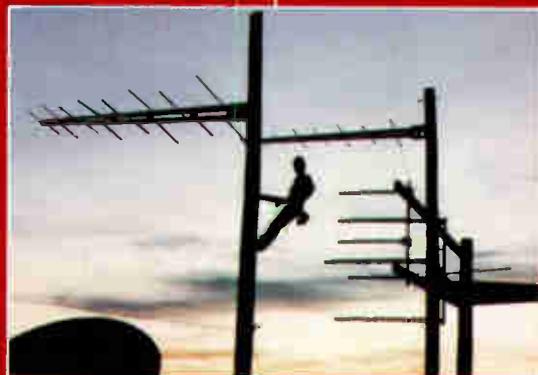


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Official trade journal of the Society of Cable Television Engineers



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June 1988

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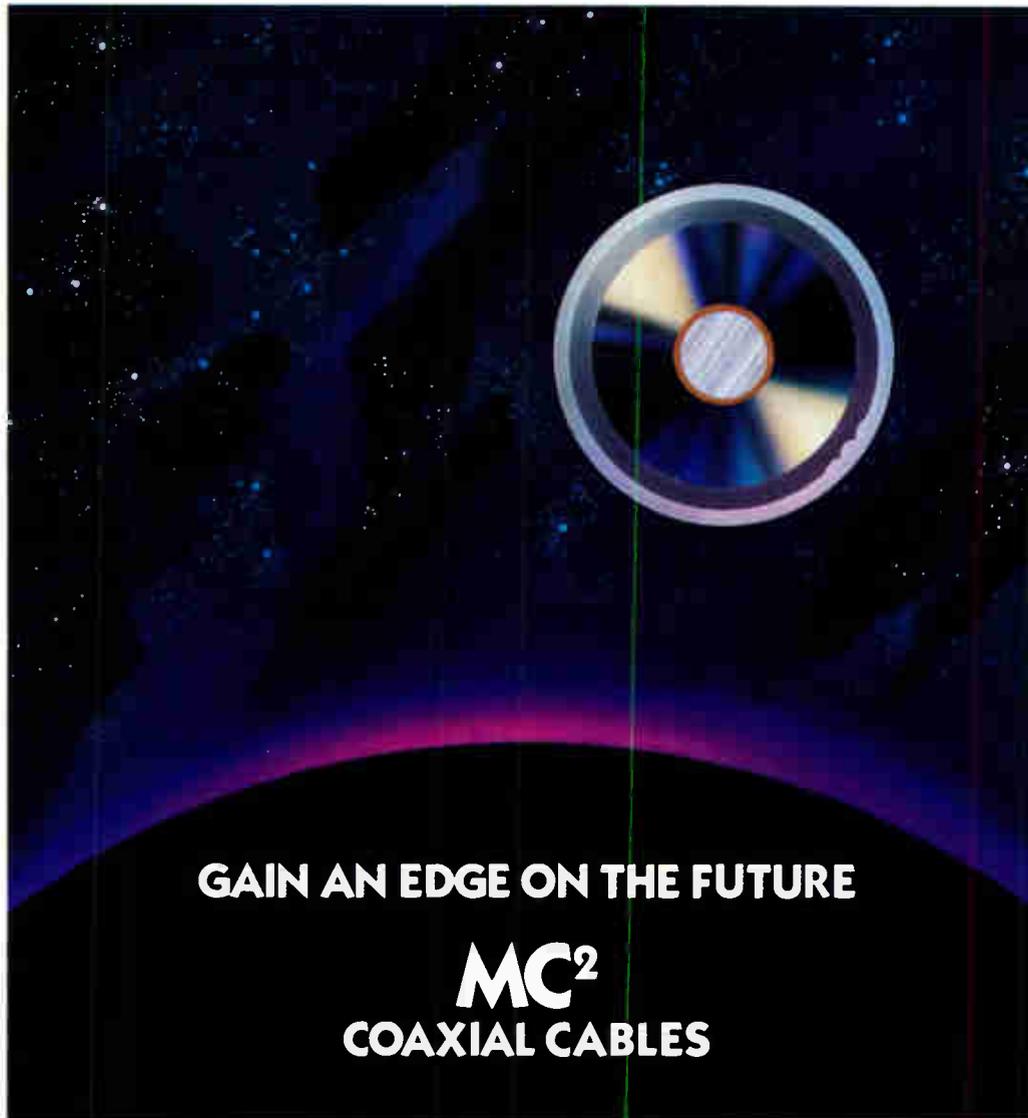
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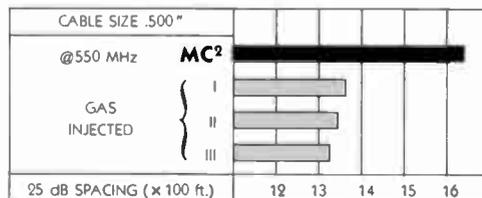
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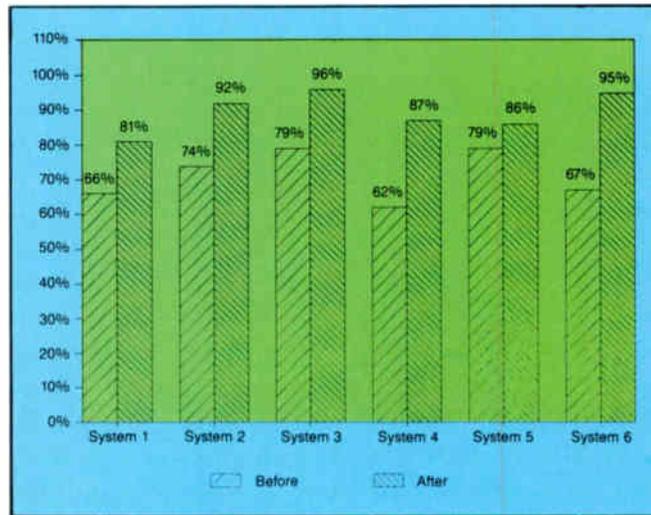
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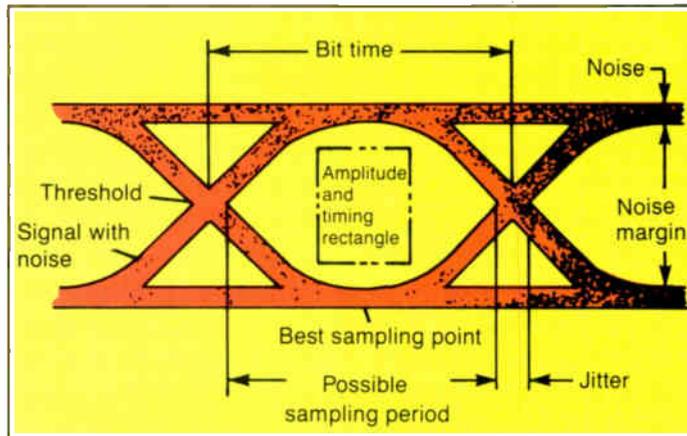
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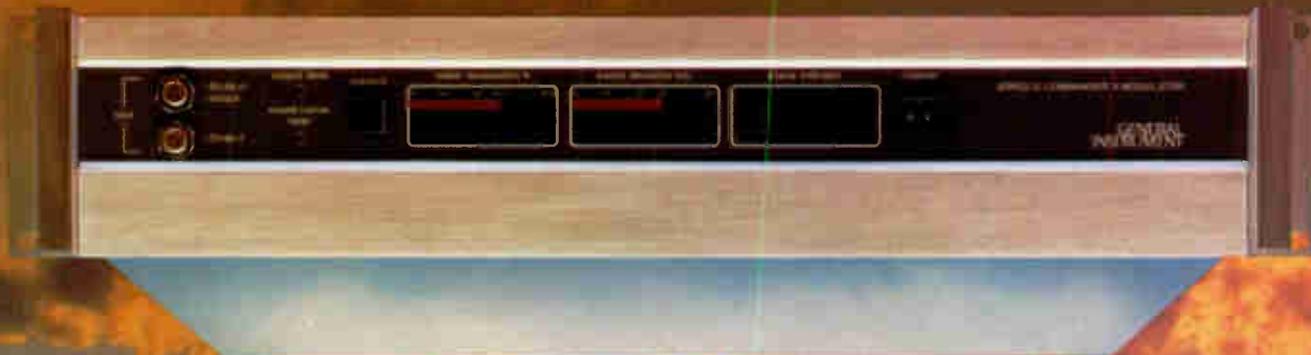


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The best of the best

Welcome to San Francisco and the Cable-Tec Expo '88. The Society of Cable Television Engineers seems to pick the best locations. And this year is no exception. This city has some of the best cuisine in the world, the Golden Gate Bridge, Chinatown, Alcatraz, cable (TV?) cars, the Embarcadero, the Transamerica Tower, etc., etc. This month (June 16-19 at the Hilton) it can also boast about having the best technical trade show in the industry.

Of course, it's no mystery that the focus of this month's CT is training. That's what the expo is known for—and usually it's the most concentrated learning event of the year. To wit:

The annual engineering conference Thursday, June 16 will feature panel discussions: "High-definition television technology;" "Fiber optics—Here and now" (the two hot topics of 1988), "Frontline: Senior cable engineers" and "The future of the CATV business."

And as for the expo itself, there are some juicy workshops planned: "Rebuilds and upgrades," "Signal leakage and CLI testing," "FCC compliance," "Spectrum analysis," "BTSC stereo" and "Developing a technical training program." Also available are BCT/E Certification Program review courses for Categories III, V and VI.

Sure to be one of the hottest items will be the announcement of the Society's new Installer Certification Program. An overview and review course will be presented to expo attendees in a workshop. The SCTE will detail its methods of determining certification through exams and practical demonstrations. The workshop will be videotaped and made available through the Satellite Tele-Seminar Program. Also on the drawing board is an installer's level of SCTE membership.

Let's not forget the social events. Wednesday evening, Women In Cable in conjunction with the SCTE is offering a cruise of San Francisco Bay. On Thursday is the Welcome Reception sponsored by Anixter, AT&T and Raychem, followed by hospitality sponsored by Scientific-Atlanta. The big event socially is Expo Evening on Friday, titled "San Francisco Casino Night." Finally, on Saturday is the exhibitors' reception and Jerrold Night. Add to this the optional tours to the Catel and Raychem manufacturing plants, Mt. Sutro Tower and Viacom Cablevision's head-end, and the KBHK-TV studio tour—and you'll have a busy weekend indeed.

Be sure to watch for us at the expo. As usual, we'll be there in force, not only with this issue of CT and the June issue of our newest CATV trade magazine *Installer/Technician*, but with the *CT Daily*. The daily will bring you up to date on the various workshops and action from the exhibit floor. If your company has something of interest to include in the daily, just stop one of our staff at the expo. Also, in addition to the *CT Daily*, we'll be distributing material from various companies



in a bag (suitable for carrying all those show giveaways and literature) hanging on the doors of the rooms each morning. And please support our advertisers; many of them will be displaying their ads (as they appeared in *CT* and *IT*) at their exhibits.

Anyway, there will be those of you not fortunate to be able to attend, as well as those who'd like a bird's-eye view of this event for their scrapbook. Worry not: The August issue of *CT* will have an extensive wrap-up of the expo in word and picture.

In my expo letter of 1987, I mentioned that "the ranks of the SCTE have swelled to over 3,300 members strong, a record." Now I can say, "The record now stands at over 4,000 members strong." And if you're reading this magazine at the expo and you're not a member of the Society, I'm frankly...speechless. Join, join, join!

A round of applause

Congratulations to the new SCTE officers, who were elected at the National Show last month: Ron Hranac of Jones Intercable, president; Bill Kohrt of General Instrument/CommScope, Eastern vice president; Richard Covell of GI/Jerrold, Western vice president; Wendell Woody of Catel, secretary; and Gary Selwitz of Warner Cable Communications, treasurer. Also, welcome to Bob Price of BradPTS, the new director for Region 12.

Finally, a pat on the back and a trip to the expo for Barry Smith, a technician in the Research & Development Department of Tele-Communications Inc. Barry's photo won this year's *CT/SCTE* contest among the many, many excellent entries we received. According to Barry, the photo (which appears on this month's cover) was taken at sunset in the antenna farm of Desert Cablevision in Rosamond, Calif., circa summer 1985. By the way, Barry's wife Lauri, who also will be attending, serves as secretary to Tom Elliot, TCI's director of R&D.

Well, here's to yet another eventful and educational expo! Enjoy!

Paul R. Levine



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SCTE Expo '88 agenda announced

SAN FRANCISCO—The Hilton will be the site of the 1988 Annual Engineering Conference and Cable-Tec Expo, to be held here June 16-19. Sponsored by the Society of Cable Television Engineers, the agenda is as follows:

Wednesday, June 15

5-8 p.m.—Conference registration

Thursday, June 16 (Annual Engineering Conference)

7:30-11 a.m.—Registration

8:30-9 a.m.—Opening remarks by William Riker (SCTE)

9-10:30 a.m.—Session A: "High-definition television technology," with Walt Ciciora (ATC), Ben Crutchfield (National Association of Broadcasters), Lawrence Lockwood (TeleResources), Paul Resch (ATC) and William Thomas (ATC).

10:45 a.m.-noon—Session B: "Frontline: Senior cable engineers," with Wendell Bailey (NCTA), Vito Brugliera (Zenith Electronics Corp.), Tom Elliot (TCI), Dave Large (Raynet) and Joe Van Loan (Consultant).

Noon-2 p.m.—Membership luncheon with keynote speaker Corey Busch (San Francisco Giants and Giantvision).

2-3:15 p.m.—"Fiber optics—Here and now," with Jim Chiddix (ATC), David Grubb (General Instrument/Jerrold), Dr. James Hood (Catel), Al Johnson (Synchronous Communications) and Lawrence Stark (Ortel).

3-5 p.m.—Expo registration.

3:30-4:30 p.m.—"The future of the CATV business," with Edward Allen (InterMedia Partners), John Goddard (National Cable Television Association), Bill Johnson (Scientific-Atlanta) and Hal Krisbergh (General Instrument/Jerrold).

5:30-8 p.m.—Welcome reception sponsored by Anixter, AT&T and Raychem.

7:30-10 p.m.—Hospitality sponsored by Scientific-Atlanta.

Friday, June 17

8 a.m.-1 p.m.—Expo registration

8:30-9:30 a.m.—Workshop Period A

9:45-10:45 a.m.—Workshop Period B

11 a.m.-noon—Workshop Period C

Noon-2 p.m.—Lunch served in Exhibit Hall

Noon-5 p.m.—Exhibit Hall open

7:30-10:30 p.m.—Expo Evening "San Francisco Casino Night"

Expo workshops

The following workshops will be presented during each workshop period designated in the agenda.

- "Rebuilds and upgrades," with Timothy Dugan (Times Fiber) and Michael Holland (Pico Macom).

- "Signal leakage and CLI testing," with Robert Dickinson (Dovetail Systems) and Tom Polis (RTK Communications Group).

- "FCC compliance," with Syd Bradford (FCC) and Brian James (NCTA).

- "Spectrum analysis," with John Cecil (Hewlett-Packard) and William Benedict (Tektronix).

- "BTSC stereo," with Ron Hranac (Jones Intercable), Steve Fox (Wegener Communications) and Dane Erickson (Society of Broadcast Engineers).

- "Installer Certification Program," with Richard Covell (General Instrument/Jerrold) and Ralph Haimowitz (SCTE).

- BCT/E Certification Category III review course, with Tom Straus (Hughes Microwave).

- BCT/E Certification Category V review course, with Al Koulas (American Cablesystems).

- BCT/E Certification Category VI review course, with Jim Farmer (Scientific-Atlanta) and William Cohn (Zenith Electronics Corp.).

- "Developing a technical training program," with Roger Keith (Warner Cable Communications).

Saturday, June 18

8 a.m.-1 p.m.—Expo registration

8:30-9:30 a.m.—Workshop Period D

9:45-10:45 a.m.—Workshop Period E

11 a.m.-noon—Workshop Period F

Noon-2 p.m.—Lunch served in Exhibit Hall

Noon-5 p.m.—Exhibit Hall open

4-5 p.m.—Exhibitors' reception

7-11 p.m.—Jerrold Night

Sunday, June 19

8:30-noon—BCT/E Certification examinations

court has ruled that the A/B switch requirement remains in effect even though the must-carry rules were struck down; however, the commission has not given a date for the re-implementation of the rules.

TV Answer has submitted a request for rule-making to the FCC requesting reassignment of spectrum allocation to allow its use in a two-way technology. NCTA supported its request for rule-making but is reserving support for the system until testing is complete.

The FCC has granted a waiver of the cable telco cross-ownership rules to the telephone company in Cerritos, Calif. The cable industry argued against the waiver as it would have been possible to build a cable system without the backing of the telephone company but the commission was not convinced. This case will probably go to court.

The commission has scheduled a public meeting May 16 to review the positions on proposed automatic transmitter identification systems for video uplinks. The HBO proposal for a subcarrier system is gaining support as development of the dispersal waveform system is not progressing.

The first report from the FCC Advanced Television (ATV) Committee is due May 17. This report will be mainly the input of the working parties of the Planning Subcommittee. This subcommittee is developing the required attributes of an ATV system or systems and the test procedures to determine which proponent system(s) meet the requirements. The working parties have been meeting often to develop the inputs before the deadline. Subcommittee reports include the following:

Multiport: A questionnaire has been sent to the top 50 MSOs to determine whether the problem of direct pickup still exists with current cable-compatible TV sets. A booth will be setup at the NCTA convention to demonstrate the port. Some TV manufacturers are now obtaining TV sets with the ports but there is significant delay in obtaining decoders to work with the port.

Multichannel TV sound: The test procedures for the recommended practices manual are under final review and should be ready for submission at the next meeting.

Signal leakage: A recent Atlantic City, N.J., FCC inspection confirmed that there is more money available for the FCC to inspect cable systems and they are stepping up the inspections. The policy still appears to be if the cable company is diligent in monitoring and record keeping there will be little problem with the inspection. However, if records are not kept then inspections can result in fines.

Satellite practices: Two documents are being developed for use by VideoCipher II operators. One document deals with proper setting of audio levels and the second deals with the use of subcarriers on the same transponder as a VideoCipher signal. The subcommittee also is investigating the reliability of audio cue tones for ad insertions. There have been some complaints regarding missed inserts so other, more reliable

NCTA Engineering Committee report

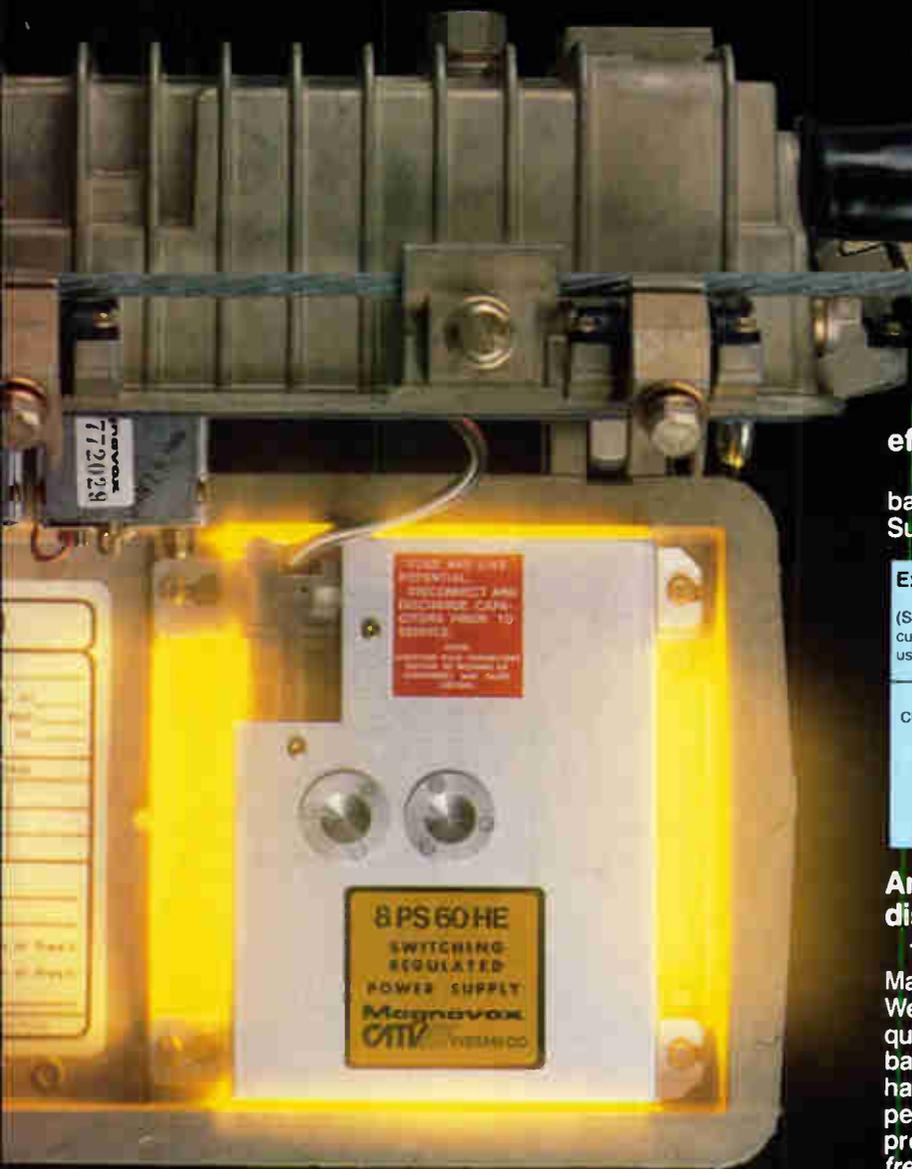
"CT" is presenting a report of the bimonthly meetings of the Engineering Committee of the National Cable Television Association, written by Brian James, NCTA director of engineering.

CHICAGO—The NCTA Engineering Committee's most recent meeting was held here April 20-21. A premeeting session was held at the Telaction office where the video shop-at-home system was

demonstrated. This system allows cable customers to browse through a number of video catalogues in the comfort of their home as well as order desired merchandise.

Wendell Bailey updated the members on the recent happenings in Washington, D.C. The A/B switch, terminal devices and Part 15 rewrite remain in limbo waiting for decisions by the Federal Communications Commission. The appeals

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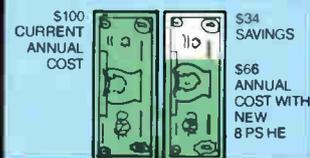


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methods are being considered.

National Electrical Code: The next revision process is well under way. It will contain a rewrite of Section 820 (which applies to cable) so that it follows Section 800. In addition, a specific paragraph defining the various types of indoor drop cables will be included.

ATSC: The Executive Committee is reviewing the structure of the ATSC to determine if it would be better to reorganize along the lines of the FCC Advanced TV Committee. A number of new companies have applied for membership in the ATSC resulting in additional operating funds. Broadcast transmission tests procedures are almost completed and some testing has been performed. Cable tests procedures are under development.

CEBUS: The standard development is progressing well and equipment should be demonstrated at the winter Consumer Electronics Show.

Amateur TV transmits with stereo sound

ENGLEWOOD, Colo.—In what is believed to be the first use of multichannel television sound in amateur television (ATV) frequencies, a group of Denver area hams transmitted video accompanied by a BTSC-encoded audio carrier in the 70 cm amateur band. The stereo audio signal contained a Morse Code ID on the left channel and voice on the right channel.

Ron Hranac (N0IVN) and Doug Greene

(N09I) of Jones Intercable used a headend modulator and BTSC encoder feeding 5 mW (+56 dBmV) into a 16 element yagi antenna. The 439.25 MHz signal was received 0.3 miles away by Steven Johnson (N0AYE) and Raleigh Stelle (NY0Y) of American Television and Communications Corp., using a homemade 12 element yagi antenna and a set-top converter for a receiver. Bob Luff (W3GAC), also with Jones, conducted two-way ATV communications with the group using mobile ATV equipment in a vehicle.

The five engineers are involved with local amateur efforts to establish an ATV video communications network that will be used to provide severe storm monitoring for the National Weather Service, as well as other public service, emergency and amateur communications in the Denver area. The significance of stereo transmission in the ATV bands is the fact that BTSC encoding provides for multiplexing of up to four audio and/or data signals on a single television audio carrier, which enhances the efficiency of spectrum usage. The group plans to repeat the experiment using higher power levels for longer distance transmission.

- TV Answer filed reply comments with the Federal Communications Commission on its Petition for Rulemaking (RM-6196) to allocate one-half MHz for a nationwide TV viewer response service.

- Booth American Co. agreed to purchase more than \$1.25 million of Pioneer's BA-5000N

series multivendor compatible addressable converters to be used in Booth's Birmingham, Mich., system.

- Cable Link Construction began the first phase, a 35-mile section, of a system build for TV Cable Carlisle in Atoka, Okla.

- Broadband Networks successfully closed a \$1 million financing package, including equity placement of \$600,000 with a group of investors. This package also includes \$200,000 loan agreements each with both SEDA-Council of Governments in Lewisburg, Pa., and People's National Bank of Central Pennsylvania.

- Cable Exchange acquired Cable Business Associates (CBA) and will issue over 1 million shares of its common stock for all of the issued and outstanding shares of capital stock of CBA.

- Cable Services Co. signed a turnkey construction agreement valued at \$10 million to wire 14 towns on the south coast of Puerto Rico for Teleponce Cable TV.

- Nexus Engineering was awarded an Export Development Award by the British Columbia Ministry of Economic Development to recognize Nexus' outstanding work in the pursuit and development of international export markets.

- Cablevision of New York City selected Jerrold's distribution and subscriber equipment for its new-build in the Bronx and portions of Brooklyn. Equipment sales are anticipated to be \$60 million to \$80 million.

- Tronitec of Woodstock, Ga., added CATV repair parts sales to its distribution equipment service business. The toll-free number for parts or service orders is (800) 962-2588.



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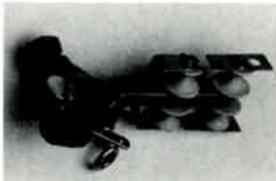
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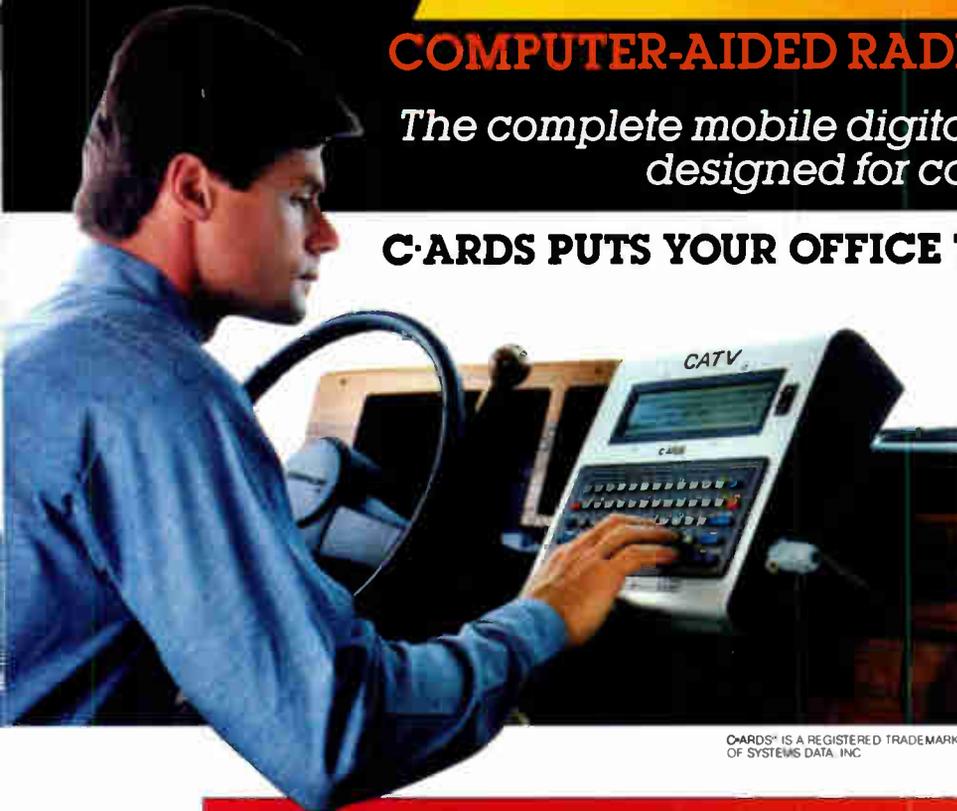
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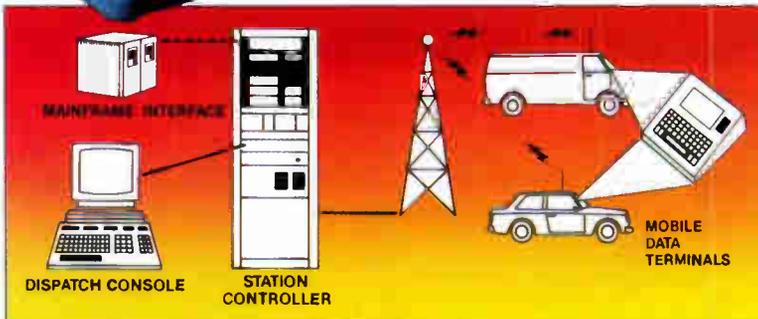
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The H Factor

By Isaac S. Blonder
Chairman, Blonder-Tongue Laboratories Inc.

Last month, in the role of technical advisor for IECSC12G (wired cable distribution), I commented on the lack of input from American engineers and laboratories to help the U.S. National Committee in facilitating the deliberations on cable TV standards conducted by the International Electrotechnical Commission. Naturally, the standards involve current state-of-the-art technologies requiring the highest level of knowledge, expensive and intensive laboratory equipment—all lubricated by sufficient funds to prove or disprove the proposed standards.

While I possess a modicum of physics education, long years of laboratory slavery and plenty of business hard knocks, I cannot challenge the IEC deliberations all by myself: seemingly, there is neither interest nor dedicated funds coming from the U.S. cable industry. Nothing new, of course—yesterday, today and probably tomorrow presents the same dreary scenario of doing nothing on standards.

Oh well, on to the H Factor.

