THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS

ELECTRONIC™ Servicing & Technology

January 2001

PROFAX 10 YEAR DIRECTORY — 2000 ARTICLE INDEX

REPLACEMENT PARTS/SERVICING SOURCEGUIDE

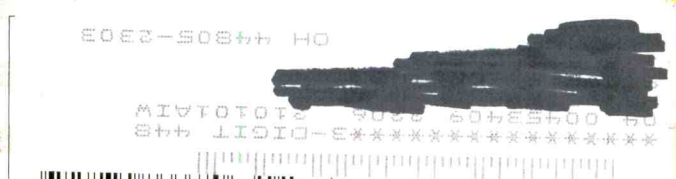
50th ANNIVERSARY FEATURE:

ELECTRONIC SERVICING & TECHNOLOGY
50 YEARS of Service
ES&T

A History of Electronic Projection Display Technology

ZWORKIN'S 1929 KINESCOPE

- Understanding and Servicing Playstations
- Consumer Electronics Show
- NASC Preview
- DVD Servicing
- Materials Handling



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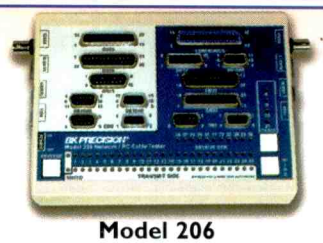

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- AM and FM modulation
- Burst operation
- External frequency counter to 30MHz
- 5 digit LED display

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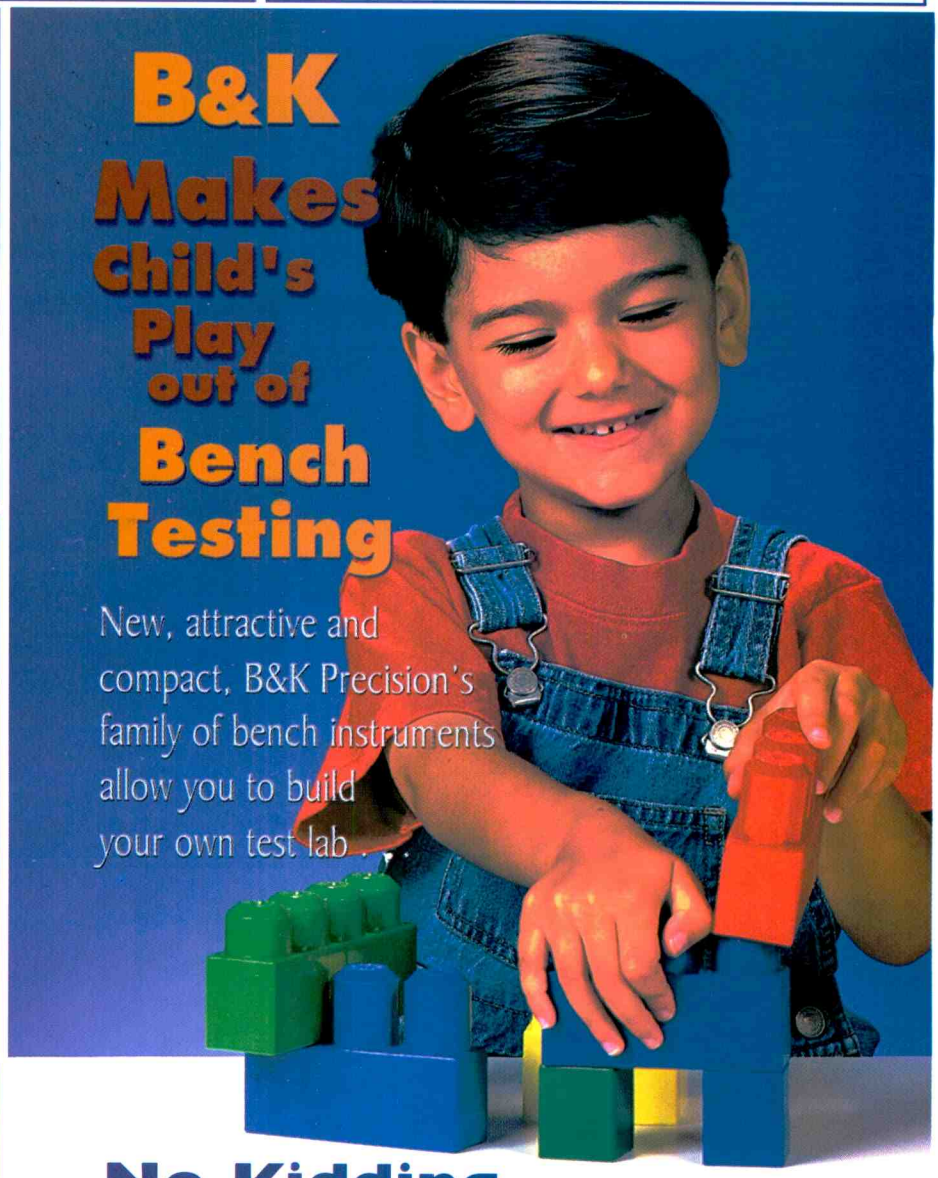

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THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS
ELECTRONIC Servicing & Technology

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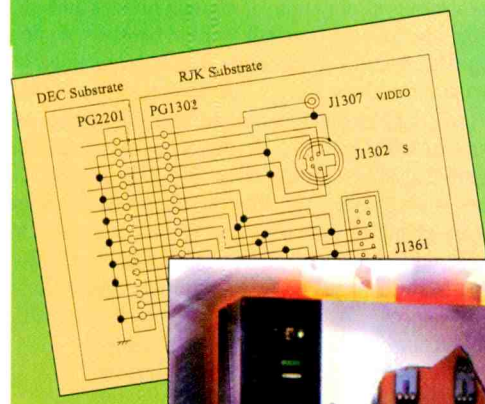

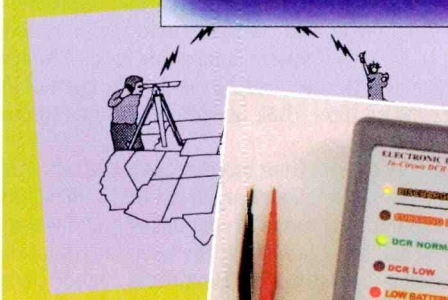

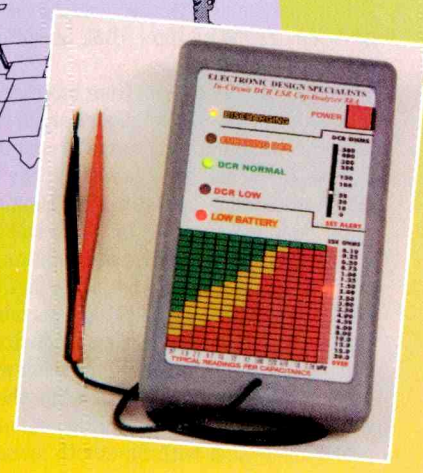

DEPARTMENTS

Editorial

by Nils Conrad Persson

DO YOU KNOW BLUETOOTH?

Do you know Bluetooth? If not, let me introduce him. Harald Bluetooth was a Danish King of the 10th century. Why he was called Bluetooth, I don't know. His claim to fame was that he united kingdoms in Denmark and Norway.

What does that have to do with ES&T, and electronics servicing? Well, nothing directly. However, several years ago companies who were involved in wireless communications, cell phones and such, were working on a technology that would unite wireless communications and computing and needed a name for that technology. My suspicion is that because northern Europe has been a leader in the adoption of wireless (cellular) technology, that someone from that part of the world came up with the name, dredging back through local history to find a name that implied unification. Hence Bluetooth.

So what is Bluetooth? And why should consumer electronics technicians care about it? Here's a quote from a document at the Motorola Bluetooth website at www.mot.com/bluetooth: "Bluetooth in its most basic form is cable replacement. Where cables now connect many devices, a wireless Bluetooth connection will provide low-cost wireless communications and networking between PCs, mobile phones, and other devices. This will enable untethered, wireless connectivity to the Internet and other devices, anytime, anywhere. Bluetooth is based on a global radio-frequency (RF) standard, which operates on the 2.4GHz ISM band, providing license-free operation in the United States, Most of Europe and Japan.

"The fact that companies numbering in the thousands...have joined a Bluetooth special interest group (SIG), implies that this will soon be a major technology."

The fact that companies numbering in the thousands, from cell phone manufacturers to computer manufacturers, and manufacturers of IC chips that will provide the connectivity have joined a Bluetooth special interest group (SIG), implies that this will soon be a major technology. We thought that consumer electronics technicians should be aware of it. Nine well-known companies in the Bluetooth SIG constitute a "Promoter Group" leading the development of the technology: 3Com, Ericsson, Intel, IBM, Lucent, Microsoft, Motorola, Nokia and Toshiba.

Bluetooth has evolved from basic cellular digital radio designs implemented in mobile phones since the early 1980s. It will enable users to connect a wide range of computing and telecommunications devices easily and quickly without the need for cables. It will expand communications capabilities for computers, mobile phones and other mobile devices in the office and outside the office.

Here's a little technical information about Bluetooth. First of all, communications should be pretty fast. The raw data rate of the technology can be as high as 1Mbps, certainly a lot faster than communications with a 56Kbps modem. A device with Bluetooth capability will be able to exchange information within about a 30-foot radius. As to cost, Motorola says that when the adoption of the technology is widespread, and manufacturing economies are attained, the cost of providing devices with Bluetooth technology should not be significant.

And if you're concerned that someone else might gain access to your data via the Bluetooth connection, that's unlikely to happen. The technology was designed to be secure under most normal conditions. To be specific, the Bluetooth specification included the following features: data encryption, low layer support for user authentication, fast frequency hopping (1600 hops per second), output power control that automatically limits power to optimally fit the distance between connected devices.

Again according to Motorola "these features provide both low layer physical radio security that is unlikely to be eavesdropped on as well as mechanisms to support higher layers of security such as passwords and PIN's. Like all communication technologies, there is always some level of risk of exposure to unintended parties, but Bluetooth wireless technology was designed to make that very unlikely and difficult to do.

The things that Bluetooth will do for people are truly amazing. For example, users of the technology will have instant, automatic, access to business and personal data. All of the Bluetooth enabled devices a person owns will be able to wirelessly synchronize with each other without any intervention by the user. The user of a Bluetooth device will have access to e-mail and the internet from anywhere. A person with one of these units will be able to network with airlines, hotels, theaters, retail stores and restaurants for automatic check in, meal selection, purchases and electronic payment.

The Motorola web site mentioned earlier includes several pages of slides that show some of the things that will be possible. For example, one slide has this scenario: "While in a meeting, you access your PDA (personal digital assistant) to send your presentation to the electronic whiteboard. You record meeting minutes on your PDA and wirelessly transfer these minutes to the attendees before they leave the meeting."

Or how about this picture: "You arrive at the airport. A long line is formed for ticketing and seat assignment. You avoid the line, using your PDA to present an electronic ticket, and automatically select your seat. The airline's on-line system checks identification via the "ID-tag" feature built into your PDA and confirms your reserved seat."

The slide set includes a number of other situations in which this technology can make the lives of people easier. Continuing on with the way it can help on a trip, the presentation mentions simplification of the process of renting a car, and checking into a hotel.

Most likely you've seen this commercial: a guy, presumably in Italy, is talking on his cellular phone, he eyes a soft-drink machine. He's thirsty. Reaches in his pocket. No change. He sees a lot of coins in a fountain, reaches in. A nun standing by gives him a disapproving look. He looks guilty. Then a young woman comes by, stands in front of the soft-drink machine, punches a few numbers into her PDA (or cell phone) and out pops a can of soda. She takes a big gulp. No doubt this is an application of Bluetooth. Pretty slick.

While Bluetooth will make life easier much of the time, can't you see it leading to some spectacular messes? What happens if you're in that meeting ready to transfer that presentation to the electronic whiteboard and your batteries give out, or some other malfunction occurs to your PDA? And what will happen if you lose your PDA and someone picks it up? If you've never had a password on your computer at work or at home, you had better be sure your Bluetooth-enabled PDA is password protected. And don't forget the password.

This technology is so new that at the moment we're not sure what the implications might be for consumer electronics service. But we felt that this is a technology that every technician ought to at least be aware of. As the Bluetooth devices proliferate, and the mist begins to clear, we'll provide continuing coverage of this fascinating technology.

Conrad Persson

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

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News

FCC Makes Spectrum Available for New Fixed Satellite Services at Ku-band; Seeks Comment on Licensing New Fixed Service at 12 GHz

(This is an unofficial announcement of Commission action. Release of the full text of a Commission order constitutes official action.)

The Commission has adopted a First Report and Order (First R&O) to permit non-geostationary satellite orbit (NGSO) fixed-satellite service (FSS) providers to operate in various segments of the Ku-band, and adopted rules and policies to govern these operations. NGSO FSS can provide a variety of new services to the public, such as high-speed Internet access, plus other types of high-speed data, video and telephony services. Because of its ability to serve large portions of the earth's surface, NGSO FSS can bring advanced services to rural areas. The Commission also adopted technical criteria so that NGSO FSS operations can share spectrum with incumbent services on a co-primary basis without causing unacceptable interference to them and without unduly constraining future growth of incumbent services or NGSO FSS system flexibility. The Commission also adopted a Further Notice of Proposed Rulemaking (Further NPRM) seeking comment on technical and service rules for licensing the Multichannel Video Distribution and Data Service (MVDDS). MVDDS could be used to deliver a wide array of video programming, including local television, and data services in both urban and rural areas.

The Commission's action to provide spectrum for NGSO FSS operations was taken in response to a petition for rulemaking filed by SkyBridge L.L.C. (SkyBridge). The Commission's decisions in the First R&O were promoted by actions taken at the 1997 World Radiocommunication Conference (WRC-97) which permitted NGSO FSS operations in various segments of the Ku-band and the 2000 World Radiocommunication Conference (WRC-2000) which reached consensus on technical sharing criteria between NGSO FSS and incumbent fixed satellite and fixed terrestrial operations.

In the First R&O, the Commission also concluded that a new fixed terrestrial service, MVDDS, can operate in the 12.2-12.7 GHz band under the existing fixed service allocation, i.e., on a non-harmful interference basis to incumbent Broadcasting Satellite Service (BSS), and on a co-primary basis to the new NGSO FSS. The Commission determined that it could establish technical criteria for MVDDS that would not impair the provision of BSS.

In the Further NPRM, the Commission proposes to authorize MVDDS in the 12.2-12.7 GHz band. The Commission seeks comment on various technical and service issues concerning authorizing MVDDS in the band, including the issues described below.

Technical sharing criteria between the MVDDS and BSS and between the MVDDS and NGSO FSS.

FCC Announces First 255 Applicants Eligible for Low Power FM Radio Stations

(This is an unofficial announcement of Commission action. Release of the full text of a Commission order constitutes official action.)

The FCC announced on December 21 that 255 noncommercial educational applicants in 20 states are eligible for new low power FM (LPFM) licenses.

Applicants could begin receiving construction permits for their new LPFM stations after 30 days. Additional eligible applicants from these twenty states, whose applications conflict with other applications filed in the same geographic area, will be announced at a later date. The FCC said that, pursuant to provisions of the Commerce, Justice State Appropriations Bill passed last week, applicants are only eligible for LPFM licenses if the stations proposed in their applications fully protect full service FM and FM translator stations authorized on third-adjacent channels. In addition, pursuant to the bill, eligible applicants have not, as certified in their applications, engaged in the unlicensed operation of any broadcast station.

Low power FM radio stations will have power levels from 50W to 100W covering a radius of about 2 Ω to 3 miles. Licensees must be non-profit organizations operating on a non-commercial basis and serving their local communities.

The 255 eligible applicants announced today filed their applications in the first two of five filing windows. These first two windows, open to ten states each, encompassed Alaska, California, Connecticut, the District of Columbia, Georgia, Illinois, Indiana, Kansas, Louisiana, Maine, Mariana Islands, Maryland, Michigan, Minnesota, Nevada, New Hampshire, Puerto Rico, Rhode Island and Utah, Virginia and Wyoming. Last week, the FCC announced that a third filing window for LPFM licenses will be opened from January 16 to 22, 2001 for applicants from American Samoa, Colorado, Delaware, Hawaii, Idaho, Missouri, New York, Ohio, South Carolina, South Dakota, and Wisconsin.

Video Sales Strong in October

According to the Consumer Electronics Association (CEA), video sales to dealers in October were strong, moving up 10% to 7.9 million units in the month, and remaining 12% ahead of 1999, with 54.4 million units shipped so far this year.

October is typically a good month for video sales and 1999 sales were particularly strong. Consequently, despite outstanding unit sales of analog direct view and projection televisions, both categories posted losses over 1999 figures. Despite the losses in the two TV categories, both categories are up 3% in the year to date with direct view sets at 19.2 million and projection sets at 978 thousand. TV/VCR combinations grew 5% in October, while the year to date shows this category topping 4 million-up 11%. VCR shipments exceeded 2.9 million in the month alone showing a 6% increase there, and a 4% advantage in the year to date with 19 million units sold so far this year.

Camcorder sales were terrific in October, moving up 21%, and putting the ten-month sum at 4.8 million units, which is 22% higher than last year. At this point, digital camcorders make up more than a quarter of the total camcorder pie.

DVD sales soared in October with shipments well over 1.2 million units. So far this year, 6.3 million units have been shipped-more than double the number this time last year.

Online Shopping

The results of a new survey by the market research department of the Consumer Electronics Association (CEA) identify five distinct categories of online shoppers, and also finds that, regardless of category, convenience and price are the major factors that drive consumers to shop online. When compared to the results of a similar survey conducted last year, the importance of price as a driving factor for online shoppers has increased, while the importance of convenience has decreased, the "Online Shopping: Impact on Consumer Technologies" survey found. The five categories of shoppers were identified as: Convenience Lovers (52 percent of online shoppers), Focused Shoppers (16 percent), Money Savers (15 percent), Selection Seekers (9 percent) and Smarter Shoppers (6 percent).

Convenience Lovers are by far the largest segment of online shoppers, comprising more than half of the total. The main characteristic of this group is the value they place on the time saved by shopping online.

Focused Shoppers are the second largest group of online shoppers. Their defining characteristic is an appreciation of the ability to find exactly what they want when shopping online.

Money Savers believe that by shopping on the Internet, they will be able to find better prices. The Money Saver group is made up of more men and Generation-X shoppers than other segments.

Selection Seekers are drawn to online shopping because of the wide variety of products and services available. The Selection Seekers group is generally comprised of lower income consumers.

For Smarter Shoppers, information is the key. Shopping online appeals to this group because the Internet provides valuable information and research opportunities before making a purchase. They are the group most likely to use the Internet solely for research, opting to utilize a traditional brick-and-mortar retailer to make an actual purchase.

We have seen an increase in the importance of price in driving e-commerce transactions," said Todd Thibodeaux, CEA vice president of market research. "However, we cannot overlook the fact that a majority of those surveyed believe that the Internet has made them a more educated shopper. It is the opportunity for research and variety afforded by the Internet that will further extend its role as a retail channel. More than half of the respondents indicated that they expect their level of online shopping to increase in the next year."

An opportunity for expanding the amount of shopping done online lies in wireless products. Thirty-eight percent of online shoppers expressed an interest in using a wireless device (such as a Palm device or wireless phone) to shop and/or buy online. And, despite the considerable amount of publicity that has been given to consumers' fears and the potential risks of buying online, most online shoppers (78 percent) are confident that online retailers have not compromised the security of their personal information.

The "Online Shopping II: Impacts on Consumer Technologies" survey was designed and formulated by CEA Market Research and fielded during October 2000 to a representative sample of 2,718 online households.

Audio Sales Strong

Factory sales of audio products continued its upward trend this year with strong sales in September, according to the Consumer Electronics Association (CEA). At the beginning edge of this holiday selling season, total audio product revenues rose eight percent from the same month last year to $916 million, with all the audio categories reporting growth. For the first three quarters of the year, total revenues are up 11 percent to $6.2 billion compared to the same period in 1999, leading the industry into its busiest selling season.

Aftermarket autosound put the pedal to the metal in September, with revenues up 12 percent. In-dash CD players and power amplifiers were the driving force behind this growth with the former pulling in $116 million in the month, an increase of 28 percent from September of last year. Sales dollars from the power amplifier category rose 24 percent to $29 million. The year-to-date aftermarket autosound revenues are up three percent from the first nine months of last year to $1.7 billion.

Hot summertime sales of portable audio products continued to burn in September. Sales increased five percent to an impressive $293 million, with year-to-date revenues up 19 percent to $1.9 billion. Much of this growth is due to sales of the popular and convenient headset CD players, which are up 30 percent for the year thus far, with revenues of $609 million. Portable devices that play compressed digital audio files (MP3 players) have reached revenues of $78 million in the first three quarters of the year, with 414,000 units sold to dealers.

In the home audio category, audio systems sales were up 11 percent in September to $243 million, bringing the year-to-date dollar figure up nine percent from last year at this time to $1.5 billion. The sales of separate components rose four percent in the month to $157 million, sounding out a year-to-date number that is a substantial 12 percent ahead of 1999 at $1.1 billion.

NARDA Officers Elected

Lombard, IL.- Robert Cremer, president Aronson Furniture, Appliances and Electronics, Chicago, IL, was reelected to a third term as president of the North American Retail Dealers Association (NARDA) during a Board of Directors meeting held on October 13-16.

Other officers elected were first vice-president Mike Fischer, Nielsen Tire Co,, Inc.Spencer, IA; second vice-president Randy Whitehead, ServiceWest, Salt Lake City, UT; secretary Bill Benson, Benson's Appliance, Bloomington, IL and treasurer Sandra Combs, AAA Appliance Co., Little Rock, AR.

