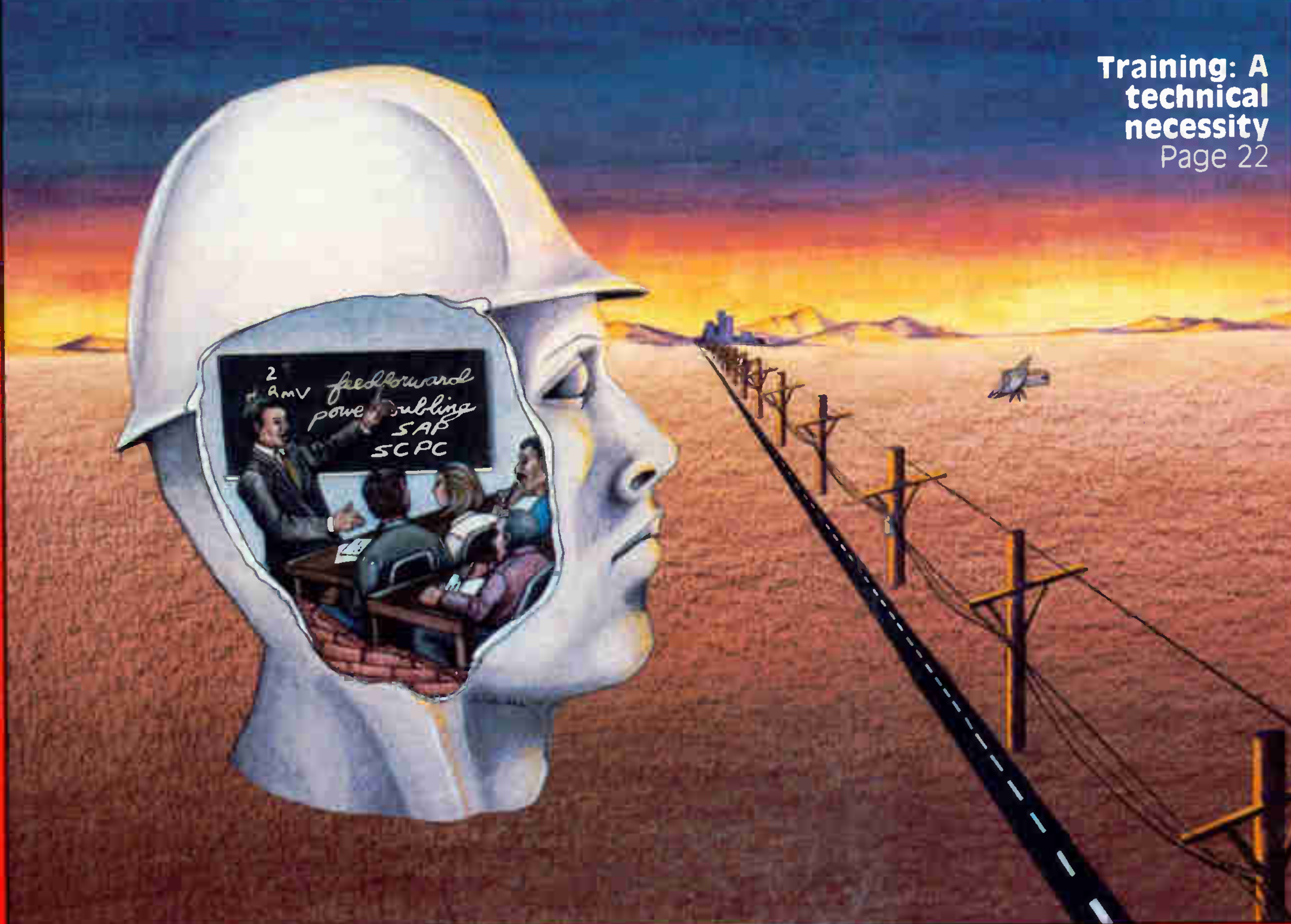
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers



Training: A technical necessity
Page 22

Fiberoptic supertrunking
Page 54

December 1984

for broadband network interface...

ZETA OFFERS THE INDUSTRY'S MOST COMPREHENSIVE FAMILY OF FREQUENCY AGILE MODEMS FOR COAXIAL CABLE DATA COMMUNICATIONS!

Model ZR7 rack mount with Z19 modems installed. Model ZP7 plug-in power supply also available.

MODEL	Z19	Z56	ZT1
DATA RATE	19.2 KBPS	56 KBPS	1.544 MBPS
INTERFACE	RS-232C	RS-232C/RS-449/V. 35	DS1
SUBCHANNEL SPACING	50 KHz	150 KHz	1 MHz

ZETA's series of RF data modems are designed to provide point to point and multidrop data communications over broadband coaxial cable networks. ZETA modems are fully transparent to any data format or protocol. Superior spectral efficiency offers increased data circuit density within available cable bandwidth. Horizontal desk top and vertical rack mount configurations are offered.

FEATURES:
- Switch Selectable Subchannels
- Error Free (10^{-9} BER or better)
- Synchronous or Asynchronous
- Frequency Coverage to 500 MHz
- Spectrally Efficient
- Flexible Channel Pairing
- Internal Diagnostics

Model Z19. 19.2 KBPS Modem with 120 switch-selectable subchannels.

ZETA, a leader in RF and microwave products since 1968, offers standard or custom configurations to suit your needs. Stock to 45 day availability. Call or write, today.

ZETA LABORATORIES, INC.
A SUBSIDIARY OF CCT
3265 Scott Blvd., Santa Clara, California 95054
(408) 727-6001 TWX 910-338-7336

Future Friendly.

No matter what technology is unfolded next, two things are for certain.

One, your customers will want it.

And two, this system will welcome it.

That's right. This is the Z-TAC® addressable system from Zenith. Built with the future in mind.

As you may already know, we designed the Zenith Z-TAC system to be VCR friendly, with a remote control that allows your customers to preprogram their Z-TAC and VCR to record multiple programs on different channels. But that's only the beginning.

We've really designed Z-TAC for the future. With features like our Redi-Plug™ option which allows you to tap into advanced technologies for tomorrow's customer services like TV stereo, two-way, and teletext. So you won't have to worry about replacement for a very long time.

You can't find a more solid investment. Because no matter what the future brings, you know the Z-TAC system will keep paying you back.

After all, it's the only system that has earned the Zenith name.

For more information contact Zenith CATV Sales, 1000 Milwaukee Ave., Glenview, IL 60025, (312) 699-2110.

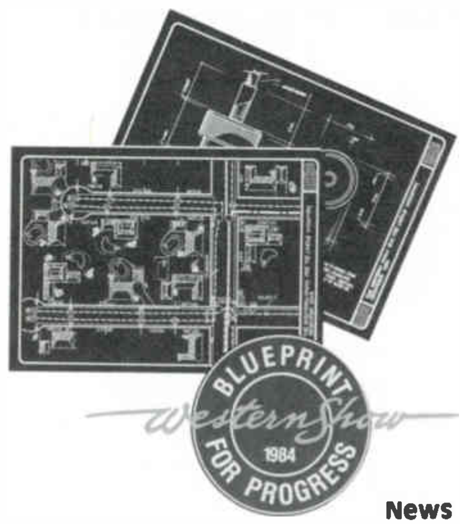
ZENITH | cable products

THE QUALITY GOES IN BEFORE THE NAME GOES ON.®

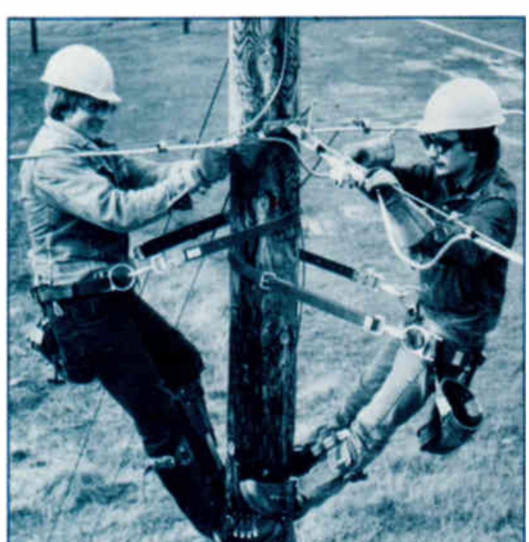
CONTENTS

Departments

Fiberoptics 72



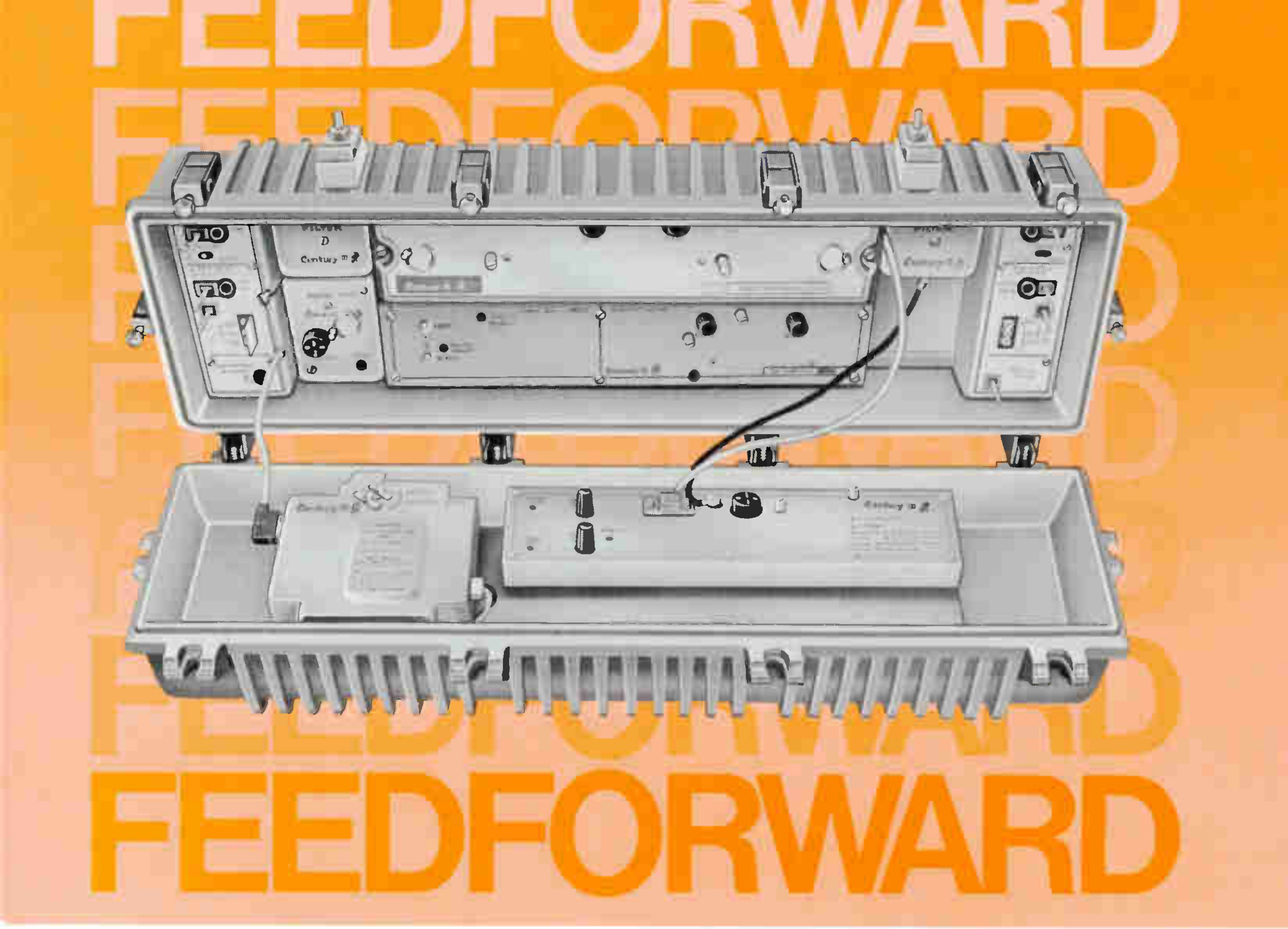
News 10



Training 32

Features

 Communications Technology is published monthly by Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112 — or — P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023. December 1984, Volume 1, Number 10.



ONLY JERROLD CENTURY III HAS IT FOR YOU NOW!

There's been a great deal of talk and many promises made in the industry lately about Feedforward technology. But, despite all of that "noise," the simple fact remains that only the Jerrold Century III Division is delivering state-of-the-art Feedforward technology today.

When Century III joined the Jerrold group of divisions, its Feedforward amplifiers were operating successfully over thousands of miles of cable systems. Customers had already saved millions. The amplifiers and savings were real, not just talk or promises.

Right now our Feedforward is economically providing greater capability and improved system performance as demonstrated in numerous system applications of newbuild, rebuild, and upgrade. You maintain high levels with less distortion, eliminating the cost of hubs, and significantly reducing plant maintenance.

Add to this the flexibility afforded by our modular construction, which accommodates virtually any need within a system and you begin to appreciate how easy upgrading will be in the future.

But don't lose sight of the present and today's truths: Only Century III Feedforward technology is backed by nearly a decade of field experience; only the Jerrold Century III Division is delivering state-of-the-art Feedforward technology today.

For Feedforward now, let our engineering team put together the right proposal for your needs.

Call 1-800-523-6678, (in PA 1-800-562-6965) or write General Instrument Corporation, Jerrold Century III Division, 2200 Byberry Road, Hatboro, PA 19040.

JERROLD
Century III Feedforward

MATCHING YOUR NEEDS • RIGHT TO THE BOTTOM LINE

GENERAL INSTRUMENT

See us at the Western Show booth #335.

EDITOR'S LETTER

Successful undertakings

The 1984 Atlantic Show held recently in Atlantic City, N.J., was one of the most successful regional shows to date. Business was brisk as MSO personnel with purchasing authority did just that—signed new orders for equipment at the show. Most of the vendors I spoke to were extremely pleased with the orders written. Interestingly, construction service companies had more than their hands full (especially with the on-set of winter months).

While the show was pretty much devoid of the glamour and hoopla of the National and Western shows, it was successful in the number of exhibitors (162), attendance (2,305) and the quality of the technical sessions.

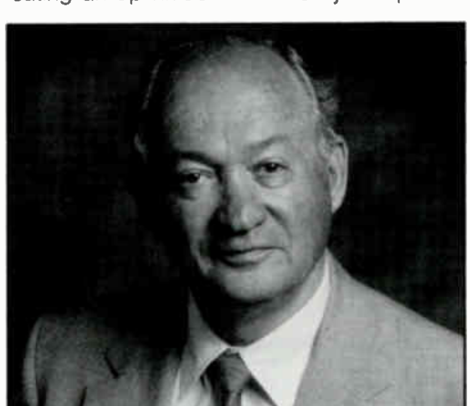
Technical highlights

For the third consecutive year, the Society of Cable Television Engineers has coordinated the technical program for the Atlantic Show. John Kurpinski, SCTE director-at-large, headed the committee that coordinated eight sessions covering such topics as headend maintenance, feedforward equipment, system design and addressability. Hats off to Kurpinski for a terrific job!

Of particular interest was a session on 2 degree satellite spacing that featured an announcement by Harry Purlow of Domesticom. It seems Domesticom experienced the effects of reduced satellite spacing first-hand the day before by receiving a report of interference to a satellite 1½ degrees adjacent to the target bird while uplinking its signal.

Bill Riker, formerly with the NCTA and currently executive vice president of the SCTE, reviewed the FCC's actions and the NCTA's fillings that led to the commission's decision. Riker also warned that the commission may consider the reduction of satellite spacing to less than 2 degrees in order to accommodate future applications for slots in the geostationary arc.

Manhattan Cable's Robert Tenten discussed his company's engineering feat in locating an uplink/downlink facility compatible



Blonder

with 2 degree spacing in the heart of New York City.

On the whole, the technical sessions were well attended and the attendees found them to be well structured and informative.

The SCTE also organizes the technical programs for a number of other regional shows (including the Western Show) and plans to direct additional effort toward future sessions by coordinating the programs to include important technical issues presented nationwide.

Welcome aboard

We at *Communications Technology* are very honored to feature two monthly columnists starting in January. Isaac "Ike" Blonder, cofounder and chairman of the board of Blonder-Tongue Laboratories Inc., will be presenting his viewpoints on a variety of controversial subjects. Blonder is a colorful character well-known in the cable industry. Keep an eye out for "Blonder's View" as he tackles the FCC in January.

Our other new columnist is Mike Holland, vice president of Macom Industries/OEM Enterprises. Holland will be writing the "Tech Tips" monthly column. This column, however, still will be an open forum for engineers in the field with different approaches and ideas. We at *CT* believe that both Blonder and Holland will make substantial contributions to the telecommunications industry.

Congratulations also are in order for *CT*'s editorial assistant, Peyton Koeppel. Koeppel attended, and successfully completed, an intensive three-day basic cable course given at the ATC National Training Center. Even with the excellent tutelage of ATC's Chief Instructor Bill Williams (who incidently has an article on training in this issue), it is doubtful that Koeppel will become an ace pole-climber, but then, she doesn't need to climb a pole to know what it is.

Toni I. Barnett

POWER KING™
Proven Dependability!
Standby and AC Regulated Power Supplies

RMS ELECTRONICS, INC., CATV DIVISION: 50 Antin Place, Bronx, New York, 10462
Toll Free: (800) 223-8312 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands) (212) 892-1000 (Call Collect, New York State Only)
WESTERN OPERATIONS: 2901 W. Garry Ave., Santa Ana, Ca., 92704 • TEL.: (714) 662-1041
Toll Free: (800) 247-8435 (Cal. Only) Toll Free: (800) 624-2511 (Continental U.S.A., Puerto Rico, U.S. Virgin Is., Alaska, Hawaii)

See us at the Western Show booth #1075.

COMMUNICATIONS TECHNOLOGY

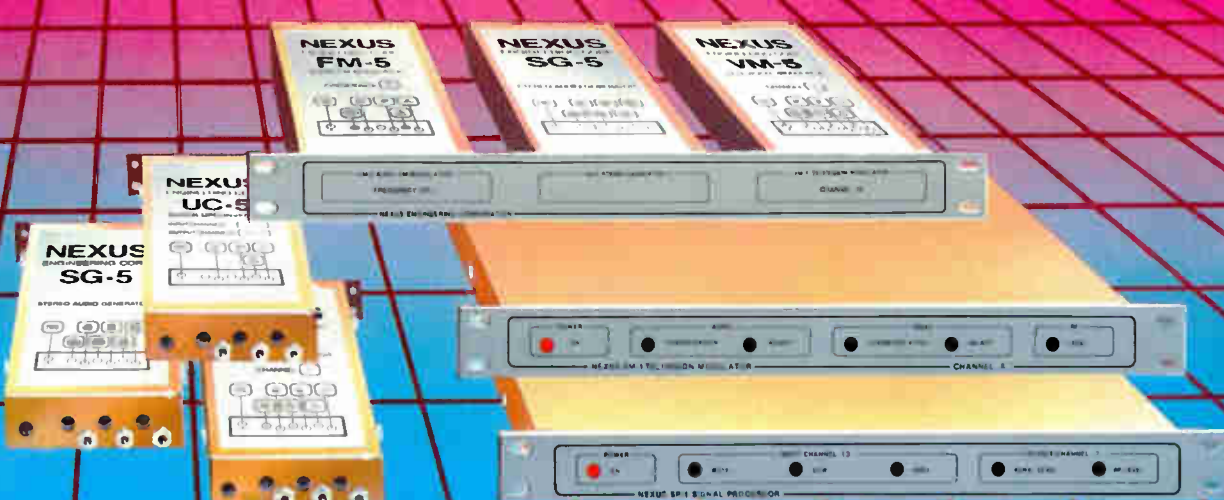
Official trade journal of the Society of Cable Television Engineers

Denver: Communications Technology Publications Corp. 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112—or—P.O. Box 3208, Englewood, Colo. 80155 (303) 792-0023 **New York:** 1641 Third Ave., Suite 2K East, New York, N.Y. 10128 (212) 599-0209

BPA membership applied for November 1984.

PRICE
PERFORMANCE
QUALITY
RELIABILITY
PACKAGING
DELIVERY

NEXUS
BRINGS IT ALL TOGETHER.



Nexus builds solutions for all your cable system problems. The Series-1 line of television modulators and off-air signal processors deliver the ultimate in headend performance, features and flexibility. The compact Series-5 line of modulators, upconverters and channel processors are ideally suited to those smaller systems where price and reliability are key requirements. Our audio products allow you to offer the popular stereo simulcast and other subcarrier services to your subscribers. Nexus never compromises on quality, reliability, or price.

For more information call: (206) 644-2371; or write: NEXUS ENGINEERING CORP., 4181 McConnell Drive, Burnaby, B.C., Canada V5A 3J7

NEXUS
ENGINEERING CORP.

PERFORMANCE YOU CAN SEE.

See us at the Western Show booth #190.

Western Show offers 'blueprint' for cable's future

OAKLAND, Calif.—"Blueprint for Progress" is the theme of the California Cable Television Association's 16th annual Western Cable Show (Dec. 5-7). Approximately 9,000 persons are expected to attend the convention, which will feature industry related panels as well as special programs on the implementation of the nation's new national telecommunications policy.

"We've tried to emphasize panels that deal with specific issues facing our maturing industry," said Richard Maul, director of marketing and corporate planning for Western Communications Inc., who serves as the Western Show chairman.

Maul said the seminars include all facets of day-to-day system management: "Regardless of whether people are in operations, marketing or engineering, they'll be getting concrete help."

The opening panel Wednesday, Dec. 5 at 1:00 p.m., will offer a strategic overview of the industry by Neil Austrian, chairman and CEO of Showtime Inc.; Jack Clifford, president of Colony Communications; Mel Harris, president of Paramount Video; and Jim Mooney, president of the National Cable Television Association. Sandy Freeman, host of *The Freeman Report* on Cable News Network, will serve as press reactor during the session.

Said CCTA Chairman Gary Hokenson, "This has been a critical legislative year for our industry. The Western Show will be a timely forum on how decisions made in Washington impact the individual cable operator." Hokenson is vice president and general manager of the southwestern region for Cox Cable.

Over 215 companies have secured approximately 138,000 square feet of exhibition floor space to promote the latest developments in programming services and cable equipment technology. This year, the exhibition area has been relocated in the southwest wing of the Anaheim Convention Center.

The Western Show technical sessions, organized for the CCTA under the Society of Cable Television Engineers' banner, will be held all day Thursday, Dec. 6. The program committee responsible for putting together the tech agenda included Pete Petrovich of Viacom Cable, who is president of the SCTE Golden Gate Chapter, Bill Riker, SCTE executive vice president; and Bob Vogel of Raychem Corp., SCTE Region 1 director.

Western Show agenda

Tuesday, Dec. 4
Preconvention activities begin; preregistrant may pick up registration packets at the Anaheim Convention Center from 3-6 p.m. Hospitality suites and entertainment begin tonight.

Wednesday, Dec. 5
8 a.m.—Registration opens
9 a.m.-6 p.m.—Exhibits open
1-2:30 p.m.—Welcome address and keynote panel
2:45-4 p.m.—Breakout sessions

Thursday, Dec. 6
8 a.m.—Registration opens
8:30 a.m.-5 p.m.—All day technical sessions
9 a.m.-6 p.m.—Exhibits open
9-10:15 a.m.—Breakout sessions
10:30-11:45 a.m.—Breakout sessions
12:45-2:15 p.m.—Luncheon
2:30-4 p.m.—Breakout sessions
Evening—Hospitality suites and entertainment

Friday, Dec. 7
8 a.m.—Registration opens
9 a.m.-3 p.m.—Exhibits open
9-10:15 a.m.—Breakout sessions
10:30-11:45 a.m.—Breakout sessions
12:45-2:15 p.m.—Luncheon
2:30-4 p.m.—General session
6 p.m.—Cocktails
7 p.m.—Annual banquet and entertainment

Tech agenda—Thursday, Dec. 6, Orange County Room

8:30-8:40 a.m.—Welcome to engineers and technicians

James Emerson
President
SCTE

8:45-10:30 a.m.—Broadband engineering issues
Moderator: Jim Stilwell, president, Teleresources

- *Cable interface with consumer devices*
  Walter Ciciora, vice president-research & development, ATC
- *NCTA update*
  Wendell Bailey, vice president-science & technology, NCTA
- *Cable isolators*
  Dr. Raymond Capek, director-ceramic technology, Zenith
- *FCC report*
  John Wong, supervisory engineer, Cable Television Branch, Mass Media Bureau, FCC

10:30-10:45 a.m.—Break

10:45 a.m.-12:30 p.m.—The final connection
Moderator: Steve Ross, chief, Cable Television Branch, Mass Media Bureau, FCC

- *Off premises—off or on?*
  W. Sherwood Campbell, director, communications systems, ATC; Larry Brown, manager of engineering, Pioneer; Nancy Kowalski, product planner, General Instrument
- New technology:
  Stereo television compatibility
  William Riker, Executive Vice President, SCTE
  Scrambling implementation
  Paul Heimbach, director of technology group, HBO

12:30-2:30 p.m.—Lunch

2:30-3:45 p.m.—Rebuilds
Moderator: Milan "Pete" Petrovich, engineering manager, Viacom Cable

- *Cable system design re-considerations*
  Harold Katz, vice president, broadband communications, Stern Telecommunications
- *Rebuilds: The operator's perspective*
  Robert Forde, plant manager, Oroville, Calif., Viacom Cablevision
- *Single-mode fiberoptic supertrunks*
  Robert Leroux, Pirelli Cable

3:45-4 p.m.—Break

4-5 p.m.—Advertising insertion equipment roundtable
Moderator: Bill Schweizer, regional sales manager, Western CATV Distributors
Panelists: Richard Eidson, vice president, commercial cable, TV Watch; Bill Killion, president, Channelmatic Inc.; Roger Strawbridge, project director, Adams-Russell; Jack Yearwood, vice president, Bay Area Interconnect

A Complete CATV System Sweep

Just $5385

The Texscan 9552 T/R system provides the CATV operator with a high level system sweep that is easy to use, precise in performance and very affordable. The 9552 T/R System makes gain and slope alignment quick and simple.

The 9552 Transmitter generates a fast rate sweep signal that is present in any given TV channel for a period of less than one horizontal line, minimizing subscriber interference and allowing system sweep work during subscriber programming. The transmitter output level is nominally 20db above program carries, providing a receiver display representing actual system response.

The 9552 Receiver is synchronized to the transmitter and incorporates logarithmic display, making on-screen measurement of response-level variations quick and simple. Non-stored or stored display modes are selectable. A variable marker makes frequency identification quick and simple too. The 9552 is portable, with internal battery power. A latched, sealing cover with power interlock protects the control panel during storage.

9552 Receiver

Sensitivity	+8dBmV = 0dB Display
Display Range	1dB/DIV or 2dB/DIV
Flatness	± 0.3 dB
Power	Internal rechargeable battery-12 VDC (Charger converter included)
Dimensions	8.5" H x 14" W x 14.6" D

9552 Transmitter

Frequency Range	4-450
Sweep Width	100-200-450 MHz
RF Output	+60 dBmV
Sweep Interval	2, 4, of 8 Secs, or external trigger
Tilt Range	8 dB
Power	115 VAC, 50-60 Hz, 20 Watts
Dimensions	1.75" H x 19" W x 12" D, Rackmount

Texscan CORPORATION

Texscan Instruments
3169 North Shadeland Avenue
Indianapolis, IN 46226
(317) 545-4196

See us at the Western Show booth #635.

Belden/CPD develops SCATscan tester

GENEVA, Ill.—Belden/CPD has developed the SCATscan tester for shielded cable assemblies. This device measures cable assembly shield performance on a production basis.

The SCATscan is capable of testing subminiature D connectors with 9, 15, 25, 37 and 50 pins. It also can be utilized to test DIN, modular and other styles of shielded cable assemblies. The SCATscan tests the connector shield and the interfaces between the connector shell and the cable shield for RF leakage. This RF measurement technique is based on International Electro-Technical Commission recommendations. The results are correlated to performance measurement on an open field antenna test site. Repeatability is ±3 dB.

Prior to development of the SCATscan, RF shield test procedures were considered incompatible with a production environment. Typical RF shield test procedures involve shielded rooms, sophisticated test equipment, highly trained technical personnel and slow turn-around time. In contrast, the criteria for successful production line shield testing include fast turnaround time, go/no-go decision capability, low cost and operation by production line personnel.

According to Belden/CPD, it is the only manufacturer to have this capability on the production line.

Infotron equipment helped tie together AT&T's Olympic messaging system.

Infotron equipment aids AT&T Olympic effort

CHERRY HILL, N.J.—Infotron Systems' 168 network concentrators made it possible for AT&T to design and construct its critically acclaimed electronic messaging system (EMS) at the Summer Olympics.

The EMS linked together 2,000 terminals and printers scattered over 4,500 square miles of Southern California. More than 90,000 athletes, officials and reporters used the system to retrieve information and exchange electronic messages.

Infotron's network concentrators saved Olympic organizers a lot of money—about $9 million in facilities, engineering, installation and usage charges, according to the company. The messaging system is an example of what multiplexing equipment can do to cut costs and improve efficiency in an information network.

The EMS required 174 lines to accommodate 2,000 devices and handle an average of 180,000 transactions a day. Using a statistical multiplexing algorithm that permits overbooking of the digital links, the concentrators enabled up to 44 terminals to operate on a single link instead of the 11 terminals that would be running without the special algorithm. And through the integrated network management features of the multiplexers, the entire network was operated from a central control room located several miles from the AT&T Computer Center.

NCTA call for tech papers

WASHINGTON—The National Cable Television Association has issued a call for technical papers and speakers for the association's 34th annual convention and exposition. The convention is scheduled for June 2-5, 1985, at the Las Vegas (Nev.) Convention Center.

Outlines and summaries are invited on any communications engineering topic of interest to the cable television community. Only noncommercial, original (not previously published) proposed papers of significant reference value will be selected.

Abstracts of approximately 250 words should be submitted by Jan. 4 to: Wendell Bailey, Vice President of Science and Technology, NCTA, 1724 Massachusetts Ave. N.W., Washington, D.C. 20036.

C-COR's earnings, move and new distributor

STATE COLLEGE, Pa.—C-COR Electronics Inc. recently made three announcements. Sales for its first quarter ended Sept. 30, 1984, were $6,894,000 compared to $3,894,000 for the same quarter last year. Net income for the first quarter of fiscal 1985 was $202,000 compared to $300,000 for last year's first quarter. Earnings per share for the first quarter of fiscal 1985 were 7 cents compared to 9 cents for the same quarter last year.

C-COR's second announcement concerned the move of its data products research and development operation in Oregon. The 10,000 square-foot Oregon Graduate Center in Beaverton will serve as the new facility.

Also, C-COR has selected Comlink Systems Inc. to be its Canadian distributor. Products to be sold by Comlink include conventional and feedforward amplifiers with status monitoring as an option, mainline passives, power supplies and other equipment for cable television distribution systems.

SCTE firms up plans for multichannel TV sound seminar

PLEASANTON, Calif.—Are you ready? Virtually every television set manufacturer will be heavily promoting stereo television sets for Christmas this year. The networks are gearing up for full-scale stereo production; already several stations are broadcasting in stereo. Tests conducted by the NCTA and others have shown serious potential problems for cable operators who attempt to carry this new programming without adequate preparation. Stereo television may represent your most serious technical challenge this year.

In January, the SCTE will assemble a distinguished panel of industry professionals to give *you* the information needed to deal with this new format. Topics will include:

- Potential technical problems of television stereo sound
- Actual field tests and experiences of other operators
- Status of FCC must-carry ruling on multi-channel sound
- Scrambling system compatibility issues
- Headend and microwave equipment compatibility issues
- Alternate technologies for providing stereo sound

The seminar will be held at the Sheraton Hotel, Concord, Calif. (415-825-7700), Jan. 22-23, 1985. Registration is $150 for SCTE members, $195 for non-members (paid in advance), which includes lunches and cocktail reception. For more information, contact Pete Petrovich (415-828-8510) or Dave Large (408-998-7333); or write to Society of Cable Television Engineers, P.O. Box 455, Pleasanton, Calif. 94566.

Anixter named materials manager for PSN

SKOKIE, Ill.—Anixter Communications has been named a national materials manager for Private Satellite Network Inc., which provides direct satellite broadcast communications to the commercial marketplace.

With this decision, Anixter is responsible for management of materials necessary for installation of PSN systems at the customer sites. This role includes warehousing through Anixter's nationwide network of on-line, computer-linked distribution centers, and delivery to PSN's local installers for installation anywhere in the country. These materials include earth station antennas, electronic receiving packages and various types of ancillary hardware.

The search for excellence

By Thomas Gimbel
Professional Engineer, Comcast Corp

At the beginning of a budget year, we plan a preventive maintenance program and make allocations of people and supplies to support a comprehensive project. But, during the year as "demand maintenance" problems such as service calls, system outages and employee vacation time put pressure on the work schedule, preventive maintenance falls in priority. Many times signal leakage testing is the only part of the program completed on a disciplined basis. We are too often pulled into the day to day repair and activities that we ignore those preventive activities that would reduce the demand load and improve subscriber service.

Prevent what

In a print shop recently I saw a sign the proprietor had posted on the wall. The sign read:

A Tribute to My Competitors

My competitors do more for me than my friends. My friends are too polite to point out my weaknesses, but my competitors go to great expense to advertise them. My competitors are efficient, diligent, attentive and would take my business away from me if they could. They keep me alert and make me search for ways to improve my products and services. If I had no competitors I would be lazy, incompetent, inattentive. I need the discipline they enforce upon me. I salute my competitors. They have been good to me. God bless them all!

That sign focused for me what is wrong with the cable business. We have no direct competition in town. Our customers politely go away if service is lacking. We have no competitor to highlight our faults, delineate our weak areas and show comparable sales figures quantifying the amount of business that they have taken away.

The airlines and the fast food companies have it easy because their industry is highly competitive. The network broadcast engineer also has it easy. He has two other networks in town that keep his attention well concentrated; and you can bet the broadcast engineer does preventive maintenance. I have not seen one of the Philadelphia network stations go down in the last 20 years.

Strive for perfection

The recently published book, *In Search of Excellence*, was the first business book to ever reach the top of the best-seller list. The authors tried to discover what makes the best of the highly competitive companies successful. The most consistent answer was service to the customer. There were many different stories that described how large companies, such as IBM, mobilized their thousands of employees to provide customer service, including a description of how McDonald's operates thousands of restaurants with consistently good service.

We in the cable industry must do what IBM and McDonald's did not have to do. That is, we must strive for excellence without the aid of a clear competitor to give us incentive and course correction. Our direction must come from within, we must drive ourselves.

How to do it

Start by orienting yourself toward the customer. Contact with the customer is the most important thing that is going to happen to you during the day. Look, feel and act concerned about their problems. Fix the problem. Don't try to talk the customer into accepting things the way they are. Don't you accept things the way they are, if there is a problem. Become a fanatic about service calls and outages.

Keep track of what goes wrong. Look at your service calls, outage reports and equipment repair invoices. Say out loud to yourself and to those around you, "What can I do to prevent this from happening?"

Break your operation into "chunks." The headend is a chunk. What can you check periodically to make sure nothing is going wrong? Inspect all brackets, down leads, bolts, fittings, standby equipment. Measure and record all output levels. Make a list of these PM checks.

Check the chart every Friday to make sure you are maintaining the schedule. Take another chunk, distribution plant. What are its check points; power supplies, distortions and signal levels?

Electronic failures should be anticipated. Plan ahead for minimum downtime, use standby equipment and redundancy whenever possible. Locate or move equipment to places that are protected from vehicular traffic. If certain components are constant problems make a change.

Do "what if" analysis. Think about each component or link in your system and ask "what if" it failed. Are the spares standing by? Is there an alternate route to restore service? Does everyone know what to do, whom to call?

Success in the cable business will require caring for the customer. Excellence will require a preventive maintenance program. Commit yourself to excellence. Stimulate the rest of your organization to expect perfection. Send a copy of this article to your boss and in place of a competitor, challenge each other.

Cable installs:

Expertise based on 12 years and 3,000,000 connections.

If installs have you feeling snake-bit, our Installation Services Division is the solution. We're setting the pace in both residential and multiple dwelling unit installations. All of our crews and field supervisors must prove themselves capable *and* courteous on every job—or they don't go out. We also handle special projects (like audits, rebuilds, regrounding, converter changeouts and upgrades), and we specialize in MDU construction. Cable installs? No problem!

Converter repairs:

Warranty-authorized by the industry's leading manufacturers.

RTK's Converter Services Division is the answer when converter repairs are eating your profits. We're showing the industry how repairs should be done. Our technicians check and re-check every component—not just those with obvious problems—so your subscriber gets back a unit that's as good as new. We stock parts and supplies for all models, and back our work with the most comprehensive guarantee in the business. Converter repairs? No problem!

Cable construction:

We build better cable systems—from the ground, up.

RTK's Communications Construction Division takes the hardhat pains out of the *entire* project. We handle site planning, electronics design, surveys and strand-mapping, make-ready, cable and materials purchasing, aerial and underground construction, debugging, and maintenance for the life of the system. We can design a system and provide full or modified turnkey construction to the most exacting specifications. Cable construction? No problem!

RTK™ **The cable industry's problem solvers.™**

RT/KATEK COMMUNICATIONS GROUP

Installation Services Division 201/678-2083 □ **Converter Services Division** 800/441-1334 Toll Free (In PA, 717/534-1161) □ **Communications Construction Division** 215/269-1946

Planning saves time = $$$

By Doug Adams
Group Engineer, Tele-Communications Inc

How to provide effective, comprehensive maintenance and do it *economically*, is a dilemma that chief technicians have faced for years. Establishing realistic and economical maintenance procedures, and how to best schedule man hours to be spent on those procedures need careful consideration.

The service call is probably the largest man-hour consumer in a system. If one of your personnel told you that he or she was going to do 260 more calls next year, you probably would assume it would involve overtime. But if, in fact, this could be done with no additional time spent on the job then you probably would at least listen to what they had to say. Presuming that an average service call takes 20 minutes and that a person did one additional call per day for 52 weeks you would get your 260 additional calls. How could this happen? If that person spends 20 minutes per day sorting and routing their own calls and you eliminate this task, then you have your one additional service call per day. Planning, sorting, analyzing location, all of these factors can enhance the performance of the field personnel.

Preventive maintenance can play a big part in any economizing effort and can pay for itself in minimizing service problems down the road. In many cases less time is spent here than in any other category of maintenance. Anything we do that either prevents or reduces the impact of a problem could be considered preventive maintenance. Many systems perform monthly end-of-line readings. After these readings are recorded they are filed and never looked at again. In a system where signal level readings, signal-to-noise, hum modulation and radiation readings are taken regularly, and these readings are evaluated on a monthly basis, changes from the previous month indicate potential problems and thus the problems can be resolved before they become a source of additional labor requirement and monies. The potential problems can then be dealt with on a non-emergency basis.

For systems that use standby power supplies, routine inspection and servicing of batteries can save many man hours spent on outages that normally would have been prevented if the batteries had been serviced and inspected.

Consolidating operations

It seems that in many cases we spend large amounts of time doing routine maintenance. We go through and set levels, fix broken lashing wires, do pole change outs, sweep amplifiers, etc. More often than not all of the projects are done one at a time. If we could consolidate some of the operations we may be visiting a location only once rather than two or more times.

In general it seems that we are all guilty of spending most of our time putting out fires or even worse, treating symptoms rather than causes. If you feel that you are in that position, put on the brakes. Evaluate your problems and see if you can consolidate some of your tasks.

Another area that can yield good dividends is the training of customer service personnel to impart TV set and converter compatibility information to the subscriber. Knowledgeable subscribers contribute directly to service cost reduction.

Every system operation has a certain degree of uniqueness. Each must be analyzed, therefore, on an individual basis and proper plans and procedures established to maximize the job performance of system personnel and the technical performance of the system. Remember the five "Ps"—Proper Planning Prevents Poor Performance. And poor performance affects the bottom line.

EAGLE

TRAPS

ONLY EAGLE KEEPS MAKING THEM BETTER!
NOW AVAILABLE . . . SIX POLE TRAPS TO IMPROVE REJECTION ON BAND EDGES OF MULTI-CHANNEL TRAPS.

Only Eagle Traps have their main bodies totally protected by double neoprene gasketing.

Only Eagle Traps are completely sealed around their pins by a special hot-melt process.

Only Eagle Traps are 100% foam-filled.