Two documents were being considered for adoption as standards—12G105, *Performance Requirements for Data Transmissions on Cable Distribution Systems Using the H Factor* and 12G107, *Method of Measurement of Data on Cable Distribution Systems Using the H Factor*. "H Factor" is defined as a measure of the analog characteristics of the teletext signal.

System distortions have well-known effects on video signals and the characteristics of video distortions are measured by test signals specially designed to take into account the psychological tolerances of vision. However, these distortions do not have the same effects on data signals as on video signals. Two common test signals for video, the 2T pulse and the amplitude and phase responses at certain discrete frequencies—multi-

"Will U.S. cable engineers and cable systems be able to compete in the world marketplace?"

burst, 12.5T, multipulse—can occasionally help explain deformations in the data signal.

Eye pattern

A more useful analog characterization of the data signal comes from an "eye" pattern, specifically by measuring the eye height. This measurement is relatively complex since several instruments are required. The eye pattern is formed of superimposed data bits with a time base of a multiple of the clock frequency $1/T_b$. These main parameters can be measured: the eye height, eye width and overshoot level. Of these parameters, the eye height is the most common method for measuring the analog quality of the data signal. It measures the distance between the lowest of the "ones" and the highest of the "zeros." A minimum package of equipment to measure the eye pattern requires a quality television signal demodulator, a wide-band oscilloscope, a teletext decoder with data clock output and a waveform monitor. Eye factor measurements are difficult to interpret, resulting in an error probability of 10 percent.

A new proposed test signal, the H Factor, partially eliminates the disadvantages of the eye pattern measurement while giving a maximum of information about its analog quality of the data signal. The instrumentation is considerably simplified: Only a video waveform monitor equipped with a special graticule and connected to a high quality demodulator are required for the measurements. The test signal uses a "one bit" pulse and its inverse, the isolated "zero bit" pulse. Digital data located at the start of the line con-

taining these two pulses give the test signal the status of a teletext data signal in compliance with the standards of the North American teletext specifications NABTS. This test signal can be inserted into a line of the vertical blanking interval just like any other video test signals. When the two pulses of the test signal are superimposed on the screen of a waveform monitor, they form a pattern that somewhat resembles the letter H; hence, H Factor.

At this point, the authors of the H Factor indulge in a mathematical analysis designed to translate the oscilloscope figures into precise mathematical equivalents of the distortion endured by the data signal in its passage through the cable system. The math leaves me rather breathless, so I will pass on to a final reprise definition of the H Factor. It is expressed by the dimensions of the pupil formed at T_0 by the superimposition of two pulses, minus the sum of the signal values measured at times nT_b , which are below zero for the "one bit" pulse and exceed the "all-ones" level for the inverse pulse.

There are three major types of distortion in a cable system affecting analog data transmission: 1) linear amplitude, 2) linear phase and 3) non-linear amplitude, all of which can be measured within 5 percent using the equipment and techniques described by the IEC documents. Distortion caused by echo creates special situations when the echo delay is greater than $3T_b$ (525 milliseconds). The effect of positive and negative echos can be measured and the H Factor modified accordingly.

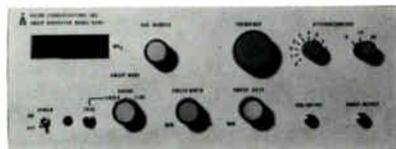
Extensive experiments carried out in the Netherlands showed that a minimum value of 40 percent for the H Factor would allow one or more errors per page of teletext, 60 percent of the time. It was therefore proposed that the minimum H Factor be raised to 60 percent. As the technical advisor for the United States I was asked to comment on this proposed standard. Unable to find a single U.S. laboratory to verify the quality of the mathematical analysis and the experimental evidence supporting a tightening of the H Factor level from 40 to 60 percent, I meekly consented to the change.

Questions

What is the implication of yet another standard set by the energetic scientific members of IEC12G? Can our cable systems deliver data with the low distortion levels mandated by IEC12G? Is HDTV carriage quality far behind data? What is the added cost per subscriber for a 60 percent H Factor compared to 40 percent (if our current cable systems even reach the 40 percent quality level)? Will U.S. cable engineers and cable systems be able to compete in the world marketplace?

Add your own questions and, I hope, answers as well.

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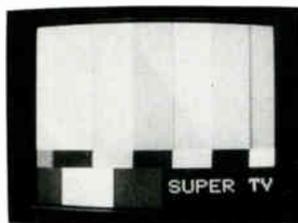


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Training for the technical future

By Kenneth T. Deschler

President, Cable Correspondence Courses

As CATV continues to grow, the tasks accomplished by a talented few must now be performed by many people with varied backgrounds and knowledge.

Because of the complexity of a modern cable system, it is becoming increasingly more important for cable workers to know what constitutes a cable system and how each part fits into the overall plant. For years the cable industry has recognized proper training at all levels will improve performance, efficiency and growth of any system committed to it. In this day and age, the cable industry *must* insist on knowledgeable, competent and ambitious employees to maintain the CATV systems to come. The way to achieve this goal is to have training programs that prepare cable workers not only for the present, but also for the future.

Correspondence courses

One of the many ways training can be accomplished is through the use of correspondence courses. This method of training is gaining greater acceptance in cable systems. One of the major advantages of this form of training is that time and personnel are not lost during busy periods. Another is that the seller of the course certifies that the student is competent.

Traditionally, training in the cable industry has been accomplished by "on-the-job training" (OJT). OJT assumes that the trainer is competent to instruct, but many times the person assigned is a product of the same type of training. Certainly the concept of the blind leading the blind could apply if the trainer does not possess the necessary knowledge, teaching skills and patience. Correspondence courses on the other hand are designed to flow smoothly, progress from the simple to the complex and provide effective feedback to the student.

When a correspondence course is augmented by in-house specialists, the student profits from structured course material as well as experienced tutors. A good correspondence course does not assume that the student has a vast body of knowledge to draw from. Rather, a well-designed correspondence course starts the student off with all of the background knowledge necessary for successful completion of the course.

In order to complete a correspondence course the students should possess the will to complete the course and adjust their schedule to include a regular time for course work.

I firmly believe that the student, not the employer, should pay for the course and that the employee should be reimbursed only for those lessons actually completed. That way the student is motivated to finish the course. A reasonable time limit should be incorporated to ensure that the student stays on task.

If these strategies are employed, a poorly motivated employee is soon eliminated. On the other hand, if the employee is consistent in work-



ing on the course material, a more knowledgeable and productive worker is obtained.

In-house training

In-house training is the preferred method for a cable system to train employees. The main advantage is that they are trained not only in the basic concepts of CATV, but also receive training on the system they are to maintain. Because they are trained on the system they are employed by, each element has a special meaning. To implement an in-house training program the system must first decide who will conduct the training sessions, where to hold them and how long each session will last. Also to be determined: the participant capacity for each training session, what criteria constitute completion and what subjects to teach.

The ideal format for in-house employee training is to divide students into two or more groups. While one group is receiving training, the others are maintaining the system.

The key to in-house training is the person teaching the course. The instructor should be an individual who possesses patience and has knowledge and experience in the subject being taught. The instructor does not necessarily have to be proficient in *all* areas of the subject, but rather should be able to convey general knowledge and simplify the instruction given by guest speakers.

Before training starts, a list of objectives or goals should be determined and a plan outlined to teach these objectives. This plan is known as a "lesson plan." The lesson plan is used by the instructor to ensure that each element of the lesson is covered.

In-house training classes should be given at regular intervals, generally twice a week, at a specific time and not to exceed one hour in duration. Specific tasks should be assigned for completion by the next session and a grade given. Periodic oral testing should be incorporated within each training session as well as after a group of sessions to determine whether the students are grasping the material being presented.

To be most effective, a reward should be given upon satisfactory completion of the training.

Typical rewards may be: a small increase in pay, a title change or a preference in duty assignments.

The most important aspect of in-house training is to increase the knowledge and skills of each employee so that efficiency and productivity results.

Technical seminars

Technical seminars conducted by our industry are probably one of the best methods of achieving intensive training on a specific topic. Personnel chosen as instructors have many years of experience in teaching as well as vast stores of knowledge about their product.

Behind each seminar are the engineers responsible for the design, quality control and packaging of their product. Coupled with the expertise of the engineers are the talents of the technical writers who bring the jargon of the engineer down to the everyday language of the technician.

Seminars may range from the basic concepts of cable TV to design engineering of a cable system. Industry seminars also cover the theory of operation of each individual piece of electronic equipment used in a cable system.

Although the cost of presenting a seminar is high, sponsors are more than willing to do it if a sufficient number of participants will avail themselves of these opportunities. The excuse "We cannot afford to lose these employees for two days" is foolish. With technology changing daily, can cable afford not to have the most knowledgeable technicians possible? Remember, for every signal interruption due to a lack of knowledge or ability on the part of your technicians, your system suffers. Training all members of your system on a regular basis is one of the best methods to ensure an efficient and successful cable system. There are many sponsors of seminars within the CATV industry and it would be to a system's advantage to utilize them. (An opportunity that should not be missed is the SCTE's Satellite Tele-Seminar Program, which uplinks seminars for systems to tape and use anytime they wish.)

Other training sources

Magazine articles—Reprints of magazine articles should be distributed to personnel as a means of updating them about specific aspects of the cable industry. Just a cursory review of the many fine magazines and periodicals dedicated to the CATV industry will supply your system with a multitude of valuable information for every member of the cable team.

Along with technical updates, information on new products and technologies also may be obtained from these excellent sources.

Manufacturers' literature—Second only to magazine articles are the many and varied publications supplied by manufacturers of cable products. Technical tip sheets, specification charts and data in the form of booklets and fliers are all available. Most of these are free and may

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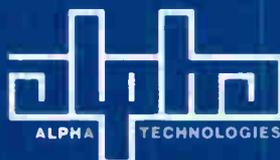
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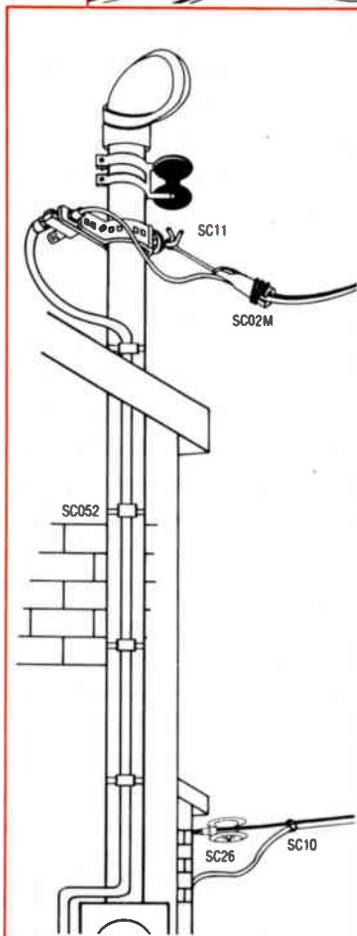
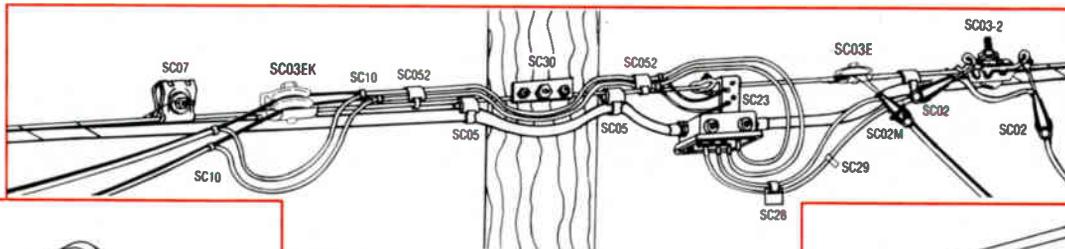


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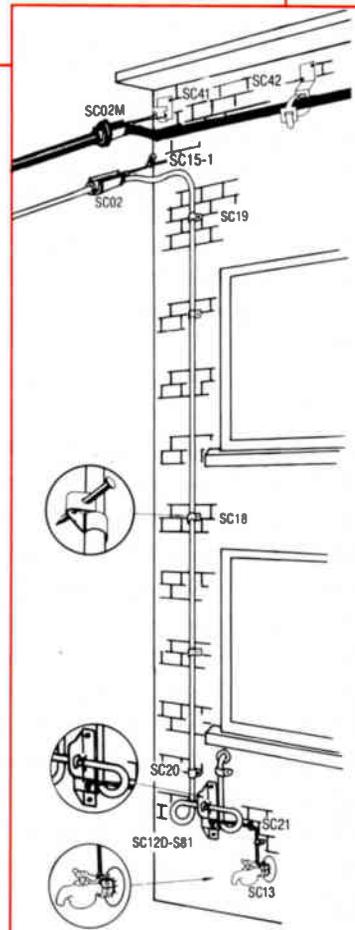
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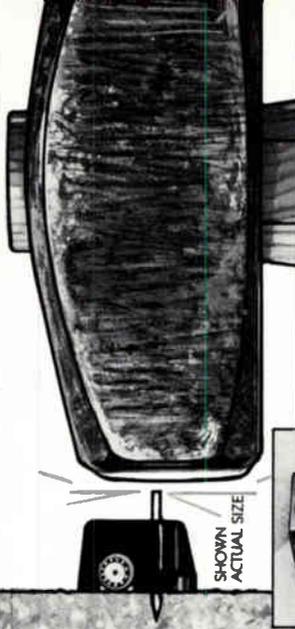
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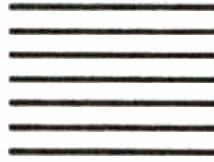


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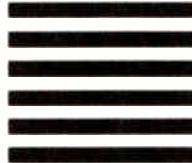
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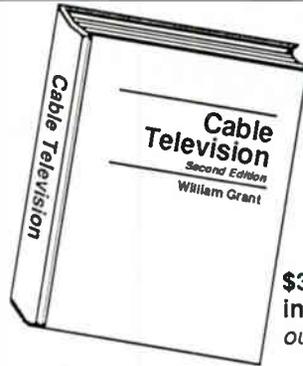


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- 3) The voice should convey to the subscriber that he is important and that his needs will be satisfied.
- 4) Correct telephone procedures.
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 - B) Greet subscriber.
 - C) Identify yourself and company.
 - D) Be courteous.
 - E) Listen carefully.
 - F) Write down a record of the call and its disposition in the phone log.
 - G) If it becomes necessary to leave the phone, explain to the subscriber why you are leaving.
 - H) Thank the caller for waiting and inform him of the progress being made on his behalf.
 - I) Make a definite disposition of his need or request.
 - J) Allow the subscriber to hang up first, thereby giving him an opportunity to add anything additional.

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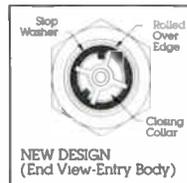
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Alternatives in training

By Al Dawkins

President, Al Dawkins Enterprises Inc.

It is often said that training is an important and necessary part of the cable industry, but this is easier said than done. One result is that cable systems find it difficult to hire qualified technical personnel. You can't just go out to a college and pick your technicians. An alternative is to hire electronic school graduates or those willing to start at lower levels and work their way up. However, these people need to learn the intricacies of CATV, while non-electronics people need electronics basics as well as CATV technical training.

If service techs have the basic knowledge of electronics and understand how the system works, their job becomes easier. This doesn't mean they will become immediate hotshots at troubleshooting. But understanding active and passive devices, coaxial cable, system noise and distortion, test equipment, and system powering can change a mechanic into a technician.

Some cable systems hire people "off the street" and use on-the-job training to teach ladder handling, pole climbing, installs and customer relations. All of this is done in a few days, then the graduates are set loose into the system doing installs.

And where do most of the trouble calls originate? "Installs" is the common answer. Putting on drop connectors improperly can cause leakage problems and low signal callbacks. Proper installer training can cut service calls, leakage problems, climbing and ladder accidents and customer relations difficulties.

Training options

Correspondence courses will help technicians develop skills, but

students need self-discipline to complete the courses in a timely fashion. It's difficult to work eight to 10 hours a day then go home and study a course while carrying on a family life. Not all people have this initiative.

A system might designate an employee trainer within the facility to train at various levels. The problem in some cases is that these trainers have other job responsibilities; training is put on hold because the plant comes first. Few systems have a full-time trainer.

Major manufacturers hold seminars periodically. These are excellent, but in some cases they target specific parts of the plant and might not be held at the time you can send a number of technicians.

Any and all of these options can work in many instances. If not, where can you get the training you need, cover the subjects you want, use hours that are flexible to keep the plant going while you train and target your amplifiers, passives, addressable devices and power system vs. a generic study of these subjects? Answer: the turnkey training consultant.

The turnkey trainer can come to a system and train the technical personnel in many CATV topics. Training can range from cable introduction, installation, basic technician non-electronics studies, basic electronics, advanced technical electronics instruction and so on. A turnkey trainer can even train people to teach. Time spent can be a few days or an extensive program covering a wide range of subjects and technical levels.

Commitment

We all agree that training is a necessary part of keeping the plant up with the least amount of time and funds. In the final analysis, the most important part is the commitment of the company to provide both time and funds to produce a workable program. If the commitment is not solid, training gets put on the back burner. You are back to square one. ■

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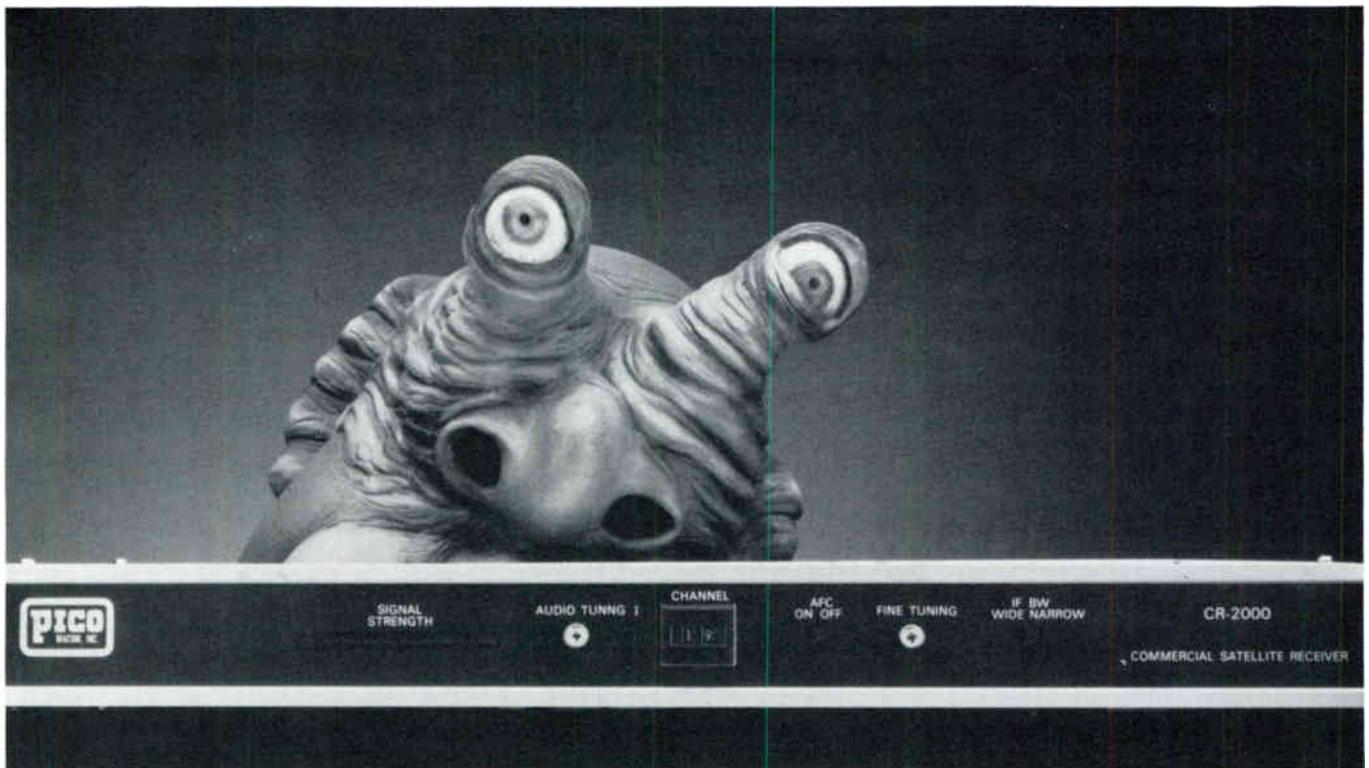
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By Robert A. Luff

Group Vice President of Technology, Jones Intercable

Don Sutton

Executive Director of Mind Extension University, Jones Intercable

Pam King

Technical Trainer, Jones Intercable

And Dana Eggert

President, Performance Plus Training Programs

Based on the industry average of 3 percent per month service call ratio of 60 million subscribers at an average cost of \$30 per call, the cable industry now experiences a service call expense of nearly \$1 million per day—and this expense continues to grow. Research by several MSOs shows that 80 percent of all service calls are caused by problems between the pole and the back of the TV set—i.e., the drop system, and in the domain of the installer. Nearly 40 percent of the problems are the direct result of poor training, workmanship and accountability of the installation work force.

As an example, a large MSO with nearly 1 million subs documented that its service call ratio is just at the industry average, receiving a little over 30,000 calls per month at an average cost of \$30 per call. (Most industry experts believe \$30 per call to be conservative. The phone company uses \$72 per call.) This means that service calls cost this MSO at

least \$900,000 per month every month, or \$10.8 million per year. Typical cable systems with 10,000 subs would have \$9,000 per month and \$108,000 per year service call expense.

The Performance Plus Installer Program (PPIP) was introduced this year at Jones Intercable. This approach addresses the service call problem by ensuring that the initial installation or service call is done right the first time. It also establishes a performance tracking and feedback system. Unlike traditional training programs where performance peaks immediately after the training session then rather quickly falls back, PPIP offers a long-term approach to performance management through ongoing monitoring.

Initially, performance expectations are established and clearly communicated by a policy statement from the user company for quality workmanship and an installer handbook including company practices and policies on installations. An evaluation of those performance standards is achieved through a written exam and field evaluation. Performance continues to be monitored by periodic field evaluations. The program in its complete form provides computer analysis of the initial and periodic tests, as well as field evaluations that are graphically represented to show performance trends and improvements by system, team, contractor or individuals in summary or by specific item (e.g., loose F fittings, unlocked pedestals and grounding). Such graphic and quantitative output serves as feedback to the installers and supervisors.

The Jones Qualified Installer Program (QIP) is not a training program

Qualified Installer Program manual

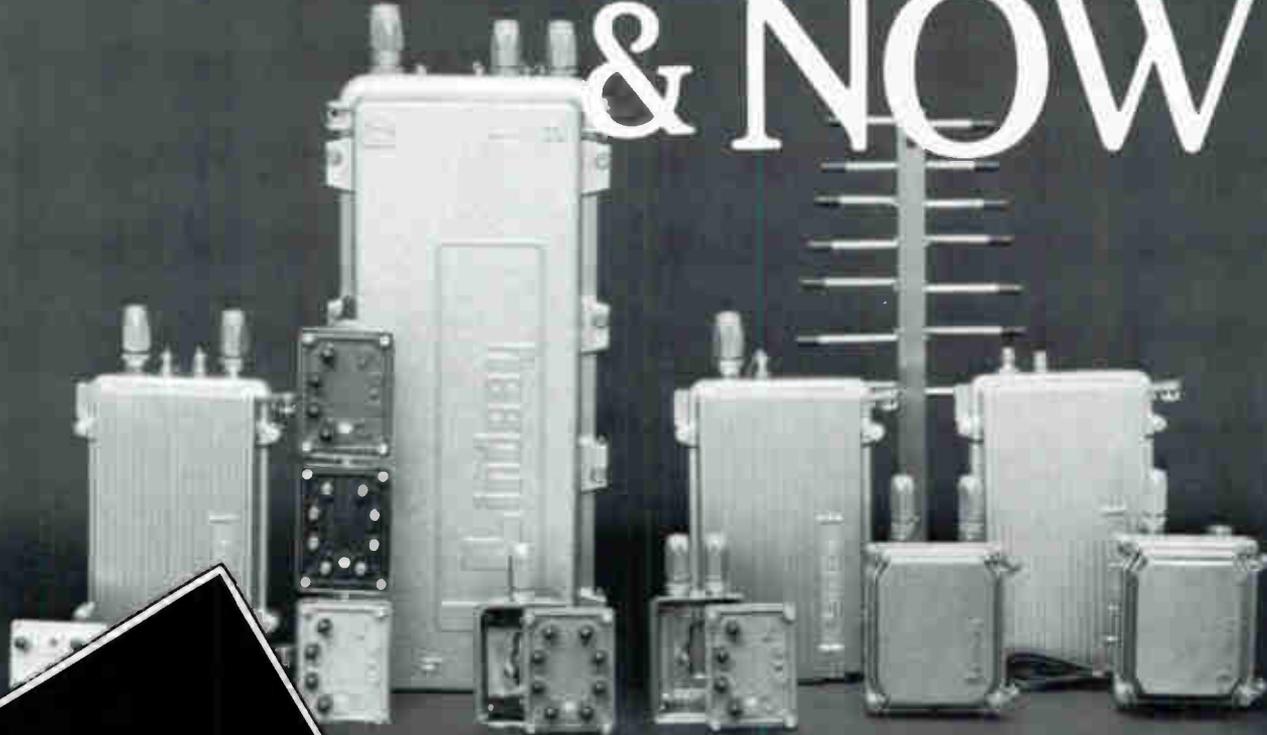


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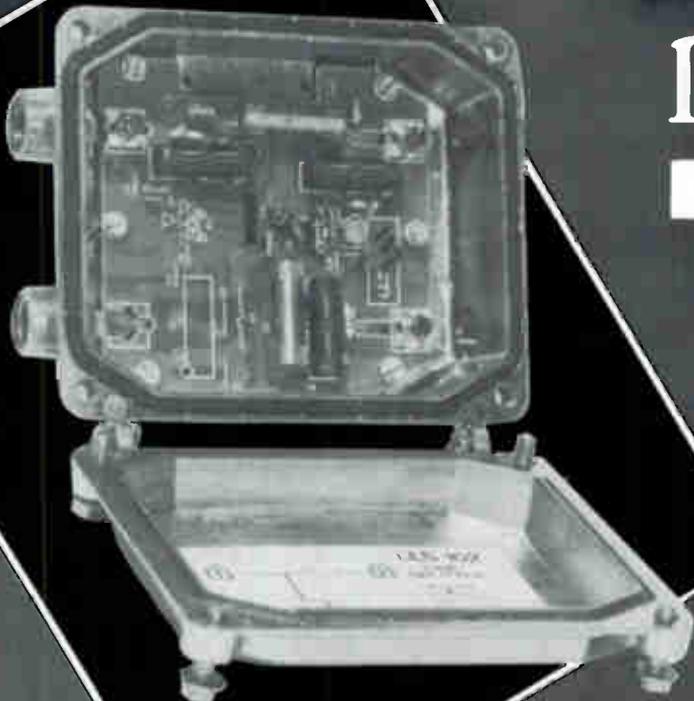
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per se, nor is it just a manual. Further, it is not based only on written or field evaluations. Based on the Performance Plus structure, QIP has several parts: 1) an illustrated installer's manual that is easy to use in the field, 2) a statement of commitment regarding the priority for quality installations and customer service, 3) a written self-evaluation of the manual's practices and policies, 4) a written proctored evaluation when the installer is ready, 5) initial and recurring field evaluations and 6) a formal method to include the QIP results in the personnel record.

The heart of QIP is the manual, which contains everything the installer should know about a company's installation practices. It is styled much like a typical state driver's manual, printed in a 6- by 8-inch format with soft covers allowing easy fit in the glove box or back pocket. An effort was made to keep the illustration-to-text ratio to about 50 percent. The text was checked repeatedly for readability and understanding at the eighth-grade level (a common target for manuals of this type). The manual also was checked to ensure that there was no ethnic, age or gender bias in either the text, illustrations or skill evaluations.

Statement of commitment

A strong statement of commitment to quality workmanship and to the highest standards of customer service by the president of the company is one of the most important guarantees of success for a quality-oriented installer program. (Too often the field personnel hear guidance regarding only the quantity of daily work.) The statement of commitment includes both the company's and the installer's pledges to quality performance; it requires all company or contract installers to sign the commitment.

Perhaps the strongest factor in early enthusiastic acceptance of the program is the self-evaluation feature of the manual. Every two or three pages in the text there are three to five "bullet questions" covering the important procedures or policies of the immediate text and illustrations. Readers are able to immediately determine whether they fully understand that section before going on, with the answers given in full on the next page. At the end of each chapter is a quiz, again with the answers on the next page. The chapter self-evaluation quizzes presented in the same format as the

final written exam builds confidence in the installer's ability as well as to the fairness of the questions.

Proctored exam

No element of the program was debated more than whether it would work best (or at all) with or without a final written proctored exam. The argument against the exam centered around the fear that the installers would object to the requirement. The argument for the exam centered around accountability of the program as well as the installation work force. The decision was made in favor of the exam to ensure that the program is scrutinized by all those involved and that the exam remains fair, accurate, up-to-date and carefully administered.

The last element of QIP is actual field evaluation of installer workmanship quality. To become a qualified installer, the candidate must pass an initial field evaluation and recurring evaluations to maintain that status. When ready, the installer simply requests a field evaluation. The supervisor accompanies the installer on a regular work order and observes the installation without interfering with the job, using a computer check sheet. The installer is rated on the defined performance standards in all areas including safety, customer service, drop procedures, etc.

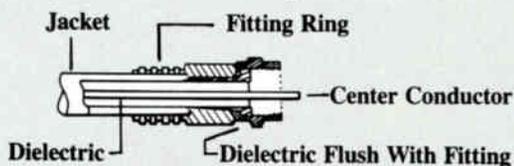
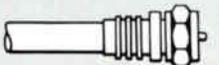
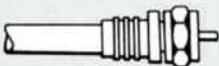
When the installation is over, the supervisor more closely inspects the drop for mechanical and electrical integrity. The results of the evaluation are shared and discussed with the installer immediately at the site to provide more effective feedback with concrete examples.