Members of the NARDA Board of Directors are elected by a mail vote of the membership and the directors elect the officers. Cremer was also reelected to a new three-year term on the Board by a mail vote in September.

Other directors elected by the mail vote were Garey Alimia, A-1 Appliance and Electronics, New Orleans, LA; Michael Fischer, Nielsens', Spencer, IA; and Barry Gunn, Edmonds Appliance Center, Burnaby, BC, Canada.

Newly elected were Oliver Dyer, Oliver Dyer's Appliance, Fort Worth, TX. They join seven other carry over directors. ■

From Cathode Rays to Digital Micromirrors:
A History of Electronic Projection Display Technology

Adapted, with the permission of Texas Instruments, from an article by Dr. Larry J. Hornbeck which originally appeared in the Texas Instruments Technical Journal of July-September 1998. Dr. Hornbeck was the inventor of the Digital Micromirror Device™ optical switch which is at the heart of Digital Light Processing(tm) technology.

Historically, the central concern for consumer electronics service technicians has been television. These products constitute the majority of the business of most consumer electronics service centers. The concept of the television has remained constant over the years: it's a system that transmits video and audio program material from a broadcast studio of some description, over terrestrial radio waves, coaxial cable, or satellite link, or some combination of those, to viewers' homes.

But while the basic concept of television has remained constant, much has changed in the details. Television was originally broadcast in strictly monochrome. Today lifelike color is the norm. The sound associated with television programming was for years very poor, and monophonic. Today's sets provide the viewer with high-fidelity sound in all its stereophonic glory.

But perhaps most striking about the changes that have taken place in the television experience has been the improvement of the picture tube, and the introduction of a greater variety of display technology. Early television sets were based on the cathode ray tube display. Most sets today still use CRTs. Even among those sets that use CRTs, however, many displays are large-screen three-tube projection units.

In a number of sets, however, the manufacturers have introduced liquid crystal display (LCD) technology. More recently, some manufacturers have introduced plasma display technology. Most people are probably not even aware of some of the technologies used in video projection that require high brightness and large images as used in a theater setting.

Recently, a new technology has been introduced that relies on controllable mirrors to project a bright, crisp image. The following article is the first in a series of articles that will provide technicians with a history of electronic projection display technology, and will suggest a few display possibilities for the future.

2001 is ES&T magazines' 50th year of service to the Consumer Electronics Servicing Professional. This is the first of a series of retrospective articles ES&T will feature on technology, business and servicing professional developments over these 50 years. Your comments and observations are welcome.

Moving Images Early Experiments

Mankind's early fascination with the viewing of life-like moving images led to the development of a variety of optical gadgets in the 19th century. One of the earliest was the phenakistoscope, a set of phased drawings mounted on a twirling disk (circa 1832).

With the invention of the positive photographic process in 1839 by Daguerre, the drawings were replaced with a succession of phased photographs. These optical toys were based on the understanding that a closely spaced series of images could be used to portray a sense of time and motion. This entertainment curiosity was intriguing enough to become a popular and rather sizeable niche business, although the subject or content of the flipping images was of little creative value. Revenues were limited by the fact that only one person could view the images at a time by peering into an eyehole.

It was not until the invention of the motion-picture camera, or "Kinet-ograph," in 1887 by Thomas Alva Edison, (or his assistant Dickson, as some would argue) that a continuous set of photographic images could be generated. An adjunct to the Kinetograph was a single-viewer apparatus called the "Kinetoscope."

Projection of Moving Images

During an exhibition in Paris, a Kinetoscope demonstration inspired the Lumiere brothers, Auguste and Louis, to invent the first commercially viable film projector, the "cinematographe."

The first public screening using this new technology was in Paris on December 28, 1895. This event is generally regarded as the birth of the "cinema."

Film projection technology enabled a new business model based on a large

(paying) audience who could simultaneously view the same content, thereby allowing higher revenue potential than the early single- viewer novelties. This fueled the creative passions of the early movie moguls, who founded the movie entertainment business, using photographic film as their capture and display medium. Beyond the increased profit potential, projection technology enabled a large audience to view a motion picture together as a "shared experience," enhancing the enjoyment in much the same way as when people experience a symphony, play, sports or other group entertainment.

Film-based projection technology has its limitations, however, including its inability to provide live content to the audience, the expense of the film prints (including transportation costs) and their inexorable deterioration with repeated screenings. Electronic projection display technology provides an answer to these shortcomings, but the stimulus for its development had to await the age of commercial television.

Electronic displays: The CRT

The grandfather of electronic displays, the CRT or cathode-ray tube, was invented more than 100 years ago. In spite of its age, the CRT is still the dominant display technology today. In the 1940s motion picture studios and the youthful television industry sought to bring live television programming to the theater by using electronic projection technology, but the CRT lacked the necessary brightness. The so-called "light-valve" technologies were developed primarily for sports-driven display venues. In other, less demanding applications, the CRT remained dominant because light-valve technologies were too expensive, bulky and heavy.

But recently, new light-valve technologies are replacing both the CRT and the older first- and second-generation light valves in high-brightness display venues. And because these new light-valve technologies can be designed into more compact products, their availability has opened up new market opportunities where low weight and portability are required. Perhaps soon, the CRT will be replaced in high-end consumer projection display products for the home as well.

The projection CRT's longevity can be attributed to several factors. First, although the projection CRT is considered a "mature" technology, it has been steadily improved over a long period and incremental improvements are even being made today. And second, until recently light-valve technologies were unable to take full advantage of the economies and stability offered by the digital electronics revolution. This digital age has brought us such advanced services and products as the Internet, digital satellite TV, digital cell phones, CD audio, the digital video disc (DVD) and others.

LCDs

Another popular display technology today, the liquid crystal display (LCD) has been partially successful in replacing the CRT in certain projection display venues. But LCDs have traditionally been fabricated on glass and more recently on quartz. Integration with single-crystal silicon, the stuff that has fueled the semiconductor electronics industry revolution, has been difficult and only recently have such LCD products emerged. These displays, as well as the CRT, are still ultimately based on analog technology at the modulated light level and subject to analog limitations.

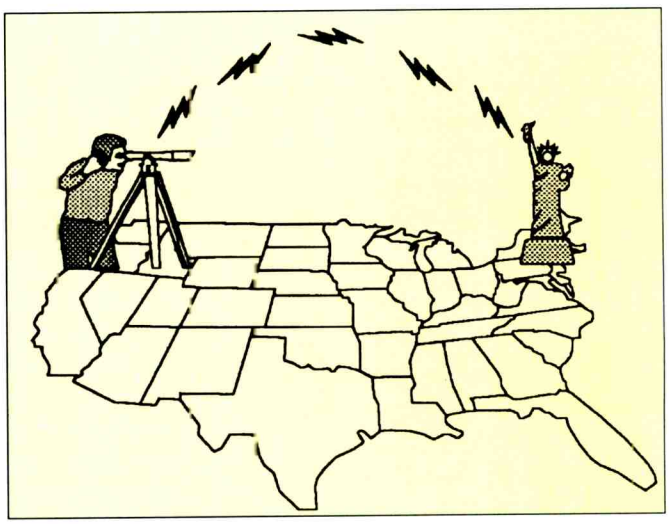

Figure 1. Electric telescope, circa 1886.

The Digital Micromirror Device (DMD)

What has been lacking until recently is a projection technology without any analog links in the electronic chain between source material and viewer: a true all-digital display. This technology would be monolithically integrated on a digital chip. It would present a bright, flicker-free, seamless image to the eye, with the characteristics that we have come to expect from digital technology, namely high image fidelity and stability. The display would exhibit no lag or smearing of the image from one digital frame to the next.

In fact, such a technology has recently been commercialized. Silicon-based digital technology combined with new materials and processes allows, for the first time, the monolithic integration of an efficient digital light switch with a digital address chip to produce a fast digital projection display. This technology, invented and developed at Texas Instruments, is called the Digital Micromirror Device (DMD). Digital Light Processing (DLP) projection systems based on the DMD have outstanding image fidelity combined with inherent digital stability and noise immunity. In 1998, only two and one-half years after product introduction, DLP projection systems have achieved acclaim from customers and industry experts alike, with more than 100,000 systems sold to date.

The story of how the display industry evolved from cathode rays to digital micromirrors is both illuminating and complex. In what follows, we will simplify for the sake of clarity and brevity.

Distant Electric Vision and the CRT

Our dream to see instantaneously beyond the horizon with electric technology had its origins in two 19th century

inventions, the telegraph and the telephone. Samuel F. B. Morse, using his telegraph, demonstrated the first successful communication at a distance with electricity in 1837. The telegraphic code, consisting of dots and dashes, provided a crude means for communicating with words. Soon several inventors came up with schemes for using the telegraph to transmit copies of writing and designs.

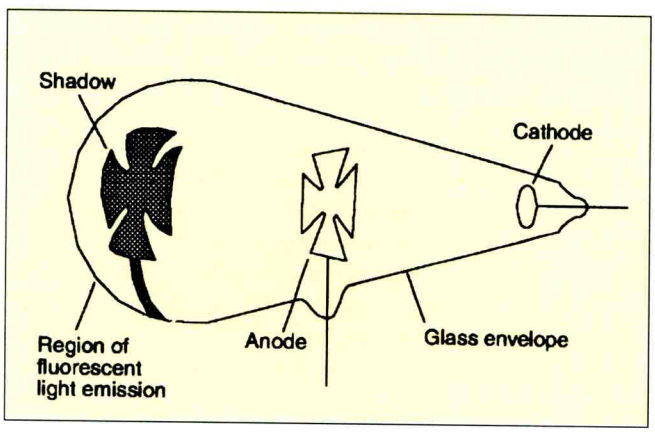

Figure 2. Crook's tube.

These ideas were based on synchronized rotating cylinders at the transmitting and receiving end and metal styluses that traced a spiral path across the cylinders. Alexander Graham Bell invented the "speaking telegraph" or telephone in 1876. The intimacy of spoken communication provided a powerful stimulus to devise methods for communicating instantaneously with images as well.

Beginning in the 1870s there were numerous schemes proposed for "seeing" beyond the horizon (Figure 1) and they were given the names "distant electric vision," "electric telescope," "telectroscope," and "telephot." It was not until 1900 that distant electric vision received the name that we recognize today, "television." Constantin Perskyi first used this word in a paper read at the International Electricity Congress held in connection with the 1900 Paris Exhibition. Twenty-eight years later C.P. Scott, editor of the Manchester Guardian, wrote "Television? The word is half Greek and half Latin. No good will come of it."

While inventors were dreaming up schemes for distant electric vision, groundwork was being laid for the invention of the cathode ray tube (CRT), the device that would be the first window for seeing beyond the horizon. From 1858 to 1897 a host of researchers, including Geissler, Crooks, Fleming and Thomson, discovered "cathode rays" and demonstrated their properties. They showed how to produce cathode rays in low-pressure discharge tubes; how to focus, accelerate and deflect them; and finally how to convert these rays into light by slamming them into phosphor and causing the phosphor to emit light. A Crook's tube, shown in Figure 2, demonstrated the fact that the mysterious rays came from the cathode. We now know that cathode rays are actually electrons.

In 1897 Ferdinand Braun took the ideas of his predecessors and constructed a tube that was named after him and became the forerunner of the modern CRT. He devised a way to define the cathode rays into a pencil-like beam by passing the rays through an anode aperture. He covered the end of the tube with a fluorescent material that gave off light when struck by the high-energy electrons. The Braun tube was magnetically deflected in one dimension, and by viewing the tube through a rotating mirror it was first used as an oscillograph to study electrical waveforms.

Vladimir Zworykin, a student of Boris Rosing, was later to develop the first practical CRT for home television use while an employee of Westinghouse Research Laboratories. Zworykin delivered a paper on November 18, 1929, to the Institute of Radio Engineers at Rochester, New York, describing his new "Kinescope" or CRT, shown in Figure 3. It included a means of focusing the light by using an electrostatic "lens."

Albert Abramson writes in the history of television, 1880 to 1941: "The disclosure of the Kinescope changed the history of television. Zworykin's tube was the most important single technical advancement ever made in the history of television." Later, Zworykin was to join the Radio Corporation of America (RCA) where he would introduce a new, all-electronic camera tube called the Iconoscope. The Kinescope, together with the Iconoscope, would enable RCA to demonstrate an improved all-electronic television system in 1933.

Early Electronic Projection Displays

In the United Kingdom the London Television Service began regular commercial television broadcasting in 1936. However, in the United States commercial television was delayed because of an absence of broadcast standards. In 1941 the National Television Standards Committee (NTSC) finally adopted standards for the U.S., and the American television industry was launched. The blossoming of this new industry was hindered as the United States entered World War II. During the war, RCA built a huge CRT manufacturing facility with Navy financing to support the war effort. More than 20 million tubes were manufactured there for military applications.

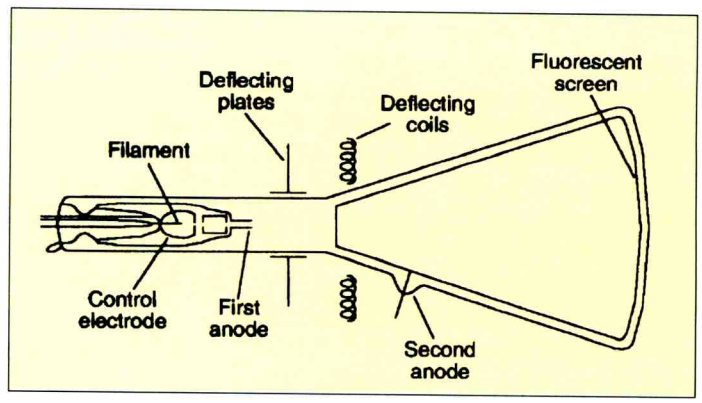

Figure 3. Zworykin's 1929 Kinescope (CRT).

Soon after the war, RCA began to manufacture 10-inch television sets that sold for $375, expensive considering the value of 1945 dollars relative to today. At the beginning of 1949, television was attracting 19 percent of the broadcast audience, and by December more than 41 percent.

The motion picture industry began to feel threatened by the burgeoning television audience. It was true that television receivers in the home had small picture tubes and were expensive. However, there was growing concern in the late 1940s about the growing popularity of television receivers in local bars, where patrons were flocking to see sporting and other live events. If electronic projection displays could be developed for the motion picture theater screen, live television broadcasts of news and sporting events could be displayed in ordinary theaters on large screens for the moviegoer's enjoyment. Live programming could even be mixed with conventional movie presentations. The expectation was that film-based theaters could eventually be replaced by video theaters, provided electronic projection technology could be developed to deliver film-like images. Today, ironically, theaters are still film-based in an era when films are distributed electronically via digital satellite TV and the digital video disc. Perhaps new digital projection technology based on the DMD will finally provide the means to fulfill this expectation after more than 50 years.

Three technologies were developed in the early 1940s for the projection of television images inside a movie theater, namely, the CRT with Schmidt optics, the Eidophor and the Scophony. These technologies were early representations of the three modern-day classes of projection displays, the CRT, "light-valves," and laser projectors.

The CRT Projector

On May 7, 1940, RCA demonstrated its large-screen projection television system based on a CRT and very efficient Schmidt reflective optics. Although the images were only 4.5 x 6 feet, the New York Times declared "Projection 'Gun' Shoots Televiews: The Aim is to Hit a Theater Screen." RCA's Schmidt optics projection system is shown in Figure 4. In this system the CRT faces away from the projection screen. It is driven to maximum brightness and the light is collected by a spherical mirror and projected onto the screen through an aspherical corrector lens.

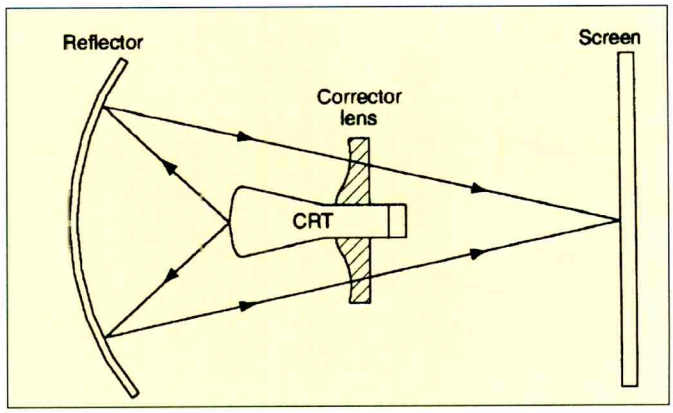

Figure 4. CRT projection system with Schmidt optics.

On May 9, 1941, one year after its initial large-screen demonstration, RCA demonstrated a larger version of its new projector at the New Yorker Theater, where the Soose-Overlin prize fight from Madison Square Garden was displayed live on the big screen. This new system had a 7-inch diameter CRT. The Schmidt projection optics employed a 30-inch mirror and operated at an optical magnification equal to 45x. The projected screen image had a diagonal of 26 feet but only half the brightness of conventional film projectors today, even though the screen had a 5x forward gain.

The Eidophor

Clearly, the CRT projector was not going to be practical for the large screens found in a typical movie theater. Interestingly, Professor Fritz Fischer, head of the Technical Physics Department at the Swiss Federal Institute of Technology in Zurich, had been studying this problem even before the demonstration by RCA in the New Yorker Theater. He published his findings under the title "A Study on the Feasibility of the Cathode Ray Tube with Fluorescence Screen for the Television Projection in Movie Theaters."

The light output of a projection CRT was limited (and still is today) by the capability of the electron gun to maintain focus at high currents and by phosphor saturation. Fischer believed that a new approach to high-brightness projection displays was required. What he proposed was the first spatial light modulator or light-valve technology. In a light-valve technology, the functions of light generation and light control are separated.

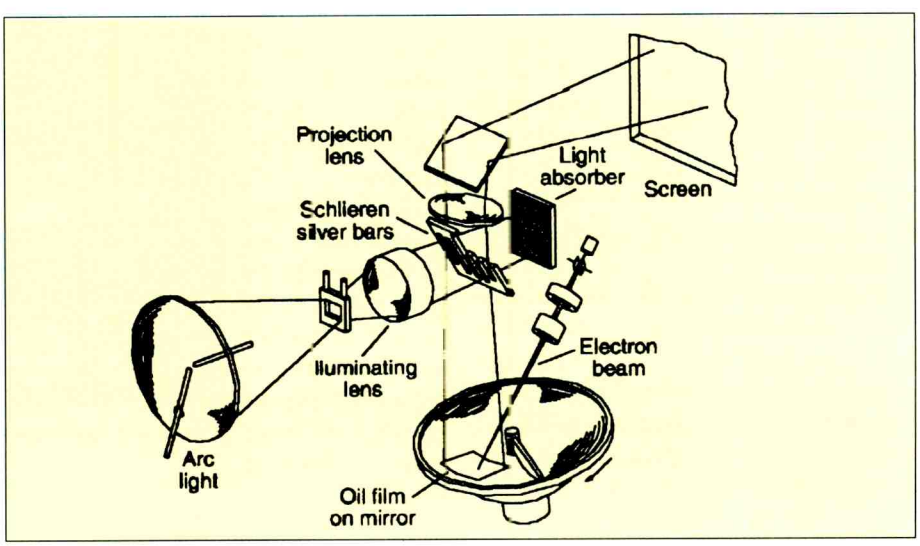

Figure 5. The Eidophor system (third prototype).

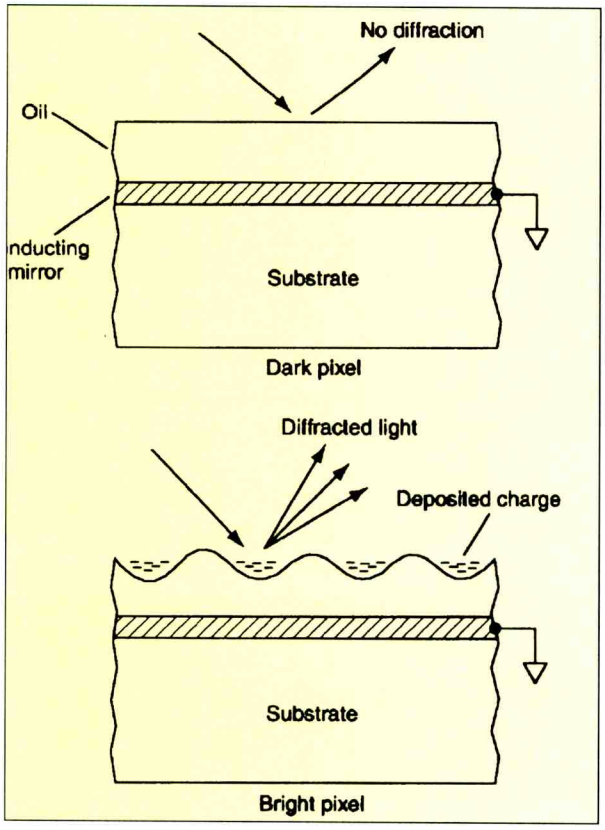

Figure 6 Principle of Eidophor operation.

In November 1939 he applied for a patent for an ingenious light-valve technology based on a thin oil-film control layer. The light valve was later given the name Eidophor or image bearer (in classical Greek, image is "eido" and bearer is "phor"). Figure 5 shows the Eidophor projection system. A thin oil film is spread on the surface of a conducting and reflecting spherical-shaped substrate and addressed by a rastered electron beam. As the e-beam scans the oil surface, it deposits a charge pattern, as shown in Figure 6. The charge pattern is electrostatically attracted to the conducting substrate and causes a deformation pattern in the oil that, in turn, acts as a phase diffraction grating.

