CED

THE MAGAZINE OF BROADBAND TECHNOLOGY / JUNE 1990

Outdoor addressability: Has the puzzle finally been solved?

—page 41

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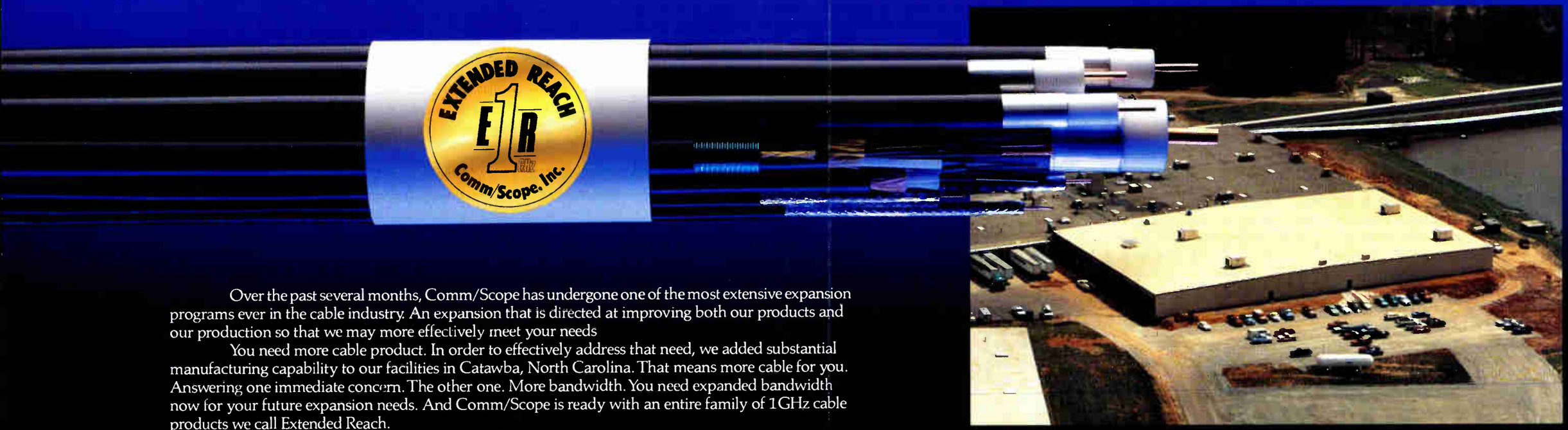

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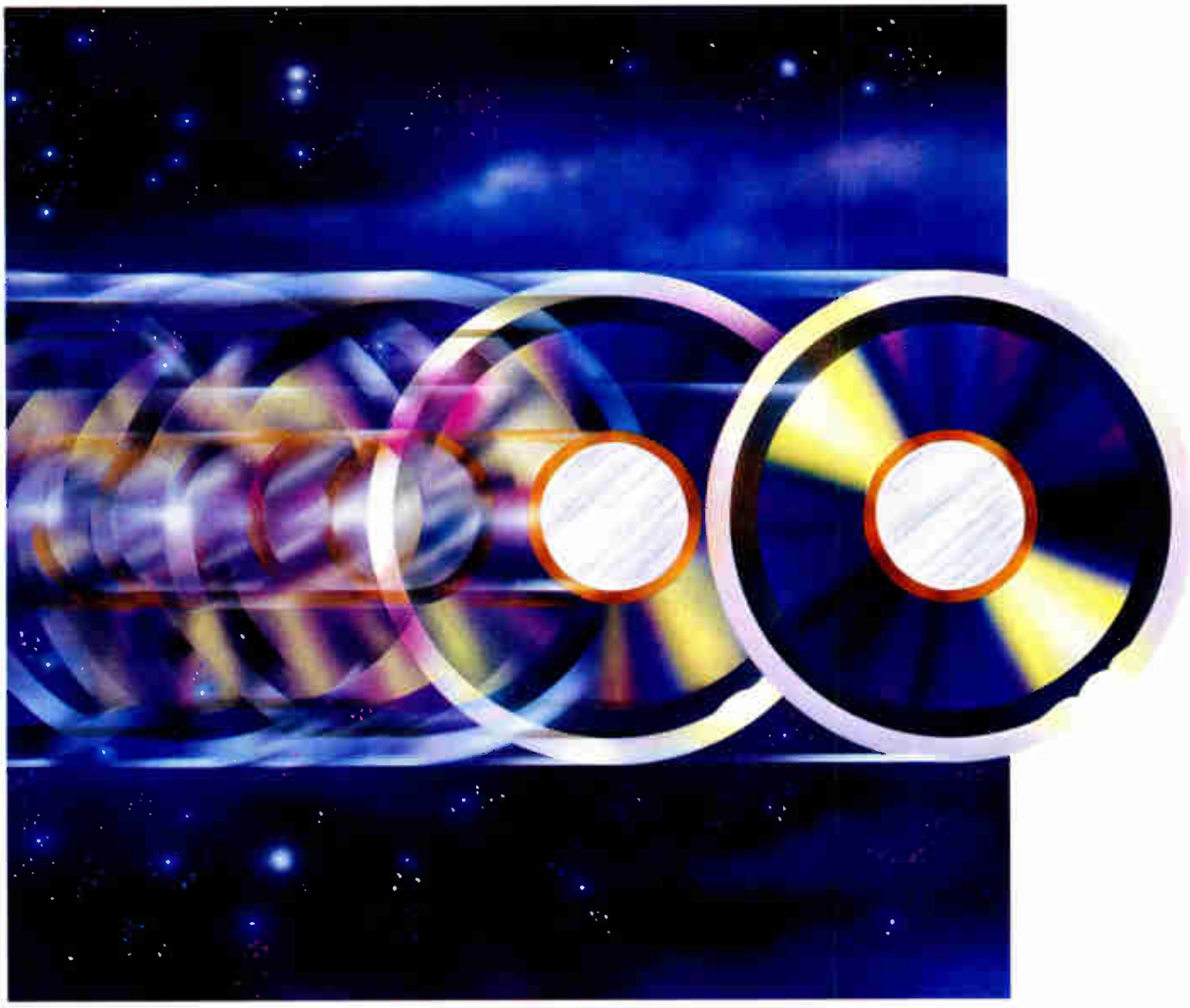

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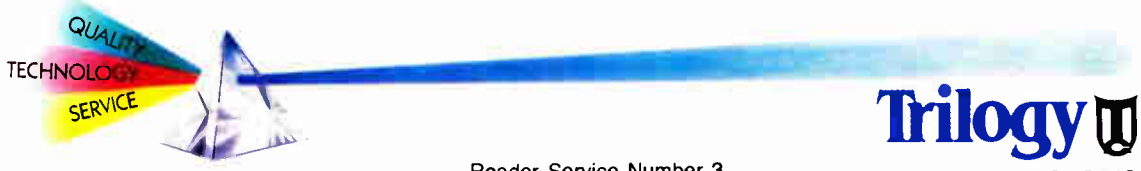

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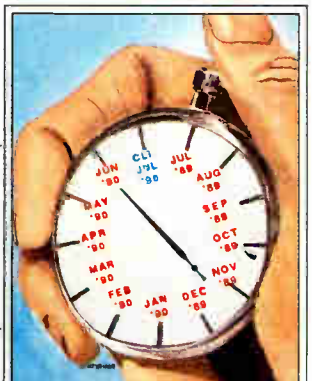
June 1990 CED Volume 16, Number 7

About the Cover: *The cable industry has been puzzling over the economics and reliability of interdiction technology for years. New products spur new interest. Photo from The Image Bank.*

CLI COMPLIANCE



An analytical look at CLI. *See page 122.*

DEPARTMENTS

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PUBLISHER'S LETTER

In your hand, you hold one of the most successful issues in *CED*'s history. It's also our SCTE Cable-Tec Expo issue and I thought now would be an appropriate time to mention several items related to the Expo and the Society. Starting on page 71 you will find a map of the convention hall and a special section featuring descriptions of products being displayed on the floor. We hope you find this helpful as you plan your visit to Nashville.

If you are unable to attend the Expo, you will be glad to know that the *CED* staff will be covering the show for an editorial wrap-up to be featured in July's issue.

Covering the news and events of the SCTE is something *CED* has long been committed to. For example, every month you will find an extensive calendar of upcoming technical seminars sponsored by the Society's various chapters and meeting groups. And, from those seminars come many outstanding technical presentations, which *CED* reprints each month in our "SCTE Focus" section.

As you know, the SCTE organization has grown dramatically in the last few years. With membership in excess of 6,400, you will be glad to know that there is a reference source that lists all active members. Hopefully, you have already seen it, but if not, the 1990 SCTE Membership Directory and Yearbook is not to be missed. It not only lists all current members, but a wealth of information on the organization. *CED* was proud to publish this year's Directory and I trust you will find it useful.

You will notice something new this month when you look at the display advertisers. It's called FAX RESPONSE and it's designed to give you product information faster than ever before.

On selected ads, you will find an 800 number and an advertiser ID code. If you would like additional information on the products or services featured, simply dial the toll-free number and follow the series of audio prompts. Within minutes, you will receive a fax sheet on the product you are interested in. Please keep in mind that this is a trial program so not all ads have this feature. Try using the FAX RESPONSE and then give us your impression.

In this month's issue you will notice some new names and recognize others. Managing Editor Kathy Berlin will be leaving *CED* full time to pursue personal interests, but her excellent writing will continue to appear on a regular basis. Kathy has been an integral part of our team—join us in wishing her the best. I'm proud to welcome Leslie Miller as our new Managing Editor. Leslie comes to us from Telecommunication Products Corp., where she served as technical administrator. She brings the kind of talent you have come to expect from *CED*.

I also welcome Dr. Jeffrey Krauss to our list of monthly columnists. Krauss is a telecommunications policy consultant and is actively involved in the CATV industry. A former assistant chief of the FCC office of plans and policy, Krauss will now pen the "Capital Currents" column.

CED is also honored to welcome back one of the industry's most respected engineers as a regular contributor. Cable pioneer Archer Taylor, senior V.P. of engineering at Malarkey-Taylor Associates, rejoins *CED* this month with his always-interesting commentary. Welcome home, Archer.

Rob Stuehrk
Associate Publisher

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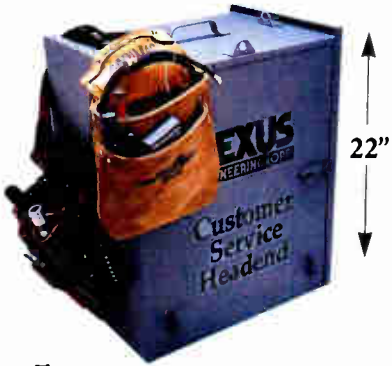

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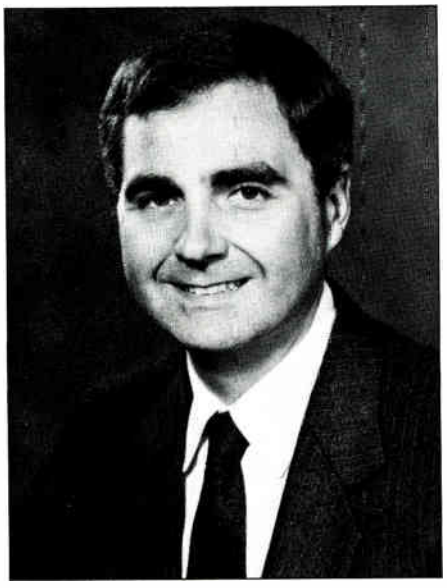

Ned L. Mountain

Singing a different tune

With interest in audio quality surging (and a primary focus of consumer electronic manufacturers), the National Cable Television Association's engineering committee decided to create a new subcommittee on Quality Audio for Cable Television. Spearheading this effort as chairman is Ned Mountain, vice president of marketing for Wegener Communications Inc., a cable veteran whose first concentrated effort in the industry was audio.

"What I really hope to contribute," says Mountain, "is quantifying some of the elusive audio problems that we as an industry have. The very least I want to see happen is the adoption of methods and procedures for standardizing audio within our industry once and for all. And at the very best, we need to find ways to capitalize on the new breed of consumer products that are going to hit the marketplace with regard to Surround Sound and other things. The consumer is going to expect and we, as an industry, will have to deliver and deliver well."

A high school job

Delivering to consumers is a key element of Mountain's career. His first technical job began 25 years ago as a broadcast technician for WJAC-TV in Johnstown, Pennsylvania. The job, working summers during high school, evolved into a college position that enabled Mountain to pay for his bachelor's degree in engineering.

After his 1971 graduation from the University of Pittsburgh, Mountain worked for the phone company in Chicago for nine months doing "busy work, lots of paperwork" before taking a job with Motorola Communications and Electronics Inc. as a systems engineer in Cleveland, Ohio. Mountain stayed with Motorola for eight years "learning real-world applications of technology," he says.

But Mountain learned even more at Motorola. It was there that Mountain got his first taste of cable television while designing systems for communications in coal mines in Pennsylvania and Virginia. "It turned out the most logical technology to use was CATV," says Mountain. "We put the communication systems in—television systems underground to watch conveyor belts—because if the conveyor belt broke a mile underground, you had a big problem."

It was this involvement with coaxial networks that got Mountain to his first NCTA convention in 1975. "That's really when I made the decision that there was another career path that potentially was as much fun, probably more fun because of all the things going on with communications in general," says Mountain. However, after making the decision, Mountain found it extremely hard to break into the cable industry. "Nobody wanted to talk to a guy with an engineering degree without pole climbing experience. It was very frustrating."

Regardless, Mountain eventually was hired as corporate senior engineer for new technologies for United Artists Columbia Cablevision Inc. in 1979. Mountain's main responsibility at the San Antonio, Texas, system was to look after new services in a time when the cable industry was going through its "blue sky" era.

It was also when Mountain began his involvement in audio. "I got involved with all aspects of delivering audio services on cable and investigated some of the reasons why quality wasn't as good as it should be in regards to FM stereo on cable and things like that.

It was this interest in audio and a new technology by Wegener Communications Inc. in 1981 that led to Mountain's involvement with the company to test a new product. At the same time, the company was starting to grow, needed someone "intimately involved with the cable industry, especially in audio and it made perfect sense" says Mountain of his new position with Wegener as the marketing manager.

Mountain joined Wegener the day that MTV launched. "I remember arriving in Atlanta, and going to an MTV launch party at the Wegener plant," muses Mountain. "I'll never forget that day. I was right in the middle of all the things I loved to do: cable, audio and just having a good time."

Moving to marketing

Although he was a little nervous about moving from engineering to marketing, Mountain felt his eight years with Motorola had always been associated more with salespeople than with engineers, so "I sort of understood what I was getting into," says Mountain. "I felt comfortable knowing that selling in the cable industry, to do it properly, requires a technical background."

And his technical background helped in other ways. Prior to his commitment to the quality audio subcommittee, Mountain served as chairman for the subcommittee for advanced signalling and control. Mountain has also presented numerous technical papers at the NCTA conventions, on the subject of audio quality over cable.

According to Mountain, the industry's future will be full of competitors. "There's still a lot of good things cable can do better than direct broadcast satellites (DBS) and that's provide a better overall service—including local broadcast and satellite delivered service," says Mountain. "I think the potential for pictures and audio to get better is greater than it has been—just because the delivery technologies are improving all the time."

And for someone who has focused a lot of attention on the audio aspect of cable, that competitiveness means "the need for a lot of new and different products to take care of the problems that are here now, and problems that are about to occur. I would hope that personally," says Mountain, "I would have a role in defining products that the industry needs and helping get them to market, which would help everybody."

For an industry that's focused on providing better quality pictures, Mountain's wish may indeed be "music to the ears" of cable television subscribers everywhere. ■

—Kathy Berlin

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Reader Service Number 9

Feeding the passion

In recent years I have found myself, like a lot of other engineering professionals, being invited to meetings by cable system management groups and programming supplier management groups to discuss technology. These discussions center on what technology is, where it is going, what the groups can look forward to in the future, and how they can begin to learn about possibilities or problems that are techno-management driven.

Occasionally, I am accused of being an engineer who wants to be a marketer, salesman, system manager, personnel director, or any of a number of other personnel title. But more importantly—while these accusations come with a great deal of implied humor and are often tongue-in-cheek—what almost invariably follows is that other engineers in the industry, who have spoken to different groups, have laughingly been accused of the same trespasses.

Pleading guilty

Well, I am here to tell you that I plead guilty. I think engineers should not just engineer and technologists should not just beaver away in their labs. Everyone has a duty to think about all aspects of their business. And while I am not an expert in marketing or human resources in any way, I think that any ideas I have in that genre should be considered for whatever they are worth.

I mention this because of the feelings I usually have when I leave these managers' meetings. I leave with feelings of great respect, and indeed hope, for the future of the cable television industry. That feeling is engendered by the number of creative ideas and solutions to industry problems that I hear bandied about and discussed at these meetings, in both formal sessions and informal conversations at coffee breaks, which show me that a lot of very intelligent people are committed to and interested in making cable television successful now and in the future.

The ideas run the gamut of management techniques and marketing techniques. While one person is speaking about an idea for improving, for instance, employee productivity in installs, you can see literally dozens of fellow managers taking careful notes and asking extremely pertinent and probing questions. These questions lead to a discussion of how best to understand an idea like this and how it can be implemented in their system.

It is hard to appreciate, from the corporate level, how close and how sensitive the local system people can be to their communities.

The same is true of the marketing managers who engage in discussions with their peers about concepts that will help to increase the penetration in their systems. There also invariably is a keen understanding of how these decisions affect customers in a community.

It is hard to appreciate, from the corporate level, how close and how sensitive the local system people can be to their communities. More than once I have sat in amazement as different managers in an overall management meeting argue a case from their subscribers' point of view for change in corporate policy. Time and again I have seen corporate leaders do their own version of note-taking as they seek to understand whether or not their policy is in conflict with the ability of the local cable system to satisfy its customers. And time and again I have subsequently seen changes made that reflect the very discussions that I had recently witnessed.

Committed to customers

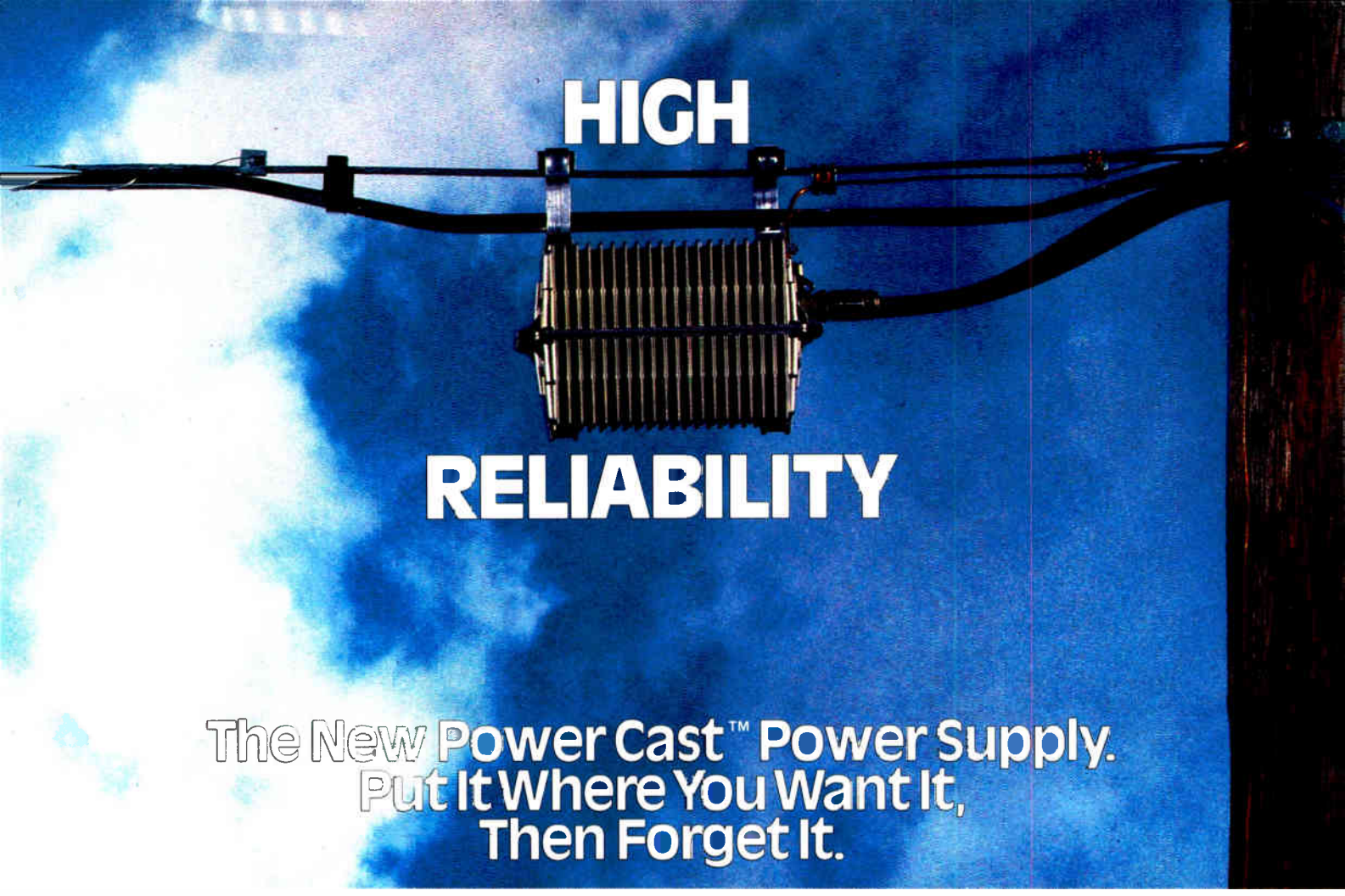
This indicates to me that this industry is filled with people at the local level who understand the delicate balance between providing service, via cable programming, to a community while making it a going business. I have long believed that nothing is as powerful a statement for change in a system as one or two people passionately committed to improvement of the product and service delivered to the customers. People with this passion can infect an entire operation with their enthusiasm. That passion and enthusiasm multiplied over the typical workforce will allow projects to be accomplished in a way that obviously benefits the dual goals of providing good customer service and running a profitable business.

The engineers can have a piece of this action as well. At the NCTA Engineering Committee meetings, cable engineers, equipment suppliers and program engineers frequently argue back and forth about problems and their possible solutions. What can be detected and understood after listening to hours of these comments and debates is that the engineers (at least at the corporate level) care deeply about the right way to satisfy customers along with the impact it can have on the cable system as a viable entity.

The question I have, and the point of this column is: What do we need to do to raise the level of enthusiasm at every local system—those who go into our customers' homes, do the construction, answer the phones, and indeed the people who run the administrative side of the business as well, who pay our employees' benefits and do the paperwork?

If each and every department manager takes the time to recognize the germ of enthusiasm, the glint of passion, in their staffs and crews and finds a way to nurture that from the bottom up, and from the middle up and down, and from the top down, our work force will be motivated to make the cable television business as successful in the future as it has been to date. ■

By Wendell Bailey, Vice President Science & Technology, NCTA



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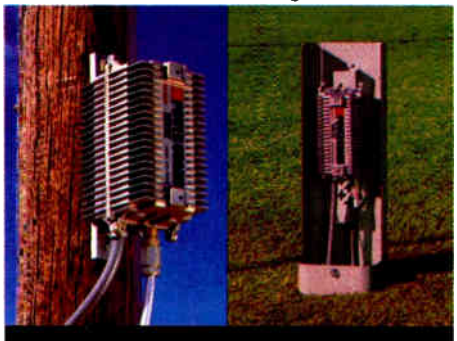

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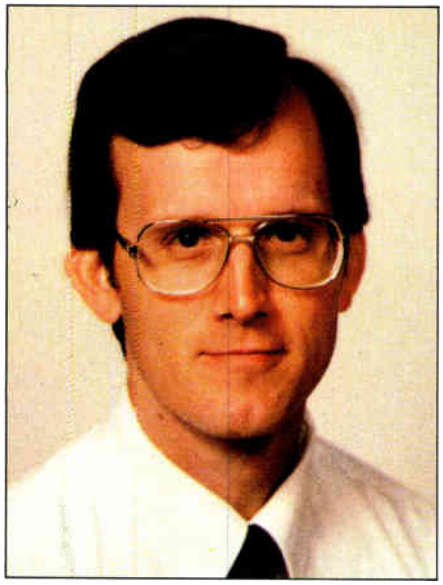


Occupied FM bandwidth

A topic of conversation recently has been the relationship between a satellite receiver's IF bandwidth vs. the occupied FM bandwidth of the video and audio subcarrier information actually transmitted over the satellite. Some have expressed concern, for example, over the trend to narrower IF filters in the earthstation receiver.

Carson's Rule defines the bandwidth of an FM signal as: $BW = 2(f_d + f_m)$ where f_d is the deviation of the carrier and f_m is the highest modulating frequency.

In words, the bandwidth of the FM signal over the satellite is dependent upon several factors, including:

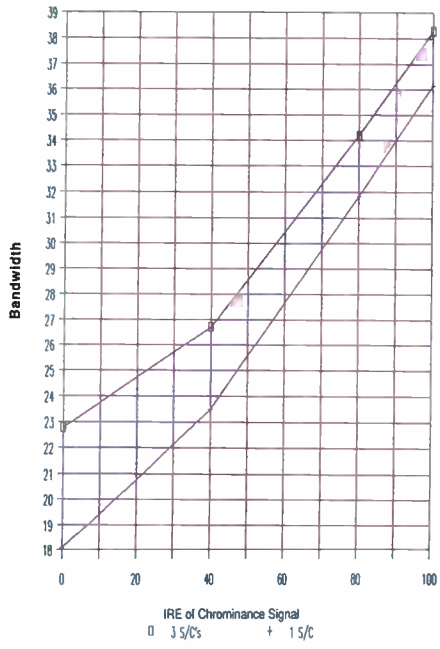
The deviation of the main carrier caused by the baseband video information; The deviation of the main carrier caused by each of the audio subcarriers (if any exist); The highest instantaneous modulating frequency.

For NTSC, the deviation of the main carrier by the baseband video information is usually defined as being 10.75 MHz *peak* for 1 volt peak-to-peak input at 761.6 kHz. Why such an unusual frequency? Remember that prior to modulation, the baseband video signal is preemphasized. As a result, sync and much of the low-frequency video information is attenuated by about 10 dB prior to modulation. The chroma subcarrier, on the other hand, is emphasized by about 3.2 dB.

The peak deviation of the main carrier is therefore defined to occur at the unity-gain crossover point for the preemphasis network of 761.6 kHz. This is the frequency at which the preemphasis network is transparent. Note also, that it is the higher frequency information in the video baseband signal, not sync, that creates the largest amount of deviation to the main carrier (especially with preemphasis).

Therefore, with NTSC, the amplitude of the color subcarrier at 3.58 MHz will determine the ultimate instantaneous deviation of the main carrier due to video.

The composite deviation of the main carrier by each of the audio subcarriers is dependent upon the number of audio subcarriers present as well as the frequency of each of the subcarriers. The more subcarriers, the higher the composite deviation of the main carrier. Likewise, the higher the individual subcarrier frequencies, the higher the composite deviation of the main carrier.



As defined in Part 3 of the *NCTA Recommended Practices*, the *total* or *composite* deviation of the main carrier by the video baseband information plus each of the audio subcarriers and energy dispersal waveform can be found by:

$$f_d = ((f_1)^2 + (f_2)^2 + (f_3)^2 + (f_n)^2)^{1/2}$$

where:

f_d = total deviation of the main carrier

f_n = deviation of the main carrier by the nth subcarrier

If, for example, we use 10.75 MHz peak deviation for video (at 761.6 kHz), 1 MHz deviation for energy dispersal, and 2 MHz deviation for one 6.8 MHz subcarrier (modulation index = 0.294), then the total composite deviation of the main carrier will be:

$$f_d = (10.75^2 + 1^2 + 2^2)^{1/2}$$
$$= 10.98 \text{ MHz}$$

Now that we know the composite deviation of the main subcarrier, we only need to determine the highest instantaneous modulating frequency (f_m) so that we may apply Carson's Rule in determining the transmission bandwidth of the FM signal. The highest instantaneous modulating frequency is equal to the sum of the highest subcarrier frequency (6.8 MHz in this case) and its deviation caused by the information it is carrying.

Therefore, the total occupied bandwidth of this signal, assuming full deviation of the main carrier by video information (high color saturation) would be:

$$BW = 2(10.98 + 7.04) = 36.04 \text{ MHz}$$

Visualizing the concept

To help visualize the relationship between the number of subcarriers, the amplitude of the chrominance signal and the occupied bandwidth of the FM system, a spreadsheet was developed, from which the graph of Figure 1 was constructed[1]. It plots occupied bandwidth vs. the amplitude of the chrominance signal (in IRE) for a one-and a three-subcarrier system.

Note that for "average" levels of chrominance saturation (40 IRE and below) the occupied bandwidth of the signal, even with three subcarriers, stays below 27 MHz. On the other hand, a signal containing high levels of color saturation (such as 100 IRE) with only one 6.8 MHz subcarrier has an occupied bandwidth of just over 36 MHz. This agrees with the calculations performed above. The bottom line here is that for average programming, relatively narrow IF filters seem to do the trick. However, at high color saturation levels, a receiver's narrow IF filter will begin to truncate the video on modulation peaks, possibly causing threshold to occur, and "sparklies" to appear in highly saturated areas of the video. ■

By Chris Bowick, Vice President Engineering for Headend Equipment, Scientific-Atlanta Inc.

Will you be ready for the big picture?

Someday soon, a few demanding subscribers will pull up a chair, turn on their HDTV, and put your system to the test.

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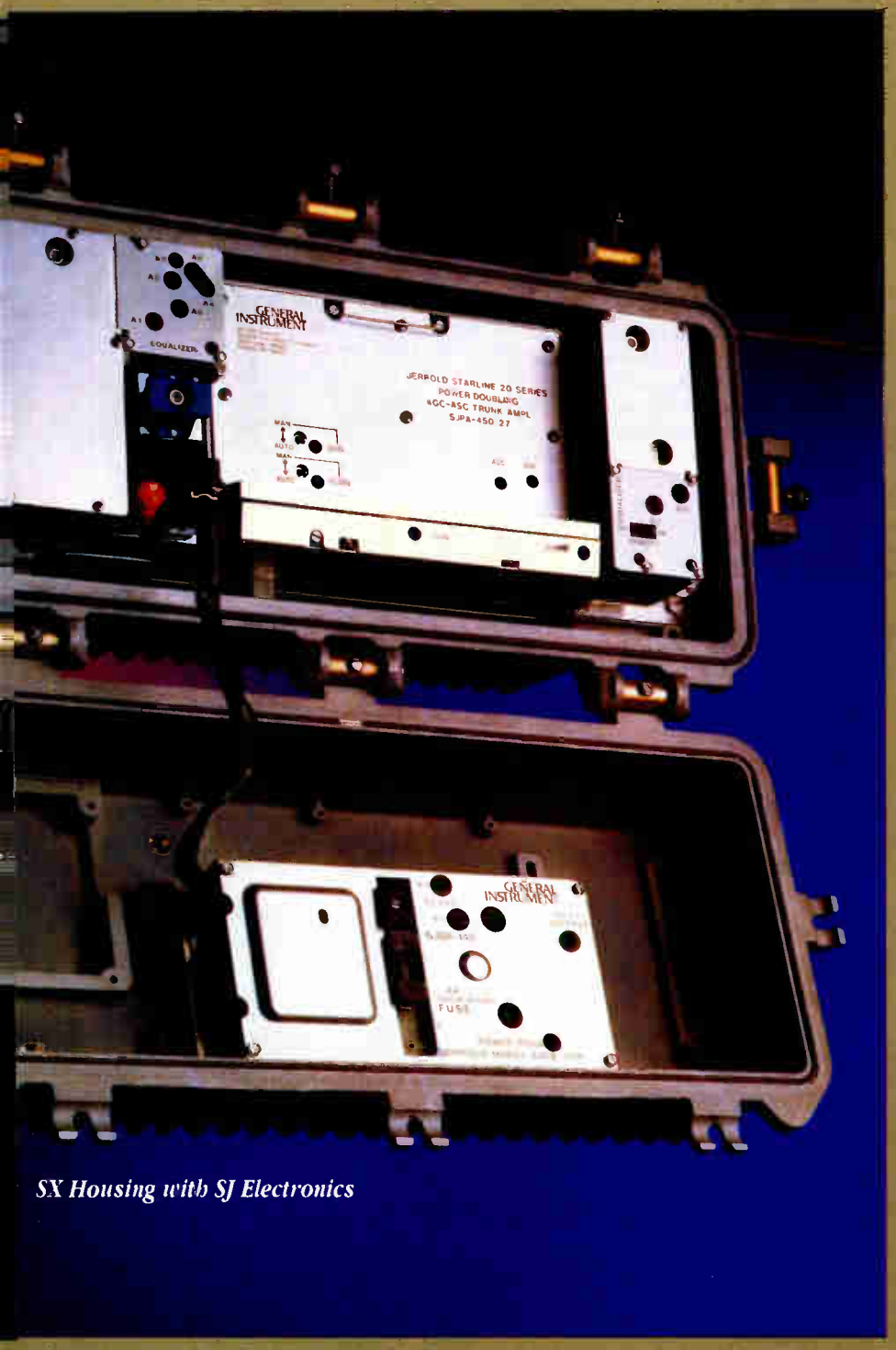

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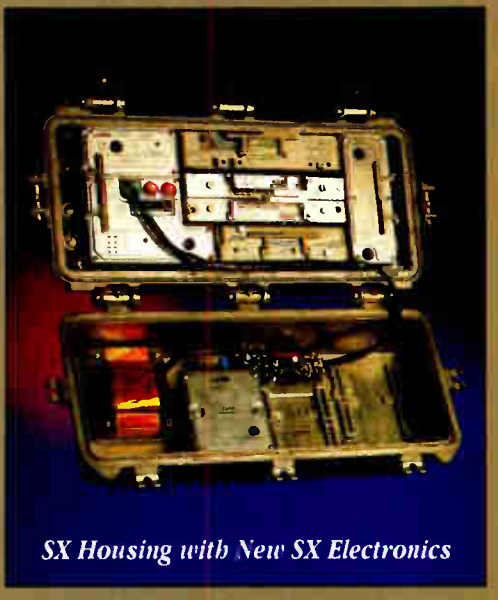

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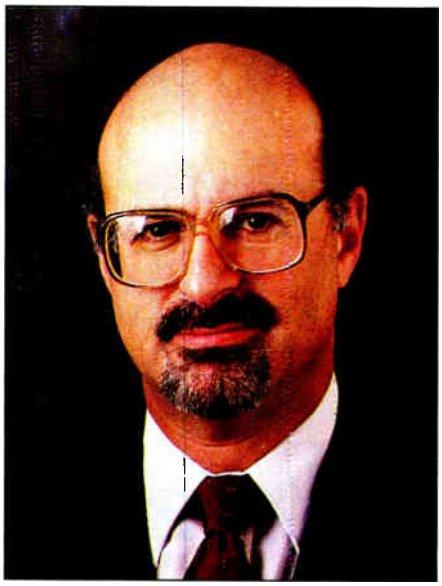

Access to name-brand programming

Coca-Cola and Heinz Ketchup are name brands. So are Home Box Office, ESPN and Nickelodeon. These programming services each have some unique features that make them desirable to consumers and valuable to cable operators.