UNRETOUCHED PHOTOGRAPHS

Eagle Trap Quality starts inside. Every Trap is completely sealed for superior moisture resistance. Our extensive sealing techniques and 100% filling of all interior cavities insures stability over broad temperature ranges. That's why Eagle Traps are virtually fail-safe in preventing signal drift.

Install Eagle Traps to safeguard existing scrambling methods. Our Traps can be used at high and super band frequencies, as well as low and mid band.

To meet your system's requirements, Eagle Traps are available in 3, 4 and 6 pole configurations for maximum economy and effectiveness.

Some companies can make Traps cheaper. . . only Eagle makes them better!

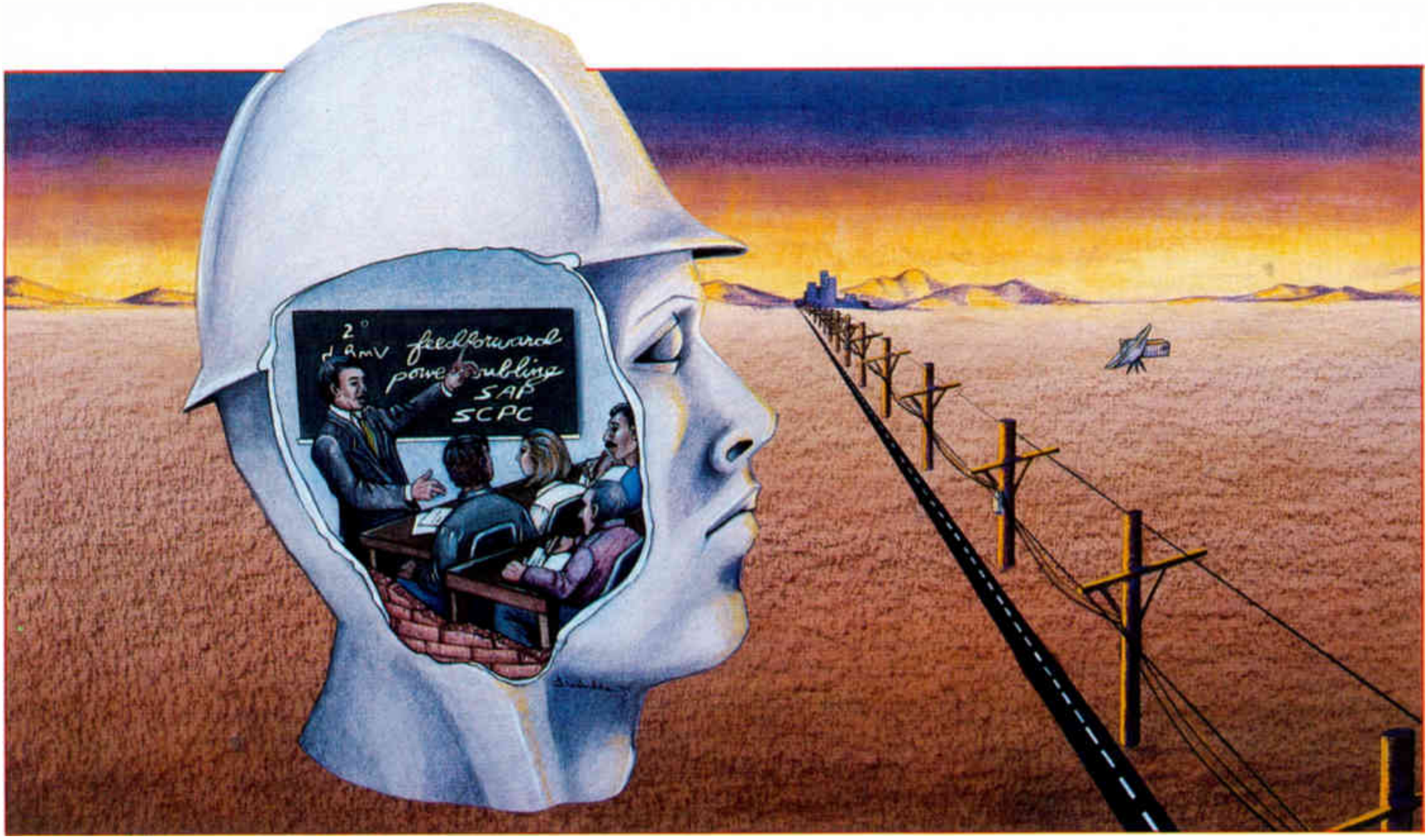
A Secure Investment for System Profitability

OTHER EAGLE QUALITY PRODUCTS. . .
Converters, Addressable Descramblers, Programmable Descramblers, Splitters, Traps, Decoding Filters, Video Amplitude Controllers, Band Pass Filters, Channel Dropper for Batch Descrambling

EAGLE COMTRONICS, INC.
4562 Waterhouse Road, Clay, New York 13041
TO ORDER, CALL TOLL-FREE: 800-448-7474
In New York, call 315-622-3402/In Canada, call Deskin Sales, 416-475-1412
In Europe, call Electro Service, Brussels, Belgium, 011-32-15-209575

EAGLE
COMTRONICS INC.

NEW!



Setting up a technical training program

American Television and Communications has prepared this guide to training program management. It is designed to make the time allocated for the educational process more productive and efficient, leaving more time for the primary responsibility—providing good cable service to the customers.

By Bill Williams
Chief Instructor National Training Center
American Television and Communications Corp

The turnover of personnel in the cable industry, especially at the lower level, is higher than just about any other. The technical demand on our technicians and engineers is greater than ever before and increases daily. This means that everyone is constantly in a state of teaching or learning or both. One way to lessen the burden is through an effective training program. Figure 1 shows the overall plan for developing a program.

The training program should stress, but not be limited to the following goals: competence of personnel in their current assignments; preparation for promotion and added responsibility; technical self-sufficiency at the system level; development, knowledge and experience in related technical assignments; and adequate training in matters relating to safety in all work areas.

For any program to be successful, someone has to be responsible for its management. Usually this assignment of responsibility is in addition to a person's primary duties; and therefore, needs to be well organized and supported to facilitate the program's management.

Keeping a list of items that will be suitable subject matter for a training program will be a valuable aid in developing the long-range training schedule. Make sure references are given or time will be wasted trying to obtain them. There are many sources from which subject matter may be received. Some of these sources are:

- Management
- Engineering
- Governmental agencies
- Technical publications
- Corporate directives
- Work supervisors

Subject matter *priority* of training should be the responsibility of the supervisor in the area involved or the chief technician. The designated in-house technical training coordinator (herein known as training coordinator), however, is charged with the final schedule preparation based upon *all* inputs. Setting a priority on subject is an important responsibility. A lesson prepared and delivered in *August* on "How to do underground installs" when underground installs began in *June* is probably a waste of everyone's time.

Coordinator responsibilities

For the training coordinator, it is best to plan ahead on a quarterly basis. This gives others involved in training a chance to get prepared and the training coordinator time to supervise progress. Making out the schedule should be accomplished, based upon inputs previously discussed, and any continuing type training that is to be given, such as safety practices and procedures, advancement training or basic courses in electronics theory. Selecting the best time and date for each lesson will be simplified, if you consider subject matter, attendees, work schedules, priorities and supervisors'/attendees' desires.

The most helpful input is the latter for obvious reasons. The subject matter will be the primary dictate as to the length of a lesson. Complicated subjects or ones that require the student to redevelop an old skill or develop a new one may demand more than one lesson. Some other useful inputs for lesson length are:

- Student preparation
- Type of lesson
- Importance
- Instructor's ability

One of the more difficult tasks a training coordinator will have is the selection of the instructor to prepare and deliver the lesson. One must not make an assignment that is beyond the capability of the individual. People like to talk about things with which they are familiar or in which they have an interest. If the subject matter deals with a new procedure or concept, the person with the most experience or background should be assigned to prepare the lesson. Some of the characteristics you should look for in the selection of instructors are:

- Willingness to accept
- Knowledge of subject matter
- Personality

The 1985 Tech Almanac

Communications Technology's
Complete Equipment Buyer's Guide

TAPIN® Clip

ITW Linx™ INSTALLER PRODUCTS
ILLINOIS TOOL WORKS INC.
195 ALGONQUIN ROAD
DES PLAINES, IL 60016

Attn: Greg Hayward

The 1985 Tech Almanac

Communications Technology's
Complete Equipment Buyer's Guide

Special pre-publication price $450 plus postage
($550 after publication plus postage)
Quarterly updates $65/qtr. plus postage
Special rates for volume purchases

We honor MasterCard ______ Visa ______
PLEASE NOTE: Expiration date ______
Account # (all digits) [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Signature ______

To order *The 1985 Tech Almanac* or for more information, call COLLECT 0-303-792-0023 or 0-303-792-0024

Company name ______
Contact ______
Address ______
City ______
State ______ Zip ______
Telephone (   ) ______
Number of copies ______

Please make checks payable to:
Communications Technology Publications Corp.
P.O. Box 3208
Englewood, CO 80155

CT 12/84

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 127 DES PLAINES, IL
POSTAGE WILL BE PAID BY ADDRESSEE

TAPIN® Clip

ITW Linx™ INSTALLER PRODUCTS
ILLINOIS TOOL WORKS INC.
195 ALGONQUIN ROAD
DES PLAINES, IL 60016

Attn: Greg Hayward

NEW TAPIN® CLIP ATTACHES COAX CABLE TO CONCRETE!

- **NO NEED TO DRILL HOLES.** Two tempered steel pins easily penetrate poured concrete, cinder blocks, mortar, bricks, hardwood floors and attach coax cable.
- **ROUTE CABLE AS YOU INSTALL.**
- **8 SIZES**—to fit all coax cable.

Please send me more information about TAPIN® CLIP

Name____________________

Company____________________

Address____________________

City__________ State______ Zip______

Telephone____________________

CT 12/84

TAPIN® Clip

ITW Linx™ INSTALLER PRODUCTS
ILLINOIS TOOL WORKS INC.
195 ALGONQUIN ROAD
DES PLAINES, IL 60016
Attn: Greg Hayward

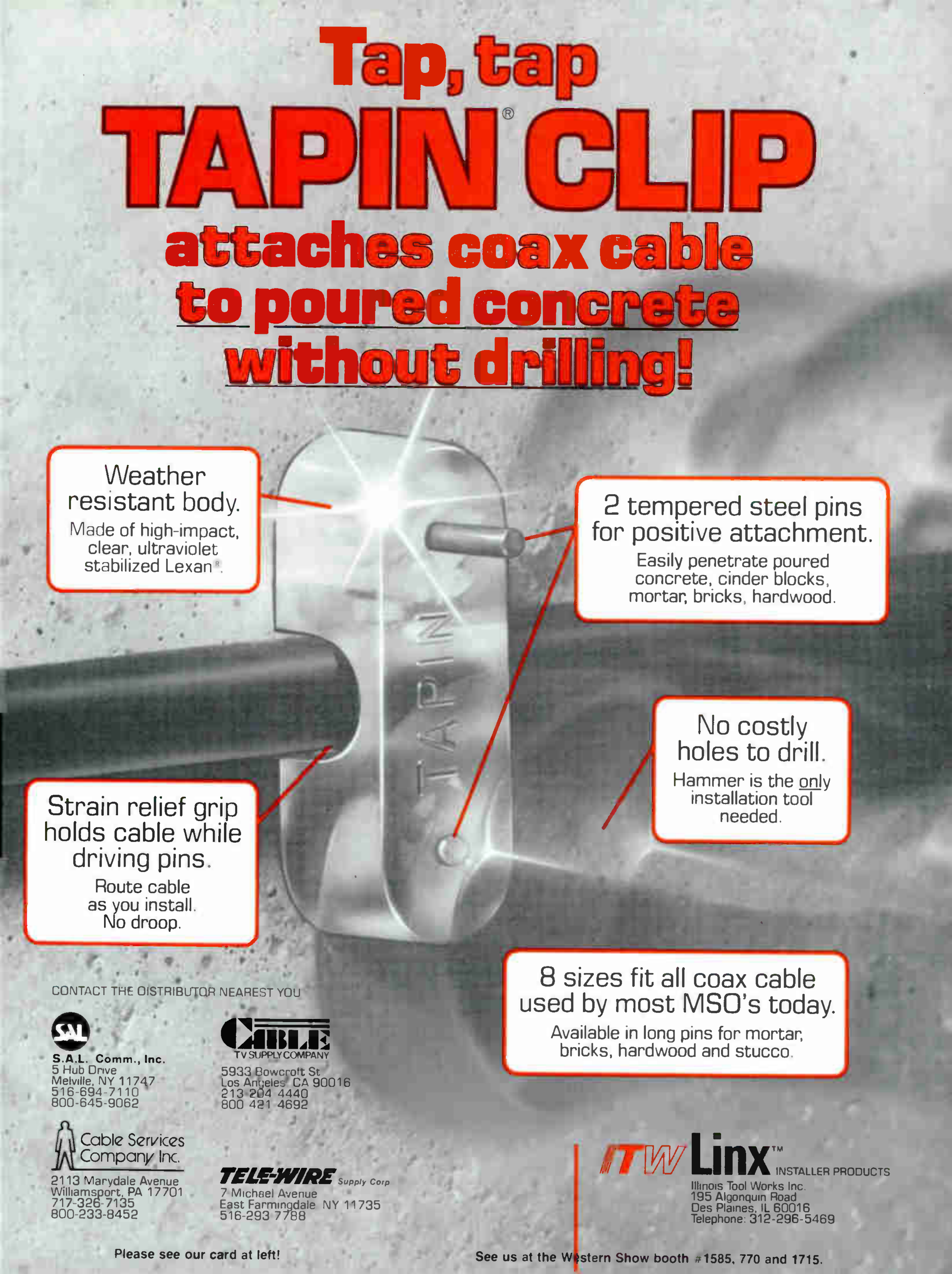
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 1571 ENGLEWOOD, CO

POSTAGE WILL BE PAID BY ADDRESSEE

COMMUNICATIONS TECHNOLOGY
7600 E. Arapahoe Rd., Suite 305
Englewood, Colorado 80112-9989

The 1985 Tech Almanac
Communications Technology's Complete Equipment Buyer's Guide


Tap, tap
TAPIN® CLIP
attaches coax cable
to poured concrete
without drilling!
Weather resistant body.
Made of high-impact, clear, ultraviolet stabilized Lexan®.
2 tempered steel pins for positive attachment.
Easily penetrate poured concrete, cinder blocks, mortar, bricks, hardwood.
TAPIN
No costly holes to drill.
Hammer is the only installation tool needed.
Strain relief grip holds cable while driving pins.
Route cable as you install. No droop.
8 sizes fit all coax cable used by most MSO's today.
Available in long pins for mortar, bricks, hardwood and stucco.
CONTACT THE DISTRIBUTOR NEAREST YOU
SAL
S.A.L. Comm., Inc.
5 Hub Drive
Melville, NY 11747
516-694-7110
800-645-9062
CABLE
TV SUPPLY COMPANY
5933 Bowcroft St
Los Angeles CA 90016
213 204 4440
800 421 4692
Cable Services Company Inc.
2113 Marydale Avenue
Williamsport, PA 17701
717-326-7135
800-233-8452
TELE-WIRE Supply Corp
7 Michael Avenue
East Farmingdale NY 11735
516-293 7788
ITW Linx™ INSTALLER PRODUCTS
Illinois Tool Works Inc.
195 Algonquin Road
Des Plaines, IL 60016
Telephone: 312-296-5469
Please see our card at left!
See us at the Western Show booth #1585, 770 and 1715.

- Ability to communicate ideas
- Interest and concern

Availability of the instructor also is very important. If the prospective instructor has all the characteristics above, it would be wise to juggle the schedule to fit him/her in. *Good* instructors are hard to come by.

Record keeping is a must for several reasons. One of the most important is a proof that instruction has been given to employees on matters dealing with safety. It also provides documentation on the amount of training an employee has obtained toward advancement. An individual employee record of training can be used most effectively for this purpose.

The teaching process

Before sitting down and making out a lesson plan, be sure the subject matter is understood thoroughly. This may require some brushing up on details. Doing this also builds confidence and makes it easier to prepare the lesson.

Just as important, is knowing how people learn. People learn at different rates with varying degrees of efficiency and comprehension. The ability to learn can be improved just as knowledge and skill can be acquired.There are five senses—sight, hearing, touch, smell and taste—through which we learn; each used to a varying degree depending upon the subject to be learned. In planning a lesson, the more of our senses we involve in the presentation, the more we enhance the learning process. An individual will learn faster by seeing *and* hearing than by hearing alone. So, if the subject matter will allow, *show* it, *tell* it and *do* it.

Every lesson must have an objective or a goal. Many books have been published on writing learning objectives or goals; however, a good example will set you on the path to writing your own. Simply stated, the objective tells you "where you are going" and the lesson plan "guides you there."

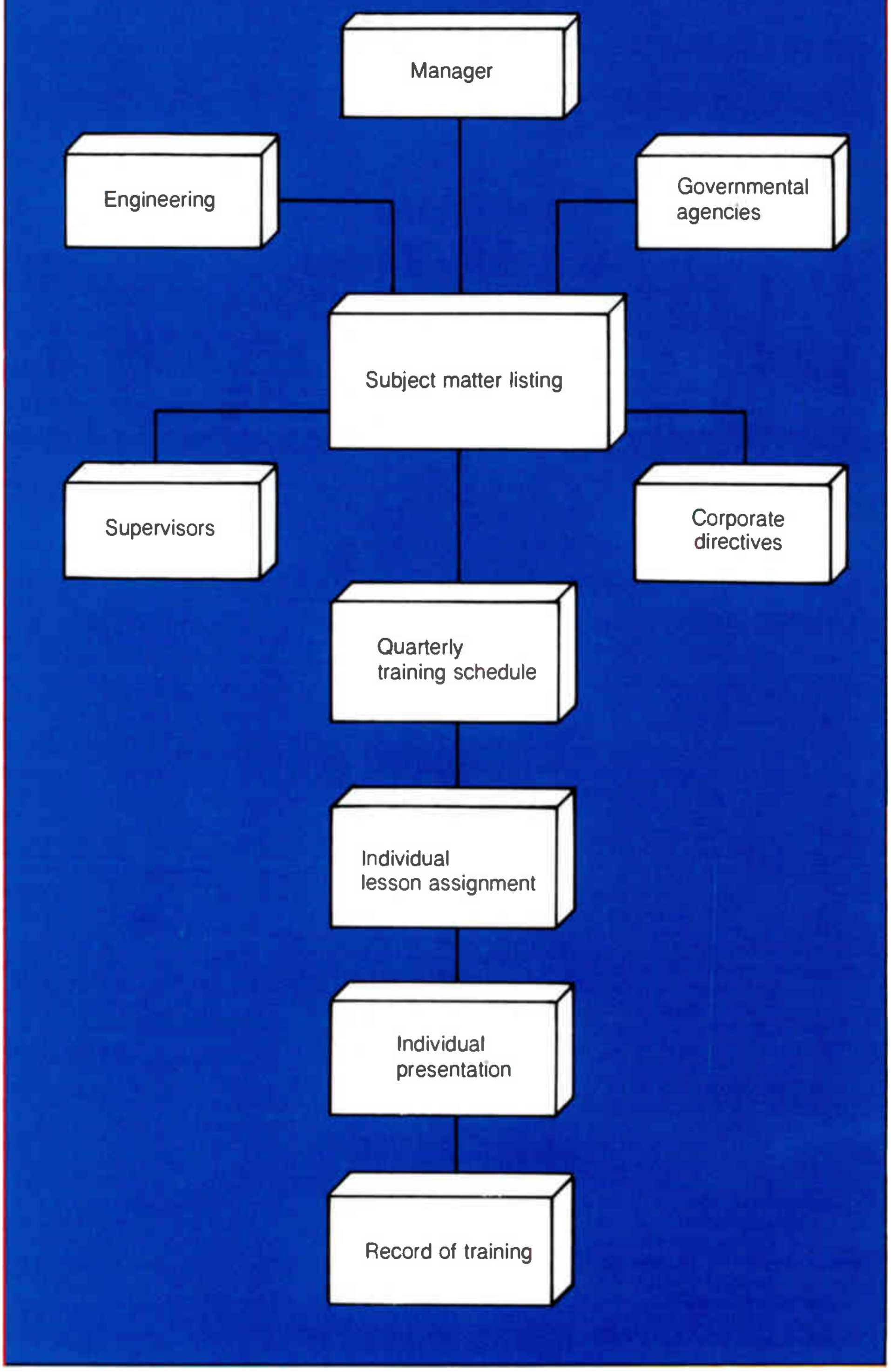
A well written objective should include or imply performance, conditions and standards. To illustrate their use, let us assume that we desire to teach a group of new installers how to climb a 20-foot telephone pole. A well written objective for this lesson would be:

> Upon completion of this lesson, the student will be able to climb to the top of a 20-foot telephone pole, wearing approved climbing equipment in a snowstorm in 4 minutes or less. The "performance" here is naturally to climb to the top of a 20-foot telephone pole. The "condition" under which the installer must perform is in a snowstorm (used to emphasize condition), wearing approved climbing equipment. Finally, the "standard" that is stated here is "in 4 minutes or less."

In this next example, the performance required is mental rather than physical:

> Upon completion of this lesson, the student will be able to calculate the resonant frequency of a bridged "T" oscillator using an electronic calculator or slide rule to an accuracy of ± 5 Hz.

Figure 1: Technical training program development plan

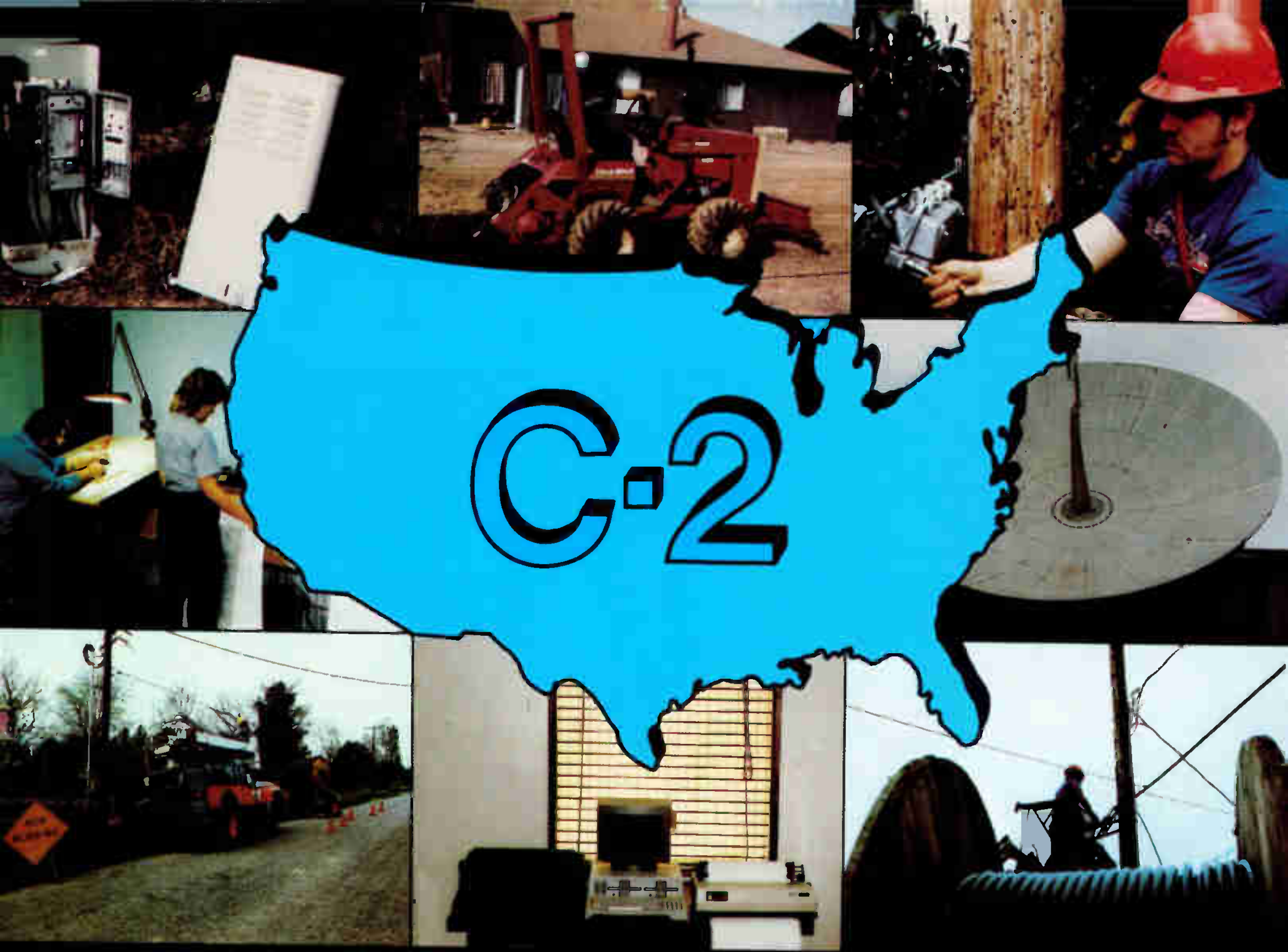


Writing good lesson objectives will require some practice. However, a well written objective leaves no doubt about what the student *must* learn.

Methods and tests

Knowing the subject matter and objective is only part of the process. The way you are going to "get the message across" to the student is just as important. Of the many methods that could be used, three are recommended: lecture, demonstration and discussion. A combination lecture/demonstration-type lesson is preferred. (It's the most effective for both the instructor and the student.)

Instructional aids are the tools of the teaching trade. They will increase the effectiveness and ease the process of learning. When used properly, they can spark an otherwise dull


C-2

lesson into a pleasant learning experience. The important thing is to make the best use of what you have available. Instructional aids include: chalkboards, textbooks/reference books, periodicals, charts, filmstrips and video tapes. The most frequently used aid is the chalkboard. It allows the instructor to put into the lesson, both sight and hearing senses. Chalkboards are usually available in every system. If not, one should be purchased.

Charts are another good instructional aid. The instructor usually will have to make them up, but it is worth the effort. You can simply use a large size poster board to illustrate a complete electrical circuit, to list items for an install, to show production figures or any of a thousand different things. The other items listed are useful, but may not be available. In which case, the aids just discussed should do the job.

The instructor may stimulate the desire of the student to learn by relating the lesson to a known fact, past experience or model. These are just a few of the techniques good instructors use to get the student's attention. Student motivation to learn is the responsibility of the instructor and should be given serious thought in the preparation of the lesson.

The preparation and use of a lesson plan is to make sure your lesson is complete. It will guide you through the lesson, tell you what has to be covered, what the objectives are, what technique or statement will motivate, and contain a list of materials required to teach the lesson. Assemble the materials, follow the plan, and you are sure to meet the lesson objectives.

If the lesson is of a demonstration type, then "show and tell." The instructor should ask questions to encourage the student to think about the job performed. As well, the instructor should show the learner "how" to do the job safely and efficiently. When the instructor is convinced the student understands the lesson, it is time to apply what has been taught. The instructor should supervise the efforts of the student to perform the job, making any suggestions and guiding the student through the steps in a relaxed manner. This will give the student confidence and prepare him/her for the *test*.

The only way an instructor has of knowing if the student has learned the lesson is through a performance evaluation. The evaluation can take one of several forms:

- Written exam
- Oral exam
- Observation (on-the-job performance)
- Inspection of finished product

To evaluate a student who is learning how to splice cable, it would be correct to inspect the end product of the student's efforts based upon the lesson goal. If the lesson required, as its objective, only the *recognition* of different size cables, evaluation may take the form of a written or oral exam. In any case, the instructor must use some means of evaluation to determine if the student has learned.

The end result...

For a training program to be effective, goals must be established and used as a guide for all training. The responsibility for the overall operation of a successful training program must be assigned to one person. This person should oversee the entire program and assign lessons to individual instructors for preparation and delivery.

The teaching process is an organized process that involves the instructor as well as the student. Each must be prepared for learning to take place. The instructor should have a thorough knowledge of the subject matter and be prepared to teach. The student, in turn, must be ready to learn if learning is going to take place. The proper use of instructional aids will enhance the learning process and create interest to the student. Establishing lesson goals and teaching toward fulfillment of these goals makes student evaluation meaningful. The type evaluation used will depend on the type lesson that was taught. The end result is that the instructor has *taught* and the student has *learned*.

Now when you install CATV converters, you can install Panasonic® reliability.

When you install the new Panasonic CATV converters for your cable customers, they'll be getting far more than the reliability they've come to expect from Panasonic.

Take our TZ-PC110 with full-function infra-red remote control. It includes subscriber-oriented features such as 15-channel memory to make tuning easier, two-speed up/down scan tuning for quick search and a built-in holding bay for the remote when not in use. Even an optional parental guidance key so your customers can control the channels children watch.

When remote control isn't yet a customer priority, there's the "remote ready" TZ-PC100. And it accepts our optional remote control unit at any time, since no field retrofit is needed.

So now there is no reason to give your customers just any CATV converter. Give them the performance and reliability of Panasonic.

For more information, call Panasonic at (201) 392-4109 or contact one of these Panasonic CATV distributors.

Cable TV Supply Company
1-800-527-6482

S.A.L. Communications
1-800-645-9062

Panasonic
Industrial Company

'Believing that training programs are a cure for operational problems is like believing that Kleenex is a cure for the flu'

Training: A different perspective

By Robert A. Luff
Senior Vice President, Engineering
United Artists Cablesystems Corp.

The cable television industry is rapidly becoming a major telecommunications force in the country. While cable's primary business for some time is likely to remain the distribution of television entertainment signals, an even greater potential is beginning to unfold as cable's two-way and data transmission capabilities develop hand in hand with the nation's information explosion of home and business computers, and competitive opportunities in the traditional voice communications industry. Yet many cable systems, companies, indeed the industry at large, is still groping with training program problems necessary to maintain reliable and quality downstream CATV signals and improve efficiency of valuable personnel and equipment resources.

Despite full acknowledgement of the counterproductive effects caused by not finally addressing needed training programs industrywide, the problem continues year after year. Why?

Not enough training budgets—not really. Not enough commitment to training—closer. Not enough top management commitment to training—closer still. Not enough top management commitment to solve the problems training is designed to solve—jackpot!

Many companies have the wrong perspective on training. Many believe that if they could just get a training program underway, their operational problems would be solved. Believing that training programs are a cure for operational problems is like believing that Kleenex is a cure for the flu. Training is only the kinetic arm of a total body of interrelated companywide commitments necessary to put day-to-day signal quality and reliability and operating waste and inefficiencies behind us, and keep them there. So, before wasting another year's worth of training tissues, let's first define and solve the root of the problem.

Building the commitment

If your system or company is having chronic trouble getting an effective training program started, ask yourself the following: Is your system or company really *committed* to solve the problems training is designed to solve? Of course, every top system and company manager wants to improve signal quality and reliability and reduce waste and inefficiency, but they all would like a new car or a vacation in Hawaii too. The question is, do they want improvements enough to make the necessary high level commitment to finally achieve their goal—unknowingly, probably not. Some managements can be inadvertently elusive or deliberately slippery on making such a commitment. But this strong upper management commitment in your organization is absolutely necessary for the evolution of events to occur that will result in maintaining high signal quality and reliability, improved operating efficiency, and reduced waste—all for less money.

The commitment must be from the very top of the organization in the form of a strong written policy from the board of directors or president. Then, this policy must be "built-in" to every position, from the top all the way down to the bottom—from the president to the installer—no exceptions. Built-in means written into everyone's job descriptions as one of their major functions and responsibilities. Built-in also means that every executive's, manager's, supervisor's and employee's performance evaluations, including their salary increases and bonuses, should strongly consider the degree of measured performance that person or position has achieved in quality, reliability, overall efficiency and waste reduction. Just as important, poor or mediocre performance in these areas should not be noted without appropriate penalties.

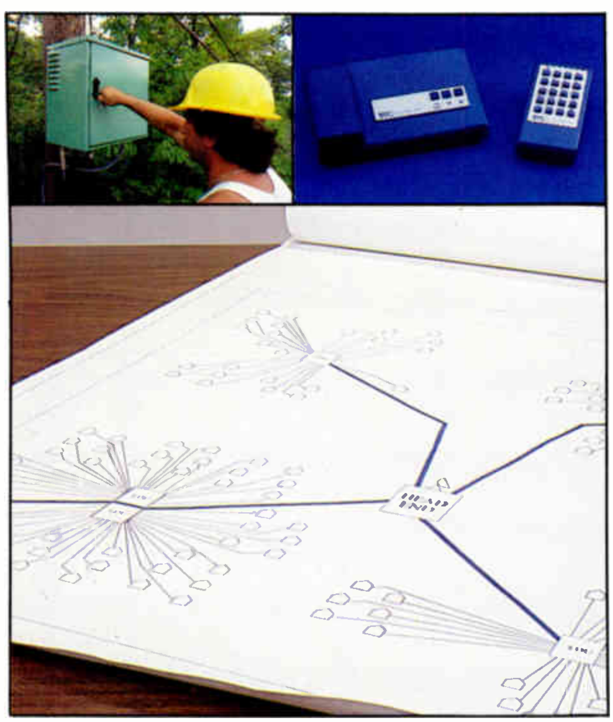
It is only this type of built-in organizational commitment that can guarantee an effective training program. Now every person in the organization stands to gain as a group and personally from training. Training programs will then be fully supported by everyone in the organization from the top to bottom as an aid to achieving desired departmental and personal improvements, for which a guaranteed reward or penalty will be forthcoming. Without the commitment, training programs often appear to be only a drain on the budget and without either a reward or penalty, regardless of performance, there is little incentive to administer or accept the rigors of training.

Possible consequences due to lack of commitment

The consequences of apathetic attitudes in dealing with the problems that training is designed to solve in our increasingly complex day-to-day operations are far greater than just mediocre efficiency of personnel and equipment, as revealed by the following example of a 12-channel system previously known for efficient and quality operations, but upgraded to 40 channels and addressability one year ago.

System X was recently inspected by a regulatory agency. Although no fines resulted, many deeply revealing system technical problems surfaced in the process.

There are three particularly troublesome points that need noting in the System X situation. The first is that the several problems observed by the regulatory agency were "bread and butter" type (but nonetheless important) technical items covered time and time again in recommended industry practices and internal written company practices and bulletins. If the system is having trouble with the bare basics of technical operations, then obviously major concerns must be raised about



its overall level of operation, and in particular, the ability to manage the finer points of technical operations necessary to protect the long-term investment of the system's recent major upgrade and high-tech addressability, not to mention the subscriber's signal quality and reliability.

Is top management giving enough commitment to System X's performance and protecting its investment? Is the system management and engineering leadership in touch with the real system performance? Before all the fingers start pointing at System X, it should be noted that System X is not alone. There are many systems like it. The technical problems so abruptly brought to attention by the regulatory agency are just the tip of a growing iceberg of other technical problems that have developed in System X for sure, but very likely throughout the industry, to a lesser or greater degree.

Of course, the knee-jerk reaction is perhaps to blame the system management and engineering staff for falling below minimum industry and regulatory performance levels. More thought on the matter, however, suggests that this is only another symptom of the lack of training programs industrywide. The inadvertent lack of real commitment to quality operations by upper management in many situations has not provided the necessary personal incentives for the system manager, chief and staff to perform at increased expected levels. Further, corporate managers and engineers industrywide, who often have more incentives, have been distracted for too long from the day-to-day finer points of their system's basic bread and butter operations. So many aggressive system new-builds, upgrades and introduction of complex addressable systems during recent years have pulled corporate management and engineers away from time proven attention to day-to-day system nuts and bolts operations. Simply monitoring system budgets or reports from a distant desk is not an effective control of system overall performance. The result is a day-to-day level of operations far less than realized by all parties except our subscribers and the regulatory bodies.

Who is responsible for "System X" type problems? Upper managements have grossly underestimated the real effect that the three years of growth and rapid system technology changes has had on system managers and chiefs, and staff ability to meet today's much more demanding and expanded job functions and performance objectives without additional across-the-board personnel skill development.

Building a strong foundation for training

The industry has a history of curing its own problems. Upper management should force "space" in their company's busy schedules for the sole purpose of focusing on the commitment to running quality cable systems. The additional complexity of system operations might require input from outside experts on topics beyond the traditional agenda, such as many of the following items.

Strictly personal

By Frank Bias
Vice President, Science and Technology
Viacom International Inc.

In entering my 43rd year of electrical engineering practice, mainly in the various forms of television, I offer these "biased" remarks on the past and future development of cable television. Many in the cable industry would regard me as a "Johnny-come-lately," since I did not enter CATV until October of 1969. By then the industry had essentially completed its first, very successful, phase of operation.

This first phase consisted of bringing television to areas (mainly small suburban and rural) where it could not be received reliably off-air. CATV's early success was due to fulfilling a need of people—its limitations were due to technology. The fact that a business succeeds only when it meets the needs of people is classified as a "trite cliché" by many sophisticated people—yet the history of CATV may be almost completely written in terms of this one concept.

Those of us who were active in CATV in the period 1972-1976 will remember the time described as a "plateau" in CATV development. Why did the growth of CATV hesitate during this period? I believe it was caused by the movement of CATV from the traditional areas to the big cities. At that time the average big city television viewer had good reception from the three networks and probably a couple of independents. The viewer did not *perceive* a need for the additional services that CATV could provide. It should be noted that at this time the technology was ahead of the need. Equipment for multichannel transmission, broadband amplifiers and 24-channel converters had been developed and were available economically from several vendors.

The explosive growth of CATV resumed in 1976 when the viewer perceived a value in the premium services, e.g., HBO, Showtime, etc. The growth was limited mainly by the supply of the emerging security devices (traps, converters, descramblers, converter/descramblers, etc.).

In 1982 many people felt that CATV had come upon another "plateau" (which still may exist). Much of the urgent demand for premium services had been satiated, and the situation compounded by the retrenchment required by overzealous franchise commitments.

Now, technology is not a limitation. The mechanisms to deliver teletext, home shopping, home banking, home computer downloading, pay-per-view, etc., are all in place. Which one will the subscriber perceive to be of value? More than a decade of experimentation has failed to develop a non-entertainment service that any significant number of viewers value. It is an expensive and time-consuming activity to determine what the subscriber wants, yet it must be done before the CATV industry will move forward again.

The role of the technical community must change, at least temporarily. In all my years, there never has been a time when technical possibilities have so outstripped the marketing ability. The question is not *how* to provide a service but *why*? The technical community must place priority on assisting in the marketing of our services (determination of what subscribers want) over innovation that may not meet subscribers wants for years to come.

In 1985 we have all the risks and uncertainties of the past in determining customer requirements, plus the threat of effective competition. The day when CATV was the only cost-effective manner of delivering special video signals to the television receiver is gone. VTRs have burst that bubble and MMDS and DBS may not be far behind. In addition, the hungry Bell Operating Companies (BOC) will soon be instituting what could be a more cost-effective means for special video delivery—the switched fiberoptics network.

Three years ago the use of fiberoptics in inter-city and inter-LATA connections was an occasion for a press release. Today copper is not used in this application, and the use of fiberoptics in the local loop is cause for a press release. In three to five years it will be commonplace. On the other end of the scale, local area networks have progressed from linking a few word processors in a business office, to serving manufacturing processes in several buildings, to where they are challenging the "institutional" networks so optimistically offered during the CATV franchising orgies.

The CATV engineer of the future is going to have to direct more of his attention to the technical solution of keeping his tree-and-branch coaxial network competitive. To do this he will have to work with the marketeers to determine the most cost-effective method of serving the next great *perceived need* of our subscribers. This is in addition to, not in lieu of, his considerable load in maintaining efficient operations, good customer service and system reliability.

The future will be exciting. How will CATV engineering respond to the competition? I hope I am around for 43 more years to help lick the problems.

Plug-in Broadcast Stereo

Another Innovation From The People At Wegener.

Wegener Communications, the people who pioneered satellite delivered stereo technology, have done it again.

Introducing TV stereo, the technology known as "broadcast multi-channel sound," that makes true high fidelity and bi-lingual audio a reality with the new stereo equipped TV sets now entering the marketplace.

For cable services, all it takes to start offering subscribers this exciting new audio format is a broadcast stereo modulator card that plugs into your Wegener 1600 Mainframe.

Over 3,000 cable systems are already using our expandable 1600 Mainframe to provide FM delivered stereo services such as MTV and The Nashville Network. Now that plug-in broadcast TV stereo is also available, shouldn't you be talking to the stereo audio experts at Wegener, too?

Call today for more information.

WEGENER COMMUNICATIONS
150 TECHNOLOGY PARK/ATLANTA
NORCROSS, GEORGIA 30092
(404) 448-7288 TELEX 54-3634

See us at the Western Show at Booth #2065.