Light from an arc lamp is focused onto the oil surface after being reflected from a set of silvered "Schlieren" bars (or light stops). For the first pixel of Figure 6, no charge has been deposited and the oil surface is flat. The light passes through the transparent oil film, is specularly reflected from the spherical substrate, focused back onto the bars and then reflected from the bars into the arc lamp. In this case, no light gets to the projection lens and that pixel appears dark. For the second pixel of Figure 6, a charge pattern has been deposited, which in turn produces a phase grating in the oil. Light is diffracted by the grating and no longer focuses on the Schlieren bars. Some of it passes through the slots and is imaged onto the screen by the projection lens. In this case, the pixel appears bright. Intermediate brightness levels are achieved by controlling the amount of deposited charge between zero and a maximum level.

The oil film is made conductive with its resistivity and thickness carefully controlled so that the charge from one video field decays before charge for the next is written.

Late in 1943 Professor Fischer demonstrated a prototype Eidophor. The first prototype had many shortcomings, and a second version was begun under Fischer's direction until his untimely death in 1947. Work continued and a second prototype was demonstrated in 1948 with much improved results. Gretener A.G. (GRETAG) commercialized this technology in the early 1950s. Color projection was first implemented with time-multiplexed color and later with three separate units, each projecting a primary color image.

The Eidophor has a long and successful history as a very bright electronic projection display technology for auditorium, theater and other large-venue applications. Many units are still in operation around the world today.

An innovative variation of the Eidophor for color projection was invented in 1958 by William E. Glenn at General Electric. Called the Talaria, this oil-film projector uses a single electron gun to write three diffraction gratings, one for each primary color, on a single oil-film surface. This provides a more compact color projection system than the three-gun Eidophor system. Product shipments began in 1968, and like the Eidophor it has achieved a long period of commercial success.

The Scophony Projector

Scophony Ltd. of England began the development of a projection display system that was first demonstrated in July 1936. In some respects, this early projection technology bears resemblance to the modern laser projector.

A laser projector consists of a laser beam whose amplitude is modulated by a video signal using an acousto-optic modulator. The beam is then mechanically scanned in the horizontal and vertical directions to form an image on a projection screen. The Scophony projector employed scanning in the vertical direction and it used a very clever acousto-

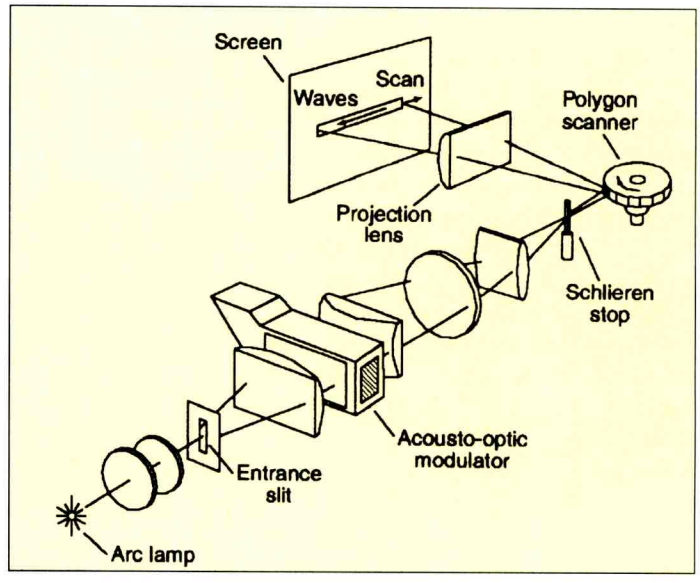

Figure 7 Scophony projection system (vertical scanner not shown.)

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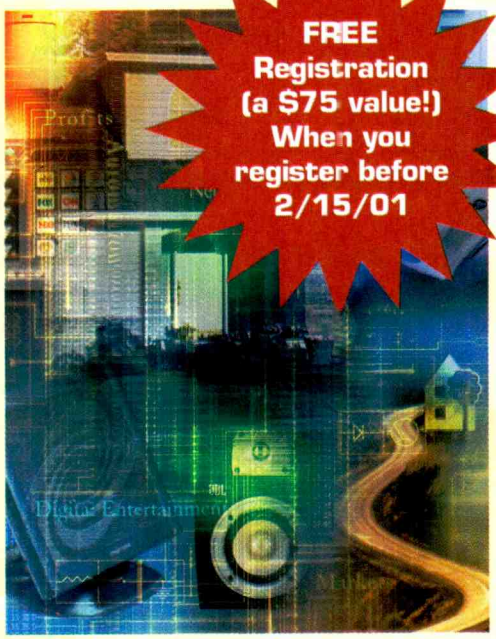

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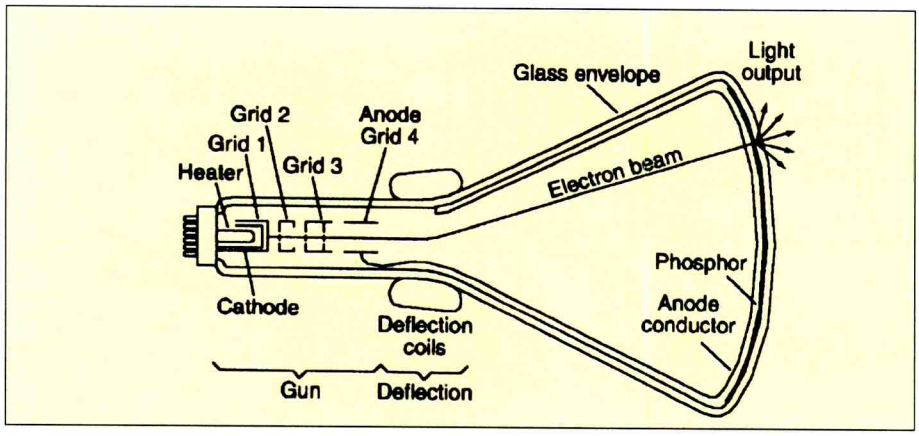

Figure 8 Magnetically deflected CRT.

optic modulator scheme for both the modulation function and the horizontal scanning function.

Figure 7 shows how a single line of video is produced at the screen by the original Scophony projector. Light from the arc lamp passes through an acousto-optic modulator consisting of a glass-sided cell filled with a transparent liquid and fitted with a piezoelectric quartz crystal at one end. The video signal modulates an ultrasonic carrier signal that drives the input to the quartz crystal. The crystal vibrations launch acoustic waves in the liquid whose amplitude depends on that of the video signal. The acoustic waves act to produce a variable amplitude phase diffraction grating.

Using the same principle as the Eidophor, the grating diffracts light around an optical (Schlieren) stop, and an image is produced that moves at the speed of sound in the liquid. A counter-rotating polygon mirror freezes the moving line image so that it appears stationary at the screen. A second rotating polygon mirror scans the line image vertically to produce the complete image of the video frame. By integrating the light from one line of video at a time on the screen, the rather dim carbon arc lamps could be made to produce brighter images than if a single spot had been scanned, as in today's laser projectors.

On January 15, 1941, at its New York City headquarters, Scophony Ltd. demonstrated an improved projector on a 12 x 9-foot rear projection screen. The Scophony projector was never widely adopted. However, Scophony modulation is used today in high- power laser projectors to improve the coupling efficiency and to avoid thermal overload in the acousto-optic modulator.

CRT Projectors: A Story of Continuous Evolution

The CRT has continuously evolved since Vladimir Zworykin's 1929 demonstration of his Kinescope. So-called "electron optics" for focusing the beam on the phosphor is achieved either electrostatically, magnetically, or by using a combination of both techniques. Figure 8 shows a simple magnetically deflected CRT.

Of the three technologies that were available for large-screen projection in the 1940s (CRT, Eidophor, and Scophony), only the CRT had the potential for home applications because of its cost advantages. For high-brightness applications in which cost was a lesser issue, the Eidophor and later improved light valves were the technologies of choice. In the late 1940s development was under way to put the projection CRT in the home. But these systems had low brightness and when larger direct-view CRTs became available, interest declined in the CRT projection approach.

In 1972 the Advent Corporation introduced a three-tube color projection system having a 7-foot screen that dwarfed direct view television screens. This new technology is believed by many to have renewed public interest in projection television. The three tubes (one for each primary color) had internal, reflective Schmidt optics that yielded high light-collection efficiency. A folded optical design enabled the integration of the three tubes, along with a front projection screen, into a single cabinet. A new screen design provided forward gain that directed more light to the viewer.

Soon Advent and others introduced less costly projection systems based on aspherical, refractive plastic optics that were placed in front of each tube. Today the common configuration for both front and rear projection CRT displays is the in-line system with refractive optics, shown in Figure 9. The in-line projection configuration places the two outer tubes at an angle with respect to the screen. This results in both a keystone and a nonlinear scan line distortion that must be corrected electronically. For consumer applications the tube diameter is commonly seven inches, while for commercial projectors and for high-definition applications it is nine inches.

Convergence of three color images on the screen has been a historical problem. In the beginning, registration was accomplished manually by tediously adjusting numerous convergence controls. The problem is exacerbated for high-defini-

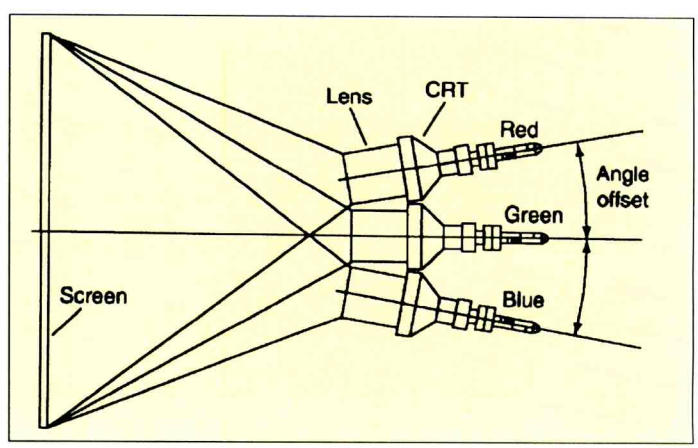

Figure 9 Magnetically deflected CRT.

tion displays. Now automatic convergence is achieved with photosensors and a microcontroller.

A sustained effort by the projection tube manufacturers has been directed at simultaneously increasing brightness, resolution and color saturation while limiting cost, volume, tube weight and, at the same time, preserving phosphor life. This has often been a frustrating endeavor.

The CRT has one fundamental advantage over light-valve technologies: peak brightness. It can be briefly overdriven to produce brightness levels for local highlights that are far in excess (up to 5x) of the large-area brightness. The word used to describe the resulting sensation is "punch." For light valves, the local- and large-area brightness levels are equal, because the light is simply being "valved" to varying levels of brightness.

CRT projection display development has continued on a broad front with constant performance improvements from year to year. Historically, CRT projection technology has dominated the home consumer, projection television market from its beginning.

But will the new light-valve technologies begin to make inroads against the CRT in this market? They will if they can deliver superior performance at comparable cost and with reduced weight and volume. The gradual shift to high-definition displays in the consumer market may make it increasingly difficult for the projection CRT to maintain its market dominance.

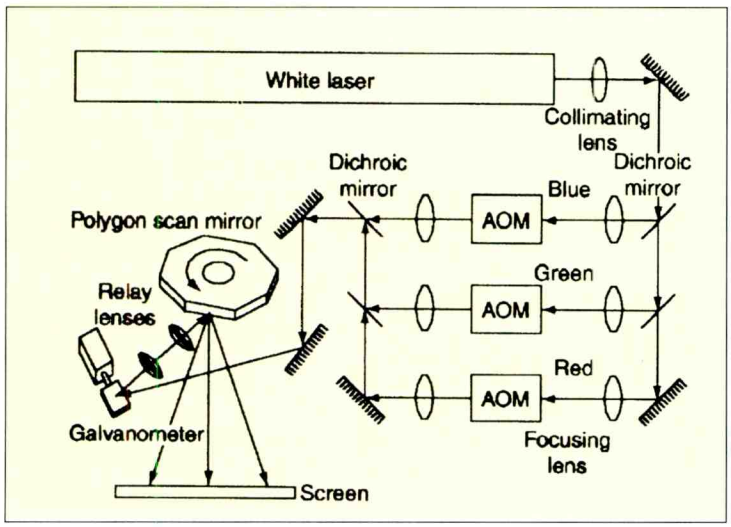

Figure 10 Laser projection display.

Laser Projectors

The laser was first demonstrated in 1960 and was called by many an "invention looking for a job." It has since found applications from manufacturing and range-finding to surgery, laser printing and projection displays. Its advantage for many applications, including that of the laser display, has been its ability to put a large amount of optical power into a very small spot size.

A recent laser projector design is illustrated in Figure 10. It consists of red, green and blue laser beams modulated by a video signal and mechanically scanned in the horizontal and vertical directions to produce an image on a screen.

Light from a krypton-argon white-light laser is separated into its red, green and blue components by dichroic beam splitters. The red, green and blue beams then pass through acousto-optic modulators.

The video signal is decomposed into its components (R, G, B) and each component is input into its corresponding modulator. The amplitude of the video signal modulates a high-frequency carrier that sets up acoustic waves in a crystal. The acoustic wave causes diffraction of the light passing through it proportional to the video signal amplitude. The diffracted light beam is amplitude-modulated with the video waveform and the undiffracted light is blocked from the optics path.

The three modulated light beams are combined by dichroic mirrors into a single beam. This beam is steered to a mechanical scanner that consists of a galvanometer-driven mirror for the vertical or frame-scan direction and a rotating polygon mirror for the horizontal or line-scan direction.

One annoying artifact produced by a laser projector is called "speckle" or scintillation of the image. Because laser light has spatial coherence, wavefronts of the light that are reflected back from the screen can interfere with one another, causing a scintillation effect. Speckle can be reduced by using certain types of screen material, vibrating the screen, or adding a fixed "bias" level of light to the image reflected from the screen. Of course, the latter method reduces contrast ratio.

One unique advantage of laser displays is their infinite depth of field, which allows the displayed image to be viewed on curved surfaces. Examples include hemispherical-screen theaters or planetariums, uneven or tilted surfaces, buildings, and moving surfaces such as water screens. They are expensive but find application in simulators, amusement parks and special effects shows. To date, the lack of low-cost laser sources and scanners has prohibited the laser display from being used in the consumer projection television market.

The Next Installment

The next installment of this series will describe the technology behind "light valves." ■

Understanding and Servicing Playstations

By Oscar Sugnitan

Today's video games are considerably more sophisticated than the early games. Based on CD-ROM technology, they offer superb graphics, sophisticated animation, high-fidelity sound and exciting gaming action. Sony's PlayStation is the number 1 selling game console, but other manufacturers offer similar products, such as the Sega DreamCast and Nintendo 64.

Because it is immensely popular, consumer electronics service centers will likely be requested to service some of these units. Presented here is an overview of what tools are required to service these units, a description of some of the subsystems, and a few of the problems that may be encountered along with suggestions on how to remedy those problems.

Before we get down to business, let me just inform you that some units were manufactured outside of Sony. These units may have a different outcome when being remedied. Also, a lot of "fake" consoles have already invaded the market - most of them using disposable plastic-slide lens originally used for the 100X series models. But rest assured, I have also encountered such units and my techniques will also work for them, but with a much lower success rate.

Author's disclaimer: I cannot take responsibility if a reader using these techniques causes damage to any PSX, even if all procedures are performed in accordance with these suggestions.

Tools and Supplies Required

There are not many moving parts in one of these units. Basically there's a disk spindle, a motor to turn it, and the pickup assembly that moves the laser/lens across the disk. Most problems associated with one of today's video games can be traced to problems with the pickup unit caused by wear, tear, dirt, lack of lubrication and misalignment. Therefore, most diagnostic procedures on one of these units will be confined to the pickup.

It doesn't take much to dissect the lens. The tools and materials shown here cost very little. Aside from a multimeter, which every service center already has, you'll need the following to service one of these units.

- Precision drivers, for both screw heads (-) and Philips heads (+), better if it's a non-magnetic set but doesn't really matter.
- Cotton swabs, on average you need around 6 swabs for every lens unit.
- Alcohol, preferably 70% isopropyl solution to loosen grease. Solvents are too strong and will damage the lens.
- Silicon lube/grease. Better if you could get the actual white grease used for the lens.
- Aluminum tape, available at any hardware.
- Cutter and/or scissors, primarily for cutting the aluminum tape into strips.
- Paint brush - nylon or sable, for getting rid of accumulated dirt and dust.
- Dry washcloth or rag, for excess dirt and grease.

Mechanical Portions of the Unit

I have only defined several PSX parts which will be tackled for the repairs. Some of the parts were labeled only for repair referrals and are not the universal terms.

1. LENS UNIT PARTS

A. Objective Lens
B. Lens Pickup Cover
C. Focus Pivot
D. Tracking Pivot
E. Magnet
F. Lens Pickup Retainer
G. Snap-On Pinion Gear
H. Gear
I. Screw-Type Gear
J. Lens Pickup Tracks
K. Lens Unit
L. Lens Pickup
M. Lens Pickup Cover Screw
N. CD Motor

2. LENS PICKUP PARTS

O. Optical Alignment Screws
P. Lens Pickup Slide
Q. Laser Data Cable
Y. Slide Washer
Z. Laser Power Adjust

3. POWER SUPPLY PARTS

R. Voltage Capacitor
S. Transformer
T. Reset Switch
U. Power SwitchV. Power Cord Socket
W. Power Supply IC
X. Fuse

4. CONTROLLER PARTS

1. Controller Circuit
2. Rubber Padding Conductors
3. Action Buttons
4. Directional Button
5. Front Cover
6. Controller Data Cord

Problems, Symptoms and Cures

This section is very appropriate especially for beginners, although advanced troubleshooters will benefit from it as well. This will help you isolate the problem of a PSX first before moving on to the appropriate actions.

1. CD TRACKING & FMV SKIPPING

Problem #1:

GAME WON'T LOAD. ENDS UP WITH THE MEMORY CARD AND CD PLAYER SCREEN.

Symptom #1:
CD partially spins then stops.
Cause: Objective lens is dirty / slightly misaligned.
Action: Go to ***Lens Repair Stage 1.***
Symptom #2:
CD spins continuously while making tracking noises then stops.
Cause: Lens pickup / gears can't move freely.
Action: Go to ***Lens Repair Stage 2.***
Symptom #3:
Cd spins unusually fast.
Cause: Incorrect lens unit voltage.
Action: Go to ***Lens Repair Stage 2*** - Steps 15 and 16 in particular.

Problem #2:

FMV SKIPS. SCREEN FREEZES DURING FMV SEQUENCE.

Symptoms:
Cause #1: Objective lens is dirty / slightly misaligned. Lens pickup / gears can't move freely.
Action: Go to Lens repair stage 2 for slight skippings or go to Lens repair stage 3 for really extreme cases (screen freezes permanently).
Cause #2: Very old CD / deeply scratched CD.
Action: Buy new CD!
Cause #3: Pirated / bad CD copy.
Action: Buy new CD! Pirated CD's vary in quality depending on distributor or manufacturer.

2. POWER SUPPLY

Problem:
POWER DOESN'T TURN ON.
Possible cause #1: Bad power supply.
Action: Go to Power supply.
Possible cause #2: Loose power cord socket.
Action: Adjust / tweak power cord (temporary) or go to power supply to solder the appropriate loose part (permanent).

3. GENERAL

Problem:

SCREEN IS BLANK WHEN TURNED ON - NO INTRO SOUND OR SONY LOGO.

Possible cause #1: Loose AV jacks.

Action: Adjust / tweak AV jacks.

Possible cause #2: Motherboard IC "glitch" (sometimes referred to as "IC 102 glitch").

Action: Power off then on, or press reset.

Possible cause #3: Faulty IC 102.

Action: Check if any of IC 102's connectors are in contact with each other. If there is evidence of solder bridging, use a soldering iron to melt away the bridging solder. IC102 is the centermost IC of the PSX motherboard, partly covered with a metal plate in some models.

Repair of the Pickup – Stage 1: Cleaning the Lens

If the video game constantly hangs up, operates slowly, or otherwise does not operate properly, a very likely cause is a dirty, worn, or out-of-alignment optical pickup. There are a number of actions, from simple cleaning of the optics and mechanics to complete replacement of the pickup unit that may restore a PlayStation to proper operation. Cleaning/repairing the pickup unit is probably the hardest stage in repairing your PSX. It requires extreme skill, care and patience on the part of the technician.

The action that I call "Stage 1," of pickup repair entails using a cotton swab moistened in alcohol (not soaked) to wipe the objective lens with about 5 gentle, completed circular motions. This removes the accumulated dust and dirt on the objective lens that hinders the laser from tracking accurately. Also, the "extra nudge" that the lens gets from wiping aligns its tracking pivot and focus pivot into place.

Repair of the Pickup - Stage 2: Cleaning/lube

If Stage 1 fails the first time, or if you frequently have to redo lens wiping, only then should you progress to Stage 2.

1. Unscrew lens unit cover using a Philips (+) screwdriver.
2. Unsnap the lens unit cover from this end first for easier uncovering.
3. Twist downward to free the other snap that holds the cover in place. Pull and lift the lens unit cover.
4. Remove the snap-on pinion gear first which locks all the others in place. This can be accomplished 2 ways, turn lens unit over to expose the stopper then:
5. a) Pinch the 2 plastic pieces together with pliers or tweezers then push down; b) Insert screwdriver between 2 plastic pieces and twist before pushing down.
6. Remove the 2 remaining gears.
7. Remove the lens pickup retainer by sliding the lens pickup to the right. Lift and slide lens pickup retainer out of the way.
8. Lift and remove the lens pickup.
9. Using cotton swabs soaked in alcohol, remove all traces of grease on the lens pickup tracks and lens pickup. Use a rag for excess grease.
10. With a screwdriver, remove excess and/or hardened grease from each gear, also the screw type connected to the motor. Soaking the gears in alcohol helps.
11. Lubricate the lens pickup tracks with silicone grease, including the gears and gear holders.
12. Lay the lens pickup back on its tracks. Slide it back and forth to evenly distribute the grease and to make sure that it is sliding smoothly.
13. Restore all the other parts. The last that should go is the snap-on pinion gear. Snap it on while the lens pickup is propped to the left end.
14. Position the lens unit cover and snap it into place. Fasten screws.
15. With a screwdriver, "reset" the lens unit's power by turning the laser power adjust halfway counterclockwise, then halfway clockwise to its original setting.
16. Using a piece of cotton swab dipped in alcohol (not soaked), wipe the objective lens with about 5 gentle, completed circular motions.

