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Official trade journal of the Society of Cable Telecommunications Engineers

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September 1995

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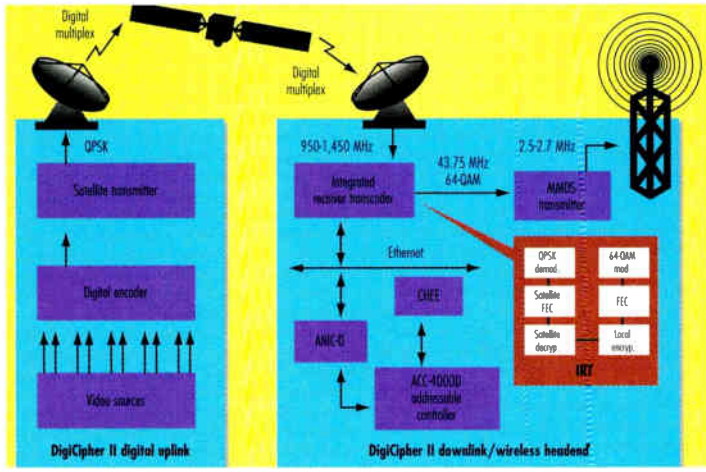

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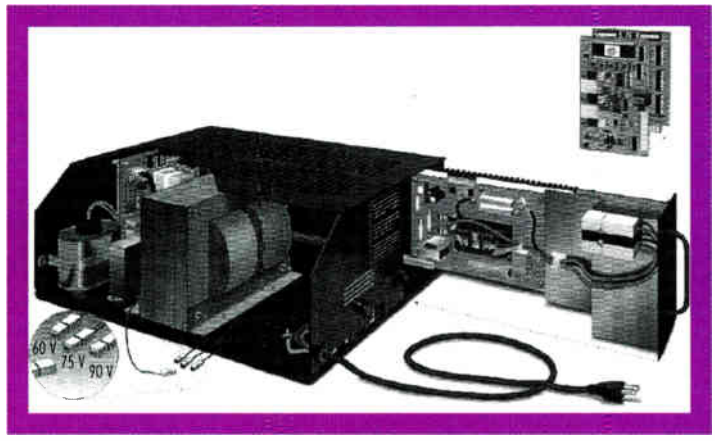

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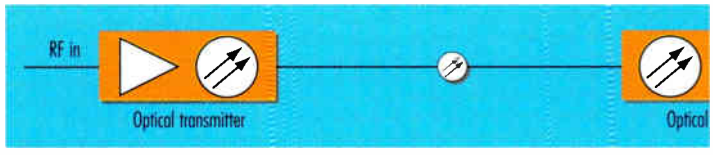

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As cable explores alternative techniques for powering new and old system components, Jack Webb of Alpha Technologies describes potential powering schemes.

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With recent developments in system design, a significant debate about powering requirements has arisen in the cable technical community. Tom Osterman of Comm/net takes on the task of explaining hybrid fiber/coax distribution powering techniques.

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Randy Goehler of Cox Cable San Diego presents a primer on the fundamentals of AM optical links.

Cover
Art by Debra Gavant Swan.

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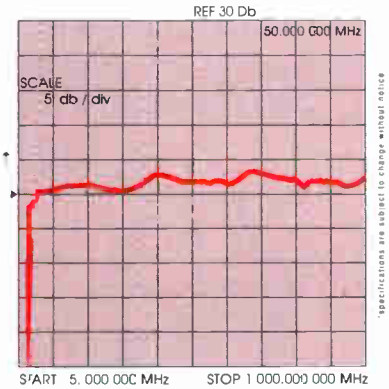

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77	+10 dBmV	+40 dBmV	-60	-60	-60
77	+15 dBmV	+45 dBmV	-55	-55	-55
77	+20 dBmV	+50 dBmV	-55	-50	-50

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Reader Service Number 111

More on OSHA

Remember last month's editorial about the Midwestern system that was visited by the Occupational Safety and Health Administration? The story continues: Representatives of the cable company have completed their informal fact-finding conference with OSHA reps. I had a chance to read a transcript of the conference. We could have some problems here, folks.

I'll skip the details and get right to the point. In this particular case, OSHA is maintaining the position that the cable company's technicians must be classified as either "unqualified" or "qualified." If the technicians must be classified as unqualified, then they can't come within 10 feet of overhead power lines. According to 29 CFR 1910.333(c)(3)(i): "Unqualified persons." (A) When an unqualified person is working in an elevated position near overhead lines, the location shall be set so that the person and the longest conductive object he or she may contact cannot come closer to any unguarded energized overhead line than the following distances: {1} For voltages to ground 50 kV or below — 10 feet (305 cm); {2} For voltages to ground over 50 kV — 10 feet (305 cm) plus 4 inches (10 cm) for every 10 kV over 50 kV.

Bottom line, according to the OSHA regulations, is that "unqualified" technicians cannot get within 10 feet of overhead power lines.

So what's a "qualified" person? One who is qualified, through training, to get closer to power lines than the 10 feet limit by knowing safe approach distances vs. voltage. For example, if the voltage is "300 and less," the minimum approach distance is stated in OSHA regulations as "avoid contact." Over 300 volts, but not over 750 volts, the minimum approach distance is 1 foot, 0 inches (30.5 cm). The regulations in 29 CFR 1910l.333 go on to say that "only qualified persons may work on electric circuit parts or equipment that have been de-energized under the procedures of paragraph (b) of the section. Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools."

Or how about "a qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are de-energized."

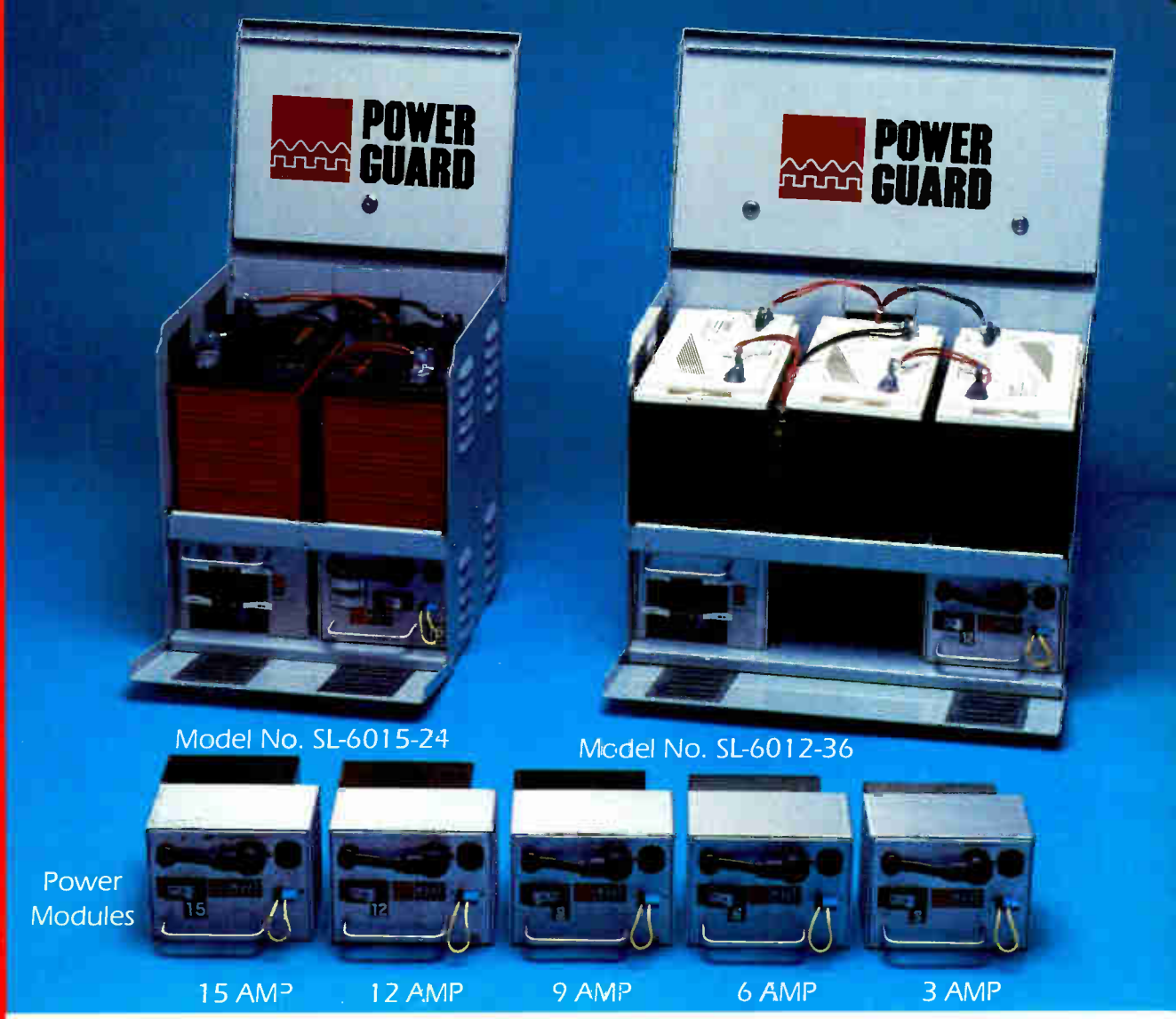
As I read the rules, a "qualified" person sounds a lot like a power company lineman. But that doesn't matter to this particular OSHA inspector. He said in the conference, "these ... standards apply to everyone" and "your technicians ... have to work in close proximity to overhead power lines and [the law] divides them into two categories. Unqualified — 10 feet away, or qualified — able to work closer to the power lines, depending on the voltage. Those are the laws we have."

If these OSHA rules are going to be interpreted as applicable to cable, I'd wager that most of the industry is in violation of the rules. As I said last month, I don't know of any CATV personnel outside of plant personnel who could be defined as "qualified." According to the rules, if our cable plant is, for the sake of discussion, 4 feet from power, then the 40,000 or so of us who are unqualified can't get within 6 feet of the cable!

Suggested reading this month: *The Death of Common Sense* by Philip K. Howard (Random House).

Ronald J. Hranac
Senior Technical Editor

Power by Design



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Reader Service Number 13

Antec, Nortel announce ventures

Antec Corp. and Northern Telecom (Nortel) signed a letter of intent regarding three proposed interrelated business relationships.

The first will be the formation of a systems integration joint venture company to provide the cable TV and telephone markets with integration services for hybrid fiber/coax (HFC) networks as they evolve to include voice, data and interactive video applications.

The second is a joint venture company that will focus on the product development of Nortel's integrated digital access technology and Antec's digital video technology. This effort will involve the design and introduction of new products to meet the evolving requirements of the server to set-top market.

The third proposal is a marketing and sales arrangement for the Cornerstone voice and data product line, as well as products to be developed by the joint venture. It is expected that Antec will be the primary sales channel to the cable TV industry and Nortel to the telephone industry. These relationships are subject to the negotiation and execution of definitive agreements and requisite regulatory approvals.

LG Electronics to control Zenith

LG Electronics Inc., formerly Goldstar, and Zenith Electronics Corp. signed a definitive agreement under which LGE will acquire a controlling interest in Zenith. In this transaction, LGE will purchase for $10 per share 16.5 million newly issued shares of Zenith common stock and more than 18.6 million shares from Zenith shareholders in a tender offer. The total transaction value is more than $350 million.

LGE currently owns 1.45 million shares of Zenith common stock. LGE will own 57.7% of the outstanding common stock of Zenith upon successful completion of this transaction.

NOTE

• **General Instrument** announced that **Dan Akerson** will resign as chair and CEO to work full time at **Forstmann Little & Co.**, GI's largest shareholder. Akerson, who has been a general partner at Forstmann Little since 1993, will remain chair and a director of GI until Dec. 31, 1995. **Richard Friedland**, president and COO, replaced Akerson on August 1.

Correction/clarification

"Videoconferencing for cable operators" by George Lawton on page 44 of the July issue of *Communications Technology* stated that the H.320 standard covers all of the International Telecommunications Union standards for videoconferencing. However, H.320 only covers the standards pertaining to the terminal equipment. In addition, ANSI is developing the T1.800 series of standards for videoconferencing in North America, which is based on the ITU standards.

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With the **DIR-747 integrated receiver/descrambler,** you get a 1¾" IRD that brings low profile to the next generation of performance. And, it's from the industry leader ***DX Antenna.***

For us, it wasn't just producing a thin receiver, we needed to produce the best receiver, period! And, we have done just that.

The **DIR-747** is a combination of the space saver you need when adding channels and the best technology available today. Also, it includes a long list of features from an integrated VCRS® descrambling module, to front panel controls and a video test port.

Easy is a key word when working with the **DIR-747.** It's menu driven with an LCD display that makes selecting the many options simple. When combined with the all new **DSM-180** modulator, your subscribers will receive the sharpest video and soundest audio signals possible.

For more information, write to **DX Communications Inc.,** 10 Skyline Drive, Hawthorne, NY, 10532 or call (914) 347-4040.

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The DIR-747 Satellite Receiver

Reader Service Number 86

Call for papers: Emerging Tech '96

The Society of Cable Telecommunications Engineers is currently seeking abstracts for technical papers to be presented at its 1996 Conference on Emerging Technologies to be held Jan. 8-10, 1996, in San Francisco. Topics of discussion will include:

- Digital compression and transmission
- Telephony
- Multimedia
- Future technologies

Those interested in presenting technical papers at the conference should contact Roberta Dainton at SCTE by calling (610) 363-6888 or via fax at (610) 363-5898. Submissions should include an abstract of the proposed paper or presentation.

The Society of Cable Telecommunications Engineers

1996 CONFERENCE ON EMERGING TECHNOLOGIES

JANUARY 8-10, 1996

The Hilton on Hilton Square San Francisco, CA

SCTE premiers training seminars

The SCTE announced two new seminars, "Introduction to Telephony" and "Introduction to Fiber Optics," which will be offered at various locations across the United States on a varying schedule.

"Introduction to Telephony," which was recently premiered, is a two-day seminar for technical personnel who want basic knowledge of telephone system operations, telephone networks and customer equipment with the various interconnect and service options. This seminar also is beneficial to nontechnical personnel who need a general understanding of tele-

Six ways to maximize your system performance.

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Hand-held instrument functions as signal level meter, leak detector and data logger. Measures signal levels, hum, carrier to noise, and performs 24-hour test. Calibrated leakage optional.

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Reader Service Number 146

phony basics such as telephone terminology, telephone company structure, network systems and services and customer equipment.

Everyone attending the seminar receives a certificate of attendance. Those who pass the exam receive a certificate of achievement. The registration fee fro "Introduction to Telephony" is $195 for SCTE members and $235 for nonmembers. It will next be offered Sept. 11-12 at the Ramada Inn in Andover, MA.

Initial response to this new seminar has been very positive, with participants commenting, "Good information, very helpful ... it broadened by telco knowledge" and stating that they "would recommend this to someone who has no exposure to telephony."

"Introduction to Fiber Optics" is a three-day seminar designed for industry personnel who desire a general understanding of fiber optics, fiber-optic systems and fiber-optic test equipment. Attendees can greatly benefit from the hands-on demonstrations of mechanical and fusion splicing that will be included in the seminar. The registration fee for this "Introduction to Fiber Optics" is $240 for SCTE members and $280 for nonmembers.

The fiber-optics seminar will be held for the first time Sept. 13-15 at the Ramada Inn in Andover, MA.

The seminars will next be presented back-to-back in October, with "Introduction to Telephony" scheduled for Oct. 16-17 and "Introduction to Fiber Optics" set for Oct. 18-20 at the Holiday Inn West in Fort Lauderdale, FL.

In November, the Radisson Plaza in Indianapolis, IN, will host "Introduction to Telephony" on Nov. 6-7 and "Introduction to Fiber Optics" on Nov. 8-10. The seminars will be held at the Harvey Hotel Dallas in December, with "Introduction to Telephony" set for Dec. 11-12 and "Introduction to Fiber Optics" scheduled to be held Dec. 13-15.

For information on future dates and locations, please contact SCTE National headquarters at (610) 363-6888.

Nomination call: Board of directors

The Society currently is seeking nominations for candidates to run for eight positions on its national board of directors:

- Region 3 — Serving Alaska, Idaho, Montana, Oregon and Washington
- Region 4 — Serving Oklahoma and Texas
- Region 5 — Serving Illinois, Iowa, Kansas, Missouri and Nebraska
- Region 7 — Serving Indiana, Michigan, Ohio
- Region 8 — Serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee
- Region 10 — Serving Kentucky, North Carolina, Virginia and District of Columbia
- Region 12 — Serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont
- At-Large Director — One position is open. The person can be from any region and is elected by all members.

Interested parties should contact Bill Riker or Roberta Dainton at SCTE national headquarters by calling (610) 363-6888 no later than Oct. 15.

channel surfing

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By Lawrence W. Lockwood, President, TeleResources, and East Coast Correspondent

Wireless Cable '95

The Wireless Cable Association International's three-day annual convention and exposition was held in Washington, DC, in mid-July. The attendance was over 2,000 which is small compared the last National Cable Television Association's National Show attendance of over 24,000, but the NCTA is much older having been formed in 1952 while the Wireless Cable Association was formed in 1988.

The two events are similar in many respects — attendees in both are a mixture of programmers, operators and vendors. Many cable programmers had booths (e.g., HBO, Showtime, MTV, etc.). The '92 Cable Act gave wireless cable operators access to all cable programming at equitable pricing, and now that telephone companies (Nynex, Bell Atlantic and Pacific Bell) have invested heavily in wireless its future looks bright.

One of the chief reasons for the phone companies' interest is due to the benefits digital compression bestows on a wireless system. Wireless has a maximum of 33 channels available but with digital compression that can be expanded to 150 to 200 channels, which makes it a true competitor in the home delivery business. Wireless cable may well deliver digital video to the home before wired cable. Wireless will provide formidable competition to satellite-delivered programming (e.g., DirecTv and Primestar) since it can offer local programming such as local news, weather, etc.

Three days before the convention over 100 companies petitioned the Federal Communications Commission via the Wireless Digital Coalition for authority to adopt digital compression technology. The convention had several breakout sessions on digital technology and the exhibit floor was heavily populated with digital equipment.

The Wireless Cable Digital Alliance, which has been testing wireless digital cable transmission for more than six months, announced plans to begin a commercial trial of a system that it claims will deliver 150 to 300 channels of programming. Formed a year ago, the alliance members include American Telecasting Inc., Andrew Corp., California Amplifier, EMCEE Broadcast Products, Microwave Filter Co. and Zenith Electronics Corp.

John Bowler, vice president of research and development for Zenith, speaking for the alliance, reported results of field tests conducted over the past year in Lakeland and Orlando, FL, Colorado Springs, CO, and Chicago.