A supermarket might have a hard time attracting customers if it were not allowed to carry Coca-Cola or Heinz Ketchup. And cable's competitors are now arguing that they have a hard time attracting subscribers because they cannot get access to certain name-brand programming services.

In particular, "wireless cable" (MMDS) and "private cable" (SMATV) operators have testified both in Congress and at the FCC that the cable TV industry is abusing its monopoly power by denying them access to name-brand programming, or by charging them higher prices than cable systems must pay. They argue that most of the name-brand programming services are owned by cable MSOs, and the cable MSOs are intentionally denying programming to MMDS and SMATV competitors.

Home dish demands. The controversy extends to the home dish market, where there are demands for "third-party packaging" of programming services, by entities that are independent of the cable industry. A third-party packager would be a middleman who provides home dish consumers with a multi-channel package of programming services at a price lower than the sum of the individual prices. A number of the satellite programmers have done their own packaging of multiple channels, however, and they argue that there is no need for an independent third party to replicate their offerings.

DBS demands. Sky Cable has not announced its program plans, but clearly Sky Cable recognizes the value of name-brand programming. In the current FCC Docket No. 89-600 proceeding on competition in the cable industry, two of the Sky Cable partners have asked for access to name-brand programming.

Rupert Murdoch's News Corp. said that in order to be successful, Sky Cable must have fair access to established quality programming services, on the same terms as established cable operators. Hughes Communications Galaxy said that availability of quality programming is critical to attracting the necessary investment for a DBS system, and that the FCC should prevent abuses by the cable industry that might result in restricted access to programming.

PacWest antitrust lawsuit. Pacific West Cable Co. has just filed a $25 million lawsuit against Turner Broadcasting System because TBS is threatening to shut off PacWest's access to Turner Network Television. PacWest operates both a cable system and a wireless cable system in Sacramento.

The Turner policy is to sell TNT only to cable systems. Turner argues that TNT has a higher value if it is distributed exclusively by cable operators, rather than by a wider group of distributors.

Court decisions on exclusivity

It may seem unfair for a manufacturer or supplier to refuse to deal with a distributor, but it is perfectly legal. In fact, courts have decided that exclusive distribution arrangements can bring benefits to the public.

In a 1976 case, the Supreme Court decided that GTE Sylvania, which at that time was a TV-set manufacturer, was perfectly justified in selling Sylvania TV sets through a limited group of franchised dealers. Even though this might limit competition in the sales of Sylvania TV sets, the court said that it would increase competition between Sylvania and other brands.

Exclusive distribution arrangements are needed to induce retailers to advertise aggressively and to invest in service and repair facilities. In a purely competitive market with both "full service" and "discount" retailers, the discounters might be "free riders" and these services might not be provided at all.

The FCC decided in 1988 to reinstitute syndicated exclusivity for broadcast programming. The FCC said that syndex would benefit the public because it would reduce duplication of available programming and open up "shelf space" on cable systems for a wider variety of programming. The exclusive rights to carry a syndicated program would make that program more valuable to the TV station that carries it, and TV stations should be willing to pay more for exclusive rights.

Prospect for changes

The FCC probably does not have the legal authority to force cable programmers to sell to all distributors. Even if it had authority, based on its syndex policy, it seems unlikely that the FCC would want to require cable programmers to make their programming available to MMDS and SMATV operators. Exactly the same arguments that justify syndex would appear to justify exclusive distribution contracts for name brand cable programming.

The FCC is concerned, however, about discriminatory pricing. The FCC has already found that there is a substantial wholesale price difference between programming prices offered to cable systems compared with prices offered to MMDS, SMATV and home dish packagers. It remains to be seen whether the FCC will try to force the programmers to justify or eliminate the price differences.

This controversy will be played out in the Congress. The Congress seems to be looking for ways to stimulate more competition with cable TV. Mandated access to programming for wireless cable and private cable might be one element of a legislative package. It is certainly on the minds of key legislators, including Senator Al Gore and Congressman William Tauzin. The entire video distribution industry is participating in this process, and it is too early to say what will finally happen. ■

By Jeffrey Krauss, Independent Telecommunications Policy Consultant and President of Telecommunications and Technology Policy of Rockville, Md.

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Reader Service Number 16

Video compression: gift or menace?

The recently announced plan of a group of companies to launch the Sky Cable DBS service has raised considerable interest within the cable television industry. Sky Cable, which is scheduled for launch in the mid-90s, is to be a 108 channel service delivered by three co-located, high-powered DBS satellites. Each satellite is to have nine transponders, and video is to be delivered in digital, compressed, multiplexed form, four channels per transponder. The high transmit power of these satellites is to allow the use of small dishes or flat panel antennas. No positioning will be required since all the transmissions included in this service will come from the same point in space.

It is natural that many cable operators see Sky Cable as a competitive threat, and indeed it has the potential to be one. One response of the cable industry has, however, been to deny that Sky Cable can happen for technical reasons. While there are formidable hurdles ahead of Sky Cable, its technical claims are not beyond the realm of the possible.

Sky Cable is at least a billion dollar gamble, but its backers include some of the largest corporations in America. There are challenges to the venture in terms of launch vehicle availability, transmit power, the battery life required to get such powerful satellites through the night, and the feasibility of building terminal equipment, including digital demultiplexing, at a cost low enough to make the service attractive to subscribers. Nevertheless, it is highly likely that the cable industry will have competitors (or cooperators) who use DBS with digital video transmission and compression in this way. It is not possible to predict when a viable, high-power DBS service will actually be launched, but at least one such service is almost certain to arrive during this decade.

By Jim Chiddix, Sr. Vice President, Technology and Engineering, ATC

Challenging the cable industry

The cable industry's response is clear. Increasing competition will require us to continue to improve customer service, and our ability *to communicate our product* more clearly to our subscribers. It will require more channel capacity for even greater diversity. Fiber technology will help in this regard, but many of the challenges facing us are operational. We are in an excellent competitive position as the incumbent video provider, and if we continue to invest in our business and to refine the service and product which we give to our subscribers, we face a bright future.

What is more, new technologies are always double-edged swords—technologies which are of use to potential competitors can be useful to us as well. This is certainly true of optical fiber technology, which we have every prospect of utilizing for video delivery long before telephone companies build fiber to the home. It is also true of compressed digital video. It is worth a quick review of how digital video can be compressed in order to understand ways in which we may use it within our own networks.

NTSC video is usually converted to digital form in a brute force fashion. This involves point-by-point examination and conversion of the video waveform. In eight-bit encoding, each sample of the video waveform is represented by one of 256 possible levels. Nine-bit encoding yields 512 levels. If these samples are taken often enough, generally three times the color subcarrier frequency or about 10 MHz, all the information within the video waveform will be effectively captured, including the color subcarrier, synchronizing pulses, luminance, etc.

There is some "quantizing" noise inherent in this process, which results from the waveform sometimes falling between the 256 or 512 discrete encoding levels, but it is generally not objectionable. The result is a binary digital data stream of approximately 100 megabits per second.

Using binary coding, at least 50 MHz is required in order to carry 100 megabits. Thus, digital transmission of signals encoded in this way is terribly spectrum inefficient, and is certainly not feasible for cable television transmission or, realistically, for satellite transmission.

There are, however, compression techniques which allow substantially the same information to be carried in far fewer bits. In order to compress the number of bits, it is necessary to discard redundant information, and to reconstruct the full picture at the receiving end.

Redundant information within a frame of video consists of uniform or identical picture areas (a flat area of blue sky, etc.). These areas can be mathematically represented much more efficiently than each of their individual elements, allowing compression. In addition, in most program material there is very little change from one frame to the next until there is a dramatic scene change or redirection of camera angle. In addition, in most program material there is very little change from one frame to the next until there is a dramatic scene change or redirection of camera angle. In such cases, only those things that change need be transmitted, resulting in the discarding of substantial redundant information.

Predictable information

In addition to redundant information, there is predictable information. Objects within a picture which are in motion will appear in nearly the same position in subsequent frames. Their motion can be described efficiently, and a good guess made at the picture information in succeeding frames.

These techniques, motion prediction and discarding of spatial and time redundant information, can result in dramatic compression of most pictures most of the time. A key to whether the techniques are usable, however, is how the picture looks as the compression system begins to get overloaded.

Thus, a camera zooming, panning and tilting while focused on the crowd

in a football stadium will have very little redundancy from frame to frame, very little picture element redundancy, and will be very difficult to predict from frame to frame. Failure modes which involve the picture turning into a colored mosaic, or breaking into other nonrealistic patterns are unacceptable. Some of the line-doubling IDTV sets which are beginning to appear exhibit this kind of failure when challenged by complex moving picture elements. The ideal compression system would be one which merely began to lose resolution gracefully as it approached information overload.

Additional efficiency

In the kind of video compression being discussed by Sky Cable, where four video channels are multiplexed into the data stream on a single transponder, an additional kind of efficiency is available. Such a system could dynamically allocate the bits in the data stream between the four signals sharing it. Thus, when there is a high degree of motion in one of the four images being transmitted, but little motion or change in the others, most of the bits are used to describe the picture with the motion. Only rarely would all four signals contain enough motion that all would be forced into overload.

Programming which has originated on film has inherent frame-to-frame redundancy because film is a 24 frame-per-second medium and video runs at a 30 frame-per-second rate. In the conversion process to video, some film frames are repeated in order to make these rates come out even. This allows film material to be more aggressively compressed than material originated from a video camera.

High-powered DBS transponders have 27 MHz spacing, with a usable bandwidth of about 24 MHz. In transmitting a digital signal, this means that the absolute maximum bit rate is 48 megabits per second.

Compressing four digital video signals into such a data stream means that the compression efficiency must be about 10:1, when compared to brute force digitization. This is technically possible, and such compression systems have been demonstrated by a number of vendors.

Cable television networks can take advantage of this same technology. Because of the high linearity and high carrier-to-noise ratios which we have built into our systems in order to carry multichannel AM-VSB video, an additional technical advantage is available to us. Unlike satellite systems, which run at carrier-to-noise ratios of perhaps 10 dB to 12 dB, we can employ multi-level coding. Thus, instead of merely transmitting ones and zeroes, we can effectively transmit zeroes, ones, twos and threes, represented by different modulation levels. This means that it is possible for us to get a large number of bits within one 6 MHz channel, although it is not exactly clear how aggressively this can be done.

It is important that the CATV industry explore potential uses of digital video transmission within our own networks. We should recognize that using digital video means giving up some consumer interface advantages which we currently have. There nevertheless may be hybrid analog/digital broadband systems which make sense for us as we begin to contemplate the services we will deliver later in this decade. I firmly believe that such approaches can open the door for us to deliver even better quality and variety as we face a more intensely competitive future. ■

Re-reg bills: Will they pass?

The bimonthly NCTA Engineering Committee meeting was held in Washington at the NCTA office and chaired by Dr. Walter Ciciora. An update of major happenings in Washington, as they pertain to the cable industry, was given by Wendell Bailey of NCTA.

The House and Senate are very interested in the cable industry at this time because of customer reaction to price increases, poor service, etc. A number of bills have been introduced in an attempt to rectify the problems as seen by the bill's sponsors. The solutions to the perceived problems include re-regulating the industry, allowing or requiring competition, possibly as another cable operator in the same franchise, telephone company cable ownership, etc.

Some people believe the major problem stems from a lack of competition and that allowing or mandating competition would help solve the problem. In addition, if rates are re-regulated then increases would not be as large as they were immediately after deregulation. Fortunately for the cable industry, while the Senate is expected to move a bill this session, the House is not as organized in its thinking about the cable industry and it is doubtful that a bill will be passed this year.

Effective competition

The FCC has issued a Notice of Inquiry into effective competition to determine if the present three off-air channel requirement is sufficient to create competition. The Cable Act required that the FCC review a number of items and report the results of the review to Congress late this year. The FCC has issued a Notice of Inquiry to obtain facts on all the required issues and expects to deliver the report to Congress this summer.

A report and order on the scrambling inquiry has been issued. The FCC has determined that the development of satellite scrambling systems is working very well in the open market and it is not necessary for the FCC to issue a scrambling standard. A notice of proposed rule making has been issued which proposes to allow master antenna operators access to the 18 GHz CARS band.

By Brian James, Director, Advanced TV Testing, CableLabs

The subcommittees then presented their reports, beginning with Ted Hartson reporting on signal leakage. The FCC field operations branch is starting to include frequency checks on a more regular basis during system visits. The offset requirements and tolerances for channels in the aeronautical bands are tight but must be maintained.

Nick Hamilton-Piercy provided an update on advanced TV developments. The FCC has decided, because of spectrum availability limitations, not to accept an augmentation type advanced TV system. ATV proponents need to have the requirement for an access denial scheme emphasized. If incorporated into the system at the beginning it will be more universal and, hopefully, a better scheme than an add-on type system. The simulcast systems tend to have a more even spectral distribution than NTSC and should allow operation at a lower power level. A question has been raised on whether a simulcast system needs to carry the same programming as the associated NTSC channel.

The Japanese have developed a ghost cancelling system which uses a sin x/x training signal and Bell Labs has proposed a system operating with a random number sequence. These are under investigation by the ATSC. A field test was carried out on a sin x/x system. It showed a 35 dB reduction in ghosts off an antenna but after the signal was passed through a cable system and microwave system there was only a 3 dB to 4 dB reduction in ghosts.

VC problems addressed

Norman Weinhouse reported on the actions of the satellite practices subcommittee. General Instrument is progressing on problem resolution and improvements to the VideoCipher system. Modification kits and retrofit procedures have been developed. It acknowledged that the procedures are somewhat difficult to implement and some less capable systems may have a problem completing the procedure. The video streaking problem can be eliminated if the requirement for the energy dispersal waveform is removed or at least reduced.

The MultiPort specification has been adopted as an ANSI standard. A form is being developed to gather information on direct pickup interference in a more rigorous manner.

The production technology group of the ATSC is working toward worldwide agreement on a common image format for high definition signals. A revised specification for colorimetry has been adopted.

The ATSC transmission technology group is investigating the interoperability of advanced systems with cable, consumer equipment, satellite plus terrestrial broadcasts. In addition, an investigation of proposed ghost cancelling systems is under way. Requirements for the digital data stream and encryption is being investigated. An ATV MultiPort specification is being developed. There has been the suggestion that the port be FCC mandated to ensure it is universally available.

An investigation of present sound quality on cable systems and methods of improving it has been undertaken by the sound quality subcommittee under Ned Mountain. An initial investigation of sound levels on one cable system resulted in significant variation in levels from one channel to the next and that the levels on a given channel may change from one program to the next. A method of setting a specified level needs to be developed and adopted by the industry.

Wiring the home

The in-home wiring subcommittee, under Larry Nelson, is developing its charter and beginning to determine which areas it will investigate first. Some areas include developing a standard for in-home wiring during new-home builds, participating in the CEBus specification development, training program, etc.

Ciciora reported that the EIA/NCTA joint committee has completed work on the MultiPort and it is now a marketing issue. Set manufacturers are threatening to remove it from some sets and the need for it must be proved by having set dealers demand sets with the port.

Japan has shown a lot of interest in the idea of an electronic program guide which could be used to program a VCR. Direct pickup by cable-ready sets is beginning to be recognized by the set manufacturers.

Bob Dickinson reported that he has received only one amateur complaint about cable leakage but he has also received a report that one system has greatly improved its integrity. ■

CATV deserves to be 'bashed'

I am extremely tired of CED Editor Roger Brown's constant whining about "cable bashing." His ultra-defensive stance personifies a negative attitude that festers cable TV industry outsiders' skepticism, criticism and subsequent poor perception of the industry's objectives. If he feels so strongly that all cable bashers are proceeding on an unsubstantiated premise, maybe his time would be better spent documenting the false nature of their perceptions.

As a former technical manager in a large (more than 80,000 subs) CATV system located in the Northeast, I sincerely feel that most cable bashers have more than substantial evidence of the industry's shortcomings. I recently left the industry after years of frustration, caused by dealing with non-progressive co-managers and being grossly underpaid for my efforts. If you would like specifics Roger, let's talk. For now though, you will have to accept the fact that there is an additional cable basher out there.

In reality, my intent is not to bash the cable industry, but rather to help the consumer. I have recently put together a consulting firm with this objective in mind. I will be offering the public a cable TV Consumer Education Guide. The Guide contains information on subjects ranging from credit to picture quality. It also describes in detail the various actions consumers may take to voice their discontent with any aspects of a cable company's service. My firm also strongly encourages disgruntled customers to organize and defeat franchise renewals and offers consulting and legal services.

I, too, have had my fill of the ploys used by the cable industry to "fool" customers and lawmakers alike, that there is indeed a true industry commitment to quality customer service. An example of such a ploy is the creation of the NCTA's new Customer Service Standards. Although I have a great deal of respect for Wendell Bailey (NCTA vice president of science and technology), and admire his efforts on behalf of cable TV, I cannot help but sneer at his belief that these voluntarily implemented Customer Service Standards will have a substantial impact on the industry. Voluntary standards in any industry have a minimal impact, at best.

It would behoove the influential voices of cable TV, who's access to various media forms affords them widespread visibility, to not only address, but to evaluate and promote concrete, viable solutions to the ground floor level problems with the cable industry. These problems include:

1. The lack of sufficiently educated and technically oriented managers at the local system level.

2. The lack of progressive, comprehensive technical training programs for employees.

3. The need for wages competitive with other technical industries.

Although the NCTA's Customer Service Standards are useful and well-meaning, nothing guarantees their success. The implementation and management of such standards cannot be overlooked.

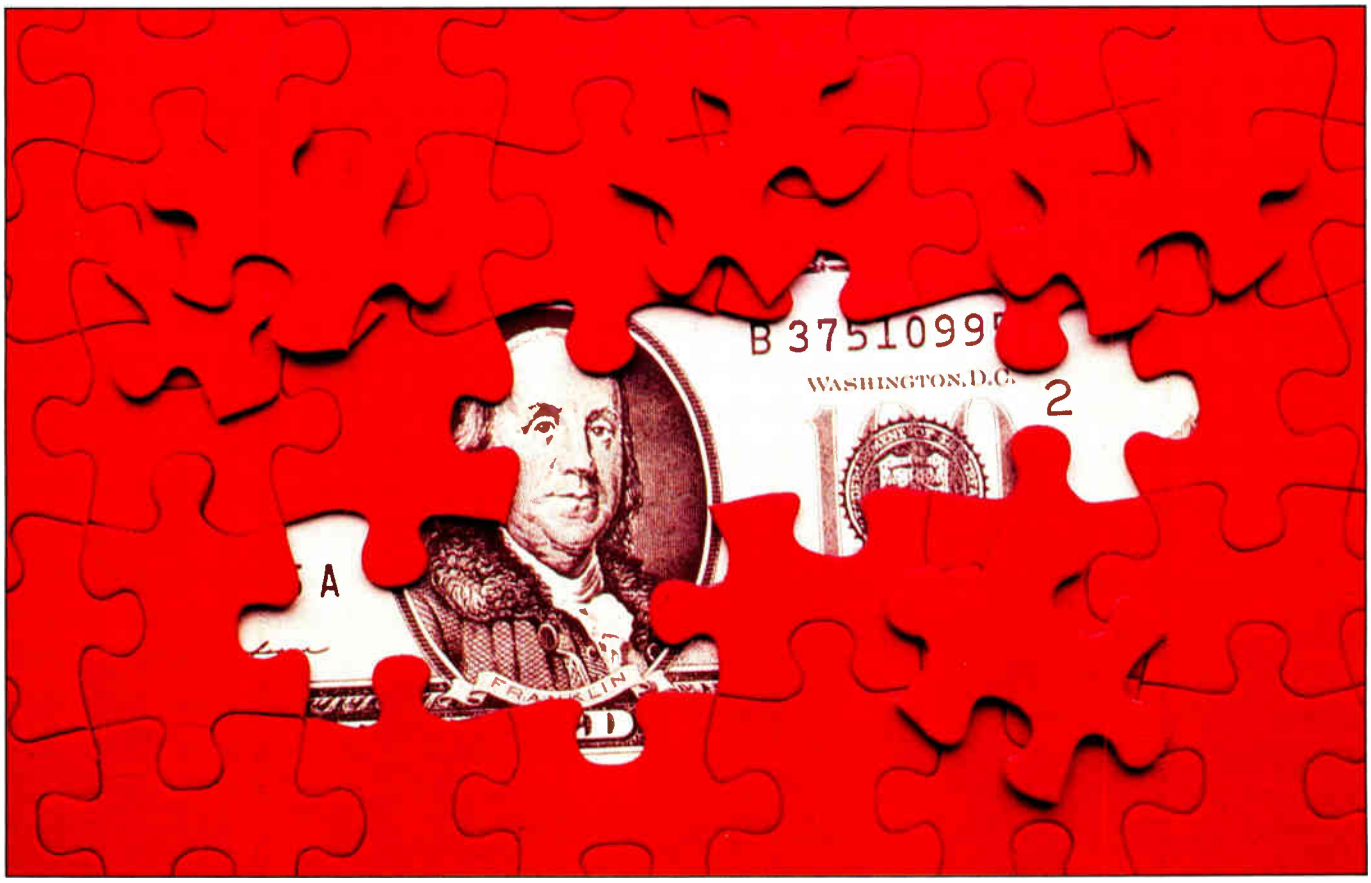
A brief example of what I feel is a testimony to glaring mismanagement of supposedly high standards is the approach many managers take to responding to technical problems within 24 hours. While many companies boast that they respond within this time frame, they do so by overloading the technicians with a large number of calls.

Unfortunately, this popular method is extremely detrimental to the quality of service the customer receives. Technicians are left with little time to properly troubleshoot and repair many problems. Obviously, the emphasis is placed on quantity over quality. The "Band-Aid" approach to repairs often leads to repeat service calls and infuriated customers.

If Roger Brown and Wendell Bailey wish to continue to whine about cable bashing, then so be it. I, for one, have chosen to address the ground-floor problems with cable TV customer service and find solid solutions. Since for various reasons I could not accomplish this as a cable industry "insider," I will do so as an "outsider." To be successful, my approach and tactics have had to change to coincide with my new stance. However, my goal remains the same: to seek an intelligent commitment to quality customer service!

Michael Devolve
Providence, R.I.

Outdoor addressability: Back to the future



Perhaps like fine wine, some ideas just take time to reach their peak. If you believe that premise, you'll understand why interest in outdoor addressability is again experiencing a widespread resurgence with cable operators.

But for those searching for more concrete reasons why "off-premise" addressable trap-based or interdiction systems are gaining popularity, the choices are many: the addition of addressability without the need for converters; avoidance of the well-known interface problems associated with subscribers' TVs, VCRs and stereos; operational money savings from reduced truck rolls related to service level changes; savings resulting from less theft of service and equipment; the resurgence of tiering; and improved picture quality and customer service.

Regardless of the reason, outdoor addressability is gaining viability as an alternative method of controlling subscriber access to CATV programming. At least eight product manufacturers presently offer or are finalizing design of this type of system. Meanwhile, two major MSOs are convinced interdiction's day is finally here and even Tele-Communications Inc., the nation's largest operator and an early adoptee of addressable traps, has expressed great interest in interdiction.

Outdoor addressability

Before this story continues, some basic terminology as it relates to technology must be understood. Essentially, this article focuses on addressable systems that operate outside the home, attached either aerially or underground, or to the side of the subscriber's home. Either way, the attention here is on non-converter based addressability.

Secondly, the technology referred to is founded either on well-known trap methods of signal scrambling (negative trap) or descrambling (positive trap) or on interdiction, which scrambles only those signals subscribers have not purchased immediately prior to the drop. For the sake of simplicity, all of these technologies will be referred to in this article as outdoor addressable products.

Obviously, the concept of removing the converter from the house and replacing it with a "transparent" method of conditional access is not new. Addressable or "smart" traps that could turn drops on and off have been in existence for a decade. Likewise, experiments with pole-mounted converters began in the early 1980s. However, these technologies never moved beyond the testing phase because of reliability problems, the growth of premium services or the inability to pass the broadband spectrum of signals all the way to the television or VCR.

But significant technological devel-

opments have taken place over the past 18 to 24 months that seem to suggest outdoor addressability's time has come. While small manufacturers started the ball rolling, it took the backing of manufacturers like Jerrold Communications and Scientific-Atlanta to get major cable system operators to sit up and take notice.

Interest growing

And take notice they have. With few exceptions, manufacturers of equipment are reporting increased interest by operators in their products. While that curiosity hasn't resulted in huge product orders, the groundswell of inquiries may make the 1990-91 timeframe a watershed for outdoor addressable equipment.

For example, Jerrold and TCI made headlines last fall with the development of a four-port addressable trap system that would fit inside a plastic enclosure mounted on the side of the house. By utilizing existing traps, TCI could remotely control premium channels individually or entire tiers of channels.

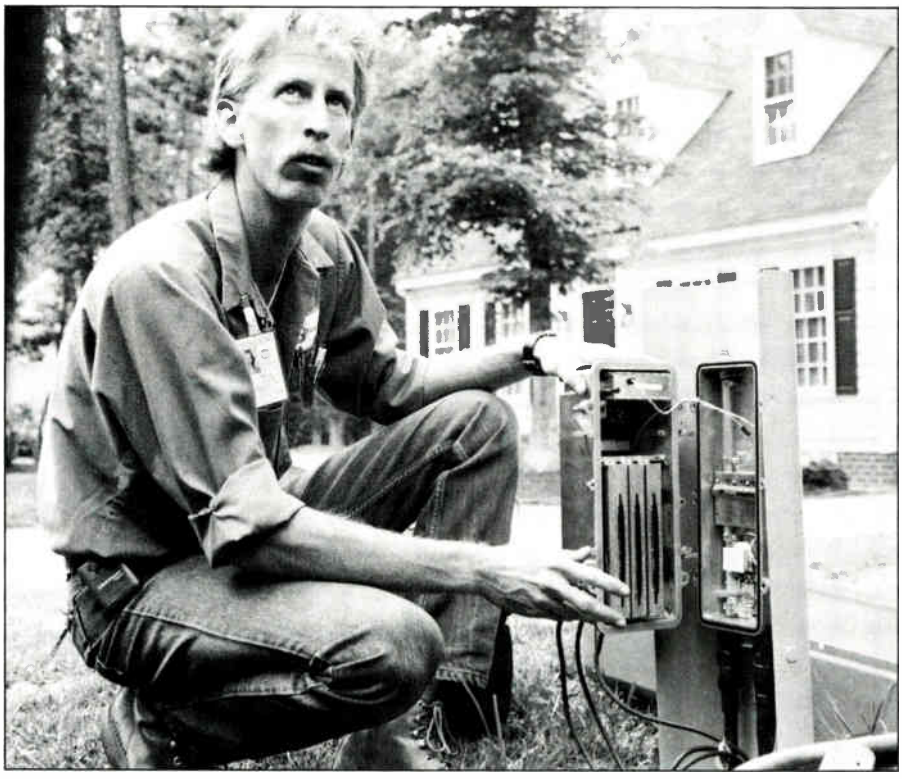
Now comes word that S-A's interdiction system is up and running reliably in a 250-home pocket of Warner's Williamsburg, Va. site, and Jones Intercable's announcement that it plans to roll out the technology systemwide in Elgin, Ill., a 29,000-home system.

In those locations, the S-A system has performed so well it's won converts at corporate headquarter locations. Warner's Senior Vice President of Operations Brad Johnston says he's simply waiting for test results through the thunderstorm and lightning season before locking in more orders, but anticipates committing to interdiction in all Warner system upgrades. Why? Because Warner's strategy is to deliver as many channels as possible to the subscriber, in a friendly manner.

Likewise, Jones Intercable, as of press time, was developing its long-term strategy, but according to Group Vice President of Engineering and Technology Robert Luff, Jones is "prepared to make a major commitment to outside addressability." It was unclear whether that meant more than the one Jones system would commit to interdiction in the near-term.

But it isn't only the "big boys" who have experienced success. Midwest CATV, which markets Syrcuits' Matrix addressable trap product, now has nine operating systems throughout the country, representing nearly 7,000 devices, and proposals for another 30 systems on the table, according to Chris Sophinos, president of Midwest.

"I think over the past year operators have taken a look...and said the time is now, the technology is ready," says Sophinos. "The attitude is, let's test it and see."



Warner technician displays S-A's interdiction device installed in Williamsburg, Va.

Operators like ATC and Falcon have installed Matrix, while Century has expressed interest. Small-MSO Comlink was impressed enough with the technology that it purchased two Matrix systems.

Looking for a partner

Although interest is high, Matrix and Midwest are plagued by operators who refuse to let go of converter and remote control revenue. "There's still a lot of apprehension to walk away from that revenue," Sophinos says. "It's hard to prove pay-per-view revenue will offset those losses."

Also, Midwest has been actively searching for a manufacturer for the Matrix product, which just last month was approved for a patent related to its method of addressing traps. That patent will most likely be issued sometime in July, says Mario D'Arrigo, president of Syrcuits. He adds that discussions regarding manufacturing agreements have taken place with several major CATV equipment manufacturers and predicted an agreement would be in hand by mid-June.

Eagle Comtronics, which markets a simple trap-based system designed for attachment to the home, has likewise benefited from increased interest by operators. Upwards of 18 systems, accounting for nearly 10,000 devices, are working in the field already and interest is picking up, says Joe Ostuni, vice president of sales and marketing.

He reports that operators are drawn to this type of device in areas where there's high spin and churn. Additionally, the optional auto dialer gives system operators an inexpensive method to implement and deliver near-impluse pay-per-view.

Eagle debuted the multiple dwelling unit (MDU) version of its product at the NCTA convention in Atlanta and announced it would be available for shipping in the latter part of this year. "We've been listening to operators who have said they need this product for several months," Ostuni says. "Some have said we should have developed (the MDU product) first."