Re-greasing the appropriate lens unit parts ensures that it runs smoothly again. Adjusting the laser power adjust should be done with caution. If it works fine after the first adjustment, leave it at that. Making huge adjustments at a time may permanently damage the laser. Slowly but surely does the trick.

Repair of the Pickup – Stage 3: Adjusting the Pickup Focus

You should progress only to Stage 3 after engaging your unit to at least a couple of Stage 2 repairs or if a 2nd Stage 2 repair doesn't work anymore. Do not progress to Stage 3 just to improve a game's FMV. Actually, for a professional service procedure, it might be best to skip this stage, and Stage 4 altogether and simply install a new pickup assembly (Stage 5). But as an experiment, you might give this stage a try.

1. Perform Steps 1 through 10 of Lens repair stage 2.
2. Flatten and smoothen a piece of aluminum tape about 5 inches long on an old CD case.
3. Using the bottom part of the CD case as a ruler, cut the tape into 1 mm strips, about the same width as the lens pickup tracks.
4. Lay the strips of aluminum tape on the lens pickup tracks - 3 tracks total.
5. Cut the excess aluminum tape. To ensure that the tape is adhered securely, smooth the strip against the track using a dry cotton swab.
6. There are notches near the right side of the track where you will have to cut and fold part of the tape. The lens pickup retainer will go in here later.
7. Lubricate the lens pickup tracks with silicon grease, including the gears and gear holders.
8. Lay the lens pickup back on its tracks. Slide it back and forth to evenly distribute the grease and to make sure that it is sliding smoothly.
9. Restore all the other parts. The last that should go is the snap-on pinion gear. Snap it on while the lens pickup is propped to the left end.
10. Position the lens unit cover and snap it into place. Fasten screws.
11. With a screwdriver, "reset" the lens unit's power by turning the laser power adjust halfway counterclockwise, then halfway clockwise to its original setting.
12. Using a piece of cotton swab moistened in alcohol (not soaked), wipe the objective lens with about 5 gentle, completed circular motions.

The aluminum tape elevates the lens pickup by 0.3 mm to 0.5 mm. Even if it is just a relatively small elevation, it helps the laser track the CD better since technically, it is doing so at a closer range. In some cases, doubling the ply of the tape to 0.6 mm (2 pieces propped together) helps the laser track even better. But you should only resort to this if 1 ply of tape isn't enough to make the lens unit work efficiently.

Repair of the Pickup – Stage 4: Thorough Cleaning of the Optical Pickup

You should only progress to Stage 4 as a last resort, and only after you have engaged your unit to a Stage 3 repair. Do not jump repairs from Stage 2 immedi-

ately to Stage 4. And again, if this is a professional service procedure for a customer, it might be best to skip this stage and go right to Stage 5, replacement of the pickup assembly. But if it's your own unit, this might prove an interesting experiment.

1. Perform steps 1 through 11 of Lens repair stage 2. Set aside and work on the lens pickup.
2. Remove the 3 optical alignment screws located at the bottom of the lens pickup.
3. Remove the screw that holds the lens pickup cover. Lift and remove the cover.
4. Lift the right portion of the magnet together with the objective lens to expose the mirror mount located underneath.
5. Using a piece of cotton swab dipped in alcohol (not soaked), gently wipe the mirror mount to remove any dust and dirt that may have accumulated.
6. You may also wipe the objective lens from under it by rotating the cotton swab between your thumb and index finger.
7. Lift the objective lens several times to flex the tracking pivot and focus pivot into alignment. Restore lens pickup cover and optical alignment screws.
8. Lay the lens pickup back on its tracks. Slide it back and forth to evenly distribute the grease and to make sure that it is sliding smoothly.
9. Restore all the other parts. The last that should go is the snap-on pinion gear. Snap it on while the lens pickup is propped to the left end.
10. Position the lens unit cover and snap it into place. Fasten screws.
11. With a screwdriver, "reset" the lens unit's power by turning the laser power adjust halfway counterclockwise, then halfway clockwise to its original setting.
12. Using a piece of cotton swab moistened in alcohol (not soaked), wipe the objective lens with about 5 gentle, completed circular motions.

Dust may have also accumulated on the laser mirror making it difficult to track CD's. The above procedure corrects that problem. I wouldn't advise doing Stage 4 though, unless you have nothing more to lose! If you still want to go through with it, I would suggest skipping STEP 6 unless you trust yourself enough not to scratch the objective lens - it is only made of plastic, not glass so it scratches rather easily. The laser mirror on the other hand is made of glass making it safe to wipe even with applied pressure.

Repair of the Pickup – Stage 5: Replacement

For a truly professional repair, if the problem with a PlayStation is caused by a faulty optical pickup, the procedure of choice is to simply replace the entire unit. In some cases, however, you might be able to just replace the lens unit. In time, your own experience will act as a guide. Here is the procedure for replacing the lens unit.

1. For Stage 5 repair, you will need to buy a Sony lens unit normally used for VCD or DVD players.

2. Carefully remove the objective lens by inserting a screwdriver in between the objective lens and its holder then gently prying it off.
3. Remove the old objective lens from the lens unit and replace it with the new one. Hold it in place with a little bit of super glue. Be careful not to get any glue on the objective lens itself.
4. Elevate the lens pickup with this new technique I've been using lately: remove the 2 slide washers with a screwdriver.
5. Get a strip of cardboard 0.5 mm in thickness, and about as wide as the slide washer's base. Cut 2 pieces from the cardboard strip.
6. Cut a hole at the center of both cardboard pieces. Lay the cardboard pieces where the slide washer used to rest.
7. Put back the slide washers, which are now a bit higher because of the sandwiched cardboard pieces in between them.
8. Gently tweak the 2 magnets inwards by about 1mm, but not too much because if it gets in contact with the copper wires, there will be friction.
9. Finish-off by doing Steps 9 through 16 of Lens repair stage 2.

Troubleshooting may be required during testing. Culprits could be any of the following:

a) too much magnet tweak / adjust;

b) sandwiched cardboard is too thick;

c) objective lens is not properly in place.

Believe it or not, a simple replacement of the objective lens may be all that is needed to make the lens unit like new.

The Power Supply

Power supply deals with power failure in PlayStations. If you encounter a power-related problem, try these steps.

1) Check first to see if the power cord socket is firmly attached to the circuit board and if the soldering points are still intact.
2) A loose power cord socket can be easily remedied by soldering the appropriate points, re-attaching it to the board.
3) Check to see if the fuse is still intact. A blown fuse usually occurs during a power surge, or more frequently if a 110V unit is plugged into a 220V source.
4) Replace a blown fuse. Just be sure that the replacement is of the same voltage as the unit. They are sold for about $0.25.
5) A 110V unit plugged into a 220V source usually fries the voltage capacitor. If this happens, you will know this by the noticeably elevated top of the capacitor. In some cases the capacitor will be totally blown out.
6) Remove the blown capacitor with a soldering iron.
7) Replace with a new voltage capacitor (usually 200V, 100uF for 110V units, and 400V, 82uF for 220V units). They are available at any electronics store for about $1.25.
8) If the power supply still doesn't work after all this, it may be the transformer that needs repairing, and possibly one of the power supply ICs.

If a 110V unit is accidentally plugged into a 220V source and the power is turned on immediately, then only the fuse gets fried. But if it stays plugged for a longer period without turning on the power, then the power surge also fries the voltage capacitor. If kept plugged even longer, then it's the transformer and possibly the motherboard itself that gets fried. So be careful and remember the voltage of your unit!

Maintenance of the Controller

Only basic controller maintenance is tackled here.

1) Unscrew controller using a philips (+) driver (8 screws total).
2) Lift bottom cover.
3) Lift controller circuit together with the cord which is connected to it.
4) Remove all rubber padding conductors.
5) Remove action buttons and directional button.
6) Using a screwdriver, scrape and remove all traces of dirt and residue sticking to the controller casing.
7) Do the same with the action buttons and directional button.
8) Check the rubber padding conductors to see if they are worn out. If so, you need to replace them with new ones. They're available at any PlayStation shop for about $1.50 a set.
9) Put everything back in its proper place. Test controller to see if it works. Troubleshooting tips: rubber padding conductors need to be aligned in place to work efficiently; screws should be tightened to hold all parts tightly in place.

Usually, cleaning is all you need for controller maintenance. All of my controllers at home (about 20 pairs) have been maintained this way with no major repairs needed. ■

Consumer Electronics Show (CES)

By Nils Conrad Persson

More than 1,800 companies showcased the latest in consumer technology at the 2001 International CES-Your Source for Workstyle and Lifestyle Technology, January 6 through January 9 in Las Vegas, NV. These exhibitors represented more than 25 different technology segments including: digital audio and video, information technology (IT), home networking, emerging technologies, broadband, home theater, mobile electronics, personal electronics, content media, specialty audio, delivery systems, the Internet, telephony and wireless communications.

Targeting Technology

As the center stage for the interaction of content media, delivery and hardware, CES offered the latest in technology for more than 110,000 buyers, installers, financial analysts, developers, engineers, CEOs, media and all related industry professionals. CES hosted presentations from leading industry visionaries and a variety of special-interest areas that highlight the industry's most recent developments driving the revolution in workstyles and lifestyles.

Education in One Place

In addition to the pavilions and specialized areas, that were featured, the 2001 International CES conference program offered more than 100 sessions led by industry experts and visionaries.

First-Time Exhibitors

With exhibits from PC peripherals to set-top boxes, the 2001 CES featured some of the hottest products in the consumer technology industry from more than 40 first-time exhibitors.

In the hot category of digital and Internet radio, iBiquity Digital Corp. exhibited its digital radio and audio compression technology solutions, which allow the radio industry to offer high quality digital audio and wireless data services. Kerbango Inc. showcased the world's first stand-alone Internet radio.

Showcases and Pavilions

CES highlighted certain technologies by providing them with a showcase or pavilion where a number of manufacturers involved in that technology could be grouped together to exhibit.

1394 Showcase hosted by the 1394 Trade Association.

Bluetooth Pavilion, endorsed by the Bluetooth Special Interest Group highlighted that technology. The Bluetooth revolution enables two-way transmission of data, making efficient, fast, flawless, wireless connections a reality.

DSL Showcase, hosted by the DSL Forum suggested to visitors that twisted copper pairs may soon be obsolete. Digital Subscriber Line (DSL) transforms ordinary phone lines into high-speed, digital lines for ultra-fast Internet access.

Digital Car Pavilion, visitors experienced the ride of the future. They discover developments in vehicle navigation, global positioning systems (GPS), geographic information systems (GIS) satellites, vehicle safety, obstacle warning systems, emergency notification and wireless products.

Digital Imaging Pavilion allowed attendees to be part of the big picture in digital imaging. The digital market continues to explode as pixel counts increase and prices decrease, and key industry players promise to make digital imaging easy, fun and affordable for all.

E-Commerce Pavilion, attendees learned that as dot-coms multiply, electronic commerce is soaring. Goods and services sold online increased 75 percent in 2000 over the previous year.

Emerging Technologies Pavilion allowed attendees to see tomorrow's technologies today. This was a showcase of the latest innovations in consumer technologies.

Home Security Pavilion helped visitors see that home automation and security are among the fastest-growing product categories at CES. Featured were the latest developments in integrated security systems, identification products, access control systems, intrusion detection devices, perimeter protection systems and closed- circuit TV.

Intelligent Data Bus (IDB) Pavilion learned that intelligent Data Bus (IDB) plug-and-play technology enables consumers to buy and go.

MP3 and Internet Audio Pavilion found out the latest buzz is about in the world of downloadable digital audio. They were able to explore the convergence of the entertainment, computer and Internet industries. Information was available as to which emerging companies offer the hottest products with the newest features.

Timepiece Pavilion showcased the finest in timepieces and related products. See the latest and most exciting timepieces, clocks and other personal electronics products that keep the world on schedule.

Upside's Digital Living Room Pavilion showed visitors how to boost their lifestyles and workstyles. From digital televisions to voice-controlled thermostats, the future of digital entertainment is at your fingertips.

The Electronics Explosion Continues

Once only used in consumer products such as radio and TV, electronics now seems to be everywhere. The continuing microminiaturization of electronics products, and the introduction of digital technology in all types of consumer products have greatly expanded the role of electronics in the consumer world. The recently held 2001 Consumer Electronics Show (CES) was a showcase of the latest in consumer electronics products, and a foretaste of the further inroads electronics will make in all of our lives. ■

For more news on CES visit www.CESweb.org

National All Service Convention (NASC) Preview

The National All Service Convention, sponsored by the Professional Servicers Association (PSA) and the Electronic Technicians Association (ETA) will be held February 7 through February 11, 2001 at the Delta Orlando Resort, Maingate at Universal Studios in Orlando, Florida.

The convention will offer a School of Service Management to help attendees learn how to survive and grow in the 21st century. Other learning opportunities include Training Schools in Appliances, Electronics and Satellite Fiber Optic

Technology. Also featured are preparation for certification in Electronics, Appliances and Service Management. Other events at the convention include a Trade Show, Business Management seminars, Entertainment, Awards, Recognitions, Industry Round Table Discussion, Survival Meetings, Industry panel discussions with Manufacturers, Third Party Administrators, and Industry Leaders.

Also featured will be training and documentation of Certified Consumer Specialists. Consumer relation skills and protocols for all service center personnel.

For further information, contact:
Electronics Technicians Association (ETA)
502 N Jackson
Greencastle IN 46135
800-288-3824
http://www.eta-sda.com/ or
Professional Service Association (PSA)
71 Columbia Street
Cohoes, NY 12047
518-237-7777

NASC SCHEDULE

(subject to change)

SHOW HOURS FEBRUARY 9, 2001

WEDNESDAY FEBRUARY 7TH

12:00 Registration — Convention Center Foyer
1:00 PSA Board of Directors meeting
2:00 – 5:00 Parts Distributor Meeting
5:00 – 6:30 Hospitality hour

THURSDAY FEBRUARY 8TH

8:00 Registration — Convention Center Foyer
8:00 Basic Appliance Service Part 1 (Ohm's Law & Basic Ckts) (Whirlpool)
8:00 Consumer Relations (CSM) (CCS)
8:00 Electronics Training Part 1 (Hitachi)
8:00 ETA Customer Svc Specialist (CSS) Part 1
8:00 Technician certification tests El & App
10:00 Electronics Training Part 2 (Hitachi)
10:00 Basic Appliance Service Part 2 (Reading Schematics) (Whirlpool)
10:00 ETA Customer Svc Specialist (CSS) Part 2
10:00 Establishing Charges for Service (El & App) (CSM) Cost of Doing Business Software Karen Percent, CPA (Consultant)
10:00 Technician Certification Tests (El & App)
12:00 Lunch
1:30 Industry Roundtable Session (El & App)
1:30 Basic Appliance Service Part 3 (Reading & Troubleshooting with Schematics)
1:30 Electronics Training Part 3 (Zenith)
1:30 Technician certification tests (El & App)
1:30 ETA Customer Service Specialist (CSS) Pt 3
3:30 Understanding Personalities for better Management (CSM)
3:30 Basic Appliance Service Part 4
3:30 ETA Customer Svc Specialist (CSS) Part 4
3:30 Electronics Training Part 4 (Zenith)
3:30 Technician Certification Tests El & App
6:00 Dinner Splendid China Dinner and Show
7:00 Setup for Trade Show

FRIDAY FEBRUARY 9TH

8:00 - 11:30 Electronic Service Seminar (Philips)
9:30 - 11:30 Appliance Parts Dist Meeting
10:00 - 12:00 Electronic & Appliance Waste Disposal (State of Florida)
10:00 TechnicianCertification Tests (El & App)
12:00 Lunch
1:30 - 4:30 Electronic Service Seminar (Philips)
1:30 - 3:30 PSA Certification Committee Meeting
6:30 Dutch Treat Social at the Pool Bar
7:30 Association Banquet and recognition dinner

SATURDAY FEBRUARY 10TH

8:00 Measuring The Effectiveness of Technicians (CSM)
8:00 Basic Appliance Service Part 5 (Electrical Codes & Safety); (Troubleshooting Controls & Loads) Mike Krokidas
8:00 StarBand Internet Access Training (ETA Part 1)
8:00 Electronics Technical Training (RCA) Part 1
10:00 StarBand Internet Access Trng (ETA) Part 2
10:00 Basic Appliance Service Part 6 (Understanding Microwave Cooking)
10:00 Service Marketing (CSM)
10:00 Electronics Technical Trng (RCA) Part 2
10:00 Technician Certification Tests (El & App)
12:00 Lunch
1:30 Basic Appliance Svc Part 7 (Open Forum)
1:30 Compensation Plans for Technicians and Productivity (CSM)
1:30 StarBand Internet Access Training (ETA Part 1)
1:30 Electronics Technical Training (RCA) Part 3
1:30 Technician certification tests (El & App)
3:30 StarBand Internet Access Trng (ETA Part 2)
3:30 Final Summary on Service Management and Test (CSM)
3:30 Electronics Technical Tring (RCA) Part 4
3:30 Technician Certification Tests (CSM, (El & App)

The CapAnalyzer

By Bob Rose

About three months ago, I received a package from Electronic Design Specialists (EDS) of Boca Raton, Florida. The package contained an instrument called a "Leak Seeker," the purpose of which is to help a technician quickly and easily find a shorted component on a circuit board. It also contained what EDS calls a "CapAnalyzer," a sophisticated device used for checking the equivalent series resistance or "ESR" of an electrolytic capacitor without removing it from the circuit. The letter that accompanied the package asked me to use the instruments for sixty days and evaluate them from a practical, or working, point of view.

At the end of the sixty days, I concluded that my service center, which specializes in television service, can live without the Leak Seeker. On the other hand, if I were doing lots of work with digital circuits, I expect I would add it to my line of often-used test equipment.

The LeakSeeker 82A is a dedicated instrument with only one purpose: it identifies the exact place on a pc board where a given reference resistance is at the lowest reading. The LeakSeeker automatically calibrates itself to the resistance of the defective component (within a 12mO "window") as soon as its test lead is touched anywhere along the pc board foil that shows the short or low reading (under 150O). Then, as the tech touches pads along the foil, the Leakseeker beeps higher or lower depending on whether the tech is getting closer or further from the defect. The instrument will recalibrate itself periodically to a new "window" as the tech probes closer to the defect.

I used it several times, and it did help me to find a few shorted components, like two lightning-damaged microprocessors, but I already knew what I was looking for. If I were doing lots of work with digital circuits, I expect I would add it to my line of often-used test equipment. In other words, I see its value, but I don't feel that I would use it enough in my line of work to justify the modest price of $179.00. Maybe later, but not now.

But the capacitor analyzer, well, that's another matter! I used it for sixty days and promptly paid $179.00 for it, and think I got a bargain. Let the record show that it was not given to me; I paid for it.

Finding Defective Capacitors

Bad electrolytic capacitors present a technician with the problem, "How do you quickly and efficiently locate it and replace it?" Most of the capacitor checkers with which I am acquainted require you to remove a capacitor from circuit to check it. I have an older Z meter that checks capacitance, ESR, and leakage. It is highly accurate and is the standard by which I judge other, similar, instruments. But I must unsolder the suspected component to check it. As you know, that takes time, and I used to spend lots of time unsoldering and soldering capacitor leads. I used to, that is, before I became acquainted with ESR meters.

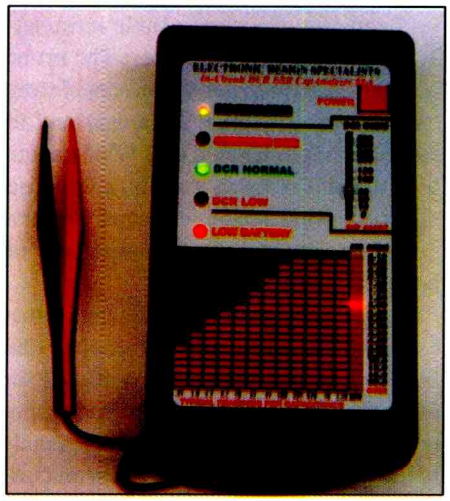

Figure 1

ESR Meters

An ESR meter is a wonderful gadget because it helps you locate a bad electrolytic while it is still in the circuit. It accomplishes this feat, not by measuring capacitance, but by measuring equivalent series resistance (ESR). A perfect capacitor measures as an open circuit at dc and shows less ac resistance as the frequency across it increases (or as its capacitance rises). An ESR meter generates an ac frequency, applies it to the capacitor under test, and evaluates the results using either an analog or a digital readout.

I have two ESR meters, really three now. The first is homebrew. It generates a 50kHz frequency, applies it to the capacitor under test, and reads the results on an analog scale. It works great, but it tends to be a bit inaccurate when I check low value electrolytics. It also has the drawback of being unable to detect a shorted one. I use a linear taper potentiometer to calibrate it before I begin the tests. I short the leads together and adjust the potentiometer for full deflection of the meter. You see now why it won't detect a shorted electrolytic, don't you? A shorted capacitor actually shows up as a good one when I check its ESR.

Feeling the need for greater accuracy, I purchased a microprocessor-controlled ESR meter with a digital readout. It does an excellent job and even has a scale on the front to tell me the typical ESR value of a good capacitor, but it has one draw back. I must discharge a capacitor before I check it. Well, you guessed my problem. I have blown it up once and damaged it a second time. And like my home-made meter, it won't detect a shorted capacitor, making me suspicious of one that checks "too good."

