

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

# ELECTRONIC<sup>T.M.</sup>

Servicing & Technology

December 1994/\$3.00

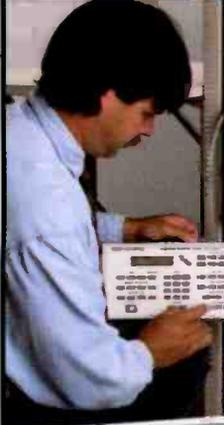
Replacement parts/servicing information sourcebook

Filter capacitors cause strange symptoms

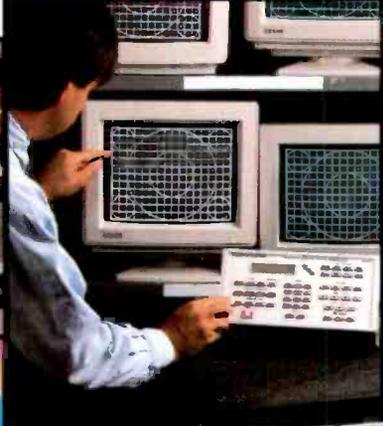
## Test equipment showcase



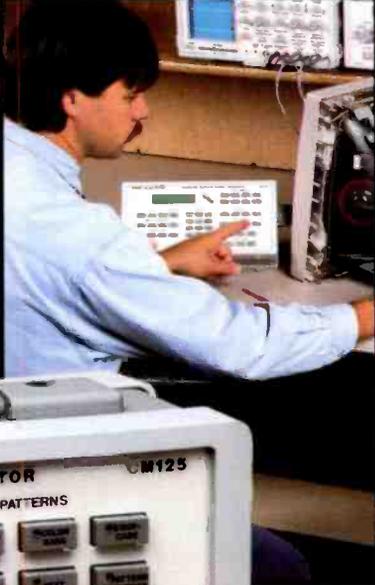
In The Field



At The Test Rack



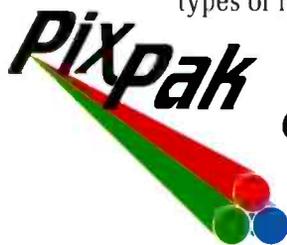
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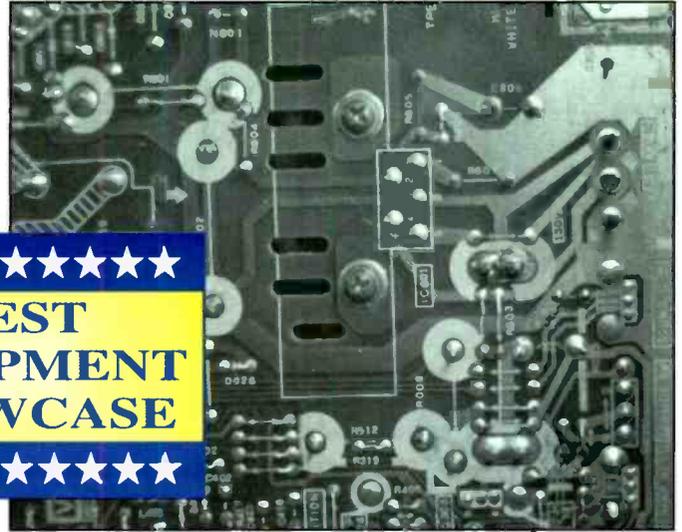


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## TEST EQUIPMENT SHOWCASE

### SPECIAL ADVERTISING SUPPLEMENT

#### 41 Test Equipment Showcase

Today's consumer electronics test equipment products are highly complex. Because of this, the decision to purchase one is so pivotal, the more you know about the manufacturers of suppliers, the better informed your decision will be. This special advertising section was conceived as a way to help bring more information about test equipment providers to our readers. Every advertiser in this section has been given additional space to tell readers something about that company, or to help readers understand the value and use of that company's products. **ES&T** invites you to see what these companies have to say.

### FEATURES

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*By The ES&T Staff*

Because consumer electronics servicing presents so many difficulties in simply locating replacement parts and service information, each year

in the December issue, **ES&T** publishes this replacement parts and servicing information sourcebook that provides service companies with several tools to help them overcome these problems.

#### 17 Filter capacitors cause strange symptoms

*By Homer L. Davidson*

Defective filter capacitors can cause odd symptoms on the face of a picture tube. This article takes a look at some of these symptoms.

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*By John Kull*

This article provides suggestions and procedures for troubleshooting consumer electronics equipment without service documentation. The article focuses on TV repair but the same principles and concepts can be used to service any type of consumer electronics equipment.

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### ON THE COVER

The essence of consumer electronics servicing is testing. Resistance, current, voltage, waveshape and waveform amplitude, logic states and other values displayed by the right piece of test equipment can reveal the condition of a product or circuit to a technician and lead to a successful diagnosis and repair. (Photo courtesy TENMA Test Equipment)

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

**ELECTRONIC**  
Servicing & Technology

# Happy Holidays

Happy Holidays to all **ES&T** readers.

It's that time of year again when the weather turns dark and cold and dreary, and people's thoughts turn to the warmth and cheer of home and family and friends. It's also the time of year when people tend to spend time reflecting on the past year and preparing for the year ahead. That's what we've been doing at **ES&T**.

The staff would like to take this opportunity to say thanks to all of our readers who have not only been subscribing to this magazine, giving us all a reason for continuing to do what we do, but all of you who also take the time out of your busy days to call us, or write, or to fill out the survey cards that we ask you to fill out every month, or to fill out the comment blocks on the reader service cards.

A lot of readers may not be aware of it, but the information we gain from correspondence with readers directly affects what we publish. If we're not responsive to the information needs of readers, they'll go elsewhere, or just stop renewing their subscriptions altogether.

### **The sourcebook was a response to readers**

As an example of how important reader feedback is to us, just take a look at the "Replacement parts/servicing information sourcebook" in this issue. We've been publishing it now for some years, and every year it changes some. We add a few companies that someone has discovered, and drop a few that have gone out of business or otherwise disappeared. We make changes where changes are called for.

Ten years ago we didn't publish this feature. We didn't know it was needed. But then conversations with servicers on the telephone and at trade shows, and correspondence with others, gradually brought it home to us that a lot of consumer electronics manufacturers were just plain hard to find. So we went into the business of trying to find them and publishing what we found in this sourcebook.

One of the resources that we publish in the sourcebook, and one that many readers say is very helpful, is the FCC ID listing. The idea for this came from a technician who is also a service center owner, and a member of the Virginia Electronics Association (VEA).

Some years ago when I was talking to this technician, Jim, at a convention, he told me that the VEA had compiled a list of FCC ID

numbers that had helped members of that organization to identify the manufacturer of a product when it was not obvious from any of the markings on the product; as long as it carried an FCC ID number.

Jim and the VEA were kind enough to share this list with us, and readers have found it extremely helpful. We have since expanded this list, and will continue to do so.

### **Reader service cards and survey cards**

And we would very much like to thank all of our readers who have filled out the survey cards that are bound into each issue. For sometime now we have been using the information from those cards to help decide what types of articles we would publish.

Beginning next month, we'll report some of the results of the surveys in the magazine from time to time. It has occurred to us that some of the information provided by these survey cards will be of value to other readers. The old saying goes that two heads are better than one. But several thousand heads are better yet, so keep on writing and calling and filling in those cards and telling us what kinds of information you need. We are listening to you.

And don't forget, if you've found a manufacturer of a product that was hard to locate, or found a supply of parts or service information that were hard to find, let us know. We'll publish that information for other readers. And tell us if we can mention your name. We'll be glad to publish it to let the readers know who they have to thank.

### **Articles always welcome**

And if any of you is harboring an idea for an article and would like to get a copy of our writers' guidelines and/or our editorial calendar to help you know how to proceed, just drop us a line or give us a call or send a fax to:

Conrad Persson  
Editor  
Electronic Servicing & Technology  
PO Box 12487  
Overland Park, KS 66282-2487  
Phone/Fax: 1-913-492-4857

We'll get it right out to you.

And again, best wishes from all of us to all of you for a happy holiday season, and best wishes for a bright and successful year in 1995.

*Nils Conrad Persson*

# 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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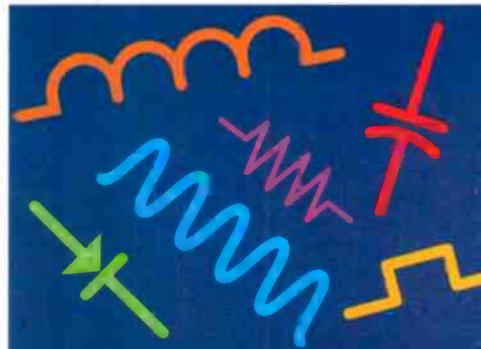


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### ETS sets Philadelphia as '95 convention site

The Greencastle office of the Electronics Technicians Association has announced Philadelphia, PA as the location for the not-for-profit organization's 16th annual convention. The dates are scheduled for May 19 and 20, with the Board of Directors meeting on May 18th.

Philadelphia Wireless Technical Institute, 1900 Pine Street, will be the site for the technical seminars portion of the annual event.

Pete Honczar, CETma, President of PWTI, and ETA Treasurer said: "Philadelphia Wireless is proud to host the ETA convention and we are happy to see the international convention come to the East after many years of Midwestern, Western and Southern locations. PWTI has worked closely with ETA as a part of the national electronics technician certification program committee and as an FCC examination test site. Since our primary business is training technicians, conducting the annual convention here is a natural follow through."

For the first time since 1992, the ETA convention will not be a joint affair with the Satellite Dealers Association (SDA), which will conduct its own convention in Minneapolis in June.

A special feature of the Philadelphia ETA convention, in addition to the two-day Electronics Technician Seminars and Workshops, will be a separate program to teach Local Area Network (LAN), computer installation and troubleshooting. This LAN workshop is aimed at helping technicians cope with the intricacies of networking and is to be conducted by Novel certified technicians from ETA's New York City chapter.

### TV's scored at convention serviceability inspection

Four televisions received a rating of "good" in serviceability inspections held at the National Professional Electronics convention, August 8, 1994, in Portland, OR. This is the third ISCET (International Society of Certified Electronic Technicians) sponsored Serviceability Inspection since the program of non-authorized inspections began. Inspected at this session were a JVC C20CL5, which scored 83.12%; a Hitachi 20SA4B, rated 81.78%; and a Magnavox 19PSC50121,

which rated 80.62%. In addition to these, Thomson Consumer Electronics requested an inspection of a pre-production 35 inch RCA Proscan PS35160 Television. A pre-production examination permits changes to the product that will improve serviceability prior to the manufacture of the set. Because service data had not yet been prepared, the set scored 80.69%, but still rated in the "good" category.

Sets are rated on the criteria of product identification, back removal, and re-installation, preparation for and performance of in-home service or minor service, at the service center, preparation for and performance of major bench servicing, and service data considerations. Four other sets were rated at last year's National Professional Electronics Convention. All were rated as fair. Two that were inspected in January at the Florida Electronic Service Convention scored a good and a very good. Even though these inspections were not authorized by the manufacturer, several of the manufacturers have chosen to purchase their reports following the inspections.

The Serviceability program is a joint effort among the manufacturers, the technicians, and ISCET to improve product serviceability in the future. A manufacturer can schedule a confidential inspection at his selected site by contacting the ISCET office.

#### **Joint venture announced to market first HDTV system to U.S. consumers**

Sonance, a manufacturer of specialty home audio products, and Captain, an independent producer of high definition TV programming, have announced a joint venture to market the first home HDTV video system in the U.S. The alliance, called Captain Sonance, will immediately begin to market HDTV recorders through Sonance dealers nation-wide.

Captain founder David Niles, said, "HDTV has been a long time coming to the U.S. We're pleased to say that it's finally here."

Sonance president Scott Struthers, said, "Our companies are both successful innovators in home entertainment technology and marketing. Captain's strength is in video technology and production. Ours is in audio technology, product development, and U.S. and international distribution. Our dealers can now have a

complete HDTV system to sell to consumers and install in their homes."

Sonance, based in San Clemente, CA is a manufacturer of high-fidelity, in-wall loudspeakers used in home theaters and other residential audio/video systems.

According to Niles, their HDTV VCR plays and records baseband HDTV, as well as conventional VHS and S-VHS tapes, so that consumers can use it with video tapes they rent or already own.

Niles said that HDTV software, produced by Captain and other companies, will be sold through their dealers and that the number of titles available is growing steadily. The HDTV VCR will also be fully compatible with future American HDTV broadcast standards.

According to Struthers, monitors and video projection systems capable of displaying HDTV images from the VCR are currently being sold in the U.S. by a number of companies.

#### **PACE announces new training schedule**

PACE Incorporated announces its 1995 Pacenter Training Schedule at the Laurel, MD Training Center with a 15% increase in the number of classes offered in 1994. Pacenter Training teaches the skills, techniques and process control development necessary to perform non-destructive assembly and repair on all types of electronic modules and assemblies.

Classes include Universal Repair for Electronics, an in-depth, hands-on program covering Hi-Rel soldering, component removal, circuitry repair and ESD control; Multilayer and Flexible Circuit Repair, an advanced, hands-on course covering the latest techniques needed for excavations, interfacial connections and internal conductor repairs, as well as the latest repair technology for broken conductors and land areas; Surface Mount Technology, a comprehensive program emphasizing the safe installation and removal of SMCs (surface-mount components) which covers the latest developments in this rapidly advancing area of electronic assembly, rework and repair; and The PACE Instructor Training Seminar, an intensive one-week course designed for personnel who are involved in solder instruction.

Classroom reservations and tuition schedules may be obtained from Jane

Gazaway at (301) 490-9860 or (301) 498-3252 (Fax). On-site training, detailed course descriptions, brochures, videos and training supplies are also available.

#### **Curriculum seminar teaches how to give students school-to-work transition skills**

"Without question, the most successful technicians are those who've experienced the VICA Professional Development Program" says John W. Shurtz, National Technical Training Programs manager at Toyota Motor Sales, U.S.A., Inc. "That's actually what brought Toyota to VICA. We recognized the value of professional development and became heavily involved with VICA because of what it brought to the student in the workplace."

Developed by VICA for secondary and postsecondary students, the Professional Development Program (PDP) teaches skills that will help students make a smooth transition from school to the world of work like goal setting, communication skills and teamwork. In conjunction with their occupation-specific skills, PDP includes competencies for employability.

Teachers can now learn how to get the most out of this award-winning curriculum by attending VICA's new one-day training workshop. Participants will learn specific methods of integrating PDP activities into their curricula and how to run an active student organization.

"When we initiated PDP into our curriculum, our instructors thought: 'I don't have time to work this into my curriculum,'" says William Moyers, principal at Triplett Business and Technical Institute in Mt. Jackson, VA. "Once they got into it and realized that it was what their advisory committees had been begging for, they promoted it, too."

The workshop focuses on the role of the advisor, student responsibilities, and the role business and industry play in the process. Participants will hear from people currently implementing successful student organizations within their training programs.

The VICA PDP includes a teacher's manual with methods, transparency masters and strategies for special needs stu-

*(Continued on page 61)*

# Replacement parts/servicing information sourcebook

By The ES&T Staff

There are several facts of life of which every consumer electronics service center should be aware. They should also make their customers aware of them:

- *Consumer electronics manufacturers do not make their products to last forever.* The standard useful life of a TV, VCR, stereo, or other consumer electronic product is considered to be between seven and ten years. Beyond that, service literature and replacement parts are available on a hit or miss basis.

And, it should be understood that that length of useful life applies to products manufactured by the reputable manufacturers that have recognizable names. The useful life of some of the fly-by-night manufacturers, whose products show up with unrecognizable names on the shelves of the discount stores, may be considerably less, or nonexistent.

- *The stability of a supplier of consumer electronics products is generally only as good as the reputation of the company.* If a consumer buys an RCA or GE TV set, or a Magnavox or Panasonic VCR, they can reasonably expect that that company will be around in three years, five years or seven years if the service center needs to obtain some replacement component.

If the consumer buys some obscure brand of product, a Bohsei or Kawasho TV set for example, he should be aware that the great price he paid for the prod-

uct may not seem so great when the company goes out of business, or retreats from the U.S. market, leaving a limited selection of replacement parts and service information behind in the hands of a distributor that may be hard to find.

- *Brands may not be what they seem.* These days, even large, reputable manufacturers import products from offshore and sell them under their own brand. Generally, this is not a bad thing, as the reputable manufacturer maintains the quality of the product, and maintains stocks of replacement parts and literature for the product during its useful life.

However, many brand names today have become commodities, and it has happened that a manufacturer with a venerable old name sells the brand to a company that then sells shoddy merchandise to unsuspecting consumers, who may then find it difficult, or not worth the bother and cost to get the product serviced.

These are only a few of the factors that make it difficult for the average service center to locate and obtain service literature and replacement parts for some products. Some of the other reasons are:

- Companies move, and after a set amount of time the post office doesn't forward mail.

- Some companies are small and have a very low profile in the marketplace, so they're just hard to locate.

- Many private brands of consumer electronics products have little or no support at all.

- An offshore manufacturer may sell and support products in the U.S. for a period of time and then leave the market. In some cases these companies will have sold their stocks of replacement parts to a distributor in the U.S., but how do you know who?

- Some companies don't wish to have independent service companies service their products, so they refuse to provide service literature and replacement parts to the independent.

## Here's some help

Because consumer electronics servicing presents so many difficulties in simply locating replacement parts and service information, each year in the December issue, **ES&T** publishes a replacement parts and servicing information sourcebook that provides service companies with several tools to help them overcome these problems. This sourcebook is published annually because so many changes take place within a twelve month period that the list is largely out of date by the time a year has gone by.

This sourcebook contains the following sections:

- A list of suggested references,
- A list of FCC (Federal Communications Commission) ID number prefixes that identifies the manufacturer of any consumer electronics product that bears an FCC ID number,
- A sidebar that describes how to use the FCC public access system to look up the manufacturer of a product on which you have found an FCC ID number,
- A list of UL (Underwriters' Laboratories) ID numbers,
- An updated list of manufacturers with addresses and telephone numbers.

## Finding replacement parts

Here's a list of references that are useful in tracking down the manufacturer, or

Please send me a copy of the Consumer Electronics Show Directory, as mentioned in **ES&T**. Enclosed is a check for \$25.00, payable to the Consumer Electronics Show. (For **ES&T** readers only. Stated value is \$100.00.)

Name \_\_\_\_\_ Occupation/Title \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Mail to: **CES Directory**  
2500 Wilson Blvd.  
Arlington, VA 22201-3838

parts distributors. We think that every electronics servicing facility should have all of them:

**Consumer Electronics Replacement Parts Source Book**

**Consumer Electronics Group,**  
Electronic Industries Association  
PO Box 19100  
Washington, DC 20036  
Include \$1.00 for postage and handling

**Electronic Industry Telephone**

**Directory** (Or some equivalent)  
Harris Publishing Company  
2057-2 Aurora Rd.  
Twinsburg, OH 44087-1999  
This will cost around \$50.00 (Or you might be able to get a copy free from your distributor.)

**The Howard W. Sams and Company Annual Photofact Index**

(This document is available in printed form and on computer floppy disk)  
Available from your distributor, or directly from  
Howard W. Sams & Company  
2647 Waterfront Parkway East Drive  
Indianapolis, IN 46214-2041  
800-428-7267

**Consumer Electronics Show (CES) Directory**

Electronic Industries Association  
Consumer Electronics Group  
2001 Pennsylvania Ave. N.W.  
Washington, DC 20006-1813

The CES directory includes over 1,000 manufacturers, brand names, products and key personnel. The best way to get a copy of this directory is to attend the Consumer Electronics Show in Las Vegas, January 6 through January 9, 1995. It comes with the price of attendance. For further information about CES, write to the address above, or call 202-457-8700.

If you can't get to the show, limited numbers of copies of the directory will be available from the above address. Limited quantities of the CES Show Directory will be available at a reduced price to **ES&T** readers who send in the coupon in this issue. Quantities are limited, but the EIA/CEG will fill as many orders as possible.

FCC ID numbers	
Code Prefix	Manufacturer
A3D	NEC
A3L	Samsung
A7R	Orion
AAL	Phone Mate
AAO	Radio Shack
AAV	Midland International Corporation
ABL	Hitachi
ABW	JC Penney
ABY	Motorola
ACA	Yorx Electronics
ACB	Phonotronics
ACJ	Matsushita
ADF	Carterfone
ADT	Funai
AES	Uniden
AEZ	Sanyo
AFA	Fisher
AFL	Sharp
AFR	Curtis Mathes
AGI	Toshiba
AGV	Montgomery Ward
AHA	RCA
AIH	Litton Microwave Cooking Products
AIX	Sylvania
AJU	GE
AK8	Sony
AKC	Superscope Inc
AKE	Marantz Co Inc
ALA	Wells Gardner Electronics Corporation
ALI	Kenwood USA Corporation
ANV	Capetronic Int'l Corporation
API	Harman Kardon Inc
ARR	AOC Int'l of America Inc
ASH	Akai
ASI	Victor Company of Japan
ATA	Sharp
ATO	Zenith Electronics Corporation
ATP	Advent Corporation
BEJ	Goldstar
BGB	Mitsubishi
BOU	Philips
E0Z	Shintom

CSF Daewoo  
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**Figure 1.** Every VCR, personal computer, cordless telephone and microwave oven must carry an FCC ID number. The first three characters of that ID uniquely identify the manufacturer of the product. This is a listing of manufacturer vs FCC ID number prefix, alphanumerically by code.

**A VCR model number and parts reference**

Another invaluable reference is published by the International Society of Certified Electronics Technicians (ISCET): a *VCR Model Number and Parts Cross Reference*. The Fifth Edition of the *VCR Model Number and Parts Cross Reference* is available in both paper and software editions from ISCET.

The software allows the user to search by manufacturer for model numbers and description for part numbers, and to perform a sub-search by manufacturer and part description is also a feature of the program. The editing sequence for parts shows on screen all the substitutes for the part entered.

There are 1,704 models and 4,943 parts with all updated prices in the 128-page.

FCC ID numbers

Manufacturer	First 3 Characters of FCC ID	Manufacturer	First 3 Characters of FCC ID
Advent Corporation	ATP	NEC	A3D
Akai	ASH	Orion	A7R
AOC Int'l of America Inc	ARR	Philips	BOU
Capetronic Int'l Corporation	ANV	Phone Mate	AAL
Carterfone	ADF	Phonotronics	ACB
Curtis Mathes	AFR	Radio Shack	AAO
Fisher	AFA	RCA	AHA
Funai	ADT	Samsung	A3L
GE	AJU	Sanyo	AEZ
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Hitachi	ABL	Shintom	E0Z
JC Penney	ABW	Sony	AK8
Kenwood USA Corporation	ALI	Superscope Inc	AKC
Litton Microwave Cooking Products	AIH	Sylvania	AIX
Marantz Co Inc	AKE	Toshiba	AGI
Matsushita	ACJ	Uniden	AES
Midland International Corporation	AAV	Victor Company of Japan	ASI
Mitsubishi	BGB	Wells Gardner Electronics Corporation	ALA
Montgomery Ward	AGV	Yorx Electronics	ACA
Motorola	ABY	Zenith Electronics Corporation	ATO

Figure 2. To make it easier for readers who may be interested in locating the FCC ID prefix of a particular manufacturer, here is the same information presented in Figure 1, alphabetically by manufacturer name.



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laser-printed book. Even though the model and part numbers have been increased by hundreds, the new edition of the book cuts the number of pages in half by using a reference system that crosses each model and part to its matching category. The book sells for \$29.95 plus \$3.00 shipping.

First time purchasers of the software can buy the program and data disks (one 3 1/2-inch disk or two 5 1/4-inch disks) for \$69.95 plus \$2.00 shipping. Registered previous purchasers of the original program can purchase the upgrade for \$29.95 plus shipping.

A combination of the 128-page, laser-printed book and the software sells for \$95.00 plus \$3.00 shipping. This combination is available for \$55.00 to registered owners of the program.

