THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC Servicing & Technology

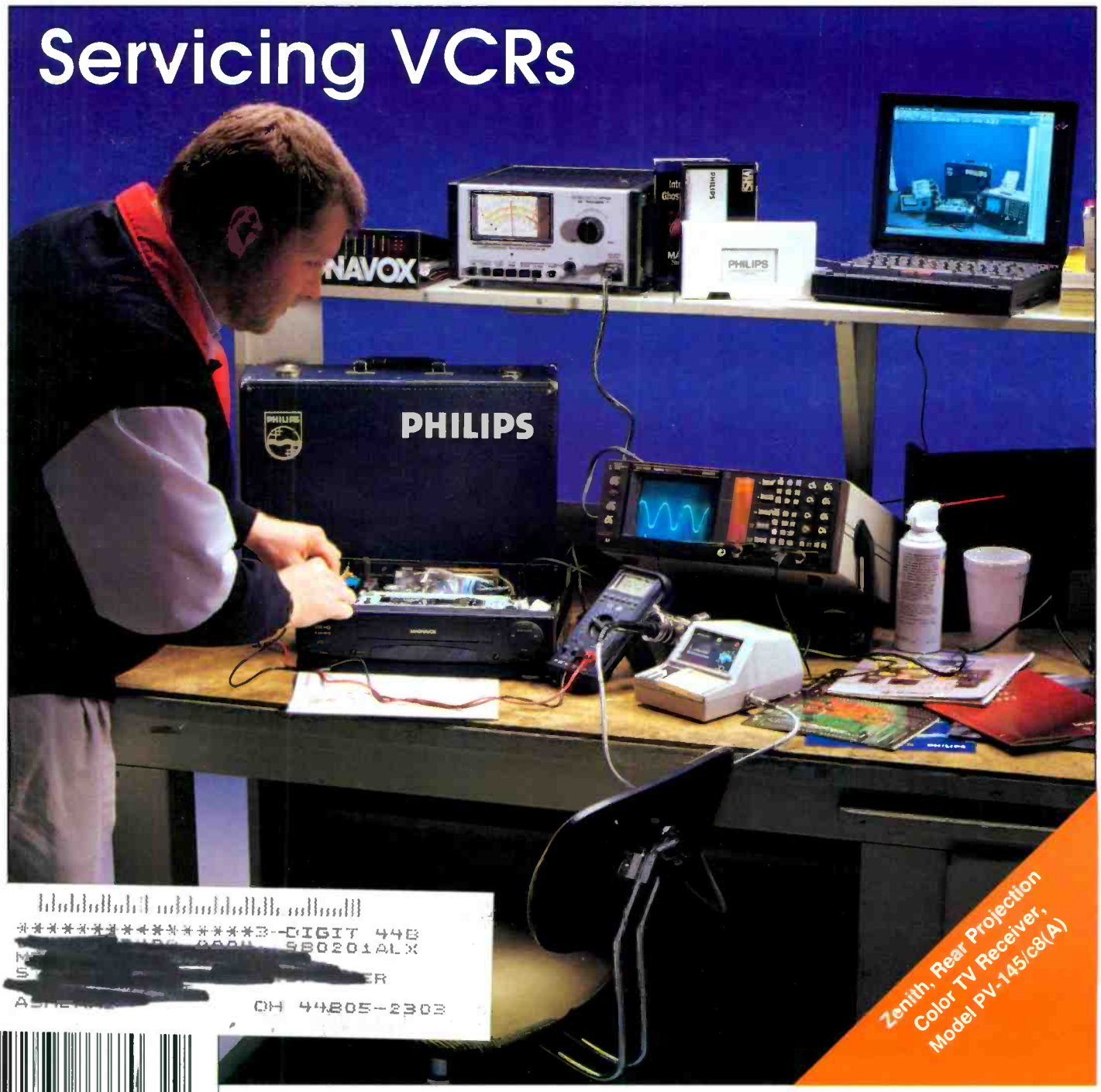
T.M.

February 1998

New technology update

Servicing the CD player with important waveforms

Servicing VCRs



Zenith, Rear Projection Color TV Receiver, Model PV-145/c8(A)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THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING

ELECTRONIC Servicing & Technology

Volume 18, No. 2 February, 1998

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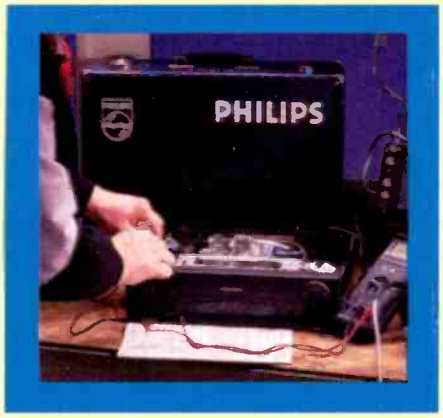

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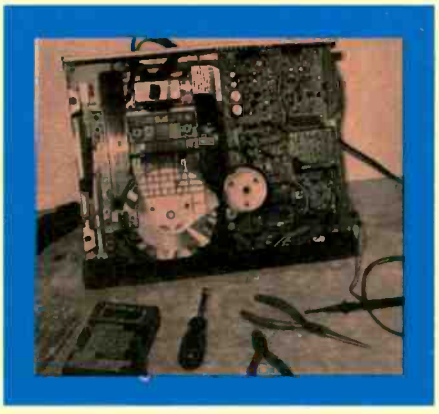

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ON THE COVER

VCR service can still be a source of income for consumer electronics service centers, in spite of their low price. When troubleshooting VCR faults, always make a very careful analysis about the symptoms when attempting to isolate the problem. Separate the VCR into its mechanical and electronic systems to simplify the process of finding the problem. (Photo courtesy of Philips).

EDITORIAL

What's going on with HDTV?

Consumer electronics service centers work on a lot of different brands and models of television sets and other consumer products. Moreover, they see these products at their worst. Technicians who service consumer electronics products know which manufacturers produce good, solid, reliable products and which ones cut corners, or have made engineering blunders. For that reason, consumers tend to turn to their service center when they have questions about what television, VCR or camcorder might be the best choice, or whether they should be thinking about buying some newly introduced marvel of technology.

What about HDTV?

No doubt one of the big questions in the minds of consumers today is "What's going on with HDTV (high-definition television)?" They have heard about it, and in the near future a lot more will be said about it as sets begin to appear on the market, and broadcasters gear up to provide HDTV programming. We thought that this might be a good time to devote this space to a rundown of the current state of HDTV, to provide readers with a little information that they can share with their customers who ask their opinion of HDTV. All of this information was provided by the Consumer Electronics Manufacturers Association (CEMA).

Consumers think they want their digital TV (DTV) now, but what they might not know are these two critical points: initial DTV sets will be very expensive, and NTSC models they buy today won't be made obsolete by the transition to DTV.

What will DTV sets cost when they roll out in late 1998? Mitsubishi has stated that its rear-screen projection models will be priced between $8,000 and $11,000, while Hitachi and Panasonic have acknowledged similar pricing due to production start-up costs and limited manufacturing quantities.

Potential buyers also need to know that the purchase of a large-screen NTSC TV today doesn't mean they've got a dinosaur on their hands when the transition to digital TV is complete. TVs today have an average useful life of approximately eight years. By simply adding an inexpensive digital converter when they're available next year and beyond, a consumer will enjoy all the entertainment options available with digital transmissions.

DTV (digital TV) sets may not be available until late 1998, but the consumer has two other choices to deliver the digital video experience today. First, digital broadcast systems (DBS) provide consumers with extensive programming options, digital quality video and Dolby Digital sound quality. In addition to basic and premium cable networks, pay-per-view movies, news, information and sports networks, DBS providers offer a greater selection of premium and special-interest programming than most cable systems can provide.

Second, digital versatile disks (DVD) provide consumers not

only with superb resolution and color reproduction of pre-recorded video, they add Dolby Digital soundtracks which can recreate a theater-like experience in the home. What's more, the digital compression technology used in DVD enables recording engineers to add a lot more functionality to each title. You can play back titles in multiple aspect ratios, which allows users to switch between the conventional 4:3 pan-and-scan format and full 16:9 widescreen TV. The DVD format also allows software producers to include multiple language audio tracks, subtitling, and even multiple camera angles.

What will be available for broadcast HDTV?

On April 3, 1997, the Federal Communications Commission (FCC) allocated 6MHz of spectrum to every broadcaster for digital programming. All network-affiliated broadcasters are required to transmit digital broadcasts in the top ten markets by May 1999, reaching nearly 30 percent of American households. By November 1999, the network affiliates must begin transmitting in 20 additional markets, bringing DTV availability to nearly 50 percent of American households. All other commercial stations must transmit DTV by May 2002, and non-commercial stations must begin digital transmission by May 2003.

During the transition period from analog to digital transmission, broadcasters will continue to provide over-the-air NTSC signals, and DTV signals will coexist in a given marketplace with traditional analog NTSC signals. As part of the DTV rollout, the FCC is loaning every one of the nation's 1,600 TV stations a second broadcast channel to be used for digital high-definition programming. The original channel, even though it has not been mandated by the FCC, most likely will continue to broadcast conventional NTSC programming in a simulcast arrangement. With simulcast being optional, the broadcast provider has the option to boost revenues by selling more airspace to advertisers.

Providers who do choose to broadcast the NTSC signal most likely will continue simulcasting for a period of up to nine years. The nine-year period may be extended depending on when the broadcasters can complete the change over to digital transmission equipment. At the end of the conversion to an all-digital television system, broadcast providers will have to relinquish their existing VHF/UHF NTSC broadcast frequencies to the Federal Communications Commission. Initially, DTV broadcasts will probably comprise prime time programming, movies and commercials. You may also see programming on DTV that is not simulcast on traditional NTSC channels.

The transition from NTSC TV to HDTV will involve a transition period in which everyone involved with all aspects of the technology spends quite a bit of time and effort learning about its capabilities and limitations. The more information that those involved in any aspect possesses and can share, the smoother the transition will be.

Nick Conrad Pensen

ELECTRONIC INDUSTRIES ASSOCIATION
FACTORY SALES OF AUDIO EQUIPMENT
NEWS RELEASE
September and Year to Date 1997
Thousands of Dollars

For Release: November 24, 1997

	September		
	1997	1996	% Change
Portable Audio *	309,237	310,500	-0.4
Components	195,228	207,441	-5.9
Systems	238,161	222,410	7.1
Aftermarket Autosound	173,748	171,501	1.3
Total **	916,375	911,853	0.5

	Year-to-Date**		
	1997	1996	% Change
Portable Audio *	1,592,907	1,632,346	-2.4
Components	1,157,376	1,303,816	-11.2
Systems	1,347,571	1,169,671	15.2
Aftermarket Autosound	1,439,787	1,436,806	0.2
Total **	5,537,641	5,542,639	-0.1

* Includes home radio
** Totals and year-to-date may not add due to rounding.
Information contained in this report reflects total market statistics for products sold in the United States regardless of the brand name or country of origin.

Source: Consumer Electronics Manufacturers Association
2500 Wilson Blvd.
Arlington VA, 22201
For further information please contact Ed Korenman at (703) 907-7648

Audio systems report monthly sales increases

For September and the first nine months of 1997, systems were the best performing segment of the U.S. audio equipment business, the Consumer Electronics Manufacturers Association (CEMA) reported.

System sales to dealers rose seven percent in September to $238 million, and on a year-to-date basis outpaced 1996's numbers by an impressive 15 percent. According to CEMA, much of that growth can be traced to a 20 percent gain in compact systems, which on sales of $940 million accounted for 70 percent of the $1.35 billion sold through September.

Industry-wide audio sales remained in a statistical dead heat on a cumulative basis. For the first three quarters, the dollar volume of factory sales stood at $5.54 billion, barely one-tenth of a percentage point behind the comparable 1996 figure. Just as January-September sales were virtually identical to the same period a year ago, so were the September numbers. For the month, the audio total was $916 million, a one-half percentage point improvement over September 1996.

Aftermarket autosound grew fractionally in September, up one percent to $174 million, and for the first nine months totaled $1.44 billion, a marginal increase over 1996. Within that category, in-dash CD players continued to impress, surging 289 percent relative to September 1996, and car speaker sales enjoyed a monthly gain of five percent, to $33 million.

Portable audio products slipped in September to $309 million, and their nine-month results trailed 1996's subtotal of $1.63 billion by two percent. Home radio shipments rose 12 percent in September, however, and monthly sales of portable headset CD players expanded 13 percent to $84 million.

Separate components dropped another six percent in September on factory sales of $195 million, and through the first nine months were 11 percent behind the previous year's pace. Yet, a high note was sounded by CD players holding ten or more discs, which soared 80 percent above their September 1996 levels.

CEMA is a sector of the Electronic Industries Association (EIA), the 73-year-old Arlington, Virginia-based trade association representing all facets of electronics manufacturing. CEMA represents U.S. manufacturers of audio, video, accessories, mobile electronics, communication, information and multimedia products which are sold through consumer channels.

OEM and aftermarket work together to develop dual bus design for new cars

After a series of meetings, representatives of the Consumer Electronics Manufacturers Association (CEMA), the society of Automotive Engineers (SAE) and all three U.S. auto makers (Chrysler, Ford and General Motors) moved further ahead on developing a dual bus architecture that will allow multiple OEM and aftermarket devices to be installed easily, cost-effectively and safely in future cars.

Current automobile design cycles

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(three to five years) preclude the use of the latest electronics devices in a new car. Car makers are reluctant to make major changes in wiring and electronics to accommodate today's Intelligent Transportation Systems (ITS) technologies and other mobile electronics advances, since tomorrow's technologies may be very different. A standard interconnect method, supported by the car manufacturers and the electronics equipment suppliers, will allow the use of the latest electronics devices in any new car so equipped.

Last year, CEMA and its members identified an aftermarket "wish list" of In/Out requirements for present and future aftermarket devices while offering benefits to OEMs, the aftermarket and end-users. During the recent meetings, organized under the auspices of the SAE's ITS Data Bus (IDB) Task Force, OEM and aftermarket players began revising CEMA's wish list into scenarios of how the dual bus would function in real world applications.

One sample scenario involves an aftermarket cellular-based security system which could be integrated into the IDB, providing connectivity into the in-vehicle networking bus. This means that if an accident occurred and an airbag deployed, the network bus would send a message into IDB. At that point, the aftermarket system would detect the airbag deployment and automatically dial to a service center. If a GPS device or a navigation system is on the IDB, then the cellular product could grab the GPS position data and airbag notification and automatically dial the service center. With the IDB, devices manufactured by different companies would be able to communicate with one another.

In another scenario, an aftermarket cellular phone could be "hot plugged" into the vehicle's IDB whenever the driver used the vehicle. If the driver had so instructed the vehicle previously, whenever an incoming call was received, the phone could send commands across the IDB to other devices on the IDB or to systems within the vehicle itself. Such instructions could include muting the aftermarket audio system and rolling up the windows, or even displaying the caller's ID or phone number on the vehicle's instrument panel or heads-up display. If the driver purchased a new cell phone with an IDB compliant feature, this new phone would work with all other IDB devices and also integrate into the OEM networking bus.

In yet another scenario, a driver with several daily appointments could preprogram those destinations into a personal digital assistant (PDA) or laptop computer in the comfort of his/her home or office. Upon getting into the car, the driver would connect the PDA or computer to the IDB and download the data to the vehicle's on-board OEM or aftermarket navigation system. The navigation system could then calculate the most efficient route and guide the driver to each stop. This communication would eliminate the tedious programming of each destination individually that exists today.

"Our collective goal is to achieve a true 'plug and play' architecture in the vehicle so that various devices from different manufacturers, both OEM and aftermarket, can all work together in harmony. The arrival of such an architecture will change the motor vehicle forever, opening it up to the purest form of free enterprise by leveling the competitive playing field," said Eric W. Abbiss, director of IVS product development for Sherwood America and leading CEMA member on the SAE IDB Task Force.

Another Task Force leader, C. Edward Brice, director of new business development at Sony MobileComm, added, "The IDB bus represents an opportunity for more affordable ITS products and services to be made available to the consumer through existing aftermarket distribution channels, while at the same time increasing the ease of use and productivity for the consumer while in the vehicle environment. Aftermarket and OEM manufacturers - and especially consumers - will benefit from the development of standards like the IDB." ■

THE PROFESSIONAL MAGAZINE FOR ELECTRONICS AND COMPUTER SERVICING
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Presenting the most complete lineup of VCR service information.

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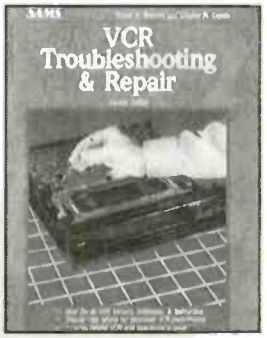
Complete VCR Troubleshooting & Repair

by Joe Desposito and Kevin Garabedian

This book contains sound troubleshooting procedures beginning with an examination of the external parts of the VCR, then narrowing the view to gears, springs, pulleys, belts, and other mechanical parts. It features nine detailed VCR case studies, each focusing on a particular model of VCR with a specific and common problem.

ISBN# 0-7906-1102-3 • $29.95



VCR Troubleshooting & Repair

by Gregory Capello and Robert Brenner

This book focuses on VCR preventative maintenance, and does an excellent job covering basic electronics principles and how they relate to VCR performance. *VCR Troubleshooting & Repair* presents step-by-step details on how to maximize performance, and gives suggestions on how to avoid breakdowns. This second edition also covers stereo, Super-VHS, H-VHS, and bar codes.

ISBN# 0-7506-7045-2 • $19.95

The In-Home VCR Mechanical Repair & Cleaning Guide

by Curt Reeder

Like any machine that is used in the home or office, a VCR requires minimal service to keep it functioning well and for a long time. *The In-Home VCR Mechanical Repair & Cleaning Guide* shows readers the tricks and secrets of VCR maintenance using just a few small hand tools, such as tweezers and a power screwdriver.

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Sources of replacement parts

by the ES&T Staff

As electronics technology becomes ever more sophisticated, the range of solutions available to engineers to solve design problems becomes ever broader. Where once an engineer could create a circuit using vacuum tubes or transistors and a multitude of passive devices wired together, today the approach is to design an integrated circuit, specific to the product being designed. Therefore, where once the selection of replacement parts for consumer electronics devices was quite limited and changed slowly, today the inventory of replacement parts is huge, and changing rapidly.

Finding the right replacement part

Given the broad array of consumer electronics parts that exists today, locating the correct replacement for a faulty part, especially for a product that is either brand new, or very old, is occasionally a lot like looking for the proverbial needle in a haystack. We present this list of parts distributors with the hope that it will be of use to service centers in locating hard-to-find parts that will help them complete those critical repairs.

Consumer electronics parts distributors

Alfa Electronics
P.O. Box 8089
Princeton NJ 08543
609-520-2002
800-526-2532
609-520-2007

Amcom Corporation
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800-328-7723
612-949-9400

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800-356-1227
800-926-2062

Computer Parts Unlimited
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Moorpark CA 93021
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805-532-2599

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404-263-5984
800-431-7671
404-263-5780

Global Micro-Parts Depot
11151 Denton Drive
Dallas TX 75229-4707
214-241-9470
800-325-8488
800-433-2060

Harco Electronics
Rte 22 Carsins Run
Aberdeen MD 21001
410-838-7990
800-638-7616
410-734-7288

Herman Electronics
7350 N.W. 35th Terrace
Miami FL 33122-1241
305-477-0063
800-938-4376
800-938-4377
Info@hermanelectronics.com
Http://hermanelectronics.com

Herman H. Sticht Co., Inc.
57 Front Street.
Brooklyn NY 11201
718-852-7602
800-221-3203
718-852-7915

HMC - Hub Material Co.
33 Springdale Avenue
Canton MA 02021-3200
617-821-1870
617-821-4133

Hosfelt Electronics, Inc.
2700 Sunset Boulevard
Steubenville OH 43952-1158
614-264-6464
800-524-6464
614-264-5414

ICM Components
1545 Sawtelle Blvd., Suite 21
Los Angeles CA 90025
310-268-1005
800-748-6232
310-445-5003
Icmsteve@worldnet.att.net

Industrial Electric Supplies
2101 N. Fairview Street.
Santa Ana CA 92706
714-971-2292
800-4-HURLEY
714-971-5033

Instek Corp.
1205 John Reed Court
City of Industry CA 91745
818-336-6537
818-369-1748
Instek@earthlink.net

Internat'l Components Corp.
107 Maxess Road
Melville NY 11747-3836
516-293-1500
800-645-9154
516-293-4983

Jameco Electronic Components & Computer Products
1355 Shoreway Road
Belmont CA 94002
415-592-8097
800-831-4242
415-592-2503

Jayso Electronics
3210 White Plains Road
Bronx NY 10467
718-798-1050
718-655-1196

JDR Micro
1850 S Tenth Avenue
San Jose CA 95112
408-494-1400

W.S. Jenks & Son
1933 Montana Avenue. N.E.
Washington DC 20002
202-529-6020
202-832-3411

Jim-Pak
1355 Shoreway Road
Belmont CA 94002
415-595-5936
415-592-2503
Info@jameco.com

Joseph Electronics
8830 N. Milwaukee Avenue
Niles IL 60714-1794
847-297-4200
800-323-5925
800-446-8366
Joseph@shoga.wwa.com

Kelvin Electronics
10 Hub Drive
Melville NY 11747
516-756-1750
800-535-8469
516-756-1763

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

L.J. Enterprises
11 McMillan Way
Delaware Industrial Park
Newark DE 19713
302-369-1590
800-627-8755
302-369-1594
Lee@ljent.com
Http://www.ljent.com/

Marshall Industries
9320 Telstar Avenue.
El Monte CA 91731
818-307-6000

Coming next month

In the March 1998 issue, we will present the 12th Annual Buyers' Guide, a Guide to National, State and Regional Associations, a guide to Service Information on the Internet, Motors in Electronics and a Servicing Technicians' Glossary.

The Buyers' guide will be a completely updated listing of names, addresses, telephone numbers, fax numbers, e-mail addresses and URLs (web site addresses) for the hundreds of companies that **ES&T** readers look to for service literature, replacement parts, test equipment, software and more.

The guide to associations will provide address and telephone information for anyone wanting to get in touch with local, state, regional and national servicing associations.

The guide to service information on the Internet will provide a listing of URLs for companies and other organizations that have web sites that provide useful information for consumer electronics service centers.

Motors in Electronics will provide service technicians with a host of information on motors in consumer electronics products, including the history of motors, types of motors found in consumer electronics products, theory of operation of those motors, a list of typical problems that motors experience, and actual case histories of diagnosis and correction of motor problems.

Last, but not least, this issue will include a glossary of newly introduced terms that many consumer electronics technicians may not have experienced yet.