The CapAnalyzer

Enter Electronic Design Specialists CapAlalyzer 88A.

The first thing I noticed when I unwrapped it was that it was well packaged and felt good in my hand (Figure 1). It comes in a sturdy plastic case that is just a little larger than my DMM, has a nice and long test lead, and an easy to read front panel. The test lead consists of a single cable terminating, not in two probes, but in a tweezers-like probe that fits nicely into just one hand. Then I noticed the easy to read front panel consisting of a tri-color (green, yellow, and red) good-fair-bad chart as well as a bar graph.

Reading the instruction manual, I immediately saw four features that I liked. Now, I don't always read the manual first. Sometimes I read it when all else fails. You know the saying, "When all else fails, read the owner's manual." Since I was

supposed to do an evaluation, I thought I ought to be prudent and read the manual first. Here's what stuck in my mind.

First, this ESR meter automatically discharges a capacitor before it begins the test sequence. (I haven't been able to blow this product up yet even though I have heard the sizzle of a stored voltage as I connected the test leads across a capacitor.)

Second, the CapAnalyzer measures what EDS engineers call "DCR" or dc resistance. Since it checks dc resistance first, the meter automatically informs you if the capacitor is shorted or has a lower resistance than the reference you have set. The meter in the illustration has been set for DCR Ohms of 50, which is the normal setting. If the capacitor under test, said the owner's manual, has a resistance lower than 50O, "DCR LOW" light comes on, and an audible tone tells you that it is shorted and you need not test it further.

Third, I read about the tri-color (green, yellow, red) chart on the front as well as a bar graph. The manual said that the bar graph and the chart permit the technician to get an immediate good-fair-bad reading of a typical capacitor at a glance.

Fourth, the manual informed me that the meter has a series of audible tones to alert the user to the condition of the capacitor being tested. It chirps once after a connection has been established to let the user know the connection is good. It emits a distinctive tone to indicate that the DCR is low. If the connection is good and the DCR is okay, the meter then emits from one to five beeps, depending on the ESR reading of the capacitor.

The Performance Test

Having given you a description of the meter and its functions, let's move on to see how the EDS-88A CapAnalyzer performed when I put it to work.

When I turned it on, the meter fired up, sequenced the LED's, and flashed the "OVER" LED, informing me that it was ready to use. Then I set the "DCR OHMS" slider to "50" per the instructions. The manual told me that if the slider were set to fifty ohms, the DCR LOW light would come on and an audible warble would sound notifying me that the capacitor under test is most likely defective, or at least presents a resistance lower than 50O.

By the way, the DCR OHMS slider may be set to any value between 0O and 500O, which gives the meter expanded capability. If, for instance, I were checking a very high-power motor controller where the power supply must operate a 15O device, I would set the slider to ten ohms. I have been able to locate shorted capacitors in a fraction of the time the chore used to take. Moreover, I have used the CapAnalyzer to check for open low-ohm resistors and fuses without having to lay aside one set of test leads and pick up another set that are attached to a DMM.

These remarks lead me naturally to talk about the test lead. As you can see from the picture of the meter (Figure 1), the test lead consists of a single cable terminating in a tweezers-like probe. The probe is so designed to lower the effects of stray capacitance (says the literature) and to facilitate single-handed use. I find it quite helpful in most instances. I am able to use the probe and check every capacitor in a given area, or even on the whole circuit board, in just a few minutes.

However, there have been times when I wished I had the option to replace the factory test lead with a conventional set of leads. If I am checking the capacitors on the top of a circuit board, I am usually unable to get the factory probe in contact with the electrolytic's leads and find I have to reach for one of my other ESR meters. Maybe I'm nit-picking here, but I do wish I had the option.

By the way, don't even attempt to bend the tips of the test probe because you will break them if you do. No, I am not speaking from experience. For once in my life, I'm prepared to take someone else's word.

The green-for-good, yellow-for-marginal, and red-for-bad chart and bar graph work pretty much as described. I found that I was able to evaluate a reading by making just a quick glance at the face of the meter. I wouldn't want to change those features.

The thing that makes the CapAnalyzer really neat is the audible tone alert. It beeps once when you have touched the capacitor leads with the probe to let you know you have a good connection. I no longer have to look at a meter or digital display and wonder if the reading is good because my ears tell me when the connection is stable.

If the DC resistance is low, indicating a possible shorted capacitor, the meter not only lights the DCR LOW LED but also emits a distinctive warble. When I hear the tone, I know to replace the capacitor. This is a great feature. Moreover, once the test has been completed, the meter emits from one to five beeps depending on the ESR reading of the capacitor. I found that once I got accustomed to the various sounds, I was able to breeze through a dozen or so capacitors in quick order. Oh, it also has a distinctive set of tones to alert you to the fact that you have forgotten to turn it off. I used it today and put it away without turning it off. In about a minute the meter sounded off, letting me know that I had forgotten to turn it off.

As I have already said, one of the features that attracted me to this little fellow in the first place was that it discharges a capacitor before it begins its diagnostics, and it does. However, the literature warns the user that there are limits. If the capacitor is large enough and has stored sufficient voltage, you run the risk of blowing the ends off the test probe and destroying the resistors in the discharging circuit. So, use your common sense.

I have used the CapAnalyzer almost daily since it arrived in via UPS three months ago. It has helped me fix the usual problems: dead power supplies, vertical deflection defects, loss of sync, no color, distorted video, poor audio, etc. It almost goes without saying that in almost all instances, it has become my ESR meter of choice. What more can I say than I was so impressed I whipped out the plastic and bought it when the evaluation period was over.

ESR Isn't Everything

But, I guess there's always a "but," this ESR meter isn't the "be all and end all" of test equipment even though I like it better than any of the ESR meters I own or have used. If you read the hype, you're like to come away with the impression that it, or any other one for that matter, is really all you will ever need. Oh, it's handy and does save you loads of time, but it has limitations. What am I talking about?

Let me put it this way. High ESR

accounts for more defective capacitors than any other factor, but a service technician has to take into account another factor, namely low capacitance. I am told that dielectric absorption should also be considered, and it probably should, but I don't have a meter that checks it. Since that is the case, I have to talk about what I know.

For example, a friend brought in a thirteen-inch Magnavox combi that was manufactured by our friends at Funai. It was about seven years old and had the power supply mounted on a separate printed circuit board just to the left of the VCR deck. I'm sure you know the unit to which I have reference. He said it would come on, stay on for a minute or perhaps five minutes and just turn itself off. I plugged it in and noted that the power supply came on with a high-pitched squeal that got louder when I turned the set on. I measured the regulated B+ and saw that it began at about +118V, which was high, and began a steady climb until it tripped the XRP circuit.

Two possibilities popped into my mind, an open resistor in the regulation circuit and one or more defective capacitors. I found the open resistor in quick order (R056 which is an 18kO, 1/8W, resistor) and replaced it. The regulated B+ dropped to +112V and held steady, but the squeal persisted. I reached for the CapAnalyzer and checked every capacitor on the circuit board in less than five minutes, and they all checked good. But I wasn't satisfied. Using a bit of knowledge garnered through experience, I pulled two capacitors in the primary of the SMPS and four the secondary supplies to check with my Z meter. Both capacitors from the primary circuit checked at half their rated capacitance as did two of the others. I replaced the four capacitors, which fixed the power supply.

There is no doubt that ESR is important when you evaluate a given electrolytic, but don't overlook the possibility that your problem may be caused by a capacitor that has lost a significant amount of capacitance. The CapAnalyzer will most definitely help you find almost all of the bad capacitors in a circuit, but it won't help you find all of them all of the time. There will come a time when you'll just have to dig a little deeper. So, I have three ESR meters and a trusty Z meter that sees a little use almost every day. If I had to give one or the other up, I guess I'd keep the ESR meter and retire the Z meter. I'm thankful, though, that I have both instruments on my bench.

Anyway, thank goodness that electrolytic capacitors fail. They help us to make a living, don't they? ■

From time to time, ES&T reviews products and tools available to the professional servicing community. The February issue will feature a follow up to this article describing the basics of capacitor technology.

Replacement Parts/Servicing Information SourceGuide

By The ES&T Staff

There was a time when consumer electronics products: TVs, radios, stereos, that bore the brand name of a manufacturer were made by that manufacturing company. That changed some time ago. Nowadays, a TV, VCR, camcorder, or other consumer electronics product, might bear the brand name of a big-name manufacturer, but actually be made by a no-name manufacturing company somewhere on the other side of the Pacific Ocean.

These products present some problems for consumer electronics service, but generally it's at least possible for a service center to find service literature and replacement parts thems.

Other products that cause greater problems for service centers: products that bear brand names that are not recognizable. Importers contract with offshore manufacturers to produce quantities of products, bring them into the U.S., and sell them to the public with little or no support.

In such cases, it's often difficult to find service literature or replacement parts.

In some cases, the service center may still be able to determine the identity of the company that actually built the product. That company may or may not be able to provide service literature on the unit in question. If the product is identical to one sold by the company under their own brand name, the company may be willing to furnish service literature for the similar brand product. On the other hand, they may not make a product anything like that orphan brand, and may have left it up to the company that bought the product to generate the service literature.

In the first instance, you're in luck and will be able to fix the product. In the second instance, unless you can locate the company that imported the sets, and they have service literature to sell, you'll have to service the product without a manual, or return it to its owners.

More Service Difficulties

Other factors that make it difficult for the average service center to locate and obtain service literature and replacement parts are:

- Companies move, and post office forwarding notices expire.
- Some companies are small and are just hard to locate.
- Many private brands provide little or no support.
- An offshore manufacturer may market products in the U.S. for a period of time and then leave the U.ß. In some cases these companies may sell their stocks of replacement parts to a distributor in the U.S., but how do you know to whom?
- Some companies don't wish to have independent service companies service their products, so they refuse to provide service literature and replacement parts to the independent.

Clues to Manufacturers' Identity

If you encounter a product that has an unfamiliar name and no other information such as an address or phone number to help you determine its origins, you may still be able to find out how to locate its manufacturer or distributor. Two pieces of information that can help make such an identification are the FCC (Federal Communications Commission) ID number and the UL (Underwriters Laboratories) code number.

Here's Some Help

Because consumer electronics servicing presents so many difficulties in simply locating replacement parts and service information, each year we publish a replacement parts and servicing information SourceGuide that provides service companies with several tools to help them overcome these problems. This SourceGuide is published annually because so many changes are taking place in the market.

Things change in the regulatory organizations, too. For example, as will be discussed later, a couple of years ago the FCC web site was such that getting information on a company or product listed on that site was like pulling teeth. Today, that information is available in abundance, and this article tells you how to access it if you have a personal computer and an internet provider.

This SourceGuide contains the following sections:

- A list of suggested references
- A list of FCC ID number prefixes that identifies the manufacturer of any product that bears an FCC ID number
- An identification for the website for the FCC. At this site you can identify the manufacturer of a product by the FCC ID number it bears. Currently you can do this in one of two ways: you can browse, and search for manufacturer identification for a given FCC ID number, or you can download the entire database of manufacturers, with FCC ID numbers, street addresses and more for any recent year.
- An updated list of UL ID numbers
- An updated list of manufacturers with addresses and telephone numbers.and internet addresses.

Finding Replacement Parts

Here's a list of references that are useful in tracking down the manufacturer, or parts distributors. Every electronics servicing facility should have them:

Consumer Electronics Replacement Parts Source Book
Consumer Electronics Manuf Assoc.
Electronic Industries Association
2500 Wilson Boulevard
Arlington, VA 22201
This document costs $8.00, including shipping and handling
The most recent edition of this source book is 1999. Quantities are limited.

Electronic Industry Telephone Directory (EITD)
Cahners Publishing Co
301 Gibralter Drive, POB 650
Morris Plains, NJ 07950-0650
Tel: 973-292-5100, Fax: 973-292-0783
Cover price is $65.00 (Or, you might get a copy free from your distributor.)

(Continued on page 33)

Howard Sams Annual Photofact Index
Available in print and on disk from your distributor, or directly from
Sams Technical Publishing
5436 West 78th Street
Indianapolis, IN 46268-4149
800-428-7267
Fax: 800-552-3910
www.samswebsite.com

Consumer Electronics Show (CES) Directory
Electronic Industries Association
Consumer Electronics Group
2500 Wilson Blvd.
Arlington, VA 22201
703-907-7500
The CES directory includes over 1,000 manufacturers, brand names, products and key personnel. If you did not get to the show, limited numbers of copies will be available from the above address.

A VCR Model Number and Parts Reference
Another invaluable reference, published by the International Society of Certified Electronics Technicians (ISCET). The Eighth Edition of the VCR Cross Reference Manual is available in both paper and software editions from ISCET. Unfortunately, this reference has not been updated in a couple of years. The software allows the user to search by manufacturer for model numbers and description for part numbers, and a sub-search by manufacturer and part description is also a feature of the program. The editing sequence for parts shows on screen all the substitutes for the part entered.
The Cross Reference, which lists equivalent model numbers among brands and equivalent part numbers among brands is now available from ISCET. This three-hole punched, 144 page expanded edition includes more than 6,000 parts and 1746 models. About 50 brands are covered in the manual. Typically, this manual would enable a user to repair say, a Canon VCR with a Panasonic part, using RCA Service data. The price or the paper version was originally $29.95, plus $3.00 S&H. It is now on sale, for $10.95, plus $3.00 S&H. The software version on diskette, was $39.95; now $19.95, plus $3.00 S&H.
ISCET, 2708 West Berry, Fort Worth, TX 76109; Telephone: 817-921-9101.

The FCC ID Number Can Help

Most consumer electronics products carry clues as to who the manufacturer is. An FCC ID number, for example, appears on every VCR and computer, and any other product that might generate electromagnetic interference. The first three characters of this number, letters, or a combination of letters and numbers, identifies the manufacturer of the product. If a technician is faced with a product on the bench whose name he doesn't recognize, and if it bears an FCC ID number, he may look the number up in a list of such numbers and determine who the manufacturer was, and an address and telephone number. This is a very helpful bit of information, but it might, or might not, yield the information that the technician needs. For starters, the name of the manufacturer might or might not be the same as the name on the product. The address and telephone number in the FCC database might be up to date, or it might not. The information in the database is the information that was current when the manufacturer provided the communications interference information concerning the product to the FCC.

Now this information is available from the FCC via the internet.

Currently, the FCC operates a website with a great deal of information about the FCC and its operation. It is again possible to look up individual FCC ID numbers, and/or download the entire database of FCC ID numbers for any year from 1987 to 1999. Each file is a .dbf file, compressed into a .zip file. You can unzip the file and load it into any compatible database program and search for any information you might need.

Three web site addresses are included here: the main FCC website, the one that contains the FCC ID number search form, and the one that contains the Equipment Authorization Data Files (eadf). You might try the main site, but unless you know exactly where you want to go, it's not easy getting from there to the other pages (at least it wasn't for me). The main site is www.fcc.gov. Actually you might want to have a look at that site because there's a lot of interesting information there. But if you want to get to the FCC ID search page, go to http://www.fcc.gov/oet/fccid/. If you want to go directly to the eadf site to download the database(s), (this is an ftp, or the transfer protocol, page) go directly to
ftp://ftp.fcc.gov/pub/Bureaus/Engineering_Technology/Databases/eadf.dat/.

Actually, the FCC ID number contains information other than just that needed to identify the manufacturer of a product. The first three characters of the ID number are enough to tell you what company made the product. This article lists a number of FCC ID number three-character prefixes and the name of the manufacturer of the products that bear that number.

Unfortunately, manufacturers of television sets are no longer required to apply for FCC authorization for their products, because TV sets are no longer considered to be potential sources of communications interference. Because of this, when you run into a hard to identify TV set, you may not find an FCC ID number on it.

The UL Manufacturer's Code Number

Another source of manufacturer identification information is the Underwriters Laboratories code number. The manufacturer of every product submitted to UL for certification is assigned a unique code number that identifies the manufacturer . Figure 3 is a partial list of UL numbers and the manufacturers they represent.

Locating the Manufacturers

It's not unusual for a servicing organization to have difficulty finding the address and telephone number of a manufacturer of a product for which they need to order parts, even when the manufacturer is well known. Figure 4 is a listing of manufacturers, gleaned from ES&T's own records, the Consumer Electronics Replacement Parts Sourcebook, The NESDA Professional Electronics Yearbook, ES&T reader correspondence, many telephone calls by the ES&T staff, and other sources.

Information Sources Close to Home

Those of you who are located in a city with a good library system have a ready source of information available free. For example, the ES&T staff regularly call the local library for information. References they have available include the *Thomas Register Catalog*, a book called "*Companies and Their Brands*", and one called "*Brands and Their Companies*." Try checking with the reference librarian in your local library the next time you have a question about who makes what brand of TV or VCR, or similar questions.

Look on the Internet

Another good way to find information on a company is to search the worldwide web. It's pretty much hit-or-miss, but might just help you find the information you need. To find information on a company this way, just use whatever browser you ordinarily use, enter the name of the company that you want to search for, in quotes. Start by using the simplest search string, for example just the name of the company, without the word "Company," or "Inc."

And if you don't find any information at first, see if there are any other names that you might search under. For example, if you don't find anything under "Philips," try Magnavox, or vice versa.

Here are URLs for a couple of useful sites that list businesses:

- http://www.companiesonline.com/
- http://www.hoovers.com/

FCC ID NUMBERS BY CODE

Figure 1. Every VCR, personal computer, cordless telephone and microwave oven, or other product that could possibly cause electromagnetic interference must carry an FCC ID number. The first three characters of that ID uniquely identify the manufacturer of the product. This is a listing of manufacturer vs FCC ID number prefix, alphanumerically by code.

CODE	MANUFACTURER
A26	Alpine
A3D	NEC
A3L	Samsung
A6R	Yamaha
A7R	Orion
AAL	Phone Mate
AAO	Radio Shack
AAY	Midland Intl Corp
AB6	Northern Telecom
ABL	Hitachi
ABW	JC Penney
ABY	Motorola
ACA	Yorx Electronics
ACB	Phonotronics
ACJ	Matsushita
ADF	Carterfone
ADT	Funai
AES	Uniden
AEZ	Sanyo
AFA	Fisher
AFL	Sharp
AFR	Curtis Mathes
AGI	Toshiba
AGV	Montgomery Ward
AHA	RCA
AIH	Litton Microwave Cooking Products
AIX	Sylvania
AJD	Pioneer Electronics Corp.
AJU	GE
AJX	Toshiba (Cordless phones)
AK8	Sony
AKC	Superscope Inc
AKE	Marantz Co Inc
ALA	Wells Gardner Electronics Corporation
ALI	Kenwood USA Corp
ANV	Capetronic Int'l Corp
API	Harman Kardon Inc
ARS	AOC Int'l of America Inc
ASH	Akai
ASI	Victor Company of Japan
ATA	Sharp
ATO	Zenith Electronics Corp
ATP	Advent Corporation
AZ4	Motorola Inc.
AZD	Canon
B4S	A10 (USA) Inc.
BBO	Cobra
BCG	Apple Computer
BEJ	Goldstar
BFY	Shintom Co. Ltd.
BGA	Audiovox Corp
BGB	Mitsubishi
BJM	Tatung Company
BO7	Sanyo Fisher
BOU	Philips
C3K	Microsoft
C5F	Daewoo
C9S	Fujitsu Limited
CKL	Hyundai Electronics
CLV	Recoton
CNT	Compaq Computers
E0Z	Shintom
E2K	Dell Computer
F67	Ampex
FOD	Packard Bell
FYL	Sampo
G9H	Thomson Consumer Electronics
GBU	3M
GQ8	Acer
HVM	Sanyo Fisher

FCC ID NUMBERS BY MANUFACTURER

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

MANUFACTURER	CODE
3M	GBU
A10 (USA) Inc.	B4S
Acer	GQ8
Advent Corporation	ATP
Akai	ASH
Alpine	A26
Ampex	F67
AOC Int'l of America Inc	ARS
Apple Computer	BCG
Audiovox	BGA
Canon	AZD
Capetronic Int'l Corp	ANV
Carterfone	ADF
Cobra	BBO
Compaq Computer	CNT
Curtis Mathes	AFR
Daewoo	C5F
Dell Computer	E2K
Fisher	AFA
Fujitsu	C9S
Funai	ADT
GE	AJU
Harman Kardon Inc	API
Hitachi	ABL
Hyundai Electronics	CKL
JC Penney	ABW
Kenwood USA Corp	ALI
LG Electronics	BEJ
Litton Microwave Cooking Products	AIH
Marantz Co Inc	AKE
Matsushita	ACJ
Microsoft	C3K
Midland Intl Corp	AAY
Mitsubishi	BGB
Montgomery Ward	AGV
Motorola	ABY, AZ4
NEC	A3D
Northern Telecom	AB6
Orion	A7R
Packard Bell	FOD
Philips	BOU
Phone Mate	AAL
Phonotronics	ACB
Pioneer Electronics	AJD
Radio Shack	AAO
RCA	AHA
Recoton	CLV
Sampo	FYL
Samsung	A3L
Sanyo	AEZ
Sanyo Fisher	BO7, HVM
Sharp	AFL
Sharp	ATA
Shintom	E0Z, BFY
Sony	AK8
Superscope Inc	AKC
Sylvania	AIX
Tatung	BJM
Thomson Consumer El	G9H
Toshiba	AGI, AJX
Uniden	AES
Victor Coy of Japan	ASI
Wells Gardner El Corp	ALA
Yamaha	A6R
Yorx Electronics	ACA
Zenith Elec Corp	ATO

UL LISTING NUMBER TO VCR MANUFACTURER (UNOFFICIAL)

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

UL NO.	MANUFACTURER/BRAND
146C	Goldstar
153L	NEC
16M4	Samsung Supra, Multitech, Unitech, Tote Vision, Cybrex, GE, RCA, Sears
174Y	Toshiba, Sears
238Z	Hitachi, RCA, GE, Penny, Pentax
270C	Sony
277C	JVC
282B	Sharp
289X	Emerson
333Z	Symphonic, Teac, KTO, Realistic, Multitech, Funai, Porta Video, Dynatech, TMK
336H	RCA
347H	NAP
43K3	Kawasho
403Y	Fisher/Sanyo , Realistic, Sears
436L	Quasar
439F	JVC, Zenith, Kenwood, Sansui
444H	Zenith
44L6	TMK,Emerson, Lloyds, Broksonic
504F	Sharp, Wards, KMC
51K8	Portavideo
536Y	Mitsubishi, Emerson, Video Concepts, MGA
540B	GE
570F	Sony, Zenith
623J	Sampo
628E	Samsung, MTC, ToteVision
679F	Panasonic, RCA, GE, Magnavox, Quasar, Canon, Philco
723L	Sanyo
727H	Hitachi
74K6	Funai
781Y	NEC, Dumont, Video Concepts, Vector, Sears
828B	Panasonic, Olympus
843T	Magnavox
86B0	Goldstar, Realistic,Penney, Tote Vision, Shinton, Sears, Memorex
873G	Mitsubishi
41K4	Portland

ES&T REPLACEMENT PARTS SOURCEGUIDE

Figure 4. Sometimes it's difficult to find parts or servicing information for a product, even if you know who the manufacturer is. This listing, gleaned from a number of sources will provide some parts and technical literature sources for some products.

