadcasts.

The format feature is great for travelers and listeners on the road. You can pick a format and the receiver will find the appropriate stations. As a station's signal fades into the noise, the receiver selects a stronger signal with the same format.

RBDS has another unique feature that travelers will find useful. The traffic and emergency alerting function will interrupt the broadcast in progress to relay safety messages. It can even override a cassette or CD. The FCC is looking closely at RBDS to see if it might be a suitable replacement for the existing Emergency Broadcasting System.

What about AM stations? Unfortunately, the 10kHz bandwidth of AM channels can't support the standard 57kHz subcarrier for RBDS. A suitable alternative hasn't been developed yet, and may not appear until a digital AM broadcasting standard can be developed.

For now, AM station data can be carried along with the FM data in a mode called ID Logic B. This function scans a table of data within the receiver to find the appropriate station data. It is likely that FM stations will be used to download updated data tables to the receivers in a given area.

The more exotic features of RBDS are yet to come. Any type of information that can be put into a text format can potentially be transmitted to selected receivers or the general public. Some stations are already sending song titles and artist names along with the music. At least one company is already making paging equipment. On the horizon—printed coupons. Soon your car or portable radio could really become a mobile information center.



## ES&T READER SURVEY


Bound into this issue is the ES&T Reader Survey card. It's located on page 29.

It's a mini survey about ***you.*** We would like to hear about the problems you face, the opportunities you see and the equipment you use during the course of your work day.

The postage is paid. All you have to do is fill it out and mail it.

*What could be easier?*

**Please fill yours out and mail it today.**

# Will total quality management work for you?

By John Ross

Success in any form breeds not only competition but also mimicry. The success of the Japanese electronics industry and the inability of American industry in general to compete caused many analysts to study everything about the Japanese industrial complex.

Aside from drawing conclusions about Japan's unfair trade practices and the transference of Japanese religious and family traditions to the workplace, analysts also pointed toward the Japanese adoption of management philosophies authored by W. Edwards Deming. As a result, many American private and public organizations are beginning to adopt Deming's Total Quality Management.

To Deming, improving quality throughout an organization will improve the productivity of the organization. His theories build on the relationship between quality, productivity, costs and profit, and the belief that higher quality results in lower costs. Quality, from the Deming perspective, begins with commitments to the consumer and from top-level management.

### Quality starts with satisfied employees

In addition, Deming believes that quality extends from employees who are secure on the job, and who are allowed to exhibit pride in their workmanship. Security and pride in workmanship evolve from cooperation and the absence of competition in the workplace. Also, the theory propounded by Deming shows that having access to resources and training makes employees more satisfied.

Rather than rely on a merit evaluation for each individual, application of the Deming theory requires a performance evaluation of units within the organization. However, and most importantly, rather than foster competition between departments, the Deming-style evaluations are used to further the concept of interrelated units that work together within an organization.

Originally, Deming applied his theories to the manufacturers. The success story of the Deming management theories have enlarged their utilization beyond the manufacturing sector and into the service and public sectors. Deming uses fourteen major points to suggest methods for introducing and enhancing quality within any organization. Since each point takes a broad look at achieving quality, a different interpretation works when considering service business, departments, or other service organization.

### The TQM philosophy

The next several installments of Business Corner will present the TQM philosophy, point by point. Depending on the size and type of a given business, the number of employees and the products serviced, TQM may be more or less applicable. In some cases it would probably make sense to attempt to formally adopt most or all of its tenets. In other cases, it might simply provide a general guideline.

Whatever the case, quality of service is a concept that customers are demanding, and manufacturers are requiring of their authorized service centers. Whether it becomes a formal part of your company's culture, or just a conglomeration of ideas that you keep in the back of your mind, quality is something that we wish to receive from the products and services we pay for and wish to provide to our customers. Every service center that wants to be successful should at least be aware of the concept of total quality management.

### The points of TQM in brief

1. Create constancy of purpose toward improvement of the quality of product service.
2. Adopt the quality philosophy.
3. Cease reliance on mass inspection to achieve quality.
4. End the practice of awarding business on the basis of price tag.
5. Improve constantly and forever the system of production and service.
6. Institute training on the job.
7. Institute leadership.
8. Drive out fear so that everyone in the company may work effectively for the organization.
9. Break down the barriers between departments within the organization.
10. Eliminate slogans, exhortations and targets for the employees of the company asking for zero defects and new levels of productivity.

11a. Eliminate work standards.

11b. Eliminate the idea of management by objectives.

12a. Remove barriers that rob hourly workers of their right to the feeling of pride of workmanship.

12b. Remove barriers that rob people in management and engineering of their right to pride of workmanship.

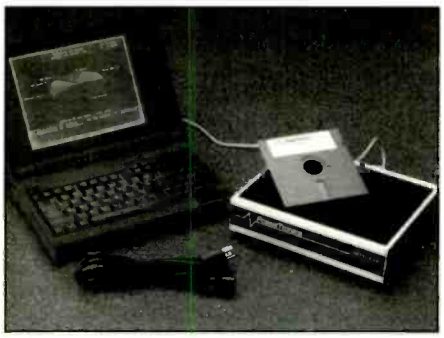
13. Institute a vigorous program of education and self-improvement.
14. Put everyone in the company to work to accomplish the transformation.

### Details to follow

Future installments of this column will provide additional details to support these points, and provide an approach to improve the quality in any service organization. ■

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

# Products



### Power monitor

The Detective PC edition power monitor from *PowerTronics* provides a complete analysis of the ac powerline so that the technician can solve the customers power problems and recommend the correct power conditioning equipment.

Power disturbances are difficult problems to track down and solve. Power line disturbances cause hardware damage, system resets, memory or program loss and equipment malfunctions. Power problems waste countless hours.

This unit records each problem in a non-volatile RAM chip. Events are time and date stamped so that the user can trace system problems to actual power problems. Up to 1500 time and date stamped events, and 256,000 summary events may be stored in the battery backed memory. Events include: spikes, sags, surges, noise, voltage and frequency changes half cycle dropouts, power failure,andhot/neutral wiring reversal.

The monitor comes complete with an IBM compatible Power Audit Diagnostic software and operates in a DOS environment. The software automatically transfers the data to the hard drive and operates in pull-down menus. Four easy to understand charts describe the disturbances: Detail Reports, Pie Charts, Bar Charts, and Power quality Audit.

Circle (90) on Reply Card

### Service cassette for 8mm camcorders

The Tenma Ultimate 8mm Service Cassette #32-4605, from *MCM Electronics*, operates in all 8mm camcorders and VCRs allowing maximum visibility and accessibility during service. This service cassette's many features include: tape detect function, latch release, sensor switches and cassette alignment guides.

It is easy to operate and ready to assist with troubleshooting in seconds. Simply insert as you would a normal 8mm tape and the unit runs as if a real 8mm tape were inside!

Circle (91) on Reply Card

### Screwholding screwdrivers

*Willi Hahn Corporation* introduces Screwholding Screwdrivers to their popular line of high quality hand tools.

Available in Phillips or slotted styles,

both feature a spring loaded clamping sleeve to hold the screw. This assures full depth screw head engagement and positive holding of fasteners. The blades are hardened CVM tool steel resulting in high quality, long life screwdrivers.

According to the manufacturer, these screwdrivers have comfortable, square handles. Manufactured from high quality cellulose-acetate (cadmium free), they are impact resistant and designed for a comfortable fit in any hand.

Circle (92) on Reply Card

### Active differential probe kit

An active differential probe that lets an oscilloscope user measure and compare differences in voltage inputs is offered by *ITT Pomona* in kit form with a variety of input accessories.

The model 5942 kit includes the MX-9000 Differential Probe, an active device that analyzes floating signals safely and is useful in making power semiconductor dv/dt measurements in fast switching

circuits such as thyristors, bipolar transistors or power MOS FETs. The unit is battery powered or may be used with an optional 6V power supply.

Using a built-in differential amplifier, the probe scales and converts differential voltage inputs to a low voltage BNC output. Attenuation ratio is switchable, 1:20 or 1:200. Both the positive and negative sides of the balanced input feature high impedance to ground. It can accommodate differential input to 700V; its sensitivity can extend down to 100mV.

The unit's oscilloscope lead ends in a standard BNC connector, its two input probe leads are equipped with Pomona sheathed pop-jack plugs. The kit includes interchangeable test probe handles, spade lugs, fully insulated alligator clips, and Mini-grabber to pop-jack leads.

Circle (93) on Reply Card

### Replacement parts pricing software

Quest, Inc., announces the publication of their pricing software, DataQuest. This software, distributed by Vance Baldwin, allows the user to quickly search through the complete list of almost half a million parts and factory authorized prices for most manufacturers. The software currently supplies factory authorized pricing for Sony, RCA/GE, Panasonic/Technics/Quasar, Philips/Magnavox/Sylvania, Zenith and Hitachi. Additional manufacturers will be added in future updates.

If there is an alternative part (or part number) that coincides with the one that the user is looking for, the software will display that information, even if the part number is that of another manufacturer.

Circle (94) on Reply Card

REPLACEMENT PARTS SHOWCASE

# Choosing a replacement parts supplier

Servicing technicians and managers face a lot of problems in their jobs: products with malfunctions that are difficult to diagnose, difficult customers, keeping up with rapidly changing technology. Two of the most common problems facing service technicians and managers today are locating replacement parts and finding service literature.

Many of the consumer electronics products being sold today have brand names that are not nationally known. Many service centers have no idea where to go for parts and information on these units. Exacerbating the problem is the fact that much of the circuitry in these products is highly sophisticated, featuring unique components for which no one but the manufacturer has the replacement. What can a service center do when faced with this increasingly common problem?