The Zenith booth had a working digital set-top that decoded MPEG signals (at 3.5 Mb/s) for home reception. The set-top used prototype semiconductor chip sets developed by Zenith, LSI Logic Corp. and Raytheon. The digitally compressed

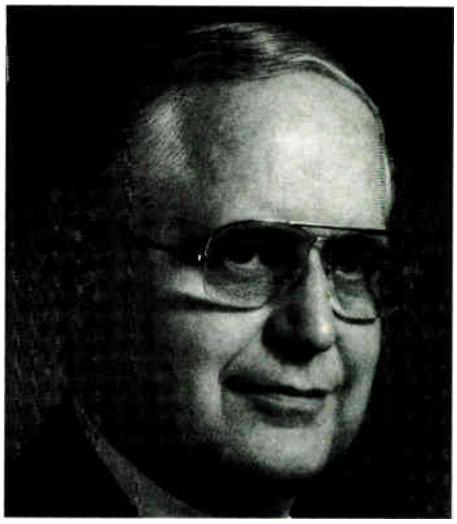


Figure 2: Zenith's digital set-top converter for video services

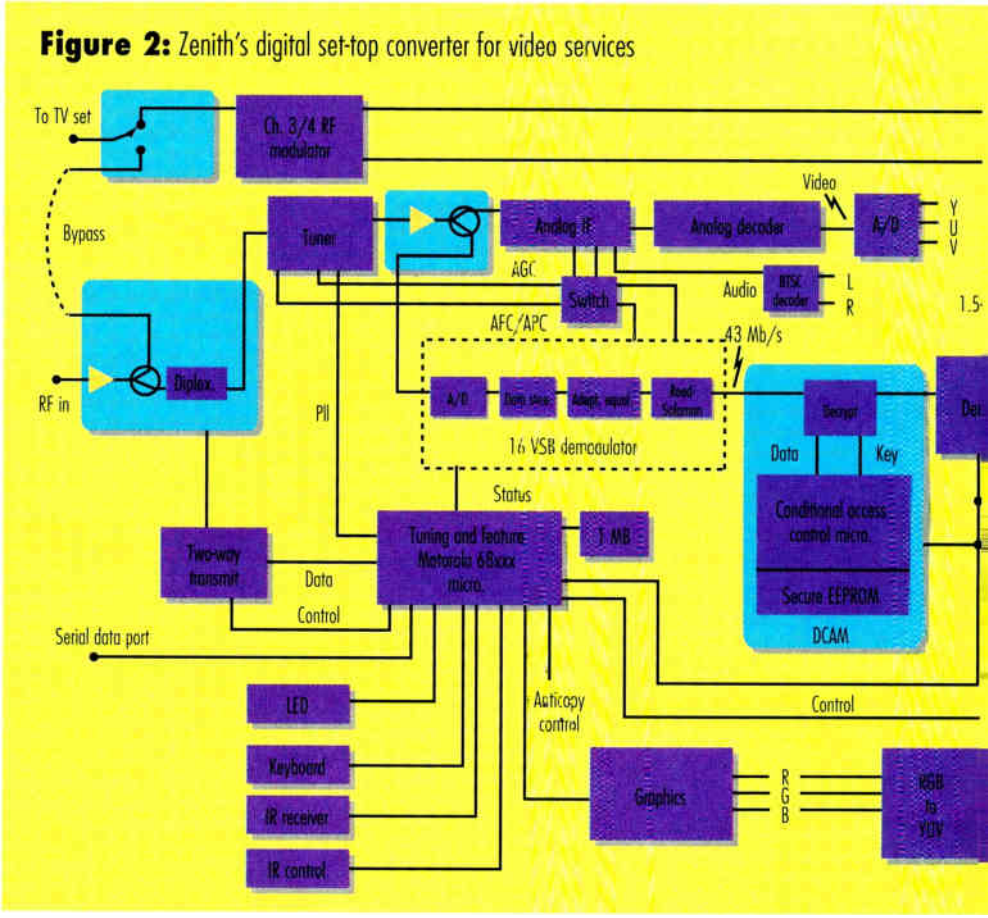
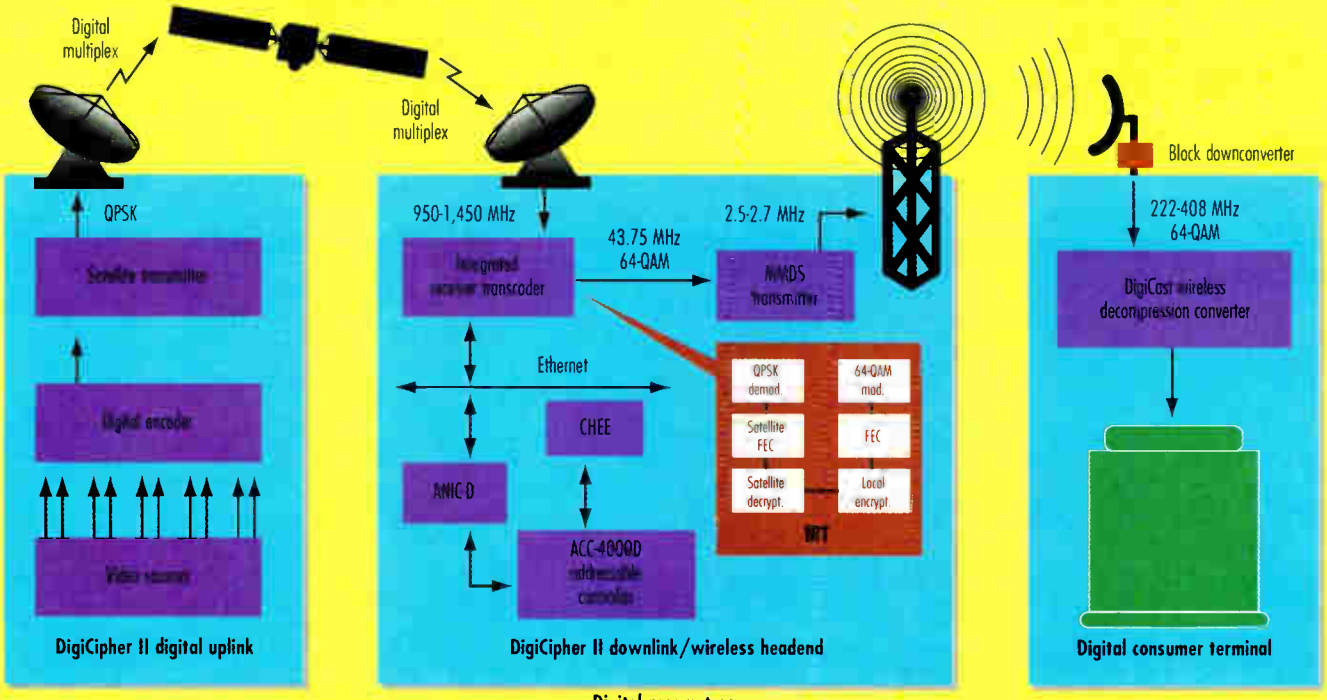


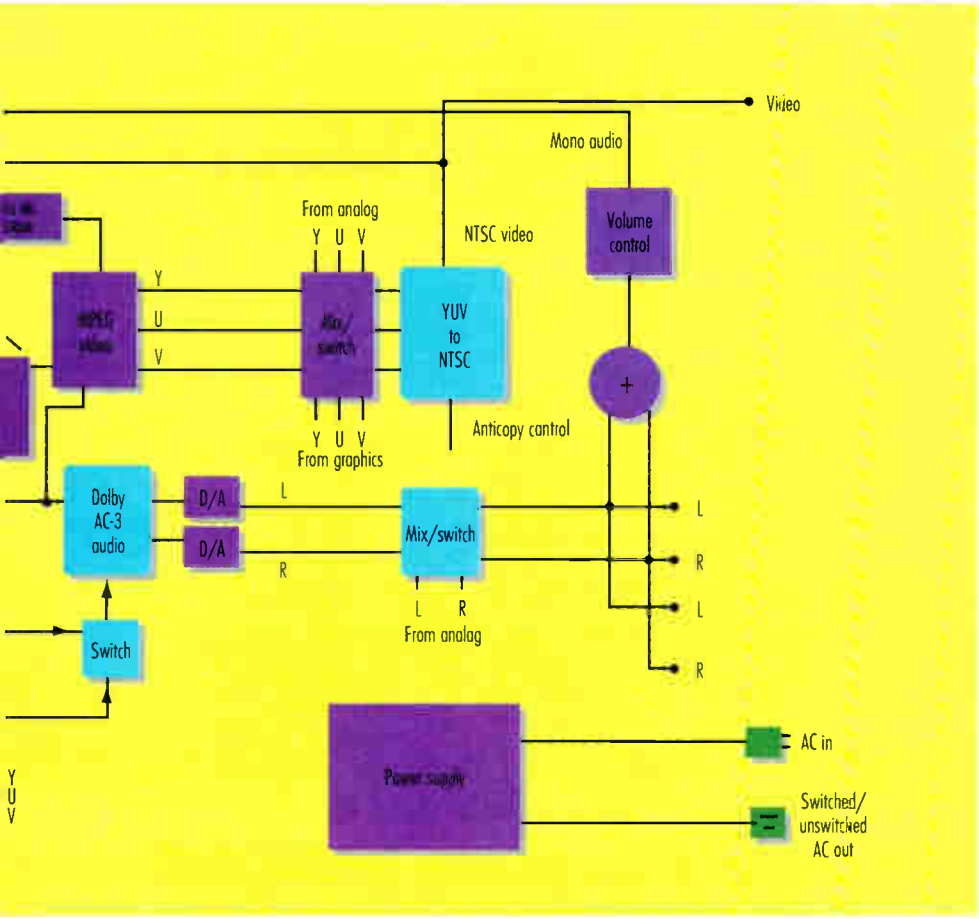
Figure 1: GI's end-to-end wireless digital system



Digital parameters

Satellite uplink/downlink	Parameters	Wireless headend/consumer terminal
24 MHz (MCPC)	Channel bandwidth	6 or 8 MHz
27 Mb/s	Information rate	27 Mb/s (6 MHz)
39 Mb/s	Total data rate (w/FEC)	30 Mb/s (6 MHz)
QPSK	Modulation	64-QAM
7.5 dB S/N	Threshold	30 db C/N (recommended)
2-10+	Programs per channel (NTSC/PAL)	2-10+

Note: 2-6 programs video mode; 8-10 programs in film mode



video was transmitted (on wireless cable frequencies) via 8-VSB (vestigial sideband modulation) at 29 Mb/s. Bowler noted that VSB modulation is "scalable." That is, if there is excessive interference or low level signals producing unacceptable reception the operator can drop to a lower VSB level, i.e., 16 VSB to 8 VSB or to 4 VSB.

General Instrument also had a working digital set-top in its booth but it used 64-QAM (quadrature amplitude modulation) and it did not provide scalability. A block diagram of GI's end-to-end wireless digital system is shown in Figure 1. A block diagram of the Zenith digital set-top is shown in Figure 2. Bowler said that the same digital set-top box will be used in wireless and wired cable (with possible differences in return path methodologies). As done at the Zenith exhibit, the wireless cable receiving antenna had a block converter to bring the wireless cable RF to standard TV frequencies for input to the set top. When pressed about set-top pricing, Bowler estimated that "in a quantity of one, initial costs might be about $399." **CT**

Women in Technology Award Nomination Form

This award is co-sponsored by the Society of Cable Telecommunications Engineers, Women in Cable & Telecommunications, and *Communications Technology*.

Objective: The annual Women in Technology Award will recognize and honor leading women in technology positions within the cable and telecommunications community, and will create visibility for all women in technical careers within the industry. Each year it will identify and acknowledge the achievements of an individual woman within the industry's technical community who has demonstrated significant personal and professional growth, and has contributed significantly to the industry.

Eligibility:

- Open to all women in a technical field of cable TV and telecommunications
- Current national SCTE member
- Current national WIC&T member
- Demonstrates meaningful contribution to the industry
- Exhibits high level of knowledge, skills and professionalism
- Commitment to community and/or professional activities that serve to enhance the perception of the cable industry in general, and women in technology specifically
- BCT/E program involvement or equivalent

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Address: _____
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Why are you nominating this person? (Attach additional sheets if necessary.)

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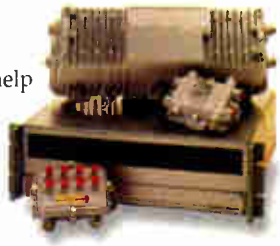

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By Bob Luff, Chief Technical Officer, Broadband Group, Scientific-Atlanta

Future set-tops: Who will own this valuable asset?

One of the great successes of the cable industry is the set-top or home communications terminal (HCT), as some people call it. Set-tops have given operators, who purchase and integrate them as an integral part of their security and end-to-end network systems, a powerful tool that has brought unprecedented programming growth and services to subscribers and great growth and opportunities for our industry. The strategic value and control of set-tops by the cable operator is the envy of other telecommunications industries. And, at a time when competition from direct broadcast satellite (DBS) and other terrestrial providers may make such a powerful tool even more valuable, legislation is being drafted that could change who actually owns this device (you or the subscriber) — or more importantly — who can sell set-tops that work in your system. Will it be just you or any and all consumer electronic stores?

The potential issues are far reaching and the outcome will affect all of us. The first part of this article will focus on why this is such an important issue. A second part in a future issue will suggest actions we all should be doing to influence or cope with possible set-top regulatory changes.

The cable industry and the public has had a love/hate relationship with the cable set-top since its beginning. Indeed, most of us (system operators, chief engineers and techs, installers, customer service representatives, ad sales, programmers and, yes, even the cable lawyers) owe our very livelihood to set-tops — or at least the industry growth triggered by the programming and services made possible by their technology advances. And, the public has benefited significantly from expanded programming and services as well.

But, along with the tremendous benefits there also has been serious lingering set-top issues that have never been fully solved. Compatibility with advanced TV features and recording complexities are well-known problems that triggered Congress to focus the Federal Communications Commission's attention on satisfactory solutions. But, as the importance of the set-top continues to grow, others want to share or control its future key role as the residential gateway of broadband and two-way services of the future.

Its humble beginning

In its early years, the set-top seemed to do little more than expand the tuning or channels of the limited 12-channel VHF TV detent tuner. But as we know, breaking the 12-channel barrier was just the beginning step that along with RF amplifier advancements allowed the industry to constantly expand its capacity to 21, 36, 40, 46, 54, 64, 78, and soon to hundreds of interactive MPEG/DAVIC-compliant digital compressed channels.

It was this seemingly endless supply of capacity that encouraged the programmers to create CNN, C-SPAN, ESPN, Discovery, USA Network, TNN, The Weather Channel and Mind Extension University, to name just a few.

The second major early set-top technology was its descrambling technology. Operators could nearly double their revenues with minimal cost as a result of set-tops and their expanded abilities. Pay services such as HBO, Showtime, Cinemax, Disney and regional sports grew rapidly.

Indeed, these set-top technologies triggered a total transformation of the industry from a small rural-only 12-channel "reception improvement" based CATV industry into today's much more valuable 60- to 80-channel "program/service" based cable industry that has led to major MSOs and metro and regional cable operations with the ability to deliver far more than just one-way video entertainment. In fact, these dual developments form the bedrock on which the

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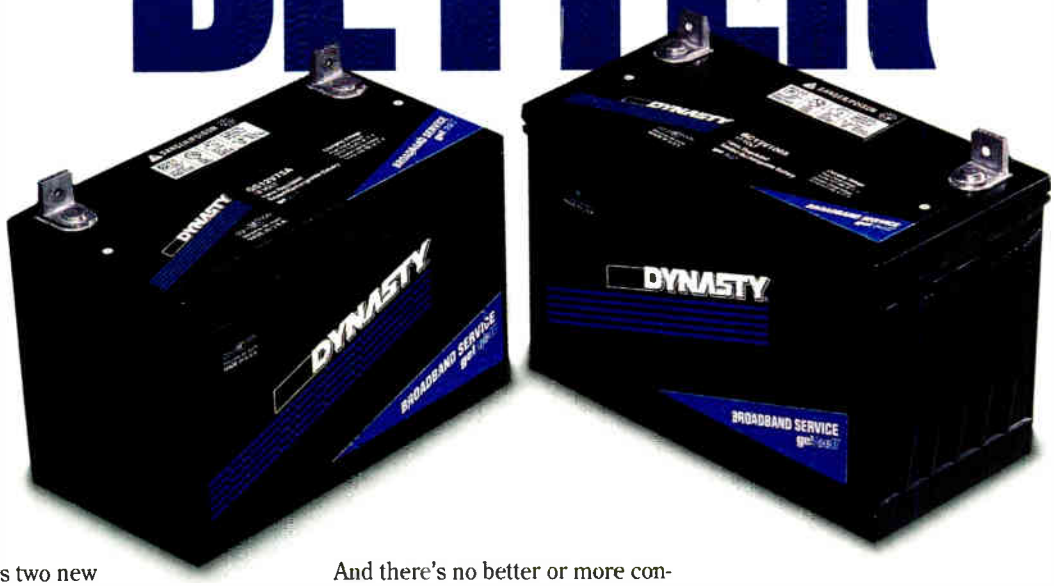

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cable industry continues to operate today — expanded channels and security.

Timing is everything

Perhaps more important than the ability to support more channels and program security, which would have developed at some point anyway, is the ability to influence the timing of such breakthroughs for industry competitive gain. Talks had been underway for years between the cable industry and the consumer electronics TV manufacturers for TV sets that could tune more than the 12 VHF detent channels. But TV manufacturers were unable to support making a CATV-friendly TV tuner for a nation with only 20% cable penetration.

It was the cable industry's ability to unlock itself from the mass market "lowest common denominator" consumer electronics industry that gave it such an advantage. It allowed unique new services and features to be quickly and efficiently deployed when they made business sense — not years later when purchases of replacement TV sets had eventually reached some penetration level sufficient to finally justify developing new services. Since TV sets last for 9-12 years, it would take a long time to be able to introduce new services. Had this been the model, most of us would not be at our current jobs!

Fortunately, that was not the model. Instead, the cable MSOs and cable set-top manufacturers were able to identify the key new features and services and develop cost-effective set-tops to satisfy that demand and get them installed earning new revenues in record time. Items like set-top remote volume and channel control and parental control were extremely valuable to the subscribers. And, they could be added without having to purchase a new TV set — something we now just take for granted.

You break a few eggs making an omelet

Unfortunately, the cable industry inadvertently made a few enemies along the way. Some subscribers complained about box and remote fees.

Some complained about the confusing wiring to watch and record different channels. TV set manufacturers and electronic retailers complained that set-top functionality was competing with their high-end set features. Now, electronic retailers feel they will be left out if they can not freely compete by offering the same or compatible set-tops to your subscribers.

Regulatory interest

Not surprising, this occasional complaining from our subscribers and efforts by various lobby groups have attracted congressional and regulatory interest. On the surface, it first appears like more competition in the distribution chain of set-tops might be in the public interest. What could it hurt? Well, signal security for one and future ability to package technology products like advanced digital set-tops and the services they support. Problems in either or both of these areas could create major industry issues.

Part 2 of this article will review what the possible impact of future retail sales of set-tops would be on system signal security, signal leakage compliance, and the complicating issues surrounding service calls on equipment not owned by the cable operator. **CT**

By George Lowton, West Coast Correspondent

Competition comes to the cable industry

For a long time, the cable TV pipeline was the only effective multichannel distribution system. The advent of digital technology is about to change that. With more choices for multichannel video delivery opening up, competition will focus on the quality and availability of product. The regulations that govern the relationships between video programming product manufacturers and distributors will become of paramount importance.

Government regulations on the local, state and federal level will have an ongoing effect on competition to the cable industry. The current battles being fought in Congress are over uniform rate requirements, regulation pre-emption to wireless, and broadening program access provisions of the 1992 Cable Act.

Apart from regulations, the playing field is changing. In an analog world, cable was king. No other delivery modality could effectively compete for quality multichannel delivery of video programming because the bandwidth needed was so large. Analog product cannot be compressed to any great extent. The pipelines must be large in order to get the product through fast enough to be an acceptable viewing experience. That effectively limits the number of pipes that can operate in a broadcast delivery system.

Those factors do not apply in a digital world. Digitized information can be compressed much more effectively than information in an analog format. Consequently the cost per channel is less. That opens the playing field for all sorts of new programming entrants who want to ride the 500-channel superhighway into the home. To the extent that digital technology advances, the advantage of multichannel delivery that wired cable enjoys will disappear.

There are a number of obstacles to the implementation of digital technology. The primary one is the lack of a standard digital encoding scheme. Lacking such a standard, there is no way to assure that all digital programming is compatible with all distribution systems.

"The playing field is changing. In an analog world, cable was king."

A second obstacle is the lack of digitally encoded programming. Converting analog programming to a digital format imposes even more costs on a video product that already has additional costs associated with implementation.

Wireless

Wireless cable has the potential to grow into a powerful competitor to the cable industry. Using digital technology, wireless cable could offer the same or better service at a fraction of the investment of cable operators. As such it has been growing at a rapid clip. The industry grew from 50 systems serving 300,000 subscribers in 1990, to 143 systems serving 550,000 subscribers in 1994.

With the programming field leveled by the Cable Act, wireless operators can provide service comparable to cable operators for lower prices. This is primarily because wireless cable system operators incur lower costs for system construction and maintenance.

However, wireless operators have limited channel access. At this time wireless operators can gain access to only 11 MMDS channels and either two or three MDS channels, depending on the city, for full-time use. On a part-time basis, wireless operators have access to the 20 channels allocated to ITFS (instructional TV fixed service). This gives them access to a maximum of either 32 or 33 channels. With existing technology this may not be enough to provide a service competitive with cable operators.

Continuing improvements in digital compression techniques promise to be the answer to limited channel capacity. Soon, wireless operators may be able to upgrade their systems to utilize digital compression and offer interactive applications at a lower cost per subscriber than cable operators. In March 1995, the Wireless Cable Digital Alliance announced that it has commenced testing digital technology to be used in wireless systems. According to the alliance, using compression algorithms with a digital signal can increase the channel capacity of wireless systems to at least 200 channels and possibly up to 300. Cross-County Wireless announced that it intends to use digital compression techniques to offer more than 100 channels by the end of 1996. (For more details on wireless cable's digital developments, see Lawrence Lockwood's "Correspondent's Report" on page 16.)

Consolidation in the wireless industry has already begun. America Telecommunications Inc. purchased over 40,000 subscribers from existing systems in 1994 and 1995 thereby becoming the first wireless company to have

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"Video competition is coming to the consumer from all sides."

over 100,000 subscribers. Although these are relatively small numbers compared to cable's 60 million subs, those numbers could change rapidly. Cross-Country Wireless announced in April of this year that it would be purchased by Pacific Telesis for $175 million. Bell Atlantic and Nynex announced on March 30 that they would invest $100 million into CAI Wireless Systems Inc.

PacTel, Bell Atlantic and Nynex have formed a new programming company called Tele/TV and have issued an RFP for 4 million digital set-top boxes capable of handling wired and wireless delivery. AT&T and Silicon Graphics formed a new company, Interactive Digital Solutions, to develop network infrastructure and related services. BellSouth, Ameritech and SBC Communications have formed a liaison with Disney to develop and package video programming and interactive services.

Broadcast TV service

Broadcast TV stations have been and continue to be at the top of the delivered video programming hill. In the 1993-1994 season, the four major networks maintained a combined 72% share of all prime-time viewers. In households subscribing to cable, broadcast TV stations maintained 66% market share via retransmitted signals. More than 33% of all households that can subscribe to cable service elect not to do so. For these viewers, broadcast service satisfies their current desires for video programming.

The principal weakness of broadcast is the restriction on specialized program services due to its signal being limited to a single channel. This has led to predictions of the eventual, if not imminent, demise of this medium. However, broadcast is alive and well. The infrastructure is growing. The number of broadcast stations grew from 1,149 to 1,518 between 1984 and 1994. The programming supply and distribution is growing. A fourth major national network, Fox, and two new "mini-networks," United Paramount and Warner, were added.

The broadcast infrastructure will be able to take advantage of technological developments such as digital compression and advanced TV. These could overcome the current channel limitations of broadcast stations by expanding the overall number of broadcast video signals available in a given area and/or permitting multiple programs to be transmitted over a single channel.

