

THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS

ELECTRONIC™

Servicing & Technology

September 2001

TELECOMMUNICATIONS TEST EQUIPMENT

AUDIO TRANSFORMERS

HOME THEATER OPPORTUNITIES



**HDTV — THE ROLE OF THOMSON 101
CEDIA WRAP UP**

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SHOWCASE**

**ADVERTISING
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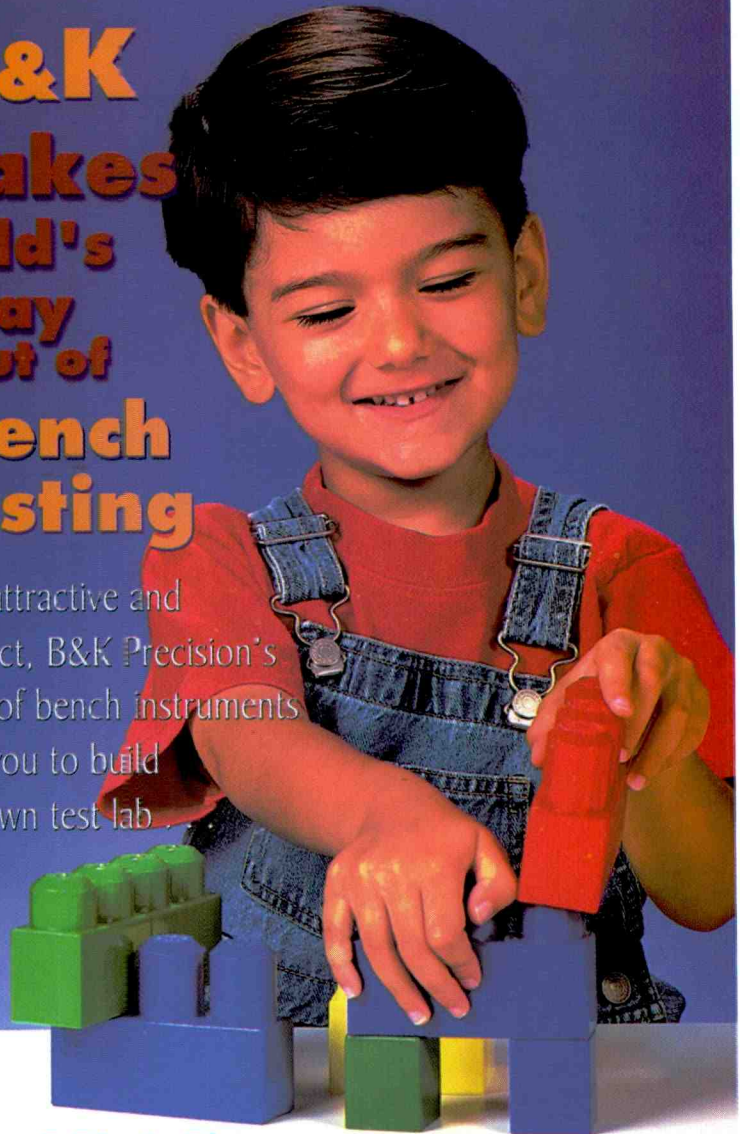
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Circle (6) on Reply Card

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Adapted from NPSC presentation

by Brian Gibson and Fred Paradis, Elite Media

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With the development of the Home Theatre, Professional Servicers need a variety of new, additional and unique tools and aids to provide timely, professional service. A number of ES&T advertisers describe their offerings and commitment to assisting the Professional Servicer in this new environment.

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CEDIA once again illustrated the strength of the Smart Home Market and their ability to bring the entire industry - manufacturers, vendors, distributors, servicers, installers and packagers - together for a week of learning, buying, demonstrating and 'oo-ing' and 'awe-ing'.

TELECOMMUNICATIONS TESTING _____ 23

Adapted from a book written by Jim Hayes and the staff at Fotec

Telecommunications, whether within a modern home, or from the telephone company, or a cable provider to the residence, means fiber optic.

This article considers some of the test required on fiber optic systems, and details some of the equipment used to perform those tests.

AUDIO TRANSFORMERS _____ 41

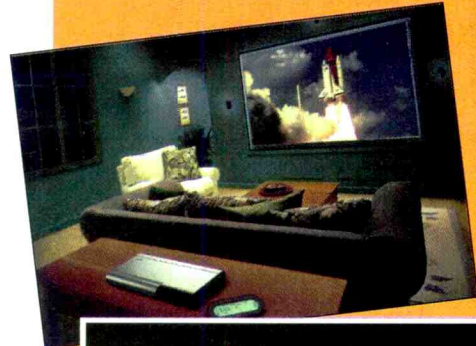
By Rick Waller

This article covers the use and applications for transformers within audio circuits, and provides helpful information and ideas for the Professional Servicer troubleshooting problems in audio equipment.

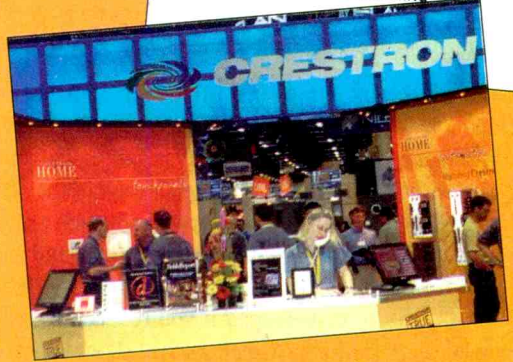
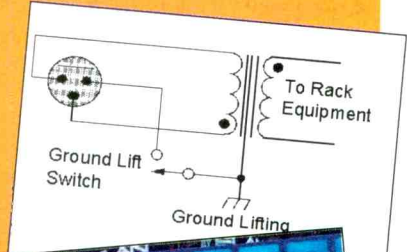
NOTE TO SUBSCRIBERS

As many of you know the publishers of ES&T recently lost two family members after extended illnesses. While the first year of ownership of any publication or business is difficult in its own right, these events simply compounded the situation and put us behind in production. We are well on our way towards getting back on track and all subscribers will receive their full years' subscription.

And, to all who have expressed their condolences and encouragement, we say "Thank You." — Marie Marcellino, Dave Allen



HOME THEATER SHOWCASE AN ADVERTISING SECTION



Cover Photo Courtesy of Bose Corporation

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Editorial

by Nils Conrad Persson

FIX IT OR THROW IT OUT

"Use it up, wear it out, make it do, or do without." That's an old expression I remember hearing back in a different age. People who grew up during the depression, or during other hard economic times, remembered that if something broke and couldn't be fixed, a new one might not be available.

My how things have changed! These days, there is such an abundance of inexpensive products, many people think nothing of tossing away something that no longer meets their needs and getting a new one. That is especially true when it comes to the home electronics products we have come to take for granted: TVs, VCRs, DVD players, camcorders, microwave ovens, cordless phones, answering machines, computers.

After all, when any of these products can be purchased for not much more than it would cost to repair the old one, and the new one produces a better picture and better sound, and has more convenience features than the old one, why should the owner even consider repair? Well, of course there are reasons: the old one might be more sturdily built, the owner is familiar with its operation, and the more products we replace, the more the landfill will be filled with products that may leach toxic chemicals into the earth. But that's hard to see when the owner is down at the mass merchandise outlet salivating over the latest technology.

Things may have just become even worse for the service center who may be trying to convince a client to service a faulty product rather than buy a replacement. The October 2001 issue of one of my favorite magazines, "Consumer Reports," includes an article entitled "Fix it or Forget it," which gives their readers advice on whether to have a product serviced, or to buy a new one.

I don't mean to imply that I find fault with the article. I don't. I seldom buy a new product without consulting CR. And I pretty much agree with the findings they report in this article. I'm writing this merely to make service centers aware of the article's existence, and suggest that they read it. Forwarned is forearmed, so they say. If a customer comes in with a faulty product and is looking for you to help him make a repair/replace decision, you'll have a better shot at performing that repair if you're ready with some kind of sensible explanation of why the client should opt for service. In other words, you may have to sell service.

The article introduces three categories of decision:

- Repair the product
- Consider repairing the product
- Replace the product

The article doesn't just consider consumer electronics products. They cover most household products that have moving parts, or electrical or electronic circuitry: Lawn tractors, riding mowers, self propelled mowers and push mowers, refrigerators, ranges, computers, washing machines, clothes dryers, vacuum cleaners. Moreover, they even name names when it comes to products that require service more frequently than others. You might be surprised at some

of the names among the electronics products (or maybe not).

Here are some examples of what the article advises when it comes to consumer electronics. Keep in mind that we're talking about products that are not under warranty. Obviously, if the product is under warranty, the consumer will want to have it repaired (or replaced). For television sets from 19 inches to 27 inches, consider repair during the 2nd or 3rd year. After that, replace the item. For VCRs, consider repair during the second year. After that, replace.

A lot of the repair/replace advice is based on the ratio of the purchase price of the product to the cost to fix it, as well as the likelihood that buying a new product will obtain for the purchaser a considerable improvement in features. For example the article recommends repairing a lawn tractor or riding mower as long as eight years beyond its purchase date. Hey, those babies sell for something in the range of \$800 to \$2,500, and you can get one fixed for between \$100 and \$300, according to the article.

The article also includes a page of details meant to help consumers make up their minds. Including a segment called "Special repair problems". To get specific, under Projection TV's, CR reports that their readers had reported that parts are hard to get and repairers hard to find. Actually that's helpful information for servicers. Advertise and otherwise get your name out there, and you won't be hard to find. And be ready with answers about the availability of replacement parts.

The article also points out that a decision to replace adds one more product to the landfill. Additionally, it points them to the websites of several organizations that have information about recycling.

Of course, you already know this, but the best way to sell service, when you truly believe that the consumer will be better served by your expert service rather than by replacing the product is to act and dress professionally, and project an attitude that gives the consumer confidence that you're advising him in his best interests, and that you can successfully retun the product to like-new operation, and that it will remain that way for some time.

CONSUMER HELP SITES:

www.pcappliancerepair.com
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RECYCLING SITES:

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www.eiae.org
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www.recycle-steel.org/database/main.htm
Rechargeable Batter Recycling Corp.:
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Conrad Persson

THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICES

ELECTRONIC

Service & Technology

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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403 Main Street, 2nd Floor
Port Washington, NY 11050 USA
516-883-3382 Fax 516-883-2162
mmei@mainlymarketing.com

EDITORIAL

Editor: NILS CONRAD PERSSON
P.O. Box 12487, Overland Park, KS 66212
913-492-4857
cperseedit@aol.com

CONSULTING EDITORS

TV Servicing Consultant: BOB ROSE
TV Servicing Consultant: HOMER L. DAVIDSON
Components Consultant: VICTOR MEELDIJK
Audio Consultant: ALVIN G. SYDNOR

BUSINESS

Publisher: MARIE MARCELLINO
mmarcellino@mainlymarketing.com

President: DAVID L. ALLEN
dallen@mainlymarketing.com

CIRCULATION

Circulation Coordinator
Tel: 516-883-3382 admin@mainlymarketing.com

PRODUCTION

Production Manager: MARIANNE MEADOWS
mmeadows@mainlymarketing.com

SALES STAFF

Sales Director: DAVID L. ALLEN
dallen@mainlymarketing.com

Sales: JONI JONES
P.O. Box 346, Port Washington, NY 11050
Tel: 516-944-8068 Fax: 516-944-2739
jmjones@ix.netcom.com

Sales: BARBARA ARNOLD
60 Thoreau Street, Concord, MA 01742
Tel: 781-259-9207 Fax: 781-259-9883
bhacat@tiac.net

International: JAY FEBRER
jfebrer@mail.com

Classified/Display Classified: LYNDIANE PAOLETTI
Tel: 516-883-3382 admin@mainlymarketing.com

Sales Coordinator: LYNDIANE PAOLETTI
admin@mainlymarketing.com

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EIA Announces Industry Pilot Project for Electronics Recycling

The use of electronic products has dramatically changed and improved the way we live. Consumer demand for new and innovative technologies has never been greater. However, there is concern that demand for the latest technical advancement will result in the generation of large volumes of used or discarded electronic products.

The Electronic Industries Alliance, in cooperation with contributing manufacturers Canon, Hewlett Packard, JVC, Kodak, Nokia, Panasonic, Philips Electronics, Sharp, Sony, and Thomson, today announced the development of an innovative electronics collection and recycling pilot project. Scheduled to launch in October, the pilot will test several different models of electronics collection and recycling. From the pilot, participants hope to generate data that will help guide the development of a cost effective and efficient long-term electronics recycling program.

The scope of products covered under EIA's pilot program will be CRT, (Cathode Ray Tube, or traditional) and LCD (Liquid Crystal Display, or flat-panel) monitors, TVs, computers and computer peripherals.

Three separate models will be tested: a municipal model, a retailer model, and a consumer drop-off model.

Municipal — Under this model, municipalities would collect used electronics and transport to a designated recycler. Companies participating in the pilot would then reimburse the designated recycler(s) for the cost of recycling any of their products.

Retailer — Similar to an "advanced disposal fee," under the retailer model, industry will provide funds to participating retail outlets based on the number of products sold that are covered under the EIA pilot program (see above for covered products.) In turn, retailers must hold collection events and transport the materials to chosen recyclers.

Consumer Drop-Off — Industry will partner with any retailer willing to hold a collection event at their site. Industry funds would be used to pay for promotion, education, coupons and/or rebates surrounding the event. The retailer would

in turn contract with recyclers and charge consumers a "drop-off" fee for each product collected. The drop-off fee would pay for the cost of the recycling.

At the end of one year, these models will be evaluated on the basis of their collection and recycling rates, as well as their relative costs.

New York - Weak TV Signals for 3 Years.

The Television All Industry Council has concluded that it may take up to three years before full signal strength and coverage will be restored to the New York Market.

The September 11 attack on the World Trade Center demolished a 364 foot transmission tower that provided an analog TV signal to viewers in three states.

The NY stations have worked to restore their signals with varying success. Channels 4, 7, 11 and 13 are using an antenna in Alpine, N.J. Channels 5 and 9 will also originate there with limitations.

Only channels 2 and 41 have full power on the Empire State building, which according to ES&T sources will require major rewiring and construction before additional towers and facilities can be added.

The Neilson NY Designated Market Area includes some 20 million viewers 4 million of which do not have cable.

CEA Files Comments on Distribution of Interactive Television Services Over Cable

The Federal Communications Commission (the Commission) should promote a level playing field in the burgeoning market for Interactive TV (ITV), said the Consumer Electronics Association (CEA) recently in comments filed with the Commission. CEA also expressed concern in the filing about the impact of program and interactive services, including electronic program guides (EPG) that are essential for program navigation in "cable-ready" products, such as TV sets and set-top boxes. The Commission is reviewing both the distribution of ITV services over cable and its 1998 rules on navigation devices in separate proceedings.

"The questions posed by the Commission in this Notice of Inquiry for ITV services should not be considered in isolation. The openness of the market for ITV services is closely linked to the likelihood that a competitive market for cable-ready navigation devices will arise..." CEA said in its filing. "Unless the program and system information that makes possible the creation of EPGs is made available to manufacturers and other parties, such as providers of competing EPG services, then competition in both equipment and

services will be stifled."

As the principal trade association of the consumer technology industry, CEA has been an active participant in negotiations as the Commission has formulated its various digital TV (DTV) and ITV policies. CEA agreed in this proceeding with comments filed by the Consumer Electronics Retailers Coalition (CERC), Gemstar-TV Guide International (Gemstar), Media Access Project and TiVo in their call for Commission intervention in the market for ITV services. Without Commission intervention now — in the form of a non-discrimination policy — to forestall the need for future regulatory action, CEA said, ITV market concentration will be left in the hands of cable "gatekeepers" to the ultimate harm of the consumer.

"Both consumers and consumer electronics manufacturers will benefit from a marketplace built on reasonable, open standards along with the freedom to innovate. Moreover, the transition to DTV will be accelerated if the Commission fosters an open standards environment where competition can flourish, and consumers become excited by a wide variety of choices," CEA argued.

Premier Farnell Global Expands to Mexico, Brazil and China

Global electronics distributor announces major initiatives in Mexico, Brazil, China as part of \$130 million program.

Continuing its global expansion program, electronics and industrial components distributor, Premier Farnell plc, made public the details of major initiatives in Central and South America, and China. Chicago-based Newark Electronics, a wholly-owned subsidiary of Premier-Farnell, will manage operations in the Americas, while UK sister distributor, Farnell will cover Europe and Asia.

Present in 22 countries around the world Premier Farnell now has 37 such global agreements with suppliers such as Agilent, Microchip, Molex and Schurter.

In response to huge demand from companies in the free-trade boom area on the Mexican side of the US border, known locally as 'Maquiladoras', Premier Farnell is stepping up its distribution

effort, shipping product from its main warehouse in South Carolina, USA. The area is currently dominated by American and European-owned companies, mainly working in manufacturing, automotive, telecommunications and consumer electronics. From autumn 2001, the company will serve this market as well as Mexican-owned companies through keys sales office locations within Mexico.

Within South America, senior Premier Farnell executives identified Brazil as the country with the greatest growth potential within maintenance, repair and operation (MRO), in the automotive and general manufacturing sectors. With a warehouse established in Sao Paulo, the distributor is basing its main office operations in that city and from Rio de Janeiro. Growth to date is 39 percent, year on year.

On the other side of the Pacific, Premier Farnell has already established a sound

presence in China and is poised to take advantage of the country's scheduled entry into the World Trade Organization (WTO) in 2002. In accordance with current Chinese trading restrictions, the company currently operates through local import/export agencies throughout China, shipping products from its regional hub warehouse in Singapore.

Warranty Services

Kemper Warranty Services (KWS) has signed an agreement with Philips Consumer Electronics North America to manage the electronics manufacturer's Priority Retail Services™ and Priority On-Site™ service contract programs.

The service plans, which include coverage of all brands of consumer electronics and most appliances, regardless of the manufacturer, will carry the Philips brand name and be sold through specialty retailers and mass merchants. Service Net, a KWS company, will administer the programs. The programs will allow retailers to offer Philips-branded extended service contracts on televisions, DVD-video players, home cinema systems, audio systems and other consumer electronics as well as appliances for any eligible make or model of product carried by their stores.

"With Kemper Warranty Services," we have a great warranty, support and service team to ensure that our customers receive the maximum enjoyment from

their covered products," said Ken Goins, VP, GM-Philips Service Solutions Group. "The Philip Priority service contract programs will help Philips and the programs' retailers reach new customers for multi-brand product coverage, as well."

Under the arrangement, Service Net will manage 24-hour/7-day customer-telephone support, claims processing and, if necessary, service dispatch for Philips Priority service contracts. Service Net will also assume management and administration of the majority of Philips' existing portfolio of service contracts. Kemper will provide the insurance backing for future Philips Priority service contracts.

The Philips Priority service plans that Kemper Warranty Services will provide Philips' customer-or customers of other electronics or appliance brands-upgrade the industry-standard one-year manufacturer's warranty. These service contract programs will extend coverage for a selected number of additional years.

Loss at Union Electronics

Union Electronics suffered a tragic loss of two employees on Sept. 19 evening: Mike Bridges from our sales department, and Kerri McCulloch from our ordering processing department. They were both killed in a automobile accident on the way home from work.

In addition to the great loss of our nation suffered last week, this is very difficult for us here at UED to deal with. Please bear with us, while we try to continue our normal business operations to the best of our abilities.

Regards,

Carol Surufka

Union Electronics

-800-648-6657, carol@ued.net

On behalf of The National Electronics Service Dealers Association its members, officer, and staff, we wish to express our sincere condolences to all of our industry partners at Union Electronics upon the recent news of the tragic loss from your staff and our industry family. May you find comfort in faith with the knowledge that your peace and well being are in the prayers of many friends.

Sincerely,

John Eubanks

NESDA President

Union Electronics would like to express great thanks to all that have sent their thoughts and prayers. All of your kind messages have been forwarded to Mike & Kerri's families.

Regards,

The Union Electronics Family

WinSTIPS, ServiceTalk, and MonitorTalk Have Returned Home to ServiceSoftware.com.