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

## Products are complex, varied

Today's consumer electronics products are highly complex. In many cases, a consumer electronics product is far more than a product; it's an intricate system. Consider a VCR. The electromechanical portion of the system loads the tape and records or plays it. The electronic portion manipulates the video signal. The control section makes sure that all the other sections work properly together, and in addition senses conditions like the presence of moisture or end of tape and shuts down the system if there's danger of damage.

Because there are so many components with unique characteristics, designers of today's sophisticated consumer electronics products are able to design the circuits for the product they want to build in a broad variety of ways. If they should want to achieve a function but they 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 manufacturers' parts numbering systems are all different. In some cases, when a technician has identified a particular faulty component, he can find a cross reference that will allow him to determine if he has an equivalent in stock. Unfortunately, in many cases, there is no cross reference, and even if the service center has a needed part on hand, no one is aware of it.

## Identifying components

Service centers can do a number of things to make obtaining replacement components easier. One step is to obtain copies of every available cross reference and become familiar with them so that when a part is needed it can be identified. Some cross references are available free from manufacturers through distributors. Other cross references cost a considerable amount of money. However, if a service center adds up all the long distance calls, and all the time spent on the phone, to say nothing of the toll charges for those long distance calls, any cost for cross references might be found to be money that is well spent.

## Working with a distributor

Once you've determined which component is the cause of a malfunction, your next step is obtaining a part from the distributor. Just as with any supplier, distributors differ in their commitment and ability to help you identify a component and obtain it for you.

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

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

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

When you're searching for a replacement part supplier you can count on for 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 left with an irate customer.

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

REPLACEMENT PARTS SHOWCASE

# 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 eight 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.

## Light boxes

We learned from these training meetings that there was a need for an inexpensive light box with charts. So we built our own, and are currently selling it at a price that makes camera repair more profitable. It is now much more cost-effective for servicers to make the transition from VCR to camera repair.

## Computer software

Servicers informed us of a need for a computer program that would give instant access to part numbers, substitute numbers, dealer cost, dud prices, descriptions, and availability. We immediately began working to develop a program. Today, it is available, and includes over 260,000 part numbers. It includes generic and Philips part numbers, as well as all other requested information.

## Video tape

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, service tips review, and cameras. In fact, the demand was so high we decided to expand our video production facilities to triple our output of videos by the end of 1993!

## Highest quality

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

## Order your catalog

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


REPLACEMENT PARTS SHOWCASE

# Philips Consumer Electronics

401 East Old Andrew Johnson Highway
Jefferson City, TN 37760
Phone: 615-475-0317
FAX: 615-475-0071

Philips Consumer Electronics Company, one of the United States' largest replacement parts suppliers has declared war on eroding margins at the servicer level and developed a new program to help service dealers succeed in today's competitive marketplace.

Citing industry figures, Philips demonstrates that as the cost of replacement has fallen and that of repair has risen, more and more consumers are choosing to replace consumer electronics products rather than repair them. This disturbing trend has successfully knocked some servicers out of the marketplace.

"According to Connie Bell of the National Electronics Service Dealers Association," says Rob Whorley, Philips parts national sales manager, "the number of electronics servicing dealers has decreased significantly in the last ten years. As an industry, we must work together to find ways to help servicers stay in business."

Whorley points out that the Electronics Industries Association (EIA) has compiled figures showing a leveling of sales and erosion of pricing for the major product categories of TVs and VCRs. These factors have contributed to the decline in the number of dealers in the service industry and the trend toward replacement rather than repair, making it much more difficult to maintain profitability.

The encouraging news, however, is that there is a solution. Fewer servicers means bigger customer bases for those that stay in business. And, according to Whorley, customer satisfaction is the key to serving that customer base successfully.

"Satisfied customers are 63% more likely to give you their repeat business," said Whorley. "Over 80% of customers who are satisfied—and 50% of those with no complaints—will revisit your shop.

"On the other hand, only 19% of customers who are dissatisfied will return."

In response to these trends, Philips Service Company has entered 1993 with an emphasis on helping service dealers manage their shops profitability. Rather than simply selling replacement parts, Philips is canvassing the country consulting with service dealers about how to achieve both total customer satisfaction and profitability.

"Servicers have ranked us number one in total aftersale support for three years running," Whorley continued. "Our challenge now is to help servicers achieve a similar level of customer satisfaction, while at the same time increasing their profit margins."

According to NESDA, there are five main determinants of customer satisfaction: turnaround time, technical skills, people skills, price and accessibility. Turnaround time and technical skills are rated highest. In other words, people will pay for quality.

"If you can turn repairs around quickly and do it right the first time, chances are you're going to have satisfied customers," Whorley explained. "The higher the level of satisfaction you can achieve, the better off you'll be."

By analyzing various dealers' turnaround times and repair success levels, as well as their own replacement parts and technical training programs, Philips was able to develop a set of criteria for evaluating service dealers' level of success in meeting the customer satisfaction determinants outlined above.

The criteria include things like order processing, delivery, returns, credit processing, parts quality, stocking levels, service aids and technical training. How servicers meet these criteria—and how Philips helps them meet them—can be the difference between profitability and failure.

With these benchmarks in place, Philips is consulting with servicers in an effort to help them attain high levels of satisfaction with their customers.

Whorley believes the whole process has other direct and indirect advantages.

"This new way of doing business is very beneficial in many ways," said Whorley. "Our people in the field are much more attuned to our customers' needs. We don't just sell parts and we don't just help them with stocking levels, marketing advice and technical support.

"Now more than ever, we can customize our products and services to meet the needs of either a single customer or the entire service industry. This partnership approach is critical to our collective efforts to strengthen our position as we approach the turn of the century."

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

"We are continually looking for ways to improve our service to dealers," concluded Whorley," and, in turn, to consumers. After all, our commitment to excellence is total customer satisfaction."

In addition to quality replacement parts, Philips Service Company sells test equipment and service aids, all available as single parts or as recommended kits. The Service Company provides a wide variety of products and services designed to enhance and protect all brands of consumer electronics products, including Philips' own Magnavox, Philips, Sylvania and Philco brands. These aftermarket solutions include accessories, service contracts, replacement parts, technical training and systems support, all established to make Philips the easiest service company in the business to do business with.

# Philips Service Company has been in one place for four years running...

# First.

## Our Commitment to Excellence

Philips Consumer Electronics Company has joined with servicers, dealers and consumers to enter a new era of service: Total Customer Satisfaction. Everything we do is subject to the scrutiny of our newest chief executive officer – you. And the strategy is working.

## The Service Leader

Across the broad spectrum of accessories, service contracts, replacement parts, training and technical field services, Philips has been ranked first by independent surveys of servicers and dealers in every major category measured. Number one in accessibility, availibility and reliability. Number one in delivery, pricing satisfaction and people skills. Number one *overall.*

**Why have so many dealers across the country signed on with Philips Service Company?** Contact a Philips Retail or Service Consultant today to find out: **(615) 475-0437**

Another First from Philips

PHILIPS



Circle (36) on Reply Card

REPLACEMENT PARTS SHOWCASE

# Matsushita Services Company

50 Meadowland Parkway
Secaucus, NJ 07094
201-348-7589; FAX:201-348-7527

From headquarters in Secaucus, NJ, Matsushita Services Company (MSC) coordinates a U.S. network of factory servicenters, independent servicenters, self-servicing dealers, parts and accessory stocks and training sessions.

Matsushita Electric Industrial Company (MEI) manufacturer of Panasonic, Technics and Quasar products, is the world's largest manufacturer of consumer electronic products. MEI sales worldwide have passed the $46 billion mark. At the heart of this success is a tradition of service.

The life blood of Matsushita is a blend of state-of-the-art products, accurate anticipation of market demands, effective manufacture and distribution, and a compelling program of sales promotion and marketing. But the heart of its business is the quality of service it renders to each customer.

That's why Matsushita Services Company (MSC) was established to meet the service and parts needs of customers. These customers include Matsushita authorized servicenters, authorized replacement parts distributors, the nationwide network of Panasonic, Technics and Quasar dealers, and the many millions of Americans who purchase Matsushita products each year.

The total commitment to service quality at MSC is evident everywhere. It is the philosophy that guides every person in the organization. Even if an employee doesn't deal directly with one of the customer groups, the goal of everyone is to provide excellent service so that customers receive maximum satisfaction of their service needs. The MSC service organization is Matsushita's way of saying to customers, "Thanks for your business and we hope you will select a Panasonic, Technics or Quasar product again."