Eagle and Midwest both applaud the entrance of Jerrold, Scientific-Atlanta and others, claiming that it legitimized their products as well. "Other manufacturers have accepted the technology," says Ostuni. "They've joined the

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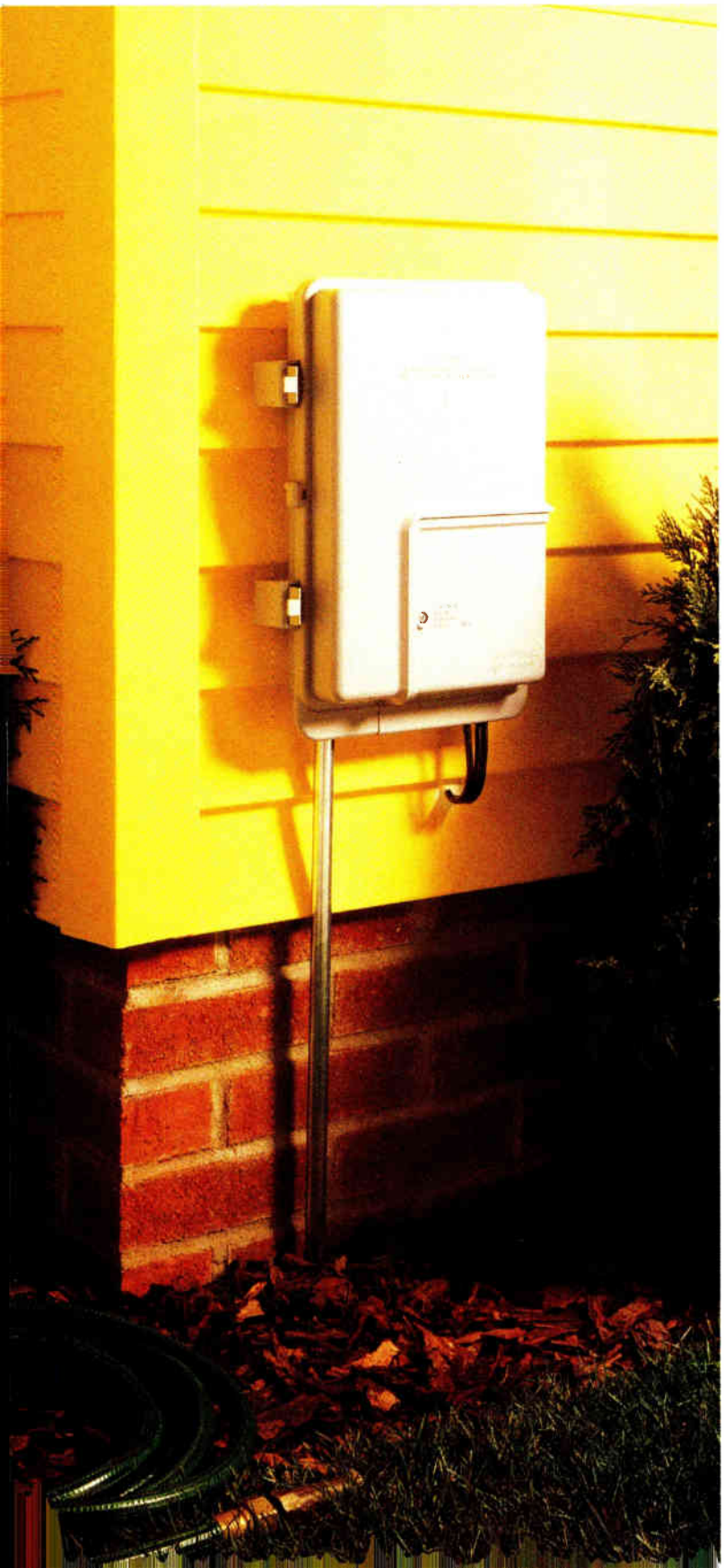

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march to the side of the home." Sophinos concurs: "I'm very glad to hear S-A's news (about interdiction acceptance). I think it's a very positive sign that other manufacturers are embracing this (outdoor) technology."

That may be an admirable attitude, but one wonders if every manufacturer can remain viable in a crowded field. In addition to the companies mentioned so far, equipment is available from Blonder-Tongue Laboratories, AM Communications and Electroline. A new entrant will be Regal Technologies, which plans to offer a trap-based system this year and an interdiction system in 1991. Not to be outdone, look for Jerrold to begin talking openly about interdiction in the very near future.

Blonder-Tongue's Guardsman II interdiction system differs from S-A's in that it is placed after the tap in the system. A total of eight functions can be controlled: Six channels can be selectively scrambled, while other features include control of a tier of channels and a connect/disconnect switch, says Martin Eggerts, engineering services manager.

B-T, which has four Guardsman systems operating, is counting on a product upgrade, which would make PPV ordering possible, to spur new interest in its device. Regardless, B-T will continue to focus its marketing efforts on small- to medium-sized operators who want to upgrade from simple trap security to addressability.

Meanwhile, AM Communications is excited about the resurgence. AM, which offers a jamming device (Tier Guard) and an addressable tap (Drop Guard), is experiencing new inquiries from operators plagued by high churn or urban theft of service, says Joe Rocci, vice president of cable TV products at AM.

However, AM, which has tried unsuccessfully for six years to gain marketshare with this type of product, is actively looking to develop marketing and licensing agreements with other equipment distributors, says Rocci.

Interdiction—a winner?

It's beginning to look like Scientific-Atlanta has hit a home run with its addressable interdiction device. The unit, which resembles a small amplifier mainstation housing without the fins, is presently available in four-port and MDU versions (a single-dwelling unit is planned for introduction when the market demands it). Signals are scrambled through the use of four oscillators that dwell upon the signal. The level of signal security can be controlled by the dwell time spent upon each channel; the more dwell time, the more the picture is broken up. (For a full explanation of how the Scientific-Atlanta system works, see "The interdiction alternative," *CED Consumer Interface Handbook*, April 1990, p.33.)

"The issue is consumer friendliness and it's picking up steam," says Tom Elliot, vice president of science and technology at CableLabs. "More and more people believe we have to be friendly and interdiction is probably the leading candidate" to achieve that goal, he says. Elliot believes the industry is faced with two major hardware challenges: providing enough channels to subscribers with good performance (50 dB carrier-to-noise or better) and management, or conditional access, of those channels.

TCI, which has long talked of being more subscriber friendly and went out and did something about it by adopting its much publicized "on-premise" control enclosure, now sees the need for an interdicting device, too. "It will be the primary (means of) security in the next few years," says Dave Willis, director of engineering at TCI.

In the meantime, however, TCI has slowed the implementation of the addressable Starport units it purchased from Jerrold because of uncertainty over re-regulation and the effect it may have on the industry. In fact, Willis says TCI's entire rebuild schedule has been "shut down" in anticipation of re-regulation. And, because Starports were scheduled to be integrated into TCI systems in conjunction with rebuilds and upgrades, the project has ground nearly to a halt.

Last fall, TCI announced the purchase of 250,000 Starport units and predicted they would be deployed rapidly. Willis says he now expects to have only 60,000 devices in service by the end of 1990, but added, "I don't see how we can make it." Presently, TCI has just 20,000 Starports in operation.

First again?

However, Jones Intercable seems to be moving in the opposite direction. The innovative operator, arguably the first MSO to widely implement AM fiber optic node technology, is ready to adopt interdiction as part of its overall strategy to deliver high quality signals to its subscribers transparently. "The time has come to (move forward) on conditional access technology," says Luff. "It's time to scrutinize what we've been doing historically."

That history has been filled with trap technology, followed by converters. While the former is subscriber friendly, it's labor intensive and primitive, says Luff. The latter is more secure, but highly unfriendly. "You add all that up, look at your competitors and you see (the issue) is a major item on the table."

Luff believes "smart" trap technology might be a viable way to go if the industry wasn't changing as rapidly as it is. But with DBS coming, HDTV developing, and other changes occuring, Luff is convinced a new, better conditional access technology is needed. And while interdiction probably costs more than traps or converters (depending on penetration levels), Luff says, "I'm more confident that interdiction-type technology will be cheaper in the long-run because it's more obsolescence-proof.

"I'm personally convinced (interdiction) will work exactly as advertised," Luff says. "It's been up and running (in a Jones system) for a month or so now and we're pleased, very pleased, with the results."

That should come as good news to vendors looking for buyers. Only 30 percent of Jones systems are presently addressable and some of those use early Zenith, Oak, Tocom and S-A converters. "Set-tops have a (design) life of about seven to 10 years," Luff says. "After that, maintenance and repair costs begin to spiral up."

So, Luff predicts Jones will be an early adoptee of interdiction technology. However, it's a decision that impacts more than the technical staff, therefore, it's a situation that must be studied longer. "There's a whole slew of other things that have to be considered," including billing interfaces, addressable control, marketing campaigns, etc., he says.

Besides S-A, Jerrold and Regal Technologies are known to be working feverishly on interdiction devices. For Jerrold, it would give the supplier both trap-based and interdiction products. Regal, too, plans to work both sides of the street.

Regal plans to introduce a trap-based product in beta test sites this fall, with full ramp-up to production devices by early 1991, says Mike Armstrong, president of Regal. The four-port system will be powered from the home and can control as many as eight levels of service. The device has been specifically designed to fit in the enclosure TCI uses but can also be placed aerially or underground.

Starting from scratch

Regal has taken its trap device one step further than the others by including proprietary traps, which made their debut at the NCTA convention last month. The Regal Failsafe trap will incorporate components that Armstrong says are more temperature stable and consistent than other traps. Those custom components are manufactured by Mitsumi, the same manufacturer of Regal converters, Nintendo game equipment and a large percentage of the TV tuners used in the U.S., according to Armstrong.

"We believe a trap-based system will appeal to a wider audience (than interdiction), which is why we developed it first," says Armstrong. "If re-regulation of rates occurs, operators will need (to implement) PPV and tiered services to augment their revenues. This product addresses that need."

That product will be followed by an interdiction system, which is presently in the design stage. Armstrong termed the interdiction system a "second generation device" that will be final dized after the trap-based system is in production.

Also developing product is Jerrold, which demonstrated an interdiction product at the NCTA convention but declined to say precisely when the device would be unveiled. However, Ed Ebenbach, subscriber systems marketing vice president, admitted that Jerrold is developing such a product. "We have come to a clear decision that there's more than one way to skin a cat," he says. "Fundamentally, we are an addressability house—it just may take different forms."

Indeed, Jerrold continues to advocate the use of addressable converters. "Converters provide a lot of channels securely in a cost-effective manner," Ebenbach says. While he admits some operators find them subscriber unfriendly, he continues to work on ways to make set-tops less of a burden on subscribers. "People have been opposed to the converter because it's obtrusive and doesn't really bring them anything," he says.

Regarding interdiction, Ebenbach believes significant obstacles—namely, powering, cost, hardware and software, and security—must be overcome before large portions of the market become receptive to it. "We're working on packaging and solving these problems. I think it's safe to say we won't have long gray beards before we see this product."

While cost and reliability issues of interdiction still have to be overcome, the cable industry is showing signs it's ready to accept the new technology as it adopts long-term strategies to shore up its reputation with subscribers by removing active components from the home. In addition, its flexibility regarding tiers of channels is advantageous as the industry rethinks its programming approaches.

But the real key will be operations. If service call schedules no longer have to rely on subscribers being home and truck rolls are reduced significantly, then maybe cable operators can begin to maintain their plants proactively instead of reactively. That's an intriguing concept. ■

—Roger Brown

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Optical discs: The new wave in commercial insertion

Ask most any technician working at a cable system that actively engages in commercial insertion what his biggest headache is and you'll most likely hear about videotape equipment failures, network breakdowns, videotape jamming and wear-out and loss of revenue from missed spots. As more operators continue to add more decks and sell more time, system complexity goes up, which increases maintenance and repair.

Commercial insertion gear has always been videotape-based. But CATV operators have been itching for new technology that will reduce the headaches and costs involved in running an ad insertion business. Operators would like more flexibility, less complexity of operation and reduced maintenance costs.

Now comes new insertion technology, based on optical disc players and recorders, similar to consumer-grade videodisc equipment, which offers high quality video and audio. Examples of this emerging equipment are being integrated and shown by several ad insertion equipment vendors, including Arvis, Channelmatic and TE Products (formerly Tele-Engineering), to name a few.

Write once, read much

Arvis and TE Products are developing ad insertion systems around a type of recordable optical disc called "write once, read much," or WORM. These discs allow cable systems to record ad inventories for playback via optical readers for an almost unlimited number of airings.

Channelmatic is waiting for the marketplace to tell it what it wants. "We are not going to have it connected to an ad insertion system," says Tom Walsh, vice president for business development at Channelmatic. "We are going to have it connected to our tape compiling system because we feel the existing optical disc technology is too expensive for most cable operators."

Walsh may be correct in his assessment. The advantages optical disc technology bring to ad insertion are speed of cut-in, no pre-roll, S-VHS video signal quality, longer life of source material, longer life of equipment, and in most cases, smaller size and space requirements.

By George Sell, Contributing Editor

And just on the horizon is a new disc technology that is erasable and re-recordable. Arvis and Channelmatic have been showing prototype erasable optical disc systems built by Panasonic which will be available probably in the first quarter of next year. TEAC reports it expects to have its erasable and re-recordable units available at about the same time.

To test a fundamentally new technology is more than just an incremental next step for cable operators, however. "You could take out tape decks," says Gil Moreira, vice president of Arvis Corp., "and put in, for example, three optical discs for every four tape decks and do a better job and have a higher quality picture.

"But what we found is that the cost to make the conversion to commit yourself fully to optical discs probably causes people to shy away" from the technology. Write-once (non-erasable) videodiscs cost about $300 each. And when the library compiled on that videodisc is replaced by new ads, the videodisc is no longer usable and is tossed out.

"What we foresee is the initial customers will have a mix of optical discs and videotape players. They'll use the optical discs for the longer playing flights," speculates Moreira. "In other words, say you have a customer who buys 32 weeks of time playing his commercial. In that case, you just put it onto videodisc and let the thing fly. That would allow the continued use of videotape for shorter-running ad schedules.

"I see the same thing," says Walsh of Channelmatic. "Initially, you are going to see a hybrid approach and you are going to see, once these erasable laserdisc players are on the market, more and more people moving toward those."

Another market driver will be video quality. "I also think pressure will come from their customers," says Moreira. "One customer will call and say, 'How come so-and-so car dealer's commercial looks so much better than mine?' And they'll have to go back and see why and they'll find out one's playing on tape and one's playing on videodisc and the tape is on it's third week and the videodisc is on it's third month and looking fine."

Moreira says Arvis currently interfaces with both the Panasonic optical disc and the TEAC optical disc. And Walsh says Panasonic, Sony and TEAC will be the major players in this market. "I see Panasonic working the hardest at it right now," Walsh says. "They have a lot of experience with their consumer line."

Panasonic is promoting, among the write-once machines, its TQ-3031F Optical Disc Recorder and TQ-3032F Optical Disc Player. Panasonic uses new 12-inch disc cartridges in protected plastic housings that have a play time of 30 minutes per side.

TEAC is offering its LV-210 Series or its LV-220P "auto-turn" two-sided machines.

While the TEAC units feature composite video inputs and outputs, the Panasonic units offer Y/C as well as RGB, reports Lynn Yeazel, regional sales manager, optical discs. "The Y/C component is the same Y/C that's on S-VHS tape so you can keep the whole signal system routing those pictures around in component (format) and it never becomes composite until it finally goes into the headend."

To share or not to share

While Channelmatic and Texscan, two major players in CATV ad sales equipment, have offered increased flexibility through dedicating multiple machines to individual networks, Arvis has carved out its market share in the competitive insertion equipment world by offering reduced cost through a computer controlled "machine sharing" approach. It seems fortuitous, now, that this approach readily permits an evolutionary intermixing of videotape players with optical disc players.

"It's an RS-232 interface and our software was always made to be able to share decks among networks," says Moreira. Flexibility is increased given the speed with which an optical disc

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player can go from one spot to another. With no pre-roll ever required, in a sense the optical disc player is always in a cue mode and at play speed. "Disc players, when given a start command, have no wow and flutter. They are always at play speed," says Dave Oren, project manager at TEAC.

"You can store a whale of a lot on a disc," Oren continues. "On our product, the LV-220P, a two-sided player, under computer control you can access both sides of the disc without human intervention. So if you had a full disc—and our belief is you can build to a full disc—by laying out your inventory in a logical manner, you can have two machines with four 30-minute sides available. It takes about 20 seconds to go from Side One to Side Two on one machine. So, while you are playing a 30-second (spot) on machine A, machine B could actually scroll through a whole hour, get to the other side and be prepared to play the next spot."

Arvis believes because of the machine's ability to rapidly move from one ad spot to another, you don't need as many players and you don't need to dedicate them to a network. Says Moreira, "One disc can take care of your whole four plays on one network or four spots on one break with no problem."

Yeazel echoes that thought. "You can park one machine on a channel and that makes the playback economics identical (to videotape). We are twice the price of a tape deck but you only need one of them, so it's a wash. But the recorder is more expensive and the way you would library it initially would be slightly more expensive. But you would create your spot reels from your library much faster."

Moreira acknowledges that machine sharing reduces flexibility. "Because you are using fewer decks you are limiting your capability somewhat. But with the laser disc, with its maintenance expectations and quality, that puts it right back as a very viable way to go."

However, Walsh of Channelmatic sees things differently. "Yes, you can share (machines) fairly easily with two or three networks but the problem with the networks is many of them are aligned at the same times—and when you are selling fixed position and guaranteeing the run, if you are serious about ad insertion, you don't want to sit there and be looping spots. It just doesn't make sense."

Walsh sees some cases where certain networks can be shared, but to make sure every one of them is run, a system is going to need more players especially with networks shifting and changing. Walsh also foresees the possibility of some "roadblocking" where networks align their breaks. "If a customer buys a system and is sharing everything and then those things happen," surmises Walsh, "he is going to end up stuck."

But roadblocking is not currently happening. "(Right now,) they don't. But most of them, if you look at an alignment of channels, are at the top

Interactive optical disc technology used for cable training

Optical disc technology has proven itself in many industries for training at large corporations such as General Motors, Ford, IBM and others. And it's now moving into cable television. A division of the Mind Extension University at Jones Intercable, The Business Learning Group (BLG), has developed interactive training programs using Pioneer Laservision optical disc players.

BLG has had basic training programs up and running in cable systems for some time now. "Customer Service: Your Key to Success," is a basic customer service skills training program and "Sales Through Service" focuses on giving basic selling skills to system customer contact personnel. BLG is now poised to launch programs aimed at technical training, beginning with "Basic Installer Training" followed by "General Safety."

According to Connie Buffalo, who heads up the BLG projects, BLG now has 40 MSOs using the programs, to different degrees. Some, like Heritage, are using it as a full component of their training, launching it through all of their systems. Other MSOs still are testing the waters, making sure that it does for them what the promise of the technology says it will.

What a cable system needs to make the system work is a television monitor, a personal computer with EGA graphics capability and a Pioneer LVP-4200 Laservision player. According to Buffalo, the LVP-4200 allows, among other things, the use of the second audio track while questions are read. The video screen blanks out while they play the second audio channel and the program continues.

BLG sells the Laservision players if the system doesn't have one. Buffalo believes the player is rugged enough to withstand the rigors of a roadshow. "We have chosen an industrial strength unit so we know that for the systems who are having to bicycle the laserdisc player—because sometimes we get into a system that's small, which means they can't afford training and are too small to buy a laserdisc player—without problems."

Training program lengths vary from a single disc to multiple discs. Each disc side is equivalent to half an hour of rolling video. When it's used in it's interactive format, however, 90 minutes of rolling video can equate to about a 10-hour training program by the time people are stopping and asking questions, thinking through and going through all the simulations.

BLG sees interactive optical disc technology as an effective tool for presenting information, providing immediate and accurate feedback to the trainee, evaluating the student's competency, and reporting the student's progress to supervisors. And the impact on trainees results in higher retention, training schedule flexibility, maximum availability of training and consistant training standards.

Specifically, the Basic Installer Training program will cover topics such as a history of cable television, cable equipment, basic design and theory including signal leakage, underground and aerial drop practices, exterior and interior wiring, subscriber interfaces, disconnect, reconnects, mobile homes and MDUs, troubleshooting and customer interaction. The safety topics will include equipment (personal and vehicle), excavation and trenching, aerial (ladder/pole/bucket truck), power awareness, customer safety, traffic safety, working environments, physical safety, when to back off in situations, and substance abuse issues.

BLG is currently planning a full-scale launch of its technical training library of discs in the fall. BLG will also be in attendance at the SCTE Cable-Tec Expo. "In the Education Room (off the main floor) there'll be a pre-view videotape on the technical series that we will be showing," Buffalo says.

—George Sell

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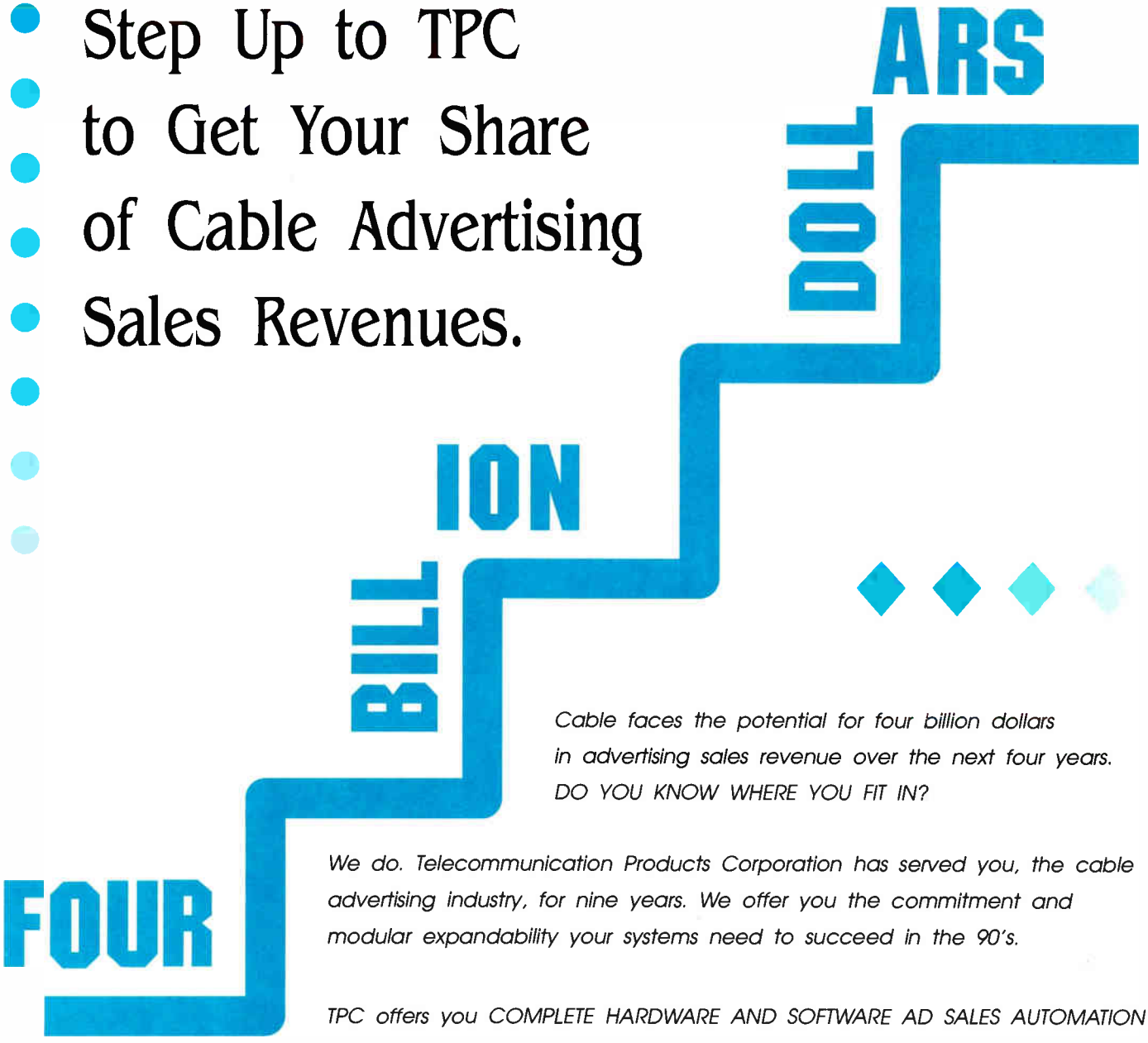

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and bottom of the hour. And some of them are at quarter past the hour and there's a few that are sporatic like ESPN," Walsh points out. "Generally, if you take an ESPN system which could be running a break at any time, and you put that up with a system that has fixed times, you are going to end up with collisions.

But no matter how they are configured, probably the most important advantage optical discs have over videotape is reduced maintenance. "When you come to tape you bring the same problems that 3/4-inch brings. Tapes stretch, tapes break, multiple moving parts of tape decks, all those things can go wrong," says Moreira.

"With the laser disc...all you have to do is clean the light every now and then. That's what we think over the long run will cause people to turn to laser faster—once the message starts going out that 1) you don't need someone every week cleaning the heads, 2) you don't have to take it in every two months to find out why it stopped working or why the tape isn't wrapped around the head. That's probably not why someone will buy the system (initially) but I think over the long run what keeps them buying more."

"We did the equivalent of a year's worth of insertions with absolutely no problems, no failures," Yeazel continues. "The only thing the machine required was cleaning at the end of that years—cleaning the optical assembly with a cotton swab—and that was it." Arvis and Panasonic also ran the same test with the units sealed in plastic to drive the heat up and, they claim, the units still didn't fail. "It's a three miliwatt laser that's actually reading the disc and it's just designed to do not much more than sit there and spin."

Erasables

Essentially, when you record on a laser disk, you change the reflection of light on that disk in the spot where you made the recording. With WORM disc technology, once you have made that surface reflectivity change it is a permanent feature of the surface. But the re-recordable disc has a magnetic film underneath that. When you want to erase that spot, it raises up that magnetic film and "pops out" the previous reflection. Once you've done that, you can re-record on that spot an innumerable amount of times.

However, unlike magnetic tape, you must first erase before you can re-record. "That's the same requirement that you would find for any magneto-optical data device," says Oren of TEAC. "You must first erase and it takes the same amount of time as writing. So writing now takes twice as long."

Channelmatic, at this point, envisions using the advanced erasable and re-recordable discs with a compiler for creating videotapes for commercials. Because inventory turns over so much, and optical discs cost so much, making write-once discs for commercials with short shelf lives doesn't make sense to Walsh. "Our idea is take the re-writable system and use it in a compiling system. That way you get instant access of a group of commercials that you can make tapes with, put them on a tape for the ad insertion system to play back."

With Channelmatic's approach of controlling multiple players, whether tape or disc, and dedicating players to networks, the cost of putting seven optical disc players in such a configuration can exceed $35,000 per channel. "If some cable system wanted to use a laserdisc for the playback and is willing to put $35,000 per channel on the line to be controlled, it's easy to control these things."

Arvis' suggested method for getting spots on the air using optical discs is the opposite of Channelmatic's. Arvis would

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use master videotapes as the source for write-once discs. "The way we've been looking at it in a perfect world is you record in half-inch and you go to your half-inch editing suite with your master and go right off the master to the disc. You take that disc to your headend and play your commercials. What has happened is you have lost no generation. And right now when you use 3/4-inch decks, by the time you are on-air you are in third or fourth generation regardless of who's equipment you are using."

And what about the durability of erasable discs? "We don't see any difference at this moment," says Panasonic's Yeazel.

Price curves

According to Moreira, "Quantity is going to bring the price down. The other thing that will go down dramatically is discs themselves. I'm hearing that they will go down below $100 in quantity and may go down in price to where re-recordable will not be an issue."

Currently, Panasonic's TQ-3031F is a $19,000 machine and its TQ-3032F player is $5,500. TEAC's LV-210 recorder is reported to be within $1,000 of Panasonic's and the two-sided player goes for $3,800.

But Yeazel takes a different view, believing the price floor has been reached already. "I don't see it changing much. If you look at the history of the write-once disc, the eight-inch machine has been on the market six years. There were some dramatic changes the first two years when the prices came down to where they currently are. The 12-inch machine has been around since '88, so it's going into it's third product year and it has not changed in price at all. The only thing that would have an effect on that is if it were wildly successful and could start producing these in very large quantities."

But Yeazel believes replacement of tape machines will happen slowly. "The insertion world probably has tens of thousands of 3/4-inch machines to be potentially replaced and if we could do that in a timely manner, I would say that if you took a target of 40,000 machines to replace over two years, I think we could have a dramatic effect on the price curve.

"But I don't see it happening that way. The cable systems and the integrators are very realistic. They are saying, 'Look, the first 12 months we have this as a system, maybe 30 systems, maybe 30 people will convert, or 10 new sales and 20 conversions.' And I think that probably will evolve over a three- to five-year period which doesn't give us the ability to drive the price curve down like we would like to."

Also, operators may not be driven by the video signal quality right away. There is always the question of just what is good enough. "If we err in quality it's at the high end," Yeazel claims. "It's a very high quality signal—almost as good as one-inch tape."

Evolution underway

Obviously, however, the cost of optical disc technology is a major obstacle to implementation that must be overcome. Regardless, the evolution to optical gear has already begun. Cable Laser Ad Sales Services (CLASS) is a turnkey commercial insertion service designed for cable systems that prefer not to establish in-house operations. CLASS provides equipment, the sales force and the spot advertisements. The equipment supplied is the Pioneer 8000 Laservision players. CLASS provides generic ads with graphic overlays and custom audio for the advertiser. The cable operator supplies the avails.

"From the technical end," says Bill Leventer, president of Video Data Systems, developer of the optical equipment used, "the laser player is a read-only system because our whole thrust is using generic commercials for the live motion video and we supply graphic-type overlays through a computer system to customize the commercials for any particular advertiser on a cable system." Therefore, there's no need for a unique laserdisc for each system.

In terms of the marketplace, the CLASS service falls somewhere between tape-based ad insertion and photo-classifieds but with the high video signal quality of optical discs. But Leventer says, "It's not just filling in a gap. It's providing a *bona fide* commercial service where the cable operator has a minimum amount of effort he has to perform. When we do the turnkey service, he really does nothing except collect checks."

"The other major factor is the extreme reliability of laser players," Leventer adds. "We've been using laserdisc players in pay-per-view applications for 24 or 25 months without a single failure. And we have certain test situations that have been running almost that long with the same laser discs and nothing has failed on those units in that time frame. Compare that to operating with a 3/4-inch tape or any kind of tape system; it's virtually unheard of."

Other features come as part of the package. Once the generic commercials on laserdisc are sent out to the cable system, CLASS can change the custom overlays and the custom sound that appears over that generic commercial via telephone, without any headend intervention.

With remote computer control, CLASS can change the various files that relate to the overlay and the sound and query the system to see what commercials have played in order to generate billing information.

Regardless of who sells the time or provides the equipment, clearly the wave of the future is toward optical discs. While the equipment may be more expensive initially, if the gear offers better reliability, improved pictures and more flexibility, everyone, including the advertiser and viewer, comes out the winner. ■

Current cost comparison between videotape and optical disc commercial insertion installations

Optical disc industry sources report the following installation cost figures and comparisons. While eraseable discs have not been assigned final prices, estimates are they will be double that of write-once discs. Chart assumption: Eight channels inserted.

Type of system	Installation costs	Maint. & media replace.	First year costs
3/4 inch tape with eight players and one VCR	$ 22,000	$13,000	$ 35,000
Optical WORM hybrid with seven optical players, one optical recorder and one VCR	$ 59,000	$17,000	$ 76,000
Optical eraseable with eight players and one recorder	$109,000	$ 1,200	$110,200
(If same eraseable system gains 30% price reduction)	$ 76,300	$ 1,200	$ 77,500

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stringent radiation requirements. A cable system supplies signals to a VCR which is allowed to radiate more than the cable system, and which sits on a TV allowed to radiate even more energy. The radiation has equal chance of causing trouble regardless of whether it comes from a cable system, a VCR or a TV. The discrepancies come from the fact that different rules were adopted at various times, when perceived requirements were different.

Even though set-top converters were formally qualified to Part 15C, when they were used they became part of a cable system. The cable system has more stringent radiation requirements than does the equipment it employs. Because of this disparity, Scientific-Atlanta (and we presume others) has voluntarily tested converters to Part 76 radiation limits, though we did the formal qualification to 15C. No mechanism is provided in Part 76 to qualify a device, because Part 76 applies only to an operating cable system, not to a piece of equipment.

In 1985 the Commission recognized this problem and set out to do something about it. This action was taken, not because a problem had surfaced, but because the discrepancy was noticed. It issued a Notice of Proposed Rule Making, the infamous Docket 85-301. In this document, the Commission proposed to place set-top converters (known in the docket as cable system terminal devices, or CSTDs) under part 15 subpart H. This would have made set-tops comply with the same radiation requirements as a VCR or TV game.

The effort was laudable, but had several dastardly side effects. The radiation disparity was improved, though a dichotomy still existed between the requirements imposed on a cable system and those for associated equipment. However, 15H also required several things not reasonable for a CSTD.

To make hook-up simple and reliable, part 15H devices had to be supplied with all required interconnecting devices. Thus VCRs come with connecting cables, a balun and an antenna transfer switch (often built in). This did not make sense for a set-top converter.

Also, 15H required a maximum output level of 3,000 microvolts (9.54 dBmV). This was intended to restrict the potential for interference if the consumer inadvertently connected his VCR to his antenna rather than to the TV.

Set-top manufacturers and others pointed out that Part 15H really didn't address the needs of our devices. The Commission partially understood our objections and rescinded most of the inappropriate requirements. This is one of the reasons that the action, initiated in 1985, is not effective until 1990, an unusually long delay.

The process was accompanied by numerous appeals for further reconsideration, appeals for stays, and other procedural actions. When the dust finally cleared, we had prevailed with all of the needed changes—with one exception. The maximum output level requirement is not met by RF converters, the most common type in use today.

RF set-tops are simply tuners which translate the many frequencies used on cable systems to a fixed output channel, usually 3 or 4. (Many set-tops include descramblers and addressing circuits, but these do not change the basic signal handling job.)