• *Engineering and management skill training incentives*

Engineering and management personal skill demands have never been greater than today. It will take roll-up-your-sleeves disciplined study of advanced management principles by managers and engineers to ensure maximum utilization of personnel and capital resources in today's expanded and much more complex cable system operations. Upper management should put into place stronger incentives for managers and engineers to seek special management development and other specialized training. There are many independent management seminars held during the year in nearly every city, and nearly every community college has management sessions available in the evening.

• *Development of manager performance incentives*

Managers who usually control the purse as well as the final setting of system priorities, may not have natural incentives at present to ensure the best internal balance between short-term budget performance vs. long-term system technical performance and efficient utilization of staff and resources. Upper management should review and revise system managers performance incentives to ensure that the manager's personal performance incentives are the same as the company's overall system technical performance goals and objectives.

• *Revised system manager priorities*

Related to development of manager performance incentives is de-emphasizing the usual budget obsession at the manager level. System managers do not spend near the time planning employee training, personnel development, their own management skill development and plant spot inspections, as they do planning and putting together and executing the system's budget process. When unbudgeted problems are encountered during the year, the focus is to preserve "at all costs" the budget and not quickly fix the problem. Missed budgets are very visible to upper management and frowned upon. Missed technical performance would be frowned upon too, but is not as readily visible to top management and, therefore, can be more easily risked to keep the budget balanced.

• *Manager performance evaluation*

It may not be clear to managers what their responsibility is regarding technical performance of their system. They are all well aware of their budget performance responsibility and this seems industrywide to have hands down priority over sometimes a mutually exclusive technical performance responsibility. Upper management should establish an effective means to evaluate managers' overall performance in carrying out the company's commitment to the full slate of operating practices and policies.

• *Budget emphasis too great at employee level*

Management is continuously being tested to determine which policies or practices are more important. There is perhaps too great an emphasis placed on short-term, bottom-line budgets by upper management and its dominance is strongly felt all the way down the company's organization to the system employees at the exclusion of many other important performance criteria along the way. Budgets are important, but they should not be the only performance measurement of the system or division manager's year's work. And certainly, system employees should not be tempted to take short cuts because "it is actually helping the company." Also, employees should not be intimidated against bringing forward problems or oversights because of an unpopular budget impact.

• *Quality policy at the employee level*

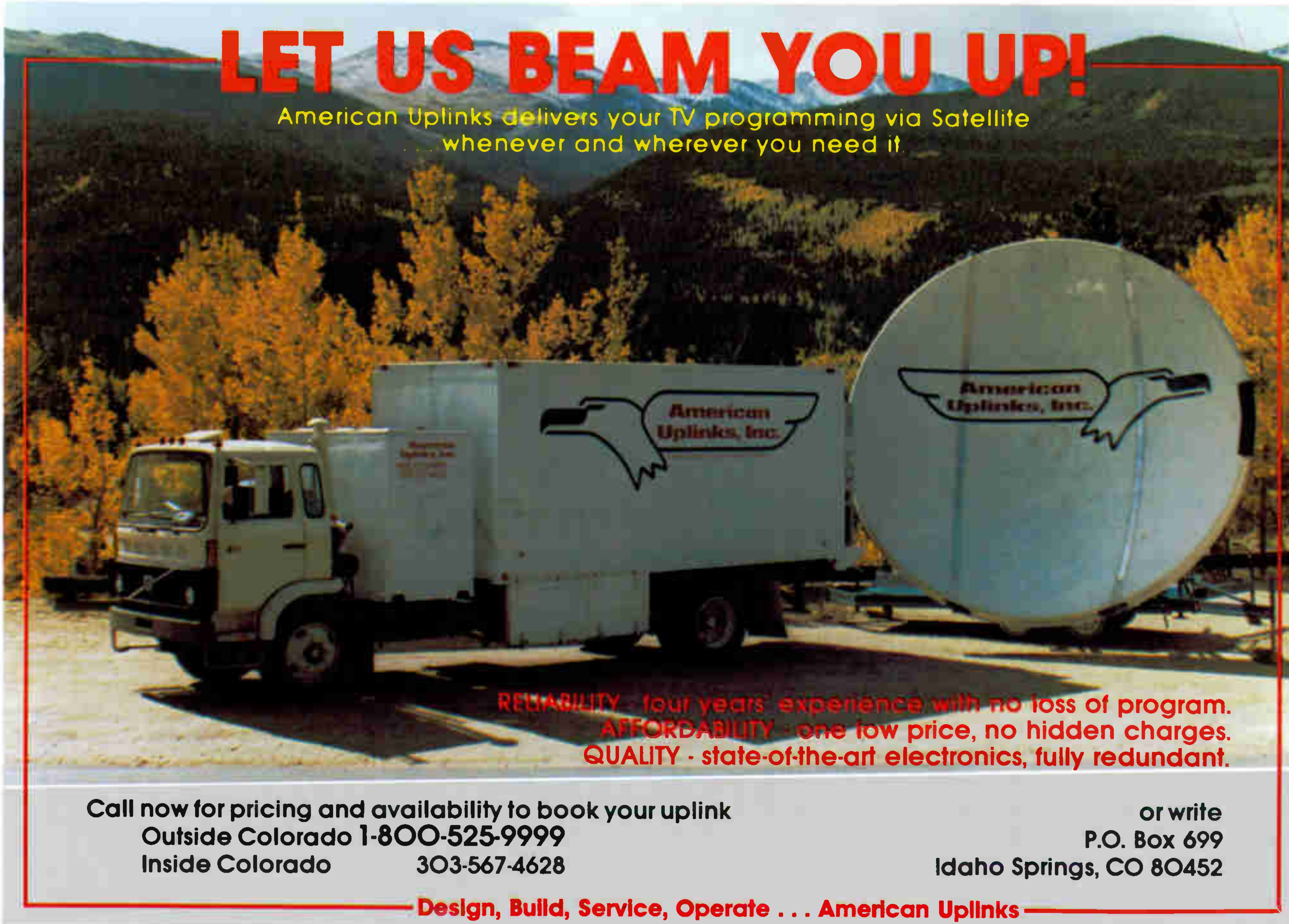
Upper management needs to ensure that the system employees are never directly or indirectly discouraged from coming forward with system problems. System managers need to be encouraged to tackle needed corrections or programs when the need becomes apparent and discouraged from slipping needed corrections and programs to a more convenient (budget) time. If any criticisms are made by upper management, they should be made for not anticipating the problem; but never for quickly correcting technical or operational oversights.

System employees have unilaterally picked up on the unpopularity to ask for unforeseen corrections that cost money. And, if unaddressed, there is a dangerous incentive for employees to just ignore or postpone reporting unbudgeted system problems or let someone else (regulatory agencies) be the bearer of bad news and support more funding. If uncorrected, upper managements will unconciously build an organization that rewards employees for looking the other way when problems develop.

A technical task

Trying to establish a training program before developing the necessary foundation of upper management commitment to solve the problems training is designed to do, will be a frustrating and probably unsuccessful experience. Additionally, in this day and time of ever increasing complexity of day-to-day technical operations, lack of such a commitment from upper management can result in far worse than simply poor or non-existent training programs. System X is but one example of a metamorphosis from a stable 12-channel "sleepy" system to a rebuilt, high-tech addressable system with advanced control and billing computers, inventory control systems and an expanded customer service department with online terminals—all in less than one year, being managed and operated by an excellent pilot and crew, but who still have 12-channel job descriptions, if any, and no additional operating guidelines or training.

It may be up to the technical community, who are closest to the day-to-day problems of quality, reliability and inefficiency, to convince their management to first address the evident lack of commitment to efficient operations and quality in order to put into place a means for effective training programs to be funded and fostered.



LET US BEAM YOU UP!
American Uplinks delivers your TV programming via Satellite
. . . whenever and wherever you need it.
American Uplinks, Inc.
American Uplinks, Inc.
RELIABILITY - four years' experience with no loss of program.
AFFORDABILITY - one low price, no hidden charges.
QUALITY - state-of-the-art electronics, fully redundant.
Call now for pricing and availability to book your uplink
Outside Colorado 1-800-525-9999
Inside Colorado 303-567-4628
or write
P.O. Box 699
Idaho Springs, CO 80452
Design, Build, Service, Operate . . . American Uplinks

'Can you send me any more technicians like the last one I hired?'

Working safely is the most important lesson that can be learned. A job can not be done right if safety is not first. Here we find a crew trenching in a feeder line.

The making of a technician

By Douglas E. Schwartz
Wadena Area Vocational Technical Institute

The need for quality technicians in the cable TV industry was recognized by the Electronics Department at the Wadena Area Vocational Technical Institute in the early '70s. The Electronics Department had been in existence for over 10 years with a proven training and placement record. With the help of an advisory committee, made up of people from the cable TV industry, a course curriculum was developed. The first class graduated in 1976. Since that time this advisory committee has met annually to revise and upgrade the 20-month program.

Beginning with the basics

The course begins with nine months of basic electronics. This gives the student the basic electrical concepts including the calculations and measurement of circuit parameters, voltages and current, phase relationships, transistor configurations, testing procedures, the ability to determine input and output impedance, and amplifier gain. At the end of this first year the students take the FCC test for a general class license.

The first two months of the second-year program are spent in a 40-acre training field. Here students learn the mechanical aspects of cable TV. After understanding the safety needed when working in the field, the students learn pole climbing, framing, bonding, lashing, forming expansion loops and cutting on fittings.

With the help of a R-45 trencher, which was donated to the school by Ditch Witch, students are instructed in the proper procedures for underground installation of cables, splices and setting pedestal locations. Because this is a training facility, as many different kinds of cable, locators, taps and construction techniques as possible are utilized. With this technique of field training students learn firsthand what is expected from them in actual working conditions.

In the school lab setting, the principles of cable TV are instructed thoroughly; both theory of operations and practical hands-on. The students work with headend equipment, trunk amplifiers, line extenders, converters and any other type of electronics that would be encountered on the job. They are trained in the

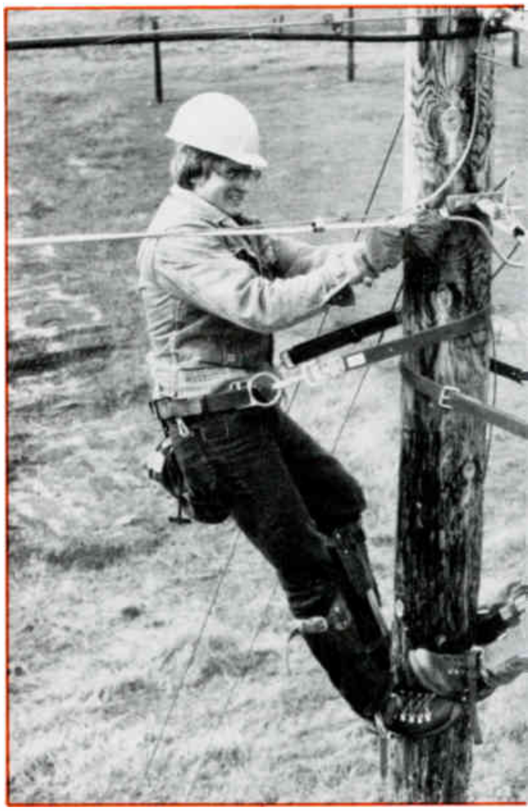
Wadena's technical training program at a glance

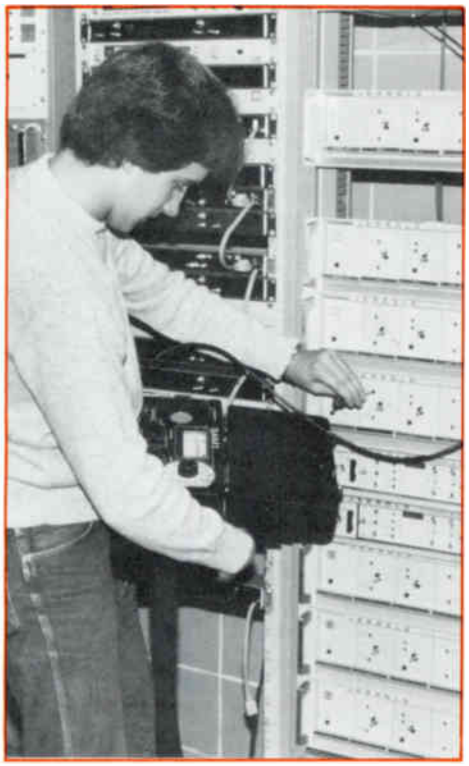
Technical subjects for first year (9 months or 1,080 hours)

• Direct current circuit analysis and magnetism	165 hours	5.5 weeks
• Introduction to alternating current circuits	105 hours	3.5 weeks
• Basic semiconductors	210 hours	7 weeks
• Advanced AC circuit analysis	90 hours	3 weeks
• Special semiconductors and linear amplifiers	120 hours	4 weeks
• Electronic application to communications	360 hours	12 weeks
• Basic test equipment	30 hours	1 week

Technical subjects for second year (11 months or 1,320 hours)

• Construction practices	240 hours	8 weeks
• Local origination	30 hours	1 week
• Pulse and digital principles	360 hours	12 weeks
• Television transmitters and receivers	60 hours	2 weeks
• Antennas and towers	30 hours	1 week
• Headend equipment	120 hours	4 weeks
• CATV line equipment circuits	150 hours	5 weeks
• Satellite earth stations	30 hours	1 week
• Microwave	60 hours	2 weeks
• New technologies	30 hours	1 week
• System design, checkout and troubleshooting	180 hours	6 weeks
• Customer relations	30 hours	1 week





A student adjusting a processor in the school's headend, using a signal level meter. Because this headend serves only the school he can take as much time as is needed to do the job right.

Two students working on part of an aerial cable system. They will do all of the building, cutting in connectors and checking the performance of the cable system.

operation, testing, alignment and repair of all cable TV electronics used in the lab.

In addition to the standards, newer technologies, such as digital principles (which enable students to understand the operation of microprocessor controlled equipment), also are covered. Only equipment actually employed in the cable TV industry is used in instruction and an effort is made to utilize as many different brands and models as possible. Time also is spent on other aspects of cable TV such as local origination, antennas, microwave, pay security, status monitoring and fiberoptics.

The final instructional block covers system design and troubleshooting. In this instructional block, the student is required to design and map a system showing equipment locations, RF and AC levels, and cable placement. Students then install the electronics in cable lines that they had previously built in the training field, turn it on and check the operation.

Achieving technical competence

At Wadena, great effort is made to develop the knowledge and skills needed to make top level technicians. Regardless of whether the technical training program is in-house or one such as Wadena's, the goal is the same: competence. There is no substitute for a qualified cable TV technician. This point is emphasized by an often-echoed sentiment from many employers of Wadena graduates: "Can you send me any more technicians like the last one I hired?" ( )

We Wrote The Book On Cable.
And It's Free!

T-Series Amplifiers

CATV Distribution

Vital Signs

Status Monitoring

Textop Ultra

Converters

Texscan
CORPORATION

Complete Test Bench

Test Equipment

SpectraGen SG-3

Program Automation

HE 42000 Modular

Headend

Every now and then, each of us needs a little help finding what we're looking for.

Sometimes we discover things quickly. Other times it seems we'll never find the right answer. Or at very least, we'll waste a lot of time and energy chasing up and down blind alleys.

But why is it that some people always seem to have all the answers at their fingertips? Their secret is, not in what they know, but in who they know.

More often than not, these are the same people that look to Texscan for know-how...and with good reason: we wrote the book on cable television technology.

In fact, we've written quite a few highly recommended books, like Basic CATV Concepts, CATV Systems Applications and a monthly Technical Topics series.

We've even developed special training seminars to help you know cable systems and equipment from the ground up. Plus we're still making more kinds of cable television equipment than anyone else around.

So next time you need a little help in cable, all you really have to know is Texscan.

For Your Full-line Catalog and *Free* cable television handbooks, call or write:

Texscan Corporate Headquarters
3102 North 29th Avenue
Phoenix, Arizona 85017
(602) 252-5021

Texscan Corporation has offices worldwide to serve you.

See us at the Western Show booth #635.

Students learn how to wreck out old cable in one facet of the construction process.

Training for the future

'Every person has the right to an education that will provide the skills necessary to make a living'

By Jim Heino
Dakota County Vocational Technical Institute

Dakota County Area Vocational Technical Institute in Rosemount, Minn., advances the belief that every person has the right to an education that will provide the skills necessary to make a living. Our highly technical society changes rapidly and the need to become employable, and remain employable, is essential.

One of the programs at DCAVTI ensuring this premise is the Cable Television Technician Program. A 2,640-hour (two-year) course, it has enjoyed phenomenal success in placement and salaries. During the past 10 years over 98 percent of the students have successfully found employment upon graduation, with an average starting salary of $14,750.

It is indeed fortunate that cable TV employment opportunities are still unlimited due to the fact that it is one of the fastest growing segments of the communications industry. Previously, cable TV students could count on acquiring employment in systems of 5,000 or less subscribers. With the advent of cities of over 25,000 population being wired, the new cable student can obtain employment in the country's major metropolitan areas. This, of course, means greater numbers of jobs and higher starting salaries.

New graduates are being hired by increasing numbers of MSOs. In the past three years we have seen students placed with Rogers Cablesystems, American Television and Communications, Group W, Storer, Cox, Palmer Cablevision, Total TV, Jones Intercable and RCA Cablevision to name a few.

Graduates can expect to enter the field in a variety of positions, depending upon job availability, geographic area and personal academic endeavors. Students can specialize, determining their own particular preferences to obtain jobs in CATV construction, headends, mainline technical, production, service technical, installation, system design and bench repair. Past graduates in current positions include technical managers, system managers, chief technicians and even system owners. Placement records and follow-up correspondences indicate a general rapid advancement for students in the field.

Students attend classes 6½ hours a day for nearly 22 months. Divided into two separate years, the course provides a diverse curriculum preparing the individual for any eventuality in the electronics and cable field. First-year students are prepared to enter the work force in any number of electronic areas. Most, however, remain in the program for the second year of instruction where cable engineering courses are provided.

The first-year curriculum includes first aid and CPR, an introduction to electricity and electron theory, AC and DC circuitry, vacuum electron tubes, cable TV mathematics, solid-state devices, oscillators, audio frequency amplifiers, radio frequency amplifiers, amplitude modulation, frequency modulation, TV receivers and systems, and cable TV system construction. Currently in the development stages is a curriculum addition dealing with basic microprocessor concepts to prepare the student for the ever-increasing use of computers in cable TV. Students, during the course of the first year, receive theory and hands-on experience with a myriad of learning aids, including lab volt equipment and various other electronic gear.

Second-year students receive training in introduction to cable TV, signal reception, signal processing, signal distribution, cable TV equipment, system layout and design, dB/dBmV power levels, cross-modulation, intermodulation, second order distortion and composite triple beat, signal-to-noise and various other distortions, cable powering and CATV cables, cable system characteristics, matching and reflections, microwave theory and implementation, increased channel capacity and allocation, satellite theory and reception, fiberoptics, system management, personnel management, resume writing, and job selection.

The Dakota County Vo-Tech administration and the state of Minnesota have been most accommodating in providing excellent instructional materials to make the learning experience a rewarding and interesting one. For example, the school currently has the most modern equipment available in the industry including a 5-meter satellite dish with top-of-the-line receivers, a 140-foot tower with the most current antennas and preamplifiers available, a sophisticated headend utilizing a variety of signal processors and modulators, and eight different kinds of field strength meters and spectrum analyzers. In addition, a sophisticated headend source and various types of sweep transmitters and receivers are employed to prepare students.

As an adjunct to classroom time, students go on field trips, participate in extra curricular projects and belong to a variety of clubs and organizations. One current extra curricular project is the development of a 10-mile microwave link from the school to its sister institution, Inver Hills Community College, which will facilitate video and data transmissions between the two. Students also will participate in the upcoming designing, cabling and proofing of an in-house system at Inver Hills, which will distribute signals throughout the college.

In addition to classroom, students receive plenty of hands-on training, such as this student doing antenna work on a 140-foot tower.

If This Kid Gets A Good Look At Her Mons Pubis You Could Be Knocked On Your Gluteus Maximus.

Parental lockout used to mean keeping a 12 year old boy from becoming too familiar with Miss October's 37C's.

A lot of people thought it was a fun little game, and in a lot of ways it was.

But as adult TV becomes so adult that a lot of grownups are shocked, controlling what children do and do not view will become very serious business for the MSO.

M/A-COM's new 3025 addressable converter system has uncompromising hardware and software security systems that not only protect your integrity but prevent unauthorized service and subsequent loss of revenue.

If you'd like to see some very explicit data or take a closer look at a test system, contact your M/A-COM field representative or call 1-800-438-3331.

M/A-COM

M/A-COM Cable Home Group, PO Box 1729,
Hickory, NC 28603, 800-438-3331, in NC 800-222-6808, telex: 802-166

See us at the Western Show booth #355.

'The cable industry was founded by technicians. . .and. . .is still run predominantly by technical people'

Management: A series of transitions

By Nancy L. Carlson
and Richard S. Lewine
Achievement Groups/RSL Associates Inc

Making the transition from entrepreneurial management to a professionally managed organization is difficult. The cable industry was founded by technicians, the industry's entrepreneurs, and now, several decades later, it is still run predominantly by technical people.

The need for professional management is well illustrated by the constant cry from new technicians for training. At the March 1984 SCTE show in Nashville, Tenn., this cry was heard from chief executives to techs. The Magnavox mobile training center, which was at the show, can hardly fill the needs of an industry as large and labor intensive as the cable business, even as it criss-crosses the country.

While the need for technical expertise is obvious, the need for the development of managerial talent from the first line field supervisor up through the chief executive ranks also needs attention.

For example, when a service crew arrives at a subscriber's house to find no one home, it is often because they've arrived at the wrong time. On the surface this may appear to be the service crew's fault, but with a little checking we discover that ineffective management at the system is to blame. Without clearly stated policies and procedures, through definition of responsibility, and improved internal communication, this will continue to happen. The losses generated by these oversights are formidable.

Without sound management practices, decisions are downgraded to simple good intentions because they are never implemented. Empty promises become standard operating procedure. Certainly this progression does not represent the intentions of ownership; that is just the way the procedures evolved. In the end, cancelled subscriptions, reduced service levels and inefficiency result.

Contributing factors

Two factors create this situation. First is the lack of understanding that management's responsibility is to serve the people on the front line so that they may serve the subscriber. Second is management's failure to define corporate goals.

It is the subscribers, the ones who pay the bills, that permit the organization to function. It seems ironic then, that the typical organization is perceived with the CEO at the top, but the customer is not represented at all. In reality, the customer should be at the top and the management team should support the efforts of the front line people so they can meet the customers' needs. The realization that "the customer is king" can make a significant difference in the attitudes of both the front line people and their managers.

While playing the role of "Atlas," the chief executive must provide opportunities for the staff to learn how to manage others as well as themselves. Many organizations make this attempt by sending their management people to seminars. While the content of these sessions is usually good, the retention level of the attendee is only between 2 percent and 10 percent after four weeks.

Even if there was greater retention, the chances for making change are minimal due to the second factor: In many organizations there is neither clear direction nor a clear statement of goals to guide the staff.

The clarification of these corporate goals and their dissemination throughout the organization on a need-to-know basis, is a time consuming, sometimes frustrating, but always rewarding task. In addressing this factor keep in mind there are eight major areas that make up a corporate goals program:

1. *Sales:* The gross revenue produced by all activities of your organization.
2. *Profit:* The net profit before taxes produced by the efficient operations and effective administration of your organization.
3. *People:* The number, positions, qualifications, pay ranges, time of need and training development needs of your human resources.
4. *Diversification:* The creation of new products or services to broaden your organization's marketplace and ensure growth and profit.
5. *Systems and procedures:* The methods used to ensure the best use of human capital and equipment resources to generate profit.
6. *Community image:* The way your organization is perceived by the social, vendor, customer and employee communities.
7. *Customer satisfaction:* The activities and policies that determine how your customers'/clients' needs will be satisfied.
8. *Place:* The physical space, layout, square feet, furniture, fixtures, etc., in which your people work.

Once the management team has this information, they can effectively begin to develop their own departmental and divisional goals, involving their people in the process. Asking for input from subordinates is one sure way of getting answers to questions that have been hanging around for years.

Effective management is the art of getting this done. It takes planning, organizing, communicating, delegating, tracking, monitoring, training, self-discipline, self-confidence and a clear understanding of who you are and where you're going.

Let's go back to the previous service crew mix-up example. If they knew how much it cost every time they made a dry run to an empty subscriber's house, and they understood the corporate goal of improving customer service by "20 percent," you can be sure that the crew and their management would develop a system to prevent this kind of occurance.

One of the reasons many people fail as managers is that they are not aware of the transitions they must undergo—from technician to manager—and the changes they must make. A few of these are:

- Giving orders, not just receiving them.
- Getting work done through others rather than doing it themselves.
- Making decisions not just carrying them out.
- Using more people skills.
- Solving problems not just pointing them out.
- Being a leader not just a follower or a buddy.

The knee-jerk response to the needs of a growing company has been to fit or force the best workers into management positions. Often, the best accountants, engineers, salesmen, etc., don't necessarily make the best managers. From the best intentions, top managers have rewarded and recognized excellent work only by promotion, assuming the most meaningful reward was a management position. But, as an industry, we've suffered under this faulty premise.

Changes in thinking

In order for business and management to survive the future many of our approaches and well-worn techniques *must* change. This change begins with the awareness that a superworker does not necessarily make a good supervisor.

The percentage of use of people skills at the worker level is somewhere between 10 percent and 20 percent. The need for people skills increases to about 50 percent at the supervisory level. This is true whether the supervisor is a working supervisor or purely a manager. The promotion that occurs on Friday night and takes effect on Monday morning leaves no time for the individual to acquire the skills and talents necessary to perform effectively in a supervisory role.

A system of preparation for the transition from worker to manager must be put into place so that your people are ready to assume the responsibilities of leadership when the organization is ready to give them that role.

As one moves up through the ranks, the need for technical expertise diminishes and the need for interpersonal and management skills (such as decision making) increases.

At the top level the percentages are just about the reverse of what they are at the worker level; i.e., executives need about 85 percent to 90 percent management, conceptual and people skills and only about 10 percent to 15 percent technical skills. The number of times that the actual technical expertise is put to use should be minimal compared to the time and effort spent in being a manager.

The commitment of top level management to this new thinking is paramount. Support for the organization while it goes through these transitory stages will determine the outcome. More specifically, management must:

1. Recognize that different skills are needed for different jobs and put more emphasis on matching people to positions.
2. Learn what each individual wants and help them set their personal goals in such a way that they are compatible with organizational goals.
3. Update our reward and recognition systems.
4. Offer and actively support training in both the management development and technical areas.
5. Create an environment that fosters attitudes of growth, development, achievement, risk taking and the willingness to make mistakes in order to learn.

The cable industry subscriber base has mandated the delivery of quality service. Fulfilling this role will take more than just high tech; it will take knowledgeable technicians, well-trained managers and a commitment to excellence.

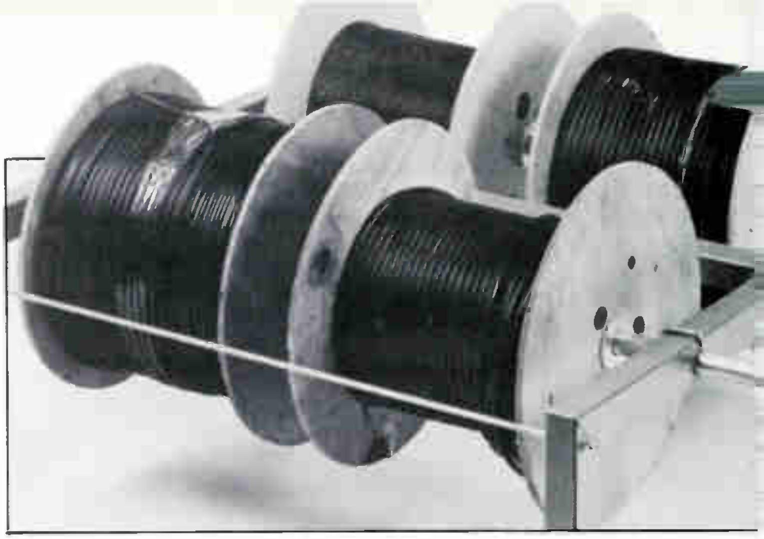
Richard Lewine, president of Achievement Groups/RSL Associates Inc., was president of Delatex Corp. prior to founding AG/RSL in 1977. With more than two decades of management and sales experience, Lewine has helped executives, managers and their organizations achieve increases in profits and productivity. He created Sales Plus, a multi-level sales skills enhancement program, and conceived and implemented The President's Group, an executive level and mid-management development process.

Nancy Carlson, vice president of AG/RSL Associates, holds a BS in psychology from Penn State University and a masters degree from Fairleigh Dickinson University in work motivation. She has counseled in industry, worked in employment screening, staffing, interviewing, hiring, market research and sales. As a human resource specialist in a multi-national electronics firm, she organized and scheduled the first Employee Assistance program for over 500 managers and employees.

Is The Tech Almanac complete? Judge for yourself.

A Table of Contents that includes:

Sweep testing of coaxial cable



Here is Chapter X of the "Technical Handbook for CATV Systems." Sweep testing is essential for coaxial cables used in ETV and CATV distribution systems. This chapter compares three basic methods: measurement of transmission loss, measurement of input impedance, and measurement of reflection coefficient

By Ken Simons
Consultant to Wavetek CATV Division

The technical requirements for flexible coaxial cable were organized in Military Specification JAN-C-17, originally issued in 1944. This specification and its subsequent revisions spell out in detail the requirements for physical construction and a number of electrical parameters, including attenuation and dielectric strength of the cable. Regarding the characteristic impedance, JAN-C-17 specified the *nominal impedance* which was determined by a calculation involving the total measured capacitance of a reel of cable, and the delay factor measured on a short sample. For cables of relatively short lengths, this specification was adequate; but the advent of CATV systems, where TV signals are transmitted through many miles of cable, uncovered the need for an additional specification.

The problem first came to light in our organization about 12 years ago when one of our field engineers returned to the laboratory a reel of cable which, he claimed, would not pass TV channel 6.

Figure 92 shows the measured attenuation of this reel of cable, indicating an attenuation spike 50 dB deep at 87 MHz[1].

Investigation showed that this effect was due to periodic discontinuities. Something in the manufacture of the cable produced variations in characteristic impedance recurring at precisely spaced intervals throughout the length of the cable. Due to this precise spacing, many reflections, precisely phased at a certain frequency, arrived back at the input end of the cable, causing this severe distortion of the transmission characteristic.

To prevent the recurrence of this problem, a program of factory tests was begun. The original test method involved measuring the transmission loss through each reel of cable over the frequency bands then in use. A reel of cable was rejected if the loss in these bands dipped more than 0.25 dB below the smoothed attenuation characteristic.

Figure 92: Loss versus frequency for 2,000 feet of defective RG11/U cable

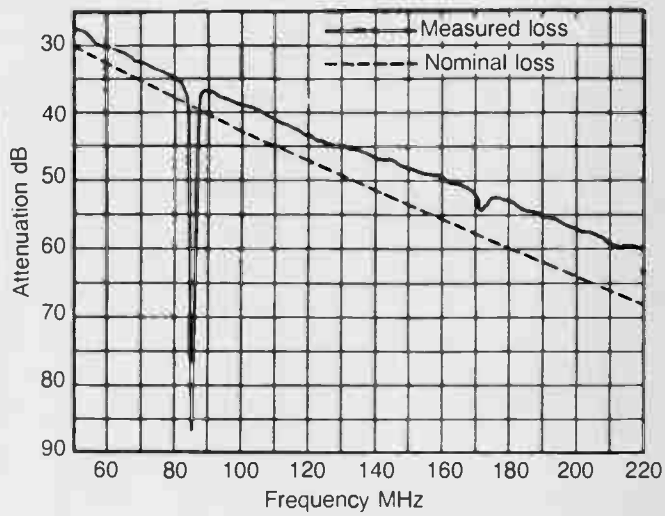
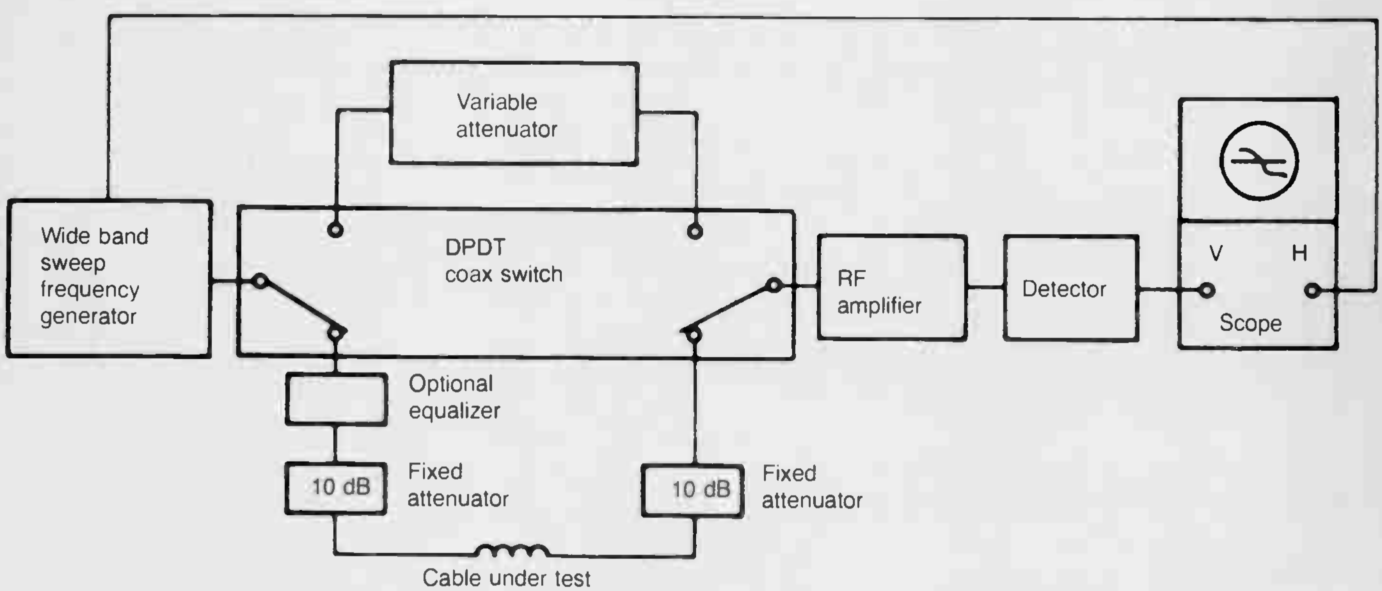


Figure 93: Equipment connection for transmission loss test



TELSTA® VAN OR UTILITY MOUNTED LIFTS

We made a great value better than ever

Telsta A28C's are the most wanted lifts in the CATV industry. Now, we've made them easier than ever to own.

First, we're offering them at a price far lower than you would expect. Not just stripped down models, but fully equipped lifts like the ones above. Complete, down to the tool hangers. You simply can't buy a better lift at a better price.

Secondly, delivery has never been faster. Telsta maintains a chassis pool at our plants, so there is never a long wait for delivery.

And finally, you can get a Telsta A28C with our new APU (Aerial Lift Power Unit). This is an outboard mounted, heavy-duty industrial grade engine/generator which powers the three-way boom movement and provides 2250 watts of 110V AC power for your tools. Unlike other lifts, the boom can be operated with the truck engine off, thus eliminating overheating, conserving fuel and reducing battery drain.

Take advantage of Telsta's low prices, quality features, and fast delivery now.

General Cable
COMPANY
APPARATUS DIVISION
MOPECO PUREGAS TELSTA

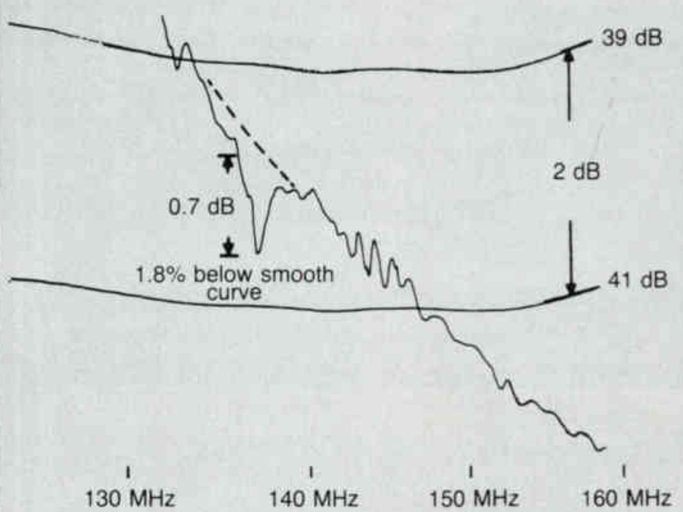
A Unit of The Penn Central Corporation

P O Box 666 5600 West 88th Ave
Westminster Colorado 80030
Phone 303 427 3700
Facilities in San Lorenzo CA Frederick MD and Lithonia GA

See us at the Western Show booth #1580.

After this transmission loss measurement method had been used for several years, it became evident that a more sensitive test was needed. It was found that a measurement of the *input impedance* at each end of a reel of cable gave a more sensitive indication of the existence of periodic reflections. Experience with the impedance measurement method showed two major defects: it was difficult to arrive at an accurate calibration, and the measured deviation was a critical function of cable length. Removing two or three feet from the end of the cable would change the entire pattern.

Figure 94: Transmission loss measurement, 100-foot reel of RG59/U



To overcome these defects, a test method was developed employing a bridge; this method allowed observation and measurement of the *reflections* from the cable end, eliminating uncertainty and allowing easier calibration. This reflection measurement method has been used by a number of cable manufacturers during the past five years and has provided a satisfactory way of controlling periodic defects.

The relative merits of the three methods of sweep frequency cable testing can perhaps best be developed by describing each method in some detail and comparing results.

Transmission loss measurement

Figure 93 shows a diagram of the equipment used in the sweep frequency technique for measuring cable loss vs. frequency. A wideband sweep frequency transmission measuring set is connected alternately to the cable under test and to a variable standard attenuator. This arrangement provides an attenuation reference line on the oscilloscope against which the loss of the cable can be compared. For accurate measurement it is essential that the cable face a well-matched impedance at each end. Ten-dB fixed attenuators are used to establish this condition.

Figure 94 illustrates the loss characteristic of a particular reel of cable measured with this technique. The frequency range was chosen to include a major defect at 137 MHz. The rapid change in attenuation with frequency makes accurate measurement of the dip at 137 MHz difficult.

The measurement is made easier by inserting an equalizer in series with the cable so that the average loss is flat and the irregularity is more clearly displayed and measured, as shown in Figure 95. One of the defects of the transmission loss measurement method appears on this plot. With the high end-to-end attenuation present on this reel, the single shield allowed sufficient coupling to produce ripples in the frequency characteristic.

Impedance testing

A more sensitive test, free from this coupling problem, is obtained by using the technique diagrammed in Figure 96.

The output of a wide-band generator is fed through a bridging detector to one end of the cable under test, with the other end accurately terminated. The detector measures variations in the input voltage as a function of frequency. With a well-matched source (assured by the 10 dB attenuator) the input voltage varies almost directly with the magnitude of the cable's input impedance. An impedance plot made by this technique for the same reel of cable is illustrated in Figure 97 (compare with Figure 95).

Calibration was obtained by substituting a precise 75-ohm terminator for the cable end and varying the attenuator above and below 10 dB by an amount corresponding to the indicated impedance levels.

Structural return loss testing

The bridge used for reflection testing is diagrammed in Figure 98. When the variable standard arm of the bridge is adjusted to equal the average characteristic impedance of the cable, the bridge acts as a directional coupler with directivity in excess of 50 dB and a constant insertion loss of about 12.5 dB. The bridge is connected into a test system, as shown in Figure 99.

The variable attenuator generates a reference trace which is set to cross the cable trace at peaks of the reflection characteristic. Since the measurement is made in dBs, the results are most conveniently expressed in these terms. The reflection coefficient expressed in dB is the "return loss," and the return loss characteristic of cable, due to periodic variations in its structure, has become known as the "structural return loss."

Figure 100 illustrates a structural return loss plot with the characteristics of the same cable defect as shown on the curves in Figures 95 and 97.

The sensitivity of this method is illustrated by Figure 101, which is similar to Figure 100, but shows a 15 dB increase in sensitivity. Return loss variations as low as 50 dB (0.3 percent reflection) can be clearly displayed.