Sanford, ME - After nearly a year-long absence, WinSTIPS will return to ServiceSoftware.com. Since January of 2001, WinSTIPS has been maintained and distributed exclusively by Doug Hull, a son of WinSTIPS' founder.

The return of WinSTIPS to ServiceSoftware.com marks resumption of sales, maintenance, and development by the application's creator. Paul Gendreau brings more than twenty years of consumer electronics industry experience to the job, as well as recognized software development expertise. Gendreau says that enhancements to the WinSTIPS platform are already in the works.

ServiceSoftware.com also plans to re-introduce Web-site features that will allow ServiceTalk members to access a subset of WinSTIPS service tips online at ServiceSoftware.com, as

well as enter new tips while online.

Facilitating collaboration among service centers-and enabling service centers with information -- has been a primary focus of ServiceSoftware.com in the past.

WinSTIPS is a database of service tips (symptoms and cures) for consumer electronics service centers, and has been consistently recognized as the industry leading application. WinSTIPS enables service centers to make a profit by reducing troubleshooting time to a minimum. WinSTIPS does this by leveraging the collective experience of thousands of technicians.

ServiceTalk and MonitorTalk are email-based forums for the discussion of technical and business issues that are of interest to consumer electronics service professionals.

SatisFusion Acquires How2TV

SatisFusion has acquired How2TV, a full service provider of audio/visual sales, support and training solutions. The technology brought by How2TV will complement SatisFusion's portfolio of customer satisfaction tools, according to a company spokesperson.

AMX Opens West Region Office in Denver.

Richardson, TX - AMX corporation, producer of advanced control system technology has opened a new Rocky Mountain office in Arvada (Denver) Colorado, to provide their dealer network hand-on customer service, according to a company spokesperson.

AMX Chairman, President and CEO, Scott Miller commented, "The opening of the Denver office will provide additional customer support and service required by the demand for AMX products within the West Region operations."

The new office is located at 5310 Ward Road, #G05, Arvada, CO, 80002.

John Johnson Returns To NHTAS Director of Sales For Home and PRO Speakers

Benicia, CA-John Johnsen has returned to Now Hear This (NHT) to re-claim the role of Director of Sales for home and pro audio products, according to an announcement made by Chris Byrne, Vice President, General Manager of NHT.

Johnsen, who previously held the position from 1990 - 1997, takes over the Director of Sales role from Randy Dowis, who now moves to Director of Marketing.

"From his knowledge of the specialty audio and pro markets to his personal passion for the products, John is easily one of the most energetic and enthusiastic sales executives in the business bar none."



*John Johnson
Director of Sales*

said Byrne. "Veteran NHT dealers know that his razor-sharp attention to detail, along with his keen ear and unending enthusiasm for the category, helped develop the NHT personality, making it one of the most revered brands in the high-end audio industry."

In addition to his work for the original NHT brand, Johnsen was, along with Byrne, a co-founder of Vergence Technology from 1997 - 1999, where he served as Director of Sales for the NHTPro line of studio monitors. Following his role at Vergence, Johnsen moved to Parasound Products, Inc., where he served as Director of Sales and Marketing from 1999 - 2001.

Fragmented, Yet Focused Market

According to Johnsen, the current state of the high-end audio market requires manufacturers and dealers to reassess and

perhaps realign their respective styles of doing business.

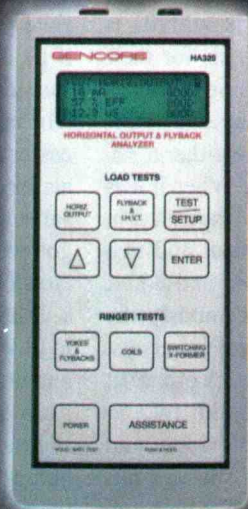
"The audio market is far more fragmented than it was as recently as five years ago," said Johnsen. "There may be less unit volume, but, overall, there's more business, and new niches are evolving at a rapid pace. Subsequently, many specialists are tailoring their services to specific needs, and it's up to companies like NHT to offer products that make it easy for retailers to cater to consumer demands."

"Moving forward, NHT is in a particularly good position to work with retailers as their markets evolve. This company enjoys a strong history of developing high-performance, application-oriented speakers that are truly functional with exceptional value for the price, which is why we enjoy such intense dedication from our dealers."

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Circle (8) on Reply Card

A Look at an HDTV Precursor: The Thomson MM101

by Bob Rose

As I plan to discuss in a series of future ES&T articles, “peripherals” in a consumer electronics product, devices that are tied to a communication bus, may and in fact do cause problems. The purpose of this article is to call attention to peripherals that are not only on the horizon but also in actual use, in a chassis that, with modifications will be used as the platform for HDTV sets.

I’m talking, for instance, about the ability of newer home entertainment equipment to be linked together in various ways to permit the consumer to control an entire system through just one piece of equipment. I could have used any one several devices to illustrate the point. Of those, I have chosen Thomson’s MM101 as the example. The reasons for my choice are simple: the technology is here and in use by consumers, and I have far more information about it than anything else.

An Overview of System Control

According to Thomson, the MM101 the “newest platform of digitally controlled chassis” serving as a spearhead for

Thomson’s efforts to get into the high-end integrated TV/computer monitor market. With a few modifications, the MM101 is expected to be the base chassis for their HDTV products. Its selling features include multi-input, multi-scan, and multi-sync capabilities packaged in either a 32-inch or 36-inch tube format. When it was first introduced, the MM101 operated in the standard 4x3 NTSC format and two computer formats (640 x 480 and 800 x 600), but there are plans to modify the chassis for 16x9 format and projection sets.

Input connections on the back of the set include three NTSC baseband, two S-video, two VGA, one YUV video, and corresponding audio inputs. It also has provisions for SDTV and HDTV inputs from compatible sources like the DTC100 set top box.

It even has a USB port with an upstream port from the computer and two front panel downstream ports and meets all the requirements for USB hub performance and sourcing.

Because of this, I have chosen to use it as illustration of what’s on the horizon

with respect to peripherals. I like the way Scottie, the engineer on the Starship Enterprise, put it when Captain Kirk asked if he could “sabotage” one of the newer starships. Scottie said he could because “the more sophisticated the plumbing, the easier it is to stop it up.” Given peripherals like bus expanders and USB (universal serial bus) ports, the “plumbing” has gotten really sophisticated, and the means “to stop it up” have multiplied.

I shall forego reproducing the schematic of the complete system control circuit and present the material in block diagram form only. Take heart, then, and look at Figure 1, paying attention to how each “block” is configured with respect to the microprocessor. I assume you know that anything tied to the microprocessor via the bus can be considered a peripheral!

The microprocessor, U13101, belongs to the Thomson ST9 family of microcontrollers that are specially suited to function as system control of a television chassis (Figures 2 and 3). The controller comes in a 56-pin dual-in-line package and uses a 16-bit processor equipped with eight

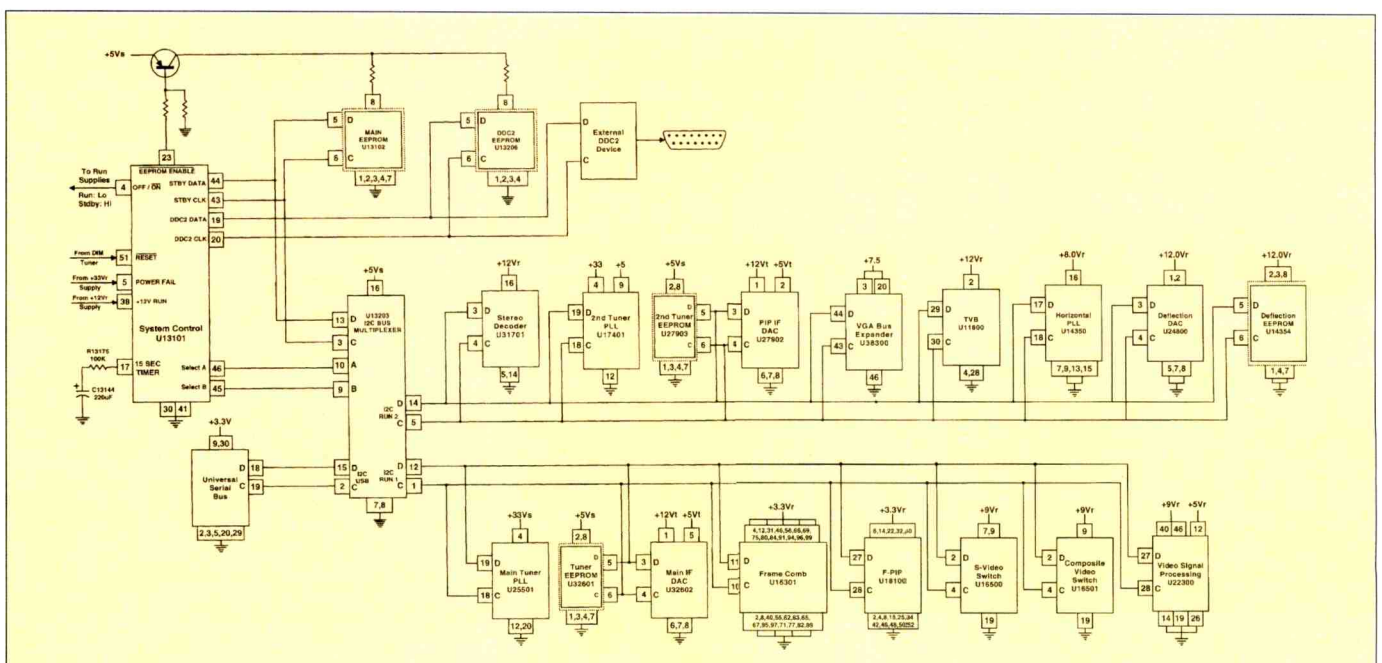


Figure 1. System Control

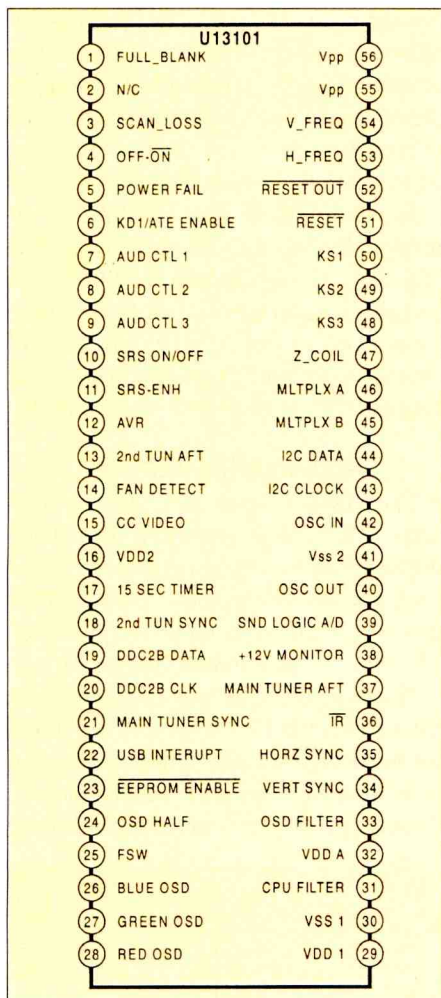


Figure 2. Microprocessor Pin Out

digital-to-analog converter ports that are individually addressable for different functions and communicates with the chassis via the industry standard I2C bus.

Like the microprocessors with which you and I are familiar, U13201 depends on programming information stored outboard in a 32 kilobit (4K) EEPROM. The EEPROM, U13102, contains all system control functions, some chassis alignments, and status registers that store customer settings and current operating conditions. Make a note that the set has three additional EEPROMs that are associated with other chassis functions.

So far, so good. There is nothing particularly new about what I have just presented, except for the fact that the MM101 uses four EEPROMs instead of one. We see it over and over again in the units we service on a daily basis. Much of the stuff, then, that is new pertains to the peripherals that have been added to the system and put under the management of the microprocessor.

The Universal Serial Bus

I suppose the most noticeable of the new peripherals is the universal serial bus. If you are the least bit computer literate, you are on speaking terms with its technology as the latest peripheral connection scheme.

Developed by a consortium of companies that include Compaq, Digital, IBM, Microsoft, NEC and Northern Telecom, Universal serial bus technology (abbreviated USB) promises faster data transfer, simplified hookup, and easier configuration of hardware devices. Having used USB technology for more than two years, I offer the opinion that the technology lives up to its promises, and I am heartily grateful for it.

USB technology makes the claim of faster data transfer, but data transfer speed may be misleading. Table 1 shows the relative bandwidth of some of the more common methods of data transfer. Note that USB is slightly faster than a normal T1 communications line but not as fast as other internal computer bus structures.

But it certainly does improve the connection of add-on peripherals in a number of ways. It is in fact simplicity itself. Using intelligence from the host computer, the USB detects when a device is added or removed while power is on without having to reboot the system. If you have had any dealings with computers, you know how convenient such a scheme is: no expansion slots, no need to turn the machine off to disconnect or connect a device, no device cards, etc. The USB even automatically determines the host resources including driver software and bus bandwidth and makes

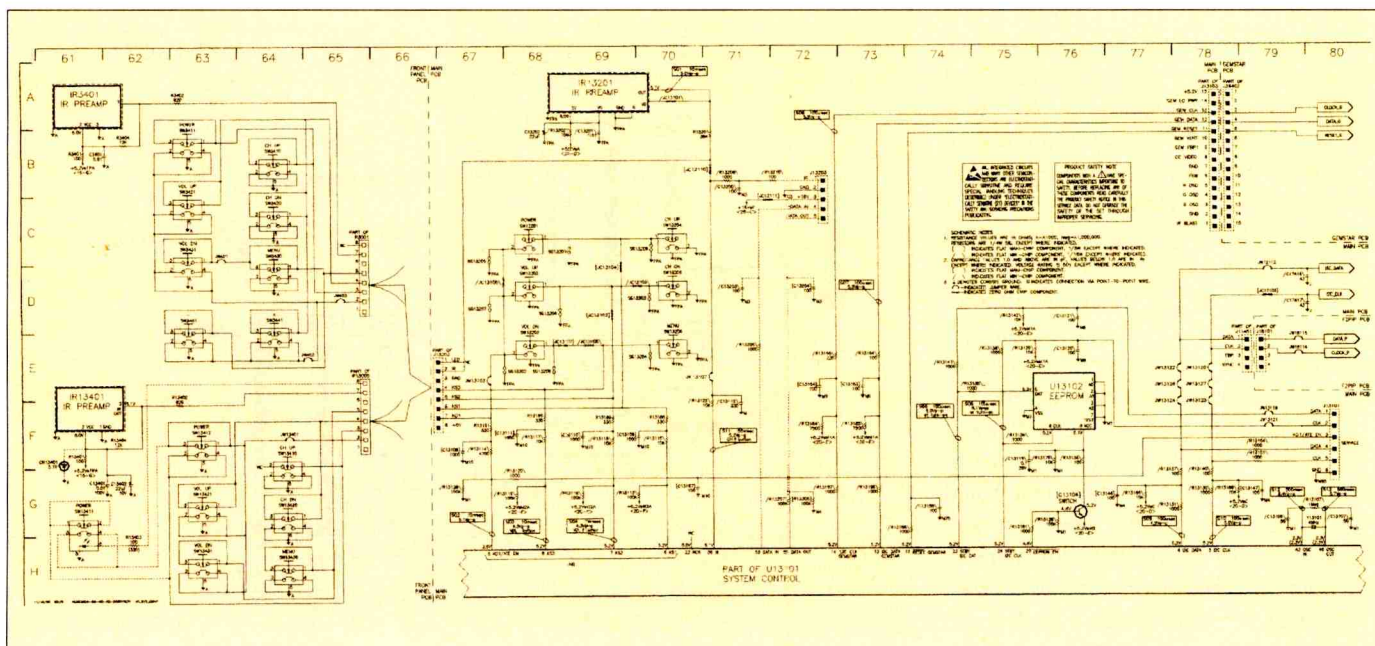


Figure 3.

PORT	Data Rate (Mbits/sec)
Serial Port	0.0143 MBYTES/s (115kbits/s)
ISDN	0.016MBYTES
Standard Parallel Port:	0.115MBYTES/s (115KBYTES/s)
T1 Communications Line	0.193MBYTES/s
USB-Low	1.5MBYTES/s
ECP/EPP Parallel Port:	3MBYTES/s
IDE	3.3-16.7MBYTES/s
SCSI-1	5MBYTES/s
SCSI-2 (Fast SCSI, Fast Narrow SCSI):	10MBYTES/s
USB-High	12MBYTES/s
Fast Wide SCSI (Wide SCSI)	20MBYTES/s
Ultra SCSI (SCSI-3, Fast-20, Ultra Narrow)	20MBYTES/s
UltraIDE	33MBYTES/s
Wide Ultra SCSI (Fast Wide 20)	40MBYTES/s
Ultra2 SCSI	40MBYTES/s
IEEE-1394 (Firewire)	12.5-50MBYTES/s
Wide Ultra2 SCSI	80MBYTES/s
Ultra3 SCSI	80MBYTES/s
Wide Ultra3 SCSI	160MBYTES/s
FC-AL Fiber Channel	100-400MBYTES/s

Table 1. Data Rate Comparison

those resources available with very little user intervention. Moreover, USB specifications define both a standardized connector and a socket that all peripherals claiming USB compatibility use, eliminating the existing mix of connectors and cable styles. Yes! Somebody has done something smart.

My computer has two USB hubs into which I am able to plug peripherals. I grew beyond those two connections and found that I needed additional ones. No problem. I simply added an expansion port or hub that allows me to add up to seven additional peripherals. This is another benefit of USB technology, the ability to add expansion ports as the need to add peripherals grows (Figure 4). Such a configuration is called a "tiered star topology," meaning that hubs can serve as connection ports for other USB peripherals.

Even the USB cable is simplicity itself (Figure 5). It is made up of just four wires, B+ or Vcc, D+, D-, ("D" for "data"), and GND, and uses two different size and shape plugs to ensure that downstream and upstream connectors can't be crossed (Figure 5). Data is driven over D+ and D- at a bit rate of about 12 megabits per

second for full speed signaling or at a rate of 1.5 megabits per seconds for the USB low speed signaling mode.

And now a word about "hubs" and "devices" before moving on to the MM101.

Hubs are divided into two categories, passive bus-powered (which means that the hub itself is unpowered) and powered. There is only one "root" hub in any chain providing all application software commands, and it is usually the personal computer itself. Expansion hubs simply pass on commands from the root hub to the proper devices. These devices may be also be hubs that provide expansion ports for other downstream devices.

A passive hub divides available bus power from an upstream USB port among its own ports but must limit current to 100mA for any single downstream port and is able power no more than four simultaneously. Passive hubs work great for low power devices such as a mouse and keyboard because their current demands are meager. But devices like scanners, modems, and data storage

devices need more power and thus require either a powered hub or their own internal power supply. Powered hubs are capable of supplying a maximum of 500mA to each downstream device and are limited to seven downstream ports.

In an effort to be clear about the terminology I'm using, let me say that a "device" as opposed to a "hub" is a peripheral under the control of a USB hub. Monitors like the MM101 are natural devices to combine with a powered hub because they have a large power supply.

USB and The MM101

The MM101 meets all USB specifications. It has one downstream port and one downstream connection (Figure 6) on the back and two connectors on the front for downstream devices only like joysticks, a keyboard, and a mouse (Figure 7).