The Cross Reference book or disk can be ordered from ISCET, 2708 West Berry, Fort Worth, TX 76109; Telephone: 817-921-9101.

This two-part reference will help any servicing organization that services

VCRs to cross reference among different brands made by the same manufacturer. Part 1 of this reference will allow the user to determine when he has a product in for servicing, if it's possible that it's identical, or almost, to a product for which he already has a service manual. Part 2 of the reference cross references parts, so that if you can't find a particular part number for a product you are servicing, you may find that you have it on hand under a different part number for a product that was made by another manufacturer.

### The FCC ID number can help you find a manufacturer

Most consumer electronics products, carry clues as to who the manufacturer is. An FCC ID number, for example, appears on every VCR and computer, and any other product that might generate electromagnetic interference. Armed with this number, a technician may call or write the FCC:

Federal Communications Commission  
1919 M Street, NW  
Washington, D.C. 20463,

Give the ID number and ask for the name and address of the manufacturer. A partial cross-reference list of manufacturer name versus FCC ID numbers is provided in Figure 1. Figure 2 is the same information in alphabetical order by manufacturer name.

A private company has downloaded this information and sells it in the form of a compact disc. The address and telephone number for this company are:

M.I. Technologies:  
3310 E. Peterson Road  
Troy, OH45373  
513-335-4560

### Identification using the UL manufacturer's code number

Another source of manufacturer identification information is the Underwriters Laboratories code number. The manufacturer of every product submitted to UL for certification is assigned a code number that identifies who the manufacturer

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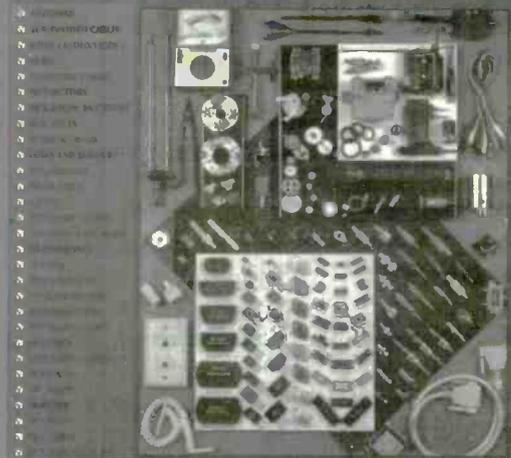
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### UL listing number to VCR manufacturer (Unofficial)

UL Number	Manufacturer	Brand Names
146C	Goldstar	
153L	NEC	
16M4	Samsung	Supra, Multitech, Unitech, Tote Vision, Cybrex. GE, RCA Sears
174Y	Toshiba	Sears
238Z	Hitachi	RCA. GE, Penney, Pentax
270C	Sony	
277C	JVC	
282B	Sharp	
289X	Emerson	
333Z	Symphonic	Teac, KTO, Realistic, Multitech, Funai, Porta Video, Dynatech, TMK
336H	RCA	
347H	NAP	
43K3	Kawasho	
403Y	Fisher/Sanyo	Realistic, Sears
436L	Quasar	
439F	JVC	Zenith, Kenwood, Sansui
444H	Zenith	
44L6	TMK	Emerson, Lloyds, Broksonic Wards, KMC
504F	Sharp	
51K8	Portavideo	
536Y	Mitsubishi	Emerson, Video Concepts, MGA
540B	GE	
570F	Sony	Zenith
623J	Sampo	
628E	Samsung	MTC, ToteVision
679F	Panasonic	RCA, GE, Magnavox, Quasar, Canon Philco
723L	Sanyo	
727H	Hitachi	
74K6	Funai	
781Y	NEC	Dumont, Video Concepts, Vector, Sears
828B	Panasonic	Olympus
843T	Magnavox	
86B0	Goldstar	Realistic, JC Penney, Tote Vision, Shinton, Sears, Memorex
873G	Mitsubishi	
41K4	Portland	

Figure 3. The UL listing number on a consumer electronics product identifies the manufacturer who made it. Here's a partial listing of UL numbers vs manufacturer.

## The FCC public-access information system

Every VCR, personal computer, microwave oven and cordless phone sold in the United States must bear an FCC identification number because they may possibly generate radio-frequency interference. Some products outside of this category, such as TV sets may also bear FCC ID numbers. This number identifies which company manufactured the unit. If you have one of these products in your shop for service and can't identify the manufacturer, you can contact the FCC through its public-access system.

There are two ways to get this information: via voice telephone or via computer and modem by contacting the public-access bulletin board. The FCC prefers to have people use direct computer-to-computer contact.

To contact the FCC bulletin board, you must have a computer and a modem capable of 300 baud or 1200 baud. The number to call, in Maryland (just outside of Washington, D.C.), is 301-725-1072. This is a toll call. Dialing this number at any time should get you in direct contact with the bulletin board.

Once you have made contact, the computer screen will tell you how much time you have and provide you with a menu of items to choose from. When ES&T dialed up the bulletin board in October, once we logged onto the bulletin board, the following information appeared on the screen:

"P A L"

1—Access Equipment Authorization Database

2—Definitions—Terms/Codes used in Application Records

3—Applying for an Equipment Authorization (1/92)

4—Other Commission Activities and Procedures (8/92)

5—Laboratory Operational Information

6—Public Notices (8/92)

7—Bulletins/Measurement Procedures (5/92)

8—Rulemakings (8/92)

9—Help

a—Information Hotline (7/92)

b—ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE

c—Processing Speed of Service (10/92)

d—Test Sites on File per Sec 2.948 (10/92)

0—Exit PAL

Enter your selection:

Pressing the number 1 on the keyboard brought up the following information on the screen:

### Equipment Authorization Database

Form 731: Until Form 731 is revised the March 1988 and July 1989 editions may continue to be used. The OMB expiration dates shown on the forms do not affect public use. Availability of the revised Form 731 will be announced here and by public notice. est: 7/92

1—Equipment Authorization Application Status

2—Applicant/grantee Names and Addresses by Code

0—Exit this Menu

Enter your selection: Enter Grantee Code (CR to end):

At this point, it was only necessary to enter the three character alpha or alphanumeric code, and the name, address and telephone number of the manufacturer identified by that code appeared. For example, entering the three letter ID aaa and pressing the ENTER key brought up this information on the screen:

AAA Code A Phone Corporation  
PO Box 5656 Portland, OR  
97228 USA

The system gives you eight minutes at a time, and you can enter as many codes and gather as much information as you can in that time period. If your software allows you to download information, you can download all of this information to your computer's disk for future reference.

The other method of obtaining this information is to call 301-725-1585, Monday through Thursday between 2:00 and 4:30 p.m. and ask to be connected to the status desk. The individual who answers will relay your question to the bulletin board via a computer terminal and will then relay the information it provides to you.

Obviously, if you have a computer and a modem, it makes far more sense to contact the computer directly. You'll cut out the middle man and, of course, you can contact the computer any time.

is. Figure 3 is a partial list of UL numbers and the manufacturers they represent.

### Look for the obvious

Close inspection of a product may even provide the service technician with a useful address and telephone number directly. One technician called ES&T earlier this year asking for help in finding the manufacturer of a Capehart TV set. We asked him if he could see either a UL number or an FCC ID number on the back of the set.

The UL number didn't correspond to any on file, and there was no FCC num-

ber. Interestingly, there was an abbreviation and an address on the back of the set, and an address:

NATM  
45 W. 34th Street  
New York, NY 10001

ES&T called directory assistance and got a telephone number, then called it to find out about this organization. As it turns out, NATM is a 16-member buying group of stores mostly in the northeast,

including ABC Warehouse, Lechmere and Lustig stores. They buy sets from a number of manufacturers, some of them well-known brand manufacturers, with the Capehart and Spectracon brands on them. They buy in a group because they have more buying power that way.

When we called the reader with this information, he took another look at the back of the set, and the telephone number was there as well: 212-239-7222.

As it turns out, NATM puts their name, address and telephone number on all the sets bought through their organization and

sold through the 16 outlets they represent, so that service centers can call them to identify the manufacturer of the product and obtain service literature. The reader was just so accustomed to being plagued with the difficulty of TV set manufacturers and vendors who try hard not to be identified, that when one made it easy to find them, he just wasn't looking for it.

### Locating the manufacturers

It's not unusual for a servicing organization to have some difficulty finding the address and telephone number of a man-

ufacturer of a product for which they need to order parts, even when the manufacturer is well-known. Figure 4 is a listing of manufacturers, from the Consumer Electronics Replacement Parts Sourcebook, the NESDA Professional Electronics Yearbook, **ES&T** reader correspondence, many phone calls by the **ES&T** staff, and other sources.

### Information sources close to home

Those of you who are located in a city that has a good library system have a ready source of information available

free. For example, the **ES&T** staff regularly calls the local library for information. References that they have available include the Thomas Catalog, a book called *Companies and Their Brands*, and one called *Brands and Their Companies*. And they're always pleased to receive a call for this kind of information. It's what they're there for.

Also, try giving the reference department of your local library a call next time you have a question about who makes what brand of TV or VCR, or similar questions. ■

Figure 4. Names and addresses of manufacturers.

## Replacement parts source

Sometimes it's difficult to find parts or servicing information for a product, even if you know who the manufacturer is. This listing, gleaned from the 1991 Consumer Electronics Replacement PartsSourcebook published by EIA/CEG, the 1991 Professional Electronics Yearbook & Directory published by NESDA/ISCET, and information otherwise developed by the **ES&T** staff, will provide you with some parts and technical literature sources for some products.

Acoustic Research (AR)  
330 Turnpike Street  
Canton, MA 02021  
617-821-2300  
Fax: 617-784-4102

Action TV<sup>1</sup>  
(American Action TV)  
100 Exchange Place  
Pomona, CA 91768  
909-869-6600

Adcom Service Corporation  
11 Elkins Road  
East Brunswick, NJ 08816  
908-390-1130  
Fax: 908-390-9152

AIWA America Inc.  
800 Corporate Drive  
Mahwah, NJ 07430  
201-512-3600  
Fax: 201-512-3705

Akai American, Ltd.—See Mitsubishi

Alpine Electronics of America, Inc.  
PO Box 2859  
Torrance, CA 90509  
310-326-8000  
800-421-2284  
Fax: 310-533-0369

Altec Lansing Consumer Products  
Routes 6 and 209  
Milford, PA 18337  
717-296-4434  
800-258-3288 (ext PA)  
Fax: 717-296-2213

AmPro Corporation<sup>2</sup>  
5 Wheeling Ave.  
Woburn, MA 01801  
Sales: 617-932-4800  
Fax: 617-932-8756

AOC International  
311 Sinclair Frontage Rd.  
Milpitas, CA 95035  
408-956-1070  
Fax: 408-956-1516

Apple Computer  
20525 Mariani Ave.  
Cupertino, CA 95014  
408-996-1010  
Fax: 408-996-0275

Aristo Computers Inc.  
6700 SW 105th Ave., Suite 307  
Beaverton, OR 97005  
503-626-6333  
800-3ARISTO

Atari Corp.  
PO Box 3427  
Sunnyvale, CA 94088-3427  
Parts: 408-745-5501  
Tech: 408-745-2466  
Warr: 408-745-2367

Audio Technica U.S., Inc.  
1221 Commerce Drive  
Stow, OH 44224  
216-686-2600/Fax: 216-688-3752

Audio Video Technologies Inc.  
60 E. Ida  
Antioch, IL 60002  
708-395-6321

Audiovox Corp.  
150 Marcus Drive  
Hauppauge, NY 11788  
516-231-7750  
Fax: 516-434-3995

Barcus-Berry, Inc  
5381 Production Drive  
Huntington Beach, CA 92649  
714-898-9211/800-854-6481

Blaupunkt  
PO Box 4601  
Carol Stream, IL 60197-4601  
708-865-5200  
Fax: 708-865-5209

BSR<sup>3</sup>  
C/O Warranty Central  
8130 Remmett Ave.  
Canoga Park, CA 91304  
213-689-9188

Canton North America, Inc.  
915 Washington Avenue South  
Minneapolis, MN 55415-1245  
612-333-1150  
Fax: 612-338-8129

Capehart<sup>4</sup>  
NATM  
45 W. 34th Street  
New York, NY 10001

Capetronics USA Inc.  
150 East 58th St., 29th Floor  
New York, NY 10155-2998  
212-832-1331

Casio Inc.  
570 Mt. Pleasant Ave.  
Dover, NJ 07801  
201-361-5400  
Fax: 201-361-3819

Channel Master  
Industrial Park Drive  
Smithfield, NC 27577  
919-934-9711  
Fax: 919-989-6951

Chinon America, Inc.  
615 Hawaii Ave.  
Torrance, CA 90503  
310-533-0274  
Fax: 310-533-0274

CIE American, Inc.  
2515 McCabe Way  
PO Box 19663  
Irvine, CA 92713  
714-833-8445  
Fax: 714-757-4488

Citizen American Corp.  
Subsidiary of Citizen Watch Co.  
2450 Broadway, Suite 600  
Santa Monica, CA 90411  
310-453-0614  
Fax: 310-453-2814

Clarion Corp. of America  
661 W. Redondo Beach Blvd.  
Gardena, CA 90247-4201  
310-327-9100  
800-821-6693  
Fax: 310-327-1999

Columbia Data Products  
851 W. Hwy 436, Suite 1061  
Altamonte Springs, FL 32714  
407-869-6700

Commodore International Ltd.  
1200 Wilson Drive  
West Chester, PA 19380  
215-431-9100  
Fax: 215-431-9465

COMPAQ Computer Corp.  
20555 SH 249  
Houston, TX 77070  
713-370-0670  
Fax: 713-374-1740

Connecticut Microcomputer  
568 Danbury Road  
New Milford, CT 06776  
203-354-9395  
Fax: 203-355-8258  
800-426-2872

Craig Consumer Electronics  
12845 Artesia Blvd.  
Cerritos, CA 90701-5001  
310-926-9944  
Fax: 310-926-9269

Curtis Mathes Corp.  
1 Curtis Mathes Pkwy  
PO Box 2160  
Athens, TX 75751  
903-675-2292  
Fax: 903-675-2843

Daewoo Electronics Corp. of America  
100 Daewoo Place  
Carlstadt, NJ 07072  
201-935-8700 *Parts + Research*  
Fax: 201-935-6491

Dell Computer Corp.  
9505 Arboretum Blvd.  
Austin, TX 78759  
Sales, Parts and Warranties:  
800-426-5150  
Service: 800-624-9896

Denon America, Inc.  
222 New Road  
Parsippany, NJ 07054  
201-882-7490  
Fax: 201-575-2532

Design Acoustics  
An Audio-Technica Company  
1225 Commerce Drive  
Stow, OH 44224  
216-686-2600  
Fax: 216-688-3752

Eastman Kodak  
343 State St.  
Rochester, NY 14650  
716-724-4000

Electronic Systems Products, Inc.  
1301 Armstrong Drive  
Titusville, FL 32780-7999  
407-269-6680/Fax: 407-267-6211

Electroponic—See Pilot<sup>5</sup>

Emerson Radio Corp. *Parts - Fox*  
One Emerson Lane  
North Bergen, NJ 07047  
201-854-6600 *Tech*  
*800-388-2333*

Epson America, Inc.  
20770 Madrona Ave.  
Torrance, CA 90509-2842  
310-782-0770  
Fax: 310-782-5220

Fujitsu Ten Corp. of America  
National Service Headquarters  
19600 South Vermont St.  
Torrance, CA 90502  
800-423-8161

Funai USA Corporation  
(Also Symphonic)  
100 North Street  
Teterboro, NJ 07608  
201-288-2666  
Fax: 201-288-0239

GE Appliances/Microwave  
Products Dept.  
Appliance Park  
Bldg. 4L, Rm. 106  
Louisville, KY 40225  
502-452-3568

Gemini, Inc.  
103 Mensing Way  
Cannon Falls, MN 55009  
507-263-3957

GoldStar Electronics Int'l, Inc.  
201 James Record Rd.  
Huntsville, AL 35824-0166  
205-772-8860 *Research*  
Fax: 205-772-8987

*Parts - Shines - 800-221-0404*  
Grundig/Lextronix Inc.  
3520 Haven Ave., Unit L  
Redwood City, CA 94063  
415-361-1611/Fax: 415-361-1724

Harmon Kardon, Inc.—JBL  
240 Crossways Park West  
Woodbury, NY 11797  
516-496-3400

Heath Company/  
Heath-Zenith Consumer Products Group  
PO Box 1288  
455 Riverview Dr.  
Benton Harbor, MI 49022  
616-925-6000  
Fax: 616-925-2898

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

Hitachi Home Electronics  
(America), Inc.  
675 Old Peachtree Rd.  
Suwanee, GA 30174  
404-279-5600  
Fax: 404-279-5692  
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Compton, CA 90220  
310-537-8383

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Torrance, CA 90505  
310-539-1940

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Fax: 708-317-3826

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Fairfield, NJ 07004-2105  
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Syosset, NY 11791  
800-426-6423

Kaypro Corporation  
4174 Sorrento Valley Blvd.  
San Diego, CA 92121-1407  
619-535-2155  
Fax: 619-535-2170

Kenwood U.S.A., Corp.  
PO Box 22745  
Long Beach, Ca 90810-5745  
310-639-9000  
Fax: 310-609-2127

Kloss Video Corp.—See Ampro Corp.

KTV Inc.  
205 Moonachie Road  
Moonachie, NJ 07074  
201-440-9090  
Fax: 201-440-6557

Kyocera Electronics, Inc.  
100 Randolph Rd.  
Somerset, NJ 08875  
908-560-0060

Lloyd's Electronics, Inc.  
National Parts  
6500 West Cortland St.  
Chicago, IL 60635  
312-889-8870  
Fax: 312-889-6797

Luxman  
Division of Alpine  
19145 Gramercy Place  
PO Box 2859  
Torrance, CA 90509  
310-326-8000  
For non-account customers  
Pacific Coast Parts Distributor  
15024 Staff Court  
Gardena, CA 90248  
310-515-0207  
Fax: 800-782-5747

Marantz USA  
A Division of Bang & Olufsen of  
America, Inc.  
1150 Feehanville Dr.  
Mount Prospect, IL 60056  
708-299-4000  
Fax: 708-299-4004

Matsushita Services Co. *Tech 201-392-4297*  
50 Meadowland Parkway *201-392-4297*  
Secaucus, NJ 07094  
201-348-7000 *Manuals, Parts 206-395-7343*  
Fax: 201-348-7527

Mattel, Inc.—See INTV

Micro Palm Computers  
13773-500 ICOT Blvd.  
Clearwater, FL 34620  
813-530-0128  
Fax: 813-530-0738

Midland International Corporation  
1690 North Topping  
Kansas City, MO 64120  
816-241-8500  
800-MIDLAND

Mitsubishi Electronics America, Inc.  
National Service Department  
5757 Plaza Drive  
PO Box 6007  
Cypress, CA 90630-0007  
714-220-2500

NAD (USA) Inc.  
633 Granite Court  
Pickering, Ontario  
Canada L1W 3K1  
416-831-6333  
Fax: 416-831-6936  
800-263-4641

NATM<sup>7</sup>  
45 W. 34th Street  
New York, NY 10001

NEC Technologies Inc.  
Consumer Electronics and Computer  
Products Divisions  
1255 Michael Drive  
Wood Dale, IL 60191-1094  
708-860-9500  
Fax: 800-356-2415

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

Okidata  
532 Fellowship Road  
Mount Laurel, NJ 08054  
609-235-2600  
800-OKIDATA

Onkyo U.S.A. Corp.  
200 Williams Drive  
Ramsey, NJ 07446  
201-825-7950  
Fax: 201-934-1845

Orion Sales Inc.  
11 Union Drive  
PO Box 10  
Olney, IL 62450  
618-392-7000  
Fax: 618-392-7100

Ortofon, Inc.  
65 East Bethpage Rd.  
Plainview, NY 11803  
516-454-6570  
Fax: 516-454-6515

Penney, J.C.  
National Parts Center  
6840 Barton Road  
Morrow, GA 30260  
404-961-8408  
800-933-7115

Philips Consumer Electronics  
Company  
Philips Service Company  
PO Box 555  
401 Old Andrew Johnson Highway  
Jefferson City, TN 37760  
615-475-8869  
Replacement Parts/Service Literature  
800-851-8885  
Fax: 800-535-3715

Pilot Audio Video Systems—See  
Electrographic<sup>8</sup>

Pioneer Electronics Service, Inc.  
1925 East Dominguez St.  
PO Box 1760  
Long Beach, CA 90801  
310-746-6337

800  
2) Lit  
3) Service  
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Tech 708-285-4550

Fax: 310-816-0412  
Proton  
Proton Parts Department  
5630 Cerritos Ave.  
Cypress, CA 90630  
714-952-6900  
Fax: 714-952-4600

Radio Shack  
Business Products Support Services  
1600 One Tandy Center  
Fort Worth, TX 76102  
817-390-3011

Radio Shack Business Products Parts  
812 E. Northside Dr.  
Fort Worth, TX 76102  
817-870-5695

Ricoh Corp.  
3001 Orchard Pkwy.  
San Jose, CA 95134  
408-432-8800

Rotel of America  
290 Larkin Street  
Buffalo, NY 14220-8089  
800-543-0471

Sampo Corporation of America  
5550 Peachtree Industrial Blvd.  
Norcross, GA 30071  
404-449-6220  
Fax: 404-447-1109

Samsung Electronics America, Inc.  
Service Division  
One Samsung Place  
Ledgewood, NJ 07852  
201-691-6200  
Fax: 201-347-8650

Sansui Electronics Corp.  
Parts Department  
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# Filter capacitors cause strange symptoms

By Homer Davidson

Defective filter capacitors can cause odd symptoms on the face of a picture tube. Inadequate width, black hum bars, black lines in the picture, and relay chatter are some of the symptoms of a dried out electrolytic capacitor. Unstable video pictures or pulling and crawling pictures can be caused by a defective filter capacitor (Figure 1).

Jail bars on the left side of the picture may be a symptom of a defective filter capacitor in the low-voltage source feeding the flyback. Open filter capacitors in the scan-derived flyback boost voltage source can leave the left side of the picture dark and shaded. Low brightness and hum in the audio may be the result of an open or dried out electrolytic filter capacitor in secondary voltage sources.

## No raster—no HV

When the main filter capacitor becomes leaky or shorted, the line fuse may blow, causing the B+ voltage from the low-voltage power supply to drop to 0V. If the main filter capacitor opens, the output voltage can drop to 0V.

The screen of a JC Penney 685-2012A

Davidson is a TV servicing consultant for ES&T.

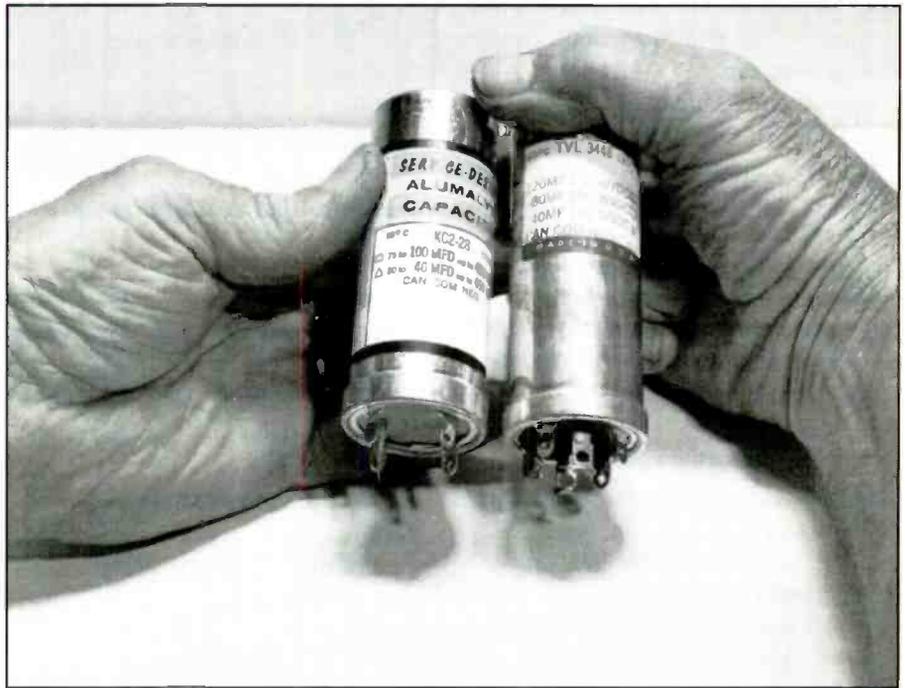


Figure 1. Large filter capacitors found in higher-voltage power-supply circuits can cause odd symptoms on the screen.

chassis was black. The voltage on the horizontal output transistor was very low. I traced the path of this voltage back to the low-voltage power supply. Voltage at the positive terminal of filter capacitor C814 was 0V (Figure 2). Further checks re-

vealed that C814 was open. Replacement of C814 restored the set to operation.