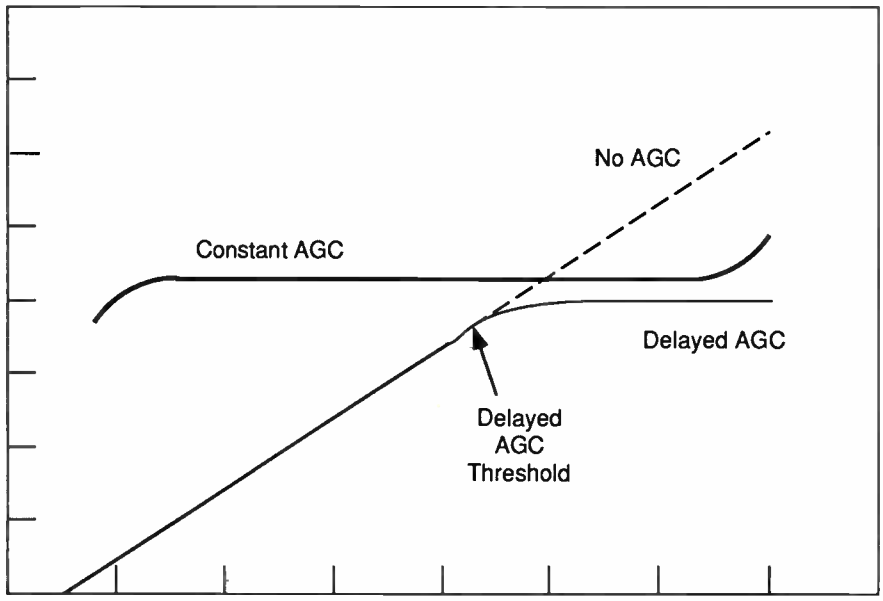
The input signal is amplified, typically by 5 dB or 6 dB, and this becomes the output level. If O dBmV is supplied to a set-top having 5 dB gain, the output level is 5 dBmV. If +15 dBmV

is supplied, the output is +20 dBmV. This is no problem for the TV, which has automatic gain control (AGC). However, it violates the Part 15H output limit.

In the process of negotiating with the Commission, we received some relief in level—CSTDs are allowed to supply output up to +15.56 dBmV. Unfortunately this was a very hollow victory. While the FCC did not specify measurement conditions initially, a test input level of +25 dBmV was subsequently adopted. With a maximum gain of perhaps +10 dB and an input level of +25 dBmV, a set-top will supply +35 dBmV. This is certainly not a normal operating condition. Nonetheless, it is the legal test condition. Since we must meet this condition, we have to add circuitry (and cost) to all RF set-top converters.

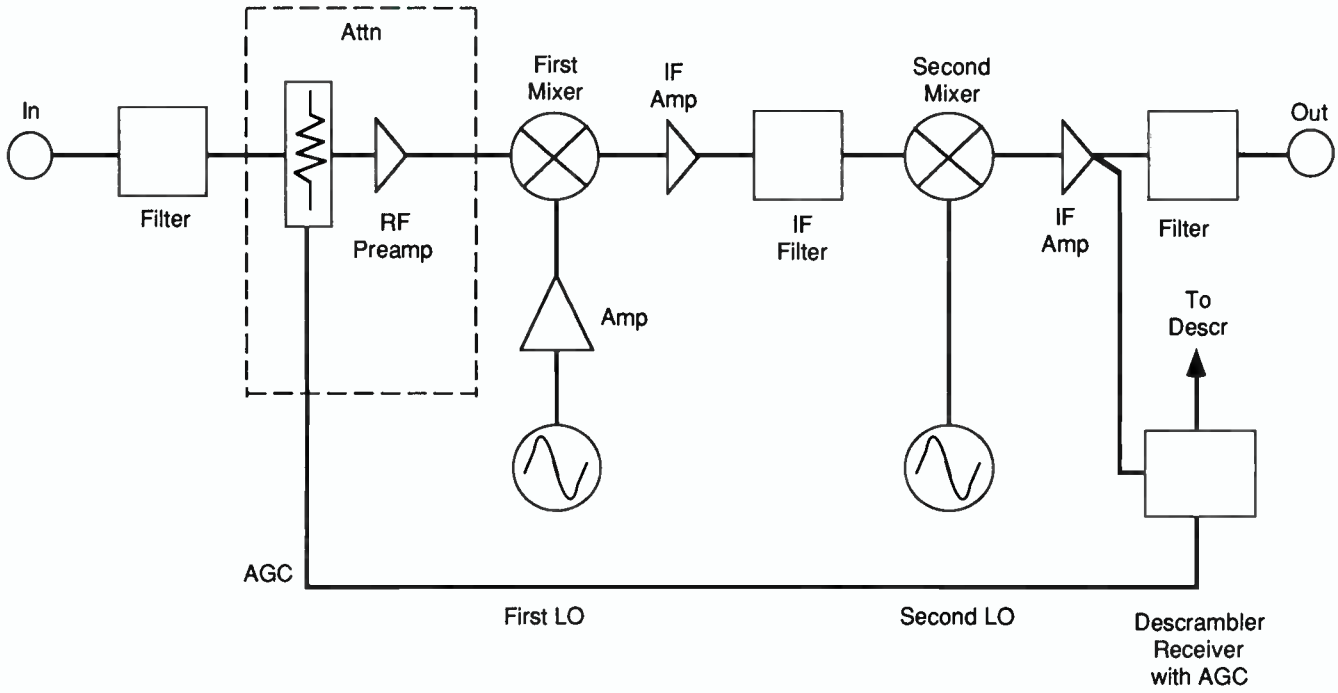
We must add an automatic gain control circuit, which will not allow the output to exceed +15.56 dBmV with any input level up to +25 dBmV. The most desirable way to implement this AGC is with a delayed AGC circuit.

Note that "delay" has nothing to do with time delay. Rather, it refers to the solid line in Figure 2. At low signal levels, the output tracks the input 1:1, increasing the output level 1 dB for every 1 dB increase in the input signal. Above a threshold the output level is constant with changes in input level. A constant AGC of the type used in the front end of receivers is shown for



Effect of AGC on Output Level

Figure 2



Set-Top Block Diagram
Showing AGC Detector in Descrambler

Figure 3

comparison.

Delayed AGC is commonly used in the front end of all types of receivers, to allow the signal-to-noise ratio to improve with increasing signal level, until futher increases in level would result in unacceptable distortion. In the present application, delayed AGC allows the input to the TV to increase until the FCC's maximum allowable signal level is in danger of being exceeded.

Implementing the Rule

Possible alternatives for controlling the output level include a manual gain adjustment that would be set at the time of installation, an over limit detector that would insert a fixed attenuator if the limit were exceeded, and an automatic gain control (AGC) circuit.

The manual adjustment, though a simple and inexpensive addition to the converter, was rejected because it does not meet the intention of the Commission. Compliance isn't guaranteed because of the possibility of misadjustment or changes in the input signal level after adjustment.

Switching in a fixed attenuator also does not appear practical. To "legalize" the test input signal of +25 dBmV on a set-top converter with a gain of 10 dB, an attenuation of approximately 20 dB would be required. If this same attenuation were applied as the converter approached the output limit (+5 dBmV input), then the converter output would be switched to -5 dBmV. Obviously this is a problem.

The only practical approach is the addition of automatic gain control circuitry to the RF set-top. This requires an attenuator, a video detector and comparator circuitry. Most descrambling RF converters already contain the detection and comparison circuitry, requiring only the addition of the attenuator. Non-descrambling RF converters usually require the addition of all.

Figure 3 shows a simplified block diagram of an RF converter with descrambling, though the actual descrambling circuit is not shown. The descrambler detector is used to recover descrambler synchronizing information from the signal. The synchronizing information may be carried on either the audio or video carrier.

In either case, the set-top must include a receiver to recover the information. Such a receiver generally includes an AGC circuit. This circuit can be rather easily expanded to operate an attenuator for output level control. Figure 3 also shows a delayed AGC being supplied back to the front end of the set-top (see below).

Location of the attenuator at the input or output of the converter is the next decision. The decision is based on cost and performance and may vary from model to model and from manufacturer to manufacturer. Let's look briefly at each.

Attenuator location

Attenuation at the input limits the input signal level to the converter, resulting in possible inprovements in noise and distortion performance (depending on the distortion performance of the attenuator itself). However, limiting the input signal results in limited carrier-to-noise ratio above the AGC threshold. The attenuator circuit usually has a minimum insertion loss of about 1 dB, resulting in an increase in noise figure of about 1 dB.

For a descrambling RF converter with a maximum noise figure (NF) of 13 dB, the attenuator would increase

the NF to 14 dB and the delayed AGC might limit the contributed carrier-to-noise (C/N) ratio to 45 dB. To overcome the insertion loss and improve C/N, an RF pre-amplifier is usually employed.

The amplifier improves the overall NF performance 1 dB for each dB of gain in excess of the attenuator loss, but this improvement must be balanced against increasing distortion with increasing gain. This equates to an improved NF at low signal levels and added value to the complaint unit.

Figure 4 shows the carrier-to-noise performance of an RF set-top with and without delayed AGC and a pre-amp. The unit with the AGC and an RF pre-amp exhibits improved C/N performance at low signal levels, thanks to the pre-amp. The limiting effect of the AGC operation on C/N can easily be seen.

When the attenuator in the front end begins to reduce the signal applied to the pre-amp, then the set-top noise figure will remain constant with increasing input level. The point at which the two curves intersect can be called the crossover point.

At input signal levels below the crossover point, the RF preamp inproves the C/N. Above this value, C/N limiting of the delayed AGC outweighs C/N improvement of the pre-amp.

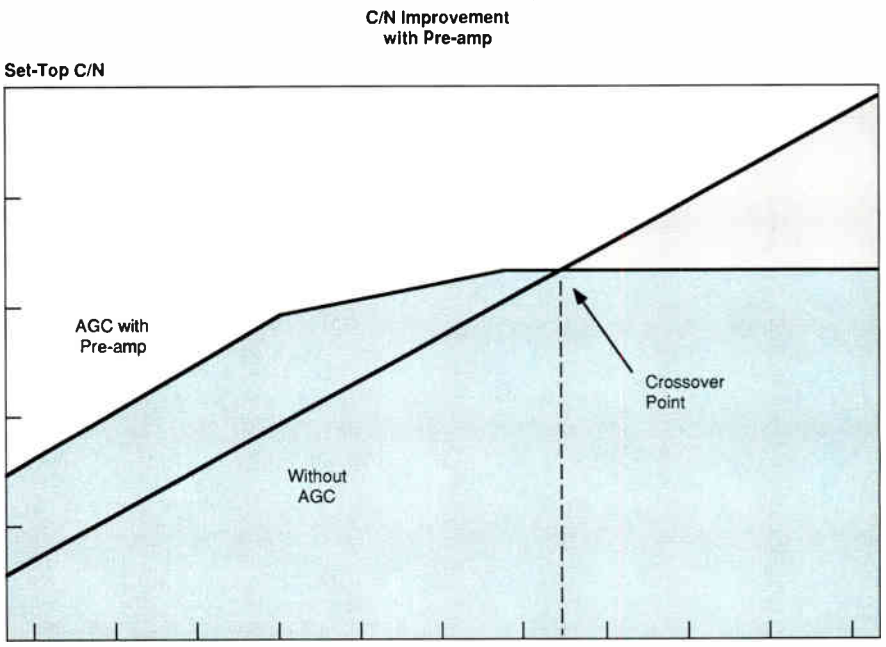
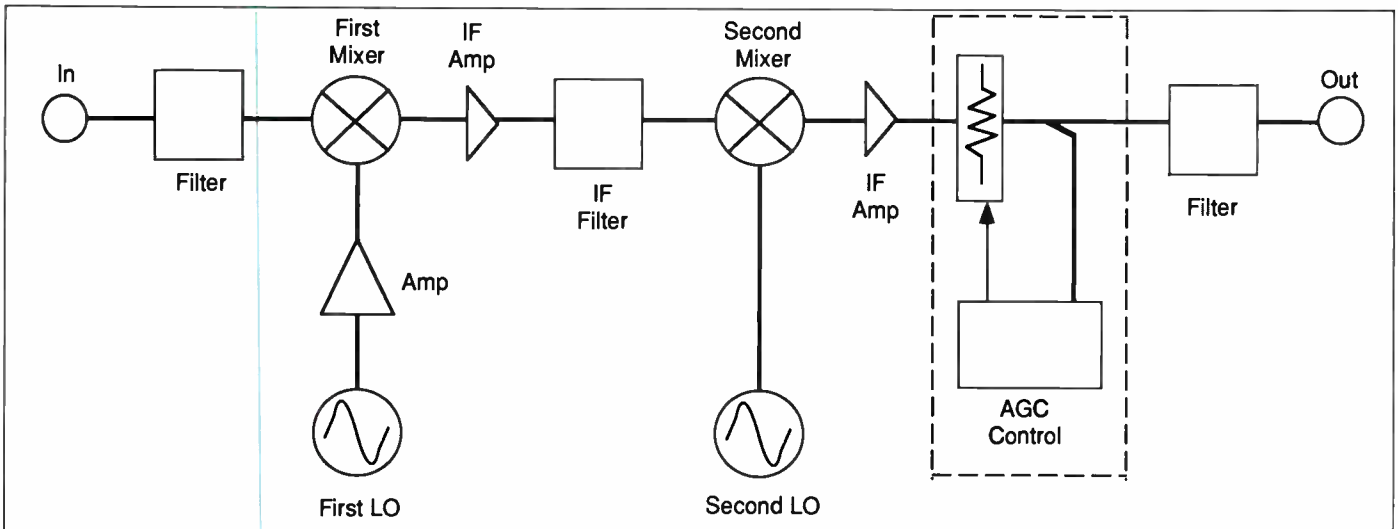


Figure 4

Figure 5 shows the simplified block diagram of a nondescrambling set-top with AGC operation on the output side of the converter. Attenuation at the output usually has no effect on distortion as it does not change the signal



AGC Added at Output
Figure 5

levels within the converter and because most adjacent signals are attenuated heavily before this point.

Likewise, the effect on NF is slight. For a set-top with a +15 dBmV input signal and 5 dB of gain, an output attenuator will increase the overall NF by only about 0.1 dB. In this case, the effects of the addition of the delayed AGC are transparent to the cable operator in a technical sense (but not in a financial sense).

In summary, attenuation at the output of the converter results in negligible changes to the converter performance at increased cost. Attenuation at the input can result in improved C/N performance when an RF pre-amp in used, but at higher cost.

Descrambling converters already contain much of the AGC control circuitry and deliver premium services where C/N performance is especially important. For these units, we feel that the input delayed AGC with RF pre-amp is the correct choice. For basic converters where the AGC control circuitry must be added, we feel that an output side AGC will provide the most cost-effective solution. ■

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SPECTRUM 2000

Amplifier System

Reader Service Number 40

Vendors appear healthy despite regulatory doubts

For an industry fraught with frustration stemming from regulatory uncertainty and skepticism on Wall Street, hardware vendors at the 39th annual NCTA Convention and Exhibition in Atlanta were decidedly upbeat over the future. While the show floor lacked any single, "gee-whiz" focal point, numerous new product evolutions were displayed.

Even the hold placed on capital expenditures related to rebuilds by huge operator **Tele-Communications Inc.** couldn't dampen the spirit of most vendors, who introduced enhanced fiber optic systems, more subscriber-friendly converters and devices aimed at improving signal quality, operations and customer service.

Fiber optics

The chief product category that saw a lot of new equipment—and some new players—was again the fiber optics area. With 1990 revenues already surpassing the $30 million mark, **Anixter** decided to spin off its fiber optic business into a new company, called **Optical Networks International**, and installed Andy Paff as its president. According to Anixter President John Egan, ONI will scour the planet for technology (as well as continue to develop product with AT&T) with an eye toward marketing to telephony, cellular and data markets in addition to CATV.

ONI's first product announcement was also made in Atlanta. Laser Link II, a modular, shelf-based AM transmitter, features seven slots to accommodate plug-in transmitter cards, RF amps, receivers or network management modules, which can be configured any way an operator desires.

Also debuting was the ONI high performance optical bridger, designed to help operators take fiber all the way to the bridger and avoid using trunk amps. Four ports output 50 dBmV each and supply up to 550 MHz of bandwidth. The unit, built by **Texscan Corp.**, can also be configured in a variety of ways: with a return data module for status monitoring; single or dual optical receivers; redundant powering; and/or with a new low-noise optical detector developed by AT&T and Texscan.

Digital transmission schemes also began to take new shape as **Synchronous Communications** and **C-Cor**, through its partner **Comlux**, both showed new gear.

Synchronous' new QPSK digital system can multiplex 12 channels on one fiber, according to a company spokesman. The system will be installed in its first field testbed sometime later this year, it was reported. Meanwhile, C-Cor and Comlux displayed a system capable of delivering 16 channels over one fiber and features a direct digital-to-AM converted output.

The Model 3806 Digital IF Modulator converts transmitted, digitized baseband signals to an IF signal. The signal is then fed to the Model 3845 Quad RF converter to produce an AM/VSB output on any user-selected channel. The system could be placed at a hub site and would replace four analog modulators.

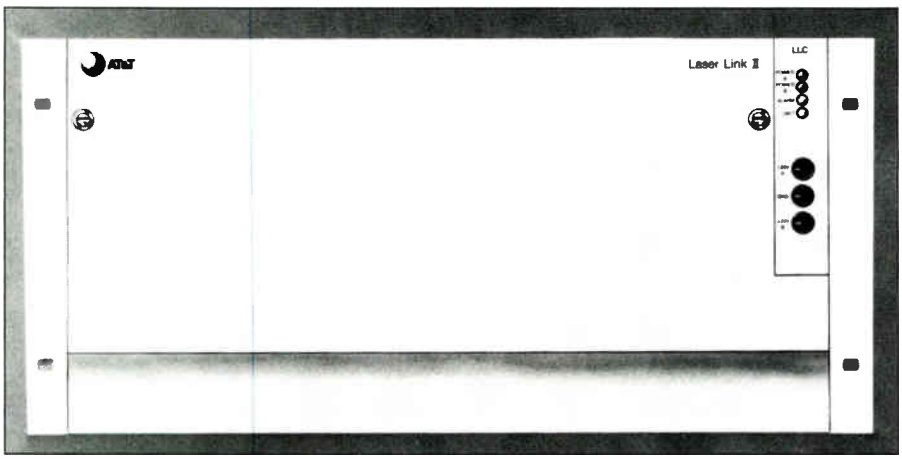
American Lightwave Systems, which prior to the convention announced an agreement to supply C-Cor with AM fiber gear, announced separately that it will supply its LiteAMp AM equipment to **American Television and Communications** to support the Fiber Trunk and Feeder architecture being used in the MSO's Marion, Ind. rebuild (for details about the architecture, see *CED*, May 1990, p.28). According to ATC's David Pangrac, ALS will supply two transmitters and five receivers initially, with additional equipment needed later.

A more low-key approach was taken by **Jerrold Communications**, which again showed its Starlite AM 550-AT laser transmitter and AM-550R receiver in a backbone configuration. The system is based on a high performance DFB laser manufactured by Ortel. It is scheduled to be field tested beginning this month, Jerrold officials said.

Jerrold has already built a three-mile, 24-fiber link between its Hatboro, Pa. Cableoptics laboratory and Comcast's Willow Grove headend to act as a "real-world" test link. Link fibers can be daisy-chained to simulate outdoor installations of up to 30 miles in length and can test both 1310 nm and 1550 nm technology.

Scientific-Atlanta showed its fiber system in a variety of configurations, including one which the **Corning Inc.** optical switch was used to automatically or manually switch in a back-up laser transmitter in the event of primary system failure. The switch will be offered as an option to S-A's transmitter and will be available in July.

And finally, **Catel Telecommunications** reported that final full approval of its AM Transhub III units has been granted by Jones Intercable for installation in its Broward County, Fla. system rebuild. Twenty-seven nodes are expected to be in place by the end of 1990, Jones officials said. Catel is expected to make an announcement regarding equipment for ATC's Fiber



Anixter's Laser Link II transmitter

Trunk and Feeder architecture next month.

Also, the company displayed its new FM baseband demodulator, the CFM 3800. A third-generation device, it takes up 75 percent less space and is roughly one-third the price of previous equipment.

Actively using passives

Several significant developments related to F-connectors and new passives also occurred. **Raychem** and **Augat/LRC** both introduced new indoor push-on connectors designed to ease connector installation while providing RFI security. Both connectors are intended for in-home installations over a wide variety of port sizes.

Augat/LRC's Push-N-Lock 'F' connector

Raychem's EZ Twist can be used on either RG-59 or RG-6 coax and are color-coded for each type. The connector is placed on cable prepared with the EZF cable prep tool and is twisted on the cable with a clear plastic aid that allows visible inspection of the connector. It is priced in the low- to mid-30 cent range.

Raychem also unveiled the Gel Drop Splice designed to environmentally seal underground and buried CATV splices. Two rectangular pieces of plastic are filled with a gel that, when pressed together, conform to the splice and for an environmental seal. No mixing, tapes, tools or special cable preparation is necessary.

Augat unexpectedly showed a one-

In-home wiring issues discussed

"In-home Wiring and Security" was the focus of one NCTA show technical session moderated by Larry Nelson, executive vice president of Comm/Scope. The panel covered topics including in-home wiring problems, electronic in-home integration, indoor connectorization trends and problems, and on/off premise technology.

Dave Wachob, director of advanced technologies, Jerrold Corp., presented the first paper, entitled "Electronic In-home Integration," which investigated the issues surrounding integrated telephony, automation, monitoring and data networks within the home. Explaining that the current CATV infrastructure is already well-suited to provide conventional and non-conventional cable services, Wachob said that all the elements exist to combine voice, video, telephony and broadcast signals in an addressable converter or on/off premise device.

Wachob further proposed two home-integration concepts: one involving a combined remote control/cordless teleph ne capable of communicating with either a converter or an on-premise device. Common components existing in both the remote and the cordless phone afford simple integration, and simple appliance control additions would enhance the concept. Or, Wachob continued, all available media could be combined in an in-home integration interface. The trade-off, Wachob says, is complexity and cost. Wachob closed the discussion by reinforcing that the integration of voice, video and data will continue to increase, and that cable operators are inherently well-positioned to provide these integration services.

Speaking on "The Indoor Challenge: Problems with In-Home Wiring and Connectorization," Joe Lemaire, manager of application engineering for Raychem Corp., continued the panel discussion by conveying some surprising statistics on in-home wiring deterioration and improper installation. Three cable systems were surveyed for one week, to provide a first-hand view of the service call environment.

Lemaire revealed that of all service calls, 80 percent of the problems were located in the drop. Of this figure, 60 percent of drop problems are indoors. Moreover, half of the incidences of actual cable replacement were indoors, and 61 percent of 'F' connector adjustments occurred inside the home. Also, examination of subscriber service histories showed that a high percentage of subscribers had repeat calls as early as three months previously with the same fix code. The implication, Lemaire explained, is that operators are effective in eliminating subscriber complaints only 70 percent of the time.

Recommendations on cable, connectors and indoor amps concluded the discussion, as Lemaire summarized the results of the survey. In cable, Lemaire recommends exterior cable that is more abrasion resistant and more forgiving of the connectorization process, and interior cable that is smaller in diameter and tougher exteriorally. Similarly, Lemaire highlighted the need for exterior connectors that are weather-sealed, and interior connectors that eliminate the need for wrenches and swivel fittings. Indoor amps, Lemaire points out, must meet MSO specifications and guard against signal leakage.

John Burke, product manager, Jerrold Communications, continued the in-home wiring discussion with the paper "Improving Consumer Friendliness with On- and Off-Premise Addressable Equipment." In his presentation, Burke discussed interdiction, switches and hybrids, and a cost comparison of on-premise vs. off-premise devices. On- and off-premise technology, Burke explained, holds several advantages in providing consumer friendly services. For example, service connects and disconnects, PPV services and premium service upgrades/downgrades can be handled remotely. Similarly, all existing consumer electronic devices can be fully utilized

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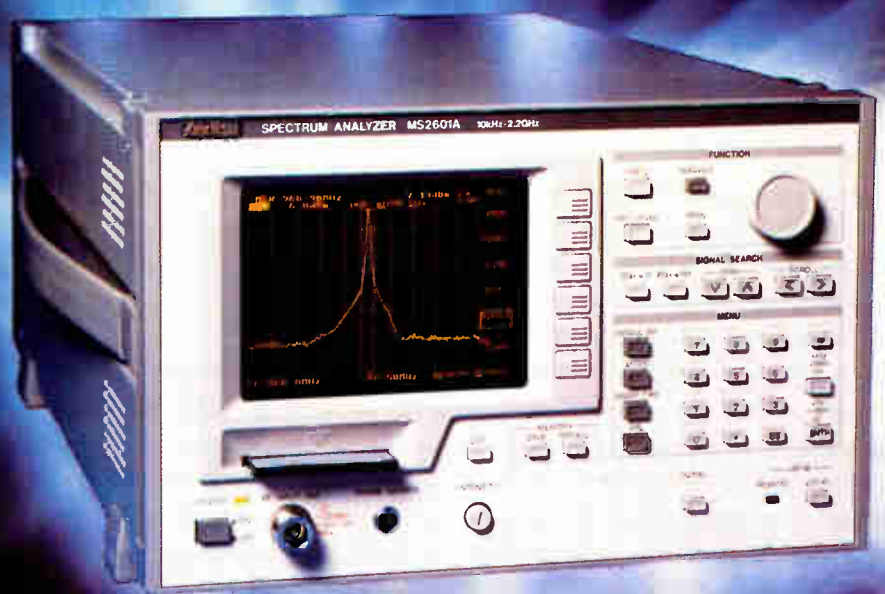

Reader Service Number 43

1990 SCTE Cable-Tec Expo

Booth Guide & Floor Plan

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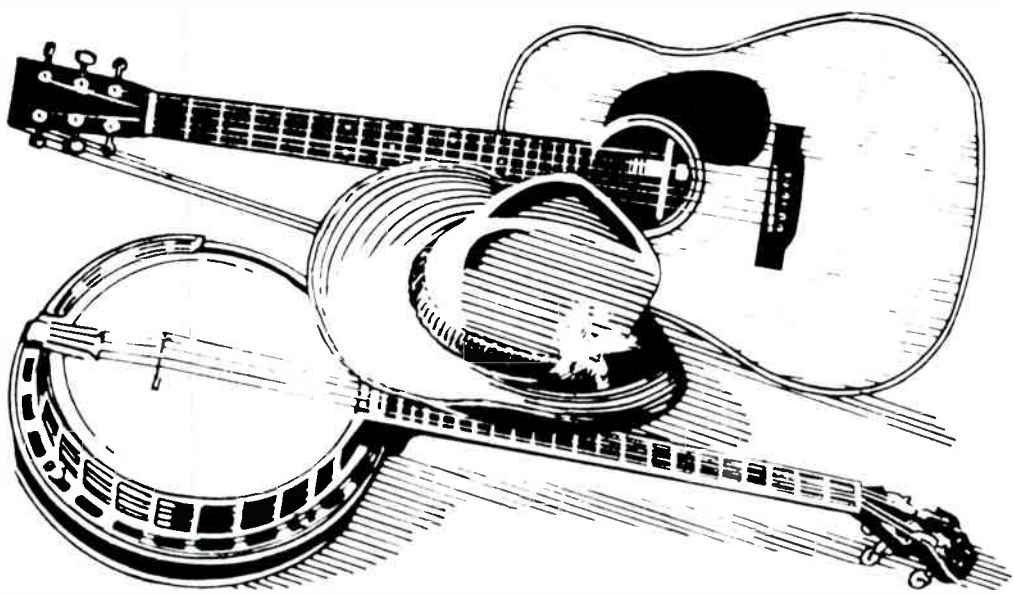

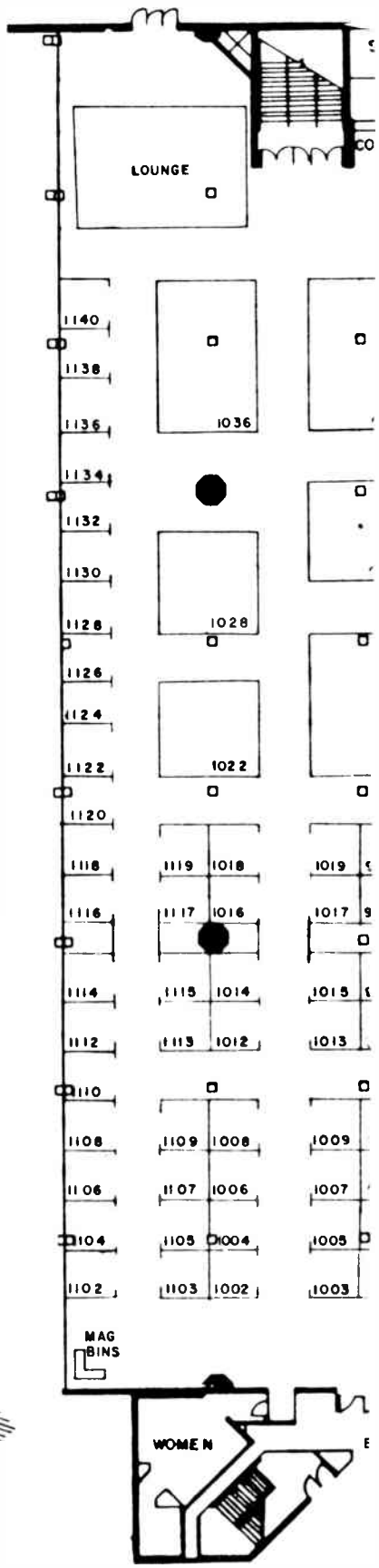

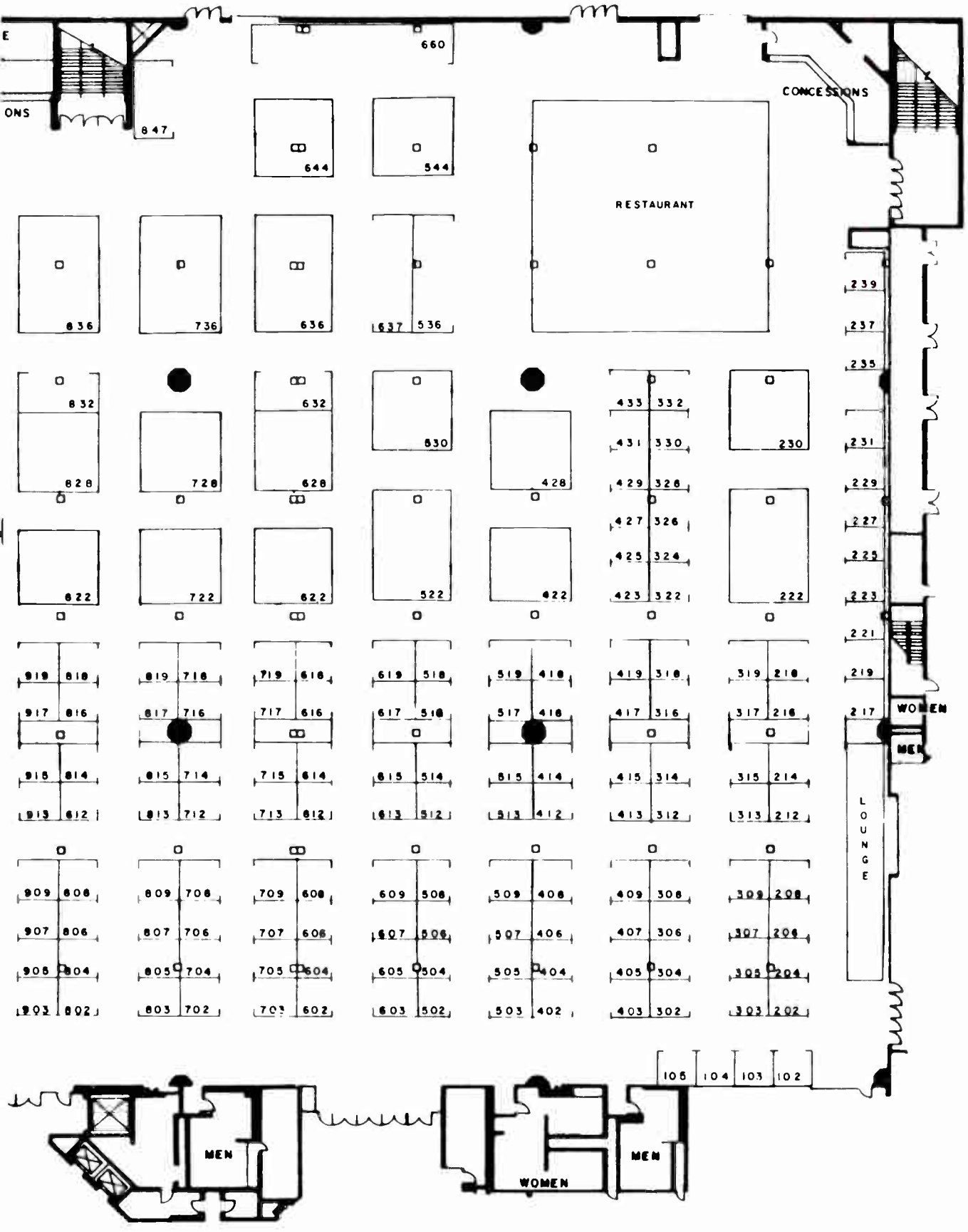
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CED
Cable-Tec Expo Product Showcase

ALS
an
LPL Company

1) LiteAMp ™ and LiteAMp Plus ™ 80 channel AM fiber systems so advanced that no fiber experience is required. Adjustable RF gain and slope.

2) Fiber Network 6000 ™ 16 channel/ fiber 60 dB system with 60 dB BTSC audio.

3) SMART-NET ™ Control software for fiber networks

Booth 1132-1134

COOPER INDUSTRIES **BELDEN**

CLI a big issue?
Stop by **booth 719** for a live demonstration on shield effectiveness. Bring three 6-foot cable samples to the booth and **Belden** will evaluate the shield design using its Transfer Impedance Clamp. All results will be presented in graph form.

Booth 719

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cable prep
BEN HUGHES COMMUNICATION PRODUCTS CO

Ben Hughes/Cable-Prep® - Full line of Hex Crimp Tools, Coring and Stripping/Coring Tools, and accessory items. New products for CATV will be introduced. Free samples available.