To be considered a "powered" host hub, the MM101 has to provide +5V at 500mA for downstream devices. The power supply is derived from the +8V standby supply (Figure 8). If you want to know how it

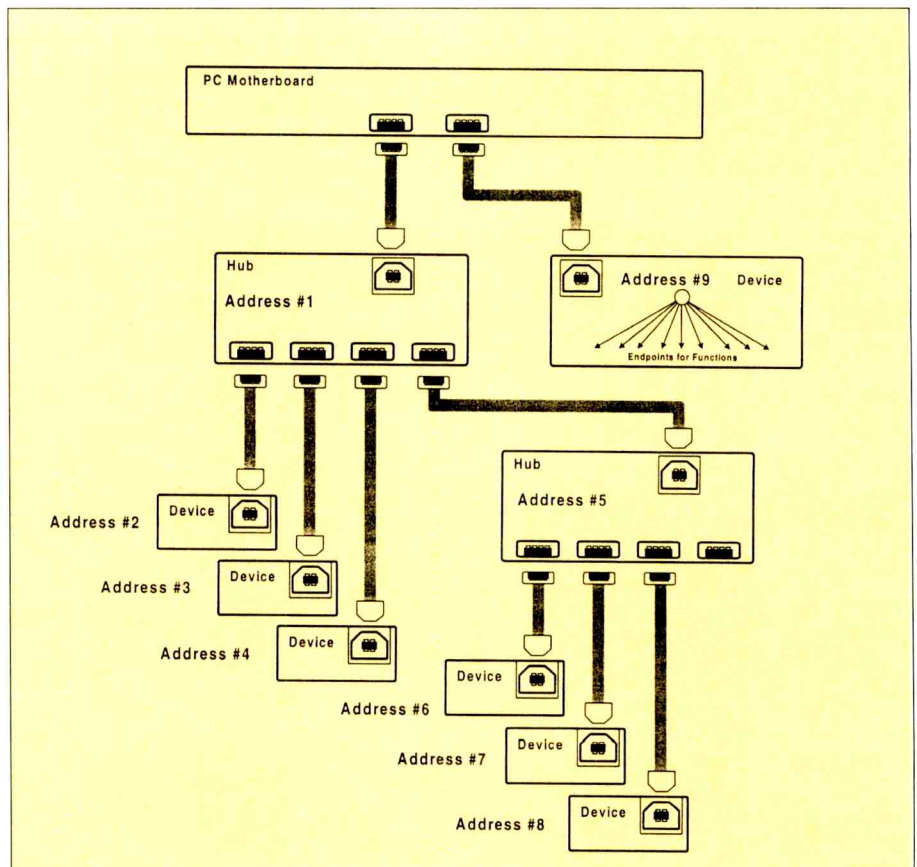


Figure 4. USB Address Assignments

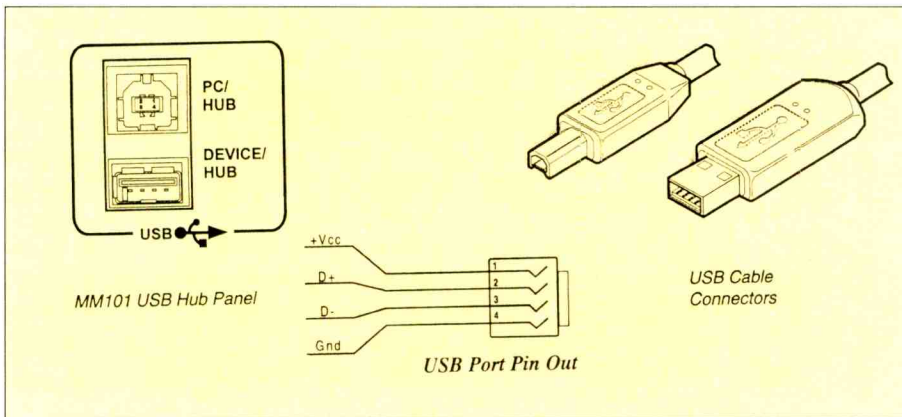


Figure 5. USB Port Pin Out

works, consult the Thomson training manual MM101: Technical Manual, pages 156-157. I will go just far enough into the technology to point out that the output device is protected against overcurrent by two circuits and spend a little time talking about those circuits because they have the potential to cause trouble and there-

fore get us involved in troubleshooting the USB ports

The first overcurrent sensing device is Q13202. The voltage drop across R13241 increases as current through it increases. When current increases to point that the voltage between the emitter and base becomes greater than 0.6V, Q13203 turns

on and provides a current path between the output voltage and the base of Q13204. The current path draws the voltage closer to the emitter of Q13204, which is the bias voltage of the output. As the bias voltage decreases, current flow in the output device decreases. When current decreases enough to lower the bias voltage of Q13203, the transistor turns off and normal operation returns.

The second overcurrent sensing device is U13201, the USB integrated circuit. Pin 10 of this IC monitors the USB regulated supply via a voltage divider consisting of R13226 and R13235. If the regulated supply decreases, indicating a heavy current demand, the IC turns the voltage supply off shutting off the output signal at pin 11, which has the effect of turning Q13204 off.

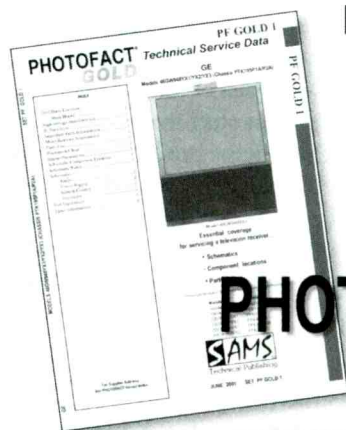
The USB supply protects against overcurrent from any device by interrupting all

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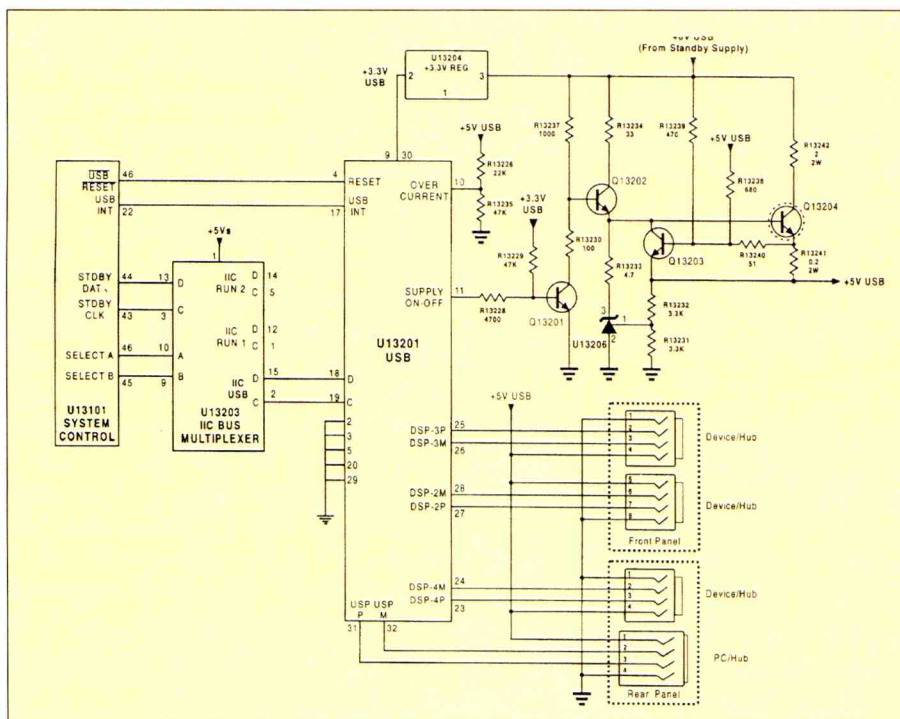


Figure 6. USB Block Diagram

current flow. Some USB hubs have the ability to sense each port and turn off an individual port when the device hooked to it draws excessive current while leaving the other ports operating normally. The MM101, on the other hand, must shut off all downstream current flow when it senses an overcurrent condition. In the event that you encounter an overcurrent condition, simply unplug the downstream devices one at a time until you locate the defective one. You may then reconnect the other devices.

The final point on which I want to touch is communication.

The USB controller IC, which in this instance is U13201, administers all communication to USB devices attached to it. Communication in the MM101 naturally takes place over the I2C bus. I don't know of a better way to present the information than simply to list it.

- The MM101 may initiate a reset of the USB controller or jettison the device connected to it during a "batten down the hatches" routine. You may recall that such a routine occurs during power down sessions like those that occur during a "brown out." The micro-processor initiates the routine to save power while it stores current setting in the EEPROM.

- The USB controller provides data and control isolation between the device(s) connected to the port and the chassis. It (U13201) is a self-contained IC capable of handling all communications on the USB without MM101 intervention.

- Activity between downstream devices and the upstream host are reasonably independent once the MM101 USB hub has been recognized and enumerated. "Enumerated" means "assigned an address."

- Finally, even though USB supports interactive control of monitor functions, the system requires a suitable "HID" ("human interface device") from a third party vendor. Thomson doesn't supply such an applet at retail delivery.

Here, then, is the kind of stuff that awaits you and me in the very near future. There is no doubt that "the plumbing" has gotten sophisticated. I suppose that is the "bad news." However, the good news is this. Given a little knowledge plus our experience as folks who makes a living solving problems, we should have little difficulty dealing with those problems when they arise. ■

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Home Theater Opportunities



Adapted from a presentation, "Home Theater Boot Camp", by Brian Gibson and Frederick Paradis, of Elite Media Solutions.

We've said it before in the pages of this magazine, but it bears repeating: home theater encompasses a broad range of levels of price, quality and sophistication. For those of us with more modest incomes and homes, a home theater system might consist of a good basic largish screen TV/monitor, and one of those "home theater in a box" products from someone like Sony, Thomson, Panasonic or whoever at a price somewhere in the \$500 to \$1,000 range, all hooked together in the living room or family room.

For someone who has more money than they know what to do with, a home theater might consist of a dedicated room, specially constructed to keep the theater sound in and noise out, a front projection DLP (digital light projection) monitor, a sound system that can put out sound at the threshold of pain, real theater seats that cost thousands of dollars each, in an atmosphere that resembles an actual movie theater. Home theaters in this class have been installed to the tune of more than a half million dollars.

And, of course, there's everything in between.

Most consumer electronics service centers have the expertise to help a homeowner select components for such a system, and to perform the hookup. Many service centers have the ability, or can work with a builder and/or electrical contractor, to perform functions such as pulling wire, sheetrock work, etc., to provide a more theaterlike installation. In the

face of continuing decline in electronics service work, it couldn't hurt to at least consider performing such work.

As every service technician and service manager is aware, profit on service of products is limited, and is dictated by the cost to replace the unit. When it comes to profits on installation of home theater, the sky's the limit.

The Building Blocks

The home theater system consists of a number of building blocks:

- Video display
- Signal sources
- Subwoofers
- Receiver
- Speakers
- Remote controls

Following are details about each of the building blocks.

Building Blocks: The Display

There are many choices of display device depending on the size of the home theater room, and the budget and visual preferences of the homeowner:

- CRT
- LCD
- PlasmaRear projection
- Front projection

The most commonly used display is the display based on a CRT. These units range in size from 13-inch to 40-inch, and cost anywhere from \$129.00 to \$4,000.00. It's doubtful that you'll ever actually see a home theater with a 13-inch display. More likely the minimum size for this application would be in the 25-inch to 27-inch range. Unless the room is small; the bigger the better.

LCD sets are generally not very large, and their technology is such that their brightness is limited. The picture they produce is generally quite sharp and clear.

Plasma displays are produced in larger sizes, and their flat shape makes them pleasing to people who prefer to hang the display on the wall instead of having it take up floor space. With an HDTV quality input plasma looks incredibly sharp and clear. These units are available in sizes from approximately 42 inches to 50 inches, with price tags between \$7,000 and \$20,000. These units are a good choice for the bedroom in cases where price is no object. Just don't hang them on the ceiling. That manufacturer who had a commercial showing a plasma screen on the ceiling above the bed says that that is actually not a good idea.

Rear projection sets come in 42-inch to 73-inch screen sizes, at prices of \$1,500.00 to \$40,000.00. Obviously, these are for use in big rooms, and will be purchased by clients with bigger budgets.

For the homeowner with a huge room to devote to home theater, the ultimate in display technology is front projection. These units, which, given a high quality screen and a high definition signal, can project a moving picture that is as good as, or perhaps better than, the picture you'll see at your local theater. These displays range in size between 60 inches and 200 inches, and cost between \$3,000.00 and \$70,000.00.

Building Blocks: Receivers

The receiver is considered to be the heart of any home theater system. This unit contains the surround sound processor, amplifier and tuner, and may be expected to sell for somewhere between \$199.00 and \$4,000.00. As with anything else, you get what you pay for. Or, more correctly, you don't get what you don't pay for.

The power of the amplifier should be matched to the size of the room. A bigger room requires more power to fill it with sound. Or, if the client likes to play the system loud, a more powerful amplifier is indicated. Make sure that you use speakers that can handle the power output by the amp.

Another way to insure sufficient power is to install a separate preamp and power

amp. You might consider a two-zone unit to provide for system expansion.

Building Blocks: Sources

The home theater system needs to have a source of the entertainment signal. In this day of electronics marvels the choices of signal source are many:

DVD player: must have

Satellite system: 500 channels

VCR: it's not dead yet

Hard drive based recorder: TiVo, Showstopper

CD recorder: With this unit you can make your own CDs

DVD recorder: this product is not yet available economically

Building Blocks: Speakers and Subwoofers

The video display portion of a home theater is extremely important, but these days, with the audio portion is also extremely important. Movies these days have sound tracks that include great orchestral scores, exquisite voices, or that recreate the effect of an earthquake. The Dolby digital audio on which most sound tracks today are based, and on which the audio portion of a great deal of the HDTV broadcast experience will be based, consists of six channels of sound, although it's usually called 5.1 channel because the sixth channel consists of only the very low frequencies, well below 100Hz.

A home theater sound system has to be able to provide sound from each of those channels: left and right front speakers, a center channel front speaker, left and right surround sound speakers, and the subwoofer. Some home theater purists advocate yet another speaker for the rear center of the listening environment.

The subwoofer is a must have for the home theater. This channel adds the deep bass that's required to recreate explosions, trainwrecks, dinosaurs, etc. Subwoofers can be as small as 14 inches by 14 inches. Cost for these devices ranges between about \$299.00 and \$3000.00. Subwoofers may be either floorstanding or mounted in a wall. Placement of these units is not terribly critical, as bass is not directional. The

guys from Elite Media Solutions say "spend the money here; bass is fun."

Remote Controls

With all the sources, and the receiver, that a well equipped home theater system includes, the client is going to wind up with as many as six, or possibly more, remote control units. That's clutter of a high order, and a confusion factor: which remote is for which component? If a home theater installer leaves the client in this situation, the client will not be very happy, and will most likely recommend to his friends that they go elsewhere for their home theater installations.

The answer is to provide, and program, a universal remote control that replaces all the individual remote controls that came with each of the units. One of the universal remote control units that the Elite people mentioned was the Philips Pronto. Anyone interested in this unit can get more information by accessing this website: www.pronto.philips.com.

Business hint: Even if you don't ever install home theater, you might offer a service to your existing clients to help them reduce clutter in their living rooms or family rooms by providing them with a universal remote that can control all the products they own.

New, and/or Confusing Terminology

Along with every new technology comes a new language. Home theater and HDTV are no exception. Many of these terms are tossed around as if everyone knows what they mean, but frequently, nobody really knows what they mean. Here's a list of some of the terms. No doubt you'll be familiar with many of them, but there might be a few new ones that will help you understand this subject.

- Dolby Digital
- THX
- Widescreen
- Learning remote
- DTS
- HDTV
- Progressive scan
- Video switching

DOLBY DIGITAL

Dolby Digital is a method of encoding the audio signal of a video program or an HDTV broadcast into six (5.1) channels:

left front, right front, center front, left surround, right surround, and subwoofer. The sound quality of Dolby Digital is at least as good as that of a standard compact audio disk.

DTS

DTS stands for "Digital Theater Systems." It is also a way of encoding the audio into six digital channels. This scheme uses less compression than does Dolby Digital, and is better sounding, according to some. However, there is less software available for this audio scheme than there is for Dolby. Most home theater receivers are capable of playing back both Dolby Digital, and DTS programs.

THX

THX stands for "Thompson Holmison Xperimental." THX equalizes Dolby Digital 5.1 to sound more like an actual theater. If a component can meet this standard, it will bear the designation "THX Certified." Components that are THX certified are usually more expensive than non-THX components.

HDTV

"HDTV" describes a system that can produce a television signal with 1080 lines of resolution. Unless and until cable TV system operators agree to transmit HDTV signals, viewers will receive these signals via satellite, or terrestrial antenna. Some stations in larger markets began transmitting HDTV in 1996. The number of cities where HDTV is available is continually growing. By 2006, all broadcast stations in the country are required, by the federal government, to broadcast programming in the HDTV format. TV sets that are designed to receive NTSC signals only will require a settop box to convert from HDTV to NTSC.

WIDESCREEN

A standard TV set has an aspect ratio of 4:3, that is, if the screen were sixteen inches wide, it would be 12 inches high. HDTV wide screen presents an aspect ratio of 16 x 9, that is, if the screen were 16 inches wide, it would be 9 inches high. Sets today are available in both formats.



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The presenters of the seminar recommend that any company selling home theater products try to sell a widescreen set, because programming will be phasing to 16 x 9, and, of course, most movies on tape and disk these days are in the widescreen format, and look "squished" vertically on a 4:3 aspect ratio set.

PROGRESSIVE SCAN

Most service technicians are familiar with the idea of "interlaced scan," which is the method used in NTSC programs to present the picture on the screen. In the interlaced scan scheme, each frame of video is presented as two interlaced fields; that is, the electron gun scans odd numbered lines, starting at the top center of the screen until it reaches the bottom right of the screen, then starts again at the upper left of the screen and draws even numbered lines, finishing at the bottom center of the screen, then moves back to the top and begins drawing the next frame.

Interlaced scanning was used in the NTSC system because of the relatively low frame rate. If the NTSC system drew every line in order, by the time the elec-

tron beam was drawing the last few lines at the bottom of the picture, the top of the picture would be darkening. This would have created an annoying flicker.

In the HDTV scheme, or any "progressive scan" system, the frame rate is higher, so the entire picture can be scanned line by line, in order, without the creation of flicker. In the case of today's DVD players that output progressive video, 480i (the system in which the picture is scanned as 480 lines in a progressive scheme), is digitally enhanced to provide 480P output. This results in a smoother, more filmlike, flicker-free image.

LEARNING REMOTE CONTROL

A learning remote control has an infrared receiver, and some degree of intelligence. If the client has several remote controls that he wants to replace with a single unit, you can put the remote control into the "learn" mode and aim the remote that you want to eliminate at the universal remote. The universal remote will learn the IR codes that the standard remote transmitted to it and store them in its memory. Then the universal remote

can be used to control the unit that had previously been controlled by the remote that came with it.

Some universal remotes have macro functions, so that if the client wants to, say, watch a movie from a DVD, he only has to push one button to perform all the necessary functions. For example, now when the client wants to watch a DVD movie, he pushes one button and all of these take place:

- turn on the TV,
- turn on the receiver,
- switch the receiver to the DVD input,
- switch the TV to the video input from the receiver,
- start the DVD player.