The Federal Communications Commission licenses low-power TV stations (LPTV) that use the same VHF and UHF broadcast spectrum as full-power stations. LPTV stations operate at a lower power and service a smaller geographic area. In contrast to full-power, current regulations allow an LPTV broadcaster to own more than one such station in a market. Multiple LPTV stations could be

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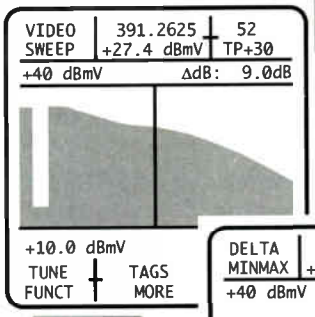
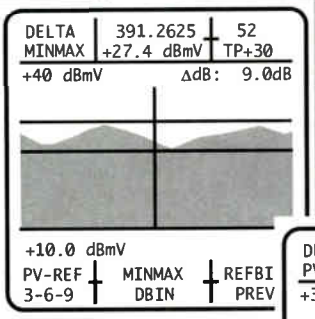
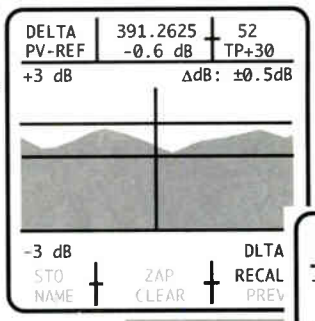


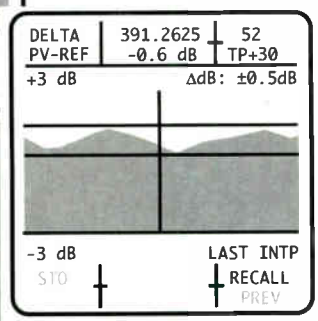
Compare it...



Store it...



Recall it!



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combined to effectively provide multichannel video service. This depends on future FCC rulings. At this time, spectrum allocation for LPTV use has been frozen in the largest markets in the United States.

Direct-to-home satellite services

DTH comes in two flavors. The first and the one with the most potential to make inroads to cable's turf is direct broadcast satellite (DBS), which transmits in the Ku-band. Hughes Communications/DirecTv, United States Satellite Broadcasting (USSB) and Primestar Partners L.P. have over a million subscribers combined. EchoStar Satellite Corp. and AlphaStar, a venture of Tee-Comm Electronics Inc., plan to begin DBS service in 1995.

According to Linda Brill, spokesperson for DirecTv, its customer service surveys report extremely high customer satisfaction for product quality. "Ninety-eight percent of our customers end up signing up for our total choice package. We expect to triple our customer base to 1-1/2 million by the end of this year and we project 3 million subscribers by the end of 1996."

The second flavor, which has really been around for sometime, is the home satellite dish (HSD), receiving signals transmitted in the C-band. HSD owners can watch approximately 150 unscrambled signals without payment, and over 100 scrambled channels. If they have access, 37% of the estimated 4 million HSD users subscribe to cable services, indicating that HSD and cable may be complementary delivery modes.

Telephone companies

Since 1990, the FCC has been easing the regulations that prevented local exchange carriers (LECs) from entering the multichannel video marketplace. In 1992, the FCC established a video dial tone (VDT) framework that permits an LEC to make available a platform that offers nondiscriminatory access to multiple video programmers and delivers video services to end users within its local service area, without obtaining a local cable TV franchise. In 1993 the courts struck down the cross-ownership restriction that prevented LECs from offering video programming.

Most of the regional Bell operating companies (RBOCs) seem to have some plan to offer video services. Pacific Bell already started construction of a hybrid fiber/coax network to support voice and broadband cable TV service throughout California.

US West is spearheading a trial in Omaha, NE, of video services. It is still in the technical trial stage, but it already passes 50,000 homes. Initially it will offer analog CATV, with plans on ramping up to a digital video-on-demand (VOD) system in the near future.

Omaha may be one of the best test beds to study the future of cable/telco competition, since Cox Communications also will be conducting a trial of VOD there. David Banks, a spokesman for US West, noted, "It will be a truly competitive marketplace. It will show how many customers we can wrest from them, and how they will do at holding on to them."

However, the telephone companies seem to be shying away from VDT as it was first proposed. Both US West and Bell Atlantic have canceled their initial deployment plans. Many speculate that they want to op-

erate under a different regulatory scheme than common carrier VDT providers.

Telephone companies also are in the process of buying up cable companies to offer video services today and for offering a competitive telephone service in the future. The most prominent example of this is US West's substantial stake in Time Warner. More recently US West bought a 65% stake of all cable subscribers in Atlanta.

According to US West's Steve Lang, the company is planning on offering a competitive telephone service as soon as possible in Atlanta. A new state law allowed companies to offer competitive switched telephone service beginning in July. However, there will be a long process of certification and negotiation before US West is able to roll out the service.

Lang noted, "It may be the first example of one Bell company going into another Bell market with wired competition. Our alliance with Time Warner and the purchase of the cable systems are part of US West's strategy to gain access to additional customers."

Electric utilities

Municipal electric utility companies are considering the development of broadband networks capable of distributing video programming and telephone services. Plans to use electric power lines to provide multichannel video services are not well-developed but a number of power companies have formed alliances with cable companies or telephone companies.

Utilities must develop two-way communications capabilities to implement energy management solutions and there is no physical reason why the existing network also cannot be used as a pipeline for video programming providers. Given that electric utilities have already deployed a network that reaches nearly every household in the country, the utility industry has significant interest in developing this "third line" into homes.

One utility is already doing this in Glasgow, KY. Its experience shows that municipal utilities can be a powerful competitive force for the wired cable industry. According to William Ray, superintendent of the Glasgow Electric Plant Board, "Once plans to construct the municipally owned broadband network were announced, the (local) cable operator suddenly found an interest in reconstructing their outdated plant and drastically lowering their cable TV rates. Before construction of the municipal system, the private operator had a system capable of delivering 36 channels of video and sold a basic package consisting of about 24 channels for $14.25 per month. After construction began on our system, overnight they found the capital necessary to upgrade their plant to a state-of-the-art 54-channel system and began offering a basic package consisting of 45 channels for $5.95 per month."

Conclusion

Video competition is coming to the consumer from all sides. In the air, it is being transmitted via terrestrial MMDS transmitters. In the sky, DTH services are reaching happy consumers today. From the ground, telephone and electrical companies are exploring new video markets to expand into. **CT**

By Jack Webb, Product Manager, Cable Television, Alpha Technologies Inc.

More power, please

ARGH! ARGH! ARGH! It's the call of macho types as they cheer efforts for more power in their cars, trucks, lawnmowers and power tools. It's a quest that seems natural to many. But what does it have to do with cable TV? Actually quite a lot. Leaders in modern cable TV are currently exploring alternative techniques to power both the new and old system components. New powering systems designed to fit new architectures make sense with the advent of new technology. Not to say that the industry will do away with tried and proven success. It will, however, build on those successes with innovations, which are more cost-effective and support the technology of new services in current or future systems.

Modern architectures incorporate various configurations of fiber-optic cable to connect some form of node to the headend. Nodes vary in size and complexity, but all perform the essential function of converting optical signals back to a form that can be distributed to and utilized by the customer. The node design strategy follows the premise for all fiber architectures — minimizing the components in the plant and centralizing those that are necessary. Similarly, the same design strategy should be applied to powering the system. Centralized powering from each node would have obvious benefits.

Figure 1: Typical system powering

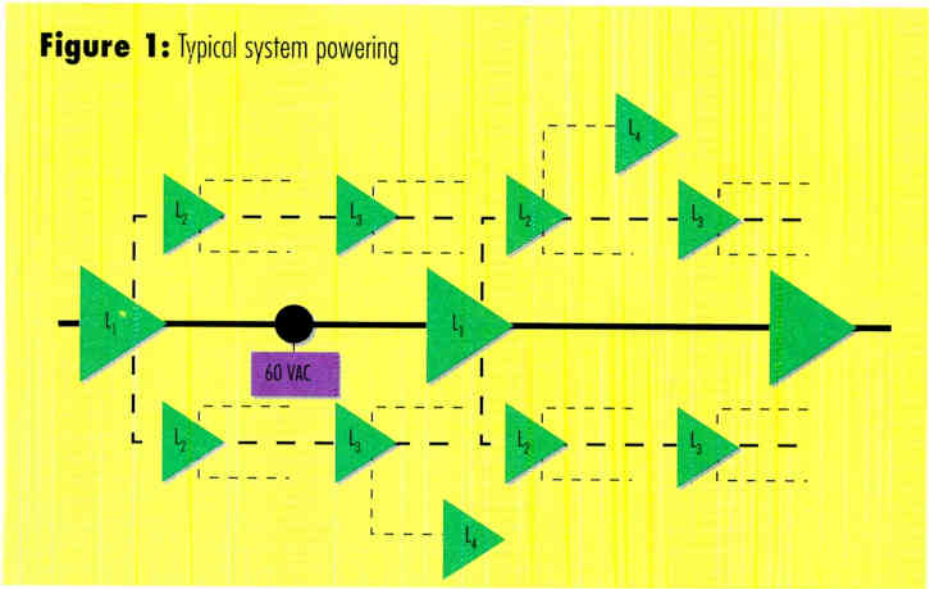
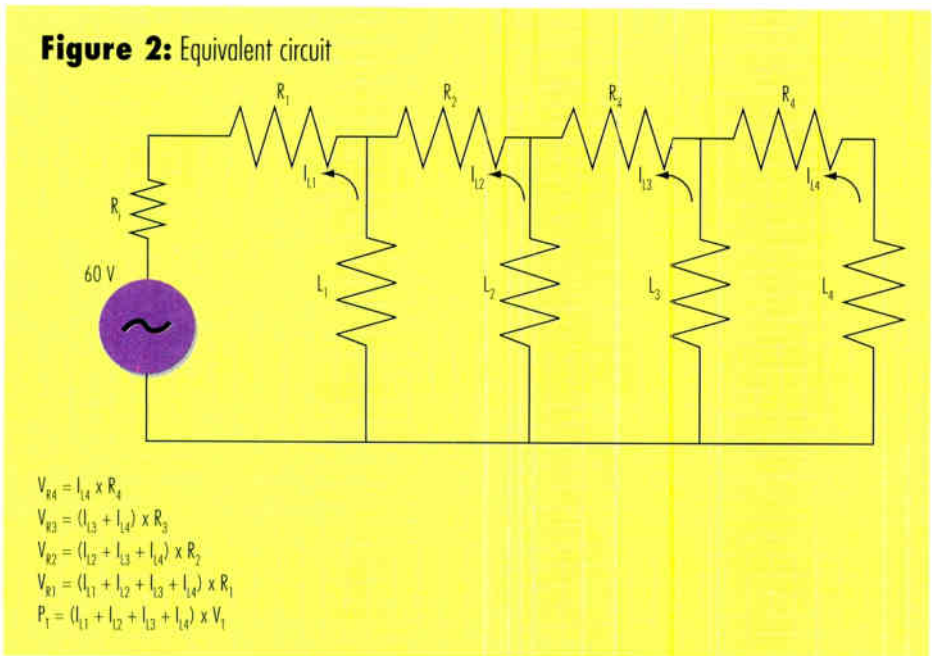


Figure 2: Equivalent circuit



$V_{R4} = I_{L4} \times R_4$
$V_{R3} = (I_{L3} + I_{L4}) \times R_3$
$V_{R2} = (I_{L2} + I_{L3} + I_{L4}) \times R_2$
$V_{R1} = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times R_1$
$P_1 = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times V_1$

A centralized strategy

Centralized power is not a new concept. Power for telephony has long been centralized, with huge strings of batteries and backup generators providing power for telephone service, even when utilities are out of service for extended periods. Telephony and other vital services provided on modern networks will require the same level of quality service, including power to support additional broadband hardware. Telephony and other services survive floods, earthquakes and hurricanes. Customers and the industry understand that vital services cannot be compromised by some intoxicated driver hitting a pole and putting the network out of service. Centralizing power at each node, along with other distribution hardware, will provide both lower costs and more reliable service. Nodes will naturally require standby power capability to endure utility outages, brown outs and grid switching glitch-

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The 3M™ Photodyne™ 17XTG and 17XTI Hand-Held Fiber Optic Power Meters represent the cutting edge of fiber testing technology. These rugged, weather-resistant instruments give you:

- High-power testing functions
- Improved testing accuracy
- Widest dynamic range available today

Advanced test capabilities. Together with the 3M™ Photodyne™ 7XT Light Source, these new meters will keep pace with technical advances in industry specifications today and for years to come.

Economical prices. Best of all, our manufacturing experience allows us to offer these advanced capabilities and reduce the cost to you.

High-performance applications. Armed with these advanced instruments, your construction and maintenance crews can handle high-performance applications such as cable TV networks and erbium-doped amplifiers, or more basic tasks involving today's SONET and ATM digital systems. Whether you use these 3M instruments to test single- or multimode systems, your results will be more accurate and useful because:

- Fully automated test functions simplify operation and reduce training time
- Built-in RS-232 port provides a communications link to print-out test results or export data to personal computers for manipulation and analysis
- Our optional software package eases data handling and recording

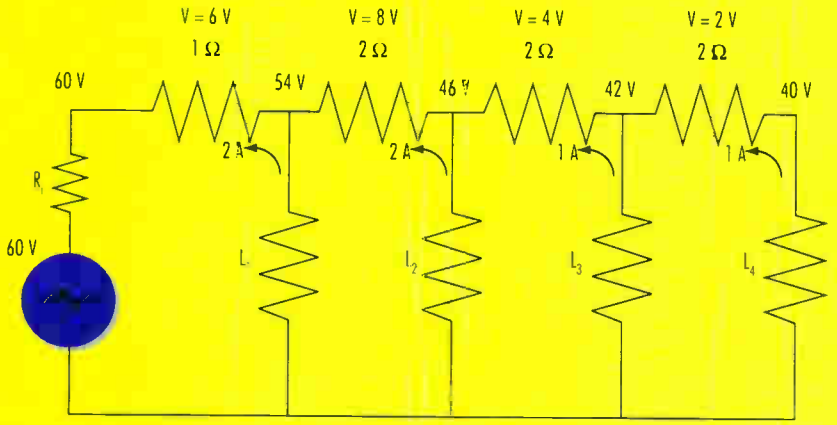
Take the pain out of installation and troubleshooting in fiber optic networks. Specify the Photodyne 7XT light source and advanced Photodyne 17XTG/I fiber optic power meters. Learn more by talking to an authorized 3M Telecom Systems distributor or your 3M representative. Or contact 3M Telecom Systems Division at 800/745 7459 or via fax at 512/984 5811.

3M *Innovation*

Reader Service Number 133

ISO 9002

Figure 3: Equivalent circuit with 60 V source



$V_{R4} = I_{L4} \times R_4 = 1 \times 2 = 2$ V
$V_{R3} = (I_{L3} + I_{L4}) \times R_3 = (1 + 1) \times 2 = 4$ V
$V_{R2} = (I_{L2} + I_{L3} + I_{L4}) \times R_2 = (2 + 1 + 1) \times 2 = 8$ V
$V_{R1} = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times R_1 = (2 + 2 + 1 + 1) \times 1 = 6$ V
$P_T = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times V_T = 6 \times 60 = 360$ W

es. Centralized power also will provide the following benefits:

• A single power location means lower installation costs. All of the node hardware is located at one site, possibly in one enclosure, simplifying the installation and eliminating multiple utility installations.

• Reliability is inherently higher as the number of system components is reduced. With fewer locations redundancy becomes economically feasible. Status monitoring also becomes a vital link. Without status monitoring, power would go into the standby mode and simply deplete the backup source before the operator will know there is a problem.

• Single higher capacity components are more cost-effective — lowering initial capital investments.

• Servicing is simplified with a single location. Servicing a few larger installations is easier than servicing many smaller installations.

• Standby operation can be implemented more economically. Backup generators can be economically justified when they can back up an entire node.

• Single enclosures are more economical. Environmental control, which will increase the life and reliability of system components, can be considered.

• Higher overall operating efficiency can be achieved — reducing overall operating expenses.

Naturally, in a centralized design, the power supply must be capable of providing ample power for the node. Nodes vary in size and complexity from a few hundred subscribers to a few thousand. Power requirements will vary from 2 W to 5 W per sub-

EXFO FIBER OPTIC NEWSLETTER

FALL 1995 Volume 1, Number 3.

EXFO celebrates 10-year milestone.

Welcome to our second decade

Ten years ago in Quebec City, EXFO Electro-Optical Engineering set out to become the world's leading manufacturer of fiber optic test equipment. The company focused on three objectives — innovative products, high quality, and unmatched customer service — as the means to achieving this end. EXFO's first products were a single power meter and light source combination.

Today, EXFO employs over 200 people in manufacturing and sales in Canada and the United States, and in its international sales office in France. The company's line of high-quality fiber optic test equipment includes OTDRs, attenuation and ORL test sets, and other instruments designed for specific applications such as FDDI, FTTH, CATV in the field and laboratory environments.

EXFO's first contracts were for the development of customized test equipment for telephone companies in Canada and the U.S. Our success in this market permitted us to invest heavily in further R&D, and the company moved beyond handheld test sets into optical time domain reflectometry.

In 1991, EXFO established its new main office in Vanier, Quebec and success in the international market led to the opening of the European international sales office one year later. Meanwhile, EXFO was breaking into new markets around the world. The manufacture of attenuation test sets custom-designed for the U.S. military led to the establishment of the company's facility in Richardson, Texas in 1993, which today employs sales, administrative and production staff.

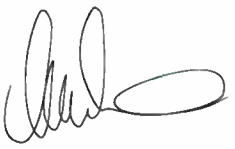
Our rapid growth quickly made our 16,000 sq. ft. facility too small, and we have since outgrown a subsequent expansion to 24,000 sq. ft. A recently acquired 40,000-sq.-ft facility should provide enough additional production capacity to meet the needs of EXFO's market through the end of the century. We hope to move production into its new home by the end of 1995.

This rapid growth in production capacity has not however slowed the pace of EXFO's technological advances. Massive re-investment of revenues in R&D ensures a steady supply of innovative products. Some of milestones of EXFO's industry-firsts include our dual wavelength handheld test set, the full duplex talk set, a universal test system for OTDRs and test sets that works on a PC platform, automated attenuation/ORL test sets, and a touch-screen mini-OTDR.

EXFO Electro-Optical Engineering won ISO-9001 certification in 1994. Our commitment to an externally-monitored system of quality assurance, administrative as well as technical, means our customers know they are guaranteed a consistently high standard in product quality as well as in sales administration and after-sale service.

We are proud of these achievements and very pleased to have been singled out within the high technology industry for our innovations, the quality of our products, and the quality of our management systems. We were honored earlier this year to be named one of the 50 best-managed private companies in Canada by the Financial Post . Some of the other awards we are proud of include Best Canadian Product of the Year (1990), Best High Technology Firm of the Year in Quebec (1992), and Company of the Year - Quebec (1994).

Every company in business today owes its success to its customers, but EXFO's customers have also contributed enormously to product development and the innovations that have characterized our first 10 years in business. We are particularly grateful to our customers of long standing, those who put their trust in us in the beginning, before we had the impressive 10-year track record of success we have today. To you, I say thank you on behalf of all EXFO employees, and we intend to continue to deserve your trust and your business. To our newer customers, I would like to say that we welcome your association with this still-young but now firmly established company as we enter our second decade.



Germain Lamonde
President
EXFO Electro-Optical Engineering Inc.

EXFO
Electro-Optical Engineering

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High performance, low cost options for CATV

EXFO has supported the CATV industry with application specific test equipment for many years. Our unique combination of high power optical loss test sets, OTDRs, Optical Return Loss testers, and clip-on technology instruments, among other equipment has provided the industry with high performance and low cost options. The range of equipment which EXFO supplies has grown as have the applications and increasing fiber deployment within CATV; cable providers are diversifying into telephony services while Telcos are exploring broadband technologies.

Fiber testing requirements for both the cable TV and telecommunications industries to characterize the optical condition of the system, and to ensure reliability in its day-to-day operations and quality control include: cable acceptance, splice and connector optimization, end-to-end testing and optical return loss testing. Equipment is also required for on-going preventive maintenance and troubleshooting once the system is up and running.

The cable acceptance test at pre-installation has the objective of determining whether any damage has occurred to the cable during transit. The cable acceptance test is performed with the OTDR. The OTDR is the only tool which can provide an inside view of the fiber which cannot be generated any other way. Fiber length, attenuation, and uniformity are verified for every fiber. During installation and splicing, an OTDR may also be used in its real-time mode to optimize splice loss; alternatively an optical power meter can be used to monitor power level. After installation, testing includes an end-to-end loss test. Optical return loss testing is important as well due to the optical characteristics of the DFB lasers in conjunction with the CATV's system AM modulation schemes. The latter combination is susceptible to reflection problems causing weaker signal-to-noise ratio resulting in static or sparkle on TV screens due to power fluctuations, mode hopping, and multi-path interference. Therefore to characterize a fiber properly, OTDR, power meter, and ORL testers may be required.

EXFO offers mini-OTDR equipment which provides novice mode operation where test parameters are automatically selected as well as expert mode operation which enables manual measurements. This Fiber Tool Box mini-OTDR is of great benefit to the multi-tasking technician since it is very simple to operate. A large touch-screen display with large selection keys reproduces the conventional layered menu operation. The unit is PC-based and incorporates hard and floppy drives; access to DOS may be password protected. While the CATV company's deployment of fiber is relatively new, the PC-based technology becomes very attractive since it is also a powerful documentation tool and easily implemented within new systems.

There are a number of power meter and loss test set options used to measure power and loss. EXFO's complete line of power meters and test sets all offer a high power measurement range (up to +23dBm) required for testing with DFB lasers. These power meters include simple power level measurement or loss measurement and may feature data storage and extended memory. Loss test sets also available feature WaveWise signal wavelength recognition (FOT-40) and FasTesT automated bi-directional loss testing (FOT-910).