Action TV
(American Action TV)
100 Exchange Place
Pomona, CA 91768
909-869-6600
This company sells through truck stops and discount stores.

Acoustic Research
2950 Lake Emma Rd
Lake Mary, FL 32746
800-969-AR4U

Adcom Service Corporation
10 Timber Lane
Marlboro, NJ 07746
732-683-2356
www.adcom.com

AIWA America Inc.
800 Corporate Drive
Mahwah, NJ 07430-2048
201-512-3600
www.aiwa.com

Akai American, Ltd. -
See Mitsubishi

Alpine Electronics of America, Inc.
19145 Gramercy Place
Torrance, CA 90501
310-326-8000
800-421-2284
www.alpine1.com

Altec Lansing Consumer Products
PO Box 277
Milford, PA 18337
570-296-4434
800-258-3288
www.altecmm.com
Apple Computer
1 Infinite Loop
Cupertino, CA 95014
408-996-1010
www.apple.com

Aristo Computers Inc.
6700 SW 105th Ave., Suite 300
Beaverton, OR 97008
503-626-6333
www.aristo.com

Atari Games Corp.
675 Sycamore Drive
Milpitas, CA 95035
408-434-3700
www.midway.com

Audio Technica U.S., Inc.
1221 Commerce Drive
Stow, OH 44224
330-686-2600
www.midway.com

Audiovox Corp.
150 Marcus Drive
Hauppauge, NY 11788-3723
516-231-7750

Blaupunkt/Robert Bosch Corp.
2800 South 25 Ave.
Broadview, IL 60153
800-323-1943
Fax: 708-865-5209

Canton/Luxman Electronics Corp.
1723 Adams St NE
Minneapolis, MN 55413
612-706-9250
Fax: 612-706-9255
www.cantonusa.com

Casio Inc.
570 Mt. Pleasant Ave.
Dover, NJ 07801-1620
973-361-5400
Fax: 973-361-3819
www.casio.com

Channel Master
1315 Industrial Park Drive
Smithfield, NC 27577
919-989-2205
Fax: 919-989-2200
www.channelmasterinc.com

CIE America, Inc. (C. Itoh)
2701 Dow Ave
Tustin, CA 92780-7209
949-573-2942
Fax: 949-757-4488
www.citoh.com

Citizen America Corp.
831 S Douglas St. Suite 121
El Segundo, CA 90245-4965
310-643-9825
Fax: 310-725-0182
www.citizen-america.com

Clarion Corporation of America
661 W. Redondo Beach Blvd.
Gardena, CA 90247
310-327-9100
Fax: 310-327-9100
www.clarionmultimedia.com

Columbia Data Products
PO Box 163088
Altamonte Springs, FL 32716-3088
407-869-6700
Fax: 4017-862-4725
www.cdp.com

COMPAQ Computer Corp.
20555 State Hwy. 249
Houston, TX 77070-2698
281-378-6020
Fax: 203-775-4595
www.compaq.com

Connecticut Microcomputer
PO Box 186
Brookfield, CT 06804
203-740-9890
Fax: 203-775-4595
www.2cmc.com

Curtis Mathes Corp.
(See Uniview)

Daewoo Electronics Corp. of America
120 Chubb St.
Lyndhurst, NJ 07071
201-460-2000
Fax: 201-935-5004
www.daewoo.com

Dell Computer Corp.
1 Dell Way
Round Rock, TX 78682
512-338-4400
Fax: 512-283-1111
www.dell.com

Denon Electronics
222 New Road
Parsippany, NJ 07054
973-882-7458
Fax: 973-808-1608
www.del.denon.com

Emerson Radio Corp./
Emerson Computer Corp.
9 Entin Road
Parsippany, NJ 07054
973-884-5800
Fax: 973-428-2102

(Continued on page 34)

Figure 4. (CON'D)

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

Fujitsu Ten Corp. of America
National Service Headquarters
19600 South Vermont St.
Torrance, CA 90502
310-327-2151
Fax: 310-767-4355
www.fujitsu.com

Funai USA Corporation
(Also Symphonic)
100 North Street
Teterboro, NJ 07608
201-288-2666
Fax: 201-288-8019
www.funai-corp.com

Gemini, Inc.
103 Mensing Way
Cannon Falls, MN 55009
800-533-3631
Fax: 507-263-3129
www.geminicases.com

GoldStar Electronics Int'l, Inc.
See LG Electronics

GoVideo
See Sensory Science

Grundig/Lextronix Inc.
3520 Haven Ave., Unit L
Redwood City, CA 94063
800-872-2228
Fax: 650-361-1724
www.grundigradio.net

Harmon Kardon, Inc., JBL, Infinity
250 Crossways Park Drive
Woodbury NY 11797
516-496-3400
Fax: 516-682-3523
www.harmonkardon.com

Hitachi America, Ltd./
Home Electronics Division
1855 Dornoch Ct.
San Diego, CA 92154
619-661-0227
Fax: 619-661-3991
www.hitachi.com

Intek Global Corp.
(Formerly Midland International)
1690 North Topping
Kansas City, MO 64120
816-241-8400
Fax: 816-920-1144

International Jensen
25 Tri-State Int'l Office Center
Suite 400
Lincolnshire, IL 60069
800-323-4815
Fax: 708-317-3836

JVC Service & Eng. Co. of America
Division of U.S. JVC Corp.
107 Little Falls Rd
Littlefield, NJ 07004
973-808-2100
Fax: 973-315-5040
www.jvcservice.com

Kenwood U.S.A., Corp.
2201 E Dominguez
Long Beach, CA 90801
310-639-9000
Fax: 310-631-3913
www.kenwoodusa.com

Kyocera Electronics, Inc. (Printers)
3201 Cottontail Lane
Somerset, NJ 08873
908-563-4300
Fax: 908-560-8380

LG Electronics Service
201 James Record Rd
Huntsville, AL 35824
800-243-8000
Fax: 256-772-8987
www.leg.lgeservice.com

Luxman Electronics Corp.
(See Canton/Luxman)

Marantz USA
440 Medinah Rd.
Roselle, IL 60172
630-307-3100
Fax: 630-307-2687
www.marantzamerica.com

Mattel, Inc.
See INTV

Midland International
(See Intec Global Corp.)

Mitsubishi Consumer Electronics
America, Inc.
9351 Jeronimo
Irvine, CA 92618
949-465-6000

NEC Technologies Inc.
Consumer Electronics Division
1250 Arlington Heights Rd
Itasca, IL 60143
630-467-5000
Fax: 630-467-4190
www.nec.com

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

Nintendo of America
4820 150th Avenue NE
Redmond WA 98052
425-882-2040
Fax: 425-882-3585
www.nintendo.com

Okidata
2000 Bishops Gate Blvd.
Mount Laurel, NJ 08054
800-OKIDATA
Fax: 856-222-5310
www.okidata.com

Onkyo U.S.A. Corp.
200 Williams Drive
Ramsey, NJ 07446
201-825-7950
Fax: 201-825-7950
www.onkyo.co.jp

Ortofon, Inc.
1363-42 Veterans Hwy
Hauppauge, NY 11788
516-979-5828
Fax: 516-979-5920
www.ortofon.com

Panasonic Services Company
20421 84th Ave South
Kent, WA 98033
800-833-9626
Fax: 800-237-9080
www.pasc.panasonic.com

Penney, J.C.
National Parts Center
11800 West Burliegh
Milwaukee, WI 53222
800-933-7115
or
6501 Legacy Drive
Plano, TX 75024-7311
972-431-8900
Fax: 972-431-3184
lkelley@jcpenney.com

Philips Consumer Elec Co
Philips Service Company
PO Box 555
401 E Old Andrew Johnson Highway
Jefferson City, TN 37760
800-851-8885
Fax: 800-851-8885

Pioneer Electronics Service, Inc.
1925 East Dominguez St.
Long Beach, CA 90810
310-835-6177
Fax: 310-952-2247
www.pioneerelectronics.com

Proton Corporation
13855 Struikman Road
Cerritos, CA 90703
562-404-2222
Fax: 562-404-2322
www.protonusa.com

Radio Shack Business
Division of Tandy Corp.
1801 S. Beach St.
Fort Worth, TX 76105-2122
817-390-3011

Ricoh Corp.
1996 Lundy Ave.
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DVD Servicing

By The ES&T Staff

Optical disk technology appears to be the portable storage medium of choice for large quantities of data. At least for the time being. Only the researchers in their laboratories know what new mass data storage media may be coming along later. So for now, large computer files will be stored on CD-ROM and the rewriteable variations of that medium, music and other audio will be sold in stores on compact disks, and movies will be available in the form of digital versatile disks (DVD).

DVD has a great deal to offer. For a few hundred dollars, consumers can buy a machine that can play back disks that provide high-quality video, and six (well, 5.1) channels of high-fidelity audio. In short, in conjunction with a large screen TV or monitor and a high quality audio system, DVD provides the home theater experience.

And DVDs provide options that other media do not. For example, DVDs allow the viewer to listen in a variety of languages. Some disks provide a choice of formats: pan and zoom or letterbox. And most, if not all disks, provide a sort of table of contents that allows the viewer to go directly to a particular scene in the movie.

The DVD Player

This magazine has published articles on the technology of the DVD disk, as well as the technology of CDs, so we won't go into the way information bits are stored in pits on the disk, or how the laser retrieves the data. Weíll jump right into the technology and construction of the DVD player, and see how the data from the disk are processed to turn them into a video motion picture and the accompanying audio. It would be useful to mention, however, that because of the huge amount of data required to store a motion picture, the digital representation of the video on the disk is compressed using the MPEG (moving pictures expert group) scheme, similar to the way in which signal information is compressed for transmission in HDTV, so a DVD player has to have circuitry to decompress the data.

We would also like to say at the outset that this will not be a comprehensive treatment of DVD players. That kind of coverage would require several manuals and possibly several days of classroom time. This article will be an overview of DVD operation.

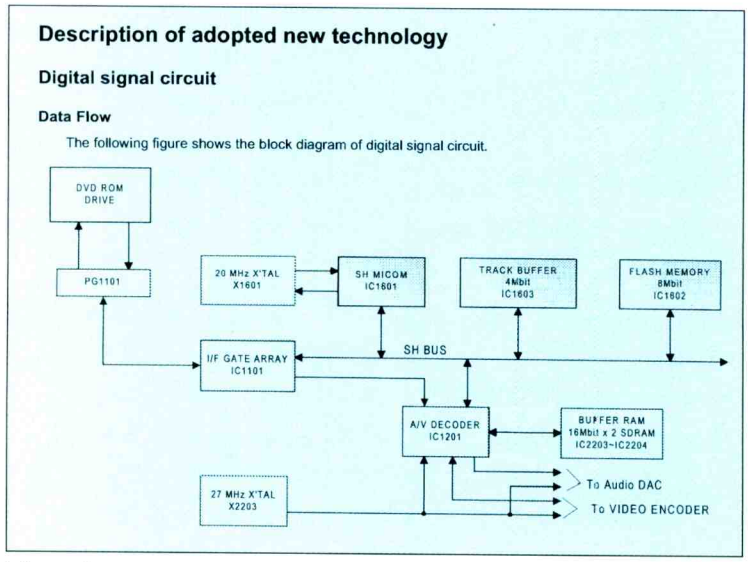

Figure 1

The operating portions of a DVD player consists of three primary systems:

- The DVD ROM drive and servo control,
- The video process,
- The audio process.

Of course, in addition to these three operating subsystems, another critical part of the DVD player is the power supply, which provides the power in order for all of the other systems to operate. And, of course, power supplies are frequent causes of failure in all consumer electronics products.

The Digital Signal Circuit

Figure 1 is a block diagram of the digital signal circuit in a Hitachi DVD player. Here is a general description of what takes place in that subsystem. The disk data is read by the DVD ROM drive, then passes through the I/F gate array (IC1101). The data is stored in the track buffer by the SH MICOM (IC601). The stored data is then read out of the track buffer in response to the demand of the A/V decoder (IC1201) and sent to the A/V decoder via the I/F gate array. The final step in this process is demodulation/decoding of the data by the A/V decoder according to their contents, and the outputting of the audio data to the Audio DAC (IC1501~1504) and video data to the video encoder (IC2202).

IC Functions

Table 1 is a brief overview of the functions of each of the ICs in the digital signal circuits of this DVD player. Below is a description of the same functions in more detail.

1. I/F gate array (IC1101): This IC executes signal timing changes between SH MICOM (IC1601), the DVD ROM drive IF (PG1101), and the AV decoder (IC 1201). It operates on a 20MHZ clock which is an output from SH MICOM.

2. SH MICOM: (IC1601): This IC transfers data and executes presetting and control of each IC. Data transfer from the DVD ROM Drive I/F is done by setting a register of the IF gate array, and by operation of the I/F gate array. In addition, SH MICOM controls the audio DAC ((IC15O1 through IC15O4) and video encoder (1C2202), manages track buffer (1C1603) and flash memory (1C1602), and communicates with FL MICOM (1C1701). With the 20MHz XTAL(X1601) connected, it pulses and is used as a system clock.

3. FLASH MEMORY (IC1602): This IC is an 8Mbits flash memory. This is the device in which the SH MICOM program is stored. Access to IC 1602 is controlled by the SH MICOM.

4. TRACK BUFFER (IC1603): The track buffer is a 4Mbit DRAM. It stores data read out from disc. This IC is controlled is done by the SH MICOM, and its

data is read/written via the I/F gate array. In addition a part of this buffer is used as the work area of the SH MICOM.

5. A/V DECODER (IC1201): Data input from the track buffer via I/F gate array is separated into audio data and video data. MPEG compressed data are decompressed (decoded) and output as digital video and digital audio (AC-3). The SH MICOM IC controls the A/V decoder via the I/F gate array. System clock, clock of video interface signals, and clock of audio interface signals operate by inputting 27MHz.

6. BUFFER SDRAM (IC2203 through IC2204): The buffer SDRAM consists of two 16 Mbit SDRAM ICs. This SDRAM, controlled by the A/V decoder, is used to decompress audio and video data compressed by MPEG.

Functions of Each IC

NO.	IC	FUNCTIONS	OPERATING VOLTAGE
1	IC1101 I/F GATE ARRAY	Execute data transfer timings from ATAPI to track buffer, and from track buffer to A/V decoder.	5V
2	IC1601 SH MICOM	Execute data transfer, presetting and control of each IC	5V
3	IC1602 FLASH MEMORY	Store memory for SH MICOM software	5V
4	IC1603 TRACK BUFFER	Buffer memory for data transfer	5V
5	IC1201 A/V DECODER	Execute decompression (decoding) of data compressed by MPEG	3.3V
6	I2203-1C2204 BUFFER RAM	Memory used for decompression (decoding) of data compressed by MPEG and controlled by A/V decoder	3.3V

Table 1

Video Circuit (DEC Substrate)

The 8bit YCRCB digital video stream (P) output from the A/V decoder is input to video encoder ADV7172(IC2202). The video encoder is preset in master mode, which generates reference signals and receives 27MHz from system clock, X2203, and outputs H and V synchronous signals to the A/V decoder.

The video encoder can be set to generate either NTSC (North America, Japan, Taiwan) or PAL (Europe, Asia) output by presetting of an internal register.

A filter circuit eliminates high frequency components of the analog video signals output from video encoder. Later in the S2 processor circuit dc voltage is superimposed on C signals which results in the output of 3 types of video signals: composite video signals, Y/C(S2) video signals and YPBPR/RGB to the RJK substrate via connector 17P (PG2201).

The Video Encoder ADV7172 (IC2202)

A block diagram of the video encoder circuitry is shown in Figure 2. This segment of the circuitry accepts the digital video stream, manipulates it, and outputs three versions of analog video. Operation of the various subsystems in the video encoder is described below.

1. MULTIPLEXER SECTOR
   The multiplexer sector transforms the input digital video stream (input at pins 2 through 9) into 8bit parallel data, then separates them into Y data and CB/CR data and simultaneously changes rate (from 6.75MB/S to13.5MB/S).
2. CONVERTER SECTOR
   The converter generates various internal timing signals with the synchronous signal as standard by adding synchronous signals generated within the IC to Y data, according to the conditions set in the internal

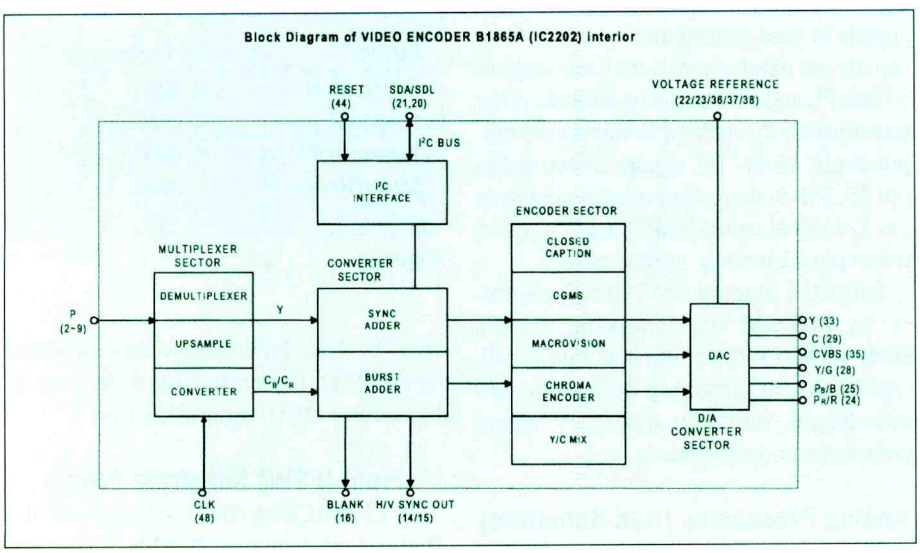

Figure 2

register or by adding BURST signals to CB/CR data. At the same time, the converter outputs these synchronous signals to the A/V decoder (Output at 14,15 pins). In addition, when power is turned ON, a

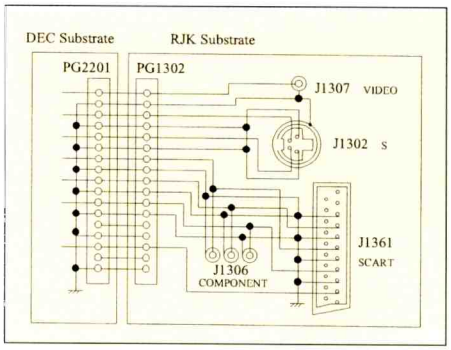

Figure 3

RESET signal (Input of L level at pin 44) is input to reset the register in IC. Writing in the internal register (presetting) is done via 12C BUS (pins 20 and 21).

3. ENCODER SECTOR

The following 1-3 data are inserted in VIDEO DATA depending on which conditions have been preset in the internal register:

a. Closed caption
NTSC Mode: 21 lines and 284 lines/ PAL Mode: 22 lines and 335 lines.

b. CGMS (Copy Guard Management System)
20 lines and 280 lines of NTSC.

c. Macrovision Copy Prevention System

In a final series of steps, the encoder sector generates digital intensity data, digital chroma data, and digital composite data.

4. D/A CONVERTER (DAC) SECTOR

This is a 10 bit DAC. This circuitry transforms DIGITAL VIDEO DATA to ANALOG VIDEO DATA for output. Under control of the DAC output voltage at pins (22, 23, 36, 37 and 38), it output 3 kinds of analog video signals:

a. Analog composite video signals (CVBS/pin 35), output voltage 1.0Vpp.

b. Analog intensity signals (Y/ pin 33), output voltage 1.0Vpp.

c. Analog chroma signals (C/pin 29), burst part output voltage 286mVpp.

d. Analog component YPBPR/RGB.

Video Output Circuit (RJK Substrate)

Figure 3 is a representation of the video output circuit. Analog composite video signals (CVBS), analog intensity signals (Y), analog chroma signals (C) and analog component signals (YPBPR/RGB) are sent from the DEC substrate to the RJK substrate by passing through connector 17P (PG2201-CN1302). From the RJK substrate, CVBS signals are output from output terminal J1307 and Y/C signals are output from output terminal J1302. Component signals are output from output terminal J1306 (YPBPR) orJl36l (RGB).