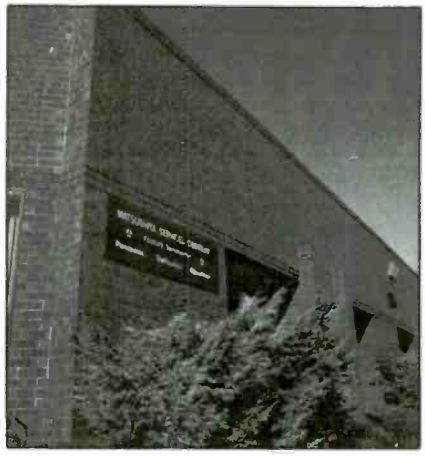
To meet its service commitment in North America, MSC has a support operation second to none in the consumer electronics industry. A staff of 900 trained men and women provide a wide range of services to customers. Twentyfour MSC factory servicenters (FSCs) are strategically located throughout the country. Technicians in each FSC are well-trained in diagnosing and correcting malfunctions in sophisticated electronic products. Independent authorized servicenters and self-servicing dealers, backed by a factory training and a comprehensive stock of original equipment replacement parts, complete the network that makes service easily available to owners of Panasonic, Quasar and Technics. ■

# REPLACEMENT PARTS SHOWCASE

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

### Distributors of:

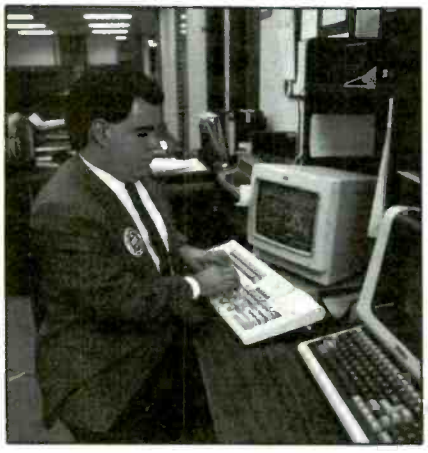
**Panasonic** **Technics** **Quasar**



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

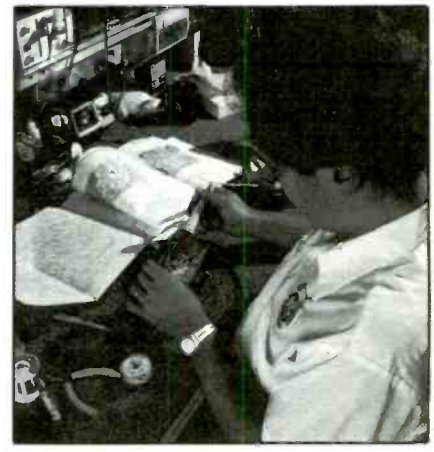

Owners of Panasonic, Quasar and Technic products are never far from factory-trained service technicians.

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



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

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



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

# Matsushita Original Replacement Parts and Accessories

# Let's Keep the Promise!

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

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

**A Promise Kept! Here's How:**

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

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

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

**Matsushita Services Company**
50 Meadowland Parkway, Secaucus, NJ 07094

Panasonic® Technics™ Quasar®

# MATSUSHITA

## AUTHORIZED REPLACEMENT PARTS DISTRIBUTORS

**Panasonic®** **Technics™** **Quasar®**

### CALIFORNIA

**Andrews Electronics (C/V/M/A)** • 25158 Avenue Stanford, Valencia 91355 • 800-289-0300 • FAX 800-289-0301

**Audio Video Parts, Inc. (C/V/M/A)** • 1071 South La Brea Ave., Los Angeles 90019 • 213-933-8141 • FAX 213-933-7008

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

**Chuck Hurley Electronics (CM/A)** • 2557 Albatross Way, Sacramento 95815 • 916-927-5891 or 800-655-4004 • FAX 916-927-5956

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

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

**Star for Parts (V)** • 12930 E. Sunnyside Place, Santa Fe Springs 90670 • 800-525-6046

**Blakeman Wholesale/Tacony (V)** • 14281 Franklin Ave., Tustin 92680 • 714-544-0446 • FAX 714-544-0792

### COLORADO

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

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

### CONNECTICUT

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

### FLORIDA

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

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

**Vance Baldwin (C/M/A)** • 2207 S. Andrews Ave., Fort Lauderdale 33316 • 305-523-3461 • FAX 305-523-3464

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

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

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

### GEORGIA

**Buckeye Vacuum Cleaner (V)** • 2870 Plant Atkinson Rd., Smyrna 30080 • 404-351-7300 • FAX 404-351-7307

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

### ILLINOIS

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

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

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

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

### INDIANA

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

### IOWA

**Jones Distributing Co. (C/V/M/A)** • 2650 Bridgeport Dr., Sioux City 51111 • 712-277-8600 • FAX 712-252-5645

### KANSAS

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

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

### MARYLAND

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

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

**Tritronics, Inc. (C/V/M/A)** • 1306 Continental Dr., Abingdon 21009-2334 • 410-676-7300 • FAX 410-676-7658

### MASSACHUSETTS

**M.I.L. Electronics (C.V.M.A)** • 1500 Main St., Waltham 02154 • 617-891-6730 • FAX 617-891-6733

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

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

### MICHIGAN

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

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

### MINNESOTA

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

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

### MISSOURI

**Citritronix, Inc. (C.V.M.A)** • 1641 Dielman Rd., St. Louis 63132 • 314-427-3420 • FAX 314-427-3360

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

### NEW YORK

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

**Green Tele-Radio Dist. (C.M.A)** • 84-00 73rd Ave., Glendale 11385 • 718-821-1114 • FAX 718-821-3987

**GMB Sales (C/V/M/A)** • 140 N. Belle Mead, Setauket 11733 • 516-689-3400 or 800-874-1765 • FAX 800-635-0596

**Panson Electronics (C/V/M/A)** • 268 Norman Avenue, Greenpoint 11222 • 718-383-3400 • FAX 718-383-2425

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

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

### OHIO

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

### OREGON

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

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

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

### PENNSYLVANIA

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

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

### SOUTH CAROLINA

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

### TENNESSEE

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

### TEXAS

**Electronic Component (C/V/M/A)** • 2401 Bissonnet, Houston 77005 • 713-525-3290 or 800-531-3224 • FAX 713-528-1046

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

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

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

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

### VIRGINIA

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

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

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

**Fairway Electronics, Inc. (C/V/M)** • 2304 Chamberlayne Ave., Richmond 23222 • 804-321-7255 • FAX 800-955-7043

### WISCONSIN

**G.M. Popkey Company (C/V/M/A)** • 2035 Larsen Ave., Green Bay 54307-2237 • 414-497-0400 • FAX 414-497-4894

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

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

(as of 8/2/93)

REPLACEMENT PARTS SHOWCASE

# Dalbani Corporation

2733 Carrier Ave.
City of Commerce, CA 90040
Phone: 1-800-Dalbani
1-800-325-2264
FAX: 213-727-6032
213-888-6032

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

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

Dalbani Corporation keeps customers informed of the latest introductions of new items by publishing two full line catalogs per year including catalog supplements, seasonal brochures, and notifications of sales promotions and specials. The multilingual Sales Department coupled with the state-of-the-art computerized order processing, enables Dalbani Corporation to offer prompt and efficient service to benefit the customers: Monday through Friday 7:30 a.m. to 5:00 p.m. and Saturdays 9:00 a.m. to 3:00 p.m. Pacific Time. A toll-free number (1-800-DALBANI/1-800-325-2264) for the U.S.A. and Canada is available, in addition to a 24-hour fax line (213-727-6032/213-888-6032).

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

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

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

SPECIAL ADVERTISING SUPPLEMENT

REPLACEMENT PARTS SHOWCASE

# CitiTronix, Inc.

1641 Dielman Rd.
St. Louis, Missouri 63132-1597
Phone: 314-427-3420, 800-846-CITI
FAX: 314-427-3360, 800-397-8587

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

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

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

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

- April, 1981 Sony
- July, 1982 Magnavox
- July, 1984 Matsushita
- July, 1984 Panasonic, Quasar, Technics)
- October, 1985 General Electric
- September, 1986 Sanyo & Fisher
- October, 1987 RCA
- April, 1990 RCA, Premier Parts Distributor
- November, 1991 Zenith
- August, 1992 Kenwood

On January 8, 1988, the name of City Refrigeration Co, Inc. was changed to CitiTronix, Inc. Since its beginning the company has been owned and operated by the Daniels family. The officers of CitiTronix are Jeffrey A. Daniels, Sr., President, Mary A. Daniels, Vice President, and Loretta A. Daniels, Secretary and Treasurer.

CitiTronix has received several prestigious awards as follows:

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

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

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

CitiTronix is an equal opportunity employer with 31 full-time employees. The company maintains a semiautomatic telephone system, FAX, and CitiLink for communicating with the customer.

REPLACEMENT PARTS SHOWCASE

# PTS Corporation

5233 Highway 37 South • PO Box 272
Bloomington, IN 47402-0272
Phone: 800-844-7871
FAX: 800-844-3291

PTS Electronics has been providing fast dependable service to thousands of service dealers for over 25 years.

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

### Expanded services

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

PTS has consistently kept up to date with all the latest makes and models of televisions from major manufacturers. Their 40,000 square foot corporate facility contains over 300 individual test positions for testing complete chassis and mainboards. PTS is capable of providing replacement or service on all the most recent mainboards and electronic tuners, while still being able to provide service on older models.

If a service dealer needs assistance or a replacement for any television tuner, mainboard or complete chassis, chances are good that PTS has a replacement in stock. If it is currently not in their inventory they can provide rebuilding service on the unit.

Specialization has made PTS the largest and most efficient independent electronics rebuilder in the world. Maximum use of available resources and skill has made PTS the leader in electronics rebuilding, with the ability to adapt to new technologies and advance into new markets according to customer needs.

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

Currently, PTS rebuilds over a million analog and digital products, components and subassemblies each year.

### Dedicated to customer satisfaction

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

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

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

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

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

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

SPECIAL ADVERTISING SUPPLEMENT

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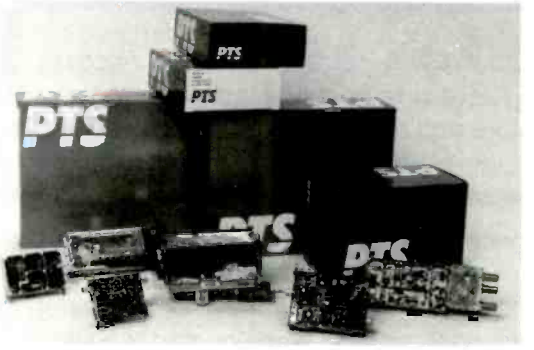


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Corporate Headquarters:
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BLOOMINGTON, INDIANA 47401
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Local: 812-824-9331
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REPLACEMENT PARTS SHOWCASE

# Print Products International

**8931 Brookville Rd.**
**Silver Spring, MD 20910**
**Phone: 800-638-2020**
**FAX: 800-545-0058**

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

Print lives up to its logo "we make ordering simple." With our friendly staff, toll free phone and fax, huge inventory, and quick processing of orders, it is no wonder that Print has become the "source" for electronic test equipment.