If you have ever been confused when sorting out cabling, the 2-kHz tone feature in all light source and power meter test equipment will prove indispensable. Talk set and loss test set pairs feature both 2-kHz optical tone generation and detection, while light sources feature tone generation and power meters offer tone detection for fiber identification. To complement this feature, the FCD-10 clip-on device accessory can provide access to any intermediate point along the fiber. It allows fiber identification before finally breaking the fiber open in combination with a power meter or talk set. The clip-on device is designed to work on 250 µm fiber for 1300 and 1550 nm wavelengths. The unit induces a loss of under 7 dB when clamping onto a fiber and results in a coupling loss to an instrument of 14 to 22 dB. A fiber pigtail provides connection to the test equipment.

Other handy options for fiber identification are the FLS-230A visual fault locator and LFD-100 live fiber detector. Visual fault locators allow fiber identification and fault location by its highly visible 650 nm wavelength red light source. The live fiber detector is a clip-on device, having low insertion loss. It is particularly useful as it detects traffic and test signals in addition to optical tones, integrating an absolute and relative power measurement display. The universal head accommodates 250 µm, 900 µm, and 3 mm jacketed fibers employing a safe macrobending technique on the fiber.

The use of ORL testers instead of OTDRs for ORL measurement gives the operator a clear idea of the test process and accuracy of the test. OTDRs can only provide an estimate of total link ORL based on individual reflectances, while the ORL tester measures total reflection or ORL. With the FOT-910 instrument, by integrating the loss and ORL tests in two stages, the entire testing process is faster than ever before.

Today's loss test sets, OTDRs and ORL testers are all PC-based or incorporate a PC link for data analysis and modem capability. The use of PC test platforms is advantageous as it is also a platform for management programs such as inventory and word processing programs. Modem-fitted field test equipment can also allow communication between offices not only for data transfer but for servicing of trouble tickets for example. To further simplify the role of the PC in network data management, including loss, OTDR, and ORL data, EXFO has designed the Fiber Test Manager and DocuNet complete test data management system. The FTM is the central database server while the DocuNet is the field version of FTM. The software automatically creates a database of test results based on the user's own fiber network topology. Test results are directly archived according to their fiber's identification, cable, and test location. It provides time savings and reduces manual errors.

For more information on these products, contact EXFO at 1-800-663-3936 (418-683-0211) or your local Antec representative (US only).

New from EXFO
First-ever Windows-based modular test system

Years of research and study have resulted in the development of EXFO's new IQ-200 test instrument product family. The IQ-200 is a modular test system comprised of mainframes and modules, including high performance, programmable optical power meters, light sources, programmable variable attenuators, variable backreflectors, ORL testers, optical multimeters with remote heads, EDFAs, DFB lasers and optical switches, among many others.

Both singlemode and multimode instruments are now available for high precision testing. In addition to research and development labs, the IQ-200 product family is designed for manufacturing, production and engineering testing environments.

The mainframes of the IQ-200 family are represented by the IQ-203 PC/Windows mainframe with three module slots, and the IQ-206 expansion unit with six module slots. The capacity of the test system can be extended by serially adding up to four expansion units for a total of 27 single-slot modules. The basic IQ-203 configuration integrates a 486 microprocessor architecture including 4 MB RAM, 127 MB hard disk, 1.44 MB floppy drive, 640x480 VGA display, mouse, hard and soft keys and output ports for external VGA monitor, keyboard and mouse and two free slots for expansion PC cards such as GPIB or modem card. The IQ-203 mainframe and IQ-206 expansion units can be stacked on top of each other or rack-mounted.

Windows application software controls all modules simultaneously via the IQ-203 bus. The system's PC architecture enables loading of commercial software including spreadsheets and word processing software, among others.

The range of power meter modules is extensive and will fulfill most lab applications. Power meter modules are available in single, 4- and 12-channel configurations. Features include sensitivity from -100 dBm up to +25 dBm, display reading selectable in W, dBm or dB and resolution selectable to 0.001 sampling rates up to 40 samples per second, and wavelength range from 450 to 1800 nm. Measurements are run in programmable real time, interval, or triggered mode. The trigger of the power meter allows conditional programmed acquisition based on threshold parameters and channel comparisons (multi-channel units). Applications include measurements of power, attenuation, insertion loss for component specification, signal monitoring and analysis, and network failure monitoring. Fiber monitoring by multi-channel power meters is an alternate approach to remote fault monitoring with an OTDR. It allows remote access to the optical fiber cable to perform power level testing from a central location; this access can be either on demand or an automatic mode can be programmed. Power testing is a simple method for the detection of problems prior to service loss; a simple comparison against threshold limits can trigger central alarms. Multi-channel power loss measurement is also available for parallel testing of multiple components.

A secondary calibration standard power meter module is also available for calibration, verification or recalibration of IQ power meter modules or other instruments with step-by-step or expert procedure and certificate reporting. Accuracy as good as 1% is available. The calibration power meter will be used in conjunction with highly stabilized and narrow linewidth DFB laser modules.

Stabilized light source modules are also provided for testing. Configurations exist in both singlemode and multimode LED, and TE-cooled laser sources at 850, 1300, 1310, 1550 nm and dual wavelength output. They feature variable output power over 10 dB, internal modulation at tone frequencies, and precision wavelength display.

Optical attenuation of single and multimode light sources with the variable attenuator module is programmable down to -100 dB. The module offers low insertion loss (better than 2.2 dB) and low return loss (better than 55 dB) optics.

Testing of reflections in fiber is fast becoming a testing requirement in today's telecommunications systems which feature high speed and high performance lasers. These are susceptible to the effects of reflections which result in noise characteristics. The optical return loss test set is an instrument, specifically designed as an optical continuous wave reflectometer, which measures the total reflection at the near end of a fiber cable. It is the most precise equipment for the measurement of Optical Return Loss (ORL). ORL test modules are available in the IQ product family at 1310 and 1550 nm wavelengths with step-by-step and expert test procedures and certificate reporting.

Complementing the ORL test set is the variable back reflector module. It is a passive device which offers variable selectable levels of reflection of its input signal. As in the case of the attenuator module, the variable back reflector module can be programmed to offer maximum testing flexibility. The module is ideal for monitoring signal degradation/bit error rates with increasing reflection levels.

Optical switch modules are available in up to 1x32 and 2x2 configurations.

The IQ-200 product family is designed to high performance accuracy, stability, resolution and environmental standards. The operating temperature range is specified from 0 to 50 °C with 0 to 80% relative humidity, non-condensing and storage from -20 to 60 °C.

For more information on these and many more modules to come, or other EXFO laboratory products, contact EXFO technical support at 1-800-663-3936 or 418-683-0211, fax 418-683-2170.

Portable PC-platform OTDRs for the field

EXFO has revolutionized the Optical Time Domain Reflectometer with its self-contained, PC-based test kits. Lightweight and field portable, the OTDR test kits are comprised of a Universal Test Platform, serving as a computer expansion case and carrying case all in one, PC computer notebook, and OTDR PC card.

The OTDR is a full performance Optical Time Domain Reflectometer which provides the capability to analyze, test, and maintain a wide variety of fiber optics communications systems and equipment. The unit can also incorporate power meter, stabilized light source, and visual fault locator options. The light source/power meter allows true end-to-end loss testing, while the visual fault locator detects faults in the patch bay operating in the OTDR's deadzone.

The OTDR's PC-based architecture is a characteristic which makes the unit very powerful and flexible. Data storage is virtually unlimited by the use of the equipment's internal hard drive and floppy disk drive. It offers compatibility with data management software, greatly simplifying the treatment and access to test data via selected identifying parameters such as test locations and cable numbers instead of complicated DOS filename codes. Furthermore its flexibility is exemplified by the ability to load other OTDR applications.

Operation of the Universal Test Platform is run by the ToolBox software. This software supports not only the OTDR test kit, but additionally accommodates the FOT-910 automated loss test set application. Loss test data acquisitioned with any FOT-910 family unit can be downloaded to the Universal Test Platform PC, appearing in its characteristic loss test record format. Both the Toolbox's OTDR and Loss Test Set applications offer compatibility to the DocuNet and Fiber Test Manager softwares. The software is a means to easily organize and archive network test data. It allows users to build the network database of locations, cables, and fibers.

The OTDR Universal Test Platform test kits with color computer configuration are now available under a special promotion while quantities last. This promotion offers the color Compaq LTE Lite computer at a reduced kit price compared to its monochrome configuration! Call our offices today for full details. (800-663-3936, 418-683-0211).

Test kits for every application

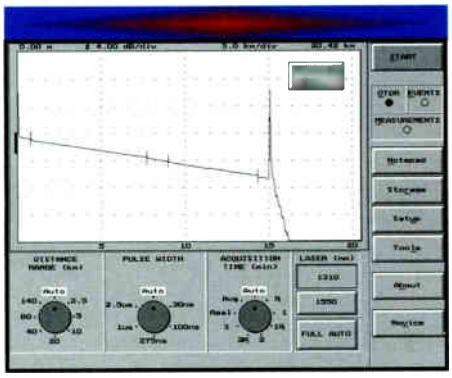
EXFO manufactures a large range of fiber optic test equipment. This range includes power meters, light sources, loss test sets, OTDRs, ORL test sets, visual fault locators, talks sets, attenuators and other optical equipment. There are numerous configurations of this equipment which can incorporate different testing options. To further integrate varied component test equipment, EXFO also offers a wide variety of test kits at special prices.

Test kits are available for LAN installation, construction, long haul and military applications. Newly available from the test kit selections are the TK-028 and TK-029. These high-end test kits combine the FOT-910 dual wavelength laser loss test set unit and the ultimate full duplex talk set, the VCS-20A. The creation of these new kits is similar to the Great Duos and the Expert's Trios which also combine the FOT-910 dual wavelength laser loss test set with the lower range VCS-10 talk set and FLS-235 visual fault locator. The purpose of these new kits is to offer a great combination of instruments in one case at special reduced prices.

The TK-028 test kit includes the FOT-912-23BL test set and VCS-20A-02BL talk set. The FOT-912-23BL is a 1310/1550 nm laser loss test set. This test set performs automated bi-directional testing over a single fiber. The patentend FasTest feature automates the entire loss testing process from the calibration of the test set pair to the transmission of the stabilized signal and test parameter information and data storage. The VCS-20A-02BL talk set is a long range 1310 nm laser full duplex digital transmission talk set. Together the test set and talk set provide the perfect package for telephone company and CATV operations.

The TK-029 test kit includes the FOT-912-BR23BLC test set and VCS-20A-02BL talk set. This kit is similar to the TK-029 kit and adds the Optical Return Loss testing option to the automated loss test set. ORL measurement is important for telephone companies and CATV companies as high bit rates in digital fiber optic transmission systems and CATV AM installations may suffer from the effects of back reflection. Basically, reflection increases BER in digital systems and decreases SNR in analog systems.

Free Toolbox 4.1 software upgrade brings test equipment performance to new heights



EXFO is releasing a new version of its popular ToolBox test equipment software and offering our clients a remarkable free upgrade kit.

Mass upgrade

By installing ToolBox 4.1, existing users of the ToolBox environment will notice some significant improvements over the current version. This new version also replaces the dedicated operation software for the FOT-910, be it handheld or PC type. To provide our customers with the best technology available, we are offering this upgrade free of charge to all OTDR and FOT-910 customers. Whether you own an FCS series PC-based OTDR card, an OTDR KIT, our Fiber Tool Box mini-OTDR, or the FOT-910 FasTesT power meter (card or handheld), you are eligible for a free ToolBox 4.1 software upgrade, regardless of the purchase date. Here are some of the key features of the new version.

Compatibility

ToolBox 4.1 is compatible with all of our OTDR products: FTB, OTDR KIT (COM-1010 & COM-1020), and FCS OTDR cards (FCS-100 & FCS-200). From now on, ToolBox 4.1 will be installed on all these units when they leave the factory. The FOT-910 download software has also been integrated into ToolBox 4.1, so all FOT-910 handheld units and FOT-910PCs will be delivered with ToolBox 4.1.

Change test parameters "on the fly"

OTDR users can now change test parameters "on the fly," allowing you to get a better feel for the trace during an acquisition. This exciting, new feature puts the operator in total control of the mini-OTDR. Simply start an acquisition and change the pulse width, distance range and acquisition time until the trace is to your liking, then lock in the parameters for a full acquisition. You can even shoot the trace in real time and adjust the other acquisition parameters later.

Improvements to the analysis

The importance of the analysis for mini-OTDRs cannot be overstated. This, along with the optical performance, can very easily make or break a sale. Some will even go so far as to say "a mini-OTDR is only as good as its analysis software." That's why we've worked overtime to improve the performance of the analysis and make it even better than it was. With ToolBox 4.1 you will notice a marked improvement in the end-of-fiber detection, the response to high reflective events, and the event location accuracy.

Multilingual software & translator

ToolBox 4.1 now has multilingual capabilities. The ToolBox and OTDR software (FCS-1000) comes standard in English, French, Spanish, Italian, and German. A simple language toggle button switches between languages. In addition, ToolBox 4.1 includes a translator so that the user can translate the software into virtually any language that uses the ASCII character set.

Bigger trace print-out

The size of the trace print-out has been enlarged to make it easier to see all events along the trace, including splices down to 0.03 dB.

Autozoom

The new autozoom is a great function that lets the user automatically zoom in on a specific event by simply selecting the event in the event table and pushing the autozoom button. The event is automatically zoomed to full zoom at the touch of a button. This feature has been requested by many people out in the field and greatly enhances the functionality and user-friendliness of the unit.

Attenuation/ORL test data compatible

That's right, ToolBox 4.1 makes the FTB (and all our OTDRs) the first mini-OTDR to integrate loss test with OTDR data. You can now download all your FOT-910 test data to the FTB (or any computer equipped with ToolBox 4.1) for complete data uniformity. The transfer is done via the RS-232 port and is a simple field operation. And there's more. Once the data is safely stored in the FTB, it can be easily transferred to DocuNet, our test data management system. Now OTDR and loss test data are located in the same database. Data retrieval and analysis have never been easier.

Ordering procedure

To get the upgrade, simply call us at 1-800-663-3936 or 1-418-683-0211 and ask for Product Support Group 2. We will fax you an order form with instructions.

Mini-OTDRs for every application and universal software for data archiving

The purpose of the Optical Time Domain Reflectometer (OTDR) is to provide communications technicians and engineers the capability to analyze, test, and maintain a wide variety of fiber optic communications systems and equipment on the bench and in the field.

The OTDR is a fiber optic test set used to characterize a fiber optic span, which typically consists of sections of fiber joined by connectors and splices. It provides an inside view of the fiber; fiber attenuation and uniformity, splice and connector losses, breaks and fiber length can be calculated from the fiber profile. The OTDR is capable of measuring reflective and non-reflective faults at 1310 and 1550 nm on singlemode fiber optic cables. Multimode models are also available for 850 and 1300 nm testing. The test set is capable of performing optical attenuation and distance measurements.

The EXFO FTB series of OTDR Fiber Tool Box is available in both singlemode and multimode versions. It features full OTDR functions, complete data storage and documentation and built-in options such as the power meter, CW light source, and visual fault locator. The user interface is its touch sensitive screen; an external keyboard may also be used. The unit includes a standard 120 MB hard drive and optional floppy disk drive, serial, parallel external VGA, external keyboard and optional PCMCIA Type II 14.4 kBps data fax modem or memory card interfaces.

The multimode mini-OTDR was introduced last quarter, bringing a new style of testing to multimode applications. A dual wavelength 850/1300 nm unit is available which can perform one button trace acquisition using the touch screen or by way of an external mouse or keyboard. The singlemode mini-OTDR product is also new in its operation with the addition of the 10 ns pulse width. Shorter pulse widths yield shorter deadzones and greater event resolution. The complete selection of pulse widths now includes: 10 ns, 30 ns, 100 ns, 275 ns, 1µs, 2.5 µs, 4 µs, and 10 µs.

The current OTDR software supplied with all FTB and COM-1010 mini-OTDRs is included in ToolBox version 4.1. It offers enhanced OTDR functionality over its previous version. This includes:

- real time pulse width, distance range and acquisition time test parameter selection;
- expert operation mode long duration trace averaging;
- enhanced autozoom function, and multilingual/translation facility.

The ToolBox software includes various tool applications: the FCS PC card and FTB unit OTDRs, OTDR power meter and light source options, FOT-910PC (PC card loss test set) and the new addition of the FOT-910 hand-held loss test set data downloading software. The need for many diskettes for tool operation and information download is eliminated! Users of the FOT-910 hand-held equipment can now transfer data to the FTB mini-OTDR or the OTDR Universal Test Platform platform notebook computer.

Good data management pays off during emergency restoration.

In addition to the integration of the PC card and component equipment software applications, the ToolBox software also accommodates a universal data management software for all tools. As more fiber is being installed, proper maintenance and restoration procedures must be utilized. The original test data is critical information for network upgrade and modification, troubleshooting and routine report generation. Outdated data management procedures and archiving methods can easily complicate the recovery of test data and an inefficient deployment of resources may result.

Emergency restoration is another example of when a good data management system is useful. Most installation, repair, and maintenance crews today employ one of two traditional ways to file or manage their test results. Printing and filing OTDR test results is the most common way to manage results. Misplaced and lost printouts are the obvious disadvantages to this simple filing method. An alternative method relies on computer technology. Data is stored on disks under a formulated naming scheme. This technique however does not take full advantage of a computer's real data processing capability. Today's computer technology is such that graphical user interfaces are popular. These allow for elaborate tasks, including database management, to be as simple as clicking on small, user-friendly buttons on a computer screen.

EXFO's solution to data management is DocuNet software. The software is installed as an application to the FiberToolBox and services all of the FiberToolBox's measurement/data storage tools. It allows the user to integrate OTDR traces and characteristic information with Optical Return Loss data and test set end-to-end loss data. DocuNet presents this network data in a structured manner according to specific test location, cable, and fiber identification. These identification parameters are entered one time only using plain language labels of up to 100 characters. This simple process intrinsically filters the desired tests; key information is displayed by DocuNet and complete information is simply accessed through the specific ToolBox application.

The DocuNet station software is essentially a database with an embedded tree structure that reproduces the actual fiber network's topology. Its complement is the Fiber Test Manager software which is simply a master DocuNet station acting as a database server to all PCs using DocuNet. It automatically centralizes all data obtained from PC devices. It is run on a dedicated PC equipped with an internal modem and a high storage capacity.

To obtain your copy of Toolbox 4.1 including the DocuNet evaluation software, call us at 1-800-663-3936 or 1-418-683-0211 and ask for Product Support Group 2.

A decade of rapid change points the way to the future

Automation and Integration of Test Equipment

The emergence and growth of fiber optic communications are the result of developments in every component of the system, increasing transmission rates, quality, and reliability. Technical developments in transmitter, receiver, fiber, and test equipment alike have made fiber communications a cost-effective technology.

The evolution of cable and testing can be linked directly to improvements in the fiber link's major performance drawback: attenuation. Improvements in the fiber itself and its connections contributed greatly to performance, and the steady enhancement of test equipment was an essential part of these improvements. Fiber optics systems are tested for optimization of loss margins, verification of cable plant integrity and performance. Such fundamental tests are OTDR (Optical Time Domain Reflectometry) testing and optical loss test set end-to-end attenuation testing. The OTDR characterizes the fiber for identification of events loss data and reflectances. The other test procedure is the end-to-end attenuation test. It has always been an important part of acceptance testing, which indicates whether or not the optical loss measured is within loss budget quality standards.

In the early days of fiber optic communications, various factors restricted performance and reliability. Some problems were intrinsic to the transmission medium itself, the optical fiber, and made connections difficult and testing tedious. Two problems were core diameter variance and fiber concentricity. The first function of the OTDR was as a troubleshooting tool to provide a view of the fiber and not as a measurement instrument. It was used to locate faults, namely points of high loss and breaks. It was not accurate as a measurement tool to provide loss data, including splice loss measurements. At the same time, functionality was similarly not fully developed. While features and ease of use were clearly basic, performance specifications were relatively prohibitive; OTDR deadzones were large and the spatial resolution of events made a simple estimation of end-to-end loss unreliable.

Alternatively, the loss test set, or light source and power meter, were used for accurate end-to-end measurement. The power meter measured transmitter power levels at a certain degree of accuracy. The first light sources and power meters used in the field were the exact instruments used in the lab. These instruments were quickly seen to be unsuitable for the environment in which they were now operating. Light sources required hours to stabilize. Typically they were powered up overnight in preparation for the next day's testing. Testing was equally laborious: loss tests were performed in both directions and each test was repeated three times, requiring the complete connection and disconnection of the units from the system each time. The single test result was an average of all of these readings. This was necessary because of problems in fiber manufacture and splicing and the poor repeatability of the connectors. The laboratory instruments were large and bulky, and light sources and power meters were component equipment; an integrated loss test set was not yet available for bi-directional testing.

In 1990, test equipment miniaturization and automation continued. The first mini-OTDR was introduced.

Powering the test equipment was another difficulty in the field. Since the instruments operated on AC power, a generator was required to provide power in the field.

In the early 1980s, the telephone companies started installing singlemode fiber. The multimode OTDR had proven acceptable when the singlemode OTDRs were introduced. Loss test power meters did not have power referencing capabilities, and fiber loss still had to be calculated manually as the difference between the test light source power level and the far end receive power level.

By 1986 — the tenth anniversary of the first prototype fiber optic system — network reliability had improved dramatically due to tighter cable manufacturing tolerances, improvements in fusion splicing, and new connector technologies. Within the next two years, the loss test set became available as an integrated piece of test equipment, with power meter and built-in dual wavelength light sources in a single handheld unit. The loss calculation could be performed automatically by the test set, eliminating the need for manual records. In addition to referencing power level data storage, units provided loss data storage in memory. A serial port connection permitted an interface to a personal computer for data downloading.