Booth 1007, 1009

CED

Visit **booth 417** to learn all about **CED Magazine**, the number one technical publication in the cable industry. Also see our *CATV Buyers' Guide*, the only guide for complete hardware products and services.

Booth 417

CableVision

CableVision is the leading analytical journal for the proactive manager in cable TV. It covers topics such as HDTV, fiber optics, off-premise addressability, international developments and more. It is written in layman's terms for corporate and systems management.

Booth 417

CALAN

Visit CALAN at **booth # 544 SCTE** to learn more about our new **SPECIAL PACKAGE** offering and **TRADE-IN** program.

The **SPECIAL PACKAGE** allows you to save over $1000 on CALAN's most popular sweep system configuration.

The **TRADE-IN** program offers an allowance of up to $3000 when purchasing a CALAN sweep system.

Booth 544

CATEL
THE CLEAR CHOICE IN FIBER

CATEL will demonstrate its transhub family of fiber optic transportation systems that can be applied economically to help you expand or upgrade your cable system.

Booths 608 and 609

CHANNELMATIC

Save time at SCTE with a one-stop equipment shop! Over 200 products for you -

- Ad Insertion Systems
- LO Playback
- Automated Editors
- VCR Sequencers
- A/V and Routing Switchers
- DAs
- Time/Tone Controllers, and more...

You'll take home money-saving ideas and valuable new product information from the cable automation specialists - Channelmatic.

Booth 307/309

Comm/Scope, Inc.
THE Cable in Cable TV.

Complete quality cable products line featuring QR, P3, CableGuard jacketed P3, NEC rated and Corrosion Resistant Drop (CRD) cables and Optical Reach fiber optic cables.

Booth 530

CED
Cable-Tec Expo Product Showcase

DROP SHOP inc

Industry suppliers of drop and installation materials. Stop by and see our new line of 125 dB space RF-shielded super splitters. Other products featured are connectors, hook-up kits, molding, tools and other RFI secure products.

Booth 1022

EAGLE COMTRONICS INC.

Eagle's new MDU addressable trap switch provides cable operators what they have been long waiting for; addressability with IPPV, consumer friendliness and total control outside the apartment. Eight tiers of pay channels, complete on/off control, parental control, store and forward technology, non-volatile memory and low cost computer control makes this product versatile and economical. See us at **booth No. 908** at the SCTE convention in Nashville.

Booth 908

fm Systems

See the new CSPM-1 CABLE STEREO PERFORMANCE METER and a hands-on test of the MMC MODULATION MEASUREMENT SYSTEM and the ALM 673 AUDIO LEVEL MASTER at our booth at the SCTE show!

Booth 913-915

HUGHES

Hughes is featuring products that enhance AML system reliability. Stop by to see our line of frequency-agile upconverters, test sets, receiver redundancy units, and new compact outdoor transmitters.

Booth 616

Jackson Tool Systems

Come see our new booth at the SCTE Cable-Tec Expo.

Look at our tool line and get in the drawing for a **Jackson Tool jacket**

Booths 316 & 318

Lectro

Highly diversified line of ferroresonant & standby power supplies ranging from 2 to 18 amps. Metered and unmetered pedestals. UL, ETL & CSA products available.

Visit **Lectro Products** at **Booths 702, 704.**

Long Systems, Inc.

A New Tradition In Cable Software

A New Tradition in Cable Software

LES - Leakage Evaluation System

VIC - Vehicle Information Center

MOM - Monthly Outage Management

come ooh and aah at **Booth 408**

MAGNAVOX
CATV SYSTEMS CO.

At **booth #644**, Magnavox is *Taking Broadband Beyond 2000* by featuring the latest in CATV distribution equipment including fiber optic receivers and transmitters and the new Spectrum 2000 amplifier system.

Booth 644

MIDWEST CATV

Make your plans to attend the **MIDWEST CATV booth 836** to see new products like fiber optic gear from General Instrument and Sumitomo Electric, optical cables and fusion splicers manufactured by Sumitomo and the newest entry, the "Micro" Fusion splicer from Preformed Line Products. See optical test equipment from Noyes and the new "POWERCAST" manufactured by Power Guard. For the subscriber premise, see "THE MATRIX SYSTEM", an on-premise technology that merges traps with addressability.

Booth 836

CED
Cable-Tec Expo Product Showcase

MONROE ELECTRONICS, INC.

Visit **booth 502** for your swiching solution. **MONROE ELECTRONICS** introduces two new switch modules for the SERIES 3000 product line.

MONROE ELECTRONICS: it takes the leader to solve the problem.

Booth 502

MOORE

Put up a **MOORE** Security Enclosure and walk away confident knowing your CATV investment is protected! **MOORE** enclosures are an ideal balance of security, ease of installation, serviceability, durability and value.

Booth 603

Multichannel News

Multichannel News is the weekly newspaper serving the CATV industry. When our technical writers go out to get a story, they bring back more than a breezy synopsis. They bring you the facts. Week after week our technical editor Gary Kim covers key issues in his column *The Cutting Edge* in the weekly technology section of **Multichannel News**. If it impacts your business it's going to be on our pages.

Booth 417

Panasonic
Communications & Systems Company

Panasonic is exhibiting portions of its full line of CATV equipment including Subscriber Equipment, Fiber Optic Trunking Equipment, Studio Production Equipment and Ad Insertion Equipment.

Booth 1012

POLYTECH CLOSURES Incorporated

Polytech Closures Inc. strives to meet your every need. Come see our complete range of sizes from hand helds to pedestals 8" to 36" in height. Low cost with high protection due to our multiple security features.

Booth 1016

POWER TECHNOLOGIES INC

Power up with PTI at booth No. 1028.

Come see how you can retrofit your existing power supplies with ease. Introducing a new patented technology that eliminates costly battery replacements and improves performance.

Booth 1028.

Power & Telephone Supply Company

Taps, Splitters, splices, Connectors, Surge Protectors, Power Supplies, CLI Tools, and Electronics from top manufacturers like Scientific Atlanta, Times Fiber, Gilbert, Panamax, Power Guard, Antronix & others will be shown.

Booth 1071

RTK CORPORATION

Full/modified turnkey residential, multifamily and commercial installation services. MDU pre-wiring and post-wiring, survey, design, audit, rebuild, upgrades and converter change-outs.

Booth 916 & 918

RELIANCE COMM/TEC

Utility Products introduces a new line of plastic and metallic pedestals. The Access 360 line is designed to improve pedestal performance. The lift-off cover provides technicians with 360 degree working access to distribution equipment.

Booth 328

CED
Cable-Tec Expo Product Showcase

RISER-BOND INSTRUMENTS

**** MODEL 1210 ****
TIME DOMAIN RELECTOMETER

THE MOST ACCURATE TDR ON THE MARKET TODAY!

Demonstrations of Model 1210 TDR, Cable Fault Locator, featuring AUTOMATIC CURSOR SET and SUPER-SIMPLICITY. Don't MISS US at CABLE-TEC EXPO.....

Booth 812

Scientific Atlanta

Come to **booth 922** to see **Scientific Atlanta's** Addressable Interdiction System—a subscriber and operator friendly technology that allows complete addressable control of programming with electronics outside the home. Also, see the complete line of headend, distribution, fiber, addressable and non-addressable products.

Booth 922

SUMITOMO ELECTRIC
Fiber Optics Corp.

SUMINET 5840 VSB-AM Optical Video Transmission Equipment 40 channels, single-mode transmission up to 20 km.

SUMINET 5630 Optical Transmission Equipment 8 channel video, 16 channels audio transmission up to 50 km.

Booths 506 & 508

TPC

TPC will be exhibiting CLIDE, the Cumulative Leakage software Solution, with all of its supporting products: the PSION hand-held computer for remote data entry, the Wavetek CLM-1000 Leakage Detection meter that is fully CLIDE compatible, and the Radio Shack RS-102 laptop computer. Also, TPC will display CASEY, a syndex software solution, and automated headend control packages.

Booth 602

TRILITHIC

Trilithic will display its full line of RF test equipment at booth number 202. Products include the new SP 1700 Digital Signal Level Meter, CLI equipment, a new 1 GHz bench sweep system, 1 GHz spectrum analyzers and SYNDEX\headend reconfiguration products.

Booth 202

Trilogy
COMMUNICATIONS INC.

A full line manufacturer and supplier of high quality coaxial cables including state-of-the-art MC^2 air dielectric, foam trunk & feeder, and drop cables meeting your NEC requirements.

Booth 708

WEGENER COMMUNICATIONS

Demonstration of BTSC encoders and audio AGC. On display are the various network control and commercial insertion cueing products as well as **Wegener's** recently introduced Series 1800 addressable Video Receiver.

Booth 428

WESTEC
COMMUNICATIONS, INC.

Westec offers services for AML system users including receiver and transmitter modifications and upgrades. Long life rebuilt klystrons provide reliable service and considerable savings. Westec CARS band receivers and transmitters are also displayed. Stop by!

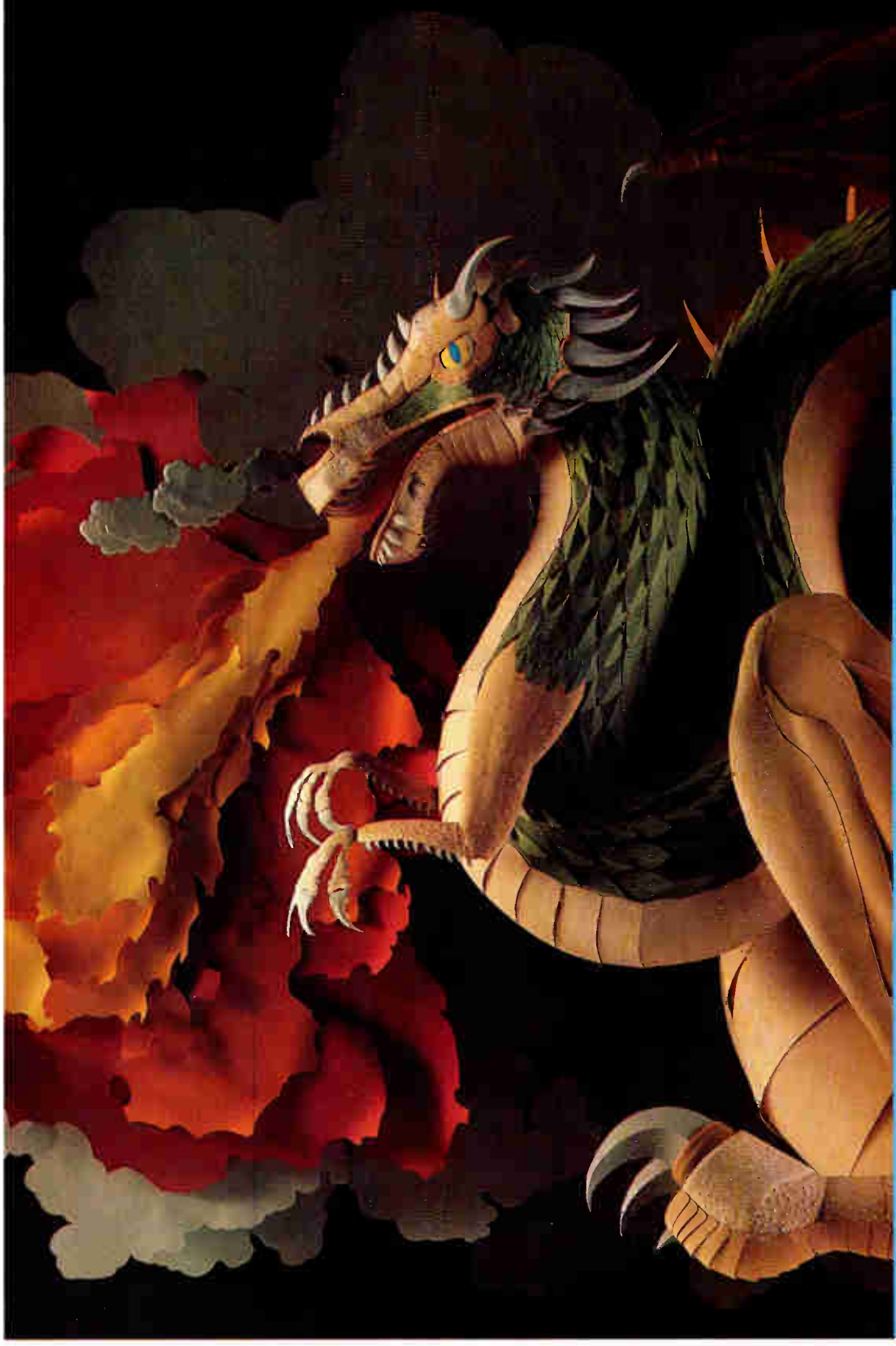
Booth 221

ZENITH

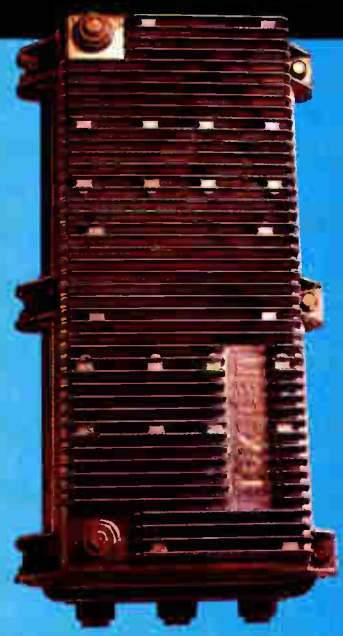
Zenith will display a live PMII RF Addressable system. Register to win a PCC Multibrand Remote Control, 10 to be given away each day.

Booth 807

It's Not Always This Easy To See The Power And Reach That Legends Are Made Of.



Sometimes It Takes A Closer Look.



Fiber to bridger (FTB) among your goals? Meet **"FLAMETHROWER"**, newest member of Texscan's PATHMAKER PLUS + Opto/RF family. Features include a high performance, low noise, dual or single LASER LINK detector, and a high-powered RF distribution amplifier. Typical FTB system performance is nothing short of impressive.* **"Node-to-node"** RF REACH> 3.0 km.

Subscriber tap performance: CTB > 53 db, CSO > 53 db, C/N > 50 db

Make sure your goals are in REACH.

*10 db optical loss budget, 77 channels, .625 inch coax, with up to 4 ports and 3 LE's.

Texscan

PATHMAKERS IN TECHNOLOGY

Reader Service Number 45

Continued from page 70

four-pole trap eliminates traditional "O" ring seals via precise machining of solid brass. Custom capacitors are said to improve stability.

On the business side, Augat also announced the signing of a marketing and distribution agreement with **Channell Commercial Corp.** to promote Augat's high-end technology products, including Snap-N-Seal connectors, stripping tools, connector crimping tools, CLI test equipment and fiber curing ovens. Also, Channell has agreed to act as the exclusive marketing rep for Augat's fiber optic products. The agreement allows Augat to distribute its products from Channell's three warehouses.

Also, the two companies will work to develop training tapes showing proper design and installation of fiber cables and equipment. An Outside Plant Services group of experts will be formed to provide face-to-face interaction with system field personnel to inspect and train CATV engineers and techs on proper installation methods, said Bill Channell Jr., executive VP.

Subscriber equipment

On-screen displays have finally come to cable converters. **Scientific-Atlanta**'s Model 8600 set-top features a menu-driven set of instructions, direct channel access and newly designed front panel keys.

The result of consumer focus groups, the converter "walks" users through a series of functions, including sleep timer, VCR program timer, parental control code and favorite channel memory. The baseband unit features volume control with on-screen indication of volume levels and optimal volume level for stereo. A one-touch pay-per-view "buy" button is included.

Also, up to nine different operator defined barker channels can be internally generated without affecting an operator's bandwidth, a feature which could free up valuable channel space for other purposes, said Steve Necessary, VP marketing of S-A's Subscriber Systems Division. The addition of on-screen circuitry is expected to add $5 to the price of the terminal, he added.

Also shown, often to large audiences, was S-A's addressable interdiction system, which is being installed by Jones Intercable in its Elgin, Ill. system.

Zenith Electronics Corp., playing the familiar role of interactive video provider, introduced the PMII-Pulse, a two-way impulse pay-per-view (PPV)

Zenith's "PM-PULSE" addressable decoders

Viewers demand better quality

"Subscriber expectations are higher today as they become exposed to more sophisticated technology," says Paul Heimbach, senior vice president of engineering for Viacom Networks Group and moderator of the technical session 'Delivering Improved Picture Quality—Present and Future.' "Because cable is taking steps to improve technology, it is important that we understand the technology and the new equipment to be built." With that, Heimbach introduced Mike Jeffers with the Applied Media Lab, Jerrold Communications.

Jeffers began his discussion of "Controlled Subjective Testing of Cable System Impairments to Picture Quality using Psychophysical Methods." The testing is an arrangement with Cable Television Laboratories (CableLabs) to study cable system impairments to picture quality. (The study is sponsored by CableLabs under the direction of Tom Elliot, vice president of science and technology. Bronwen Lindsay Jones, an audio-video expert in the field of psychophysical testing, will establish this criterion for the subjective measurements and record all data.)

Saying that the industry as a whole has never really done a test of impairments, Jeffers stated the impairments to be measured are: video signal-to-noise; composite second order; third order distortions; chroma/luma delay inequality (envelope delay); phase noise and reflections (echoes). A test system will be set up at the Applied Media Lab with a headend composed of 60 channels. The channels will carry 20 separate video channels. The tests will be conducted twice, once with experts invited in to establish a threshold for signal-to-noise (S/N) tests and secondly, once the reference is established, a second "non-expert" group will be subjected to the pictures and their opinions recorded.

From these tests will come a series of reports with the printed threshold of the experts and the reaction of the uninitiated. These tests will be conducted for each impairment.

"In all," says Jeffers, "what we hope to come up with is effective reports. The subjective results of non-expert viewers will more easily show the picture level quality that subscribers will demand."

system with a real-time interactive link to subscribers. PMII-Pulse is designed to give operators a way to do three jobs: audience surveys; system status monitoring; and program authorization.

Zenith's Command Series addressable controller operates the system, which can simultaneously run Zenith's Phonevision ANI or management-activated PPV systems. Features include expanded headend control, 256 program tags and full 84 channel downloadable channel mapping. Both the IR remote control receiver and the VCR timer function are software controlled.

Meanwhile, the international flavor

Pioneer's BA-6160E PAL-1 converter

of the show was apparent from the large numbers of displays dedicated to international cable equipment. **Pioneer Communications** introduced the BA-6160 PAL-I unit and displayed it with converters designed for PAL-B/G, Japanese and U.S. cable markets. The new PAL-I converter offers volume control, wireless remote control, PPV capability and VCR program timers, teletext transparency, changeable output channel and Nicam stereo compatibility.

Jerrold also showcased its ability to market to the world by demonstrating the route a signal takes from reception to the home. New equipment includes a S450M PAL-B/G and PAL-I modulator and S890D demod, DX amplifier for European, British and Japanese splits, line extenders and a new Intercon 7000 baseband converter, which joins a previously announced RF device.

Jerrold also showed a converter equipped with a low-noise preamplifier designed to help cable operators improve picture quality via better signal-to-noise specifications. The improvements are expected to add $3 to the cost of an RF unit and $2 to a baseband converter, said Ed Ebenbach, VP marketing of Jerrold's Subscriber Systems Division.

Jerrold also debuted the ACC-2000 addressable controller for cable sys-

LET'S TALK CREDIBILITY.

Until recently, some people had barely heard of Sumitomo Electric. Yet we've quietly been a leader in fiber optics and cable TV for nearly 20 years. ■ And we've long been committed to improving your tools of the trade—as an early pioneer of VSB/AM optical transmission, for instance. Fusion splicing. And vapor axial deposition (VAD), the world's most advanced fiber-making process. (It's helped us set the world record for low loss.) ■ In 1984 we invested more than $100 million starting up a major North Carolina manufacturing complex. Its centerpiece: our VAD fiber optic manufacturing facility—now 51 percent American-owned. ■ Sumitomo Electric engineers install fiber optic communication systems, including cable TV, from coast to coast. ■ In fact, we're the only one who can give you a total turnkey system using our own fiber, cable, electronics and fusion splicers. Plus construction, training and support. Single source, single responsibility. ■ Pretty darn incredible.

See us at the Cable Tec Expo, Booth #506.

SUMITOMO ELECTRIC
Fiber Optics Corp.
YOUR LIGHT SUPPORT SYSTEM™

Reader Service Number 48

78 Alexander Drive ■ Research Triangle Park, NC 27709 ■ (800) 358-7378 or (919) 541-8100 ■ Fax (919) 541-8297

Member of the Sumitomo Electric Industries, Ltd. Group

tems serving up to 32,000 subscribers. Based on Compaq 386S computers, the system allows store-and-forward impulse ordering via telephone. It upgrades the existing ACC-1000 system.

Other equipment

Additional new products rolled out by the industry's equipment manufacturers include some of the following:

AML Specialties

A new solid state amplifer kit, designed to replace the klystron in a microwave transmitter, and a new low-noise receiver were announced by AML Specialties.

The KMVS301 retrofit kit replaces the klystron and high voltage power supply while providing RF power in excess of 2 watts, according to the company. Also, linearity is improved and noise figure is 20 dB better than the klystron. For information, call (619) 569-7425.

Calan

Available from Calan is the Snap Shot computer program which allows stored traces from a receiver to be downloaded into a computer. Designed in conjunction with **Long Systems Inc.**, the FS80, added to a Calan box, can store 80 traces, display four at a time, and allows for the superimposition of displays taken months ago. According to Edward McDonald, director of new business development, the software was developed to eliminate the need for operators to take pictures in order to compare traces. For details call (717) 828-2356.

Channelmatic Inc.

The new CompEditor family of automated editing and compiling systems from Channelmatic was shown at the convention. Also, the company displayed one of only five existing Panasonic LQ-4000 Rewritable Optical Disc Recorders.

CompEditor Series 300 features the ECU-300 with A/B roll and optional DTMF encoder for three VCRs is aimed at the small system operator with light editing needs. The Series 400 has a 1,000 event memory and is geared toward small or medium sized systems with moderate editing needs and sequential or random access equipment. The Series 600 is intended for heavy editing at larger cable systems. For

ers will accept." The report will be under the control of CableLabs and is expected to be out in the fall.

Dr. Yozo Utsumi, deputy director of the radio research division of NHK, then addressed "HDTV MUSE Signals on Cables and Optical Fibers." Utsumi began by explaining the technology of the two MUSE HDTV transmission schemes. The first is HDTV MUSE (Multiple Sub-Nyquist Sampling Encoding) VSB/AM (Vestigal Sideband/Amplitude Modulation) transmission on coaxial cable via communications satellites. The second, and a more recent development, is the MUSE FM transmission on-demand access optical fiber.

After performing an experiment through two transmission systems in cascade, the MUSE VSB/AM transmission results showed "excellent HDTV pictures," according to Utsumi, with carrier-to-noise (C/N) ratios of better than 23 dB; better than 44 dB C/N at the receive end and S/N ratios of better than 39 dB.

The demand access system distributes 34 MUSE-FM signals over 20 km, and at any hub, any four MUSE-FM signals can be selected by the subscriber and are transmitted on each subscriber line of about 2 km. The results of this type transmission is a "received C/N ratio, when all channels are unmodulated," says Utsumi, "of 25 dB C/N ratio for 25 channels."

In conclusion, Utsumi stated that VSB/AM transmission has been demonstrated successfully and fiber to the home HDTV has been recognized by demand access optical fiber CATV system.

Dan Moloney, director of product management for the subscriber systems division of Jerrold Communications, presented a paper on "Improving Picture Quality in Today's Converter Market." Saying he wanted to address why people are so sensitive to picture quality and what the industry can do to improve that quality, Moloney began by addressing why quality is important. "Used to be," says Moloney, "the picture delivered to the house was so poor, it didn't matter what you did at that point (putting in a converter)." Now that fiber optics and other technologies are pushing better pictures farther into the distribution line, people's perception of what is good is important to deal with.

In order to deal with this, Moloney stated it was necessary to improve the plant, as well as improve S/N ratios. Fiber optics is one way, improving the converter is another. Currently, Moloney says converters are running at 13 dB to 14 dB noise figures. When you add a converter with a 13 dB noise figure to a system with a 46 dB C/N at 0 dBmV input level, the picture quality will be degraded to approximately 43 dB, a 3 dB change which can be noticeable to the subscriber.

One means of improving the quality through the converter is with the inclusion of a pre-amp, according to Moloney. Because amplifiers perform non-linearly as the input level is increased, it is important to include an automatic gain control (AGC) feedback loop in the design. If the picture quality is "good" to begin with, -46 dB or better, several benefits can be seen from the low-noise pre-amp: low drop level, ±10 dBmV at tap; and a high drop level with two or more splits.

Other converter enhancements included: using quasi-parallel detection circuitry; using a phase lock synchronous detector/modulator; and developing custom video and audio SAW filters. In summarizing, Moloney again stated that consumers are concerned about quality. "They're exposed to video and audio that makes them question cable quality," says Moloney. "Converters need to be better and one way to do it is through pre-amps."

The final paper by Walt Ciciora, vice president of technology at ATC, again focused on advanced television: "Cable's Excellent Position in HDTV." The message, says Ciciora, is that HDTV will not happen quickly; that we need to take care of NTSC subscribers; and the cable industry can deliver HDTV long before the subscribers will want it. There are three reasons HDTV is important, he continued. One is the telco threat; secondly, we have to live with the final standard for 50 or so years; and the industry has to plan for upgrades and rebuilds.

Ciciora also focused on four objectives of the cable industry for HDTV: preserve cable's ability to compete; deliver broadcaster's HDTV signals; serve the NTSC population; and accommodate cable's unique needs. Ciciora also addressed the improvement of existing NTSC but said there were fundamentally three constraints: compatibility with existing receivers; the existing population of receivers; and the need for pre-processing.

Ciciora then discussed each constraint in detail before concluding that "cable will be ready before the subscribers (for HDTV)." ■

—Kathy Berlin

LET'S TALK RESULTS.

November 1988: A lot of people were still just talking about VSB/AM optical transmitters. Sumitomo Electric was delivering. ■ *Today:* Our second-generation Series II gives you a loss budget that's 3 dB better–packaged in a double-module rack unit that's only 19"x 14"x 4." Or your choice of strand- and pole-mount units. ■ Our patented VAD fiber-making technology gives you a matched clad fiber delivering unsurpassed specs. Such as <0.50 dB typical "water peak" attenuation at 1380 nm, providing an exceptionally flat operating region. ■ Prefer depressed clad? We'll gladly supply it. Along with everything else you need to build and operate a fiber installation–including the experience to do it right. ■ After all, Sumitomo Electric people have helped engineer, construct, equip and support fiber optic cable TV systems all over the world. ■ Talk with us about your fiber plans. We'll help you produce some mighty impressive results.

See us at the Cable Tec Expo, Booth #506.

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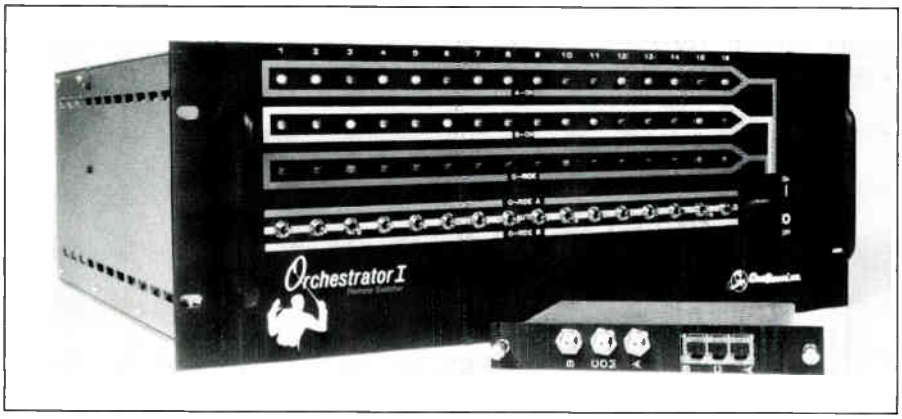

Orchestrator™ I Remote Switcher by ComSonics, Inc.

details, call (619) 445-2691.

ComSonics

The Orchestrator I remote switcher from ComSonics is a computer-based headend control system that includes everything a cable operator needs to comply with syndex and non-duplication requirements. It includes a rack-mounted control unit with processor, schedule memory and up to 16 switch cards; a switch capable of handling RF, IF, baseband and associated stereo audio signals; and ComSonics software designed for IBM and compatible computers.

The device takes entered or downloaded scheduling information and remembers conflicts to switch off duplicated programs from distant sources and air alternative signals selected by the operator. For information, call (800) 336-9681.

Display Systems Int'l

Display Systems International Inc., (previously CompuCable Systems Inc.) demonstrated the Elite Crawl line generator. Designed at the request of operators, the generator allows an operator to advertise without interrupting the signal. The Elite Crawl allows for genlock over external video; the placement of a horizontal crawl anywhere; multi-colored background and patterns; two different sizes text; 4,096 colors; and other standard features. For more info call, (814) 257-8210 or (306) 934-6884 in Canada.

Lectro Products

Lectro Products Inc. launched the EconoMax, a 15 amp ferroresonant power supply that utilizes Lectro's heat sink technology for longer transformer life. The EconoMax is a pole or ground mounted unit that features built-in short circuit and overload protection, and MOV input surge protection. Also released was a new line of Unmetered Service Pedestals, which feature 210 to 255 VAC, 50 Hz input and 60 VAC output in 12, 15 and 18 amp sizes. These units are available with cabinets or with mounting brackets designed to mount in existing utility cabinets. For more information call (800) 551-3790, (404) 543-1904 in Georgia.

Magnavox

Magnavox CATV Systems introduced a new line of amplifier products. Designated the Spectrum 2000 Amplifier System, it includes the previously introduced 7-TH housing but adds a new 600 MHz, two-way interconnection chassis in a variety of bandsplits for both domestic and international applications. New modules are available in feedforward, power doubling or push-pull versions.

Also included is the new LE90 line extender, available in push-pull and power doubling versions. Finally, the Magnavox Management System is a status monitoring system that gathers and evaluates information taken from a variety of locations. For information, call (315) 682-9105.

Nexus Engineering

Originally designed for Rogers Cablesystems in Canada, Nexus announced the availability of the Customer Service Headend, a signal generating source capable of delivering messages concerning the status of scheduled or unscheduled outages over as many as 33 channels simultaneously.

The unit can be strand or pole mounted and weighs 50 lbs., according to Leonard Zapalowski of Nexus. Although originally intended for planned service interruptions associated with Rogers' fiber rebuild, the unit can be used for similar purposes or in the case of unplanned outages. The system is based on Nexus' Series 5 modulator, is housed in a rugged metal weather-proofed housing and uses 3.5-inch diskettes to generate the text messages. The headend is priced at about $10,000.

For more information, call (206) 644-2371.

Realtime Electronics

Because cable system audio levels often vary by wide margins from channel to channel, this company designed the Audio Rider 2000, a system which matches the audio level of as many as 120 channels to a single software reference. A rack-mounted computer directs and coordinates the operation of up to 60 Intelligent Gain Control units.

The actual sound level of every channel is continually monitored and changed if necessary back into the target range. Audio signal magnitude, frequency and duration are all considered in the calculation. The result is consistent preceived audio levels from one channel to the next. The computer is priced at about $7,000 and each module is priced at about $300. For details, call (602) 838-5038.

Standard Communications

Standard Communications Inc. announced the development of two products—the second generation Agile IRD II (integrated receiver descrambler) and the TVM450 frequency agile modulator. The Agile IRD II is a 1.75-inch VideoCipher II Plus commercial module capable satellite receiver designed to save an additional 50 percent rack space over first generation commercial IRDs. The receiver portion is a synthesized PLL, C/Ku-band, 950 MHz to 1450 MHz input with dual conversion 70 MHz IF. Maintenance and T.I. evaluation are facilitated by front panel test points for 70 MHz IF and scrambled/unscrambled video.

The TVM450 450 MHz modulator, which is expected to be available in October, can be configured three ways. The first, the TVM450S, has Standard's BTSC stereo encoder installed and is compatible with all RF scrambling formats. Secondly, the TVM450P contains the OAP450 off-air processor. And finally, the TVM450R, RS, RP is the modulator in any configuration with "SAM," the CRC450 System

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Getting ready for digital transmission

"HDTV and the application of fiber optics is causing engineers to rethink the way television pictures are being delivered to the home," says Robert Burroughs with Panasonic Technologies, Communication Systems Technology Laboratory, as he began the first paper in the technical session "Digital Systems: It's Not Just Zeros and Ones."

Because discussions about new delivery methods often include a reference to Shannon, Burroughs paper, "What Shannon Really Said About Communications and its Implications to CATV" reviewed Shannon's fundamental theorems and premise as well as contemplating future digital systems.

Shannon's fundamental theorem for a discrete channel with noise is the basis by which all systems should be judged, an ideal system. Burroughs explained Shannon's theorems on signal quality and noise. Burroughs also discussed Shannon's work on the definition of information and its subsequent application to the communications problem.

Burroughs then compared television transmission systems for CATV by doing a system evaluation for a FM system and a digital system. In conclusion, Burroughs stated that the interface to the TV has been the problem with digital transmission. "Once the decision to go digital is made," says Burroughs, "the possibilities are unlimited as to how to transmit it. It's coming about time for cable to start performing, because it will happen."