Due to our huge buying power, Print is able to claim that we are the most competitively priced equipment distributor in the country. Print buys in large quantities, and passes these savings on to their customers. As our sales staff says, "If you didn't buy it at Print, you've paid too much!" Because of this buying power, Print sub-distributes equipment to other distributors.

Print accepts VISA, Mastercard, American Express, and COD orders. Open accounts are available to rated firms. Print will ship your order UPS Ground, UPS Blue, UPS Red, Federal Express, or whichever carrier you request. A 10 day trial is available on all equipment.

Remember, when you need test equipment—think Print! "We make ordering simple."

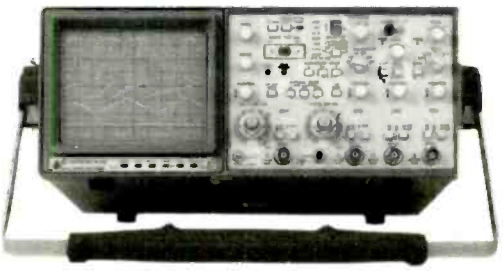
A toll-free phone 800-638-2020 and toll-free fax (800) 545-0058 are available for your convenience. Please contact us for our free catalog.

PRINT™ Products International

SPECIAL ADVERTISING SUPPLEMENT

## HITACHI

***Digital Storage scopes***



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| VC-6025A | 2 Ch, 50 MHz, 20 MS/s, 50 MHz repetitive sampling, 2 KW/ch, frequency counter, RS-232 w/HPGL support | 2695.00 | PRICE QUOTES! |
| VC-6045A | 2 Ch, 100 MHz, 40 MS/s, 100 MHz equivalent sampling, 4K Mem, frequency counter, RS-232 w/HPGL support | 3295.00 | CALL FOR PRICE QUOTES! |
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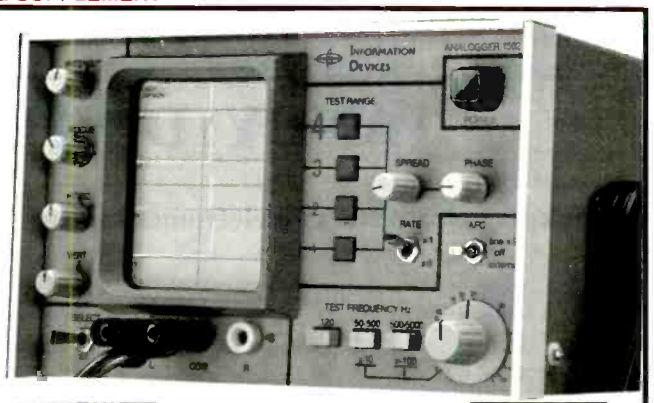

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REPLACEMENT PARTS SHOWCASE

# Tandy National Parts

**900 East Northside Drive**
**Fort Worth, TX 76102**
**Phone: 1-800-442-2425**

Tandy National Parts was established in 1961 to supply replacement parts for products sold by the small but growing chain of Radio Shack stores. With Radio Shack's growth into the nation's largest retailer of consumer electronics products, Tandy National Parts has become one of the nation's largest and most reliable volume shippers of electronic replacement parts.

Its facilities are located in Fort Worth, Texas, near the corporate headquarters of its parent company, Tandy Corporation.

Today, Tandy National Parts supplies more than 7,000 Tandy retail outlets, 120 company-owned service centers, a large number of OEM manufacturers and thousands of other customers.

Parts availability is a hallmark of Tandy National Parts. A modern 150,000-square-foot warehouse facility and an advanced inventory system stocks more than 90,000 SKUs with parts and components from more than 500 vendors. The parts inventory is monitored so closely that the percentage of out-of-stock items is less than two percent.

On an average day, approximately 8,000 parts are shipped to Tandy National Parts customers. Each year, nearly 1.5 million calls are received over 72 inbound WATS lines. Orders placed before 2:00 p.m. (CST) are normally filled by the next day.

From friendly and knowledgeable operators to assist customers, to computerized order entry and processing, Tandy National Parts has the ability to service customers' needs.

Tandy National Parts also stocks owner's manuals and service literature for Radio Shack/Tandy and GRiD products. These can be obtained by calling 1-800-442-2425.

Customers can use a variety of payment plans to purchase replacement parts from Tandy National Parts. Parts are shipped UPS unless otherwise specified by the customer. An operator will be glad to provide information on these services.

Tandy National Parts has a well-deserved reputation in the parts distribution industry and a standing commitment to dependable, courteous and responsive customer service.

To place an order to electronic parts, or check price and availability, call 1-800-442-2425 from 8:00 a.m.-5:00 p.m., CST, Monday through Friday.

Call 1-800-442-2425 for more information or circle number 101 on reader service card.

SPECIAL ADVERTISING SUPPLEMENT

REPLACEMENT PARTS SHOWCASE

# MCM Electronics

650 Congress Park Dr.
Centerville, OH 45459-4072
Phone: 800-543-4330
FAX: 513-434-6959

MCM Electronics is a company of dedicated people committed to offering only the best electronic parts, components and services to the customer.

Because the electronics industry is constantly changing, MCM Electronics continually and thoroughly researches the market to meet its ever changing needs. And MCM is constantly in touch with national and international manufacturers to bring both commonly used and hard-to-find products to its customers. In fact, two full-sized catalogs are mailed each year. The latest issue introduced more than 1,400 new items. MCM is a Premier Distributor for RCA/GE replacement parts. MCM carries many brand names including: Chemtronics, Fluke, Panavise, Sams Photofacts, Weller, Xcelite, Hakko, Leader, Hitachi, 3M and many more. Over 20,000 items are stocked.

Sales flyers are mailed regularly which feature specially priced products. These flyers keep the customers constantly informed of new items that are being added.

The sales department answers all calls promptly and efficiently. The sales representatives are professionals who are available on toll-free lines to provide immediate information on stock availability and pricing. They are available Monday through Friday, 7:00 a.m. to 8:00 p.m. EST, and Saturday 9:00 a.m. to 6:00 p.m. EST. Orders can be placed after hours with a national toll-free number, ensuring service 24 hours a day, seven days a week. MCM also provides highly trained electronic technicians to answer customers product questions. With a separate toll-free "Tech Line," customers receive prompt answers to their product questions by calling 1-800-824-TECH (8324).

MCM offers a broad range of payment terms. Customers can have their orders shipped COD or establish Net 30 terms, charge to MasterCard or Visa, prepay by company check or pick up their order at the Dayton, Ohio Distribution Center Will-Call area. There is a $20 minimum order for COD, checks and open accounts, and a $25 minimum for MasterCard and Visa orders.

A second distribution center will open in Sparks, Nevada just outside Reno. This warehouse will service all customers west of Denver, allowing MCM to provide two day shipping service to all customers nationally.

For more information and a free catalog, call 1-800-543-4330, in Dayton, OH call 434-0031.

SPECIAL ADVERTISING SUPPLEMENT



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REPLACEMENT PARTS SHOWCASE

# MAT Electronics

975 Jaymor Road
Southampton, PA 18966
Phone: 800-628-1118
FAX: 800-628-1005

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

MAT Electronics stocks an extensive line of flybacks (TV and monitor), 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 competitve pricing.

The company publishes an easy-to-read 72-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 lable service is also available to ensure even faster delivery service if necessary.

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

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

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

SPECIAL ADVERTISING SUPPLEMENT

## VCR REPLACEMENT PARTS

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| VXP0521 Panasonic Idler Orig. | $2.99ea (10 min) |
| 164113 RCA Idler Original | $2.99ea (10 min) |
| NPLY0111GEZZ Idler Original | $9.95ea |
| 613-022-2534 Sanyo/Fisher Gear | $.69ea (10 min) |
| 199347 RCA Belt Kit | $2.95ea |
| VTK-1 Video Tool Kit (15 Pc) w/case | $59.95ea |
| 198522 Audio Bias Oscillator | $2.25ea |
| VSJS0018 Original Panasonic Solenoid | $5.95ea |
| VEMS0099 Panasonic Motor | $8.95ea |
| 143-0-7504-01000 Fisher Belt | $.85ea (10 min) |
| 157061 RCA Belt | $.85ea (10 min) |
| 157062 RCA Belt | $.85ea (10 min) |
| MSU911 Toshiba RF Mod | $14.95ea |
| MSU951 Toshiba RF Mod | $14.95ea |
| VA3409 Emerson RF Mod | $14.95ea |
| VA3422 Emerson RF Mod | $14.95ea |
| RTU006GEZZ Sharp RF Mod | $14.95ea |
| RTU0035GEZZ Sharp RF Mod | $14.95ea |

## POPULAR SEMICONDUCTORS

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| 2SD1426 | $1.99ea (10 min) |
| 2SD1427 | $2.50ea (10 min) |
| 2SD1650 | $1.99ea (10 min) |
| 2SD1651 | $2.50ea (10 min) |
| 2SD1879 | $2.50ea (10 min) |
| JU0017 | $11.95ea |
| JU0069 | $11.95ea |
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| STK4273 | $8.95ea (10 min) |
| STK0080 | $14.95ea |
| STK5481 | $12.50ea |
| TA7777 | $9.50ea (10 min) |
| TDA4505A | $8.95ea |
| TDA8305 | $9.50ea (10 min) |
| UPD1705C12 | $9.95ea |