Absence of raster accompanied by noise in the audio of an RCA CTC135 chassis was traced to C676, a 100 $\mu$ F capacitor. Replacing the capacitor solved

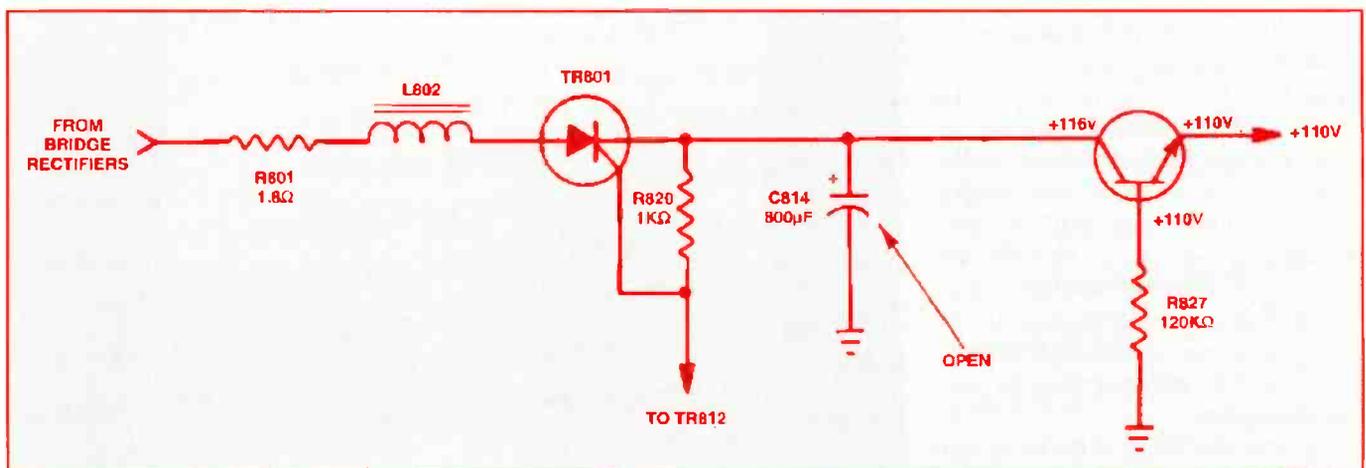


Figure 2. Open C814 (800 $\mu$ F) filter capacitor in the low-voltage circuits of a JC Penney 685-2012A chassis produced little voltage to the horizontal output circuits.

the problem. Whenever the symptom is absence of raster on the TV screen, go directly to the main filter capacitor and measure the low voltage.

Often, the service technician's mind is focused on the input line voltage components and possible damage to the silicon diodes when the power supply voltage is low. Very seldom does one think an open electrolytic capacitor can cause the no voltage symptom.

In many cases, simply shunting the suspected capacitor with one of the same or higher capacitance and working voltage solves the no raster symptom. When testing the function of a filter capacitor by shunting it with a known-good capacitor, always turn off the set first, discharge the filter capacitor, then parallel the suspect capacitor with a known-good electrolytic capacitor using test clips.

### Distorted raster

In one Sears 562.40290300 TV set, there was hum in the audio, and the picture was distorted. One common cause of this picture symptom is a defective AGC circuit. A standard diagnostic procedure, however, is to start at the low-voltage power supply to determine if the dc voltage is correct.

A voltage test in this case indicated low output voltage. When the main filter capacitor (4700 $\mu$ F, 200V) was shunted with another electrolytic capacitor, the picture returned to normal.

### Dark bars in the raster

You can almost bet that the main filter capacitor is defective when one or two dark bars slowly roll up the screen. Occasionally, dark bars in the raster may be caused by a shorted or leaky video transistor. Hum bars in the picture may be caused by defective electrolytic decoupling capacitors in the dc voltage source.

To determine which of these components is actually the cause of the problem, eliminate the video signal by tuning the TV to a channel where there is no broadcast or cable signal. If there are still dark bars on the screen, go directly to the low-voltage power supply and check the main filter capacitors.

Improper adjustment of the B+ or high voltage control can cause dark bars in the raster. A leaky regulator transistor or corresponding zener diode in older TV chas-

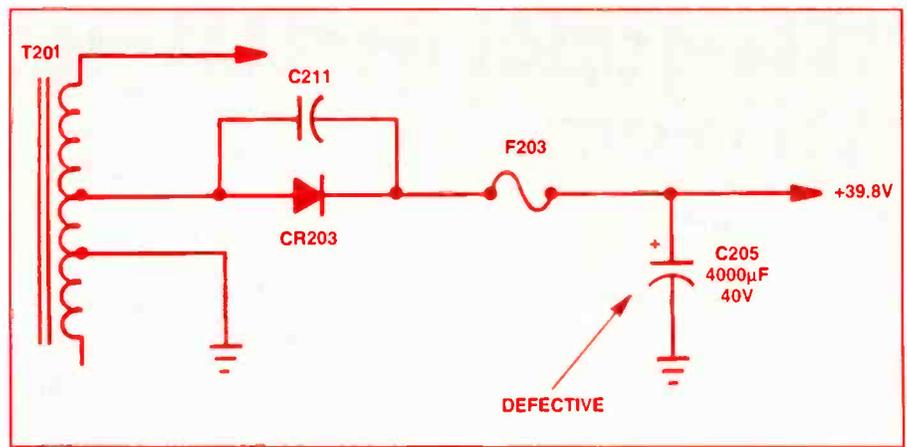


Figure 3. In an RCA CTC81R chassis, a 4000 $\mu$ F, 40V filter capacitor caused dark bars in the raster.

sis can cause dark bars in the raster. Replacing a 4000 $\mu$ F, 40V filter capacitor in an RCA CTC81R chassis eliminated the black bars squirming and rolling up the TV screen (Figure 3).

### Too many curves

Insufficient picture width can be caused by a defective horizontal sweep component, or defective filter capacitors in the low-voltage power supply. Suspect the main filter capacitor if picture width is inadequate and there are curves at the outside edges of the raster (Figure 4).

Sometimes a portion of the raster may be dark and display curved lines. Often when the picture looks like this, the dc

voltage on the main filter capacitor in the low-voltage power supply is too low. A wiggly picture of insufficient width also indicates a bad main filter capacitor.

### Twist, shout and crawl

The picture would pull and twist and a dark section would crawl up the raster in an Emerson ECR-210 portable. When I checked the schematic, I suspected that the problem might be a defective voltage regulator IC801 (Figure 5). However, when I looked at the circuits in the set, I saw that some white and black substance was oozing out around the positive terminal of C802.

I shunted a stock 800 $\mu$ F at 200V capac-

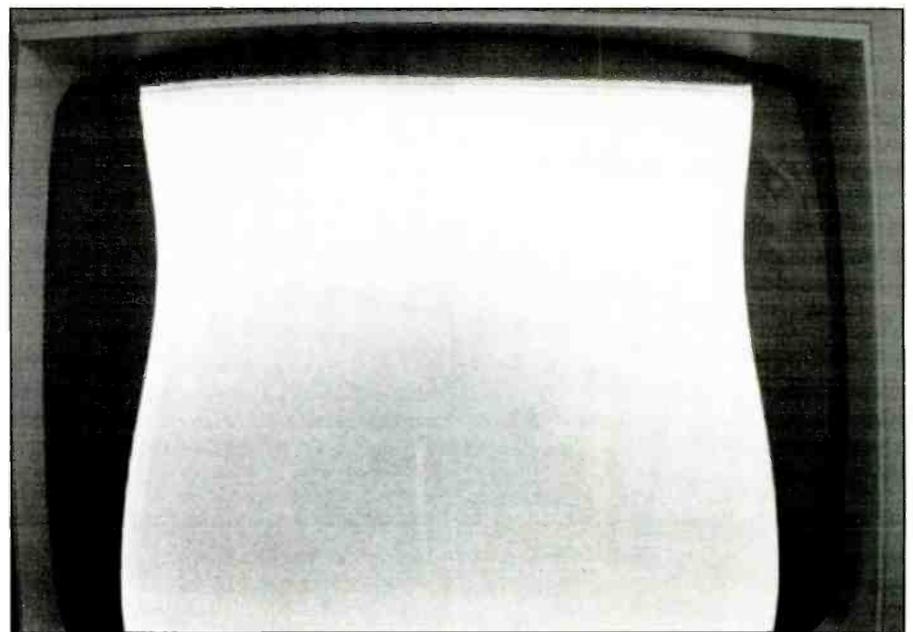
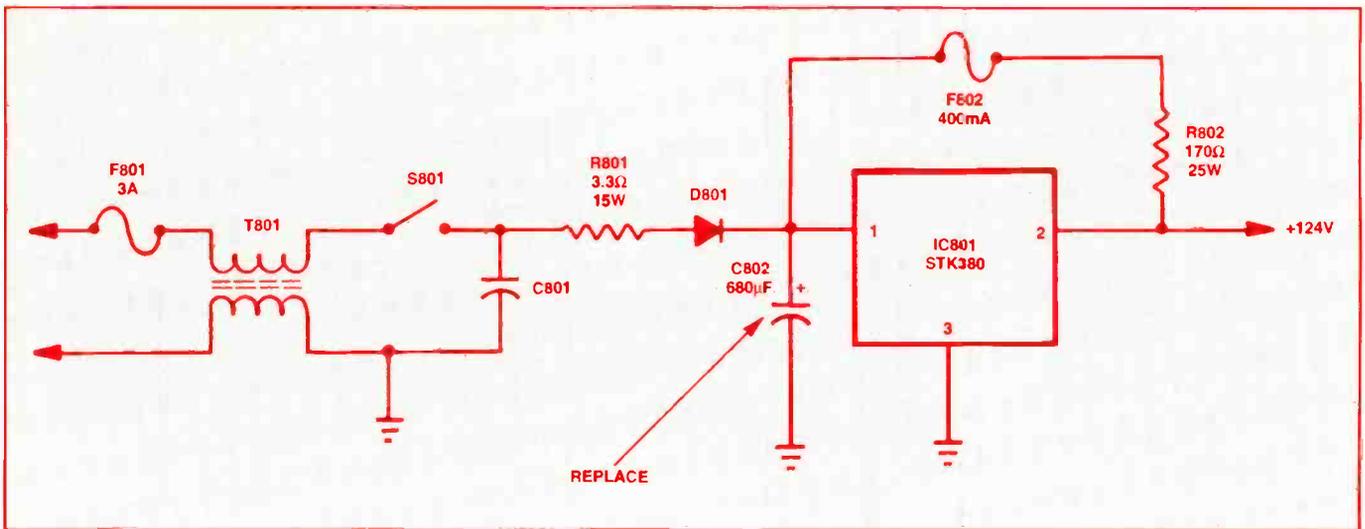


Figure 4. Insufficient width of raster with curves at the outside can result from an open or dried up filter capacitor.



**Figure 5.** A twisting, crawling picture with hum in the audio was caused by a defective electrolytic capacitor C812 (680μF, 180V) before regulator IC801.

itor across the main filter capacitor. The twisting and crawling symptom stopped. Replacement of this capacitor completed the repair.

#### Unstable vertical and horizontal picture

Although there were no signs of hum bars on the screen of a defective Sampo

CS-13AS TV set, the vertical and horizontal sync were very unstable. Sometimes the picture would pull horizontally and then roll upward.

Since both the horizontal and vertical sweep circuits were unstable, the problem had to be something that affected both circuits. I suspected that the problems might be caused by a defect in the low-voltage

power supply.

Tracing the low-voltage source of both horizontal and vertical circuits back to the power supply confirmed that both were indeed fed from the same 110V source in the power supply. The power regulator adjustment had little effect on the picture.

At first I suspected a voltage regulator problem, since a power regulator, power

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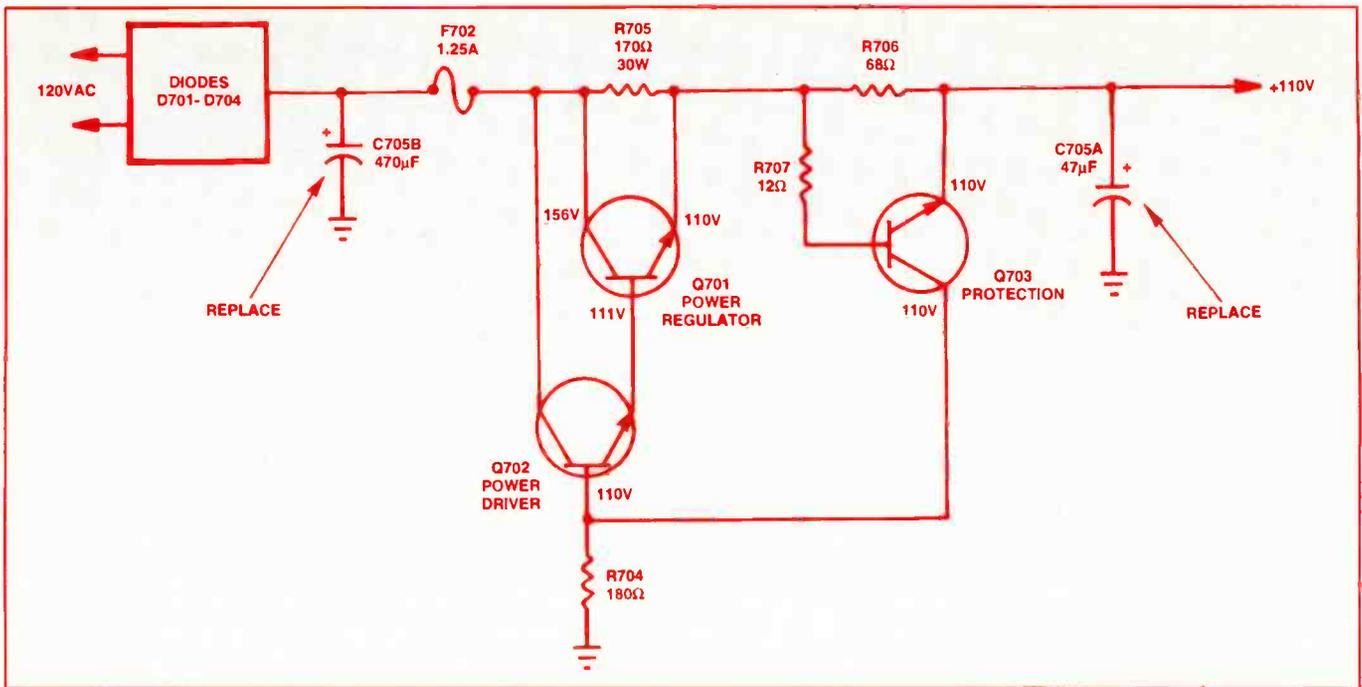


Figure 6. In a Sampo CS-13AS chassis, open filter capacitor C705A and C705B were replaced to cure unstable vertical and horizontal pictures.

driver and error amp were found in the B+ regulation system (Figure 6). All three transistors were tested for open and leakage conditions and appeared normal.

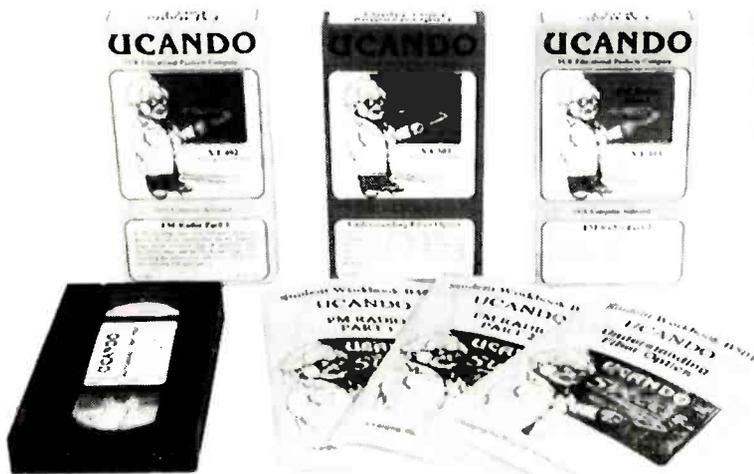
Next, I shunted the main filter capaci-

tor, C705B, with a known-good capacitor. This helped some. When both C705B and C705A were shunted, however, the picture returned to normal. C705A is a 47µF, 160V capacitor and C705B is a

470µF, 200V electrolytic capacitor in the same container.

Upon checking the capacitor parts list, I found that the main filter capacitor contained three different capacitors in one

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can. I replaced C705 with a universal 470 $\mu$ F, 50V and 50 $\mu$ F, 200V capacitor.

Always replace the entire can even when only one capacitor is defective.

### Twisting picture with dark areas

In an RCA GA750S console model TV, the picture would pull to one side, dark bars would roll up the picture and sometimes the raster would collapse (Figure 7). Relay K201 would chatter during start-up. Shunting the main filter capacitor helped, but the dark bar areas remained. When electrolytic capacitor C205 (4000 $\mu$ F, 50V) was shunted in the +39.8V source, the picture returned to normal.

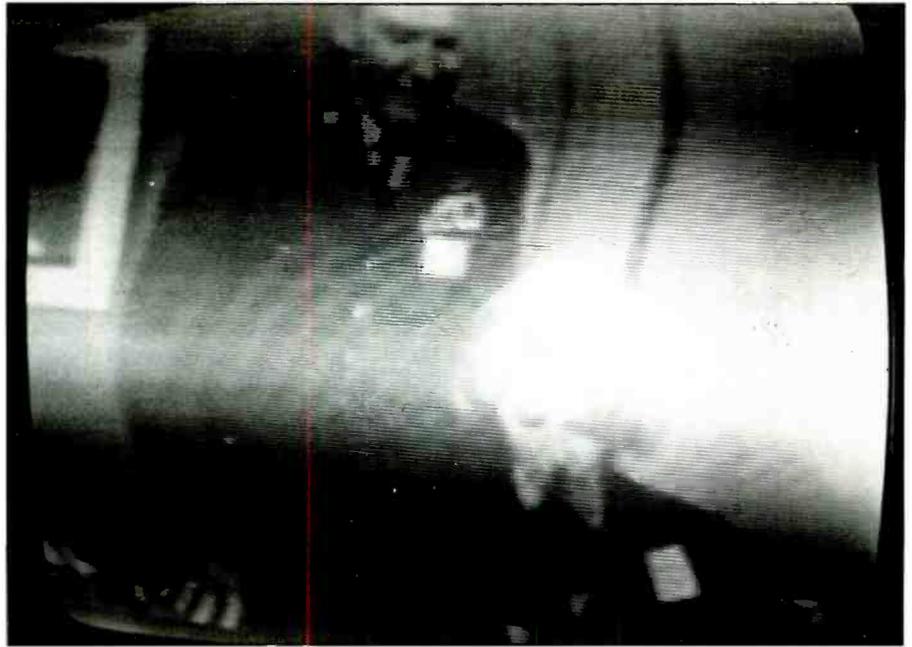


Figure 7. A twisting/pulling picture with dark bars was caused by electrolytic capacitor C205 (4000 $\mu$ F, 50V) in an RCA GA750S model.

### Scan derived voltage sources

If the screen is darker than normal, the horizontal is off frequency, there are lines in the picture or the left area of the picture is dark, suspect an open or dried out filter capacitor in the secondary circuits of the horizontal output transformer. Often, only one problem or symptom is caused by defects in the power source feeding the defective circuit. When you observe more than one symptom, such as horizontal and vertical problems, check the voltage source that is common to both of the circuits.

Very low brightness was found on the screen of a Goldstar CNR-845 model (Figure 8). A voltage measurement indicated a very low voltage at the 16V

source. I suspected an open isolation resistor (R442) or a leaky diode (D441).

Continuity of L443 was normal and the secondary winding of flyback (T461) was good. When filter capacitor C442 (1000 $\mu$ F) was shunted, the 16.2V source was restored. With the 16.2V source back to normal, the picture returned.

Sometimes poor filtering in the scan-derived voltage sources can be located by scoping the different dc voltage sources.

Notice how the noise or hash and amplitude of the waveform has increased with an open filter or decoupling capacitors. Clip a new capacitor across the suspected one with the power off. Now, turn the set on, take another scope test, and notice the change in waveform.

In a Radio Shack 16-210 model the symptom was no raster with noise in the sound. All voltages were very low in the secondary voltage sources. C115 was

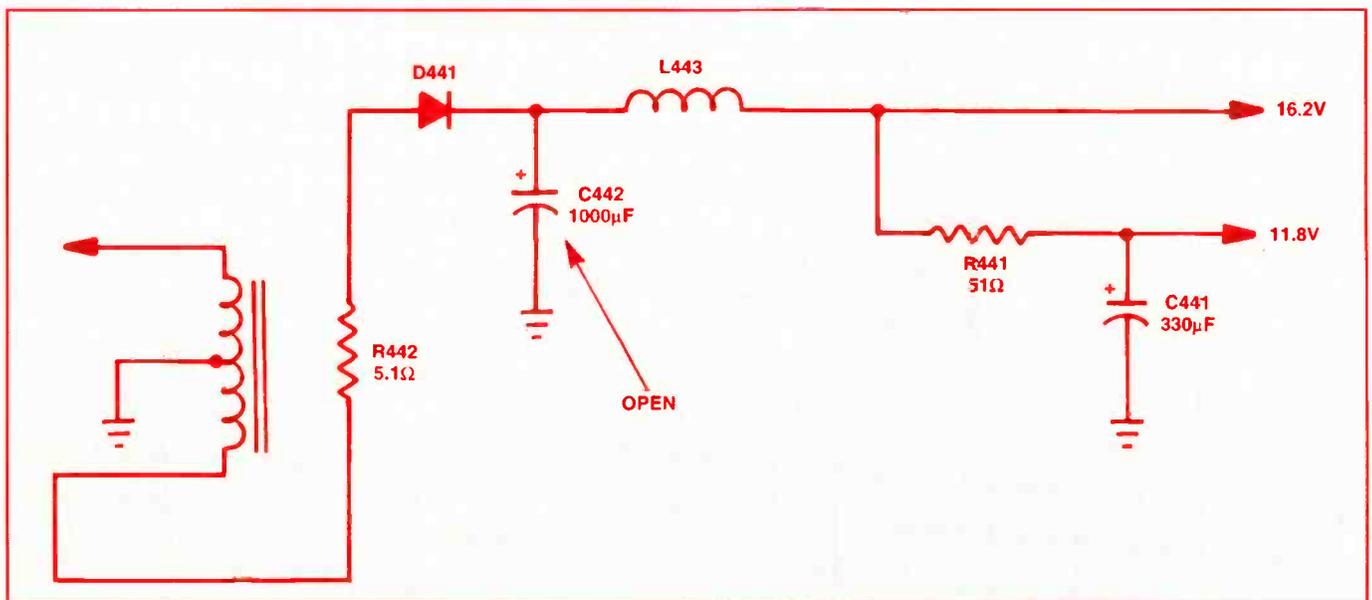
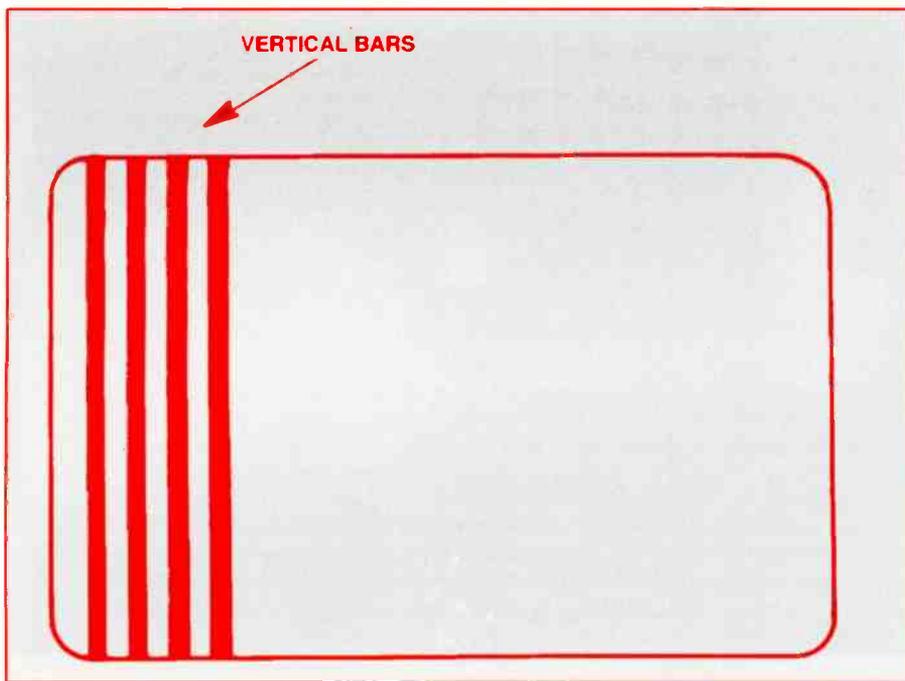


Figure 8. Low brightness was observed in a Goldstar CNR-845 TV set with open C442 (1000 $\mu$ F) in the scan derived 16V source.