VIDEO SWITCHING

Video switching takes place within the receiver. This function routes all video sources to the TV or monitor along with the audio. This ensures that the audio and video are always synchronized so that you will never get this dreaded phone call from your client: "I have a picture, but there's no sound." Most audio/video receivers have this feature. ■

THEATER DESIGN CHECKLIST		Customer: _____	Date: _____
What type of TV or HDTV?			
<input type="checkbox"/> Tube (27" - 40")	<input type="checkbox"/> Rear Projection (40" - 63")	<input type="checkbox"/> Dolby Digital receiver	<input type="checkbox"/> DVD player
<input type="checkbox"/> Projector (60" - 200")	<input type="checkbox"/> Flat TV (42" - 50")	<input type="checkbox"/> Satellite system	<input type="checkbox"/> SVHS VCR
Electronics			
Front speakers			
<input type="checkbox"/> In-wall	<input type="checkbox"/> Surface mount	<input type="checkbox"/> Floorstanding	<input type="checkbox"/> Bookshelf
Satellite system			
<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> PreWire	
Center speaker			
<input type="checkbox"/> In-wall	<input type="checkbox"/> Surface mount	<input type="checkbox"/> Freestanding	
Multiple TVs			
<input type="checkbox"/> How many?	<input type="checkbox"/> Modulator for video source?		
Rear effects speakers			
<input type="checkbox"/> Ceiling	<input type="checkbox"/> In-wall	<input type="checkbox"/> Dipole (side walls)	
Existing equipment			
List all customer's existing equipment, including model number. If any existing components can be used, use them.			
Subwoofer			
<input type="checkbox"/> Freestanding	<input type="checkbox"/> In-wall		
System controller/learning remote			
<input type="checkbox"/> Philips Pronto	<input type="checkbox"/> RTI		
Equipment location			
<input type="checkbox"/> Cabinet	<input type="checkbox"/> In-wall rack	<input type="checkbox"/> Other	
Additional rooms for sound			
<input type="checkbox"/> Kitchen	<input type="checkbox"/> Deck	<input type="checkbox"/> Dining	<input type="checkbox"/> Master Bedroom
<input type="checkbox"/> Master Bath	<input type="checkbox"/> Foyer	<input type="checkbox"/> Other	
TV location			
<input type="checkbox"/> In cabinet	<input type="checkbox"/> Freestanding	<input type="checkbox"/> Wallmount	
Type of control system			
<input type="checkbox"/> Keypad	<input type="checkbox"/> Rotary volume control		

AN ADVERTISING SECTION
HOME THEATER SHOWCASE

At a recent gathering of local Consumer Electronic Service Professionals, one of the group took some time to explain his new found income...providing the technical savvy to Home Theater sales and installation firms here on Long Island. He explained how he had 'interned' at a local shop, learned the way they operated and went back on his own while providing his expertise to a number of firms including the local shop where he had interned.

He was enthusiastic and almost evangelistic in his encouragement for others to do the same. However, from the other side of the table came the inevitable question, with its built in negative "so, how many \$30,000 installations can there be on Long Island?" As if to imply that there could not possibly be enough work for more than one or two servicers.

"I only work on installations of \$100,000 or more."

Our enthusiastic convert never missed a beat, "I do not know" he replied, "I only work on installations of \$100,000 or more."

This pretty well sums up the variety and vagary of opinions and attitudes about the home theater business and opportunity for the professional servicer.

Some see almost no opportunity, some see \$5,000 to \$30,000 installations, and



**Home Theater is here;
from "haute couture"
to "off the rack".**

others see gold in those new and refurbished homes down the street, across town, or going up on the farm land just off the expressway.

At ES&T we are working to find ways to identify the size, range and value of the opportunities the new world of home theater or smart homes offers the Consumer Electronic Service Professional. We haven't seen, or been able to generate real numbers as yet, but the road signs are clear... the home theater and 12 volt wired home is here and it isn't going away.

Take a look at the last two CEDIA Shows, The EH Expo conventions in Orlando and Long Beach and the change in NPSC this year. CEDIA draws 15,000 to 19,000 energetic, aggressive, smart individuals looking to learn more and more about what they can sell to the home owner out front, or as ancillary products

and services. And more than a thousand exhibitors are there to promote the advantages and benefits of their products and services to the attendees.

EH EXPO, while smaller and probably more 'smart home' than 'home theater' in flavor, brings its own group of excited attendees and exhibitors.

At NPSC in 2000 few people were interested in discussing home theater except in the context of 'large screen TVs' and the mention of CEDIA drew many blank stares of non-recognition. Yet, in 2001, one of the best attended sessions was the Home Theater Boot Camp presented by the folks at Elite Systems...and what the attendees heard was almost

overwhelming!

So, Home Theater is here; from "haute couture" to "off the rack".

To keep our audience aware of the

*...and what attendees heard
was overwhelming*

opportunities this arena offers and the support products your traditional vendors and potential new sources offer, ES&T presents the following pages of 'advertorial'. The advertisers included provided the adjacent editorial materials to better describe their operations, offerings and interest in helping the Professional Servicers get their piece of this brand new pie.

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Electronic Design Specialists makes test equipment designed to help servicing electronic technicians troubleshoot problems as quickly and accurately as possible. All test equipment is designed by David T. Miga, CET, who is an electronic engineer and a certified electronic technician.

The EDS corporation was started in 1986 when Dave designed a digital capacitor meter and a semiconductor analyzer to increase his own productivity as a contract technician. When other technicians saw what the EDS-52 capacitor meter and the EDS-59 semiconductor analyzer could do, Dave found himself being asked to build more of these prototypes for them. The production version of the semiconductor analyzer, the SemiAnalyzer 59C, was very successful and was sold from 1987 until 1997. Other unique test equipment followed, such as the Bus Line Tracer, the Micro-Analyzer, the Leak Seeker, and the very popular CapAnalyzer. Although designed for independent service technicians, regular users are the US military, most of the fortune 500 companies, NASA, the TV networks and cable companies, Panasonic,

Pioneer and many trade schools and colleges.

Dave designs his test equipment with an entirely different perspective than most test equipment companies. All ideas start with interviewing thousands of independent service technicians for their opinions and special needs. This approach is different from conventional test equipment manufactures, where equipment is designed by engineers that may have never picked up a soldering iron, who wouldn't be able to repair their own television, even with their own test instruments. Their idea of test equipment is to bombard the technician with numbers, to be expensive and to be difficult to use. This is overkill for a servicing technician; check out the "used test equipment" section in the classifieds of this magazine for these products.

For this reason, all EDS equipment is designed to give the technician the tools to tell whether a component is good, poor, or bad, in a circuit, as accurately as possible. A technician doesn't need to know what a capacitor's dissipation factor or dielectric constant is; just is it bad, can I move on? EDS test equipment is designed by technicians, is guaranteed accurate for in circuit tests, and is designed for easy use. Determining the quality of a component in questions done by the test instrument, not the technician.

To design a test instrument to decide whether a component is good or bad, EDS analyzes actual defective

components sent in by technicians. Calibrating the test equipment is done by comparing new, old but still working, and known defective components, then programming the test equipment to make the decision, with Dave's 30-year experience as helpful input. Every CapAnalyzer 88A is still tested with the same actual good, poor, and bad electrolytics and tantalums used to design the original prototype, before releasing it to the customer.

EDS was the first on the World Wide Web with animated demonstrations of test equipment products, and has one of the best technical assistance programs on the internet. You can even download replacement owner's manuals and review tech tips, and get self-maintenance help for each product.

As the electronic repair industry moves into the twenty first century, more and more technicians will discover that to be productive, less time must be spent looking at schematics of increasingly complicated circuits. Simply checking components in the circuit with the problem, with the right instruments, is how profitable repairs will be done by surviving technicians in the next millennium.

EDS products are available from your distributor. For international sales contact EDS directly. Check out www.eds-inc.com for a current list of distributors. All products come with a 60 day satisfaction guarantee or money-back policy.

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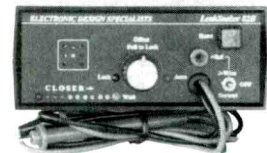
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For over 50 years, Sencore Electronics has been dedicated to one goal — Making our customers more successful in electronic servicing. Today, Sencore is a leading manufacturer of electronic test equipment because we listen to our customers needs and design them instruments that help them achieve success. Sencore is committed to its customers with an exclusive product line and the absolute best support in the industry. Our obligation and support are just the beginning when a customer says “yes” to Sencore equipment.

Sencore was started in 1951, in downtown Chicago, Illinois, by R.H. (Herb) Bowden. As the business grew, Sencore moved west to Sioux Falls, South Dakota, in 1971, attracted by the area’s superb quality of life. The now second generation business remains in Sioux Falls where Sencore is actively involved in community events and charities. Sencore’s second generation, represented by co-owners Al and brother Doug Bowden, is committed to adapting to the technical challenges necessary to take Sencore into the 21st century.

Sencore’s highly trained employees continually design new equipment based on advances in the electronics industry. With each new product, the company deals with complex issues of marketability, design feasibility, and manufacturability, and brings these together in the shortest time possible. Sencore designs and manufactures test instruments that provide the highest quality and reliability in the entire service industry.

Every Sencore instrument is engineered to provide our customers with exclusive tests and capabilities that will make testing and troubleshooting easier and more efficient. When customers invest in Sencore instruments, they also receive the best after the sale support available in the industry.

During the past 48 years plus, Sencore has remained dedicated to one goal-making our customers more successful. And since our success depends on our customers success, were working even harder to be in the industry.

The future looks exciting at Sencore. As technology advances from the broadcast studio to your living room TV receiver, Sencore is preparing itself for new challenges and forming global alliances to stay on top of the industry. We’re a forward looking engineering/manufacturing marketing firm with an eye on the future.

Sencore Electronics remains the leading manufacturer of video calibration and service test equipment for the electronics industry.

Over the past few years Sencore’s Home Electronics Division has moved into the home and commercial installation/theater market with several new products and training offerings. With over 80,000 new installers needed per year (CEDIA 2001) for the next 5 years this may be a market that you, an electronics servicer may wish to investigate. Our professional staff at Sencore can help educate you on all the opportunities available and provide you with valuable solutions to be successful in this booming field.

Sencore offers dealer and installer package specials that includes everything you need for high quality commercial and residential installations. Ask a Sencore Product Sales Engineer about the “Installers Suite Pro” which includes the VP300 Video Pro Multimedia Generator, the CP291 “Pocket PC” Color Pro 2 Color Analyzer, the SP295 Sound Pro Audio Analyzer, the SL754D Channelizer RF Signal Level Meter, and a heavy duty Travel Case.

Some of our New Installer Tools Include:

Our new VP300 “Video Pro” Multi-media Generator. The VP300 delivers the HDTV, NTSC, PAL, and Computer Display Video Signals you need for accurate alignment of front and rear projectors, monitors, direct view displays and video walls in all operating modes. The VP300 generates all 18 ATSC-HDTV formats including 1080I and 720P in both 4 by 3 and 16 by 9 aspect ratios. The VP300 provides Y PB PR, RGB H/V, Composite, S-Video, and

Vesa outputs, and is hand-held, portable, and battery operated! This is also a great generator for in-home HDTV service!

Our new SP295 “Sound Pro” Audio Analyzer. The Sound Pro is a professional quality audio analyzer designed to help you quickly equalize room acoustics, optimize speaker placement, and calibrate system settings for concert quality audio installations. The Sound Pro’s standard equipment includes a real time analyzer, sound pressure level meter, energy-time graph, noise criteria test, an integrated audio signal generator and many other features.

The CP291 “ColorPro” is a Pocket PC-based color analyzer that helps you align color tracking and luminance levels on video displays to give you the confidence that the display is aligned to perform its best and to industry specifications. The CP291’s easy-to-use graphical interface greatly decreases calibration time with easy to follow measurement screens. The CIE and RGB screens make calibrations simple by illustrating exactly which colors need adjusting. CP291 readings are displayed in xyY, RGB, and color temperature is displayed in degrees Kelvin.

For TV/hdtv service, we just released the HA325 Portable Horizontal Output & Flyback Analyzer. The HA325 is designed to greatly slash servicing time on all types of CRT-based video displays. According to industry estimates, over 250 million CRT-based video displays are currently in use, with sales of another 22 million units this year including 1 million projection systems. Technicians servicing these video displays indicate that over 50% of the failures involve the horizontal output stage. These problems are especially difficult to troubleshoot because of their confusing interaction with other circuits and their potential for dangerous currents and voltages that quickly damage other circuitry and expensive components. Servicing is further complicated by the need to service projection and large screen displays on location.

Who knows where the future will take us next. We do know one thing. Sencore will be at the forefront of new technology with new products and alliances to insure we remain on top of our industry.

See you in the future!

CEDIA Expo 2001

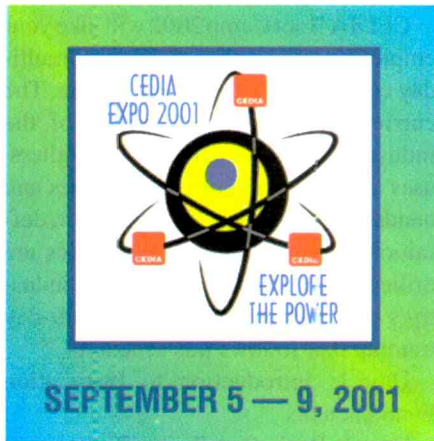
Wrap-up

The 2001 CEDIA Expo, which took place at the Indiana Convention Center in September, was a well attended event. The event was so successful that the "Boot Camp" was booked to capacity. ES&T attended with several staff members, and a trade show booth. Because the convention center itself was filled to capacity, a number of exhibitors, including ES&T, were assigned booth space in the RCA Dome adjacent to the convention center. Our booth was very nearly on the 50 yard line of the field on which the Indianapolis Colts play football.

Before this article gets into the expo itself, first a little about what CEDIA is all about. All of the information presented here is based on material provided by CEDIA.

Organization

The Custom Electronic Design and Installation Association (CEDIA) is an international trade association of companies that specialize in designing and installing electronic systems for the home—typically media rooms, single or multi-room entertainment systems, home



automation and communication systems, home networking and integrated whole-house subsystems providing control of lighting, security and HVAC systems.

Mission

CEDIA is the international association of professionals who create high quality, home electronic systems for the discerning consumer. CEDIA provides education, develops the industry, and creates demand and profitability within the marketplace.

Core values

According to CEDIA informational, the organization's values include:

- Extraordinary Customer Satisfaction
- Absolute Accountability
- Continued Professional Growth:

Home of Electronic Lifestyles

One of the exhibits at the Expo that was intended to help attendees and the general public realize the potential in custom electronic design available for homes today, was one that CEDIA designed and constructed: the "Home of Electronic Lifestyles™".

Recently featured in USA Today, the home contains the latest in technology and convenience. Imagine the following scenarios:

- A person rings your doorbell. Sitting in the study, your television immediately senses the ring, and displays the image from the security camera mounted over the door. Seeing it is your neighbor, you remotely open the door.
- On your way home from work, and ready to begin a relaxing evening, you select "Entertainment" from the touch-



pad. Immediately, the lights dim, the shades close, and the piano begins playing in concert with the CD player. A few minutes later, you walk in the door to the perfect atmosphere.

Scenes from the future? No - this is the world that CEDIA members design today.

Unveiled at CEDIA EXPO '98 in New Orleans, the home is now traveling around the country to events like the Consumer Electronics Show

Boot Camp

A great deal is involved in designing and installing all of the entertainment, networking and automation products that are available for homes today. In order to help the companies that are actively involved in this business, CEDIA pulled out all the stops to unleash the potential of installers during CEDIA Boot Camp. The course provided comprehensive training for new hires in the custom design/installation industry with the added opportunity to achieve CEDIA certification through the Installer Level I Exam.

Here is an overview in the words of the CEDIA website.

CEDIA Boot Camp 2002 will take your employees off-site for an intense, multi-day course and skills-based training. The curriculum, designed by some of the industry's most experienced installers, uses a combination of short lectures and hands-on workshops. Key concepts, definitions, techniques and procedures are drilled repeatedly. A group of the industry's best instructors leads the multi-day training that follows this schedule:

Day 1: Introduction to Installation Fundamentals

Day 2: Basic Installation Techniques: Framing Structure, Drilling Plans and Drilling Techniques

Day 3: Basic Installation Techniques: J-Box Trim, Device and Speaker Installation

Other Training

The boot camp was only one of dozens of training classes. There were seminars on just about every subject of interest to a designer or installer: soundproofing a

home theater room, home networking, networking multiple video sources and formats, creating and keeping satisfied customers, home theater audio tuning tricks, fundamentals of electric circuits, technical aspects of wired lighting control, multi-channel audio formats, category 5 installation procedures, what you need to know about DTV, and much, much more.

Exhibitors

The list of exhibitors at this year's CEDIA was a veritable Who's Who of companies involved in manufacturing or distributing products and software for use in upscale home entertainment, home networking, and home automation. We won't include a complete list, but here are some of the names in no particular order: AMX, Crestron, Sony, Panamax, Belden, Princeton, Pioneer, Mitsubishi, Compaq, MicroSoft, Thomson.

For more information, and links to these companies and more, direct your browser to www.cedia.com.



Telecommunications Testing

Adapted from the book "Fiber Optic Testing, A Practical Guide to Testing Fiber Optic Components and Networks," by Jim Hayes and the staff at Fotec.

Much more information about fiber optics can be found at Fotec's website at <http://www.fotec.com>.

There was a time when the term "telecommunications testing" meant pretty much only one thing: testing various configurations of copper wiring, and the telecommunications equipment connected to it, to see if it was performing properly, and if not, to determine why not. Today, telecommunications, whether within a modern home, or from the telephone company or cable provider to the home, means fiber optic. This article will consider some of the tests that are required on fiber optic systems, and will detail some of the equipment used to perform those tests.

Overview of Fiber Optic Testing and Instrumentation

Testing fiber optic components and systems requires making several basic measurements. The most common measurement parameters are shown in Table 1. Optical power, required for measuring source power, receiver power and loss or attenuation, is the most important parameter and is required for almost every fiber optic test. Backscatter and wavelength measurements are the next most important and bandwidth or dispersion are of lesser importance. Measurement or inspection of geometrical parameters of fiber are essential for fiber manufacturers. And troubleshooting installed cables and networks is required.

Standard Test Procedures

Most test procedures for fiber optic component specifications have been standardized by national and international standards bodies, including the EIA in the US and the IEC internationally. Procedures for measuring absolute opti-

TEST PARAMETER	INSTRUMENT
Optical Power (Source Output, Receiver Signal Level)	Fiber Optic Power Meter
Attenuation or Loss of Fibers, Cables & Connectors	FO Power Meter & Source, Test Kit or OLTS (optical loss test set)
Source Wavelength	FO Spectrum Analyzer
Backscatter (Loss, Length, Fault Location)	Optical Time Domain Reflectometer (OTDR)
Fault Location	OTDR, Visual Cable Fault Locator
Bandwidth/Dispersion (Modal & Chromatic)	Bandwidth Tester or Simulation Software

Table 1. Fiber Optic Testing Requirements.

cal power, cable and connector loss and the effects of many environmental factors (such as temperature, pressure, flexing, etc.) are covered in these procedures.

In order to perform these tests, the basic fiber optic instruments are the fiber optic (FO) power meter, test source, optical time delay reflectometer (OTDR), optical spectrum analyzer and an inspection microscope. These and some other specialized instruments are described below.

Fiber Optic Power Meters

Fiber optic power meters measure the average optical power emanating from an optical fiber. They typically consist of a solid state detector (silicon for short wavelength systems, germanium or InGaAs for long wavelength systems), signal conditioning circuitry and a digital display of power. To interface to the large variety of fiber optic connectors in use, some form of removable connector adapter is usually provided.

Power meters are calibrated to read in linear units (mW, uW and nW) and/or dB referenced to 1mW or 1uW optical power. Some meters offer a relative dB scale also, useful for laboratory loss measurements. (Field measurements more often use adjustable sources set to a standard value to reduce confusion).

Power meters cover a very broad dynamic range, over 1 million to 1, so some form of automatic range switching is provided in the signal conditioning circuitry to allow

reasonable display resolution. Although most fiber optic power and loss measurements are made in the range of 0dBm to -50dBm, some power meters offer much wider dynamic ranges. For testing analog CATV systems or fiber amplifiers, one needs special meters with extended high power ranges up to +20dBm (100mW). Although no fiber optic systems operate at very low power, below about -50 dBm, some lab meters offer ranges to -70 dBm or more, which can be useful in measuring optical return loss or spectral loss characteristics with a monochromator source.

Power meters measure the time average of the optical power, not the peak power, so the meters are sensitive to the duty cycle of an input digital pulse stream. You can calculate peak power if you know the duty cycle of the input, by dividing the average power by the duty cycle. For most loss measurements, you use a test source with CW (steady state) or 2kHz pulsed output. As long as the source modulation doesn't change, no compensation needs to be made. When testing link transmitter power or receiver sensitivity, it is necessary to establish a standard test pattern, generally a 50% duty cycle, called a square wave, to allow accurate measurement of transmitter output or receiver sensitivity.