Joseph Waltrich with Jerrold Communication's Applied Media Lab presented the next paper entitled "A Tutorial on Digital Video Compression Techniques." Stating that the advantages of digital are well known as long as signal quality is maintained, Waltrich stressed that the price we pay is increased bandwidth. His paper focused on compression requirements and transmission bandwidth, along with a review of video compression schemes. In regards to compression, Waltrich looked at the degree of compression as best expressed in terms of the compressed video source, in terms of pixels. He then discussed compression techniques, saying there are four different methods: predictive coding (differential pulse code modulation), with the advantage being the error signal has less spraying than the original image and it lends itself well to coding techniques (such as Huffman coding); Transform Coding which involves transferring from the time domain to frequency domain; Vector Quantization which is a pattern matching process; and Subband Coding (which forms the basis for MIT and Zenith's proposed HDTV systems) where the signal is divided into frequency subbands, subsampled, followed by the coding of frequency sidebands.

In summarizing, Waltrich felt the compression implications for cable are: equipment; fiber optic transmission; encoding/decoding; and pre-filtering. "Will cable give up VSB/AM in favor of digital communications?" asked Waltrich. "I can't say we'll go completely digital."

Not forgetting digital audio, Craig Todd with Dolby Laboratories then addressed "Digital Audio for NTSC Television." Todd first focused on the 1987 proposal Dolby made to add a QPSK carrier with alpha = 0.7 filtering, a carrier frequency 4.85 MHz above the video carrier and a carrier level of -20 dB with respect to peak vision carrier level. However, because the system needs to be compatible with both broadcast television as well as cable, there were changes needed for both broadcast and interference problems. Todd then discussed the individual problems and subsequent solutions.

Todd wrapped up the paper by saying the new system costs about 10 times as much to decode. "In the case of HDTV sets," says Todd, "the cost penalty is acceptable."

The final paper was delivered by John Sie, senior vice president of TCI, who addressed the topic of "Processed Digital HDTV for Cable." (The paper is not included in the *1990 NCTA Technical Papers*. Anyone wishing a copy of the paper may request it from TCI.) Sie began by looking at the strategic imperatives of processed digital transmission to CATV. "The purpose," says Sie, "is to give engineers the realization of the significance of technical policy to business decisions—bring the importance of processed digital technology to the front."

Sie believes the deployment of a processed digital system: has a long term impact; will extend to other non-entertainment businesses (i.e., medical, government); and form a core for a communications infrastructure for the 21st century. "Simply put," says Sie, "it's a design of technology for video waveform transmission." This transmission will look to optimize the transmission coding technique for the medium used and focus on the narrow responsiveness of the human eye.

Currently, applications of compression are done in isolation. It should be done scalable, says Sie. Videoconferencing is at 200 lines, studio quality NTSC, HDTV with 35 mm resolution; now there is ultra high definition television (UDTV) which is approaching 70 mm resolution, 400 MHz, 2,000 lines. "Once equipped, cable can expand beyond entertainment," states Sie.

The advantages of processed digital transmission include: no degradation; noise quality relaxed; sophisticated processing; integration with computer technology; integration with other digital transmission applications.

Other strategic considerations include: the FCC decided the terrestrial standard for HDTV would be a simulcast system; (In 1993, says Sie, the decision will be made for HDTV. Why do we embrace a technology now when three years from now it will be different?) What's happening in Japan and Europe is another strategic consideration; computers are moving into graphics (these will interface at some point in the future); telco fiber optic transmission is all digital. If computer technology is being worked on, telcos are doing it, cable needs to work on it to maintain a competitive edge; and the final strategic consideration is DBS (direct broadcast satellite). Sky Cable has announced it plans to utilize 4:1 compression. The ability of DBS to work means cable can do the same, stated Sie.

Sie also asked how processed digital fit into the "4 C's" architecture:

Computer & Communications
with Cable & Consumer

"The combination of both," says Sie "is an advanced, dynamic communications infrastructure where cable is a cost effective distribution network." The consumer doesn't see where it comes from, he just sees the end result, added Sie. So, how do we go from here to there? Take an evolutionary approach with 750 MHz to 1,000 MHz capability in the last mile, says Sie. By mid decade, add fiber optic nodes into neighborhoods and a personalized system into the home for interactive services. The infrastructure will be there to do it. "With processed digital transmission," says Sie, "we can move into business applications. Proper research and development is central to the future in public policy as well as our well being." ■

—Kathy Berlin

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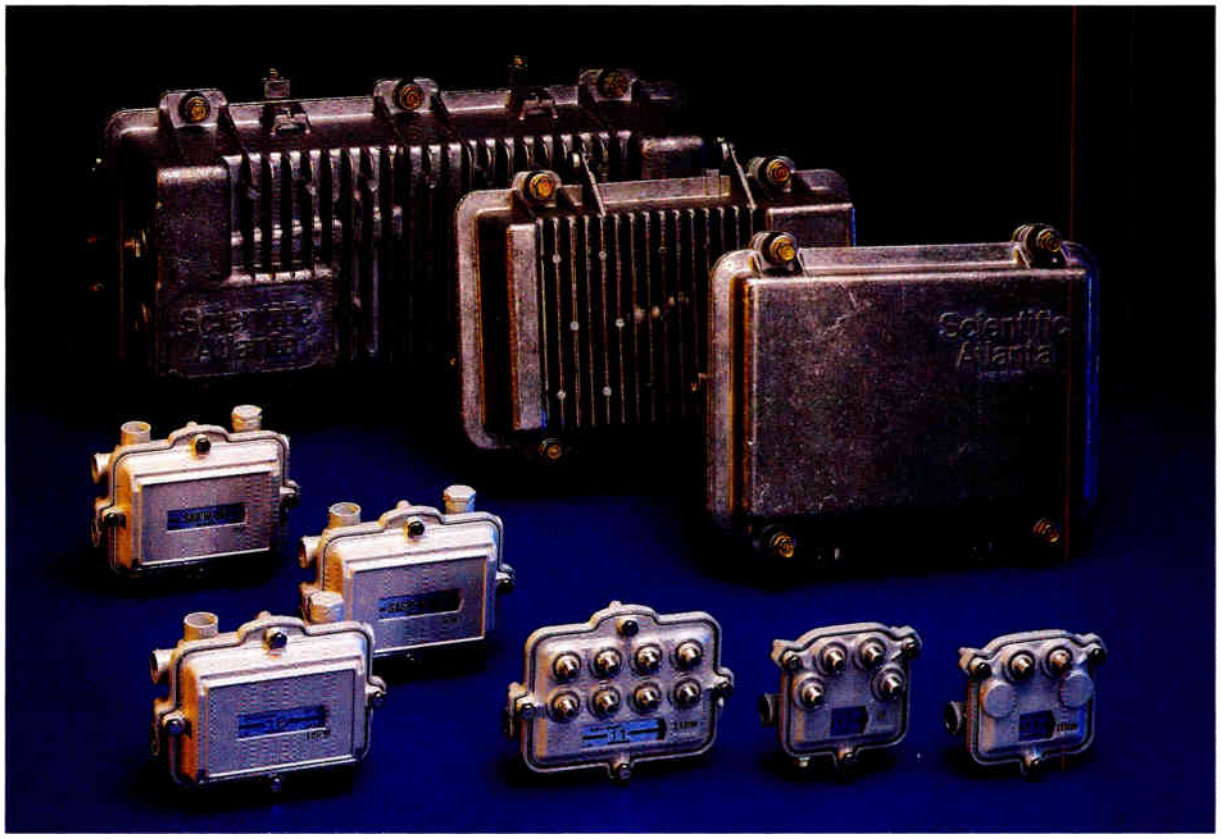

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For more information on Standard's products call, (213) 532-5300.

Times-Fiber

Times Fiber Communications introduced a new low-loss coaxial cable designed for emerging technologies, such as HDTV. The product features 1 GHz signal bandwidth and lower insertion loss, which will help carry more channels with higher picture quality.

In addition, Times announced an agreement with Cox Cable of Santa Barbara to supply the system's rebuild with T10 trunk and feeder cable and the environmental system of T10 drop cable with Lifetime and Amphenol connectors. For information, call (203) 265-8500.

Toner

Demonstrated by Toner Cable Equipment Inc. was the Toner Quadtap™ which puts four taps in one. The Model XQT-48 contains 48 ports whereas the XQT has 32 ports, both with nominal tap values of ±1.5 dB. Bandwidth is 5 MHz to 600 MHz, 75 ohm impedance, isolation greater than 22 dB and RFI greater than -100 dB.

Also announced were new Toner distribution and subscriber passives. The subscriber passives, both splitters and directional couplers, have better than -100 dB RFI integrity. Toner's distribution passives are AC power passing, two-way devices operating within an RF passband of 5 MHz to 600 MHz. For information on the Toner products call, (800) 523-5947 or (800) 492-2512 in Pa.

Vyvx

Vyvx (pronounced "vih-vix"), a company that provides nationwide fiber-optic route-switched video transmission, announced the availability of its network for the distribution of broadcast quality video programming. The switching route features multipoint-to-multipoint distribution, centralized switching and control, and redundant routing design.

The Vyvx National Video Network is comprised of a backbone network of fully duplexed DS-3 channels connecting major cities. Vyvx provides digital coding and decoding equipment to connect DS-3 channels for video users. Call (918) 588-5760 for details.

Jack Trower (center), SCTE President, accepts a check for $20,700 from Rob Stuehrk (left), associate publisher of CED *magazine and William McGorry, group publisher, during the May SCTE Board meeting. The check represents SCTE's revenue from the 1990 Membership Directory and Yearbook.*

Westec Comm.

Westec Communications Inc. is now offering microwave receivers and transmitters for the CARS band. The equipment will not be offered for sale for approximately one month, pending FCC approval. The CBTX-S-045K transmitter uses a klystron amplifier and a switching power supply which reduces the size of the transmitter while providing higher efficiencies, says Robert O'Hara, president of Westec.

The CBTX-S-045T single-channel transmitter uses a traveling wavetube (TWT) amplifier, has a lower noise figure and reduces power consumption, according to O'Hara. Both models have self-contained high voltage supplies. The CBRX-450 microwave receiver uses a DRO (dielectric resonated isolator) and has a 450 MHz bandwidth. Once FCC approval is gained, O'Hara expects production of the units within two months.

Westec also featured long life rebuilt klystrons. The rebuilding process, done by Econco (specializing in vacuum tube rebuilding), is tested by Westec for bandwidth, flatness distortion products and other parameters. For information on any Westec products call, (602) 948-4484.

Zenith Cable Products

Besides its new converter, Zenith also announced the "Command Series Release 3.5" software for all PC-based controllers for Zenith PM RF and Z-TAC baseband systems. Designed to allow operators to put service-upgrade orders into effect 24 hours a day, the software release also contains an audience-measurement capability. "Channel monitor snapshots" allow for the polling of 1,000 decoders in 30 seconds to determine which programming is being viewed. Command Series Release 3.5 is available now as an upgrade option for existing Z-TAC and PM systems, and is standard with all new installations.

In a final announcement, Zenith introduced a microprocessor-based PPV encoder designed to maximize the efficiency of tag management in Z-TAC baseband addressable cable TV systems. The new encoder provides the capability of using one tag for each PPV channel, instead of assigning a different tag to each event on a recurring PPV channel.

For info on Zenith products call, (708) 391-8181.

—Roger Brown with Kathy Berlin and Leslie Miller

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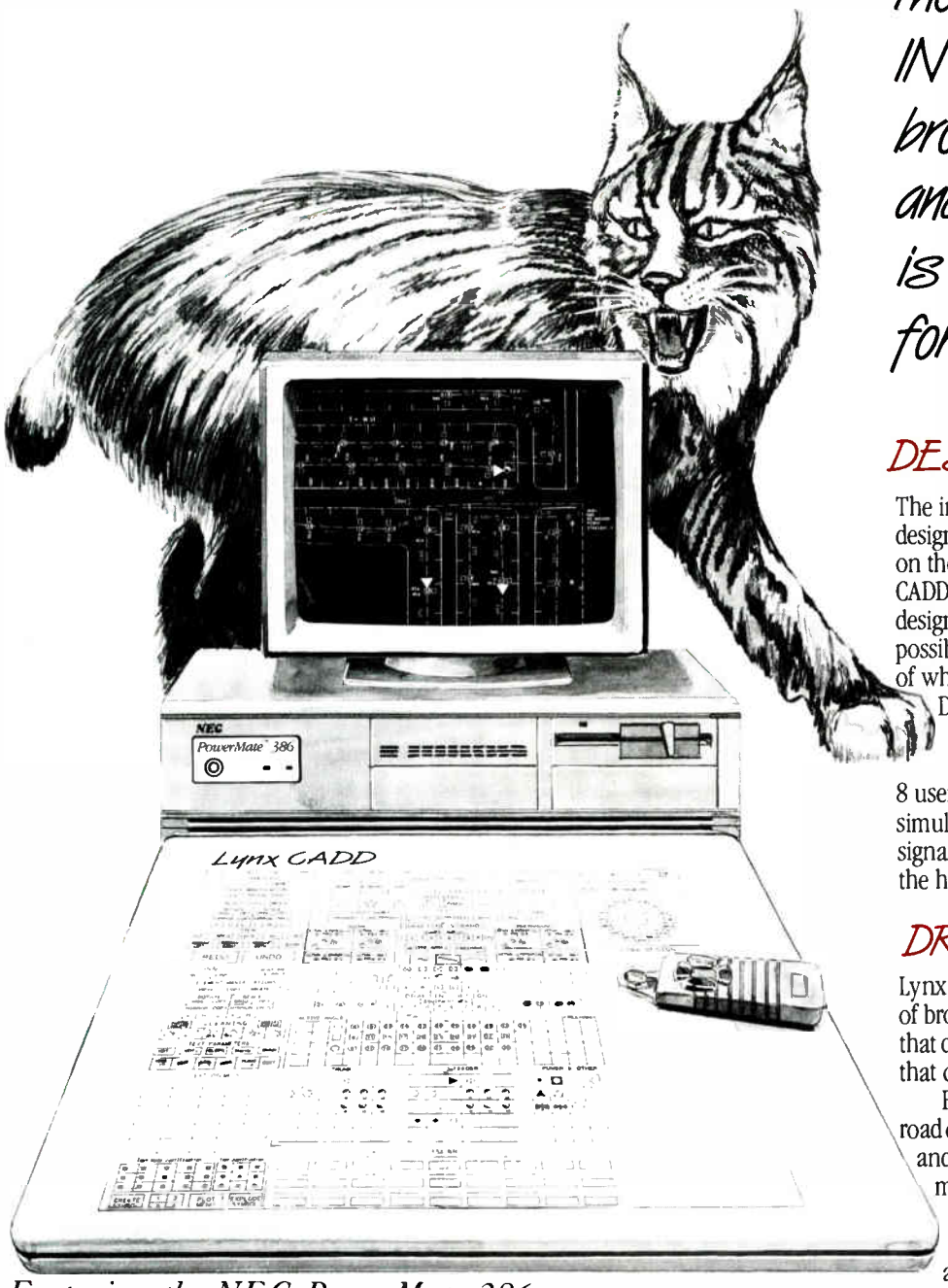

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CLI concerns continue

In a well attended panel discussion titled "Advances in Signal Leakage Management," NCTA attendees listened as Ted Hartson, vice president and chief engineer, Post-Newsweek Cable, Inc. moderated ongoing discussions on cumulative leakage (CLI). Topics included EIA 'F' connector standards, handheld direction finders and flyover calibration techniques.

Brad Keller, electrical engineer, Raychem Corp., presented the first paper titled "The New EIA 550 FD-Connector Standard." In response to industry concerns regarding 'F' connector reliability and application in the international marketplace, a comprehensive F-connector standard has been established.

According to Keller, meetings began in 1987 as the LAN and CATV communities recognized the need for standardization. On April 19, 1990, the proposed electrical, mechanical, environmental and mating characteristics specified were approved for publication as "EIA-550: 75 Ohm Type FD Connector Interfaces, Ratings and Characteristics." The reference to an "FD" connector denotes an F-connector for data. (For a reprint, contact the EIA at (202) 457-4900. Reprints cost $10.)

Keller described the new 'FD' connector as "a 75 ohm impedance controlled connector with a nominal center conductor plug diameter of 0.032 inches, that carries a full set of VSWR, insertion loss and contact resistance specifications which apply when mated with another FD-connector." Connector manufacturers must specify cable(s) intended for use with their product, since a reliable connector/cable interface is critical to meeting mechanical and environmental specifications. Also, Keller highlighted, the committee standardized on tin plating, citing that it performs nearly as well as gold with better economics. Finally, the connector must be a "pin type," in order to conform to RG-6-type and larger cable.

Keller also reviewed the standardized mating characteristics, citing that the jack must have at least 0.250 inches of 3/8-32-2A thread and protrude at least 0.299 inches from the panel or housing. In the worst case, the male pin will always extend at least 0.04 inches past the center conductor socket. The socket must be deep enough to house the maximum length pin.

In comparison to regular 'F' connectors, the new 'FD' connector dimensions were selected in such a way that they will mate with existing Type-F connectors, though possibly not at optimum performance. Keller concluded by mentioning the the SCTE is currently working on an 'F' connector standard of its own in the Interface Practices Committee.

Cliff Schrock, president, CableBus Systems Corp., continued the CLI discussion by presenting his paper titled "Handheld Direction Finder for Cable Leakage Location." Aware of the difficulties encountered when attempting to pinpoint the exact location of a signal leak, Schrock developed and discussed a hand-held direction finder.

Schrock described existing leak location devices, beginning with the dipole antenna. Although excellent at measuring field strength because of the ease of antenna factor characterization, dipole usage makes it difficult to establish whether the leak is behind or in front of the user without taking measurements at multiple locations and triangulating.

> Factors such as crosswinds, pilot proficiency, and interference can complicate the calibration process.

Schrock described his hand-held direction finder, the Leakage Locator System, as a unit which combines direction finding circuitry, receiver, antenna array, visual peaking display and a precision field strength meter. The antenna array consists of two dipole antennas, tuned and loaded to frequencies in the 108 MHz to 136 MHz band. The system is horizontally polarized and produces a cone shaped, three dimensional null pattern. This allows location in both the vertical and horizontal axes.

Bob Dickinson, president, Dovetail Systems Corp., presented his paper "Flyover Calibration Techniques." Dickinson defined the flyover process by explaining that the threshold of 10 μV/m must be established at 450 meters above the average terrain in order to meet FCC pass/fail regulations. However, Dickinson noted, "inherent inaccuracies exist in the flyover process due to incorrect calibration techniques."

The flyover aircraft is equipped with a receiver, antenna and data gathering and storage equipment. All units with the exception of the antenna, Dickinson noted, are easily and accurately laboratory calibrated. However, because the antenna pattern is affected by its mounting and environment, calibration measures are complex and tricky to measure. Factors such as crosswinds, pilot proficiency, cable system proximity, and co-channel interference can complicate the antenna calibration process.

Antenna calibration is achieved by placing two horizontally polarized antennas on the ground which are fed with radio frequency energy equal in amplitude, but differing in phase by 90 degrees. The result, Dickinson explained, is that the resulting electric field vector rotates about the vertical axis producing circular polarization. The presence of crosswinds during the flyover can cause inaccurate readings from the circularly polarized reference. Crosswinds are not a major factor, however, because an aircraft crab angle is tolerable and the approach can be made from any angle with the same results, provided the aircraft is directly over the circularly polarized field.

Flying directly over the antenna at a 450 meter altitude, Dickinson continued, requires a high degree of pilot proficiency, particularly because of the need to visually judge lateral aircraft offsets. Even with electronic aids, Dickinson explained, a discrepancy of a few hundred feet is not uncommon.

Factors such as adjacent cable system proximity and co-channel inteference can also distort the calibration process, Dickinson continued. For example, the existence of a spurious signal 10 dB below the calibration signal will result in an indicator in the aircraft receiver that is roughly 1 dB too high. This, in turn, causes the receiver to be calibrated to the wrong level, and signal leakage measurements to be 1 dB lower than actual.

"The purpose of flyovers is not to locate specific leaks, but to qualify systems," Dickinson concluded. Properly calibrating flyover equipment for the qualification requires great care and a system of checks and balances to assure accuracy and repeatability. ■

—Leslie Miller

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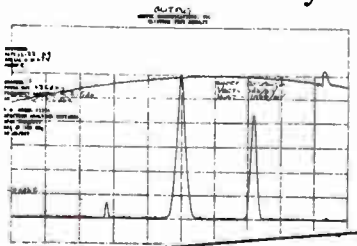

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3/8" UTILITY GRADE	2100 POUNDS

Figure 1

Design conditions

Figure 2 is a loading map of the United States taken from the National Electrical Safety Code.[6] The country is divided into three conductor-loading regions: heavy, medium and light. The division is based on the wind, ice and thermal loading expected on overhead conductors. These loads are explained in detail in NESC Rule 250B.

The NESC Rules are intended to safeguard the public. Simply stated, aerial plant designed to withstand the prescribed loads is not supposed to fall down. The criterion for such designs is strength. For aerial structures supporting fiber cable, however, a design based on strength alone is not sufficient. The design must also limit the elastic strain in the glass fibers to safe levels. Otherwise, strains large enough to break some of the fibers or to compromise transmission performance can occur with no apparent damage to the cable or its supporting structure. Such events may take place months or even years after installation.

The most severe contraction of the suspension is assumed to take place at -40 degrees Fahrenheit in still air with no ice. These conditions establish the lower limit of the range of acceptable fiber strain and are taken here to represent the worst case in all three conductor-loading regions. The maximum allowable added compressive strain in a fiber under these conditions is assumed to be 0.05 percent.

Tensile stress in the fibers increases with increasing transverse load because the arc-length of the suspension becomes longer, and with increasing temperature because the coefficient of thermal expansion of glass is relatively small. Thus, in the heavy- and medium-loading regions, the maximum tensile stress in the fibers occurs at 32 degrees Fahrenheit under full ice and wind loading. In the light-loading region, where wind is the only transverse environmental load, the maximum cable temperature is assumed to be no more than 100 degrees Fahrenheit.

System design engineers must make sure their aerial lightguide plant is sufficiently robust to keep the strain in the fibers within acceptable bounds under worst-case loading conditions, *and* strong enough to support the conductor loads given in NESC Rule 250B without exceeding the allowable force in the support strand, normally taken to be 60 percent of its rated breaking strength.

Span rules

The fiber stress in a composite suspension supporting given loads can be found by tedious but straightforward calculations based on the mechanics of flexible cables.[7] A maximum permissible span can be determined for each combination of strand and loading such that the stress in the fibers and the force in the strand remain within the limits defined by the dual design criteria explained above. The results of such calculations are given in Figure 3.

The prototype cable assumed in the development of these results has a diameter of nearly 0.6 inches, and weighs about 150 pounds per 1,000 feet. A 50,000 psi proof-test level for the fibers is assumed and the modulus of elasticity of glass is taken to be 10,000,000 psi. Thus, the range of allowable fiber strain in the idealized composite cable upon which the span rules given in Figure 3 are based lies between -0.05 percent and +0.125 percent.

Sag

The stringing-tensions listed in Figure 1 were established to support heavy cables under storm loads. Because lightguide cable is so small and weighs so little, the sag of an installed fiber cable is noticeably less than that of conventional cables. Taut lightguide cable runs may make it difficult to maintain adequate mid-span separations on joint-use pole lines, or may even interfere with other cables in the communication space.

By stringing the strand at a lower tension, additional sag can be introduced in the fiber span to maintain adequate separation from cables above or to conform better with existing

RAL LOADING MAP OF THE UNITED STATES RESPECT TO LOADING OF OVERHEAD LINES

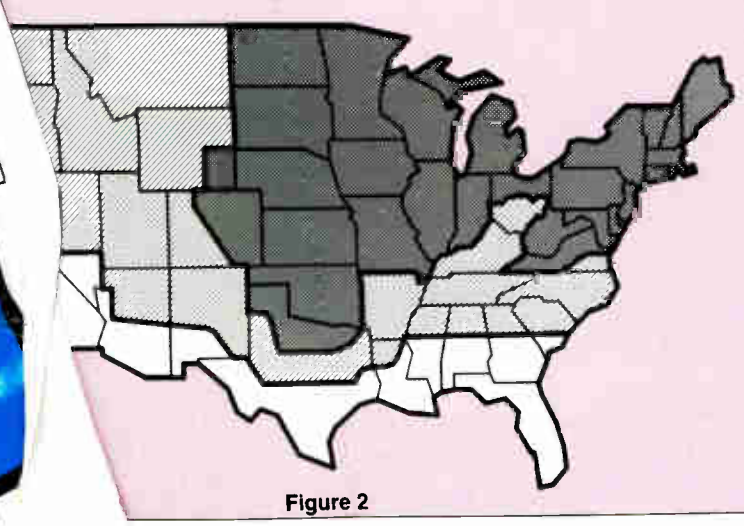

Figure 2

How do you have your cake and eat it too?

There may be other good reasons to build such loops into aerial spans, such as a future need to accommodate strand-mounted equipment, or to comply with the recommendations of a cable manufacturer, but it should be understood that their presence in aerial fiber plant is a matter of choice, not necessity.

Other considerations

Although there is nothing special about the stringing tensions listed in Figure 1, the results given in Figure 3 depend on them. If a different stringing tension is chosen for a given strand size, a different maximum permissible span results. This is why the temperature at the time the strand is placed is important, and why the spans listed in Figure 3 must be reduced by 15 percent when the lightguide suspension is sagged-in.

The results given here also depend on the properties of the load-carrying elements in the suspension, the back-tension during lashing, the fiber proof-test stress, the sheath contraction to be tolerated at low temperature, the maximum cable temperature and the allowance made for static fatigue. Changing any of these parameters will affect the maximum permissible spans given in Figure 3, sometimes in a quite unexpected way. For example, reducing only the weight of the fiber cable reduces maximum permissible spans.

There may appear to be a comfortable margin built into the results given here. Because the span rules are based on worst-case design loads, the fiber stress will not reach even allowable levels if such loads do not occur. It is certainly possible, however, to accumulate more than one-half inch of ice on overhead lines in certain parts of the country. Fortunately, such incidents are rare, but because they are unpredictable, the design margin cannot be found deterministically.

The average span in this country is less than 200 feet, less than the shortest span given in Figure 3 by 25 percent or more. Thus, most dedicated aerial lightguide routes built to date are probably adequate by default. If, however, in the heavy loading region, a fiber cable is overlashed on an existing coax or lightguide route that was sagged-in when it was placed, the maximum "safe" span for a one-quarter inch EHS messenger is only 117 feet. Since many spans in such a route may be longer than that, frequent severe weather would be a legitimate cause for concern.

Summary

The basis for the design of aerial fiber plant has been explained to provide system design engineers the background they need to evaluate the trade-offs confronting them, and to dispel some of the misunderstandings that have attended the introduction of this new medium in aerial plant.

Sagging-in and overlashing are important issues, and both are permissible under certain conditions.

No mention has been made of special construction procedures to build aerial lightguide routes, and except for the need to maintain a low back-tension on the cable as it enters the lasher, there aren't any. The cable is easy to handle and is more resistant to abuse than the same size copper or coaxial cable. It can be hung over blocks or rings without risk to the fibers, and the long reel lengths customary on fiber jobs pose no special problem in aerial construction. With so many advantages and so few drawbacks, it is not surprising that fiber-optic cable is the medium of choice for so many new aerial installations. ■

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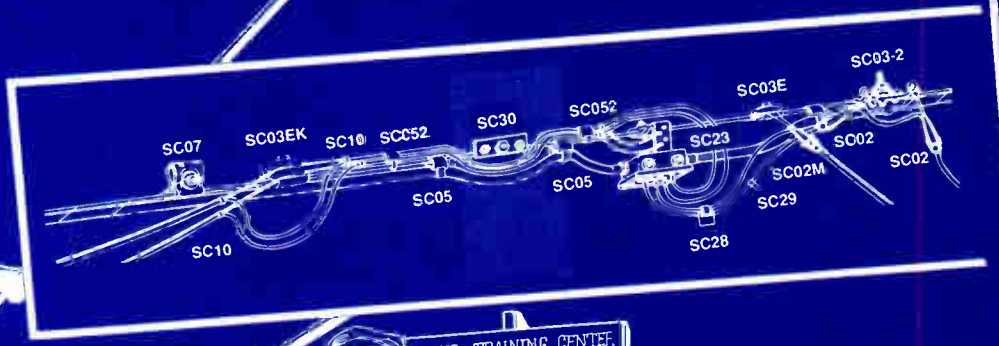

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Reader Service Number 59

STEREO AUDIO

home?" The answer is, "Just hook it up." Surround Sound information is contained within the original left and right audio signals. That is, if a program is produced with Surround Sound, it will be present when transmitted as a BTSC stereo signal.

Furthermore, the number of Surround Sound decoders in consumers' homes is growing. Moreover, Dolby stated that every movie currently produced in stereo is produced with Surround Sound. Most top rated movies take advantage of Surround Sound's dramatic effects. While stereo seems to put you where the action is, Surround Sound seems to actually make you a part of the action.

Technical aspects

Before going further, a quick review of the BTSC signal is in order. The modulation consists of a L+R (monaural or sum) channel, a pilot and a L-R (stereo difference) channel. The L+R channel is identical to the monaural signal for the viewers who have not yet converted to stereo. The L-R (stereo difference) channel is a dbx companded AM double-sideband suppressed carrier, centered at twice the horizontal sync frequency.

For the stereo-capable viewers, the pilot is used to regenerate a 31.468 kHz suppressed carrier needed to demodulate the stereo difference channel and is phase-locked to the horizontal sync of the video. The pilot is also used to illuminate the stereo light on the consumer's decoding device. The BTSC signal may also include a Second Audio Program (SAP) channel and a professional channel (PC).

The SAP channel is primarily intended for second language programming, but it could be used for any supplementary audio service. The PC channel is used primarily by broadcasters for voice or low-speed data.

An interesting application of the SAP channel is currently being used by Public Broadcasting Stations (PBS) as an aid for the visually impaired. Descriptive Video Services (DVS) provides audio to be transmitted via the SAP channel. A narrator is dubbed onto the original soundtrack. Anytime a pause occurs in the program, the narrator describes the action in the scene.

In fact, according to the EIA, as of January, 32 PBS stations were broadcasting DVS signal. "It turns television programs back into the old-time radio program format. The narrators use such descriptions as: 'She turns around, startled, with a wide expression on her face,' " Mock says.

BTSC generator interfaces

The addition of stereo is a relatively simple process. All that is usually needed is a BTSC stereo generator. This generator accepts a left and a right channel of audio information and encodes the signal into the BTSC format, which can then be distributed throughout the cable system.

The output of the stereo generator is fed into the TV modulator. A variety of interconnections are possible. The generator may be interfaced with the TV modulator as BTSC composite baseband and video, as a video plus 4.5 MHz aural subcarrier, as a 4.5 MHz aural subcarrier separate from video, or as a 41.25 MHz intermediate frequency (IF) carrier.

The specific interface chosen will

depend on the individual components in the headend as well as personal preferences. Most TV modulators are BTSC compatible with little or no modifications. For further technical details, please refer to the article entitled "The Growth of BTSC Stereo" published in the May 1988 issue of *CED* magazine.

When to add stereo

Now is the time to add stereo. More and more subscribers are becoming stereo-capable. Direct comparisons can be made between the off-air channels in stereo vs. the satellite delivered channels. When a subscriber switches from a network in stereo to a pay service which is not offered in stereo, the sound drops to mono and the subscriber may become dissatisfied.

Furthermore, both the networks and the satellite services boast of their stereo capability. In many cases the statement "*In Stereo Where Available*" is announced at the onset of the program. This statement generates a smile on the faces of subscribers in stereo-capable systems.

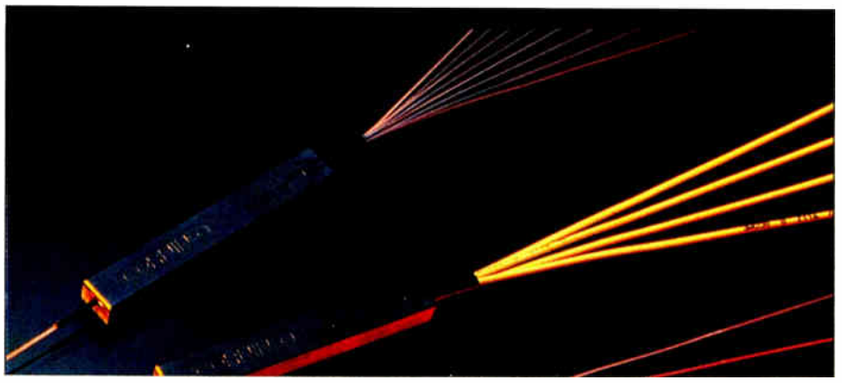
This same statement, on the other hand, creates confusion and discontent for stereo-capable viewers watching a non-stereo service. These same subscribers may voice their discontent in the form of a service call to their local cable system, a call to the programming service, or they may just go elsewhere for their stereo programming (e.g.: videocassettes, videodiscs, movie theaters, off-air broadcast programming and direct satellite reception).

"Our company feels it should provide top-of-the-line service and stereo is a part of it," says United Artists Cablesystems' Hershey. "We feel stereo TV is picking up and our customers appreciate it." Stereo is a good way to offset the inconvenience of a price increase or a channel re-alignment. The timely addition of stereo could avoid costly negative feelings. And, stereo can actually improve customer service by providing what your customers are requesting.