The program requires all supervisors to perform at least five random field evaluations for each installer under their supervision every quarter. This requirement ensures continual focus on the program. It also provides an important mechanism for the supervisor to "schedule in" field visits for the purpose of reviewing the installer's performance. By requiring quarterly evaluations of all installers, the supervisor and the installer are able to observe through graphic representation any positive or negative performance trends in as little as six months. Because the data sheets are optically scanned into a computer, any amount of analysis and comparison is easily done.

Sample QIP manual text

"F" FITTING INSTALLATION

1. Remove the jacket $\frac{1}{4}$ " to $\frac{1}{2}$ ", depending on the cable type. Do not cut the braid or foil. Remove the dielectric $\frac{1}{8}$ " to $\frac{1}{4}$ ". Do not score the center conductor.
2. Fold back the braid (and foil if quad cable) and twist tight against the jacket.
3. Twist the fitting on reversed as shown to smooth the foil.
4. Twist fitting on cable until dielectric is flush with the bottom of the fitting. Crimp the ring with a hex crimper against the front of the crimp ring.
5. Trim the center conductor $\frac{1}{16}$ " to $\frac{1}{8}$ " past the end of the fitting.

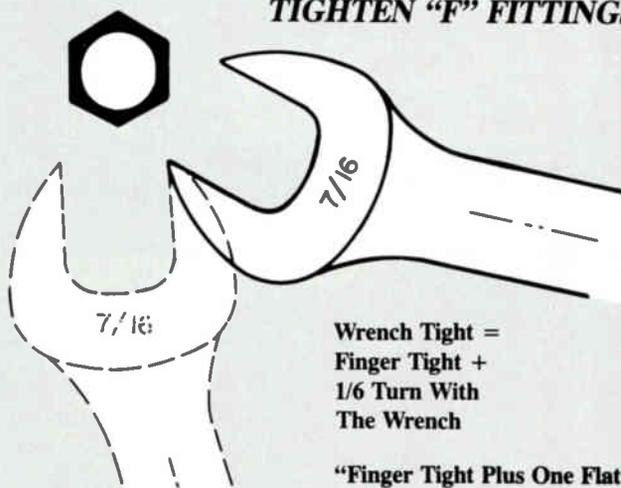


Remove the locking terminator on the tap port. Spray the tap port lightly with LPS spray. Screw the F-fitting onto the tap port **WRENCH TIGHT** (finger tight plus one flat, or $\frac{1}{6}$ th turn).

If the cable system uses traps, rather than an addressable converter to prevent unauthorized reception of programming, your supervisor will provide you with the approved system procedures for installing and removing traps.

Fill the weather boot with an approved weatherproofing compound such as silicone grease. The weatherproofing compound is the main means for protecting the connections. It is important to use it.

TIGHTEN "F" FITTINGS



Beta test

The primary reason for a controlled and limited beta test of the program was to evaluate the attitudes and receptiveness to QIP from field personnel. The Jones technical department exercised some degree of caution by introducing it to one system at a time in a total of six systems of varying sizes and installation complexity (in-house vs. contract installers and known high quality field work vs. known areas of needed performance improvement). Any unforeseen employee concerns could be analyzed and addressed at a single system level.

As it turned out, employee acceptance was enthusiastic. And, as expected, the manual text, illustrations and test questions quickly revealed areas requiring further change as a result of the careful review by the installers who were now agreeing to be held more closely accountable to the stated requirements. Each system added valuable recommendations; as a result, it was decided to form a QIP Review Committee comprised of several "Gold Medalist" installers.

For the test systems, a typical launch included descriptive memos to the manager and chief engineer, as well as a scheduled date where all field personnel could be present for the rollout briefing. At the meeting, the whole scope and intention of QIP was explained. Following this was a pretest and field evaluation of recent installation workmanship and practices.

The participants were challenged to improve their understanding of company installation practices, and a contest among the beta test systems was developed to reward the team with the most improved written test scores and field evaluation scores. This team concept as well as individual achievement was purposely developed to foster positive peer pressure. In addition, it helped the participants recognize that the public perceives the company as a team or single entity. Poor driving habits in a service vehicle, rude attitudes or poor workmanship of any one member reflects the entire team.

A second briefing was held after 30 days; at this visit, a written exam and field evaluation were given. The exam, as with the first, was graded on the spot. Exam and field evaluation improvements were discussed in full.

One of the most important findings during the beta test period was the need to have a formal waiver policy of specific practices and procedures

Field evaluation checklist

THE QUALIFIED INSTALLER PROGRAM

QIP FIELD SKILL EVALUATION

NAME _____

SYSTEM _____

JOB TITLE _____

DATE _____

REALIZATION COMPLETED BY _____

1. Installation completed on time	<input type="checkbox"/>
2. Installation completed within budget	<input type="checkbox"/>
3. Installation completed with minimal customer disruption	<input type="checkbox"/>
4. Installation completed with minimal customer inconvenience	<input type="checkbox"/>
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that were unsuitable to a particular system for one reason or another. Climate differences between systems is one such justification. For example, long periods of significant snow cover prevents burying of drops for many months at a time. Very dry climates eliminate the need for extra boots and silicon gel weather protection.

The waiver policy requires the chief engineer and manager to make a formal request for a variance on a specific form, stating the reasons as well as a draft of the specific changes to the text, illustrations, test questions and field evaluations. The self-mailing form is returned upon approval by corporate engineering for implementation and permanent filing.

Implementation and results

QIP implementation began in late November 1987 and is proceeding smoothly and similarly to the beta test launches. New systems continue to be launched at a rate of several a month, with full implementation of

all 65 Jones systems by the end of the year. It was later decided that a 20-minute videotape explaining QIP as well as a strong facilitator's guide would allow all remaining systems to implement QIP totally on their own and at their own pace.

During the implementation the company realized how significant QIP was in terms of positive individual and team morale. For the first time, installers were observed during lunch and breaks discussing company practices and procedures. It also was recognized that reaching the full qualified installer status was a highly sought and prized accomplishment. The company felt a more visible indication of an installer reaching this status should be developed. Hence, along with a special patch, a new qualified installer picture ID is issued.

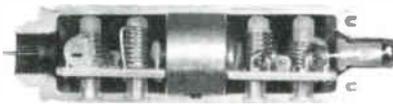
Jones is also rolling out a comprehensive electronic mail system to all of its cable systems. QIP facilitators and corporate staff will then be able to communicate via computer to ensure an ongoing flow of information,

Permatrap



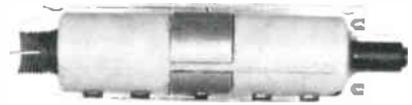
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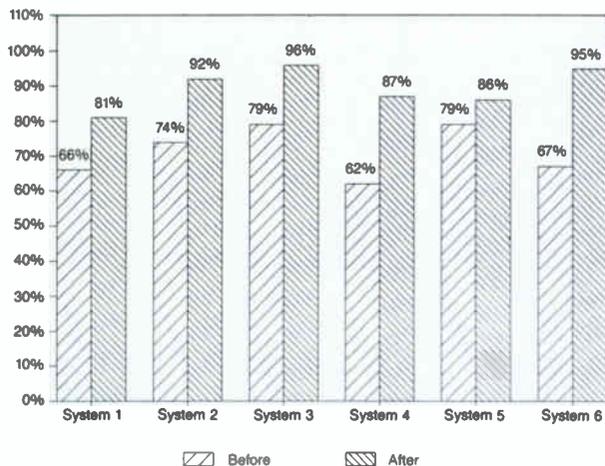
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Figure 1



support and feedback on QIP.

The results of QIP are already very favorable, considering that for many systems the program is just starting. These early results also show that positive impact to the company as a whole will far exceed the initial goals and projections. Using the six beta test systems, Figure 1 shows a before and after comparison of the written test scores on important installation practices and procedures. Performance improvement on these scores is seen as very significant because without a firm understanding of exact performance expectations on service call-producing operations, the installer and company are doomed at best to mediocre execution. While there is still room for improvement in this area, observers agree that the difference between a mid-60 percent score on installation requirements and a high-80 to low-90 percent score as a company-wide average is in-

Prerequisite to a training program

By Pam King

Technical Trainer, Jones Intercable

Do I put on my steel-toed boots today or my open-toed heels? Do I load up my briefcase or grab my SAM? I had to make these decisions many mornings as I learned the installer side of CATV.

Many times when the final product is presented in a nice, tidy format, the assumption is made that it was always this easy. This assumption could be made regarding the Jones Qualified Installer Program (QIP) but it wasn't always that way. It is not too difficult to read a book and write a training guide based upon what was read. However, gaining knowledge first-hand brings life, strength and reality to the final product. If a program does not reflect real life, employees are not going to follow it.

One of the first steps in beginning this particular program involved gathering the necessary field experience to complete such a project. Since I had started with Jones in its corporate office, I did not have the opportunity to work my way up through the ranks as many technicians and corporate engineers have done. As part of my training program, I became a part-time installer.

I worked as an installer two days a week for about seven months. While at one of the Jones systems, I bounced ideas off any technicians I might've been working with on a given day. They were always willing to give me their opinions (even those I didn't want to hear!). This was more valuable for me than learning how to connect the converter to the customer's television (and it was easier than pole climbing). Carrying large ladders around was not an easy task. Personal scheduling was also a challenge. Many days I had

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two or three changes of clothes in my car, just so I could be prepared for other appointments.

Then the actual writing began. The QIP committee was made up of a variety of people with a wide range of experience, including two degreed engineers, an industry consultant knowledgeable in writing CATV training programs, an expert in education and a field technician who was recently an installer. The diversity of talent in this group was a strong contributing factor to the success of QIP.

Our field tech, Charlie Turner, brought much appreciated input to our group. And, partly because of his assistance with this program, he was the first field associate to be awarded the special Installer Recognition Award.

The QIP committee met about every two weeks, typically during the evening (these meetings were in addition to each associate's workload) and the meetings were *long*. As we went through the text, chapter by chapter and sometimes word by word, time ticked away. As the evening wore on, we sometimes found ourselves changing a word back to one we had changed from the previous week. After meeting for three months, we came up with a final manuscript.

When the program was about 80 percent complete, we conducted a beta test in six of our systems throughout the country. This is where the most important part of the development occurred; the input we received from these systems was invaluable. Before final publication, we had a new consultant review the text for readability.

QIP is presently being launched in all 65 Jones systems. A major update is already planned for this summer. Having 1,000 associates giving feedback is a good way to improve a program.

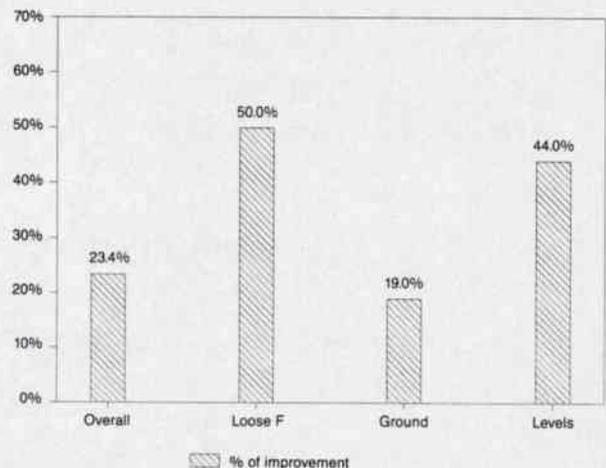
Is working as a part-time installer enough to fully understand the job? No, the work I did just skimmed the surface. Nothing can replace years of experience in a system and being able to actually "feel" the job. But it was a very valuable and important tool for training program development. This summer, plans are being made for additional field training, for the Qualified Technician Program.

deed a significant improvement.

The question then turns to whether QIP is actually producing better workmanship and procedure compliance in the field. Figure 2 shows the percent improvement in installation quality as measured by the evaluation data sheets. The most impressive result, steady reduction of controllable service calls, is as yet simply too soon to reliably measure. We must remember that today's service calls are the result of poor practices that occurred months or even years prior. Even the most successful installation procedures will take some time to fully address years of less structured performance management.

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Figure 2





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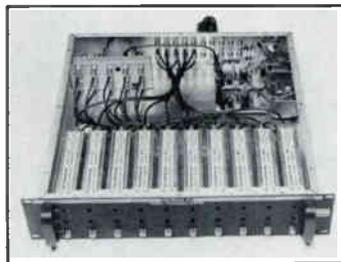
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Providing needs-based training

By Alan Babcock

Acting Manager, ATC National Training Center

How do you know the training you are providing your people is of any value? If you spend \$300 or \$1,500 to send an employee through a training program, how long will it take to realize a benefit to your organization to offset that investment? Can a professional organization guarantee improved performance of your technicians if they passed a test? If anyone could answer these questions, definitively, every technician would be involved in the BCT/E Certification Program of the Society of Cable Television Engineers, every cable operator would have ongoing training programs and my job of increasing enrollment in ATC's training courses would be easy.

I have encountered service technicians who don't have signal level meters—let alone know how to use them—and headend technicians who crimp connectors with lineman's pliers. Today we are planning for fiber backbones and high-definition television; how will today's technicians function in tomorrow's cable systems? Training must be the answer. And yet, how do we know whether to show them how to use crimpers or fusion splicers, SLMs or optical TDRs?

There are two types of training we can and should provide to our installers, technicians and engineers if we as an industry are to be success-

ful. We'll call these "job skills" and "knowledge enhancement." Job skills training provides instruction on the use of crimpers and SLMs. It involves the learning of functional skills necessary for the performance of the job as it is today. Knowledge enhancement may include the learning of some specific skills such as the use of OTDRs, but primarily exists to provide the student with the knowledge necessary for further growth within the industry. It teaches the student to become a student, to apply existing knowledge in solving today's problems while looking for new and unique ways to address tomorrow's needs. To determine the type of training necessary for yourself, your fellow workers or your employees, you should perform a needs analysis.

Needs analysis

The term "needs analysis" has been used for many years in training and development circles, but many technical supervisors or employees will be unfamiliar with it. "Troubleshooting" would be a more comfortable term for us to use, since needs analysis is nothing more than determining what type of problem exists and defining possible solutions to the problem. We have a feeling that training of some type is needed to solve some of our technical problems. But, before you define training as the solution to your problem,

let's do some troubleshooting.

Decide on an area of your operation that isn't working as well as you would like it to. Maybe only one or two service techs seem to be able to adequately solve customer complaints, maybe you have noticeable intermod in your headend or perhaps several employees have fallen off poles. It doesn't really matter where you decide to target your troubleshooting, but pick only one problem at a time to work on.

Now try to determine as exactly as possible what the problem really is. Don't just look at the symptoms of the problem but analyze the situation as you would troubleshoot a reception problem. Don't assume only two techs know how to use SLMs; test them and find out. Ask the customers what happened. Investigate the types of problems the techs seem to be unable to solve. Are the problems low signal, distortions, ingress/egress, powering or something else? Remember your troubleshooting days—you can't fix the problem if you don't know what it is.

The analysis process should be exhaustive. If you exert a lot of effort, you will be much happier with the outcome later. For our example, let's assume you have discovered only two of the service techs are equipped SLMs. Everyone claims to know how to use them but there just aren't enough to go around and the maintenance techs have the rest of the meters. The two service techs

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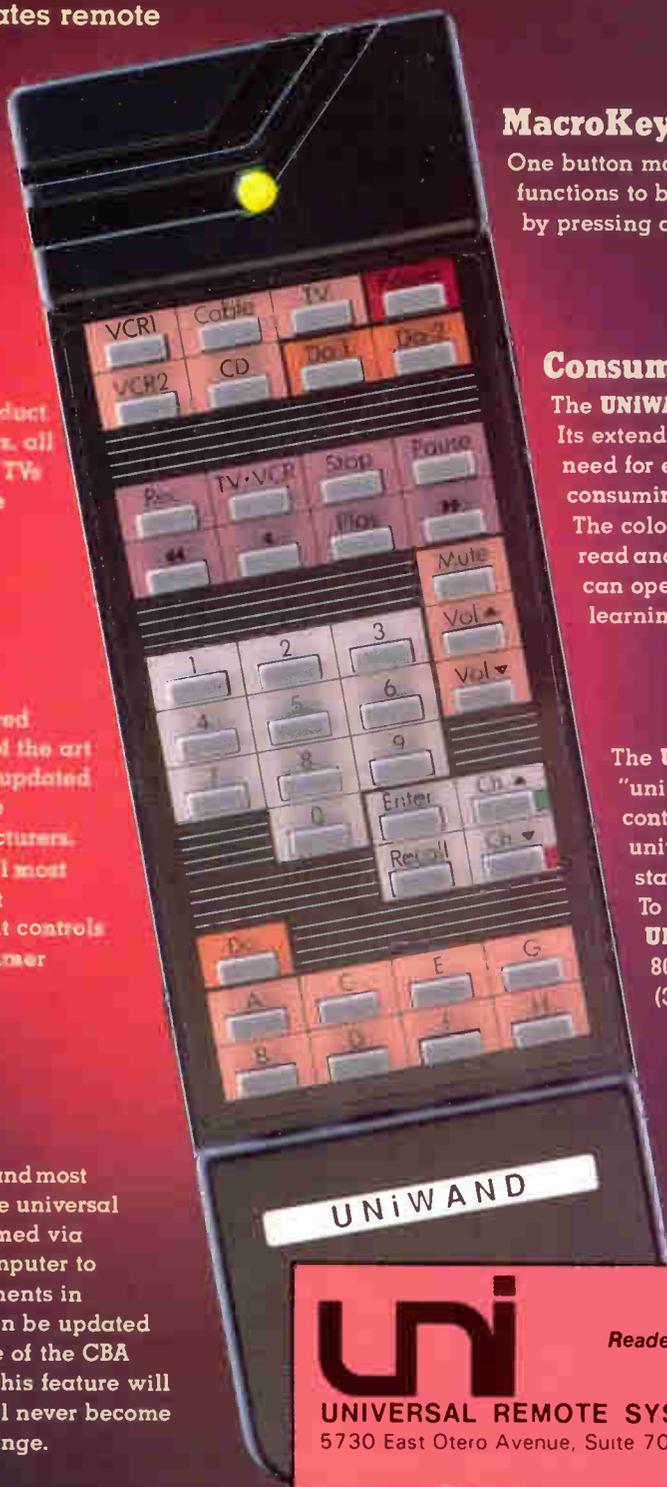
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Reader Service Number 32.

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are the more senior and the remaining techs are already working with them to determine which calls can best be done without the use of meters. Granted, this isn't an ideal situation, but the solution to this problem certainly isn't training.

Initially, we thought the problem could be a training problem. As much as I hate to admit it, training won't solve all of your problems. As a matter of fact, if you don't troubleshoot to find the actual problem in a situation similar to our illustration, the trainer would get blamed for not fixing a problem that didn't exist anyway. If the other service techs had been sent off to school to learn to work SLMs, you would have been sorely disappointed after they returned to the job to discover you still only had two service techs solving customer signal reception problems.

Let's retrace our steps and change the outcome of our hypothetical situation. The service techs really *don't* know how to use an SLM. Now we have a training problem. Often, situations we have observed seem to have training solutions. If this is the case, we now need to determine whether job skills or knowledge enhancement training is appropriate for the technicians who need training.

Job skills training

Job skills training is a fairly new area for our training center; it is designed for people who need or want primarily to become functional in a particular job. Service techs may want to know how to use an SLM to determine whether a customer has sufficient signal levels, but they don't need to know or want to know what a dBmV or the electrical equivalent circuit of a piece of coax is. The techs need to be able to troubleshoot the customer's drop but don't need to know that noise and distortions increase by 3 and 6 dB, respectively, through an amplifier cascade.

We have found many people who need to be proficient in their job duties but don't have the electronics education to fully understand the whys or hows of the more advanced theory of cable TV. It is extremely difficult to teach technicians who have no formal electronics education why distortions exist or increase in an amplifier cascade. On the other hand, it is possible to teach them what proper amplifier levels are and why they need to maintain the plant accordingly. Installers without an extensive math background can't be expected to understand the CLI formulas but can be expected to know if they don't help in the reduction of signal leakage the cable system could be fined or shut down.

Knowledge enhancement

Many technical employees have a desire to obtain, or already have, formal electronics education. They want not only to know how to do their jobs but how to improve the existing system through applications of new technologies or find new and unique solutions using existing technologies. These employees will become the key individuals as new technologies (such as fiber optics) are incorporated.

Knowledge enhancement is education rather than training. It is expected that people receiving this education are able to apply the knowledge

to related situations rather than just the specific situation for which they were trained. For example, individuals may be educated in the operation and use of a spectrum analyzer. They may learn this operation and use as related to, say, an HP 8558 but will be able to apply the knowledge to any spectrum analyzer. On the other hand, job skills training may have taught students to use a particular make of cable locator but they may not be able to apply that knowledge to other brands.

It is this application of knowledge that distinguishes the differences in the people who participate in training programs. In many instances it isn't the supervisor but the student who decides what type of training is appropriate. Within our training program the determining factor be-

comes a function of how much (if any) formal electronics education the student has. Mostly, the determining factors as to which type of training is valid are the student's wants and needs.

Because every situation is different, it is the trainer's task to provide training or education that will fit each situation and motivation. It becomes the supervisor's and the student's task to recognize the motivation within the potential student and select the proper type of education to fit the situation and the motivation. If an effort is made to determine the needs and wants of both the student and the company with training provided accordingly, you will see a return on your training investment. That return will probably be so great that you will soon find you can't afford *not* to train your employees.

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Inspected by: Michael Spears Date Purchased: 8-5-87
Purchased from: Sadelco
Name and Title of Purchaser: Jay Chicago, Engineering Manager Tel. No. (904) 317-7960
Company Name: Continental Cablevision Tel. No. (904) 322-16
Address: 5934 Richard Rd. Jan. Fl.
Type of Operation: CATV System MATV MOS
 Construction Contractor STV Other
This product will be used by: Engineer Tech Installer Other
Your comments about our product: Used a 300Mhz Sadelco for 9 years, expect same of this unit.
Above warranty covers to the original purchaser all parts and labor for repairs due to component failure or manufacturing defects. It does not cover misuse, tampering, neglect, accident or repairs made outside our factory. Warranty on all portable equipment is for 90 days. This card must be mailed within ten days. Failure to return this card voids warranty.
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This unit has been received by us undamaged and in good working condition. Please register it for warranty purposes.
Inspected by: ENNITTE WOODS Date Purchased: Recd 11-12-87
Purchased from: CATV SUPPLY
Name and Title of Purchaser: McCaw Cablevision E. Woods Mgr. Tel. No. (509) 674-2101
Company Name: McCaw Cablevision Tel. No. (509) 674-2101
Address: 215 PENN AVE. (LELLUM, WASH.: 98923
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This product will be used by: Engineer Tech Installer Other
Your comments about our product: I REPLACED A 7272 WITH THIS METER. ITS BETTER THAN EXPECTED AND HAVE SHOWN & RECOMMEND TO OTHER SYSTEMS.
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Inspected by: DENNIS PATRICK Date Purchased: 9/12/86
Purchased from: SADELCO BENILIA (Punch mg#) Tel. No. 214,423-0991
Company Name: SADELCO BENILIA
Address: 1414 SUMMIT AVE
Type of Operation: CATV System MATV MOS
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This product will be used by: Engineer Tech Installer Other
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Reader Service Number 33.

Training in the use of fiber optics

By Rebecca S. Frye

Training Supervisor, Secor Corp.

Fiber optics is well entrenched in traditional telephone installations and is becoming the medium of choice for cable television. If you're considering fiber as a transmission medium, the time to begin training is now. Optimum training in fiber can be broken down into three stages: fundamentals, basic skills with hands-on experience and supervised field experience.

Fundamentals: Anyone involved with a fiber-optic system—from decision-making managers to field personnel—should understand its basic principles. Don't be put off by the theoretical or mathematical properties associated with fiber. You won't require an engineering degree to master the fundamental principles of how and why it works. In simple terms, fiber optics involves the transmission of information by light pulses rather than RF signals. In a basic system, RF signals are converted into light and transmitted over a hair-thin glass fiber in digital or analog fashion. At the receiver end, it is converted back to RF.

Single-mode fiber offers a number of advantages to CATV in addition to its small size and weight. Its channel capacity (i.e., bandwidth) is almost unlimited, and its low-loss characteristics reduce and in most instances eliminate the need for amplifiers. Also, the optical signal is immune to electromagnetic interference.

Basic skills and hands-on training: Once the fundamental principles are mastered, field personnel should learn the basic skills with use of associated equipment. While this hands-on experience can be in a controlled environment, it should simulate the actual application as much as possible. How this training is given will depend on the structural organization of the field crews. For this discussion, two groups' needs will be addressed: construction and maintenance crews.

The construction crew, often subcontracted for specific jobs, requires a working knowledge of coaxial cable, as well as the specific requirements pertinent to fiber-optic cable. There are many similarities, but the use of fiber will require additional skills and insight. For example, fiber has a minimum bend radius that must be maintained. Exceeding the radius might result in temporary or permanent signal loss. For many reasons, splicing should be minimized. Cable lengths of 20,000 feet are routinely installed. This requires proper planning and technique.

Even though some of the hardware (e.g., closures) will be familiar to those who have worked with coax, the crew also needs to master proper fiber handling and storing procedures to avoid fiber damage or breakage. Splicing and termination methods will vary depending on the specifications of the application. Workers should be familiar with the various options:

- Field splice points: Fusion, single-fiber mechanical or multiple fiber array.
- Termination points: Pigtail splicing (by fusion or single-fiber mechanical means), field installation of optical connectors and installation of preconnectorized cable.

Since different applications will call for different methods, training should involve experience using all of these termination options. Becoming adept in the use of all methods will result in a more versatile construction team.

After the fiber has been installed, the construction or maintenance crew will need to perform final acceptance tests as well as routine optical tests to ensure the system is operating according to specification. This includes continuity testing, testing with an optical time domain reflectometer (OTDR), and end-to-end attenuation testing to measure total system loss. All test results should be accurately documented for future reference.

Maintenance teams should have a plan in place and the personnel to restore a system as quickly as possible in the event of a break in the fiber. Members of the crew should be versed in their specific responsibilities and know what materials are available. Routine drills are recommended. In this case, time is money, and preventive maintenance pays.

The operation of test equipment also becomes important for maintenance and troubleshooting. Personnel should be able to perform end-to-end attenuation tests, as well as fault location using an OTDR. After the fault is located, the team must repair the damage as quickly as possible. The restoration may require the replacement of a pigtail, optical connector or splicing in a new length of cable. Regardless of the requirements, *all workers* should be prepared to perform their specific functions quickly and accurately.

Field experience: Once the crews learn the basic skills, supervised field training is recommended. The length of time required for detailed supervision will depend upon the expertise of each crew.

For companies with limited time, personnel or budgets, a shorter, more concentrated training program may be needed. On-the-job training (OJT) focuses on the specific needs of a particular installation. The main advantage of this method is that the program usually requires a shorter time away from the job for classroom work (usually one-half day), with "earn and learn" field experience.

Here's an example of the requirements of a specific OJT experience. Let's assume the application requires crews to pull one cable through a duct between two buildings. Optical connectors will be installed on the fiber that will terminate in a patch panel. An attenuation test and documentation are required.

The OJT would include: installing a pulling grip, cable placement techniques, cable handling and stripping procedures, field-installing connectors, loading the connectorized cable into the hardware, end-to-end attenuation testing and documentation. While this training seems in-

Choosing the best training program

Before investing your money into a training program, invest a little time and ask some questions:

- 1) Do I want to attend a seminar course that provides a general understanding of the subject matter or a hands-on type course that teaches skills?
- 2) Are all of the topics that I want to learn about covered in the course? If not, will the supplier customize a course to meet my specific requirements?
- 3) If the supplier provides customized training, ask these questions:
 - a) What is the development fee for customizing a course?
 - b) Is there a minimum number of students required for customized courses?
 - c) What lead times are involved with customizing a course?
 - d) Is on-the-job training available?
- 4) If the course claims to provide hands-on training, ask these questions:
 - a) What is the maximum class size?
 - b) How many instructors are available per student?
 - c) What is the student/equipment ratio?
 - d) How many "consumable" items (connectors, mechanical splice parts, etc.) are provided for each student?
 - e) What percentage of the course is actually spent performing hands-on tasks?
- 5) What qualifications does the instructor have?
 - a) Does the instructor have field experience?
 - b) How long has it been since the instructor actually worked in the field performing the same tasks being taught in the classroom? Does the instructor plan to continue gaining field experience as well as instructing in the classroom?
 - c) Will the instructor or someone with comparable expertise be available to answer questions after course completion? (i.e., Can you call the instructor once you've returned to your normal job to ask a question?)
- 6) What is the course location?
 - a) Can this course be offered at your site for a group of students?
 - b) Does the quality of the course remain the same regardless of location? (Ask questions 1-5 again.)
 - c) How does location affect the price of the course?



Any course designed for field personnel must emphasize hands-on experience with equipment.

involved, it provides field personnel with just the specifics of the particular job involved. One splicing method is taught and one type of hardware is used. If the next job is different, additional training is required.

Selecting the best training program

The number of fiber-optics training programs has soared over the past several years. Manufacturers, consultants, industry organizations and independent firms are among those opening their doors to potential fiber-optics users and handlers to prepare them for the evolving technology. But how can you be sure you'll get your money's worth? Before selecting a training program, research the potential educators thoroughly to ensure the training will provide the skills that best suit your particular needs. Here are several areas to investigate:

1) *Extent of hands-on training:* The experience of working with the tools of the trade is perhaps the most valuable part of any training program. This is especially true in the case of an evolving medium like fiber. Any course designed for field personnel must emphasize hands-on experience with equipment for installing, splicing, testing, troubleshooting and maintaining a fiber system. Examine the amount of experience offered; don't be fooled by abbreviated courses claiming to provide extensive hands-on work. Learning how to operate equipment and tools properly takes time. Ask the instructor what percentage of the program will involve actual equipment use. An effective course will ensure that at least 75 percent of the instruction is hands-on training.

2) *Class size:* The size of each class also reflects the training's effectiveness. Smaller classes, with no more than six to eight pupils, permit more hands-on experience.

3) *Student/instructor and student/equipment ratios:* Also affecting hands-on participation are the number of trainers and the amount of equipment provided during class sessions. There should be one instructor for each four to six students. No more than three students for each piece of equipment provides optimum experience.