**Figure 9.** Unusual black bars on the left side of the screen may be caused by defective filter capacitors in the AGC and horizontal output circuits.

found to be open. Replacing C115 with a 330 $\mu$ F electrolytic capacitor solved the raster and sound symptom.

#### Unusual pictures

Vertical jail bars, dark left side of screen, shady bars to the left and unusual sound problems can be caused by open or dried out filter capacitors in critical cir-

cuits. Jail bars on the left side of the screen can be caused by open or dried out filter capacitors in the AGC or horizontal output circuits (Figure 9).

In older sets, when adjustment of the AFT and fine tuning controls will weaken or strengthen the intensity of these dark bars, check the AGC circuits. If the dark bars are only found in the presence of a

strong TV station signal, suspect small electrolytic capacitors in the AGC circuits. Shunt each capacitor until the bars or lines disappear.

When several dark bars are found at the left of the picture and in the raster, suspect filter capacitors in the dc voltage source feeding the horizontal output transistor.

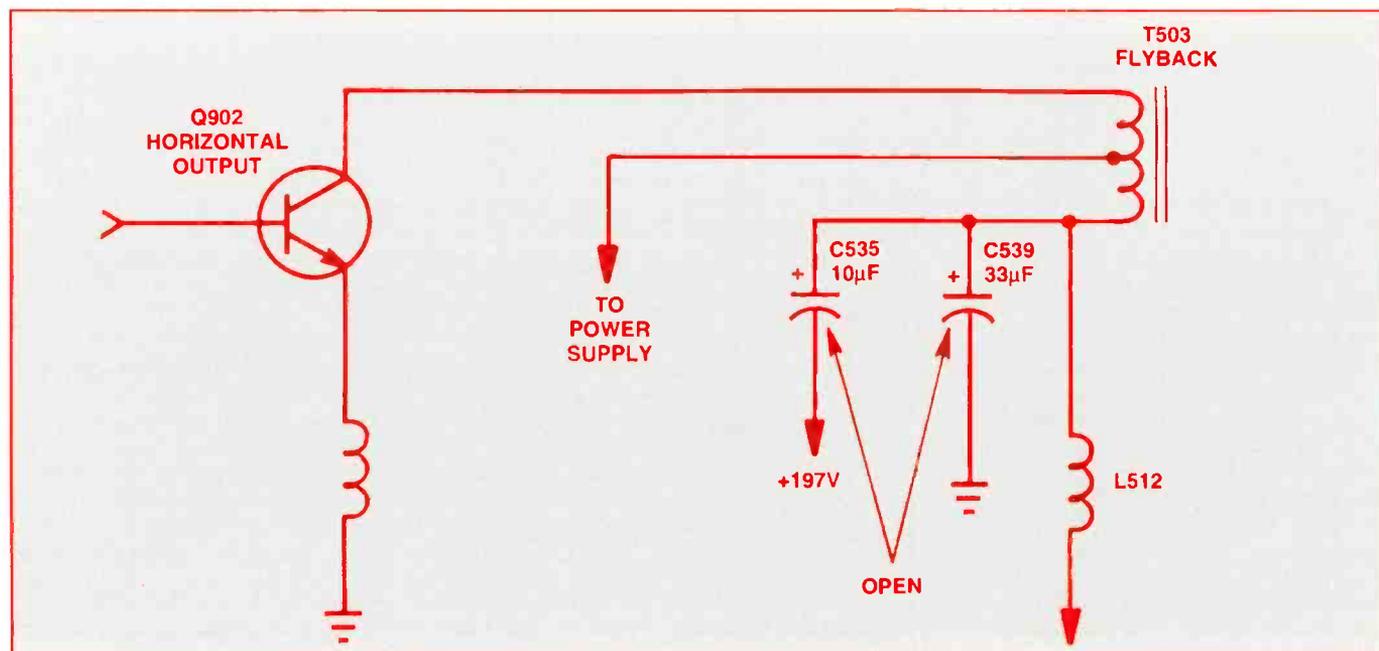
Four dark bars were found at the left side of the raster in a Sony KV-2643R portable. After several hours of trying to determine what caused the dark bars, I shunted C535 and 539 with new electrolytic 180V capacitors (Figure 10). Normal operation was restored with the installation of new electrolytic capacitors.

The left side of the picture in a Sylvania E32-22 chassis was dark and shaded. I had encountered another chassis only last month with the same problem, so I measured voltages on the picture tube socket.

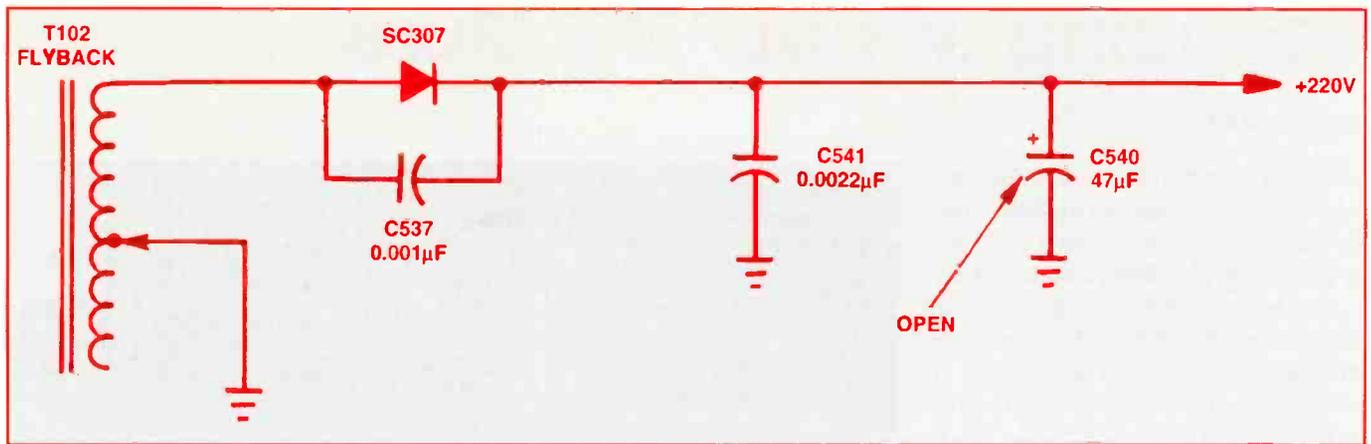
The boost voltage on pins 3, 8 and 10 of the CRT were around 65.5V. The normal cathode voltages of V901 should range somewhere between 125V and 160V. Perhaps a leaky color output transistor or picture tube component was pulling down the boost voltage.

The 220V source in the scan-derived voltage source of T102 was found to be extremely low. Diode SC327 was normal. The ac pulse waveform at the anode side of SC-327 was quite high (275V), indicating normal input transformer voltage.

Resistance to common ground at the



**Figure 10.** Shunt capacitors C535 and C539 of the primary winding of T503 to determine if they're the cause of dark vertical jail bars in a Sony KV-2643R TV set.



**Figure 11.** Replacing filter capacitor C540 (47µF) capacitor in the boost scan derived T402 winding so voided the dark-shaded picture in an Emerson E32-22 chassis.

cathode terminal appeared fairly normal. The boost voltage and picture were restored when C540 (47µF) electrolytic capacitor was shunted with a new one (Figure 11). Most boost voltages are quite high, so defective filter capacitors should be replaced with a 160V to 200V working voltage capacitor.

### The waterfall

The “waterfall” symptom looks like water flowing down from a water fountain to another fountain below. If you encounter this symptom you will never forget it. The cause of this symptom is that the main filter capacitor opens or the foil common ground terminal of the filter capacitor is broken away from the PC wiring. There may be more than one electrolytic capacitor in the same container.

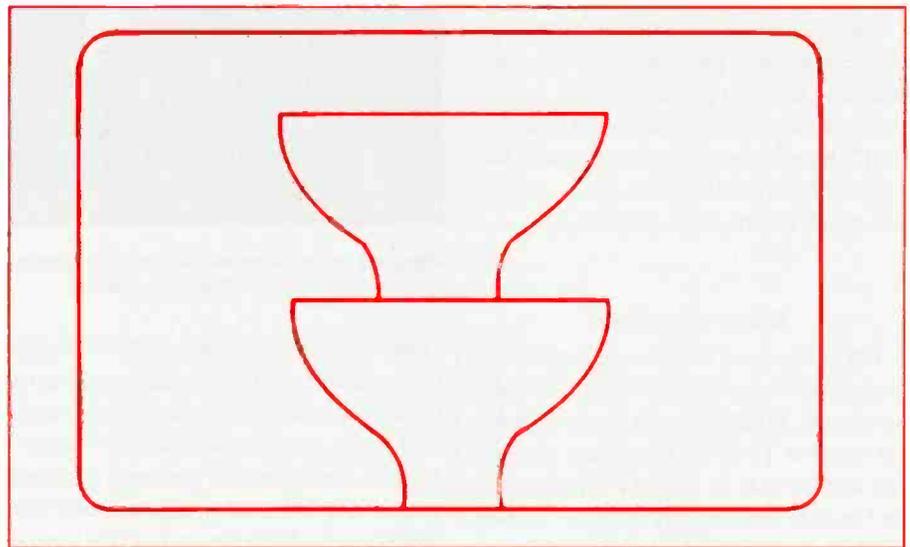
In a Panasonic ETA-3 chassis, capacitor C853 (1200µF) opened and created the waterfall symptom (Figure 12). In a Midland 15023 TV chassis, only one waterfall was noted, caused by a broken trace of PC wiring around the common ground terminal of the large filter capacitor.

Although these waterfall symptoms were found in an older TV chassis, the defective filter capacitor can produce odd raster and pictures in any set.

One other symptom of a defective filter capacitor is a loud plop in the audio when the set is turned off.

### Conclusion

When you observe odd pictures on the screen, suspect an open or dried out main filter capacitor. Check for broken PC wiring terminals of the electrolytic capacitor. Usually, these conditions occur in older



**Figure 12.** The unusual waterfall symptom may be caused by an open or cracked ground wiring connection of a large filter capacitor in the low-voltage power supply circuits.

TV chassis or sets that have been damaged, as from being dropped. If you encounter a set that has been abused in this way, go over the PC wiring with a magnifying light looking for cracked or broken PC wiring.

Do not overlook the odd symptoms caused by an open or dried up electrolytic capacitor in the secondary circuits of the flyback voltage sources. Often lower than normal voltages are found in these circuits when the filter or decoupling capacitors are defective.

Look for noise or oscillations caused by a defective filter capacitor in the scan-derived horizontal output transformer secondary circuits. One at a time, shunt all electrolytic capacitors in the low-voltage power supply and low-voltage sources.

To check the function of a suspected

capacitor, turn the set off, discharge the filter capacitor, and clip a new electrolytic capacitor of the same or higher value across the suspected filter capacitor. Never clip or shunt the original capacitor with power on or you may damage solid-state devices and IC's in the TV circuits.

### Symptoms of defective filter capacitors:

- Inadequate width
- Black hum bars
- Black lines in the picture
- Relay chatter
- Unstable video
- Pulling and crawling pictures
- Jail bars on the left side of the picture
- Dark at left side of the picture dark
- Low brightness and hum in the audio ■

# Servicing without literature

By John Kull

A job is usually done most effectively when the proper tools are available. Unfortunately, these tools may not always be at your disposal. Many times this is the case when working on something that may be considered an "off" brand piece of consumer electronic equipment. A technician is then left to his own devices to troubleshoot and repair. While this is not always an ideal situation, with some available resources and a little detective work, it is possible to service this equipment without literature.

The purpose of this article is to provide suggestions and procedures for troubleshooting this equipment without service documentation. While the article focuses on TV repair, the same principles and concepts can be used to service any type of consumer electronics equipment.

## Using experience

For the veteran technician, experience can play a big role in servicing without a schematic. If you are working on a familiar brand of TV or VCR you may remember and be able to identify certain areas and trouble spots. Many sections, such as the horizontal output, vertical output and power supply, are usually easily identified by familiar components. Also, many technicians keep a log of each piece of equipment they have serviced. It contains make and model information and specific details of how they went about troubleshooting and repairing the problem. The technician can then refer to this case history when a similar problem arises.

## Gaining experience

If your experience is limited, then reviewing a particular product or circuit theory can be invaluable. A good way to do this is to begin building a reference library. Electronics book clubs offer books on theory and repair of many consumer electronic products. Your library also should include component cross-reference guides, transistor and IC data books and a good basic electronic textbook.

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

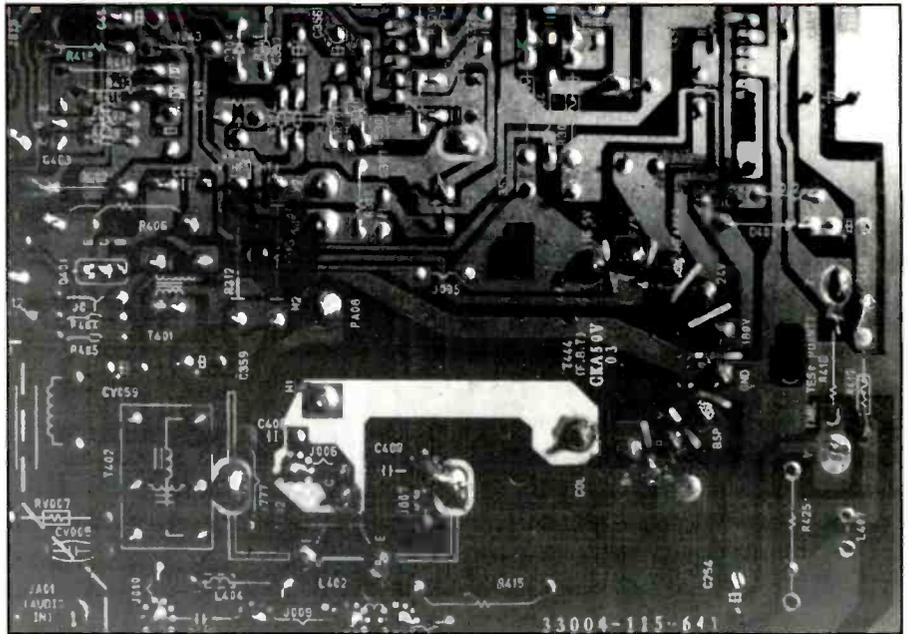


Figure 1. Many modern consumer electronics products have component designations (R1, C1, D1) marked on the printed circuit board.

Although manufacturers will invariably have differences in how they construct a particular circuit, the general operation will be the same regardless of the manufacturer. For example, the vertical output circuit in a TV must produce a sawtooth waveform to drive the vertical deflection yoke. This is the same in any manufac-

turer's TV. This concept is true in many consumer products.

## Troubleshooting without a schematic

The process of troubleshooting without a schematic is the same as troubleshooting with a schematic. The first step is to verify the customer's complaint and de-

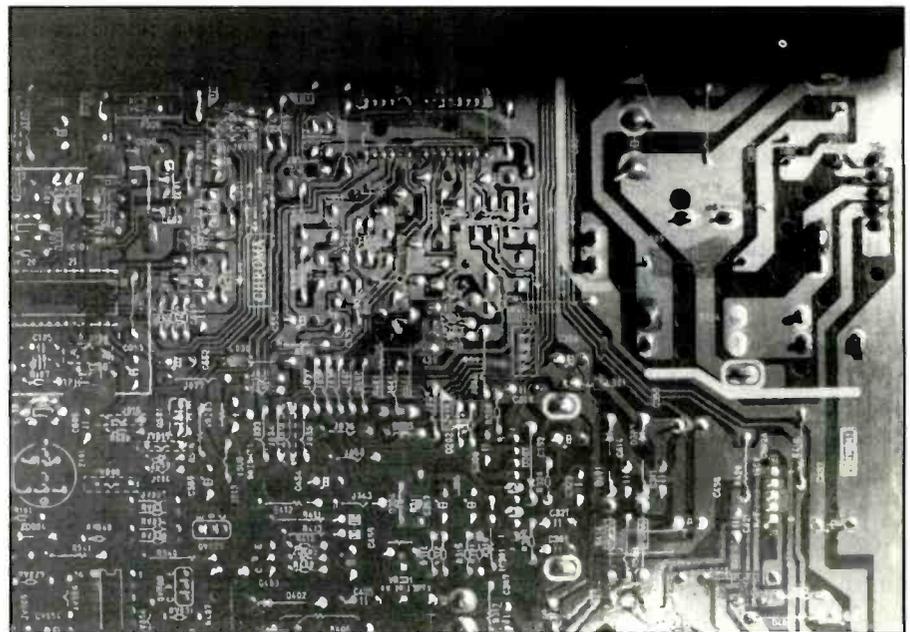
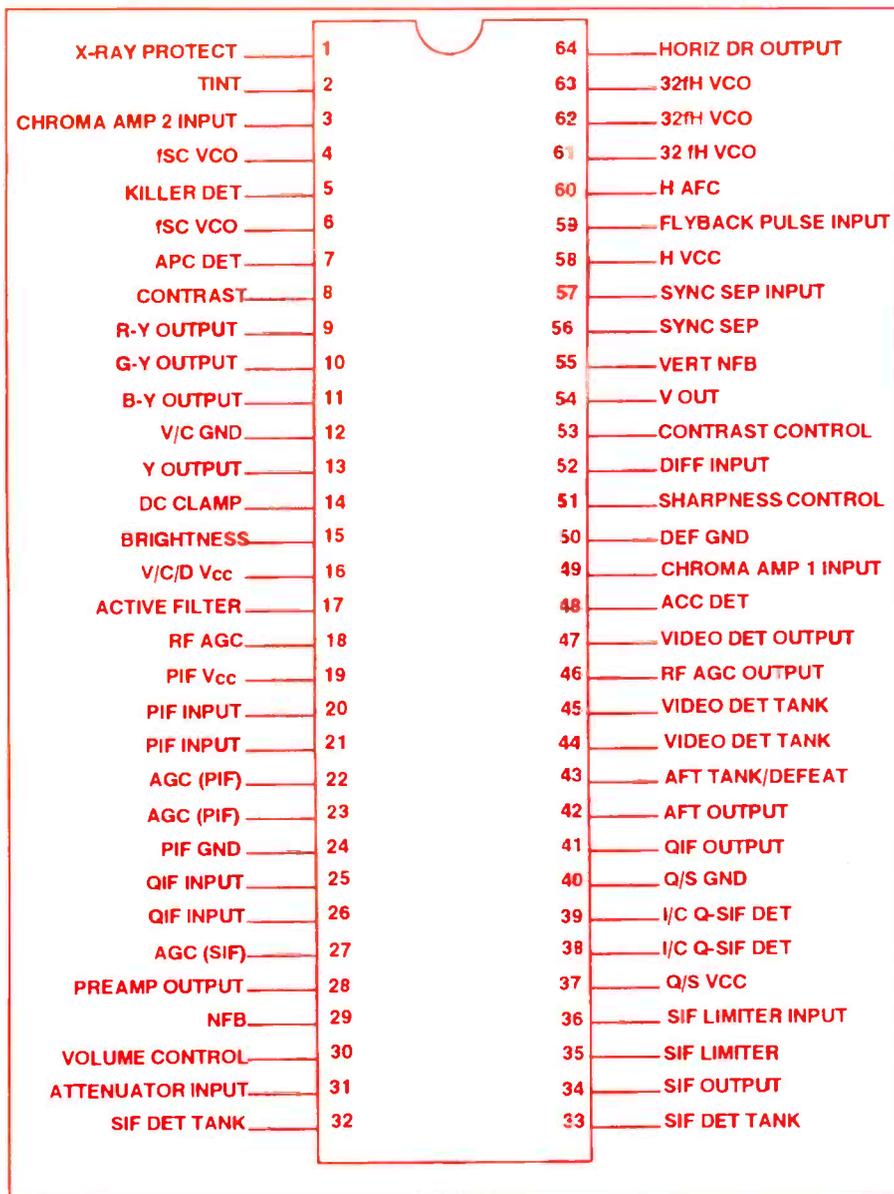


Figure 2. Specified voltages marked on the printed circuit board may help a technician troubleshoot a consumer electronics product where there is no service literature available.



**Figure 3.** One source of useful information are the replacement parts catalogs published by ECG, SK, and NTE. In addition to the cross reference information, these guides also contain pinout diagrams on transistors and IC's and proper testing procedures for various semiconductor components.

cide what stage may be malfunctioning. Perform an initial visual inspection to look for obvious component failures such as burned resistors or darkened areas on the PC board.

If no damage is evident, then you must pursue other resources.

The first place to look for information would be schematics and manuals for similar products. Often manufacturers will use the same or similar circuitry for different models.

If you can isolate the problem to a particular functional block, you can then use the schematic for a similar model to assist you in troubleshooting. If no similar schematic is available, then try to identify a

particular stage or key component. Some sets contain a pictorial drawing of the PC board that shows the location of key components and test points. This drawing is usually glued to the back cover of the set.

#### Using the evidence available in the product

If you can't easily identify a stage, then you must do some investigating. Examine the printed circuit board closely for silk screen legends on the top or bottom of the board. Many manufacturers will draw an outline around each section, making functional blocks easy to identify.

In addition component designations (R1, C1, D1) and voltages may be print-

ed on the board (Figures 1 and 2). All this information can be very helpful when trying to isolate a problem.

If no silk screen information is present then try to locate key components such as IC's, transistors, etc. The next step would be to begin tracing the circuit and make voltage or waveform measurements to further isolate the problem.

Without a schematic you must rely on the silk screen information, if present, along with "foil tracing." Foil tracing involves tracing a signal path by following the printed circuit board's copper foils or "traces." The signal path is followed by tracing the paths from component to component. By tracing the foils you can actually derive your own schematic. (This is how Sams Photofact data is derived.) This process can be tedious, but like anything else, with practice and experience you become faster.

#### Collateral sources of information

As you trace signal paths you probably will encounter specialized semiconductor components. Since you do not have the proper literature you must use other resources for pinout information.

One source of useful information are replacement parts catalogs published by ECG, SK, and NTE. In addition to the cross reference information, these guides also contain pinout diagrams on transistors and IC's and proper testing procedures for various semiconductor components (Figure 3). This information is helpful when tracing a signal path in a particular circuit. The diagrams help you identify V<sub>CC</sub>, ground and input and output pins.