FO power meters have a typical measurement uncertainty of +/-5%, when calibrated to transfer standards provided by national standards laboratories like the US National Institute of Standards and

Technology (NIST). Sources of errors are the variability of coupling efficiency of the detector and connector adapter, reflections off the shiny polished surfaces of connectors, unknown source wavelengths (since the detectors are wavelength sensitive), nonlinearities in the electronic signal conditioning circuitry of the FO power meter and detector noise at very low signal levels. Since most of these factors affect all power meters, regardless of their sophistication, expensive laboratory meters are hardly more accurate than the most inexpensive handheld portable units.

Fiber Optic Test Sources

In order to make measurements of optical loss or attenuation in fibers, cables and connectors, you need a standard signal source as well as a FO power meter. The source must be chosen for compatibility with the type of fiber in use (singlemode or multimode with the proper core diameter) and the wavelength desired for performing the test. Most sources are either LED's or lasers of the types commonly used as transmitters in actual fiber optic systems, making them representative of actual applications and enhancing the usefulness of the testing. Some tests, such as measuring spectral attenuation of fiber requires a variable wavelength source, which is usually a tungsten lamp with a monochromator to vary the output wavelength.

Typical wavelengths of sources are 665 nm (plastic fiber), 820, 850 and 870 nm (short wavelength glass fiber) and 1300 and 1550 nm (long wavelength). LED's are typically used for testing multimode fiber and lasers are used for singlemode fiber, although there is some crossover, especially in older telecom systems which used multimode fiber with lasers and the testing of short singlemode jumper cables with LED's. The source wavelength can be a critical issue in making accurate loss measurements, since attenuation of the fiber is wavelength sensitive especially at short wavelengths. Thus all test sources should be calibrated for wavelength.

Adaptability to a variety of fiber optic connectors is important also, since over 70 styles of connectors exist, although the types most commonly used are SMA, ST, FDDI and ESCON for multimode fiber and

Biconic, FC, SC and D4 for singlemode fiber. Some LED sources use modular adapters like power meters to allow adaptation to various connector types. Lasers almost always have fixed connectors. If the connector on the source is fixed, hybrid test jumpers with connectors compatible with the source on one end and the connector being tested on the other must be used.

Other source-related factors affecting measurement accuracy are the stability of the output power and the modal distribution launched into fiber. For extremely accurate measurements, the source may need optical feedback stabilization to maintain output power at a precise level for long times required for some measurements. And mode scramblers, filters and strippers may be required to adjust the modal distribution in the fiber to approximate actual operating conditions.

Optical Loss Test Sets/Test Kits

The optical loss test set is an instrument formed by the combination of a fiber optic power meter and source which is used to measure the loss of fiber, connectors and connectorized cables. Early versions of this instrument were called attenuation meters. A test kit has a similar purpose, but is usually comprised of separate instruments and includes accessories to customize it for a specific application, such as testing a FO LAN, telco or CATV.

The combination OLTS instrument may be useful for making measurements in a laboratory, but in the field, individual sources and power meters are more often used, since the ends of the fiber and cable are usually separated by long distances, which would require two OLTSs, at double the cost of one FO power meter and source. And even in a laboratory environment, several different source types may be needed, making the flexibility of a separate source and meter a better choice.

Optical Time Domain Reflectometer

The optical time domain reflectometer (OTDR) uses the phenomenon of fiber backscattering to characterize fibers, find faults and optimize splices. Since scattering is one of the primary loss factors in

fiber (the other being absorption), the OTDR can send out into the fiber a high powered pulse and measure the light scattered back toward the instrument. The pulse is attenuated on the outbound leg and the backscattered light is attenuated on the return leg, so the returned signal is a function of twice the fiber loss and the backscatter coefficient of the fiber.

If you assume that the backscatter coefficient is constant, the OTDR can be used to measure loss as well as to locate fiber breaks, splices and connectors. In addition, the OTDR gives a graphic display of the status of the fiber being tested. And it offers another major advantage over the source/FO power meter or OLTS, in that it requires access to only one end of the fiber.

The uncertainty of the OTDR measurement is heavily dependent on the backscatter coefficient, which is a function of intrinsic fiber scattering characteristics, core diameter and numerical aperture. It is the variation in backscatter coefficient that causes many splices to show a "gain" instead of the actual loss. Tests have shown that OTDR splice loss measurements may have an uncertainty of up to 0.8dB. OTDRs must also be matched to the fibers being tested in both wavelength and fiber core diameter to provide accurate measurements. Thus many OTDRs have modular sources to allow substituting a proper source for the application.

While most OTDR applications involve finding faults in installed cables or optimizing splices, they are very useful in inspecting fibers for manufacturing faults. Development work on improving the short range resolution of OTDRs for LAN applications and new applications such as evaluating connector return loss promise to enhance the usefulness of the instrument in the future.

OTDRs come in three basic versions. Full size OTDRs offer the highest performance and have a full complement of features like data storage, but are very big and high priced. MiniOTDRs provide the same type of measurements as a full OTDR, but with fewer features to trim the size and cost. Fault finders use the OTDR technique, but greatly simplified to just provide the distance to a fault, to make the instruments more affordable and easier to use.

Visual Cable Tracers and Fault Locators

Many of the problems in connection of fiber optic networks are related to making proper connections. Since the light used in systems is invisible, one cannot see the system transmitter light. By injecting the light from a visible source, such as a LED or incandescent bulb, one can visually trace the fiber from transmitter to receiver to insure correct orientation and check continuity besides. The simple instruments that inject visible light are called visual fault locators.

If a powerful enough visible light, such as a HeNe or visible diode laser is injected into the fiber, high loss points can be made visible. Most applications center around short cables such as used in telco central offices to connect to the fiber optic trunk cables. However, since it covers the range where OTDRs are not useful, it is complementary to the OTDR in cable troubleshooting. This method will work on buffered fiber and even jacketed single fiber cable if the jacket is not opaque to the visible light. The yellow jacket of singlemode fiber and orange of multimode fiber will usually pass the visible light. Most other colors, especially black and gray, will not work with this technique, nor will most multifiber cables. However, many cable breaks, macrobending losses caused by kinks in the fiber, bad splices etc. can be detected visually. Since the loss in the fiber is quite high at visible wavelengths, on the order of 9dB/km to 15dB/km, this instrument has a short range, typically 3km to 5km.

Fiber Identifiers

If you carefully bend the fiber enough to cause loss, the light that couples out can also be detected by a large area detector. A fiber identifier uses this technique to detect a signal in the fiber at normal transmission wavelengths. These instruments usually function as receivers, able to discriminate between no signal, a high speed signal and a 2kHz tone. By specifically looking for a 2 kHz "tone" from a test source coupled into the fiber, the instrument can identify a specific fiber in a large multifiber cable, especially useful to speed up the splicing or restoration process.

Fiber identifiers can be used with both buffered fiber and jacketed single fiber cable. With buffered fiber, one must be very careful to not damage the fiber, as any excess stress here could result in stress cracks in the fiber which could cause a failure in the fiber anytime in the future.

Measuring Fiber Bandwidth

Although fiber has a very high bandwidth, some applications actually approach its limits, requiring performance evaluation. Since two factors limit fiber bandwidth: modal dispersion and chromatic dispersion, it is not easy to build a single instrument that makes bandwidth measurements.

Modal dispersion arises from the various paths, or modes, light takes through multimode fiber. Since the average speed of light in each mode may vary, pulses are dispersed along the fiber. Modal dispersion can be tested with a high speed laser source and receiver, looking for degradation of pulse risetime and falltime. Instruments are available for performing modal dispersion tests, even in the field.

Since the index of refraction of light (a measure of the speed of light in the medium) is a function of wavelength, light of different wavelengths will have different speeds in the fiber. Thus a source of wide spectral width, like an LED, will suffer considerable chromatic dispersion, limiting the bandwidth of the fiber. Even the narrow spectral width of a laser will cause spectral dispersion in singlemode fiber, given long enough lengths of fiber.

Testing chromatic dispersion requires measuring the pulse speed through the fiber at various wavelengths. Only a few instruments have been developed for testing fiber dispersion, and they are generally limited to laboratory measurements due to the difficulty of performing the measurement. Alternately, optical to electrical (O/E) and electrical to optical (E/O) converters are used to interface the fiber under test to high speed electronic instrumentation that can cover the frequency range of the fiber. Simulation software, developed to analyze multimode fiber bandwidth as a function of source and fiber parameters, can calculate total fiber dispersion with an uncertainty no larger

than actual testing (about 11%) and are therefore more widely used by end users.

O/E and E/O Converters

Optical to electrical (O/E) and electrical to optical (E/O) converters have other uses besides testing fiber bandwidth. O/E converters can be used with high speed oscilloscopes to analyze pulses in fiber optic links to see if the waveforms are of the proper shape. This means measuring rise and fall times of the pulse and the depth of modulation (the difference between the peak power of the pulse and the lowest power reached between pulses). They can be used for testing lasers and LEDs used in transmitters and link dispersion in long links. E/O converters are used to test receivers for bandwidth and margin, usually in conjunction with a bit error rate tester and attenuator.

Optical Continuous Wave Reflectometers (OCWR)

The OCWR was originally proposed as a special purpose instrument to measure the optical return loss of connectors installed on patchcords or jumpers. Unfortunately, its purpose became muddled between conception and inception. As actual instruments came on the market, they had much higher measurement resolution than appropriate for the measurement uncertainty (0.01dB resolution vs. 1dB uncertainty), leading to much confusion on the part of users as to why measurements were not reproducible. In addition, several instruments were touted as a way to measure the optical return loss of an installed cable plant, obviously in ignorance of the fact that they would also be integrating the backscatter of the fiber with any reflections from connectors or splices. Since the measurement of return loss from a connector can be made equally well with any power meter, laser source and calibrated coupler, and an OTDR is the only way to test installed cable plants for return loss, the OCWR has little use in fiber optic testing.

Optical Fiber Analyzers

There are many parameters of optical fiber that require testing by the manufacturer. These include attenuation (as a function of source wavelength), band-

width/dispersion, numerical aperture and all the physical dimensions such as core and cladding diameter, ovality, and concentricity. Automated laboratory instruments are available to measure all these parameters automatically, but many fiber manufacturers prefer to build their own. The most difficult part of fiber measurements is the fact that subtle differences in test setup and instrumentation can cause differences in measured values.

Multichannel Test Systems

Often it is necessary to test a number of components simultaneously, such as environmental testing of connectors or a multifiber cable. Since it would be ungainly and certainly not cost effective to use a large number of individual power meters and sources, there are multichannel test systems available. These systems are usually based on either a number of individual power meter modules with sources

split out through couplers or systems based on one source and one meter with multichannel fiber optic switches to select each component to be tested in sequence.

Both types of systems are usually controlled by a personal computer and data acquired by a PC-based data acquisition system. Most vendors offer some form of software that can be customized for any particular application.

Visual Inspection With Microscopes

Cleaved fiber ends prepared for splicing and polished connector ferrules require visual inspection to find possible defects. This is accomplished using a microscope which has a stage modified to hold the fiber or connector in the field of view. Fiber optic inspection microscopes vary in magnification from 30 to 800 power, with 30-100 power being the most widely used range. Cleaved fibers are usually viewed from the side, to see breakover and lip. Connectors are viewed end-on or at a small angle to find polishing defects such as scratches.

Fiber Optic Talksets

While technically not a measuring instrument, FO talksets are useful for FO installation and testing. They transmit voice over fiber optic cables already installed, allowing technicians splicing or testing the fiber to communicate effectively. Talksets are especially useful when walkie-talkies and telephones are not available, such as in remote locations where splicing is being done, or in buildings where radio waves will not penetrate.

The way to use talksets most effectively is to set up the talksets on one fiber (or pairs appropriate) and leave them there while all testing or splicing work is done. Thus, there will always be a communications link between the working crew, which facilitates deciding which fibers to work with next. The continuous communications capability will greatly speed the process.

Recent developments in talksets include talksets for networking multiparty communications, especially helpful in restoration, and system talksets for use as intercoms in installed systems. There are also combination testers and talksets.

There are no standards for the way talksets communicate. Some use simple AM transmission, some FM and some proprietary digital schemes. Thus no two manufacturers' talksets can communicate with each other. Bellcore has addressed this matter in a technical advisory that proposes a FM method at 80 and 120 kHz, but it will take years before a standard has been set and manufacturers offer compatible instruments.

Attenuators

Attenuators are used to simulate the loss of long fiber runs for testing link margin in network simulation in the laboratory or self-testing links in a loopback configuration. In margin testing, variable attenuators are used to increase loss until the system has a high bit error rate. For loopback testing, an attenuator is used between a single piece of equipment's transmitter and receiver to test for operation under maximum specified fiber loss. If systems work in loopback testing, they should work with a proper cable plant. Thus many manufacturers of network equipment specify a loopback test as a diagnostic/troubleshooting procedure.

Attenuators can be made by gap loss, or a physical separation of the ends of the fibers, inducing bending losses or inserting calibrated optical filters. Both variable and fixed attenuators are available, but variable attenuators are usually used for testing. Fixed attenuators may be inserted in the system cables where distances in the fiber optic link are too short and excess power at the receiver causes transmission problems.

Reference Test Jumper Cables and Bulkhead Splice or Mating Adapters

In order to test cables using the FOTP-171 insertion loss test, one needs to establish test conditions. This requires launch jumper cables to connect the test source to the cable under test and receive cables to connect the fiber optic power meter. For accurate measurements, the launch and receive cables must be made with fiber and connectors matching the cables to be tested. To provide reliable measurements,



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launch and receive cables must be in good condition. They can easily be tested against each other to insure their performance. Bulkhead splices or mating adapters are used to connect the cables under test to the launch and receive cables. Only the highest performance bulkhead splices should be used, and their condition checked regularly, since they are vitally important in obtaining low loss connections.

Summary

Fiber optic testing requires special instrumentation that has been designed specifically to the needs of testing the performance parameters of fibers, cables, connectors, splices and a number of other fiber optic components.

The most common instrument is the FO power meter, since optical power is the most common measurement.

Test sources and FO power meters are used for loss measurements.

Specialized instruments are used to find faults in cables for troubleshooting. Visual fault locators are used for short cables and OTDRs for long cables.

Test equipment must be matched to the system being tested to get reliable test data.

Fiber Optic Standards

Accurate test and measurement always requires standard test methods and good calibration standards. In fiber optics, this means standardized test procedures for optical loss of fibers, cables, connectors and splices under many varying environmental conditions. Primary and transfer standards for optical power, attenuation, bandwidth and the physical characteristics of fiber are also required.

These standards are developed by a variety of groups working together. Testing standards primarily come from the EIA in the US (Electronics Industries Association), internationally from the IEC (International Electrotechnical Commission), and other groups worldwide. Primary and transfer standards are developed by national standards laboratories such as NIST (National Institutes of Standards and Technology, formerly the US National Bureau of Standards) which exist in almost all countries to reg-

ulate all measurement standards. International cooperation is available to insure worldwide conformance to all absolute standards.

We can also discuss "de facto" standards", those generally accepted standards for components and systems that developed because there weren't any de jure standards yet and everyone accepted the work of a supplier. In fact, we want to discuss all of those and their status in today's fiber optic systems.

De Facto Standards Come First

In any fast developing technology like fiber optics, there is always resistance for developing standards. Critics say standards stifle technology development. Some critics object because it's not their standard that is proposed, and in some cases, nobody really knows what standards are best. Under these circumstances, users choose the best solutions for their problems and forge ahead.

In fiber optics, those who have gone ahead and committed heavily to the technology or who have marketing strength have established many of the standards for today. Thus most fiber optic telecom systems in the US are based on single mode fiber and 1300 nm lasers. These components offer the best solution for the application, and had the largest suppliers and users behind them, so they became dominant. Overseas the government-controlled telecom authorities generally dictate the system configurations, but only the connectors seem to differ, with each country choosing its own national suppliers. The IEC has voted to recommend the SC style connector, which has already been adopted by several US telcos, but the singlemode ST and the FC connector still have their supporters.

In telecom systems, there are many types of systems but all are operating on singlemode fiber at 1300 or 1550 nm wavelengths. Bit rates of 1.544 Mbits/S up to 2.5 Gbits/S are already in operation, with up to higher rates promised. Today, there is virtually no compatibility between manufacturers of terminal equipment, but SONET (Synchronous Optical Network) or SDH (Synchronous Digital Hierarchy) promises to relieve some of the system

incompatibility in telecommunications.

In datacom systems (the generic category that includes datalinks and LANs), the situation is reaching consensus. Four multimode fibers have been used in datacom systems: 50/125, 62.5/125, 85/125 and 100/140 (core/clad in microns), but 62.5/125 fiber has become dominant. It was chosen as the preferred fiber for FDDI and ESCON, and the US government is using 62.5/125 in offices exclusively (FED STD 1070). Connectors have often been SMA, but AT&T's ST is now the multimode connector of choice. Most datacom systems need a duplex connector, but so far none has become widely acceptable. Perhaps the FDDI connector will become the duplex standard. While short wavelength LED (820-850 nm) systems have been most popular to date, the higher bit rates of new systems are requiring 1300 nm LED's due to the limiting effects of chromatic dispersion in the fiber. Higher speed standards like Fiber Channel will probably be based on singlemode fiber and 1300 nm lasers to accommodate the GB/s speeds of these networks.

Industry Standards Activities

In light of these de facto standards, many groups are working to develop standards that are acceptable throughout the industry.

Primary Standards

The keeper of primary standards in the US is the Dept. of Commerce, National Institute of Standards and Technology (NIST). Although some optical standards work is done at Gaithersburg, MD, fiber optic and laser activity is centered at Boulder, CO. Today, NIST is actively working with all standards bodies to determine the primary reference standards needed and provide for them. With fiber optics applications, their concern has been with fiber measurements, such as attenuation and bandwidth, mode field diameter for single mode fiber, and optical power measurements.

NIST standards are in place for fiber attenuation and optical power measurements, the most important measurement in fiber optics. Since all other measurements require measuring power, several

years ago NIST ran a "round-robin" which showed up to 3 dB differences (50%) in power measurements among participants. A optical power calibration program at NIST has resulted in reliable transfer standards at 850, 1300 and 1550 nm. Using new transfer standards, measurements of better than 5% accuracy should be easily obtained.

Component and Testing Standards

Several bodies are looking at fiber optic testing standards, but the most active by far is the Electronic Industries Association. EIA FO-6 and FO-2 committees meet at least twice a year to discuss technical issues and review progress on the writing of standards test procedures and component specifications. At the current time, there are over 100 EIA FOTPs (fiber optic test procedures) in process or published and many component specifications are being prepared. The EIA publication "Component Bulletin 9F" provides a full summary of all EIA FOTP activity with cross references.

Besides being a standards writing body, the FO-6 and FO-2 committees are a forum for the discussion of technical issues, relevant to the FOTPs being prepared, and are sometimes scenes of heated debate over these issues. But real progress is being made in defining relevant tests for fiber optic component and system performance.

Another body active in fiber optic standards is the US Dept. of Defense (DOD.) Through DESC (the Defense Electronics Supply Center in Dayton, OH), they are evaluating the EIA work for applicability in the DOD and adopting or changing standards as needed. With the magnitude of the fiber optic projects in the military and government today, the DESC project has become very important. Fiber has such high priority at the NAVY, they are funding a project (NAVSEA 56ZC) to assess the standards requirements of the NAVY for the foreseeable future and develop those standards.

Within the US, Bell Communications Research (Bellcore), the spin-off R&D organization for the divested RBOCs (Regional Bell Operating companies),

sets standards for its RBOCs by issuing Technical Advisories (TAs) on subjects of mutual interest. Bellcore is working on specifications covering cable, connectors and test equipment, as well as a variety of other fiber optic equipment. Work regarding transmission equipment standards is also being considered.

Internationally, almost every country has its own standards bodies, but most work through the IEC (International Electrotechnical Commission) to produce mutually acceptable standards. The IEC work is at least as large in scope as the EIA.

System Standards

Very few standard fiber optic systems have been proposed to date. Most systems are compatible to some electrical standards, such as T-3, RS-232, etc., but each manufacturer uses their own protocol on the optical part of the network. As a result, there is little current compatibility in fiber optic systems. Even in telephone, fiber optic links developed as adapters for standard T-carrier systems, so each manufacturer used their own protocol. Bellcore has been working on developing SONET and CCITT works on SDH to provide a standard protocol for telephony.