## POPULAR FLYBACK REPLACEMENTS

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| 154-074E | Goldstar | $19.95ea |
| 2434391 | Hitachi | $29.95ea |
| 2434651 | Hitachi | $29.95ea |
| 3214003 | Emerson | $24.50ea |
| 043220011 | Emerson | $29.95ea |
| 79A307-1 | AOC | $24.95ea |
| 1-439-357-11 | Sony | $29.95ea |
| F0014 | Sharp | $19.95ea |
| F0015 | Sharp | $19.95ea |
| F0016 | Sharp | $19.95ea |
| F1588 | Sharp | $29.95ea |
| TLF14401F | Panasonic | $29.95ea |
| TLF14423F | Panasonic | $29.95ea |
| TLF14530 | Panasonic | $29.95ea |
| TLF14515F | Panasonic | $29.95ea |
| TLF14561F | Panasonic | $29.95ea |
| TLF14801F | Panasonic | $22.50ea |
| FCC1415AL | Samsung | $19.95ea |
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| 100M/160V | Radial | $1.00ea (10 min) |
| 100M/200V | Snap-in | $1.00ea (10 min) |
| 100M/250V | Radial | $1.25ea (10 min) |
| 330M/200V | Snap in | 10/for $5.00 |
| 470M/200V | Snap in | $1.99ea (10 min) |
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| 800M/200V | Snap in | $1.99ea (10 min) |
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**REPLACEMENT PARTS SHOWCASE**

# Premium Parts +

**P.O. Box 28**
**Whitewater, WI 53190**
**Phone: 800-558-9572**
**FAX: 800-887-2727**

PREMIUM PARTS + Electronics Company is a leading distributor of electronic parts, supplies and information. At PREMIUM PARTS +, our customers come first in everything we do. The entire PREMIUM PARTS + staff is dedicated to working hard to provide all of our customers with high quality products and the best service and cross reference material possible to assure their complete satisfaction.

PREMIUM PARTS + offers a free catalog listing over 10,000 popular items available at economical prices and volume discounts. Our catalog is also the source for the complete PRB Line Replacement Belt System. It contains all the information you need to order the right replacement belt for most electronic equipment.

This year, the PRB LINE introduced two new and exciting reference products: 1) The PC Cross Guide; and 2) Innerworks™ VCR Mechanical Replacement Booklets.

The 1993 edition of the PRB Comprehensive Belt and VCR Parts Cross Guide is available both as a manual and the new PC version. The convenient, easy-to-use computer disk*, PC Cross Guide, has a self-driven menu which quickly and accurately provides the information needed to get the replacement part and/or belt needed in mere seconds. (*Available on either 5 1/4 inch or 3 1/2 inch disks. System requirements: IBM compatible, DOS 3.1 or higher, 512K Real memory and 7MB free hard disk space minimum.)

Both versions of the Cross Guide have been updated to feature the latest comprehensive information on replacement parts and/or belts for: VCRs; camcorders; answering machines; CDs; cassettes; car stereos; plus replacement belts for a wice variety of electronic equipment.

InnerWorks—VCR Mechanical Replacement Booklets provide mechanical information for a wide variety of VCR makes and models. Each booklet includes detailed, easy-to-follow mechanical drawings, as well as complete listings of all mechanical parts and assemblies for each model included.

InnerWorks booklets are arranged and grouped in families so you can:

- Economically obtain the information you need (each booklet provides information for 15-20 VCR models of a particular manufacturer).
- Easily solve VCR failures—since 80% of them are due to mechanical parts malfunction.
- Gain the knowledge of which models use similar parts.

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 $5.75 charge, regardless of its weight. * For many customers this is faster than UPS Ground Service. Of course, since UPS does not make regular deliveries on weekends, Thursday orders will be delivered on Monday, and Friday orders will be delivered on Tuesday of the following week. Or we'll send your order via UPS Overnight Air with a guaranteed noon delivery anywhere in the 48 states for just a $14.75 charge, regardless of its weight. * For PREMIUM DELIVERY service just place your order before 3:00 P.M. CST on any week day, and specify if you want 2nd Day Air or Overnight Air delivery.

*NOTE: Plus a $1.75 handling charge. Excluded from this offer are: Shipments to Alaska and Hawaii; chemicals; Eveready & camcorder batteries; literature including Tech Library; and all back orders.

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 + wants to be your one source for high quality electronic products. Call us toll free at 800-558-9572 for your FREE copy of our exciting new 1993-1994 catalog. Remember . . . PREMIUM PARTS + is First in Quality, Service and Delivery!

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PREMIUM PARTS+ ELECTRONICS COMPANY™

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*See feature above for complete details

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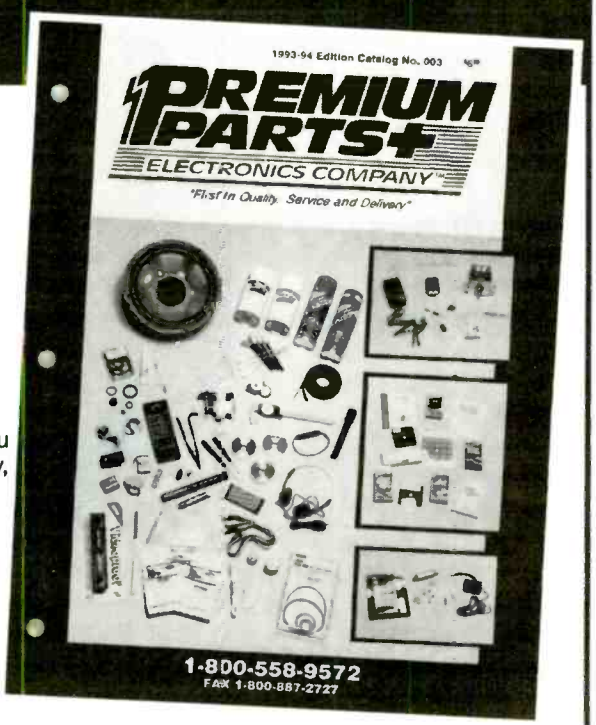


P. O. Box 28 . Whitewater, Wisconsin 53190

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REPLACEMENT PARTS SHOWCASE

# Video Display Corporation

1868 Tucker Industrial Dr.
Tucker, GA 30084
Phone: 404-938-2080
FAX: 404-493-3903

Since its founding in 1975, VDC has always been a leader in the replacement cathode ray tube business. We are now expanding our replacement projection CRT line since we find that too many service dealers have difficulty in getting quality replacement projection tubes.

In the early days of projection TV repair, CRT's were not always immediately available, pricing was not stable, quality and warranty were not too reliable. VDC elected to enter the market to provide a stable source. First, the Kloss Videobeam tube plant was purchased with exclusive manufacturing rights. By moving the equipment to an established plant in Bossier City, LA, already owned by VDC and manned by trained personnel, VDC was able to reduce production costs, increase quality and stabilize quantities to the point that the order backlog was virtually eliminated. Now, new contracts with other projection set manufacturers have increased production and quality plus allowing VDC to sell a broad line of projection tubes directly to service dealers at fair prices and a one year warranty. The projection tube division is expanding constantly and continuing to build a marketing relationship with projection set service dealers.

Several factors make the manufacturing of projection tubes different from a standard color TV tube. One, there is no mask in a projection tube. Instead, there are three monochrome tubes, each a red, green and blue. When a projection tube is recycled, the glass is the only thing that is reused. New phosphor screens and electronics are always installed, thus producing a product equal to the original. Great care is used to purchase the factory's original phosphor type, giving us an exact match. Therefore, your customer sees the same quality image he is accustomed to viewing.

As HDTV gains a foothold in the American market, you will see more and more projection TV sets made. The projection tube can be adapted more easily to HDTV than the dot-matrix or stripe-matrix tubes. These HDTV tubes will be quite expensive to begin with, placing both sets in the same retail price range. This remarkable situation will increase projection TV set sales. Whatever happens, VDC will be there to give full support to your service needs.

REPLACEMENT PARTS SHOWCASE

# Herman Electronics

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

Herman Electronics is a diverse, full-line distributor of everything in electronics. The company, now over 40 years old, has clearly established itself as one of the best in the industry by providing quality products to all phases of the electronics industry.

Herman Electronics' product base varies from transistors to soldering stations and everything in between including all types of batteries, audio, video and telephone accessories, cable, connectors, semiconductors, test equipment, tools, line conditioners, solder, chemicals, universal remote controls, audio and video tape in all formats, and much more.

The heartbeat of the business lies in the OEM parts department. While servicing the industry for over three decades, Herman Electronics has acquired many of the major OEM parts lines in order to provide more efficient and cost effective service to you. Herman Electronics is a factory authorized original replacement parts and accessory distributor for Sony, Magnavox, GE, Samsung, Panasonic, RCA, Quasar, Sylvania, Casio, Philco, Technics, and Philips. Stocking one of the largest and most comprehensive inventories, we fill over 80% of our orders from our 25,000 stocking items and guarantee two-day service to your door 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 maintaining a standard of excellence in serving customers. We have several service representatives to serve your needs from 8:30 a.m. to 5:30 p.m. (EST) Monday through Friday and from 8:30 to 12:30 on Saturday. Whether your request is for pricing, stock availability, or research, the company's toll-free lines and 24-hour fax lines are readily available to fulfill all of your requests. Furthermore, the company guarantees to fill your research requests within three hours and generates computerized backorder reports with ETAs to keep you abreast of your backordered items.

The company prides itself on being flexible and accommodating to its customers' requests. "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. Our industry has clearly become service oriented. Therefore, we are dedicated to maintaining a standard of excellence in serving our clientele."