Another useful resource is *The Modern IC Data Book* available from WEKA publishing. This guide contains specs and pinout information on a variety of semiconductors used in consumer and industrial applications. It is purchased by a yearly subscription and is updated monthly.

Another useful service included with your subscription is an information look-up service. You contact them via telephone and request information on a component not included in the manual and they will research it and fax you the information if available.

Also available from this company is an electronics repair manual. This manual provides service tips, schematic and procedure diagrams for working on a variety

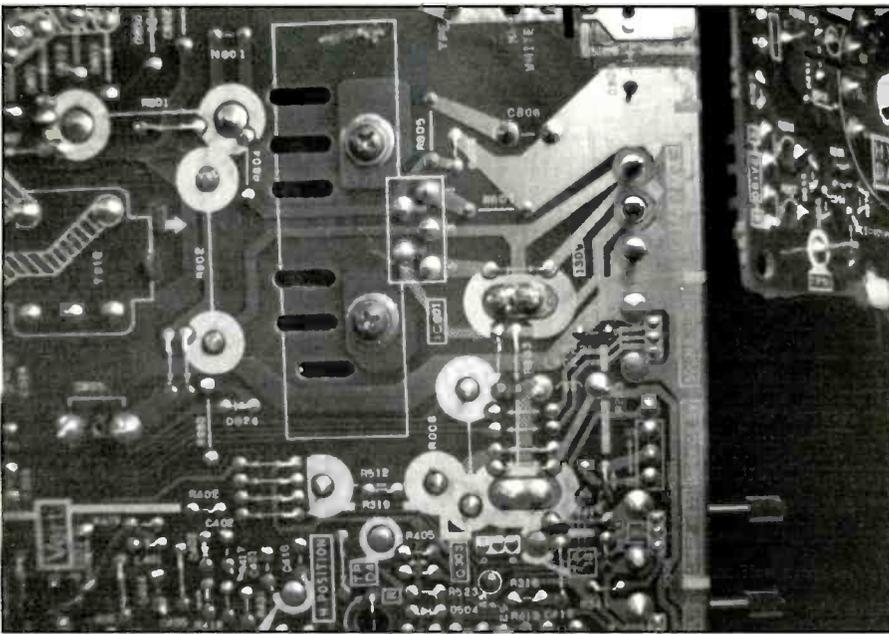


Figure 4. This bottom view of the printed circuit board shows the foils that lead to IC801.

of consumer electronic products.

Once you have located the pinout information, you can then make voltage or waveform measurements to further isolate the problem. It may be helpful to draw the schematic as you trace it out. You can then make notes of voltages and wave-

forms obtained at various test points. Continue tracing the circuit until you have found the defective component.

#### One experience

The following is a case history of a television repair completed without a sche-

matic. Many previously discussed techniques were used to troubleshoot and repair the set.

A customer brought in a 19-inch JC Penney TV. The set was dead: no sound or raster. The customer explained that he had removed the back of the set and found a fuse blown. He replaced the fuse but the set still did not operate. I told him I would check it out and call him with an estimate.

I looked the set up in the Sams Photo-fact Annual Index, but found that it was not listed. I checked my own library and found that I had very few JC Penney schematics. The ones I did have were on older model sets. I probably could have ordered the service documentation from JC Penney or a parts supplier, but I decided to continue without documentation.

I removed the back and visually examined the circuit board for burned or damaged components. I found no signs of damage. I removed the fuse and found it to be good. I then examined the bottom and top of the circuit board in more detail. I was able to identify the power supply section from the silk screen legend and the familiar four discrete diodes and a large filter capacitor.

I connected the set to a variable isola-

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tion transformer and slowly brought up the line voltage while I monitored the voltage across the filter capacitor. When the line voltage reached 120Vac, the voltage across the filter capacitor measured around 160Vdc. I then traced the printed circuit foils to what I assumed to be a voltage regulator (Figure 4). This component was a five pin device, marked as part number STR30130.

I looked up the "regulator" in my NTE reference guide and found that I was correct in my assumption. The device was a 130Vdc regulator, NTE replacement number 15032. I was then able to identify input and output pins on the regulator from the pictorial drawing provided in the guide (Figure 5).

I returned to the set and measured the input voltage to the regulator. I measured less than 1V on the input pin. Tracing the foils back from the input pin I discovered R801, a 5.6Ω, 3W power resistor. I measured the resistance of this resistor in circuit and found it to be open. I knew from experience that this resistor was there to limit current to the regulator and was designed to open and act as a fuse if the regulator drew excessive current (Figure 6).

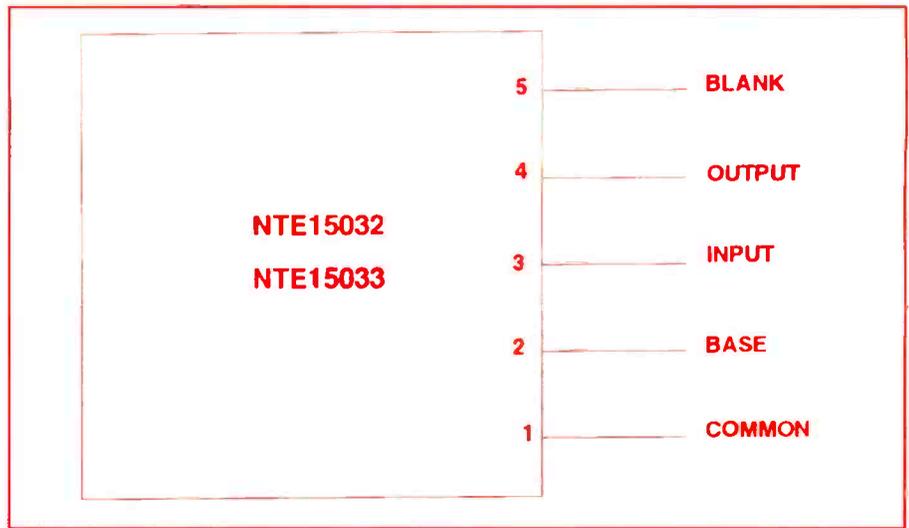


Figure 5. This pinout diagram obtained from the NTE cross-reference guide provided me with information on the input and output voltages for IC801.

I then reasoned that something was probably loading down the regulator or it was defective. I made a resistance check on the output pin of the regulator to ground and measured 112Ω. I knew that this resistance was too low. A normal measurement would have been at least several KΩ.

My first thought was that this could be an indication of a shorted horizontal out-

put transistor. I quickly identified the horizontal output transistor mounted near the flyback transformer on a large heatsink. I removed it and checked it with a DMM. The transistor was good.

At this point I knew it might take some time to trace the circuit further to find the shorted or leaky component. However, I decided to continue tracing the circuit with the PCB foils. I already had spent



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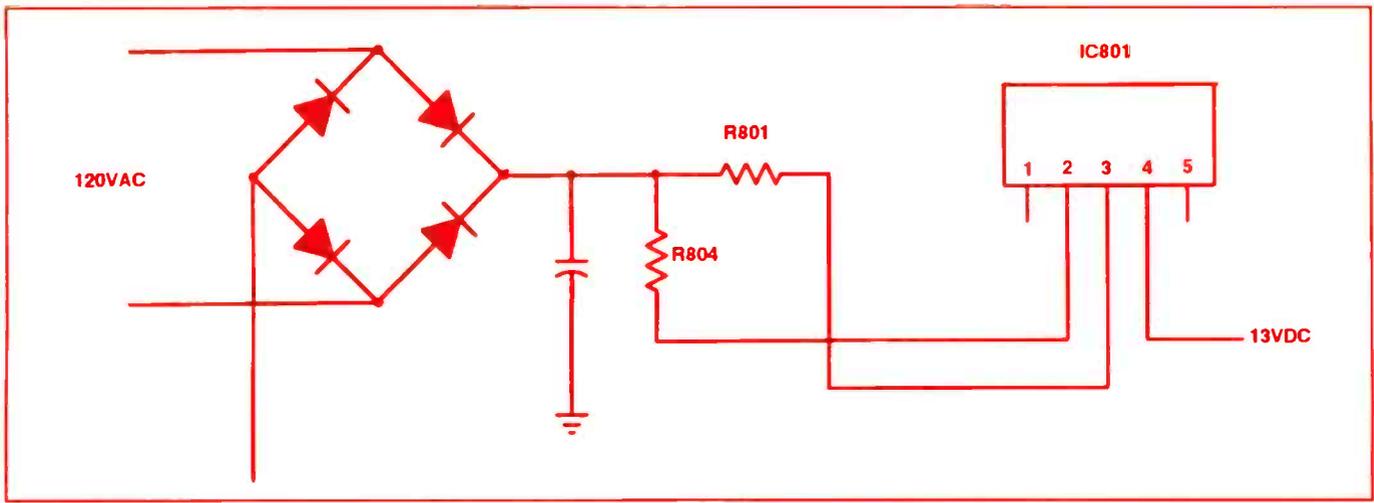


Figure 6. By tracing circuit foils, you can draw your own simplified circuit diagram such as this one, which will provide you with an idea of the circuit construction.

about 45 minutes on the repair, so I felt additional time would be justified.

### Tracing power supply outputs

The technique I use involves tracing the printed circuit foils from the power supply to try to isolate feeds to different sections in the set. I do this by following a PCB foil until I find a component or jumper wire that I can desolder at one end to isolate it from the rest of the circuit. I

then recheck the resistance from the power supply to see if it has changed. I continue tracing and isolating sections until the measured resistance returns to "normal." At that point I know I have found the defective section or component. This process can sometimes be tedious, but with practice I have found it to be a very effective troubleshooting tool.

As Murphy's Law would have it, one of the last sections I tested turned out to

be the defective area. A ceramic capacitor in the horizontal output circuit had arced over and shorted. The capacitor had a large black mark across it. It was located on the opposite side from which I originally viewed the set during my initial visual inspection. I replaced the capacitor and power resistor and the set operated normally.

I spent a little over two hours on this repair including component replacement and final checkout. The total replacement parts cost was less than five dollars. I was able to save the cost of documentation and still complete the repair in a reasonable amount of time.

In some cases, documentation may be available, but its purchase is cost prohibitive. You may be working on a popular manufacturer's product, but you don't expect to ever see another one again. The price of the documentation probably will be figured into the cost of the repair, increasing the cost to the consumer and decreasing your profit margin.

### Is the service justified?

Although, this form of servicing can be very challenging and rewarding, servicing without documentation can very often be time consuming. You must consider this when giving your customer a repair estimate. Often the time may not be justified. The cost of replacing the product, and what you feel the customer is willing to pay for service, will dictate the amount of time you spend on a particular repair. The skills you develop in this type of servicing will enhance your abilities when you do have documentation, and it will make you a better technician. ■

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When a person visits the doctor's office with a complaint, the first thing that happens is a series of tests: temperature, blood pressure, weight, height, blood samples, etc. All of these tell the doctor something about the condition of the patient. Depending on the nature of the complaint and the results of this battery of tests, the next step may be to order some more tests: x-rays, electrocardiogram (ekg), electroencephalogram (eeg) and others.

When a driver brings his car in for service, a similar procedure may take place. The service may start with visual checks, but then it will probably proceed to things such as compression tests, voltage tests, and possibly a full-blown engine analyzer test.

The same type of procedure generally takes place, no matter what the nature of the patient may be, or the nature of the complaint. In each case, a series of tests is performed, and the accuracy of the test results depends on the quality of the instruments and the skill of the tester in applying the test equipment and in interpreting the results of the tests.

The tasks performed by a technician in servicing a consumer electronics product usually follow a similar logical procedure. The first step is a thorough visual check to see if there are any obvious signs of the cause of the problem. After the visual check, it's time to perform the operational check: plug the unit in, turn it on, and see if he can duplicate the symptom(s) described by the owner.

### The test equipment

After the preliminary steps described above, the technician connects the test equipment to the suspected problem area and begins to take resistance readings, voltage readings, and observes waveforms on the oscilloscope. Just as with the doctor's x-ray, ekg and eeg, it's this sophisticated test equipment that really lets the technician know what's

going on in the circuitry of the patient.

Today's consumer electronics products are highly complex. In many cases, a consumer electronic product is far more than a product; it's an intricate system. Consider a camcorder. The electromechanical portion of the system loads the tape and records or plays it. The electronic portion manipulates the video and audio signals. 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. The optical system adjusts magnification, focus and converts the visual scene into an electronic signal.

Because of this complexity of today's consumer electronics products, the test equipment used by the technician in performing diagnoses and repair must be sophisticated. And because many of the products a technician faces today—VCRs, CD players, computer disk drives—are electromechanical, adequate diagnosis and repair may require sophisticated mechanical test equipment as well as electronic test equipment.

The value of a piece of test equipment to the technician depends on a number of factors. Here are a few:

- Ease of use
- Capability
- Accuracy
- Cost
- Support by the manufacturer
- Versatility

### Buying a piece of test equipment

Often when a service center buys a piece of test equipment, the purchase is not completely thought through. For example, when it's decided that the service center needs a new oscilloscope, some research is performed on the products and prices, and an oscilloscope is purchased.

Most purchases done in this manner turn out fine, but sometimes the

organization learns to its chagrin that the unit just doesn't do the job. Sometimes the organization learns too late that the unit they just bought is overkill. You see some of those items listed in Readers' Exchange.

Just as with any purchase, the use to which the test equipment will be put should be thoroughly studied. The best approach would be to put together a checklist, and every technician who is likely to use the unit should be given an opportunity to participate in the decision. The example checklist questions are for an oscilloscope, but a similar checklist would be useful for any other piece of test equipment.

### The checklist

- What products will this equipment be used to test?
- What bandwidth is needed?
- Single-channel, or two-channel?
- Is waveform storage needed?
- Will this be used at the bench, or on site as well?
- Does it need to have readout of waveform parameters?
- Can this purchase be cost justified as a time and effort saver?

### Getting acquainted with the suppliers

Because the decision to purchase a piece of test equipment is so pivotal, the more you know about the manufacturers or suppliers, the better informed your decision will be.

This special advertising section, "Test Equipment Showcase," was conceived as a way to help bring more information about test equipment providers to readers. Every advertiser in this section has been given additional space to tell readers something about that company, or to help readers understand the value and use of that company's products.

We invite you to read what these companies have to say about themselves and their products.

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A VCR contains rubber belts, wheels, idlers, gears, brakes and tension bands that are there to maintain the proper torques and tape tensions during the various loading, play, rewind, fast forward, and stop modes. All of these, plus the actual video head tips are subject to normal wear.

Every time the consumer plays a tape, these components stretch, wear, shift position, and are stressed. Contaminants and oxygen, in the air, cause many of these parts to age and break down even without use.

By the time a VCR requires service, several of these components are probably out of tolerance. Nine out of ten (90%) VCRs brought in for service have mechanical, rather than electronic, problems. When a customer brings in a VCR for service, the entire tape transport system should be checked.

Since many components in the transport are subject to wear during its use, once the immediate cause of the problem has been corrected, you should perform a thorough check of the other mechanical components to be sure that they too are in proper operating condition.

If you merely correct the immediate problem and return the VCR to its owner without a thorough check, there's an increasing risk that one or more mechanical components will soon either fail or cause erratic operation. The result of all this is a disgruntled and possibly lost customer, and either a call-back that wastes time or, even worse the customer tosses the VCR in his closet and purchases a new one, carefully selecting a different VCR manufacturer. (It's the same for cars, if you get a "lemon" and the dealer can't fix it properly, the customer will typically change to a different manufacturer!)

That's why every VCR service should include a check, and adjustment if necessary, of tape guide heights, holdback tape tension, and numerous torques (including FF, REW, brakes and restoring torques). All of these checks and adjustments are specified in the service manuals of every manufacturer. You may also find it valuable to check the video head wear to see how many more hours of life the VCR owner can expect from them.

A thorough test and adjustment will allow the service center to do it right the first time, and possibly collect a little more money for performing all the work that should be done anyway, plus you'll avoid disappointing the customer and avoid those dreaded call-backs.

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Payment for orders may be made by check, money order or cash, as well as Visa, Mastercard, American Express and Radio Shack credit cards. A commercial charge account may be set up for your company—just ask your sales representative how to set up an account.

**Tandy National Parts Distributor Sales** is committed to provide quality products, dependable service and on-time deliveries.

To place an order or request manufacturer catalogs, call 1-800-322-3690 8:00 AM–5:00 PM CST, Monday through Friday.



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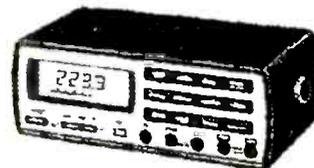
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**Fluke Corporation**  
**P.O. Box 9090**  
**Everett, WA 98206**  
**Phone: 1-800-44-FLUKE;**  
**Fax: 206-356-5962**

"Our customers have the right to get a little more than they thought they paid for," says John M. Fluke, Sr., the Founder of Fluke Corporation.

Fluke's mission is to be the world leader in compact, professional electronic test tools. For many customers, that means turning to Fluke for the world's highest quality handheld digital multimeters and accessories. For others, it means harnessing the power of a digital storage oscilloscope by using Fluke's revolutionary ScopeMeter test tool. And for others still, it means discovering new products and new areas of Fluke expertise, such as wireless data logging and LAN troubleshooting.

Regardless of the specific product and application involved, Fluke encourages its customers to look beyond basic specifications, and look at the total combination of features, functions and overall value represented by a product's design and care taken in its production. This concept is engineered into every Fluke product, and is best exemplified by looking at our handheld DMM family.

**Proprietary circuit design and manufacturing facilities**  
 Innovative instruments result when

engineers design products to solve specific problems, using state-of-the-art design and manufacturing resources.

Integrated circuits developed in our Microcircuits laboratory have produced breakthrough performance features for handheld DMMs, such as dB, capacitance, frequency and duty cycle measurement, virtually invisible autoranging, a fast analog bar graph, and a Touch Hold function.

**Human engineered with attention to detail**

You may never notice the finer details built into our multimeters, but each has been thoughtfully created for your benefit. Like non-skid rubber feet, grooved sides and textured cases for surer grip, and careful attention to color selection to match the job.

No other DMM manufacturer we know of invests as much care in human engineering.

**Environmentally tested for reliability**

Reliability, especially under tough conditions, is more important than ever today. So, by the time Fluke DMMs are ready to be tossed in tool cases, they've undergone a rigorous testing and evaluation program.

Fluke DMMs are regarded by industry professionals as the toughest, most forgiving multimeters ever made.

**Accessories for every purpose**

A full-line of accessories extend the measurement capabilities of Fluke DMMs. This includes temperature probes that convert any DMM into a thermometer (thermocouple, semiconductor and infrared types are available), current clamps, high-voltage probes, high-frequency probes, test leads and carrying cases.

**American quality recognized worldwide**

Design innovations and production efficiencies are essential to our commitment to manufacture the world's most capable multimeters . . . in the U.S.A. Fluke uses a variety of automated manufacturing processes, allowing us to offer you one of the highest quality multimeters available, at affordable prices, and backed by the finest warranty coverage in the business.

The Fluke multimeter. It's a product with a reputation to uphold. Built to meet your needs, and consistently exceed your expectations. An electronic tool you'll rely on for accurate measurements year after year.

**For more information**

For more information on Fluke multimeters, or any of our other professional test tools, call 1-800-44-FLUKE. Or write to: Fluke Corporation, P.O. Box 9090, Everett, WA 98206.



# ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

**MCM Electronics**  
**650 Congress Park Dr.**  
**Centerville, OH 45459**  
**Phone: 800-543-4330**  
**Fax: 513-434-6959**

MCM Electronics is dedicated to delivering the finest test equipment on the market. MCM offers brand names like Fluke, Leader, B&K, and Hitachi because they are recognized leaders in the consumer electronic service industry.

### Tenma®, The Worlds Most Affordable Test Equipment

One name that is rapidly emerging as the top choice among service technicians is MCM's exclusive line of TENMA Test Equipment. Every TENMA product is engineered to exacting industry standards required to meet the needs of professionals in service, research and development, testing and training. Regardless of our measurement or test application, TENMA delivers reliable performance, accuracy, functional design

and dependability. Known throughout the industry as, "The Worlds Most Affordable Test Equipment," TENMA offers unsurpassed value across a broad range of products. Included are oscilloscopes, benchtop and hand held DMM's, laboratory grade power supplies, pattern generators soldering equipment and our exclusive computer monitor testers.

### Discover The MCM Electronics Difference

MCM publishes two full-sized catalogs annually. The latest issue boasts over 2,600 new products and 324 pages, with over 30 pages devoted solely to test equipment. In addition, MCM stocks over 21,000 of the most commonly used replacement parts, components, semiconductors and tools in the electronics industry. Sales flyers are mailed regularly featuring specially priced items and new product additions keeping the customers up to date on the latest available products.

### Superior Customer Service

The MCM staff is trained to answer all

calls fast, friendly and efficiently. All 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 9:00 p.m. EST, and Saturday 9:00 a.m. to 6:00 p.m. EST. Faxed orders are also accepted 24 hours a day, seven days a week. MCM also provides highly trained electronics technicians to answer customers product questions. With a separate toll-free "Tech Line," customers receive prompt answers to their questions by calling 1-800-824-TECH (8324).

### Top-Notch Distribution

MCM is committed to providing superior customer service. Distribution centers are strategically located in Moraine, Ohio and Sparks, Nevada. This enables ground rate shipping to most of the U.S. within 72 hours. In addition, with over 21,000 items stocked, 99% of all orders are shipped within 24 hours. For more information and a free catalog, call 1-800-543-4330, in Dayton, Ohio, call 513-434-0031.

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Function Generator



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ES-76

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## Wavetek Corporation

9145 Balboa Ave.

San Diego, CA 92123

Phone: 800-854-2708; 619-279-2200

Wavetek Corporation designs, manufactures, and markets worldwide a broad range of electronic test and measurement instruments that are used for the design, service, evaluation, production, and maintenance of electronic devices and systems. Wavetek operations are tightly focused on well-defined segments of the diverse test and measurement marketplace with products specifically designed for particular applications. Recently, Wavetek acquired the Schlumberger Communications Test Division (CTD), which includes both the Radio Communications Test Equipment and the Telecommunications Test Equipment groups. These groups manufacture and distribute portable video transmission, data communications, and optical fiber network test equipment.

Wavetek has three operating divisions: Calibration Division, Communications Division, and Instruments Division. The Instruments Division offers a full line of calibration products, test simulators, LAN cable test equipment, digital multimeters, function generators, counters, and service test instruments.

Wavetek's calibration and test simulation instruments are widely used in research and manufacturing environments. A large variety of precision voltage references, meter calibrators, arbitrary waveform generators, and function and pulse generators are available to choose from.

The newest addition to the Wavetek family of calibrators is the Model 9000 Multifunction Calibrator. Model 9000 is designed to affordably and completely calibrate modern handheld DMMs.

For LAN cable system testing and TIA/EIA Category 5 certification, Wavetek has just introduced the hand-held LANTEK™PRO. The LANTEK PRO offers next-generation features that help measure a variety of critical cable characteristics necessary for reliable cable installation and also increase user productivity.

Wavetek's digital multimeters have an established reputation for quality and reliability. The comprehensive line offers selection to fit a range of applications and features for all job requirements.

The Series 2000 provides engineers and technicians with highly versatile, professional-grade, handheld digital multimeters. The series offers a variety of standard DMM functions in addition to a frequency

counter, capacitance meter, and intermittent and pulse detector. The extra large, 4-digit, LCD is backlit with fiber optics in Models 2020 and 2030. Model 2030 offers 0.1% accuracy, capacitance range from 100pF to 2000µF, a frequency counter range to 2MHz, and true RMS. The 2030 offers the most troubleshooting features available in a handheld instrument.

The XT series features specialized high-performance, full-function digital multimeters. Each measures not only voltage, current and resistance, but also offers additional functions important to troubleshoot the electronics you work with. The most versatile of the line, the DM27XT measures inductance from 1mH to 20H, frequency up to 20MHz, and capacitance from 1pF up to 2000µF. The newest model, DM28XT, combines DMM capability with a high-accuracy, wide-range temperature meter to address the demanding service needs of HVACR building maintenance technicians.