In 1990, test equipment miniaturization and automation continued. The first mini-OTDR was introduced to the market. These units were up to a third of the size of traditional OTDRs, and they were portable. They performed automatic fiber analysis, selecting test parameters automatically. The OTDR had evolved to become a unit with one button operation. While the portable mini-OTDR was attracting interest, another OTDR platform surfaced. It was an OTDR on a PC card. The card was to be installed in a laptop computer designed for field use. This first generation of PC OTDR relied on the computer as the instrument processor. The new PC OTDR was marketed with a turnkey solution: a universal test system platform. Numerous advantages became available with this new OTDR platform, most importantly it provided the power of a personal computer and the flexibility of numerous testing applications.

Today there are still newer portable mini-OTDRs with the simplest operation ever: touch screen command. The mini-OTDR is no longer just a mini-OTDR, but a multi-functional test kit for testing, measuring and data management.

Over the past 10 years, fiber optic test equipment has moved in the direction of greater automation, towards PC-based platforms, and better system integration and data management. As EXFO enters its second decade this year, the company is committed to remaining on the leading edge of fiber optic technology.

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☐ FTB Mini-OTDR
☐ Loss Test Set kits
☐ IQ-200 lab instruments
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Fall issue (CT)

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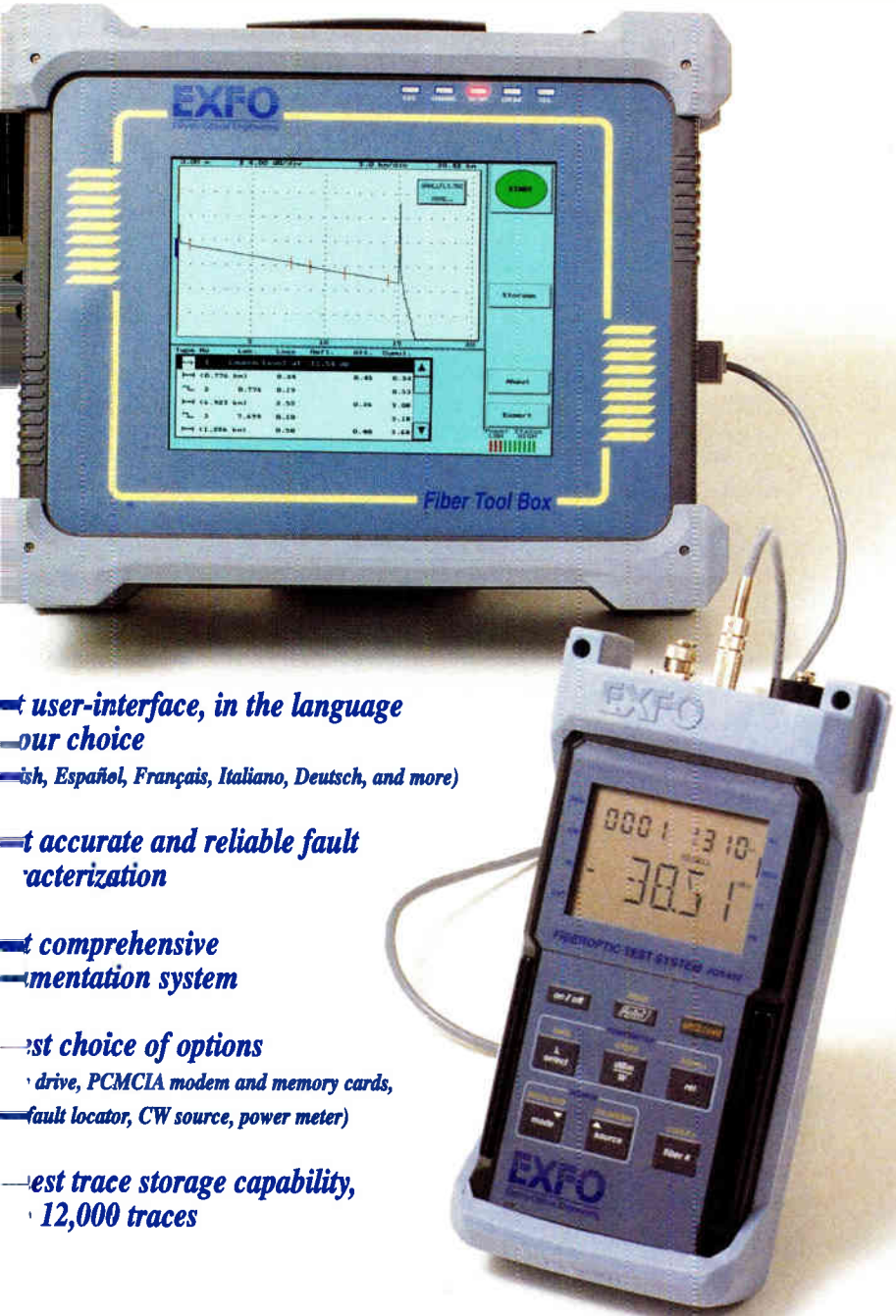

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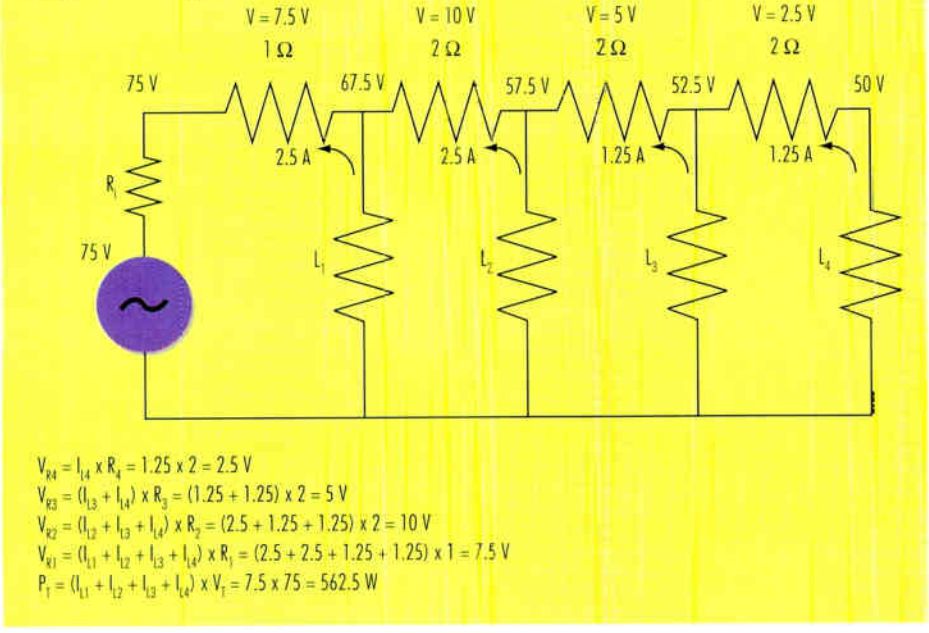
Figure 4: Equivalent circuit with 75 V source



$V_{R4} = I_{L4} \times R_4 = 1.25 \times 2 = 2.5\ V$
$V_{R3} = (I_{L3} + I_{L4}) \times R_3 = (1.25 + 1.25) \times 2 = 5\ V$
$V_{R2} = (I_{L2} + I_{L3} + I_{L4}) \times R_2 = (2.5 + 1.25 + 1.25) \times 2 = 10\ V$
$V_{R1} = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times R_1 = (2.5 + 2.5 + 1.25 + 1.25) \times 1 = 7.5\ V$
$P_T = (I_{L1} + I_{L2} + I_{L3} + I_{L4}) \times V_T = 7.5 \times 75 = 562.5\ W$

scriber, depending on the services provided and the population density of the area. This correlates to a power supply requirement of 400 W to 10,000 W; with 2,500 W very typical. A lot of power! Distance also becomes a concern due to the voltage loss of the distribution cable. Typical designs are limited to 6,000 to 7,000 feet. As power is carried along the cable, voltage is dropped across the cable's resistance, depending on the current in the cable.

Figure 1 (page 30) illustrates a typical RF distribution system. Current providing power to the longest leg of the feeder creates a voltage drop across the cable, thus reducing the voltage across the load L_4. The reduced voltage results in less power delivered to the extremities of the system. (An equivalent circuit is illustrated in Figure 2 on page 30.) This then limits the distance that can be covered from the central power location when the cable loss drops the voltage to the minimum acceptable voltage for the last component. The voltage at the last component can be calculated by using Ohm's law for each branch of the equivalent circuit to determine the voltage drop across the cable.

Figure 3 (page 33) illustrates the equivalent circuit and simple calculations used to find the voltage at any point in the system. As you can see in the illustration, the voltage at the last line extender is 40 V, a minimu for most amplifiers. This limitation clearly requires a solution.

Upping the power

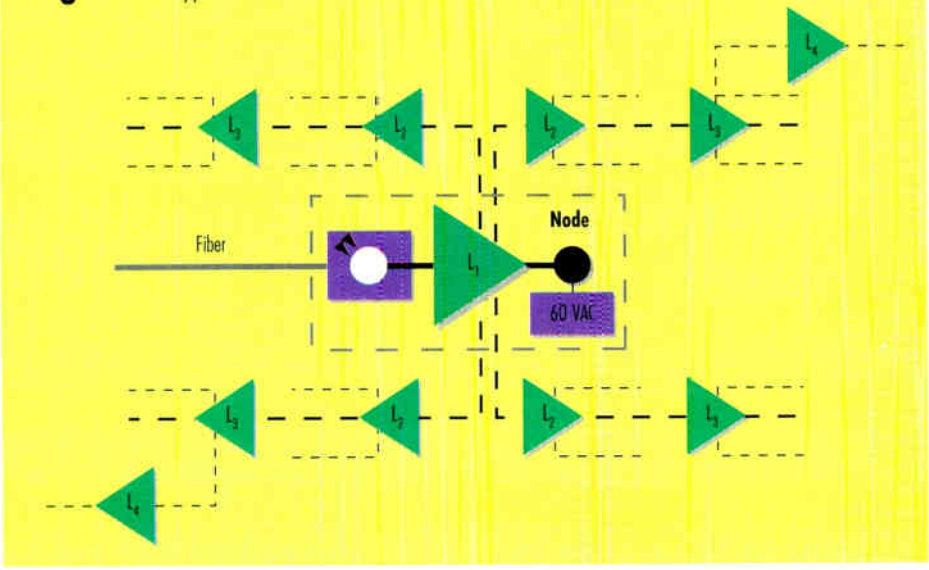
More power. ARGH! One metho of extending the range of our powe ing system is to utilize a power sup ply with higher voltage output cap bility. Starting with a higher volta will ensure that a higher voltage reaches the extremities of the node Figure 4 illustrates the same syste equivalent circuit with a 75 VAC power supply replacing the previou 60 VAC power supply.

In these two examples, linear D power supplies are used to simplif the calculations. At the higher volt ages, the system components draw more current and therefore cause t system to utilize more power. Add tional benefits are gained when switch-mode DC power supplies a used in system components. In a s tem utilizing switch-mode power s plies, a higher applied voltage wil sult in a lower current through th leg, thus reducing the voltage loss across the cable. In this situation gain from both benefits. Caution should be used in determining the maximum loading for a power sup however, since the switch-mode power supply also will draw more current when the applied voltage low. This results in larger losses across the cable, higher voltage l es, even larger currents and the eventual overloading of the pow supply. Some newer switch-mod power supply designs have a cu rent-limiting feature that preve this condition. Specifications sh be checked carefully when maki design changes with this type o supply.

Figure 5 illustrates the same p tion of the distribution system in earlier example, rebuilt with fibe using a fiber-to-the-feeder (FTF) chitecture. Note the approximate and coverage area. With a single power supply, the system is at it limit. Only 40 V is available at t last line extender L_4.

Figure 6 (page 36) illustrates same node with one additional li extender (LE) that is to be adde the system in order to expand se to a new housing development. T choice in the past has been to a new power supply location and t redistribute the load. Increasing

Figure 5: Typical fiber node



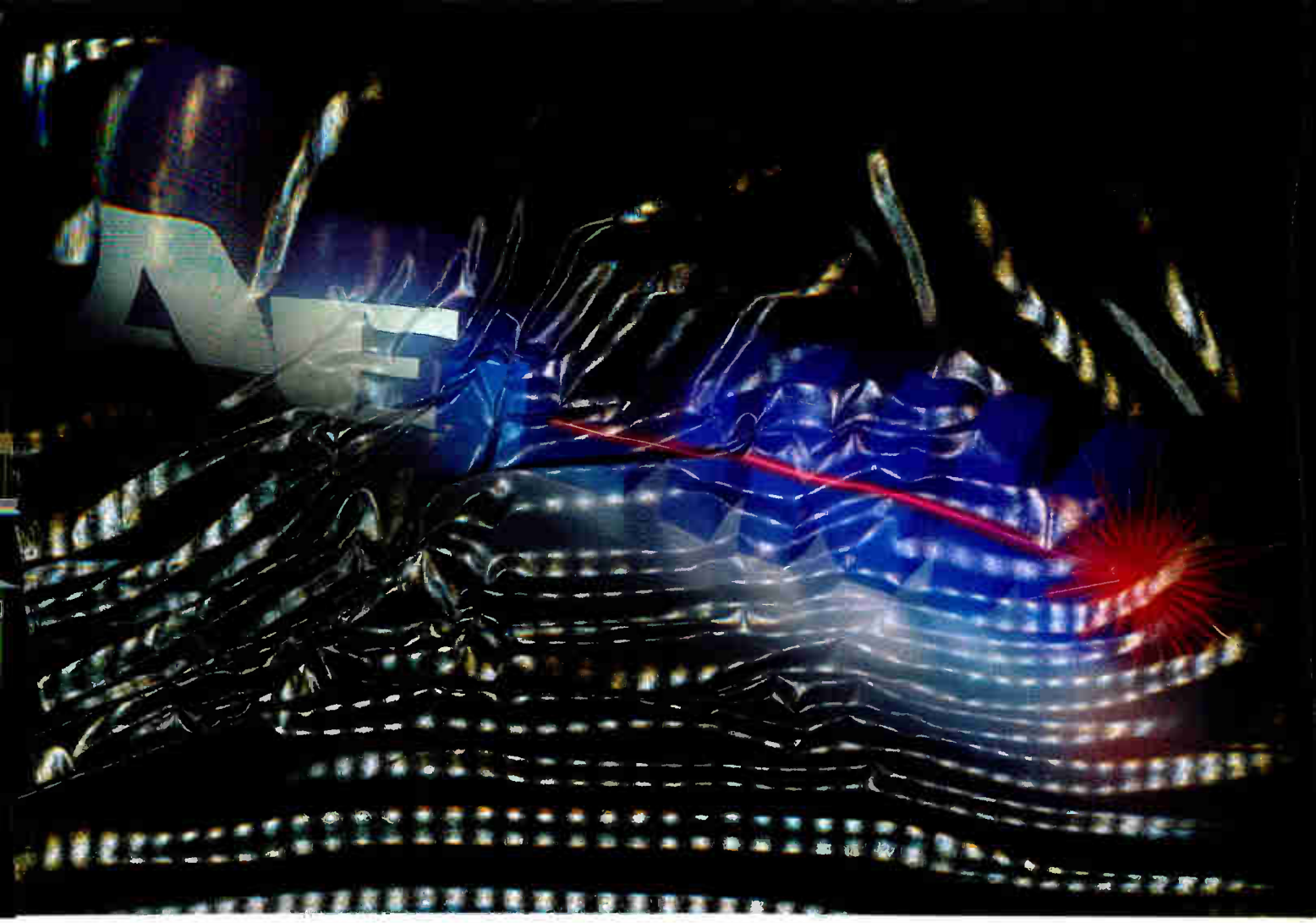


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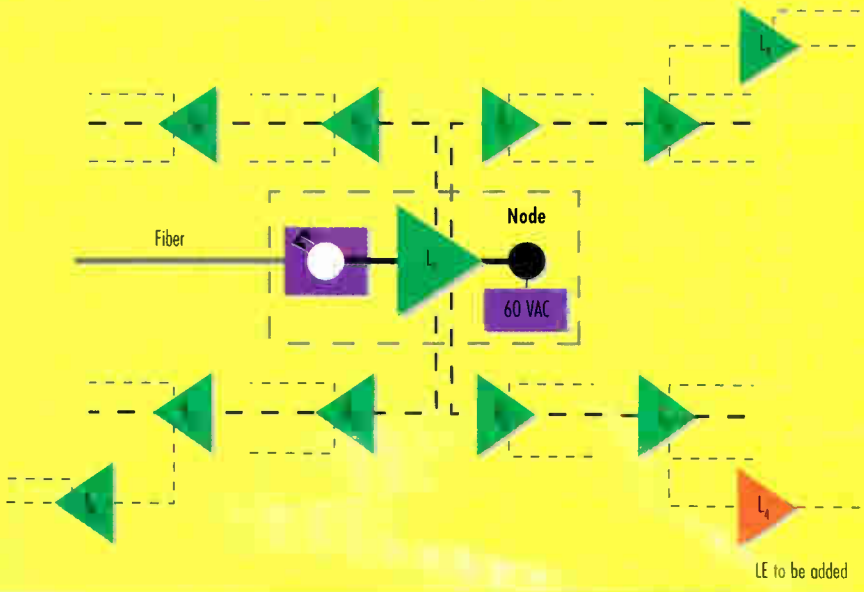
Figure 6: Typical fiber node powering



voltage of the power supply as shown previously in Figure 4 (page 34) would provide more than enough power for the new line extender.

Note that the voltage across the last line extender L_4 is increased from 40 V to 50 V and that additional components could be added at the end of the system or further "upstream." Figure 7 illustrates the same area expanded by the capabilities of a 90 VAC power supply.

Some manufactures provide additional voltage "taps" on new power supply designs. Ninety volts has received considerable attention since it, obviously, will provide more power to the system for any given current (P = V x I). Voltage taps provide the ability to utilize the 60 V tap for power today and move up to 75 V or 90 V power in the future or to utilize a single product in a system that utilizes more than one power level. Some locations may require minimal power, operation on 60 V, while other areas require 90 V powering. Another advantage is that 60 V can be used today and 75 V or 90 V is readily available when the system expands. (Figure 8 on page 38 illustrates the taps on a typical power supply.) Changing taps is as simple as unplugging the 60 V tap and plugging in the 75 V or 90 V tap.

So why not just jump to the 90 V power right away? ARGH! ARGH!

Figure 7: Typical fiber node powering with 90 V power

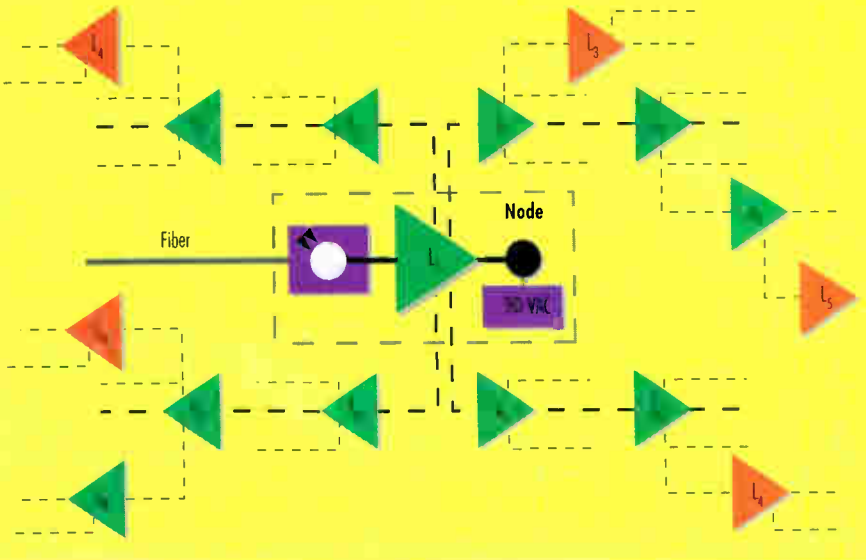


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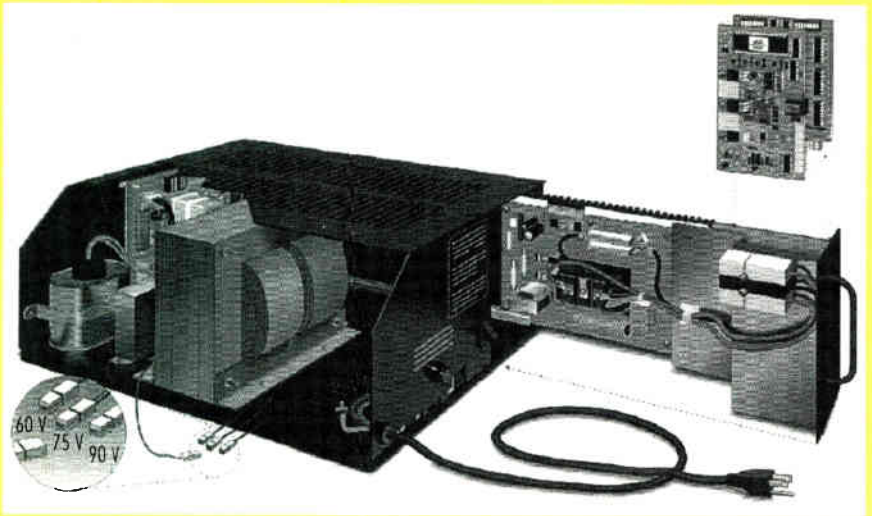
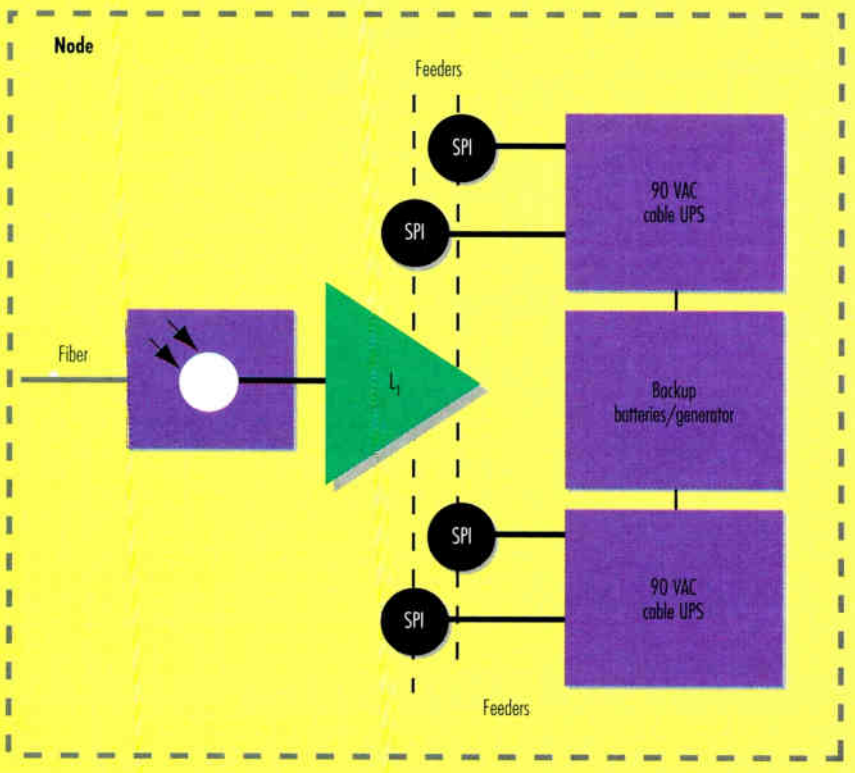
Figure 8: Voltage taps on typical power supply



ARGH! Some existing system components (typically DC power supplies) are not rated for higher voltages. These may be fine in locations where the cable loss drops the voltage into the usable range, but will not work in locations close to the node. Additionally, many older DC power supplies are linear — opposed to the newer switch-mode design — and operating these at higher voltages will simply waste the additional power in the form of heat. This will decrease power supply efficiency and result in excessive operating costs. This is where the 75 V tap also becomes useful. When one more amplifier is needed to complete a line extension, you would normally have to install another power supply. With a new taped power supply you can simply switch the existing power supply up to the 75 V tap and save the expense of an entire power supply installation.