"For Comcast, the value was that we did something positive (added stereo) before our customers asked us to. We were ahead of the local affiliates. We added stereo in many of our systems before the off-air broadcasters in these same systems had modified their transmitters for stereo," says Cerino. Also, the prices for stereo generators have gone down. It's relatively inexpensive to provide the expected enjoyment.

Some systems and MSOs have gone "gung-ho" with stereo and added stereo to nearly every satellite channel on their system. Many systems and MSOs, on the other hand, have gradually added stereo. That is, they began with the music channels and a few of their pays. Additional channels were added until all stereo programming sources were actually being transmitted in stereo.

From there, many engineers add stereo as new channels are added to their systems or as services encrypt via the VideoCipher II. "When we began with stereo, we didn't try to assess how many channels each system would ultimately need. Rather, we allowed them to buy four to six generators each year and each system decided which of their services would be in stereo," says Cerino.



David Willis, director of engineering, Tele-Communications, Inc. "Anything that pushes fiber further into the system is a plus, because at some point in time we're going to need more bandwidth."

Cox Cable's Best echoes that sentiment, but also points out that FTF must prove in economically for individual MSOs before it enjoys widespread acceptance.

"I've read the articles and I love the concept. Improving reliability and picture quality along with 1 GHz bandwidth potential are all very strong

Syndex 'bomb' turns into a dud

As January 1990 rolled around, many in the cable industry watched and waited for the syndicated exclusivity (syndex) rules to grow, peak and explode into a flurry of switching requirements and irate customers. But the first week of January came and went, followed by a second and third, without the anticipated explosion. As the weeks continued to fly by and became months, not only did the anticipation die down, but syndex itself fizzled out, leaving nothing but a smoldering smoke bomb, instead of the bang from a bomb.

Now, six months later, syndex is not even an issue. It is seen by many as a complete dud, a situation that "might" have to be dealt with, but maybe only after the cumulative leakage index (CLI) requirements are taken care of. This complete reversal of industry concern was a surprise to many hardware vendors, as well as operators, who expected a different outcome.

Still, ask those same vendors and operators *why* syndex fizzled and the answers are varied and often vague. Some attribute the quietness to good broadcaster/cable relationships, others feel it's the lack of enforcement on the part of the FCC to monitor syndex and still others see the non-activity as the reluctance of the broadcasters to implement syndex rules.

"It was said when this rule was starting to come up," says Pete Smith, vice president of engineering at Rifkin and Associates, "that the rule may actually be to the detriment of the broadcasters. Because one broadcaster is basically hurting another broadcaster in an awful lot of cases, and that other broadcaster turns around and hurts the guy who hurt him, in the outlying markets."

Situation could blow up

This situation was very evident to NBC affiliate KCFW-TV in Kalispell, Mont., when the station received bomb threats from an angry cable subscriber after KCFW-TV invoked syndex rights against TCI of Kalispell. In order to comply with the syndex requirement, TCI dropped its Spokane NBC affiliate, KHQ-TV, when the January deadline became effective.

"We had requested syndex and non-network duplication protection from the distant signal in Spokane," says Steve Fetveit, station manager for KCFW-TV. "That resulted in holes being cut in the distant signal's programming. They (TCI) were putting up a billboard and that made people angry.

"I think it's a matter of...changing people's viewing habits," continues Fetveit. "They (customers) had a very unusual benefit or luxury in my market area because they were able to cross time zones and watch programming on a two-hour delay basis. This enabled them to watch, for example, an *Unsolved Mysteries* at (either) 7 p.m. or 9 p.m. When that luxury was taken away, they didn't like it. They didn't lose their programming," adds Fetveit, "they simply lost the duplication of that programming."

> 'It was said when this rule was starting to come up that the rule may actually be to the detriment of the broadcasters.'

As for why his station, not the cable company, received the bomb threats, Fetveit believes viewers saw the broadcasters as the "bad guys." "Both of us (TCI) knew what the issues were and what had to be done," says Fetveit. "Basically the cable company and the broadcasters were weathering a lot of problems from viewers. It was fairly convenient for the cable company because under the FCC rules, (broadcasters) don't *have* to exercise the right of protection, it's a choice you make. So the broadcaster is the bad guy in the viewers' eyes, because he didn't have to do it."

However, Fetveit views the station's relationship with TCI as "good." And surprisingly, it's a sentiment that is echoed by many in the cable industry. Robert Householder, system manager for Continental Cablevision of Fairborn, Ohio, believes his system has very little syndex requirements because of its good relationships with the broadcasters. "We have meetings every couple of months with the broadcasters and cable operators," says Householder. "We talk about our common problems and some of our differences. It helps."

William Bradford, system manager for Service Electric Cable TV in Mahanoy City, Penn., has seen absolutely no effect from syndex. In his situation, the "local broadcasters and cable companies have been able to work something out and the broadcasters are not requesting protection," says Bradford.

Syndex still around

Although the requests for syndex haven't been overwhelming, cable operators are still being exposed to syndex. "I'd say that if I were to guess," says Kevin MacKenzie, president of J.D. McKay Corp., "a third of the industry didn't have a problem at all, a second third solved the problem either by dropping (signals) or broadcaster negotiations and the third category is the people who actually went and did something—that bought equipment or had something on hand to allow them to do it."

For Bob Saunders, director of engineering for Sammons Communications, his systems fell into two of the mentioned categories. "We didn't have to buy much equipment," says Saunders, "but we had to buy some. I think we did a very good job of determining our exposure of distant channels and also of what local stations had the right to invoke syndex protection by closely examining grade B contours and 35-mile radius markets.

"Two, we dropped some channels that were exposed to syndex rules and did some substitution," he continues. "We made a decision that it was better to put another service on rather than give people 30 percent of a distant channel because of syndex rules."

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Reader Service Number 65

Bill Butts, vice president of marketing and public affairs for ATC's Greensboro division in North Carolina, continues to "get a fair number of syndex requests," yet Butts doesn't see the requirements as a problem. "The vast majority of requests come from Fox affiliates in our area," says Butts. "They have by far been the most aggressive in terms of local stations submitting requests. So that wasn't a surprise to us. But we really haven't had to do any blackouts because of the excellent relationship (we have) with both United Video and the Turner people.

"They're doing their best to purge their lineups," explains Butts, "so there's been nothing in the ultimate schedule, of either programmer, that's been a problem for us locally. We've been very, very fortunate in that regard."

In spite of the network/operator relationship flourishing, syndex can have other adverse effects. "The outgrowth of all this now," says Barry Nelson, technical operations manager for Warner Cable in Dekalb, Ill., "is for our sports programming, we've made the broadcasters jump through all the burning hoops for contracts. We want to see contracts and stuff like that. It used to be more of a gentleman's agreement when they requested something—they'd send us a letter, we'd honor it. We don't necessarily do that right off the bat now."

No need for panic

Even though operators are pleased with the reduction in expected syndex requirements, the vendors are amazed at the sudden silence that came with the January 1 deadline. "There was this great big panic situation," says Tom Russell, manager of new product development for TV Host, "and it turned into nothing overnight."

"It was surprisingly slow," agrees Leslie Miller, marketing and sales representative for Telecommunication Products Corp. "From my conversations with people, they were cautious to put their money into a lot of equipment, into an unknown. So a lot of them did it manually or worked out a deal with the broadcasters so they weren't stepping on each others toes."

"When it really came down to it," says Bruce Robertson, product manager for the All Channel Message (ACM) system from Quanta Corp., "the broadcasters and cable people got together and said, 'Come on, let's not be ridiculous and figure out what we really want to do.' Consequently, when that discussion took place, they reduced the effective syndex by 50 percent."

Still others think the reduced activity was partly because of the lack of rule enforcement by the FCC. "I don't think anybody's been in any trouble for violating the syndex rules," says Brian Ives, executive vice president for Monroe Electronics. "A lot of people, before syndex went into effect, were taking a wait-and-see attitude. I think a lot of them are still waiting to see."

Actually, this wait-and-see attitude could be a simple case of priority. With July 1, 1990 a mere month away, many cable systems are focusing attention on an issue the FCC is definitely enforcing—signal leakage. And although operators have had a longer time period to react to CLI, there are teeth to the rulings and a much larger bite if compliance is not met.

'Perhaps syndex hasn't hurt us so bad because we already had an awful lot of alternative programming in place.'

"I think the attitude now," says Terry Bush, vice president of the instrument division for Trilithic Inc., "is we're worried about CLI, we'll think about syndex in July. Just pull the channel off, we'll get to that problem next. I mean, these are regulation-driven problems and they're kind of an aggravation anyway."

"If somebody gets their hands slapped (for syndex non-compliance)," says Ives, "that will get a lot of people's attention. If somebody gets in trouble, then there might be more activity."

Syndex here to stay

Until then, syndex will continue to quietly exist in the background. Historically, it was this same lack of activity that caused non-duplication rules to go away 10 years ago. It was decided by the FCC that if the rules were not going to be implemented, there wasn't a need for the rules. Then, with the changing competitive environment between cable and the broadcasters, the rules were reinstated at the request of the broadcasters.

However, many in the industry don't see syndex going away this time. "I think it's going to be an ongoing and continuing requirement for awhile," says Robertson. "If the broadcasters decide they're going to become hard-nosed about it, they can raise the flags again. It's going to have some bumps and it is going to be with us for awhile."

Yet ATC's Butts doesn't think any flags will be raised. "We've received a few requests up to this point. None of them have proven to be a problem. I really don't see it becoming a bigger issue than it is now.

"I don't think there will be any changes," agrees Mike Watson, vice president at Channelmatic Inc. "There's been too much momentum and lobbying on the broadcaster side to get this ruling passed. I don't think the broadcast industry or the FCC want to change their positions. What I do see changing is maybe how the cable operators are going to fill those blacked-out programs. Initially, in January, those blackouts would go to snow or to a character generator. Now, those blackout segments are being filled with new programming, locally originated or satellite filled."

It is this very programming that leads Rifkin's Smith to believe syndex was not the problem it was originally perceived to be. "Cable has a good ability to bring in alternate programming. Look at some of the stuff that's come about in the last couple of years, TNT and a wide variety of new programs on existing services. Perhaps syndex hasn't hurt us so bad because we already had an awful lot of alternative programming in place."

Bob Hall, vice president of Ad Systems, summarizes the syndex situation quite simply. "I don't know that it's over with yet. I don't know exactly what the broadcaster's plans are but syndex certainly didn't turn out to be the boon that a lot of hardware suppliers thought it would—nor perhaps the degree of problem the operators thought it would be." ■

—Kathy Berlin

Deterring theft of service

Last month, CED announced the winners of a contest conducted by the National Cable Television Association's Affairs Department (Coalition Opposing Signal Theft) on signal theft prevention. This month, CED is reprinting the first-place entry submitted by Peter Hurst of Metrovision Inc. The following article has been reprinted with permission by the NCTA's Coalition Opposing Signal Theft.

In 1985, Metrovision implemented a theft-of-service program in its Chicago systems.[1] As of March 31, 1990, its Security Department has investigated almost 2,000 cases which has resulted in:

1. $270,898.60 in additional annual revenues.
2. 710 new subscribers.
3. $53,039.27 in court-awarded restitutions.[2]

Table 1 and Figure 1 outline the specific nature of the complaints received.

During the latter part of 1988, Mike Burcham, Metrovision's regional business manager (Chicago), authorized significant changes in the theft-of-service program. These changes included:

1. A focus on the conversion of unauthorized viewers instead of prosecution.
2. Concentration of auditing efforts in the multiple dwelling units (MDUs).
3. Reliance upon line personnel as the source of unauthorized viewer complaints in single-family dwellings and commercial establishments;
4. Implementation of an Auditor's Special (conversion marketing) Program in the MDUs.
5. Routine use of the statutory treble damage clause in cable theft cases (Chy. 38, 16-13, Illinois Revised Statutes).
6. Inclusion of the security personnel in company incentive programs.

As a result, $128,000 in revenues and 561 new subscribers were added in the succeeding 15 months! In 1989 alone, restitutions doubled and annual conversion revenues increased by 400 percent to $118,405.32 compared to $23,609.52 for the previous year. It is projected that 1990 conversion revenues will exceed $300,000 based upon performance in the first quarter. Table 2 provides a summary of revenues received and case disposition to date.

TABLE 1
CASE REFERRAL SUMMARY

Year	Security Referrals	Illegal Hook-Ups	Unauthorized Upgrades	Unauthorized Additional Outlets	Pirate Dealers
1985	148	121	18	05	04
1986	264	252	10	01	01
1987	204	189	05	01	09
1988	254	244	03	01	06
1989	610	556	06	44	04
3/31	478	454	00	15	09
Total:	1,958	1,816	42	67	33

Table 1

Background

Prior to the inception of the theft-of-service program, Metrovision had no effective means for curtailing unauthorized services. Upon detection of illegal hook-ups, the technicians would dis-

By Peter F. Hurst, Security Director, Metrovision Inc. (Chicago)

connect them, without documentation, with the assumption that the problem was corrected. Unfortunately, ridding a system of unauthorized viewers (UV) is like weeding your lawn—it requires follow-up treatments. An undocumented UV disconnect or one-time system audit only provides short-term relief. To ensure long-term compliance, detected UV should be documented, rechecked in 60 to 90 days for compliance, or prosecuted whenever appropriate.[4]

Historically, cable operators, including Metrovision, have assigned UV complaints to the system manager. This has resulted in a diversion of the manager's time away from his primary responsibilities, and on occasion, a confrontation with an irate UV. The end result is that few illegals are actually investigated. In fact, it was a system manager who was challenged by an unemployed steel worker while investigating a UV complaint that caused Ron Murray, Metrovision's vice president and general manager (Chicago), to seek outside assistance.

This article describes the development of the theft-of-service program under Ron Murray and recommends some basic operating procedures.

Problem diagnosis-solutions

Metrovision, like its industry counterparts, experiences theft of service from two primary sources:

- **Company error** which results in passive theft because of faulty workorders, improper installations/disconnects, and employee or subcontractor misconduct.
- **Active piracy** in which the resident arranges for unauthorized service.[5]

> Ridding a system of unauthorized viewers is like weeding your lawn—it requires follow-up treatments.

Passive theft can be curtailed by:

A. Education of proprietary and subcontractor employees regarding company policy and the statutory consequences of improper install/disconnect procedures and piracy involvement.

B. Quality control inspections, based on random checks of all work performed. The Quality Control Unit should be manned by an independent inspector(s) that reports to a mid-level manager.

C. Termination or prosecution of employees engaged in theft of service. (Don't base termination on the outcome of the court case. Check with legal counsel regarding the separation of administrative and adjudicative approaches to employee misconduct.)

D. Adoption of a quality circle approach to obtain employee input for ways to reduce passive theft.

Metrovision provides quality control through routine inspections by technical supervisors, and random checks by audit personnel working out of the regional office. Employee or subcontractor piracy complaints are referred to the Security Department for investigation. The audit and security personnel report to Business Manager Mike Burcham. Twice yearly, an auditor and

an investigator meet with the line employees to discuss ways to improve the security-audit functions. Monthly activity summaries regarding security operations are routinely forwarded to each system manager.

Active piracy can be minimized by:

A. On-going community education programs funded on an area or statewide basis regarding the statutory and operational consequences.

B. Implementation of a continuous audit program (in-house) focusing on MDUs and residential "hot-spots."

C. Participation of line employees in the identification and reporting of UV (including CSRs, direct salespersons and telemarketers).

D. Formation of a security department that investigates and prosecutes theft of service complaints.

Start-up procedures

In order to implement a theft-of-service program, the following should be undertaken:

A. Establishment of detection and reporting procedures (utilizing line, QC and audit personnel).

B. Recruitment and training of investigators (full or part-time).

C. Development of a leads flow and reporting system.

D. Enactment of operational guidelines (including case prosecution criteria).

E. Orientation of employees regarding program operations and goals.

F. Establishment of a liaison with local criminal justice officials.

Operations

A. **Leads flow:** The processing of UV complaints can take two paths:

1. Path A: UV Identified ± Direct Sales Follow-Up ±; Re-check site (60 to 90 days) ± Security referral on all repeat offenders.

2. Path B: UV Identified ± Security Referral (abatement, conversion or prosecution).

B. **Documentation:** The key to any theft-of-service program is documentation. Standard forms that track a complaint from the detection through

FIGURE 1: BREAKDOWN OF TYPES OF COMPLAINTS RECEIVED
1985 - 1990 (3/31)

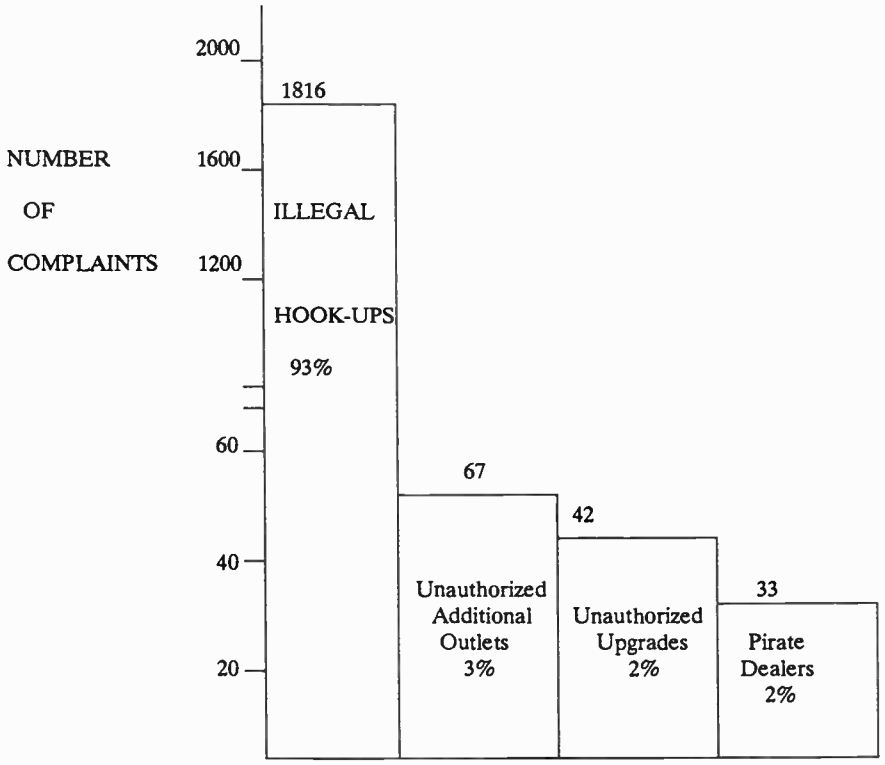
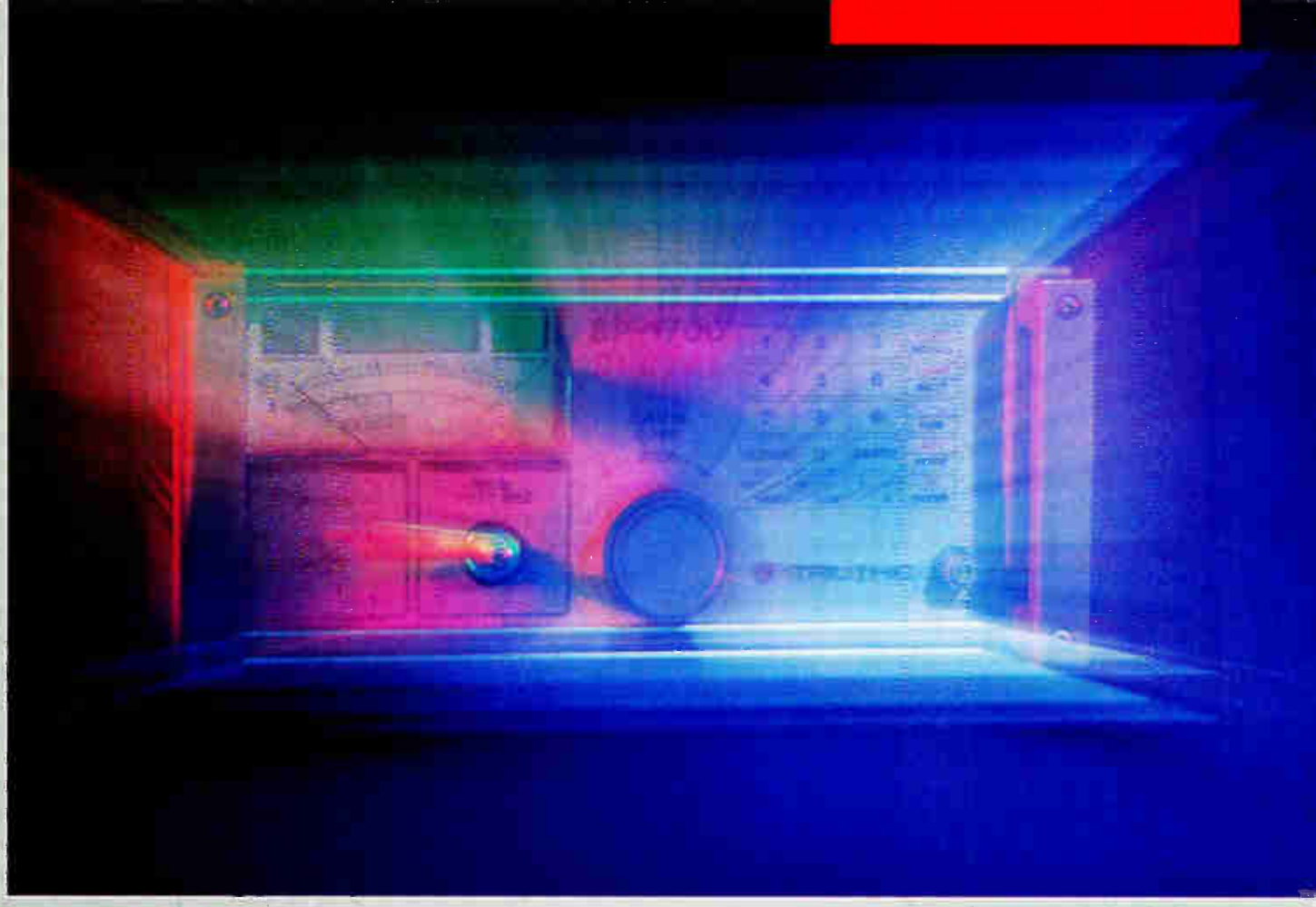


Figure 1



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TRILITHIC

the prosecution stage are crucial.

C. **Reporting:** Once a complaint is referred to security, a report should be filed that specifies the allegation(s), date/time of discovery, complainant's name and the account status of the offender. In addition, the investigators should retain actual connector/coax samples as evidence and photograph or diagram the illegal hook-up (or tampered service).

D. **Criminal justice liaisons:** In order to evince cooperation from the local police and district attorney, the system manager and a security investigator should meet with the local agencies and describe the theft of service problem, security methods (reports, evidence collection, documentation), and anticipated number of court referrals. This will communicate to the police and the courts that you are filing well-documented complaints that have been thoroughly investigated by your personnel.

Conclusion

Based upon Metrovision's experiences since 1985, it can be concluded that an effective theft-of-service program requires:

- Adequate inspection (QC) and detection procedures (audit, line support).
- Systematic documentation—evidence recovery.
- Trained investigators (full or part-time).
- Established criminal justice liaisons. ■

TABLE 2
CASE DISPOSITIONS

Year	Reported Cases	Conversions	Annual Conversion Revenues[3]	Restitution	Unfounded
1985	148	08	$ 2,861.76	$ 0	27
1986	264	22	7,869.84	2,569.00	59
1987	204	53	18,959.16	8,670.70	23
1988	254	66	23,609.52	12,957.84	35
1989	610	331	118,405.32	25,688.64	39
03/31	478	230	99,193.00	3,153.09	11
Total:	1,958	710	$270,898.60	$53,039.27	194

Table 2

References

1. Currently at 75,000 subscribers.

2. As of March 31, 1990, 1,314 cases have been closed; 54 percent of those were converted to paying subscriber status.

3. Based on average subscription rate of $29.81 monthly or $357.72 yearly. The first quarter figures for 1990 represent the specific rates paid. Source: Mike Burcham, Metrovison Inc., 1-30-90.

4. It is recommended that re-checks be deferred until after 60 days to provide ample time to detect re-connected UV or establish compliance.

5. According to research by Showtime/The Movie Channel, 47 percent of unauthorized viewing stems from passive theft; 53 percent from active theft (which includes 14 percent for pirate decoder rings). *Source: Unauthorized Reception of Cable Services*, Office of Cable Signal Theft, National Cable Television Association, Washington D.C. August 1989, p.2.

Peter Hurst is a retired Chicago suburban police chief with 20 years in law enforcement. He has been involved in cable security consulting since 1985 when he was recruited by Metrovision to develop a theft-of-service program in its Chicago systems. In addition, he operates programs for portions of the Chicago-area systems of Jones Intercable, Multimedia and Continental. He holds a Master of Public Administration degree from Roosevelt University and is a graduate of the Police Training Institute, University of Illinois.

COMPLIANCE

fourth possible scenario. Out-of-phase pattern characteristics are depicted in Figure 4.

The discussed simple simulations present a great variety of possible radiation patterns and field intensity fluctuations, as a function of frequency, excitation and current distribution.

However, leaking cable plant equipment is not located in open space. In the real world of cable TV, the telephone and power lines are less than a half wavelength away from the coax. Also, there might be large metal objects in the vicinity, such as power transformers, pole hardware, light fixtures, etc. (Figure 5). Then, if the ground below exhibits reasonable conductivity, the leakage source can form a "doublet" with its image. Additional changes in the patterns will depend on the conductivity of the ground, the relative position of the wires, the shape of the metal objects, just to list a few additional parameters.

The spread in the test results could be significant, in the range of 5 dB to 10 dB, or even higher.

A leakage test, conducted on a single frequency in the VHF aeronautical frequency range, would hardly clear the 225 MHz to 400 MHz UHF aeronautical frequency range.

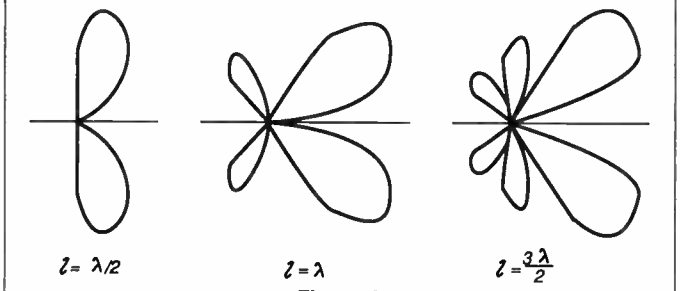


Figure 4

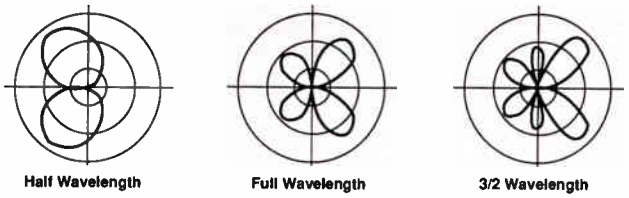


Figure 3

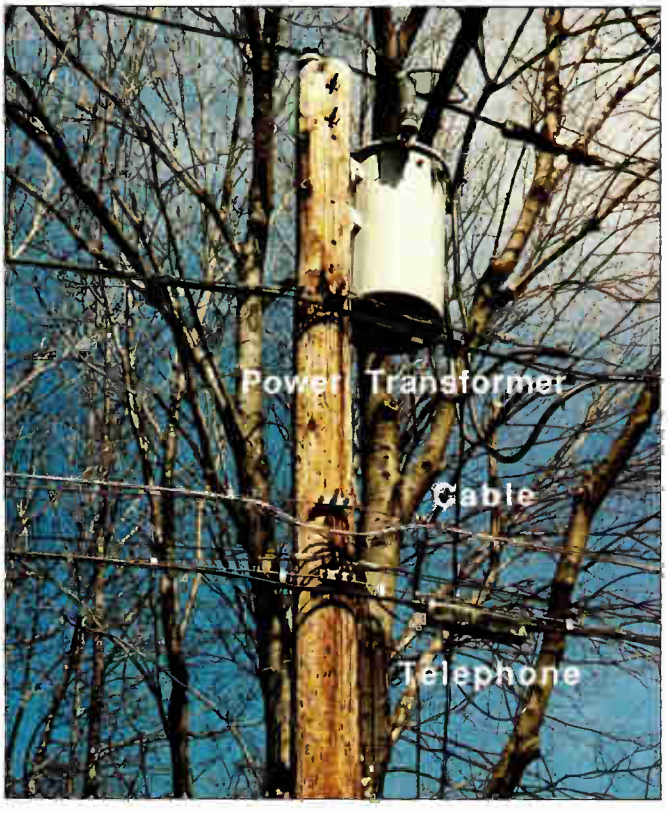
Polarization

The transfer of power between two antennas is not only a question of resonance or antiresonance. It also depends on the polarization of the emanating electromagnetic waves. For maximum power transfer, the transmitting radiator and receiving antenna must be co-polarized.

In the extreme case, when they are orthogonally polarized, no power will be transferred.

A prime example for the application of crosspolarization is the frequency re-use on all U.S. domestic communications satellites. The odd and even number transponder transmissions are orthogonally polarized. Thus, when the feedhorn of the parabolic antenna is correctly adjusted, the spectrum on the vertical LNA will be free of horizontally polarized carriers, and vice versa

Continued on page 127



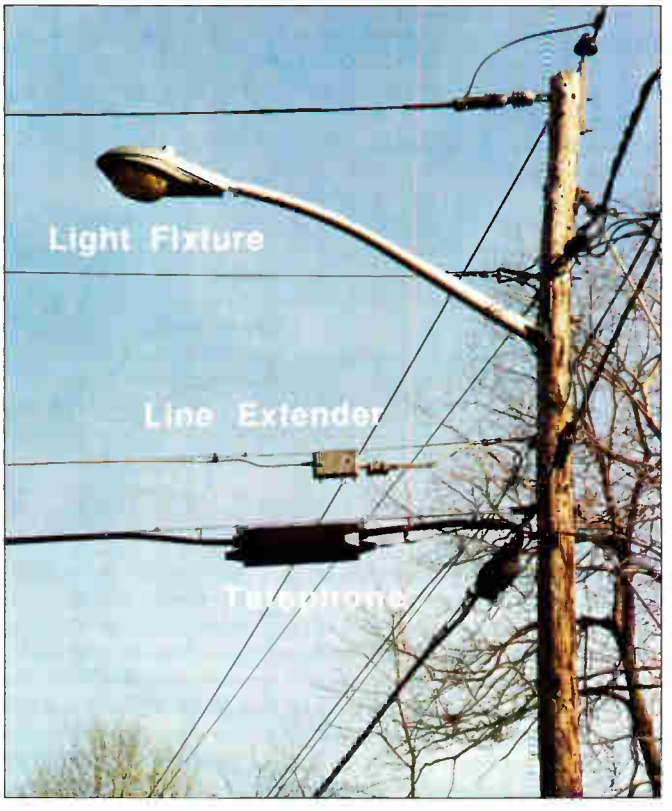


Figure 5

Basic electronics

The following article is adapted from a presentation made at numerous SCTE chapter meetings throughout the country.

The discussion of basic electronics starts with the atom. An atom is the smallest particle of an element that retains the characteristics of that particular element.

Atoms have what is called a planetary structure. The atom consists of a central nucleus with orbiting electrons surrounding it. The electrons are the basic particles of negative charge.

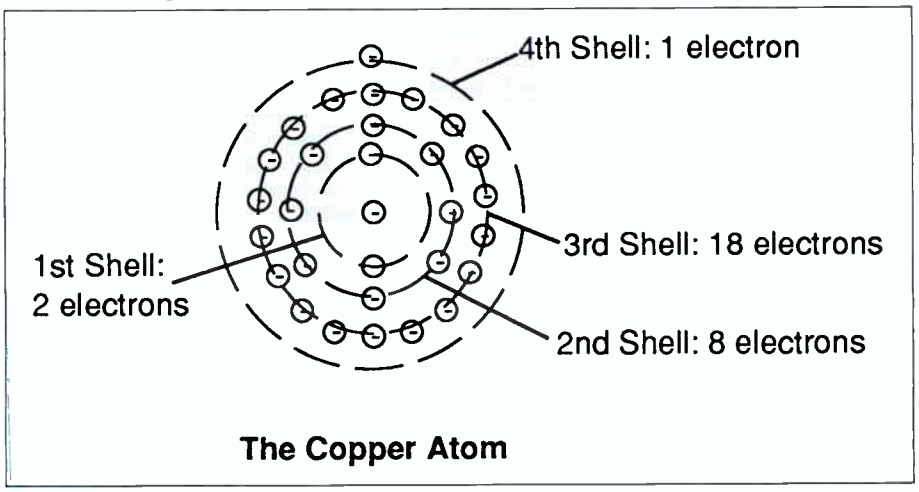
Each element's atoms have a certain number of electrons orbiting their nucleus, which distinguish them from all other atoms of other elements.

All elements are arranged in the "Periodic Table" according to their atomic number. This number is the number of electrons in the orbits of the atom. As the number of electrons increase, they all do not occupy the same orbit. Instead, they move in orbits at varying distances from the nucleus. These orbits, where the electrons revolve, are called shells. The number of electrons in each shell follows a predictable pattern.