M.A.T. Electronics
400 Pike Road
Huntingdon PA 19061
215-364-7667
800-628-1118
800-628-1005
7471.645@compuserve.com

MCM Electronics
650 Congress Park Drive
Dayton OH 45459-4072
513-434-0031
800-543-4330
513-434-6959
Http://www.mcmelectronics.com

Mendelson Electronics
340 East First Street
Dayton OH 45402
513-461-3525
800-344-6324

Metric Supply
21029 Itasca Street, Unit C
Chatsworth CA 91311-4924
818-701-9911
800-289-8953
818-701-6011

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

Montgomery War d
National Parts Center
5750 McDermott Avenue.
Berkeley IL 60163
800-323-1965
800-215-3767

Mouser Electronics
958 N. Main Street.
Mansfield TX 76063
817-483-4422
800-346-6873
817-483-0931
Catalog@mouser.com
Http://www.mouser.com

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

Nationwide Electronics
1242 E Lexington Avenue
Pomona CA 91766-5561
909-591-5885
909-627-3391

NCS
PO Box 1200
Newfields NH 03856-1200
603-773-5500
800-767-2554
603-773-9789

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

Neptune Electronics
PO Box 245495
Brooklyn NY 11224-5495
800-242-5556
800-239-6349

P.K. Neuses
1401 Rohlwing Road.
Rolling Meadows IL 60008
708-253-6555
708-253-6652

Northeast Electronics Inc.
6 Wilkins Drive #207
Plainville MA 02762
508-699-6935
508-695-9694

NTE Electronics, Inc.
44 Farrand Street
Bloomfield NJ 07003
201-748-5089
800-631-1250
201-748-6224
Maillist@nteinc.com
Http://www.nteinc.com

Omnitron Electronics
280 North Midland Avenue.
Saddle Brook NJ 07663
201-703-9800
800-379-6664
201-703-9804

Panasonic Services Company
20421 84th Avenue. South
Panazip: 2B-6
Kent WA 98032
253-872-7616
253-872-6512

Panson
180 & Maple Avenue.
PO Box 2003
Pinebrook NJ 07058
201-244-2400
800-225-5229
800-332-3922

Parts Express International
725 Pleasant Valley Drive
Springboro OH 45066
513-743-3000
800-338-0531
513-743-1678
Xpress@parts-express.com
Http://www.parts-express.com

Parts Port Ltd
1801 Walthall Cr Drive
Colonial Heights VA 23834
804-530-1233
800-253-0515
800-253-5640

PC Service Source
2350 Valley View Lane
Dallas TX 75234
972-406-8583
800-727-2787
972-406-9081
Http://www.pcservice.com

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

Pfanstiehl Corp.
3300 Washington Street.
Waukegan IL 60085
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800-323-9446
708-623-9107

Plaza Distributing
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Largo FL 34643
813-531-5484
800-531-5484
813-530-1821

G. M. Popkey Company, Inc.
2035 Larsen Road
PO Box 12237
Green Bay WI 54307-2237
414-497-0400
800-444-5920
414-497-4894

Projector Recorder Belt
P.O. Box 176
Whitewater WI 53190-0176
414-473-2151
800-558-9572
800-887-2727
Info@prbline.com
Http://www.prbline.com

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

Print Products International
8931 Brookville Road.
Silver Spring MD 20910
301-587-7824
800-638-2020
800-545-0058
Smprodintl@aol.com

Priority Computer Parts
125 Springhill Blvd #1
Grass Valley CA 95945
916-272-8084
916-272-8090

Q B Products
Microwave Parts Div
1260 Karl Court
Wauconda IL 60084-1094
847-487-3333
800-323-6856
847-487-2689

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

Richardson Electronics, Ltd.
40W267 Keslinger Road
LaFox IL 60147
708-208-2200
800-348-5580
708-208-2550

RNJ Electronics Inc.
202 New Highway
PO Box 667
Amityville NY 11701
516-226-2700
800-645-5833
516-226-2770
Rnjelect@rnjelect.com

RS Electronics
34443 Schoolcraft
Livonia MI 48150
313-525-1155
800-555-5312
800-773-5320
Http://www.rselectronics.com

Russell Industries
3000 Lawson Avenue.
Oceanside NY 11572
516-536-5000
800-645-2202
516-764-5747

Salen Enterprises
P.O. Box 915
Morton Grove IL 60053
773-736-0999
773-736-4238

Sony Service Co.
National Parts Div.
8281 N.W. 107th Terrace
Kansas City MO 64153
816-891-7550
800-821-5662

Specialized Prods Company
3131 Premier Drive
Irving TX 75063
214-550-1923
800-866-5353
800-234-8286
Http://www.specializedproducts.com

Sprague Magnetics, Inc.
12806 Bradley Avenue
Sylmar CA 91342
818-364-1800
800-553-8712
818-364-1810

SR Components, Inc.
52 Railroad Avenue.
Valley Stream NY 11580
516-872-8100
800-341-0003
516-872-8118

Standard Electronics, Inc.
215 John Glenn Drive
Amherst NY 14228
800-333-1519

Tadiran Computer Batteries
21303 Sherman Way
Canoga Park CA 91303
818-887-3337
800-234-2444
818-887-1686

Tandy National Parts
900 East Northside Drive
Fort Worth TX 76102
817-870-5600
800-322-3690
817-870-5626

A.G. Tannenbaum
P.O. Box 386
Ambler PA 19002
215-540-8055
215-540-8327

Telogy
3885 Bohannon Drive
Menlo Park CA 94025-1001
415-462-9000
800-835-6494
415-462-5152

TOPS Computer Company
461 Boston Street. E-2
Topsfield MA 01983
508-887-5915
508-887-9216

Tritronics, Inc.
1306 Continental Drive
Abingdon MD 21009
410-676-7300
800-638-3328
800-888-3293
Tritronics@aol.com
Http://www.tritronicsinc.com

Truminco of California Inc.
1875 Century Park E Suite 1880
Los Angeles CA 90067-2519
818-891-2345
800-331-0088
818-891-5251

Tucker Electronics Co.
P.O. Box 551419
Dallas TX 75355-1419
214-348-8800
800-527-4642
214-348-0367
Sales@tucker.com
Http://www.tucker.com

Union Electronics Distrib
311 E. Corning Road
Beecher IL 60401
708-946-9500
800-648-6657
708-946-9200
Http://www.unionel.com

Vance Baldwin Inc.
2701 W McNab Road
Pompano Beach FL 33069-4802
954-969-1811
800-432-8542
954-969-0226

Vintage TV and Radio Supply
3498 West 105th Street
Cleveland OH 44111
216-671-6712

Waytek Inc.
P.O. Box 690
Chanhassen MN 55317
800-328-2724
800-858-0319

Wholesale Electronics Inc.
P.O. Box 1011
Mitchell SD 57301-7011
605-996-2233
800-351-2233
605-996-4300
Wei@weisd.com
Http://www.weisd.com

Zack Electronics
2514 Channing Avenue.
San Jose CA 95131
408-324-0551
408-324-1110

Zenith Sales Co.
A Div of Zenith Electronics Co
1900 N.Austin Avenue
Chicago IL 60639
312-745-2000
312-745-2546

General software

by the ES&T Staff

The personal "computer" is a very inaptly named device. The predecessors of today's computers were, of course, used to compute. In fact, the first computers were used to compute tables of trajectories of artillery shells used during World War II. The desktop, laptop and palmtop computers of today, descendants of those early computers, are much smaller, much more powerful, and perform a broad variety of tasks. They would be more properly called "all-purpose information processing devices." But then, that would be a cumbersome name. And the acronym for that name wouldn't be very useful.

So, we're stuck with "personal computer," or "PC" to describe today's machines, but they do so much more than compute, although they would be able to generate those tables of trajectories in a fraction of the time that it took those computers from the early days.

The versatile computer

Let's take a look at some of the tasks that a computer can perform these days. For starters, of course, they can still compute. If you load, say, a spreadsheet program, you can enter numbers into several of the cells in the spreadsheet, and combine those numbers in any of the usual mathematical ways. You can add them, subtract them, multiply them and so forth, and store the results in other cells in the spreadsheet. There are also programs specifically designed to deal with complex mathematical formulas.

But you can do so much more with a computer these days. For example, this article was written using a word processor. Instead of scrawling on a piece of lined yellow paper, I used a keyboard to enter characters. The resultant words appeared on a monitor screen in black letters. One of the values of preparing manuscripts using a computer is that once the text has been created, it's no longer necessary for anyone else to key in the words.

When I have completed a manuscript, I send it via the internet (in mere seconds) to the magazine's associate editor in New York. She edits it, but does not have to retype it. And when the manuscript goes to be typeset, the typesetter doesn't have to key it in again. She merely has to indicate type sizes, set column width, and add some attributes such as **boldface**, *italic*, etc., and the article is ready to print out in page make-up form.

Some other things a computer can do

But there's more, much more. For example, on my computer, I have a copy of the American Heritage Dictionary. When I need to look up the meaning or spelling of a word, I don't have to get a dusty old book off the shelf, I merely click the mouse button a few times, key in a few characters, and there's the information I need. Ditto with the Compton's Encyclopedia, although in that case, I have to locate and insert a CD-ROM disk. And I have the yellow pages from every telephone directory in the U.S. on a CD-ROM. If I need to find the address and phone number of any kind of business anywhere in the country, it's on that thin, small piece of plastic, instead of several bookcases worth of books.

Many of the drawings that illustrate the articles in ES&T are created using a drafting program on this computer. This by someone who can't draw a straight line.

Well, you get the idea. The computer is a powerful, versatile, tool that can help any business be more productive.

For the purposes of this article, by the way, we're using the term "general software" to mean any generally used software other than service management.

Software suites

One of the more interesting ideas in general-purpose software that is used today is that of software "suites," groups of programs that can be bought separately or together and that can be used together to make using a personal computer even more productive.

For example, a computer user is working along on a word processor and needs to extract some information from a spreadsheet to illustrate a point. If that word processor program is part of a suite of programs, it may be possible to invoke the spreadsheet from within the word processor and easily insert the data.

Or let's say that a business has just developed a form letter on a word processor and wants to mail it to all of the customers in their database. Once again, it's simple to merge the name and address data with the body of the letter and print out a personally addressed letter to each individual in the database.

A number of software manufacturers offer software suites; Lotus and Microsoft to name a couple. The Lotus suite is called "SmartSuite," and the Microsoft suite is called "Office." Both contain: a spreadsheet, a word processor, a database program, and presentation graphics. The Lotus suite also includes time management software, and business multimedia software programs.

Of course, software such as this takes a certain amount of time to learn, but the rewards can make it well worth it.

Throw away those 3 X 5 cards

As the above subheading suggests, the right software for a personal computer will allow you to dispense with any 3 X 5 card filing system. You can also dispense with your business card file, and just about any other type of data filing system you may be using. Not only that, but the information will be easier to access.

For example, would you like to retrieve a list of your customers who live in a specific zip code. Just use the database program to select only those customers. How about a list of customers who haven't used your services in the past year. Using the right selection criteria with your database program, you can do that as well.

Automate your ledger

One of the beauties of using a comput-

SOFTWARE

- Word Processing
- Spreadsheet
- Database
- Personal scheduling
- Drafting
- Schematic capture
- Circuit simulation
- Photo/drawing manipulation
- Financial record keeping
- Banking
- Telephone answering/Fax sending receiving
- Virtual instruments
- Geographical maps
- National telephone directories
- Dictionaries
- Encyclopedias
- Internet access
- Legal/medical advice
- Calendar creation

Figure 1. This is a partial list of software programs that are available.

er for financial types of applications is that you can automate all of the calculations, and update them automatically as well. For example, let's say that you want to keep a running total of your expenses for the month in a ledger style sheet in a spreadsheet program. In the column in which you put the dollar amount, at the bottom of the page you would place a formula that calculates the sum of all of the cells above it.

The formula would have a form something like: @SUM(h7..h30). The @ tells the spreadsheet that the following characters will represent a formula, and the characters in parentheses identify the cell locations where the data is stored.

With a ledger sheet such as this set up in your computer, every time you add a line with a new amount in the dollars column (between cells h7 and h30), the amount would be added to the total, so you're keeping a running total. You could keep another ledger sheet for receipts. In fact, some spreadsheet programs allow you to keep related spreadsheets in a "workbook," so for any given period, week, month or year, you could have your receipts ledger on one page of the workbook, your expenses ledger on another page, and any other financial information on other sheets. Moreover, you can take any of the numbers, totals, etc., from one sheet and copy it into any of the other sheets (automatically) and manipulate it in any way you want to on that sheet.

What general software can do for you

As we have suggested in the text above, the very powerful, reliable, software available from a multitude of companies today will let you do things with your computer that will help you be more productive in your business. Figure 1 is a partial list of some of the things that can be done on an inexpensive (around $2,000) personal computer using generally available, low cost software. ■

New technology update

By the ES&T Staff

Just when you thought that the geniuses who think up all the wonderful electronics products that consumers enjoy might be taking a little breather, they come up with a host of new products for all of us to marvel at and scratch our heads about servicing. But then, we knew they would. After all, we've been planning this issue for months.

Just to name a few of the new products that are either available, or soon will be, there's the Rex PC Companion, an electronic Rolodex file that you can hook up to a computer, download your contact list into, and carry around with you. Oh, by the way, it's the size of a credit card, only slightly thicker. Or how about one of those new digital cameras. You can shoot a number of photos (they're recorded digitally), display them on the camera's viewfinder/viewer, or on your computer monitor and print them using your color printer. Or if you don't like any of the photos you've taken, you can just erase them.

Another new product is called the WebTV Plus. With this new product, you can not only use your TV as a display when you surf the web, but while you're watching certain programs you can access the web and display information that's related to the program being shown.

Following are a few other nuggets that describe some of what's going on in the world of consumer electronics today, as well as a little information about how electronics technology has gotten to where it is today.

AT&T PocketNet service

AT&T PocketNet is a new wireless service which integrates wireless two-way email, a personal organizer with calendar and address book, and Internet content access from a specially equipped cellular phone. According to the press materials, it is the first voice and data service of its kind to enable users to manage essential information while on the go.

Highlights of this service include:

PocketNet Email: send and receive with notification.

Online personal organizer: manages calendar and appointments with integrated voice features. Latest news, financial quotes, sports content and more.

Password-protected "Private Web Site": manage service features from the phone or a PC.

Each AT&T PocketNet Service-compatible phone is equipped with specialized browser software that retrieves text-based information from Internet sites and intranet Web servers using AT&T's wireless network. The 11-ounce device allows mobile users to remotely access and manage essential information, adding a new dimension to wireless business and personal connectivity. AT&T PocketNet Service content providers include: ABCNews.com, Bloomberg Online, NewsAlerts, Travelocity, WhoWhere, ESPN/SportsZone, InfoSpace, Mapquest and 14 more services.

"HDTV is a whole new approach that brings broadcast television into the digital age."

For an online demo, or additional information, go to the AT&T PocketNet page: http://www.att.com/pocketnet/

DTV: Essential facts about digital television

The Consumer Electronics Manufacturers' Association (CEMA) has developed some information about digital television that should be of interest and value to anyone associated in any way with this emerging technology. Some of that information follows.

What is digital TV?

Digital TV (DTV) is a new broadcast standard recently approved by the FCC that will ultimately replace the analog television broadcast signal we receive today. The centerpiece application of Digital TV, known as High-Definition Television (HDTV), is a whole new approach that brings broadcast television into the digital age.

Digital TV will require new television receivers as well as new broadcast facilities. Because of the enormous scope of this conversion, the changeover will be a gradual one.

The new picture format offered by DTV allows for both a high-resolution and a wide-screen presentation. (In existing TVs, the ratio of picture width to height is only 4:3, or 12:9. DTV allows a ratio of 16:9).

The combination of wide screen and photographic quality resolution ultimately will allow for the presentation of an entire football game using a single camera, showing the viewer the field as it can be seen from seats on the 50-yard line.

The move to digital broadcasting, in addition to supporting the superiority of the DTV signal, offers more choices and allows new services to be created. The broadcaster can choose multiple channels of television in lower resolution and screen width, as well as provide data, information, and interactive services - bringing consumers into the digital age.

What is high-definition television (HDTV)?

HDTV provides about five times more picture information (picture elements or pixels) than conventional television. This includes twice as much vertically, twice as much horizontally and then a bit more to fill the wider screen. HDTV will typically include multiple channels of digital surround sound, like a movie theater.

What is the difference between DTV and HDTV?

Digital TV encompasses HDTV and standard-definition TV (SDTV), as well as an assortment of potential data broadcasting applications. SDTV offers essentially the same picture res-

olution as today's TV, but the picture quality is much higher because digital transmission eliminates snow and ghosts.

Broadcasters have the capability to transmit multiple channels of SDTV, a combination of SDTV and HDTV or two HDTV programs simultaneously within its assigned digital channel. What is actually transmitted will depend on the type of programming being broadcast.

When will digital TV come to my community?

There will be a gradual rollout of service. By May 1999, affiliates of the four major networks (CBS, NBC, ABC, FOX) in the top 10 markets must construct digital TV facilities. These markets are: Atlanta, Boston, Chicago, Dallas/Ft. Worth, Detroit, Los Angeles, New York, Philadelphia, San Francisco and Washington, DC. In addition, broadcasters have promised the FCC there would be at least one digital station in each of these markets by November 1998.

By November 1999, affiliates in the remaining top 30 markets (11-30 ranking) must construct digital facilities. These markets are: Baltimore, Charlotte, Cincinnati, Cleveland, Denver, Hartford/ New Haven, Houston, Indianapolis, Miami/Ft. Lauderdale, Minneapolis/St. Paul, Orlando/ Daytona Beach/ Melbourne, Phoenix, Pittsburgh, Porland, Raleigh/ Durham, Sacramento/ Stockton/ Modesto, San Diego, Seattle, St. Louis, Tampa/ St. Petersburg/ Sarasota.

By May 1, 2002, all other commercial stations must construct facilities. All non-commercial stations (Public Broadcast System) must construct by May 1, 2003.

When will broadcasters stop transmitting analog signals?

For now, the FCC has set 2006 as a target changeover date. However, few people really believe that there will be enough DTV penetration for this to happen at that time.

What happens to analog sets after 2006?

These sets will still work with cable, direct-to-home satellite, VCRs and DVD players. To help make the transition to digital, it is anticipated that manufacturers will produce set-top converter boxes that will deliver DTV broadcasts to analog televisions.

How much will an HDTV set cost?

The first HDTV sets will be large screen models and there have been wide ranging estimates from manufacturers about the cost. Some companies estimate that the first sets will cost between $2,000 and $5,000 more than today's sets, while others say the costs will range between $8,000 and $11,000. However, in 1999, when mass production of sets begins, prices are expected to drop rapidly.

How fast will consumers adopt this new technology?

It will be a slow process. CEMA estimates that after five years of availability, only 10 percent of the population will own a DTV, that number will increase to 20 percent in seven years and then to 30 percent in eight years.

How do I convince my customers to buy a television now?

You need to explain to consumers that HDTV is not around the corner (see market rollout information above) and that the TV they buy now will work for many years to come. You should also explain how they can still take advantage of current digital technology, with products such as Direct Broadcast Satellite (DBS) and Digital Video Disc (DVD). You can demonstrate using today's televisions how these products can improve their viewing experience. Also, let them know that a set-top converter box will be available to allow them to experience the features of Digital television programming (in a SDTV mode) on the set they buy today.

Glossary of digital video technologies

Digital Television (DTV) - DTV is a new broadcast standard recently approved by the Federal Communications Commission that will ultimately replace the analog television broadcast signal we receive today. The new picture format offered by DTV allows for a high-resolution and wide-screen presentation. Digital TV will require new television receivers as well as new broadcast facilities. The first digital broadcasts are expected to begin in 1999, and the first digital receivers will be available for purchase in late 1998. Because of the enormous scope of this conversion, the changeover from analog to digital television will be a gradual one and will take place over a period of several years. Thus, currently available analog televisions will provide years of use and enjoyment.

Direct Broadcast System (DBS) - DBS is a high-powered, high-band digital satellite television transmission system that uses a home receiving dish 18 inches in diameter. These units provide consumers with up to 200 channels of digital video and audio programming with superior picture and CD-quality sound. DBS was the first product to bring digital video to the living room.

Digital Camcorder - Camcorders using the Digital Video Cassette (DVC) standard. Advanced digital camcorders provide high-resolution pictures and superior editing capabilities. With a touch of a button, users can create special features, including fade, wipe, mosaic, dissolve and scroll. These camcorders offer resolution levels of 500 lines and better, far exceeding that available with analog recorders. They can be used with televisions and personal computers.

Digital Camera - Digital cameras take pictures very much like traditional point and shoot cameras, but instead of storing light on film, they create digitized image files that are saved to memory. Users can then transfer these files to a desktop or laptop computer, where they can be integrated into multimedia presentations, web sites, or screen savers.

Digital Versatile Disk (DVD) aka Digital Video Disk - Also known as the digital video disk, DVD is a particularly powerful high-density disc capable of holding unprecedented amounts of data. In fact, just one side of the 4.7-inch disc can hold an entire two hour movie. DVD takes home theater to a new level, delivering images of outstanding clarity and sharpness, with CD-quality sound. DVDs provide many more features than videotapes, such as instant access to scenes, slow motion and freeze framing, all without ghosts and distortion. DVDs allow movie studios to include various subtitles, language tracks, camera angles, and multiple aspect ratios (screen shapes).

Digital Videocassette Recorders (D-VCRs) - Recently introduced, Digital VCRs are designed to let DBS users make digital recordings. DBS owners with digital video outputs on their systems will be able to get full digital benefits, whether they watch a program live while it's being broadcast or record it.

High Definition Television (HDTV) - The centerpiece of digital TV, HDTV provides about five times more picture information (picture elements or pixels) than conventional television, creating unprecedented clarity and wide-screen perspective. For example, HDTV will ultimately allow for the presentation of a

football game using a single camera, providing viewers with a perspective similar to that from seats on the 50-yard line.

Standard Definition Television (SDTV) - In addition to HDTV, digital TV encompasses standard-definition TV (SDTV). This application offers essentially the same picture resolution of today's televisions, but the picture quality is much higher because digital transmission eliminates snow and ghosts.

These terms are being more formally standardized by the industry. They were expected to have been released in January at the 1998 International CES conference.

HDTV Chronology

Television has come a long way from those early days. We found this chronological information on the CEMA website. We thought that it would make interesting reading for anyone who sells, services, or is in any other way involved with television.

1884 - Scanning disc for mechanical television invented by Paul Nipkow.

1897 - First cathode ray tube scanning device constructed by German scientist, Karl Ferdinand Braun.

1900 - Professor Reginald A. Fessenden transmits speech without wires.

1907 - Boris Rosing in Russia and A.A. Campbell-Swinton in England simultaneously develop image reproduction methods using electromagnetic scanning.

1923 - National Association of Broadcasters (NAB) formed.

1923 - Complete TV system including kinescope, or picture tube, demonstrated by Dr. Vladimir K. Zworykin; Zworykin applied for patent of iconoscope or TV camera tube.

1924 - Radio Manufacturers Association, predecessor of EIA, founded.

1927 - Philo Farnsworth applies for patent on electronic television.

1927 - Bell Telephone Laboratories demonstrated wireless TV between Whippany, NJ and New York.

1928 - First experimental TV station permits issued by federal government.

1928 - First successful trial of video delivery through telephone lines; motion pictures sent from Chicago to New York by AT&T.

1934 - Federal Communications Commission (FCC) established.

1939 - TV introduced at New York World's Fair. First television sets offered for sale in U.S. by RCA, GE, DuMont, Philco, and two other companies.

1948 - TV set sales increase more than 500 percent over the 1947 level.

1950 - Cable TV introduced.

1953 - NTSC-compatible color TV successfully demonstrated to FCC; FCC authorizes broadcasts to begin January 22, 1954.

1954 - Color TV broadcasting begins.

1956 - Back-and-white portable TV era begins.

1957 - Radio-Electronics-Television Manufacturers Association changes name to Electronic Industries Association (EIA).

1960 - First rectangular screen TV introduced . First battery-operated transistorized TV for sale.

1962 - Legislation passed requiring all-channel tuning (UHF and VHF) in television receivers.

1971 - Electronic tuning first seen in U.S. TVs.

1973 - Giant-screen projection color TVs marketed.

1982 - Surround Sound is introduced for home use by Dolby Laboratories.

1984 - Multi-channel TV sound broadcast authorized by FCC; first stereo TV broadcasts begin.

1984 - Sales of stereo color TV receivers and adapters begin.

1984 - First color TVs with all-digital signal circuitry marketed.

1985 - Color TVs with 35-inch picture tubes marketed.

1986 - Scrambling of satellite-fed cable TV programming starts; sale of decoders and program subscriptions to home dish owners begins.

1986 - Stereo-sound in television broadcasting available in all major U.S. population centers.

1987 - First Advanced Television (ATV) system demonstrated.

1987 - Movie theater experience moved into the living room:

1987 - Dolby Pro-Logic Surround Sound is available at home.

1988 - First Improved Definition Television (IDTV) receivers marketed.

1990 - Production of giant-screen (over 27-inch) color TV picture tubes starts in U.S.

1990 - Legislation requiring close captioning decoders in all larger color TVs manufactured after July 1, 1993 signed into law.

1990 - All-digital high definition television (HDTV) system proposed; FCC sets testing schedule.

1991 - First TVs with built-in closed-caption display capability introduced in U.S.

1991 - U.S. testing of HDTV systems begins.

1993 - 16:9 Aspect Ratio (widescreen) television sets marketed in U.S.

1995 - First television program (Computer Chronicles) delivered via the Internet.

1995 - First television station (KOLD 13) uses a networked digital video server in its daily on-air operations.

1995 - EIA's Consumer Electronics Group (CEG) becomes CEMA, Consumer Electronics Manufacturers Association, a sector of EIA.

1995 - Interactive cable modem trials with consumers started.

1995 - Flat-screen plasma display TVs introduced.

1996 - First TV sets equipped with VCR Plus+ introduced in U.S.

1996 - HDTV is broadcast and received live at commercial station WHD-TV in Washington, D.C.

1996 - Set-top boxes plug into TV and telephone and allow viewers to surf the Internet's World Wide Web via remote control.

1996 - Zenith introduces the U.S. market's first HDTV-compatible front projector TV.

1996 - Agreement between broadcasters, TV manufacturers and PC makers sets inter-industry standard for digital HDTV. HDTV sets to hit shelves in 1998.

1997 - FCC assigns digital spectrum to broadcasters and sets schedule for digital broadcasts.

ATSC conducts first digital HDTV broadcasts in southern hemisphere

Demonstration and testing of HDTV continues throughout the world. On October 1, 1997, the Advanced Television Systems Committee (ATSC) conducted the first over-the-air broadcast of digital high-definition television (HDTV) service

"DTV is a new broadcast standard recently approved by the Federal Communications Commission that will ultimately replace the analog television broadcast signal we receive today."

in the southern hemisphere. The digital signals - with crystal clear HDTV pictures and CD-quality six channel surround sound originated from the TCN Channel 9 tower in Willoughby and were received at the Observatory Hotel in Sydney where government and industry leaders gathered to enjoy the demonstrations and to learn about the ATSC Digital Television Standard. Additional broadcast demonstrations and a seminar on the ATSC DTV Standard took place on October 2 for invited guests. Following the demonstrations, field tests to evaluate the performance of the ATSC DTV system commenced in the Sydney area and continued for several weeks.

The ATSC HDTV demonstrations, laboratory tests, and field tests were organized with the assistance of the Federation of Australian Commercial Television Stations (FACTS). FACTS is playing a leading role in a cooperative government and industry effort to evaluate the ATSC Digital Television (DTV) Standard and other possible approaches for the introduction of digital television services in Australia.

Observing the demonstrations, Tony Branigan, general manager of FACTS, said "Today's broadcast of digital HDTV marks an important milestone in Australia's efforts to bring the benefits of this new technology to the Australian people. We are actively evaluating ATSC digital television, as well as the European digital standard, to determine the best course for Australia to pursue, and this demonstration provides an important focal point for our deliberations."

Bruce Robertson, executive vice-president - engineering of Nine Network Australia, and chairman of the FACTS advanced transmission specialist group that is evaluating alternative approaches to digital television, added "The upcoming field tests of the ATSC system, together with laboratory test data already gathered on the North American ATSC system and a competing system developed in Europe, should provide us with the data we need to make the best decision for Australia on digital television."