Figure 9: Typical fiber node powering with dual 90 V power



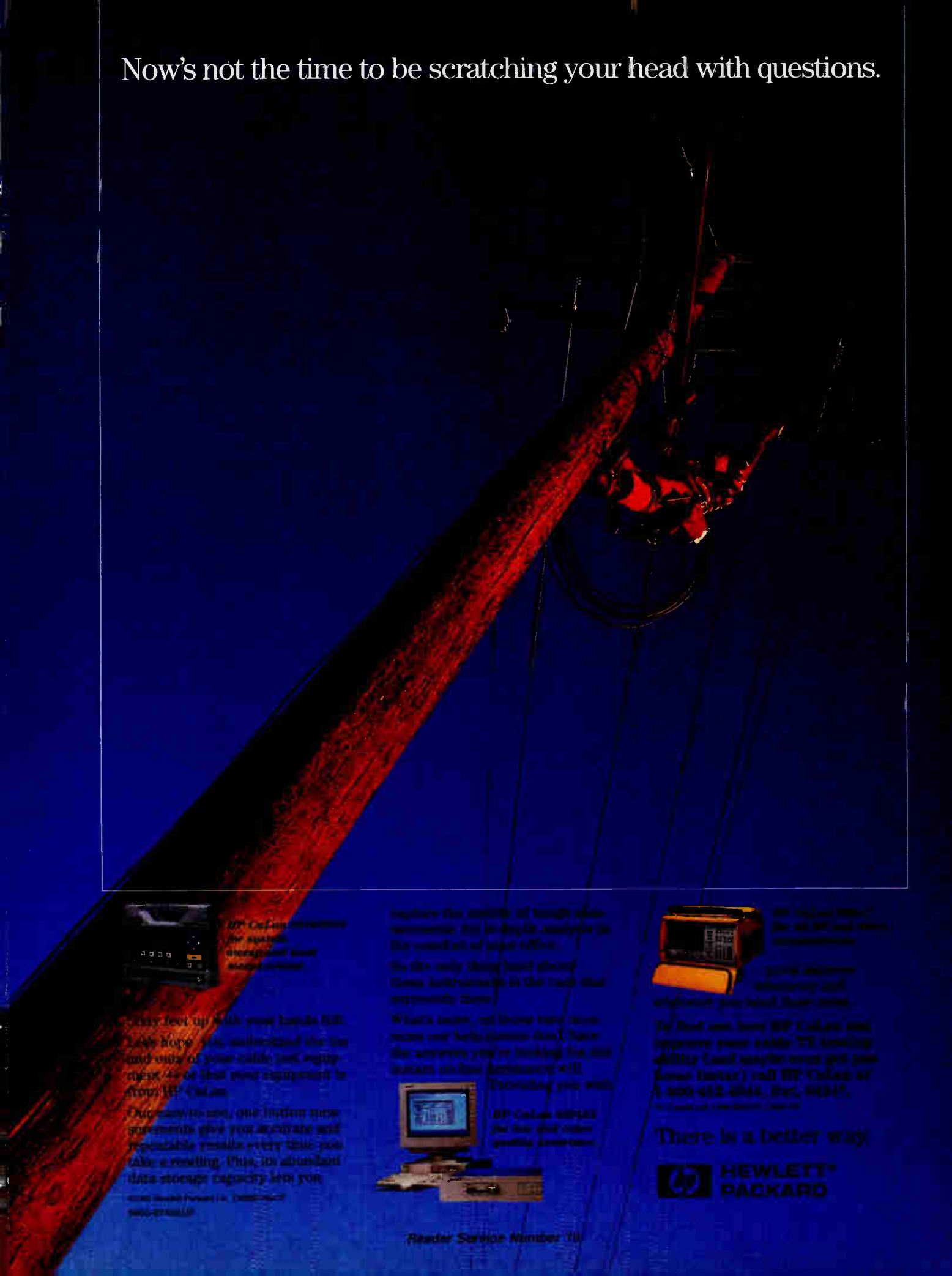
More power. ARGH! Ninety volts at 15 amps is 1,350 W — a healthy power supply, but not enough for many nodes. Nodes requiring more power can be doubled up with multiple power supplies. A typical installation is illustrated in Figure 9. Note that passives are limited in current capability, typically 7.5 A to 10 A. The insertion technique will have to avoid overcurrent in all of the power passing components. The hub and spoke design of the node used to reduce RF distortion and noise also aids in distributing the power without exceeding current limitations. The central location of the node allows a balanced distribution of power, just like the RF signal distribution system. (This was illustrated in Figure 7.) In this way power is fed to each leg of the distribution system allowing a typical area with a radius of 1.5 to 2 miles. Range will vary significantly with system design and subscriber density.

Conclusion

Centralized node powering is not yet widespread, but is in use by more than a dozen major cable operators today. As broadband networks continue to develop, these techniques will be deployed on a large scale. Deploying 90 V systems in place of current 60 V systems is not necessarily a plug-and-play implementation. Consideration must be given to utility service requirements, electrical codes, new and existing line equipment and the future needs of our network.

Whether doing a simple line extension or rebuilding to the latest and greatest architecture, chances are good that the network is going to need "more power" at some time. While 90 V is the most contemporary solution for many applications, 75 V and 60 V power also have their place. While some existing line equipment is not rated to operate with 90 VAC there is no problem using 75 V. The flexibility provided by selectable power taps will benefit almost any installation. Move to a higher voltage tap when more power is needed or to a lower tap to conserve power when a lower voltage is usable. It is ecologically and economically correct to only use the power that you need. Modern power node architectures and power systems will help make sure that "more power" is available when you need it. **CT**

Now's not the time to be scratching your head with questions.



Reader Service Number 111

By Tom Osterman, President, Comm/net Systems Inc.

HFC network distribution powering

The following is adapted from a paper that ran in the "1995 Society of Cable Telecommunications Engineers Cable-Tec Expo '95 Proceedings Manual."

With the recent developments in the design of broadband communications systems has come a significant debate about powering requirements and implementation. The debut of hybrid fiber/coax (HFC) networks for telephony delivery in addition to existing CATV service has affected powering so significantly as to fuel a divergence in approaches. This is ironic due to the anticipated convergence of the telephony and CATV industries. Although architecture, signal processing and distribution techniques share many similarities for both services, at the time of this writing there are no less than half a dozen different powering schemes in various stages of deployment.

Existing CATV networks almost universally utilize 60 volt alternating current at 60 Hz with a "quasi-square" wave shape. MSO powering philosophy varies in the amount of battery backup (standby) power supplies utilized. Some operators still use nonstandby power supplies and use standby power for node locations and long feeder runs only. Recently there has been deployment of 90 VAC power supplies (both standby and nonstandby) as a transition from 60 VAC for further operating capacity.

Telephony network designers are much more concerned with power backup capability due to long-standing regulatory requirements and customer expectations. Power backup requirements are a minimum of 8 hours assuming worst-case conditions. Most sites can operate considerably longer, especially with local generator backup in addition to battery systems. These networks are being designed with several levels of power redundancy, conservative loading and network monitoring.

Telco network powering

The regional Bell operating companies (RBOCs) network powering systems all share the following characteristics:

1) Plant powering of all devices including "side-of-the-home" interface equipment. (Side-of-the-home devices require powering via a special power passing tap and down the coax drop or twisted-pair conductor to the home.)

2) Long backup time in case of power outages (8 hours minimum).

3) Network monitoring systems for remote status of utility power and backup systems.

4) Higher network power consumption due to powering of broadband actives as well as telephony-specific devices. Typically a 40 to 60% increase in power requirements over HFC for CATV only. Power equipment designed for longer service life and ease of serviceability. Uninterruptible power supply (UPS) output instead of switch-to-standby topology.

5) Redundancy — Multiple rectifiers in parallel, battery systems backed up with generators, auxiliary power inputs for mobile generators.

6) Tighter specifications for powering reliability and accuracy. Compliance with applicable Bellcore specifications for grounding, enclosure design, reliability etc.

7) Desire for centralized powering units collocated with the fiber node. Single "power node" to provide power in four or more directions from a central point to the "quadrants" of each node service area. Power is fed down each feeder to the actives and telephony equipment located at the curb or on the side of the house. A single power supply per each 480-home node provides only one location for large and expensive battery systems and/or generator. One point for maintenance and monitoring is preferred over the CATV approach of multiple distributed power supplies with shorter backup time.

"Telephony network designers are much more concerned with power backup."

CATV network powering

The CATV industry in comparison typically uses power supplies located in several areas within a given node. Each unit has typically 2-3 hours of standby time capability assuming it has been maintained properly and has functioning batteries. A power supply typically feeds the node device itself and the closest actives located on feeders from the node. Actives further out are powered by additional power supplies added to the extremities of the node area. There is no current requirement to power any devices other than the node and amplifiers. The electrical power consumption is low enough to permit use of fewer, smaller power supplies. Typical power supply output ratings range from 8 to 15 amperes at 60 VAC (up to about 900 watts output). There is no redundancy deployed, no provision for integrated generator backup aside from extension cord connection to a vehicle-mounted generator that is dispatched to the site.

CATV network powering systems

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share the following characteristics:

1) Distributed powering (several power supplies for a given node area).

2) Lower power consumption due to fewer active devices requiring power.

3) Standby time of 1-3 hours, but not universal to all locations.

4) Status monitoring available but not frequently implemented.

5) Currently no subscriber premises devices that need to be plant-powered (no powering down the drop to the home).

6) Very little redundancy in power supply design. Power supply equipment failure immediately results in subscriber service outage.

Power source characteristics

In traditional CATV systems the AC power supply operates from a 120 V utility power connection and by the use of a ferroresonant power transformer converts the output to a regulated 60 V, quasi-square wave. There are many significant details to this design, which are covered in greater detail in other publications (see references).

The basic capabilities include:

- Voltage regulation that prevents utility power fluctuations from causing intermittent amplifier operation.
- Line conditioning and filtering of high-frequency noise and voltage transients.
- Short-circuit protection (the output "folds back" into an overload or short without damage to the transformer).
- Quasi-square wave output that is efficient in power delivery through the coaxial conductors and has reduced harmonic content compared to a pure square wave. (This minimizes RF interference.)
- Output power typically 600 to 900 W.

The vast majority of cable systems in North America utilize this powering system. The power supply manufacturers vary on their design of the battery backup function of the power supply but the nonstandby or line-mode functionality is almost identical. The 60 V RMS output is really a peak voltage of 72-75 V. That is to say that the DC equivalent of the 60 VAC system is 72-75 V. Active devices are designed to operate from a low voltage of 30-40 V to a typical high voltage of 60 VAC. Tolerance for higher voltages of up to 200 V is typical for short periods of time due to the presence of transients such as those caused by lightning.

"Current HFC designs utilize the full capacity of the power source output."

Current HFC designs utilize the full capacity of the power source output. Unlike previous designs where 20-30% margin was designed into the system for the inevitable addition of more loads such as line extenders, newer networks are being installed with up to 90-100% of the power source output capacity used. This approach economizes the power supply requirements but also results in systems subject to instability and intolerance to brief overloads. This practice also is limiting MSO deployment of telephony devices without the complete re-powering of the system or, at minimum, the addition of several power supplies per node.

The power sources being considered and deployed by the RBOCs also include the same CATV power sources as well as variants of the basic design. Additional requirements are higher power outputs so that fewer power supplies are needed per area and new telephony devices can be powered. The problem with this is that even if a high-capacity power source is designed, there is still a fundamental limitation on the amount of current that can be reliably fed down each coax feeder. The power passing components such as the inductors, RF connector interfaces and printed circuit boards in the active devices can carry at best up to 12 A. If a larger output supply is used, it typically must divide its output power into several lower current individual outputs for delivery of no more than 12 A on each coaxial feeder.

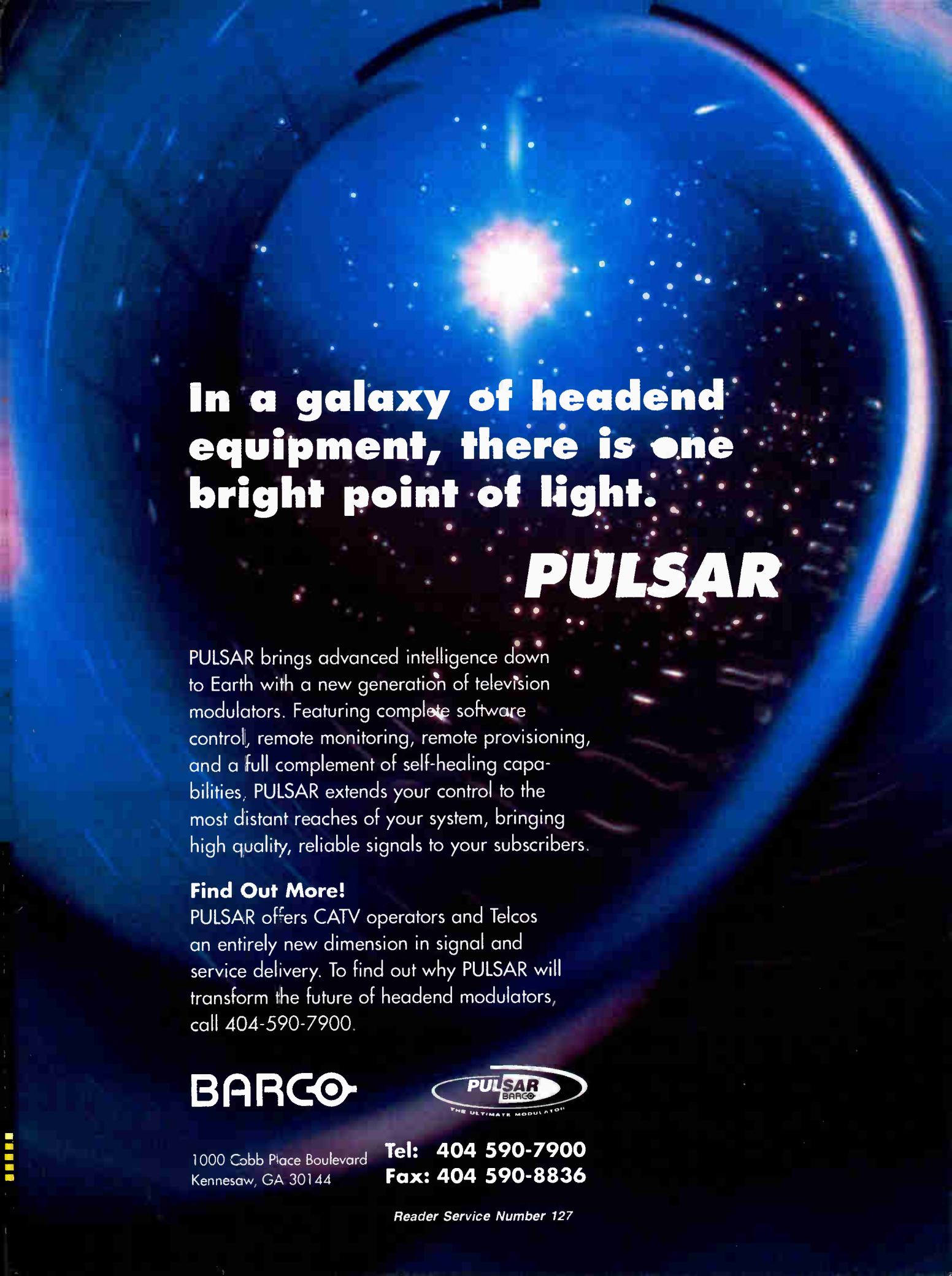
Recent telephony powering approaches under consideration include:

- 60 VAC, 60 Hz, quasi-square wave
- 90 VAC, 60 Hz, quasi-square wave
- 150 V, 1 Hz, quasi-square wave
- 90 V, 1 Hz, quasi-square wave
- 90 VDC
- 48 VDC (in subscriber loop cabinet and central office)
- 90-110 V, 1 to 10 Hz, quasi-square wave

The 60 and 90 VAC designs are essentially ferroresonant transformer-based and are usually constructed with total output capacity of up to 5,000 W. This output power is divided over four or more individual outputs for connection to separate feeders that carry power form the node location to the distribution actives. Output current is limited by individual current-limiting devices for each output. These devices typically do not exceed 12 A and may be adjustable in the current limit threshold. Integrated into these large cabinets may be a natural gas or LPG fueled generator to provide longer operation than the internal battery pack can support. Physical size of these large power nodes can be up to 5 x 5 x 3 feet and must be mounted to a concrete pad base located in the easement area on the side of a street, sidewalk, etc.

The 150 V, 1 Hz system originated with one RBOC that is utilizing plant powering of a customer premises terminal device. This is an example of the highest power consumption for a new network design carrying broadband telephony. Due the 4-12 W per home power requirement and the power passing tap providing power down the high-loss coax or copper pair drop, the total node power requirement is up to 6-7 kW. Consideration was given to using 150 V to provide the power needed by each quadrant for actives and the network interface devices (NIUs) located at each residence. Due to the aforementioned 12 A current limit in the through-path, the only option was to increase the voltage (at the same 12 A current) to provide more power down the coax feeder (12 A x 150 V = 1,800 W — instead of 12 A x 60 V, which is only 720 W). Although the higher voltage does solve the through-current limitation for the power delivery to each quadrant of the node, use of the higher voltage results in the following significant impacts:

1) Higher operating voltage is dan-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gerous to field personnel working on the equipment.

2) Internal power-carrying conductors in actives need to be shielded to avoid inadvertent shock.

3) Short-circuit energy delivered by any feeder is in excess of 1,800 watts, which can and will destroy conductors, circuit devices and overheat contact points.

4) Provision of plant power from the feeder to the home requires a power passing tap that provides current-limiting to prevent the 1,800 W or more from being delivered to a short on the coax drop cable stapled to the home or into the NIU circuit board. This power passing tap is larger, more complex and more expensive.

5) Amplifier power supplies need to be redesigned to operate from the higher voltage. Circuit protection elements such as fuses and circuit breakers are difficult to get with higher voltage rating. They are physically much larger too.

6) Power sources with 1 cycle per second (1 Hz) output must be solid-state switching devices instead of the 60 Hz ferroresonant transformer designs. These power converters or inverters operate full time and convert a DC input to the quasi-square wave, 1 Hz output. This reduces reliability but allows for redundant inverter units to be installed to provide automatic parallel switch-over in case of unit failure. The power stage complexity is increased and operating efficiency is decreased.

7) Output current limit must be a solid-state switching system that senses an overload or short and turns off or reduces output to protect inverter transistors from failure as well as network devices in series with the short-circuit path.

8) A low frequency is selected to compensate for the higher shock hazard of the higher voltage. Several studies have shown that power frequencies in excess of 10 Hz through 1,000 Hz cause more tissue damage, cause heart fibrillation and are more dangerous volt for volt compared with frequencies 10 Hz and below including DC. Direct current would be preferable if it wasn't for the significant galvanic corrosion that would occur in a coax plant with all of the exposed dissimilar metal junctions that exist. So the compromise in increased voltage is reduced frequency. The theory being that the net effect is a minimal increase in operator risk compared with 60 VAC, 60 Hz CATV systems.

After consideration of this 150 V system, it was decided that due to a number of issues, they should operate at 90 V, 1 Hz instead. Regulatory issues, technician licensing and other roadblocks to rapid deployment caused reconsideration and reduction to 90 V.

The same comments about 150 V apply to 90 V systems and the equipment required is the same however there is no longer sufficient power to deliver to the quadrant using one feeder (12 A x 90 V = 1,080 W). A parallel feeder or conductor is now required to carry additional current at least to the power distribution section of the first amplifier out of the node. From this point, current can be divided through multiple feeder outputs staying below the 12 A per path limit to the rest of the distribution devices.