A more compact series of meters is the XL Series. These compact, reliable, and rugged DMMs are small size and low cost. They feature large LCD digits for easy viewing, and input warning beepers and safety test leads for user safety. All three models (DM5XL, DM10XL, and DM15XL) are designed to safely meet measurement requirements of the field service industry. The DM10XL features the Safety Tester™ to detect and display the presence of particular ac or dc voltage levels. The DM15XL offers a Logic Tester to detect and display the presence of TTL pulses up to 20MHz.

The CPM series are clamp-on, true RMS power meters that combine many meters into one, easy-to-use handheld instrument for installing, maintaining, and monitoring electrical systems with linear and nonlinear loads.

Wavetek's CDM600 is a digital multi-clamp for ac and dc current. Using advanced Hall-effect technology, it accurately measures ac and dc current up to 600 Amps without disturbing the electrical wiring.

Beyond hand-held DMMs, a broad line of other test instruments are offered for the professional service technician. Included are bench-mount, portable function generators, frequency counters, and DMMs. For component test and troubleshooting, LCR meters, capacitance

meters, logic probes, and the oscilloscope and complementing Scopemate™ 21C analyzers are available.

An extensive selection of replacement and application-enhancing test leads and probes are available for various requirements. These leads are high-quality and can be used with any brand of meter. The lead tips are shrouded to protect the user from the dangers of exposed metal during testing. The silicon-insulated lead wires offer increased flexibility and high resistance to solder burns for the best performance and long life.

Wavetek's TC253 is a temperature converter which allows any brand multimeter to read temperatures from -50°C to 900°C (-32.4°F to 1652°F). A variety of measurement probes are available for this model including immersion, surface, air/gas, piercing tip, and more.

Wavetek also offers high-voltage probes and a radio frequency probe for use with multimeters. The RF241 is a radio frequency probe perfect for two-way communication applications. It is designed to operate with 10 or 22MΩ input digital multimeters.

To ensure that the equipment performs to specification over the life of the product, Wavetek offers its customers a variety of services. All Wavetek instruments are warranted against defects in workmanship and materials. The digital multimeters have standard warranties ranging from one to three years. On some of these, additional warranties for calibration and contamination are also included. Maintenance training courses are available and can be designed and customized to meet specific needs. Comprehensive operator and maintenance manuals are available for all current products as well as many discontinued products. Product support is provided on all products by Wavetek's highly qualified team of customer support technicians. For customers requiring calibration certifications, such as ISO9000 programs, Wavetek offers selection from basic certification to full NIST traceability.

For over 20 years Wavetek has provided high-quality products and services to our customers. Wavetek has a strong commitment to customer satisfaction and offers customers expert technical support. Dedication to understanding our customers' needs in an industry of constant technological advancements, keeps Wavetek in the forefront of product development and innovation.

With headquarters in San Diego, California, Wavetek sells its products through a worldwide network of representatives, distributors, and dealers. For the distributor nearest you, call (800) 854-2708.

# ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

**Herman Electronics**  
**1365 Northwest 23rd St.**  
**Miami, FL 33142**  
**Phone: 800-938-4376**  
**Fax: 305-634-6247**

Herman Electronics is one of the country's largest original replacement parts distributors and is now a major supplier of TEST EQUIPMENT. In business for over 40 years, Herman has clearly established itself as an industry leader by providing quality products and superb customer service to all phases of the electronics industry.

If you need test equipment, Herman has it. Herman Electronics is now an authorized distributor for such leading brands as FLUKE, B&K, WAVETEK/BECKMAN, GOLDSTAR, HITACHI, TRIPLET, SIMPSON, AMPROBE, and LEADER as well as large numbers of probes and accessories. The company is quickly establishing itself as stocking one of the largest and most diverse inventories of tools, test equipment and soldering supplies in the

country. It has always been the philosophy that in order to serve the customer, the item must be on the shelf when needed in order to facilitate immediate delivery; and Herman does just that.

Herman's new focus is to become a SINGLE SOURCE to all facets of the electronic service industry. As one of the nation's largest factory authorized OEM parts distributors for SONY, PANASONIC, GE, TOSHIBA, QUASAR, KENWOOD, SAMSUNG, and RCA, there is no longer any need for busy service organizations to call all over the country to buy parts and all related service peripherals such as tools, test equipment, soldering equipment, storage devices, etc. says Jeffrey A. Wolf, Vice President and son of the company's founder. "It is our goal to be a SINGLE-SOURCE to fill all of our customer's needs."

In order to accommodate this extensive expansion and significantly increased inventories, Herman is preparing to move to their new state-of-the-art facility in April 1995. Located only minutes from the Miami International Airport and in the

heart of the electronics center of Miami, this facility will allow them to grow and prosper well into the 21st century.

Also coming soon is the first edition of the HERMAN CATALOG. This 350-page buying guide will be an extensive profile of all the products Herman has to offer. After over a year in the making, this book will become a standard for those in the service industry.

Herman Electronics makes ordering easy. Customer service representatives are standing by to take your call. Call toll-free (800) 938-4376 or FAX (800) 938-4377. If you have any questions or you're not sure as to what you need, please ask to speak to an industrial sales representative for assistance. All out-of-state orders are shipped 2nd day air at NO additional charge to insure 2-day service to you.

If you have not given Herman Electronics a try, please do so NOW. Quality, reliability, and service excellence is what they stand for. Let Herman work for you!



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## RNJ Electronics, Inc.

805 Albany, Ave., PO Box 528  
Lindenhurst, NY 11757  
Phone: 800-645-5833  
Fax: 800-RNJ-FAX1



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

such as cameras, monitors, sequential switchers, quad splitters, lenses, etc.

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

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

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

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

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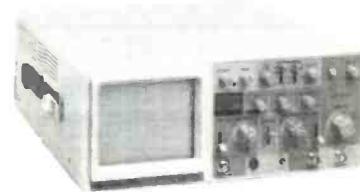


B&K MODEL 2120-  
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\$379<sup>99</sup>



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**Print Products International**  
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**Silver Spring, MD 20910**  
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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.

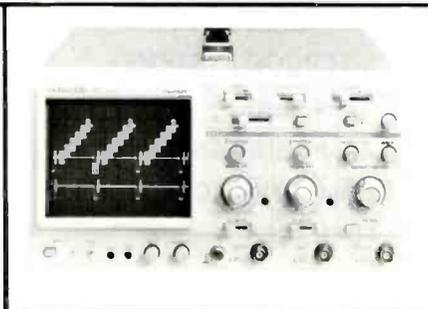
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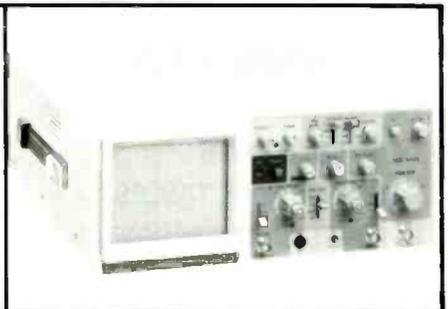
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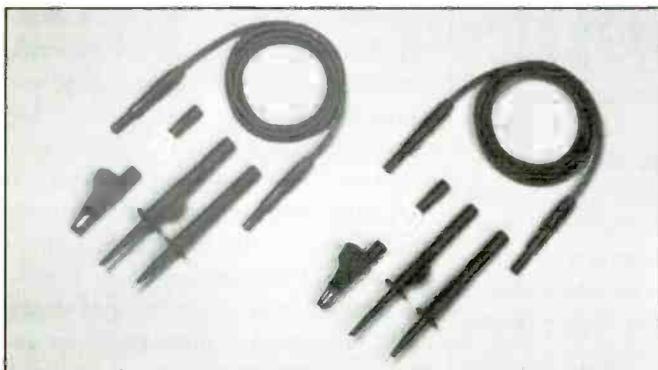


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# ★ ★ ★ TEST EQUIPMENT SHOWCASE ★ ★ ★

**Test Probes Inc.,**  
**9178 Brown Deer Road**  
**San Diego, CA 92121**  
**Phone: 619-552-2090**  
**800-368-5719**  
**Fax: 619-535-1260**

Test Probes Inc., was founded in the mid-seventies initially as a master distributor for a UK manufacturer of oscilloscope probes. Since then, TPI has grown steadily to become a major supplier of test and measurement accessories servicing companies throughout the world. This unrivalled success has been due to sup-



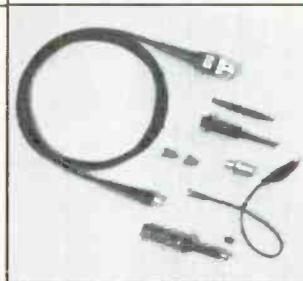
plying quality products at realistic prices, together with fast delivery and dedication to customer service.

In addition to the stock items in the catalog, TPI is able to offer a complete design and manufacturing service for instrument OEMs and indeed, many major manufacturers specify TPI products to be supplied as original equipment with their instruments. Continuing in this tradition, we are pleased to announce the release of a new catalog containing more innovative and high quality products for the test and measurement industry including a handy fuse and lead tester, a new high frequency (1 GHz) FET probe with unique switch selectable attenuation and a range of high quality co-axial adaptors for cellular radio and other high frequency applications. Other items recently re-introduced include the HV15HF high voltage probe with bandwidth up to 5MHz and a 0-31dB switchable attenuator, with a bandwidth of DC-500MHz. Whether your requirements can be met from our stock items or our design and manufacturing service, we invite you to call now for prompt and expert attention.



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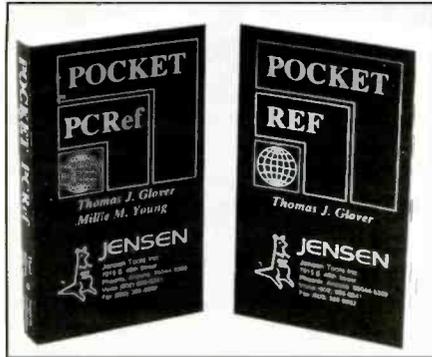
**TEST PROBES, INC.**



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***The Pocket PC Ref*, By Thomas J. Glover and Millie M. Young, Jensen Tools, Inc., 320 pages, \$14.95. *The Pocket Ref*, By Thomas J. Glover, Jensen Tools, Inc., 480 pages, \$9.95.**

Jensen Tools Inc. offers two pocket-size handbooks that contain reference



information on a broad range of technical subjects. They are about the size of a 3 x 5 postcard and less than a half inch thick.

*The Pocket PC Ref* (939B010) is a reference of computer information—particularly on PC hardware. It presents 320 pages of tables and charts on video standards, keyboard scan codes, floppy drive and hard drive specifications, printer codes, and CPU processor types, ASCII codes, trade marks, DOS 5.0 commands, and more.

*The Pocket Ref* (939B005) contains 480 pages of tables, diagrams, conversions and constants in such categories as carpentry and construction, glues, solvents, paints and finishes, hardware, pipe and plumbing, tools, and electrical (wire, motors, and frames), automotive, electronics, weights and measures, welding and more. *The Pocket Ref* also contains a section on trade names and trade marks, a 10-year calendar, and blank pages for personal notations.

Jensen Tools Inc., Phoenix, AZ

***Schematic Diagrams: The Basics of Interpretation and Use*, By J. Richard Johnson, PROMPT Publications, 208 pages, \$16.95 paperback.**

*Schematic Diagrams: The Basics of Interpretation and Use* is designed to teach readers about schematic diagrams in a simple, systematic manner.

Step by step, this book shows the reader how to recognize schematic symbols and determine their uses and functions in diagrams. The reader will also learn how

to design, maintain, and repair electronic equipment as the contents of this book move logically through the fundamentals of schematic diagrams.

The subjects covered include: component symbols and diagram functions, functional sequence and block diagrams, power supplies, audiosystem diagrams, computer diagrams, and more.

*Schematic Diagrams* is an instructional tool for students and hobbyists, and a guide for technicians.

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

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

***General Radiotelephone Operator's License Study Guide, Fourth Edition*, By Thomas LeBlanc, NX7P, McGraw-Hill, 352 pages, 200 illus., \$29.95 hardcover.**

This book has helped electronics technicians and students pass the FCC General Radiotelephone Operator's License exam. Now revised to include the latest questions and answers from the FCC's official question pool, this book is an essential study guide for anyone who wants to hold a commercial radio license on the first try.

In addition to helpful details on when, where, and how to apply for the license examination, LeBlanc includes important information on new FCC rules and regulations, satellite basics, radio wave propagation fundamentals, frequency counters and spectrum analyzers, series and parallel impedance calculations, and receiver theory.

McGraw-Hill,

Blue Ridge Summit, PA 17294-0850

***Build Your Own Low-Cost Signal Generator*, By Delton T. Horn, McGraw-Hill, 320 pages, 100 illus., \$19.95 paperback, \$32.95 hardcover.**

Most electronic systems work on a signal and, in most cases, a very specific one. This book describes how to generate almost any kind of signal the hobbyist or experimenter is likely to need.

Complete circuits, parts lists, and helpful illustrations guide the reader through the process of generating signals—from

direct current to complex digital synthesis. In addition, this book features one complete project—a low-cost signal generator—which has a myriad of applications in the electronics world, including troubleshooting, repair, and circuit design.

For beginning- to intermediate-level professionals and intermediate- to advanced-level hobbyists, this book will also appeal to inventors and electronics manufacturers.

McGraw-Hill,

Blue Ridge Summit, PA 17294-0850

***The Benchtop Electronics Reference Manual, 3rd Edition*, By Victor F.C. Veley, TAB Books, 736 pages, 400 illus., \$54.95 hardcover.**

*The Benchtop Electronics Reference Manual 3rd edition* covers dozens of topics not found in the first two editions, including differentiator and integrator circuits, radio frequency transformers, piezoelectric crystals, directional antennas, Smith chart, propagation, scientific notation, partial derivatives, quadratic equations, matrices, determinants, and graphical analysis.

Drawn from such subjects as direct current, alternating current, solid-state, communications, Boolean algebra, microwaves, and mathematics for electronics, the topics are presented in three stages: basic principles, mathematical derivations, and examples that demonstrate the use of the various equations.

Veley is a professor of electronics technology at the Los Angeles Trade-Technical College. He lives in Palm Desert, CA, and is the author of *Basic Electronic Communications for the FCC General Radiotelephone Operator's License Exam*.

TAB Books, McGraw-Hill Inc.,

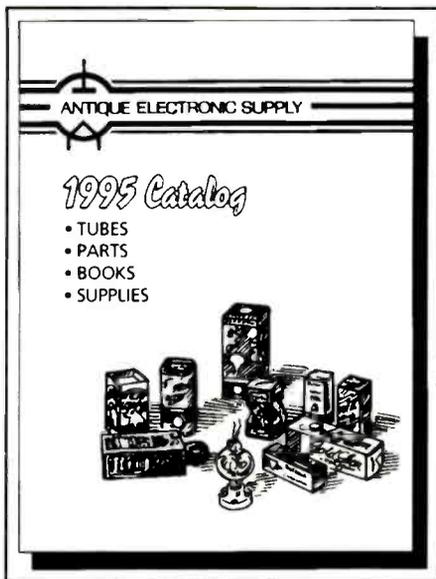
Blue Ridge Summit, PA 17294-0850

***Complete Guide to Semiconductor Devices*, By Kwok K. Ng, McGraw-Hill, 676 pages, 500 illus., \$54.00 hardcover.**

This complete collection of semiconductor devices includes all existing semiconductors in one book. This book contains all the practical information on: the history, the structure, the characteristics, and the applications. Each device is covered in a self-contained, short chapter, with minimal cross-references—making it ideal as a reference as well as a guide.

McGraw-Hill,

Blue Ridge Summit, PA 17294-0850 ■



### Catalog of tubes, parts and supplies

Antique Electronic Supply offers its 1995 catalog of electron tubes, parts and supplies for collectors and hobbyists.

The '95 catalog has been expanded to 36 pages listing over 3000 types of receiving, audio, transmitting, and industrial tubes plus an extensive line of capacitors and other items needed for repair or construction of tube type electronic equipment.

Also cataloged and stocked are over 75 book titles covering collecting, restoration and related subjects.

Circle (50) on Reply Card

### Fiber optic catalog

Fotec offers a catalog covering its products and training programs for fiber optic networks and components.

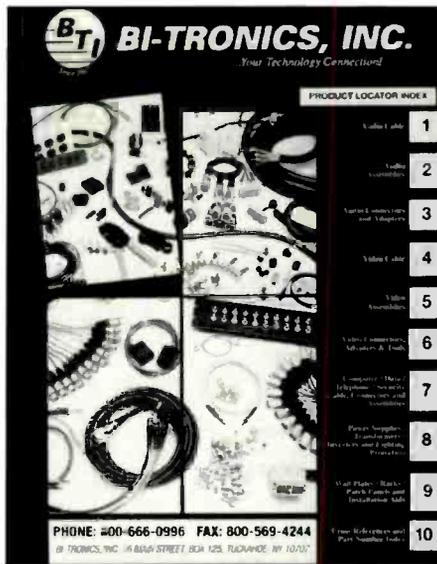


The 16-page catalog includes information on the company's complete product line of fiber optic test equipment for telecom, datacom and CATV applications. In addition, it includes information on training seminars on video, textbooks (including Fotec's new book on fiber optic testing), and "Fiber U," the annual hands-on training conference on fiber optics managed by Fotec.

Circle (51) on Reply Card

### New 1995 catalog

Bi-Tronics introduces its new 1995 full-line catalog that is now available. There are 140 pages filled with electronic connectors, cable assemblies, cables, power supplies and installation aids for pro video, pro audio, CCTV and multimedia systems of every kind.



The catalog's new, easy-to-use format provides clear pictures, technical specifications, application notes, plus a detailed table of contents and parts number index.

The company continues to offer free, pioneering connector locator and custom cable assembly design services. Customers provide the manufacturer and model number of the system products to be connected, and in most instances, the company will quickly provide the connector or cable assembly required.

Circle (52) on Reply Card

### Fume extraction brochure

Pace announces the release of its new Fume Extraction Systems multi-product brochure that illustrates the full range of

the company's products designed to remove hazardous fumes from the worker's breather zone. This four-page, full-color brochure has photos and specifications.

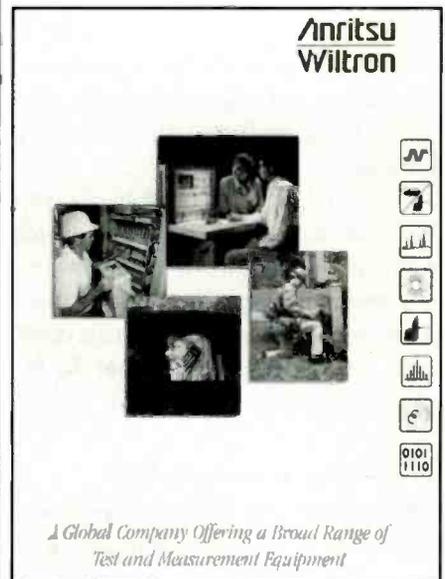
The accessory chart offers a quick and easy comparison of compatible accessories for each fume extraction system. This brochure also describes the advanced three-stage filtration method that removes noxious odors and microscopic particles so cleaned air can be safely recirculated back into the working environment.

Circle (53) on Reply Card

### Test and measurement equipment literature

A 12-page, full-color, short-form catalog of Anritsu Wiltron test and measurement products has been released by the company. Products in this catalog are organized by application with a concise listing of specifications and features.

The catalog provides an overview of the product line including digital cellular, microwave and RF, and SONET/SDH applications. Several pages are dedicated to fiber optic test equipment including main frame and mini OTDRs, optical power



meters, and optical spectrum analyzers. Other products include spectrum analyzers, digital mobile radio base station and bit error rate testers, network analyzers, and data transmission analyzers.

A convenient list of the company's international offices is included for quick reference and ordering information.

Circle (54) on Reply Card

## Intermittent solder joints

By The ES&T Staff

Some malfunctions in the CTC175, CTC176 and CTC177 television sets from RCA may be caused by intermittent solder joints at the shields of the microprocessor and/or the tuner. Other malfunctions in the same television sets may be caused by intermittent solder joints in the high voltage transformer, the HOT and one of the jumpers.

If you encounter a problem with one of these sets that appears to originate in these areas, inspect the solder joints for evidence of problems. See drawing.

### The microprocessor and tuner shields

In order to gain access to the ground connections on the tuner shield to perform this inspection thoroughly, remove the bottom cover of the tuner. If you don't remove this cover, you may not be able to perform this procedure completely, and the problem may happen again once the customer begins using the set again, resulting in a callback.

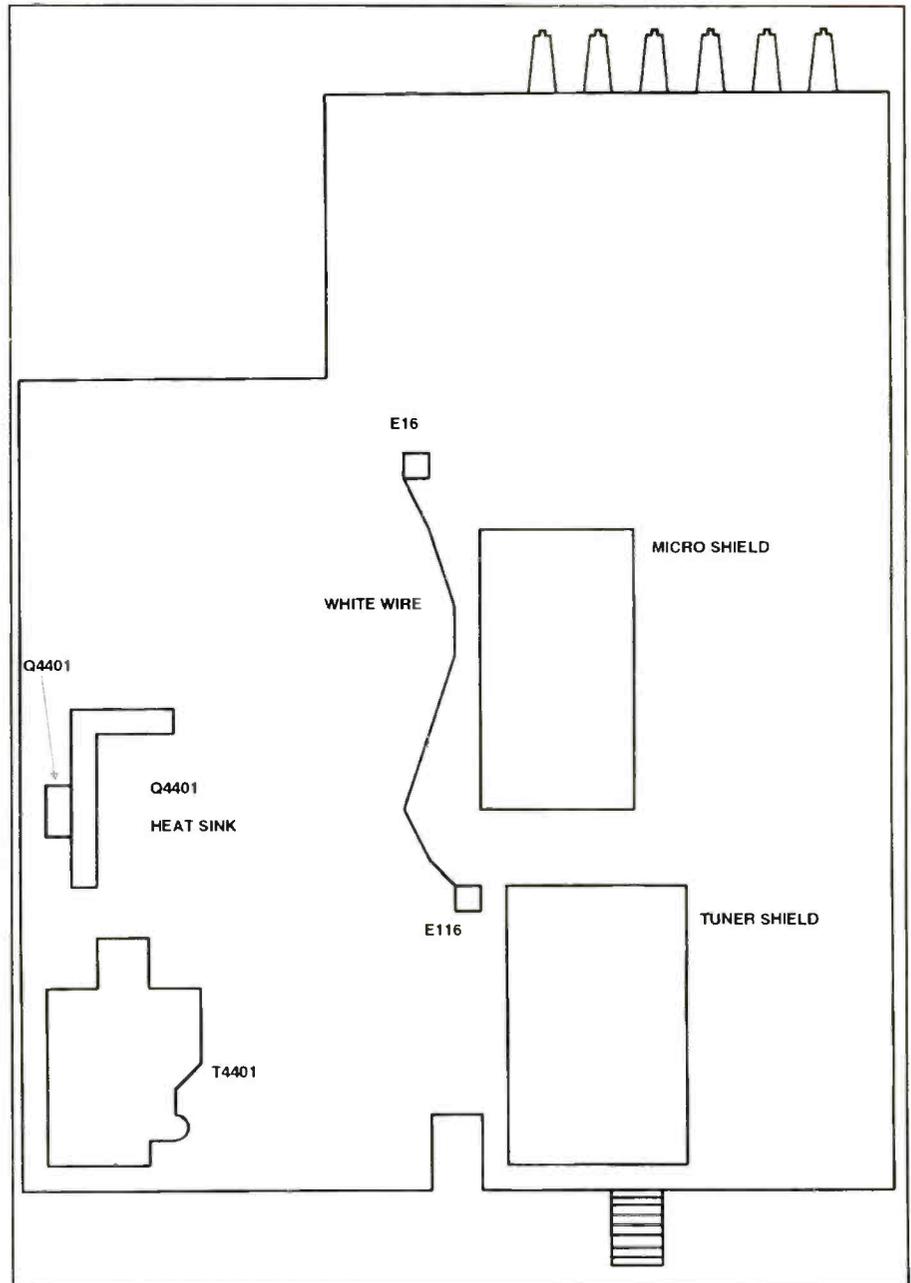
If you find evidence of problems with the solder joints connecting these shields to ground, resolder all of them. As always, be extremely careful not to heat these joints excessively, as too much heat could cause the foil traces to lift from the PC board or otherwise be damaged.