"We are enthusiastic and excited about the advent of digital television,"said Robert Graves, ATSC chairman. "The ATSC DTV Standard offers broadcasters around the world the flexibility to provide many different combinations of high-definition television, multiple programs of standard-definition digital television (SDTV), and a virtually limitless set of potential information services. Implementing the ATSC Standard will mean a quantum improvement in the technical quality of television service and will provide data delivery capability that represents a fundamental improvement in the information infrastructures of the nations that adopt it."

"What's more," Graves added, "implementing common or similar digital television standards in many countries will benefit those countries by providing wider availability of broadcast and consumer equipment at lower prices. We look forward to working with manufacturers and broadcasters in implementing this standard throughout the world."

The ATSC Digital Television Standard is based on the Digital HDTV Grand Alliance system created and tested as part of a 10-year process for developing a North American advanced TV standard.

The ATSC digital television standard has been formally adopted in the United States, where an aggressive implementation process is under way.

U.S. DTV broadcasts will begin in 1998, and more than 50 percent of American viewers will have access to at least three digital signals by the end of 1999. The ATSC Standard has also been recommended for adoption in Canada and Mexico, and is actively being considered for adoption in other countries in South and Central America, Australia, and Asia.

The Sydney demonstrations were supported by several member organizations of ATSC, including the Advanced Television Technology Center, which provided integration and technical support; Harris Corporation, which provided the digital transmitter; Zenith Electronics Corporation, which developed the digital transmission system incorporated in the ATSC DTV Standard; Dolby Laboratories, which developed the multi-channel surround sound audio system contained in the standard; Mitsubishi Electronics America, which provided video decoding equipment; and CBS, Snell & Wilcox, and Sony Electronics, which provided equipment and technical support. JANDS Electronics also provided equipment for the demonstrations.

Noting the flexibility of the ATSC DTV Standard to provide HDTV, SDTV and data services, Graves stressed the importance of HDTV to broadcasters in the U.S. "I believe that HDTV will become the medium of choice for producers, programmers, the distribution media, and the viewing public. For those countries who believe that HDTV capability is an essential part of their mix of digital TV services, the ATSC DTV Standard is the only digital TV standard that offers real economies of scale for HDTV receivers and other HDTV equipment. While the competing European digital TV standard offers HDTV capability on paper, no one has announced any plans to implement HDTV capability using that standard."

The ATSC, composed of more than 100 member corporations, industry associations, standards bodies, research laboratories, and educational institutions, is an international organization developing voluntary standards for the entire range of advanced television systems.

The ATSC is also developing DTV implementation strategies and creating a certification program for television sets, computers, and other consumer video devices. ATSC members include broadcasters, broadcast equipment suppliers, consumer electronics manufacturers, cable television providers, motion picture companies, computer hardware and software companies, telecommunications firms, and other entities interested in advanced television.

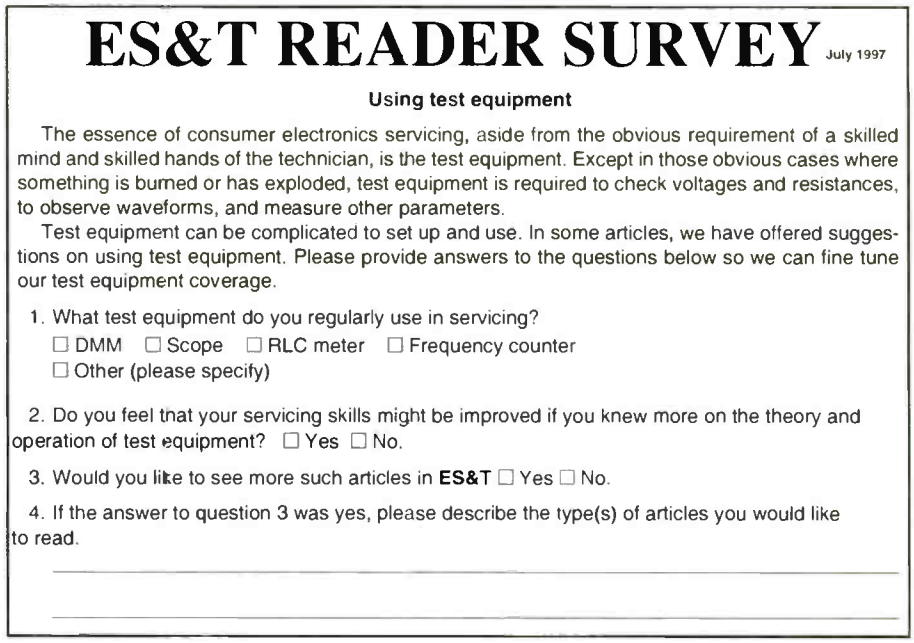
The beat goes on

The current surge in developments in consumer electronics, fueled by advances in microminiaturization, applications of digital electronics to traditionally analog processes, and revolutionary changes in communications technology can be expected to continue to yield technological marvels. Stand by for future reports such as this, and let's all hope we can find ways to fix them. ■

Reader survey report

by the ES&T Staff

Each month in ES&T we include a Reader Survey card in which we ask readers to provide us with information and opinions on subjects that are of interest to our readers. This information is invaluable to us in learning more about readers: what types of products they service, how they go about servicing those products, and what kinds of difficulties they may be having in completing servicing. We also ask readers for their opinion as to what kinds of information they would like to see in the magazine. It helps us to determine what kinds of articles we should be publishing.



ES&T READER SURVEY July 1997

Using test equipment

The essence of consumer electronics servicing, aside from the obvious requirement of a skilled mind and skilled hands of the technician, is the test equipment. Except in those obvious cases where something is burned or has exploded, test equipment is required to check voltages and resistances, to observe waveforms, and measure other parameters.

Test equipment can be complicated to set up and use. In some articles, we have offered suggestions on using test equipment. Please provide answers to the questions below so we can fine tune our test equipment coverage.

1. What test equipment do you regularly use in servicing?
☐ DMM ☐ Scope ☐ RLC meter ☐ Frequency counter
☐ Other (please specify)

2. Do you feel that your servicing skills might be improved if you knew more on the theory and operation of test equipment? ☐ Yes ☐ No.

3. Would you like to see more such articles in **ES&T** ☐ Yes ☐ No.

4. If the answer to question 3 was yes, please describe the type(s) of articles you would like to read.

Figure 1. July reader survey card.

Time for a little feedback

For those of you who were kind enough to take the time to fill out the reader survey cards, we thought that you might be interested to see what some of the other respondents had to say. We selected two subject areas that we thought would be of interest: the surveys that were included in the July and October 1997 issue.

Figure 1 is a copy of the survey card that was published in the July issue. The subject was test equipment: what test equipment readers use and how they use it. Figure 2 is the survey card that was published in the October issue. The subject was audio servicing: how many readers service audio equipment, and what kinds of information they require in servicing it.

We would like to make it very clear at the outset that this article makes no representation as to the statistical validity of these surveys. The fact is that they are not statistically valid. For one thing, the people who filled out the cards are members of a self-selected group. For another, the number of respondents does not represent a statistically significant portion of the total readership. Therefore, we can't project the results of the survey over the entire readership of the magazine and say that because 25% of the respondents said something, that 25% of all readers say that. That would not be correct.

What we have learned about the groups that responded to these surveys applies only to those groups. However, for editorial planning purposes, the staff of the magazine is going to assume that the results of the surveys apply in a general way to all the readers of the magazine. From what we know about readers in general, the results are generally valid But we won't try to kid anybody. We don't, and we can't, know for sure.

Test equipment

The total number of readers who returned the survey that appeared in the July 1997 issue was 87. Of those, 80 said that they use a DMM when they're performing service. Interestingly, a number of respondents checked only the box marked DMM, leading us to believe that that's the only piece of test equipment they ever use in servicing.

The oscilloscope was the test device of choice for 70 of the 87 respondents. Again, interestingly, a few respondents checked only the oscilloscope, suggesting to us that that's the only piece of test equipment they use for service.

Most of the respondents checked both DMM and oscilloscope, which seem to be the two pieces of test equipment that most servicers generally use in thoroughly diagnosing problems in electronics equipment. The DMM provides quick measurements for voltage, continuity and resistance, and the scope provides a display of those all-important waveforms.

A fairly sizable portion of the respondents, 38 (or 44%), checked the frequency counter as their pieces of test equipment of choice, while only 24 (or 28%) said that they use an RLC meter.

One of the open-ended questions in the survey asked respondents what other types of test equipment they use, and requested that they specify what type of test equipment it might be. This question brought a variety of responses: ESR meter, temperature measurement, signal generator, CRT tester, power meter, software, waveform analyzer, logic pulser, logic probe, variable transformer, variable power supply, function generator.

Who needs help using test equipment?

Two other questions in the survey asked readers if they felt that their servicing

ES&T READER SURVEY October 1997

Audio/Radio

Because radio technology is generally less complex than television technology, and audio technology is less complex than video technology, this magazine tends to emphasize television and video. However, we recognize that for many readers, audio servicing is a significant part of their business. The answers to the following questions will help the editors in planning furture articles on audio/radio.

1. What types of product are serviced in your service center, and approximately what percentage of the total business does it represent?

Product	Percent	Product	Percent
TV/Video		Audio/Stereo/Radio	
Microwave Oven		Personal Computer	
Video Game			

Other (please specify) _____

2. What sources of information do you use in servicing audio/radio products?
   - ☐ Manufacturers' Service Literature
   - ☐ Technical Books
   - ☐ Audio Magazines
   - ☐ Other (please specify) _____

3. Would you like to see more audio coverage in **ES&T**? ☐ Yes ☐ No

4. If the answer to question number 3 was Yes. Please describe the types of articles you would like to see.

_____

Figure 2. October reader survey card.

skills might be improved if they knew more about the theory and operation of test equipment and if they would like to see more such articles in **ES&T**. The responses to those questions were overwhelmingly affirmative: 72 of 87 respondents feel that they would benefit from more knowledge about the theory and operation of test equipment, and 71 of 87 would like to see more such articles.

We won't be planning on overwhelming readers with articles on test equipment, but based on the results of this survey, we will continue to provide articles that provide instruction and tips on test equipment application.

Types of test equipment articles wanted

The last question on the survey was open ended. We asked "please describe the types of articles you would like to read." Here are some of the answers:

- How to build an ESR meter. Test equipment needed to do a thorough job on tuner alignment and repair without having to guess.
- How to use a variable transformer and its purpose. How to use an isolation transformer and its purpose. Basics on using the oscilloscope. Verifying B+ voltage. When I hire a technician from school these are needs. Get graphical.
- How to use the NTSC generator for video work. How to use other test equipment to improve repair techniques (Make job go faster), i.e. wow and flutter, jitter.
- Troubleshooting with a scope.
- Using the scope and interpreting the signals on the display screen.
- More on newer types of scopes. Many instruction manuals from the manufacturers are very weak on operation.
- Articles on spectrum analyzers or RF synthesizers; general principles.
- New digital scope measurement info.

Audio servicing

The survey card that was included with the October 1997 issue asked readers to approximate the percentage of their business that each of several classes of consumer electronics products represented. As it turns out, the information that was provided was a nightmare to try to tabulate for publication, so we gave up on that aspect of the survey. Rest assured, those percentages will be of value to us in planning future editorial.

We did learn, however, that there is no "typical," service center in terms of the products they deal with. Some of the respondents spend 90% to 100% of their efforts servicing TV and /or video. Some of the respondents spend 90% or more of their efforts servicing microwave ovens. A few concentrate mostly on audio, video games or personal computers.

Some readers hardly service any consumer products. Among the non-consumer items that some readers service are: converters, inverters, radio control, test equipment, power supplies, amusement machines, arcade games, jukeboxes and two-way radio.

However, the thrust of the survey was to determine the interest of readers in articles on audio servicing. We know that some of our readers want audio servicing articles, while others couldn't care less about audio about audio. Moreover, we haven't published a lot of audio servicing articles, so we wanted to find out if we were doing enough in that subject area.

Here's what we found out. Of 95 respondents, 52 said that they would like to see more emphasis on audio, while 35 said that they would not. A total of 8 of the 95 respondents didn't seem to care one way or the other. We think that this suggests that we should place a little more emphasis on audio servicing, but we won't go overboard. TV and video still seem to be the areas in which most of our readers specialize, so that's where the bulk of our editorial will stay.

Comments on audio servicing

We included an open-ended question on the October survey card asking readers to let us know what audio-related subject areas in particular they would like to see covered in **ES&T**. Here are some of the comments:

- One reader who answered "Yes!, Yes!, Yes!," to the question of whether we should include more audio coverage (we only counted his "yes" answer once in totaling up responses, however) asked for more coverage on "AM/FM stereo troubleshooting and repair. PLL, AF, IF, digital control, etc. Digital servo control. Carousel changer mechanisms. Feature articles on test equipment, its uses and manufacturers of instruments."
- Troubleshooting shorted audio amps.
- In-depth articles on the latest compact disk and digital cassette decks. Also fast fixes on CDs.
- Dolby circuits, system control, surround sound systems.
- Surround sound troubleshooting and setup/theory. Test equipment for testing related parts and circuits.
- Troubleshooting audio power amplifiers. Bias schemes, etc. Simple, effective CD tests/alignment. Suppliers of old and very new parts.
- Theory, case histories for older audio products, not just CDs. How about servicing turntables?
- Servicing audio power amplifiers without using a schematic.

We'll get right on it

Thanks again to everyone who filled out the survey cards. The information you provide is invaluable to us in evaluating our editorial package and planning future articles. From what you've told us in letters, phone calls, comments on reader service cards and these surveys, we're doing pretty well in maintaining a good mix of articles. We'll use the results we've shared with you here in planning our direction for the future. ■

Test Your Electronics Knowledge

by J.A. Sam Wilson

1. Is the following statement correct? The number of electrons in one coulomb is 6.28×10^{18}.
   A. correct
   B. not correct

2. An SCR starts to conduct when there is a
   A. gate voltage pulse.
   B. gate current pulse.

3. A phanatron is a
   A. diode made of copper and silver.
   B. gas-filled diode.

4. Is the following statement correct? The duty cycle of a pulsed waveform is the ON time divided by the OFF time.
   A. correct
   B. not correct

5. Which of the following has the longer wavelength?
   A. red light
   B. blue light

6. An ordinary neon oscillator will have a higher frequency in a
   A. brightly-lighted room.
   B. dark room.

7. Is the following statement correct? Hydrogen is a magnetic gas.
   A. Correct
   B. Not correct

8. Is the following statement correct? Add white paint to blue paint to get a more saturated color.
   A. correct
   B. not correct

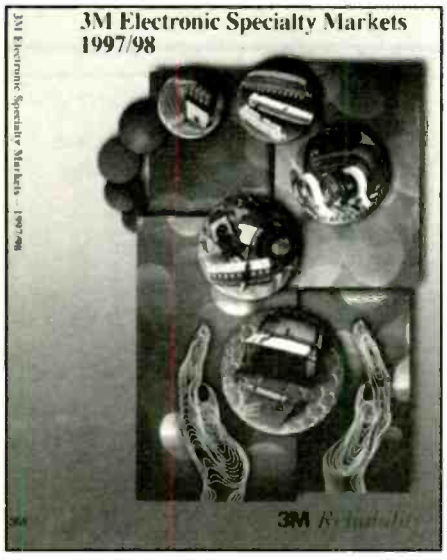
9. What is the time constant of a 1.3H coil in series with a 5Ω resistor?
   _____seconds.

10. You charge an air dielectric capacitor to 1V then move the plates of the capacitor further apart. The voltage across the capacitor will
    A. increase.
    B. not change.
    C. decrease.

Answers on page 50

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

LITERATURE



Catalog for maintenance and repair, small quantity electronics

A 200-page electronics catalog designed to meet the needs of small OEMs, R&D centers, and maintenance and repair organizations is now available from the 3M Electronics Products Division. The 1997/98 3M Electronic Specialty Markets Catalog contains information on a wide variety of electronics parts and equipment ranging from connectors and adhesives to static control products and cables.

The catalog has been enhanced with a new, easier-to-read format, and several indices for finding information quickly. It includes product specifications, technical drawings, black and white photos, as well as complete ordering information.

Circle (80) on Reply Card

Power-quality instruments web site

Dranetz-BMI, a supplier of power quality instruments and systems announces the launch of its worldwide web site, www.dranetz-bmi.com. This site is designed as a forum for disseminating the latest company and product information in the quickest way possible to the greatest number of people - via the Internet.

The web site features concise, thorough information about the entire product line. Its extensive pages include: a product selection guide with photos, descriptions, applications, and certifications; product data sheets; listing of sales representatives and international distributors; on-line library of FAQs, TechTips, Application Notes and Standards; Subscription form to receive the PQToday newsletter; e-mail links to technical support, customer care and expert teams; factoids - interesting tidbits on power quality instrumentation.

To stay informed on the latest product developments, web site visitors can also obtain information about upcoming shows that the company will be attending. Hyperlinks are provided for users to contact sister companies, Electrotek Concepts and Daytronic Corporation, as well as various companies that lease equipment for short-term needs. Additionally, the web site provides links to many other related web sites, including PowerCET Corporation, the power quality training resource used by the company.

Circle (81) on Reply Card

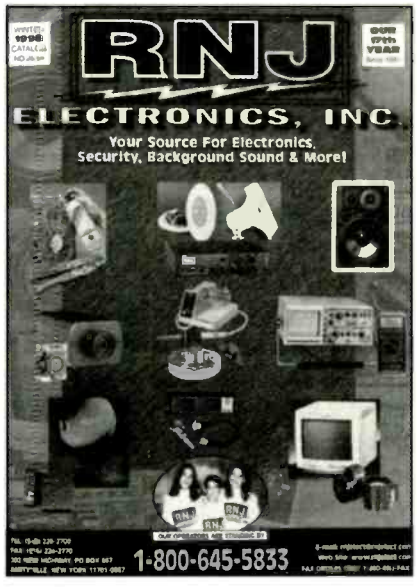
Wiring accessories catalog

A comprehensive 74-page catalog featuring cable ties and accessories, terminals and connectors, identification products, sleeving and wire routing products, and heat shrinkable tubing and molded shapes is being offered by Nelco Products.

The catalog features seven sections: cable ties and accessories, terminals and connectors, identification products including computer printable markers and labels, routing and protection products such as sleeving and tapes, tubing and molded shapes for a variety of purposes, related products and tools for assembly, and value added services such as cutting and hot stamping.

Providing a table of contents for easy reference with color coded sections, the 74-page Wiring Accessory Specialists Catalog includes product descriptions, dimensions, specifications, art numbers, and photographs or line drawings for each product offered. Helpful conversion charts with stud sizes, wire AWG sizes, and inch-to-metric sizes are included.

Circle (82) on Reply Card



Electronic products catalog

RNJ Electronics Inc., offers their new free 1998 catalog. The catalog contains 144 pages of test equipment, television and VCR repair parts, electronic kits, instructional videos, tools and soldering equipment, CCTV systems, commercial sound and intercom systems as well as parts and accessories. In addition the catalog also contains breadboarding aids, digital trainers, as well as A/V carts, screens and projectors.

Circle (83) on Reply Card

Web page

J-Works, Inc., the developer and manufacturer of PC and compact PCI based test instrumentation and home automation products announces a new web page.

The web pages located at http://www.j-works.com contains complete data sheets of products available from J-Works. These include the model ISA-104 function generator, Model HCON-1 remote I/O, Model ISA-200 and CPCI-200 DDS (direct digital synthesizer).

Servicing VCRs

By John A. Ross

Many electronic service centers believe that the profit potential from servicing VCRs has dwindled to almost nothing. Certainly, wholesale distributors and large retail merchandisers have dropped the prices of good quality, 4-head VCRs into the $150.00 range, and because of these price reductions, consumers are less likely to spend money for a repair and are more likely to replace their unit. However, the profit potential for servicing VCRs can remain if you take advantage of your knowledge about the equipment and apply efficient troubleshooting techniques.

Two key points come to mind when attempting to troubleshoot a VCR. The first involves the recognition that a VCR combines electronic and mechanical processes. Many times, a simple problem such as a worn belt or too much lubrication on a key drive surface will affect the timing of the electronic systems. The second point involves the use of consistent electronic circuit designs and the application of common components. Every VCR takes advantage of switch-mode power supplies and signal processing circuits. Those circuits are composed of transistors, MOSFETs, a variety of integrated circuits, phase-locked loops and other components. In each case, the system has inputs and outputs.

VCR mechanical systems

The mechanical section of a VCR includes the tape transport mechanism; a rotating drum assembly that contains a high-speed motor and the video heads; belts and drive gears; and a cassette loading mechanism consisting of a motor-driven worm-and-gear arrangement. Moreover, the mechanical section has direct interfaces with the electronic section of the VCR and, when defective, can produce symptoms that seem to originate in an electronic circuit.

Transporting the tape

Almost all modern VCRs contain the same type of tape transport system. The tape transport system includes:

- a rotating video head drum motor assembly;
- a fixed audio head/control stack assembly;
- a capstan shaft and capstan motor assembly;
- roller guides and roller guide tracks;
- a take-up spindle;
- one or more belts;
- a set of fixed guide posts;
- a half-loading arm;
- a back tension arm;
- an impedance roller
- an idler and idler tire; and
- a pinch roller

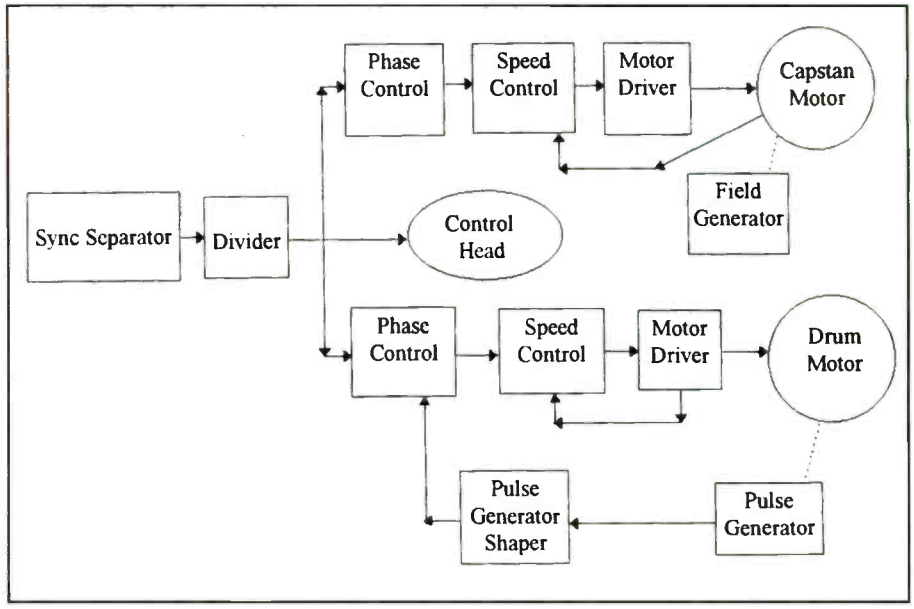


Figure 1. Block diagram of a typical servo system for the record mode.

Drum motor assembly

The drum motor assembly contains record and playback heads and spins the heads at 1800rpm, or 30 times a second. With the speed between the heads and the tape at 5.8 meters per second, the spinning drum assembly provides the frequency range necessary for a video bandwidth of 4MHz to 5MHz.

Helical scan recording

The physical relationship between the video heads and the tape causes the video signal to be recorded on the tape in a process called helical scan recording. In this system, the video heads spin at an angle to the horizontal plane. The video tape which is pulled horizontally past the video heads wraps around the rotating head drum through an angle of approximateley 180 degrees. As a result, the video heads write successive tracks diagonally across the tape. The diagonal formatting allows the use of a narrow video tape and produces tracks that are longer than the actual tape length.

Precision motor timing

A drum motor assembly also includes the **field generator (FG) sensor**, and the **pulse generator (PG) sensor**. The sensors connect with a FG/PG Hall-effect IC that produces signals resulting from the rotation of the drum assembly motor. Within the head assembly, two permanent magnets separated by 180° and having opposite polarities rotate at the same speed as the head drum and induce a pulse when passing the pulse generator coil. The opposite polarities of the magnets cause the production of alternating positive and negative pulses.