The fringe benefits provided by Herman are several resulting in service and customer satisfaction second to none. All out-of-state orders are shipped UPS 2nd day air at no extra charge. Several methods of payment are available including a net 30 day open account, COD, and Visa and MasterCard. To accommodate the west coast, and after-hours orders and requests, Herman Electronics has a sophisticated electronic phone ordering system to accommodate you 24 hours a day, seven days a week.

If you have not given Herman Electronics a try, please do so, you will be glad you did. Herman Electronics—experience, reliability and service excellence.

SPECIAL ADVERTISING SUPPLEMENT

REPLACEMENT PARTS SHOWCASE

# Russell Industries, Inc.

3000 Lawson Blvd.
Oceanside, NY 11572
516-536-5000
FAX: 516-764-5747

Russell Industries has supplied top quality replacement components into the electronics distribution market for over 25 years.

Current product categories include antennas, capacitors, solderless terminals, heat shrinkable tubing, rubber bumpers, and grommets, flyback transformers, fuses (through the Seneca division) and VCR repair parts including belts and idler wheels (through the EVG division).

All products are marketed by a network of over 1500 recognized distributors throughout the continental United States and Alaska and Hawaii.

Russell Industries is famous for their policy of "same day shipping and no back orders." Our knowledgeable and courteous customer service department is ready to assist in any situation from taking orders to locating and cross referencing hard to find parts.

Cataloging and literature are a high priority at Russell. Constant updates are published to reflect current trends in the industry. All catalogs are available on a no charge basis.

Russell has maintained efficient operations through continual innovation. One of the first companies in America to offer a toll-free (800) number (in use since 1972), they have recently added a toll-free (800) fax number to improve customer communications.

Existing product lines are periodically reviewed to guarantee that new items are being added as necessary. Entire new product categories are frequently introduced in order to allow customers "one stop shopping."

The latest product category to be introduced is Russell's full line of electronic hardware that includes metric and non-metric screws and nuts. Another recent product introduction is a full line of capacitors (electrolytic, mylar, tantalum, etc.). The flyback transformer line continues to grow with an additional 22 models just in the last year.

Family owned and operated, Russell Industries is firmly committed to the electronics servicing business. Russell Industries will continue to invest and innovate in order to provide the best products and services available.

**Semiconductor Cross Reference Data Book, Compiled by Howard W. Sams & Company, Prompt Publications, 656 pages, $24.95 paper.**

*The Semiconductor Cross Reference Data Book* is a comprehensive guide to semiconductor replacement. Compiled by the engineers at Howard W. Sams & Company, the makers of Photofact service documentation, the guide contains over 475,000 part numbers, type numbers, and other identifying numbers, including those from the United States, Europe, and the Far East.

This data book is four cross references in one, showing replacement from NTE, ECG, TCE, and Radio Shack. Also included is an up-to-date list of original equipment manufacturers.

All major types of semiconductors are covered including bipolar transistors, FETs, diodes, rectifiers, integrated circuits, SCRs, LEDs, and thermal devices.

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

**Telephone Repair Illustrated, By Stephen J. Bigelow, TAB Books, 240 pages, 169 illus., $17.95 paper, $27.95 hardcover.**

*Telephone Repair Illustrated* gives do-it-yourselfers practical guidance to install, troubleshoot, and repair virtually any type of telephone, as well as a variety of tape and non-tape answering machines.

Bigelow guides readers through every aspect of telephone technology, from basic components and circuitry to wiring systems and test equipment. With more than 150 helpful illustrations, *Telephone Repair Illustrated* shows how to quickly locate and repair problems with classical, rotary, push-button, cordless, and cellular telephones.

Bigelow is an electrical engineer specializing in the repair of computer and telecommunications equipment. An experienced technical writer, his articles have appeared in *Modern Electronics* and other magazines. He is the author of *Troubleshooting and Repairing Computer Printers* and *Maintain and Repair Your Computer Printer and Save a Bundle.*

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

**Oops! What To Do When Things Go Wrong, By Mike Miller, Que Publishing, 366 pages, $16.95.**

This is a new book published by Que. It's written for anyone who's ever met computer problems head on and didn't know how to solve them. *Oops! What To Do* is aimed at users who have turned on their computer and nothing happened, typed in a command and the computer just beeps, received an uninterpretable error message, or has deleted a file by mistake.

The plain English explanations in this book help users fix many common PC problems. Having read this book, users will never have to say "oops!" again. Instead, they can get a handle on what's plaguing their computer systems.

Que Publishing, Prentice Hall, Carmel, IN 46032

# Test your electronics knowledge

**Answers to the quiz (from page 41)**

1. A. We don't usually think of it as a diode, but, it is.

2. C. Because of their low transit time and small planar electrodes, the nuvistors worked very well at high frequencies.

3. C. Grid current is possible in the triode tube. Of the FETs named, only the JFET can have a gate current.

4. D. In the tube a grid *voltage* controls the current through the device. For the bipolar transistor a base *current* controls the current through the device.

5. Thyratrons. They are tube equivalents of the SCRs.

6. Phanatrons. They are capable of very high forward currents.

7. B. The triode introduces less distortion and generates less noise. However, the advantages of the pentode outweigh its disadvantages.

8. B. The purpose of the capacitor is to prevent degenerative feedback. The low value of C results in a very high $X_c$ and poor low-frequency response.

9. Contact bias. Because of its physical size the grid will intercept some electrons moving from cathode to plate. Those intercepted electrons must return to the power source through the grid resistor. Even though the current may be only a fraction of one microampere, it will produce the required bias voltage when passing through the high resistance of the grid resistor.

10. A. Grid leak bias requires grid current during a part of each cycle of input signal. No gate current flows in a MOSFET.

# Readers' Exchange

Readers' Exchange has been reinstated as a free service.

The following restrictions apply to Readers' Exchange:

- Only individual readers may use Readers' Exchange, and items must be restricted to those that are ordinarily associated with consumer electronics as a business or hobby. If you're in business to sell the item(s) you want to offer for sale, the appropriate place for your message is in a paid advertisement, not Readers' Exchange.
- Readers' Exchange items must be restricted to no more than three items each for wanted and for sale, and may be no more than approximately four magazine column lines in length (about 20 words).
- All submissions must be typed or printed clearly!

Send your Readers' Exchange submissions to:

**Readers' Exchange**
**Electronic Servicing & Technology**
**76 N. Broadway**
**Hicksville, NY 11801**

## WANTED

Student needs service manual/schematic for Multitech MV-080. Also looking for front assy. or timing gears. *Greg LaCava, 3900 Mumphrey Rd., Chalmette, LA 70043; 504-277-3256.*

Service manual or schematic for AKAI GXC-760D cass. deck. Will purchase or copy. *Richard Sereda, College of San Mateo A-V, 1700 W Hillsdale Blvd., San Mateo, CA 94402.*

Service manuals for Fisher VCRs, adapter socket #CR-42 for B&K 470 CRT checker. *Ed Herbert, 410 N. Third, Minersville, PA 17954.*

Cassette carriage (complete), for Zenith VRE 200 VCR. Used and in good condition. *Call Jackson VCR 1-205-643-5906.*

Heath Kit meter model #1M2212 wanted for parts. *G. O'Gara, 11 Crag Lane, Levittown, NY 11756; 516-731-4075.*

A very modestly priced working or repairable Sencore Z meter, any model will do. *W. Weathers, PO Box 51412, New Orleans, LA 70151-1412; 504-483-7685.*

Service manual for model #791C TMK color TV & Nakamichi 1000 tape deck. *Call 415-868-2930 OR write to Jack Soman, PO Box 422, Bolinas, CA 94924.*

A schematic for a Curtis Mathes TV model J2572-RG. A copy will be okay. Will pay for either one. *M.A. Garcia, PO Box 5664, Oxnard, CA 93031-5664.*

Working or non-working test equipment, audio equipment and used electronic parts. *Call 1-800-649-1144; Selwyn Joseph.*

Panasonic video phone model #WG-R2. *Ross Factory Service. 123 Farnsworth Ave., Bordentown, NJ 08505; 609-298-1106.*

RCA test jig that has the CTC140 yoke & CRT yoke matching unit and focus adaptor pack or any other test jig for checking new chassis. *Call Wayne at 504-277-6735. New Orleans., LA.*

The following tubes: 2AV2, 3A3C, 6EN4, 6H26, 12HG7. Must be new tubes in original cartons. *Max Seligsohn, FADA Industries, 3100 47th Ave., Long Island City, NY 11101.*

## FOR SALE

Sencore VC93 VCR Analyzer for sale with all leads, instructions, and original packaging. New (used three times). Worth $3000.00, will sell for $2000.00. *Call Jill at 1-207-628-4701 or write to Lattin Electric, RR 1, Box 3785, North Anson, ME 04958.*

Scopes: Tek's 422—2 MHz portable, $400.00 & 453—50.00 MHz, $550—both very good condition. Hitachi U355—35MHz $475.00, like new. Tel. Cal at 718-833-3156 or send S.A.E. for list of misc. shop test equip., to *Cal Caldero, 251 80th street, Brooklyn, NY 11209.*

Bell & Howell TV & Radio Repair course (11 volumes) with trainer. $100.00 plus shipping. RCA service manuals (1955–1961)—$7.00 ,RCA service manuals (1967–1968)—$7.00, RCA pict-o-guide (1949) Vol. I & II for $5.00. All plus shipping. *Phone: 412-483-3072*

Bunting 5BC Nurse Call components. Some new, some used. All will work. Will trade. May deliver. *Gary Baldis, 9108 Blazing Fire Ct., Las Vegas, NV 89117.*

VCR parts. Used, upper & lower drums, capstan motors, transformers, etc. for many older RCA, Lloyds and Mitsubishi, VCRs. *Call Jackson VCR at 1-205-643-5906.*

Sencore SC3080—80MHz waveform analyzer. One year old. Light use. Excellent condition. $2500.00. *Call Kent at 314-845-0010.*

Sencore FE160 Field Effect Hi-Lo meter, complete w/leads & instruction manual, $75.00. Sencore CR-31 Super Mack pix tube tester w/manual and setup book dated 1989, $100.00. Sencore TR15A transistor tester w/manual $20.00. Sencore MU150 tube tester, manual & setup book, $100.00. All prices include shipping. More items available. *Quality Electronics, Wallace Huffman, 2579E CR 550N, Warsaw, IN 46580-7183. Phone: 219-453-4811.*

Almost new Leader LBO-515B—30 MHz dual trace, delayed time base oscilloscope. Includes manuals and probes. List $3495.00. $1400.00 or best offer. *Jim, 1199 Partrick Rd, Napa, CA 94558. 707-224-4566.*

Shop leaving the repair field. Selling service manuals—Philips last 12 yrs., RCA/GE, last 10 yrs., various others. Send SASE for complete list to *Jasper County Electronics, Rt. 3 Box 153-C, Monticello, GA 31064.*

We're down-sizing our repair facility. *Call 203-885-1499* for list of available equipment, office supplies, and computers.