Work is being done by ANSI and the IEEE on developing standard systems for computer networks. The ANSI FDDI (Fiber Distributed Data Interface, X3T9.5 committee) is a high bit-rate system for computer network that is reaching commercial reality. Another ANSI committee, X3T9.3, is working on the even faster Fibre Channel (not FIBER!) specification for GB/s datacommunications. The IEEE considerations include a token-ring LAN (802.5), metropolitan area LAN (802.6) and fiber versions of Ethernet (802.3).

Summary

Standards are necessary for insuring compatibility and interoperability, but should not stifle the development of technology.

Standards come from organized standards groups and market acceptance.

Primary standards are needed to allow

measurements to be made with agreement among groups of users.

Networks standards insure product interoperability.

The Fotec Links Page lists contacts regarding standards activities

Testing Networks

Although fiber optic networks have some major differences from copper-based networks, testing and troubleshooting them is actually very similar. The techniques can be easily mastered by technicians with some basic training in fiber optics and network testing. The basic procedures outlined below were originally developed by Fotec personnel in conjunction with the customer engineering groups of suppliers of fiber optic networks. These procedures have, therefore, been thoroughly field proven in thousands of installations.

Test Equipment Required

For all cables being tested, the equipment used will be a fiber optic test kit, which includes a fiber optic power meter and a LED or laser source. The source should be of the type and wavelength used as transmitters in the network being tested. Instrument adapters provide the interface needed to the connectors used with the network. Reference test cables are needed as launch and receive jumpers for testing the network cables, and a connector coupling kit is required to interconnect the test jumpers with the cables to be tested.

Handling and Cleaning Procedures

Connectors and cables should be handled with care. Do not bend cables too tightly, especially near the connectors, as sharp bends can break the fibers. Do not drop the connectors, as they can be damaged by a blow to the optical face. Do not pull hard on the connectors themselves, as this may break the fiber in the back-shell of the connector or cause pistoning if the bond between the fiber and the connector ferrule is broken..

If there is any question about the condition of the connectors, clean them before testing. A fiber optic inspection microscope with appropriate stages to

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hold the connectors should be used to verify the condition of the connectors if there is any doubt about their cleanliness or physical condition.

What Goes Wrong on FO Installations?

In assisting users in installing and testing FO networks, the first problem we routinely encounter is incorrect fiber optic connections. A fiber optic link consists of two fibers, transmitting in opposite directions, to provide full duplex communications. It is not uncommon for the transmit and receive fibers to be switched, so you transmit to a transmitter and receive from a receiver. This doesn't work too well!

A visual tracer will make it easy to verify the proper connections quickly. A visual tracer is a visible light that you shine down the fiber and use your eyeball to trace the fiber through the cables, patch panels, etc. to the far end.

The tracer itself can be a flashlight (although it's really hard to hold the fiber in place to couple enough light to see it), a modified flashlight or even microscope that will hold the fiber in place steadily and couple an adequate amount of power into the fiber, or a special test source using a bright red LED like those used in plastic fiber links. (Do not worry about eye safety. The power level in these sources is not high enough to cause harm!)

The tracers can allow you to trace fibers up to 2-1/2 miles or 4 km. Besides tracing fibers, the tracer can be used to check continuity and find broken fibers in cables. Another highly recommended use is to check continuity of every fiber in multifiber cables before installation to insure all fibers are OK. Installing a cable with bad fibers can be an embarrassing (and expensive) proposition! Fiber tracers are inexpensive and a valuable tool for every member of the installation crew.

There is also a more powerful tool available, a high power visible laser coupled to fiber, called a "visual fault locator" (or VFL). These use red lasers, either HeNe or diode lasers, with enough power to actually show breaks in the fiber through the jacket of the fiber! They can

also be used to optimize splices and splice type connectors for verification of proper termination.

Testing the Installed Cable Plant

Fiber optic networks are always specified to operate over a range of loss, typically called the system margin. Either too much loss or too little loss can be a problem. If the loss is too high, the signal will be low at the receiver, causing a poor signal to noise condition in the receiver. If the loss is too low, the power level at the receiver will be too high, causing receiver saturation. Both these conditions will cause high bit error rates in digital systems or poor analog signal performance.

Test the complete cable plant, including all individual jumper or trunk cables, for loss, using a power meter and source and the double-ended method described above in the chapter on testing the cable plant. Use the double-ended method, since system margin specifications include the loss of connectors on both ends of the fiber. If the end-to-end (transmitter to receiver) loss measurement for a given fiber is within the network margin specification, the data should be recorded for future reference. If the loss is too low, notation should be made that that fiber will probably need an inline attenuator to reduce receiver power to acceptable levels. If the loss is too high, it will be necessary to retest each link of the complete cable run to find the bad link.

Possible causes of high end-to-end link loss are bad connectors, bad splice bushings in patch panels, cables bent too tightly around corners, broken fibers in cables or even bad launch or receive cables or instruments. There are only two ways to find the problem: test each segment of the cable individually to find the problem or and OTDR, if the lengths are long enough for viewing with the limited resolution of the OTDR.

Do not use an OTDR for measuring end to end loss. It will not accurately measure actual link loss as seen by the actual transmitters and receivers of the fiber optic link. As normally used, the OTDR will not count the end connectors' loss. The OTDR uses a laser which has very restricted mode power distribution,

which minimizes the loss of the fiber and the intermediate connectors. Finally, the difference in backscattering coefficients of various fibers leads to imprecise connector loss measurements.

Testing and Troubleshooting Networks

The installed network can be tested quickly and easily with a fiber optic power meter. The network transmitter needs to be set to transmit a clock output or other bit stream of known duty cycle. Set the power meter calibration on the proper wavelength and the reading units on watts. To test the received power, the most critical element in the network, merely disconnect the fiber optic cable connector at the receiver, attach the power meter, and measure the power.

If the receiver power is low, the transmitter power should be measured by disconnecting the source jumper cable at the first available connector and measuring the power with the fiber at that point. Alternatively, one can disconnect the cable at the transmitter and use a known good test jumper to measure the coupled power. If the output is measured through a short network jumper cable (less than 10 meters), no compensation for jumper loss is necessary. For longer jumpers, some compensation may be necessary.

If receiver power is low, but transmitter power is high, there is something wrong with the cables. They must be tested at every connection to isolate the bad cable(s) and or connectors. This can be done from either end. Starting from the transmitter or receiver end, follow the network cables to every patch panel. Disconnect the connector and measure the power at each point. By making measurements in dB, one can easily calculate the loss of the cable network to each point by subtracting successive readings.

When a suspect cable is found, by noting a larger than expected loss in the cable link, the suspect cable needs testing by the appropriate method described above. If a cable has attenuation that is higher than specifications, but still transmits light, check connectors on a microscope to determine if they have been damaged and

should be replaced. If the connectors look good, the best solution may be to replace the cable or switch to a spare. If a visual fault locator is available, it can be used to visually locate breaks in the fiber and find broken connectors. Under some circumstances, such as high loss in long jumper or trunk cables, an OTDR (optical time domain reflectometer) can be used to diagnose cable faults.

Transceiver Loopback Testing

The datacom capabilities of the network can be tested with a loopback test. This test uses a calibrated fiber optic attenuator placed between the transmitter and receiver on a piece of equipment to see if it can transmit data to itself. Many types of network equipment have diagnostics to do loopback testing. This will test the transmitter and receiver of the unit under standard data transmission conditions over the specified link loss budget.

Some equipment can also institute an electrical network loopback test, where the loopback path is inside the equipment, looping back over the entire datalink to the equipment on the far end of the link. If both ends of the link pass a unit loopback test but fail a network loopback test, the problem is in the cables, which then need testing by the methods described above.

Surviving With Fiber Optics

Once the installation is complete, the cable plant tested, the network equipment running smoothly, what is likely to go wrong in a fiber optic network? Fortunately, not much. One of the biggest selling points for fiber optics has been its reliability. But there are potential problems that can be addressed by the end user.

With the cable plant, the biggest problem is what the telcos call "backhoe fade", where someone mistakenly cuts or breaks the cable. While this most often happens when an underground cable is dug up, it can happen when an electrician is working on cables inside a building. Outdoors, the best defense is to mark where cables are buried and bury a marker tape above the cable which will hopefully be dug up first. Inside buildings, using orange or yel-

low jacket cable instead of black or gray will make the fiber cable more visible and distinctive. Outside cable faults are best found by using an OTDR to localize the fault, then having personnel scout the area looking for obvious damage. Inside buildings, the short distances make OTDRs unusable, so a visual fault locator is necessary. Another problem is breaking the cable just behind the connectors in patch panels. This is a difficult fault to find, but a visual fault locator is often the best way. Unless the jumper cables are quite long, an OTDR won't help at all.

Within the fiber optic link, the most likely component to fail is the LED or laser transmitter, since it is the most highly stressed component in the link. Lasers are feedback stabilized to maintain a constant output power, so they tend to fail all at once. LEDs will drop in power output as they age, but the time frame is quite long, 100K to 1 million hours. If there is no power at the receiver, the next place to check should be the transmitter LED or laser, just to isolate the problem to either the transmitter or the cable plant. Receivers are low stressed devices and highly reliable. But the electronics behind them can fail. If there is receiver power but no communications, a loopback test to see if the receiver is working is the best test of its status.

Summary

Fiber optic networks are tested in a similar manner to any other network, but require specialized FO test equipment.

Care must be taken to keep all components clean, since dirt on any optical surface will cause loss.

Improper connections are one of the major problems. Testing and tracing with a visual tracer or fault locator will help connect all fibers properly.

Networks specify end to end loss specifications to include the connectors on the end, so a double-ended loss test is required.

When troubleshooting, receiver power is the first thing to test. Then work back toward the transmitter, segment by segment.

Many transceivers can be tested with optical loopbacks to verify proper operation. ■

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Audio Transformers

by Rick Waller

Editor's Introduction

Transformers are an integral part of almost any consumer electronics product. Transformers are used to step down the line voltage to a value that can be used to generate the dc voltages used to operate the various circuits. In a TV, the horizontal output transformer is used to generate the large voltages used for horizontal deflection. In audio equipment, transformers are used for a number of functions, such as signal level matching, impedance matching and more.

This article, generously provided to ES&T by Shure, gives some of the details of how audio transformers are applied. Detailed knowledge such as this can certainly be of use to service technicians in troubleshooting problems in audio equipment. You can find much more useful information on audio applications at www.shure.com.

Audio Transformers

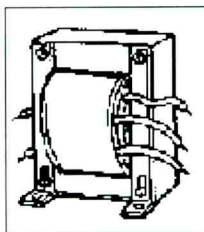
Audio transformers can: 1) Step up (increase) or step down (decrease) a signal voltage 2) Increase or decrease the impedance of a circuit; 3) Convert a circuit from unbalanced to balanced and vice versa; 4) Block dc current in a circuit while allowing ac current to flow; 5) Electrically isolate one audio device from another. While transformers are useful in other applications, this paper deals only with audio usage.

What is a Transformer?

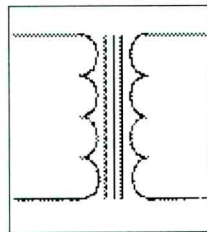
A transformer is an electrical device that allows an ac input signal (like audio) to produce a related ac output signal without the input and output being physically connected together. This is accomplished by having two (or more) coils of insulated wire wound around a magnetic metal core. These wire coils are called windings. When an ac signal passes through the input winding (the primary), a related ac signal appears on the output winding (the secondary) via a phenomenon called induc-

tive coupling. By changing the number of wire turns in each winding, transformers can be manufactured to have specific input and output impedances. The ratio between the input and output impedances provides a gain or loss of signal level as the signal passes through the transformer. Transformers are bidirectional so that an input winding can become the output winding and an output can become an input. Because of a transformer's bidirectional nature, it can provide a gain in signal level when used in one direction or a loss when used in reverse.

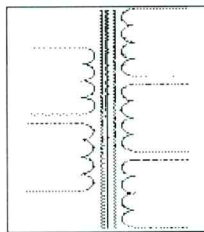
Transformers can be manufactured with multiple primary or secondary windings. A winding can also have multiple connections or "taps". Multiple taps offer different impedances along with different gains/losses.



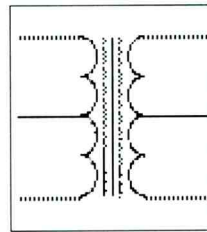
Picture of a Transformer



Electrical Diagram of a Transformer



Multiple Windings



Multiple Taps

What Types of Audio Transformers Exist?

There are two basic types of audio transformers with each having multiple functions:

Step-up/Step-down transformers

- Signal level compatibility or matching

- Impedance compatibility or matching

Unity 1:1 transformers

- DC blocking
- Radio Frequency Interference (RFI) blocking
- Ground lift and device isolation

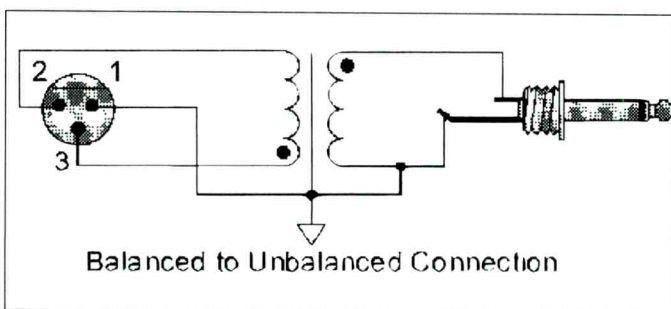
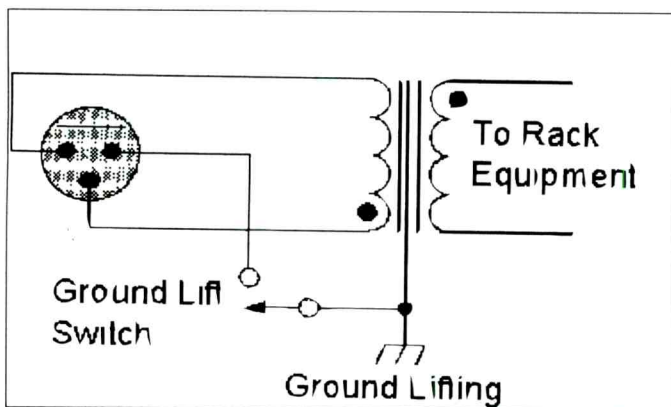
Step-up/Step-down Transformer

In a step-up/step-down transformer, the primary and secondary have a different number of windings, thus they have different impedances. Different impedances cause the signal level to change as it goes through the transformer. If the secondary has a higher impedance (more windings) than the primary, the signal level at the secondary will be a higher voltage than at the primary. A transformer with multiple taps provides access to multiple impedances and to different signal gains or losses. Many microphones have step up transformers at their output. For example, inside of every SM57 and SM58 microphone is a transformer that steps up the signal level and impedance before it exits the microphone.

Unity 1:1 Transformer

Often called an isolation transformer, it has the same number of windings on each coil. As the impedance is identical for the primary and secondary, the signal level does not change. A unity transformer allows an audio signal to pass unmodified from the primary to the secondary while blocking dc voltage and radio frequency interference (RFI). Also, since the primary and secondary are insulated from each other, a unity transformer will electrically isolate different pieces of equipment. This can solve hum problems by isolating ("lifting") the grounds of different devices. Other unity transformer applications include providing multiple outputs from a single mic input by using multiple secondary windings, and changing balanced signals to unbalanced signals or vice-versa.

Waller is an Applications Engineer with Shure Incorporated



Dos and Do Nots of Audio Transformers

- Do use a transformer to match impedances.
- Do use a transformer to increase or decrease signal level by up to 25 dB.
- Do factor in load loss when determining total signal gain/loss.
- Do use a 1:1 transformer to isolate problem components in an audio chain.
- Do not use a transformer to increase signal level by more than 25 dB.

Important Equations

The number of wire turns in each coil is related to the *Turns Ratio*:

$$\text{Turns Ratio} = \frac{\# \text{ of secondary turns}}{\# \text{ of primary turns}} \sqrt{\frac{\text{secondary impedance}}{\text{primary impedance}}}$$

The Turns Ratio is related to the voltage and current ratios:

$$\text{Turns Ratio} = \frac{\text{primary current}}{\text{secondary current}} = \frac{\text{secondary voltage}}{\text{primary voltage}}$$

What are the Limitations of Audio Transformers?

The first limitation is frequency response. By design, audio transformers only pass audio signals. Therefore, an audio transformer will block signals that are below or above the audio range of 20Hz to 20,000Hz. This can be a limitation or a benefit depending on the situation. A second limitation is that audio transformers have a maximum input level that cannot be exceeded without causing a distorted signal. When the maximum level is exceeded, the transformer is said to be “saturated”, i.e. it cannot hold any more signal. A third limitation is that audio transformers cannot step up a signal by more than about 25dB when used in typical audio circuits. Because of this limitation, an audio transformer normally cannot be substituted for a microphone preamp. If more than 25dB of gain is required, an active pre-amplifier must be used instead of a transformer.

What is the Difference Between an Expensive Transformer and an Inexpensive Transformer?

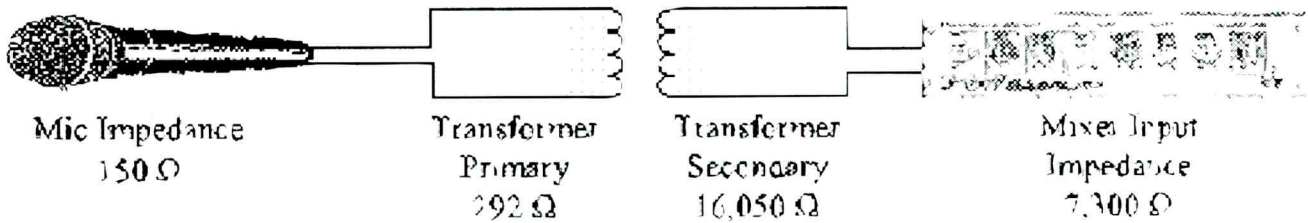
Most of the differences involve the limitations stated above. For example, an expensive transformer will have a flatter and broader frequency response. Often, a hotter input signal can be put through an expensive transformer without saturating it. Expensive transformers are also shielded better. Shielding reduces pickup of hum and interference from outside sources such as power supplies. Not only does the shielding keep unwanted signals out of the transformer, it also keeps the desired signal within the transformer. Many inexpensive transformers have no shielding while expensive transformers may have multiple shields.

As previously mentioned, an audio transformer can increase or decrease signal level. To determine exactly how a transformer will work when connected to other audio devices, gain or loss must be calculated separately at three points in the signal path: 1) between the source and the primary, 2) between the primary and the secondary, 3) between the secondary and the load. For example, if a transformer is placed in-line with a microphone, the microphone becomes source1 and the primary winding becomes load1; the secondary winding is source2 and the mixer input is load2. The following equations are used to determine the total gain or loss of a circuit when using a transformer.

$$\text{Load Loss} = 20 * \log \frac{\text{impedance}_{\text{load}}}{\text{impedance}_{\text{load}} + \text{impedance}_{\text{secondary}}}$$

$$\text{Transformer Gain} = 20 * \log \sqrt{\frac{\text{impedance}_{\text{secondary}}}{\text{impedance}_{\text{primary}}}}$$

Here is an example using these equations:



1. Calculate the load loss between the mic and the primary winding. The result is a loss of -3.6 dB. [Source is the mic and load is the primary winding.]
2. Calculate the transformer gain or loss. The transformer provides a gain of 17.4 dB.
3. Calculate the load loss between the secondary and the mixer input. The result is a loss of -10.1 dB. [Source is the secondary winding and load is the mixer input.]
4. To determine the total gain or loss of the circuit, add together: $-3.6 + 17.4 - 10.1 = 3.7$ dB. Note that though the transformer has a gain of 17.4 dB, the total circuit only has a gain of 3.7 dB because of load loss. ■

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SCC-P43DAPF GOLD 3
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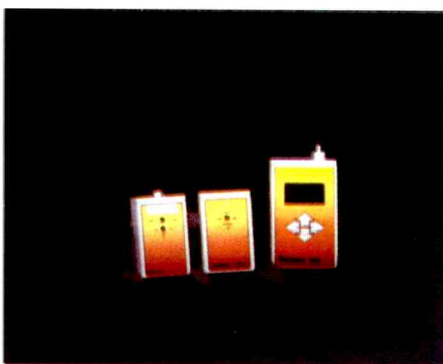
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New Products

Fiber Optic Test Kits

Fotec has introduced the DT500 series dual source fiber optic test kits, which offer the capability of testing both multimode and singlemode fibers at all the wavelengths of interest. These new test kits contain LED sources for multimode



fiber and laser sources for singlemode fiber, along with appropriate fiber optic power meters. Special versions are available for new high speed networks like Gigabit Ethernet and Fibre Channel.