Direct current is under consideration for point-to-point power feeds using coax, but with attention given to the connection points. For example, a power node could feed DC through a dedicated feeder to a fiber node cabinet several hundred feet away as long as the connectors on both ends are well-protected from moisture to reduce or avoid corrosion. (Heatshrink tubing, gel-filled terminal connectors and other sealing products should be considered.) Telephone systems all use -48 VDC powering for internal central office equipment as well as for outside plant equipment. With the advent of fiber-to-the-loop several years ago, operators were forced to install small -48 VDC rectifier and battery systems in each subscriber loop cabinet (SLC) to power the ring voltage generator, and the subscriber line cards that feed the twisted-pair drop to each home and in turn provides power and ring voltage to the telephones.

Corrosion in copper-based telephony networks is managed due to the following unique circumstances:

1) The conductors are copper, the connectors are copper. Unlike aluminum, copper-coated steel and galvanized steel in a coax and strand environment. Without the dissimilar

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metal contact, corrosion is reduced.

2) The current through each conductor is minimal, typically milliamps of current. The lower the current though a galvanic connection, the lower the rate of metal transfer.

3) Connections are point-to-point in cabinets, splice enclosures and protectors at the side of the home. Connections are sealed and well-protected from moisture.

Other voltages at 5 to 10 Hz have been considered due to preliminary test data (not confirmed) that the 1 Hz approach may not be as effective for corrosion reduction as first thought and a higher frequency may be required.

Power passing tap

Systems that will use a customer premises device powered from the plant power system need a device to provide the power to the home from the cable system. The existing RF subscriber tap is used to provide the RF splitting function to "tap" off a certain RF level of signal and deliver it via small diameter coax cable to the home devices. The obvious option is to modify the existing tap design that does not allow power (60 VAC) out the drop connection to now allow power to pass though. The existing CATV multi-output-output style tap provides a power path through the device on the feeder downstream to the next tap or amplifier that operates from the 60 V system. Modification of the tap to provide not only RF but power as well is not as simple as it may sound:

1) An internal "reverse" power inserter is required to pick off power from the through-path. This function adds insertion loss to the series RF path.

2) A power conditioning circuit is required to provide current-limiting for overload and short-circuit protection; voltage transient filtering (surge protector); and power conversion (an option to provide a DC output or a lower regulated voltage output).

3) A power inserter function is required to re-insert power on each of the tap output ports. This design must provide adequate port-to-port isolation. This device also adds insertion loss to each drop.

4) Current-limiting is required for each individual port to limit current flow to only the port that is affected without disturbing the adjacent ports.

5) The physical size of the tap is greatly increased to make room for the additional circuitry. Cost and complexity are increased.

"Power output on the coax drop ... has implications that have not been fully tested."

6) Ideally, a tap design that does not interrupt through-power downstream when the cover plate is removed is needed. This prevents power interruption to downstream subscriber NIUs when a tap plate is removed to service a problem on its local ports.

7) To avoid the complexity and insertion loss of powering out each of the coax ports, additional port outputs that provide power only can be added. The RF output is fed out of the standard F-fittings and the power output is fed out of a separate connector or terminal block for connection to copper twisted-pair. This idea has some merit with RBOCs that of course have copper to the home that would be replaced by the new coax drop for provision of telephony. An operator could now use the twisted-pair as a power conductor only to the home NIU. Some operators, however, object to the notion of a hybrid system with two wires to the home to service and maintain.

In multiple dwelling unit (MDU) applications, the output current of the tap may have to be much higher to support the power consumption requirements of a multiline NIU. In an apartment building there may be a 12- or 24-line NIU device that still needs power and RF output from the tap, but the current required is higher. This same situation applies for telephony providers that do not use a customer premises device but instead use a curb-side pedestal cabinet that provides 12, 24 or more outputs. In this scenario, the internal circuit requirements are divided over the 12 or 24 lines, which reduces power consumption compared to duplication of these functions at each and every home with the NIU approach. For example, there is one ring voltage generator to serve 12 or 24 lines, one common protocol and signaling circuit, etc. With this approach, there is a coax RF output and a twisted-pair telephone output for each home. A power passing tap is still required for this type of installation but its output feeds the requirements of the 12/24-line cabinet total power requirements.

The power output on the coax drop cable has implications that have not been fully tested. The regulatory requirements are not completely clear as well.

Regulatory issues

NEC Article 725 defines circuit classes that the power active drop could be subject to if considered as a "remote control or signaling circuit":

- Class 2 circuits (inherently limited) of 0-20 volts are allowed to a volt-ampere (VA) maximum of 5 x V max. (5 x 20 = 100 VA).
- Class 2 circuits over 20 V and under 30 V are limited to 100 VA max.
- Class 2 circuits over 30 V and through 150 V are limited to 100 VA max.

The fine print reads that "for nonsinusoidal power systems (like quasi-square wave), V max. shall be not greater than 42.4 volts peak (DC equivalent). Where wet contact (immersion not included) is likely to occur, Class 3 wiring methods shall be used or V max. shall not be greater than 15 volts for sinusoidal AC: 21.2 volts peak for nonsinusoidal AC."

Current-limiting must function within 1 minute of applied short circuit. The potential interpretation is that the power passing tap could be considered the power source device with internal current-limiting and the drop would need to comply with the 100 VA maximum output into a short and a voltage limit of either 42.4 V peak or 21.2 V peak in wet locations.

NEC Article 820 covers community antenna TV and radio distribution systems. §820-2 — Energy Limitations, reads: "The coaxial cable shall be permitted to deliver *low-energy* power to equipment directly associated with the radio frequency distribution system *if the voltage is not over 60 volts* and *if the current supply is from a transformer or other device having energy-limiting characteristics.*"

Note the italicized key words that seem to contradict the previously described 1 Hz power systems. Both of

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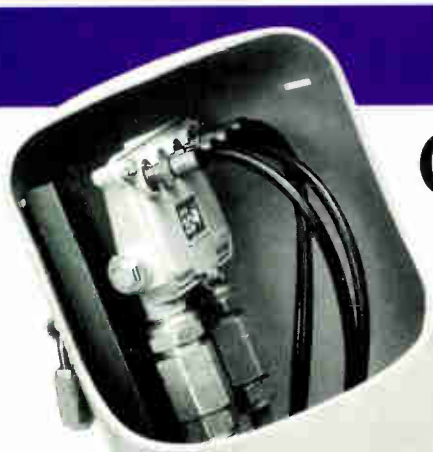

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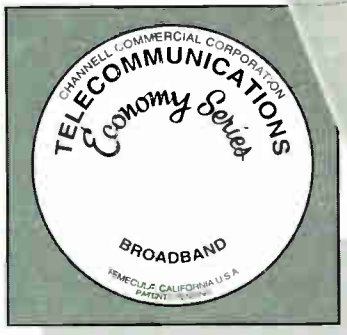

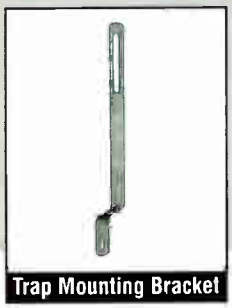
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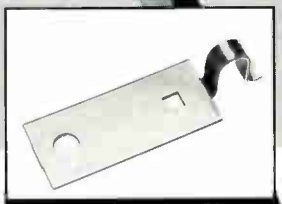
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the requirements seem to apply to the coax drop with RF and power. A potential requirement may be that the tap provide a voltage reduction from its input (which could be 60 VAC, 90 VAC, 90 V 1 Hz, etc.) to either a <42.4 V regulated DC voltage or <21.2 V regulated DC output to the home. At 42.4 V and staying within the maximum 100 VA power limitation, the maximum current allowed would be 2.358 A. At 21.2 V, the maximum current would be 4.71 A.

One implication for the power conditioning tap designer is the need for adjustability of the limiting threshold to accommodate different voltages as well as different NIU load requirements. Thermal limiting devices such as fuses, thermal circuit breakers and thermistors are affected by ambient temperature and as such their accuracy and compliance with maximum current limit is questionable over the entire temperature range that the tap will operate within. Other current-limiting circuits use active devices or hybrid approaches.

In addition to the NEC and NESC issues, Underwriters Laboratories is currently performing tests and evaluation of extension of its standards to encompass the "outside-of-the-home" distribution network. One would hope that UL would pursue this cautiously to fully understand the multitude of issues involved prior to creating standards. Typical UL focus is on fire safety, shock hazard, etc. These areas could benefit by standard requirements that all manufacturers would comply with.

Some have speculated on the corrosion effect of electrical current on the F-fittings at the tap and subscriber ends, and the dielectric effect of the connector surface junction. Oxide layers that form on the surface of the center conductor and mating surface can periodically sustain momentary discharges of voltage across this thin dielectric area. When this occurs, potential wide-spectrum arc noise could cause impulse noise interference with digital signals. Another concern is the sheath current and hum modulation impact on signals through the power-carrying drop cable. The subscriber terminal device must remove power from the drop and feed it to the input of an internal switch-mode power supply that provides the regulated voltages for the NIU circuitry, including generation of the ring voltage. This additional "reverse power inserter" adds further RF insertion loss. The RF signal must pass out of the NIU on the coax without power.

"Plant powering of subscriber terminal devices ... will be mandatory."

Some related issues to consider include: What is the reliability of the power blocking circuit in the NIU? Could it fail and feed voltage directly to the TV set, VCR or converter/tuner front end? Could sheath voltages caused by ground imbalances or neutral return current cause damage to the power passing tap output port? Could the additive effect of sheath current and center conductor current aggravate the effects of hum modulation? (All of the current carrying inductors in the tap and NIU could aggravate hum modulation conditions.)

Subscriber terminal device characteristics

The subscriber terminal function can range from a very simple interface to a complex signal processor. Potential network interface device features include:

- Ground block connection to building ground (NEC-required).
- Splitter for multiple outputs to different rooms.
- Voltage transient protector (gas discharge tube type).
- Internal power supply to provide circuit power and telephony power (-48 VDC loop power, 75-105 VAC, 20 Hz ring voltage generator) — and hopefully low voltage disconnect and restart, inrush current limit, power factor correction and soft start.
- Plain old telephone service (POTS) circuit.
- Coaxial disconnect, addressable.
- Interdiction or tiered oscillator jamming system, addressable.
- BER (bit error rate) detector for return status monitoring and loopback diagnostics.
- Return amplifier circuit, narrowband or broadband.
- Battery for backup operation.
- Input/output port for telemetry data, including 1) alarm system monitoring, 2) electrical, water, gas meter monitoring, and 3) utility load management control system.
- LAN, WAN, ISDN, ATM interface protocol options.

Conclusion

The powering requirements for HFC networks that will carry telephony and other services are significant. Not only is it important to provide reliable and redundant power at the source, but the transmission and distribution of power to active devices is crucial as well. The combination of power frequencies and RF on the same conductor and processing path requires performance and design compromises.

Reliability, safety and network performance are affected more by the power delivery system than by most other factors. Unfortunately, some projects have neglected the issue and will suffer reliability and performance penalties. Plant powering of subscriber terminal devices is a growing requirement and will be mandatory for full implementation of the information superhighway infrastructure.

Acknowledgments

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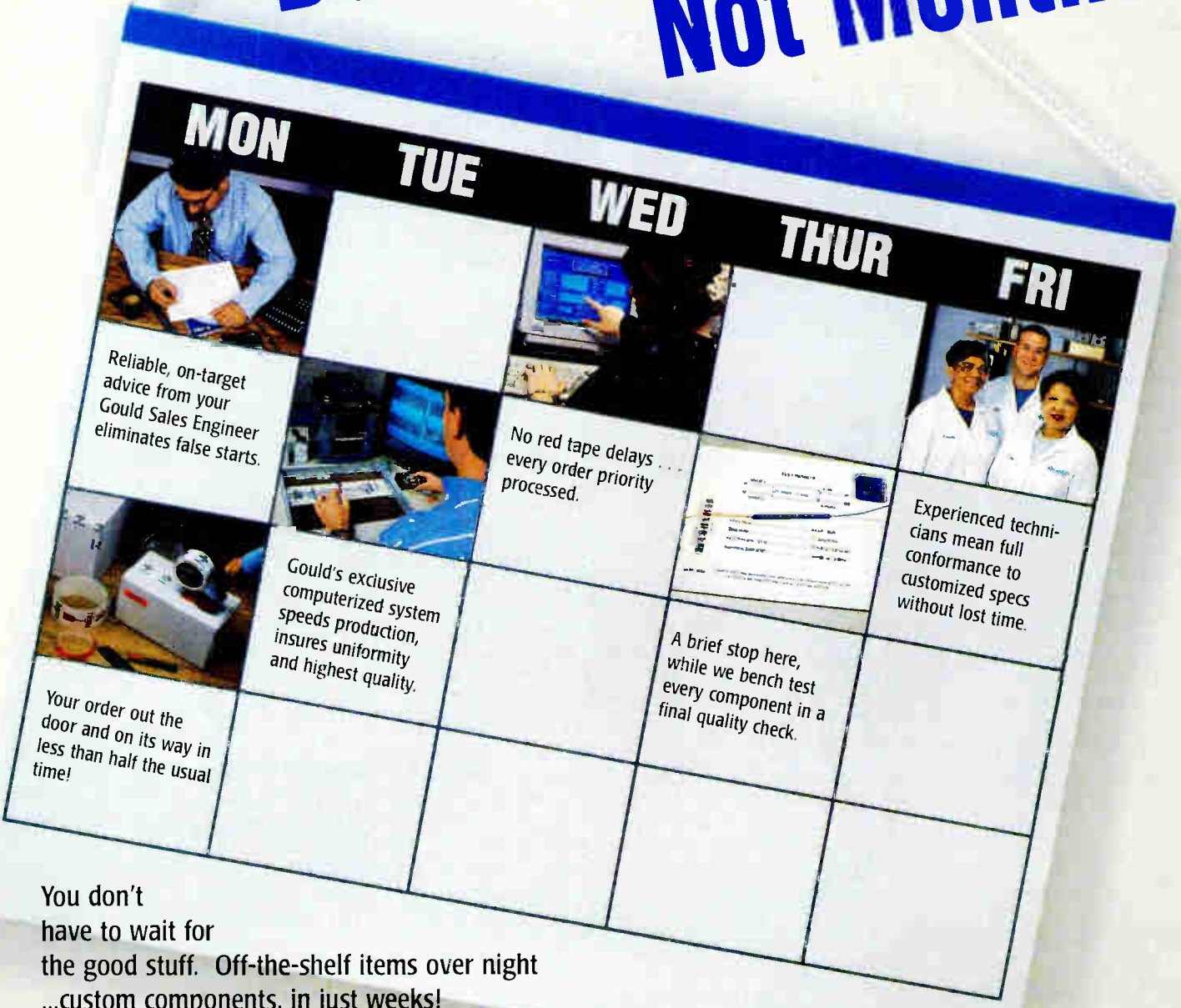

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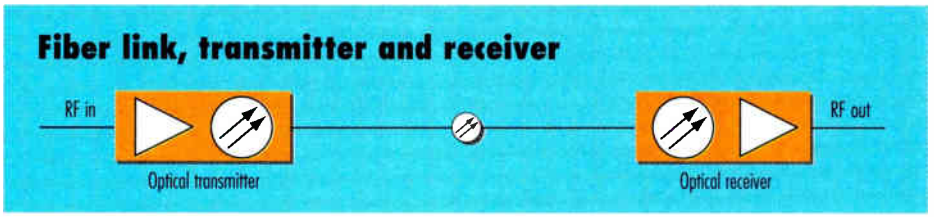
By Randy Goehler, Senior RF/Microwave Technician, Cox Cable San Diego

Fundamentals of AM optical links

With the proliferation of laser/fiber-optic technology in CATV networks, it is important for technicians to become knowledgeable with AM links. This includes understanding the fiber link, transmitter, receiver installation (see accompanying figure) and proof-of-performance of the AM link. Optical units, link loss, installing and troubleshooting the complete link will be examined in this article.



Understanding units

Understanding the units used in the laser/fiber industry will be helpful when working with AM links. Converting between power/dBm and miles/kilometers is necessary.

Decibels (dBs) and Ohm's law are familiar concepts to the CATV technician. The term dBm (decibels above or below 1 milliwatt) has been used in the communications field for years, but unlike dBmV, which is referenced to 1 millivolt across a 75 ohm impedance, dBm is referenced to 1 milliwatt of power. It is mathematically defined:

dBm = 10log(given power level/reference power)

= 10log(power/0.001)

To convert dBm to power in milliwatts, use the following equation:

$PmW = 10^{(dBm/10)}$

Table 1 shows the relationship between milliwatts and dBm. For example, a laser with an output power of 6.31 milliwatts has an output of 8 dBm. Likewise, an optical receiver having an input of 0.3 dBm has power level of 1.07 milliwatts.

The scientific community has accepted the metric system for its ease and versatility when working with numbers. It should come as no surprise to see the metric system used in the fiber industry. Conversion between miles (mi) and kilometers (km) occurs frequently. The conversion factors are:

1 mi = 1.61 km
1 km = 0.62 mi

For example, a break in the fiber displayed on an optical time domain reflectometer (OTDR) at 4.2 kilometers will be equivalent to 2.6 miles.

Optical link loss

Knowing the maximum link attenuation is important when designing AM links. Therefore, it is necessary to understand the three types of losses that comprise the link budget: fiber, splice/connector and coupler.

Fiber attenuation specifications can be attained from the manufacturer. The attenuation is given in decibels per kilometer (dB/km) at a specific wavelength. Typical losses are 0.35 dB/km at 1,310 nanometer (nm) and 0.25 dB/km at 1,550 nm.

Splice and connector loss contribute to the link budget. Typical insertion loss values for fusion splices are <0.1 dB, mechanical splices are <0.6 dB and connectors are <0.6 dB.

Maximum insertion loss for a manufacturer's couplers are given in Table 2. Additional attenuation is introduced when couplers are manufactured and the insertion loss will vary with wavelength. Check the vendor's exact losses before determining the link budget.

Table 1: dBm to milliwatt conversion

dBm	Milliwatts
12	15.85
10	10
8	6.31
6	3.98
4	2.51
2	1.58
0	1
-2	0.63
-4	0.4
-6	0.25

The losses for a typical 1,310 nm optical link is:

Coupler tap leg loss (40/60) = 4.7 dB
Fiber loss (10 km at 0.35 dB/km) = 3.5 dB
Splice loss (five fusion at 0.05 dB each) = 0.25 dB
Connector loss (two each at 0.5 dB) = 1 dB

Total link loss = 9.45 dB

Installation of the link

After the optical link is installed, verify the attenuation performance. Attenuation should be measured at both 1,310 nm and 1,550 nm. Record measurements and keep them for a permanent record. This information can be used for comparisons if any problems arise with the link in the future.

Transmitter, receiver

The most widely used AM transmitter to date uses a distributed feedback (DFB) laser. The DFB laser has been biased into its linear region for optimum performance and the input RF intensity modulates the laser. Light outputs from the transmitter are typically 4-12 milliwatts with today's technology.

The optical receiver converts light (photons) into RF (electrons) by using a PIN diode photodetector. Optical receivers are typically designed with input of 1 milliwatt (0 dBm). After the light-to-RF conversion, there is an amplifying stage. The RF is then amplified again providing a sufficient

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output level to the distribution network.

Activation

When installing optical transmitters, record their operational parameters. This includes (but is not limited to) laser power and temperature, DC and AGC voltages, and RF input levels. It is important to set the proper drive level specified by the manufacturer. The drive level, given at a specified channel loading, effects both the carrier-to-noise (C/N) and distortion performance.

At the receiver, it is important to measure and record the input optical power and the RF level at each test point. Often manufacturers will provide a DC voltage test point that will be proportional to the input optical power. This test point can be used as an alternative to using an optical power meter. The RF out of the receiver should be set to its proper operational output. The optical power and RF levels, along with pad and equalizer information, should be kept labeled in the receiver as a reference.

Verify link performance

Having installed the transmitter and receiver, verify the AM link performance. With the RF level into the transmitter and the optical power level at the receiver at the proper level, measurements should be made to verify the C/N, composite triple beat (CTB) and composite second order (CSO) performance to ensure manufacturer specifications are met. These measurements should be made following National Cable Television Association recommended practices.

The laser RF input and the receiver's optical input set the C/N and distortion performance of the link. Measure the distortions when the transmitter is fully loaded with unmodulated carriers. This will provide the worst-case distortion condition and allow for repeatable measurements. CTB will improve by 8 to 12 dB when carriers are modulated because the synchronization pulses that are at the maximum power will not occur at the same time on all channels. CSO distortion also will improve. The sweep or frequency response should be verified that it meets system specifications when the link is activated. Additionally, evaluate picture quality when the link performance is measured. This will pre-

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Reader Service Number 103

Riser Bond INSTRUMENTS

Table 2: Maximum insertion losses for couplers (1,310 nm)

Tap (low)	Tap (high)	Tap leg	Through leg
10%	90%	11.3 dB	0.9 dB
20%	80%	7.9 dB	1.4 dB
30%	70%	6 dB	2 dB
40%	60%	4.7 dB	2.8 dB
50%	50%	3.5 dB	3.5 dB

vent picture problems going unnoticed before customers are actually fed from the optical receiver.

Troubleshoot the entire AM link

Optical links usually maintain a high level of performance for years. If problems do occur, use a logical procedure to resolve them quickly.

Problems may occur at the receiver such as no RF outputs, low light, decreased C/N and distortion performance. A complete loss of RF out at the receiver is the most serious condition. Some possible causes are:

- A loss of RF into the transmitter including laser protection circuitry shutting off RF drive to the laser in some vendors' transmitters.
- Problems with the receiver including the photodiode, power supply, amplifier failure, optical connectors and backup switching.
- Transmitter failure or a break in the fiber.