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

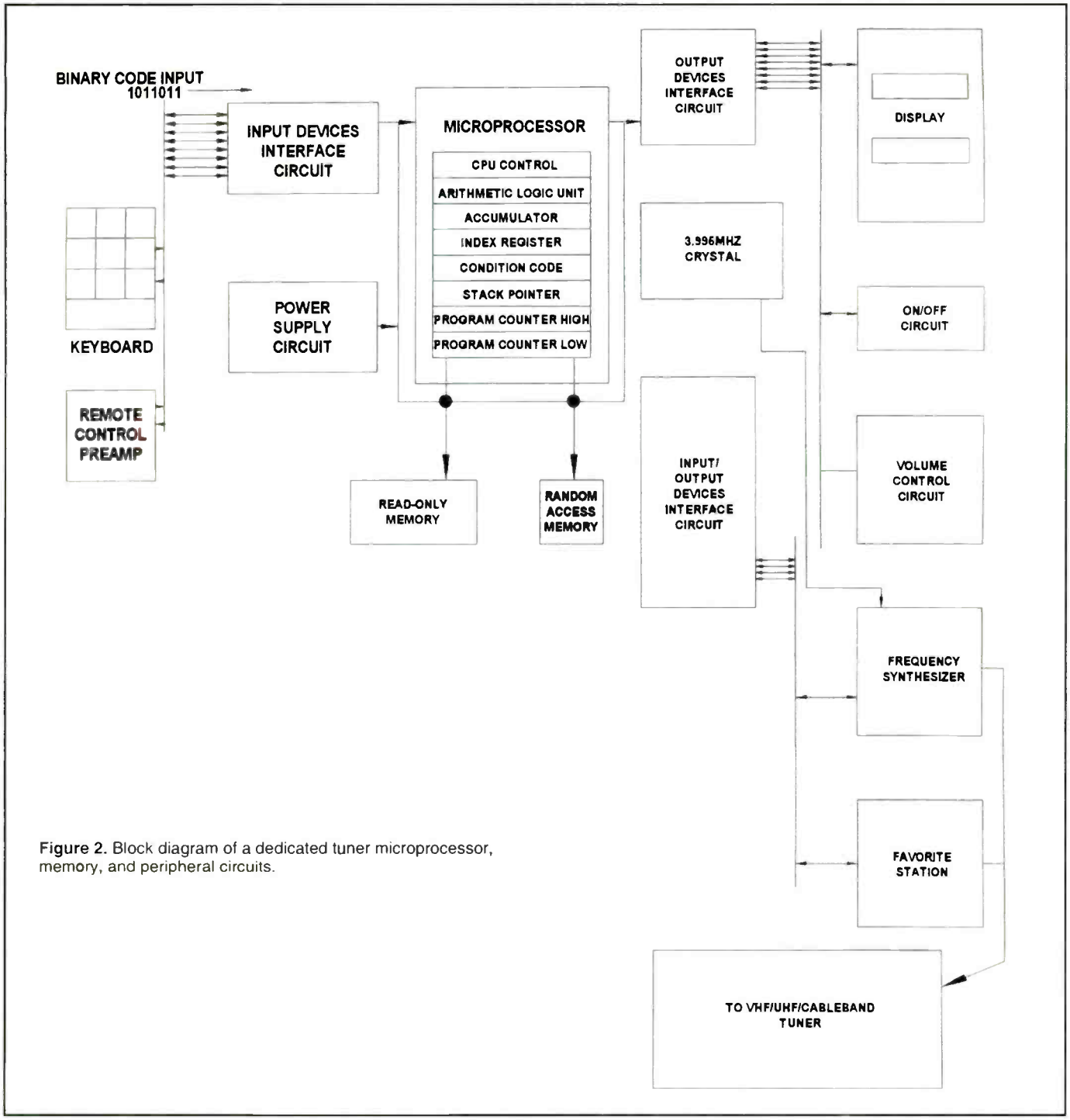


Figure 2. Block diagram of a dedicated tuner microprocessor, memory, and peripheral circuits.

An FG/PG separator separates the FG signals from the PG signals. The pulse generator signals ensure that the video heads will land against the video track at the correct position. Negative PG pulses appear at the beginning of each field scan.

A *drum assembly motor driver IC* uses low-level input pulses to control the amount of drive power going to the motor. In itself, the *drum motor* is a direct-drive motor. An 8-pole ring magnet, a position detection vane, position detection transformers, and three drive coils make up the motor. When driven by two of three coils, the assembly creates a rotating magnetic field. The position detection vane and transformers sense the direction of the motor and operate to turn on the main drive coils so that the motor assembly continues to rotate.

Capstan shaft and pinch roller

Found at the right side of the tape transport, the 3/16" diameter capstan shaft controls the movement of the tape during the playback and record functions. As the tape moves either forward or in reverse, the pinch roller presses against the capstan shaft. Pinch rollers spin freely and have an approximate diameter of 0.5 inches and a height of approximately 0.75 inches.

Solving capstan and pinch roller problems

Tape speed problems may become apparent through distorted audio reproduction or the instability of the reproduced picture. Before progressing to checks of the video heads, video drum

assembly, video head and capstan motors, and servo systems, always check to see if the pinch roller touches the capstan. If the pinch roller and capstan do not touch, the tape will slip. In addition, always clean the capstan shaft and pinch roller. A good pinch roller should not exhibit any signs of slickness or wear and tear.

Capstan motor and servo systems

The capstan motor is a direct drive motor that rotates the capstan shaft and, as a result, produces tape motion through the VCR. A capstan motor drive IC uses low-level input pulses to establish on and off control of the capstan motor. When troubleshooting tape transport problems, always take a careful look at the capstan motor and the servo system. In every VCR, the video head drum assembly and the capstan motor assembly must have the same speed and phase. Without the correct complementary action of the two assemblies, the tracks on the video tape will have the wrong pattern.

As a result, the operation of the tape transport mechanism involves:

- the correct playback, fast forward, and rewind speeds for the tape;
- the correct tracking of the video heads; and
- the playback of the audio signal at the correct speed.

Tape speed in a VCR is controlled by the capstan motor rotations per minute.

If the tape speed increases or decreases, you may observe symptoms such as picture tearing, distorted audio, noise in the picture, and bars moving through the picture surface. All this can occur because of speed or phase problems within the drum assembly or the capstan assembly. Separate head and capstan electronic servo systems provide automatic controls over the speed and phase of the motors. Each servo system monitors the present speed and phase of the motors through feedback circuits.

Roller guides

Located on each side of the head drum, two roller guides move on an assembly from a retracted position to a loaded position during the playback and record functions. The roller guide assembly moves along a combination of plastic and metal slots called roller guide tracks during the loading and unloading of the video tape. During playback and record, the roller guides spin freely and press against brackets located at the end of the roller guide tracks.

Take-up spindle, supply spindle, idler, and idler tire

Pictured at the right side of the tape transport platform, the take-up spindle contacts the idler tire and brake pad. The supply spindle is located at the left side of the transport mechanism and is associated with the supply reel. During the playback, record, fast forward, and rewind functions, the idler assembly moves between the supply and take-up reels and uses the idler tire to drive the appropriate reel. As a result, the mechanism either winds the tape or drives the fast forward and rewind. The idler tire contacts the reel edges.

Belts

The rubber belts in a VCR provide drive for the working of pulleys and gears within the tape transport system. Modern VCRs will have anywhere from one to four belts. As with the rubber surfaces of the pinch roller, any slickness found on the belts or signs of wear and tear are problem signs. In many cases, the replacement of a 50 cent belt will restore the normal operation of the tape transport system. In addition to checking and replacing belts, always clean the belt drive surfaces.

Fixed guide posts and the impedance roller

As the video tape winds through the tape transport assembly, fixed guide posts maintain the tape tension and shape. Referring to the left side of the tape transport, the impedance roller works with the fixed guide posts to stabilize the movement of the tape. During the normal troubleshooting of the VCR, always clean the fixed guide posts.

Half-loading and back tension arms

The half-loading arm sets near the right side of the tape transport assembly and near the pinch roller. During operation, the half-loading arm positions the tape around the pinch roller. The back tension arm and back tension band are found on the left side of the assembly and maintain a constant tension on the video tape during playback, record, and fast forward search. When the tape unloads, the back tension arm pulls back toward the video cassette.

VCR electronic systems

The electronic section of a modern VCR includes an RF signal modulator and processing section, an electronic tuner and tuner control system, a timer, microcontroller systems, luminance and chrominance signal processing circuits, vertical and horizontal signal processing signal circuits, dropout compensation circuits, and a switched-mode power supply. In addition, the electronic section contains a number of sensors that sense events and monitor the status of the VCR.

Typical sensor functions involve reel rotation, tape tension and torque, presence of moisture (dew sensor), and operating modes. Each of the electronic circuits relies on common components such as SAW (surface acoustic wave) and comb filters, PLL (phase locked loop) circuits, amplifiers, pulse generators, frequency dividers, and oscillators.

The electronic section also includes a number of switches, relays, and solenoids. While the switches allow the selection of different tape speeds by the customer, the relays switch heads and control the selection of either an antenna or cable signal. Solenoids initiate mechanical functions such as the pinch roller movement.

Reproducing a video signal

Each track on a video tape matches with one field of the interlaced video format. With two heads placed opposite one another on the video head drum assembly, one rotation of the drum equals a complete video frame. One video head produces the even field while the other produces the odd field. A complete rotation of the drum assembly produces or records a full frame of 525 horizontal lines. As the tape begins to wind through the rollers and guides and past the drum assembly, it also passes over a fixed, full erase head. The full erase head demagnetizes the tape.

The design eliminates crosstalk by placing the video heads at different azimuth angles. While one video head has an approximate +6° tilt, the other has approximate -6° tilt. An *azimuth angle* for a video head defines the difference between the head angle and the absolute

(Continued on page 37)

perpendicular between the head and the tape motion. During playback and for maximum output, the vertical head should be at a right angle to the tape. Any increase or decrease in the angle affects the distance between head and tape and causes a loss of high frequency response.

Head gap defines the difference between the pole pieces of the magnetic heads. The amount of head gap ranges around 1/25000 of an inch and provides the bandwidth needed to reproduce the frequency modulated video signal. The gap of the video heads is set to accommodate the frequencies used in the specific video recording system.

Multiple heads

The marketplace features a wide variety of 2-, and 4-head VCRs. VCRs using a 2-head recording system have a wider track head while VCRs using a 4-head recording system have heads with different track widths. The wider 2-head systems pick up additional noise during playback because of a poor signal-to-noise ratio. With narrow video tape tracks, the wider heads overlap the tracks. The narrower 4-head designs match the width of the video tape tracks and have an improved signal-to-noise ratio.

Video head pre-amplifier circuits

Each playback head is accompanied by a set of pre-amplifier circuits that amplify the weak video signals picked up by the head. Because the weak video signals are in the microvolt range, any wear and tear on the video head causes a noticeable reduction in signal amplitude. A video head switch connects the individual amplifier circuit of the head contacting the video tape to the playback circuits.

Video head problems and solutions

Almost all video head problems appear as snow in the reproduced picture. Generally, cleaning of the thin, ferrite heads restores the normal picture. When cleaning a video head, use a soft chamois cleaning tool with a cleaning solution recommended by the manufacturer, and press the cleaning tool against the head while you gently rotate the video head drum. Don't move the cleaning swab vertically with respect to the video head drum, as vertical movements of the tool can break the video head. After cleaning the video heads, always check the tracking control of the VCR.

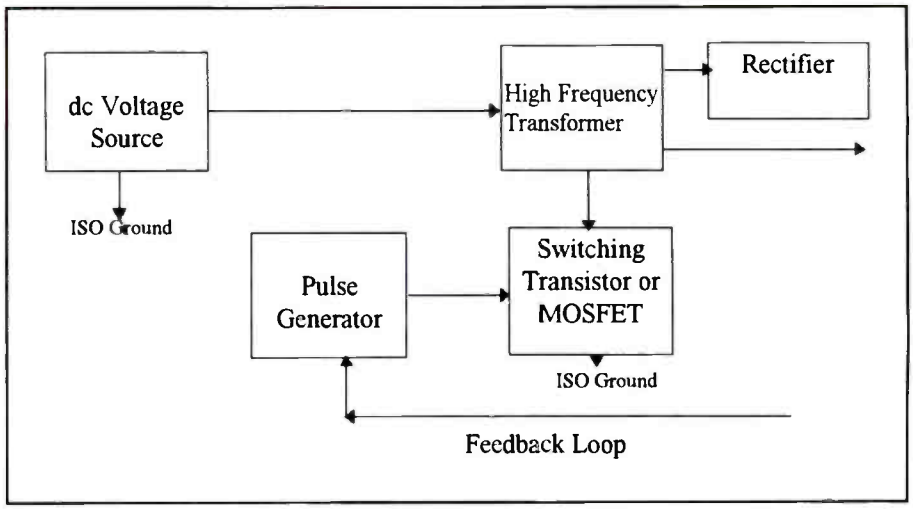


Figure 3. Switched-mode power supply block diagram.

Reproducing the audio signal

VCRs use different heads for the playback and recording of video and audio signals. Most modern VCRs utilize two audio heads for the purpose of providing two audio channels. Referring to the figure, the audio/control head fits between the right roller guide and the capstan shaft. The audio heads can reproduce MTS stereo sound or a separated two-channel sound.

Control signals

During playback, the *control head* reads control pulses from the tape and controls the drum rotation rate. During recording, the control head writes 29.97Hz square wave control pulses along the bottom edge of the video tape. Circuits within the VCR use the square wave control pulses to control the speed and phase of the capstan servo system. The control pulses develop from the sampling of 60Hz vertical sync pulses. Given the use of the vertical sync pulses as a reference, the control pulses lock in phase with the sync pulses.

Drop-out compensation

Any type of tape defect or wear on the video head can cause the head to lose contact with the tape which can result in either a complete loss of picture, the loss of sync, or a combination of the two symptoms. Drop-out compensation circuits operate during playback and are placed between the head amplifier circuits and the limiter/demodulators that make up part of the luminance circuits. The drop-out compensation circuits sense the loss of the video signal FM carrier.

During operation, the drop-out compensator delays the luminance signal for the duration of one horizontal line. The loss of the FM carrier actives a switch that disconnects the luminance amplifier and limiter circuit while inserting the output taken from a delay line. This operation substitutes the missing signal with the delayed luminance signal and replaces the dropped out signal information.

Capstan servo system operation

As mentioned earlier, servo systems in a VCR synchronize the linear tape motion and the head drum rotation during the playback, record, and freeze frame modes. During the playback mode, the capstan servo system relies on a timing pulse derived from a crystal oscillator as a reference signal. The timing pulse locks the capstan rotation speed to 30Hz. When coordinated with the tracking control, the reference signal also adjusts the phase of the head drum according to control pulses and aligns the head path across the tape with recorded tracks.

Referring to Arthur Flavell's article entitled, "Solving VCR servo system problems" from the June 1994 issue of **Electronic Servicing & Technology** magazine, the servo system consists of a feedback loop control circuit. During playback, one comparator in the servo system controls the motor speed by com-

paring vertical sync and field generation signals at its inputs, and produce a 14KHz pulse-width modulated signal. This signal feeds through an integrator and becomes a dc voltage proportional to the duty cycle of the modulated output. When the comparator senses any increase or decrease in capstan motor speed, the device either decreases or increases the duty cycle of the modulated output.

Another comparator monitors the phase of the 30Hz capstan field generation signal and uses any change in phase to cause a duty cycle change in a 3.5kHz pulse-width modulation signal. By monitoring the phase and changing the duty cycle, the phase control circuit controls any fine speed adjustments of the capstan motor. In turn, the combination of the comparator and an integrator circuit controls the phase of the capstan motor through the addition of the pulse-width modulated output signal with the signal from the speed control comparator.

When the VCR is set to record, the servo systems rely on a vertical sync pulse derived from the video input signal to phase lock the video head drum rotation. When tracing the operation back to the video signal processing circuits, a sync separator and shaper circuit produce the vertical sync pulse. As a result, the appropriate video head of a head pair contacts the tape during the appropriate odd or even field of the frame.

Again referring to Mr. Flavell's article, servo operation during the record function also depends on the counting down of the field generation signal as a reference. A select switch connects the FG signal to the reference input of the servo system CYL/CAP phase comparator.

Drum assembly servo system operation

As with the capstan motor servo system, the operation of the drum assembly motor servo system involves the use of speed and phase control. One comparator in the drum servo system monitors a reference signal derived from field generator pulses produced by the motor and compares those pulses with the vertical sync pulses. The reference signal is proportional to the speed of the motor. With the motor speed determining the frequency of the field generation signal, any increase or decrease of the drum motor speed causes the comparator to generate an error correction voltage.

Phase control of the drum motor occurs through the same methods employed with the capstan motor servo system and provides the necessary alignment of the video heads with the tracks recorded on the tape. During the recording of a video signal, the proper phase control of the drum motor ensures that the vertical sync is recorded at the same point on each track. Figure 1 provides a block diagram of a typical servo system for the record mode.

Troubleshooting servo systems

Troubleshooting a servo system is complicated by the use of feedback loops throughout the circuitry. Each feedback loop feeds information back to other circuits and then reformats the information for comparison. Servo system problems are characterized by incorrect capstan speed and appear as:

- horizontal tearing of the reproduced picture;
- loss of vertical synchronization;
- steady pulsating of the video signal;
- garbled sound; and
- noise bands that periodically move through the picture.

We can apply symptoms analysis and the monitoring of key signals with an oscilloscope to find the source of each of those symptoms. For example, the existence of normal sound during distorted playback should point towards the drum servo system while the combination of garbled sound and a distorted picture indicates that a problem exists in the capstan servo system.

A simple check of the drum speed involves putting a mark on the upper surface of the head assembly and then placing the VCR under a fluorescent lamp. If you can see a blurry, almost stationary pattern as the head spins, the servo is locked. The lack of a pattern indicates that the servo has not locked and that the timing reference was lost.

The failure of the servo systems to lock during either playback or record usually points to a problem with the 30Hz pulse generator feedback pulses found at the drum assembly motor. Again using an oscilloscope, we can check for both the presence and proper amplitude of the pulse generator pulses. Without those pulses, the servo circuit cannot generate the ramp signal necessary for driving a sample and hold circuit.

The sample and hold circuit opens and closes in response to output pulses produced by monostable multivibrators found in the pulse generator circuit. When the sample and hold switch closes, the ramp voltage charges a capacitor to the level that the ramp has at the closing time. Any decrease in motor speed alters the timing between the ramp and the pulse so that the sampling pulse appears much closer to the ramp peak. As a result, the capacitor charges to a higher voltage, drives the motor harder, and consequently increases the speed.

Any increase in motor speed changes the timing between the ramp and the pulse so that the pulse appears near the beginning of the ramp. Because of this, the capacitor charges to a lower voltage. As a result, the motor speed decreases to the correct level.

In some cases, incorrect servo control will allow a thin bar caused by the video head switching point to move through the picture. To troubleshoot the switching point problem, use an oscilloscope to check for the presence of the control pulses. The pulses should appear at the output of an amplifier before feeding into the control head.

Chrominance phase errors

Because VCRs lack stability in writing speeds and time bases, the chrominance signal information is recorded separately from the luminance signal information. As a result, the mechanical functions of the VCR have an impact on the capability of the unit to reproduce consistent colors. Any change in speed affects the chrominance phase which, in turn, causes changes in color. All this depends on the constant rotating speed of the drum assembly and the compensation provided by the servo systems.

The second mechanical factor in the reproduction of color is the tape tension. As a video tape is played and replayed, the tape stretches and the tape tension begins to change. An increase in tape tension causes a consequent increase in the width of the horizontal sync pulse and a slight decrease in the color subcarrier frequency. A decrease in tape tension causes a decrease in the width of the horizontal sync pulse and a slight increase in the

color subcarrier frequency. With each of the symptoms a chrominance phase error results and the color shifts.

Vertical sync problems

Obviously, the servo systems in a VCR depend on the presence of correct vertical sync signals. In the record mode, the vertical sync pulse is divided to produce the record control pulse and reference signals for the drum phase control servo. In most recent VCR designs, the vertical sync signal resets a down counter in the servo IC. In older designs, the vertical sync signal directly produces the signals. Vertical sync problems result in:

- noise lines appearing at any point in the reproduced picture;
- no color;
- vertical roll;
- poor recording; and
- poor head switching.

If you suspect a vertical sync fault, place the VCR into its record mode and use and oscilloscope to check for the presence of a signal at the vertical sync input terminals of the vertical processor IC. When using this procedure, use the video output signal as a reference. In addition, check for the presence of signals at the sync separator terminals of the IC.

Microcontrollers

Modern VCR tuning control systems include a dedicated microprocessor, or microcontroller, that performs pre-programmed tasks. While microcontrollers perform tasks that do not require a large amount of processing power, the circuits often include standard microprocessors that offer 4-, 8-, 16-, and 32-bit interfaces. In video products, microcontrollers:

- control other devices;
- place and remove information into and out of memory;
- handle a wide range of instructions including comparisons of
- numbers, arithmetic operations, and changing the meaning of a digital word;
- make decisions based on instruction sets and on data.

Each of these tasks becomes apparent when we consider overall operation of modern video products. The microprocessor responds to customer commands via either a keyboard or remote control device; directs channel selection and bandswitching information to the proper locations; sends instruction sets regarding tuner functions; and controls the channel display. In addition, a microprocessor moves information into and out of memory temporarily during operations such as channel changes. In some applications, such as a programmable satellite receiver, where the control system establishes locations, polarities, and audio frequencies, the customer can use the microprocessor to modify existing parameters.

Most of these designs rely on an *embedded controller*, or a controller embedded within a greater system. Any embedded controller can be defined as a computer on a chip. However, the operation of an embedded controller depends on external components such as memory, buffers, and controllers. Embedded controllers are found in televisions, VCRs, stereos, computers, laser printers, and modems. Typical embedded controller tasks include communications, keyboard handling, and signal processing.

Figure 2 shows a block diagram of a basic microprocessor. Looking at the microprocessor, we find that it contains:

- a program counter for developing addresses that go onto the system address bus;
- an instruction decoder that interprets instructions fetched from memory and then causes the implementation of the instructions;
- internal registers that store intermediate data while the microprocessor is implementing complex instructions;
- an arithmetic logic unit that performs calculations or Boolean operations;
- clocking circuitry that paces each operation at precise rates;
- control and sequencing logic for the management of external control signals;
- buffers for the address, data, and control buses.

Finding and troubleshooting microcontroller problems

If you suspect microcontroller problems, conduct a quick inventory of operating functions and, when available, rely on troubleshooting flow charts or block diagrams provided by the manufacturer. Many of your troubleshooting checks should involve the inspection of simple test points such as the front panel display and the source voltages for the microprocessor. At times, a defect in the switched-mode power supply will affect both the operation of the front panel display and the supply voltages. In addition,

check the microprocessor for the correct clock signals. This check should involve both the amplitude and frequency.

Switched-mode power supply operation

All switched-mode power supplies (SMPSs) use a high frequency switching device such as a transistor, MOSFET, insulated gate bipolar transistor, SCR, or triac to convert the directly rectified line voltage into a pulsed waveform. An SMPS that has a lower power requirement will feature a conventional transistor or MOSFET as a switcher while high power SMPS units will rely on an IGBT, SCR, or triac. Each of the last three components offers latching in the on state and high power capability. However, this type of capability also requires more complex circuitry to ensure that the semiconductors turn off at the correct time. Figure 3 shows a block diagram of a typical SMPS.

The switching on and off of the transistor closes and opens a path for dc current to flow into the transformer. With the flow of current producing a changing magnetic field in the transformer primary, a changing magnetic field also develops in the transformer secondary winding. As a result, voltage is induced in the secondary winding. Rectifiers and filters in the secondary circuit rectify and filter into stable supply voltages.

SMPS input

After the rectification of the line voltage, the SMPS may have two possible dc inputs. With the first, 150Vdc to 160Vdc arrives at the SMPS after the direct rectification of 115Vac to 30Vac line voltage. However, some SMPS units require a higher input voltage. In this case, a voltage doubler supplies 300Vdc to 320Vdc to the SMPS input. Other designs rectify a 220Vac to 240Vac line voltage and also supply the 300Vdc to 320Vdc to the switched mode power supply input.

While rectification of the line voltage occurs through the use of a full-wave bridge rectifier or a voltage doubler, the input to the SMPS also includes inductors and capacitors for the purpose of filtering line noise and any voltage spikes. Those components also eliminate the transmission of any radio frequency interference generated by the power supply back into the ac line. As mentioned, most designs feature metal-oxide varistors across the input lines for additional protection against voltage surges.

Switched-mode regulators

Switched-mode regulators provide the advantage of having a control device that has minimal power dissipation for the entire duty cycle. In particular, switched-mode regulators provide:

- the capability to produce an output voltage higher than the input voltage;
- the capability to produce either a positive or negative output voltage from a positive input voltage; and
- the capability to produce an output voltage from a dc input voltage.

A switched-mode regulator circuit uses a control device, such as a bipolar transistor, a field-effect transistor, or a silicon-controlled rectifier, to switch the supply power in and out of the circuit and regulate the voltage. Switching occurs because of the ability to send the device into either saturation or cut-off.

SMPS transformer operation

Switched-mode power supplies do not include any type of conventional power transformer and, as a result, do not have line isolation. At the input of the power supply, a small, high frequency transformer converts the pulsed waveform taken from the switching device into one or more output voltages. Other components following the high frequency transformer, rectify and filter the voltages for use by signal circuits.

Isolation in the SMPS system

Although the SMPS does not provide line isolation, the use of the high frequency transformer establishes an isolation barrier and the type of characteristics needed to operate in the flyback mode. Depending on the circuit configuration, a small pulse transformer or an opto-isolator sets up feedback across the isolation barrier. The feedback controls the pulse width of the switching device and maintains regulation for the primary output of the switched mode power supply.

Most small switched-mode power supplies such as those used for VCRs use opto-isolators for feedback. An *opto-isolator* is a combination of an LED and a photodiode in one package, and establishes an isolation barrier between low voltage secondary outputs and the ac line. Whenever a primary output voltage reaches a specified value, a reference circuit in the output turns on the LED. In turn, the photodiode detects the light from the LED and reduces the pulse width of the switching waveform. This establishes the correct amount of output power and maintains a constant output voltage. Along with the primary output winding, the transformer has six or more separate windings that provide positive and negative voltages for the electronic system.

Troubleshooting SMPS problems

Troubleshooting a switched mode power supply problem requires a consistent problem-solving procedure. That procedure should include:

- a check of the B+ voltage;
- verification of the presence of start-up voltages in a scan-derived supply;
- verification of the presence of oscillation in a scan-derived power supply;
- a check of the SMPS output voltage;
- a check for regulation.

By checking for the presence of B+, we can narrow the search for the problem source from the entire SMPS to the switching device, the bridge rectifier, or the transformer. The additional check for a start-up voltage in a scan-derived power supply discloses whether or not the power supply has the proper voltage-current source. In addition to the check for start-up voltage, also check for oscillation in the scan-derived power supply.