An increasing number of fiber optic installers are working on networks that use both multimode and singlemode fibers, so they need test equipment that covers both types of fiber. New high speed networks like Gigabit Ethernet and Fibre Channel use lasers with multimode fibers. By creating these dual source test kits, installers can test every system with one set test equipment.

These kits use the new DM series fiber optic power meters, which feature automated testing and data logging in a cable-fiber database. Also included is FOTest DM PC software for transferring data to a PC or using a PC as a "virtual power meter."

Fotec
Circle (24) on Reply Card

Test Bench DMMs

BK Precision Corporation introduces a new family of high quality, ruggedized, multifunction DMMs. These versatile meters include Component Test capabilities, Resistance Diode Test and Capacitance, in addition to measuring Frequency, Temperature and a logic indicator.

The Models 389A and 390A feature



increased capacitance capabilities and expanded frequency measurement up to 40 MHz. The Model 390A also offers an IR-RS-232 interface and comes complete with interface cable and software. The Model 391A also features true RMS capability.

Common features include resistance measurement (from 100 mOhms to 40MOhms) (391A=10mohms to 20Mohms), Diode check, frequency measurement (from 1Hz to 40MHz) (388B is 1Hz to 4MHz, 391A is 0.1Hz to 200kHz), Audible continuity, all current ranges are fused, a ruggedized case, Digital display (the 390A and 389A's display includes a 41-segment bar graph), and auto power off. All units are CE market and UL listed and have been designed to meet IEC61010-1 CATIII 600V, class 2 specifications.

BK Precision
Circle (25) on Reply Card

Portable Fiber Optic Power Meters

Fotec's new DM300s are high performance fiber optic power meters in a



portable, handheld package. The DM300 can be used to measure optical power or loss in any fiber optic network or for testing fiber optic components.

The unit can be ordered with either of two detectors, silicon or germanium, with measurement ranges in wavelength from 400-1000 or 850-1650 nm respectively. The meter is calibrated traceable to NIST standards for measure-

ments in dBm or watts. A relative dB range is provided for loss measurements, and the meter stores a reference value for each calibration wavelength.

A feature of the DM300 allows the user to program the meter resolution appropriately for their testing. Using the menu-based operating system and soft keys, the user can select measurement resolution of 0.1 dB for field of measurement or 0.01 dB for lab use or measurement of low loss values, as in testing patchcords.

Internal memory is provided for data storage in a cable/fiber database for up to 250 cables and 500 measurements. A windows-based software package allows for data transfer or operation of the meter as a "virtual meter" from the PC.

Fotec
Circle (26) on Reply Card

Optical Power Meters

Extech's new Econo OWL™ Optical Power Meters include 4 models which provide accurate readings of dBm and microwatts. Models EO400 and EO410 measure between -21dBm and 35dBm while models EO420 and EO430 measure between -21dBm and 40dBm. Models



EO410 and EO430 with built-in 850nm LED light source provide an easy method for patch cable, fiber spool, and loop back testing. Simple, one switch operation provides detector only or detector and light source modes. Indicators show detector on, low battery, and light source on. Includes NIST traceable certification, 9V battery, and case with belt clip.

Extech Instruments
Circle (27) on Reply Card

Telecom Data Tester

Xcelite®, a CooperTools brand, has introduced the Xcelite DataCom TDT1

New Products



Telecom Data Tester for verifying the condition of wiring in patch cords and coaxial cables.

The tester uses both speech (a voice module announces the results) and lights to indicate cable conditions so it is

not necessary to look at the tester to interpret a lighting sequence. Identifies open, short and good cables so mistakes can be corrected before final installation. Checks RJ-11 and RJ-45 telephone cables. The highest quality receptacles are used to assure that plugs are held securely for accurate readings. Conserves battery life by using power only during the test. Battery light indicates battery condition. Lifetime warranty.

The tester is useful to on-site installers making patch cords or troubleshooting problems. The tester quickly verifies the condition of wiring (up to 1,500 feet) in patch cords and coaxial cables not installed through walls or bulkheads (both cable ends must be plugged into the tester.)

Cooper Tools
Circle (28) on Reply Card

System Switcher With Built-In Video Scaler

Extron introduces the new System



7SC, a seven input, dual output, configurable video and computer-video switcher with a built-in video scaler. The System 7SC features system control along with RGB and video integration capabilities ideal for rental, staging, and permanent installations using plasma displays as well as CRT, LCD, and DLP projectors.

This system switcher also provides video scaling, RS-232 or IR projector & room control, universal compatibility with displays, and audio switching capabilities.

To optimize image quality as well as maintain maximum image brightness and detail, video inputs must be scaled to progressive scanning RGB resolutions that match the "sweet spot" or native resolution of the digital display being used. Using the manufacturer's advanced digital video scaling technologies, the System 7SC scales any video input, including any progressive component signal, to one of twelve common computer-video, progressive HDTV, or plasma resolutions. RGB inputs are passed through. The system offers quad-standard video decoding compatibility (NTSC 3.58, NTSC 4.43, PAL, and SECAM) using a four-line adaptive comb filter. Six of the inputs are configurable for composite video, S-video, component video, or RGB. Located on the front panel, the seventh input accepts composite video, S-video, or computer-video on a 15-pin HD connector. This makes it convenient to connect a laptop, camera, or DVD player directly, without accessing the back of the switcher. For balanced/unbalanced stereo audio, the System 7SC offers audio attenuation/gain adjustments for each input. The output is simultaneously available on a 15-pin HD connector and five BNCs.

For projector control, the System can be programmed via downloadable RS-232 or IR drivers. The system also provides user-friendly IR learning capabilities and allows for user-defined RS-232 commands, making it compatible with almost any display device. Room lighting, screen settings, and other device functions may be controlled through the system's room function, via internal relays.

System switcher control is provided via front panel operation, included IR 70 remote control, RS-232 control, optional SCP 200 hardwired control pad, or optional SCP/AAP hardwired control Architectural Adapter Plate. The system provides 350 MHz (-3dB) video bandwidth for maintaining signal integrity.

Extron
Circle (29) on Reply Card

Analog/Digital Storage Oscilloscope

B&K Precision Corporation announces the addition of the Model 5105A, a cost-effective 150 MHz Analog/Digital Storage Oscilloscope. This compact, ver-



satile, easy to use benchtop unit incorporates both a high-end Digital scope with a 200MS/s sampling rate.

Upon start-up, the oscilloscope automatically undergoes a diagnostic self test to ensure proper operating conditions. Its clear, sharp, easy-on-the-eyes blue display assures accurate readings. The unit offers the benefit of both Analog and Digital operation in one unit. A single button is used to switch from Analog to Digital storage operation.

AUTOSET, another ease-of-use features, provides automatic setup of time base, vertical axis, and trigger parameters of the signal being measured. The user can then readjust the time base and vertical axis as required. Up to 17 automatic measurements are displayed by readouts on the screen. The scope also offers many user benefits including the capability to store waveforms for analysis, the ability to view/store pre-trigger information, the ability to detect/display/capture complex waveforms, the ability to obtain hard copy printouts of the capture signal, the ability to view slow event, and the ability to view one time event.

The unit can store up to two waveforms, each 2k x 8 bit long. Two horizontal and vertical cursors allow a choice of measurements on both real time and stored waveforms. After acquisition, the data can be manipulated and displayed in many different ways. The user can change time base or vertical position, or select which portion of waveform to look at in more depth. And, the waveform can be com-

New Products

pared to a "known-good" waveform in memory. The user can also interpolate or smooth the waveform to "fill in the gaps."

B&K Precision Corp.
Circle (30) on Reply Card

Switch Mode DC Power Supply

B&K Precision announces the Model 1692, a compact, lightweight Switching DC Power Supply to its expanding product line. Utilizing a standard 115Vac outlet as the power source, the new bench top unit provides a variable voltage output of



3Vdc to 15Vdc, or a fixed 13.8Vdc (selectable), and up to 40A at continuous operation. The new dc power supply is suitable for a variety of applications, especially dc operated mobile radio equipment on the bench.

The power supply provides high current output in a lightweight (7.7lbs) and compact package (8.67" x 4.33" x 11.82"). It provides a variable voltage output from 3VDC to 15VDC at 40A continuous operation. The unit features a bright red and green front-panel mounted digital LED display which provides for an accurate and highly readable indicator of settings. Other front panel indicators and controls include an ON/OFF power switch, a Power LED, Overload LED, Variable Voltage Control Knob and a pair of easy snap-in 3A Output Terminals.

Specifically designed for use with radio equipment, the supply includes extensive filtering to provide immunity from erratic operation caused by RFI. A current fold-back circuit provides the unit with overload protection and internal circuitry provides for over temperature protection.

B&K Precision Corp.
Circle (31) on Reply Card

B&K Introduces Frequency Counter

B&K Precision announces the addition of the Model 1856C, high-quality, lightweight counter capable of frequency measurements from 5Hz to 2.4GHz to its



expanding line of cost-effective instrument. This compact, versatile, easy to use, highly reliable counter is ideal for a broad spectrum of laboratory and service applications.

The unit 1856C features a special 50Ω-terminated input for use in high frequency measurements up to 100MHz. The counter utilizes an eight-digit display, which provides up to 10Hz resolution to 2.4GHz, 1Hz resolution to 100MHz, and 0.1Hz resolution to 10MHz.

In Period Mode, the unit measures the period required (in microseconds) for one cycle, over the range of 5Hz to 3.5MHz. At low frequencies, much greater accuracy can be achieved by period measurement than by frequency measurement.

Totalize Mode permits counting of individual events. The counting process can be gated, either manually by a front panel switch, or by a gating signal applied to a rear panel jack, for more exact electronic control.

Front panel push-button switches select the Operating Mode and one of four decades of resolution. Easy-to-interpret readouts are provided by large, bright digits, automatic decimal point placement, leading zero blanking, and LED display of proper measurement units. Overrange and GATE function (indication of a measurement in progress) are also shown on front panel indicators.

A front panel HOLD switch is provided which "freezes" the display at the present reading, as well as a RESET button which clears the counter display and initiates a new measurement when released. A selectable X10 attenuator and selectable 100kHz low-pass filter are incorpo-

rated at the standard frequency input jack, for lessened susceptibility to noise and (in low frequency measurements) undesirable high frequency components.

B&K Precision Corp.
Circle (33) on Reply Card

TK-2 Telecom Cable Toolkit

The new TK-2 available from Jensen is a complete set of tools specifically designed for cable sheath slitting, ring cutting, lacing, sewing, parallel drop wire slit-



ting, switch or panel board terminating—everything needed for cable work. The toolkit comes in a handy padded zippered vinyl carrying case, and is perfect for use in the central office or in the field. The kit includes a sheath stripper, a sheath slitter, a ring cutting tool, a curved sewing needle, a straight 7" sewing needle, a wire loop lacing needle, an aerial drop wire slitter, and a straight, flat metal sewing needle.

Jensen Tools Inc.
Circle (34) on Reply Card

Electrical-H/VAC Test Tool

Wavetek Meterman has packaged and introduced a new collection of tools for electrical-HVAC applications. The multi-function test tool introductory kit includes such products as:



New Products

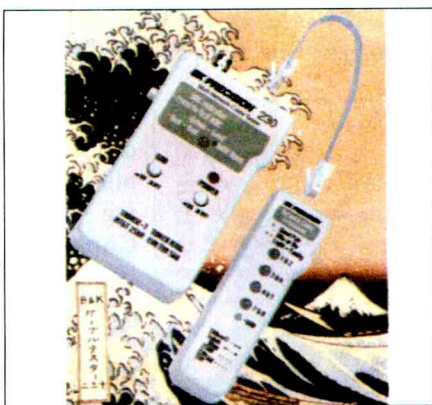
1. DM73A – Unique, pen-shaped meter ideal for troubleshooting lighting and production machinery – the tool of choice for Hollywood lighting professionals.
2. AM8 – Inexpensive, pocket-sized meter
3. 10XL – Compact DMM with built-in voltage “Safety Tester™”
4. 23XT – Best general purpose electronics/electrical handheld meter
5. AD40A – Low cost miniature digital ammeter, 400A ac range
6. AC38 – Good value, general purpose, ac clamp meter
7. AC65 – True-rms, professional, 600 A, ac clamp meter

The collection is designed specifically for the middle of the electrical-HVAC test tool market. It has a host of functions that will appeal to a broad range of users and is a fit for plant engineers and HVAC technicians.

Wavetek Meterman
Circle (35) on Reply Card

Remote Network Cable Tester

BK Precision Corporation announces the addition of the Model 230 low-cost



Remote Network Cable Tester. This lightweight, portable, battery powered unit is an easy and effective cable tester which can test all of the wiring faults of 10Base2 (coax), 10BaseTx, RJ45, 356A, TIA-568A, and Token Ring cables.

The Model 235 Remote Network cable tester can be used to identify wiring faults such as open pairs, shorted pairs, reversed pairs, crossed pairs and split pairs, as well as up to four different cables at one end

by provided remote identifiers. It can be used to test cables from 4ft. (1.2m) to 492ft. (150m) in length.

A large flashing LED displays the fault code, and the 4 pair's individual LEDs identifies which pair are tested. The remote identifiers are provided to make a remote test. Just push the “TEST” switch. The Model 235 will automatically run all tests within a few seconds and identify which faults are present, if any. It is very simple and easy to use.

B&K Precision Corp.
Circle (36) on Reply Card

Horizontal Output and Flyback Analyzer

Sencore Electronics announces the introduction of HA325 Horizontal Output & Flyback Analyzer. The HA325 is designed greatly slash servicing time on



all types of CRT-based video displays. According to industry estimates, over 250 million CRT-based video displays are currently in use, with sales of another 22 million units this year including 1 million projection systems.

Technicians servicing these video displays indicate that over 50% of the failures involve the horizontal output stage. These problems are especially difficult to troubleshoot because of their confusing interaction with other circuits and their potential for dangerous currents and voltages that quickly damage other circuitry and expensive components. Servicing is further complicated by the need to service projection and large screen displays on location.

This analyzer targets these difficult servicing problems. The unit is hand-held, battery-operated analyzer that isolates horizontal defects in any CRT-based video display to reduce servicing time, unnecessary parts replacement, return visits and costly back-to-shop transports. Three exclusive tests are key to analyzing horizontal output stages with the product.

A Horizontal Output Load test allows servicers to determine if a horizontal output stage has any major defects. This test, based on a method that has been proven effective in over 5,000 service centers, requires just 3 connections to the chassis and takes less than 1 minute to complete. The only power applied to the chassis comes from the low voltage, current limited signal provided by the analyzer. The test simulates the operation of the horizontal output stage with normal switching action and quickly identifies any problems that cause abnormal high currents. High current conditions are indicated on the display as DC LOAD, DC SHORT, AC LOAD, or AC SHORT. The display also shows numerical test results for output stage current, % efficiency and timing.

When a defective output stage has been confirmed, the new IHVT/Flyback Load test helps isolate the defective components. The IHVT/Flyback Load test analyzes flybacks and integrated High Voltage Transformers (IHVTs) for internal defects, including shorted windings, shorts or leakage from the primary winding to a secondary winding, and condition of the integrated high voltage, focus/screen dividers and secondary windings.

A Ringer Test identifies shorted adjacent turns in non-iron core inductors and transformers, such as yokes and switching transformers. A shorted turn lowers the Q of the coil without changing the inductance or resistance value, making shorted turns impossible to detect with other test methods.

Sencore Electronics
Circle (37) on Reply Card

Low-Voltage DMM Accessories

Fluke Corporation, has introduced a new line of accessories for low-energy test and measurement applications.

Designed for use with the company's test meters as well as other brands, the accessories provide everything today's technicians and engineers need to install, maintain, and troubleshoot electronic circuitry and components.

Fluke Corporation
Circle (38) on Reply Card

Work Station Catalog

A new catalog that describes All Metal Designs' complete line of Operator Adjustable™ workstations and accessories has been announced. The catalog includes standard ergonomic workstations and benches that meet virtually any workstation requirement, as well as a new line of Retro-Lifts Kits that convert any machine or fixture into an ergonomic, height adjustable unit. Models for light and heavy-duty applications (up to 2,500 lbs.) used in manufacturing, assembly and packaging operations are featured. Options include both manual and electric height adjustments, tilt worksurfaces, parts bin boards, tack boards, electrical outlets, lighting, trolleys/tool balancers, footrest, computer monitor arms, keyboard trays, shelving and drawers.

All Metal Designs, Inc.
Circle (39) on Reply Card

Tool Catalog

Wiha Tools has published their 2001, 112 page full color catalog. The catalog features over 1800 high quality professional tools. Wiha has introduced over 800 new products in the last 24 months, all of which are included in the new publication. Wiha offers a broad range of problem solving professional quality tools.

The Catalog offers an extensive range of Torx, TorxPlus and Tamper Resistant Torx products 48 different styles including; Insert/Power Bits, T-handles, L-keys, PocketStars, Screwdrivers, Precision Drivers, Cushion Grip Drivers, Sockets, ESD Safe Drivers and more.

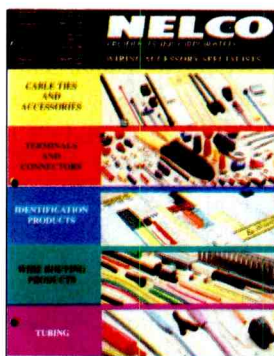
Also included is a brand new line of Tweezers. Over 150 various styles and sizes of Tweezers; including ESD Safe hypo allergenic, stainless steel Microscopy & Wafer, professional quality Guide Pins, Cutting & Self Closing tweezers, SMD component positioning & desoldering, Isolated tweezers with dipped handles, Interchangeable tweezers with heat protected plastic handle, detachable & boilable mirrors, clean room quality excavators, probes & hooks.

The company has also increased their

screwdriver bit program with sets and sizes of all styles including; Phillips, slotted, PoziDriv, Torx, TorxPlus, Hex, Square, Tri-wing, Torq Set, Spanner and Security Hex, as well as power bits for production assembly applications. Many screwdriver bits are also available in sets.

An innovative product is the Ergonomic "SoftFinish" cushion grips, 15 different styles incorporating over 130 tool configurations. The ergonomic handle shape generates up to 40% more torque than conventional extruded handles.

Wiha Quality Tools
Circle (40) on Reply Card



Wiring Accessories Catalog
A new 66-page catalog of wiring accessories that includes cable ties, expandable sleeving, heat shrinkable tubing, molded shapes, terminals, wire routing products, and various identification and packaging services is being offered by Nelco Products.

The Catalog includes a wide selection of cable ties in different styles, materials, and sizes, mounts, terminals and connectors, and other bundling, organization, and marking products. Featured is an expanded section of identification products with low-, medium-, and high-volume and packaging into kits, polybags, and labeled boxes.

Nelco Products Inc.
Circle (41) on Reply Card

Components Catalog

A 192 page catalog from Jameco features thousands of ICs and other electronic components, tools, test equipment and computer products for OEM and MRO applications. More than 425 new products have been added including: ICs, transformers, computer cables, tools, motherboards, switch boxes, connectors, books, converters, power supplies, hubs, fuses, LEDs/displays, and soldering



boards, Amphenol adapters and connectors, Entelec power supplies, terminal blocks, Millennium rechargeable batteries, Triplite UPS systems, Parallax basic stamp kits, and Omron relays sockets and switches.