Sams Photofacts—33 thru 512. Some missing. 391 sets. $100.00 plus shipping. *J. Berkeyheiser, 1950 Kinter Ave., Trenton, NJ 08610; 609-585-4988.*

Sencore VC-93 VCR analyzer for sale, with all original cables, manuals, etc. *Call Art at 707-226-6235 9–5 T–F PDT.*

Leader 9 inch scope (2 available) for use with external sweep generator—Model LBO-9—new—in boxes—original distributor cost $1195—will sell for $399 each. *Call 305-655-0172—leave message for Carlos.*

B & K 465 cathode ray tube checker/rejuvenator/ with 20 adapters—600 new GE receiving tubes—0–1500 Sams Schematics not solid—best offers. *Martin E. Wiedenbeck, 7773 Akron Road, Lockport, NY 14094.*

Sencore SG165 with cables and manual, $350.00. *Curt Hancock, 518 2nd St., NW, Mt. Vernon, IA 52314; 319-895-8724.*

Sams Photofacts 1 to 1743 in metal file cabinents; Sencore AM/FM stereo analyzer model SG-165. Make offer. *507-789-6845 OR Charles Johnson, 510 4th St., Kenyon, MN 55946.*

VHS/Beta video head tester with leads, instructions, battery, original box. $29.00. *Call 303-686-7250.*

Hewlett Packard 175A scope w/1755A dual trace and 1781B delayed sweep modules: $300.00. Two RF generators—one H-P 6080 AM and one US Army SG-3 FM: both for $400.00. Precision E-450 color generator: $50.00. *Marc Loring, 206-456-4522. from 10am–9pm PST.*

Diehl Mark VII diagnostic computer with operators manual. Sell or trade for other test equipment. *George McNaught, Jr., Star Rt. #1, Box 38, Crescent City, FL 32112; 904-698-1529.*

Complete TV servicing library 1,028 Sams Photofacts sets #2131 (2/83) thru #3159 (current) including cabinets—$7,400.00. *George's Radio/TV, Rt. 3, Box 137, Waverly, TN 37185; 615-296-3631.*

Sencore PA81 w/field battery and SG80. Both complete with all accessories and covers. Hardly used 1 1/2 yrs. old. $3800.00 for both. *Coastal TV Service, PO Box 352259, Palm Coast, FL 32135-2259; 904-437-4450.*

Sams Photofacts 1–1598 complete includes five 4-drawer file cabinets, best offer. Sencore SC61 mint 1 yr. old hardly used $1,999.00. Sencore CA55 capacitor analyzer $95.00. *Danny Garris, New Bern, NC; 919-638-4477 (day).*

Sencore CR70 Pix tube checker. 3 months old—still has warranty. $1000.00. *Plentywood Electric, 113 N. Main St., Plentywood, MT 59254; 406-765-1851 OR 406-765-2780.*

# Classified

Classified advertising is available by the word or per column inch.

**By-the word.** $1.65 per word, per insertion, pre-paid Minimum charge is $35 per insertion. Initials and abbreviations count as full words. Indicate free category heading (For Sale, Business Opportunities, Miscellaneous, Wanted). Blind ads (replies sent to ES&T for forwarding) are $40 additional. No agency discounts are allowed for classified advertising by the word. Contact Emily Kreutz at 516-681-2922 to place your classified ad (by-the-word). Mastercard, VISA, American Express and Discover are accepted for phone or mail orders.

**Per column Inch** (classified Display): $235 per column inch, per insertion, with frequency discounts available, 1" minimum, billed at 1/4" increments after that 10" maximum per ad. Blind ads are $40 addition. Reader Service Number $25 additional to cover processing and handling costs. (Free to 4-inch or larger ads.) For more information regarding classified display advertising please call 516-681-2922. Optional color (determined by magazine) $150 additional per insertion.

Send your order, materials and payments to:
**Electronic Servicing & Technology**
**76 North Broadway**
**Hicksville, New York 11801**
**Attn: Emily Kreutz**
**Phone: 516-681-2922**
**FAX: 516-681-2926**

## FOR SALE

**REMEMBER,** It's not the quantity of TIPS but the Quality of Solutions that makes the difference. Our 10,000 TECH-TIPS cover VCR-VCP-TV/VCR Combo CD/LD-FAX-Camcorder/VHS/SVH/C/8MM/ Camera-Stereo TV Monitors/TV/Computer-Rear/ Overhead Projection Amplifiers-Microwave-Satellite. Our program is actual day to day repairs, written by technicians for technicians. No need for you to spend time updating your data base or paper binders. We send you a complete revised program at each update of your choice (computer or paper format). Outside technicians & students love the portability and say it is a must for the field where time is very critical. As an added extra, we provide you with an FCC ID Cross reference list which saves the expense of purchasing service manuals you may already have and just don't know it. Also, when you join our ongoing program we will send you a key to streamlining your company into profitability overnight! (We actually did it!) **CALL NOW (305) 474-2677 FOR A "FREE" DEMONSTRATION DISK OR PAPER FORMAT** or mail request to **TV-MAN SALES & SERVICE, 8614 SR-84, Ft. Lauderdale, FL 33324.**

**VCR AND TV SERVICERS** ** Make those hard repair jobs easy with our up to date symcure information **1800 item VCR symcure file and 1200 item TV tough dog symcure file available on IBM compatible disk and print out. VCR disk w/po $85.00 print out only $45.00. TV/dog, disk w/po $85.00 print out only $45.00. VCR Tune Up Center, 2610 Bay Road, Redwood City, CA 94063. 1-800-777-7883

******** The TIP Computer Program ******** The **BEST** technical tip database program on the market today. **One of the largest tip databases in the country — over 12,000 tips!!!** Used by National Association members & officers. HIGHER INTELLIGENCE SOFTWARE, 60 Farmington Lane, Melville, NY 11747 (516) 643-7740

**SENCORE** VCR analyzer VC-93 less than 9 months old. Like new. Asking $1,500. Call 612-598-3955.

**NAP A340309-1002/1003 TUNER CURE!** Repair yourself and save! For compete instructions send $15.00: **TEK Enterprises** 212 Marabou Dr. Newark, DE 19702.

**MONITOR REPAIR SOFTWARE.** Designed for the bench technician, fast easy to use, eliminates costly testers. Write or call for details. Fassenden Technologies, 116 North Third Street, Ozark, MO 65721 (417) 485-2501.

**SENCORE** SC61 Wave Analyzer $1600 & SG165 AM/FM Stereo Analyzer $600 Both With Manual & Probe Excellent Condition 310-547-5652 Stew.

**"TEKTRONIX SCOPE SALE!** New & used scopes with TV Trigger. Many models to choose from. Also have Sencore Equipment available. Call **TEST EQUIPMENT SALES** (603) 434-2544 or write to P.O. Box 986, Londonderry, NH 03053"

**VCR SHOP CLOSING:** Sencore SC3080, VC93, LC102, PR57, Tentel package, Service literature & parts, much more. Excellent Condition. Priced for quick sale. Call for details. Central Pennsylvania. 717-774-4488

**CM2000 MONITOR ANALYZER.** Purchased new in 12/92. Sent to Sencore for calibration, test, and upgrade in 6/93. 1 year warranty started 6/93. Best bid gets it. Mark (417) 889-1558 after hours.

**REDUCED 85%.** Diehl Mark III $69, Diehl Mark V Horizontal circuit tester $179. New. Conductive coating for remote control keypads S9.99 ppd. WEEC, 2805 University Ave., Madison, WI 53705. 608-238-4629, 608-233-9741.

**CABLE TV DESCRAMBLERS/CONVERTERS** Wholesale Outlet. All major brands. Money back guarantee. 1 year warranty. **THE CABLE CONNECTION 800-764-5400. DEALERS WANTED.**

**VHS-VCR** Repair Solution Sets I, II, III IV, V, VI, VII, VIII. Each contains 150 symptoms and cures, updated cross reference chart, free assistance, $11.95 each, all eight $79.95. Schematics available. Visa/MC. Eagle Electronics, 52053 Locks Lane, Granger, IN 46530.

**COMPUTER AIDED TV/VCR REPAIR SOLUTIONS:** 5 1/4" IBM compatible disks, 1,000 VCR, Printout $83, Disks $72. 5,400 TV, Printout $135, Disks $113 (Harddrive). Add to or quick scan by chassis, model and stage. Two solutions pays for it. Electronic Solutions, 407 W. Ave. "N", San Angelo, TX 76903.