Figure 95: Transmission loss measurement 1,000-foot reel RG59/U equalized

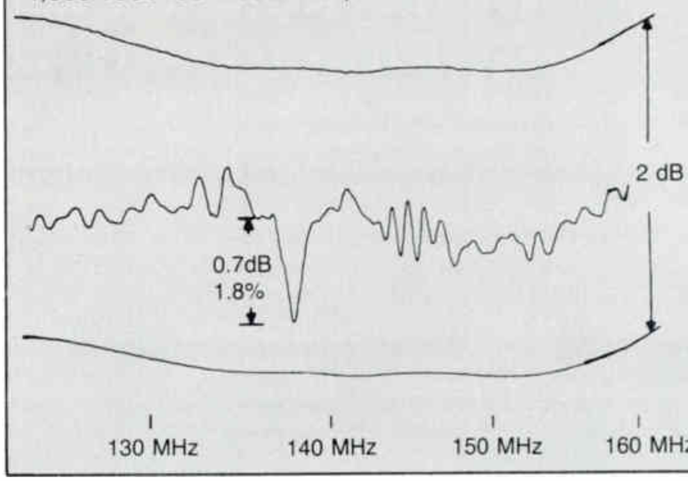
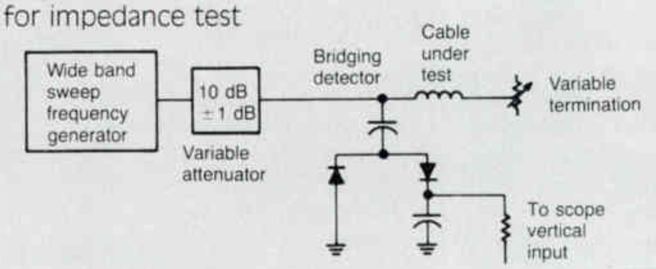


Figure 96: Equipment connection for impedance test



Burnup & Sims
Teamwork and experience, a winning combination.

There's no substitute for experience. And no other cable products company has more of it than the combined resources of our Cable Products Group.

LECTRO STANDBY POWER

Over the past 10 years our Lectro Products Division has grown to become recognized as a leader in providing standby power systems to the cable TV industry. Today we design, engineer and manufacture over 50 separate models capable of performing a variety of emergency power supply functions—nobody else even comes close. Maybe that is why we currently have more standby units in the field than any other manufacturer.

For low price, high quality and advanced technology, Lectro leads the way in standby power.

CAPSCAN CABLE

In just a few short years, our Capscan Cable Manufacturing Division has firmly established itself as the preferred supplier of choice for hundreds of cable systems and MSO's from coast to coast. Capscan has earned this position because of its commitment to quality standards and reliable service. That translates into reduced inventory costs and improved cash flow for both MSO's and system

owners. And being part of Burnup & Sims, a financially stable, time-tested corporation with assets of over $137 million, gives Capscan a solid foundation that sustains our winning record.

Whatever your trunk or drop cable needs, Capscan can fill the gap in products and service where others fall short.

THE SOLID, SENSIBLE CHOICE

Lectro and Capscan, when teamed up with our experienced Cable Com construction affiliate, provide you with complete turn-key services without the multiple cost mark-ups involved in dealing with separate suppliers. We welcome the opportunity to prove it.

Lectro and Capscan. We're what makes Burnup & Sims Cable Products Group the solid, sensible choice for cable and the power to back it up wherever and whenever you need it.

Burnup & Sims Cable Products Group:
Capscan: (201)-462-8700, (800)-222-5388,
Lectro: (404)-353-1159, (800)-551-3790,
Cable Com: (404)-482-7612.

Comparison of three methods

Although the defect plotted in Figures 97 and 100 showed up clearly in all three tests, it should be noted that it was a particularly bad defect, i.e., one that would cause picture distortion if it fell within a television channel. A defect which is about the worst that can be tolerated in a cable television system is illustrated in Figures 102, 103, and 104.

Figure 102, illustrating the transmission loss measurement of such a defect, shows the difficulty of this method: using all the scale expansion available, and equalizing the transmission characteristic, the 0.1 dB variation is difficult to discern and impossible to measure accurately.

Figure 103 shows a great improvement in sensitivity obtained by impedance measurement, but also illustrates the weakness of this method in that four different measurements were obtained, depending critically on small variations in the point at which the cable was connected to the detector. The reading on this particular defect varied from 4.4 percent up to 12.3 percent, depending on the length of the connection.

Figure 104 shows the advantage of the return loss bridge method, which gives a high degree of sensitivity with essentially the same reading, regardless of the point of connection (compare with Figure 103).

This comparison is further illustrated by measurements made on a reel of good CATV trunk line cable. Figure 105 illustrates the return loss characteristic taken over the entire TV spectrum, showing excellent structural return loss characteristics.

Figures 106 and 107 show transmission loss measurements near the worst defect. Note that the transmission loss variation at this point can hardly be seen. None of the variations below this level could be seen or measured by this method.

Figure 108 illustrates an impedance test of this worst defect, and Figures 109 and 110 show return loss tests in this same frequency range.

In summary, three methods that have been used to determine the existence of electrical problems due to periodic discontinuities in cable have been described. The transmission measurement method suffers from low sensitivity and the need for equalization. The impedance measurement method presents difficulties in calibration and is ambiguous because of variations peculiar to the point of connection between cable and test set. In contrast, the reflection test method, using a return loss bridge adjusted to the average impedance of the cable under test, provides a high degree of sensitivity, ease of calibration, and freedom from ambiguous readings.

Adjusting the return loss bridge and the cable termination

The bridge used for measuring structural return loss of cable (for example the Jerrold Model RLBV-4H-7F, with "F" fittings) used for 75 ohm cable, is provided with a resistance and a capacitance adjustment which allow matching the bridge to the average characteristic impedance of each particular reel of cable. This allows distinguishing defects in cable due to non-standard characteristic impedance from those due to periodic discontinuities. In measuring cable, it is most important that these adjustments be set correctly before reading return

Figure 97: Impedance test on 1,000-foot sample of RG59/U

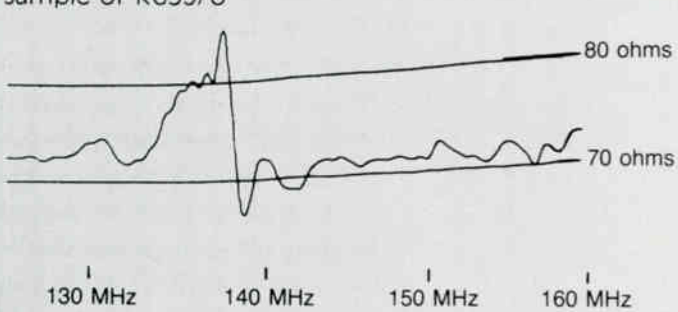


Figure 98: Variable bridge for cable reflection testing

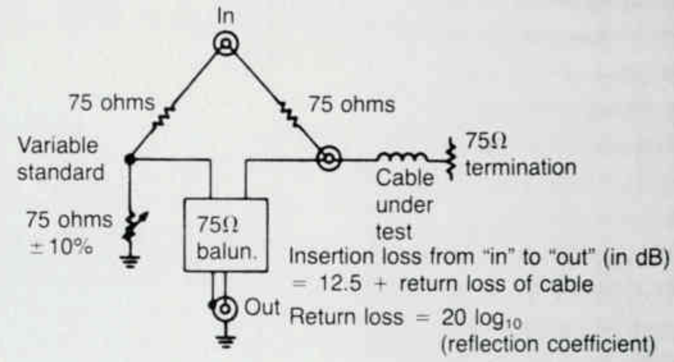


Figure 99: Equipment connection for reflection test

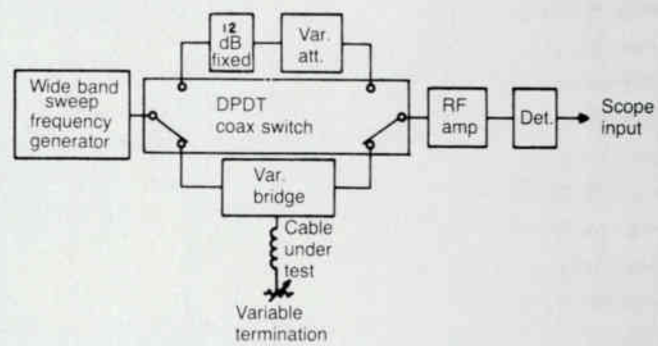
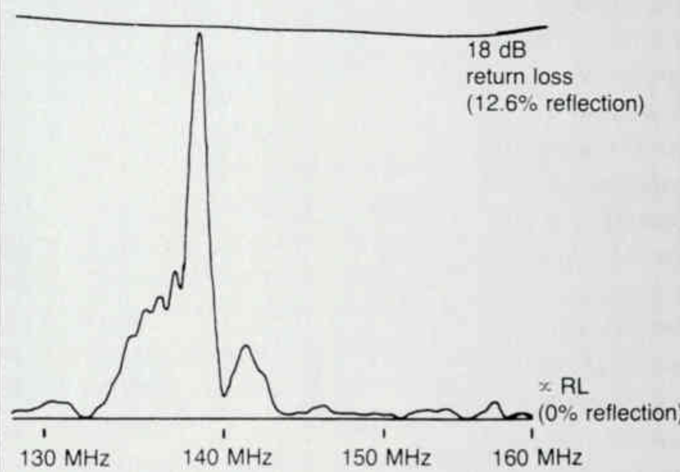


Figure 100: Reflection test on RG59/U sample



loss. The following shows the result of correct adjustment, as well as the result when one or the other adjustment is wrong.

Figure 111 illustrates the trace obtained on a reel of high-grade CATV cable with the bridge and the far-end terminator correctly adjusted. The frequency range is from 50 to 220 MHz and the reference line at the top is set at 30 dB return loss. It is essential to set the bridge so that the minimums in the trace touch the base line as they do here. Erroneous readings are obtained if the bridge is adjusted for minimum readings on the "spikes," without considering the base line.

Figure 112 shows the effects of misadjusting the far-end termination. With a long reel of cable this has a major effect only at the low-frequency end of the trace, producing a "fuzzy" trace due to the rapid oscillations

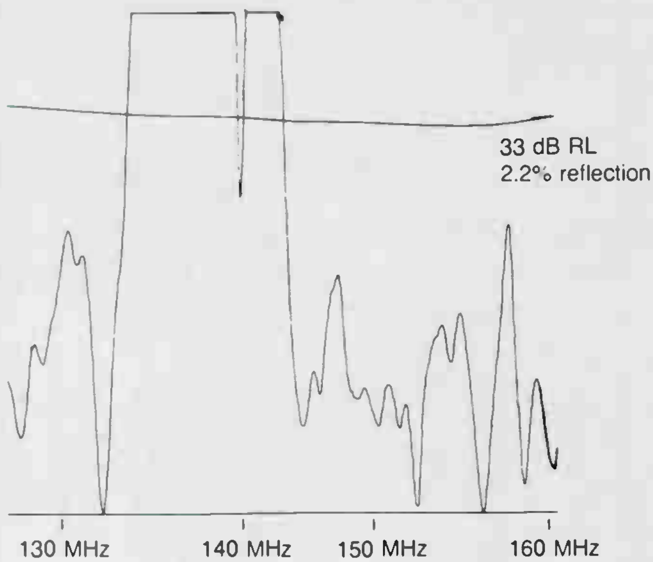


Figure 101: Same as Figure 100 with gain increased and reference changed

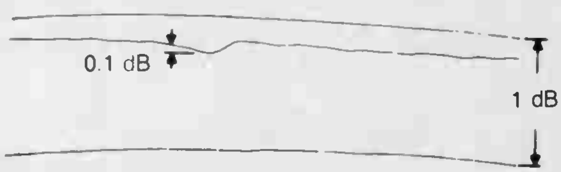


Figure 102: Measurement of a cable defect by transmission loss method

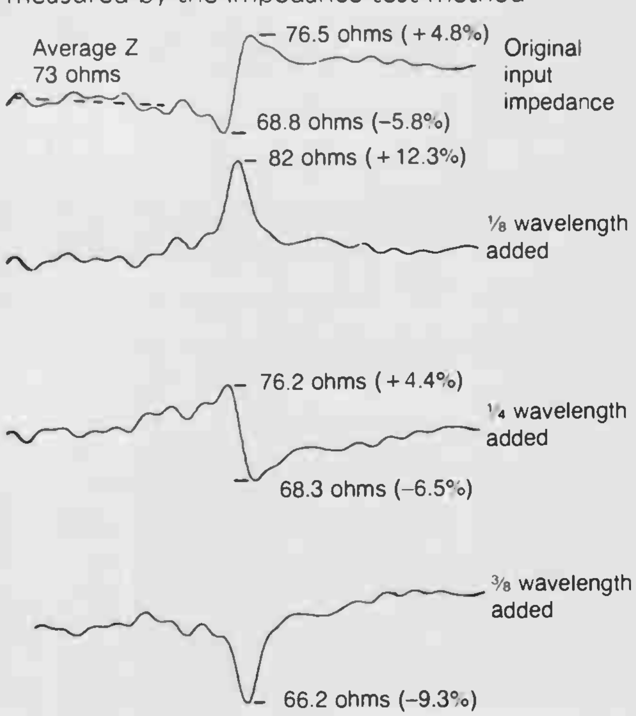


Figure 103: Same defect as Figure 101 measured by the impedance test method

in impedance caused by reflections from the far end.

Figure 113 shows a trace with the far end correctly terminated, but with the resistance balance on the bridge slightly offset from the average impedance for this reel. The effect is a trace raised off the base line across the entire frequency range.

Figure 114 shows a trace with far-end termination and resistance balance set correctly, but with a slight misadjustment of the bridge capacitance balance. This has its greatest effect at the high-frequency end, causing a rising characteristic. This is very similar to the effect

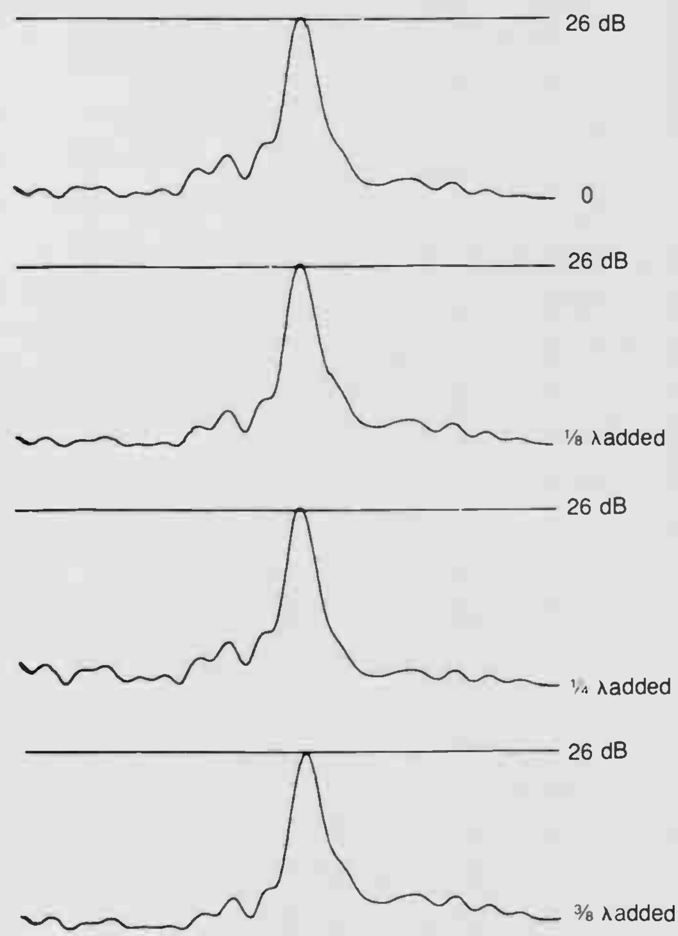


Figure 104: Same defect as Figures 101 and 103 measured by the reflection test method

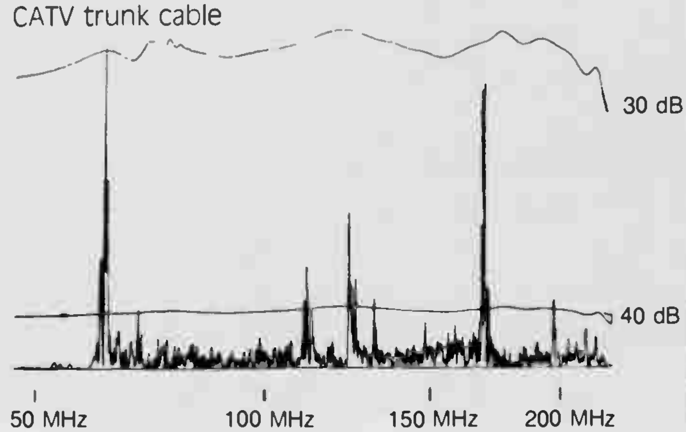


Figure 105: Reflection test on sample reel of CATV trunk cable

produced when the connector between the bridge and the cable end has a characteristic impedance which differs greatly from the average impedance of the reel.

Note: Error due to detector envelope response

To show a flicker-free display on an oscilloscope the horizontal scan of the usual sweep-frequency generator has a frequency of 25 to 60 Hz. When a complex return loss pattern, such as the one shown in Figure 105 is scanned 60 times per second, severe requirements are placed

Figure 106: Transmission loss test on same reel as Figure 105 near worst defect

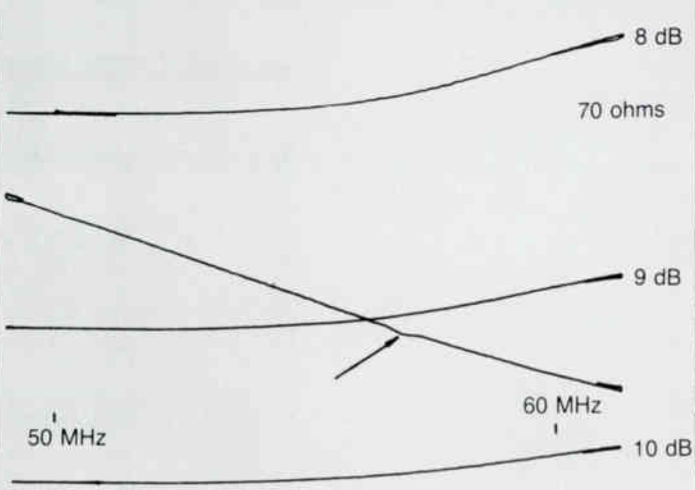


Figure 107: Same as Figure 106 except transmission line equalized

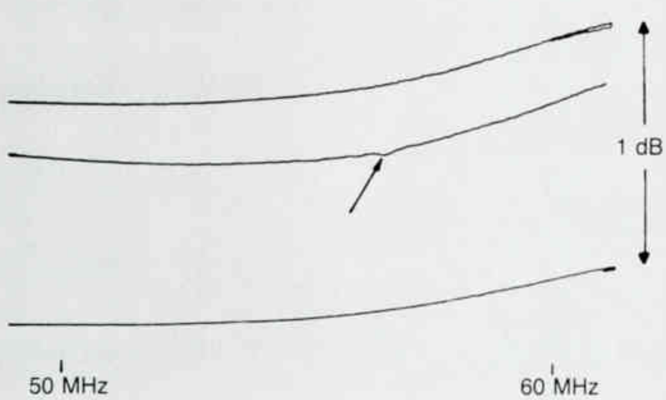
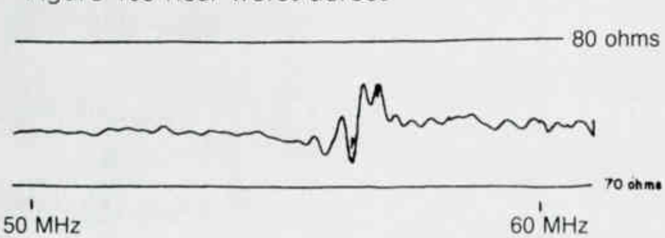


Figure 108: Impedance test on same reel as Figure 105 near worst defect



on the detector if its detected output is to follow accurately the rapid changes in RF input. Since many detectors in common use are not fast enough, errors in the measurement of structural return loss may result when scanning rapidly over wide bands.

To test for this trouble, or to be sure of an accurate measurement,

Figure 109: Reflection test on same reel as Figure 105 near worst defect

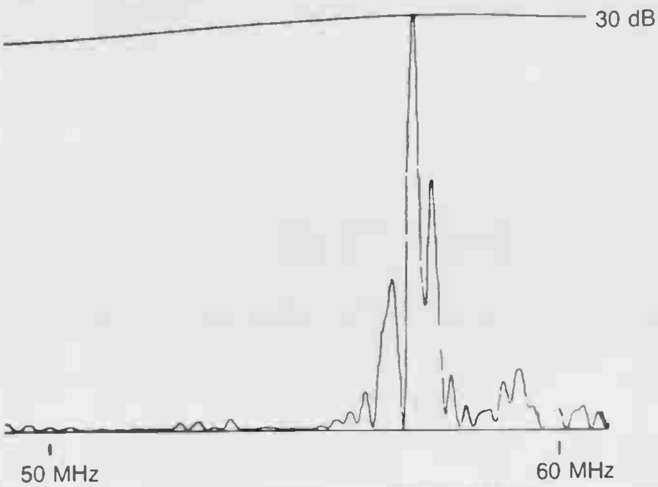


Figure 110: Same as Figure 109 except gain increased, reference shifted

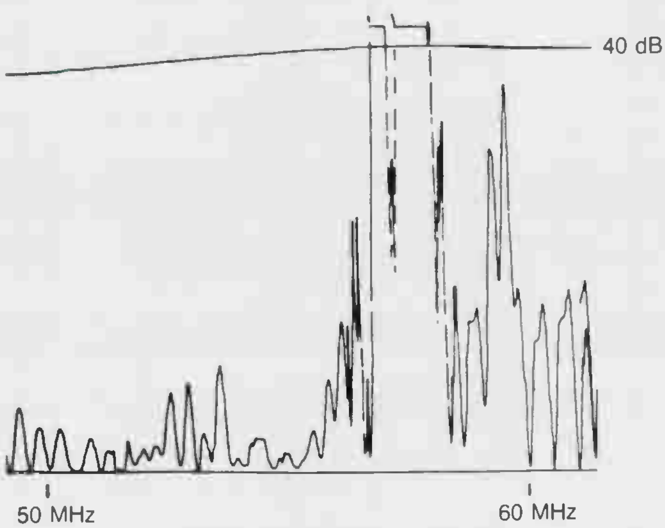


Figure 111: Correct settings—minimums reach base line at all frequencies

Traces illustrating adjustment of bridge to match cable's average impedance

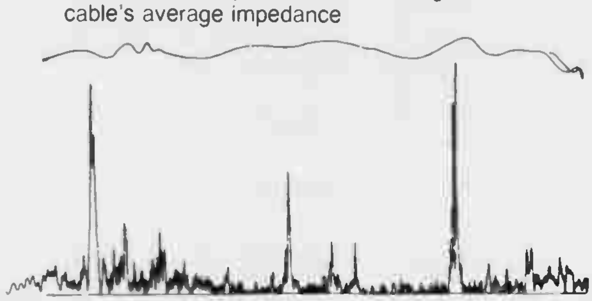


Figure 112: Termination misadjusted—makes trace fuzzy, especially at low end

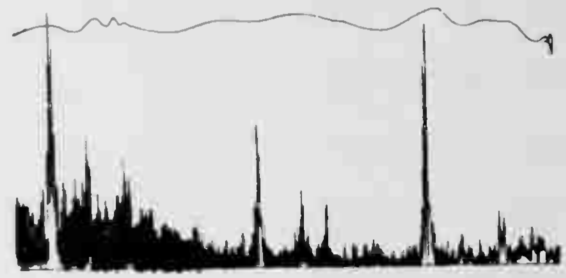


Figure 113: Resistance balance set wrong—capacitance balance and termination set correct (Note: Minimums do not reach base line)

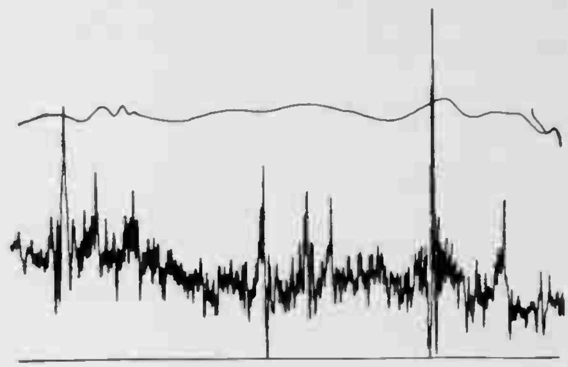
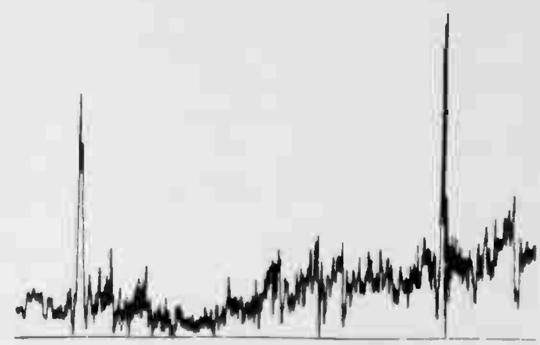
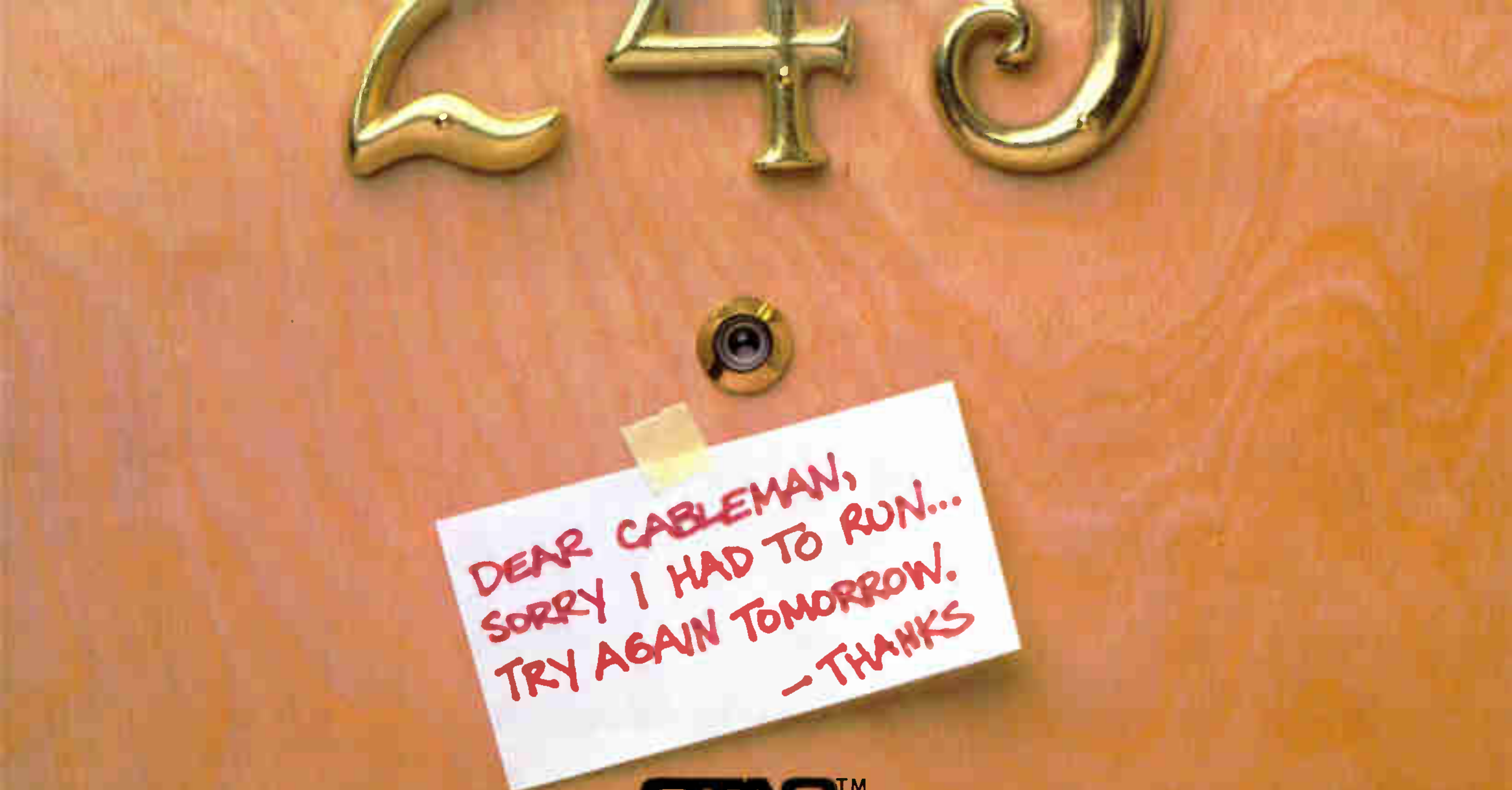


Figure 114: Capacitance balance set wrong, curve tips up at high end (this can also be caused by bad connection between cable and bridge)



reduce the sweepwidth to a few MHz and tune the sweep's center frequency to center each major spike in turn on the scope (so that it looks like Figure 109, for example). When the measurement at this setting shows a poorer return loss than the measurement with wide sweep, the latter is in error due to detector trouble and should be disregarded.

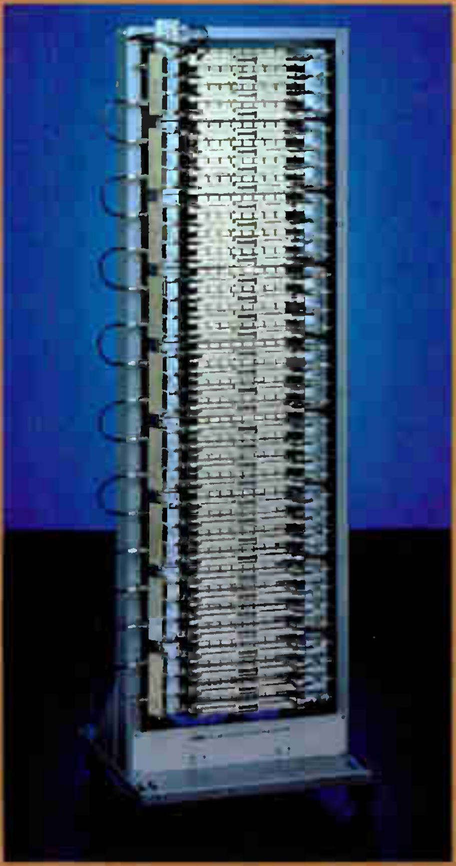
This chapter of the "Technical Handbook for CATV Systems" is being reprinted courtesy of the General Instrument Corp.'s Jerrold Division. To obtain a complete copy of the "Technical Handbook," send $10 plus $1.50 for postage and handling to: Technical Handbook Order, Customer Service Department, General Instrument Jerrold Division, 2200 Byberry Rd., Hatboro, Pa. 19040. Jerrold customers may place orders with their customer service rep. (Make checks payable to General Instrument Jerrold Division.)



OTAS™
FOR MULTIPLE DWELLING UNITS

Computer Headend

Preassembled Rack for 36 Subscribers



Security Cabinet for 8 Subscribers

When cable service is being installed or disconnected, the "nobody home" closed door costs you money. The same door may be sheltering a subscriber who is illegally receiving your cable services. When you evaluate addressability for your multiple dwelling systems, we have great news for you. Pico's field-proven OTAS™ is available for multiple dwelling applications. Now addressability is more profitable than ever for you.

OTAS IS OFF-PREMISES ADDRESSABILITY

OTAS off-premises security is a full-featured addressable system that can not be defeated in the home. OTAS gives you centralized control of basic service plus seven tiers of pay. Each tier can be single or multiple channels, including entire bands. Levels of pay can be changed and cable service turned on or off from a central location that could be thousands of miles from the subscriber.

OTAS IS REDUCED INVESTMENT IN SUBSCRIBER'S HOME

OTAS requires no equipment in the home with systems of 12 channels or less. In systems with more than 12 channels, OTAS is compatible with the rapidly growing number of cable ready television sets in use. Should converters be required, inexpensive plain vanilla converters or block converters can be sold or rented to the subscriber. Your investment in the subscriber's home is minimal.

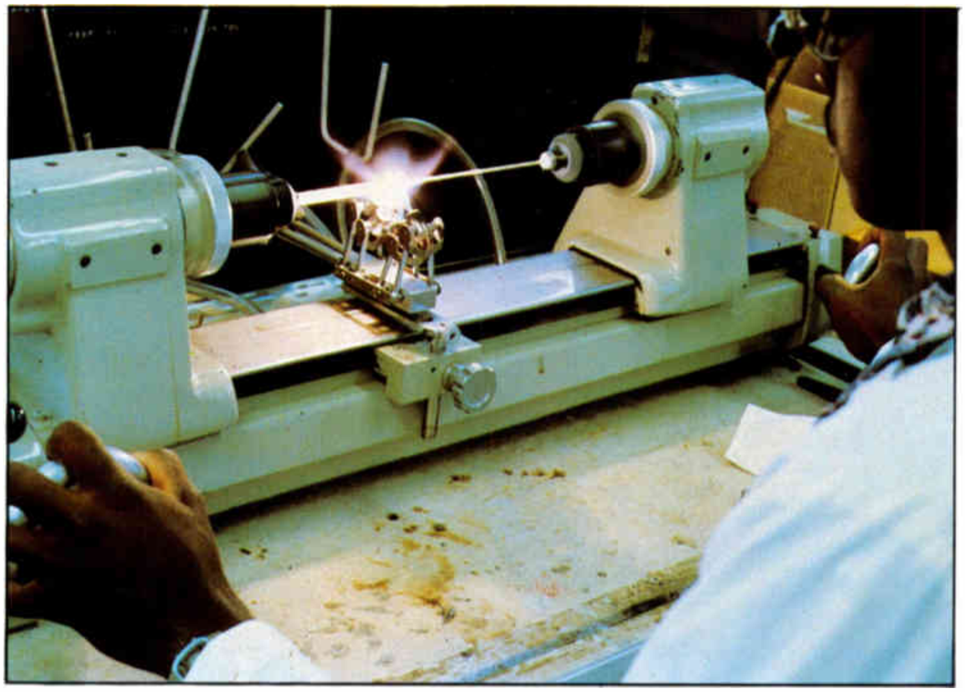
OTAS IS SIMPLE TO INSTALL

OTAS is engineered for simplicity of installation. All addressable electronics are installed off-premises in security cabinets or rack mounted in a utility room. In buildings wired for cable, there is no need to enter the subscriber's premises.

These are powerful reasons for using OTAS in your multiple dwelling units. Let us show you how profitable addressability can be for *your* system. Please call 1-800-822-7420 to arrange for a live demonstration of OTAS at your facility or at our Corporate Demo Center. Remember, OTAS is from PICO, the company with a well-deserved reputation for quality and reliability.

PICO PRODUCTS, INC.
103 Commerce Blvd., Liverpool, NY 13088
Phone: 1-800-822-7420
In New York State Call (315) 451-7700

See us at the Western Show inside booth #560, outside booth #11.



'Problems inherent in a coaxial system such as (EMI) and (RFI) are not present in a fiberoptic system'

Using fiberoptics in cable trunking systems

By Paul Dion
Associate Engineer, Times Fiber Communications Inc

In a telecommunications system, before any signals can be received by the user, these signals must be captured and transported to the local distribution network. Traditionally, this has been accomplished via a trunking system in which the signals are received, processed and distributed over conventional coaxial cables.

Theoretically, fiberoptic systems appear to be a well suited alternative to using traditional trunking systems for two reasons. First, since signal loss is much less, fewer active components are needed to sustain signal quality on a trunk and therefore links can be much longer. Second, the properties of lightwave transmission eliminate many of the undesirable characteristics of electromagnetic wave propagation found in a conventional coaxial trunk.

But how does a fiberoptic distribution system work? And does it stand up favorably to a traditional system?

By comparing a fiberoptic distribution system to a conventional coaxial system we can understand how light is transmitted and gauge the system's performance against a known standard. In this article we will look at the following:

- A comparison between a standard coaxial trunking system and a fiber trunking system;
- The basic operation of lightwaves in a telecommunications environment; and
- Three applications of fiberoptic trunking systems for communications transport—baseband-to-baseband systems, TVRO satellite systems, and data-link transmission systems.

Coax vs. fiber

The purpose of the trunking system is to serve as the medium that transports baseband or IF signals between two points (for example, from an earth station to a headend or from one headend to another headend or among several headends within a star network). For the trunking system to work properly, the signal bandwidth and type (analog or digital), the distance between the two points and the signal-to-noise ratio must be taken into account. These factors determine what size and type of cable should be used for the trunk and how many active components are needed to ensure that the signal arrives at its destination at a useable level.

Compare a coaxial trunk to a fiber trunk. Signal loss at 300 MHz is about 0.69 dB per 100 feet for standard trunk coaxial cable and about 0.064 dB per 100 feet for fiberoptic cable. This amounts to a loss that is 10 times greater for coaxial cable than for fiberoptic cable. Because of the greater loss, more amplifiers are required to maintain an acceptable signal level from the beginning to the end of the coaxial trunk. Typically, amplifiers are spaced every 2,000 feet (.6 kilometers) in a coaxial trunk as opposed to repeaters, which are spaced every 20,300 feet (6.2 kilometers) in a fiber trunk. A repeater, a receiver/transmitter pair housed together, is the equivalent of a conventional trunk amplifier. With each amplifier present on the line, more noise is introduced, lowering the signal quality.

Fewer active electronics on the line also can contribute to greater reliability of the fiberoptic system and permit longer trunk lengths.

Caltec Cablevision of Baltimore is currently

(Continued on page 66.)

E COAX TO CHOOSE
VS YOU A CURVE.

See us at the Western Show at Booth #355.

It's great for those rotten jobs installation crews hate. And, since it doesn't cost a whole lot more than standard cable, it can even pay for itself in labor savings and splicing hardware alone.

If you'd like to bend a piece for yourself call 1-800-438-3331 and ask for QR. It makes straight work out of life's curves.

M/A-COM

M/A-COM Cable Home Group, PO Box 1729, Hickory, NC 28603, 800-438-3331, in NC 800-222-6808, telex: 802-166

(Continued from page 55.)

operating a fiberoptic trunking system designed by Times Fiber Communications. This system incorporates six repeaters that join four equipment sites over a 31-mile (50-kilometer) distance. Configuring a similar system using standard coaxial trunk would require 84 amplifiers over the same distance. Considering signal degradation of approximately 0.6 dB per line amplifier, a 65 dB input signal at the headend would be reduced to 0 dB by the time it reached the other end of the trunk—in other words, it would be impossible to transport the signal that far on coax.

Light does not generate electromagnetic waves so problems inherent in a coaxial system such as electromagnetic interference and radio frequency interference are not present in a fiberoptic system. Light may escape the fiber, but there is no opportunity for the light signal to cause interference in the atmosphere. Conversely, electrical signals that may leak into the optical fiber will not create a disturbance because light and electromagnetic waves do not interact.

Another consideration is water ingress. Water seeping in and contaminating the dielectric can radically alter signal attenuation in a coaxial cable. Again, the optical fiber is designed to retain the light within a buffer shielded waveguide, which the water cannot penetrate.

Finally, the life expectancy of fiberoptic cable is considerably longer than that of coaxial cable, because coax is composed of elements that inherently degrade faster than silica-based optical fiber.

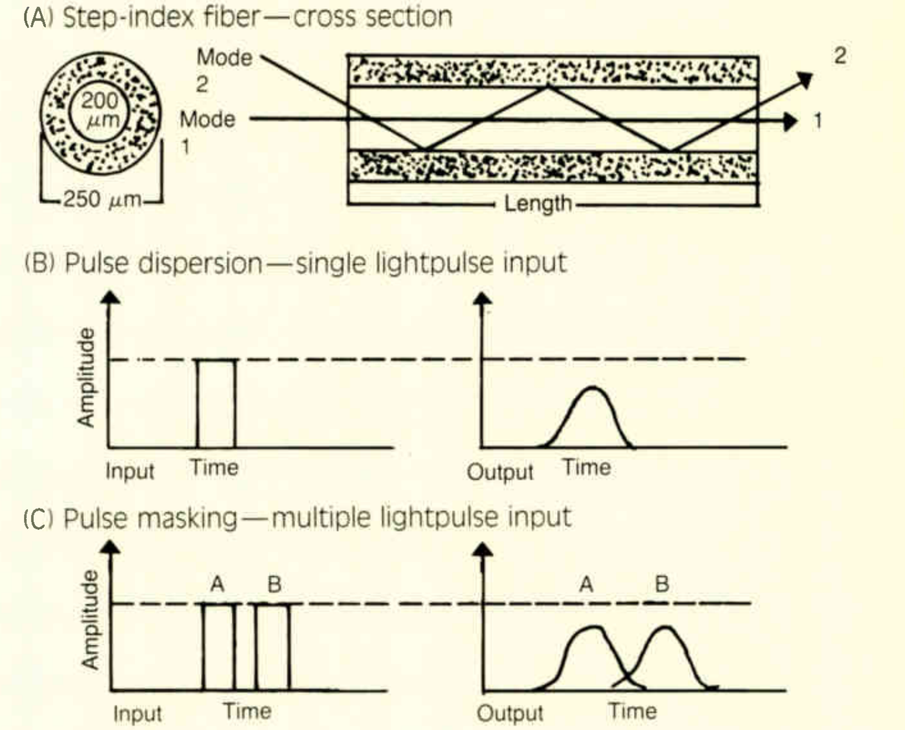
Fiberoptic operation

From a systems aspect, fiberoptic trunks are the same as conventional coaxial trunks. However, while fiberoptic systems use light sent over a glass medium (optical fiber) to the receiving end, a traditional system transmits signals directly in the form of electrical energy over a coaxial medium (metal fiber).