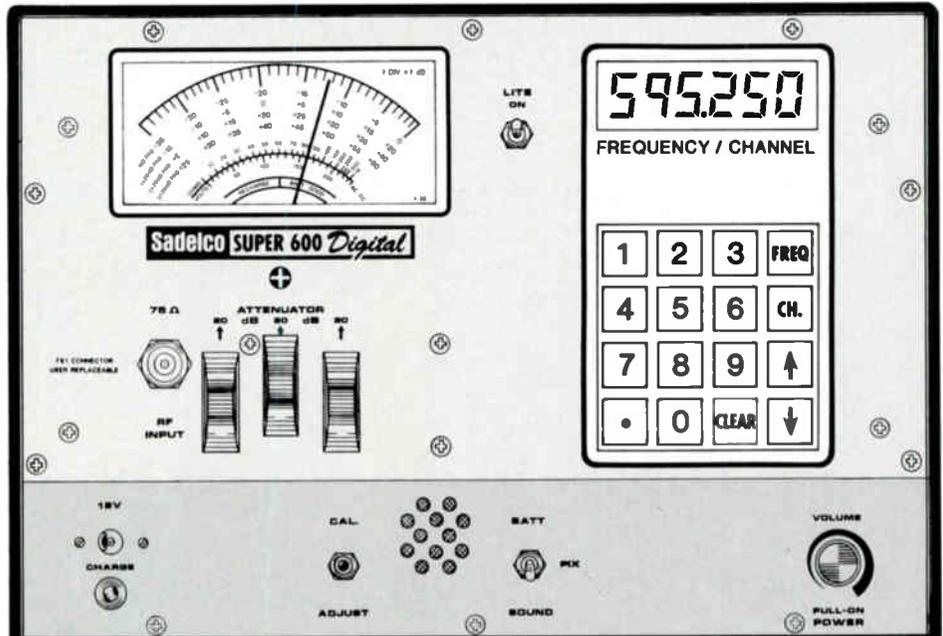
4) *Qualification of instructors:* Verify the credentials of the training program's faculty;

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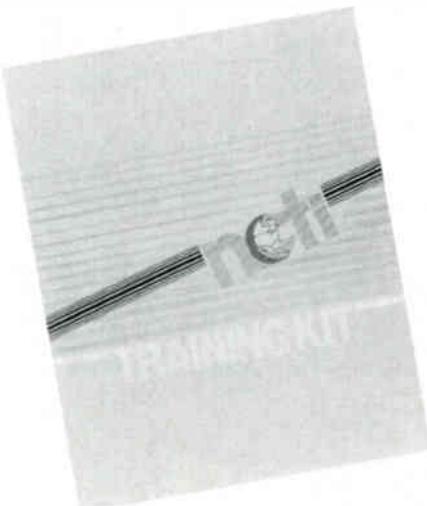
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theory as well as practical experience are essential. The instructors should be experts regarding the principles and applications of fiber. They should become students themselves in order to keep abreast of the fiber-optics information explosion. Regular field experience also ensures a qualified teacher. Often, field engineers are the best instructors because they have a keen understanding of the technology and can simulate actual field situations for the class.

5) *Up-to-date equipment:* The most current fiber-optic products are the best tools for training. You can then be assured your staff members are learning the latest in technology. Most equipment has the same basic theme, so learning any vendors' equipment will allow crossover to take place easily.

6) *Course materials:* The instructional materials should serve as a reference source once you graduate. Its usefulness and applicability to your needs will come in handy at a later date.

7) *Custom designing:* Research the proposed curriculum. An organization with a high quality program will spend time learning your group's specific requirements and then make sure the course material matches those needs.

8) *Flexibility in location:* Where are the fiber-optics courses taught? Will the instructor travel to your site to train? This information can provide valuable preparation material. It may prove most cost-effective to train several people at your facility. Keep in mind that leaving the workplace—whether it be across town or across the country—can remove the distractions of the job. Find out if classes will be taught where you need them.

9) *Scheduling:* There may be a time when conflicts arise and you may need to postpone attending a course. Be sure to check ahead of time to see if fees can be transferred to a later session. How often a course is scheduled also reflects the availability and flexibility of the training program.

10) *Follow-up:* In addition to the reference material, the training organization should be available and willing to answer questions that may arise after the training is complete.

11) *Cost:* While the fee for training is always an important consideration, it should not be the sole determining factor. Often, hands-on training will cost more than seminar sessions. If the course is good, the up-front investment quickly pays for itself through the quality of workmanship and service provided by your staff. Training costs money, but ignoring or receiving poor training ultimately can prove more expensive.

Gaining momentum

No matter what your requirements are, don't shy away from fiber because it's different or foreign. Everyone who is now knowledgeable in fiber optics had a beginning point, when terms were unfamiliar and concepts and products were new. Fiber optics is rapidly gaining momentum in the CATV market, and it won't be long before you will be faced with making decisions regarding the use of fiber. A good fiber-optics training program can help you close the technology gap, intelligently assess the market and assess your own needs. Learn now; don't pay later. ■



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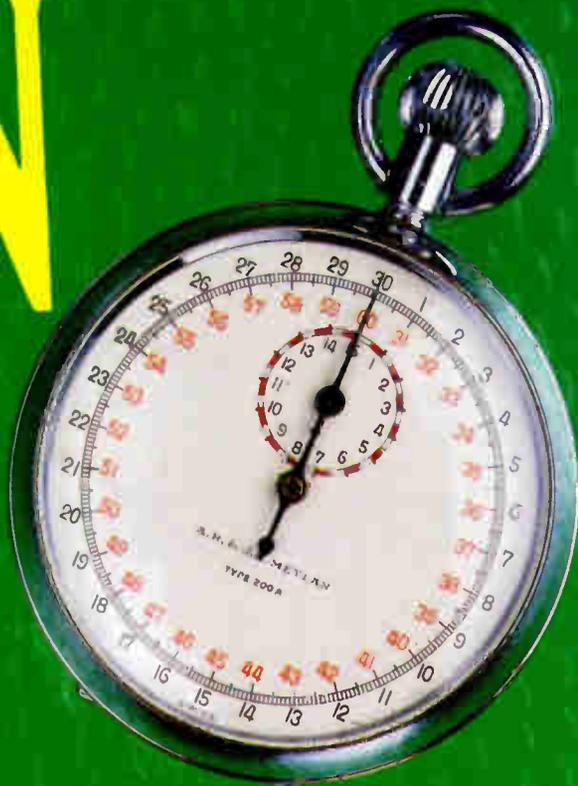
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The SCTE's role as a training resource

By William Riker
Executive Vice President

And Howard Whitman
Manager of Editorial and Promotion, SCTE

We live in an age in which quality counts and consumers will settle for no less than the best. In such times, we cannot undervalue the importance of training. As we face growing competition from such newcomers as Super-VHS and high-definition television, the cable TV industry must strive to achieve and maintain a level of excellence that will keep subscribers satisfied and attract new ones to our services. The best route to fulfilling these goals is to educate personnel on all levels, from installers to engineers to CSRs.

Education sometimes is viewed as nothing more than the development of skills in preparation for the execution of specific tasks, to be discontinued once the tasks come to fruition. In other words, you learn how to do something, do it and continue to do it. But the only way for one's skills to evolve is to continue developing and improving them through further learning. Our industry must realize this if it is to be a contender in the ongoing competition for the consumer dollar.

There is more at stake here than just business considerations. We must take pride in what we do and persevere, confident in the knowledge that we provide the best possible service. Additionally, don't we all gain a degree of satisfaction from helping others, even if helping others is our source of livelihood?

It is for these reasons that educational organizations such as the Society of Cable Television Engineers (SCTE) were formed. By providing industry personnel with technical training programs, the SCTE hopes to improve performance in all aspects of operations, resulting in an improved level of service, a flourishing industry and ultimately, a satisfied public.

Training opportunities

The SCTE offers a number of training opportunities, including its annual Cable-Tec Expo, the training and CATV hardware conference that allows industry manufacturers and suppliers to meet with system technicians and engineers. The expo offers "hands-on" instruction as well as technical seminars and demonstrations on proper equipment operation.

For those who are unable to attend the expo, training also may be derived at one of the many technical seminars conducted by the SCTE's 43 local chapters and meeting groups. These organizations can be found in accessible locations throughout the United States and the Caribbean. Seminars organized by these groups feature presentations by respected industry professionals and are valuable forums for technical discussion at the local level, expanding each member's knowledge while aiding in individual development.

Training seminars may be prohibitive to some due to inaccessibility or time constraints. For-

tunately, the SCTE has developed a method of bringing technical seminars to industry personnel everywhere. Our Satellite Tele-Seminar Program provides videotaped technical training programs each month, making them available for systems across the country to downlink and record. These programs may be received by any system and recorded for immediate and future employee training purposes. The SCTE also has recently premiered a new series of product-specific Tele-Seminar programs, developed to

"The only way for one's skills to evolve is to continue developing and improving them through further learning."

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assist in training technical personnel in the use of specific companies' products lines.

Seminars are not the only available means of technical education, however. The Society's Broadband Communications Technician/Engineer (BCT/E) Certification Program is also a valuable method of enhancing an individual's personal development within the industry. Through a challenging program of study and testing, a candidate for BCT/E Certification receives much more than a certificate, gaining valuable knowledge and experience as well as a means of evaluating professional abilities in the process.

In hopes of furthering its goals of a well-educated technical community, the Society is currently preparing another certification program. This one is directed at the industry's numerous installers. Candidates for Installer Certification will not be evaluated purely on their performance on examinations. Other means of evaluation will be utilized, such as field exercises testing a candidate's skill, experience and practical knowledge.

The Society's emphasis on training will only grow stronger in years to come. With the recent addition of Director of Chapter Development and Training Ralph Haimowitz to the Society's national headquarters staff, the SCTE will concentrate its efforts to provide training opportunities to the industry. In addition to acting as a liaison between the national headquarters and the local chapters and meeting groups, Haimowitz will be working to upgrade and increase the Society's training materials and information and develop new technical training programs that will be made available to systems throughout the country.

The bottom line

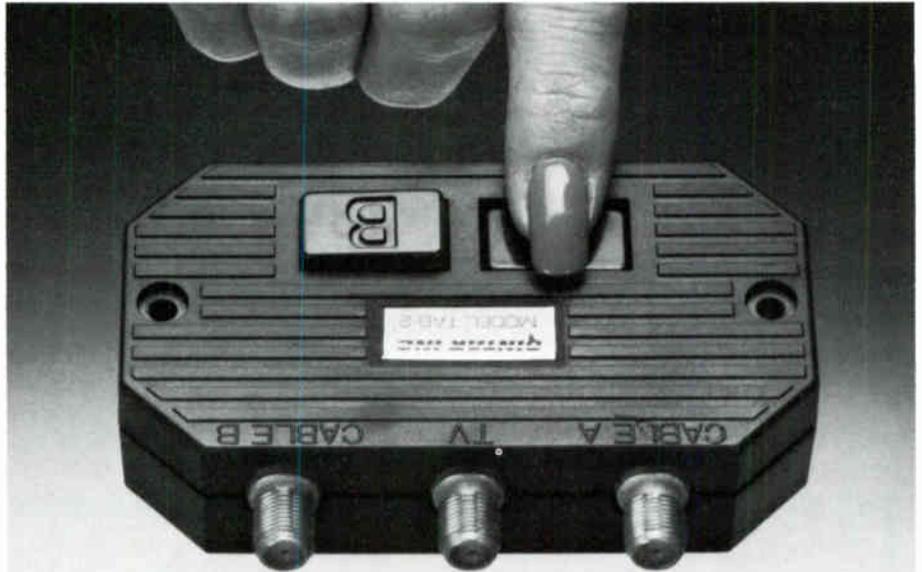
Beyond the educational and personal benefits of training, however, one must not ignore the bottom line, which is that the SCTE can save system managers money. According to research compiled by Jones Intercable's Pam King and TCI's Tom Elliot, a randomly chosen system with 18,118 basic subscribers reported 7,627 service calls in 1985 from customers, of which 2,957 or 16 percent were drop related. The per-subscriber cost

for drop calls only for this year (based on an average cost of \$32 per subscriber call) was \$5.22.

This same system instituted a training program and quality control awareness campaign in the following year. Although its number of basic subscribers rose to 22,849, only 6,879 service calls were reported, of which 2,995 were drop related. The percentage of subscribers with drop-related calls went down to 13 percent (a 3 percent decrease from the previous year), while the cost per subscriber for drop calls has shrunk to \$4.19. This represented a 20 percent decrease in service costs to the system over the course of one year as a result of a training program!

Surveys also showed that on a national level, drop related calls represented 40 percent of all service calls. Half of these drop calls were controllable and could be avoided through proper training. On an industrywide basis, assuming a cost of \$32 per service call for 40 million subscribers, this translates to a preventable cost of over \$92 million.

Of course, the SCTE is not the only organization currently offering technical training opportunities. There are a number of excellent options available, and these should be sought out. The bottom line is this: Through improving our skills and knowledge, we improve our industry, our service and ourselves. ■



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Management training for engineers

By Chris Papas

Electrical Engineer, The MITRE Corp.

Engineers making the transition to a management job usually need specific management training to enable them to do the best job they are capable of doing. Since management skills are very different from engineering skills, training is needed to help an engineer evolve from thinking like an engineer to thinking like a manager. This will improve their effectiveness and productivity as a manager on the job. To succeed in the current work environment, managers must master a wide range of complex skills. Without a good working knowledge of those skills and the current issues facing managers, an engineer could be left behind in today's competitive workplace.

Those entering management positions make a lifetime commitment to their career, and management training should be a continuing process throughout that career. Training should not be a short-term program but a series of learning events to gain new skills and reinforce previously learned ones. This training should be part of all managers' individual career development regardless of the source.

In some companies, management training is minimal at best and many new managers have had to "sink or swim" in the new position. It would be up to the individual person to seek out the necessary training to survive in the new environment. Management training for engineers shouldn't be this on-the-job method since most engineers may not have the background to swim.

Most companies, however, do realize the value of management training for their employees and spend a lot of money and effort on such programs. Employers realize that it improves the net worth of both the individual and the company.

When selecting engineers for management positions, companies should take several training factors into account to avoid potential problems. These

include personality, managerial aptitude and attitude toward management training of the engineer. Not every engineer will make a good manager no matter how much training is given. A few just don't have the personality to deal with people. It is not necessarily a fault, but just shows incompatibility with a management career. Since much of the work of a manager is working with people, this factor should be a primary consideration in selecting candidates.

Some engineers have an aversion to management training. It is very different from the facts and figures of engineering training; some have not liked it because of this. Since management training is meant to assist an engineer in adjusting to a management career, reluctance may indicate that the engineer may not do well in that type of position. It also may indicate future problems for the company.

Companies must take into consideration that a good "producer" in a technical field does not necessarily indicate aptitude in any managerial skills. Regardless of how good in that role, the engineer must be trained to supervise people rather than ideas or things. By moving up engineers who have no management ability, companies pay a double penalty: They end up with management problems and have drained their pool of technical talent.

Some engineers have found it difficult to make the adjustment to managing people even with training. They sometimes find that working with people is an inexact science. They have also had trouble adjusting to problem solving in a managerial environment because of previous training. Engineers sometimes bristle at the notion that there isn't a single right answer to a problem. But the real world just isn't so. In fact, the answer may be to decide which is the least offensive rather than the best solution.

What skills should be taught?

There isn't a magic formula or set program to transform engineers into

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the brightest and the best managers. Any training program should depend on the industry, the company and the position in which the engineer will operate. Specific goals for training should be identified before any program is selected. Programs in line with an engineer's specific areas of responsibilities and training needs should be used.

There are some basic skills that should be included in training new managers or managers for the lower levels of the company. This list should be tailored to suit the needs of the company. Training should include at least four main areas: people skills, administrative skills, problem-solving skills and business skills.

- Training in people skills can include the following:
 - 1) The role of the manager in the workplace: What are the duties, authorities, rights and responsibilities of a manager?
 - 2) How to motivate people: Motivational techniques that will bring out the best performance in employees and direct their behavior toward achieving desired goals.
 - 3) How to delegate: Managers sometimes find it difficult to delegate tasks and responsibilities. This type of training should help them learn when and how to do it.
 - 4) How to effectively direct activities: Sitting back and hoping things you wanted done actually get done doesn't always work. Effective and non-threatening methods should be used to ensure that the proper work takes place.
 - 5) Conflict resolution techniques: Techniques in resolving the many conflicts that arise in the workplace without having them accelerate toward unmanageable situations.
 - 6) Listening techniques: Managers spend far more time listening than talking.
 - 7) Recognizing personality types: This is a new and worthwhile area in management training. By knowing your own and others' personality types, you can communicate more effectively.
 - 8) Planning techniques: Establishing realistic objectives and goals for projects and how to get the most out of your employees by fitting the jobs around their individual skills.

9) Time management techniques: Making better use of your time and controlling "time wasters."

● Administrative skills should include:

1) Hiring employees: Where to find new employees, what to say in an interview and (more important) what *not* to say. Also, how to select the best candidate for the job.

2) Firing employees: How to handle this situation effectively.

3) Personnel evaluations: How to properly evaluate an employee's performance and discuss it with the employee. This can be difficult when the evaluations involve criticizing an employee's performance.

4) How to avoid sexual harassment and EEO problems: Ignorance of the law is no excuse. There are many of these cases being taken to court. Learning how to spot problems ahead of time is to everyone's advantage.

● Problem-solving skills—Engineers are typically good at this in a sense of fixing things; however, they might need retraining to solve management problems in a business context. This should include:

1) Conceptualizing problems in a broader business sense than simple yes-or-no questions: Decisions in your area may have consequences in other departments and could even affect other companies. These consequences should be properly evaluated before a decision is reached.

2) Innovation and creativity in problem solving: Explore new ways of innovative thinking when confronted with complex problems in a business context.

● Business skills—This training should include:

1) Budgeting and finance skills: These areas make a company operate more efficiently and are necessary in the managerial world.

2) Writing skills: Managers spend many hours writing memos and reports. Specific techniques should be taught in how to improve your writing skills and get your point across in the most effective manner. The greatest idea in the world won't go anywhere if it is not communicated in the correct way.

3) Effective presentation skills: Learning some of the techniques for making

(Continued on page 68.)

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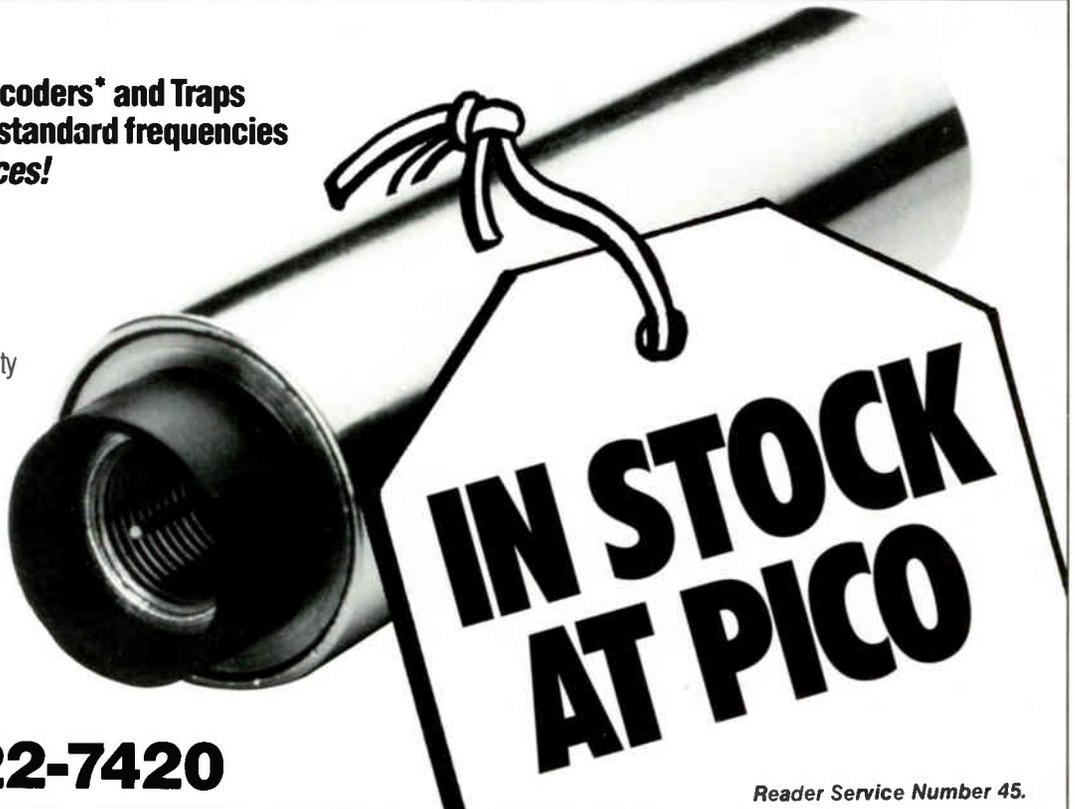
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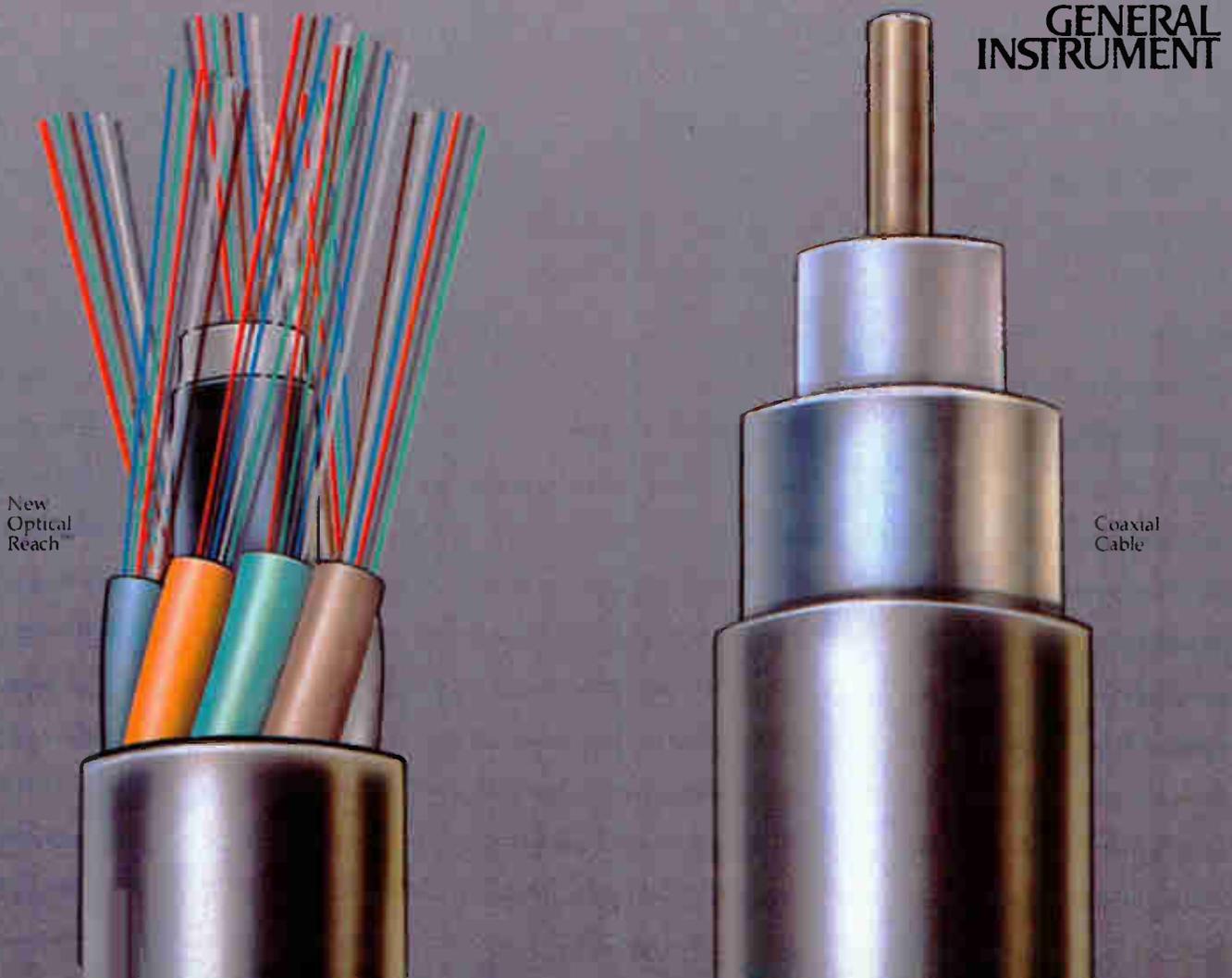
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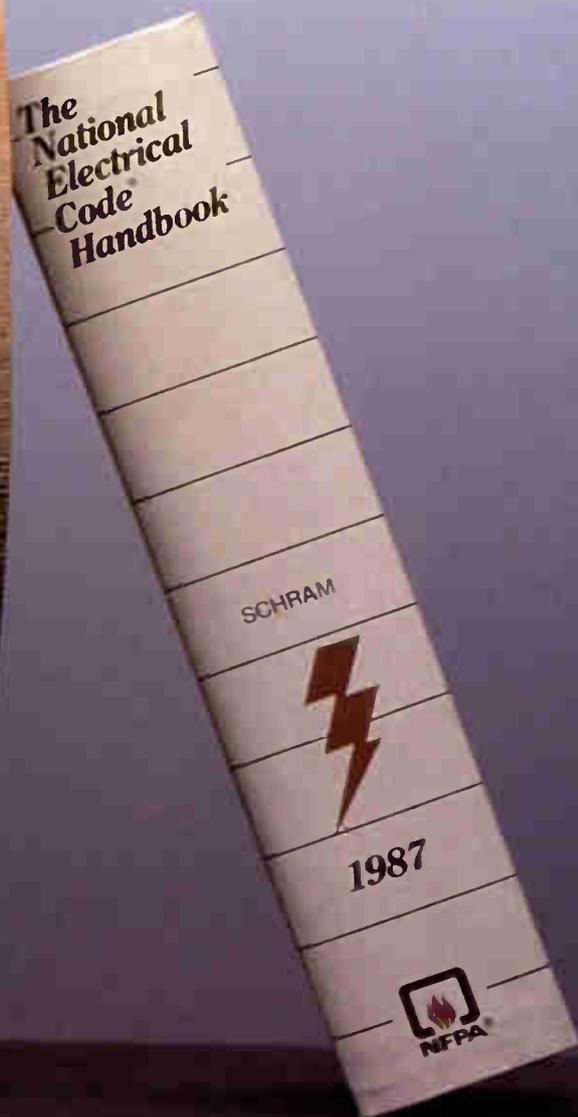
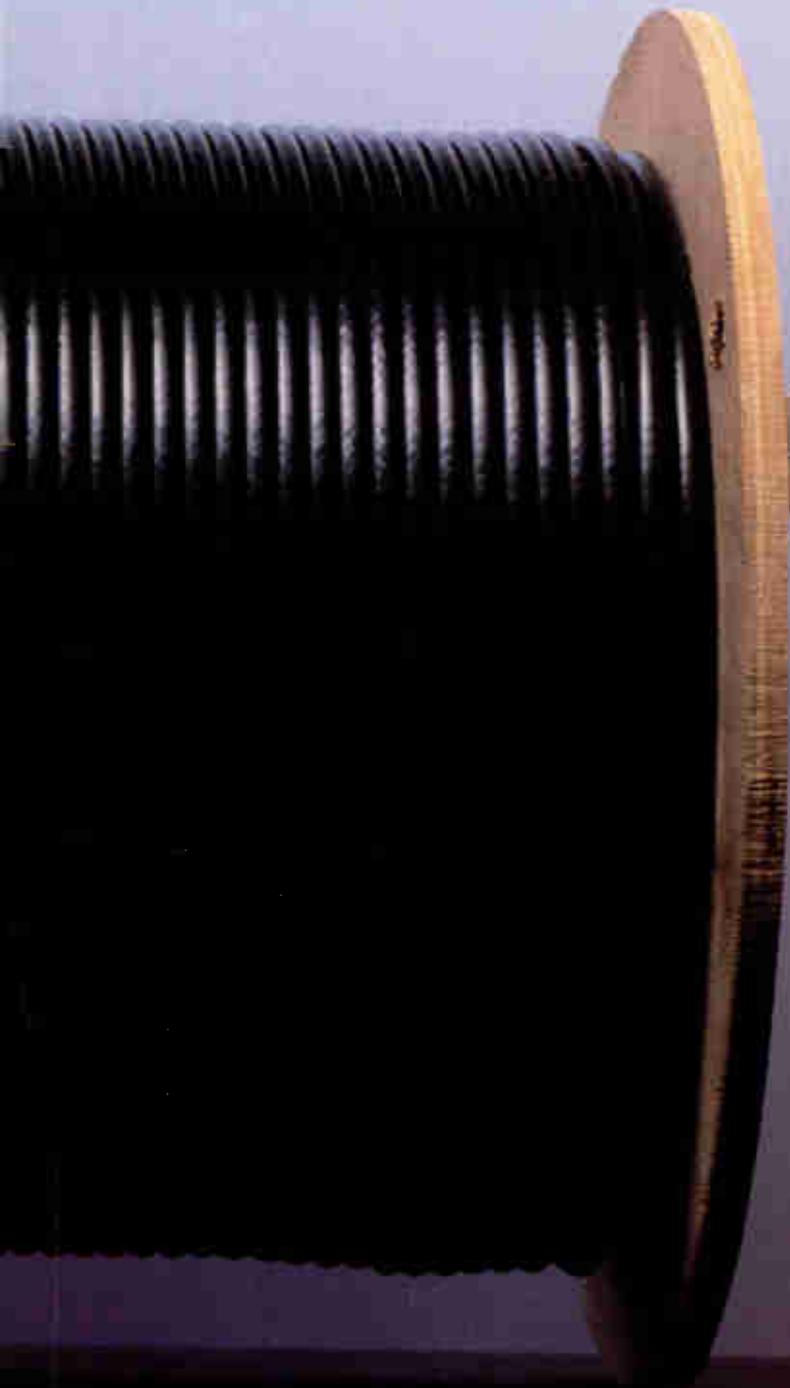
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**GENERAL
INSTRUMENT**

(Continued from page 52.)

better presentations is a big advantage to those who have to present their ideas and projects to others.