A low-light condition at the receiver is an indication that the link attenuation has increased. Several factors can create this condition. Attenuation can increase at connectors because of vibration, contamination or stress. Mechanical splices also may suffer from excessive losses when not properly installed. Fiber can exceed its maximum bend radius for its operational wavelength creating macro losses. This often occurs in fiber trays where space is limited. Fiber also can suffer micro losses by placing excessive pressure on it.

Troubleshoot the link if the laser is operating properly and light is low at the receiver. An OTDR or a optical power meter and light source can be used. The OTDR has the advantage of locating and displaying faults along the fiber route. Use the following to determine problem location:

1) Measure the optical power level at the receiver with a calibrated optical power meter. If the light is low, proceed to 2.

2) Measure the power level at the transmitter. If outputs are sufficient, proceed to 3.

3) Use an OTDR to determine the attenuation performance of the optical link.

4) Clean and reset connectors at laser and receiver.

5) After locating and repairing the problem, measure optical power at the receiver.

A decreased C/N performance at the receiver will impact the end-of-line C/N performance. Generally, the C/N will decrease dB per dB as the laser drive or the optical power into the receiver decreases. Additionally, a large reduction in C/N with a small change in optical power indicates that an optical component is excessively reflective. This may occur at connector interfaces when they are not properly seated, creating a reflective air gap.

A change in distortion performance is an indication that the transmitter drive level has changed. For each 1 dB the level increases, CTB performance (carrier-to-CTB) will decrease by 2 dB at the receiver. If the transmitter is overdriven to the point where clipping occurs in the laser, the distortion performance of the link will not follow the previous rule. Distortion performances will drastically reduce in this condition. Distortions also increase as the channel loading increases to the transmitter. Excessive distortions occur at the receiver when the optical power increases to the level where the receiver saturates.

Fiber optics is currently the medium of choice to deliver NTSC AM-VSB carriers to the neighborhood. All information pertaining to the transmitter and receiver, along with the passive optical link, should be kept on file. This will assist the troubleshooting process should a problem arise in the future. Knowing how the system works and having logical troubleshooting procedures will help when repairing the system and always remember not to look for extravagant solutions to rectify simple problems. **CT**

Correction notice: In the National Show edition of *CTDailyIC* and our July issue, we mistakenly referred to Vela Research's frame-only Encoder 2000 as a decoder. The headline should have referred to the product as an MEPG-2 encoder.

Return path ingress detection

Electroline Equipment announced ClearPath, a fully automated system said to detect unwanted noise and ingress in the return path of a hybrid fiber/coax network within three seconds. The system is designed to protect hybrid networks transporting telephone and multimedia signals. One controller and software package can locate any single return path noise source automatically on a network of up to 100,000 passings.

Larger networks can be monitored in increments of at least 1 million passings by adding one additional PC-based controller and one copy of the ClearPath software. In addition to the controller, a USM-1 upstream switch module is integrated into a SuperTap housing.

The controller monitors the 5 to 40 MHz return bandwidth, sampling signals on a tap-by-tap basis. By sequentially polling each intelligent tap, the company says the location of any signal ingress can be isolated to the exact tap port.

The system allows automated and rapid isolation of ingress sources on a drop-by-drop basis in real-time. It is the first automated detection system to offer fine granularity, according to the company, with fault detection to the level of a single drop from a single tap. This will improve mean time to repair performance since technicians can be dispatched to an exact address and served by a single drop cable without wasting time in the field.

The USM-1 automated switching module, matched with the ClearPath controller and software, contains circuitry that allows remote switching of the return path signals at any single tap, through a 6 dB attenuator for several milliseconds. Each drop also can be polled for several milliseconds. By controlling the polling sequence and switching of signals through the automated attenuators, the system can determine the precise location of an ingress source.

Reader service #312

Signal level meter

Wavetek introduced two MicroStealth signal level meters designed for service technicians and installers. Both models have a durable, waterproof, high-resolution dot matrix LCD that provides ease of measurement with a scan display that shows multiple carrier levels at once and a comprehensive single-channel display.

Other key features include multichannel measurement displays and a go/no-go quick check function designed to ensure Federal Communications Commission compliance and reduce subscriber call-backs. Available with a 5 to 890 MHz frequency

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C9517-2

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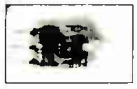
9, 12 and 15 dB

QRCA



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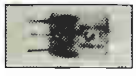

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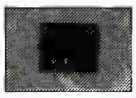

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9, 12 and 15 dB

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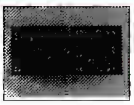

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330-450 MHz – 0-30 dB 550 MHz – 0-24 dB

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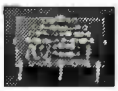

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Reader Service Number 68

sure configurations. Thus, applications that lend themselves to central, large system powering can be created out of the same basic elements that are used to power a single coax feeder. As a result, operations, status monitoring, power supply modules and interfaces can remain standardized across the entire plant, helping reduce the overall cost of plant operations and maintenance.

The company's status monitoring system is designed to work with any commercially and/or proprietary system available. Providing more than 100 different test functions and real-time data to the network manager, this system provides more monitoring capability and functional control from a remote site than any system available today, according to the company.

Because power nodes are located in varying urban and suburban locations, both the large and small system enclosures are offered in standard and low-profile configurations. These enclosures are made of durable, weather-resistant aluminum and available in standard sea foam green or a variety of environmental colors.
Reader service #310

Fiber platform

New from Photon Systems is the Series 5000, a flexible high-density modular platform for broadband fiber-optic transmission. The mainframe accommodates DFB laser transmitters, single- and dual-density optical receivers, redundant powering and status monitoring modules.

An open architecture backplane provides direct monitoring and control to any module in an attached mainframe. Connection via simple PC communication software or advanced status monitoring systems is possible. Passive thermal management ensures high reliability and minimal power consumption.
Reader service #309

Riser-rated cable

Trilogy Communications unveiled its newly developed NEC riser-rated version of it MC2 product. The CATVR-listed cable is available in 0.5-, 0.75- and 1-inch sizes and in 75 or 50 ohm impedances. The riser product line is for use in buildings for transporting video, voice and data on and between floors.

Also new is a low-cost, low-loss, plenum-rated product that does not use halogenated materials, a first for the industry, according to the company. The plenum product can be used for the same applications as the riser cables and may be installed in plenum air space.
Reader service #308

Network monitoring

AM Communications introduced its second generation monitoring system for hybrid fiber/coax TV and telecommunications networks. OmniVu includes powerful software for broadband network monitoring, analysis and regulatory compliance.

Representing a total overhaul of the company's existing software, OmniVu is a multiuser, multitasking system that runs under either Windows 95 or Windows NT.

It features the Topologer, a

schematic-based display mode that allows a user to view the status of regions, systems, headends and distribution networks. The user can quickly "drill down" into the network topology to obtain a detailed parametric reading for a single network component.

The software represents a new wave of interoperable software systems designed specifically for integrated, enterprisewide network management systems.

It is based on a documented subsystem, AM Access, an open, standards-based communications manager that allows developers and end users to interface OmniVu to operation support systems and other software applications.

The architecture accommodates third-party software developers by enabling them to interface applications with OmniVu via a documented application programmer's interface.

Reader service #306

OTDR driver program

EXFO is offering a new TSR driver program for PC-based optical time domain reflectometers (OTDRs). The FCS-200 TSR is a "terminate and stay resistant" program designed to be used with the company's FCS-200 series of PC-based OTDR cards.

The driver can control up to three OTDR cards, features a complete set of software services, and includes an OTDR trace analysis module. The card and driver combination is intended for RFTS designers, cable or component manufacturers, and lab engineers who want full control over OTDR functions and develop their own automated test applications.

The driver offers simple, direct access to the OTDR card's functions by using interrupt-based routines in the programming language of the designer's choice.

Reader service #305

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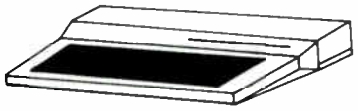

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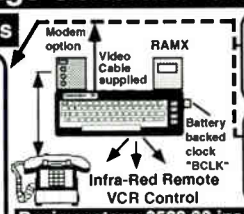

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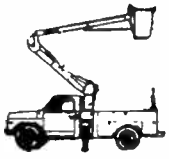
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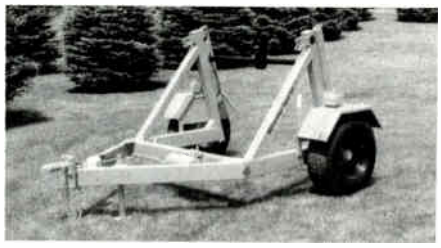

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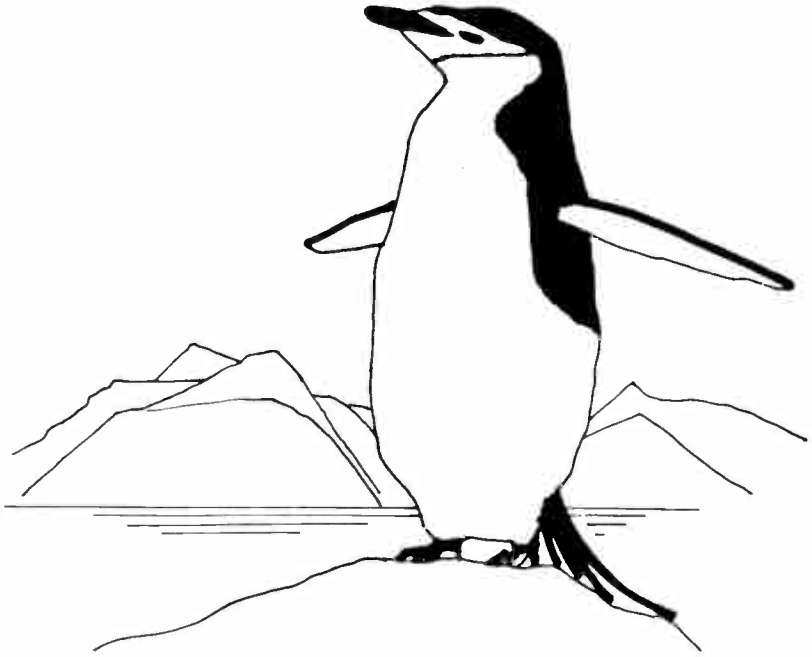

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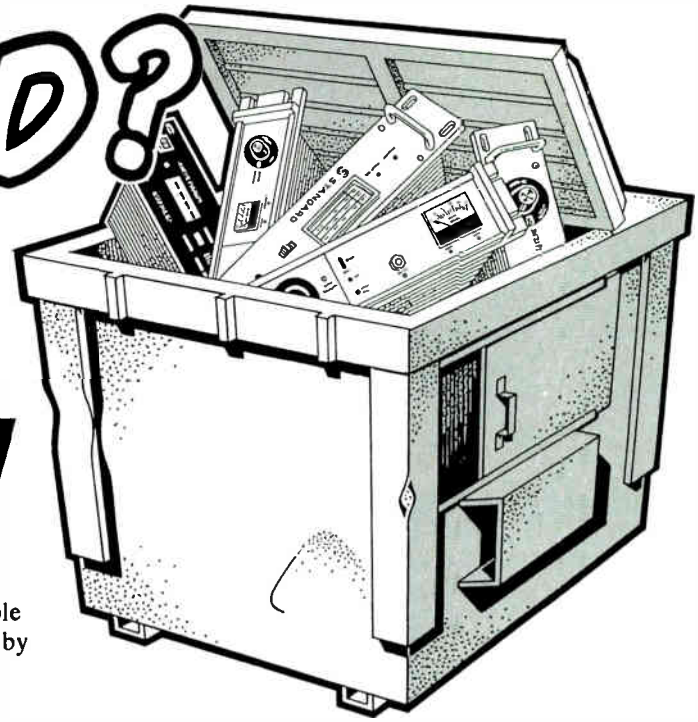

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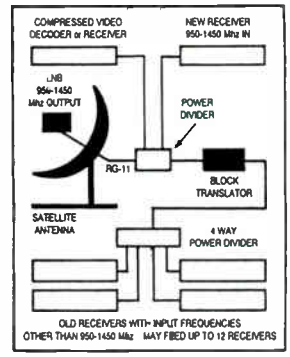

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September

1: SCTE Badger State Chapter seminar, DBS and competing technologies, EAS update, BCT/E and Installer exams to be administered, Chula Vista Resort, Wisconsin Dells, WI. Contact Brian Revak, (608) 372-2999.
8: Society of Cable Telecommunications Engineers Satellite Tele-Seminar Program, "Meeting Tomorrow's Technical Training Needs" from Cable-Tec Expo '94, to be shown on Galaxy 1R, Transponder 14, 2:30-3:30 p.m. ET. Contact SCTE national headquarters, (610) 363-6888.
10: SCTE Old Dominion Chapter seminar, BCT/E Category VII tutorial, BCT/E and Installer exams to be administered, Holiday Inn, Richmond, VA. Contact Margaret Fitzgerald, (703) 248-3400.
11: SCTE Old Dominion Chapter seminar, telephony, Holiday Inn, Richmond, VA. Contact Margaret Fitzgerald, (703) 248-3400.
11-14: Antec Fiberworks seminar, fiber-optic systems, Denver. Contact Karen Olheiser, 1-800-FIBER-ME.
12: Scientific-Atlanta training seminar, hybrid fiber/coax networks, Philadelphia. Contact Bridget Lanham, (800) 722-2009.
12: SCTE Desert Chapter seminar, digital communications, BCT/E Category VI tutorial, El Rancho, Beaumont, CA. Contact Bruce Wedeking, (909) 677-2147.
12: SCTE Southeast Texas Chapter meeting, BCT/E exams to be administered, Walden, TX. Contact Richard Grahn, (713) 579-6319.
12: SCTE Southeast Texas Chapter meeting, BCT/E exams to be administered, Houston. Contact Richard Grahn, (713) 579-6319.
12-14: Philips Mobile Training seminar, Minneapolis. Contact (800) 448-5171.
12-14: SCTE Wheat State Chapter meeting, BCT/E exams to be administered, Great Bend, KS. Contact Jim Fronk, (316) 792-2574.
12-15: Siecor seminar, fiber-optic installation, splicing, maintenance and restoration, Keller, TX. Contact (800) 743-2671.
13-14: Scientific-Atlanta training seminar, hybrid fiber/coax design, Philadelphia. Contact Bridget Lanham, (800) 722-2009.
14: SCTE Chesapeake Chapter meeting, Installer exams to be administered, Fairfax, VA. Contact Mike Nelson, (703) 313-6480.
14: SCTE Magnolia Chapter meeting, BCT/E and Installer exams to be administered, Ramada Coliseum, Jackson, MS. Contact Robert Marsh, (601) 932-3172.
16: SCTE Cactus Chapter seminar, transportation systems, Dimension Cable office, Phoenix. Contact Harold Mackey, (602) 352-5860, ext. 135.
16: SCTE Cascade Range Chapter meeting, BCT/E exams to be administered, Portland, OR. Contact Cindy Welsh, (503) 667-9390.
16: SCTE Chaparral Chapter seminar, BCT/E Category III tutorial, Sandia Preparatory School, Albuquerque, NM. Contact Bob Wiseman, (505) 761-6243.
18: Multicom seminar, design, test and installation of cable TV systems, satellite and MATV, Orlando, FL. Contact Sherman Miller, (800) 423-2594.
18-19: Antec Fiberworks seminar, broadband cable TV technology, Atlanta. Contact Karen Olheiser, 1-800-FIBER-ME.
19-20: Scientific-Atlanta training seminar, interactive broadband delivery systems, St. Louis. Contact Bridget Lanham, (800) 722-2009.
19-21: C-COR seminar, broadband communications, Hartford, CT. Contact (800) 233-2267, ext. 4422.

Planning Ahead

Oct. 10-12: Atlantic Cable Show, Atlantic City Convention Center, Atlantic City, NJ. Contact (609) 848-1000, ext. 213.
Oct. 31-Nov. 2: Private Cable & Wireless Show, Miami Beach, FL. Contact (713) 342-9826.
Nov. 29-Dec. 1: The Western Show, Anaheim, CA. Contact (510) 428-2225.
Jan. 8-10: SCTE Conference on Emerging Technologies, San Francisco. Contact (610) 363-6888.
Feb. 21-23, 1996: Texas Show '96, San Antonio Convention Center, San Antonio, TX. Contact (512) 474-2082.

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By Bill Riker, President, Society of Cable Telecommunications Engineers

Society plans another milestone in San Francisco

The new year is quickly approaching and with its coming will bring the Society's special way of ringing it in: the Annual Conference on Emerging Technologies.

Presently, planning for the 1996 conference by the Society's national headquarters staff is well underway. Our 1996 event will be held Jan. 8-10 at the Hilton on Hilton Square in San Francisco. This site is a special one in the history of SCTE, as it was the site of our first-ever meeting held on June 22, 1969. The Hilton on Hilton Square also hosted our Cable-Tec Expo in 1988. Now, we plan to return to this location for what is sure to be another milestone in the Society's 26-year history.

During our 25th anniversary celebration in 1994, the Society's national staff recounted that first meeting in 1969. The first gathering, held in conjunction with that year's National Cable Television Association convention, drew 79 people who felt the growing cable industry should have its own forum for the discussion and exchange of information on technical issues facing industry engineering personnel.

Nearly 20 years later, the Society returned to this hotel, this time for our Cable-Tec Expo '88, one of the first Expos in a string of successful conferences that has progressed to this year's record-breaking event, which has cemented its status as the industry's leading hardware show.

In 1988, Expo was starting to gain momentum as it attracted 1,300 attendees (a figure that is one-third of this year's attendee count). For that Expo, the exhibit hall was situated in a hotel ballroom, a sharp contrast to this year's huge exhibit area. It is a great testament to our growth over the years that the 1996 Conference on Emerging Technologies, which traditionally hosts a smaller attendance, will be held in the same area that once held the Expo exhibits. Considering the rapid evolution of technology and the potential impact of pending legislation, attendance at our Emerging Technology Conference is expected to steadily increase as technologies continue to merge and develop, and we expect another record-breaker in January.

For those of you who have not yet attended, the Conference on Emerging Technologies is a two-and-a-half day event comprised of intensive discussions of new technological advances expected to greatly impact the telecommunications industry in years to come. Panels comprised of the industry's leading technical authorities and engineering personnel will present scholarly papers prepared exclusively for the event and engage in lively discussion of the potential effect the topics of discussion will have on the industry in the future.

It seems only natural that this crucially important conference should be held in the historic (especially for our Society) city of San Francisco. It has always proven to be one of the most popular cities to our attendees, as it offers a variety of special attractions that can't be found anywhere else in the world. Where else could you encounter Fisherman's Wharf, Chinatown, Alcatraz, cable cars, amazing street performers, the Golden Gate Bridge and incredible seafood in one place? Nowhere but San Francisco. The city has long been recognized as a haven of cultural and artistic diversity and there is something to appeal to every taste. Its special magic, combined with its substantial place in SCTE history, make it a natural locale for this year's conference.

Call for papers

I hope you will be able to join us, as an attendee or a speaker. The Emerging Technologies '96 Program Subcommittee is currently seeking abstracts on potential technical papers that would be presented at the upcoming conference. We welcome persons knowledgeable in the technical aspects of telecommunications to propose presentations that will provide pertinent information, solutions and options. Previous conferences, including those held during the conference's original incarnation as the SCTE Annual Conference on Fiber Optics, have explored topics such as fiber optics, digital video compression, digital delivery vehicles, digital transportation, and delivery of near-video-on-demand (NVOD), video-on-demand (VOD) and multimedia services.

This year's panel discussions will provide new and useful information about the technologies that are driving and changing the telecommunications industry. Topics of discussion for the 1996 conference will include digital compression and transmission, telephony, multimedia and future technologies.

Anyone interested in making a technical presentation at the conference should contact Roberta Dainton at SCTE headquarters by calling (610) 363-6888 or via fax at (610) 363-5898. All submissions should contain an abstract of the proposed paper or presentation.

I am looking forward to the conference, and to the many technical discussions that will occur there. It is crucially important that members of the industry share information and experiences to support the building of better broadband systems around the world in the same spirit that motivated the Society's first meeting in 1969.

Events such as this conference and Cable-Tec Expo help to further our knowledge about the constantly changing telecommunications field, new types of equipment and their uses, different methods of video and telephony delivery and the effectiveness and potential downfalls of these methods.

The tremendous support of our membership has resulted in the growth that SCTE has enjoyed over the course of its history. I'd like to personally thank the membership for their ideas and support. I expect the 1996 Conference on Emerging Technologies to be a well-attended and highly successful event, the latest in a series of milestones to occur in that "little city by the bay." **CT**

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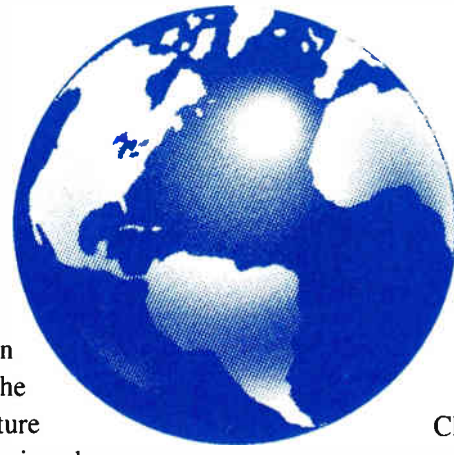

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From this big picture perspective, we offer you a simple network solution. This is what has made the Cheetah System a standard around the world. From the Pacific Rim to Europe and North America, the Cheetah System has been selected to monitor the world's broadband networks.

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