Both the presence and the appearance of the waveform at the switcher are important. After verifying the operation of the SMPS, check the quality of the output voltage. Here, we want to check for proper voltage levels throughout the power supply and for the proper regulation of the output voltage.

Common problems

Many times, typical problems account for the failure of a switched-mode power supply. Some of those problems involve blown supply fuses, open fusible resistors, high amounts of ripple in one or more output lines, an audible whine with a lower-than-normal voltage at one output, and intermittent power cycling. In many cases, bad solder connections within the SMPS can cause symptoms to appear that mimic component-caused failures.

The blown supply fuse problem may

occur because of a shorted switch-mode power transistor or other semiconductors found in the supply. While a fault in the start-up circuit for the supply may cause fusible resistors to open and shut down the supply, the main power supply fuse will not open. When considering ripple in the output lines, check for ripple at the line frequency of 60Hz or ripple occurring at the switching frequency of 10kHz or more. A dried filter capacitor connected in the main supply will cause an output line to have a 60Hz ripple, while a dried filter capacitor connected in a specific output line will cause the ripple to have a higher frequency.

The last two symptoms, audible whine with a lower-than-normal voltage and periodic power cycling, involve shorted semiconductors, a fault in the regulator circuitry, a fault in the overvoltage sensing circuitry, or a bad controller. Usually, the failure of a switching transistor is accompanied by the failure of other semiconductors in the circuit. At times, though, a switching transistor will not have the voltage rating needed to withstand the strain caused by the constant on and off switching.

Locating SMPS switching problems

If the SMPS utilizes a power transistor as a switching device and the power supply fails, always test the transistor for shorted and open junctions. The partial failure of a switching transistor often results from leakage or a change within the operating parameters of the semiconductor. Most new SMPS units rely on either an SCR or a MOSFET as a switching device. Testing either an SCR or MOSFET requires a multimeter for basic tests such as a shorted condition, and additional test equipment for any other tests. When replacing a switching device, always use an exact replacement as recommended by the manufacturer of the switched mode power supply.

SMPS capacitor problems

Any switched-mode power supply design allows a large amount of current to flow through electrolytic capacitors. In some cases, the repeated operation of the SMPS system will cause the capacitors to short internally or develop an intermediate open condition. Under high load conditions, a capacitor may open and then "heal" at line rates. Many times, discoloration or a slightly bulged appearance will show that the capacitor has been subjected to overload conditions.

SMPS power cycling problems

Many SMPS problems involve a dead supply and a sound that either resembles a "tweet-tweet-tweet" or a "flub-flub-flub". In addition, a fault of this nature may cause display LEDs to flash or, with televisions, may allow a partial raster to appear. Most power cycling problems result from a shorted component in the auxiliary power supply. Those components include diodes, capacitors, and SCRs in the overvoltage crowbar circuit.

Conclusion

As electronic technicians, we have accumulated problem-solving skills that are the subject of books. When troubleshooting VCR faults, always make a very careful analysis about the symptoms when attempting to isolate the problem. Again, we can separate the VCR into its mechanical and electronic systems. By doing so, the process of finding the problem becomes much easier. Along with using tried and true troubleshooting techniques, remember that this magazine has provided a steady series of VCR-oriented articles since 1990. Each of those articles provides a wealth of information.

When using the World Wide Web, don't forget to check manufacturer sites for service information. Another excellent source of web-based technology servicing information and technician exchanges is the Sci.Electronics.Repair FAQ site found at: http://www.paranoia.com/~filipg/REPAIR/ .

Servicing the CD player with important waveforms

by Homer L. Davidson

When you're troubleshooting the electronic circuits of a compact disc player, interpretation of certain critical waveforms can help you pinpoint the defective stage. Once you've narrowed down the problem to the defective stage, to locate the defective component, measure critical voltages and perform semiconductor tests. After locating the defective part, remove it and test it again to be sure.

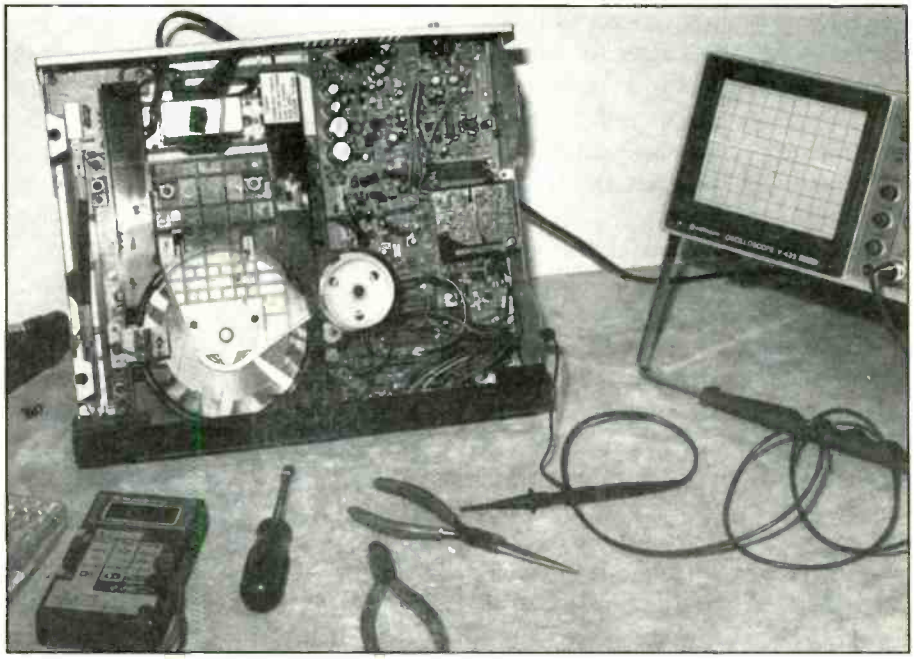


Figure 1. The oscilloscope is a valuable test instrument for observing waveforms at various points in compact disc player circuits.

The laser optical assembly

The most important and expensive component in a CD player is the laser optical assembly (Figure 1). If the cause of a malfunction in a CD player is a defective optical assembly, the cost of replacement might discourage the owner from having the CD player repaired. The laser optical assembly must operate before any music can be heard or other circuits function correctly. Often, a defective optical assembly can cause the player to start up and immediately shut down again.

Before disassembling a defective compact disc player to begin troubleshooting, clean up the optical lens assembly with camera lens cleaning equipment, or as otherwise recommended by the manufacturer, to see if this clears up the problem. The lens of a CD can become stained with cigarette or cigar smoke or other household air pollutants. Wipe off the excessive dust on the lens area. A dirty optical lens can cause the player to start up and shut down quickly.

In a portable compact disc player, the optical lens assembly is looking directly up at you. In other models, you must remove the clapper or loading device, before you can gain access to the lens assembly in order to clean it.

EFM signal waveform

The presence of the eight-to-fourteen modulation (EFM) waveform (commonly called the "eye" pattern) indicates if the laser optical assembly and RF amplifier section are operating. The EFM waveform should be sharp and steady and exhibit a clear diamond shape area throughout the waveform (Figure 2).

With some defective players, the unit will start to operate, then shuts down, suggesting a defective optical assembly or RF amplifier transistor or IC. Improper or no EFM signal can prevent the CD player from operating.

The EFM signal must be present before the focus error (FE) or tracking error (TE) signal can be found at the Focus/Tracking/SLED Servo circuits. Also, the EFM signal is sent to the digital control, CLV servo, and signal path, to provide sound at the line output jacks.

If the compact disc continues to rotate, this confirms that the EFM signal and optical assembly are functioning. Remember, the CD player can shut down

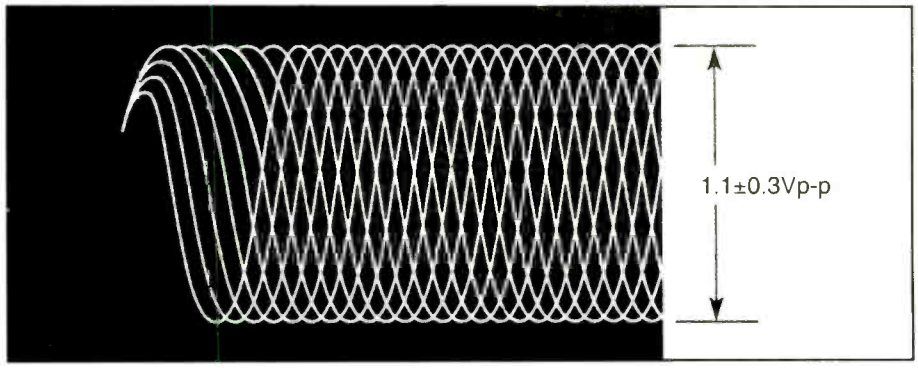


Figure 2. Presence of the EFM (eight to fourteen) waveform confirms that the optical assembly and RF amplifier circuits are normal.

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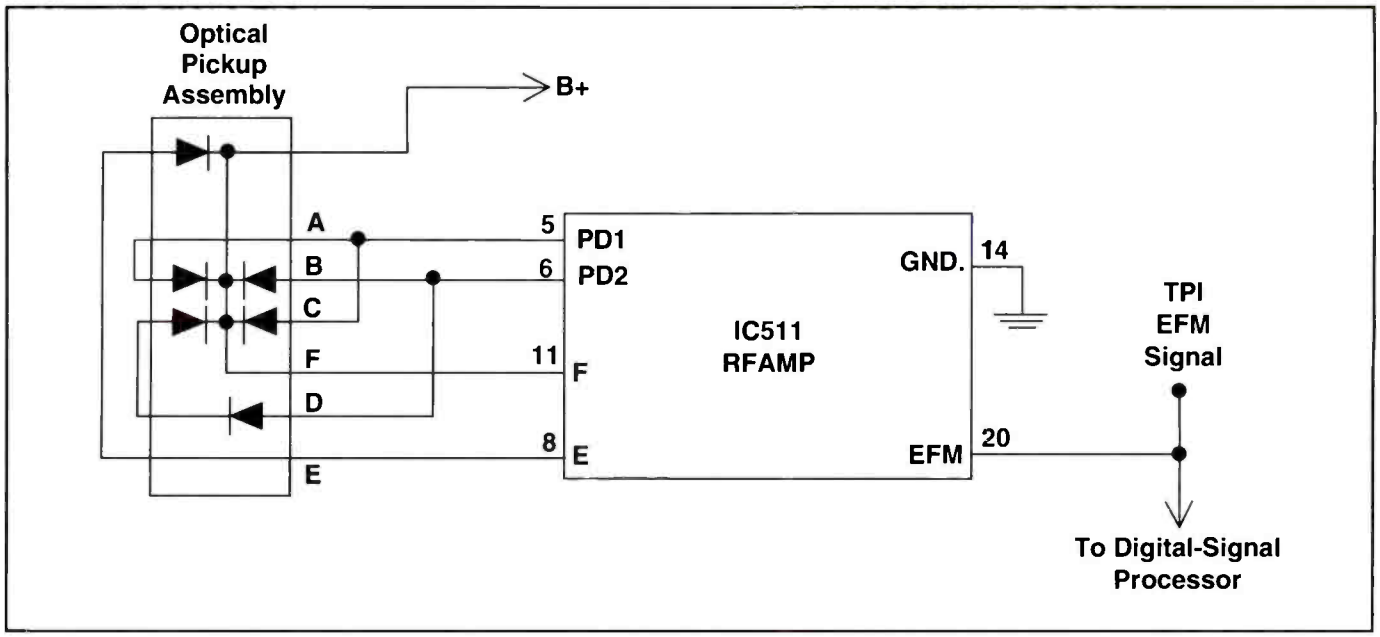


Figure 3. The EFM waveform is taken at test point (TP1) at the RF amp.

as a result of other problems, but a quick check with the oscilloscope for the presence of the EFM waveform, even under intermittent conditions, can determine if the laser optical assembly is operating. Look to see if the focus and tracking coil assembly is searching before shutdown. This indicates that the focus error and tracking circuits are normal.

If the disc stops rotating after a few seconds, observe the EFM waveform at the RF transistor or IC. In the early compact disc chassis, transistors were used as the RF amp, while in today's units you will find an integrated circuit. Check the schematic to determine the location of the test point or lug of the RF amplifier IC (Figure 3). Once you locate the RF IC, the test point should be close by.

Attach the scope probe to the test point or to pin 20 and start up the CD player. Look to see if the EFM waveform is present, even if for only a second. If there is no waveform, possible causes may be the absence of a signal from the laser optical assembly, a defective RF amp, or an improper source voltage to the RF amplifier. Measure all critical voltages at the RF amplifier before assuming that the laser assembly is defective.

If the EFM waveform is not present, and the player shuts down, check the laser beam with a laser power meter. Most laser diodes found in the CD player have a wavelength of 750nM to 850nM. Rotate the power meter to the 750nM wavelength at 1mW. The average laser maximum output is between 0.4mW and 0.75mW. In many cases, the maximum laser output is listed in the manufacturer's service literature or on the optical assembly.

Always make sure the laser optical assembly is functional by checking for the EFM waveform before spending time servicing other parts of the CD player. If the CD player owner chooses not to have the player fixed because of the expense of a new laser assembly, any other work you have done will be wasted.

Focus error waveform

The focus and tracking coils are located close to the optical lens. The beam from the laser must be focused on the disc surface at all times to read the information. If the beam goes out of focus, the focus servo must move the objective lens up or down to correct the focus. The focus error circuit is designed to detect changes in the distance to the disc and ensure that the laser beam spot is kept in proper focus on the surface of the disc.

Both the focus error (FE) and tracking error (TE) signals are taken from the RF amplifier and applied to a focus tracking servo control IC. Usually the servo IC controls the focus, tracking and sled circuits. Check the component location drawing or schematic for the FE and TE test points. Sometimes these test points are located together in one cluster, while in other cases each test terminal is mounted separately.

Make all scope connections with the CD player turned off. Clip the scope probe to the FE test point and chassis ground. Mount the CD test disc and start up the player. If they are available, follow the manufacturer's alignment procedures. Check the focus error signal at the input to the servo control IC (Figure 4). Keep your eyes away from the laser beam, at all times. Remember, you cannot see this laser beam with the naked eye.

Check the focus signal at the control IC to the focus drive coil with an oscilloscope. Often, a focus driver IC or two transistors drive the FE signal to the focus coil. Check the schematic for a test point at the output of the focus driver IC. If there is no test point brought out in the circuit, check the FE waveform at the focus coil socket on the chassis. Trace the focus coil harness back to where it plugs into the main pc board. Plug a 1/8W resistor wire terminal alongside the socket lead, at the top of the socket. Now attach the scope probe to the bare resistor terminal.

If you observe the focus driver signal at the focus coil, you know that the focus error circuits are operating (Figure 5). If you don't see this waveform, observe the FE input and output signal from the servo control IC on the oscilloscope. If you do

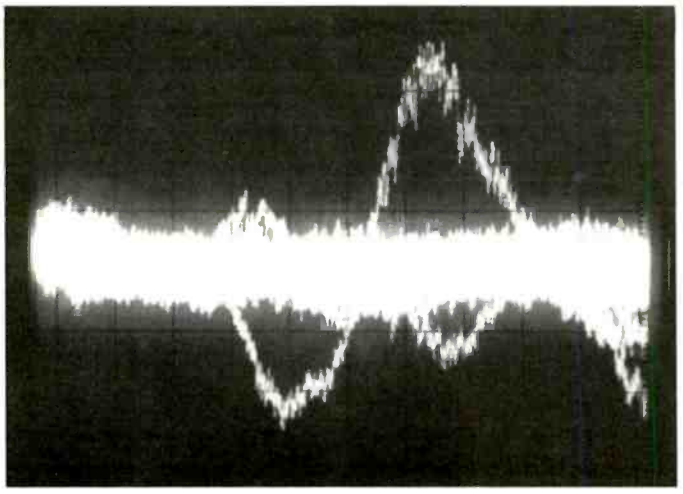


Figure 4. The focus error waveform from the RF amplifier is fed to the Focus/Tracking/Sled servo IC.

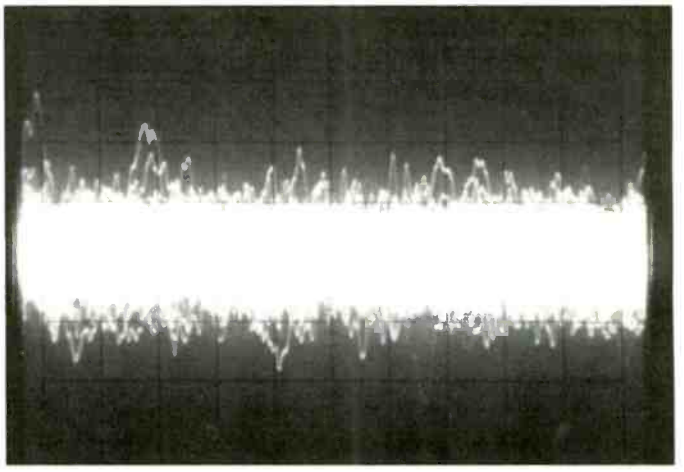


Figure 5. Check the focus coil for open winding when there appears to be a focus problem but you observe a normal waveform across the coil terminals.

not see an FE waveform at the driver IC or at the focus coil, suspect that the focus driver IC or transistors, or the voltage source are defective.

Suspect an open focus coil, broken harness cable, or a defective socket when a normal FE waveform is found at the focus coil socket. Take a continuity ohmmeter measurement across the focus coil winding. Likewise, check the harness for a broken wire or connection, with the low ohm scale of the DMM. The resistance should be from 15Ω to 30Ω. At the same time, if you notice that when the ohmmeter leads are applied to the focus coil, the optical lens shifts, you know the coil is normal.

Tracking error waveform

Like the focus error signal, the tracking error (TE) signal is sent from the RF amplifier to the control servo processor or IC. The tracking error circuit develops an error signal if the beam spot moves away from the center of the pits on the disc. This error signal is used to make sure the laser beam tracks the line of pits. The beam is shifted horizontally to the left and right as necessary to keep it tracking the center of the row of pits.

Check the schematic and parts layout for a tracking error (TE) test point. Often, the TE test point or lug is found near a FE test point (Figure 6). If the TE signal is found at this point, proceed to the input terminal of the tracking servo IC.

The tracking error signal from the RF amplifier or preamp IC goes to the servo control IC, which drives a tracking driver IC or two transistors. The purpose of the tracking servo system is to control the laser beam spot so that it stays directly in the center of the pit track laterally or horizontally. The motion controlled by the tracking coil is horizontal, where the focus coil assembly moves the laser optical assembly closer to or farther away from the disc.

A tracking gain adjustment determines the amount of signal applied to the tracking servo input from the TE preamp circuits. If the tracking error signal is normal at the input test point or at the servo IC terminal, proceed toward the input of the tracking coil driver IC or base terminal of the driving transistors (Figure 7). If the sound jumps or skips when the player is jolted or bumped, the tracking gain might be set too low. The tracking gain might be set too high if a test disc with a small scratch is played and the sound jumps.

Improper adjustment of the tracking balance control is another possible cause when the CD player comes on, and the turntable or disc rotates, then shuts down. Of course, the EFM waveform is present when the CD player starts to operate. When the player shuts down, the tracking error waveform changes to wiggly lines then stops completely.

Follow the manufacturer's tracking

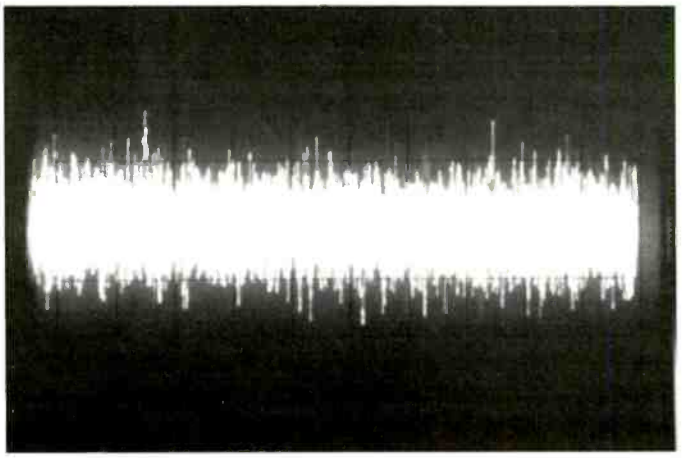


Figure 6. The tracking error signal from the RF amplifier is fed to the Focus/Tracking Servo IC.

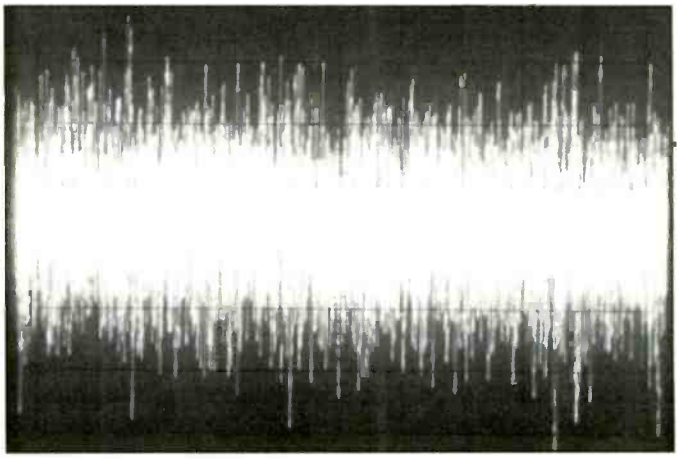


Figure 7. A tracking gain waveform indicates that the tracking error signal is normal at the input of the FE/TE/SLED Servo IC.

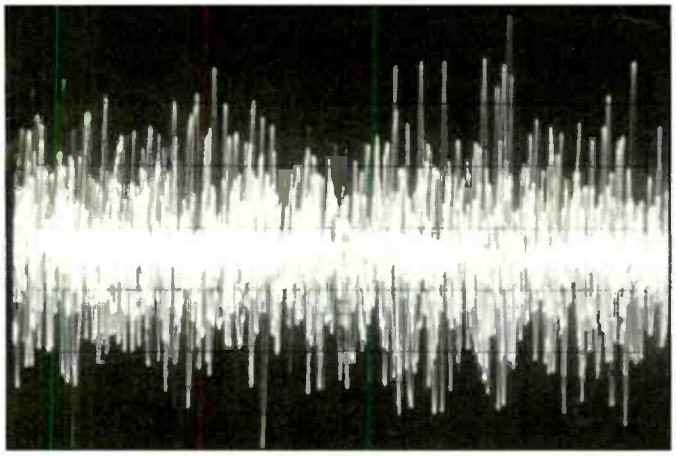


Figure 8. This is the tracking signal found at the tracking coil terminals.

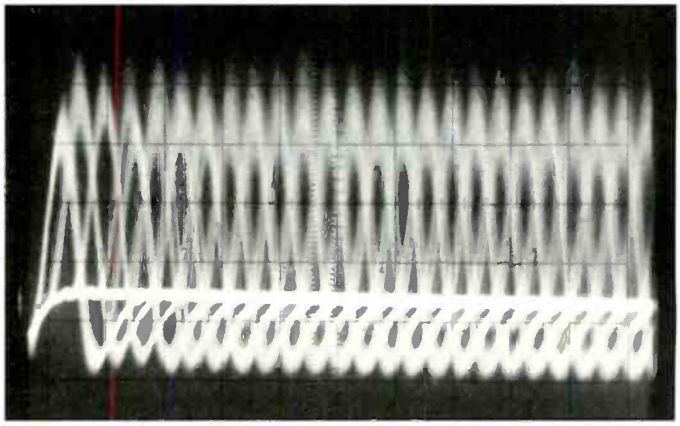


Figure 9. A PLL-VCO waveform indicates that the phase locked loop voltage control oscillator is operating.

balance adjustments, for this adjustment is quite critical. The waveform should be vertically symmetrical with around a plus or minus 20mV. This voltage might vary from one manufacturer's optical assembly to another.

Scope the tracking error signal to the input of the tracking driver circuits and tracking coil. If no signal is found at the tracking coil, suspect a defective driver IC or transistors and improper voltage source applied to the driver circuits. The tracking error adjustments can be made with the scope leads attached across the tracking coil (Figure 8).

PLL-VCO waveform

The oscilloscope waveform in Figure 9, indicates that the phase locked loop voltage control oscillator (PLL-VCO) circuits are functioning. A VCO-PLL coil adjustment must be very accurate to ensure correct recovery of the disc dropout conditions. Proper adjustment of the PLL frequency is needed so that the disc motor follows the optical lens assembly and responds to the dropouts caused by scratches or defects on the disc. Usually, the PLL-VCO oscillator is found within the digital control CLV servo IC. The PLL-VCO adjustments can be made while observing the signal on the oscilloscope or frequency counter.

Sled and spindle motor waveforms

The slide, sled, or feed motor moves the optical lens assembly across the disc from the inside to the outside rim of the disc. This keeps the objective lens constantly in line with the center of the optical axis. Often the motor is gear-driven to a rotating gear that moves the laser assembly along one or two sliding bars.

Locate the slide or feed motor socket connections on the main board. Check for a parts layout or simply trace the motor wires back to the pc board. Observation of the waveform at the motor terminals will indicate if the motor is functioning (Figure 10). If the waveform has a wavy movement the motor is operating. Usually, you cannot see this motor rotate as it is mounted under the optical mechanism. Take a low continuity measurement across the motor winding or at the socket to determine if the motor is normal, or if it is open-circuited.

A spindle, turntable or disc motor rotates the disc over the optical lens assembly. The spindle motor will cease operation and shut down at once when the EFM signal is not present at the RF amp IC. Because the compact disc is recorded at a constant linear velocity, the speed of revolution of the disc must be reduced as the laser pickup tracks toward the outer edge. The motor angular velocity varies from 500rpm when the laser optical assembly is at the inside edge of the disk to 200rpm when it has reached the outside edge of the disk.