Types of training programs

There are many ways from the simple to the exotic to conduct management training programs. The programs include: the on-the-job training (OJT), sink-or-swim method, an OJT planned development program, correspondence courses, videotaped instruction programs, short courses by management professionals, short courses by industry groups and academic courses.

Techniques used in conducting these courses include both classroom instruction and interactive techniques. Interactive techniques can include group case analysis, role-playing situations and games as methods of learning. In most well-organized training programs, combinations of these are used to give the participant experience in different learning methods. Not everyone will learn from case analysis or even classroom instruction, so a variety of methods can be used to give each person a chance to learn in their own manner. The selection of which methods to use depends on both the subject matter being taught and the instructor. Since there is no best method for all training areas, programs should be evaluated with respect to the learning objectives of the individual being trained.

Training must have a specific purpose for it to be worthwhile. Courses should be evaluated to determine whether they are in line with an engineer's specific responsibilities, training needs and the company's goals.

The decision should be made by a company whether a training program should be developed in-house or whether it should use outside sources. Both have advantages and disadvantages and each should be evaluated with respect to the company's objective and resources. In-house programs can be made specific to a particular company. They can be tailored to company policies, procedures and philosophies. The courses can be taught by company personnel and conducted in times and places that are convenient.

A disadvantage of in-house is that the people being trained would not

benefit from experiences that could be learned from employees of other companies. People don't feel alone with their problems when they find out that others have the same ones. Sharing problem areas and information across company boundary lines can bring in new ideas and fresh perspectives to problems common to managers.

In-house courses also have been found to be expensive for smaller companies. Since these programs might require people involved only in training, in-house programs would not be cost-effective for their limited use.

One point that needs to be addressed when developing an in-house program is who is going to train the trainer. Many programs have been ineffective because of the inability of the person doing the training. An error that is sometimes made is to assign the best performers to conduct the program without giving them training on how to be trainers. Training others requires different skills and abilities from operating or even managing, so some trainers might need to be taught how to instruct.

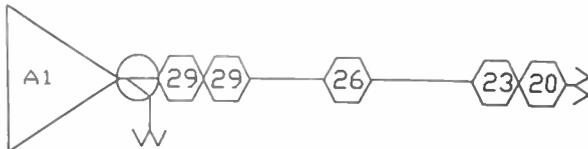
When taking courses from outside the company, participants can benefit from experiences of other companies and industries, as well as from professional teachers or trainers who have experience in management career development programs.

There are many courses available. They range from multiyear university programs to one- or two-day seminars. Courses also are given by industry and trade associations; an example of this is the management program conducted by SCTE chapters.

A middle road between in-house and outside programs are courses conducted by professional management consultants for individual companies. These have been specifically designed by and are conducted at the individual companies. This is probably the most expensive way to go but can be well worth it. But one word of caution: There are many experts in the field of management training and unfortunately a few self-proclaimed "experts." Programs should be carefully evaluated for content and trainers for experience. ■

Editor's note: Chris Papas received his MBA degree from Rivier College in Nashua, N.H., last month.

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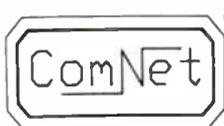
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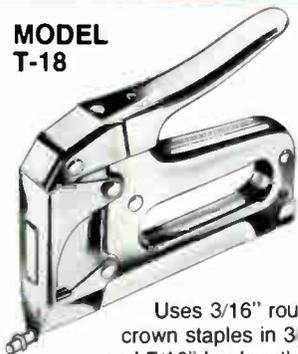
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Reader Service Number 49.

Improving efficiency of technical personnel

By Jon Ridley

Applications Engineer, Jerrold Distribution Systems Division, General Instrument Corp.

With the advent of wider bandwidth cable systems carrying more diverse information, the need to have trained service personnel is of paramount importance. The days of a system "guru" and several directed helpers are in the past. Today, it is incumbent that all people in the area of technical operations be as well-trained as possible and be technically familiar with the operating equipment of their particular system.

Due to the explosion in technology, it is unrealistic for a system to attempt to perform all of the necessary training. Equipment manufacturers can assist service personnel in acquiring the skills needed to support the equipment required to run today's systems. More advanced technologies require enhanced troubleshooting skills and, concurrently, more intensive product training.

There are two types of training available today. First, general training programs—NCTI, SCTE and technical schools—do an excellent job of exposing the service person to the broad field of electronics with direction toward cable applications. This training separates those who may want to select alternative careers from those planning to work within the cable industry.

The other training is product-specific. It assumes that the service person has had some preliminary training. It is the responsibility of the trainer to have specific goals when setting forth on this type of training session. As an example, a session could cover topics like service call reduction, broader

knowledge of equipment used in the system, reduced system operating costs and effective usage of time.

Achieving goals

As an applications engineer, I conduct more than 50 technical training seminars a year. In those seminars the focus is on achieving the following goals: service call resolution, correct usage of equipment, elimination of technical misconceptions, review of the basics and creating a desire to learn more about the workings of the equipment and how it relates to the system. Prior to beginning a seminar, I meet with the chief engineer or technical or operations manager to discuss what areas to cover and in what depth. Also, we try to ascertain the relative skill levels of the people attending the seminar. With this background information I can develop a lesson plan somewhat like this:

- A) Review of the basics
 - 1) dB and dBmV
 - 2) System math
- B) Coaxial cable
 - 1) Losses
 - 2) Loop loss
- C) Equalization
 - 1) Flat systems
 - 2) Tilted systems
 - 3) Distribution
- D) Padding
 - 1) Trunk
 - 2) Distribution
- E) Amplifiers
 - 1) Structure
 - 2) Setup
 - 3) Troubleshooting
- F) Sweep balance techniques
- G) Powering

With the group to be trained, I explain what I would like to accomplish and ask questions to ascertain the abilities of those in attendance. The presentation is kept as interactive as possible; a seminar "monologue" is of little value to either the class or the trainer. During the presentation, samples of equipment are available to familiarize attendees with the operational and non-operational controls.

As each section of the lesson plan is presented, problems are worked out. These prove (or disprove) the validity of prior training. It is sometimes more important to comprehend what has yet to be learned, as opposed to what is already known. Because of the disparate skill levels generally found within the group, the approach has to be as direct as possible. It is of no value for individuals to "vegetate" for six hours because they are lost.

At the end of the seminar I restate the objectives, how we covered them, how they relate to the special system needs of those in attendance and how, using this acquired knowledge, they will work smarter (not harder), be more effective and be more pleased with their sense of accomplishment. The success or failure of a seminar can be determined by attentiveness, interaction among those participants and understanding of the subject matter that has been covered.

After a seminar I follow up with the chief technical or operations manager to determine if there has been a measurable improvement in time usage and a reduction in service calls.

Although these are the steps I personally follow, many of them can be used in one way or another by persons conducting training seminars for technical system employees. Training, as stated before, is increasingly crucial to keep the technical competence level of system personnel on a par with the new equipment being introduced today.

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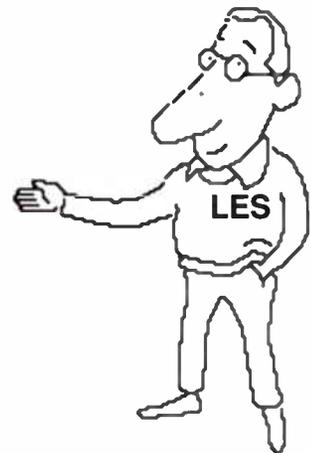
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Reader Service Number 50.

Using videotapes in training

By Russell Smith

Operations Engineer, Cardinal Communications

There are times when we forget that our newer employees have not had the time or opportunity to learn the proper methods of how to do a good install. We sometimes expect them to know (possibly by osmosis) what we were taught over 15 years ago, which is not necessarily the best way to install today. Now that we are 300 MHz or higher, the install has to be done differently. Ingress and egress are more important now.

We never seem to get enough training; it is one of the most important aspects of any cable company's policies. Whether the system is large or small (ours is 9,300 subscribers) training has to be done. How it is done varies widely from system to system.

We use videotapes as an important component of our overall training. We tape the seminars that the SCTE puts on Transponder 7 of Satcom F3R. These tapes are an invaluable addition to our training. However, they are geared more toward technicians rather than installers. The best tapes we have for the installers are the ones we take of installs out in the system. We also have taped installs we consider to have been done correctly; these tapes serve as guidelines for all the proper procedures. The idea is to tape the installs being done currently and compare them to the master tape.

Procedures

We have one of our more experienced installers tape and critique only the new installs. We do not tape reconnects, relocates, additional sets or disconnects. These would be helpful, but we just don't have enough time. While taping each install the camera operator talks about the things he sees; the audio portion of the tape catches the obvious problems right away. We almost always find more mistakes when we preview the tape at the office.

It takes about four or five hours to tape and critique four installers' work. Each install can be taped in about 10 minutes, using three minutes of tape per install. When there is a problem with an install we spend a little more time taping the problem. A problem installer can be taped every

day if necessary and can be shown and given a chance to correct mistakes before they affect too many new subscribers. There are times when a new installer is just not working out. A record of installs taken over a period of time can help to show just cause for dismissal. (This prevents the problem of whose word do we believe.)

Any subscriber comments about either the install or the installer also can be shown. When the comments are good, many subscribers are very willing to cooperate. If the work was perceived to have been done poorly then the comments are less likely to get on tape. There are obvious reasons for this: Subscribers may not want to "tell on" the installer because they fear repercussions; they quite often just do not want to get the employee in trouble.

We have a regular classroom session as often as schedules permit; meetings that are held once a week are ideal. The best length of these sessions seems to be about an hour, but the discussions tend to get off the subject if the session lasts much longer than that. The fact that the tapes can be paused, fast-forwarded or reversed allows us to cover the installs in detail.

It is very important not to mention who did the install; this avoids any embarrassment on the part of the installer. When an excellent install is shown, a "pat on the back" for whoever did the install does wonders for the ego and instills pride in the installer's work. New installers must understand this is constructive criticism to improve their work, not intended to intimidate them.

We let installers take a tape of their installs home, along with a tape of good installs. This allows them to compare good and bad ones. New installers can be shown so many more things on tape, since it may take many months for them to run into the unusual problems in the field. These problems can be shown to them to avert catastrophe to a subscriber's home or possessions.

There are costs involved that have to be justified, not only to yourself but to upper management. These include the price and maintenance costs of a video camera, tapes and the labor costs involved. The camera does not have to be studio quality. It would be impossible to



justify a \$30,000-\$60,000 camera being used in such a manner. A personal video camera will do fine; the picture quality is more than good enough to show installs. The cost of these units has dropped considerably in recent years; they range in price from \$900 to \$1,800. The basic unit is all you need for recording installs, and the basic accessories that normally come with a new camera will suffice.

A spare set of batteries is the only "extra" needed. This will prevent the downtime associated with recharging the original batteries. Batteries have a habit of failing at the worst possible time, so make sure the spares are charged up and with the camera.

Maintaining the camera will keep operating costs down. Dust and moisture can be its death. Follow the recommended maintenance practices in the user's manual.

The cost of tapes is nominal, ranging from \$4 to \$8; they can be reused several times. You will want to keep the most current tapes to show how much improvement (or lack thereof) takes place over a period of time.

The labor costs are the most expensive and the costs management sees over and over. They also will see the time spent taping, knowing that it is taken away from other projects. Since these projects are usually behind schedule already, you must be able to justify taking someone away to tape. This also holds true for the time you are showing the installers the tapes; you need to use this time wisely. Do not let the time be used up by personal experiences that might not have a bearing on the problems at hand.

Reducing training time

Videotaping can reduce training time by over 50 percent. Furthermore, the time new employees spend riding with experienced installers is drastically cut. Tapes not only let the new employee become productive sooner, but relieve the experienced installer from training duties. This keeps the experienced installer from being slowed down by teaching and helps eliminate the teaching of bad habits that experienced people may have.



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Training with interactive video

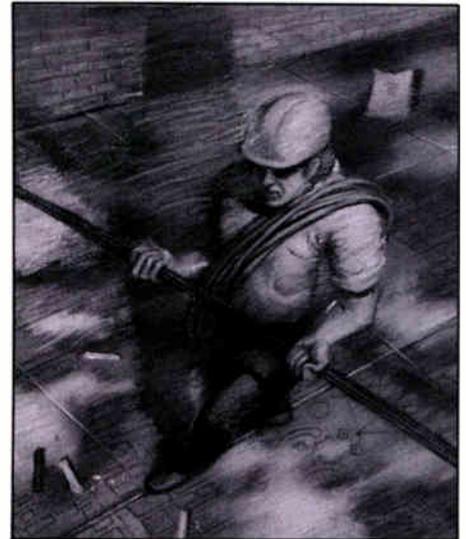
By **Judy L. Geisman**
President, InterComm International

And **Dana Eggert**
President, dB Associates

In the far off town of Cableville dwelled Chief Joe Tech, fondly known as Chief, who was famous in the industry for running the most technically sound system either side of the Mississippi. The installers and technicians on his team were considered to be the technical titans of their time in the ability to quickly and efficiently conquer difficult installations and technical problems.

There were no problems in Cableville—the pictures were crystal clear, all drops were grounded, there was no signal leakage, amplifiers were kept in proper alignment, outages were kept to a minimum and any technical disruptions in service that did occur were fixed twice as fast as the surrounding franchises. The customers were happy, the system was happy. In fact, the whole area radiated the warmth of contentment, a state of being that was truly remarkable.

Chief religiously attended the SCTE meetings because he felt it was important to stay current



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Reader Service Number 53.

on technical developments. During a break on one such occasion, a young tech from the neighboring system approached him.

"Hi, I'm Sam. You're Chief, from Cableville. You have a reputation that's hard to believe. Is it true your system never goes down?"

Chief was slightly taken aback. "Well, we have our problems, too. But generally the plant runs smoothly," he said.

"I'm glad to hear that, because based on what everyone says about you—people think you walked on water." Sam continued to tell Chief about the things he had heard regarding Cableville's system. He talked about consistently fixing outages in 30 minutes instead of three hours, stories about his bench tech repairing twice the number of converters in one day than any other tech in the entire state and of installations in which all F fittings were wrench-tight. As Sam continued to talk, Tom and Steve turned their chairs and listened.

Chief became uncomfortable with all the praise. "Whoa, I appreciate what you're saying, but what we do in Cableville can be done by any system."

"But how?" asked Steve, now very curious about Chief's methods.

Chief thought for a moment, and then answered. "The reason we're successful is the amount of training each member of the technical team receives—starting from Day One."

"How can you afford to do that? You have 75 people on your staff and over 50,000 subs. It's impossible to take the time to train everyone. You pull some guys from the field and havoc reigns supreme," Sam said, astonished.

Chief smiled. He had the same reaction several years ago, so he could understand Sam's surprise. "Even though training has always been considered important, we never took the time to do a thorough job of it. Whenever possible, we took advantage of what was available—self-paced programs, off-site seminars, vendor-sponsored workshops and even industry association meetings. Despite our best efforts, costly mistakes were still being made. Things changed

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when we started using a new form of training—interactive video.”

Someone in the front asked, “What is that?”

“It’s when you hook a computer to a VCR,” said Tom.

“You’re right about using computers and video,” Chief said. “But, interactive video combines computer capability with laser disc technology.”

Another tech in the group asked, “What’s so great about that?”

Déjà vu

The grin on Chief’s face grew. He was experiencing déjà vu, but this time from the opposite direction. “You sound like me the first time I heard

about interactive video.

“Well, first of all, this type of training is self-paced so the new hire can learn without interfering with anyone’s work schedule. It’s also a good review or refresher for anyone who needs it. This type of training allows a person to practice repairs or installations right there in the office without blowing up anything or messing up a customer’s television. And...”

“Wait a minute. I understand self-paced. But the part about practicing in the office—is that hands-on experience?” asked Ken.

“It’s not the same,” Chief explained. “Have you ever heard of simulations?”

“Yeah. That’s where a situation is created that is exactly like one faced on the job.”

“That’s right,” Chief said. “Through simulations, the techs and installers can practice repairs and installations before they go out into the field—for example, troubleshooting a bad picture. Through the use of computer and video technology, interactive training allows the service tech to complete each step of the troubleshooting process. The uniqueness of interactive video is its ability to give instant feedback. So, if the tech has followed the right procedure, the picture will clear up; if not, the problem will still be there. Learning through simulations increases their proficiency out in the field. This saves us a lot of time and money.”

One of the techs said, “That sounds great but awfully expensive. How’d you get your manager to go along with the idea?”

“I once asked that same question,” said Chief. “The person who told me about interactive asked me how much our system spends on truck rolls due to faulty repairs and installs. When I thought about it, I realized 40 percent of the truck rolls were our own doing, because we were too busy putting out fires to do proper training. And at \$30 a truck roll, you can see how that adds up.

“Another point of consideration,” Chief continued, “was the amount of time and money it takes to send people to off-site workshops and seminars. It occurred to me that only a few benefited from this form of training. And every time someone attended, we had to pay for travel, room and board, *plus* the cost of the program. Then there’s the schedule—you know what it does to the schedule when one person is out. Interactive video, however, makes training available to everyone in the system. In addition, it eliminates all the travel expenses.”

One of the techs asked, “But what about scheduling? You just said scheduling was a problem. It sounds like this interactive video program just makes things worse.”

Flexibility

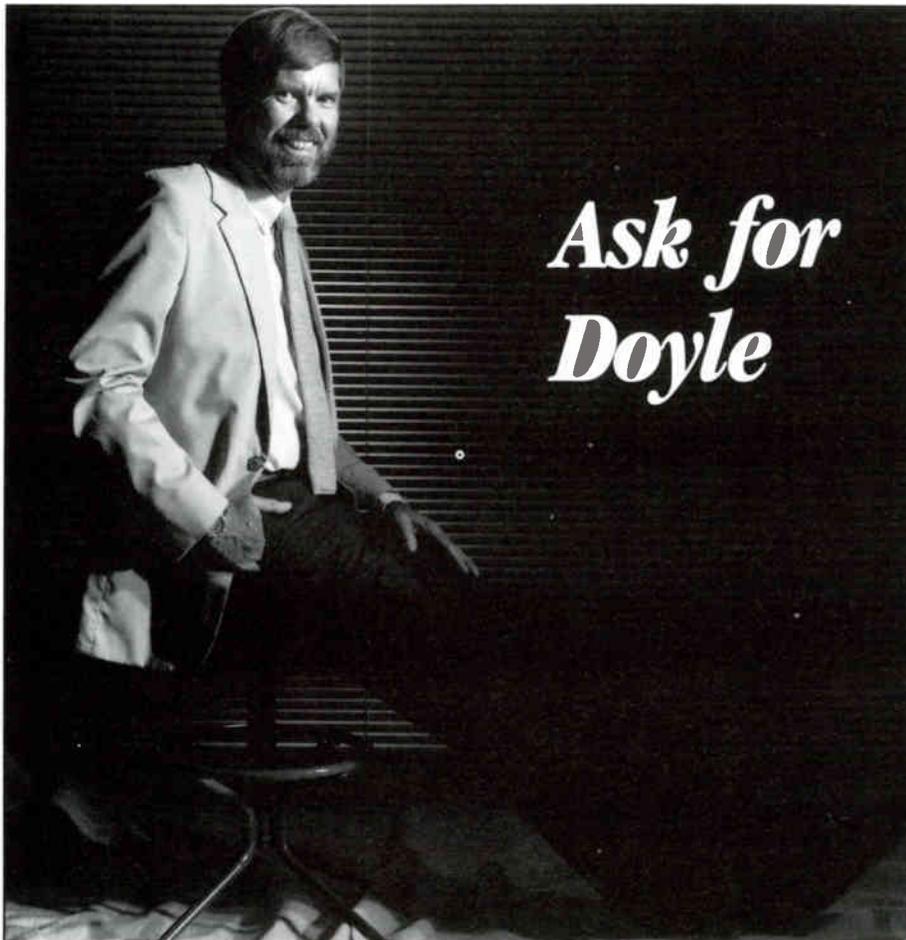
“Scheduling is a real concern,” Chief acknowledged. “The beauty of interactive video is its flexibility. A well-designed program consists of multiple units. The amount of time for each varies according to the content. You can choose to do any number of units at a time, given your scheduling and training requirements.

“In our system, the new hires are expected to spend more time training to quickly get them up to speed. Our experienced installers and techs may use the program as a quick refresher on a specific procedure. This may take them as little as 15 minutes. The secret to our success is our ongoing commitment to training. We know the small investment of time leads to greater job proficiency.”

“That’s all well and good,” Tom said, “But you know how cable technology is always changing. Can interactive video keep up with the changes?”

“A very good point,” Chief said. “Any training program requires updates, and interactive video is no different. The process involved in modifying a program is relatively easy to do.”

The speaker had returned to the podium; the break had ended. Sam leaned over to Chief. “You might not walk on water, but you sure build great bridges.”



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By Ron Hranac

Senior Staff Engineer, Jones Intercable Inc.

If your cable system is required by franchise, local or state regulatory authorities to comply with the National Electrical Code (NEC), you should be aware that the National Fire Protection Association (NFPA) has changed NEC requirements that apply to cable television coaxial cable. Specifically, Section 820-15 of the 1987 NEC states that effective July 1, 1988, cable television coaxial cable installed in buildings must be *Type CATV listed* as being resistant to the spread of fire.

This means that all cable (both drop and aluminum) installed in buildings after July 1 must meet the new requirements by being *Type CATV listed* and marked with the required listing designation. The NFPA has classified cable television coaxial cables into five categories: CATVD, CATVX, CATV, CATVR and CATVP.

CATVD coaxial cable is essentially the same cable you now use for most applications and is constructed with materials that are *not* resistant to the spread of flame. Under the new requirements, CATVD coaxial cable is intended for outside use—that is, from the pole or pedestal to the building. Manufacturers probably will not mark CATVD coaxial cable with the CATVD designator, since a non-flame resistant cable cannot be UL listed. However, some will mark the cable reel for information purposes; all other cables rated higher than CATVD will be marked with the appropriate designator on the cable itself.

CATVX coaxial cable is intended for interior wiring in one- or two-family or multifamily dwellings. It also can be used in non-residential applications, but *only* if it is installed in metal conduit or non-combustible tubing, or in non-concealed spaces with exposed lengths less than 10 feet (for example, wallplate to TV set). You can use any higher rated cable (CATV, CATVR or CATVP) in place of CATVX coaxial cable.

CATV coaxial cable is for residential or non-residential use except in vertical shafts or plenums. For example, CATV coaxial cable should be installed in multifamily dwellings, places of business or individual homes. You can use any higher rated cable (CATVR or CATVP) in place of CATV coaxial cable.

CATVR coaxial cable is to be installed in vertical shafts to prevent the spreading of fire from floor to floor. It can be used in residential or non-

One MSO's policy

Jones Intercable adopted the following new drop practices companywide to comply with NEC 820-15:

- All aerial drops from the pole to the house shall be type CATVD messengered cable.
- All underground drops from the pedestal to the house shall be type CATVD flooded cable.
- All wiring used inside (after the point of grounding) must be type CATVX, except where a higher rated cable is required. If the point of grounding is inside the building, it is not to be more than 10 feet from the point where the cable first enters that building.
- All wiring installed in vertical shafts as well as ducts, plenums and other air-handling spaces must be type CATVP cable.
- The use of aluminum cable (e.g., 500, 750) inside buildings also falls under the new NEC requirements. For these applications, you must use cable rated for the specific job—plenum, vertical shaft, etc.—or install the cable in metal conduit or non-combustible tubing.

residential applications. As with the other cables, you can use a higher rated cable (CATVP) in place of CATVR coaxial cable.

CATVP is the highest rated cable and is for residential or non-residential installation in ducts, plenums or other air-handling spaces. No other cable can be used in place of CATVP coaxial cable.

Higher costs

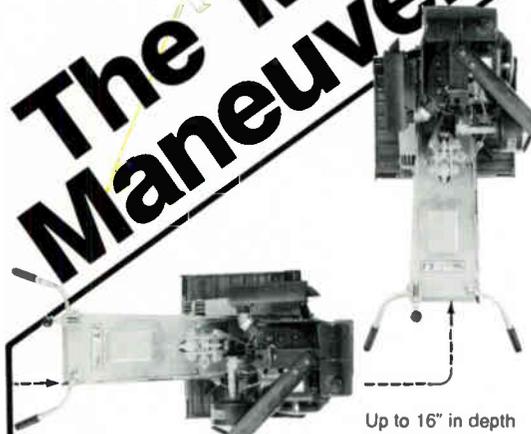
How will these changes affect your system? First, installation costs will increase. CATVX and higher rated cables will cost more than the conventional cable you now use; the higher the rating, the higher the cost. Fortunately, the majority of residential interior wiring can probably be done with CATVX coaxial cable, which manufacturers have estimated will cost about 15 percent more than regular cable. (You still will be required to use higher rated cables where specified; costs for those cables had not been determined at the time this article was written.)

Second, it will be necessary to maintain inventories of a greater number of cable types. This also means you will have to inspect new installs to ensure compliance with the new requirements and verify that drop and prewire contractors are using the correct cables.

Third, even if your system is not under the jurisdiction of NEC, and you choose not to use the new *Type CATV listed* cables, your company may be exposed to possible liability should it be proven that the spread of fire or toxic fumes was attributed to the coaxial cable in the building.

The NEC changes are significant enough that you may want to consider revising your company or system cable installation policies to incorporate 820-15. To accommodate the new requirements, you should make sure future cable orders specify the appropriate types of cable necessary to meet the July 1 deadline; if you have outstanding "blanket" orders with vendors for periodic cable shipments, contact those vendors to make sure future shipments will include the quantities and types of cable you will need to comply with 820-15.

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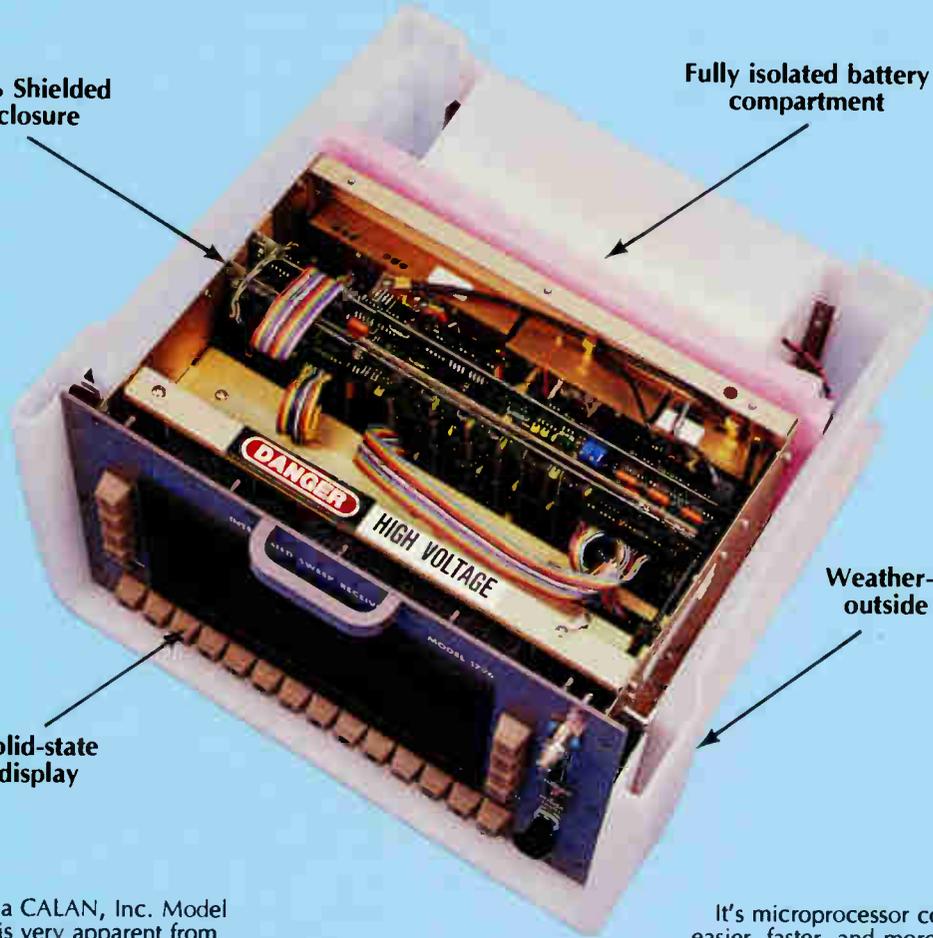
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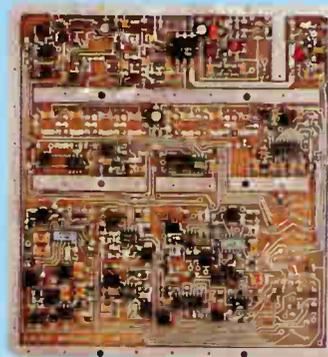
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Testing the new NEC guidelines

By Christopher D. Huffman

Senior Applications Engineer
Comm/Scope Division, General Instrument

Revisions to portions of the National Fire Protection Association's National Electrical Code (NEC), in particular Article 820 ("Community

Antenna Television and Radio Distribution Systems'') Sections 4 and 15, have caused changes and additions affecting the flame resistance requirements and identification marking of CATV cables. Because the NEC exists as a general outline for local fire safety enforcement

and there exists a growing need for comprehensive precautions, the cable community is seeing a forcing of closely defined regulatory environments governing the installation and material performance of transmission media, most commonly coaxial cable. These changes formally take effect July 1.

Section 15 details five placement classifications with respect to relative fire resistance performance. Underwriter's Laboratories (UL) flame test standards or equivalent procedures are specified as benchmarks for pass/fail criteria. In all but one case, CATVD, cable products meeting any specific classification requirement must be directly labeled (marked) accordingly as mentioned in Section 4. The challenge to the manufacturer has been to secure cost-effective materials to comply with UL and to educate the users with information concerning general applications and capabilities.

The CATVD category covers exterior cables installed from a pole or support to the structure's ground point. The NEC refers to this as CATV drop cable as referenced in Section 11(b) but, because of the placement classification, there are no flame tests and, therefore, no marking or printing requirements. There is some industry talk that the NEC will delete this grouping from its 1990 code publication. All prior manufactured cables used (not marked in accordance with the 1987 code) automatically meet the CATVD designation.