**TV-VCR SHOPS:** Now fix those tough dogs! A program of over 2800 fixes on disk. One fix could pay for all. Only $99.95. TECH-DAT, 212 Earth Row, Waynesville, MO 65583. To order call 1-800-280-2100. VISA & Mastercard Accepted.

**HERE'S HELP FINDING THOSE ELUSIVE PARTS! Tech ReSource** is a data base of hundreds of Consumer Electronic Distributors nationwide, Cataloged by Manufacturer. IBM 3 1/2-5 1/4. Visa/MC 1-800-580-4562. 24.95ppd. M.C. Humphrey & CO. P.O. Box 1414 Noblesville, IN 46060.

**TV CASE HISTORIES:** Booklet with 1,750+ histories. Satisfaction assured. Only $35 (first-class shipping add $1.50). Mikes Repair Service, P.O. Box 217, Aberdeen Proving Ground, MD 21005. Same mailing address 29 years. Send SASE for samples.

**SENCORE:** All like new. SC61 $1,700.00, VA62,3,4 $1,700.00 DVM38 $150.00, AC Cricket $150.00, DC Cricket $150.00, Super Mack CRT restorer w/dandy dapter $400.00, SG65 Stereo analyzer $600.00, VA48 $400.00, CB41 $100.00 1-914-687-4309/6-9 EST.

## BUSINESS OPPORTUNITIES

**MOVE TO SUNNY SOUTH FLORIDA:** A Turn of the key guarantees minimum take home of $100,000. Owner retiring. Fully staffed in largest growth area of Ft. Lauderdale. Established 12 years, no competition. Authorized 15 major brands. 100 percent computerized. Simple to operate business. Owner financing available. Call for details 305-474-3588.

**40 YEAR OLD ELECTRONIC SERVICE COMPANY FOR SALE.** 6 Bench Techs - 2 outside service vehicles. C.O.D. (no warranty or sales). Building Included 7500 sq ft., Land 27,000 sq ft. prime corner location. Miami Florida over 1 mil, 1-305-220-3106. Spanish Helpful.

## WANTED

**EXPERIENCED ELECTRONIC TECHNICIAN** - VCR Television repair - factory trained a strong help. Live in the beautiful Smoky Mountains near lakes and waterfalls. Very good pay - full time. Modern store - "top of the line" equipment. Call Dave, Mountain Electronics, Glenville, NC (704) 743-2810.

***Use Your Free Reader Service Card For More Information On Companies Advertising In This Issue.***

# Advertiser's Index



**We'd like to see your company listed here too. Call Diane G. Klusner at 516/681-2922 to work out an advertising program tailored to suit your needs. Or FAX 516-681-2926.**

# SOFTWARE

PHILIPS TECHNICAL TRAINING

## Leading Supplier of Hi-Tech Training

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Call, Fax, or Write:
615-475-0044
FAX 615-475-0221

Philips Technical Training
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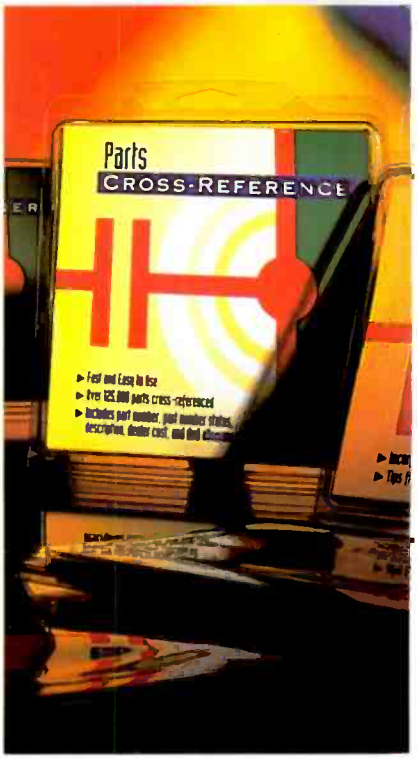
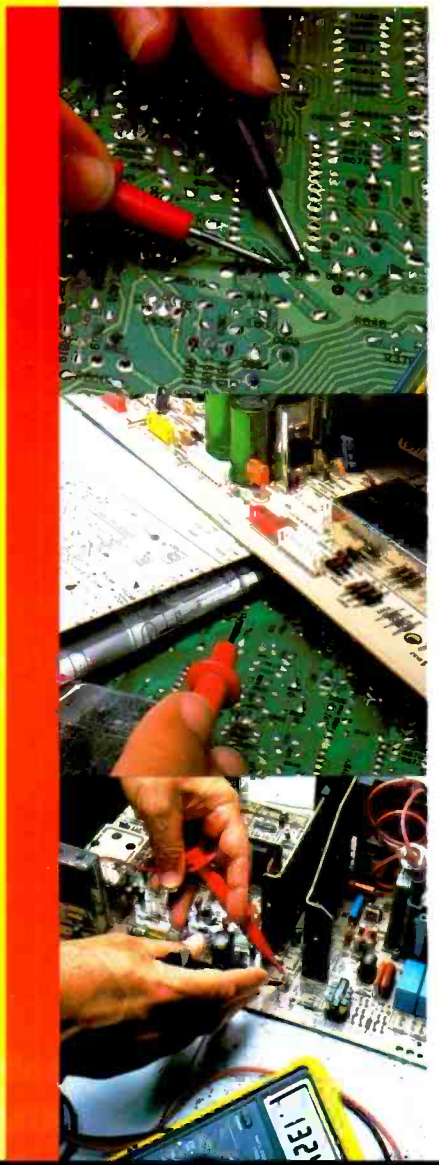
Jefferson City, TN 37760

Servicers informed us of a need for a computer program that would give instant access to part numbers, substitute numbers, dealer cost, dud allowance, and descriptions. We immediately began working to develop a program. Today, it is available and includes over 260,000 part numbers. It lists generic and Philips part numbers, as well as other key information.

Our PartSeeker program will provide part numbers used in a model or chassis when the model or chassis number (27C8), and then the component number (R114) is entered. The component in that chassis, identified by R114, is listed with part numbers. This program will greatly reduce the look-up time spent by technicians and counter people. This software includes the base program and the TV listing from 1985 through 1992. Updates will be made available.



# HANDS-ON!

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 eight 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 improve profitability and efficiency, we do our best to make it available.

## Philips Technical Training Is The Most Cost-Effective Supplier Of Light Boxes And Charts.


We learned from our training meetings that there was a need for an inexpensive light box with charts. So we built our own, and are currently selling it at a price that makes camera repair more profitable. It is now much more cost-effective for servicers to make the transition from VCR to camera repair.

Circle (34) on Reply Card

PHILIPS

# Multi-Choice.

Whether you're doing first-level troubleshooting or component-level diagnosis, Fluke meters offer you one of the widest choice of capabilities and price ranges in the industry. Choices ranging from the basic Fluke 12 with auto function V-Chek™ and Continuity Capture™. To the classic Fluke 77 with Auto Touch Hold® and current measurements.

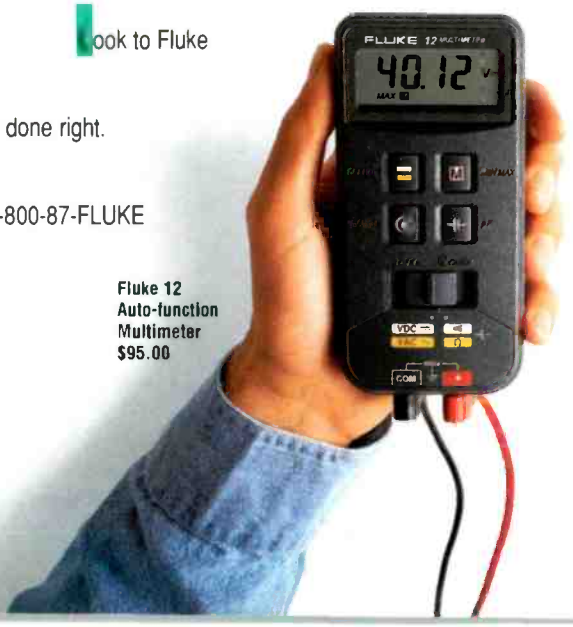

**Fluke 77**
**The classic**
**Multimeter**
**$169.00**

To the advanced Fluke 83 with Min/Max/Average recording, Frequency, Duty Cycle and Input Alert™. Plus a full line of quality accessories to extend those capabilities even further. No matter which Fluke meter you choose, you can count on precise, reliable, consistent performance year in and year out. Plus, strong customer support and product warranties that measure up to any in the industry. Make the choice that gives you the most choices.


**Fluke 83**
**Full-featured**
**Multimeter**
**$255.00**

Look to Fluke for the tools you need to get the job done right.

See your Fluke distributor, or call 1-800-87-FLUKE for a catalog and the name of the distributor nearest you.




**Fluke 12**
**Auto-function**
**Multimeter**
**$95.00**

| FLUKE 12 | FLUKE 77 | FLUKE 83 |
|---|---|---|
| The Fluke meters listed above feature DC/AC voltage, resistance, audible continuity and diode test. | | |
| Capacitance measurements | Auto Touch Hold® | Auto Touch Hold®and Relative modes |
| V Chek™ (auto function) | Current measurements | Current measurements |
| Min/Max Record with Relative Time Stamp | Analog/Digital display | Analog/Digital display |
| Two-year warranty | Three-year warranty | Three-year warranty |
| Continuity Capture™ | Yellow holster with Flex Stand™ | Yellow holster with Flex Stand™ |
| Basic accuracy 0.9% | Basic accuracy 0.3% | Input Alert™ |
| | For measurements to 4800 V-A | Capacitance measurements |
| | | Frequency and Duty Cycle |
| | | Min/Max/Avg. Recording |
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