If the disc motor does not operate, observe waveforms in the EFM circuits. If the waveform is normal, proceed to the signal or CLV servo processor. The portable CD player might be controlled by a servo control IC with signal fed to a IC driver circuit, then finally to the disc motor windings (Figure 11).

Suspect a defective driver IC or a pair of transistors, when no waveform is found at the motor terminals. Take a quick continuity measurement of the motor winding to determine if winding or cable wires are open. Replace the defective motor, when a normal waveform is found at the motor terminals. By observing critical waveforms within the compact disc player, you can quickly locate the defective circuit or component. ■

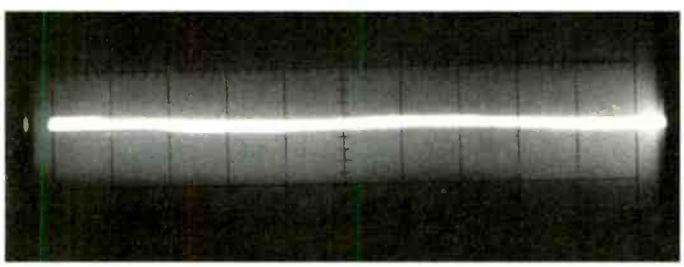


Figure 10. The normal waveform across the operating Sled or Slide motor terminals has this appearance.

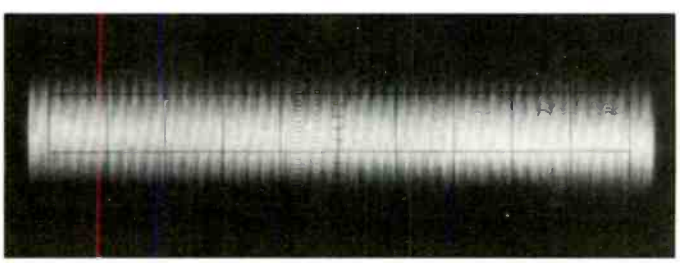


Figure 11. Presence of the spindle motor waveform indicates that the motor signal is present from the disc driver IC.

Successful Servicing

Ken's Electronic Service, Inc.

by Ken Simmons

My wife, Carolyn, and I, run an electronics service company. I do the service, books and promotion of new business. Carolyn helps with the telephone, typing, invoicing, etc.

Our service center is set up at home; small, but efficient. Keeping overhead as low as possible was the deciding factor, as our home and property is free and clear. We are fully insured for fire and theft, and carry $1,000,000.00 in liability, plus medical coverage in case of customer mishap.

We do carry-in service only, which keeps me in the service center 90% of the time, but also helps keep our service rates affordable to all customers.

The only advertising we do is in our local "Bee," which comes out once a week. That cost is about $23.00 a month, and it works well for us. We also put up business cards (Figure 1) on bulletin boards at the super markets where we shop, and at convenience stores, laundromats, etc. However, some of our best advertising has been word of mouth.

Stocking, handling and inventorying parts

We stock the most frequently used replacement parts, and special order other parts as needed, buying extra if the part is needed often.

We are not computerized yet. Parts inventory is tracked on 3X5 index cards (Figure 2), including quantity, manufacturer's part number, and general replacement numbers, such as ECG, NTE, SK and others. Cost plus shipping is also on each card, which saves a great deal of time researching invoices for what the part cost us. The cards also trigger reorder when we get down to our established minimum number left in stock.

Parts invoices are posted to the ledger when the check is mailed to the supplier. Also, we use purchase orders (Figure 3). Each purchases order is then matched to that parts order invoice. Each P.O. shows who the part was ordered for, customer (with claim check number) or for stock.

Taking a set in

When a set is brought into the service center, all information is recorded on the set tag (Figure 4), the service invoice (Figure 5), which has the same number, is not filled out until service is completed. The set is also listed on the dry-erase board for bench scheduling, and listed in the service center locator book. This is a double set of information to track the unit while it is in the service center. Carolyn loves it, as it gives her all the information she needs when a customer calls. The schedule board also contains customer name, claim check/invoice number, type of unit, and date received. Four columns also show the following:

- Check for estimate,
- Parts or service manual ordered,
- Hold for estimate approval,
- Completion.

Checking out the set

Once the unit is diagnosed, the customer is informed and kept informed as to parts on order, or a service delay. This saves a lot of phone tie-ups with customers calling to attempt to find out about the progress of their sets.

The estimate or check-out charge is collected in advance, and we have absolutely zero problems with this. It is applied to the service charges, and is not an extra charge. It does help keep the unit from being left, if the estimate ends up being more than the customer is willing to pay. Also, we have a sign posted which simply says, "All repairs left over thirty days will be sold for charges, unless prior arrangements are made." Collecting in advance does a couple of things: it adds to your cash flow, and it provides money that you can apply to such things as ser-

Simmons is independent electronic service center owner and technician.

Figure 1. Placing business cards on bulletin boards at super markets, laundromats and other local businesses helps to bring in customers.

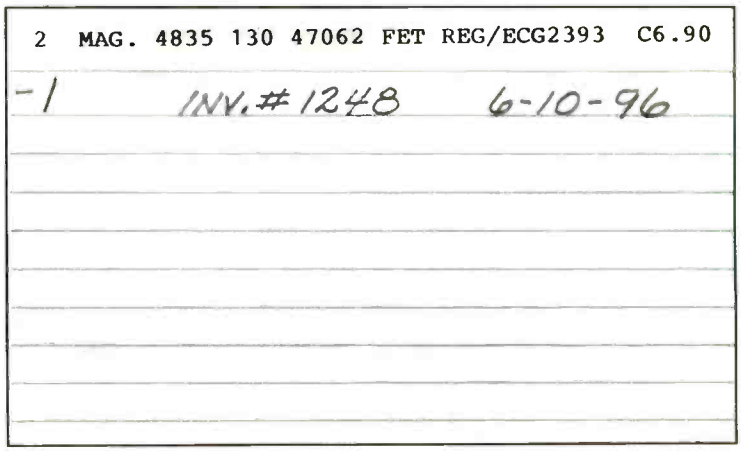


Figure 2. We keep track of inventory on 3 X 5 cards. ➔

PURCHASE ORDER

ORDER NO. 2400

PEIN #
KANSAS TAX #
ACCOUNT #

TO PHILLIPS CONSUMER ELECTRONICS CO.
ADDRESS 112 POLK ST. P.O.BOX 967
CITY GREENVILLE, TN. 37744

SHIP TO KEN'S ELECTRONIC SERVICE, INC.
ADDRESS 6902 EAST 17TH AVENUE
CITY HUTCHINSON, KANSAS 67501

FOR	REQ. NO.	DATE REQUIRED	HOW SHIP	TERMS	DATE
SMITH	1248	ASAP	PP/UPS	CHECK	06-10-96

	QUANTITY ORDERED	QUANTITY RECEIVED	PLEASE SUPPLY ITEMS LISTED BELOW	PRICE	UNIT
1	1		Q420 4835 130 47062 FET REG.	$ 4 40	$ 4.40
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

IMPORTANT

OUR ORDER NUMBER MUST APPEAR ON ALL INVOICES, PACKAGES, ETC.

PLEASE NOTIFY US IMMEDIATELY IF YOU ARE UNABLE TO SHIP COMPLETE ORDER BY DATE SPECIFIED.

PLEASE SEND 1 COPIES OF YOUR INVOICE WITH ORIGINAL BILL OF LADING

PURCHASING AGENT

REDIFORM 1L146

ORIGINAL

Figure 3. Purchase orders help us keep track of parts purchases.

vice information or special parts that you may have to order. We also have an extra charge added to each completed repair: $4.00 for miscellaneous chemicals and supplies. Believe me, it helps pay for those incidentals: solder, spray, invoices, etc. On special parts ordered by telephone (in cases where there is no 800 number), the approximate cost of the call is added to the service invoice. We pretty much know from past telephone bills that we have paid how much the call costs.

Finished sets

Finished service invoices are posted to the ledger (Figure 6) daily, including the date billed and the date paid. By glancing at the ledger, we know if we need to recall the customer to pick up the set, as storage space can become a problem if you don't stay on top of it. Sales tax is sent in quarterly, totalled, and posted to both ledgers, accounts receivable and expense ledger (Figure 7). The sales tax is highlighted on the ledger also, showing the date it was paid and sent in.

After the customer has had his set back for a week or so, we do a follow up, either by phone or form letter (with a blank space for typing in the type of unit he had serviced. This lets us know if our service was satisfactory, and the customer appreciates the thought.

Test equipment

Our major test equipment is rack mounted on rollers (Figure 8). This allows us to roll the test equipment right up to the unit being serviced. The rack also contains the necessary hookup

ES&T Calendar

Home Automation Show & Conference
February 8-10, 1998
Orlando, FL
203-840-5482

Kansas Electronics Assn. (KEA) State Convention
February 27-March 1, 1998
Hutchinson, KS
316-662-1973

CeBit '98 - Office Info & Telecommunications Technology
March 19-25, 1998
Hannover Germany
609-987-1202

CES Habitech '98 - Home Systems
June 7-9, 1998
Atlanta, GA
703-907-7600

CES Mobile Electronics
June 19-21, 1998
Atlantic City, NJ
703-907-7600

NESDA 48th/ISCET 28th/NIAS 6th Annual
August 10-15, 1998
Kissimmee, FL
817-921-9061

CeBit Home Electronics '98
August 26-30, 1998
Hanover Germany
609-987-1202

PCS 98
September 23-25, 1998
Orlando, FL
703-739-0300

Personal Computer & Electronics Expo
October 15-18, 1998
Uniondale L.I., NY
800-886-8000

PCS 99
September 22-24, 1999
New Orleans, LA
703-739-0300

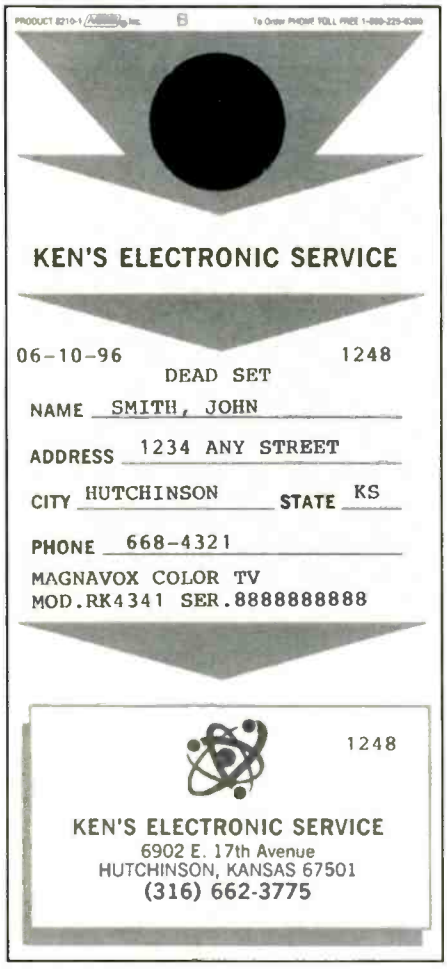


Figure 4. Recording appropriate information on the tag that goes on the set helps keep things sorted out in the service center.

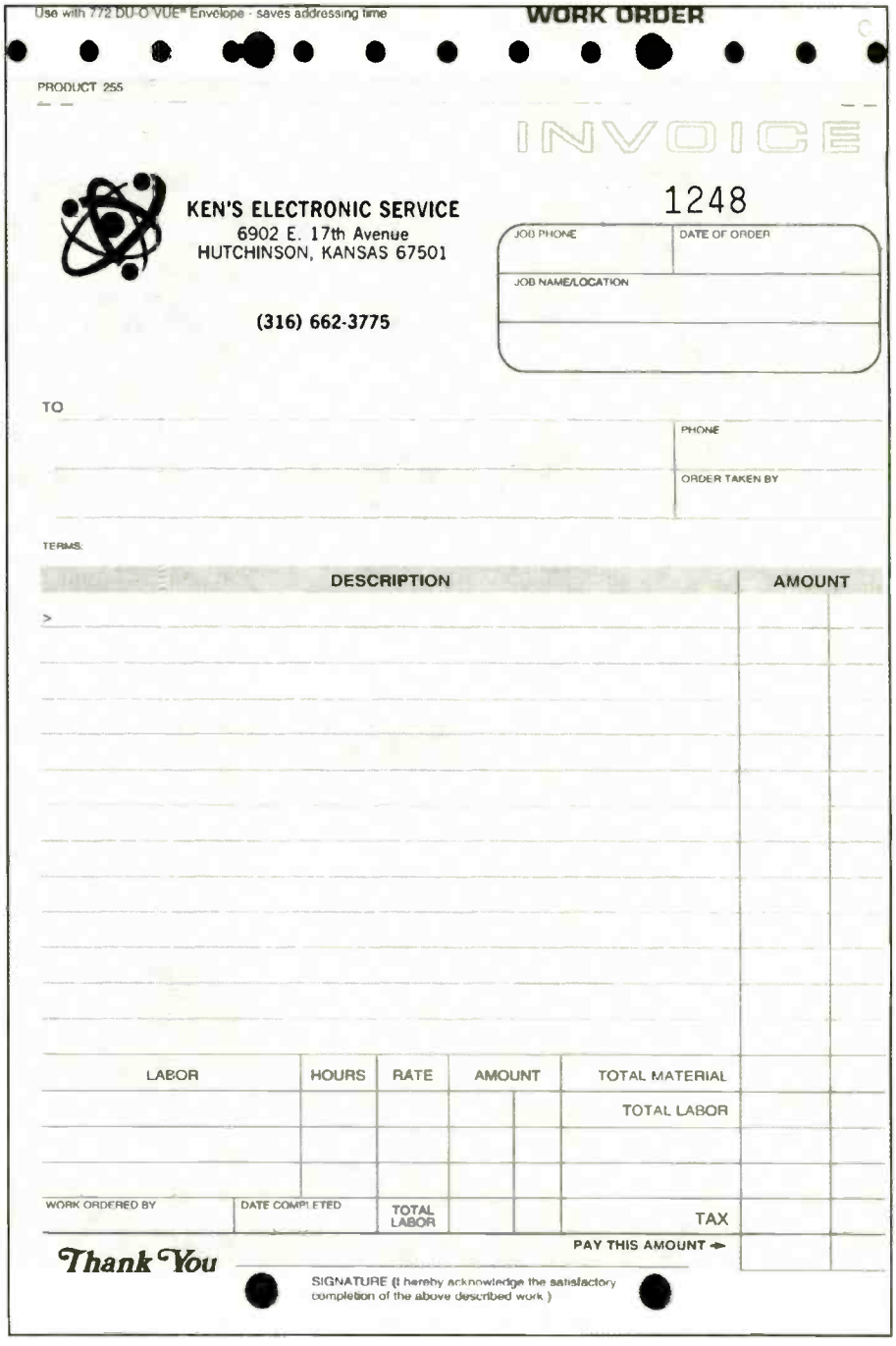


Figure 5. The service invoice bears the same number as that on the set tag.

cables, variable transformer, isolation transformer, temperature-controlled soldering station, HV probe, most-frequently-used service information, etc. It is all grounded together, and is connected to the ac line via surge protected power strips. The front panel also has antenna input/output jacks so we can tap into the master antenna anywhere in the service center. Believe it or not, this rolling test equipment rack also has a cordless telephone for convenience calling right from the bench, and stores the antistatic bench pads and wrist straps for working on static-sensitive replacement parts.

Parts are stored in plastic cabinets with each drawer labelled alphabetically. We also carry accessory VCR cables, antenna wire, plugs, jacks, speaker wire and small 10dB to 15 dB antenna amplifiers and splitters and couplers.

Organization for efficiency

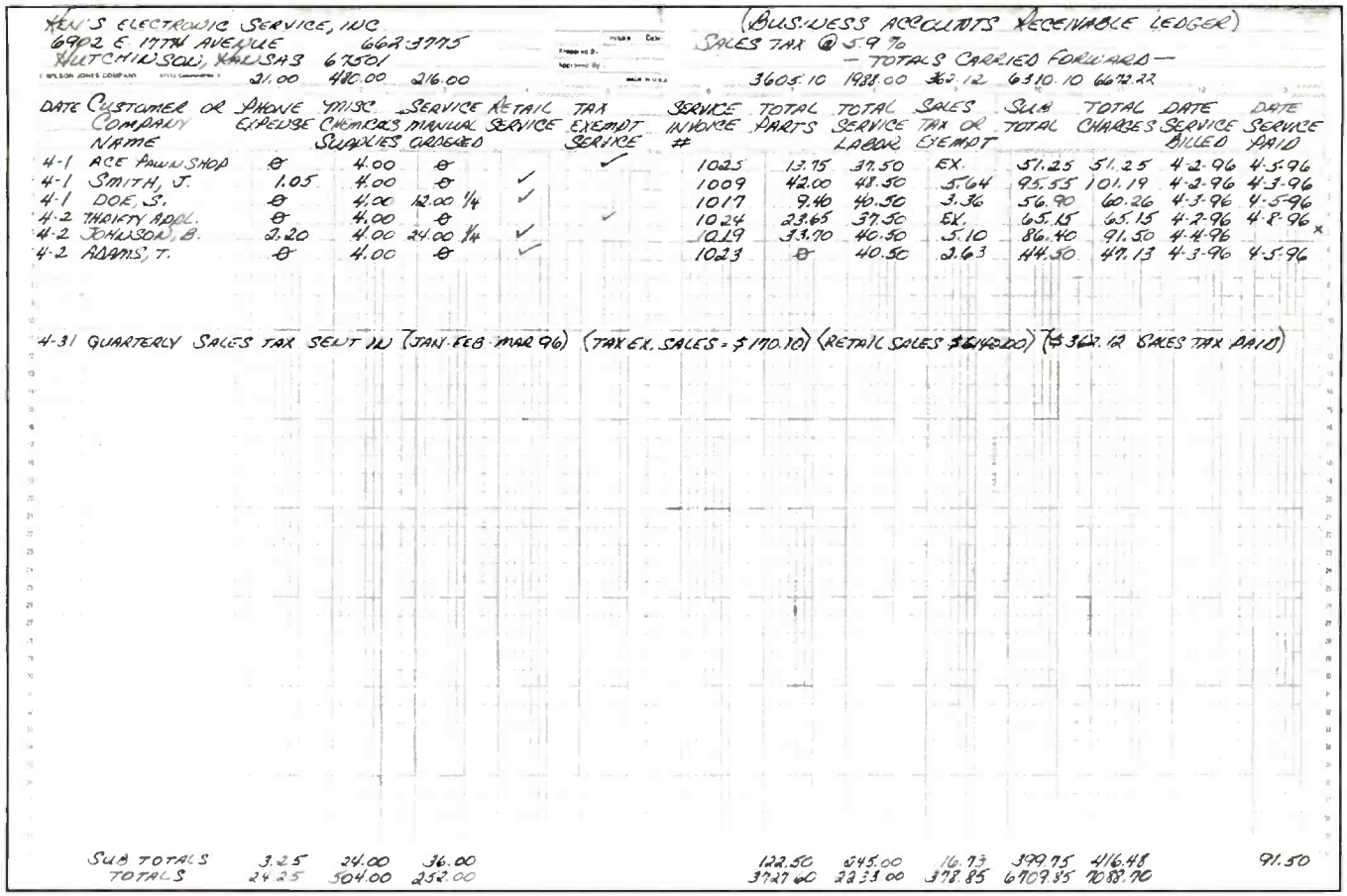
In the service business, time is what we sell. Our service center was laid out from experience gained down through the past 40 years (and a few mistakes).

The service bench is loaded (Figure 9). It contains a variable dc supply, color receiver for VCR service, with patch panel plugs and jacks so we can hook up anything to anything, chemicals, tool racks, service information holders, speakers, mirrors and magnification lamps.

We also have a 3X5 card system that contains parts suppliers' information (name, address, telephone number), filed alphabetically, and by manufacturer (Figure 10). If we need to order a part from, say, Magnavox, that card shows all the suppliers for that brand. Additionally, the telephone numbers of all frequently-called suppliers are programmed into the telephone memory system. I only have to punch one designated number to reach the desired parts company.

Bookkeeping and filing

I don't use outside bookkeeping, since I have an associate degree in business



KEN'S ELECTRONIC SERVICE, INC
6902 E. 17TH AVENUE 662-3775
HUTCHINSON, KANSAS 67501

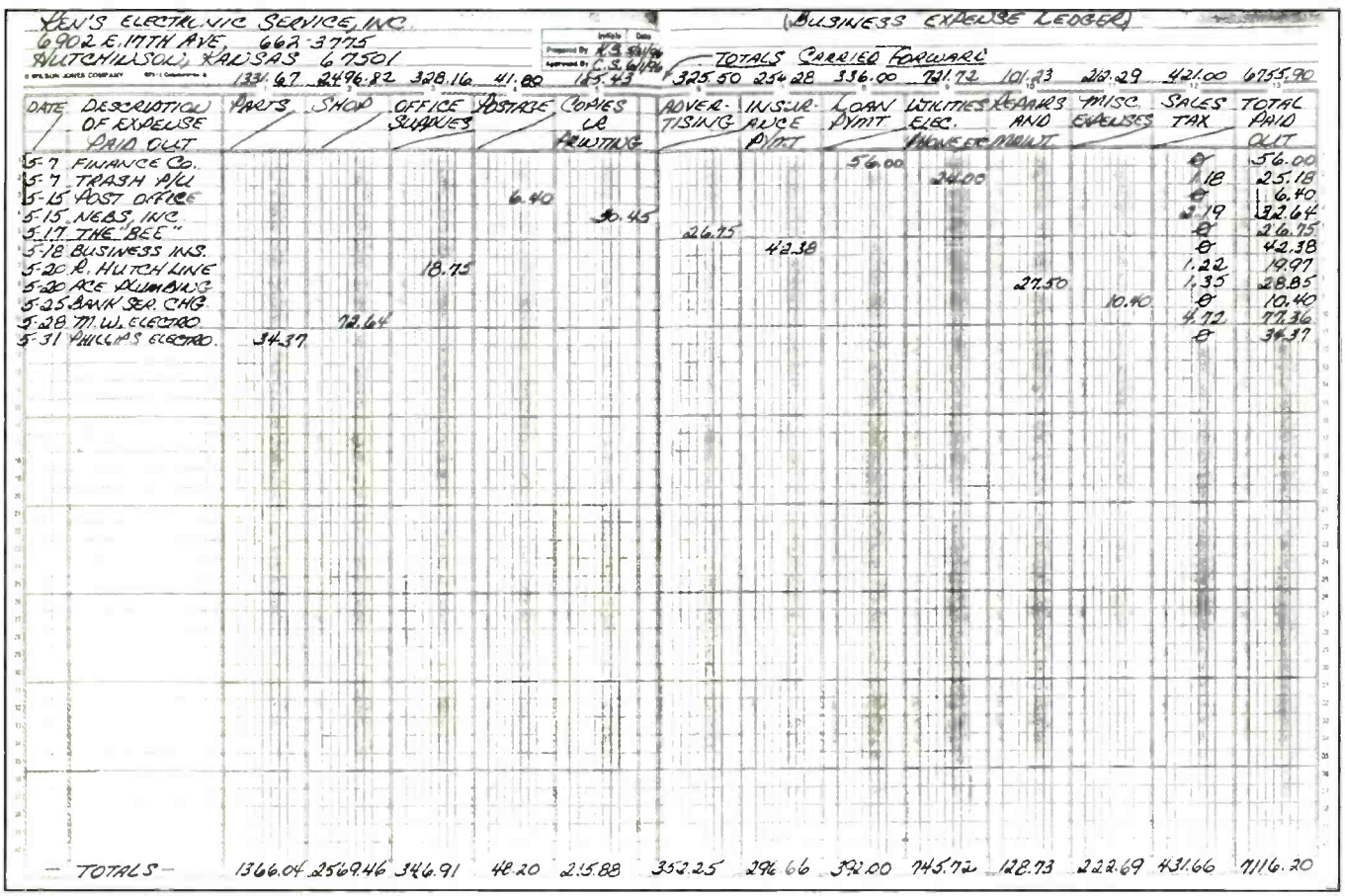
(BUSINESS ACCOUNTS RECEIVABLE LEDGER)
SALES TAX @ 5.9%
— TOTALS CARRIED FORWARD —
3605.10 1988.00 362.12 6310.10 6672.22

DATE	CUSTOMER OR COMPANY NAME	PHONE EXPENSE	MISC. CHEMICALS SUPPLIES	SERVICE MANUAL ORDERED	RETAIL SERVICE	TAX EXEMPT SERVICE	SERVICE INVOICE #	TOTAL PARTS	TOTAL SERVICE LABOR	SALES TAX OR EXEMPT	SUB TOTAL	TOTAL CHARGES	DATE SERVICE BILLED	DATE SERVICE PAID
4-1	ACE PAWN SHOP	0	4.00	0		✓	1025	13.75	37.50	EX.	51.25	51.25	4-2-96	4-5-96
4-1	SMITH, J.	1.05	4.00	0	✓		1009	42.00	48.50	5.64	95.55	101.19	4-2-96	4-3-96
4-1	DOE, J.	0	4.00	12.00 ¼	✓		1017	9.40	40.50	3.36	56.90	60.26	4-3-96	4-5-96
4-2	THRIFTY ADDL.	0	4.00	0		✓	1024	23.65	37.50	EX.	65.15	65.15	4-2-96	4-8-96
4-2	JOHNSON, B.	2.20	4.00	24.00 ¼	✓		1019	33.70	40.50	5.10	86.40	91.50	4-4-96	
4-2	ADAMS, T.	0	4.00	0	✓		1023	0	40.50	3.63	44.50	49.13	4-3-96	4-5-96

4-31 QUARTERLY SALES TAX SENT IN (JAN-FEB-MAR 96) (TAX EX. SALES = $190.10) (RETAIL SALES $6142.00) ($362.12 SALES TAX PAID)

SUB TOTALS	3.25	24.00	36.00	122.50	245.00	16.73	399.75	416.48		91.50
TOTALS	24.25	504.00	252.00	3727.60	2233.00	378.85	6709.85	7088.70		

Figure 6. Finished services are posted to the ledger daily, including the date billed and the date paid.