CATVX cables are described as CATV cable, limited use, in Sections 4 and 15(a). These products can be placed in residential building areas (homes, apartments, etc.; i.e., non-commercial) where the overall cable diameter is not larger than three-eighths inch. CATVX products possess a sufficiently flame retardant polyvinylchloride jacket to pass the VW-1 flame test (using a simple Bunsen burner flame) as described in the procedure UL 1581. Cables for this application must be marked as such on the cable. CATVX products could be substituted for ones in the CATVD classification.

Cables listed under the CATV designation are the next level in fire resistance and can be used instead of CATVX. These products will primarily be applied to commercial building areas except air ducts (plenums) or vertical shafts. Also, at least the type CATV constructions must be used inside residential areas where the diameter rule as discussed above is dictated. For example, if for some reason an RG11 was needed, it would have to be designated type CATV because it exceeds .375 inches. Cables listed as type CATV must pass the UL 1581 vertical tray flame test. This is a 70,000 btu/hr flame for 20 minutes. These cables possess a more flame retardant PVC jacket than CATVX constructions. Again, these cables must be marked as type CATV.

The UL 1666 vertical shaft flame test is required for the next level, CATVR. This is a 520,000 btu/hr flame for 30 minutes. CATVR is the riser classification and concerns vertical shafts such as elevators. Cables conforming to this category

Article 820: Community Antenna TV and Radio Distribution Systems

The following are the pertinent excerpts from the new National Electric Code guidelines as published by the National Fire Protection Association.

820-4. Cable Marking. Listed community antenna television and radio distribution cables shall be marked in accordance with Table 820-4.

Table 820-4: Cable markings

Cable marking	Type	Reference
CATV	CATV cable	820-15(a)
CATVD	CATV drop cable	820-11(b)
CATVP	CATV plenum cable	820-15(c)
CATVR	CATV riser cable	820-15(b)
CATVX	CATV cable, limited use	820-15(a) Exceptions No. 1, 2, & 3

820-11. Outside Conductors. Coaxial cables, prior to the point of grounding, as defined in Section 820-7, shall comply with (a) through (e) below.

(a) On Poles. Where practicable, conductors on poles shall be located below the electric light or power conductors and shall not be attached to a cross-arm that carries electric light or power conductors.

(b) Lead-in Clearance. Lead-in or aerial-drop cables from a pole or other support, including the point of initial attachment to a building or structure, shall be kept away from electric light or power circuits so as to avoid the possibility of accidental contact.

Exception: Where proximity to electric light or power service conductors cannot be avoided, the installation shall be such as to provide clearances of not less than 12 inches (305 mm) from light or power service drops.

(c) Over Roofs. Cables passing over buildings shall be at least 8 feet (2.44 m) above any roof that may be readily walked upon.

Exception No. 1: Auxillary buildings such as garages and the like.

Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 18 inches (457 mm) shall be permitted if (1) not more than 4 feet (1.22 m) of communication service drop conductors pass above the roof overhang, and (2) they are terminated at a through-the-roof raceway or support.

(d) Between Buildings. Cables extending between buildings and also the supports or attachment fixtures shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.

Exception: Where a cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.

(e) On Buildings. Where attached to buildings, cables shall be securely fastened in such a manner that they will be separated from other conductors as follows:

(1) Electric Light or Power. The coaxial cable shall have a separation of at least 4 inches (102 mm) from electric light or power conductors not in raceway or cable, or be permanently

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separated from conductors of the other system by a continuous and firmly fixed non-conductor in addition to the insulation on the wires.

(2) Other Communication Systems. Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand or equipment of one system cause abrasion to the conductors, cables, messenger strand or equipment of any other system.

(3) Lightning Conductors. Where practicable, a separation of at least 6 feet (1.83 m) shall be maintained between any coaxial cable and lightning conductors.

820-15. Fire Resistance of Coaxial Cables.

(a) Wiring Within Buildings. Coaxial cables installed as wiring within buildings shall be Type CATV listed as being resistant to the spread of fire. This listing requirement for Type CATV cables shall become effective July 1, 1988. In addition, where coaxial cables are in a vertical run in a shaft, Section 820-15(b) shall apply and where coaxial cables are installed in ducts, plenums and other air-handling spaces, Section 820-51(c) shall apply. Type CATVR coaxial cables listed for use in vertical runs in accordance with Section 820-15(b) and Type CATVP cables listed for use in ducts, plenums and other air-handling spaces in accordance with Section 820-15(c) shall be permitted to be used to meet the requirements of this section.

See commentary following Sections 300-22(b), FPN and 300-22(c), FPN.

(FPN): One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the Vertical Tray Flame Test in UL 1581.

See commentary following Section 725-38(b)(1), second FPN.

Exception No. 1: Where the coaxial cables are enclosed in raceway or non-combustible tubing.

Exception No. 2: In non-concealed spaces where the exposed length of coaxial cable does not exceed 10 feet (3.05 m).

Exception No. 3: Listed Type CATVX coaxial cables that are less than 0.375 inch (9.52 mm) in diameter and installed in one- or two-family or multifamily dwellings.

(FPN): One method of determining the fire resistance of Type CATVX cable is by testing the cable to the VW-1 requirements in UL-1581.

(b) In Vertical Runs. Coaxial cables in a vertical run in a shaft shall be Type CATVR listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. Type CATVP coaxial cables listed for use in ducts, plenums or other air-handling spaces in accordance with Section 820-15(c) shall be permitted to be used to meet the requirements of this section.

Exception: Where the coaxial cables are non-combustible tubing or are located in a fireproof shaft having firestops at each floor.

(c) In Ducts, Plenums and Other Air-Handling Spaces. Coaxial cables and equipment installed in ducts or plenums or other spaces used for environmental air shall also comply with Section 300-22 as to installation methods.

Exception to (c): Type CATVP coaxial cables listed as having adequate fire-resistant and low smoke-producing characteristics shall be permitted for ducts and plenums as described in Section 300-22(b) and other space used for environmental air as described in Section 300-22(c).

(FPN): One method of defining low smoke-producing materials is by establishing an acceptable value of the smoke produced per the NFPA 262-1985 test to a maximum peak optical density of 0.5 and a maximum average optical density of 0.15. Similarly, fire-resistant cables may be defined as having a maximum allowable flame travel distance of 5 feet (1.52 m) in the NFPA 262-1985 test.

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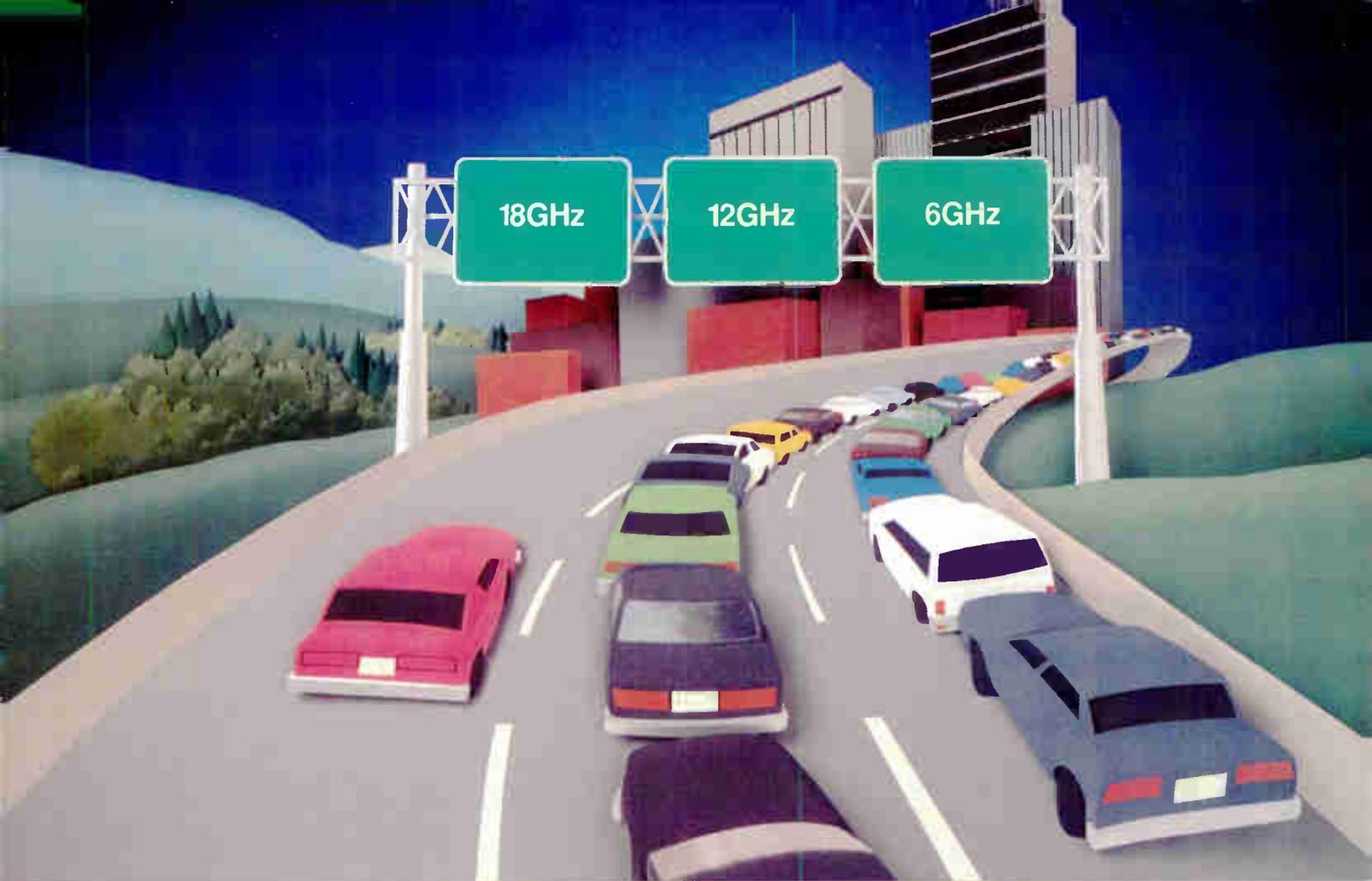
have a flame retardant jacket and dielectric as the flame test is several orders of magnitude more severe than UL 1581. CATVR products can be used in lieu of type CATV or CATVX and must be marked on the jacket as CATVR.

Finally the CATVP, Section 15(c), for environmental air handling ducts requires the most stringent flame test of all. UL 910, a modified Stiener tunnel test, dictates a 300,000 btu/hr flame for 20 minutes with flamespread and smoke generation values controlling pass or fail. Typically materials needed to comply with UL 910 (or equivalent) have been the high temperature

FEP compounds, but others are becoming available.

Material selection

It should be noted that material selection for meeting the four active classifications does not change the cables' physical or electrical properties as they have been offered in the past. Attenuation and environmental performance are maintained and are as reliable as ever. Also, implementation of the code is left to the local fire authority and cognizant users should contact them for their city's code adherence.



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Fiber-optic system design

This is the final installment of a three-part series on the design and application of fiber-optic technology.

By Robert K. Southard

Manager, Systems Technology, Electro-Optics Division, AMP Inc.

Link components contain sensitive high-speed transistors and other circuitry. The devices must be protected from electrostatic discharge through proper handling and grounding techniques.

Board considerations

For initial evaluation of transmitters and receivers, use evaluation kits. Such kits include PC boards that provide a convenient solution for putting the devices into operation for engineering evaluation. Evaluation board schematics included in data sheets or drawings in the kit provide guidelines for implementing custom boards. The transmitters and receivers are similarly packaged. However, they have substantially different requirements. The section on circuit considerations should be reviewed before attempting a custom installation.

Transmitter and receiver modules should be located near the edge of the circuit board to avoid routing the fiber over the board and to allow easy access for fiber connection. The location helps prevent other circuitry from injecting noise into the receiver module.

Link modules should be used on double-layer or multilayer circuit boards only. A ground plane should be placed under the full area of the module. No circuit traces should be routed between the ground plane and the receiver module. Signals may be carefully run near the module on the side of the board opposite the ground plane. Care also should be exercised in multiboard systems to prevent strongly interfering signals on another board from being physically close to the receiver module.

Data line connections are highly dependent on the speed of the signals.

Modules with ECL (emitter-coupled logic) data connections need circuit traces that conform to nominal ECL wiring practice. This will most likely require the use of microstrip or stripline wiring on the PC board (Figure 1).

Optical transmitters require substantially more power than typical integrated circuits; suitable conductor traces should be provided. Transmitters normally do not require special cooling. Placement of the module close to sources of heat may require care in maintaining the module package temperature at acceptable levels.

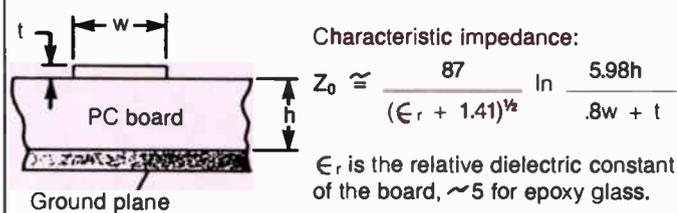
Circuit boards supplied in evaluation kits pay particular attention to power supply decoupling and filtering requirements. Custom applications should equally emphasize the importance of this area. Where two connections are indicated for a particular voltage, such as V_{EE1} and V_{EE2} , separate power supply connections are warranted. The V_{EE1} connection to the pre-amplifier of the device is sensitive to conducted interference. A pi-section filter is recommended on the supply pin, particularly on the higher speed link products. High grade capacitors suitable for RF use should be employed.

A low resistance, low inductance ground path for the modules must be provided. It is important that all designated ground pins be well grounded to maintain proper operation. Data connections should use microstrip or stripline geometry. The characteristic impedance of the lines can be chosen to be consistent with other circuit elements. Where the lines are of significant length or the modules are connected to cables from off the board, transmission line terminations will maintain signal integrity.

ECL transmitters are normally driven differentially. If a single-ended drive is desired, the unused input must be connected to the V_{BB} pin of the transmitter and capacitively bypassed to ground.

Link modules can be interfaced to a wide variety of common integrated circuits. It is recommended that a single gate be dedicated as the interface between each module and the rest of the digital circuitry. The gate will act as a buffer to help isolate the modules from other circuit elements and prevent unwanted interaction.

Figure 1: Cross section of microstrip



Transmitter and receiver considerations

Transmitter and receiver modules should not require adjustment or alignment in operation. The optical interfaces should be reliable and trouble-free through their service life. Normal care should be exercised so that the optical connectors and optical ports on the modules are kept clean and free from debris. When needed, cleaning should be done with optical grade lint-free materials.

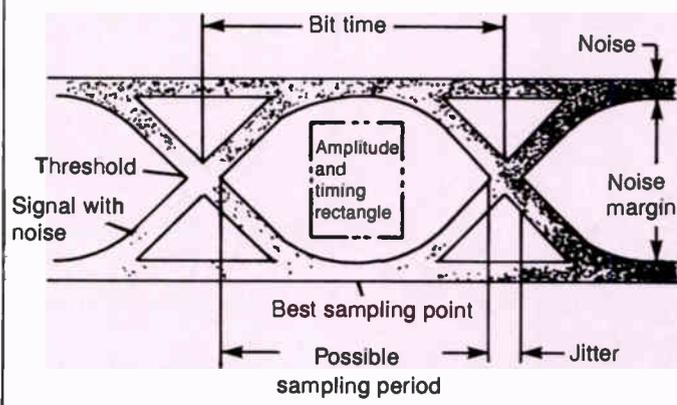
Versatile transmitters will permit straightforward application of the module in most applications. DC-coupled transmitters are insensitive to data format or frequency content up to the maximum bit rate specified. No particular precautions or limitations should be imposed on the signals presented to the transmitter, except for logic level and transition time constraints.

AC-coupled receivers rated at 50, 100 and 220 Mbps provide restricted duty cycle operation. Optimum performance of the receiver occurs with signals having an average duty cycle near 50 percent. This type of receiver takes advantage of the statistics found in commonly encoded data streams, such as produced with Manchester encoding, data scrambling or encryption circuits.

Such receivers employ decision circuitry having a threshold at the DC (average) level of the incoming signal. When signals with very small or very large average duty cycles are presented to a restricted duty cycle receiver, the decision threshold shifts toward one of the signal levels, increasing the probability that noise will contaminate the signal. This results in increased bit errors or reduced sensitivity for a given bit error rate (BER).

Restrictions placed on the duty cycle of the data entering the receiver are based on certain assumptions about the overall performance of the module. Operation at more extreme duty cycle levels is possible, but performance tradeoffs will be needed. This may require assuring power

Figure 2: Typical eye pattern



levels above the normal sensitivity limits of the receiver or allowing higher levels of BER.

One particular limitation of restricted duty cycle receivers is their inability to perform well in situations where data occurs sporadically or in bursts. This implies long periods without signal transitions in between bursts, as well as deviation from a 50 percent average duty cycle. When data occurs on a link after such a period, the receiver will require sufficient time to stabilize at the average DC level produced by the data. Specifications will only be met after this period of stabilization.

DC-coupled receivers operate with arbitrary data streams and with no restrictions on the data duty cycle, encoding or transmission bursts. The device is sensitive to the transitions of the signal, whereas the restricted duty cycle receiver uses level sensing. These devices are simple in design and relatively easy to apply.

The edge sensing that is typically used in a DC-coupled receiver is not a particularly high performance approach to receiver design. This architecture often results in a 6 to 8 dB penalty in the sensitivity of the device, compared with the restricted duty cycle design. Thus, it is more suited to optical links with limited distance, low data rate or modest error rate specifications.

Alternative links

Handling data without regard to duty cycle or format can be implemented with the high performance restricted duty cycle receiver designs. This employs encoding circuits in the transmitter module and decoding and clock recovery circuits in the receiver, to automatically transmit and receive data without regard to coding or duty cycle. These circuits perform their functions while being transparent to the user. The user connects the data and clock signals to the transmitter and obtains data and clock signals from the receiver.

This approach finds many applications in high performance links, where DC-coupled devices are not adequate. Many applications require clock recovery at the receive end of the link so that this approach satisfies this needed feature. Those products that are currently available are usually

in the form of costly board-level modules rather than components. However, the trend toward this type of component is being driven by the performance advantages that it offers.

Analysis of the eye pattern generated by the link is accomplished by attaching the optical transmitter to a signal source (often a pseudorandom data generator), connecting the output of the optical receiver to an oscilloscope and triggering the scope from the source. The typical eye pattern shown in Figure 2 is the superimposition of many data transitions.

Some keys to eye pattern analysis include:

- Sample the data at the maximum vertical opening in the center of the eye.
- The *period* when data can be sampled is shown as the width of the central eye opening.
- The *noise margin* of the receiver output is the vertical height of the central eye opening at the optimum sampling point.
- The *slope* of the signal lines on either side of the opening indicate the timing sensitivity of data sampling point. A full open center is desired over one that closes rapidly with small changes from the optimum sampling time.
- The width of the signal band at the horizontal line midway between minimum and maximum signal levels represents *timing jitter*. Jitter is variation in the signal switching point that can adversely affect timing in the system.
- *Noise and distortion* are indicated by the vertical thickness of the signal band at the optimum sampling point. Increased thickness is undesirable.
- *Signal rise time and fall time* can be measured from the eye pattern by observing the signal transitions in between the bottom to the top of the pattern and determining 10 to 90 percent or 20 to 80 percent transition times.
- The *central rectangle* can be established for a particular application to indicate signals that are acceptable in amplitude and timing. Signals are acceptable if the eye pattern falls outside of the window thus established. ■

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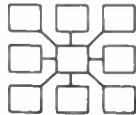
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If used for LAN applications, the loss test set includes: the AM-3500, built-in Silicon detector, rechargeable battery, AC adapter, ear-phone, choice of adapter for any multimode connector, and a bare fiber adapter, hardshell carrying case and soft packs, plus a AP-3200 LED 820nm hand held light source. The price for this complete loss test set is only \$1,590.

For more information on the loss test set, or Laser Precision's state-of-the-art OTDR's, contact: LASER PRECISION CORPORATION, 1231 Hart St., Utica, NY 13502, or call (315) 797-4449, or telex 646803.

PREVENTIVE MAINTENANCE

Eliminating paging transmitter interference

By Glyn Bostick

President, Microwave Filter Co

Paging transmitters often interfere with CATV, MATV or private TV reception. Although pagers operate at several VHF frequencies, those with transmit frequencies between 30 and 50 MHz are the most frequent offenders.

Interference can be caused by the fundamental paging frequency or one of its harmonics. If the fundamental signal strength received by the CATV system is sufficiently strong, it can overload the antenna preamplifier and drive it into saturation. This usually is more severe on the lowest TV channel—the one closest to the paging frequency. If the problem occurs on selected channels, not the lowest, then it is likely that the CATV system is seeing a transmitted harmonic (multiple of the pager's fundamental frequency).

Fundamental overload must be cured at the CATV system. This is usually accomplished by inserting a trap between the antenna and preamp (or other first electronic processor). The trap is then tuned to the pager's fundamental frequency. For example, if the offender is a pager transmitter at 42.04 MHz, a trap tuned to this frequency is connected between the cable antenna and preamp.

Harmonic interference must be suppressed at the transmitter by inserting a low-pass filter between the transmitter and its antenna. The filter suppresses multiples of the transmit frequency without affecting the fundamental. For example, the second harmonic of a 42.04 MHz pager transmitter is 84.08 MHz. This is within Ch. 6 and therefore cannot be trapped out of the cable system without removing some of the cable chan-

nel. A low-pass filter inserted between the pager transmitter and receiver will prevent radiation of the harmonic.

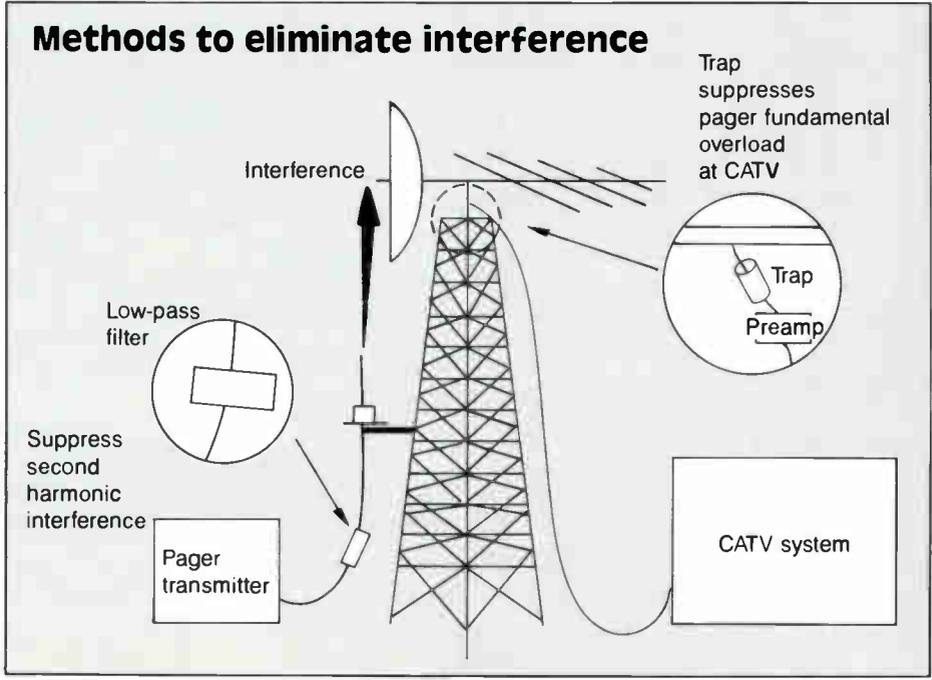
Non-antenna ingress

Sometimes both of these remedies are applied and interference persists. In this case, interference is entering the CATV system via a route other than the antenna, such as through the building wiring of the CATV system. Such wiring is often an excellent antenna for pickup of paging signals and the interference is conducted to the CATV system via the power cord. In this case, apply an RFI filter at the wall plug of the CATV equipment.

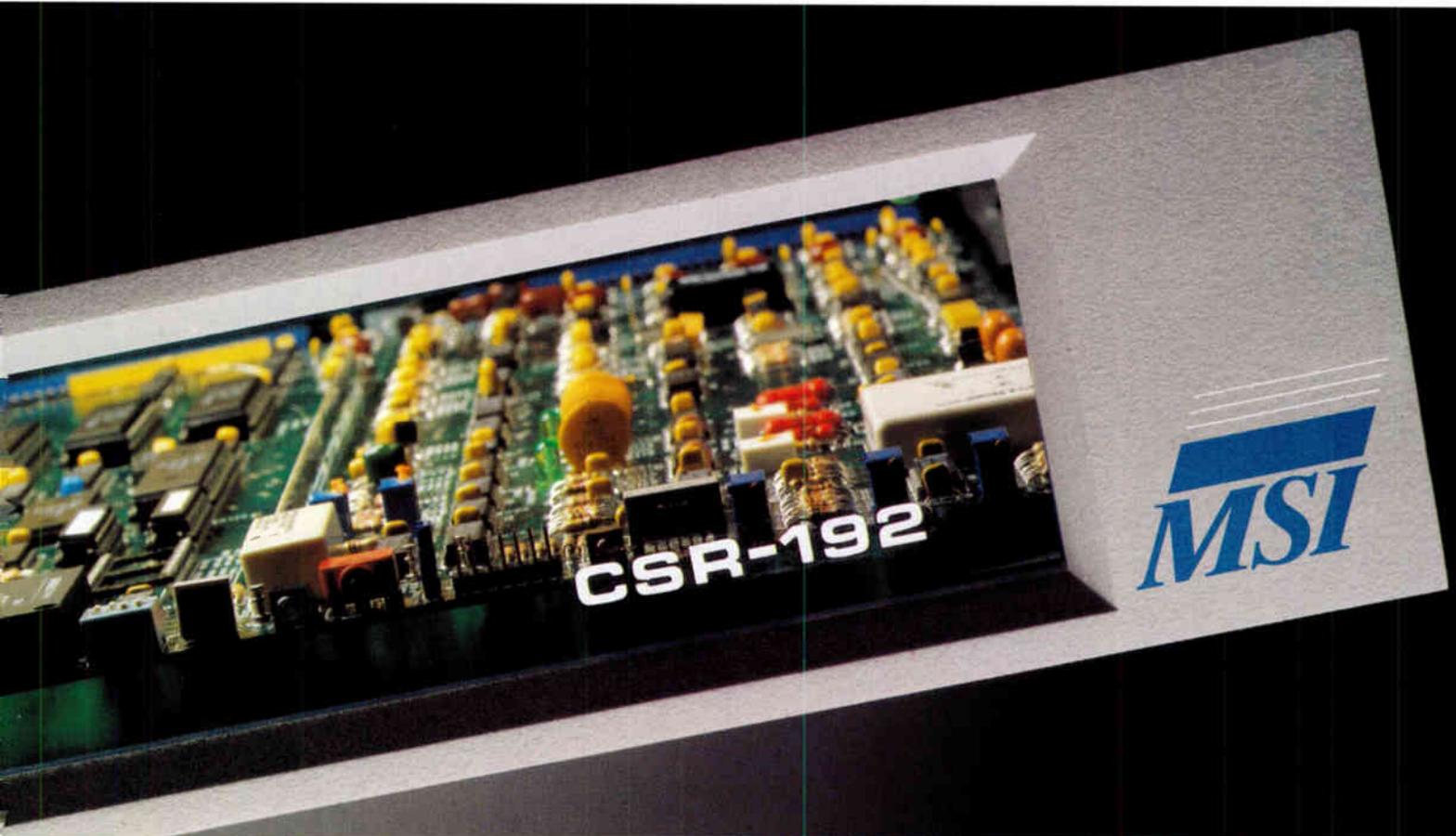
Another source of ingress is poor grounding of the CATV equipment, the pager transmitter or both. This is most likely if equipment is in the same building. Ground leads between the equipment and substantial ground (large metal surfaces or pipes going directly into ground) should be approximately 10 percent shorter than the pager wavelength.

An additional source of non-antenna pickup is the CATV downlead from the antenna to the equipment. The coaxial braid, acting as a conductor above ground, forms a transmission line that can guide the pager energy to the equipment. Grounding the braid at several points between the antenna and equipment will "short out" this unintended transmission.

Finally, ingress can result from poor chassis shielding of the CATV equipment. If it persists after applying these techniques, make a temporary test by encasing the CATV equipment in a conducting sheet, such as aluminum foil.



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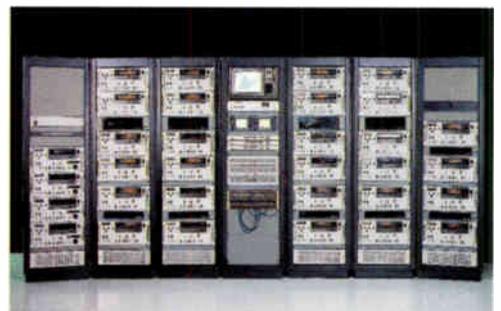
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See us at the Cable-Tec Expo, Booth 211. Reader Service Number 81.

Securing MDU equipment

By Malcolm S. White
President, Priority Television Consultants

Today the most important decisions made by a CATV engineering department are those that save money or make money. MDU converter security, however, is one of the few instances that can meet both goals. Reliable in-home converter security saves money by protecting those precious boxes and makes money by helping cable systems gain access to MDUs where converter liability is an issue.

After years of telling building owners and condo associations that "we'll get to you," some cable operators are now concentrating on serving MDUs. Often, competitive pressures force the operator into the MDU market; if you don't want to serve those buildings, someone else will.

Security addresses a major technical barrier to gaining access and maximizing profits on MDUs—the liability for the converters. It's in our best interests to put an addressable box in every unit. That's a \$100+ investment just for the home terminal, let alone the costs of installation and service. Converters are depreciable assets with high replacement and repair costs, which go even higher in MDUs.

The dilemma

You don't have to be born a criminal to steal a converter or re-PROM one. An unsecured, sophisticated piece of electronics equipment is tempting. At one time, owners didn't have much choice—if they wanted cable in the building, they

accepted liability for the box. Now things have changed: Owners have more leverage in negotiating contracts with cable operators. In fact, coming to an agreement on converter liability is often the last step in "locking up" an MDU.