The design of optical fibers is based on the principle of total internal reflection developed by John Tyndall, a 19th century physicist. He theorized that light in a dense optical medium, like glass, cannot escape into a less dense optical medium, like air, if the entry angles are kept small enough. His ideas could not be readily applied to telecommunications until the invention and refinement of the laser in the 1960s.

Lasers are necessary to transmit wideband light signals over long distances. But because lasers are nonlinear, it is impossible to group channels close together and utilize amplitude modulation (AM), as in a standard coaxial trunking system. Therefore, frequency modulation (FM) is the preferred transmission method in fiber transport systems. The intensity of the laser is varied by a frequency-modulated signal, which is used as the input to the transmitter. At the other end of the fiber, the optical receiver senses the light from the transmitter and recreates the original FM signal.

Figure 1



Frequency modulation provides a distinct improvement in signal-to-noise over carrier-to-noise ratios. Generally speaking, the wider the frequency deviation, the greater the signal-to-noise improvement. For example, standard FM modulators feature a 4 MHz peak deviation (total 8 MHz), which accounts for more than a 20 dB improvement in signal-to-noise ratio. The wideband 10.75 MHz peak deviation (total 21.5 MHz) modulators provide well over a 30 dB signal-to-noise improvement. Increased peak deviation allows fiberoptic systems to exceed 30 miles (50 kilometers) end to end and retain a signal-to-noise ratio of greater than 50 dB.

Multichannel fiber transport systems center the frequencies of the various FM channels on different portions of the useable transmission spectrum of the laser. Standard laser transmitter spectral width is typically 30 MHz to 300 MHz with channel center frequencies at 70, 123, 182, 230 and 276 MHz.

The optical fibers' performance is related to attenuation and bandwidth imposed on the light signal. The amount of attenuation is related to the length of the fiber and the wavelength of the light (i.e., attenuation can go up or down depending on the wavelength). Attenuation is predictable because optical fiber has a constant attenuation factor per a unit of length and the light is generated at a constant wavelength. The bandwidth limitations change with the type of optical fiber being used and are critical because of the wide bandwidth requirements of FM discussed earlier.

Using a step-index fiber helps to illustrate what the bandwidth limitations of the fiber will be. Consider a single light pulse injected into a length of step-index fiber. The light pulse will take several different modes (paths) through the fiber core simultaneously as it travels to the end of the fiber. Looking at two of the modes (Figure 1 [A]), we can see that mode 1 takes the straight path through the fiber core and mode 2 is taking a longer path through the fiber as it bounces up and down through the core. Because mode 1 travels a shorter distance than mode 2, it will arrive at the end of the fiber before mode 2. This difference in time of arrival between the modes causes dispersion. Dispersion is the condition in which the light pulse output is wider than the original light pulse input.

When two light pulses are injected into a step-index fiber, components of each light pulse take different modes through the core. Because some of the components of pulse B (Figure 1 [B]) will arrive at the end of the fiber before some of the components of pulse A, which was injected into the fiber first, the outputs of pulses A and B will begin to pile up on each other or mask because of pulse dispersion. So dispersion means each pulse will occupy a greater bandwidth, thus causing an overlapping of each pulse, resulting in overall signal degradation.

Therefore, there are two factors to take into consideration when designing a fiberoptic system: attenuation of the fiber to light at the specific frequency of the light source, and bandwidth of the fiber per its unit length. Attenuation of common 200/250 micron step-index fiber is 5 to 10 dB per kilometer, and bandwidth is 70 MHz per kilometer. This is not acceptable for very long distance transmissions (several kilometers between repeaters) so a different type of fiber—graded index—that simulates a property of electromagnetic wave propagation must be used.

In coaxial cable, wave velocity can be in-

THE NEW MC^2 COAXIAL CABLE IS MORE RESISTANT

Because each cell is an hermetically sealed compartment, MC^2 is more resistant to moisture ingress and migration. No other cable can stand up to its environment better than the new MC^2.

MORE SIGNAL STRENGTH

The new MC^2 Coaxial Cable's patented design of using air instead of foam means less attenuation and more signal strength. And that's with a signal load of 77 channels.

MORE SAVINGS

Because MC^2 components are bonded together for maximum flexibility and minimum signal loss, you save more money on installation, connections, labor and on the cable itself.

MORE economical. MORE reliable. MORE flexible. MC^2 outperformed the competition hands down and we'll be happy to show you the results anytime.

General Cable Company
CATV DIVISION
A Unit of The Penn Central Corporation

Visit us at booth 370 at the Western Show.

creased and bandwidth capacity improved by using a gradient density foam. This principle is applied in the graded-index fiber, where the refractive index of the glass is gradually lessened with distance from the center of the fiber outward. Figure 2[A] shows a profile of graded-index fiber.

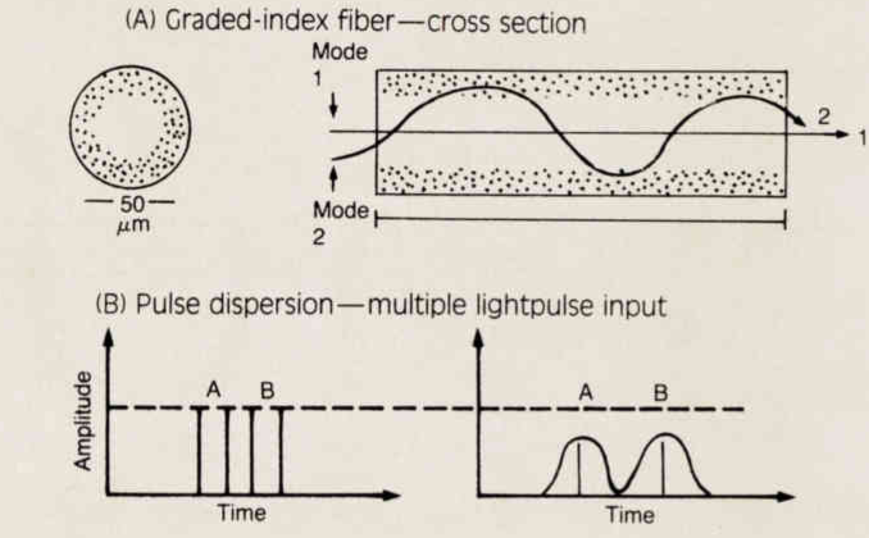
Again, if we inject a single light pulse into the fiber, we see that its components will take different modes to reach the end of the fiber. Mode 1 is the straight path but mode 2, unlike its counterpart in the step-index fiber, does not reflect off the cladding of the fiber. Instead it tends to get curved back toward the center of the fiber, its velocity increasing as it travels through the outer areas of the fiber, which have smaller refractive indexes. This allows mode 2 to almost catch up with mode 1 at the end of the fiber even though it has traveled a longer relative distance. The result is less pulse dispersion of the output and less bandwidth space used up by each pulse.

Obviously then, when several light pulses are injected into the fiber, the output pulse masking that is present in step-index fiber is minimized in graded-index fiber. Because the pulse dispersion is less, bandwidth capacity is larger in graded-index fiber.

The bandwidth of the graded-index fiber is related not only to its length but also to the relative speed of light as it travels through the total number of modes possible. The typical 50/125 micron graded-index fiber in use today in fiber transport systems has a bandwidth of 800 MHz at distances of 6 kilometers. Attenuation of 840 micron is usually 3 to 5 dB per kilometer.

Having discussed how fiberoptics work and some of the advantages of this technology, we can now look at particular applications of these systems in telecommunications. As each application is unique and each system custom designed to fit that application, the following examples are simplified explanations of systems that are installed and operating. The purpose here is to familiarize the reader with the basics of each of these systems.

Figure 2



Baseband-to-baseband systems

This type of application is generally used for headend-to-headend (point-to-point) or institutional purposes such as teleconferencing between businesses.

In a baseband system like the one shown in Figure 3, the separate baseband video and audio signals are frequency modulated at 70 MHz. These composite signals (up to five) are multiplexed to form one wideband multichannel signal. The number of channels and the multichannel frequencies are chosen depending on the specific requirements of each system.

The function of the broadband fiberoptic equipment is to convert multichannel electrical signals into light and transmit them over long distances. Optical transmitters intensity-modulate a laser with the wideband multichannel signal from the RF multiplexer. The laser light is launched into a wideband, graded-index optical fiber.

At the receiving end the laser light is delivered to an optical receiver where an avalanche photodiode detector (APD) in the receiver reconverts the laser light to the original multichannel electrical signal. The signal is then amplified and processed. If more distance needs to be traveled, the signal is immediately applied to another repeater and so on until the end of the span where only a receiver is required. At some separate stations, it may be necessary to return the signal to baseband in order to receive or inject video into the broadband system. The spacing

Figure 3: Typical baseband-to-baseband trunk block diagram

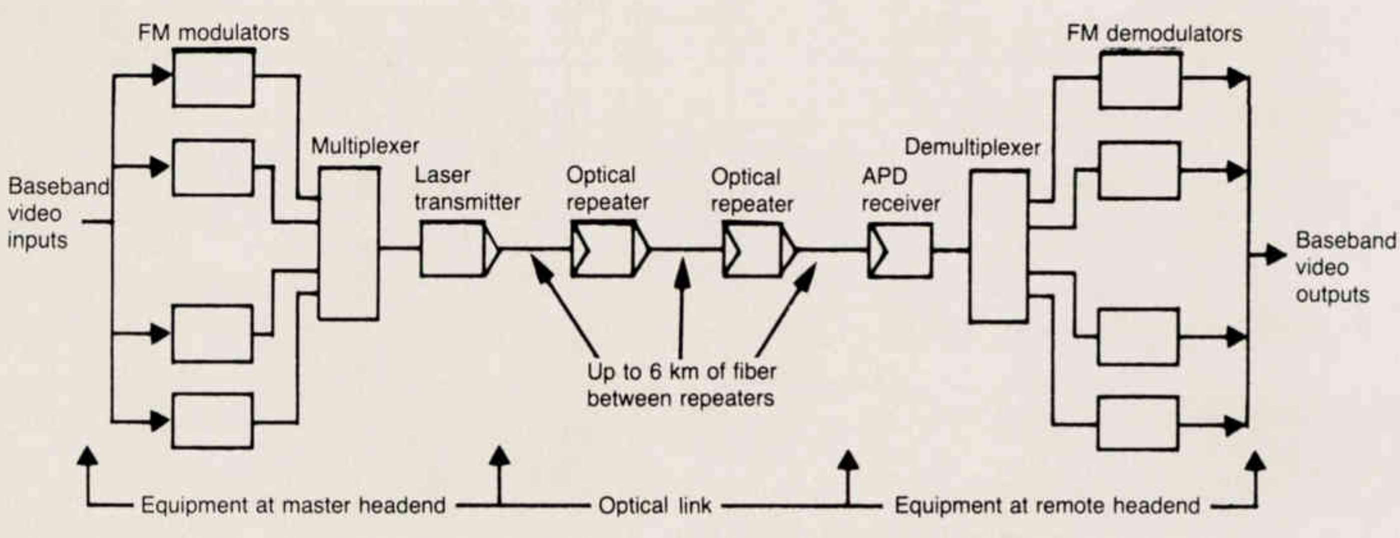


Figure 4: Typical TVRO trunk block diagram

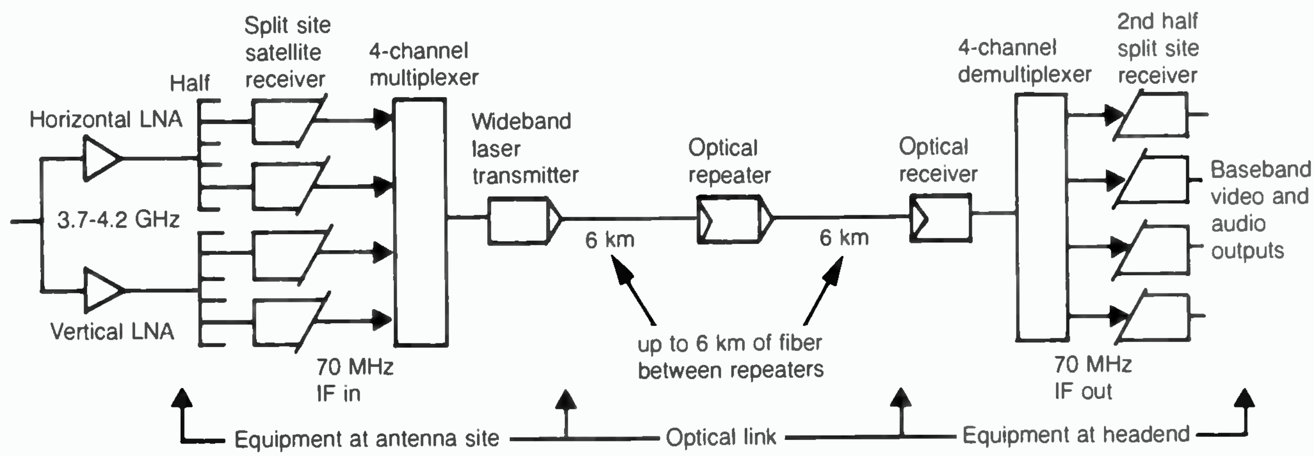


Figure 5: Typical point-to-point data transmission link block diagram

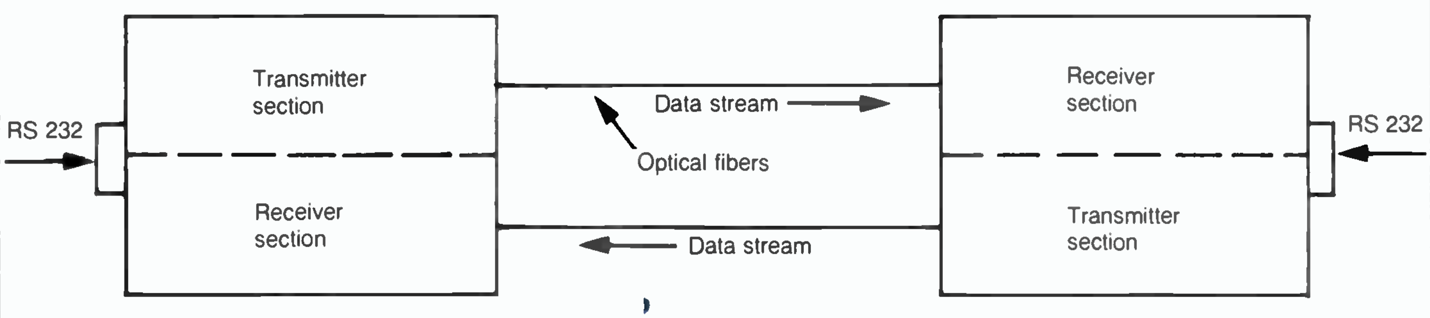
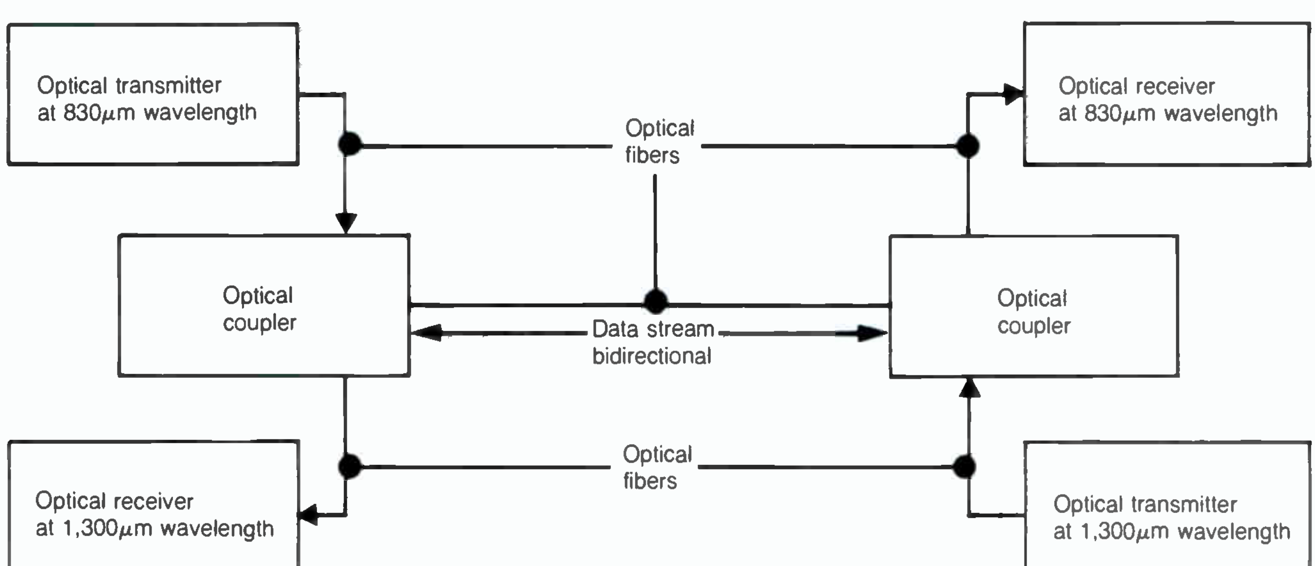


Figure 6: Wavelength multiplexing on a single fiber data transmission link



and number of repeaters needed is dependent upon the performance requirements of a given system. As mentioned earlier, repeaters are commonly spaced 6 kilometers apart.

From the final receiver in the system, the multichannel signal is applied to an RF demultiplexer. The demultiplexer converts each system channel back to the 70 MHz signal. The demultiplexer has up to five outputs — one for each channel. The FM demodulator then demodulates the 70 MHz signal from the demultiplexer and provides separate baseband video and audio outputs. The signal-to-noise ratio of this type of system is typically greater than 50 dB, but this ratio depends upon total link length.

It also is possible to transport data signals on this type of system. This application is discussed later on in the "Data transmission link" section.

TVRO systems

A TVRO (television receive-only) system receives TV signals from a satellite and transports them to the headend. Often the distance from the satellite receiving site to the headend stretches beyond 1 kilometer. Fiberoptic transport systems are suitable for transporting these signals for very long distances (20 miles or more) without the need for signal demodulation and remodulation. The technique used to accomplish this uses a split-site version of standard satellite receivers. A TVRO system is shown in Figure 4.

At the antenna site (earth station), the received satellite FM signals are fed to a low-noise amplifier (LNA) and then down-converted to 70 MHz IF signals by standard satellite receivers. These wideband deviation signals are then fed into multiplexers (up to five channels) where they are converted and added together. The composite wideband signal is then fed directly into the optical transmitter. The optical transmitter converts this wideband signal to light that is intensity modulated. Some distance away, possibly after passing through repeaters, an optical receiver picks up the light via the fiber and converts it back to the original electrical wideband signal.

From the receiver the wideband signal is fed to the demultiplexer where each of the channels of the wideband signal is downconverted to the original 70 MHz IF signals. These signals are then fed into the second half of the satellite receivers. The second half of the satellite receiver converts the 70 MHz IF outputs to the video and audio baseband signals. The signal-to-noise ratio of a TVRO link of the type shown in Figure 4 is generally over 55 dB.

Data transmission links

Data signal transmission also can be accomplished by using a fiberoptic trunking system. Figure 5 shows a simple data system.

This trunk incorporates both a transmitter and a receiver in a single housing. An optical modem connects equipment such as computers and terminals. Two modems are coupled together by fiberoptic cable. One fiber is used to transmit data in one direction and the other fiber is for transmission in the other direction. In this application the link is only 1 kilometer long, the fiber used is step index, the source of light is an LED, and the detector is a PIN diode. The baud rate of the modems in this type configuration is selectable up to 254 Kbs.

In Figure 6 there is a different type of application. These modems are capable of accommodating 32 channels at one time, which is convenient for linking a computer controller to terminals located in remote areas. This type of modem takes the fiberoptics one step further, as they are full duplex modems coupled by a single fiber. This is done by wavelength multiplexing of two light sources in one fiber. Each of these light sources operates at a different frequency of 830 micron and 1,300 micron. Likewise, the respective receivers operate at different wavelengths.

The fiber used is of wide bandwidth and is referred to as dual window fiber, meaning that it may be used at two different light frequencies.

Conclusion

All in all, fiber systems are flexible enough and, at the very least, good enough to match the performance of conventional systems as exemplified by the comparisons made previously. Its use outside the telecommunications industry and continuing refinement, coupled with its distinct advantages, indicate that fiberoptics will become the convention in time.

Caltec Headend Technician Tony Kern measuring AGC voltage on a fiberoptic receiver. This reading corresponds directly to the optical power of the incoming signal. This test, along with others, are conducted every three weeks as part of the preventive maintenance program.

'Don't let the fear of fiber get you. . .it's just another electromagnetic system'

The quest for fiber

By Tom Saylor
Signal Processing Manager Caltec Cablevision

Fiberoptic trunking has been touted as an answer to many of the shortcomings of traditional RF systems. Immunity from electromagnetic interference (EMI) and radio frequency interference (RFI), extended bandwidths, high transmission quality and fewer active parts are among the advantages. First, let's review the alternatives.

Obtaining frequency and path authorizations for microwave links is becoming increasingly difficult in some areas. Competition for the previously exclusive CARS band has often eliminated microwave as an option. Towers aren't getting any cheaper, either. And who needs the zoning or other regulatory hassles?

Cable FM, the other mainstay of the interconnect designer, has its share of drawbacks also. Long cascades suffer from the reliability problems of having many amplifiers on the job. A failure of one in the string renders the whole thing inoperative. Over the years, power and maintenance costs can add up to a very large sum. FCC approval for some frequencies is required, and forces the operator to remain vigilant for signal leakage.

So, why not use fiber? The purpose here is not to convince the industry to specify fiber under all circumstances. Individual operators need to base their decisions on sound financial and engineering analyses. But, perhaps many potential fiber users have avoided the technology because of another factor—fear of the unknown! In reality, optical and RF systems are very close kin. Consider that both are simply electromagnetic networks, one is just higher in frequency than the other. And, many an optical link's input is wideband FM, a la supertrunk.

As with any other system, lightwave networks require unique planning before and during activation, along with special training and tooling after throwing the switch. To date very little has been published exclusively for the CATV operator to assist in the acclimatization to fiber. Assuming that the channel capacity and routing have been determined, the practical concerns of installation and operation need to be addressed. To that end, let's consider construction, turn-up, personnel documentation and equipment.

Construction and activation

Common sense must reign supreme during construction and activation. If the system requires repeaters, these should be placed where they will be accessible and not present a safety hazard to maintenance crews. At the very least, splices will be required. Continuous fiber lengths of 1 km are not uncommon. Differing lengths of fiber should be assigned unique locations in the link. This will allow their ends to fall at predetermined locations where access for splicing is easiest. No backyard easements, please! After splicing, it is recommended that each fiber be checked with an optical time domain reflectometer (TDR) to document its loss signature. The system vendor should be capable of doing these tests.

Prior to actually installing the electronics for the light-link, have the vendor bench check and adjust the components on-site. Back-to-back tests under laboratory conditions will weed out the non-performers before they infect your system. Of course, thorough documentation is urged. Tests should be conducted on the system again after component placement. These end-to-end proofs will assure that the network performs as promised, and provide a reference baseline for future maintenance.

Personnel and documentation

Technological advances are marvelous. Pushing the state-of-the-art sometimes takes its toll on the end user, however. Improving an idea often makes for a more complex solution. But, maybe this is the opinion of those unfamiliar with lightwave transmission. Are MIT-trained techs along with several million dollars of test gear required to keep these links playing? In actuality, existing personnel at the headend or chief tech level will be able to manage "the beast." Cable technicians have long been known for their ability to rise to the occasion when given only the scantest of support. Providing them with necessary information and a few new tools will guarantee success.

As mentioned earlier, optical systems are essentially the same as their RF counterparts. Most fiber trunks have wideband FM video as their input signal prior to application to the laser. These techniques are identical to those employed on purely RF supertrunks. Like coax, fiber has a characteristic bandwidth (expressed in MHz/km) and loss (dB/km), all differing according to the wavelength (frequency) of the transmitter's laser. In addition to wavelength, the lasers themselves have a characteristic output power level, given in microwatts. Minimum levels of optical power are required at a receiver's input, also stated in microwatts.

The objective is to document the system in a usable form. It is suggested that a ready-reference manual be prepared. This should be a condensed version of manufacturer's specs, safety considerations, initial system performance data, setup procedures, troubleshooting techniques, system block diagrams, preventive maintenance procedures, and anything else of immediate value to the maintenance tech.

The equipment

The other aspect of system support involves equipment. Analyze the network, considering manufacturer's published failure rates, when determining how many spare components to keep on hand. An absolute minimum would be a "one each" approach. This philosophy could backfire, however, forcing personnel to rob a lower priority channel to keep a money channel operating. One cannot depend on unpredictable repair turnaround to stay operating at 100 percent.

What of equipment in the diagnostic vein? Many CATV operators already possess the key instrument—an RF spectrum analyzer. Assuming that the fiberlink has wideband FM as its input, the analyzer will be effective in maintaining this portion.

Optical measurements will require, you guessed it, an optical power meter. Commonly

A representative example of fiberoptic maintenance equipment (l-r): optical power meter, standard digital voltmeter for test point readings, spray solvent for optical connector cleaning, eye wash (safety or first aid) and optical connector installation tool.

available for under $500, this instrument will permit you to quantify laser output levels, fiber loss and optical receiver input levels. Separate detectors can be purchased that are tailored to the system laser's respective wavelength. The meter is usually calibrated in microwatts or dB-microwatts (dB above a 1 microwatt reference level). Operation is similar to a standard multimeter.

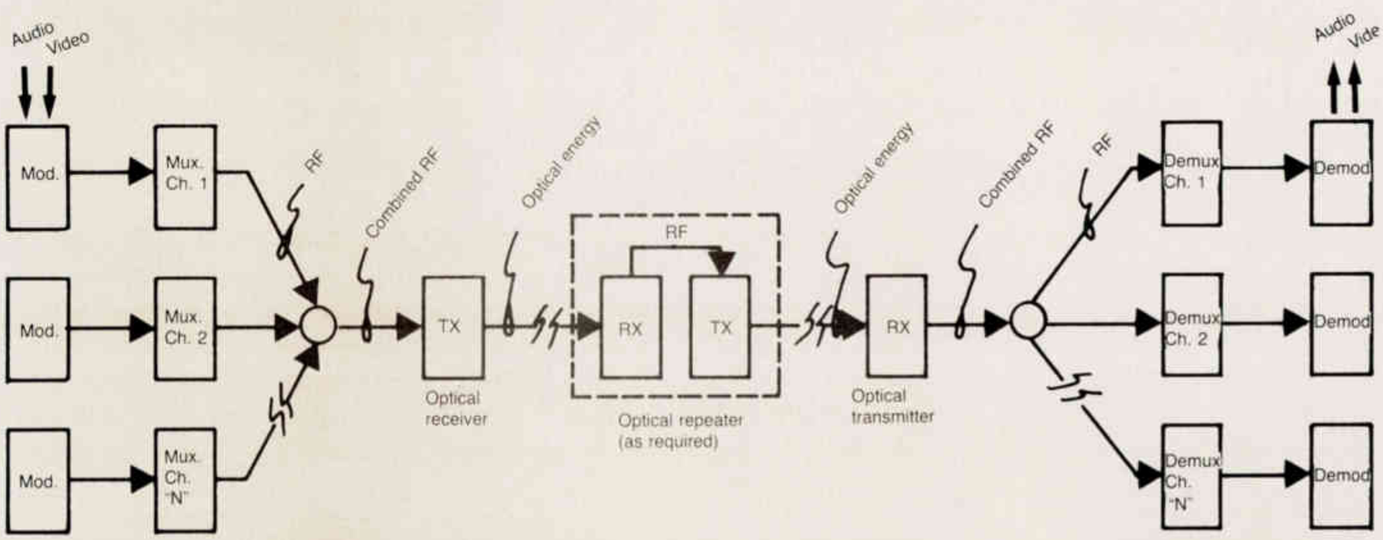
Another essential is the special tooling required to affix optical connectors to the fiber. Different system vendors will specify a particular connector. Today's connector is a distant cousin to first-generation methods requiring polishing and epoxying. Given training and proper equipment, system techs can get repeatable results. Keep a supply of connectors and feed-throughs handy for emergency repairs!

Do you need the high-ticket items like optical TDRs and fusion splicers? Probably not. These gadgets run anywhere from $8,000 to $15,000 and unless your system is of appreciable length, they won't get a lot of use. Localizing breaks that might occur in the fiber (after fiber-bearing pole runs into vehicle, for instance) can usually be done visually. Emergency splicing can be accomplished with mechanical connectors and pieces of surplus fiber. If fusion (electric arc melting) splicing was used in your system, the chances are that the system installer can be called to re-fuse emergency repairs when required.

Just another electromagnetic system

Lightwave communication can be cost-effective over both the short and long term. Don't "go glass" just for the sake of it. Carefully consider current and anticipated future needs. Compare coaxial and fiber systems over parallel routes when deciding. Remember to look at the projected savings of fewer active components and lower utility costs. And don't let the fear of fiber get you! Keep reminding yourself that it's just another electromagnetic system.

Figure 1: Typical 'hybrid' optical system



System uses discrete wideband FM carriers at different frequencies for each channel. Combined RF carriers are applied to optical transmitter. Repeaters recover original RF, amplify it and re-convert it to optical energy; optical receiver at terminal location has RF at output. Frequency down conversion and demodulation are then performed, recovering original baseband signals.

ARCOM Traps

Stack Up...

against the competition

- Superior long-term stability
- Superior moisture proofing
- Superior security-rolled case prevents subscriber tampering
- Superior RF radiation shielding

Traps
Shown
Actual
Size

2 Pole Series

4 Pole Series

6 Pole Series

8 Pole Series

**IN N.Y. STATE
CALL COLLECT
315-463-8433**

(800)448-1655

Northern
catv sales, inc.

'In order to be competitive, a PCM/TDM terminal pair with optics must achieve a cost below $4,000 per channel'

Fiberoptic supertrunking: FM vs. digital transmission

The rapidly evolving technology of fiberoptics is providing many new options to the CATV systems integrator. For many years within the broadcast and CATV industries, fiberoptics has provided short, single channel per fiber links for interference-free broadcast quality transmission. Not until recently has fiberoptics become economical for video supertrunking. The ability to frequency and wavelength multiplex large groups of channels on a single fiber for repeaterless transmission beyond 10 miles has made fiber cost-competitive with coaxial supertrunking in certain systems. Advances in the fiber technology, with the introduction of low-cost single mode fibers, provide new cost and capacity advantages to the service provider. Although FM transmission on fiber is the lowest cost near-term approach, the projected introduction of low-cost digital encoders may make PCM transmission the future choice, particularly for long-haul transmission.

By Robert J. Hoss and F. Ray McDevitt
Warner Amex Cable Communications Inc

In today's larger metropolitan areas, a trunked-hub architecture is generally employed for CATV video transmission. Such an architecture is shown in Figure 1 as conceived for the city of Dallas. Operationally, video programming originates from the headend(s) and is delivered to the hubs via microwave, coaxial or fiberoptic supertrunks. From the hubs, it is distributed to the subscriber over a conventional coaxial network. This supertrunk distance is generally on the order of 8 to 12 miles. As separate systems within a metropolitan area begin to merge through acquisition or business venture, a need for even longer, higher quality supertrunks arises for intersystems interconnects. Also, interest in data interconnects along with video is rapidly emerging.

Three approaches to video supertrunking will be evaluated here (see Figures 2 and 3):

a) Frequency modulated, frequency multiplexed, wavelength multiplexed (FM/FDM/WDM) transmission on multimode fiber;

Figure 1: Fiberoptic supertrunk routing

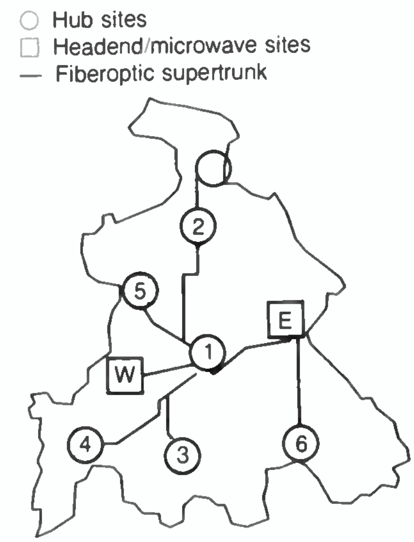


Figure 2

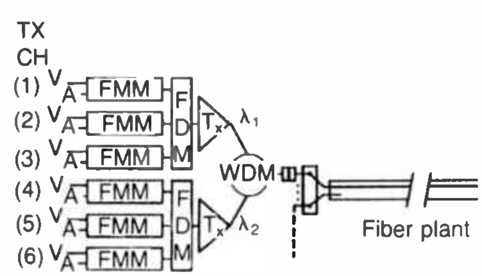


Figure 3

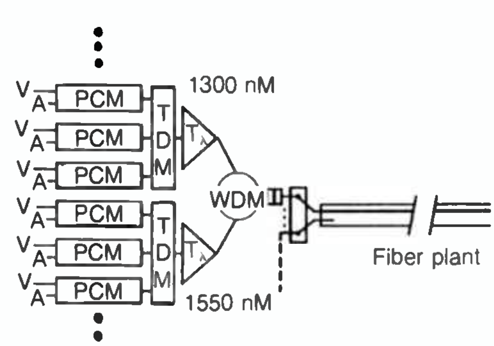
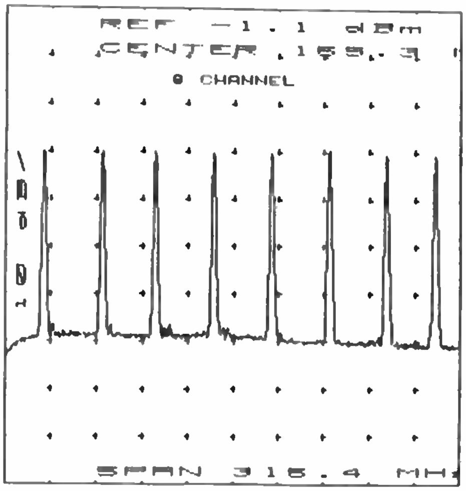


Table 1: Tests comparing single mode to multimode FM/FDM transmission (typical values shown)

Parameter	Multimode		Single Mode	
Mod./mux.	FM/FDM/WDM		FM/FDM	
FM deviation	10 MHz		10 MHz	
Wavelength	1200, 1300 nm		1300 nm	
Number of channels/fiber	4	6	6	8
Tx BW (MHz)	90	130	250	330
Tx distance (km)	22	16	20	20
Tx loss (dB)	25.6	21.1	11.5	11.5
Coupled power (dBm)	–5	–5	–6.2	–6.2
Received CNR_e/Ch.	21	24	26	24
Typical intermod (dBc)	–30	–30	–42	–40
Video SNR_W (dB)	55	58	59*	59*

*Limited by FMM/FMD

Figure 4: Eight channels per wavelength



b) FM/FDM/WDM transmission over single mode fiber; and

c) Pulse code modulated, time division multiplexed, wavelength multiplexed transmission (PCM/TDM/WDM) over single mode fiber.

Performance of a fiberoptics link is a function of the received, detected carrier-to-noise (CNR_R) vs. the CNR required to achieve demodulated weighted video signal-to-noise (SNR_W). Received CNR_R is a function of received optical power (P_R) vs. noise introduced in the optical link by the source (modal noise) and the receiver. In general, therefore, SNR_W is affected by P_R. Since optical power margins are usually small (30 to 40 dB), encoding must be used to improve the CNR-to-SNR relationship.

FM/FDM

For FM modulation, wide deviation (8 to 10 MHz) is used to reduce the required CNR_R. FM improvement factors of 32 to 38 dB have been demonstrated. A CNR_R of 21 dB, for example, is shown to achieve a 55 dB CCIR weighted video SNR. Allowing for guardband, a 36 to 40 MHz passband is required. Optical receiver sensitivity (required P_R) at 21 dB CNR_R is the range of –36 to –32 dBm. FDM divides the available optical source power by the number of channels transmitted per wavelength and utilizes a transmission bandwidth that is, as a minimum, N x Bc; where N is the number of channels and Bc is the passband per channel. A 10-channel per wavelength system, therefore, requires 400 MHz BW.

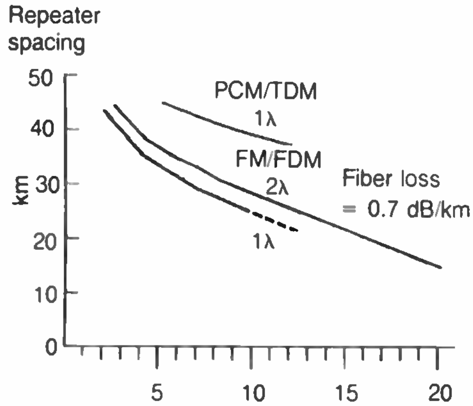
Multimode vs. single mode performance for FM/FDM

Multimode fiber has the following performance disadvantages over single mode:

Attenuation: .9 to 1.2 dB/km vs. 0.5 to 0.6 dB/km for single mode.

Bandwidth: ≤1.6 GHz-km vs. multiple GHz for single mode.

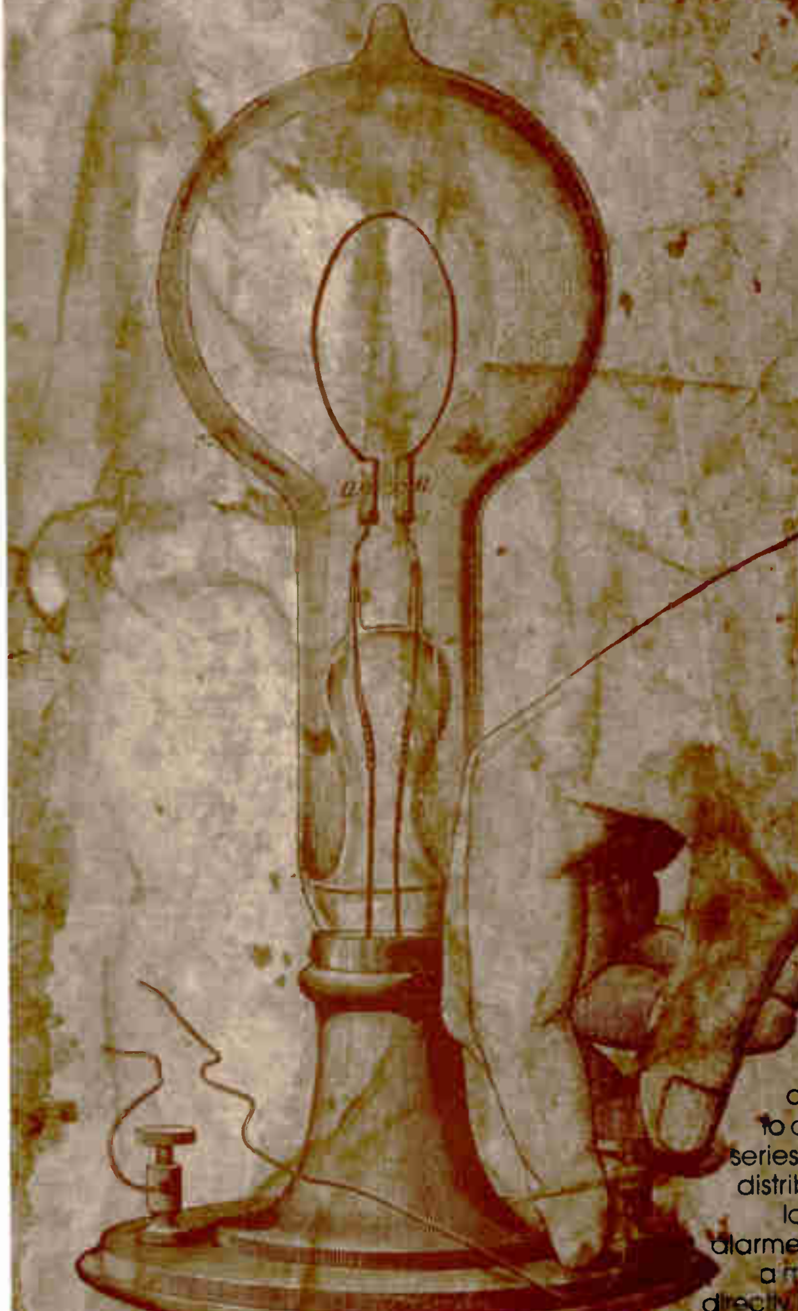
Figure 5: Number of video channels per fiber



Noise: Multimode lasers and their interaction with multimode fibers creates a noise component which becomes a limiting factor; optical power penalties of typically 3 to 4 dB can be attributed to modal noise.