KEN'S ELECTRONIC SERVICE, INC
6902 E. 17TH AVE. 662-3775
HUTCHINSON, KANSAS 67501

(BUSINESS EXPENSE LEDGER)
TOTALS CARRIED FORWARD
1334.67 2496.82 328.16 41.80 185.43 325.50 254.28 336.00 731.72 101.83 262.29 421.00 6795.90

DATE	DESCRIPTION OF EXPENSE PAID OUT	PARTS	SHOP SUPPLIES	OFFICE SUPPLIES	POSTAGE	COPIES OR PRINTING	ADVERTISING	INSURANCE PYMT	LOAN PYMT	UTILITIES PHONE ETC.	REPAIRS AND MAINT	MISC. EXPENSES	SALES TAX	TOTAL PAID OUT
5-7	FINANCE CO.								56.00				0	56.00
5-7	TRASH A/U									24.00			1.18	25.18
5-15	POST OFFICE				6.40								0	6.40
5-15	NEBS, INC.					30.45							2.19	32.64
5-17	THE "BEE"						26.75						0	26.75
5-18	BUSINESS INS.							42.38					0	42.38
5-20	R. HUTCH LINE			18.75									1.22	19.97
5-20	ACE PLUMBING										27.50		1.35	28.85
5-25	BANK SER. CHG.											10.40	0	10.40
5-28	M.W. ELECTRO		72.64										4.72	77.36
5-31	PHILLIPS ELECTRO.	34.37											0	34.37
	— TOTALS —	1366.04	2569.46	346.91	48.20	215.88	352.25	296.66	392.00	745.72	128.73	222.69	431.66	7116.20

Figure 7. Expenses are recorded in the expense ledger.

management. I filed my own corporation papers because I have also studied law for two years. As far as technical education, I have a B.S. degree in electronics engineering technology, have graduated from several technical schools, and I still take refresher courses when I can.

Our filing cabinets are set up with individual customer service records, parts supply invoices, monthly expense receipts, purchase orders, taxes, insurance, utilities, and all other pertinent information.

Providing professional service

We have been called "state of the art." It works for us. If you're going to provide professional service and charge professional rates, it's important to look and be that way. Doctors and lawyers have been doing it for years.

In closing, you can't be 100% efficient. But you can use good control, good service procedures, and a lot of good old common sense to be successful. ■

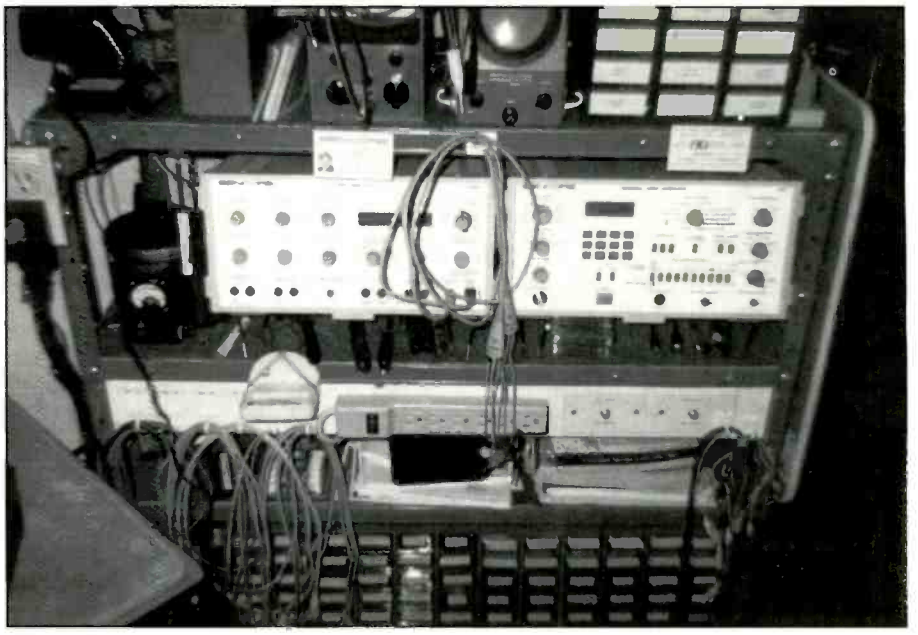


Figure 8. Major test equipment is rack mounted on rollers. This allows us to roll the test equipment right up to the unit being serviced.

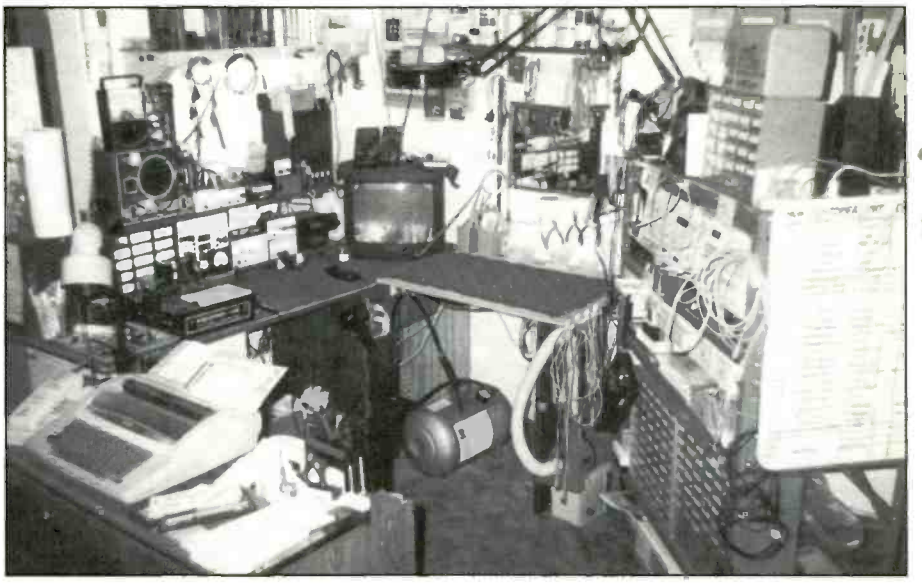


Figure 9. The service bench is loaded with modern test equipment to maximize diagnostic/servicing efficiency.

Test Your Electronics Knowledge

Answers to Test *(from page 20)*

1. B. The number of electrons in a coulomb is 6.25×10^{18}.

2. B. A current pulse in the gate circuit "fires" the SCR.

3. B. By definition.

4. B. It is the ON time divided by the TOTAL TIME for one cycle.

5. A. It's a fact.

6. When lighted, a neon bulb has a lower firing potential, so, it fires sooner in a lighted room.

7. It is correct, but, you couldn't lift a railroad engine with its magnetic field.

8. Wrong. Adding white paint makes the blue paint less saturated.

9. T = L/R = 1 and 3/5 second.

10. A. This characteristic is used in the operation of a parametric amplifier.

MAGNAVOX	
PHILLIPS CON. ELECTRO. 112 POLK ST. BOX 967 GREENVILLE, TN. 37744	1-800-851-8885
TRITRONICS INC. 1952 NW 93RD AVE. MIAMI, FL. 33172-2925	1-800-365-8030

Figure 10. We use a 3 X 5 card system to keep track of distributors sorted by the manufacturers whose parts they carry.

What Do You Know About Electronics?

by J.A. Sam Wilson

I'm going to start by doing something that I have always been advised not to do as an author. I'm going to start off with two negatives. Please bear with me. In the past I told you about my dislikes. I'm going to add two more and that will be the end of it.

(1) I don't like authors that include abbreviations in their writing and don't explain what they mean! It is O.K. for well-known abbreviations, but not for articles in specialized magazines. A young person trying to get a foothold could not possibly have encountered them. It is the "I know something you don't know , so there" syndrome.

Their writing goes something like this: "One of the latest innovations in SGD is the FGS. It allows you to skip over the SOYD and go straight to the KXL." If you try to object they say something nasty like: "You should not be reading magazines you don't understand."

(2) I don't like authors who criticize other authors!

A brief review of the UJT (unijunction transistor)

The operation of the PUT (programmable unijunction transistor) is similar in many ways to the UJT. So, it's a good idea to briefly review the UJT operation before we look at what is going on inside and outside the PUT.

In the past, I covered the UJT and some of its major characteristics. Let me remind you of its important features. Figure 1 reviews the symbol for the UJT, and, it shows a basic UJT oscillator circuit. The UJT will not conduct current from Base 1 to Base 2 until its emitter reaches the intrinsic standoff ratio voltage (h x V). That is the decimal value of the intrinsic standoff ratio (h) multiplied by the applied voltage across the UJT (V). (Note: h is a Greek letter called *eta*.)

In many cases the intrinsic standoff ratio of the UJT is set by the manufacturer to 0.63, or, 63%. That is the time constant of the R-C circuit that is used to set the emitter voltage for UJT conduction. The unijunction transistor circuit is, therefore, very easy to design.

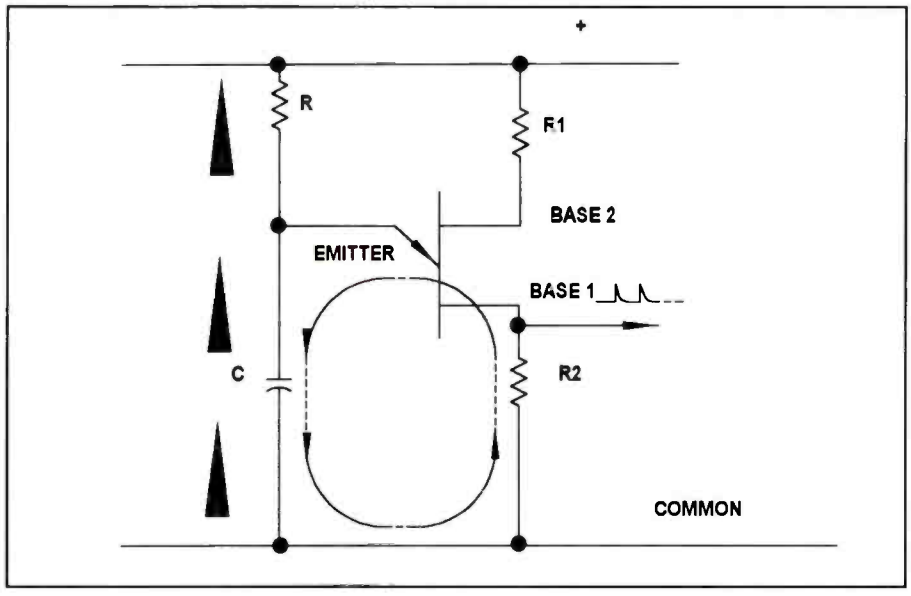


Figure 1. A UJT (unijunction transistor) can be used as the basis of an oscillator circuit.

Suppose you want the UJT oscillator circuit in Figure 1 to conduct at 5-second intervals. Assume that you are using a UJT with an intrinsic standoff ratio of 0.63. Choose R and C with a time constant of 5 seconds. It is best to choose an R-C combination with a high R/C ratio because high capacitance values may turn out to be leaky.

When the UJT conducts, it causes a short-duration current to flow through R_1 and R_2. At the same time, it discharges the time constant capacitor. That pulse can be used for many applications. The charge path for the capacitor is shown with solid arrows, and the discharge path

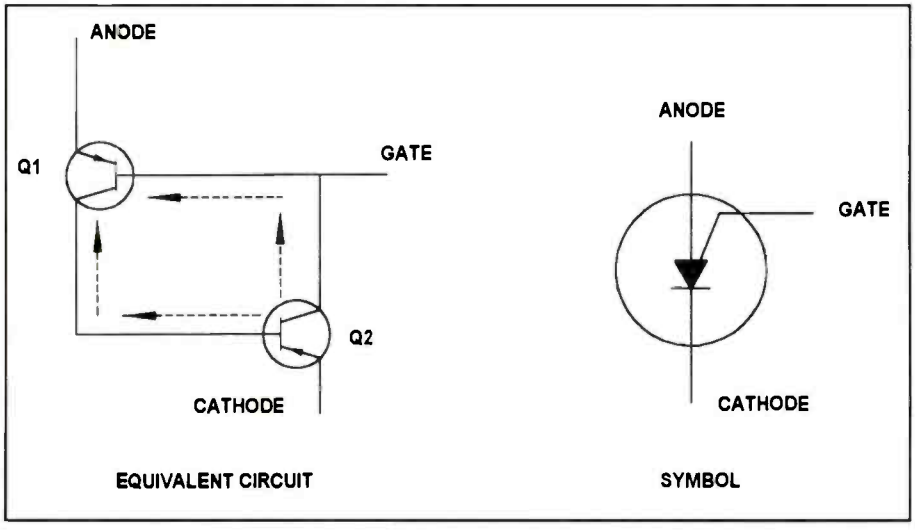


Figure 2. On the right is the symbol for a programmable unijunction transistor (PUT). At left is an equivalent circuit using bipolar junction transistors.

Wilson is the electronics theory consultant for ES&T.

is shown with broken arrows. The overall result is a short-duration output pulse as shown in the illustration.

The PUT (programmable unijunction transistor)

Even though you may never see a PUT circuit, this analysis of the PNP/NPN circuit will prove useful for analyzing other dual transistor circuits.

One important difference between the UJT and PUT is that with the PUT you set the intrinsic standoff ratio by using an external voltage divider.

Now, let's review the PUT internal circuitry. Its equivalent circuit and symbol are shown in Figure 2. The main differences between this device and the UJT are that a gate voltage fires the PUT, and, you can set the intrinsic standoff ratio by selecting the gate circuit resistance ratio:

$$h = R_1/(R_1 + R_2)$$

Here are some other important advantages of the PUT listed by GE:

- high sensitivity
- low leakage
- high breakdown voltage (It can be operated directly from the full line voltage.)
- low-voltage operation
- fast, high-energy pulses

To explain what is going on inside the PUT I'm going to use its equivalent circuit shown in Figure 2. Also, I am putting letters on the characteristic curve in Figure 3 for each important step in the operation.

It helps to know that the PUT does not conduct until the voltage on its GATE terminal reaches *h* x V. That is similar to the UJT where the voltage on the *emitter* must reach *h* x V. As shown by point X in Figure 3, at the instant that happens the voltage at point X becomes more positive than the base voltage on Q_1.

Making the emitter of Q_1 more positive than the base (in Figure 2) is the same thing as making the base negative with respect to the emitter. So, the PNP transistor is biased into conduction.

The arrows at the collector lead of Q_1 show the direction of the electron current. Observe that there is a base current flowing out of Q_2. Therefore, that transistor is biased into conduction. The arrows on the collector lead of Q_2 show that it is supplying bias for Q_1.

To summarize, each transistor is supplying bias for the other transistor. The voltage across the two transistors decreases to a minimum value when they are both conducting. See Point Y on the characteristic curve. Since both transistors are conducting at, or very near to, saturation there is a minimum voltage across each transistor.

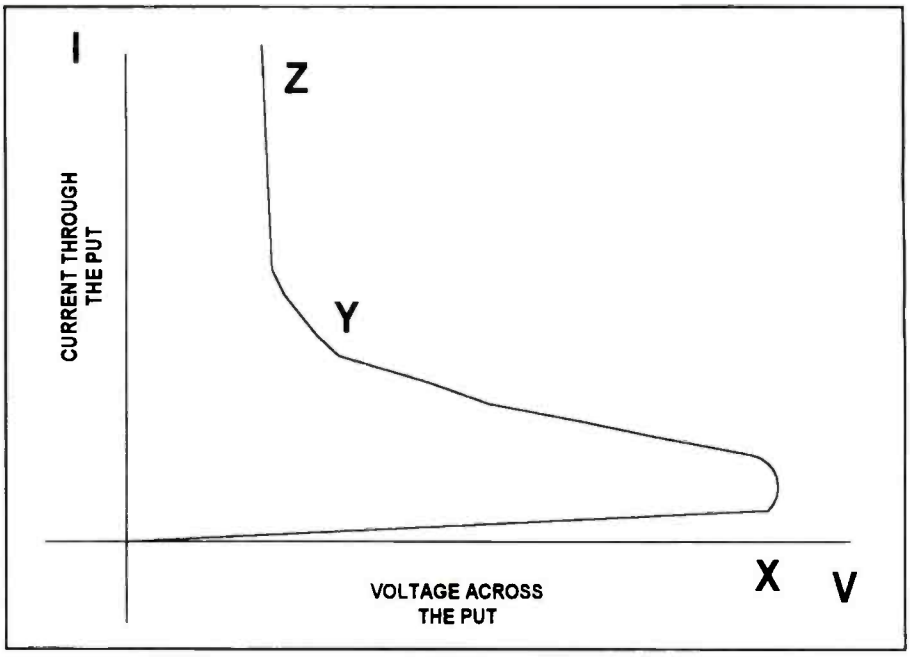


Figure 3. The characteristic curve for a PUT.

Note: Since there is less voltage drop across the transistors there is a higher current through the PUT and a higher current through resistor R_2 of Figure 4. So, there is a relatively high pulse voltage across that resistor.

From the low-voltage condition across the transistors the current through the PUT starts to rise rapidly as shown by arrow Z in Figure 3.

The description of events up to now takes time but the action is very rapid. The rising current through the PUT produces the positive pulse at its cathode.

Figure 4 shows the PUT in a very basic circuit. The positive pulse from the PUT starts conduction through the SCR at some moment after the 120V anode supply begins to rise. It is as if someone

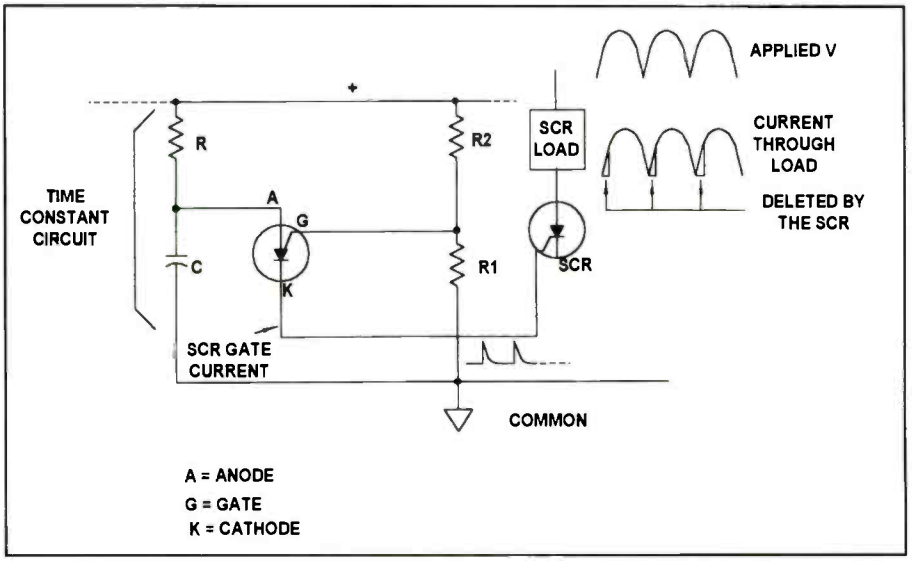


Figure 4. This circuit provides a means to control the amount of power to a load. If the load were, say, a light bulb, the effect would be that of a dimmer.

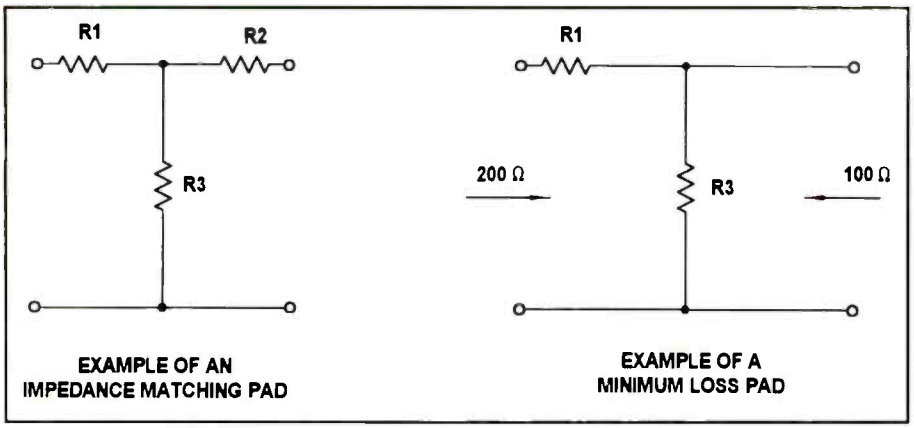


Figure 5. You can use hyperbolic functions to calculate the values of resistors used in an impedance matching pad.

switched the SCR OFF for a brief part of the ac waveform. As shown in the waveform on the illustration, the SCR does not supply current for the full duration of the input power. If that load is a light bulb it will not glow as brightly as if it was connected directly to the input voltage.

Remember this important point: It is the voltage across the time constant capacitor that starts the PUT into conduction. After a *rapid* exchange of biases, the PUT delivers the output pulse to the SCR. The amount of the SCR output waveform deleted is determined indirectly by the time constant of the R and C circuit.

Those hyperbolic functions

If you got a new calculator as a gift and you haven't had a chance to use the hyperbolic functions, the following problem will provide you with a chance .

I know the following problem can be solved without using the hyperbolic keys, but, we're giving some readers a chance to use those keys.

Problem - Design a minimum-loss resistive pad that will match a 200Ω input to a 100Ω output. See Figure 5.

Solution - The minimum-loss pad uses two resistors as shown in the illustration. Resistor R_1 must be closer to the higher input resistance.

Step 1 - Evaluate X in the following equation for matching the unequal input and output impedances or resistances:

$$e^x + 1 + \sqrt{\frac{R_I}{R_O}} = 1 + \sqrt{\frac{200}{100}} + 2.414$$

where R_I is the input resistance and R_O is the output resistance.

If $e^X = 2.414$, then, $x(\ln e) = \ln 2.414$

But, $\ln e = 1$, so, $x = \ln 2.414 = 0.8812$

Step 2 -Now you can use those hyperbolic keys on your calculator.

Sinh x = Sinh 0.8812 = 1

Tanh x = Tanh 0.8812 = 0.707

$$R_3 = \sqrt{\frac{(R_I)(R_O)}{\text{Sinh } x}} = \sqrt{\frac{200\text{-}100}{1}} = 141.4\text{W}$$

$$R_2 = [\frac{R_O}{\text{Tanh}} - R_3] = [\frac{10}{0.707} - 141.4] = 0 \text{ ohms}$$

(Observe that R_2 has been eliminated.)

$$R_2 = [\frac{R_I}{\text{Tanh } x} - R_3] = [\frac{200}{0.707} - 141.4]$$

=141.4 ohms

Proof:

The input resistance with the output resistance connected (See Figure 6):

$$R_I = 141.4 + \frac{141.4 - 100}{141.4 + 100} = 199^+ \approx 200\Omega$$

The output resistance with the input resistance connected (See Figure 6):

$$R_O = \frac{(141.4 + 200)(141.4)}{141.4 + 200 + 141.4} = \frac{48273}{482.8}$$

$$= 99.9^+ \approx 100\Omega$$

Previously in this issue I said to the math elite that I know the problem can be worked without hyperbolics. However, you do need a calculator that has logarithms. In the next issue I will give that (shorter) solution.

Why give two different solutions to the same problem?

Think about this: "You cannot improve the quality of your decision(s) by impoverishing your choices." - DeBono ■

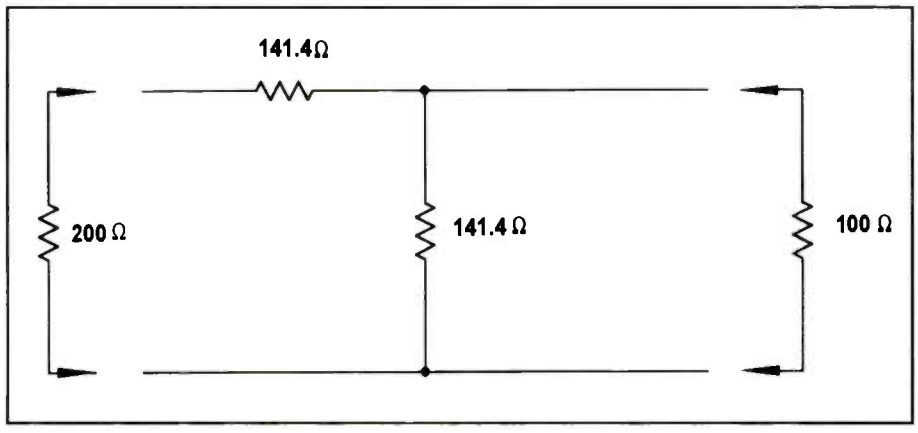
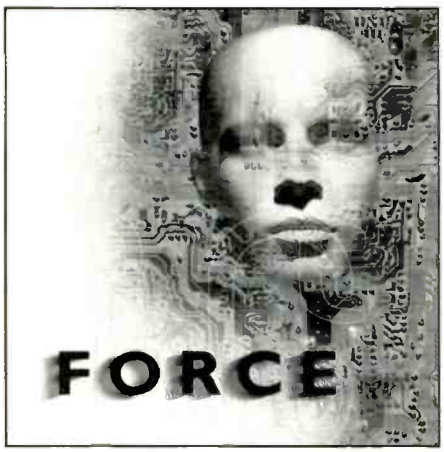


Figure 6. These values of resistors give the required impedance matching from 200Ω to 100Ω.