Let's take two hypothetical examples. The first is in an existing building—a customer for several years with an 80 percent penetration rate. The 160 subscribers in this 200-unit building pay \$12 a month for expanded basic, generating about

Calculating converter security costs

Example #1—Existing building • 200 units • 80 percent basic penetration

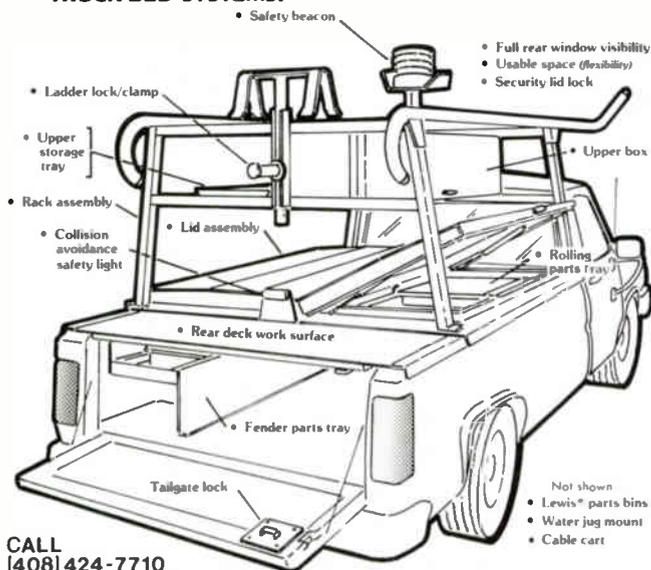
Subscribers	160
Annual turnover (20 percent move rate)	32
Annual theft (40 percent of moves)	13
Annual replacement costs (at \$100 per unit)	\$1,300
Costs over six-year average life	\$7,800
Converter investment per subscriber	\$48.75

Example #2—New customer • 500 units • bulk rate (100 percent penetration)

Subscribers	500
Annual turnover (100 percent move rate)	500
Annual theft (40 percent of moves)	200
Annual replacement costs (at \$100 per unit)	\$20,000
Costs over six-year average life	\$120,000
Converter investment per subscriber	\$240

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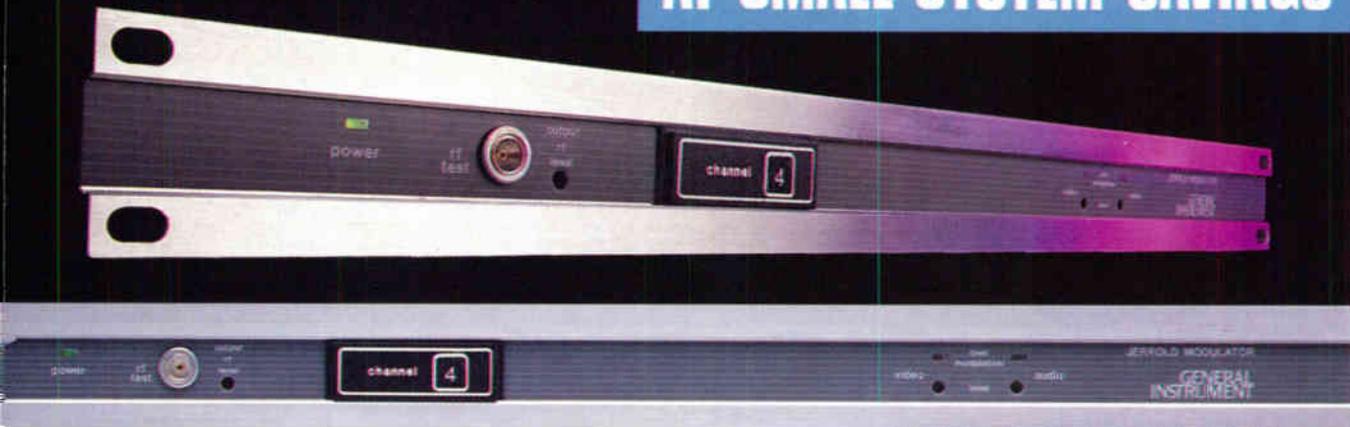
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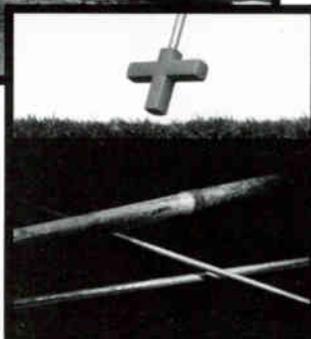
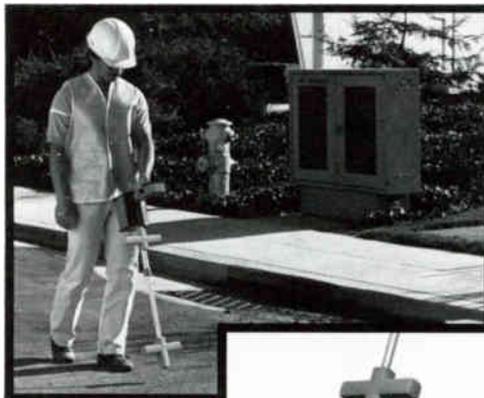
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"The cost of converter theft...is a drain on cash flow, a blow to asset value and a pain in the neck."

\$23,000 in revenue annually from basic. As shown in the accompanying figure, using a 20 percent move rate and a 40 percent theft rate means that the system will lose about 13 converters a year. This equals \$1,300 per year in converter replacement costs; over the six-year average life of a converter, total replacement costs are about \$8,000. Therefore, to secure those 160 units, the operator should be willing to spend \$50 per unit up front.

The second example addresses the issue of gaining access. Let's assume converter liability is the stumbling block in wiring a 500-unit dorm. The proposed rate, \$6 per unit per month on a bulk agreement, is not a problem for the university. What should the cable operator be willing to spend in security to get a \$3,000-a-month bulk account? Assuming everyone in the dorm moves each year (100 percent move rate) and the theft rate is 40 percent, the cable system would have to replace 200 boxes every year. The \$20,000 a year in replacement costs would amount to \$120,000 over the average six-year life of a converter. Dividing that total investment by 500 units yields \$240, what the system should be willing to invest to secure each converter for its full life.

The investment in both cases is made in the first year, but the maintenance costs and reconnect costs more than balance out the interest costs. Clearly, the cost of converter theft and tampering is a drain on cash flow, a blow to asset value and a pain in the neck.

Solving the dilemma

Up to now, the industry's answer to solving the dilemma of converter security has been to get the boxes out of the hands of the people who steal and/or break them. But these people are also the ones who pay the bills, order pay-per-view events and have multiple sets. Off-premise security may work but it runs counter to the theory that subscribers should have that box available to them.

Recently, an adaptation of existing security technology applied to converters has proved effective. The key to this approach is a lock-down plate that attaches to the wall or furniture. The converter is mounted to the plate, the plate locks into the mount and the mount locks down. The device, called Priority One, also encloses the converter, with only buttons and LED window showing.

In many ways, the solution to converter security is simply discouraging those who might not otherwise steal but are tempted by the box or simply don't know it doesn't belong to them. But in the long run, even the best solution to home security can eventually be defeated. ■



David Chandler, President, Foresight Products Inc.

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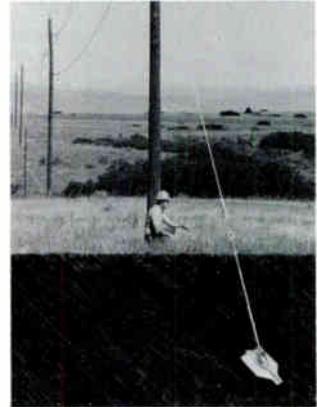
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Reader Service Number 87.

Levels in fiber-optic networks

By Lawrence W. Lockwood

President, TeleResources
East Coast Correspondent

Establishing levels in a coaxial network is a familiar task, but how do you do this in a fiber-optic network? If the level of the signal (either analog or digital, in either baseband or RF) is known at any point in an electrical network (as shown in Figure 1) and the gain and loss values of the components of the network are known, then the value of the signal level (usually in either dBm or dBmV) at any point downstream can be readily determined.

The decibel (symbol dB) is a dimensionless unit for representing the ratio of two values of power. The number n of decibels is 10 times the logarithm to the base 10 of the power ratio:

$$n(\text{dB}) = 10\log_{10}(P_2/P_1)$$

In terms of electrical quantities, power may be expressed as $P = I^2R$ or $P = V^2/R$. Accordingly, the change in power level, in terms of changes in current and voltage, is

$$N_{\text{dB}} = 20\log(I_2/I_1) + 10\log(R_2/R_1) \\ = 20\log(V_2/V_1) + 10\log(R_1/R_2)$$

The power level change, expressed in decibels, is correctly given in terms of voltage and current ratios alone *only for the special case for which* $R_1 = R_2^{1,2}$.

Fiber optics

The special case proviso is emphasized because it is a *necessary requirement* before the dBmV values rather than the dBm values can be used in an analysis. This requirement is rarely considered in an everyday analysis of any electrical coaxial network (especially broadband) because all of the impedances of the components in the electrical network are made a common value (75 ohms for CATV).

However in the case of a fiber-optic network (as shown in Figure 2) the proviso *must be observed*. Because of the light sources/detectors in the network it is apparent that the impedances are *not all the same* so the dBmV values cannot be used. Therefore, values of active fiber-optic components are always given in dBm and they must be used in any fiber-optic network analyses.

Optical dB and electrical dB

Using decibels (dB) in conjunction with fiber

optics can cause confusion³. We assume the optical power P_{opt} is converted to electrical current I in a detector. However, in detectors (photodiodes), I_{det} is proportional to P_{opt} . Therefore

$$X[\text{dB}(\text{optical})] = 10\log(P_{\text{opt1}}/P_{\text{opt2}}) \\ = 10\log(I_1/I_2)$$

We now assume P_{el} is electrical power generated by the same current I . However P_{el} is proportional to I^2 . Therefore

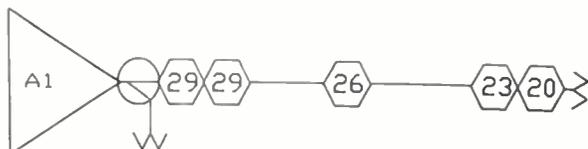
$$X[\text{dB}(\text{electrical})] = 10\log(P_{\text{el1}}/P_{\text{el2}}) \\ = 20\log(I_1/I_2)$$

Notice that the dB(electrical) number is twice as large as the dB(optical) number.

$$\text{dB}(\text{electrical}) = 2 \times \text{dB}(\text{optical})$$

This apparently contradictory relation is due to the fact that the *detector output current is linearly related to the input optical power*. One should always verify whether optical or electrical power was used to calculate attenuation, signal-to-noise ratio, etc., in decibels. It has been suggested that a clear distinction should be made

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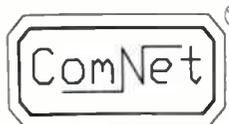
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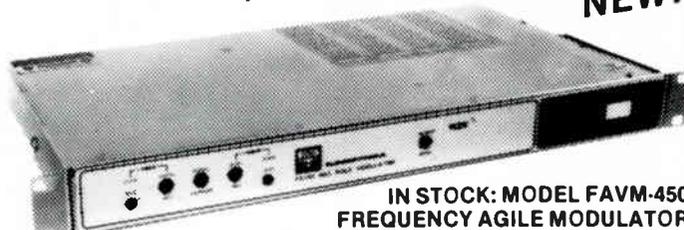
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by writing dB(optical) or dB(electrical).

But if we have a dBmV value at one point in a fiber-optic network, as in Figure 2, how do we calculate the dBmV value at another point? If we can determine the value of the optical power in dBm that the input dBmV produces in the network, then we can carry the dBm values through to the point where the dBmV value is desired and then determine what the resultant dBm amount produces as a dBmV.

These analyses require considerations of the voltage-to-light input to the fiber optics (transmitter) and the light-to-voltage output of the fiber optics (receiver). Two of the most important parameters of a transmitter to be considered are transmitter output power and SNR (signal-to-noise ratio) or BER (bit error rate). Power output must be sufficient to overcome all losses in the system and produce a signal that can be

Figure 1: A few typical elements of a coaxial network

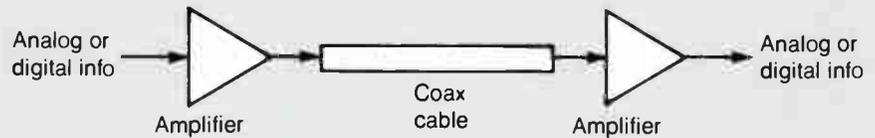


Figure 2: A few typical elements of a fiber-optic network

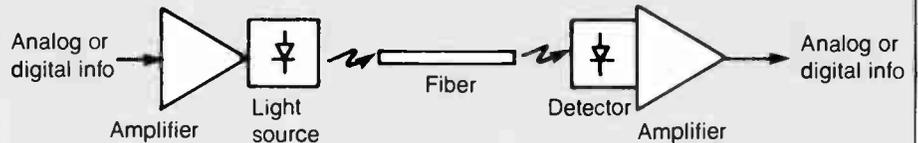
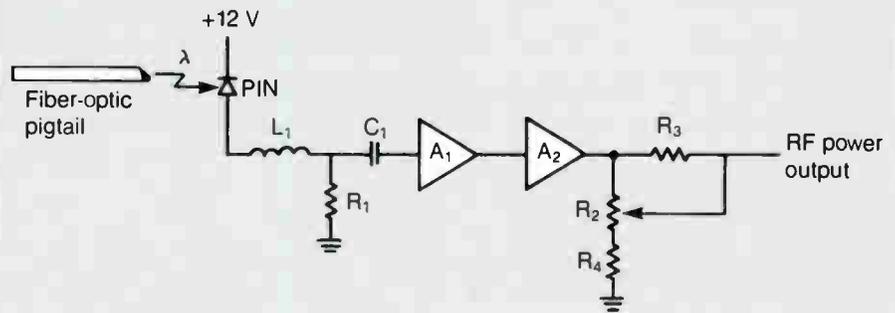


Figure 3: Simplified PIN fiber-optic receiver (analog)



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Table 1: Typical values for components in a fiber-optic network

- Transmitter output power: LED (light emitting diode, -20 to 0 dBm) and lasers (up to 10 dBm)
- SNR: 50 to 60 dB for laser transmitters
- Cable attenuation: Values vary widely depending upon whether fiber is single or multimode, the wavelength and the manufacturer. Single mode at 1,300 nm as low as 0.6 dB/km and as high as 8 dB/km at 850 nm in multimode
- Connectors: 0.5 to 1 dB
- Splices: 0.1 to 0.05 dB
- Insertion loss for couplers: 0.5 to 1 dB—the best as low as 0.05 dB
- Insertion loss for switches: 1 to 2 dB
- Insertion loss for star coupler: 1 to 3 dB
- Receiver sensitivity: -30 to -50 dBm

m = modulation index
 γ' = responsivity—defined as ratio of detectors output current to the input optical power³
 $= \gamma A_1 A_2$

The units of γ are microamperes per microwatt ($\mu A/\mu W$) or amperes per watt. The voltage of the RF output signal is

$$E_o = \frac{P_{avg} m \gamma A_1 A_2}{\sqrt{2}} \quad (2)$$

A typical application of Equation 2, given that the parameters have the following values, is

$P_{avg} = 100 \mu W$
 $m = 0.5$ (50 percent modulation)
 $\gamma = 0.5 \mu A/\mu W$
 $A_1 = 10$
 $A_2 = 1,000$

therefore:
 $E_o = 176.7 \text{ mV}$ or 44.9 dBmV

The bandwidth for a typical receiver of this type can be 200 to 300 MHz.

Fiber-optic cable plants

As in any network analysis, a power budget must be established using dBm and dB values. These values must be obtained from the manufacturers of the components in the network. Some typical values for components in a fiber-

detected and amplified undistorted at the receiver. The signal must meet some criteria to determine whether it is usable, such as SNR for the analog case and BER for digital systems. Most laser transmitters have SNRs of 50 to 60 dB. The most significant consideration for a receiver is sensitivity. Sensitivity is defined as the minimum power (time average) at the receiver input, which is required for the proper function of the system³ and typical values are -30 to -50 dBm.

The PIN detector will convert incoming signals from optical to electrical, with L_1 used to extend the receiver bandwidth. This particular receiver is AC-coupled to A_1 , the transimpedance pre-amplifier. These preamplifiers are useful because they convert the detector (current source) to a voltage signal, which is more useful as an output. A_2 produces an analog output voltage, with a level adjustment provided.

Equation 1 can be used to calculate the RF output signal.

$$E_{avg} = \frac{P_{avg} m \gamma'}{\sqrt{2}} \quad (1)$$

where:
 P_{avg} = average optical power input

Sample fiber-optic receiver (analog)

The receiver shown in Figure 3 is a PIN (positive intrinsic negative) analog type⁴. APDs (avalanche photodiodes) are often used rather than PINs when greater sensitivity is required.



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Table 2: Bit error rate vs. signal-to-noise ratio (in dB)

BER	SNR
10 ⁻²	13.5
10 ⁻³	16.0
10 ⁻⁴	17.5
10 ⁻⁵	18.7
10 ⁻⁶	19.6
10 ⁻⁷	20.3
10 ⁻⁸	21.0
10 ⁻⁹	21.6
10 ⁻¹⁰	22.0
10 ⁻¹¹	22.2

optic network are shown in Table 1.

The values of some of the components shown in Table 1 are subject to small improvements with ongoing developments by manufacturers.

After a power budget is made for a given network configuration, hopefully an excess power margin will be left—if not, redesign is required. A comparison must be made of the excess power margin with the required SNR. If the network is digital the SNR for a given BER can be determined from Table 2.

Conclusions

In a fiber-optic network, one cannot carry calculations of levels from dBmV input through dB gains and dB losses to obtain a dBmV output as in the classical case of an electrical/coax network. In establishing levels in a fiber-optic network it is essential to remember that signals are always given in dBm values. Therefore if a 3 dB attenuation is inserted in a fiber-optic net (such as would result after putting in an optical tap) the output optical power is reduced by 3 dB and therefore the output voltage is reduced by 6 dB, because the relation of optical dB to electrical dB is

$$\text{dB(electrical)} = 2 \times \text{dB(optical)}$$

Thus, in a network, a 20 dB optical SNR becomes 40 dB electrical SNR—a 20 dB/km electrical cable is equivalent to a 10 dB/km optical fiber—all because of the optical to electrical response of detectors that are needed to reconvert the optical signal to an electrical signal.

In making a power budget for a fiber-optic network, manufacturer's specifications should be used for light output power, values for various component attenuations and gains, receiver sensitivity etc.—always keeping in mind the optical/electrical dB relation.

References

- ¹*Electronics Engineers Handbook*, Second Edition, D.G. Fink, Editor, 1982, McGraw-Hill.
- ²*Reference Data for Engineers: Radio, Electronics, Computer and Communications*, Seventh Edition, E. Jordan, Editor, 1985, Sams & Co.
- ³*Fiber-Optics Handbook*, C. Hentschel, 1983, Hewlett-Packard.
- ⁴*Local Area Networks with Fiber-Optic Applications*, D. Baker, 1986, Prentice-Hall.

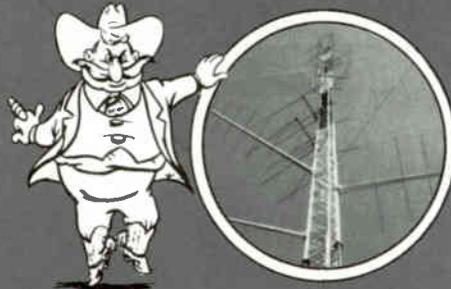
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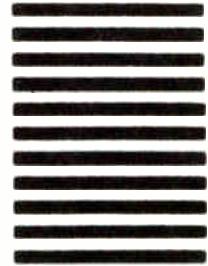
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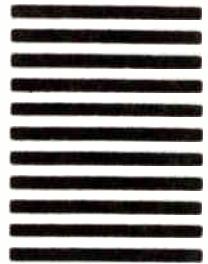
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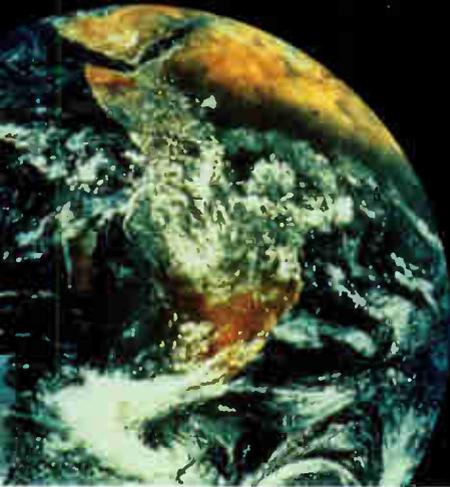
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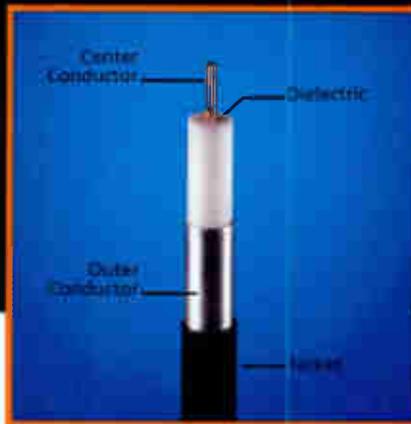
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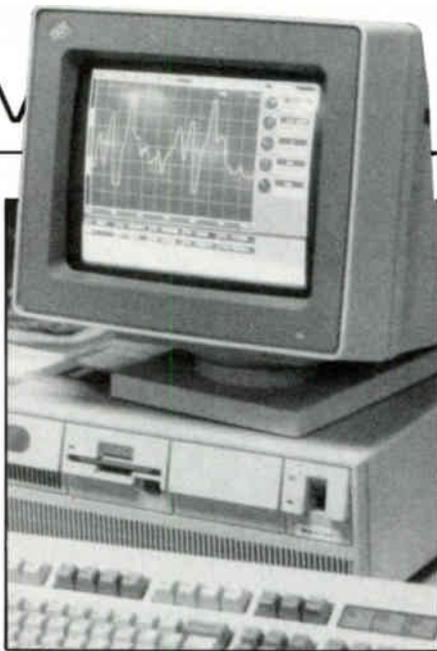
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For more information, contact Magnavox CATV Systems, 100 Fairgrounds Dr., Manlius, N.Y. 13104, (315) 682-9105; or circle #128 on the reader service card.



in a package 3½ inches high for space economy. (For more information on Model 9650, circle #133 on the reader service card.)

The company's new frequency agile drawer can be installed in an S-A 6350 modulator or 6150 processor. It also can back up an entire headend as a replacement module and has a 550 MHz range for compatibility with every cable system, according to S-A. (For more information on the frequency agile drawer, circle #132 on the reader service card.)

The Model 6380A stereo decoder has a peak limiter for consistent audio levels across all channels. Alternate stereo audio inputs allow local advertising to be run in stereo. (For more information on Model 6380, circle #131 on the reader service card.)

Also introduced by S-A are its two-way and four-way traps. According to the company, they are easier to install, almost impossible to break and fit every housing made by S-A. (For more information on the traps, circle #130 on the reader service card.)

For further details, contact Scientific-Atlanta, 1 Technology Pkwy., P.O. Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

Headend products

Scientific-Atlanta unveiled its Model 8590 and Model 8570 set-top converters. The 8590 incorporates visual sound level indicators that let subscribers "see" sound and preset the volume even when the television is muted or off. It also offers up to 50 modes of security in three layers: dynamic sync suppression, dropped field and video and sync inversion. The 8570 includes all

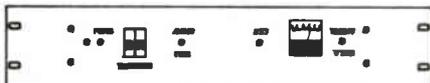
the features of the 8590 except video and sync inversion, downloadable output channel and volume control. However, when used in conjunction with S-A's learning remote, operators can offer subscribers volume control with a single remote. (For more information on Models 8590 and 8570, circle #134 on the reader service card.)

S-A also presented the Model 9650 integrated receiver/descrambler. The product combines the Model 9650 receiver with a satellite descrambler

Status monitoring

Alpha Technologies unveiled its AlphaSoft programs for remote status monitoring of stand-

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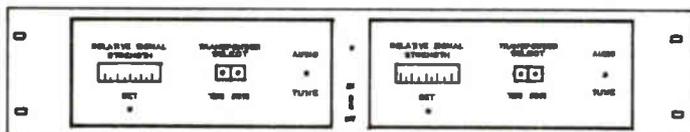
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For more details, contact Alpha Technologies, 3767 Alpha Way, Bellingham, Wash. 98226, (206) 647-2360; or circle #141 on the reader service card.



Test analyzer

Avcom of Virginia's STA-70D single channel per carrier (SCPC) test analyzer allows the SCPC uplinker to compare the performance of the carrier with other carriers to ensure the adequacy of the system. The product displays SCPC and FM signals and their frequencies from 0-110 MHz and has on-screen dynamic range of more than 60 dB. Vertical display sensitivity is switchable from 2 dB to 10 dB per division. A built-in audio demodulator allows it to function as a fixed tune receiver at zero span for simultaneous listening and viewing of carrier signals.

For more information, contact Avcom of Virginia, 500 Southlake Blvd., Richmond, Va. 23236, (804) 794-2500; or circle #135 on the reader service card.

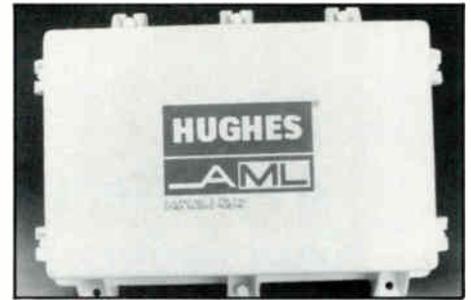


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For more information, contact Channelmatic, 821 Tavern Rd., Alpine, Calif. 92001, (619) 445-2691; or circle #140 on the reader service card.

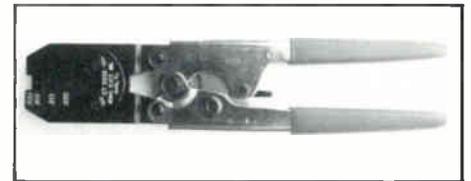


AML receiver

Hughes Aircraft Co.'s Microwave Products Division introduced the compact outdoor receiver, approximately one-half the size and weight of previous outdoor AML receivers. It is also compatible with all Hughes AML microwave receivers operating in the CARS (12.7 to 13.25 GHz) band. When used with a Hughes AML microwave transmitter, this receiver serves as a complete multichannel headend. Receiver output is used directly to drive the conventional cable plant from remote hubs, reducing amplifier cascades and the need for supertrunks.

It is available with or without a low noise amplifier for high sensitivity (as low as 5 dB noise figure) with low distortion performance, according to the company. The 550 MHz receiver also has a VHF AGC module and pilot tone trap built in, eliminating the need for an interface unit, yet providing key functions previously available only in the separate AML receiver interface unit.

For further details, contact Hughes Aircraft Co., Microwave Products Division, P.O. Box 2940, Torrance, Calif. 90509, (213) 517-6233; or circle #139 on the reader service card.



Crimp tools

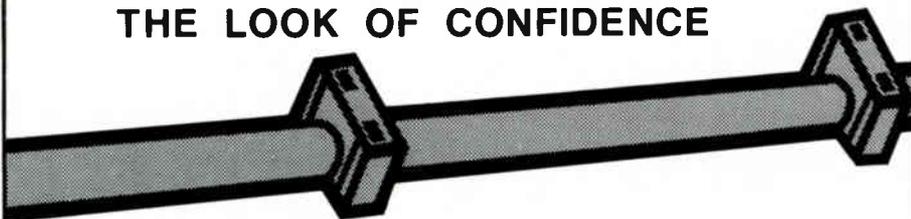
Nemal's new line of crimping tools offer full ratchet operation with machined dies and combine multiple hex sizes in a single fixed die for versatility. Model CT3500 crimps a variety of BNC, TNC, type N and other connectors on RG58, 59, 62, 142 and 223 size cables. Model CT3600 can crimp both RG59 and Belden 8281 connectors without changing dies. Both tools provide a ratchet release lever to adjust cable or connector position during the crimp cycle.

For more details, contact Nemal Electronics International, 12240 N.E. 14th Ave., North Miami, Fla. 33161, (305) 893-3924; or circle #138 on the reader service card.

Remote converter

Pioneer introduced its Model BC-4600 wireless remote converter. This product retains the same functions as its BC-4500 but includes several enhancements. Besides volume control, it offers a sleep timer that can be set in 30-minute

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increments up to 1½ hours. In addition, an options selector, a hand-held IR transmitter that modifies the converter's features and functions without opening the converter case, will be offered with the converter.

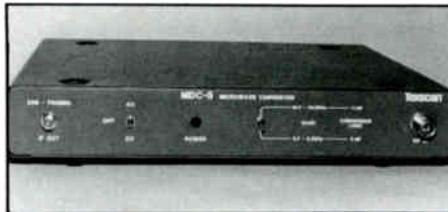
For more details, contact Pioneer Communications of America, Sherbrooke Office Centre, 600 E. Crescent Ave., Upper Saddle River, N.J. 07458-1827, (201) 327-6400; or circle #121 on the reader service card.



Cable products

General Instrument's Comm/Scope Division announced its new product, Optical Reach, a single-mode loose buffered construction fiber-optic cable available in configurations of two to 72 optical fibers. It also introduced its ADP cable, a corrosion-resistant drop cable that can be used indoors. It contains an amorphous flooding compound instead of the powder used in CRD cable.

For more information, contact Comm/Scope Division, General Instrument Corp., P.O. Box 1729, Hickory, N.C. 28603, (704) 324-2200; or circle #127 on the reader service card.



Microwave converter

Texscan Instruments introduced its Model MDC-5, a two-band portable microwave block converter that converts signals in the TVRO and AML/CARS bands down to the VHF/UHF region of 200-700 MHz. This permits viewing of microwave signals on any 1 GHz spectrum analyzer. According to the company, its product provides a cost-effective means of performing microwave dish alignment, AML system troubleshooting and searching for terrestrial interference without a microwave spectrum analyzer.

For further information, contact Texscan Instruments, 3169 N. Shadeland Ave., Indianapolis, Ind. 46226, (317) 545-4196; or circle #126 on the reader service card.