### Microprocessor shield

Follow this procedure to correct any problems with the microprocessor shield:

- Remove all solder from all of the microprocessor shield tabs. There are nine tabs.

- Once you have removed the shield, use desoldering braid or a vacuum device to remove any solder remaining on the copper pads. Inspect the tabs and the con-



Tuner and microcomputer printed circuit board for CTC175, CTC176 and CTC177 TV sets.

necting traces to see if they have been damaged. Measure continuity if you have any doubts.

- Re-tin the pads and make sure that the tabs on the shield are clean and bright and ready to accept solder.

- Reinstall the shield and resolder all nine tabs using fresh solder.

### Tuner shield

Follow this procedure to correct any problems that may occur with the tuner shield solder joints:

- Remove solder from four connections on the bottom cover of the tuner and remove the cover.
- Remove solder from all tabs of the tuner shield. There are 20 tabs. Remove the shield.
- Once you have removed the tuner shield, use desoldering braid or a vacuum device to remove any remaining solder from the pads. Inspect the pads and the connecting circuit traces for any evidence of breaks. Measure continuity if there is any evidence of problems.
- Re-tin the pads and make sure the tabs on both the shields and the cover are clean and bright and ready to accept solder.
- Reinstall the tuner shield and resolder all tabs using fresh solder.
- Reinstall the tuner cover and solder all tabs using fresh solder.

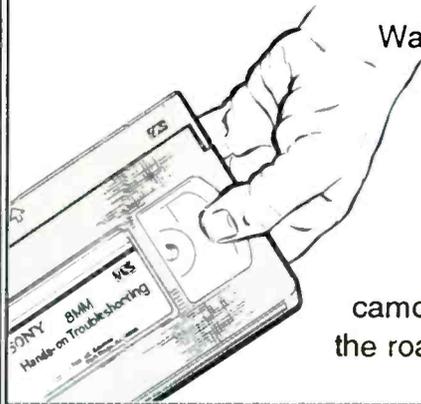
### The horizontal deflection circuits

Another possible source of problems in these sets is bad solder joints in the horizontal deflection circuits: high voltage transformer T4401, the heatsink of Q4401 (horizontal output transistor), and the jumper wire between points E16 and E116 (white).

If you encounter evidence of such problems in this area, correct them as follows:

- Desolder all connections to the high voltage transformer, Q4401. Desolder the ground tab on the HOT, Q4401, from the heatsink. Desolder both ends of the jumper between E16 and E116.
- Use desoldering braid or a vacuum device to remove solder from all copper pads from which you just desoldered components.
- Inspect the pads and surrounding traces for breaks. Check continuity if you suspect any problems.
- Re-tin the pads, and resolder the high voltage transformer, the HOT and the jumper wire. ■

## Watch and Learn. 8mm Hands-on Troubleshooting



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### ES&T Calendar of Events

January 5-9, 1995

1995 International Winter Consumer Electronics Show (CES)  
 EIA Consumer Electronics Group  
 Las Vegas, NV, 202-457-8702

April 7-9, 1995

1995 Mobile Electronics Show (MES)  
 EIA Consumer Electronics Group  
 Philadelphia, PA, 202-457-8702

April 19-21, 1995

Electronic Distribution Show and Conference  
 Electronic Industry Show Corp.  
 Las Vegas Hilton Hotel  
 Las Vegas, NV, 312-648-1140

May 11-13, 1995

CES Interactive '95 and 1995 Personal Communications and Computing Show (PCC)  
 EIA Consumer Electronics Group  
 Philadelphia, PA, 202-457-8702

May 19-20, 1995

Electronics Technicians Association 16th Annual Convention  
 Electronics Technicians Association  
 Philadelphia Wireless Technical Institute  
 Philadelphia, PA, 317-653-8262

## Servicing to the tune of Karaoke

By Linda Romanello

Times have been rough for the consumer electronics service business. With such a tight economy at hand, and businesses closing down everywhere, owners of service centers unfortunately have to struggle to prevent their businesses from succumbing to the same dismal fate as so many others in the industry.

But in the midst of these somber circumstances, there are survivors who, through their creative and innovative ideas and methods, have managed to stay afloat and even prosper. This month, **ES&T** features one of those survivors, Starlight Radio and TV, where Karaoke was the saving grace, and diversity is the golden rule.

Martin and Pamela Ellman have owned Starlight, located at 1551 Montauk Highway in Oakdale, NY, for the last 15 years (since 1979). While servicing almost anything you can think of in consumer and manufacturer-warranty equipment, the Ellmans say that they have found it increasingly difficult to remain profitable in performing consumer electronics service.

In response to this, they have remained open-minded and have therefore successfully found ways to supplement their profits. Martin Ellman says, "We've changed the focus of the business at least five times since 1979." Whether it's consumer repair, video rentals, Karaoke, or a mail-order service, the Ellmans never seem to be at a loss.

### Many services offered

Currently, Starlight offers an array of services that includes the servicing of consumer electronics equipment such as CDs, laserdiscs, camcorders, televisions, VCRs, and stereos. Services offered for professionals include repairs on turntables (for DJs), mixing boards, amps & speakers, electronic keyboards, MIDI equipment, and multi-track recorders.



Figure 1. Starlight Radio and TV, home of Karaoke, is located at 1551 Montauk Highway in Oakdale, New York.

They are authorized dealers for Sony, Panasonic, Hitachi, Pioneer, and Sharp, and also sell some accessories: like VCR cables, batteries, Panasonic accessories, etc. If that isn't enough, they also do

speaker re-coning and offer some computer monitor service. Starlight was also servicing Karaoke machines, but when the economy started hitting businesses hard a few years back, the Ellmans turned



Figure 2. Club patrons having fun with LaserKaraoke.

Romanello is Associate Editor of **ES&T**.

their involvement in Karaoke servicing into a much more profitable deal.

### Karaoke

In September, 1989, the Ellmans entered the Karaoke market as Pioneer Laser Karaoke. Starlight was an authorized service dealer for Pioneer, and as Pamela explains, "Fortunately, [Pioneer] was looking for a dealer who would help them promote this new product in our area and we were it."

So, in addition to servicing Karaoke machines, the Ellmans began selling and renting them as well. Within a year, they started to see a return. "We managed to subsidize ourselves," says Martin, "to keep an even keel."

"Business has been off for the past five years," says Pamela Ellman. "Karaoke came at a time when the economy was on a downturn. We have been trying to survive in the most expensive place to live in the nation. We own the property that our store is located on and our taxes keep going up. So, instead of our getting ahead, we were just able to continue paying our bills and stay in business." She explains that Karaoke came about when their children were grown. "We found ourselves in the store from 9 to 5, having dinner and then were out from 8 to the wee hours. We got to know nightlife in the New York area all over again."

"During the day, people beat up on you," she continues. "They have broken equipment and it's your fault because you're behind the counter. But, then we'd go out at night and stage Karaoke demonstrations. The club owners were making more money and the patrons were having a great time. We stirred up a lot of excitement and we believe we were instrumental in the current popularity of Karaoke. It took on a life of its own and we just rolled with it. We started selling the DK line, DKKaraoke, recently when the company came out with an attractive rental/leasing program."

### Efficiency helps too

In addition to finding or recognizing ways to increase profits, the Ellmans also realize the importance of efficiency in the workplace and how that, in the end, can also lead to more profits.

Pamela handles the bookkeeping and



Figure 3. Starlight recently started selling the DK line, DKKaraoke, when the company came out with an attractive rental/leasing program.

billing and takes care of the front counter (assisted by a part-time college student), while Martin runs the service center with the help of only a few part-time technicians. "He is a talented technician," says Pamela. Martin wrote the computer program that the Ellmans use in their business and together they have also created a very successful and unique filing system to help solve the problem of technicians searching through piles upon piles of service literature to find the one they need.

Their files consist of more than 15,000 cross-referenced records. If a technician needs service literature, he enters the model number of the equipment he's working on into a computer and it, in turn, gives him back a number. The cabinets, drawers, and folders are all numbered. He then walks to the filing cabinet that would contain the number that the computer just gave him, pulls out the folder with the appropriate number, and inside he'll find the schematic or manual he requires.

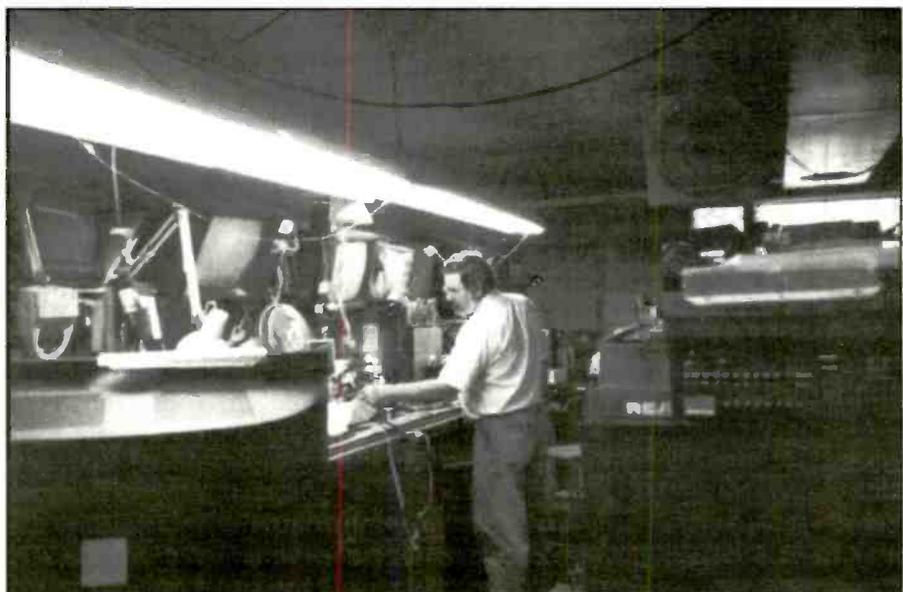


Figure 4. Owner Martin Ellman runs the service center with the help of his wife, Pamela and only a few part-time technicians.

Pamela says, "It takes the computer seconds to locate the manual and so far we have been accurate. It now takes us about a half hour a week to put the volumes of manuals away as opposed to a half hour a day."

### A good idea

In addition to Starlight's filing system, the Ellmans' propensity for innovation led to their becoming one of NESDA's National Best Ideas contest winners by simply trying to solve a problem that many servicing technicians probably face. As Pamela explains, "People bring in units for repair, and then don't have the money to pick them up."

She says that a few years back, when Long Island was in the middle of a garbage crisis, dumping fees were high and it became very expensive to throw things out—including units that customers were not picking up. As a solution, they sent letters to customers asking for \$10.00 to cover the cost of throwing the units out. Pamela says, "It all started as a joke in our office, but we really laughed when the checks started coming in. Now when we send out our letters, we tell people to bring in their cancelled check next time and we will apply the \$10.00 to their next repair. It makes people less embarrassed to come back after we had to go after them to get rid of the units that they left with us."

### Getting involved

While change is apparently something that the Ellmans don't fear, standing up for something they believe in may be another. The Ellmans heard a rumor that Suffolk County was going to pass a licensing law that would group service technicians with appliance technicians. "Martin got on the legislative agenda and pleaded our case." A committee from the Department of Consumer Affairs was appointed to meet with industry representatives to see if both parties could compromise and work out a "fair and equitable bill." After several meetings, all parties were able to have some input into the new law. "When Pat Halpin (Suffolk County Executive) signed the bill into law," explains Pamela, "I was presented with a copy and the pen he used. It is hanging on my office wall at Starlight and I



**Figure 5.** Inside Starlight, an array of services are offered that include the servicing of consumer electronics and professional equipment.

am very proud of it and the work we did."

### The beginnings and changes of a business

Before opening Starlight 15 years ago, Martin and Pamela Ellman already had a vast amount of experience in business and in servicing equipment.

Martin Ellman, currently the Vice President of TESA, Long Island, was the National Service Manager for Philips Business Systems in the late 1970s. Since the couple had two young children at the time, Martin wanted to leave the corporate world, become involved with something local, and be a part of the children's upbringing. After he left Philips, he worked as a technician in a small service center in interim. Then, the opportunity of owning a service center presented itself and the Ellmans opened Starlight.

Pamela Ellman, currently the Vice President of NESDA, New York, was a patent law secretary 28 years ago when the Ellmans were first married. She too wanted to be closer to her home and family and began a court reporting service out of the house. "When we bought Starlight," she says "I came in and helped out as needed."

The Ellmans were servicing most of the major brands at the time. "But were authorized for only Magnavox, Sylvania (which were separate companies at that time), Zenith and Admiral. We brought in

some authorizations and then expanded further into warranty service. Marty's primary interest was radio and he concentrated on that."

Later, Starlight began servicing A&S department stores, "Who sent stock units out by the truckload," says Pamela. Additionally, they did refurbishing for NEC, serviced 27 Newmark & Lewis stores, and also contracted work for Crazy Eddie, a discount consumer electronics store.

Pamela says, "When we took on servicing Newmark & Lewis' audio, I had to give up the court reporting service because Marty needed the help. The business was quick paced and I enjoyed the opportunity to expand my horizons." Both Ellmans received their servicing licenses at the same time because the county licensed people, not businesses. Pamela explains, "We were concerned that if anything happened and Marty could not operate the business, that I be able to carry it on. So, while I was entitled to a grandfathered license, I took it."

As far as the Ellmans being business partners in Starlight, Pamela says, "We became partners [in marriage] 28 years ago and it has never been an issue between us."

Eventually, A&S went Chapter II, NEC left the consumer electronics business, and both Newmark & Lewis and Crazy Eddie went out of business altogether.

Starlight then ventured into the video rental business, hoping that it would draw customers in from the street. Pamela says "that folly didn't work out because the store had to be opened more days and more hours and our income did not go up in proportion to our overhead, so we closed it after about two years."

The next step was then Karaoke.

### Mail-order

With eyes always open for new opportunities and ways to expand, Karaoke has now led the Ellmans into a new and profitable direction: mail-order service.

With a mailing list of more than 1500 names, Starlight sells laserdiscs for Karaoke machines. Pamela explains. "As the Karaoke market started expanding on a national basis, my nephew approached me and asked if we would be interested in selling the disks via mail-order. Since he is in the advertising field, we were able to take out ads in local magazines throughout the country and that was the birth of our mail-order business. Currently, the Ellmans are working on the production of their first major catalog.

### Directions and advice for the future

Currently, Starlight does not have any full-time technicians aside from Martin Ellman. Pamela says "We had three full-time techs on the bench until just recently. One of them moved, one was enticed by another company, and the other we let go because his production was down. We find that hiring part-timers fills in for us when we get busy and we don't have to keep them on when we're slow. I believe that the businesses that survive this will be the ones in which the owners roll up their sleeves and get to work."

"The service business is becoming too unpredictable," continues Pamela. "The whole consumer electronics industry is changing so fast it will be interesting to see what direction it takes."

While Karaoke's success probably won't last forever, the Ellmans have already delved into other opportunities. Besides the mail-order business (and recently arranging entertainment for parties such as psychics, clowns, etc.—something else which has grown out of the Karaoke industry), Pamela says "Marty would like to have the time to

write custom programs."

She adds that "Recently, we were approached by an audio manufacturer to take on their customer service. For the past six months we have been receiving telephone calls from non-authorized service dealers and consumers who require technical assistance and parts. We take time with these people to find out what they want, research part numbers and prices for them and supply them with

what they need. This is a unique service we can provide because of our expertise and so far it has been going very well. It is an effort that is saving the manufacturer money and diversifying our operation further. We would like to expand this by taking on other brands."

"Diversify!" Both Martin and Pamela agree. "It's a changing market out there."

Martin says, "You have to do innovative things. It's survival of the fittest." ■

## Photofacts

These Photofact folders for TV receivers and other equipment have been released by Howard W. Sams & Co. for December 1994.

### GE

CTC175K	.....	3398
CTC175L	.....	3398
CTC177BE	.....	3401
CTC177CC	.....	3401
VG7520	..... (sim. to) VCR-258	
19GT351FA1	.....	3398
19GT351JX1	.....	3398
20GT361FA1	.....	3398
20GT361TX1	.....	3398
27GT614FE1	.....	3401
27GT614JX1	.....	3401
31GT657FM1	.....	3401
31GT657JX1	.....	3401

### GOLDSTAR

CMT-9428	.....	3408
NC-06X1	.....	3408

### HITACHI

A2LXU	.....	3411
C730	.....	3404
CZ33	.....	3411
M1LXU	.....	3404
27AX0B	.....	3404
35TX30B	.....	3411

### MAGNAVOX

HD1305C101	.....	3410
PR1310C121	.....	3410
PR1310C122	.....	3410
PR1395X121	.....	3410
PS1360C121	.....	3403
XN1315C121	.....	3410
XR1320C121	.....	3410
13E601-00AA	.....	3403
13G601-00AA	.....	3410
13G602-00AA	.....	3410
13PRC10121	.....	3410
13PRC10122	.....	3410
13PSC60121	.....	3403

### PANASONIC

AEDP228	.....	3405
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ALEDP233	.....	3399
AMEDP233	.....	3399
APEDP233	.....	3399
ASEDP233	.....	3399
ATEDP233	.....	3399
CT-20S11CS	.....	3399
CT-20S11S	.....	3399
CT-20S12S	.....	3399
CT-20S21S	.....	3399
CT-20XF21CS	.....	3399
CT-31SF10R	.....	3405
CT-2040SS	.....	3399
CT-2045SS	.....	3399
PV-2800B	.....	VCR-258
PV-2800B-K	.....	VCR-258
PV-2801G	.....	VCR-258
PV-2801G-K	.....	VCR-258
PV-2802R	.....	VCR-258
PV-2802R-K	.....	VCR-258
PV-2803W	.....	VCR-258
PV-2803W-K	.....	VCR-258
PV-2805	.....	VCR-258
PV-2812	.....	VCR-258
PV-2812-K	.....	VCR-258

### QUASAR

VH5280	..... (sim. to) VCR-258	
VH5280-K	..... (sim. to) VCR-258	

### SEARS

NC-07X7	.....	3406
NC-96A	.....	3409
580.42032850	.....	3406
580.42910090	.....	3409

### SHARP

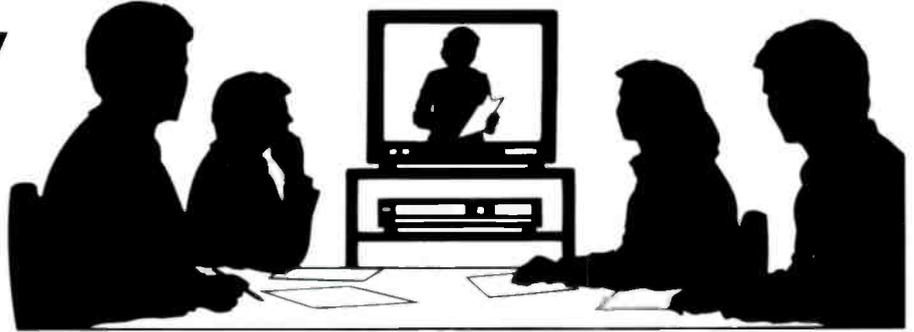
13F-M40	.....	3402
13F-M50	.....	3402
13F-M100	.....	3402
13F-M150	.....	3402
25F-M40	.....	3407
25F-M50	.....	3407
25F-M100	.....	3407
25F-M120	.....	3407

### SONY

FDT-5BX5	.....	3400
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# Leadership: a rare and valuable commodity

By John A. Ross



Recent installments of Business Corner have provided an examination of the basic concepts that make up the TQM (Total Quality Management) philosophy. Much of the advice given by TQM, such as giving priority to pride in workmanship, empowerment of the individuals, leadership and quality, should work well in any organization. Of all of those concepts, leadership works as a driving force for the success of the approach.

To make the TQM strategy work, top managers must demonstrate a commitment to the strategy and to cultural values that denote quality. To accomplish those goals, the type of leadership defined within the TQM philosophy lends control to the organization while also considering the needs of the employee.

When considering organizational needs, the founder of TQM, W. Edwards Deming, tells us that the TQM organization should foster leadership. The aim of leadership should be to help people and machines to do a better job. Supervision of managers, as well as production workers, is in need of an overhaul.

## Leader/member relationships

Nevertheless, the goal of employee-centered leadership remains evident in TQM when the philosophy emphasizes the importance of leader/member relationships. In this case, the leader is interested in developing a cohesive work group and ensuring that employees are basically satisfied with their jobs.

As they work in the TQM environment, those in leadership positions often become more aware of the feelings of

subordinates and gain added respect for their ideas. Since leader-member relations are the personal relationships between the leader and the subordinates, it also includes the degree to which subordinates trust, respect and have confidence in a leader and vice versa.

Certainly, TQM asks for supportive, committed leaders, and, theoretically, the approach should not fail. Here, though, we must make the transition from theory to the reality of managing humans. Theoretical concepts always bow to the human whims of those who make up the organization. At any time during the management process, those leaders/managers may seem to have a full commitment to the process and may seem to support the calls for change and trust. In addition, top managers may have ulterior motives when proposing organizational change, may not tolerate the opinions of others, or may not have the patience needed to allow change to occur.

## Balancing organizational and individual needs

Because of all of those possibilities, we arrive back at the dilemma of how organizational needs balance against the human needs of the individual. With organizational needs, the individual is only a resource that serves the good of the organization. Since all of us recognize the significance of organizational needs, the capabilities of the individual to serve often receives the most attention. Even given this preference, the statement that a balance between organization and individual should exist seems obvious and simple. But that balance often disappears.

For openers, the person given charge

over other individuals has all the powers of the organization or system at his disposal. Those powers, which involve such things as hiring, the giving of and the taking away of responsibilities and rewards, and the ability to terminate, can combine with individual powers, such as knowledge, status and personality, to give the person at the top an inordinate amount of control over the welfare of others.

Given these powers, it becomes easier for the individuals to shift their concerns away from other individuals and toward themselves. When this happens, a self-serving rationalization can occur. The needs of the individual at the top may seem to be synonymous with the needs of the organization. Consequently, it becomes easier for the individual at the top to take advantage of others since his or her gain seems to benefit the entire organization.

On the other hand, an imbalance in favor of the compassion for others can dramatically affect the managerial role. Rather than working from an objective position, the leader/manager who allows himself to forget the needs of the organization while favoring the needs of one employee or several employees, discovers that the individual or individuals may take advantage of the situation. Essentially, the perceived need for continual compromise allows the managerial role to become compromised. Control shifts through tainted decision making, and, in extreme situations, organizational anarchy surfaces.

## The question of balance

Surprisingly, the question of balance does not involve some powerful individ-

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

ual and a nameless faceless individual. Instead, the question rests with the leaders of the organization, and another quality comes into play. The successful implementation of TQM and the success of the organization depends on the quality of leadership. Because of that dependence, it becomes useful at this point to review several definitions of leadership.

### Types of leadership

As defined by many experts on the topic, many types of leadership, such as transactional, social, political, moral, reform, executive, and intellectual, exist. Let's take a short look at some definitions of leadership.

With *transactional* leadership, leaders approach followers with the need to exchange one quantity for another. Also along these lines, *intellectual* leaders contemplate both knowledge and values. While *social* leadership takes place in a number of settings and involves various socializing forces, *Political* leadership maintains an eye toward political motives and the structure of political opportunity. In contrast, *executive* leadership depends on bureaucratic resources, talent, character, prestige, and popularity rather than political interests or values.