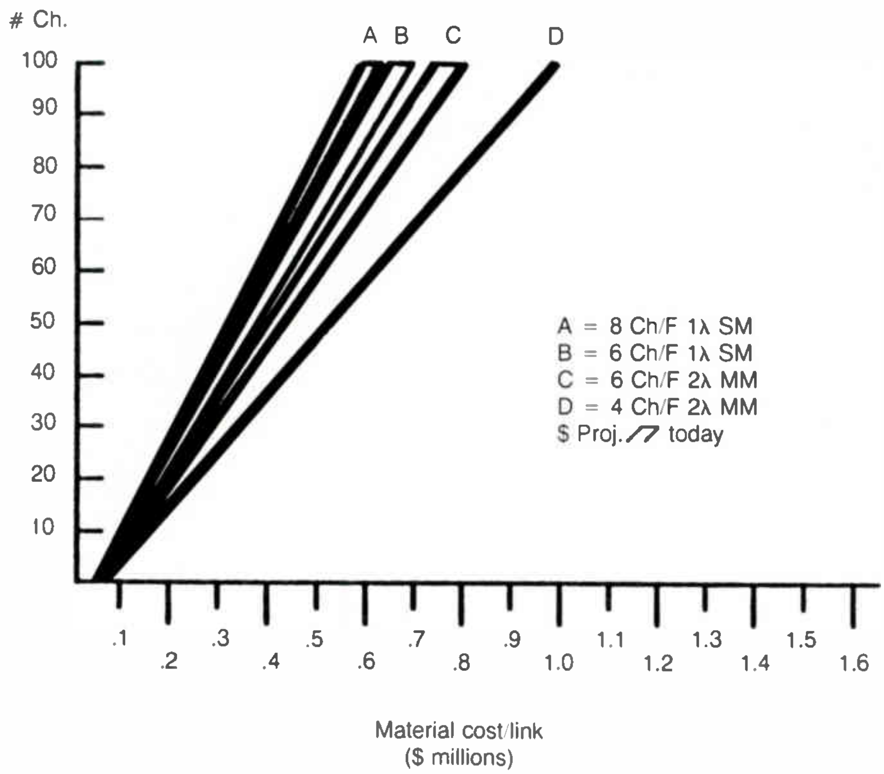
Intermod: Although single mode sources have linearity limitations, they are inherently more linear than multimode since stability of one mode is easier to control than that of multiple modes. Source screening may prove a low yield, high-cost operation for multimode.

Table 1 gives the results of tests performed




C-COR

Figure 6: Single mode vs. multimode FM/FDM 16 km hub spacing



at Warner Amex that compare the performance of FM/FDM video trunking over multimode and single mode fibers. Multimode tests were performed over 16 and 22 km, and single mode over 20 km of cabled fiber.

Figure 4 shows the spectrum analyzer printout for eight channels per wavelength FM/FDM over a 20 km distance.

PCM/TDM

The relationship between video SNR_W and number of PCM bits required is:

$$SNR_N = 6n + 10 \log \frac{fs}{b} + W$$

Where: n = number of bits per sample
fs = sampling rate
b = video BW
W = weighting factor

Note: fs ≈ 1.25 x Nyquist rate = 1.25(2b) to account for practical filtering.

The data rate per channel is as a minimum:

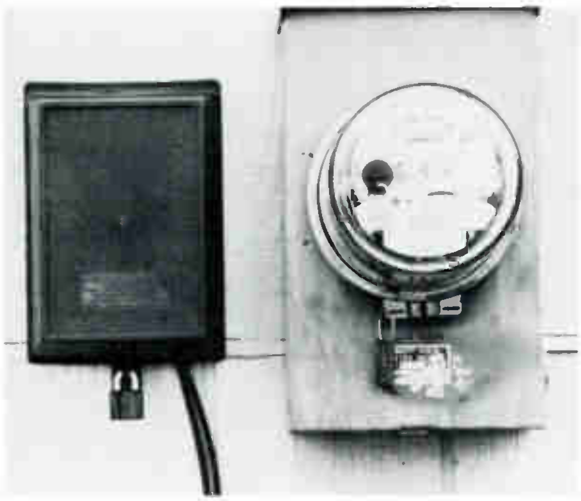
Rc = Nfs

For a 4.2 MHz video bandwidth, therefore:

fs = 10.5 MHz (10.74 often used as multiple of color subcarrier)
N = 8
Rc ≈ 86 Mb/s

Recover Profits In Your System By Turning Illegals Into Paying Customers

Professionalizing all installations with Telecrafter's Audit Control Home Box and Tele-Theft Control Seal allows a cost efficient, effective program of auditing homes for illegals.



Statistics indicate that upward of 70% of illegals become paying customers once they are discovered.

By removing connections from the pole and out of pedestals, into the tamper-proof Home Box you will reduce:

CUSTOMER SERVICE TIME AND COSTS	WEATHER RELATED SERVICE CALLS	CUSTOMER SERVICE COMPLAINTS
by 50%	by 80%	by 50%
* * * * *	* * * * *	* * * * *

Eliminate hazardous pole climbing and turn your installers into efficient installation and auditing personnel.

Home Box Features:

- Detects visual evidence of tampering
- Trailer Court ground rod application
- Mounts to any surface
- Durable engineer-approved nylon material
- Available in black and gray

Put your feet back on the ground and let your profits do the climbing.

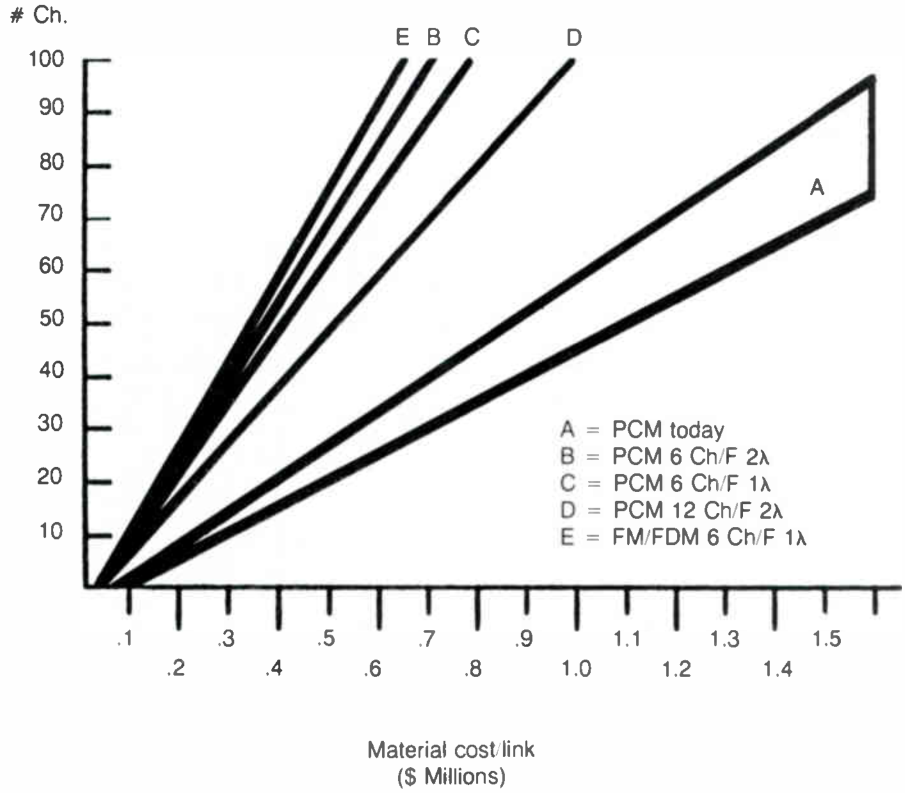
For samples, catalog and information of our complete product line call 1-800-548-7243

Telecrafter PRODUCTS CORPORATION

P.O. BOX 30635 BILLINGS, MONTANA 59107
(406) 245-8200

See you at the Western Show Booth No. 129 - Anaheim Room

Figure 7: FM/FDM vs. PCM/TDM 16 km hub spacing



For TDM, the transmission rate is:

$$R_T = N(2nBb)(1 + \gamma)$$

Where: N = number of channels
γ = an efficiency factor reflecting added frame bits for multiplexer and endcoder overhead and synchronization

If a 5 percent frame overhead factor (12/256) is assumed, the rate per channel is 90 Mb/s. If we assume scrambled NRZ encoding, then the minimum transmission bandwidth is ≈R/2. Bandwidth utilization per channel is, therefore, approximately 45 MHz or only slightly greater than that required for FM/FDM.

A key difference between FM and PCM is that for PCM, assuming few bit errors (10^{-7} to 10^{-9} BER), video SNR is a function of the encoding and not the transmission quality. The received peak signal-to-rms noise to achieve a 10^{-9} BER is approximately 21 dB (or 15 dB average signal-to-rms noise). This is a 3 dB optical power advantage over FM/FDM. PCM offers an additional advantage at repeaters where, with signal regeneration, degradation is negligible. With FM/FDM, approximately 3 dB optical power penalty per repeater can be assumed since video SNR is a direct function of received CNR above the FM threshold. Considering the above, intermode penalty, modulation depth and noise bandwidth differences, the performance comparison is shown in Figure 5 (single mode fiber is assumed).

Cost analysis

The analysis compares equipment cost only, assuming labor and construction are equal. Cost projections incorporated the following assumptions:

a) Current costs were based on actual quantity quotations or recent experience;

b) Projections were based on today's pricing for similar components where volume or maturity has influenced cost;

c) Transmission assumes video only; one video with companion audio per channel;

d) Fiberoptics cost projections assumed:
- Fiber @ 35¢/m
- Tx/Rx @ $4,500/pair multimode, $5,000/pair single mode

e) FM/FDM assumes actual costs for existing hardware; and

f) PCM/TDM projected costs assume:

Figure 8: FM/FDM vs. PCM/TDM 32 km hub spacing

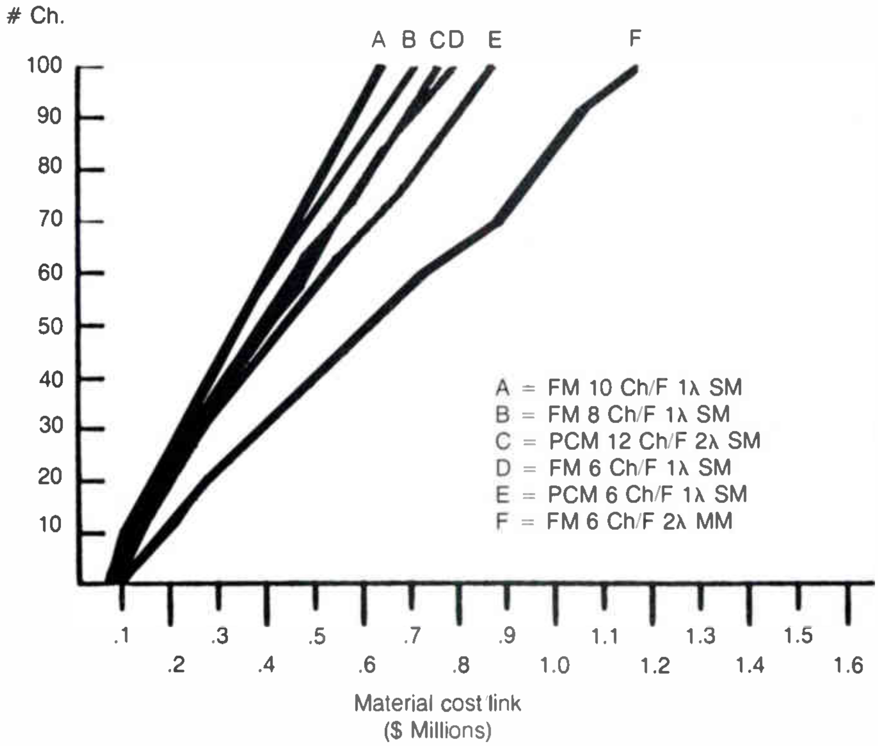
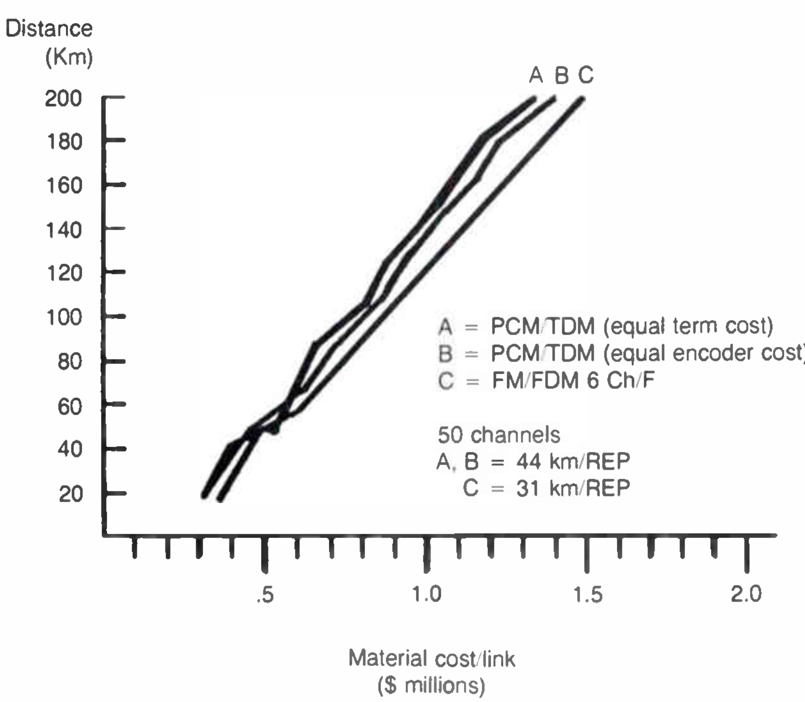
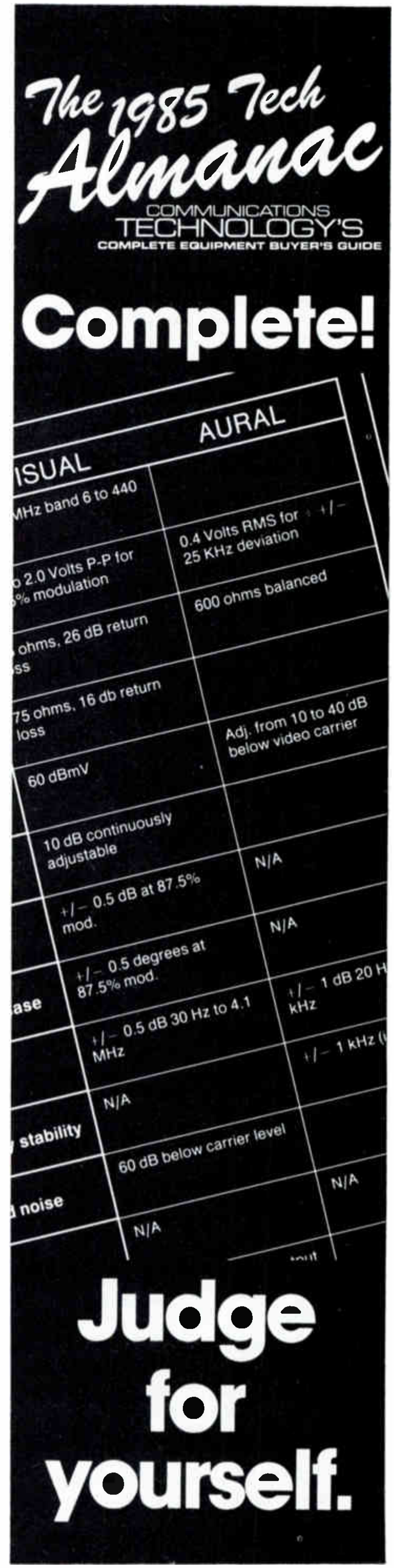


Figure 9: Long-haul trunking





- Encoder costs (video vs. audio) will achieve same price levels as FM
- High speed TDM will reach the $4,000 to $6,000 per pair range (includes shelf and power supply)

The results are shown in Figures 6 through 9. Route lengths of 16 km (10 miles) and 32 km (20 miles) are compared as to total cost vs. channel capacity.

FM/FDM observations

For a 16 km route length, transmission on multimode is in practice limited to three channels per wavelength, i.e., six channels per fiber. Single mode transmission can achieve over 8 to 10 channels per wavelength at this distance. At only eight channels per fiber, one wavelength, the single mode approach is 20 percent less than the best multimode approach (six channels per fiber). In addition to the cost advantage, even at eight channels per fiber, the single mode approach is not limited to 16 km repeater spacing. The excess optical power, the total absence of modal noise and the low intermod of single mode results in much higher video performance, more capacity and a longer repeaterless distance.

At 32 km spacing, the multimode system requires at least one repeater, while the single mode system does not. This results in a cost advantage for single mode of 40 percent at eight channels per fiber (as compared with six-channel per fiber, two-wavelength, multimode).

Of interest to note is that multiple wavelength operation over single mode only has significant cost advantage for longer trunk distances. The logistic problems of maintaining two transmitter types may outweigh any small cost advantage for shorter distances.

PCM modulation

Figures 7, 8, and 9 illustrate the projected cost of PCM/TDM/WDM in comparison to FM/FDM. For PCM, today's cost also is reflected. Today's cost reflects linear encoding, single-channel per wavelength operations as the lowest cost architecture available in product form.

What the figures show is that for short trunks (10 miles), PCM at today's product costs is at best 2½ times higher in cost than what can be achieved today with eight-channel FM/FDM. If we project PCM encoder cost to be equivalent to FM modem costs, six channels per fiber PCM/TDM becomes cost equivalent to only four channels per fiber FM/FDM. The difference is the TDM multiplexer cost.

For PCM/TDM to compete with FM/FDM in metropolitan CATV networks, for example, the cost of a six-channel video plus audio encoder/multiplexer terminal end must be in the $10,000 to $14,000 range (excluding optics). This is true of the 16 and 32 km trunk distances. These costs are possible but not anticipated in the near term.

Addressing inter-LATA supertrunk distances beyond the 32 km range (Figure 9), PCM has a distinct performance advantage in its ability to be repeated with negligible degradation. The convenience of digital encoding and its ability to handle mixed service (video and data) makes it the preferred choice if and when costs come in line with FM. Figure 10 compares PCM to FM costs for long distance trunking at the six-channel per fiber multiplexing density. Two PCM cost scenarios are presented: (a) equal encoder costs to FM modems, and (b) equal total terminal costs to FM/FDM. Using these assumptions, PCM is 5 percent to 10 percent lower in cost than FM/FDM, primarily due to longer repeater spacings assumed.

Conclusions

Where fiberoptics is employed for supertrunking, FM/FDM incorporating single mode fiber, operating at 6 to 10 (or more) channels per fiber, appears the optimum solution for metropolitan area CATV video trunking. In order to be competitive, a PCM/TDM terminal pair with optics must achieve a cost below $4,000 per channel.

PCM is more advantageous for long-haul trunking beyond 20 miles (32 km), although even here, today's costs render it non-competitive with FM.

Reprinted from the 1984 National Cable Television Association convention technical papers.

IF IT'S A DUAL CONVERSION UPRIGHT OR STRAIGHT UP IT'S TUSA'S CM-1400 CONVERTER

Inverted carriers are not required . . . low investment and high return

Model CM-1400

Add 14 extra entertainment channels on to 12 regular channels — converts mid-band and super-band to high-band (7 - 13)

FEATURES:

- Uses TV VHF tuner
- Fine tuning control
- Works with any conventional head-end processor or modulator; inverted carriers are not required
- Image interference free
- IC regulated
- Economical and reliable
- Attractive wood-look metal case
- Double metal shielding for good radiation protection
- Optional built-in AC power outlet
- Simple installation and operation

WE ARE DELIVERING!

ALSO AVAILABLE:

CM-7600
Dual conversion 7 channel block converter

CMHI-7
Inverted 7 channel block converter

CVU-1000
36 channel UHF converter with fine tuning control

CVU-40N
36 channel UHF converter with fine tuning control

For detailed specifications and prices, call:

TUSA

Trans USA Corporation • 7G Joanna Court
East Brunswick, NJ 08816 • (201) 254-3020
Telex: 138-122

Stocking Distributors

Signal Vision, Inc.
22732B Granite Way
Laguana Hill, CA 92653
(714) 586-3196

Vue Scan, Inc.
312 S. Military Trail
Deerfield Beach, FL 33441
(305) 427-5000

John Weeks Enterprises, Inc.
P.O. 645
Lawrenceville, GA 30246
(800) 241-1232
(404) 963-9870

C.W.Y. Electronics, Inc.
409 N. Earl Avenue
Lafayette, IN 47904
(800) 428-7596

North Supply Company
600 Industrial Parkway
Industrial Airport, KS 66031
(800) 255-6458
(913) 791-7000

D.F. Countryman Co.
1821 University
St. Paul, MN 55104
(800) 328-6820
(800) 832-6443 MN only

The Drop Shop, Ltd.
176 Westfield Avenue
Roselle Park, NJ 07204
(800) 526-4100

R.J.G. Enterprise
116 Fayette Street
Manlius, NY 13104
(800) 448-5176

S.A.L. Cable Communications, Inc.
5 Hub Drive
Melville, NY 11747
(516) 694-7110

Cable Services Company, Inc.
2113 Marydale Avenue
Williamsport, PA 17701
(717) 323-8518

W.A. Walker & Associates
P.O. Box 1029
Route 10 & Hwy. 52 North
Welcome, NC 27374
(704) 731-6391

Klungness Electronics Supply
107 Kent Street P.O. Box 885
Iron Mountain, MI 49801
(905) 774-1755

Two-way technology: By-products and applications

By Donald Dworkin
Group Director, Engineering, New York Times Co.

The NYT Cable system in Cherry Hill, N.J., recently reached a milestone in its progress toward transforming the 120,000-subscriber system, 10th largest in the United States, into a two-way interactive plant. This occurred when NYT's 4,000-subscriber Fort Dix/McGuire Air Force Base subsystem achieved complete software integration with the billing computer (CableData's Tandem), located approximately 20 miles away at the NYT main office in Cherry Hill.

The completion of this step now means that all customer orders for and changes in basic service and pay packages, as well as billing adjustments, are immediately entered into the billing computer by a customer service rep. The service changes are automatically transmitted to a Sprucer® computer at the headend and then to the individual Sprucer converter in the home, which is authorized or deauthorized (as the case may be) to tune the new channels. The Sprucer converter then acknowledges the order back to the computer. In addition, subscribers can order pay-per-view events through their remote, infrared key pads. These orders are transmitted by the converter to the Sprucer computer and are automatically entered into the billing data via the Tandem.

Since customer billing and service depend upon it, the return system must be a good and reliable data channel, or from an engineering standpoint, the return channels should have low noise, be reasonably free from ingress, noisy amplifiers and common mode distortion. The problem is critical because, like every two-way system, *all* these sources of noise and interference flow back up to, and add together, at the headend where the computers are located.

The Sprucer two-way interactive baseband system has been operational for nine months in the Ft. Dix/McGuire AFB area. NYT's experience with this new generation of two-way interactive cable technology should be helpful to system operators considering upgrading their plants.

To BGC or not to BGC?

In the Dix/McGuire subsystem, it was decided *not* to use bridger gate controls (BGCs), addressable switches that connect return signals from each bridging amplifier's distribution to the main return system only on command (see Figure 1).

This decision was made because Dix/McGuire is a relatively small, new and well-constructed system with radiation fittings, modern hardware and so forth. Only manual return switches needed to be incorporated into the return trunk circuits of the amplifiers to give us a rapid ability to locate noisy portions of the system by dividing and subdividing the return system first in half, then half again, and so on (see Figure 2). Within a few days, we were able to completely troubleshoot the newly turned-on system, cutting out the noise and the ingress.

It remained to be seen how much maintenance time would be used operating the manual switches as compared to the instantaneous BGCs. In the nine months of system operation, only one amplifier suddenly became noisy and had to be replaced. Although

Figure 1: Bridger gate control system block diagram

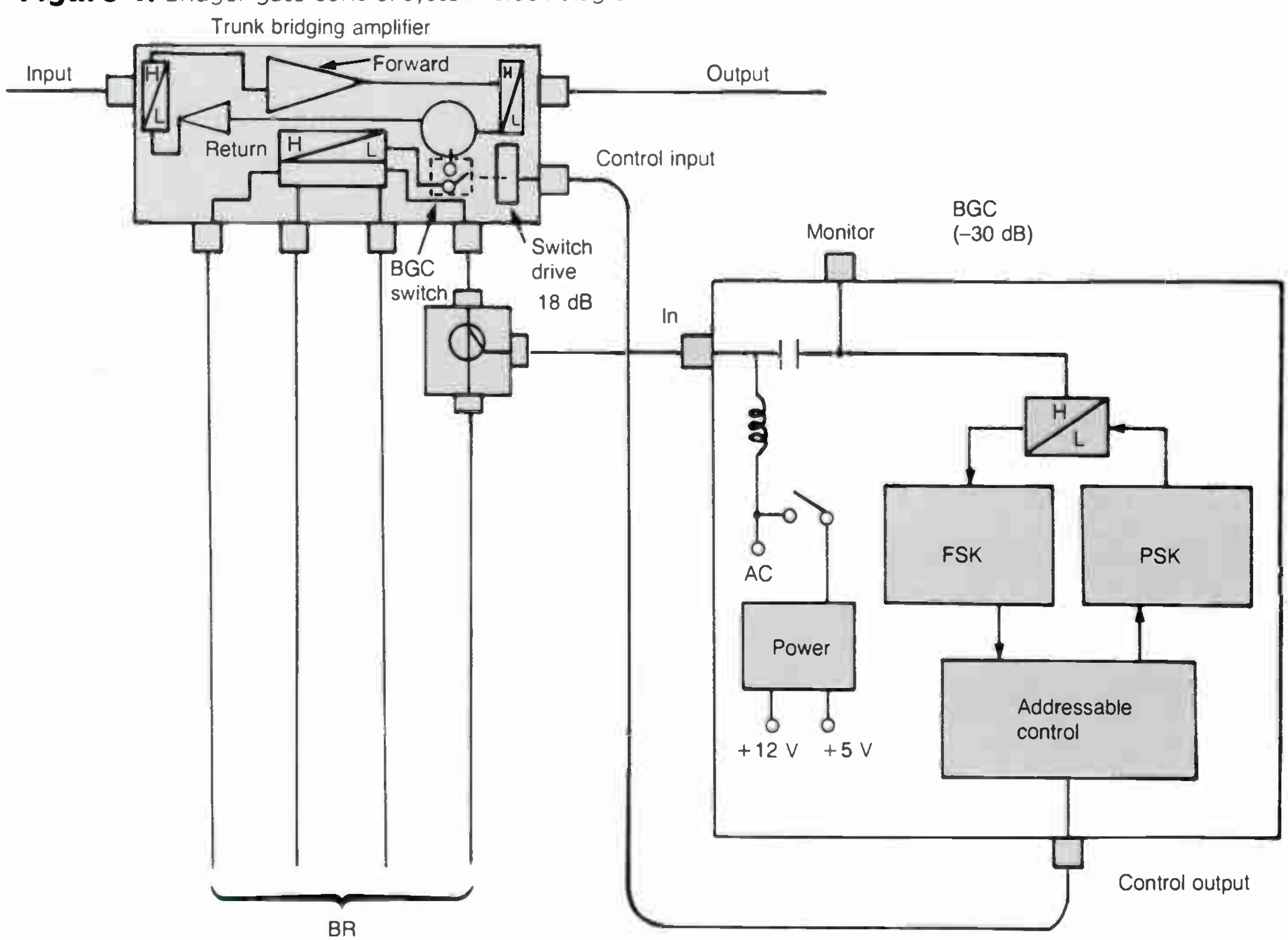
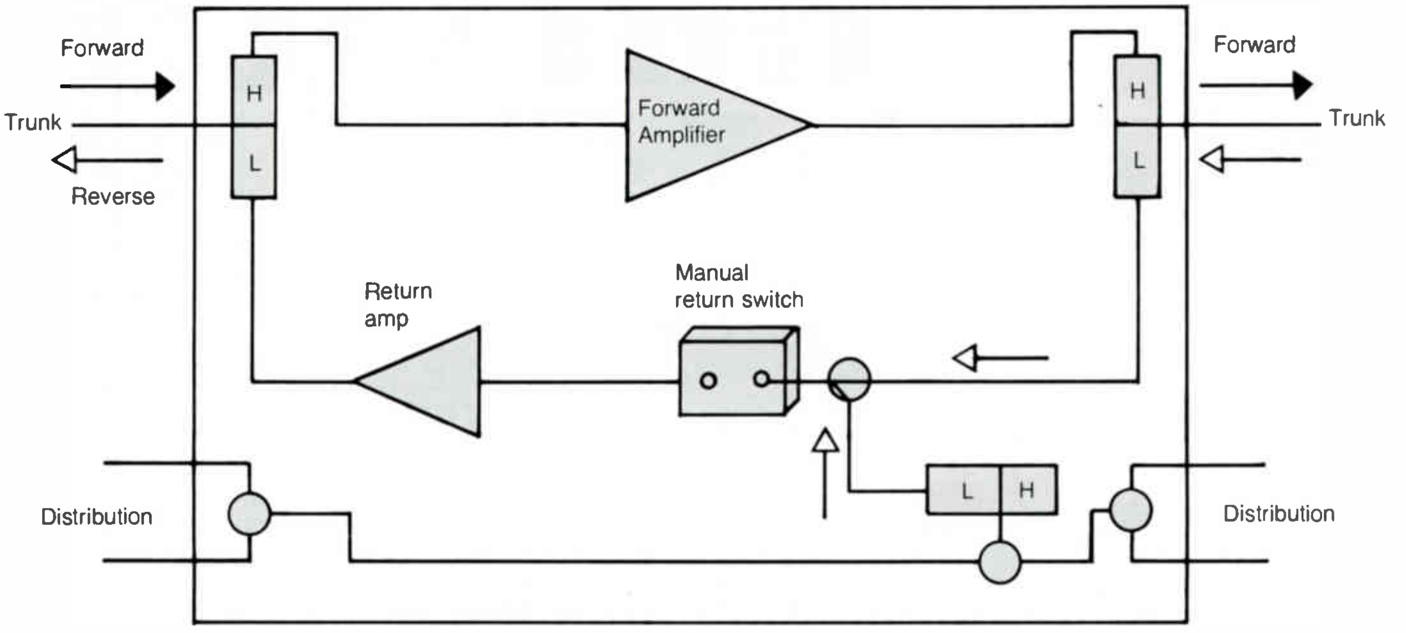


Figure 2: Manual return switch block diagram



replacement took three hours, this time does not even begin to make the use of BGCs cost effective in this situation.

On the other hand, as NYT Cable proceeds to install Sprucer technology throughout the remainder of its 120,000-subscriber plant, BGCs will be used because of exactly opposite conditions—namely, a very large 8-year-old plant. Here, the BGCs will function as an integral part of the interactive system. The Sprucer computer will poll each BGC, thereby connecting the return signal from all the Sprucer converters within that BGC's distribution area. When all the converters have been polled, the computer will poll the BGC for the second time, disconnect the return path and proceed to address the next BGC.

The by-products

This continuous polling of the BGCs provides, as a first by-product, a current status report of all amplifiers in the system (since each BGC receives its signal from its associated amplifier's output, including both trunk and bridger). It also provides a record of all outages with times off and on, available in a computer printout. A system amplifier map could be constructed with tiny light bulbs representing each amplifier. Any BGC that does not answer will cause the light bulb of its associated amplifier to flash and an alarm for that amplifier to come on.

The BGC's main purpose, of course, is to suppress most of the return system noise by connecting only one distribution area at a time for return signals. But this, too, has an extremely useful by-product, namely the ability to judge the noise and interference from a specific distribution area. Its magnitude and character can be measured and photographed and the frequencies of ingress signals can be recorded at the headend.

If a sudden increase of noise occurs, maintenance crews then know not only which area to work in, but also how severe the problem is by comparing photographs taken when the system was newly proofed against the current condition. Since ingress into the system is the mirror image of egress or radiation from the system, radiation leakage is therefore repaired *as it occurs* and not only when a technician happens to ride by or a radiation sweep is conducted.

If all types of CATV systems—new and old, small and large (and all combinations thereof)—can be used to reliably send data on both forward and return circuits, the CATV plant itself can be thought of as a high speed, duplex data channel in addition to being a video medium. With the use of BGCs, there are some constraints in the manner of data traffic, i.e., the converters replay only when addressed, they cease transmission after data has been sent and are polled sequentially.

Nevertheless, the resulting system is low noise, reliable and does its job with minimum fuss. The BGC, in effect, breaks up a complex system into a number of direct systems, each linking the headend to converters in a given distribution area. For example, approximately 10,000 converters can be polled in one minute with the Sprucer system.

If BGC's are not used, the system is a "transparent" one for both forward and return signals, and, if desired, data can be transmitted using a contention method such as CSMA/CD (carrier sense multiple access/collision detection). In this method, each converter transmits when it has data. If the return channel already has a converter using it, the would-be transmitter stops, waits, then tries again.

The converter as data terminal

The converter took on the first elements of a data terminal when two-way interactive converters were designed to receive subscriber commands and transmit them back to the computer for pay-per-view. Now that the plant has become a reliable two-way data channel, it is ready to carry channel authorizations, pay-per-view requests and acknowledgements to and from the interactive converter.

The Sprucer converter goes a step further along this path by being able to transmit 100 numbers, ranging from zero through 99, in its "opinion poll" option. These numbers can be used as codes for anything from shop-at-home to requests for a service representative to call about a billing question, a change of service or a service problem.

In other words, the interactive cable system has now become an operating two-way medium that can change its characteristics for both the system operator and the subscriber. Without going into a home or sending out a truck, the operator can (by remote control) determine the channels that are available to the subscriber (including pay-per-view), start up the TV set on an emergency channel with increased volume, or shut down cable service if a bill is not paid. Service and maintenance become more automated, producing operating economies, quicker service and higher quality.

The subscriber benefits also are more extensive. A subscriber can select exactly those events or movies he or she wishes, register opinions, shop at home, request information from the cable company, and so forth, all by using the remote, hand-held key pad, which the Sprucer system offers.

The bottom line in the evolution of the cable system into a two-way interactive operation is that service quality and economic value should be greatly improved to the benefit of both the cable system and the subscriber.

WHY DO THE
IN CABLE GIVE RCA
A TERRIFIC RECEPT

ESPN
CNN HEADLINE NEWS
HBO
SHOWTIME
THE MOVIE CHANNEL
CBN CABLE NETWORK

A SMALL SELECTION OF OUR BIG NAMES.

For good reason. In fact, for lots of good reasons. Superior satellite service is a good place to start.

It all began in 1975, when the cable TV industry was looking for expansion opportunities. It was then that RCA launched its first Satcom satellite. From that early point on, HBO®, WTBS, ESPN™, CBN, Showtime®/TMC™—all the biggest names (and initials) in programming—signed up.

There were, of course, other satellites available. But not a single one of them offered what Satcom did. Namely, the concept of a dedicated cable satellite with 24 transponders and, later, a back-up system that protected them in the event of a satellite failure. And to this day, they *still* haven't matched our protection system.

Needless to say, it is comforting for our family of programmers to find this kind of safety in RCA.

There's plenty of comfort in a reliability factor of 99.99%. It's hard to beat that kind of statistic.

This exemplary record is nothing particularly out of the ordinary. RCA has always represented the most positive images in the world of communications. Since the early part of the cen-

RCA AMERICOM. THE COMPANY THAT LAUNCHED THE SATELLI

BIGGEST NAMES AMERICOM SUCH ON?

OUR BACK-UP SYSTEM OFFERS PROTECTION AGAINST BLACKOUTS.

tury, RCA has stood for enterprise, innovation and an extremely high level of expertise.

That high level is about to manifest itself in a new launch that a lot of people are very excited about. This new spacecraft is a 47-watt, Ku-band satellite with the capability of serving receiving antennas as small as three feet in diameter, thereby opening up a whole new world to operators and programmers. Throughout the contiguous United States, all sorts of places will become easy mounting locations for these small receiving dishes. An estimated 22 million households not currently able to receive cable TV will become an exciting new marketing universe.

It's no surprise. It's merely typical of RCA's continuing technological leadership.

The launch is scheduled in the fall of 1985. Therefore, the timing couldn't be better for you to inquire about RCA Americom and learn more about all the benefits it can have in store for you and your business.

Call Bill Berman or Don Reinert at (609) 734-4000 for more detailed information.

RCA
ONE OF A KIND

GET READY FOR ANOTHER PHENOMENON.

OMMUNICATIONS INDUSTRY.

RF modem specifications

By Kenneth C. Crandall
Program Manager, RF Modems, Zeta Laboratories Inc.

Until recently, the primary application of RF modems for voice and data communication over coaxial cable broadband systems has been on private industrial and government cable systems or specialized office automation systems for centralized computer data bases. This technology is now spreading to metropolitan CATV systems where more stringent requirements must be observed. A cable operator can only add data and voice capability to his system if it does not interfere with existing services. The RF modem hardware also must be reliable and inexpensive to install and maintain.

Rigorous testing is necessary—but what are the critical parameters to test? How do you know when a modem works but is on the brink of erratic behavior or catastrophic failure?

The RF modem: What is it?

Before exploring the details of RF modem testing and answering the questions raised, a general definition of the term RF modem is necessary and consideration of its place in the CATV system should be given.

The term "RF modem" is a series of contractions. RF stands for radio frequency and means simply that its channel of communication is in the radio frequency spectrum. For CATV that usually means from about 5 MHz to 500 MHz. The term modem is a contraction of "modulator-demodulator" and is synonymous with "transmitter-receiver" or "transceiver."

The RF modem sends and receives voice and/or data over CATV facilities. The bandwidth required is dependent on data rate in the case of data transmission and fidelity in the case of voice or music transmission. Higher data rates or better fidelity require greater bandwidth.

The modulation technique also has a bearing on spectral usage and efficiency. Frequency modulation is both noise immune and inexpensive to receive. It is also one of the least bandwidth efficient modulation techniques. Amplitude modulation is more efficient spectrally but is more likely to be impaired by noise. Phase modulation is spectrally efficient and more noise immune but is more expensive to implement.

Various forms of modulation coding also are used to achieve higher bandwidth efficiencies. QPSK (quadraphase shift keying) is a good example. The increased efficiency is gained at the expense of less noise immunity and increased hardware cost.

The RF modem is usually used in conjunction with a block frequency translator at the headend of the cable system. The translator, due to its central location in the network topology, can receive all reverse channel signals. The reverse channel usually occupies the lower portion of the cable frequency spectrum and carries the signals travelling upstream to the headend.

The translator retransmits a block of spectrum back downstream on the cable system on a forward channel. The forward channel usually occupies a portion of the higher frequency spectrum. Because the retransmission takes place at the central headend, all RF modems on the system receive the translated spectrum signal. This allows any RF modem to communicate with any other RF modem on the system, provided their transmit and receive frequencies are compatible.

Although RF modems can be configured to operate without a translator, the translator is preferred for large tree topologies where single coax two-way transmission is used. The translator gives the added advantage of allowing any location visibility to the reverse channel frequency spectrum.

The published specifications

The typical specifications that RF modem manufacturers publish fall into five main categories:

1. Interface (digital or analog)
2. Modulator
3. Demodulator
4. Environmental
5. General

Interface

The interface specifications deal with the connection to the terminal equipment. In the case of voice RF modems the specifications are mostly analog and deal with signal levels, frequency response, group delay, impedance levels and connector types.