Agile modulator

ISS Engineering announced the Series II Plus frequency agile modulator, offering expanded output from 54 to 550 MHz without the need

for comb generators or special output modifications to meet FCC stability requirements. The product is microprocessor controlled and features standard, HRC, IRC or inverted frequency formats. It is also available with options that provide T-channel operation, composite video with 4.5 MHz inputs and remote tuning via an RS232 port.

For more details, contact ISS Engineering, 104 Constitution Dr. #4, Menlo Park, Calif. 94025, (415) 853-0833; or circle #137 on the reader service card.

Satellite modem

The EFDATA Corp. announced a new variable data rate open network (IDR) satellite modem. The SDM-308 Intelsat compatible modem meets all requirements of the IESS-308 specifications for immediate data rates from 64 kbps to 2048 kbps. Each modem can electronically select one, two or three of the different IDR data rates. Complete remote monitoring and control of all modem functions is a standard feature, and it utilizes a punctured K-7 Viterbi encoder and a single chip decoder.

For further details, contact EFDATA Corp., 1030 N. Stadem Dr., Tempe, Ariz. 85281, (602) 968-0447; or circle #124 on the reader service card.

FO monitoring

American Lightwave Systems announced its remote status monitoring system for frequency division multiplexed (FDM) fiber-optic transmission systems. The Model SMS-1500 consists of microprocessor-based hardware modules and software that provide functionality for performing remote monitoring, remote inquiry and diagnostics, and automatic hot standby switching for FDM fiber systems.

For more details, contact American Lightwave Systems, 358 Hall Ave., P.O. Box 1549, Wallingford, Conn. 06492, (203) 265-8802; or circle #122 on the reader service card.

Ad insertion

Rational Broadcast System's multi-channel ad insertion system provides for automatic insertion of commercial breaks across an unlimited number of channels with no pre-spot editing or tape editing and permits airing of new commercials in minutes. The system comes with full-function spot scheduling, prioritized spots, product cross-checks (to prevent spots selling the same product from airing in the same break), spot rotations and automatic PSA fills for unfilled spots. A full billing package also can be purchased with the system. Intelligent tape controllers provide direct control of the VCR and generate and read SMPTE time code from the machines.

For more information, contact Rational Broadcast Systems, 2306 Church Rd, Cherry Hill, N.J. 08002, (609) 667-7300; or circle #123 on the reader service card.

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 Chitenango, NY.....40 Miles
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 Westfield, PA12 Miles
 Norristown, PA150 Miles
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 Plympton, MA25 Miles
 Sandwich, MA200 Miles
 Windham, NH.....85 Miles
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 Bloomsburg, PA.....20 Miles
 Wilkes-Barre, PA10 Miles
 Weatherly, PA.....25 Miles
 Abington, PA.....300 Miles
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 University of Toledo, OH 5 Miles
 Brandywine, PA100 Miles
 Chalfont, PA12 Miles
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Example:

n_0 = coupling medium of air with refractive index of 1.0

n_1 = core material having refractive index of 1.5

then:

$$\begin{aligned} \text{Percent reflected power} &= \left[\frac{1.5 - 1.0}{1.5 + 1.0} \right]^2 \times 100 \\ &= \left[\frac{0.5}{2.5} \right]^2 \times 100 \\ &= (0.2)^2 \times 100 \\ &= 0.04 \times 100 \\ &= 4 \text{ percent} \end{aligned}$$

After determining power transferred you must know fiber loss, connector loss, splice loss and receiver sensitivity. These figures can be obtained from manufacturer's specifications. The next step is a simple matter of adding combined losses and subtracting them from power available.

Example:

You are designing a fiber-optic link of 30 km using a laser transmitter at 1,300 nm. Coupled power is 0.0 dBm, fiber loss is 0.5 dB/km at 1,300 nm, splice loss is 0.1 dB each and connector loss is 1 dB each. What is the system margin?

Laser power coupled	0.0 dBm
Fiber loss (30 km \times 0.5 dB/km)	15.0 dB
Splice loss (15 \times 0.1 dB)	1.5 dB
Connector loss (2 at 1 dB)	2.0 dB
Receiver sensitivity	-27.0 dBm
System margin	8.5 dB

Another approach would be to establish a desired margin and determine needed receiver sensitivity to obtain that margin.

Laser power coupled	0.0 dBm
Fiber loss	-15.0 dB
Splice loss	-1.5 dB
Connector loss	-2.0 dB
System margin	-10.0 dB
Required receiver sensitivity	-28.5 dBm



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KEEPING TRACK



Petersky

Paul Petersky was appointed marketing analyst for **Winegard Co.** Prior to this, he was marketing analyst for Adolph Coors Co. of Golden, Colo. Contact: 3000 Kirkwood St., P.O. Box 1007, Burlington, Iowa 52601-1007, (319) 753-0121.

Oak Industries elected **John Drum** to its board of directors. He is currently a consultant to the company. Contact: 16935 W. Bernardo Dr., Rancho Bernardo, Calif. 92127, (619) 485-9300.

At **Midwest CATV**, **Bill Dancy** was named product manager for the Matrix security box. Prior to this, he was a sales representative for the distributor's Southern region.

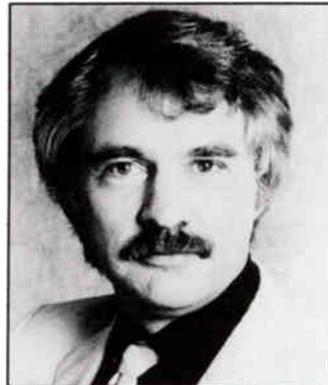
Sharon Jones was appointed assistant buyer. Previously she was product control supervisor for Aim Communications.

Jeff MacDonald was named sales representative for the Southern region. Previously he was a sales rep at Anixter/Tele-Wire.

Finally, **Richard Nensel** was named telemarketing sales rep for the Northeast region. He previously had sales-related positions with American Cablevision and TV Cable Supply Co. Contact: P.O. Box 271, Charleston, W. Va. 25321, (304) 343-8874.

John Goddard, president and CEO of Viacom Cable, was elected chairman of the board of directors of the **National Cable Television Association**. **Robert Miron**, president of Newhouse Broadcasting Corp., was elected board vice chairman. **Jerry Lindauer**, senior vice chairman of Prime Cable, was

elected secretary. **James Robins**, president of Cox Cable Communications, was elected treasurer. Contact: 1724 Massachusetts Ave., N.W., Washington, D.C. 20036, (202) 775-3550.



Bean

William Bean was appointed president of **Marconi Instruments**. Previously he was vice president and general manager of the company. Contact: 3 Pearl Ct., Allendale, N.J. 07401, (201) 934-9050.

Anixter Communications named **Ben Forrester** vice president of sales for the company's Lightguide systems. Before this, he was CATV Southeast regional manager.

David Asta was named director of product development for Anixter Manufacturing. He was previously national sales engineering manager.

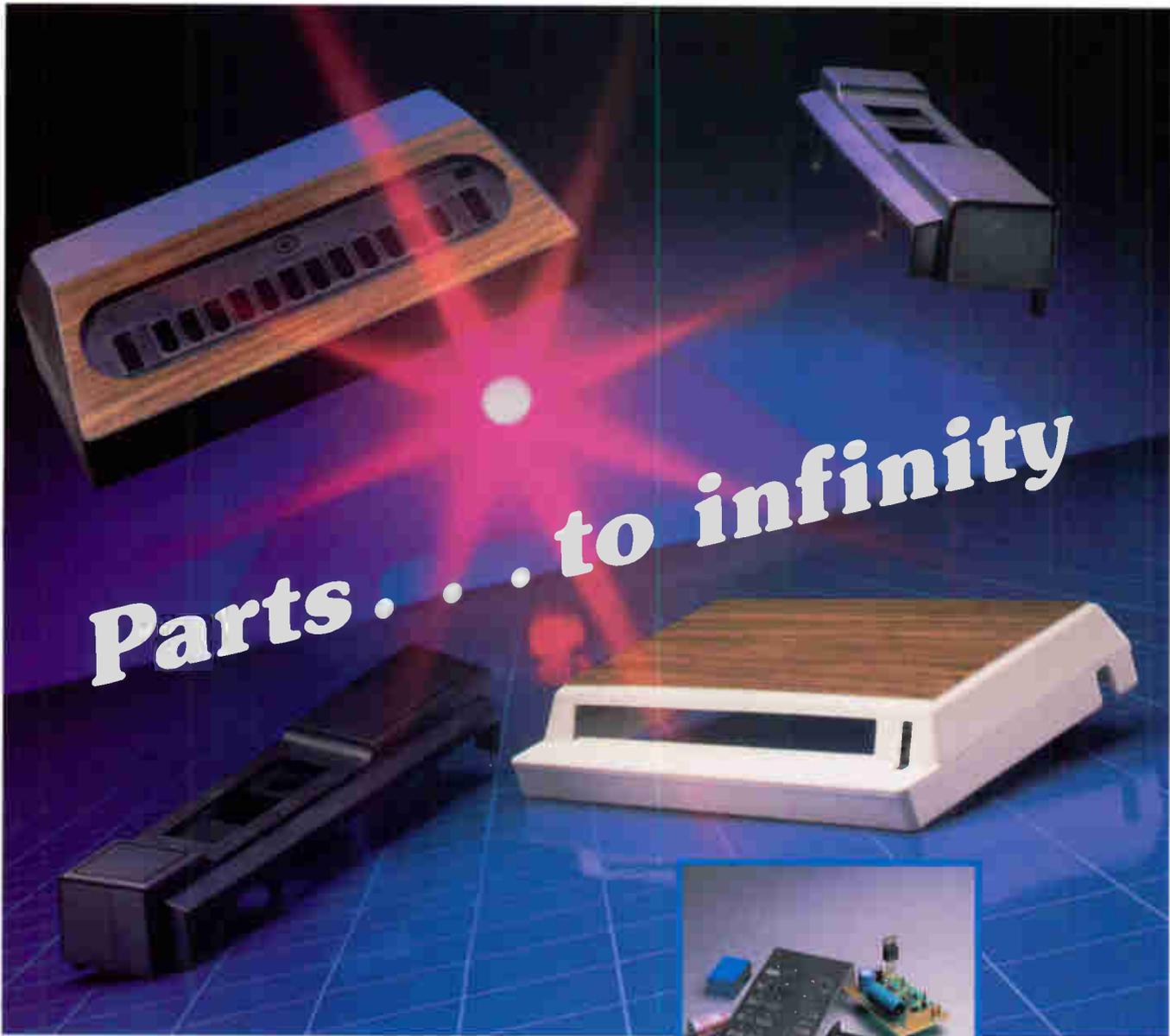
Finally, Anixter Communications appointed **Bob Santini** as Southeast region manager and **Pete Wagener** as Midwest region manager. Contact: 4711 Golf Rd., 1 Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

ComSonics named **Tom Jorgensen** manager of sales and marketing. Prior to this, he was senior marketing rep for Sperry Marine.

Also, **Gary Wilson** was appointed sales executive for the Midwest; **Cindy Tasker** was named sales executive for the Northeast. Contact: 1350 Port Republic Rd., P.O. Box 1106, Harrisonburg, Va. 22801, (703) 434-5965.

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June

June 13-15: Hughes Microwave technical training seminar on broadband AML equipment, Torrance, Calif. Contact (213) 517-6244.

June 13-15: New York State Cable Commission on Cable Television's Northeast Cable Television technical seminar on fiber optics, Roaring Brook Ranch, Lake George, N.Y. Contact Bob Levy, (518) 474-1324.

June 13-15: Maryland, Delaware and District of Columbia Cable Television Association spring meeting, Ocean City, Md. Contact Susan Hollis, (301) 268-2721.

June 13-16: Trellis Communications workshop on designing and installing fiber-optic networks, Trellis Training Center, Salem, N.H. Contact (603) 898-3434.

June 15: SCTE Midlands Cable Training Association seminar on transportation systems, Omaha, Neb. Contact Herb Dougall, (402) 330-2314.

June 16-19: SCTE Cable-Tec Expo, Hilton Hotel, San Francisco. Contact (215) 363-6888.

June 19-21: Oregon Cable Communications Association annual convention, Inn of the Seventh Mountain, Bend, Ore. Contact Mike Dewey, (503) 362-8838.

June 20-23: Siecor Corp. technical seminar on fiber-optic installation and splicing for LANs, building and campus applications, Hickory, N.C. Contact (704) 327-5539.

June 21-23: C-COR Electronics technical seminar, Minneapolis. Contact Shelley Parker, (800) 233-2267.

June 21-23: Online International's International ISDN Conference, Wembley Conference Centre, London. Contact 01-868-4466.

June 22: SCTE Great Lakes Chapter technical seminar. Contact Daniel Leith, (313) 549-8288.

June 22: SCTE Miss/Lou Chapter technical seminar on BCT/E Category II-Video and Audio Signals and Systems, Biloxi Beach Resort Motor Inn, Biloxi, Miss. Contact Rick Jubeck, (601) 992-3377.

June 24: SCTE Heart of America Chapter technical seminar. Contact Wendell Woody, (816) 474-4289.

June 28: SCTE Hudson Valley Chapter technical seminar on CLI, Holiday Inn, Kingston, N.Y. Contact Wayne Davis, (518) 587-7993; or Bob Price, (518) 382-8000.

June 28-July 1: Colorado Cable Television Association summer convention, Beaver Run Resort, Breckenridge, Colo. Contact Steve Durham, (303) 863-0084.

June 29: SCTE Delaware Valley Chapter technical seminar on CLI, leakage and FCC rule update, Williamson Restaurant, Horsham, Pa. Contact Diana Riley, (717) 764-1436.

June 29: SCTE Rocky Mountain Chapter technical seminar on CLI, fiber optics, microwave and coax, Beaver Run Resort, Breckenridge, Colo. Contact Steve Johnson, (303) 799-1200.

July

July 11-14: New England Show, Tara Hyannis, Cape Cod, Mass. Contact William Durand, (617) 843-3418.

July 14: SCTE Central California Meeting Group technical seminar

Planning ahead

July 11-14: New England Show, Tara Hyannis, Cape Cod, Mass.

Sept. 7-9: Eastern Show, Atlanta Merchandise Mart, Atlanta.

Sept. 27-29: Great Lakes Expo, Cobo Hall, Detroit.

Oct. 4-6: Atlantic Show, Convention Center, Atlantic City, N.J.

Oct. 18-20: Mid-America Show, Hyatt Regency, Kansas City, Mo.

on fiber-optics technology. Contact Andrew Valles, (209) 453-7791; or Dick Jackson, (209) 384-2626.

July 19-21: Florida Cable Television Association annual convention, Amelia Island Plantation Resort, Amelia Island, Fla. Contact Robert Brillante, (904) 681-1990.

July 25: SCTE Golden Gate Chapter technical seminar on safety programs. Contact Wayne Sheldon Sr., (408) 264-2728.

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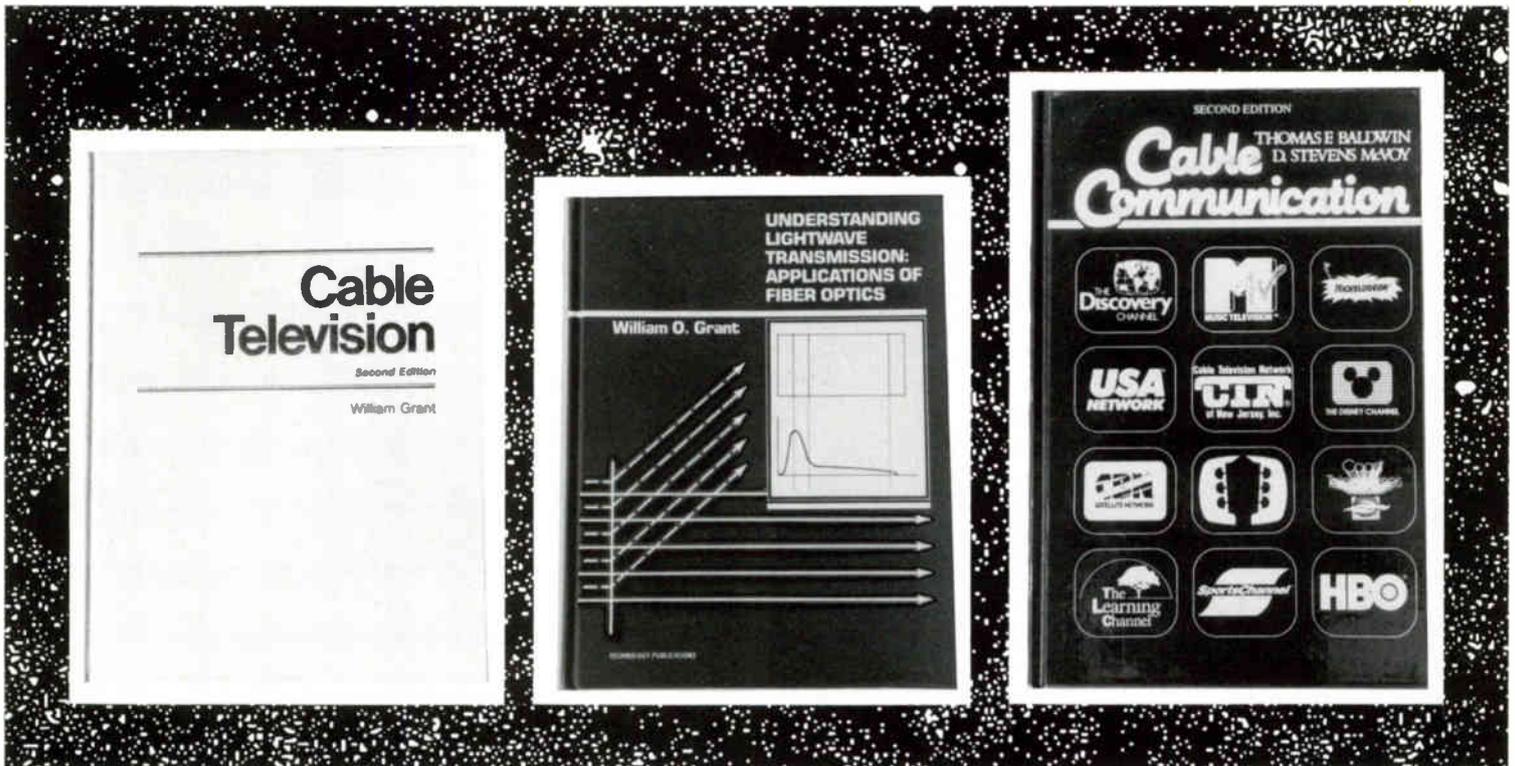
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Understanding Lightwave Transmission: Application of Fiber Optics by William Grant
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Cable Communications by Thomas F. Baldwin and D. Stevens McVoy
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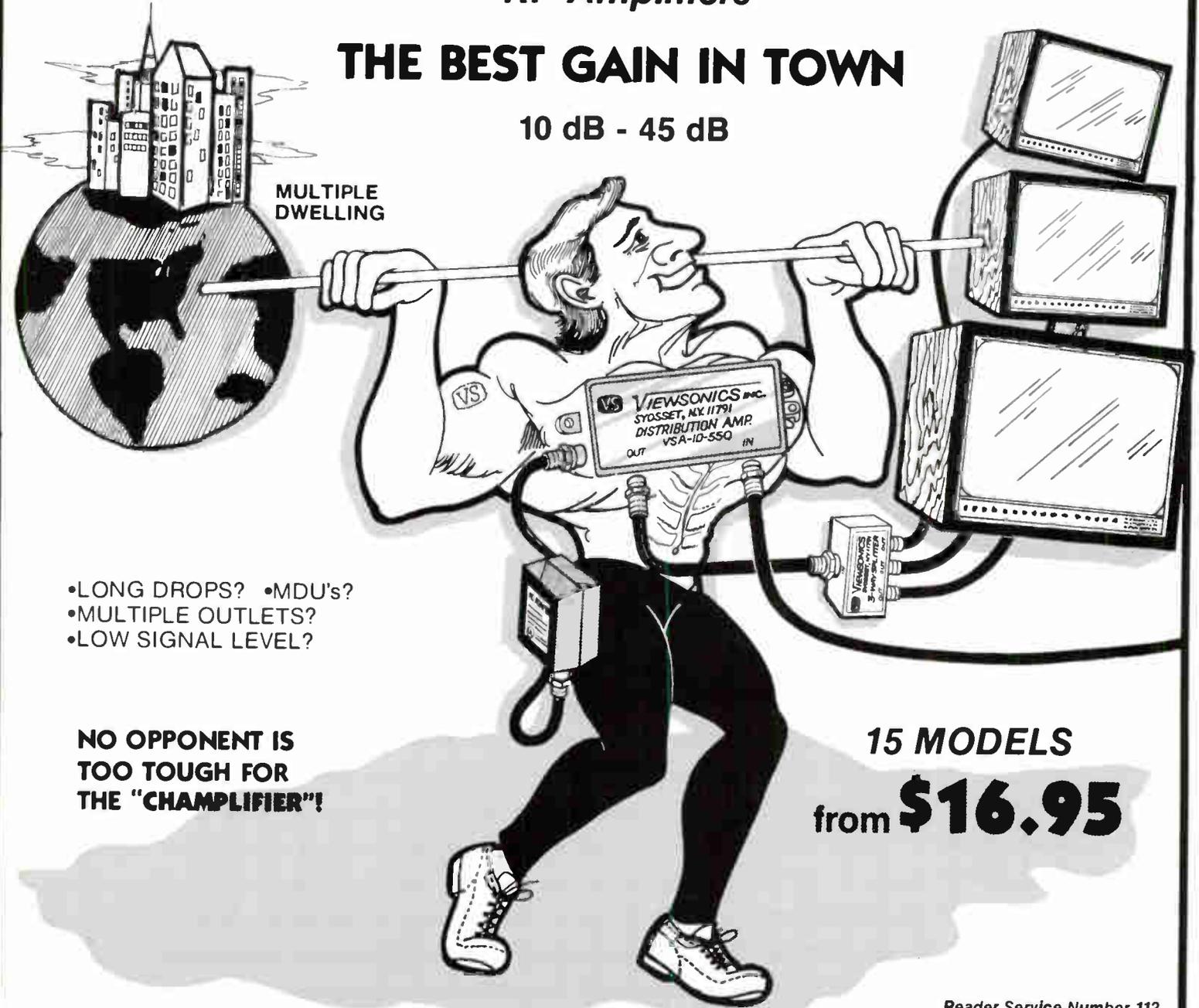
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CICIORA'S FORUM

Video digital downloading

By Walter S. Ciciora, Ph.D.

Vice President of Technology
American Television and Communications Corp.

Five years ago, when cable was flirting with a wide variety of new services and businesses and the personal computer was a new phenomenon, "software downloading" was one of the talked about hot topics. It seems to have gone the way of teletext and videotex. Recently, the digital downloading of video has been receiving attention. In particular, Mel Harris, president of television production at Paramount Pictures, referred to digital downloading as one of cable's future competitors. He warned cable to take this threat seriously.

There are two approaches to digital downloading. In one approach, the goal is to compress the video so its bandwidth is minimized, then it is speeded up for transmission. The hope is to download a two-hour movie in five minutes. The second approach reduces the video bandwidth adequately so it can be downloaded over ordinary twisted-pair phone lines during the night. If necessary, more than two hours for downloading would be acceptable.

While these concepts are theoretically possible, several daunting problems remain. The most important impediment to practical digital downloading of video into the consumer's home is the question: Download into what? At first thought, the ideal would be to download into the consumer's existing VCR. Penetration of VCRs has exceeded half of the TV households and even surpassed cable penetration. The number of homes with VCRs would form an attractive market for digital downloading.

However, the existing consumer VCR is not designed to serve as the device into which digital downloading of video can occur. In the case of the five-minute download if we are to deliver a two-hour movie, the speedup ratio is 24 times. The VCR head must rotate 24 times faster and the tape must fly by the head 24 times as fast. Also, if the recording is analog, the bandwidth is increased by 24 times to nearly 100 MHz. No consumer VCR exists that can do it. It is unlikely to be practical to accomplish this in any reasonable time frame. While digital techniques can be used to drastically reduce the transmission bandwidth from the 100 MHz resulting from the 24 times speedup, the existing VCR is designed to record and play back ordinary NTSC video. A wide bandwidth VCR that can record the compressed data directly for expansion into video at the time of playback can be designed. But this approach nullifies the most attractive aspect of the VCR, its present-day high penetration.

In the case of the phone line download, the consumer's VCR must be capable of recording one picture at a time while the next is downloaded over an expanded time period. Consumer VCRs simply don't do that yet; a special one would be required. This second type of VCR is much more

practical to consider building. Today's top-of-the-line VCRs have digital frame stores for freeze-action pictures. A rearrangement of the circuitry would allow the frame store to be loaded at the appropriate download speed and then transferred to tape. As long as the time the recording head spent on one spot of the tape was not so long as to cause excessive tape wear, this adaptation would work and even be practical. But the usual chicken-and-egg problem remains. The buildup of penetration of the special VCR would take years. Meanwhile, consumers have other attractive ways to obtain video. Can a business be built on such propositions? Likely not.

The usual assumption is that the consumer's home computer will provide the computational power to process the compressed signals into the form required for recording. There are several things wrong with this. First, the number of home PCs is a tiny fraction of the number of TV households. Further, they are mostly of the wrong kind, more suited to games and very limited in computing power, speed and memory. Second, those few computers with adequate specifications are almost always located far away from the TV viewing area. A dedicated consumer electronics product would be more efficient and cost-effective. It, too, does not exist.

In both downloading scenarios, the temptation will be to take a reduction of quality in order to make the time constraints more manageable. High-definition television (HDTV) is counter to these approaches because it greatly increases the amount of information that must be downloaded and challenges the consumer to expect high quality. Next month's discussion on the Paperback Movie will provide a partial answer to the question of video quality compromise.

In the case of the phone line download, planning for an overnight downloading is simply not in keeping with the American desire for instant gratification. It is not impulse pay-per-view.

The recordable videodisc

Expensive, recordable and even erasable videodiscs are now available for data and business applications. As is the case with many new technologies, the commercial applications will pay for the development and cost reduction. After a period of a few more years, the first consumer and entertainment applications can be expected. When the penetration of consumer recordable discs grows, video digital downloading may finally become practical. The mechanics of spinning a disc 24 times faster is a lot more reasonable than threading tape past a rotating head at high speed. Likewise, modulating a laser at 24 times higher bandwidth is more palatable than trying to drive inductive recording coils at 100 MHz. Digital downloading of video is not impossible in the future. It is almost certainly impossible with the existing base of highly penetrated VCRs.

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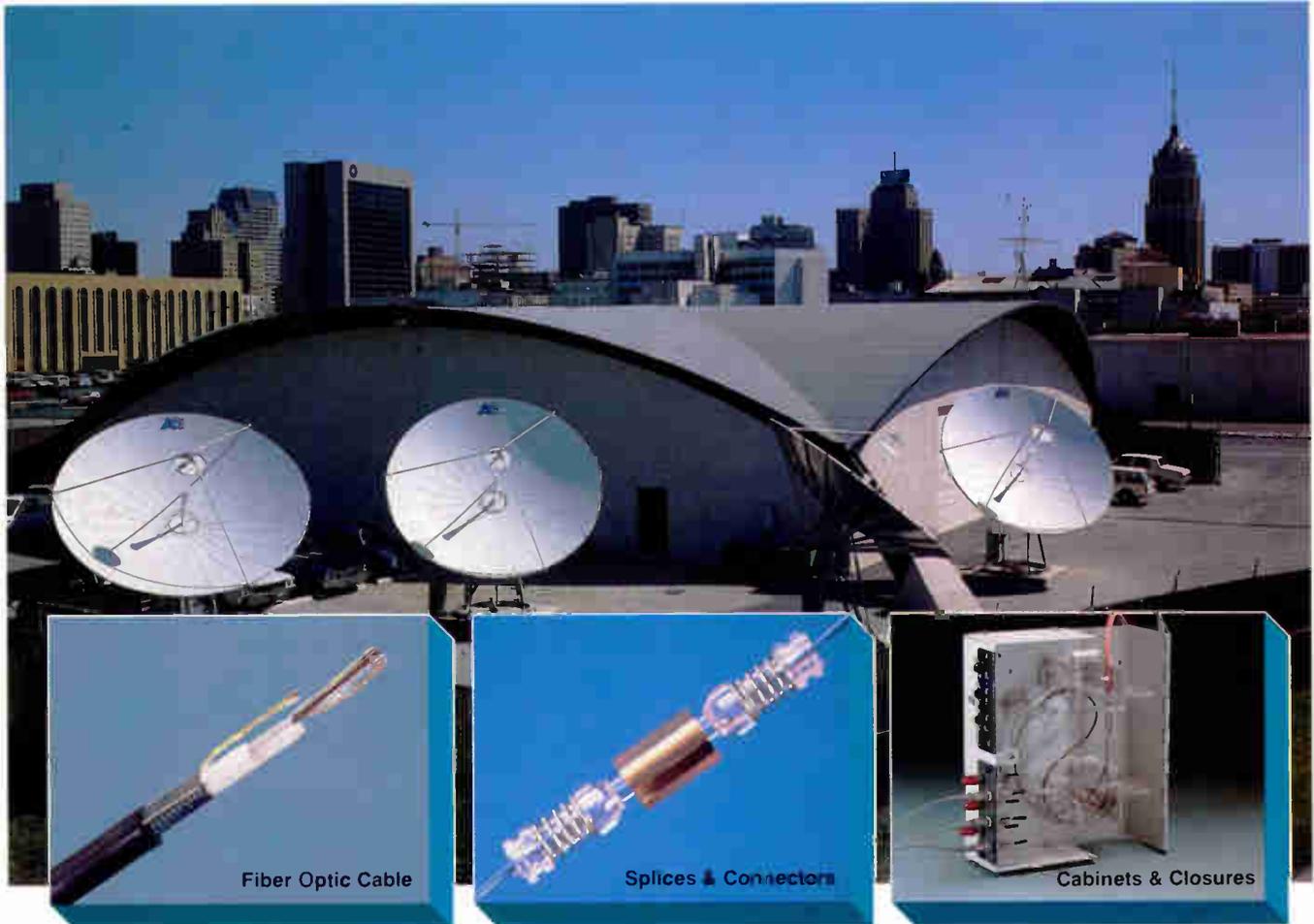
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