Audio Circuit

The audio circuit (Figure 4) is composed of a D/A converter section (DEC substrate) that transforms digital audio signals output from the A/V decoder (1C1201), an analog processing section (RJK substrate) that consists of an operational amplifier, and a mute circuit (DEC substrate, RJK substrate) for stopping audio output when required.

D/A Converter (DEC Substrate)

The D/A converter consists of IC1502, which receives and transforms digital audio signals from the A/V decoder into analog signals. IC1502 is a converter corresponding to FL and FR signals of sampling frequencies 44.1/48/96KHz and data lengths of 16/20/24bit. Digital audio signals from the A/V decoder are input at pin 2. To these digital audio signals are inserted FL and FR signals in time-sharing mode. When these signals are input at pin 1, they are separated into FL and FR signals by R clock. After transformation, analog FL signals are output at pin 16 and FR signals are output at pin 13. When there are no input signals at pin 2, a signal called ZERO MUTE is output to pin 21 to mute useless noises.

All of the functions of 1C1502 are preset by MICOM and controlling signals from SH MICOM are input at pins 26, 27, and 28. As for presetting items, there are data length, sampling frequency, signal polarity, and de-emphasis.

Analog Processing (RJK Substrate)

The analog processing section consists of operational amplifier IC1508, a filter, and operational amplifier IC1510, which amplifies audio signals.

The filter portion consists of an RC low pass filter, which along with IC1508 forms an active low pass filter. This filter has three sections. Figure 5 shows the filter portion of the analog audio processing circuit (for FL signals only).

This 3-section filter constitutes a low-pass filter of overall cutoff frequency of 44kHz. After leaving the low pass filter, audio signals are amplified by about 6dB by IC1510 and are then output to audio out1 and audio out2.

FL signals are input at pin 3 of IC1508 and output from pin 1, then input to pin 2 of IC1510 then output from pin 1. FR signals are input at pin 5 of 1C1508 and output from pin 7, then input to pin 6 of IC1510 then output from pin 7.

Mute Circuit (DEC Substrate, RJK Substrate)

The principal role of the mute circuit is the silencing of useless noises that occur when power is turned on. The mute signal for eliminating the noise is generated by SH MICOM, reverse-amplified by Q1505 and Q1506. This signal is then used to turn Q1310 and Q1311 on, thus muting audio signals.

In addition, if IC1502 detects no signal, it generate a mute signal called ZERO MUTE. This latter is reverse-amplified by 01507 and mutes useless audio signals by turning Q1310 and Q1311 on.

5.1CH Difference List

OUTPUT	D/A CONVERTER
Downmix L/R	IC 1501
Front L/R	IC 1502
Surround L/R	IC 1503
Center/Woofer	IC 1504

Figure 4

Front (FSW) Substrate Circuit

1. FL MICOM (the controller for the fluorescent display) (1C1701): This cir-

cuit performs communications with SH MICOM (pins 6, 7, 10 13, 15, 25), including the main frame key and remote control operation, FL tube (1C1702) drive, and lighting of power indicator. In addition, it operates in standby mode as well. When power is on, it outputs control signal at pin 33 to start all power sources and voltages and remove a short circuit between GND and SH MICOM reset IC (1C1605) output.

2. Inclusion of main frame key and remote control operation: Input to FL MICOM takes place at pins 2 and 4 for operation of S1701 through S1715 and S1761 through S1763 of the mainframe key. Input to FL MICOM takes place at pins 23, 24 and 37 through40 for jog shuttle Sw (S1718) operation. The remote control signal is received by infrared receiver element (IC1703), output at pin I and input to FL MICOM at pin 26.

3. FL tube drive: Grid voltage of FL tube AT pins 33-38 is controlled from FL MICOM at pins 41-46; anode voltage of FL tube at pins 5-23 from FL MICOM pins 51-69. FL MICOM pins 65-69 are connected to a 20V supply by R1743-R1747 because no pull down resistance is built into the IC. Filament voltage (AC4.2V) is supplied from power source to FL TUBE at pins 1, 2, 41, and 42.

4. Power indicator: A control signal is output from FL MICOM pins 34 and 35 then input to the LED, driving transistors Q1703 and Q1704 'ON' or 'OFF' then lights 2color LED (LED1761) green or red. When power is 'ON', Q1704 is 'ON' and the green LED lights; when standby, Q1703 is 'ON' and the red LED lights.

Power Supply Circuit

The power supply is an RCC switching type. Energy from the 120Vac outlet is stored in transformer T1, when FET Ql is 'ON'. When FET Q1 turns 'OFF', the energy is released to the secondary side of the power supply. Circuits on the secondary side includes SW (S5V, 53.3V, S12V) that are turned 'ON' by the FL MICOM control signal (P. ON/OFF) at PG19O1 pin 1 and permanently 'ON' supplies (ASV, MUTE A5V, AC4.2V, A-20V, A8V, A-8V).

Secondary side voltage is detected by A5V. D8, C16, and C17, which compose its secondary side commutating circuit. This voltage is fed back to the primary side by photocoupler PHC1, thus maintaining a stable output voltage. This voltage is supplied to FL MICOM and the infrared reception element.

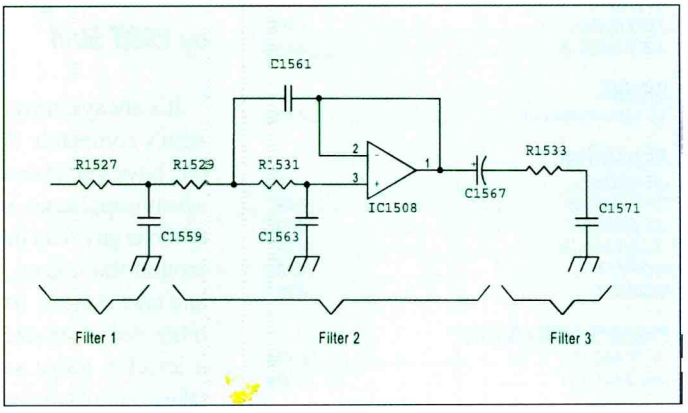

Figure 5

MUTE A5V is for AUDIO MUTE and supplied from A5V output. Output S5V is received from A5V output and via output control circuit Q3.

S3.3V is output from S5V at 3-terminal regulator 1C2.

Dl1 and C24 compose a secondary commutating circuit of S12 that is output by 3-terminal regulator IC3 and is applied to the DVD-ROM drive.

D11 and C24 compose secondary commutating circuits of A8V that is output by 3-terminal regulator IC4.

The +5V power supply for the audio circuit, AUD S5V is produced from A8V in the 5V regulator 1C1506 (in the DEC substrate).

D13 and C29 compose a secondary commutating circuit of A-8V and its output -8V via transistor Q7 and zener diode D20.

A-20V is a negative power supply for the FL tube. D14 and C33 compose its secondary commutating circuit and output -20V via transistor Q6 and zener diode D17.

The supply identified as AC4.2V is applied to the FL tube heater. To prevent fluctuations of output voltage caused by fluctuations of the ac line voltage, a self-exciting push-pull circuit is used. It is input from A5V, is applied to dc/ac inverter composed of transistors Q8, Q9 and transformer T2 and output. This circuit supplies stable voltage without in spite of fluctuations in the ac line voltage. This voltage stability plays an important role in FL tube life maintenance and decrease in brightness.

The Protection Circuit

Protection circuits vary depending on the design of the power supplies theyíre used in conjunction with. For A5V and S5V, when load current increases and exceeds the control limit of the primary side of the regulator, the overcurrent protection circuit of the primary side operates and regulator output will decrease suddenly. At the same time other outputs will be shut down.

For S12V, S3.3V, and A8V, when load current increases and exceeds the control limit of the 3-terminal regulator, the internal overcurrent protection circuit operates and output will suddenly decrease.

If the protection operates, shutting the DVD player down, pulling the plug from the wall socket will eliminate a short circuit caused by the protection circuit. Plugging the unit back in will restores the normal state. When either output A-8V or A-20V is short circuited, fuse F2 will open to protect circuit. When AC4.2V output is short circuited, fuse F3 will open to protect the circuit. When this and A5V are short circuited, fusible resistors R26 and R27 will open to protect the circuit.

Overcurrent protection for A5V, is achieved by destruction of the zener diode, which stops the output. If the DVD player malfunctions in this way, the technician may restore the unit to operation by disconnecting the unit, eliminating short circuit, replacing destroyed parts and plugging the unit in again. ■

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Materials Handling Components to Equipment

By ES&T Staff

It's always intriguing to watch someone who's competent do his work. For example, have you ever watched a mover move a heavy appliance, say a refrigerator. Some of those guys can just wrap a mover's strap around the object, lift it onto their back, and take it away. Awesome, really. On the other end of the size scale, it's fun to watch a jeweler, loupe scrunched into his eye, take a pair of tweezers and place a gem into a setting. One slip, and that expensive gem could wind up in a corner of the jeweler's shop somewhere. The deft hands and practiced eye of the jeweler are also amazing to watch at work.

Handling Things in the Service Center

Interestingly, though, while the mover will probably never be called on in his job to manipulate tiny objects, and the jeweler will probably never be called on in his job to lift a large, heavy, appliance, consumer electronics service technicians are often required to do both.

When a technician goes to a home to service a large screen TV set and it turns out that the set has to be brought into the service center to complete the repair, he's going to have to move that set, or at least the chassis, to the service truck, lift it into the truck, protect it with pads, and secure it against shifting before driving it to the service center. Then, depending on the nature of the problem, once the set is in the service center, that technician, or another technician, may have to desolder a tiny surface-mount device no larger than a large gem, maneuver a replacement part into place, and solder it in.

When you look at the duties and responsibilities of technicians that way, it becomes clear that they require a broad range of tools and aids to help in the handling of large assemblies and tiny components and everything in between. Fortunately, there are a large number of suppliers who manufacture and sell such handling products. We're going to consider a few of them in this article.

Handling the Big Stuff

Let's look at what's involved in getting a large screen TV set from the customer's home to the service center. These units can weigh up to several hundred pounds. And the technician may have to negotiate one or more flights of stairs to get the unit to the truck. And while that moving guy can do wonders with his strap, he's probably stronger than the average technician, and does that kind of thing every day. We don't think that a technician should attempt to carry a 35-inch set to the truck that way.

Something that could make that chore manageable is a stair climbing handcart. They come padded for work with products such as TV sets that can scratch easily. And they come with a variety of bed lengths. The technician places the set on the bed, anchors it with a strap or strap, and wheels it away.

A stair climbing cart has, in addition to the two wheels that it ordinarily rides on on the flat floor, a short treaded device on the back of the cart. When the technician tilts the cart back to roll it down stairs, the tread turns on its track as the cart glides down the front edges of the steps.

Getting it Into the Truck

Once the unit to be brought back to the service center has been brought to the back of the service truck, there are some choices of ways to get the product into the truck. One of course is brute strength. But even a strong fit technician might lift the wrong way, causing him to injure his back. Then he's out of work for a while, and medical attention can cost the company quite a bit of money.

Much better is to provide the technician with ways to maneuver the product without lifting it very far. A simple ramp will allow the technician to roll the handcart, with the set up into the truck. Even better is a tailgate that raises and lowers hydraulically.

At the Service Center

Many service centers have found that roll-around carts are very helpful devices in moving product through the service process. Instead of carrying the set to the

service bench, the technician takes it off the storage rack where it's awaiting service and places it on a sturdy, stable, cart, which he then wheels through the service center to the service bench. There, instead of placing it on the bench, he simply locks the wheels of the cart and services it where is sits. If the unit requires a wait for parts, it can be wheeled to a waiting area until the needed parts come in, and another set can be wheeled up to the service bench.

This requires an investment in quite a few carts, but the time, effort, and possible droppage, saved with such a scheme can be significant.

Don't Sweat the Small Stuff

Handling large-screen TV sets may be hard on your back, but handling tiny devices in the service center; components like surface mounted transistors, resistors and capacitors can be hard on your eyes and your patience: and heaven forbid you should sneeze when handling them. Not only that, but holding printed circuit boards and other subassemblies when soldering and desoldering, without damaging the substrate or any of the components mounted on them presents their own challenges.

These days, given the tiny dimensions of so many components, and the need to hold subassemblies of various dimensions and configurations, every service center should be equipped with a fairly broad array of aids for handling them; tools such as:

- tweezers
- heat sinks
- vises
- magnifiers
- pc board holders
- vacuum pick and place devices.

In addition to those tools and aids, and probably a few that haven't occurred to us, every bench position should be equipped with a set of bins and boxes and other storage units (preferably static electricity free) so that the technician has a place to store those tiny devices temporarily.

It Doesn't Cost, It Pays

All of those handling aids mentioned in this article cost money. But paying to repair or replace a single expensive consumer electronics product that has been damaged because it has been dropped or scraped is costlier still. Not only that, but the owner may consider the unit irreplaceable, and the service center could lose that business. And paying for the medical attention to a technician who has been hurt could be costlier still, not to mention the loss of productivity from a competent technician. Every service center should spend some time evaluating how they handle the products they service and the components they use to repair them, and if indicated, they should equip their technicians with whatever handling products and aids will help them do their difficult jobs. ■

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Model 25E-M100, 25E-M120 color TV3163	3138	May 96
Model 27VS-G300 TV/VCR combination	3139	June 96
Models VC-A555, 556, VC-R955, 956, 958U VCR	3142	Sep 96
Model 20C-V300 TV/VCR combination	Special	1996/97
Models 27H-S200 CH27520 color TV	3148	Apr 97
Model 25H-M100 color TV	3149	Jun 97
Models 20VT-H60, 20VT-H200 20VT-CR6 TV/VCR combination	3151	Aug 97
Models VC-A25U,C A55U, C VCR	3156	Dec 97
Model VC-A70U, VCH100U VCR	3160	Apr 98
Model 13H-M60/100/150, CR13M6/ 10/15 color TV	3161	May 98
Model 19H-M60/100/150 CH19M6 color TV	3162	Jun 98
Model VC-A575U, A578U, R973U H974U, H975U, H976U, H978U	3163	Jul 98
VCR Model 25VT-H200, 25-VS-H300 TV/VCR combination	3164	Aug 98
Model VC-A523U VCR	3165	Sep 97
Model VC-H902U, VC-H906U, VC-H907U VCR	3168	Dec 98
Model 19TG30 color television	3171	Mar 99
Models 25VT-G60/G80/G100 TV/VCR combination	3184	Apr 00
Models 25VT-G60/80/100 video cassette recorder	3187	July 00

TATUNG

color monitor	Special	1994/95

TOSHIBA

Model CF2077A: CX21772 color TV	Special	1992/93
Model M222, M222C, M227C, M227L VCR	Special	1993/94
Model SC-F990 VCR	Special	1994/95
Model CF277IA TV	Special	1995/96
Models 6F35661, CX37662 color TV	Special	1996/97
Model M-651/651C VCR	3154	Oct97

ZENITH

(Models SE3135P/SE3191H/SE3535H/ ZB2771H/ZB2771H2/ZB2777H/ ZB2777H2/ZB2797P/ZB2797P2/ZB2797Y/ ZB2797Y2/ZB3193H/ ZB3193Y/ZB3539T/ZB3539Y) CM-I 39/B2 Models SD5515, SD5535, SD5556	Special	1992/93
Model CM-139/B-I color TV	Special	1994/95
CMI43/digital (A)	Special	1994/95
L-line C-8 Chassis TV	Special	1995/96
Model SD2501W, SD2509H color TV	Special	1995/96
Model PV-144 wall projector	3134	Jan 96
Model CM-142 digital direct view	3136	Mar 96
Model CM 142/C-1 color TV	3141	Aug 96
J-Line Model PV- 143 digital color TV	Special	1996/97
Models S1322S, SMS13245/X, SMS 1325S color TV	Special	1996/97
Model PV-145/C8 (A) rear projection color TV receiver	3158	Feb 98
Models SD 2593W, SD2593Y, 5D5539W, 5D5557Y, 5D5729W, 5D5779H	3175	July 99
Model CM-144/C-3 color TV receiver	3176	Aug 99
Models SD 1995W/5D3923W/5D396IY/ SD3961YH color TV receiver	3177	Sep 99

New Products

TV/VCR Documentation

Sams Technical Publishing has released its newest service product: TVCRfacts. This product addresses the need for service literature for the growing number of TV/VCR combination units being sold in today's marketplace. As the affordability of this versatile product has grown and its applications have become more widespread, the need for repair literature has also grown.

"Repair technicians have been asking us to cover TV/VCR combo units for some time," said Jim Surface, Vice President of Operations for Sams Technical Publishing. "We are happy to be able to provide a product that will help repair technicians to more effectively satisfy their customers."

Included in the August PHOTOFACT of the Month, the first TVCRfacts, which covers four models from Sharp, is now available to be ordered from Sams.

Sams Technical Publishing
Circle (15) on Reply Card

Line of Test Meters

Meterman is a line of more than 60 test and measurement products designed for shop, tool bench, boat, home or back pocket. Wavetek Meterman products are useful anywhere electronic and electrical technicians and engineers and service technicians are installing, building, troubleshooting, servicing or maintaining electrical and lighting, environmental controls, automotive, small appliances or home electronics, says the manufacturer..

The line includes everything from rugged digital multimeters to basic and specialty testers for lighting, electrical and electronics testing. Clamp-on ammeters offer precise electrical readings, while component testers and specialty test tools are useful for electronics troubleshooting.

Digital multimeters, once found solely on the bench of seasoned specialized professionals, now are routinely used by non-professionals at work and at home. According to a study by The Research Department Inc., an independent company specializing in surveys of consumer buying habits, several million digital multimeters are sold every year in the U.S. alone. Most of them are purchased for under $100, for everything from home and car repair to inclusion in a hobby tool grip.

These tools feature large displays, extra fusing, safety test leads, Digi-Glo backlighting, live voltage safety testers, wrong input user warning beepers, a complete line of accessories and patented new T-shape designs to fit your hand.

The HD series / Digital Multimeters offer drop-proof plastic cases, special sealing to be waterproof and dust-proof, extended 1500Vdc range, superior fusing, oversized display and Digi-Glo backlight.

The XT Series / Digital Multimeters, made for multi-purpose applications is designed to be a superior tester for electronics troubleshooting and comes in two models with temperature functions and offer "Tech-Preferred" features such as data hold, max hold and auto-off

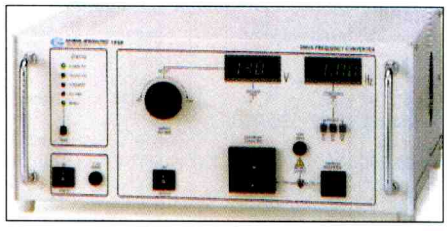
Basic Multitesters and Specialty Digital Multimeters are intended to be low-cost tools for home, ship, auto, boat and do-it-yourselfers, and come in small size that fits in shirt pocket as well as a pen-style meter that tests lighting, electrical and electronics functions

Other products in this line include clamp-on ammeters and DMMs, component testers and specialty tools such at C/R and LCR meters.

Wavetech/Meterman
Circle (16) on Reply Card

AC Power Source/Frequency Converter

Global Specialties announces the Model 1550, a new 500Vac power



source/frequency converter. The unit offers separate outputs for both 115 to 120Vac and 220 to 230Vac; dual digital panel meters for monitoring of both output voltage and frequency; low distortion, clean sine wave output; separate outputs for 50Hz, 60Hz and 400Hz; electronic protection for output overload.

This product is useful for applications involving the testing and monitoring of electrical and electronic equipment destined for the European and aviation market.

With the standard 60Hz frequency operation mode, the unit can be used as a universal ac power sourc/frequency converter for both domestic and some international product development, testing and servicing

Global Specialties
Circle (17) on Reply Card

High-Visibility Yellow Anti-Static Tape

ESD systems.com has introduced its Wescorp brand of high-visibility yellow anti-static tape. This cellulose tape is useful for general-purpose applications and features the "reaching hand" ESD susceptibility symbol. This marking is the approved symbol of MII Spec, JEDEC, and the ESD Association. The symbols are printed between the film and adhesive so they will not rub off. The tape comes in four widths: 1/2", 3/4",1" and 2". Roll length is 72 yards. Thickness is 2.4 mil. The rubber-

based adhesive absorbs moisture and has a surface resistivity of 1010 ohms. Temperature range is 100C to 500C.

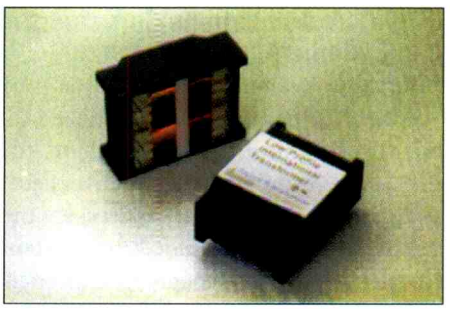
ESD Systems
Circle (18) on Reply Card

Transformers

Signal Transformer Co. introduces 12VA and 18VA sizes to its popular Low Profile International (LPI) family of transformers. The transformers have a number of new features and benefits that make them excellent for design onto new microprocessor boards as well as direct plug-in replacements on existing boards.

Signal has designed the transformers with a rigid pin construction that allows for easier board insertion and produces higher reliability. The transformers also

New Products



have an industry-standard pin configuration, for pin-to-pin compatibility. Other improvements to the transformers include mounting holes for greater resistance to shock and vibration, and the transformers are hermetically sealed so the LPI family can be wave soldered.

The 12VA and 18VA transformers feature improved electrical characteristics, including better regulation, temperature rise and efficiency. Dielectric strength of the transformers is 4000VRMS Hipot. Featuring a split-bobbin design, the transformers have dual primaries and can be designed with either series or parallel secondaries. The transformers are extremely compact, as height ranges from 1.050" to 1.22" and weight is less than one pound.