The first shell can have up to two electrons; the second shell up to eight electrons; the third up to 18 electrons; and the fourth up to 32 electrons. The outermost shell usually is called the valence shell with the electron or electrons in it called valence electrons.

The nucleus consists of positively charged particles called protons and uncharged particles called neutrons. The nucleus attracts the orbiting electrons. These electrons remain in a stable orbit because of centrifugal force. The closer the shell is to the nucleus, the greater the attractive force and the tighter the atom is bound. The valence shell electrons, because of their distance from the nucleus, are more loosely bound to the atom.

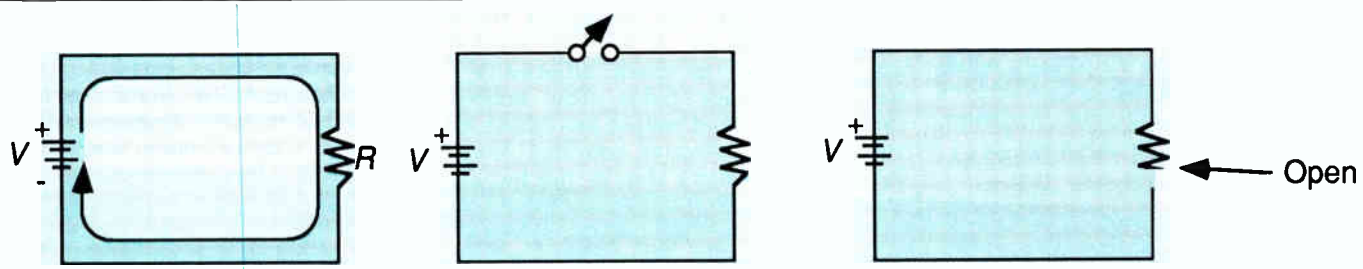
When sufficient energy is gained, any valence electron can break away from the parent atom and become a free electron. The free electrons are capable of randomly moving from one atom to another atom within a material. The free electrons make electrical current possible.



The Copper Atom

Current

Current is the rate of electrical charge flow within a conductor. Charge is symbolized by the letter Q, and current by the letter I. The formula for calculating current is I = Q/time. Charge is measured in coulombs, abbreviated C. One coulomb is defined as the charge carried by 6.28 x 10^{18} electrons. Cur-

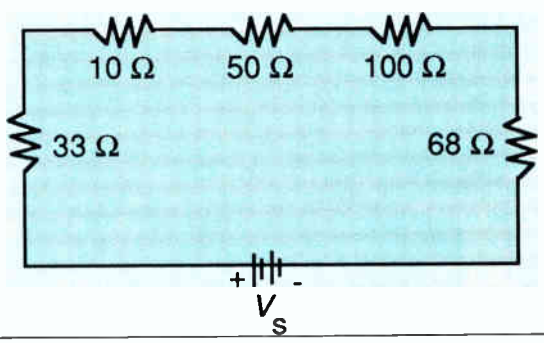


A. Closed Circuit

B. Open Circuit (switch)

C. Open Circuit (Open Component)

Closed and Open Circuits



By Steven D. Fry, Instructor, Gateway Electronics Institute

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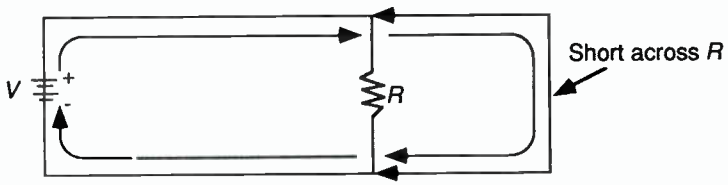


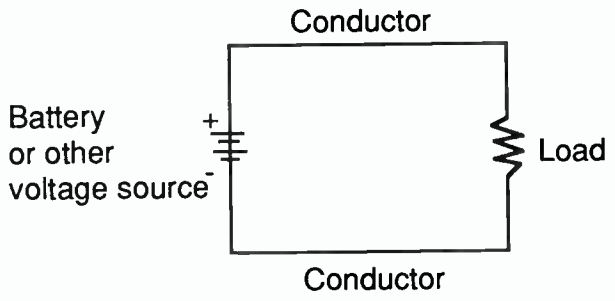
Short Circuit

rent is measured in amperes or amps. It is abbreviated by the letter A. One amp is the amount of current flowing in a conductor when one coulomb moves past a point in one second.

In order for free electrons to be present and in order to produce current which must move in a net direction, energy needs to be imparted to the electrons. This energy is connected to a conductor. The energy required to move a charge from one point to another is called voltage, symbolized with the letter V or sometimes E. Voltage also is called electromotive force (EMF) or potential difference.

The formula for calculating voltage is V = Energy/Q, where energy is expressed in joules. Voltage is measured in volts and is defined as the amount of potential difference between two points when one joule of energy is used to move one coulomb from one point to the other.

To limit or control the current flow, resistance is used. Resistance is the opposition to current. Resistance is abbreviated with the letter R. It is measured in the unit called ohms, symbolized by the Greek letter Omega. One ohm is defined as the resistance when one amp flows with one volt applied.



A Simple Electrical Circuit

For equipment such as stereos, TVs, and cable converters to function properly, an electric circuit must exist. The circuit consists of a source, a load and a current path.

The source can be a battery or anything that produces voltage. The load can be a simple resistor or any type of resistance. The current path is created from conductors, which permit current to flow easily because of the large number of free electrons in their structure, connecting the source to the load.

A closed circuit is one in which the current has a complete path to flow through. An open circuit is one in which the current path is broken and current cannot flow. A short circuit occurs when all of the current flows through the short rather than through the load.

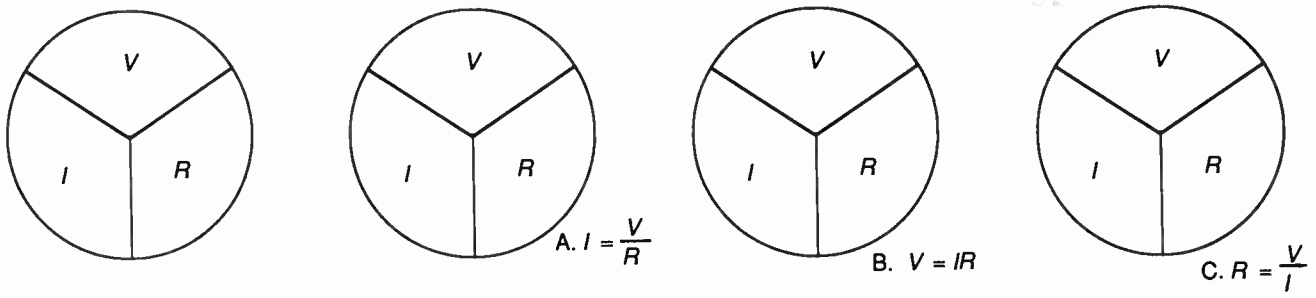
Currents, voltages and resistance of electrical circuits can be measured with the use of certain instruments. The voltmeter is used to measure voltage, connected across the current path. This connection is referred to as a parallel or shunt connection. The ammeter is used to measure the current, connected in the current path. This connection is called a series connection. The ohmmeter is used to measure resistance and is connected in parallel across the load. The resistance must be removed from the circuit or the circuit disconnected from the voltage source.

Ohm's Law

This brings us to Ohm's Law. Ohm's Law shows the relationship of current, voltage, and resistance. Ohm's Law can be stated in a formula V = IR; where voltage is equal to the current multiplied by the resistance. It can be rewritten to solve for current or resistance, as seen in the following formulas: I = V/R and R = V/I. All of the formulas are simply different ways to express Ohm's Law.

Power is the rate at which energy is used. Power is energy used in a certain length of time. We can see the relationship by the formula Power = Energy/Time. Energy is measured in joules, time in seconds and power in watts. One watt is the amount of power when one joule of energy is consumed in one second.

Whenever current flows through a resistance, energy and therefore power is dissipated. Remember that voltage can be expressed in terms of energy as voltage = energy/charge. Also, current can be expressed in terms of charge as I = Q/time. When voltage and current are multipled V x I = energy/charge x charge/time = energy/time = power, therefore the power in a resistor is the product of the voltage across the resistor and the current through it. Since power = voltage x current and voltage = current x resistance then power = current squared x resistance and power = voltage squared/resistance.



Ohm's Law--Memory Aid

There are many times when resistances are placed in series. A series connection provides only one path for current to flow between two points. Therefore the same current flows through each resistance. The total resistance of a series connection is equal to the sum of all the resistances. Formula it as R total = R_1 + R_2 + ... + Rn.

Two or more components or resistances connected across the same voltage source, are connected in parallel. Parallel circuits provide more than one path for current flow. Each path of the current flow is referred to as a branch. The voltage drop across any branch is equal to each voltage drop of the branches in the parallel circuit.

> Capacitance is the measure of the capacitor's ability to store the electrical charge.

The total resistance of a parallel connection is always less than the value of the smallest resistance. The formula is R total =

$$\frac{1}{\frac{1}{R1} + \frac{1}{R2} + \cdots + \frac{1}{Rn}}$$

Kirchhoff's current law states that the sum of the currents flowing into a junction is equal to the sum of the currents flowing out of that junction. In a parallel circuit a junction is where the branches connect together. Total current within a parallel circuit is therefore the sum of each branch current. Current is divided among the parallel resistances in a manor that is inversely proportional to the resistance values. In other words the larger the resistance, the lower the current.

Capacitance

Circuits are not made up of only resistive components. Some have capacitance or inductance. A capacitor is a device that stores electrical charge. In its simplest form, a capacitor is two parallel conductors separated by an insulating material called the dielectric. Capacitance is the measure of the capacitor's ability to store the electrical charge. This charge is an electric field in the dielectric and made up of lines of force. The basic unit used to measure capacitance is the farad. One farad of capacitance is one coulomb of charge when one volt is applied to its conductors or plates. The formula to calculate capacitance = charge/voltage.

Capacitance is directly proportional to the plate area. The larger the plate area, the larger the capacitance. Capacitance is inversely proportional to the distance between the plates. The farther away the plates or conductors the smaller the capacitance. Capacitance is also directly proportional to

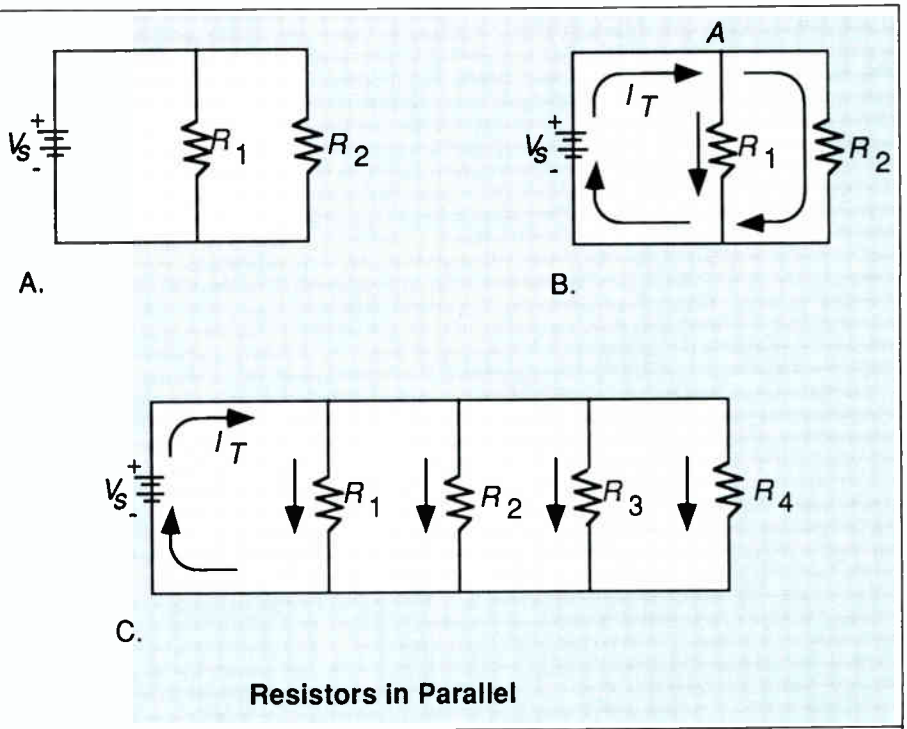
the dielectric constant. As the value of the dielectric increases, the larger the capacitance.

Capacitors connected in series result in plate separation increases and the total capacitance is less than the smallest capacitor. The formula is capacitance =

$$\frac{1}{\frac{1}{C1}+\frac{1}{C2}+\cdots+\frac{1}{Cn}}$$

total capacitance in a series circuit is found in a similar manner as total parallel resistance.

When capacitors are connected in parallel, the plate area increases and the total capacitance increases. The formula or total capacitance is the sum of the individual capacitance. C total $= C_1 + C_2 + ... + Cn$. The capacitance of a parallel are calculated in the same manner as total series resistance. Capacitive reactance is the opposition to current flow, is expressed in Ohms and inversely dependent on capacitance and frequency. It is symbolized by Xc. The formula is Xc = 1/2 FC.

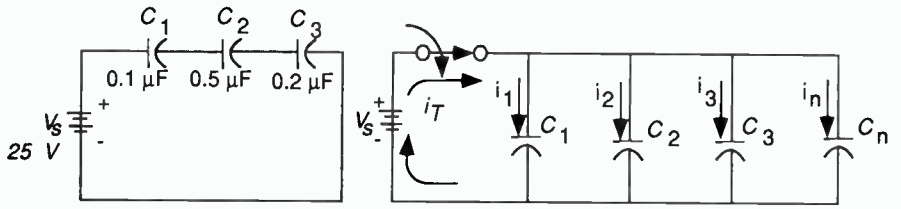


Resistors in Parallel

Magnetic fields

To understand inductance we must discuss magnetic fields. A permanent magnet has a magnetic field surrounding it. The field consists of lines of force that radiate from the North Pole to the South Pole and then back to the North Pole through the magnetic material.

Unlike poles of permanent magnets



Capacitors in Parallel

are attracted when they are close together. Like poles repel from each other. If a non-magnetic material is placed in the field of a permanent magnet, the field is not altered. However, if a magnetic substance is placed within a magnetic field, the lines of force tend to change and go through substance rather than through the surrounding air. The entire group of lines of force is called the magnetic flux. The flux density is the amount of flux per unit area in the magnetic field.

When current flows at a conductor, a magnetic field is produced around the conductor. The field produced in this way is called an electro-magnetic field. The field is stronger closer to the conductor and decreases in strength as the distance from the conductor increases. The force that produced the magnetic field is called the magneto-motive force.

When a conductor is passed through a magnetic field, a current and voltage is induced in and across the conductor. This is the basis of electrical generators. When a length of wire is formed into a coil it becomes a basic inductor. The induced voltage is proportional to the number of turns of wire in the coil, and to the rate at which the magnetic field changes.

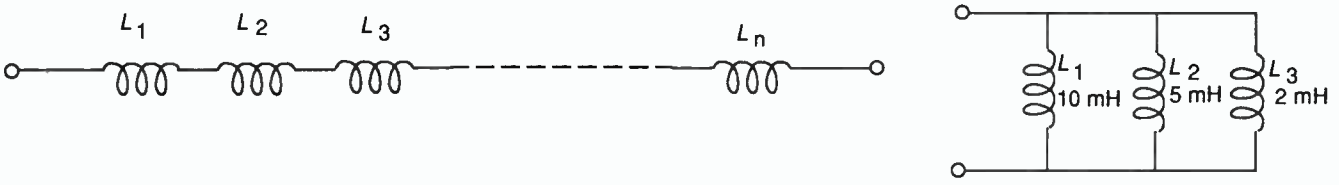
Self-inductance is a measure of an inductors ability to establish an induced voltage as a result of a change in its current. Simply stated as inductance and symbolized by the letter L, the unit is Henry, letter H.

Lenz's Law states the direction of current in a coil is such that it opposes the change in the magnetic field that produced it. Inductors connected in series have a total inductance equal to the sum of the individual inductances.

The formula for series is L total = $L_1 + L_2 + ... + Ln$, which is similar to resistance in series. Inductors in parallel the total inductance is less than the smallest inductor, similar to resistors in parallel. The formula is L total = 1

$$\frac{1}{\frac{1}{L1} + \frac{1}{L2} + \cdots + \frac{1}{Ln}}$$

This was a very brief introduction to basic electronics. There are several books about the subject for your use. ■



Inductors in Series

Do I need a P.E. license?

If you have been involved in the technical end of cable television for any length of time (and if you weren't you wouldn't be reading this magazine) you have probably dealt with an engineer who has the initials "P.E." after his name. Those initials stand for Professional Engineer, and indicate that the engineer has been licensed to practice engineering by at least one state.

In my consulting travels, I've seen about as much confusion generated by those two simple initials, P.E., as by just about anything else I could name. Typically, I'm asked if a P.E. license is "required" for some particular field of engineering work; or if a given project simply requires that a licensed P.E. "stamp" or "sign off" the work; or even if I have now become a "typical P.E. type!"

The answers to those questions, in order, are: (unfortunately) "it depends"; "*rubber stamping* is a very bad phrase in P.E. circles"; and "I don't know—what is a 'typical P.E. type'?" I'm sure these answers are very little help, even if they are accurate.

When and why licenses are required

Professional Engineering licenses are required by the states as proof that an engineer has certain basic technical knowledge and experience relevant to his area of specialization. A P.E. license is always required if an engineer prepares engineering drawings or other documents for municipal filings, where the material shown in those drawings or documents might affect the public safety. Examples relevant to cable television would include applications for the use of public rights-of-way; applications for cable attachments to bridges, viaducts, elevated railroad structures and the like; applications for railroad or waterway crossings; modifications to antennas and towers; and microwave transmitter installations, because the public safety may be affected. Although some readers may know of examples where P.E. licenses were not required for items such as these, the trend is clearly toward mandatory P.E. licensure in these cases.

By Alan S. Hahn, P.E., President, Hickory Mountain Associates, Telecommunications Consultants

BACK TO BASICS

With new technology expanding rapidly in the cable industry, so too, must the technical level of technicians and engineers keep pace. In this month's Back to Basics, Alan Hahn examines the Professional Engineer license—what it is, why it's necessary and how to obtain the stamp of "P.E."

If your work involves these items or similar ones, you should obtain a P.E. license.

P.E. licenses are issued by each state, and the licensed P.E. can practice engineering within that state, as defined by local state law. In fact, state law is often the reason for seeking a P.E. license in the first place, because an engineer will be required by law to have one if the engineer chooses to describe himself as an "engineering consultant" or "consulting engineer." In several states, you must actually avoid referring to yourself in written material as an "engineer" or to your work as your "practice" if you are unlicensed. Moreover, your employer may wish to see a P.E. license as a standard for promotion, and you definitely will need a P.E. licnese if you choose to begin your own independent consulting business.

How do I apply?

P.E. license applications are issued by various state agencies, most of which have long, bureaucratic-sounding names that would take up a lot of space in this magazine. To be brief, the various state, commonwealth and territory agency telephone numbers are given in Table 1. They should help you get started.

Table 1

Alabama	(205) 261-5568
Alaska	(907) 465-2540
Arizona	(602) 255-4053
Arkansas	(501) 371-2517
California	(916) 920-7466
Colorado	(303) 866-2396
Connecticut	(203) 566-3386
Delaware	(302) 656-7311
Dist. of Columbia	(202) 727-7454
Florida	(904) 488-9912
Georgia	(404) 656-3926
Guam	(671) 646-8643
Hawaii	(808) 548-4100
Idaho	(208) 334-3860
Illinois	(217) 782-0177
Indiana	(317) 232-1840
Iowa	(515) 281-5602
Kansas	(913) 296-3053
Kentucky	(502) 564-2680
Louisiana	(504) 568-8450
Maine	(207) 289-3236
Maryland	(301) 659-6322
Massachusetts	(617) 727-3055
Michigan	(517) 373-3880
Minnesota	(612) 296-2388
Mississippi	(601) 354-7241
Missouri	(314) 751-2334
Montana	(406) 444-4285
Nebraska	(402) 471-2021
Nevada	(702) 329-1955
New Hampshire	(603) 271-2219
New Jersey	(201) 648-2660
New Mexico	(505) 827-9940
New York	(518) 474-3846
North Carolina	(919) 781-9499
North Dakota	(701) 258-0786
Ohio	(614) 466-8948
Oklahoma	(405) 521-2874
Oregon	(503) 378-4180
Pennsylvania	(717) 783-7049
Puerto Rico	(809) 722-2121
Rhode Island	(401) 277-2565
South Carolina	(803) 758-2855
South Dakota	(605) 394-2510
Tennessee	(615) 741-3221
Texas	(512) 475-3141
Utah	(801) 530-6632
Vermont	(802) 828-2363
Virgin Islands	(809) 774-1301
Virginia	(804) 257-8512
Washington	(206) 753-6966
West Virginia	(304) 348-3554
Wisconsin	(608) 266-1397
Wyoming	(307) 777-6156

Application requirements vary somewhat, but the situation in New York State is typical of most. In the Empire State, an applicant must have either 12 years experience as an engineer, or what is called the "equivalent" of this. For example, a *four*-year B.S. degree in electrical engineering from an accredited school typically counts as *eight* years of the 12.

If a candidate went to an accredited graduate school and earned an M.S. in electrical engineering, he is usually given one more year of "equivalent experience," bringing the total to nine years. Your state application form

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Theft means signal leaks. It's as simple as that. And wherever you've got MDU's, you've got a high probability of theft.

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Reader Service Number 79

'Real world' electronics

In May of this year I had the opportunity to "ride" with a service technician in one of ATC's systems. These ventures into the "Real World" are an invaluable experience. They enhance understanding of subscriber priorities and of what can be done with available resources.

The system I visited used a baseband descrambler for approximately half of the channels. Thus nearly everyone has a set-top unit. In several cases, the subscriber's complaint is that the set-top unit is slow to descramble. Of course, in most cases, it performs well while the service tech is there. "Murphy's Law" applies here as well! Usually, the subscriber is a bit embarassed about this. The only thing the service tech could do is exchange converters, taking the previous unit back to the shop for careful examination, leaving one that just came from the shop. The hope is that the unit left will perform better and the subscriber will at least feel he received service.

In-home wiring problems

One of the more interesting visits was to a home where the complaint suggested exchanging boxes. The subscriber was uncomfortable about this. He said that the current box was one of the better ones he had seen. Most of the others had bars rolling through the screen. Several boxes were tried. All exhibited this problem.

The problem appeared to be a beat. Since the cable system uses the standard frequency plan, HRC and IRC type beats were not the culprit. It turned out that the beat was caused by a subscriber-installed A/B/C switch with inadequate isolation between ports. The subscriber had a two way splitter, a four way splitter (with one output terminated) and a three way switch very neatly screwed to the wall. Interconnections were made with purchased cables having push-on connectors. A close pass with a two-meter Ham radio hand-held revealed that the connections were tight even though they were just push-ons. Trying to remove them demonstrated why. They were really tight.

The problem was the A/B/C switch. One switch position allowed the television receiver to be connected directly to the cable system. Another of the positions connected the receiver to the channel 3 output of the converter. This was the position being viewed. Sufficient channel 3 from the cable system bled across the switch to form a beat with the descrambler's channel 3 output. This was demonstrated by removing the cable signal input from the switch. The box which performed the best just happened to have the least visible beat. Since the box's channel 3 modulator and the cable's channel 3 signal were unrelated, the beat could vary over a wide range.

Often, when in-home wiring by the subscriber is discussed, it is assumed that the subscriber intends to connect up other television sets. Paranoia sets in for some who fear the loss of additional outlet revenue. Here was a case of a subscriber simply trying to get utility from both TV and VCR.

At another visit, we were treated to a polite but clear lecture over the problems of trying to use a VCR in a scrambled cable system. The subscribers were an elderly couple who received the VCR as a gift about a year ago. The wife has given up and refuses to try. The husband is only partially successful, admitting to having to read the VCR instruction booklet nearly every time he wants to tape. His problem is over the connections to the cable descrambler. He had the same Radio Shack cables with molded push-on connectors. However, he had removed the tension ring so he could easily make connection changes. This caused the two-meter hand-held to make music.

He mentioned that this was at least his third set-top in the last year. Frequent unit exchange and confusing taping annoyed him. His final response: "When are you going to stop using this thing?"

Tuner overload

A particularly sad case involved an elderly gentleman, living alone in clean but limited surroundings. His mobility was impaired by arthritis and advanced age. It appeared that his principal joy came from sports on cable. He could afford only the lowest level cable package. This did not require a descrambler. His television was an inexpensive, small clean model without remote control. The complaint on the service order was "hum bars." But the problem was aggressive cross modulation in the TV's tuner. We could clearly see not just sync bars, but video rolling through the background. A converter cured the problem, but the subscriber could not afford that solution. A signal pad pleased him the most. While noise was slightly increased, the sync bars which annoyed him the most were gone.

Conclusion

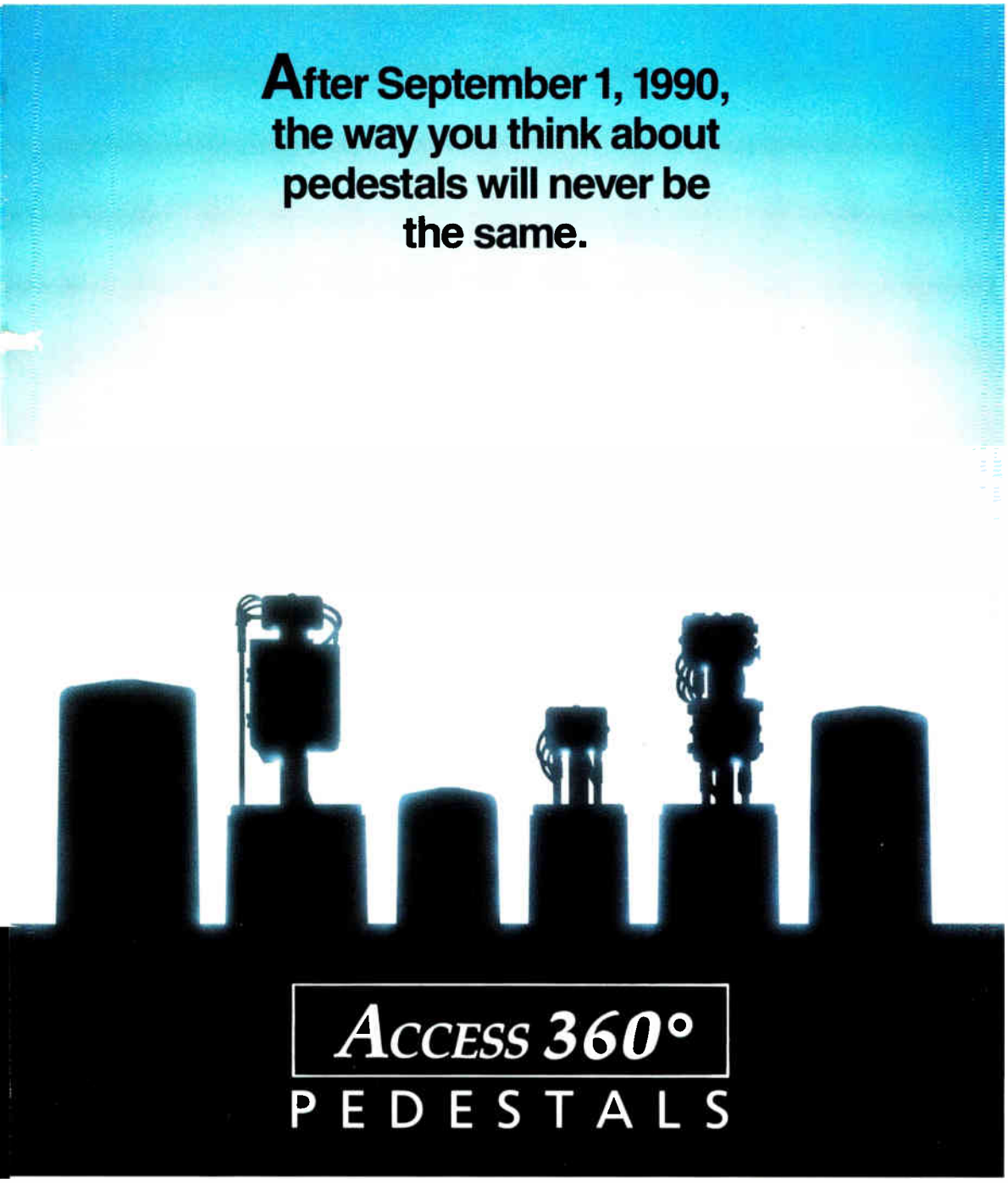
Clearly the work on the consumer electronics interface with cable has a long way to go. While substantial progress has been made, more is needed. CableLabs and the Electronic Industries Association/NCTA Joint Engineering Committee are the principal tools. Direct discussions with manufacturers and distributors are important too.

A few moments' thought reveals that several of the day's service calls would have been eliminated if MultiPort was part of the subscriber's set up. Significantly more than half of the service calls of the day were due to box performance and reliability. Since a MultiPort box has considerably fewer parts and less heat, its reliability should inherently be better, saving many of these calls. If the VCR had MultiPort, none of the difficulty-of-use comments would relate to the cable system. If the automated electronic program guide discussed in the last two columns was also in place, VCR usage would be no problem at all.

I was impressed with the service technician's skill, knowledge, politeness, and manner with the customer. He is an excellent representative of the company and the industry. ■

By Walter Ciciora, Vice President of Technology, American Television and Communications

U T I L I T Y P R O D U C T S



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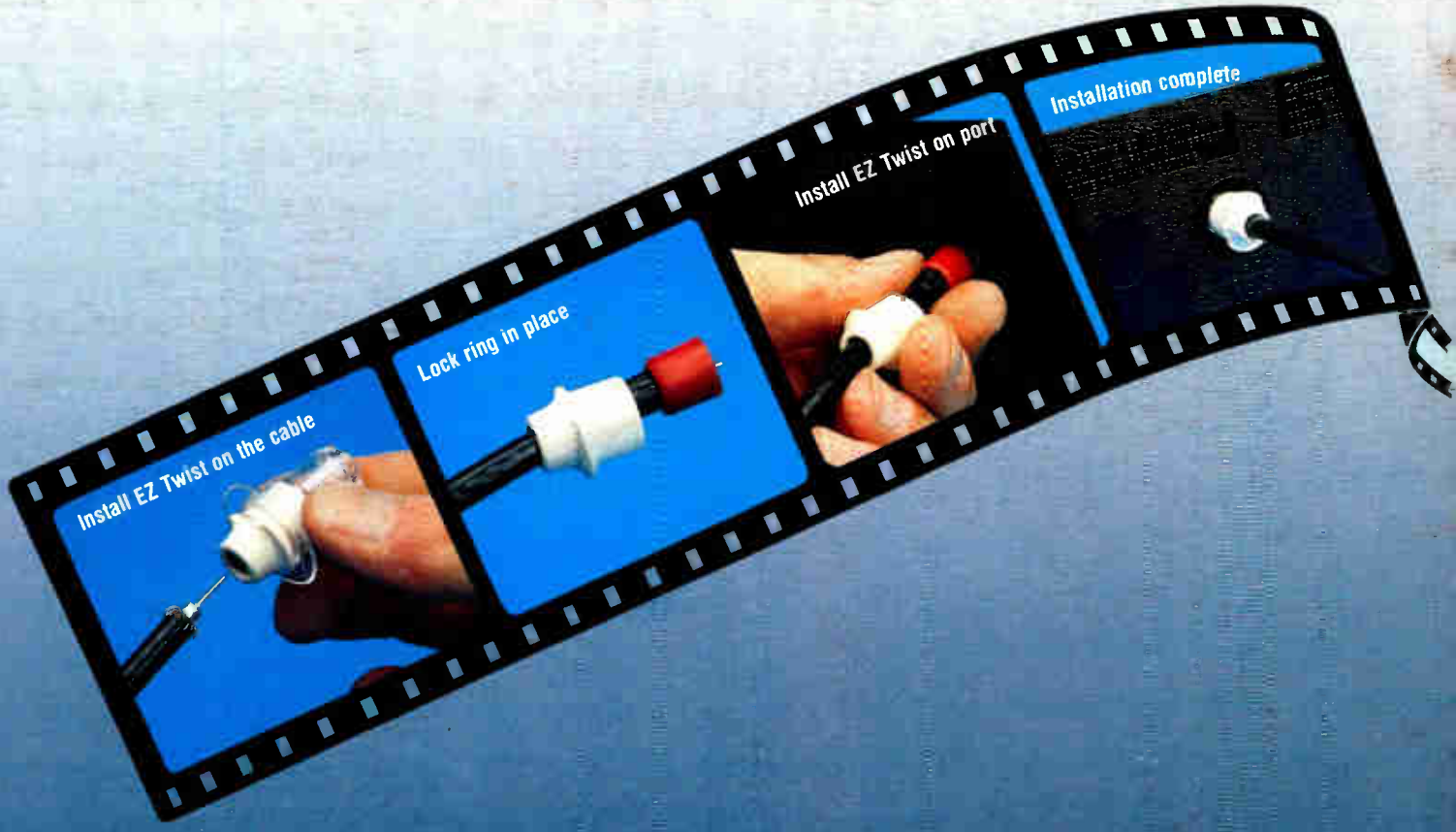
Introducing EZ Twist™...



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Raychem's new EZ Twist indoor connectors are available *now* through Anixter Cable TV. To order, or for more information, call the Anixter Cable TV location nearest you.

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