Receive up to the minute pricing and inventory information with the ability to accurately track your order status from entry through delivery. Find all the technical information you need at your fingertips. Easily search for items using text, Jameco part or manufacturer numbers. Log on to www.jameco.com.

Jameco Electronics
Circle (42) on Reply Card

Cable Assembly Catalog

RF Connectors*, a division of RF Industries, new 128 page catalog offers



nearly 60,000 stock cable assemblies featuring the RF Connectors line of high quality coaxial connectors, solid center contacts, dual-wall tubing

for strain relief and fabrication using only US manufactured coaxial cables. This product line also includes USB, fiber optics and other molded cables.

More than 10,000 variations of standard connector interfaces terminate 64 popular coaxial cable types to create this broad selection. Custom assemblies are also available with short lead times.

RF Connectors
Circle (43) on Reply Card

Association News

Two New Certification Programs announced by ETA-I

FIBER OPTICS TECHNICIAN CERTIFICATION

The Electronic Technicians Association has announced an advanced program for workers in the fiber optics field as of October 1, 2001. The name is Certified Fiber Optics Technician and the acronym is CFOT.

ETA has certified fiber optics installers since 1996. Currently over 400 CFOI's are presented with credentials each month by ETA as they prove their knowledge by sitting for a written knowledge examination. In addition they must pass a hands-on demonstration of their ability to splice or connectorize fibers in this fast growing communications field.

Both of ETA's fiber certification programs have more stringent requirements than any of ETA's 19 other certifications. The C.E.T. (Certified Electronics Technician) certifications require the passage of a written exam and proof of experience or schooling. The fiber certifications require classroom training at one of ETA's Approved Fiber Optics Training schools, passing a written knowledge exam and demonstration of hands-on skills.

Thirty eight individuals compose ETA's fiber examination development and policy committee for cabling. Competencies, equipment requirements for schools, instructor credentials verification and oversight of the examination pools are the responsibility of the industry-wide committee. In addition to members of the committee who work in communications cabling jobs, instructors at private and state schools, it also includes instructors at the U.S. military and Coast Guard fiber training schools.

The new CFOT advanced fiber training and certification has been beta tested at ECPI, Electronic Computer Programming Institute in Virginia Beach, VA. Many of ETA's approved schools are now gearing up to offer the advanced program in addition to continuing to teach basic installers.

In addition to knowledge and skills required for installers, the technician advanced program tests for further knowledge about optical technology, signal generation and measurement, methods of cabling network systems, and in troubleshooting problems in existing communications networks.

SERVICE MANAGER CERTIFICATION PROGRAM

A CSM, or Certified Service Manager, credentialing program has been initiated by ETA. The purpose of the program is to recognize high levels of professionalism by businesses which provide electronics and/or appliance services to the public.

Both ISCET/NESDA, USA and PSA have similar certification programs for service businesses. Unlike ETA's other certifications, the service manager program provides an approval mechanism for the business manager or owner, rather than a technical skills and knowledge test.

The Certified Service Manager credential provides an assessment of the business and people management abilities of the service business manager. The manager is expected to have skills in financial statement understanding and use; marketing; pricing; conflict resolution; productivity calculation; personality typing;

utilizing business financial ratios; safety; insurance; fleet management, call routing, telephone techniques and more.

Successful CSM applicants are provided with a wall certificate and wallet card (in the same manner as technical certifications.) Because ETA provides testing locations at hundreds of technical school around the U.S. and at off-shore locations, it will not be difficult for potential certified managers to find a convenient location to test. Many of these locations are listed on ETA's web site at www.eta-sda.com.

The CSM program is important just now because the entire appliance and consumer electronics industry is gearing up to begin a program to certify electronic and appliance businesses. A requirement to become a certified business (more of which will be published very soon) is for one person at a business to hold the CSM credential or equivalent. ETA's adoption of this program will help businesses meet this requirement.

The price to sit for the ETA CSM examination is \$100.00. There is no four-year certification renewal requirement at this time as there is for technical certification holders.

For more information regarding these two new ETA programs, check www.eta-sda.com, e-mail at eta@tds.net, or call 800 288 3824.



SERVICE MANAGEMENT SOFTWARE

- Electronic Claims Processing for WTI, KPINS, PANASONIC, LG ZENITH, SERVICE BENCH, MAYTAG, AND EC-HUB.
- Multiple Inventory Control with Parts Cross Referencing
- Graphical Calendar for Scheduling
- COD / Warranty / 3rd Party Invoicing & Tracking
- Password Protected User Profiles
- Prints on NARDA & NESDA Forms
- Auto Labor Rates by Product or Model Number
- Quick Record Look-Ups and Browsing
- Over the Counter Point-Of-Sale
- Technician Production & Assignment Reports
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- Service Literature Cross Referencing
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Circle (44) on Reply Card

NOW ... MORE THAN EVER ...

What is NESDA?

NESDA is the National Electronics Service Dealers Association. It is the premier trade association for professionals in the business of repairing consumer electronic equipment, appliances, or computers. NESDA's mission is to help independent servicers be successful through challenging times.

What are the benefits of membership?

- **Profit** from member discounts on parts and supplies
- **Connect** to NESDAnet, a lively online nationwide community of fellow servicers willing to share knowledge and tips
- **Gain access** to a huge lending library of factory service manuals — for just shipping costs
- **Benefit** from group volume buying for business liability insurance, a merchant credit card program, and more
- **Utilize the power** of the NESDA Industry Relations Committee for assistance in resolving issues with manufacturers, contract providers, or parts distributors
- **Unite** to improve industry processes and resolve problems
- **Advance information** on the annual National Professional Service Convention, a concentrated, focused week of management and technical training, with the opportunity to register at a reduced rate

THE NESDA CODE OF ETHICS

- ✓ I will conduct my individual business in a manner to insure the good will and confidence of the public whom I serve.
- ✓ I will not participate in any false or misleading advertising.
- ✓ I will maintain adequate equipment and qualified personnel in order to perform quality service to the public and the trade for fair, equitable and nondiscriminatory charges.
- ✓ I will not perform, or cause to be performed, any act which would tend to reflect adversely on our industry, fellow members, competitors or manufacturers.
- ✓ I will comply both in spirit and letter with rules and regulations prescribed by the law and by government agencies for the health, safety and well-being of my employees and the public.
- ✓ I will maintain liability and financial responsibility in order to uphold the guarantee for all work undertaken.
- ✓ I will represent manufacturers in an honest and intelligent manner to create an atmosphere of mutual trust and understanding and to best serve our combined interests.
- ✓ I will offer clean, attractive, and inviting facilities as well as courteous and competent personnel.
- ✓ Accurate statements or invoices will be rendered to the customers and a comprehensive record of all work will be kept. I will strive to assure that my prices are understood and easily available.
- ✓ All complaints will be promptly and courteously handled.
- ✓ The property of all customers will be carefully handled and adequate insurance will be carried to protect this property while in my custody.
- ✓ I will seek always to improve myself, to increase my efficiency, and to better my services.
- ✓ I will perform only such work as is needed and authorized by the customer, and all parts will be new and first quality unless otherwise specified.
- ✓ I will strive to continually improve the image and reputation of the industry by practicing good and enlightened public relations in the community, and to keep the community adequately informed of the functions and services of my firm and the industry.
- ✓ I will participate loyally in the industry's growth and progress through the activities and public interest efforts of the association.

Circle (45) on Reply Card

... YOU NEED NESDA!

Join NESDA & NESDAnet for 3 months FREE

Complete the information below and fax or mail to NESDA (address and fax number below) to receive all the benefits of NESDA membership plus NESDAnet, a members-only subscription service of NESDA, free for 3 months. NESDAnet is an e-mail forum for the exchange of industry-related information and technical/parts assistance by fellow members. An e-mail address is required for NESDAnet participation.

— PLEASE PRINT OR TYPE —

Date: _____

Name: _____ Title: _____

Company: _____

Street Address: _____

City: _____ State _____ Zip _____

Phone #: (_____) _____ - _____ Fax#: (_____) _____ - _____

Does your service business have a website? Please list the address: www. _____

Yes, enroll me in NESDAnet for a 3-month trial. Here's my e-mail address: _____

Important: I understand that I will receive e-mail messages from the NESDAnet list, but may elect to browse the messages online. New members also receive an informational message with instructions on how to use the service.

After your free trial period, membership in NESDA and NESDAnet is as follows:

**Membership Dues — \$180*
NESDAnet — \$60/calendar year**

(Membership in NESDA is required to continue NESDAnet past the free trial period.)



If you elect to continue your membership after the "FREE 3-Month Trial," your credit card (Visa or MC) will be billed as follows (please place a check mark in the box next to your preferred mode of payment):

12 months 6 months 3 months

- **Membership Dues (*first-year reduced rate):**
\$180/year; \$92.70/6 months; \$47.70/3 months
- **Membership Dues (after first year)**
\$240/year; \$123.60/6 months; \$63.60/3 months
(Note: The NESDAnet subscription fee is not included in the membership dues amount. See below.)

NESDAnet:

- \$60/year, billed in December for the calendar year beginning January 1. (If my membership begins after July 1, \$30/year for the remainder of that year). I understand that membership in NESDAnet past the trial period requires a valid NESDA membership to continue.

Unless I notify NESDA, in writing, that I will NOT continue my NESDA membership or NESDAnet beyond the free period, I authorize NESDA to charge my credit card the amount of dues as stated herein.

Visa/MC # _____

Name on Card _____

Expiration Date _____

By my signature below, I agree to abide by the NESDA Code of Ethics (at bottom of facing page).

Applicant Signature _____

NESDA • 3608 Pershing Ave., Fort Worth, TX 76107 • www.nesda.com
Phone 800/797-9197, ext. 16; Fax 817/921-3741; e-mail membership@nesda.com



CEDIA Group to Provide Seminars and Certification at CES

Indianapolis, IN - The Custom Electronic Design and Installation Association (CEDIA) will offer an education forum and certification program at the January, 8-11, 2002 International Consumer Electronics Show (CES) in Las Vegas.

15 classes for professionals in the custom electronic design and installation industry will be offered in business management, home networking, home theater design and installation and whole-house

subsystem installation. Two all day education programs will be offered to prepare attendees for CEDIA's Professional certification exams., and on January 11, exams for Levels I and II installer certification will be held.

"To grow and enhance our show, CES continues to reach out to new audiences and technologies. Both CES and CEDIA are committed to growing the entire custom installation market," said Karen

Chupka, VP of events and conferences for CEA, sponsor, producer, and manager of CES. "We're delighted about this new partnership with CEDIA to bring even more in-depth training and educational opportunities to our attendees. The CEDIA sessions and certification will provide a wealth of knowledge guaranteed to give our attendees the valuable tools they need to compete in the consumer electronics industry."

Executive Director of CEDIA, Billilyanne Keller added, "We are honored to bring our most popular education classes to CES and , more importantly to bring professionals the opportunity to earn the distinction of certification."

NESDA Providing 90 Day Free Trial to Build Membership

The National Electronics Service Dealers Association (NESDA) has embarked on an aggressive program to entice new members into its organization.

The NESDA organization is offering prospective members a full 3 month free membership and access to all benefits and privileges of regular membership.

The promotion and publicity from the Fort Worth based organization cites a long list of benefits available to Consumer Electronics Service Professionals including:

- Discounts from participating distributors like: PTS, MCM, Martin Distributing, and B&D.
- On line peer to peer service assistance with NESDAnet.
- A lending library of factory service

manuals available for the cost of shipping.

- The NESDA Industry Relations Committee assistance in resolving difficult issues with vendors and suppliers.
- Reduced registration fees for the National Professional Service Convention in August.

Those servicers who elect to continue their membership with NESDA after the 90 day free trial, will also be offered a reduced first year rate of \$180.00. The current annual membership dues are \$240.00.

The NESDA organization is more than 50 years old and boasts some 1500 member servicers.

SBA Forum Postponed Due to September 11, 2001 Attack in New York

The Satellite Broadcasting and Communications Association Forum on Consumer Satellite Service Industry Growth scheduled for September 14 at the New York Marriott Marquis Hotel has been postponed until Spring of 2002 according to an SBA Spokesperson. As soon as Information the rescheduled event is available it will be posted on the SBA website: www.sbca.com.

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STK392-110	121-499	2.04	221-466-01	1.44	221-940-02	42.42	610468-1	1.79			TA8210AE	3.70
STK396-010	121-1009	1.74	221-467	8.10	221-940-04	42.42	610517-3	2.91			TA8210AL	2.59
STK397-010	121-1014	2.10	221-468	1.50	221-947-01	25.74	612042-2	2.10			TA8218AE	4.07
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STK401-051	121-1088	1.80	221-473	15.59	221-949-01	25.92	612070-1	1.80			TA8410K	2.22
STK405-050A	121-1110-01	2.22	221-475	8.70	221-987-01	13.19	612072-1	1.80			TA8427K	2.79
STK407-090	121-1129	1.62	221-476	5.94	221-997-01	8.35	612076-1	2.88			TA8445K	1.79
STK430III	121-1148	3.99	221-479-03	22.91	221-998-06	20.76	612076-2	2.88			TA8601BH	4.50
STK459	121-1167-01	4.77	221-479-06	24.24	221-1006-02	27.06	612076-7	2.88			TA8655AN	8.10
STK730-010	121-1168	5.10	221-485	9.59	221-1006-03	24.36	612094-1	2.58			TA8667F	3.54
STK730-020	121-1188	2.34	221-492-01	6.83	221-1006-05	27.06	612120	3.78			TA8680BH	5.12
STK730-040	121-1188	2.34	221-493	21.06	221-1028	11.76	612160-3	2.34			TA8680N	7.14
STK730-130	121-1190-01	1.44	221-495-03	20.70	221-1033	11.76	612261-1	1.20			TA8792N	7.19
STK1040	121-1202-02	4.07	221-498	4.44	221-1046-01	20.58	612312-1	7.14			TA8825AN	8.34
STK3042	121-1275	2.88	221-516	5.94	221-1060	25.14	612313-2	8.34			TA8845AN	14.34
STK4024II	121-1276	2.22	221-518-02	9.99	221-1088	2.70	612331-2	5.82			TA8850N	8.22
STK4026II	121-1299	1.90	221-520	24.96	221-1138-01	29.76	612338-3	3.54			TA8851AN	5.32
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STK4130II	175-2771	22.99	221-524-01	19.56	221-1165	9.59	612364-1	2.14			TA8864AN	4.98
STK4130II	175-2771	22.99	221-528	5.99	221-1165	9.59	612405-1	1.50			TA8879N	5.99
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STK4162II	221-43	1.45	221-538-01	26.77	145174	9.32	612495-1	15.54			TA8891N	3.54
STK4191II	221-62	1.74	221-542-01	6.83	146149	5.70	612508-1	6.72			TA75902P	1.92
STK4191V	221-69	1.45	221-544-01	24.60	148446	16.86	612552-1	5.40			TD1003A	3.54
STK4192II	221-77	1.45	221-545	3.46	149016	3.46	612553-1	5.40			TD1013B	1.67
STK4195V	221-78	1.45	221-546	1.74	149034	3.00	612554-1	17.94			TD1017A	1.14
STK4196X	221-79-01	1.32	221-552	12.30	149036	3.72	612556-1	10.14			TD1305T/M2	7.14
STK4231II	221-81	3.54	221-554-01	28.63	149037	3.96	612565-1	8.40			TD1514A	5.94
STK4274	221-83	3.54	221-557	7.86	149039	3.96	612584-7	5.88			TD1515BQ	5.94
STK4278L	221-83	3.54	221-563	13.74	149249	5.10	612587-1	7.80			TD1521	3.54
STK5326	221-84	3.54	221-564	5.52	150645	7.20	612589-1	3.00			TD1540P	3.54
STK5332	221-84	3.54	221-565	19.94	154488	5.10	612590-1	3.00			TD1554Q	4.74
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STK5352	221-96	1.80	221-571-01	27.60	155886	3.96	612674-3	7.14			TD2005	1.50
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STK5478A	221-105	1.45	221-599-02	35.40	160094	4.50	612745-1	6.54			TD2579A	4.50
STK5479	221-106	1.45	221-603	7.46	161078	2.34	612755-3	8.34			TD2593N	1.38
STK5481	221-111-02	1.80	221-604-01	31.02	161273	7.46	612766-1	5.94			TD2595	2.34
STK5482	221-114	3.30	221-620	12.35	161362	7.46	612771-2	9.54			TD2611A	1.74
STK5486	221-140	3.12	221-628-03	22.74	164601	1.32	612792-1	3.54			TD2653A	4.74
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STK6982B	221-144	15.00	221-648	32.28	186001	6.54	612818-1	5.94			TD3048	4.50
STK6982H	221-147	2.34	221-652-01	24.60	189424	8.96	612818-2	5.94			TD3561A	4.74
STK7309	221-149-02	1.32	221-656	3.96	190486	5.94	612825-2	15.54			TD3563A	5.70
	221-153	30.60	221-657-50	4.76	192689	6.60	612829-1	1.50			TD3566A	6.19
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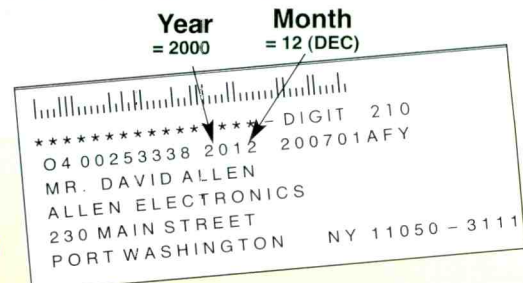
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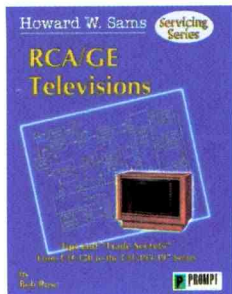
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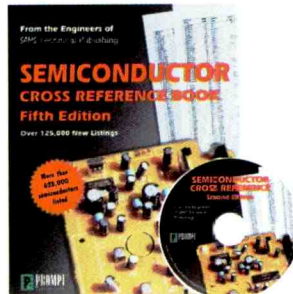
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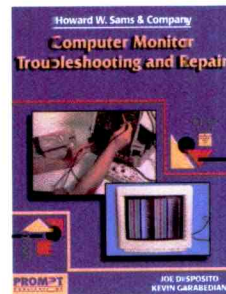


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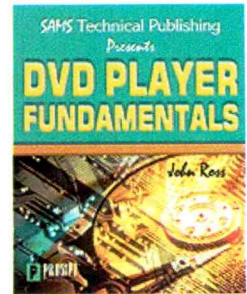


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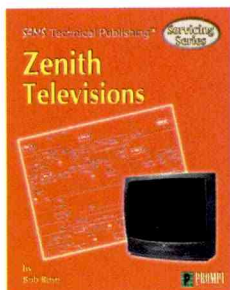
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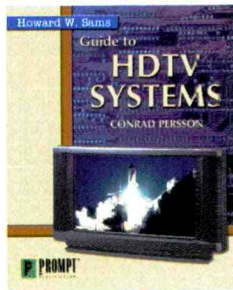


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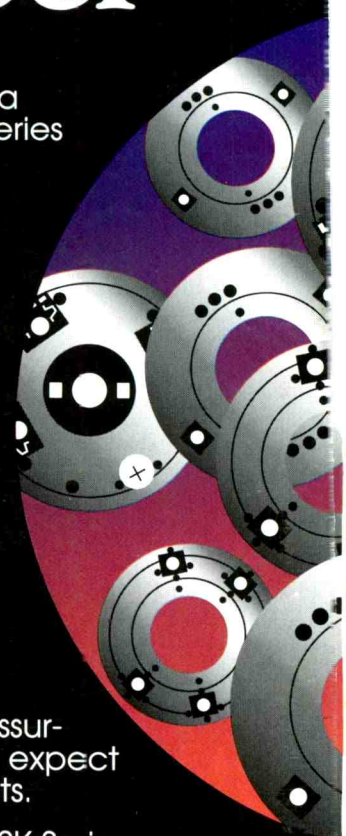
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