The omission of specification in voice modem interface usually involves voice quality and overmodulation characteristics. The tests for these are usually subjective and involve human ear judgement. Background hum or hiss are frequent problems in addition to adjacent channel cross-talk. Overmodulation is usually caused by a loud talker or the touch tone pad if a telephone set is used.

The digital RF modem interface is most often a generic type and typically cites an industry standard such as the EIA RS-232C interface. The standard gives most of the details of the interface. The data rates of the interface are not usually covered by the standard and must be specified for the particular modem. Also, the RTS/CTS delay must be specified. Synchronous as well as asynchronous capabilities often must be called out separately.

The omissions of note in data interface specifications are of various kinds. The transmit clock frequency accuracy for synchronous modems usually is omitted. The ability to provide external transmit is not mentioned in the specifications. The response of the modem to a prolonged break (space state) in asynchronous mode should be checked. The loopback capabilities should be tested to see that terminal echo as well as data regeneration (retransmitting what is received) work for both synchronous and asynchronous if that is required. Also, some multiplexers require a single system clock from the modem pair. This capability should be investigated if needed.

It should be noted that the interface omissions are done intentionally in the interest of brevity. The installation manual often answers these questions. Be aware that interfaces are a frequent source of problems during installation. Wiring errors in cables that connect terminal equipment to modems are common.

Modulator

The modulator specification is the easiest of all to test. Most often the spectrum analyzer tells all! Look for various spurious signals (spurs) around the carrier frequency as well as at harmonic multiples. Close-in signals when the carrier is not modulated indicate phase noise and are often sidebands spaced at the power line frequency. A good transmitter should deliver a clean signal with spurs down 50 dB from the carrier regardless of power setting.

If the modem is frequency agile, try different frequencies, including different receiver frequencies to see if the receiver local oscillators are leaking out to the cable.

Another modulator specification to check is the carrier disable leakage. When "request to send" is dropped the carrier should be down at least 50 dB. High leakage causes problems in single frequency multi-drop applications where the leakage signals can add up to a detectable signal level.

The frequency accuracy is associated with the temperature specification. This specification becomes more critical the closer the carrier frequencies are spaced. Transmitters usually hold tighter at low frequencies so plan your spectrum to have the narrow spaced RF modems in the lower channels if this is possible. Avoid spacing carriers any closer than 20 kHz, regardless of modulating bandwidth.

Demodulator

The demodulator performance is more difficult to test. Carrier detect threshold should be checked on a variety of frequencies if the modem is frequency agile. Certain subchannels may be unusable due to mixing products.

Two tone tests should be performed to check the receiver's front end for intermodulation products. A good way to do this is to generate two adjacent signals both at the maximum rated receiver input level. Apply these signals to the receiver input and see if the receiver detects the next adjacent channel, which is the $2f_1-f_2$ third order intermodulation product. A measure of quality is to exceed the maximum level rating until the third order is detected. More is not better in the case of RF modem received signal strength. Third order intermods are a serious consequence of receiver overloading that can degrade modem performance dramatically.

Image rejection is another important specification to test. The manufacturer probably has not volunteered the IF frequencies in the specifications. Find out and apply a signal at the image and determine if it can be detected. The image rejection should be 50 dB in a good receiver design.

The receiver dynamic range is important. Make sure the modem can operate error free (data modems) or distortion free (voice modems) over the full range of rated signal strengths. Check with the manufacturer for the preferred receiver input level. Typical narrow band RF modems operate in the range of –20 dBmV to +10 dBmV and should normally see signal levels of around –10 dBmV.

A specification most often not specified for RF modems is tolerance to frequency translation errors. Poor tolerance can be a very real impairment to the performance of the RF modem. The headend frequency translator may drift so that the retransmitted forward channel signals have shifted frequency. A simulation of this will allow a measure of how many kHz a translator may be mistuned before the modems begin to operate erratically. Temperature affects frequency drift, so test translation margins over temperature for a really rigorous test. (A good headend frequency translator should be expected to hold within 750 Hz.)

Bit error rate under poor signal-to-noise conditions also can be tested. However, it should be noted that RF modems are not normally subject to the same kinds of noise that telephone modems experience. A properly maintained cable system has a visual carrier-to-noise ratio well in excess of 30 dB, with data carrier-to-noise a function of how far below visual carrier levels the data carriers operate. Depending on the modulation scheme employed, the bigger source of noise to the modem may well be the phase noise of the headend frequency translator!

Environmental

Most RF modems are specified for a rather benign commercial temperature range. The biggest effect temperature has is causing the local oscillators to drift in frequency. This can cause poor performance if the margin of frequency translation is narrow.

Low temperature can create problems with oscillator start-up. Test the modem for cold start. You may be surprised!

FM frequency discriminators sometimes become nonlinear under temperature extremes. This may cause distortion in voice modems or bit errors in data modems.

An environmental specification that is almost never specified in commercial equipment is mechanical shock. Your RF modems may not be flying in a high G force aircraft, but vibration can be a very definite impairment to proper operation. The best test is the "slam test."

General

The general specifications group is concerned with left over details such as power, size and weight. The power specification usually gives a tolerance to line voltage variations. This should be checked with a variac (variable transformer) while observing transmitted frequency and bit error performance.

The unpublished specifications

What you don't know may either hurt you or help you. There is often a fine line drawn between important specifications and trivial detail. Experience is usually the best judge. Below is a summary of important specifications that are often found "between the lines" of the specification sheet:

1. User test points
2. User adjustments
3. Intermodulation products
4. Frequency translation margin
5. Mechanical shock tolerance

Be certain to check these details. A good RF modem needs test points to support field testing and adjustments for various parameters such as transmitter power, receiver carrier detect level and RTS/CTS delay.

Give every modem a frequency translation and shock test before installing at the user's location. Most problems show up with just these two simple tests. It takes 10 seconds and could save days!

Don't forget to test the frequency translator for the same kinds of impairments. Frequency drift and third order intermodulation products can be a real problem with translators. And of course, give it a good slam test too!

Reprinted from the 1984 National Cable Television Association convention technical papers.

Coping with distortion

By Tom Polis

Executive Vice President, Communications Construction Division, RT/Katek Communications Group

With the tremendous growth of the cable industry and the increased services, both projected and current, the move into wideband (i.e., 400 MHz and 440 MHz) systems has become widespread. The move into wideband technology has come before major improvements in the dynamic range of amplifier devices could evolve, thus we have had to look to other methods to reduce the effects of amplitude related disturbances, which result with the increased channel loading.

It is well known that the limiting factor in 36+ channel systems is the third order beat parameter, which results in a large number of individual beats stacking up around the channel carrier frequency. We have come to refer to this problem as "composite triple beat" (CTB).

The contributing factors to the CTB parameter are:

- Amplifier performance
- The number of contributing channels
- Cascade length
- Operating output levels
- The nature of the beat (A + B + C, 2A ± B or A + B–C)

Subjective testing over the past years has shown that the CTB distortion becomes visible before the classic cross-modulation parameter in 36+ channel systems. It has also been found that the average video level will impact the degree of degradation viewed on the screen. The distortion will be viewed as "streaking" in the picture in its full impact state, but can begin as a "busy background noise" at threshold.

The problem starts with the non-linear transfer characteristics of the active components of the line amplifiers. While these devices have been capable of amplifying the broad range of frequencies now in use by simply modifying equalizers, automatic gain control/automatic slope control (AGC/ASC) circuits and support circuits, they were not intended to be loaded to the current level of channels. A great deal of work has taken place over the past two years to improve the non-linear characteristics, as well as noise figures, thus improving the overall dynamic range. New devices are just now being released with considerable improvements, but they are not in wide use at this time.

It has been well established that the effects of CTB are additive in cascade. They in fact add on a voltage basis (20 Log N) and are level dependent on the same voltage basis. The net is that heavily loaded systems would have to balance a reduction in both cascade length and operational levels to hold the distortion level consistent with 36-channel and below systems.

The impact is thus economical in that more hubs/headends would be required to serve the subscribers of a given city. More equipment also would be required due to shorter reach from lower distribution operational levels. Since these results were not acceptable by management, methods were developed that "hide" the subjective effects of CTB without increasing the amplifier cost and thus allow normal, or more normal, levels and cascades. Two such methods were developed known as "harmonically related coherence" (HRC) and "incrementally related coherence" (IRC). Since these two methods were developed, new amplifier designs, such as "feedforward," have been introduced that reduce the distortion level. These designs also will be discussed.

In addition to the methods that involve reassigning channel allocations, such as HRC or use of feedforward amplifier techniques, selective use of the available spectrum can also be beneficial in reducing both the effects

Standard channelization plans

Cable channel	Converter channel (Jerrold)	Converter channel (S-A)	Standard frequency Video	Standard frequency Aural	IRC Video	IRC Aural	HRC Video	HRC Aural
2	2	2	55.25	59.75	55.25	59.75	54.00	58.50
3	3	3	61.25	65.75	61.25	65.75	60.00	64.50
4	4	4	67.25	71.75	67.25	71.75	66.00	70.50
4+	54	55			73.25	77.75	72.00	76.50
5	5	5	77.25	81.75				
5+	5, 55	56			79.25	83.75	78.00	82.50
6	6	6	83.25	87.75				
6+	6, 56	57			85.25	89.75	84.00	88.50
FM	57		91.25	95.75	91.25	95.75	90.00	94.50
FM	58		97.25	101.75	97.25	101.75	96.00	100.50
FM	59		103.25	107.75	103.25	107.75	102.00	106.50
A2	60	1	109.25	113.75	109.25	113.75	108.00	112.50
A1	61	37	115.25	119.75	115.25	119.75	114.00	118.50
A	14	14	121.25	125.75	121.25	125.75	120.00	124.50
B	15	15	127.25	131.75	127.25	131.75	126.00	130.50
C	16	16	133.25	137.75	133.25	137.75	132.00	136.50
D	17	17	139.25	143.75	139.25	143.75	138.00	142.50
E	18	18	145.25	149.75	145.25	149.75	144.00	148.50
F	19	19	151.25	155.75	151.25	155.75	150.00	154.50
G	20	20	157.25	161.75	157.25	161.75	156.00	160.50
H	21	21	163.25	167.75	163.25	167.75	162.00	166.50
I	22	22	169.25	173.75	169.25	173.75	168.00	172.50
7	7	7	175.25	179.75	175.25	179.75	174.00	178.50
8	8	8	181.25	185.75	181.25	185.75	180.00	184.50
9	9	9	187.25	191.75	187.25	191.75	186.00	190.50
10	10	10	193.25	197.75	193.25	197.75	192.00	196.50
11	11	11	199.25	203.75	199.25	203.75	198.00	202.50
12	12	12	205.25	209.75	205.25	209.75	204.00	208.50
13	13	13	211.25	215.75	211.25	215.75	210.00	214.50
J	23	23	217.25	221.75	217.25	221.75	216.00	220.50
K	24	24	223.25	227.75	223.25	227.75	222.00	226.50
L	25	25	229.25	233.75	229.25	233.75	228.00	232.50
M	26	26	235.25	239.75	235.25	239.75	234.00	238.50
N	27	27	241.25	245.75	241.25	245.75	240.00	244.50
O	28	28	247.25	251.75	247.25	251.75	246.00	250.50
P	29	29	253.25	257.75	253.25	257.75	252.00	256.50
Q	30	30	259.25	263.75	259.25	263.75	258.00	262.50
R	31	31	265.25	269.75	265.25	269.75	264.00	268.50
S	32	32	271.25	275.75	271.25	275.75	270.00	274.50
T	33	33	277.25	281.75	277.25	281.75	276.00	280.50
U	34	34	283.25	287.75	283.25	287.75	282.00	286.50
V	35	35	289.25	293.75	289.25	293.75	288.00	292.50
W	36	36	295.25	299.75	295.25	299.75	294.00	298.50
AA	37	38	301.25	305.75	301.25	305.75	300.00	304.50
BB	38	39	307.25	311.75	307.25	311.75	306.00	310.50
CC	39	40	313.25	317.75	313.25	317.75	312.00	316.50
DD	40	41	319.25	323.75	319.25	323.75	318.00	322.50
EE	41	42	325.25	329.75	325.25	329.75	324.00	328.50
FF	42	43	331.25	335.75	331.25	335.75	330.00	334.50
GG	43	44	337.25	341.75	337.25	341.75	336.00	340.50
HH	44	45	343.25	347.75	343.25	347.75	342.00	346.50
II	45	46	349.25	353.75	349.25	353.75	348.00	352.50
JJ	46	47	355.25	359.75	355.25	359.75	354.00	358.50
KK	47	48	361.25	365.75	361.25	365.75	360.00	364.50
LL	48	49	367.25	371.75	367.25	371.75	366.00	370.50
MM	49	50	373.25	377.75	373.25	377.75	372.00	376.50
NN	50	51	379.25	383.75	379.25	383.75	378.00	382.50
OO	51	52	385.25	389.75	385.25	389.75	384.00	388.50
PP	52	53	391.25	395.75	391.25	395.75	390.00	394.50
QQ	53	54	397.25	401.75	397.25	401.75	396.00	400.50

of CTB and improving the performance.

It also should be realized that these techniques can be used in combination to yield near transparent distortion levels.

Harmonically related coherence

CTB will fall, for the most part, around the carrier of a desired channel. Since the beats are the result of all other carriers on the system and those carriers are shifted slightly off of the exact frequency assignments, due to both processing accuracy and FCC assigned offsets, they will appear as a bundle of noise ±X about the desired carrier. When the carrier is detected by the TV set, the differences between the beat frequencies and the desired carrier will fall in the video passband, thus it will be displayed as part of the composite video on the screen.

Third order beats are developed from these possible combinations of the fundamental carriers:

1) A±B±C

2) 2A±C

Where A, B and C are fundamental carriers.

It should be noted that due to the 4 MHz FCC offset assignments of channels 5 and 6, beats developed by the combination of these channels with others in the spectrum will result in an equal offset of the beat. The largest number of beats are developed by A+B–C and 2A–B. In order of magnitude, the A+B–C beat appears to be the worst case.

Second order distortions (A±B or 2A) also have an impact on the overall performance, but since well-balanced push-pull amplifiers are used, this parameter has not been found to be limiting in modern systems.

The object of HRC is to make all beats developed within the cable system coherent, with zero frequency difference between them and the channel to which they would otherwise interfere. Since the width of a standard channel is 6 MHz, if the frequencies of the channels were equally spaced at 6 MHz and at even frequencies driven from a common reference, all beats, including second order, would fall coherent. If all beats were coherent, all beats would fall "on-carrier" and no "difference frequency beat" would be developed in the TV detector, thus the distortion would be transparent.

In theory, this would mean that the subjective improvement would be infinite; however, in practice there are limits:

- Third order of the non-coherent 15750 side lobes
- Compression ratio of the amplifier
- Effects of the +4.5 MHz sound carriers
- Phase distortion in the color sub-carrier

Attempts have been made to control these effects by phase adjustments of the carriers and frame synchronization of the video. Relative amounts of success have been demonstrated in the laboratory, but the cost trade-off does not appear to justify these techniques.

For all practical purposes it appears that 8-10 dB of subjective improvement in CTB can be expected, which relates to a 4-5 dB improvement in amplifier output capacity.

Since all of the channels will be shifted from FCC assignments by a maximum of 1.25 MHz (5 and 6 will be shifted up .75 MHz), the normal TV receiver may not be able to tune in the newly assigned frequencies, necessitating a set-top converter. This presents no major drawback, as expanded systems require these devices in any case. It should be noted, however, that HRC converters are a special type and are not supplied by all vendors.

Great care must be taken to ensure that off-air signals do not ingress the system; as with the new frequency assignment on the cable system a beat frequency will develop at the TV detector equal to the difference in frequency between the off-air signal and the cable-carried signal. This problem typically will be localized to the drop system or the feeder system but can occur in the trunk via poor connectors or open equipment enclosures.

Incrementally related coherence

This method is similar to HRC in that the carriers are locked to a combination generator in which they are separated by a common 6 MHz oscillator. The frequency assignments, however, are standard (i.e., the channel 2 visual carrier is 55.25) except for channels 5 and 6, which are shifted up 2 MHz.

With both HRC and IRC some overlap into

"THE WADE S.T.A.T. SYSTEM HAS GIVEN US TOTAL CONTROL OF OUR CABLE SYSTEM. AND TOTAL CONTROL MEANS BETTER PROFITS."

Ken Swift
Executive Vice-President
USA TV

USA TV provides cable television service to apartments, condominiums, and mobile home parks. Because they deal with thousands of units, in multi-family developments, control of their system, and ease of turn-on/turn-off are of utmost importance. That's why USA TV selected the WADE S.T.A.T. (Selective Trap, Addressable Tap) System for their company's installations.

Ken Swift, Vice-President of USA TV, says "The Multi-Family cable operator needs off-premise, programmable tap technology to operate efficiently and profitably. Wade's S.T.A.T. system provides us with state-of-the-art technology that is highly reliable. It works. And it gives us total control of our system.

"Using the S.T.A.T. system, we gain control of our system without the necessity to constantly enter the subscriber's home — a fact both subscribers and apartment owners greatly appreciate. The S.T.A.T. system is also very competitively priced, easy to install, and highly reliable. It's added a new dimension to our cable operations."

The Wade Communications S.T.A.T. device is available in 4 or 8 port configurations, and will control four levels of service (basic plus three pay channels).

Contact Wade Communications for more information on the S.T.A.T. system, or to arrange a personal demonstration.

Specifications
Band Pass
10Mhz-400Mhz
Trap Notch Depth
-50dB
Functions Per Port
All channels on/off
3 Premium channels on/off
Control Method
Pulse Modulated FSK
Data Message
ASCII
Power Requirement
30 or 60 VAC,
50MA, from system

WADE COMMUNICATIONS
The Leader in off-premise addressable tap technology.
GSA-TV Distributor
4201 S. Hocker Suite B1
Independence, MO 64055
816-478-1750

See us at the Western Cable Show.
Call for an appointment at the Disneyland Hotel for Mike Wade or Dennis Krumblis.

the standard FM band occurs. With HRC the sound carrier overlap is .5 MHz and with IRC, 1.75 MHz. This factor could cause the loss of channel 6, as locally strong FM signals could ingress and interfere with the normal sound carrier associated with the video carrier.

Both HRC and IRC allow for an additional channel to be placed above the channel 4 carrier, thus the lowband, under ideal conditions, could be extended to contain six channels.

The biggest two differences between HRC and IRC operation are:

1) Only A+B–C or 2A–B beats will fall coherent with the carriers.
2) Second order beats will not fall coherent with the carriers.

This would suggest that the subjective improvement to be expected would be less than that of HRC. In actual subjective testing it has been found that little, if any, differences in perceptible interference exist. There are two factors that would explain this:

1) The largest percentage of second order components fall 1.25 MHz below carrier, which is suppressed by the band shaping of the converter and TV tuner circuits.
2) The 2A+B and A+B+C beats are of the least amplitude and are well dispersed within any given channel.

Feedforward

The previously discussed methods do not improve the actual performance of the system but rather place the distortion products in such a position relative to the desired carrier that the distortion is not seen by the viewer. Feedforward, on the other hand, does yield performance improvement. In terms of real improvement, a feedforward gain block represents an 8-9 dB output capability increase over a standard gain block, with feedforward trunk amplifiers typically providing a 7 dB improvement over their standard counterparts.

The feedforward gain block uses double the active components, in that one IC is configured as an error amplifier, which introduces distortions that are 180° out of phase with the main amplifier section. The improvement is not infinite, as isolation, the distortion produced by the error arnp, and temperature effects result in the heretofore stated practical improvement.

A side benefit is that since both amplifiers are on line a redundancy is built in. If one section of the feedforward fails, the other is still active. While the signal will deteriorate over design specification, continuity will be maintained. This would be very important for digital signals.

Since feedforward yields a real improvement, the subjectively viewed picture would be equal to that of either HRC or IRC, while using a standard channel configuration. It should be understood that either HRC or IRC could be used in combination with the feedforward approach.

Summary

Each of the methods described above will yield great improvements in the subjectively viewed TV picture. Each also has its drawbacks that must be considered.

• *Feedforward:* While this technique yields an actual performance improvement, it is also very costly. The cost lies in three major areas.

1) Initial capital cost due to the number of IC devices used in the construction of these amplifiers.
2) Increased power consumption that will increase the long-term operating expenses.
3) Testing procedures required to determine equipment faults will increase maintenance costs.

• *HRC:* It has been shown that in major markets with a high number of off-air TV signals, signal ingress must be extremely well controlled. In some cases this problem has lead to great increases in both cost of the drop system and maintenance.

It has been stated by the FCC that in many cases four or more channels could be lost due to the conflict with FAA air traffic signals. This is due to the lack of flexibility for frequency offsets.

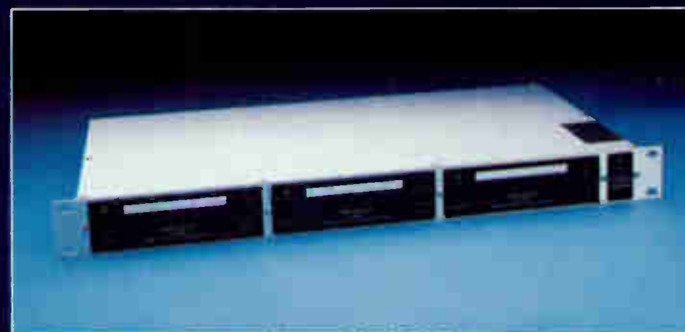
The total system depends on a single point (the control frequency generator) for total system performance.

• *IRC:* This technique displays the same problems as HRC except that the frequencies are held closer to actual assignments.

Can Your System Survive The EIA TV Stereo Revolution?

It Can with the Studioline System Built by Leaming Industries

With the recent FCC decision, television stereo sound must be carried in your system. Right now you can solve your EIA signal problems and cash in on cable TV stereo with the Studioline set-top converter and head-end equipment from Leaming Industries.



Offer Up to 69 Channels

You can now offer up to 52 channels of stereo television and 17 premium audio channels on your system. All this, with sound quality unaffected by cable noise and transmitted 25db below video carrier so they will not overload your system.

With the revolutionary set-top converter from Studioline, combined with the advanced Leaming head-end equipment, you provide the cleanest, brightest sound ever offered – quality superior to any other transmission system. While, at the same time, you offer EVERY TV channel in stereo. All EIA signals are transmitted in true stereo, and monaural signals are automatically converted to synthesized stereo so your subscribers will perceive all television audio in stereo.

Addressable and Tierable

The Studioline system is both addressable for security and tierable for flexibility. No one can steal your signal because only the Studioline converter can decode it. And with remote control tiering, your subs receive only the premium channels they pay for. You can even provide pay-per-listen services with remote tiering.

Head-End Equipment

Leaming Industries builds Studioline stereo processors for off-the-air TV channels, satellite-delivered channels, local origination TV, Studioline premium audio, and other stereo program services. Solve your EIA stereo-audio problems before they occur, and cash in on the cable TV stereo revolution. To arrange for this premium stereo service, call Leaming Industries today and learn how everyone profits with stereo.

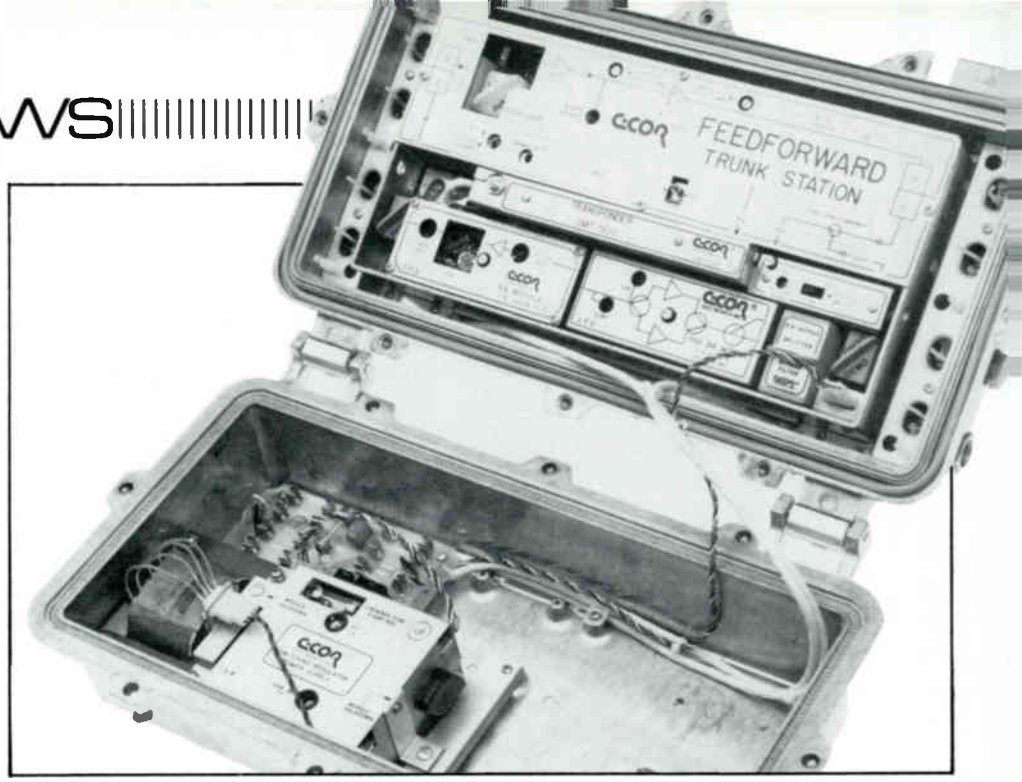
See us at the Western Show booth #1682.

LEAMING INDUSTRIES

180 McCormick Avenue, Costa Mesa, CA 92626
Telephone: (714) 979-4511

PRODUCT NEWS

550 MHz equipment



A new series of 550 MHz broadband distribution products introduced by C-COR Electronics gives cable TV systems a 77-channel capacity and allows expansion of a system's reach to 25 miles, according to the firm. The products available are the FT-519 feedforward trunk station, a power doubling PHD bridger amplifier module, the E-509 extender amplifier and a complete line of main line passives.

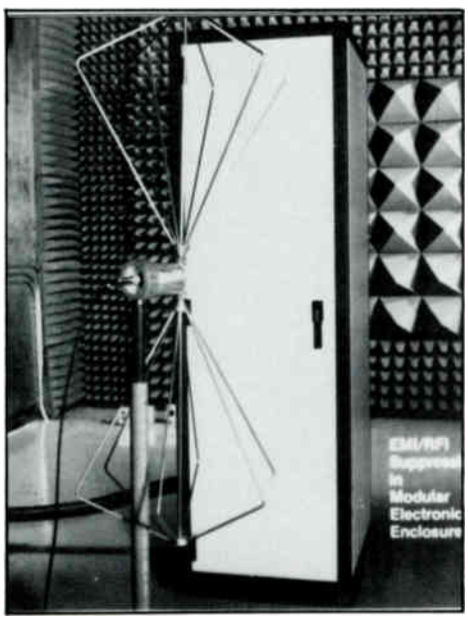
The FT-519 feedforward trunk station is a two-way amplifier with a forward passband of 54-500 MHz and a 4-channel reverse passband of 5-30 MHz. Operational spacing is 27 dB. The high gain, low noise characteristics of the FT-519 trunk station permit a 50 percent extension of a cable system without need of new hub sites. Options offered include status monitoring and an active or passive RF failsafe trunk bypass housing.

The 550 MHz PHD bridger amplifier module provides signals to the distribution ports of the trunk amplifier. The module has two amplification circuits in parallel to achieve lower distortion with higher output levels. Operational gain at the highest frequency is 29 dB.

The E-509 extender amplifier is a standard push-pull, sub-split amplifier with a forward passband of 54-550 MHz, a reverse passband of 5-30 MHz and operational gain of 27 dB.

The 550 MHz main line passives available include two-way and three-way splitters; 8, 12 and 16 dB directional couplers; a splice box and a 15 ampere power inserter.

For more information, contact C-COR Electronics Inc., 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461.



Steel cabinet

Equipto Electronics Corp. introduced a stainless steel cabinet with gasketing material, providing an electronics cabinet available for suppression of radio frequency interference. The cabinets feature material, construction and EMI/RFI shielding techniques for demanding electromagnetic environments, according to the firm. The new design also eliminates the need for special hardware that restricts access to the cabinet interior.

For complete details, contact Equipto Electronics Corp., 351 Woodlawn Ave., Aurora, Ill. 60506-9988, (312) 897-4691.

Video display software

Cable Graphic Sciences introduced a character generator software cartridge for Atari 400, 600XL, 800, 800XL, and 1200XL computers. The INFO/gen™ software cartridge is designed for use by inexperienced operators and has a variety of applications. It can be used in most municipalities, cable TV, universities and factories. It has a 36-page memory, four regions with up to 16 colored backgrounds, 480 useable characters, flashing, dwell time (1 to 99 seconds), built in clock calendar and approximately 1 amp at 5 VDC power.

For further information, contact Cable Graphic Sciences, 2939 Larkin Ave., Clovis, Calif. 93612, (209) 292-0246.

Signal processors

Synchronous Communications Inc. has introduced three new signal processors: an FM video transmitter, FM video receiver and a TVIF demodulator.

The FMVT-4000 modulates an NTSC video signal to a 70 MHz center frequency with a total passband of 18 MHz.

The FMVR-4000 receives a 70 MHz center frequency FM video signal and demodulates it to baseband.

The IFDM accepts a TVIF signal (video carrier 45.75 MHz and audio carrier 41.25 MHz) and demodulates the video and audio signals to baseband.

For more information, contact Synchronous Communications, 1701 Fortune Dr. Suite 0, San Jose, Calif. 95131, (408) 262-0541.

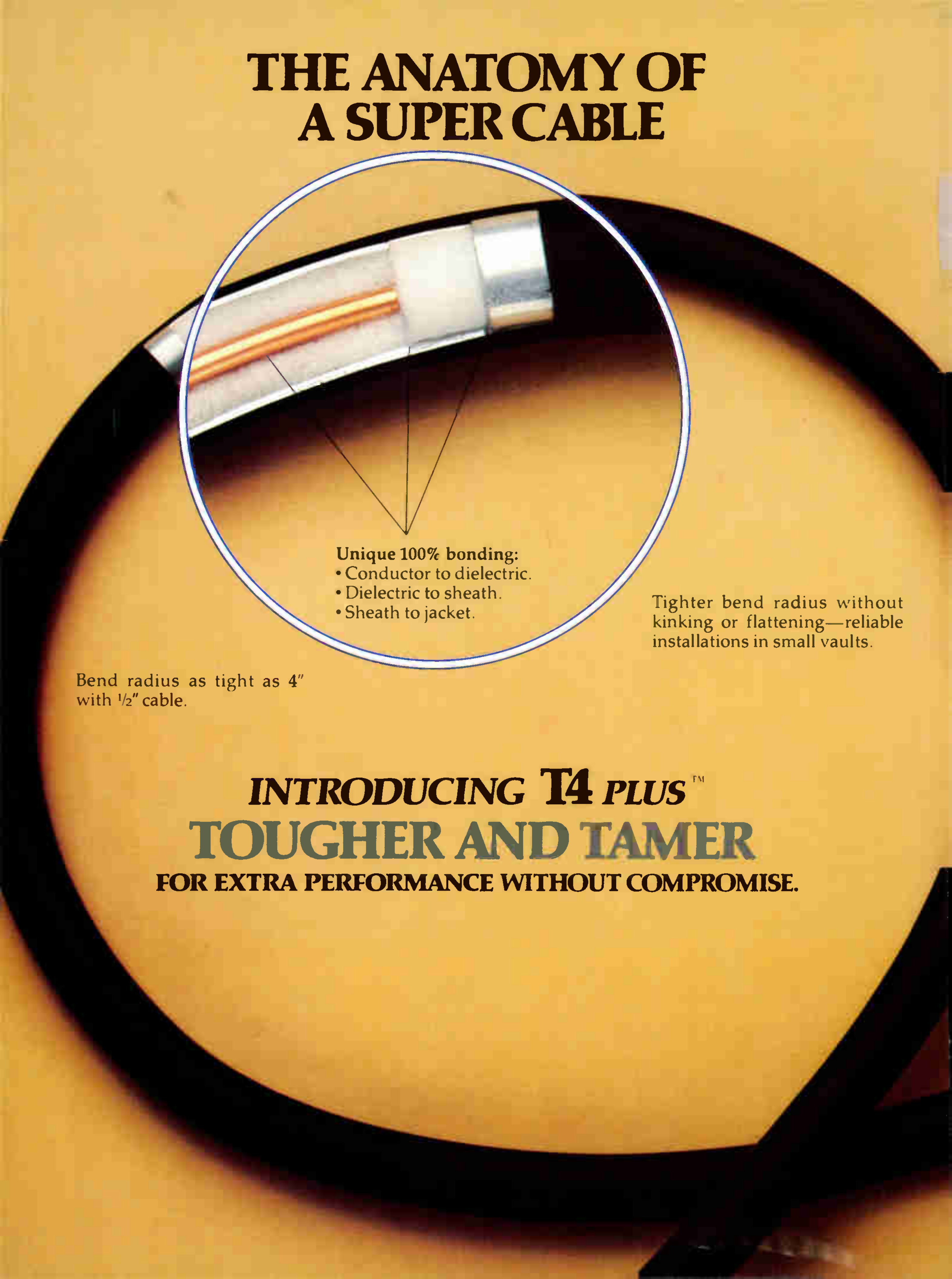
Satellite ENG

GEC McMichael/Marconi Studio Systems has developed a new electronic news gathering (ENG) unit. Named Satellite News Gathering (SNG), the unit is a compact, satellite terminal that is small enough to be flown in a light private aircraft. Once on location, the SNG terminal can be set up and operated by a crew of two. The entire terminal can be powered by a 12-volt battery or using local power supplies.

The SNG is composed of an elliptical dish antenna and an electronics unit that is linked by cables. Neither of these devices, when packed, is more than 1 meter high. Essentially, the SNG terminal is a transmit-only uplink to communications satellites that operate in the 14 to 14.5 GHz range. The antenna meets the 29-25 log θ regulation. The satellite-relayed pictures and sound can be received at any broadcasting network center on a larger antenna.

Although the SNG terminal is basically a

(Continued on page 103.)



THE ANATOMY OF
A SUPER CABLE
Unique 100% bonding:
• Conductor to dielectric.
• Dielectric to sheath.
• Sheath to jacket.
Tighter bend radius without kinking or flattening—reliable installations in small vaults.
Bend radius as tight as 4″ with ½″ cable.
INTRODUCING T4 PLUS™
TOUGHER AND TAMER
FOR EXTRA PERFORMANCE WITHOUT COMPROMISE.

THE STANDARD IS NOW THE SUPER-STANDARD

Easy coring with standard tools. Full-wall seamless aluminum tube, resistant to connectorization abuse. No objectionable non-conductive dielectric residue left on aluminum ID.

Jacket bonded to sheath for additional handling ease and increased corrosion protection. Peels away easily, leaving no adhesive residue. Continuous conductor-through-jacket bonding greatly increases sidewall and pull strength.

Jacket bonding prevents concealment of damage to aluminum. Extra-rugged LLDPE* jacket dramatically increases abrasion resistance and provides additional support.

*Linear Low Density Polyethylene is an extra-tough polymer that still can be cut for cold weather connectorization.

Standard connectors and cable preparation tools, no additional parts inventory or special training required.

Temperature-stable electrical and mechanical performance, to withstand broad temperature swings and years of winter/summer extremes. All adhesion layers maintain performance over entire temperature range.

For a sample of this remarkable new cable, contact TFC today at P.O. Box 384, Wallingford, CT 06492, (203) 265-8482 or (800) 243-6904.

TFC TIMES FIBER COMMUNICATIONS, INC.

See us at the Western Show at Booth #1620.

(Continued from page 96.)
transmit-only system, it does include a receiving facility for narrowband audio signals. This enables production or engineering spoken instructions to be sent from the broadcaster's studio center via the satellite to the SNG operating and reporting team. The entire SNG terminal is packed into two flight boxes for air transportation—one holding the electronics unit and the other the antenna unit.

For further information, contact GEC McMichael, 8260 E. Raintree, Scottsdale, Ariz. 85260, (602) 948-7255.

Line extenders

Broadband Engineering introduced its BLX Series line extenders for CATV, SMATV and MATV distribution systems. The new series includes the BLX-Plus models, equipped with Amperex power-doubler hybrids.

The units are available in 330 and 450 MHz bandwidths, offer a choice of gains from 28 through 50 dB, and have convertible 30 or 60 volt powering. The line extenders have "in," "out," and "through" powering and are system upgradable with plug-in hybrids for different gains. To allow for mounting in either direction, depending on the path of the signal, the amplifier module can be installed with the input at either end of the housing.

For more information, contact Broadband Engineering, P.O. Box 1247, Jupiter, Fla. 33458, (305) 747-5000.

Signal processor

Barcus-Berry Electronics Inc. has introduced its first signal processor, the BBE Model 202R. It uses a newly developed sound technology based on load reactance compensation. The differential load reactance compensator utilizes high-speed dynamic gain-control circuitry to audibly improve the reproduction of program transients, according to the company.

The unit's 19-inch rack-mountable chassis occupies two standard EIA spaces and measures 7 inches deep. In addition, phase adjustments are primarily directed toward preventing high-frequency time lag (transient distortion) and the automatic gain changes are based on interband program amplitude ratios. The swept frequency response of the system is essentially flat from 20 Hz to 20 kHz in both the operating and electronically buffered bypass modes.

For more details, contact Barcus-Berry, 5381 Production Dr., Huntington Beach, Calif. 92649, (714) 898-9211.

Teleconference products

The radio and transmission division of NEC America announced three products for the teleconference market. The NETEC XV is the company's most recent addition to its line of video processors. Major features of the unit include: wide level of alarm and diagnostics built-in video switcher, switch select between "continuous presence" and single channel transmission and international compatibility.

The NETEC XD video processor provides freeze frame and motion video capabilities in one unit. It allows the user to select freeze frame transmission via telephone lines, on full motion by the use of 56 Kbps service.

The AEC-1000 interactive audio system allows its user to conduct natural and interactive conferences without the "pause" characteristic of past systems; also, because of its VLSI echo canceller, the AEC-1000 permits speaking in a natural way with a performance of up to 7 kHz, according to the firm. The AEC-1000 can be used in two- or four-wire mode and it features a built-in digital bridge that supplies up to 6 ports for simultaneous audio conference. It includes one solar powered microphone.

For more information, contact NEC America, Radio and Transmission Division, 532 Broad Hollow Rd., Melville, N.Y. 11747, (703) 560-2010.

Backup modulator

Microdyne's 1100 HEM tunable headend modulator has SAW IF filtering and spurious outputs 60 dB below video. It is compatible with the major scrambler systems on the market today, according to the company. The 1100 HEM is designed as a back-up television modulator for all VHF and mid-band channels. Its front panel thumbwheel switch facilitates dialing up any channel in case of a malfunction in one of the dedicated-channel modulators. The modulator can also be used as a back-up for the processor output by using the HEM IF input.

For more details, contact Microdyne Corp., P.O. Box 7213, Ocala, Fla. 32672, (904) 687-4633.

VCR/monitor system

Panasonic Industrial Co. has introduced a compact, self-contained VCR/monitor television combination unit designed for high quality video presentations. The CT-130V measures just 16 inches across and 17 inches deep. Ideal for unattended repeat performances, the CT-130V can be set on "Auto Repeat" and left alone. Requiring no other

RAMS 5000

COMMERCIAL INSERTION SYSTEM

Commercial insertion equipment is installed between your satellite receiver and modulator, and FALCONE fits in with the best of them.

- Fully digital machine control logic
- Fully electronic switching on both audio and video
- Adjustable stop delay and gain control
- Automatic bypass
- Operational with all network formats
- Glass epoxy double sided gold contact circuit board
- Digital decoder, programmable tone sequence
- User friendly, easy to operate

Falcone International, Inc.

Distributed by
Scientific-Atlanta
Western Cable Show Booth 1420

P.O. Box 3067 • Marietta, GA 30060 • (404) 427-9496

See us at the Western Show booth #1420.

connections besides plugging it into an AC outlet, the front-loading VHS video cassette recorder has a locking front panel for tamper-proof operation.

The CT-130V comes equipped with a 10-function wired remote control keypad. Operational modes include noise-free still playback, eight-hour recording/playback capability and editing functions. The monitor has a 13-inch diagonal screen. Panabrite control and picture sharpness control let the user fine-tune image quality.

For complete information, contact Panasonic, 1 Panasonic Way, Secaucus, N.J. 07094, (201) 348-7183.