Signal Transformer Co.
Circle (19) on Reply Card

Battery Chargers

Guest Industrial battery chargers feature sophisticated electronics protected in highly durable, waterproof, shockproof 1 epoxy-potted cases.

Unlike traditional transformer chargers, which may be big, hot and noisy, these chargers are compact, cool and silent.

The manufacturer offers 38 standard models, from 6V, 0.5A to 36V, 15A. In addition, the products' modular electronics provide "mix-and-match" output configurations

The line's MTC (Multi-Task Charging) models house several special-task chargers in one convenient housing. Each converter automatically delivers closely-regulated, 3-stage charging to optimize each battery's recharge cycle. MTC is useful for multi-battery applications; for example, a vehicle with one starting battery and two constant-use batteries, each of which will have unique requirements for optimum charging.

The chargers are appropriate for many industrial on-board charging applications, including lift equipment, emergency vehicles, floor sweepers, shopping-cart pushers, mobility vehicles, refrigeration units on portable trailers, etc.

The chargers can also be used for electric generator-sets, pumping stations, uninterruptible power systems (UPSs), control and signal systems. The manufacturer also has portable chargers for applications like electric bicycles, lawn and farm equipment.

Guest Industrial
Circle (20) on Reply Card

Power circuit overload monitor

MGE UPS Systems introduces its latest solution in improving the reliability of power to critical computing, instrumentation, building and factory automation systems. Overloading power circuits is a prime concern as new computing equipment, control systems and instrumentation devices are rapidly added within a facility, often without checking the capacity of a specific current. The Branch Circuit Monitor automatically checks the current on all 42-branch circuits of a panel board, instantly sounding alarms if any circuit exceeds its user defined current limit - preventing costly mistakes from overloading circuits.

Integrated next to the raceway of the company's Power Management Module panel boards, the Branch Circuit Monitor automatically monitors the current on all 42-branch circuits - providing real-time current information and immediate alarm notification as the current approaches the circuit breakers' "trip point." The monitor also provides exact current consumption details on every circuit, saving thousands of hours of manual measurements. By receiving early notification of high current conditions, facility managers can perform preventive maintenance to avoid unnecessary and costly power drops.

When a branch circuit reaches a specific user defined current, the monitoring system generates a warning alarm on both the local display and communications output. A second alarm activates at a higher current level to indicate that the breaker is approaching its tripping capacity. All alarms identify the specific circuit with the alarm condition. In addition, users can program the alarm thresholds of breakers individually. Alarms are preset for 35A (warning alarm) and 40 A (critical alarm).

MGE UPS Systems
Circle (21) on Reply Card

Global Positioning System

The new compact, handheld 12-channel Garmin eMap Deluxe GPS from Jensen Tools offers detailed mapping

capability. It features simple, one-handed operation, plus a built-in detailed basemap for North America. Additional highly detailed map data may be uploaded to the unit from optional MapSource CD ROM products. The eMap displays street-level detail including addresses and business listings using the MapSource MetroGuide U.S.A. CD ROM. Other features include a backlit display and 14-hour battery life. This water-resistant GPS includes a PC interface cable, a manual and an 8MB datacard. An optional 16MB datacard for greater map data storage is also available.

Jensen Tools
Circle (22) on Reply Card

Literature

Product Catalog

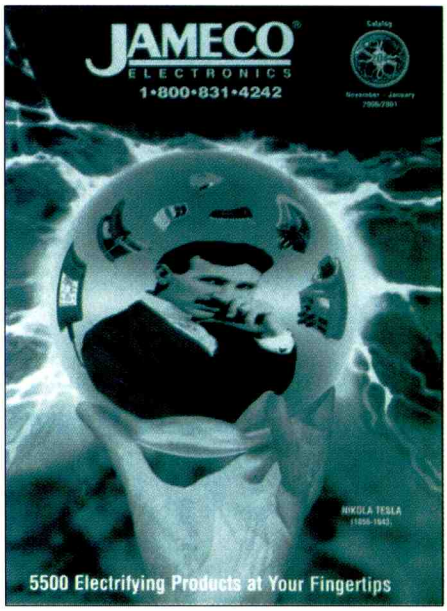
Herman/Panson announces their Catalog #C81000. This 36-page catalog features a broad line of products for use by consumer electronic service centers: tools, tool kits, tool cases, technicians aids, soldering equipment and accessories, flashlights and batteries, technical books, power protection, multimeters and testers, oscilloscopes and analyzers, power supplies test equipment/analyzers/generators and more. The catalog is organized by product category and contains photos of the products.

Herman/Panson
Circle (23) on Reply Card

Components Catalog

Jameco Electronics announces the release of their latest catalog 204, "5500 Electrifying Products at Your Fingertips."

This free 172-page catalog features thousands of ICs and other electronic components, tools, test equipment and computer products for OEM and MRO applications. This catalog is used by engineers, educators, service/repair technicians and buyers to source leading edge and hard to find components. More than 500 new products have been added including: lines of cameras, data acquisition products, fans, fiber optics, keyboards, kits, motors, relays, SMA/SMB cables, tools, power supplies, test leads, meters.. They have also added a broad selection of Samsung, Vishay, General Semiconductor, Fairchild, and Taitron diodes, transistors, rectifiers, and voltage regulators.



Jameco Electronics
Circle (24) on Reply Card

Telecom Equipment Catalog

Viking Electronics announce its 2000 "Telecom Solutions for the 21st Century" catalog. Products include digital voice announcers, emergency phones, apartment entry systems, and more.

Viking Electronics
Circle (25) on Reply Card

ESD Control Products Catalog

DESCO/Charleswater offers a catalog of ESD control products. The products listed in the catalog include personnel grounding, field service grounding, floor grounding, worksurface grounding, mat materials, packaging, test equipment, ionization generators, education and accessories, and production tools. The catalog contains information on how to contact the company via telephone, fax, e-mail and website, and a fax order form that the user can tear out or copy and fax to the company to ask for technical information, product samples, technical assistance, an ESD survey, or to have a factory representative contact the service center.

DESCO/Charleswater
Circle (26) on Reply Card

RF Communications Curriculum and Training Brochure

Andrew Institute, the training arm of Andrew Corporation, has published its RF Communications curriculum for 2001. The Andrew Institute delivers cutting-edge training that addresses the needs of RF communication system installers, project managers, field engineers, and design engineers. Training is delivered at Andrew Training Centers worldwide or at the customer's choice of location.

The 2001 curriculum includes a new VSWR Fundamentals course and expanded courses in Terrestrial Microwave Systems Installation and Connector Attachment. Courses may be modified to meet any level of technical requirement or project-based needs.

An 8 page, full color brochure is available describing the range of training courses and gives details about Andrew training locations worldwide

Andrew Institute
Circle (27) on Reply Card

Websites:

Website Promotes Magnetic Components and Assemblies Cross Reference

Magnetics of North America, Inc. (MNA) announces the launching of its new website promoting the company's standard and custom surface-mount and through-hole transformers, inductors, toroids and custom magnetic components and assemblies. In addition to providing comprehensive product and company information, the new website, located at www.MNAcorp.com, features a Competitor Part Number Cross Reference Search to locate exact or similar MNA parts, and a search function for MNA Part Numbers. In addition, the website can be used to request quotations.

A catalog on the website presents photos, drawings, product features and complete specifications of MNA products Information is also presented on the company's capability to provide custom-designed products and outsourcing and contract manufacturing of magnetic components and assemblies.

Magnetics of North America
Circle (28) on Reply Card

ES&T Readers Speakout

READER OPINION SURVEY/COMMENTS

EMAIL *I am a subscriber to ES&T and continue to enjoy the articles in your magazine. I am 63 years old and have been in the TV repair business for many years as both the owner of a small shop and as a road tech for major corporations. However, largely due to my age I can't get hired any more. So I decided to work out of my garage. That works fine except for one thing, I can't service the 32" & 36" CTVs, too heavy to transport. Obviously, I would need a test jig that I could hook up to the chassis for these sets (32" & 36"). I have the picture tube and yoke from a 27" Mag CTV, model RJ5540AK01 that I would like to use to make a test jig. Can you help me with the design, I know I could make it with your help.*
P.G. – Coral Springs, FL

EMAIL: *Can you edit in CD format circuits vertical/horizon audio video for the last 10 years in different brands? Some times ago I read vertical systems in one edition. Could be a powerful tool for service. Thanks. Subscriber for over 30 years at your magazine. R.P.*

LETTER: *Thank you for years of providing very useful up to date information and education that so aids in the service industry that when I talk to someone that doesn't subscribe I am amazed, and then they subscribe to your magazine. Thanks again.*
Palestine TV & VCR Repair
K.H. – Palestine, TX

The September issue Reader Opinion Card:

Viewpoint has it right. I use ES&T as a reference library. L.R. - Mt Solon, VA

I have seen dozens of reference books on semiconductor. ICs and other spare parts. I would be very happy to see across reference book on Fly Back Transformers. Please send me information on buying same. P.S: Yokes, too.
J.A.- Charlestown, West Indies

Topics on: Public Address Systems, Commercial Sound Systems, Sound Reinforced Systems. Your first issues of ES&T are all very well edited.
Sollis's TV & VCR Service – Costa Rica, Central America

Audio, Audio, Audio! I like to see announcements on industry manufactures and educational institutions offering service oriented workshops, especially for CD's and DVD's. Thanks.
G.G. – San Francisco, CA

1. More information articles on TV repair. 2. Repair articles on actual monitor repairs. Troubleshooting, one section of a monitor at a time. 3. Profax of monitors (Dell) (HP) (Gateway) or any known brands made in the USA.
Doug's TV Service – Crawfordville, IN

Continue to keep us up to date on the pulse of the electronic world. Equipment up dates and editorials. I'm in the Northeast and feel left out and on my own. I enjoyed the article on "What's new for Digital in 2000". The schematics and trouble-shooting techniques and notes are valuable.
David Munster's TV – Windham, ME

VCR, Camcorder and projection TV. Profax are a waste of time, you cannot provide enough info. in 4 pages to benefit any technician. I don't care for the new paper for Profax.
Shaw's TV – Vacaville, CA

October issue comments regarding Profax: White or Yellow Background? Glossy or Dull Coated Paper?

Also can use more info on state of the art PCs and installing software: Quicken, Windows me, etc. – Anon

Too many errors in magazine; should be more closely proofread.
J.M., Huron, OH

Could the magazine be put in a plastic? It gets to me in bad shape. In diagram of VCRs or cassettes, could it include sizes of belts, if any? Here in Canada, a service manual for VCR or TV is $40-$60, and can get it only if service depot in many cases.
S.B.B. – Grand Falls, NB Canada

Would like to see something on RCA/GE 175A dead set! Also on Zenith dead set mod#3SR25525. F.G. – Cedar Bluff, VA

Zenith fix was good. Had one in shop found tuner bad. Toshiba article was good. Clarks TV Service – North Manchester, IN

TV/VCR combo repair. C.P., Cambria, CA

Include part number listing on schematics for high failure components in power supplies, deflection, etc. Thanks, keep up the good work. W.E.D. – Avon, OH

Keep those Profax coming up. Service Literature is sometimes hard to find, even from manufacturer.
G.H. – Bayamon, PR

October issue arrived November 28th!
D.H. – Montreal, QUE

What would be very useful is the pinouts for ICs (showing nominal voltages and waveforms). P.J.G., Bloomsburg, PA

Return Profax to old format!
T.S. – Only, TX

Profax allows me to work on products I would not normally take in. Please go back to the old ones. Sound Furniture
S.R.S. – Swansboro, NC

When you publish schematic of very complicated systems such as camcorders, projection TV's, VCR's, etc. You can never cover it completely and for this reason may not be possible to use them. Better publish complete schematic. Servitel T.V. Service – No. Miami Beach, FL

A Profax schematic that contains only block diagrams (Like the one published in this issue) is not very useful. If the schematic for the product is too large, it's better to publish the complete schematic of a different product or model.
Infocom – C.U.P. – Torreon, Coahuila, Mexico

More good trouble-shooting articles; or TV, TV/VCR, Audio, Projection TV, DVD and CD. Also, computer and monitor trouble-shooting.
R.R. – Coleman, MI

I have every schematic from the beginning and lately have found some of them without the power supply schematic or tuner included. D.S. – Milwaukee, WI

Need articles on newer TVs and VCRs. Magazine great for electronic education before (material appears) in text books.
Petrucci TV– San Jose, CA

How about schematics on CD-ROMs?
H.P. – Palm Harbor, FL

November Issue Comments
With reference to ES&T's 2001 editorial calendar, "what products, topics, or coverage should we add, delete, expand or consider?"

More on DVD troubleshooting.
J.J. – Phila, PA

Very happy to see printers and auto computer systems on your list. Hope your articles include routine maintenance on printers also. Mfg.'s tend to just put operational information. No tech. information. Auto computers systems should be great. An article with all sensors and scan tools also. Hanks - Why isn't your magazine available to the general public on newsstands? Like Popular Science, Mechanics etc? Bigger Circulation.
Potters TV Shop - A.P. -Parlin, NJ

ES&T: *We have some newsstand distribution. We will provide a list of locations in next months' issue.*

Technical updates are a good idea.
Mikes Electronics – M.C. – Des Plaines, IL

Expand Profax to include other manufactures. Touch on computers, but don't get hung up on the subject. Keep Bob Rose on the staff. Good Writer. Keep Homer Davidson also. He's a meat and potatoes writer.
R.J. – Coldwater, MI

Add troubleshooting tips, computer corner, video corner. An article on antique radios. No Name

It appears wireless is top on the list these days. WAP, PCS, Bluetooth the emerging wireless Lan ...could use more information in these areas.
B.R.M. – Synder, TX

Bring to conformity designations in texts and schematics of articles. Print more about computer function and servicing, new parts and peripherals. Place waveforms on Profax; block-schematics for big ICs. Thank You. D.S. – Bronx, NY

More troubleshooting procedures on TV & VCR repair. Need more symfacts on common problems. L.Z., Fair Lawn, NS

More articles on troubleshooting TV's & receivers.
C-J Electronics, J.P., Bay City, MI

More on VCR's and Camcorders.
J.J. – Fremont, NE

More TV, VCR articles!!! More articles by Bob Rose and Homer Davidson. ES&T is a great magazine, if you can get it in the mail on time!
S.R.C. – Mentone, CA

Expand VCR repair power supplies, TV repair. P.T. – Robinson, IL

Looks Good. Wheeler Electronics – Hoffman Estates, IL

More individual (comprehensive) service related info. On TV's most likely needing repair... With updated "Service Tips" (separate section) every month.
Allied TV - Seattle, WA

Would like to see technical bulletins, when they become available from manufactures of electronic products such as TVs, VCRs, and others be published in your magazine. R.R. - Nutley, NJ

Set top boxes if any to convert digital to analog, for the older generation who are really confused about all this new tech.
A.J. R. - San Jose, CA

Need info. on the soldering tool. Who makes it? Or sells it? (Nov. issue)
C.H.R. - Agudilla, PR

ES&T Readers are invited to respond to any of the above or make additional comments. Wherever possible, we will put interested parties together. Send to:
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Email: dallen@mainlymarketing.com.

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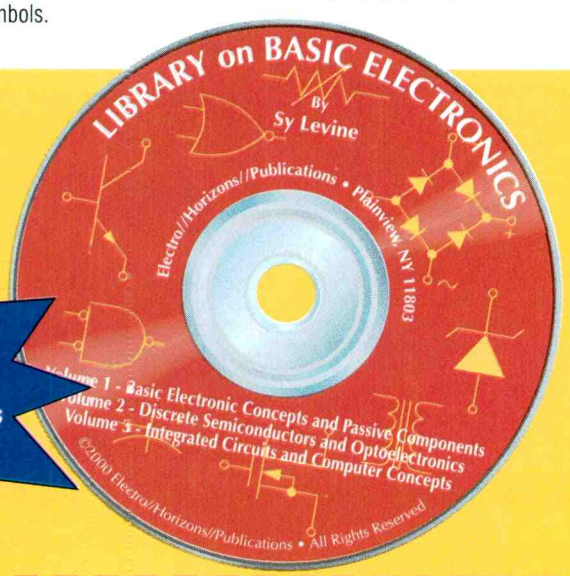

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THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS
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ELECTRONIC SERVICING & TECHNOLOGY
50 ES&T YEARS of Service

Happy New Year! Fifty Times!!!

The New Year is always an opportune time to reflect on the past and speculate on the future. This is especially true for us at Mainly Marketing and Electronic Servicing & Technology magazine.

Since the acquisition of ES&T in August we have met many subscribers, advertisers and industry vendors especially at NPSC and CEDIA. For the warm welcome to the industry, the comments and suggestions and the sincere appreciation of ES&T we thank each and every one of you.

While reflecting on ES&T we 'discovered' an item that seemed to have been lost in the various transfers of ownership the magazine has experienced. According to SRDS, the long time standard directory of publications, 2001 is ES&T's 50th year of continuous publication.

50 years of delivering troubleshooting and repair information to consumer electronics service professionals! With this fact in mind, we imagine many of you have great stories on the business, vendors, products and more. All of this in addition to the changes in technology you have seen.

During the year we will attempt to provide a number of articles, features, reviews and even some anecdotes on these past years. The first of these articles starts on page 6.

As we enter the second 50 years, it is important to address a number of leftover items.

PROFAX is, of course, one of the most important sections of ES&T. Based on input received from a number of people we converted this to white, glossy paper in September. (No, the conversion was not based on cost.) However, the response from readers individually and as a group was deafening! Not necessarily in unison, but certainly with passion.

Overall, the overwhelming response was to return to the 'flat, non-glossy' paper. On the question of running on white paper or the more familiar 'yellowish' paper, your response was virtually 50:50...(not counting the two or three people who wanted to go back to blue).

It would appear that white is better for copying, but the yellow is best for quick identification, within the issue or a stack of other papers. We know we cannot please everyone, but sincerely hope the solution illustrated in this issue serves most of our subscribers well.

Also, we need to address the printing schedule of the magazine. We apologize for the erratic nature of this over the past few months. We are working to get this back on track and beginning with February, we hope to get your issue to you by the 15th of each month.

Finally, after long hours of discussion with servicers and vendors, reading, reviewing NesdaNet and attending industry events we see a real opportunity for the service industry and a renewed obligation for ES&T.

As we finish this issue we see an obligation to provide more coverage on all the events that affect our readers including the implications of recent developments at Bradleys, Montgomery Ward, and Circuit City. So, whether it is providing new servicing information on the proliferation of new electronic products being introduced daily, or covering the changes in how servicers access parts or get paid, ES&T will bring you that information.

Marie Marcellino Dave Allen

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Readers' Exchange is a free service for ES&T paid subscribers only. Please include a copy of a recent address label with your Readers' Exchange Copy. The following restrictions apply to Readers' Exchange:

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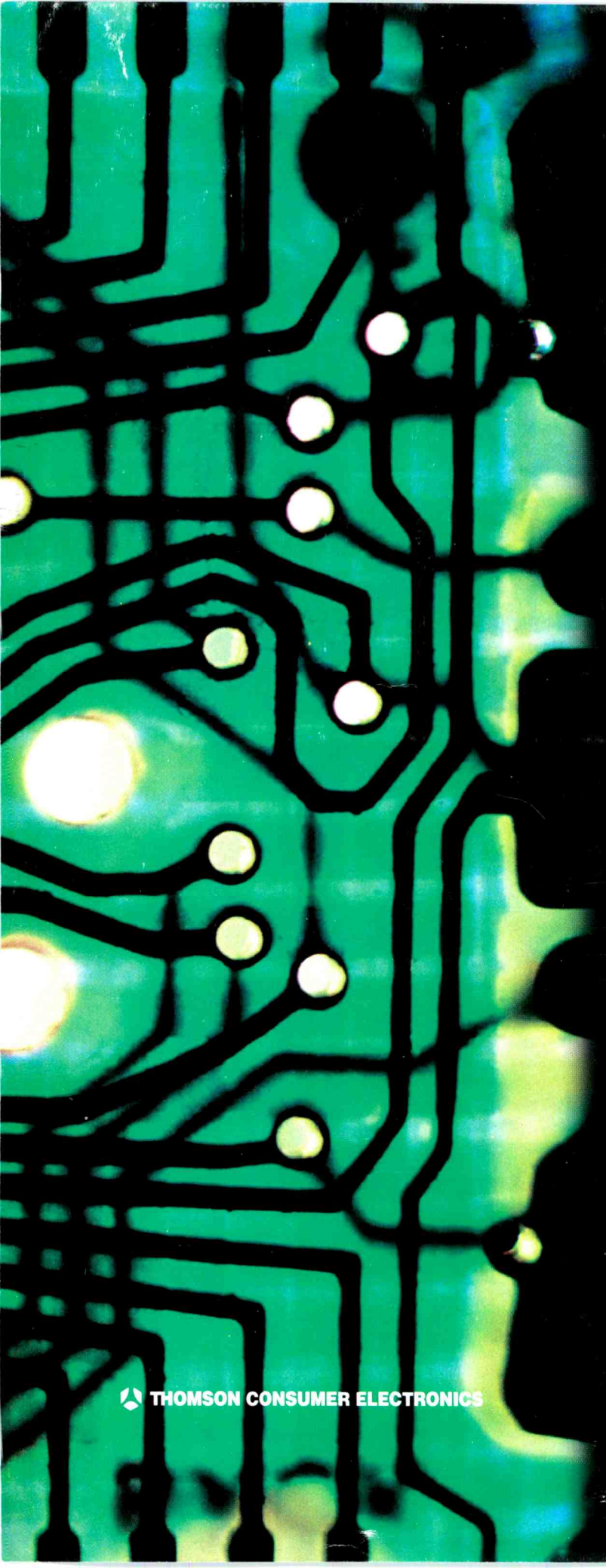

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