Interactive, online service data

Philips Service Solutions Group announces the launch of their Web site for online service data designed to run in the FORCE application software licensed by CHET Technology. For the first time, servicers can download service literature from the Internet anytime, anywhere. Beginning with color TV and projection TV, virtually all technical manuals will be available in cyberspace in 1998. This new service makes service data available to the industry on-demand, 24-hours a day, and any manual can be downloaded in 20 minutes or less. Visit the site at http://-www.forceonline.com.

Circle (90) on Reply Card

PC repair videotapes

Philips Technical Training announces the development in 1997 of a new PC repair tape series. The twelve tapes cover the basic material needed by PC servicers to pass the A+ certification test, plus more.

The tapes are designed to provide not only needed background information on the various subjects covered, but also how to use the various diagnostic packages to repair personal computers.

The twelve tapes are:

PC titles to be released in 1998:

Tape 1: Basic PC System and Terminology

Tape 2: PC System Troubleshooting

Tape 3: PC Operating System Troubleshooting

Tape 4: Hard Drive Installation and Troubleshooting

PC titles to be released in 1999:

Tape 5: Modem Installation and Troubleshooting

Tape 6: Video Cards Installation and Troubleshooting

Tape 7: Upgrading, Memory Management, and Troubleshooting

Tape 8: Serial and Parallel Communication Troubleshooting

PC titles to be released in 2000:

Tape 9: Installing and Troubleshooting Network Cards

Tape 10: PC Virus Detection and Protection

Tape 11: Preventative Maintenance for personal computers

Tape 12: Data Recovery Techniques

Subscription to the four tape per year PC series will be $199.95 a year, but servicers who subscribe before February 27, 1998 will get the first year's four tapes for $149.95. Call 423-475-0395.

Circle (91) on Reply Card

New TelCom training module

A new cabling module added to the TelCom Tech-Knowledge Series is now available from *Heathkit Educational Systems*. The Networking Topologies and Copper Cabling Course was developed in response to the increase in employment opportunities requiring proper cabling installation and maintenance. Prospective installers can meet this required skill by completing this course.

The course shows how to correctly identify and use different types of cable (CAT5 twisted pair, coaxial, UTP), connectors (CAT5 RJ45, UDCs, F and N, etc.), and tools used in today's networking environment. Prospective installers will become familiar with the configuration, construction, and specifications of cable runs and wiring closets, and will also demonstrate proper installation and testing techniques.

The system is applicable to a wide range of course topics, including residential and industrial wiring, telecommunications, PC repair and networking systems.

Circle (92) on Reply Card

Satellite signal level meter

Leader Instruments announces the Model LF 942, a signal level meter operating at satellite IF frequencies covering the range of 950MHz to 2050MHz. The small, battery-powered instrument displays signal level in DBμV or DBmV plus a bargraph to aid in dish aiming, the checkout of the link between the LNB (low noise block converter) and the tuner and the design of multiple-outlet systems. It also supplies dc voltage to power the LNB under test allowing independent checks of the dish/down-converter part of a system. The display also shows the selected satellite channel, carrier-to-noise ratio, local-oscillator frequency and dc output voltage.

Factory programming covers USA DBS and C-Band channels and includes listings for ASIA-SAT, CHINA-SAT, EUROPE DBS, ASTRA-1, ASTRA-1 UNIV, TELECOM-1C, DFS-11 and DFS-12. In addition, ten user programmable memory settings are provided to allow the user to recall routine setups and to handle future satellite assignments.

Circle (93) on Reply Card

Memory tester

Innoventions announces that it has released its new SIMCHECK II se memory tester, and entry level third generation memory tester.

Its advanced architecture combines a fast 32-bit processor with internal 1nS timing technology, making it capable to support the firm's SDRAM adapters. The tester tests all popular EDO and Fast Page SIMM modules with sizes up to 4GB at

a 2nS to 3nS resolution. Four voltage regulators provide a full range of 2.7V to 5.75V functional tests. Available optional adapters support most types of memory cards and DIMMs, including the new 168-pin SDRAM DIMMs.

Circle (94) on Reply Card

Electric drive for bench height adjustment

All Metal Designs, Inc. has announced a new electric drive option which allows for affordable electric height adjustment in industrial workstations.

The new option, which is suitable for use on a wide range of the company's workstations, utilizes two linear actuators. It has a lift capacity of 600 lbs. and features an extremely quiet, high-speed movement that provides a full 12 inches of height adjustment.

Circle (95) on Reply Card

Ultra-X launches QuickTech '98 PC troubleshooting utility

Ultra-X announces the release of QuickTech '98.

This software is an operating system independent utility program that tests for system problems in AT 386 through Pentium systems (including Pentium Pro, Pentium II, MMX technology, and all Cyrix and AMD processors). It uses direct hardware interrogation calls to implement its test routines which allows the program to eliminate the need for any operating system. The software is run from a single disk. The program is easy to run, simply insert the disk into the floppy drive and power-up the PC.

The tests are run from drop down menus. You can select from a group of tests including, base, extended, cache and video memory, hard, floppy, EIDE CD ROM drives, RTC/CMOS RAM, parallel and serial ports (with loop backs), printer, video adapters, and much more.

The EIDE CD ROM test is a direct hardware interrogation and does not require the loading of any drivers. The program also includes testing for system hardware such as: CPU/NPU, DMA and Interrupt controllers, Timer/Counter chip, Keyboard controller, and CMOS Clock. For system configuration, the program provides information for BIOS, base/extended CPU interrogation, video, floppy/hard drives, parallel/serial ports, CMOS RAM, IDE drives, interrupt vectors, and I/O port viewer.

Circle (96) on Reply Card

1998 EEM/Electronics Engineers Master Online at http://eemonline.com

Hearst Business Communications, Inc./UTP Division announces the release of the new 1998 EEM/Electronic Engineers Master database on the Internet at http://eemonline.com together with its release on CD-ROM for Windows and the publication of the printed catalog version.

The 1998 Master is the world's largest database of electronic components. It has been updated and expanded to include 4,100 different product listings with over 4,300 product catalog data pages from

more than 1,000 manufacturers. *The Manufacturers and Sales Offices Directory* lists over 5,300 manufacturers with their local sales offices. Engineers and technicians can work with the database in three formats.

Free access at http://eemonline.com delivers the most current database with product and manufacturer search capability. Updated on a regular basis, the online version offers access to new product introductions, manufacturer supplied product catalog data pages, and complete manufacturer contact information including phone, fax, and Internet address.

The CD-ROM version for Windows delivers the entire database on a single compact disk.

Circle (97) on Reply Card

BOOKS

***ES&T Presents Computer Troubleshooting & Repair*, by ES&T Magazine, PROMPT Publications, 256 pages, paperback $18.95**

ES&T is the nation's most popular magazine for professionals who service consumer electronics equipment. PROMPT Publications is combining its publishing expertise with the experience and knowledge of **ES&T**'s best writers to produce a new line of troubleshooting and repair books for the electronics market.

Compiled from articles and prefaced by the editor in chief, Conrad Persson, these books provide valuable, hands-on information for anyone interested in electronics and product repair. Computer Troubleshooting is the second book in a series and features information on repairing Macintosh computers, a CD-ROM primer, and a color monitor. Also included are hard drive troubleshooting and repair tips, computer diagnostic software, preventative maintenance for computers, upgrading, and much more.

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214-2041

***Electronic Servicing Techniques*, by J. A. Sam Wilson and Joseph Risse, PROMPT Publications, 352 pages, paperback $24.95**

Electronic Servicing Techniques is the premiere guide for hobbyists, technicians and engineers to a variety of troubleshooting tests, measurement procedures, and servicing techniques. The authors gathered many of the ideas in the book from technicians around the country who wanted to share their favorite techniques and solutions. Though it is not a book on how to repair specific equipment like VCRs or TVs, it is the ultimate reference on the logic behind troubleshooting and where to begin when trying to find problems.

The book is organized by techniques instead of by any specific troubleshooting procedure, allowing the reader both creativity and flexibility in applying their new knowledge to simple or even complex problems. With a limited amount of traditional test equipment, this book guides the reader through an overview of the subject, a list of specific objectives, and finally a self-test to demonstrate understanding of the section

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214-2041

***Complete Camcorder Troubleshooting & Repair*, by Joe Desposito & Kevin Garabedian, PROMPT Publications, 336 pages, paperback $29.95**

A video camcorder's circuits perform many tasks such as processing video and audio signals, controlling motors, and supplying power to the machine. Though camcorders are complex, you don't need complex tools or test equipment to repair or maintain them, and this book will show the technician or hobbyists how to care for their video camcorder.

Complete Camcorder Troubleshooting & Repair contains sound troubleshooting procedures, beginning with an examination of the external parts of the camcorder then narrowing the view to gears, springs, pulleys, lenses, and other mechanical parts. The book also features numerous case studies of particular camcorder models, in addition to illustrating how to troubleshoot audio and video circuits, special effect circuits, sensors and switches, lens arrays, microprocessor control circuits, servo systems, viewer arrays, video heads, power supply circuits, and more.

PROMPT Publications, 2647 Waterfront Parkway E. Drive, Indianapolis, IN 46214-2041

***The Illustrated Dictionary of Electronics, Seventh Edition*, by Stan Gibilisco, Tab Books, paperback $39.95**

Continuing in the tradition of its predecessors, this updated dictionary of electronics terms covers a broad range of subjects in an easy-to-use format.

More than 27,500 definitions—plus over 1,000 clear and functional illustrations—make the Seventh Edition a useful reference for technicians, hobbyists, and students. Many new terms and illustrations from robotics, artificial intelligence, and personal computing as they relate to electronics are included. Definitions spelled out in plain English with minimal technical jargon make the dictionary accessible to beginning, intermediate, and advanced electronics professionals. You'll find coverage of the latest terminology in: lasers, television, radio, IC technology, digital and analog electronics, audio and video, power supplies, fiber optic communications.

Existing definitions have been updated, obsolete material has been deleted, and all entries have been reviewed by an editorial review board to assure accuracy.

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

***Tab Encyclopedia of Electronics for Technicians and Hobbyists*, by Stan Gibilisco, Tab Books, 964 pages, 700 Illus, hardcover $69.50**

How do you set up a satellite TV system in your home? What should you know before buying a VCR or camcorder? How does a fax machine work? You'll find the answers to these and hundreds of other questions inside this information-packed volume. It covers virtually every aspect of hobby and consumer electronics in clear language, and offers detail while featuring an abundance of illustrations and real-world examples.

The articles inside are arranged alphabetically by topic. Should you wish to delve deeper into a particular subject, extensive cross-references will speed you to other related entries. Or you can consult the comprehensive index to locate all articles containing information about your topic of interest.

It's a place to turn when you need: clear explanations of how something works, and/or guidance on the right way to install it, insider knowledge to help make your electronics purchasing decisions savvy ones. A learning aid for students from the junior high school level on up through college, including non-electronics majors.

The encyclopedia also provides authoritative information to add to your enjoyment of ham radio, shortwave listening, and other electronics-related hobbies, and an accessible method of building your electronics literacy—regardless of your background or training.

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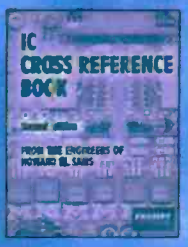

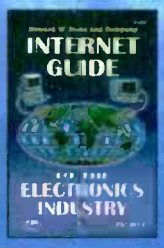

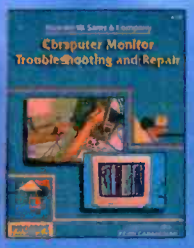

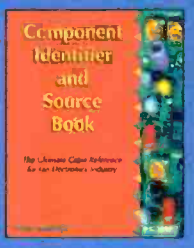

Semiconductor Cross Reference Book Fourth Edition
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This new y revised and update l reference book is the most comprehensive guice to replacement data available. With more than 490,000 part numbers listed, technicians will have no problem locating the replacement or substitution information on they need.
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IC Cross Reference Book Second Edition
by Howard W. Sams & Company
The engineering staff of Sams assembled the *IC Cross Reference Book* to help readers find replacements or substitutions for more than 35,000 ICs and modules.
Order # 61096 ..... $19.95

ES&T Presents TV Troubleshooting & Repair
by ES&T Magazine
This book presents information that will make it possible for technicians and electronics hobbyists to service TVs faster, more efficiently, and more economically.
Order # 61086 ..... $18.95

Internet Guide to the Electronics Industry
by John Adams
Electronics hobbyists and technicians can find a wealth of knowledge and information on the internet, and this book will serve mainly as a directory to the resources available on-line.
Order # 61092 ..... $16.95

ES&T Presents Computer Troubleshooting & Repair
by ES&T Magazine
Computer Troubleshooting & Repair features information on repairing Macintosh computers, monitors, hard drives and much more.
Order # 61087 ..... $18.95

The Component Identifier & Source Book
by Victor Meeldijk
This book was written to assist technicians and system designers in identifying components from prefixes and logos, as well as find sources for various types of microcircuits and other components. There is not another book on the market that lists such diverse components.
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Troubleshooting & Repair Guide to TV
by Howard W Sams & Company
This book is the most complete and up-to-date television repair book available. It contains time saving features that even the pros don't know and extensive coverage of common TV symptoms.
Order # 61077 ..... $29.95

ES&T Presents the Test Equipment Guide
Includes the latest information on choosing the best equipment, building test equipment and accessories, setting up a service bench, the practical technician's tool kit, and more.
Order # 61083 ..... $18.95

Understanding & Servicing CD Players
by Ken Clements
Written with service technicians and engineers in mind, this book is a guide to the principles involved in repairing and adjusting CD players. The problem-solving approach and numerous examples make it a helpful companion to the service manual.
Order # 67077 ..... $32.95

Servicing Audio & Hi-Fi Equipment Second Edition
by Nick Beer
As a benchside companion and guide, this book has no equal. Its purpose is to speed up the process of diagnosis, repair and testing of all classes of home audio equipment.
Order # 67076 ..... $32.95

Computer Monitor Troubleshooting & Repair
by Joe Desposito & Kevin Garabedian
This book makes it easy for anyone to fully repair monitors. There are chapters on tools and test equipment, monitor types, special procedures, troubleshooting, and case studies.
Order # 61100 ..... $29.95

Complete VCR Troubleshooting & Repair
by Joe Desposito & Kevin Garabedian
Complete VCR Troubleshooting & Repair contains troubleshooting procedures from external parts to gears, springs, pulleys, and belts. This book shows how to troubleshoot tuner/demodulator circuits, audio and video circuits, and many more.
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Sencore 3080 like new, $1500.00. All leads and probes. B&K model 415 sweep marker generator, like new, used twice, $150.00. Heathkit post marker sweep generator, factory built, model IG 57A, $75.00. *Contact: George, 281-470-9288.*

Sams Photofacts. B&K model 1077B TV analyst, original box and manuals, $200.00. B&K solid state sweep/marker generator, model VA48, original box and manuals, $400.00. Sencore ac Powerite, model PR57, original box and manuals, $400.00. *Contact: Wallace W. Huffman, 2579E 55ON Warsaw, IN 46580-7183, 219-453-4811.*

Color bar generator 246. Sams Photofacts 1-1079. *Contact: Ann Bichanich, 15 1/2 Lake Street, Chisholm, MN 55719.*

Sencore VA48 owners manuals and information available for $35.00. VA63 instruction booklet, $20.00. Plus shipping. *Contact: Maurer TV Sales and Service, 29 S. 4th Street, Lebanon, PA 17042, 717-272-2481.*

Tektronix dual trace oscilloscope model 453, 50MHz with manuals and probes. Excellent condition, $425.00 plus shipping. Sams Photofacts sets 1095 to 1366, $2.00 each or for all 84 sets, $100.00 plus shipping. TV and electronic repair and data books. All 13 for $35.00 plus shipping. Send SASE for complete list. *Contact: 412-483-3072.*

Rider Radio Trouble Shooter Manuals, volumes 2 to 19, 17 manuals - 1933 to 1949. *Contact: 914-434-6232.*

Sencore model SC61 waveform analyzer/ oscilloscope 60MHz to 100MHz, TV video analyzer, model TVA92; video analyzer, model VA62, VC63 VCR test accessory, NT64 NTSC pattern generator; variable isolation transformer/safety analyzer model PR57. Goldstar oscilloscope, model OS_9020A, 20MHz. Have all manuals, calibration records and test leads. Sams Photofact along with file cabinet, big screen Sam . *Contact: Jean 409-736-0082.*

WANTED

Electronic Technician magazines from January 1952 to December 1958. *Contact: Paul Williams, 2364 Beaver Valley Pike, New Providence, PA 17560-9622, 717-786-3803.*

Service information on Fisher Price Pixel Vision 2000 camcorder. *Contact: John Phipps, 1412 Navaho Trail, Saint Charles, MO 63304-7325.*

AM/FM generator, distortion meter, variable ac supply (0V to 140V, 7.5A) laser power meter. Send information by fax. *Contact: 714-951-4703 (fax).*

Sencore TF-46 Super Cricket. Heathkit GR-2001 horizontal output board, remote control complete chassis, and all parts. Send list of parts and price. *Contact: C&J Electronics, 5389 Harvest Court, Bay City, MI 48706.*

Emerson color model TS4451B, need yoke only. Yoke mounted on CRT A51EBD10X - CRT ok. No longer available from Emerson or any supplier. *Contact: Bill Risko, BRS Electronics, 1329 Twining Road, Drecher, PA 19025, 215-659-2349.*

Sharp 27G-S60 TV Chassis, chassis number 5N-51 working or not. Board must be repairable. *Contact: Harold V. James, 5903 W. Bogart Road, Castalia, OH 44824, 419-684-7622.*

Tube technical manual. Version printed in or supplemented in the mid to late sixties, with all the "modern audio typical tubes," such as KT88, 811, 807, 6550, 300B, 5881, etc. My old Sylvania technical manual doesn't have all the supplements/pages. *Contact: Tome Jones, N5124 Highway Y, Jefferson, WI 53549, 920-699-3862 (phone/fax).*

MITS calculator as featured in the November 1971 issue of "Popular Electronics" magazine. Will settle for kit or assembly manual. Willing to pay decent finder's fee. *Contact: Donald Dupre, 401-737-7118, 401-886-3910, e-mail dgb@cherry-semi.com.*

Schematic for Grundig model 4670 tabletop radio. Will pay for copy and shipping. *Contact: Steve Zweifach, 9018 Greylock Street, Alexandria, VA 22308, 703-780-6708, e-mail: szweifac@apc1.com.*

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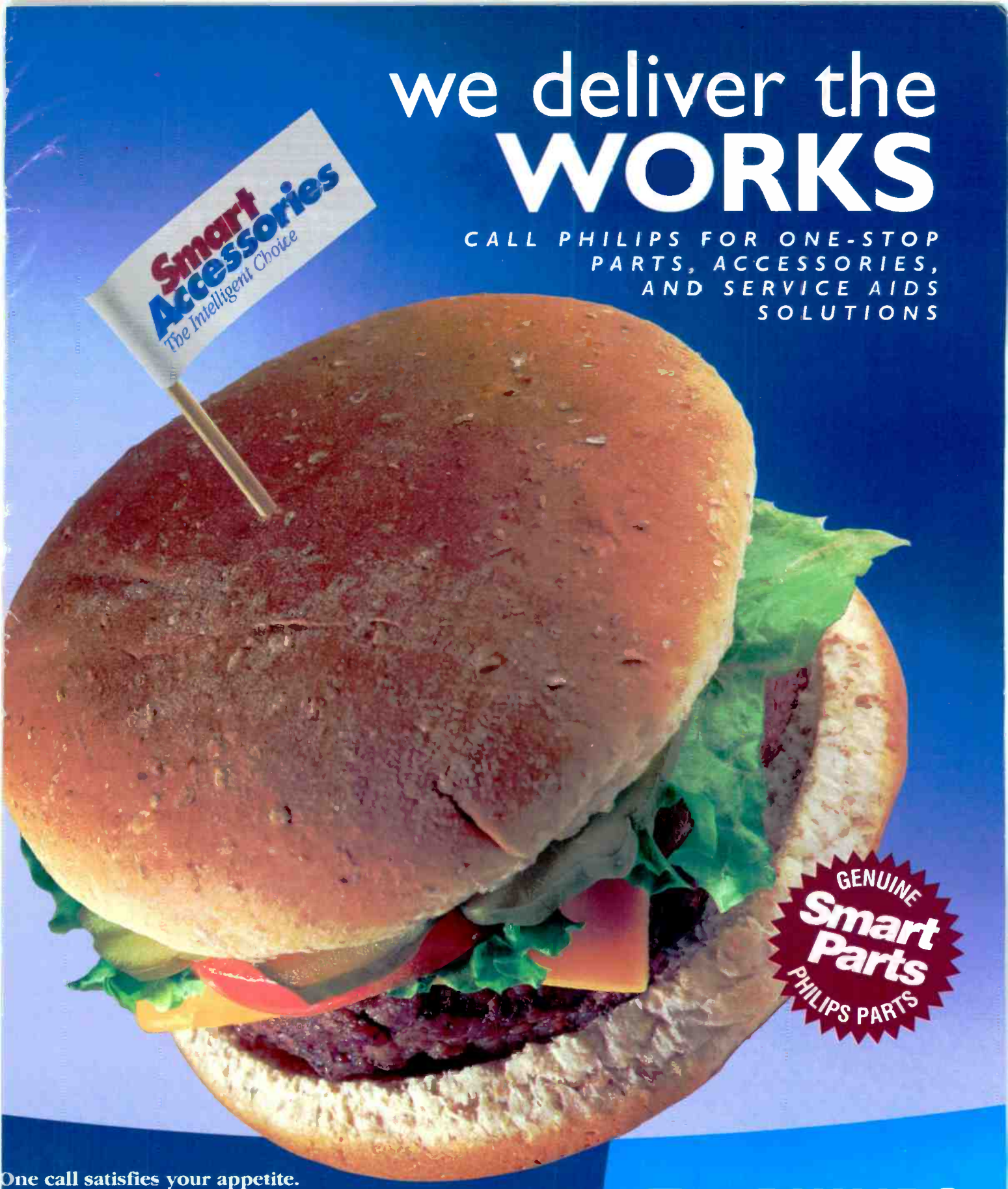

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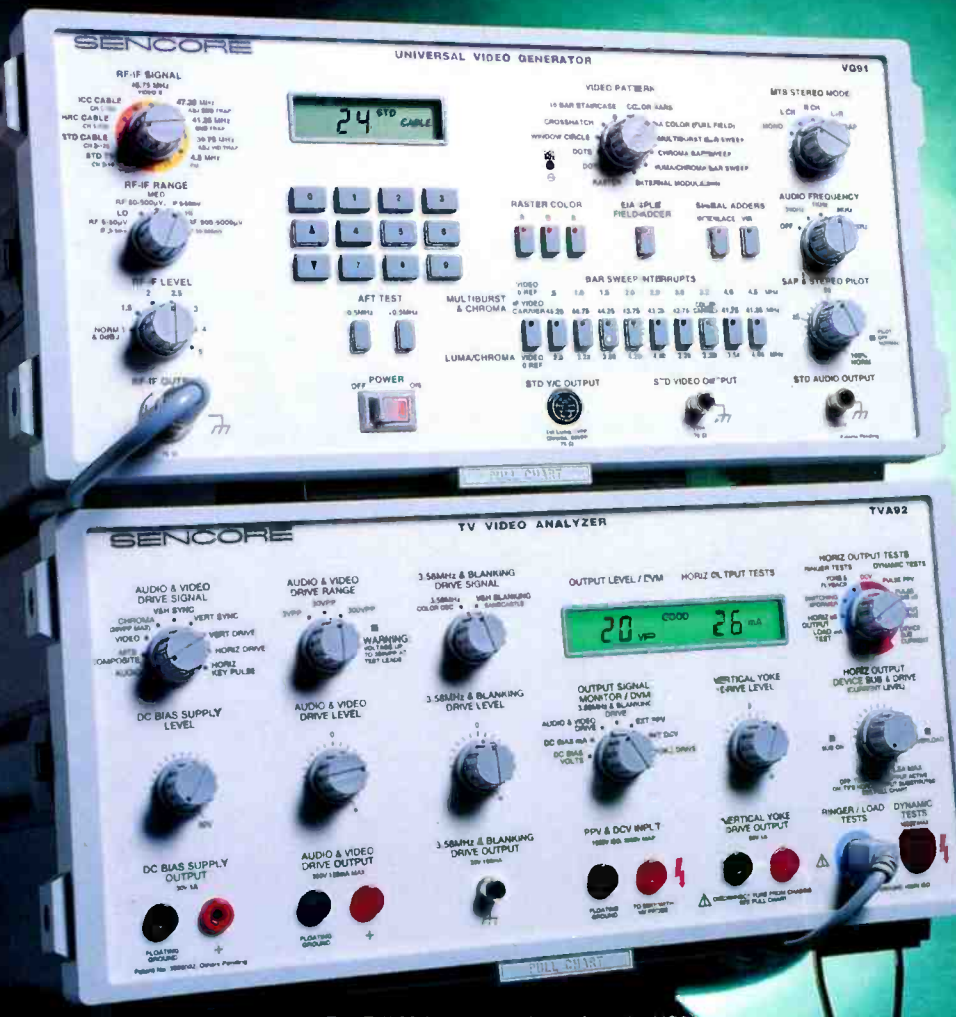

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