*Reform* or *revolutionary* leadership requires commitment to a cause, persistence, courage, selflessness and political strategies that can bring allies together in support of a cause. On another plane, *moral* leadership means that the leaders and followers have a relationship not only in power but also in mutual needs, aspirations and values. Moral leaders also take responsibility for the commitments that they make.

### Different leaders for different challenges

Why should we think about these definitions? As we develop our own leadership styles, we should remember that different challenges often call for different leadership responses. Knowledge about different leadership may further your ability to adapt. Also, the characteristics of one type may offer benefits not offered by another. The ability to lead on a total scale, though, may depend on your ability to take all those characteristics and create your own style. ■



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## News (from page 5)

dents. "It's packaged in a three-ring binder so lessons can be removed and used one at a time. Students use workbooks to progress through five levels of achievement, earning awards for each level. After graduation, some continue to work on the PDP in pursuit of the prestigious Level 6 award, the VICA International Degree.

PDP brings industry to education, and it meets federal standards, too. VICA's PDP includes competencies and basic skills identified by the U.S. Secretary of Labor and the Secretary's Commission on Achieving Necessary Skills (SCANS): What Work Requires of Schools—A SCANS Report for America 2000. In addition, the Carl D. Perkins Vocational and Applied Technology Act allows funds for professional development through state boards, accessed at the local level.

In a related curriculum and seminar, VICA offers extensive training in teaching the concepts of Total Quality Management through its Total Quality Curriculum (TQC). The TQC teaches how to boost productivity and promote greater customer satisfaction. It translates Dr. W. Edwards Deming's 14 principles, which produced the Japanese economic miracle, into relevant terms and relates them to U.S. quality programs such as the Malcolm Baldrige National Quality Award.

Developed by a partnership of educators with quality experts from industry, this 17-module curriculum was tested nationwide. When instructors teach Total Quality Management, they give students,

teachers or co-workers skills that have been identified for employment success. Like PDP, the TQC includes instruction in the SCANS skills.

"With PDP and TQC, I have a waiting list of students for my class. This year, because of increased enrollment, we've decided to open a second program so we can take all the students. And, I use my educational funds to purchase the curriculum, workbooks and the achievement pins," says Therese Marshall, vocational supervisor and former health occupations instructor at Sentinel Vocational Center in Tiffin, OH.

VICA (Vocational Industrial Clubs of America) is a professional organization for trade, industrial, technical and health occupations students and instructors. Nearly 250,000 VICA members are organized into more than 13,000 local chapters in the nation's public high schools, vocational-technical centers, area vocational schools and community colleges. VICA is dedicated to developing well-rounded students and future employees by building self-confidence and teaching positive work attitudes and good communications skills.

VICA is recognized by state and federal departments of education as an integral part of the vocational-technical educational curriculum.

VICA PDP and TQC materials and training seminars are available from VICA: Education Department, National VICA, PO Box 3000, Leesburg, VA 22075, (703) 777-8810. ■

## Surface mounted technology with new Chip Quik SMD removal kit

Premium Parts+'s new patented Chip Quik removes surface mounted devices from printed circuit boards. Current surface mount removal methods are expensive, and often damage printed circuit boards and components due to excessive heat and mechanical strain.

But this new kit is made in the U.S.A. and is recommended by the Sony Service Company, Division of Sony Electronics. The kit contains a special solder alloy, liquid flux, solder removal braid—and complete instructions.

Circle (70) on Reply Card

## Coaxial testers

The DXB3 BNC coaxial tester from L-COM provides a quick means of identifying a good or not so good coaxial cable. The tester checks for continuity, open or

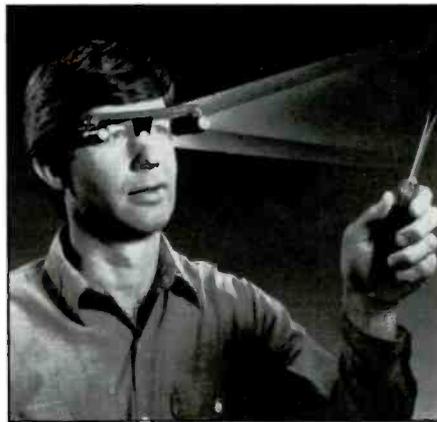


shorts. The unit has no switches. Full instructions are on the label. The tester shuts off when cable is removed. It is powered by an internal 9V battery which is included. Model DXB4 includes a feature that allows it to localize intermittent shorts. This unit locks in on an instantaneous short circuit. This unit is called the Intermittent Grabber.

Circle (71) on Reply Card

## Introduction of Bright Eyes and Bend-A-Light

Wahl Clipper introduces Bright Eyes and Bend-A-Light to its current product line. Bright Eyes Pro Headlights gives you light wherever you look, while keep-



ing your hands free to work. Bend-A-Light is available in several sizes and gives you access to light in otherwise unobtainable areas. The Bend-A-Light is thin and gives its user up to 10,000 candlepower brightness.

Circle (72) on Reply Card

## Solder system for SMT rework

Metal's STSS-002E Soldering System is a flexible, cost-effective way to accomplish all aspects of SMT rework, from the heaviest heat-sink jobs to the most delicate components and flex circuits. Over 120 tip styles, including Metal's revolutionary multi-lead "hoof" and blade tips for multi-lead soldering and over 85 SMT rework tips, are avail-



able for the STSS-002E system. Tips are offered in four temperature series (ranges) for all requirements, from low-temperature applications to heavy loads.

Circle (73) on Reply Card

## New digital CC/CV dc supplies

The Global Specialties new single output CC/CV laboratory grade dc power supplies. Have coarse and fine adjust controls for voltage and current, floating ground feature which allows for outputs of either full negative or positive output



potential, constant current/voltage mode LED indicators, large easy to read red digital LEDs, voltage and current indicators in the digital viewing area, and heavy-duty transformers with isolated design and short circuit protection.

Applications for these digital dc supplies include experimental set-ups, circuit design and development, production line testing and repair, battery charging, incoming electronic inspection and vocational-technical schools and universities.

Circle (74) on Reply Card

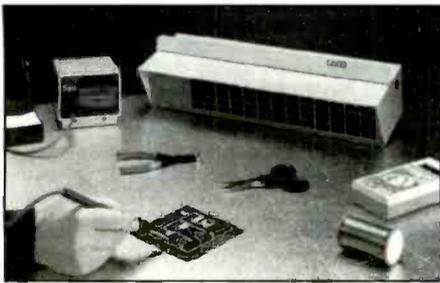
## Color LCD DSO

Hitachi Denshi America Ltd. introduces the VC-5410 Color LCD Digital Oscilloscope, with bandwidth of 20MHz, and two separate A/D's operating at 15Ms/S. The series features a "scope-like" interface for ease of use, and a number of advanced function keys to allow the user to "Autoset," make a printout,



and save and recall front panel set ups and waveforms. The oscilloscope has a 2KW record length, and features 10 waveform and 10 front panel memories.

Circle (75) on Reply Card



### Fume extractor

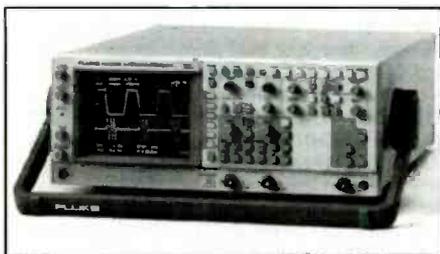
Pace announces the availability of the new turbo fume extractor designed to remove solder fumes and other airborne contaminants from the working environment. The fume exhauster's powerful fan pulls the fumes from the worker's breathing zone, then passes it through an activated carbon filter mat to adsorb noxious gases and odors. This unit is compact in size (21½ x 9½ x 3½) and may be used where benchtop space is at a premium.

Circle (76) on Reply Card

### Two-channel autoranging DSO

Fluke Corporation introduces a full-function, low-cost, two-channel Digital Storage Oscilloscope (DSO) with autoranging. The PM 3380A is a new entry in the CombiScope oscilloscope series. It combines a DSO and an analog scope into one instrument.

Just like an autoranging digital multi-



meter, the oscilloscope can automatically scale to signals. Autoranging continuously adjusts the timebase and attenuators to keep the signal on-screen even when the signal changes or while the user probes around a circuit.

Special probes supplied as standard have a user programmable command switch near the probe tip. When used in conjunction with autoranging, this feature allows the user to probe around the circuit without constantly having to reach for the control panel. The probe tip switch feature speeds up operation because the user can switch between DSO and analog modes, recall stored setups, perform volt-

age and time measurements and initiate an autoset.

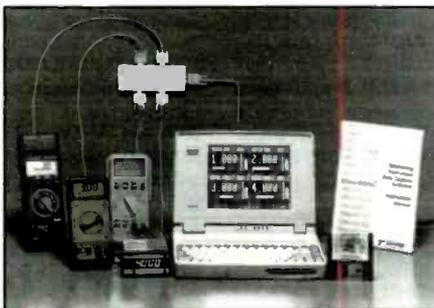
The instrument can display the waveform on the external trigger input, providing precision and confidence about the trigger point on an external trigger signal.

Circle (77) on Reply Card

### Serial port expander

Micron Meters introduces PortMUX, the automatic serial port expander/selector box, that provides four extra serial ports for use with any PC in connecting smart meters, controllers, counters, sensors or transmitters.

Intended as companion hardware for use with the company's new MeterBOSS



multiple meter software, this product is a stand-alone device, that provides any PC-user additional serial ports.

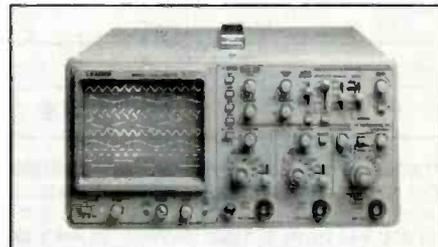
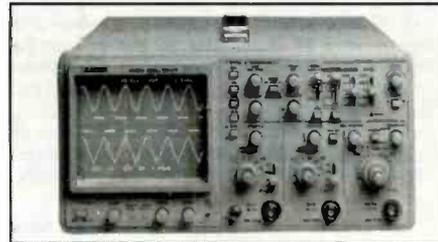
Housed in a compact plastic box, the multiplexer has five DB9 connectors, a cable to the PC and LED indication of ports in use. Enabling software identifies which port is connected to which device. All ports are self powered. Features include cascade connection, bi-directional communications, serial error fault detection and low voltage operation.

A fifth port can be used to connect to another multiplexer for expansion purposes. Used with MeterBOSS software, the unit becomes a field or laboratory data acquisition system for multiples of four serial measuring devices. Four, eight or sixteen channels of data can be displayed as virtual meters (including simple math functions as sum, difference, product or ratio) or bargraphs and reconfigured from the PC, with data storage option.

Circle (78) on Reply Card

### 100 MHz, 3-channel oscilloscopes

Leader Instruments Corporation announces the addition of two new analog oscilloscopes to the 8000 Series: Models 8104 and 8103. Both feature 100 MHz



bandwidth and 3-channel operation, and have the same operating characteristics except that Model 8104 adds cursor measurements of voltage, time, frequency and phase, and displays on-screen notices of sensitivity, time base and delay-time settings.

Both scopes offer calibrated delayed sweep with alternate sweep so that the main and delayed traces may be viewed simultaneously. Six traces are displayed in the ALT sweep mode when the three channels are active. However, the SUM (or difference with CH2 inverted) of CH1 and 2 can also be displayed together with CH1-3, making an 8-trace display possible. The Main time base ranges from 50 ns/div to 0.5s/div in 22 steps, and use of the X10 magnifier puts the fastest sweep speed at 5 ns/div. A single-sweep mode is provided to catch one-time events.

Trigger facilities include an automatic source selection coordinated with V-mode operations. (If only one channel is active, it becomes the trigger source. CH1 is automatically the trigger source in dual channel operations.) However, manual override allows the source to be selected from any of the three channels plus the power LINE. Trigger modes include AUTO, NORMAL and FIXEd. In the latter, the trigger point is maintained within the p-p signal excursion to hold sweep stability despite large swings in signal amplitude. Trigger coupling settings include dedicated H and V TV sync separators for solid video observations. Variable hold-off secures correct waveform display for complex wavetrains.

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**TV CASE HISTORIES:** Booklet with 2,150+ histories. Satisfaction assured. Only \$45 (plus \$2.90 for 2-day priority). **Mike's Repair Service**, P.O. Box 217, Aberdeen Proving Ground, MD 21005. Same mailing address 30 years. Send SASE for samples. 410-272-4984, 11am-9pm.

**Video Analyzer**—Sencore VA62 with VCR, NTSC, and triac accessories, \$1,250 or best offer. Call Keith at 206-638-2338. After January, dial new area code, 360.

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**Sencore VA48** with probes and extras. Contact: Kurt at Griffing TV, Windsor, MA 203-688-6271.

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Service manual and schematic for RCA VHS VMT285N Sansui VHS SV-R 5000. Sony FM/AM stereo receiver Model STR 6055. Contact: Gloria Flores, Apeninos 633, Puerto. Nuevo. Puerto Rico, 00920-5306.

Transformer for Eico Model 632/CRT tester. Contact: James Moore, Box 2984, Guaynabo, PR. 00970, 809-720-0805.

Need simulated leather carrying case, used would suffice, for an ohmmeter Model #260. Contact: Frank Massi, Midwest TV, 714 Walnut Dr., Apt. 310, Darien, IL 60561-4713.

Sams television service manuals need. Also, looking for B&K color bar generator Model 1251 and Sencore PR57 isolation transformer. Contact: William J. Weaver at Weavers Electronics, 419-989-4129.

Looking for servo circuit board RCA part no. 160778 for Model VKP900 portable VCR. Contact: Don Hicke, 4131 MT., San Diego, CA 92111, 619-994-3406.

Looking for a service company that repairs VCR video drums upper & lower, also service schematic/manual for Curtis Mathes VCR, MV730. Will pay reasonable cost for copies. Contact: Earl Stewart, PO Box 470, Cuero, TX 77954.

I need a flyback for a Quasar 13 inch TV, Matsushita Part No. TLF6042F. The TV is Model TT4257RW, chassis no. AGTS971A00, manufactured 9/79. Used is OK, if good. Contact: 718-275-2091.

Supremes TV-1, 2, 4, 16, and 27 manuals. Contact: Charles T. Huh, 229 Melbore St., Tiffin, OH 44883, 419-448-0007.

Flyback #95-3177 or 540 for Zenith Model 25GC45 TV. Contact: C.E. Hess, 201 So. Oak, Buchanan, MI 49107.

Looking for service manual or schematic for a Bogen amp Model number CHB35A. Contact: Jim Jordan, 2602 FM 1960 W., #114, Houston, TX 77068, 713-444-7070.

I would like to borrow or purchase a back issue of October, 1988 of **ES&T**. Contact: Alfred Pederson, 4701 Jay St., Duluth, MN 55804.

Service information (schematic at least) for Princeton Graphic Systems Model: Ultrasync computer monitor. Contact: Jim Spruill, Box 69, Doniphan, NE 68832, 402-845-6637.

Sencore VA62 video analyzer with VC63 VCR tester and NT64 NTSC pattern generator. Contact: 605-892-3856.

Schematic or manual for Realistic STA2200 AM/FM receiver/amplifier. RS#31-2085. No longer available from Radio Shack. Also need info. on Texscan Installer 3A Field Strength Meter for TV/cable. Contact: Bert Kuschner, High Tech Services, 3340 Turtle Mound Rd., Melbourne, FL 32934, 407-254-1824.

RCA PTV main chassis CTC169BM. Good working condition preferred. Contact: Randy at 404-948-9895 or 404-920-9893 after 6 PM.

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B&K 480 CRT Tester. Like new, \$550.00. May sell with the business. Contact 1919 Lincoln Bl., Venice, Los Angeles, CA 90291, 310-578-2040.

SG-80 am stereo-fm stereo analyzer, 10 months old, in original box, \$2,400.00. Contact: 208-664-0361.

Out of Business. Send SASE for shop test equipment list, schematics, parts, tubes, fixtures and merchandise. Contact: *Electronics, PO Box 2405, Aptos, CA 95001-2405.*

Sencore SC3100 auto tracker scope. Sencore VG91 universal video generator, Sencore LC101 Z-meter with SCR and TRIAC test accessory. All in excellent condition. Contact: *(612)845-2522, preferably after 6 p.m.*

Sencore FC45 frequency counter 230MHz-\$149.00. Sencore field effect multimeter FE 21-N.R. \$25.00, Mark 12 mezzar field strength meter with case \$39.00, McGraw-Edison FM signal generator 25-960MHz \$149.00. Contact: *Al Nikora Sr., 5298 Argyle Ct., Sterling Hgts., MI 48310, 810-268-6938.*

Text books, service manuals, parts, tubes—90% off list price. Send two 29 cent stamps. Contact: *M. Seligsohn, 1455-55th St., Brooklyn, NY 11219.*

Duplicate Sams Photofacts and other duplicate service manuals. Also, other duplicate service test instruments. Send SASE for list. Contact: *N. Young, 214, E. Robertson St., Brandon, FL 33511, 813-685-1900.*

Sam's Photofact #50 through 1600. Contact: *Richard Interested 201-875-6333.*

Eico VTVM Model 232 with owner's manual and test leads, \$50.00; RCA factory TV service manuals (1955-1970), \$6.00 each or all three for \$15.00; RCA TV troubleshooting Pict-O-Guide Vol. 1 and 2 (1949), \$5.00 for both; 41 Electronic Technician magazines (1965-1976) for \$15.00; TAB Books TV service manuals (different makes) 1970-1972 at \$3.00 each or all 13 for \$25.00. All plus shipping. Contact: *John Brovzakis, 247 Valley Circle, Charleroi, PA 15022, 412-483-3072.*

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Sencore universal video analyzer Model VA62, NT64, VC63, \$2,300.00. B&K Precision Model 1050 telephone analyzer, \$500.00. Contact: *216-527-2756.*

Sencore CR70, VC63, PR-57, and an NRI Electronic Design Technology Course. All items are in excellent condition and high quality. Contact: *Clarence G. McKee, 517-569-3139.*

Sencore VC93 VCR analyzer hardly used, \$1,995.00 pick up loop and all cables. Leave message, *616-383-2641.*

Heath IG-52 TV alignment generator, Heath IO-18 5 inch laboratory oscilloscope, and Eico 460 dc-wideband 5 inch oscilloscope. All excellent condition, only \$60.00 each. Contact: *219-255-9443.*

Sencore SG165 AM/FM stereo analyzer with manual, cables, excellent condition, \$750.00 including UPS. Contact: *LLoyd 502-298-3268.*

One Sencore VC63 with manual, \$125.00; one RCA Flyback 158048 new for \$45.00; one RCA Flyback 148034 new for \$75.00. Contact: *Elmer Wieland, 237 Talbot Dr., Bedford, OH 44146, 216-232-8653.*

B&K frequency counter Model 1803. Never used, in box, no probe, \$125.00. Contact: *Geo Rossetti, 51 Salmon Brook St., Granby, CT 06035, 203-653-6351.*

Two RCA mobile radios, one 100W, one 50W, one Regency 25W with one base antenna, one mobile antenna, all cables and mounts, must sell for \$300.00. Contact: *Robert Dellaan, 2885 E. Bellline N.E. Grand Rapids, MI 49505.*

5800 tubes. Distributor stock and boxed. These were inherited from a distributor who went out of business. First \$500.00 or best offer. Send SASE for list. Contact: *Robert Nelson, 1458 N. Blackfoot La., Lake Havasu City, AZ 86406, 602-453-7972.*

Sams Photofact sets, 182 through 1675. Some missing. Total 1335 sets, four 4-drawer cabinets, two single drawer cabinets. All goes for \$650.00 plus shipping. Contact: *B. O. Willy Fleeman, 707-864-8237.*

Sencore VA62 and VC63 in original condition, \$895.00. Contact: *Electro Tech, 4545 E. Tropicana #5, Las Vegas, NV 89121, 702-435-3201.*

Sencore VG92 video generator and TVA92 TV video analyzer, \$300.000; Sencore CR70 CRT tester, \$1,100; SC3100 auto tracker, \$2,800.00; PR57, \$250.00; \$6,000.00 takes everything. All in excellent condition. Contact: *Mark at 609-639-3058 (10 a.m.-6 p.m.) or 215-860-1869 after 6:00 p.m.*

Sencore VA62 video analyzer, w/VC63 VCR tester and NT64 NTSC pattern generator, cables and manuals, used very little, like new. Paid \$3,450.00, asking only \$2,300.00. Contact: *201-595-1775.*

Sencore SC61 waveform analyzer, \$1,800.00 (recently calibrated); VA62A video analyzer with VC63 VCR test accessory \$1,900.00. Both in immaculate condition. Contact: *Clarence Barnes, 614-763-3325 for details.*

Sencore CR70 CRT analyzer and restorer with extra sockets. Perfect condition, \$895.00 plus shipping. Contact: *Ken Goetsch, 12698 Shorewood Dr. S.W., Seattle, WA 98146 (206) 241-0507.*

RCA service data consumer electronics books 1967-1978, Sachel Carlson TV units, Sams Photofacts 1-1079, Sylvania television sign—lights up 19 inches L x 12 inches W for greater viewing comfort. Contact: *Ann Bichanick (Jay's), 151/2 W. Lake St., Chisholm, MN 55719.*

Hitachi V212 oscilloscope, 20MHz, \$120.00; B&K 510 transistor tester, \$75.00; 60V dc power supply, \$75.00. Contact: *Roger at 814-239-2761 after 4:00 p.m. E.S.T.*

TV and microwave parts—enough to start a repair shop, \$1,000.00 or best offer. Contact: *509-483-6240.*

H.H. Scott vacuum tube stereo components type 310D broadcast monitor, type 335 mux-adaptor, type 222c power amp, \$50.00. Contact: *Al Magnuson, 4555 58th St., San Diego, CA 92115 or 619-582-1728.*

3000 Radio and TV tubes for sale. Buy one or all. Send \$2.00 to cover shipping and handling for list. Contact: *Tim Kirby, 407 Crutcher Pike, Richmond, KY 40475.*

B&K Model 480 pix tube tester/rejuvenator. Includes 10 sockets. Excellent condition, \$400.00/or best offer. Contact: *Don at 701-772-4440.*

Heathkit Flyback and yoke tester with test leads and manual. Model #ST-5235 needs calibrated, \$75.00 plus shipping. Contact: *John at 412-483-3072.* Sencore CM2000 computer monitor analyzer. In A-1 condition, \$1,950.00 with manuals, adapters and original shipping box. I will pay shipping and COD fee(s). Must sell, closed shop Contact: *Ron at 614-554-3301.*

Fluke 8060A DMM, \$230.00 shipping included. Like new. Contact: *Doug Hoff, 140 Loraine Ct., Vacaville, CA 95688.*

Sencore CM2000 computer monitor analyzer with all adapter/manuals/cables plus tech tips for monitors. New, never used, \$2,000.00. Contact: *408-688-1426.*

Sencore VC-93, VA-62A, PR-57, CR-70, all test leads and tapes, Heath 20MHz scope, fiche viewer, all used very little, \$5,000.00 plus UPS charges. Contact: *717-458-6734 after 6 p.m. Eastern time.*

B&K Model 467 picture tube checker and restorer, like new with sockets, in excellent condition, \$350.00; B&K Model 466 picture tube checker and restorer, good condition with sockets, \$200.00; Sencore CR-70 picture tube checker and restorer with all sockets, some new, in excellent condition, \$750.00; have all latest setup manuals and all cables. Contact: *Gordon Lane, 239 Jacksonian Dr., Hermitage, TN 37076, 615-889-6195.*

Sencore VC93 VCR analyzer, \$2,000.00; Sencore CR70 CRT rejuvenator, \$600.00; Sencore PR57 Powerite, \$250.00; Heath IM 5215 40 Kvolt probe, \$45.00; Heath IG-5260 portable video generator—channel 3 and line level video composite output, \$85.00. Contact: *Andy's Electronics, PO Box 21, Millville, PA 17846.*

Sencore/SC-61 dual trace wave analyzer. Excellent condition w/all probes and manual. Will sell for \$1,500. Contact: *Marge, 409-935-3321.*

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