Design tool

ADS/Linex has introduced The Linex Scriber. The Scriber produces quality lettering and any other symbol in a fraction of the time it takes to do manually, according to the company. The Scriber comes complete with software and is fully operational. The software enables one to create and store in memory any symbol, title block, schedule or table. The Scriber also can be interfaced with many personal computers. The plotter has 0.01 mm resolution.

For more information, contact ADS/Linex, 3130 Gateway Dr., Suite 400, Norcross, Ga. 30071, (404) 448-0977 or (800) 241-3675.

Converters

Cable TV Industries' signed an agreement with Panasonic Industrial Co. to distribute its new converters. The distributor agreement covers two consumer-oriented RF cable converters—models TZ-PC100 and TZ-PC110.

Standard features of the converters include 402 MHz bandwidth; 52-channel capacity as standard, with 58-channel capable, infrared remote control (standard on Model TZ-PC110, optional for TZ-PC100); switched AC auxiliary outlet; channel 2, 3, or 4 output; switch selectable channel frequency allocation (STD, HRC or IRC); phase locked synthesized tuning; two-speed all channel scan; favorite channel memory; and a power indicator. Options include a parental control keylock and remote control A/B switch.

For more details, contact Cable TV Industries, 5933 Bowcroft St., Los Angeles, Calif. 90016, (213) 204-4440.

Converter/decoder

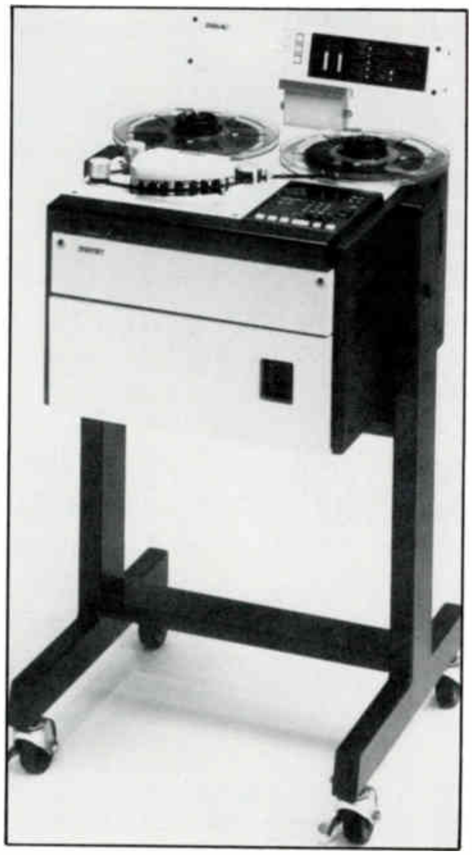
Sigma Three, an addressable baseband converter/decoder featuring multichannel sound and stereo digital audio is now available from Oak Communications. Also new from Oak is the Sigma 450V, a basic RF converter with volume control.

The new products are being previewed Dec. 5-7, at the Western Show.

The Sigma Three converter/decoder offers both stereo and secondary audio programming (SAP) resulting from its multichannel sound (MCS) decoding capability. This MCS feature processes two audio channels to provide bilingual or stereo sound to subscribers. In addition, Sigma Three incorporates Oak's Sound-In-Sync™, a digitized encrypted audio security technique.

The Sigma 450V RF converter matches the feature of volume control to a basic 64-channel RF converter.

For more details, contact Oak Communications, 16935 W. Bernardo Dr., Rancho Bernardo, Calif. 92127, (619) 451-1500.



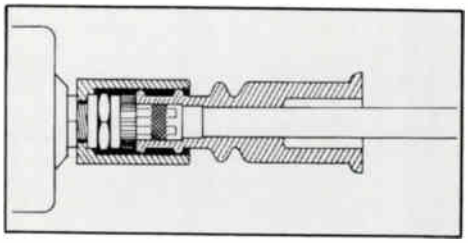
Audio recorder

Sony Professional Audio Division has introduced a two-channel digital audio recorder based on the DASH (digital audio stationary head) format.

Designed for record, radio and television production, the new PCM-3102 recorder offers the DASH format's 16-bit linear quantization and switchable 44.1 kHz and 48 kHz sampling frequencies. These features allow for a range of over 90 dB with frequency response within +0.5 dB and −1.0 dB from 20 to 20,000 Hz, according to Sony.

In addition to its two digital audio channels, the PCM-3102 provides two analog channels and one dedicated time code channel. The analog audio channels are time aligned with the digital audio to permit razor blade edits.

For further information, contact Sony Communications Products Co., Sony Dr., Park Ridge, N.J. 07656, (212) 575-1976.



Connector boot, clip

ITW Linx introduced a flexible thermoplastic boot and a new aluminum siding clip. The company's weather boot pump makes a weather seal for cable connectors allowing use of both of its ends. It is chemical and cold weather resistant and fits RG-59 and RG-6 coax. Also, Linx's boot is available lubricated and is U.V. stabilized for long life.

The dual aluminum siding cable clip is designed to attach dual coaxial cables. The clip has a barb that is positioned between overlapping aluminum siding joints, snapping into the overlap to resist pull out force. One clip is designed to accommodate vertical and/or horizontal dual cable attachment.

For more details, contact ITW Linx Installer Products, 195 Algonquin Rd., Des Plaines, Ill. 60016, (312) 296-5469.

Cable fault locator

Anixter Communications will distribute Progressive Electronics' line of cable fault locator products. These products include the Model 501 Tracker underground cable locator, the IC1 inductive coupler and Model 2003 fault locator.

The Model 501 underground cable locator is a portable, transistorized system consisting of the transmitter, which connects to one end of the cable to be located, and the receiver, a handheld unit to trace the path of the same cable.

IC1 is an accessory for the 501 Tracker II, which is designed to induce a tracking tone into a subject cable or wire without embellishing metallic contact. The inductive antenna is used to apply a tracking tone into a cable, wire or metallic pipe by radiating a signal from the ground surface.

The Model 2003 fault locator is an earth-ground cable fault-locating system, capable of pinpointing high-resistance ground faults. The basic system elements consist of: a battery-powered (12 V) pulse generator, receiver, battery charger, 12-volt auto cord, and ground stake.

For details, contact Anixter Communications, 4711 Golf Rd., 1 Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

IT WORKS!

THIS YEAR, A THOUSAND PROMISES WILL BE MADE BUT FEW KEPT. THE SPRUCER CONVERTER IS PRESENTLY OPERATING, SO WE DON'T HAVE TO MAKE CLAIMS, JUST STATE FACTS.

FACT #1. Manufactured by Matsushita, one of the world's largest consumer electronic manufacturers, Sprucer offers state-of-the-art reliability and performance.

FACT #2. With channel-by-channel addressability for each of Sprucer's 128 channels.

FACT #3. Incorporates subscriber sales features such as parental control, volume control, favorite channel memory, IR remote and prompting modes.

FACT #4. Fully interactive pay-per-view features using one-way or two-way response. No retrofits required to upgrade in the future.

FACT #5. Absolute theft-of-service security with 31 random selected scrambling modes in baseband video.

FACT #6. The first commercial remarket using Sprucer has produced outstanding results: 80% penetration to HP; 150% pay to basic; 82% penetration to basic for PPV tier, $24 average monthly revenue for homes passed.

If you would like more facts and less fancy about deliverable SPRUCER benefits, write for details.

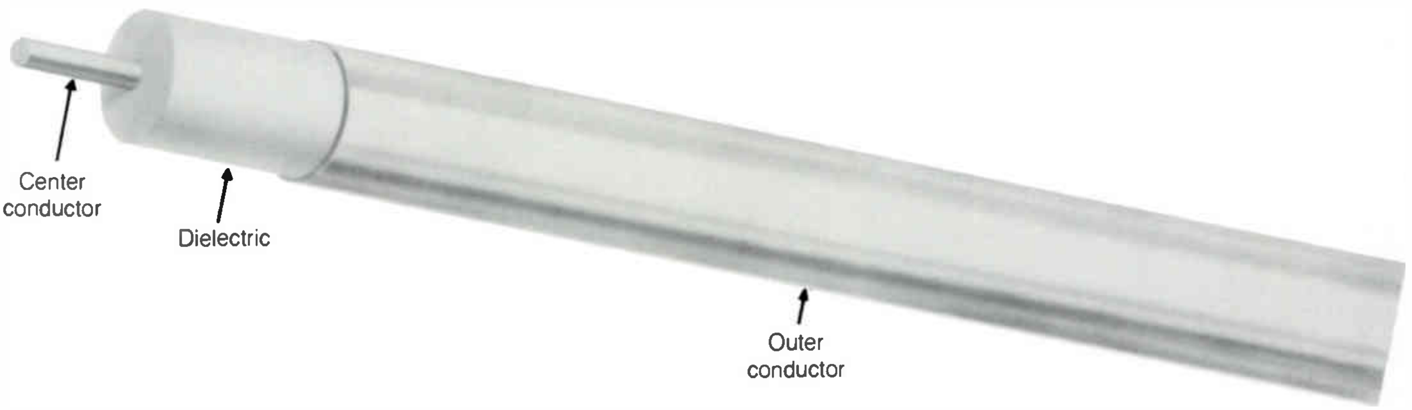
SPRUCER®

BY KG KANEMATSU-GOSHO (USA) INC.

ONE WORLD TRADE CENTER, NEW YORK, N.Y. 10048/(212) 524-8353/TWX 710-581-5713/TLX 125202/FAX (212) 524-9249

See us at the Western Show at Booth #310.

A basic coaxial cable construction



Coaxial cable: The name of the game

'(Coaxial cables) can be thought of as the blood vessels of the system'

By Paul A. Wilson
Director of Marketing, CATV Coaxials
M/A-COM Cable Home Group

In a CATV system, coaxial cables are used to transport the signal from the headend to the television set in the subscriber home. They can be thought of as the blood vessels of the system. How a coax cable is basically constructed and what makes each design detail important to its end use will be covered here.

The various CATV cables used have several things in common but also are very unique in other ways. For example, all coax used in transmission lines have an impedance of 75 ohms, and all have three major parts—center conductor, dielectric and outer conductor. However, each cable has an attenuation characteristic that is unique to the diameter, the dielectric materials and the frequency at which it will be used.

The center conductor

To discuss the make up of a cable, let us investigate it from the inside out. In the majority of today's modern systems, the center conductor is made up of a copper covered aluminum wire. This type of wire can be used with no increase in attenuation due to the fact that, at the radio frequencies used in the CATV system, signals travel on the outer copper surface of the wire. Although this layer is typically only a few thousandths of an inch thick, the RF signal reacts as if it were traveling in a solid copper wire. However, the DC resistance characteristics, which are important for the powering of the system's electronics, will utilize the entire cross-section of the conductor—copper and aluminum.

There are modern systems where, due to special powering requirements, a solid copper center conductor is needed. The lower DC resistance of the center conductor will allow greater spacing of the power supplies and a reduction in powering costs.

The dielectric

The second part of the coax, the dielectric material, is somewhat more complicated in its makeup. In the past, the selection of plastic materials was very limited. Today we have a multitude of plastic materials from which to choose—there are low density polyethylenes, medium density polyethylenes, high density polyethylenes, polypropylenes, and the dielectric could be a combination of each or all of them. No matter which material is used there are certain goals that the dielectric must meet.

The basic purposes of the dielectric are threefold. First, it must hold the inner conductor in a position centered in the material. Unless this occurs the characteristic impedance will not be 75 ohms. Secondly, the material must contribute as little to the attenuation as possible. The selection of the material for its electrical characteristics is as important as for its mechanical ones. The third design characteristic of the dielectric is to provide the internal mechanical support for the outer conductor. Without that support, as the cable is handled during testing, installation, etc., the outer conductor could "kink," "buckle" or become out of round. Each of these problems will cause the impedance to change at that point and the transmission characteristics could be hampered.

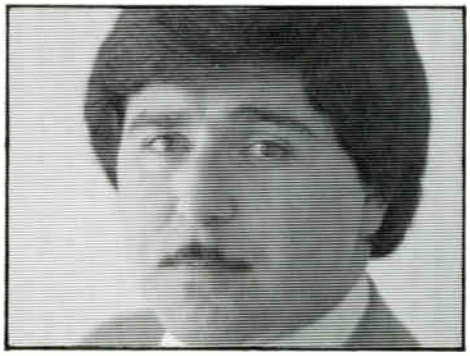
The outer conductor

The third part of the coaxial cable is, of course, the outer conductor. The outer conductor is made up of an electrical grade aluminum and is normally swaged down on the dielectric to provide a tight friction fit. Today there are a few different designs of outer conductor from which to choose. There is the standard extruded tube that has been with us for years, the thin wall overlapped type, the welded seam and the current, state-of-the-art, thin wall RF welded tube. Each of these configurations is designed to serve the same purpose—that is, to provide a return path for the transmission signals and to provide a protective electrical shield for the system.

In addition to the three basic parts of a coaxial cable, the materials used to protect the metals from moisture ingress due to environmental conditions (center conductor coatings and jacket materials) certainly are important. Each of these protective materials will have an impact upon the electrical and/or mechanical characteristics of the cable and should be considered when designing a system.

The coaxial cables now in use have progressed to a high level of sophistication. In the "old days" we were interested primarily in the attenuation per hundred feet only. Now we have to be interested not only in the attenuation, but also in any future electrical requirements of the cable and its expected life time. With the significant capital outlay for a large cable system, the owners or investors are interested in how the return on investments of the plant looks today and tomorrow. And because cable is certainly one of the most important parts of a system, it should not be taken for granted. After all, they call this the "cable industry" don't they?

Cosmetics vs. practicality



By Anthony J. DeNigris
President Nationwide CATV Services Inc

A generally shared opinion in the industry today is that a newly constructed CATV plant should be good looking. And as well, it should be built so as to ensure cosmetic appeal for years to come. Isn't it true that a cosmetically appealing system is usually recognized as well built, quality plant?

It is unfortunate, however, that many times more consideration is given to how the cable "looks" (as one might view it from the ground) rather than how the cable "works." This is not to say that good looking cable won't work well. However, what a field inspector will readily accept all too often as quality workmanship, based upon the appearance of cable plant, may actually be the result of poor construction practices. Good looking plant is a desired end result of construction, but more emphasis should be placed on *how* the cable gets put there.

I agree that cable that looks good probably works well, but not merely because it looks good, and not in all cases. Cable plant should be placed in such a way that the tools of the trade can be used in the manner for which they were designed—not to just "pretty up" the plant. Let's take an example.

The mechanical bending board

Mechanical loop formers (bending boards) were developed to alleviate the possibility of damage to a particular piece of cable by ensuring that each loop formation in a cable run is accomplished so that the effects of human error can be minimized—not to specifically produce a uniform, nice-looking loop. Uniformity and good looks are a by-product of mechanical loop forming devices. But all to frequently, the emphasis is not on the prime objective, but rather, on this side effect.

I have seen situations where a field inspector will continually appear at a job and scrutinize to the umpteenth degree what appears to be dissimilarities in loops that are supposedly mechanically formed. Time after time he asks, "Why aren't mechanical boards being used?"

In analyzing why a field inspector might arrive at this conclusion, let's keep in mind that his impressions are based upon visual observations alone. In this case, the inspector has not seen the crews actually working, forming the loops, and he therefore assumes that since variations exist (as viewed from the ground), mechanical devices haven't been utilized. How could this be so? Everyone has a picture in his mind of what good cable plant is supposed to be, and look like. If a line crew placing cable uses a mechanical bending board to form a loop (i.e., a flat-bottomed loop), and from the ground the bottom of the loop does not seem parallel to the run of the span, the line crew is then faced with a choice. Either they can leave the loop as is, or they can manipulate it in such a manner that it becomes visually appealing. As soon as that happens, and rest assured that this does happen frequently, the whole purpose for which the mechanical loop former was engineered could be negated.

'Perfect' imperfections

What is wrong with mechanical bending boards? Nothing! A few factors exist that may or may not allow for a device, properly used, to produce a good-looking loop. Let's jump to the most critical factor—overlash situations. When a multitude of cables already exist that must be lashed to, the line crew finds itself dealing with a hodgepodge of actives, passives, drops, clamps and the possibility of oversagged spans. Now in order to facilitate the proper placement of the loop, it may not be practical to "sock-up" the newly placed cable flush to the existing plant in the vicinity of the pole. Cable may have to route through, around or alongside of equipment. Hence, the mechanical formation of a loop and its resulting appearance is affected. The portion of the loop nearest the pole, in most cases, will not appear to match the opposite part of the loop. It might look as if the depth is different or the angle of the radii is not uniform, when in fact they truly are. The groundman on the crew, indicates to the lineman that the loop is crooked. The lineman is to adjust it (by hand). What he will then do is, in actuality, the worst possible thing—and that is to alter the radius of one or two of the bends manually. The possible results of such action, with only good intentions in mind, is that kinks or ripples can occur in the coaxial cable.

In a new-build, the situation is somewhat different, however, similar problems can be caused if the same methods are used. When cable is lashed into a bundle, and the lashing wire clamp, with appropriate straps and spacers, is placed at the proper points, all looks well, until the loop is being formed. If one closely looks at the strand and the angle at which it attaches to, crosses and passes from a clamp at the pole, one can envision two angles, with the vertex at the clamp. And again, realizing the fact that we do not know how much sag is placed in the strand as the operation takes place, we don't know exactly what variation takes place in these angles (picture a flat-topped triangle).

Further, the number of cables that must be formed into a loop (and for purposes of this example let's arbitrarily pick five) must all look uniform. It is no secret, from a lineman's point of view, that the more cables that have to be placed, the more difficult it becomes to form identical loops because first of all, they can't all be formed at the same time. There also exists various size cables in this bundle.

Carrying this further yet, in order to achieve that *appealing look*, the bundles will be hand manipulated so as to sock them up and attach a strap and spacer at the innermost portion (close to the pole), therefore conforming to that flat topped triangle. Anyone looking through the catalogs of the manufacturers of such mechanical devices will notice very simple looking cable configurations (only one or two cables shown) with perfectly level, tight strand and therefore, nicely formed, parallel looking loops. Incidental to the forming operation when dealing with numerous cables, the first cables formed must be moved out of the way in order to form the remaining cables. It is quite rare that actual conditions in the field will permit catalog-depicted results. All of this is not to say that the cable will not look good, but it may not, in order to work properly, look perfect.

More 'perfect imperfections'

A span of cable is a relationship. All the components fit together for a functional purpose within which a dependency exists. Specifically, lets take the correlation of lashing wire and expansion loops, to which the majority of this article has been devoted.

We all know the purpose for which expansion loops are intended, yet how often do we go out into the field to examine whether that flexibility truly exists. More often, in our inspections of completed plant, criticism will come from lashing wire that appears too loose, but never do you hear anyone say "this lashing wire is too tight." It is my contention that lashing wire (supporting the cable) is very rarely too loose, but it certainly can be, and often is, too tight. Rest assured, I am not condoning haphazardly lashed spans.

One final point, lashing wire seldom breaks at its clamp. Rather, it usually breaks at points along the span. Obviously, these are the points where the effects of stress caused by expansion and contraction are greatest. The next time you are about to criticize cable that appears to have a slight degree of space between the strand and the configuration, remember that if it was socked-up tight, you may have more to worry about down the road, than the visual impact you are trying to strive for in the present.

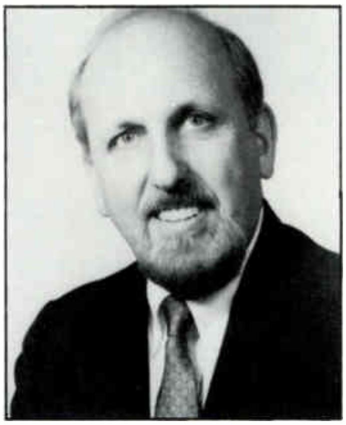
Bauer

Boyle

Infrotron Systems Corp. recently announced three appointments. Senior Vice President **Thomas Alexander** has assumed responsibility for its subsidiaries in Canada and the United Kingdom. His new title will be senior vice president of sales and marketing operations. **Robert Bauer** has been appointed vice president of the combined marketing and engineering departments. Previously he served as assistant vice president of marketing and product management. Finally, **Michael Boyle** has been named director of Infotrons independent sales organizations. Boyle comes from Micom Systems Inc., where he was Midwest regional sales manager. Contact: Cherry Hill Industrial Center, Cherry Hill, N.J. 08003, (609) 424-9400.

Anixter Communications recently announced three promotions: **Ron Pitcock** has been named vice president and general manager of Anixter Cincinnati; **Matt Endsley** was appointed district manager-Atlanta; and **Eric Perbohner** has been promoted to district manager-CATV, western district.

Pitcock has been with Anixter since 1980, most recently as CATV district manager-Houston. Endsley joined Anixter in 1979, working in the capacity of accounts manager-MSO group before this promotion. Perbohner was most recently in CATV national account sales-western region. Contact: 4711 Golf Rd., One Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.



Potter

Albert Potter has been appointed vice president sales and marketing for the cable television division of **Times Fiber Communications Inc.** He most recently served as president of the RF systems division of General Instrument Corp., a company he served in various management positions for more than 17 years. Contact: 358 Hall Ave., P.O. Box 384, Wallingford, Conn. 06492, (203) 265-8500.

Craig Johnson has joined **Hughes Aircraft Co.'s** microwave communications products as an applications engineer. He will be the primary technical interface between the Hughes Microwave Products division and its cable TV customers east of the Mississippi. Contact: P.O. Box 2940, Torrance, Calif. 90509, (213) 517-6400.

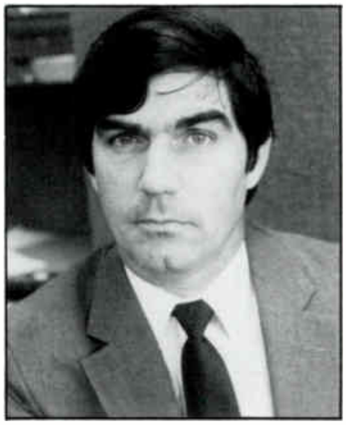
Edward Drake recently joined the management team at **Satellite Syndicated Systems Inc.** in the newly created position of vice president, Consumer Services Division. Drake comes to SSS with more than 20 years of engineering and management experience in the industry. He was past president of both the Mid-America and Oklahoma Cable TV associations, member of the Cable TV Pioneers and executive vice president of United Cable. Drake was most recently president and principal owner of Sooner Cable Services Inc., a consulting and marketing firm. Contact: P.O. Box 45684, Tulsa, Okla. 74145, (918) 481-0881.

Harvey Caplan has been appointed national sales manager for professional products dealer sales by **Ikegami Electronics (USA) Inc.** The company also announced five other important sales and executive appointments.

Caplan has been with Ikegami for five years, most recently as Midwest regional manager for the professional products division.

In other appointments at its Maywood, N.J., headquarters, Ikegami has named **Thomas Laury** national service manager for its nationwide customer service activities; **Louis Rainford** has been appointed senior video consultant for the black & white closed circuit video division and **John Di Tucci** is the new controller for Ikegami, joining the firm from Touche Ross & Co.

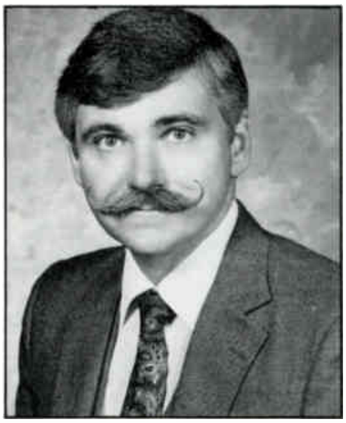
Ikegami also made two new appointments to its staff based in Torrance, Calif. **James Dempsey** is western regional sales manager for the display division, and **Ronald Abbey** is the new office manager for the Torrance facility. Contact: 37 Brook Ave., Maywood, N.J. 07607, (201) 368-9171.



DeSantis

Philip DeSantis has joined the professional audio division of **Sony Corp.** as national sales manager. Prior to joining Sony, DeSantis was director of marketing and sales for the pro audio and broadcast products divisions of Lexicon Inc. Contact: Sony Drive, Park Ridge, N.J. 07656, (201) 930-6432.

Schwartz



Pederson

Jerome Schwartz has been promoted to manager-customer service at **Blonder-Tongue Laboratories Inc.** Schwartz joined Blonder-Tongue in February 1979 as a subscription TV sales engineer and became accounts manager-STV in July 1979. He was promoted to product manager LPTV/STV in 1983.

Also announced was the promotion of **Dennis Pederson** to credit manager at Blonder-Tongue. Pederson joined Blonder-Tongue in 1979 as supervisor, production testing and was promoted to manager-customer service in 1981. He was previously employed by F.E.L. Corp., Farmingdale, N.J., as a production testing supervisor. Contact: 1 Jake Brown Rd., Old Bridge, N.J. 08857, (201) 679-4000.

Salmas

Eileen Salmas has been appointed director of marketing for **Elbac Cable Services Ltd.**, a cable and pay TV software development and marketing company. Contact: 1751 S. Douglass Rd., Anaheim, Calif. 92806-6031, (714) 634-8467.

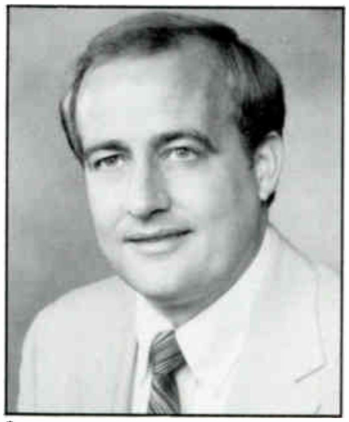
Woody

Wendell Woody has been appointed field sales manager for the commercial and institutional markets of **Catel Telecommunications Division** of United Scientific Corp. Woody will be based in Kansas City and will serve all markets from the Rocky Mountains to the East Coast. Woody comes to Catel from the Jerrold (RF Systems) Division of General Instrument where he served as sales manager for most of the U.S. markets. Contact: 1900 Erie St., Suite 203, North Kansas City, Mo. 64116, (816) 474-4289.

Steve Davidson has been appointed southeast regional sales manager-data products for **C-COR Electronics Inc.** Based in the Atlanta area, Davidson had been C-COR's southeast regional sales manager for cable television and data products for the past three years. Contact: 6137 Brooklet Dr., Columbus, Ga. 31904, (404) 561-1273 or (800) 233-CCOR.

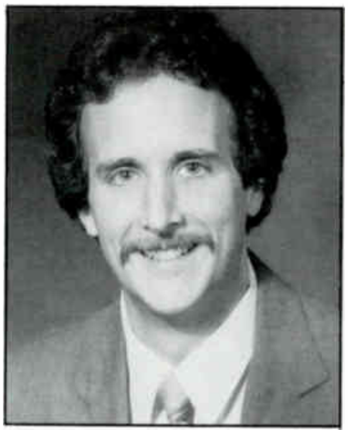
C-COR also announced that **Michael Crotts** has been named regional sales manager, southeast. Crotts brings over 10 years' experience in the cable television industry with him to C-COR. Most recently he was southeastern regional manager for Kennedy Cable (Best Communications) in Atlanta and prior thereto was an account executive-southeast region for Gardiner Communications Corp., Atlanta. Contact: 4938 Dana Dr., Kennesaw, Ga. 30144, (404) 928-6922 or (800) 233-CCOR.

Parker



Schneidewind

Belden Electronic Wire and Cable has appointed **Charles Parker** and **Charles (Rick) Schneidewind** to be regional managers. Parker will be responsible for the south central region. His appointment coincides with the opening of a new regional office in Dallas. Parker, who was formerly regional manager in the central region, joined Belden in 1969 as a field sales representative. Schneidewind replaces Parker as regional manager in the central region. He will be based at the Belden Electronic Wire and Cable headquarters in Richmond, Ind. Schneidewind joined Belden in 1972 and has held various field sales and sales management positions with the firm. Contact: 2000 S. Batavia Ave., Geneva, Ill. 60134, (312) 232-8900.



Matthews

Doering

Wegener Communications recently expanded its marketing staff. **Harry Matthews'** responsibilities will be concentrated in the communications market and **Roger Doering** will be responsible for the broadcast markets. Also, **Jon Thrasher** will be focusing his efforts in the domestic and European cable markets. Matthews comes to Wegener from M/A-COM Prodelin; Doering has been with Wegener for five years, most recently as manager, system engineering; and Thrasher, who has been employed by Wegener since March 1983, most recently worked as national accounts executive. Contact: 150 Technology Park/Atlanta, Norcross, Ga. 30092, (404) 448-7288.

The Drop Shop West Ltd. announced the promotion of **Rick Panella** to sales manager-western region. For the past year, Panella served in the capacity of western regional sales representative. Contact: P.O. Box 4771, Hayward, Calif. 94540, (415) 887-7474 or (800) 227-0700.

Compucon Inc. announced that **Fred Johnston** has joined the firm as manager of its Marketing Services unit. Prior to joining Compucon, Johnston was with AT&T, most recently in marketing and product management in the Consumer Products Division. Previously, he was involved in marketing and business planning for satellite, wideband and cellular services. Contact: P.O. Box 809006, Dallas, Texas 75380-9006, (214) 680-1000.

Scientific-Atlanta announced the appointment of **Richard Bell** as marketing manager for the company's coaxial cable division located in Phoenix, Ariz. Bell was most recently with Rogers Corp., a manufacturer of electronics materials and components, where he served as marketing manager. Contact: 2920 E. Elwood, Phoenix, Ariz. 85040, (602) 268-8744.

David Wyllie has joined **Magnicom Systems** as a marketing representative assigned to the Midwestern United States and central Canada. Wyllie comes to Magnicom from Group W Satellite Communications, Chicago, where he was lead affiliate representative. He also served as press assistant for the Hartford Whalers hockey team for three years. Contact: 1177 High Ridge Rd., Stamford, Conn. 06905, (203) 968-0088.

Tele-Engineering Corp. announced the appointment of **Gary Boot** to the newly created position of director of business development. Boot was previously director of construction for Cablevision's Boston system. Contact: 2 Central St., Framingham, Mass. 01701, (617) 877-6494.

James Hall was named recipient of the 1984 Morris Dunn Award during the Southern Cable Television Association's annual banquet held Friday, Sept. 7, at the Eastern Show. The Morris Dunn Award is SCTA's highest honor given in recognition of long outstanding service to the cable industry in the South. Hall is executive vice president of Storer Communications. Contact: 12000 Biscayne Blvd., Miami, Fla. 33161, (305) 899-1000.

WHO WE ARE

Bruce M. Brown Associates is an executive search firm serving clients in fast growth and high technology industries.

We specialize in the search for exceptional management talent to turn opportunities into achievements.

WHAT WE DO

— We perform a professional consulting service in the search for top management talent. The search process includes these key steps:

— Definition of the position; including the qualifications, specific responsibilities, and performance results of a successful candidate.

— Research of strategically targeted industries and widely diversified sources to identify prospective candidates.

— Evaluation of the very best candidates, both to achieve the position objectives, and to function smoothly within the client's organization.

— Counseling of both client and selected candidate in the presentation and acceptance of a position offer.

HOW WE DIFFER

We offer first hand line experience in defining business objectives and in organizing to achieve performance goals.

Plus a successful record of consulting services to major corporations engaged in the pursuit of high technology opportunities.

Plus a general management perspective in matching people to organizations and motivating teamwork for high productivity.

Six Landmark Square
Suite 400
Stamford, Connecticut 06901
203 359 5720

— Bruce M Brown Associates

See us at the Western Show booth #194.

Management Consulting
Executive Search
Organization Planning

CALENDAR

December

Dec. 4: QV Publishing seminar on "Addressing Addressability and Pay-Per-View," Disneyland Hotel, Anaheim, Calif. Contact Barbara Freundlich, (914) 472-7060.

Dec. 4-6: Jerrold technical seminar, Philadelphia. Contact Kathy Stangl, (215) 674-4800.

Dec. 5-7: California Cable Television Association annual convention, the Western Show, Anaheim (Calif.) Convention Center. Contact (415) 428-2225.

Dec. 5-7: Magnavox CATV training seminar, Anaheim, Calif. Contact Laurie Mancini, (800) 448-5171.

Dec. 11-12: The Yankee Group seminar on "New Technologies, New Solutions," Palo Alto, Calif. Contact Lisa Caruso, (617) 542-0100.

Dec. 12: SCTE Delaware Valley Chapter meeting on addressable terminal technology, George Washington Motor Lodge, Willow Grove, Pa. Contact Bruce Furman, (215) 657-4690; or John Kurpinski, (717) 323-8518.

Dec. 12: SCTE Golden Gate Meeting Group seminar on audio services, Concord, Calif. Contact Rich Adams, (707) 208-2340.

Dec. 14: Microwave Filter Co. Terrestrial Interference Seminar, East Syracuse, N.Y. Contact Bill Bostick or Carol Ryan, (315) 437-3953.

January

Jan. 15-17: Security Equipment Industry Association and National Burglar & Fire Alarm Association international security conference and exposition, Sheraton Twin Towers, Orlando, Fla. Contact (312) 299-9311.

Jan. 16: SCTE Rocky Mountain Meeting Group hands-on workshop on test equipment, ATC Training Center, Denver. Contact Bruce Catter, (303) 740-9700.

Jan. 22-23: Society of Cable Television Engineers technical seminar on "Multichannel Television Sound," Concord, Calif. Contact Pete Petrovich, (415) 828-8510.

Jan. 22-24: C-COR Electronics technical seminar, Los Angeles. Contact Deb Cree, (814) 238-2461 or (800) 233-2267.

Jan. 30-Feb. 1: Texas Cable TV Association annual convention, the Texas Show, San Antonio Convention Center. Contact Bill Arnold, (512) 474-2082.

February

Feb. 4-6: American Federation of Information Processing Societies Inc. annual Office Automation Conference, OAC '85, Georgia World Congress Center, Atlanta. Contact Helen Mugnier, (703) 620-8926.

Planning ahead

Dec. 5-7: California Cable Television Association annual convention, Western Show, Anaheim (Calif.) Convention Center.

Jan. 30-Feb. 1: Texas Cable TV Association annual convention, the Texas Show, San Antonio Convention Center.

March 4-6: Society of Cable Television Engineers annual convention, Cable-Tec Expo '85, Sheraton Washington Hotel, Washington, D.C.

April 9-11: Canadian Cable Television Association annual convention, 'CABLE-XPO,' Toronto Metro Convention Center.

June 2-5: National Cable Television Association annual convention, Las Vegas (Nev.) Convention Center.

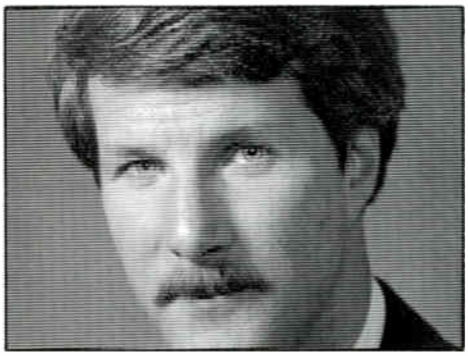
Aug. 25-27: Annual convention of the Southern Cable Television Association, the Eastern Show, Congress World Center, Atlanta.

Sept. 18-20: Atlantic Show, Atlantic City, N.J.

AD INDEX


Comm/Scope's
Plenumax™ Plenum Cable.
Now you can do it without conduit-
and still have money to burn!
COMM/SCOPE NEC-725-2(b) NON-CONDUIT RG-59
The Cable TV Industry now has a new channel to go through that can eliminate costly conduit cable applications — forever!
If you're still protecting your cable with conduit in low power commercial applications, your time and money could be going up in smoke. Because the installed cost of new Plenumax Plenum is lower than that of traditional cable and conduit systems. Which is important when you consider that more and more cities are incorporating safer, more stringent rules to their fire codes.
Comm/Scope's Plenumax Plenum cable saves installation time and labor, requires less installation space plus no special tools or training are required. It eliminates conduit costs forever, simply because there's no need for it! UL-approved Plenumax cable has a tough, Teflon® jacket to protect the cable from fire and smoke damage. It's strong, durable, corrosion resistant, abrasion resistant and flexible enough to take the toughest bumps, curves and corners. And the high dielectric performance of Plenumax Plenum is not affected by time and temperature. Comm/Scope's Plenumax Plenum cable is also available in a variety of cable types: RG-59 (shown in illustration) and RG-6, RG-11, Dual RG-59, and Dual RG-6.
So give us a call today. And take the heat off your next installation budget with Comm/Scope's Plenumax Plenum cable.
*Du Pont's registered trademark for its fluorocarbon resin
M/A-COM
Comm/Scope Marketing, Inc.
Box 199-A
Catawba, N.C. 28609
Contact Specialty Cable Sales at
1-800-438-3335
See us at the Western Show booth #355.

Part II—Busy, busy, busy: Too busy for subscribers



By Robert A. Luff
Senior Vice President Engineering
United Artists Cablesystems Corp

It is possible that many cable systems have acquired, through trial and error, a reasonable "feel" for normal call activity and required staff. However, cable companies will always have trouble guessing at the appropriate level of staff and equipment needed to ensure acceptable service under varying incoming call rate conditions. But, Blocking Theory takes the guess work out of how many lines and representatives should be on duty at any hour, day or season. Blocking Theory can be used to actually pre-schedule the required number of active lines and customer service workforce needed to maintain a constant satisfactory level of service based on a few key inputs easily obtainable from past records of incoming call rates per hour.

Extremely high peak loads are always the most difficult situations to handle. For the electric power company, its peak electric loads occur on hot summer days about 5-6 p.m. as customers arrive home from work and turn on the electric air-conditioning, start dinner on the electric stove and take a quick shower, which triggers the electric water heater. For us, not counting a major outage, it is non-pay disconnect days and special promotions. Since, by definition, peak activity means that a large number of subscribers are involved, peak problems cannot be ignored without eventual adverse impact.

As with the power company, high telephone call peak loads are very expensive to deal with in terms of operating cost or subscriber irritation. If you build and staff your facility to meet the highest peak and load conditions, it is expensively overbuilt and overstaffed for the major part of the time. And, if peak load demands are not dealt with in one way or another, then performance breaks down, sales are missed and subscriber irritation keeps building during each peak demand period. As we all know, it takes very few angry subscribers to create a potentially explosive situation. The smallest spark of a longer than usual outage or rate request increase can trigger major fireworks.

Influencing call rates

Unlike the power company, which can do very little to relieve the factors that are the cause of its peak demand, we often can have more control over the factors that influence the timing of our incoming calls. But do we want to? If you were to monitor the office incoming call rate you would find long periods of little to no activity and periods when all lines are busy. During light activity, the system is unproductive. But worse, when all lines are in use, unknown numbers of additional subscribers are being blocked and the system is inefficient. The ideal situation would be to have a steady incoming call rate from office opening to office closing, Monday through Friday, and adjust the staff to meet the needs.

This can be approached through a few simple changes in general system procedures. First is training all customer service representatives to handle all calls quickly. As mentioned previously, the single greatest factor in efficient call handling is the length of time the customer service representative has the caller on the line from start to finish.

The lineup of cable offerings, especially promotions, should be carefully engineered and advertised to avoid indecision and questions when the customer dials in on one of your precious threads of communication. If incoming calls average more than a minute or two, or if customers are asking involved questions, something is wrong with the availability, detail, or design of the system's promotional material. It is always better to take the time to design and say it right once in the ads than do it over and over again on every incoming subscriber call.

Incorporating a worksheet in ads to allow pre-organized order information along with a special "hot-line" number only for customers with completed worksheets could increase order taking efficiency many times. And, for the same reason, special problem incoming calls should be interrupted and a number taken to have a "special representative" call back (during slack periods). Orders by mail always should be encouraged (rebates) since they are by far the most efficient to process. It is amazing how many ads do not include a handy postcard or pre-mailer or even the mailing address of the system. It should be noted that "walk-ins" are the most inefficient to process and demanding in terms of office and parking considerations, and should be discouraged if at all possible.

Equipment and innovative approaches

Not all office telephone equipment was created equally. Modern office telephone systems have dynamically assignable incoming lines, call holding message tapes and continuous monitoring (and printing) of all the vital data necessary to carefully watch and apply basic traffic engineering and Call Blocking Theory. Such equipment ensures maximum system efficiency and minimum subscriber irritation. Also, it allows supervisors to easily monitor calls for employee training and sales techniques. (Companies must have employees sign a letter of understanding before supervisors can listen in on their office lines.)

Give subscribers more convenient hours. While much can be done to smooth incoming call peak load demands and improve customer service department efficiency through properly designed ads, most subscribers work the same hours you do, which forces large numbers of calls and walk-ins to occur during certain times of the day. Parallel work schedules between you and thousands of your subscribers will continue to create huge peaks of office activity and long periods of inefficient idleness. Systems should consider expanded hours. If the office opened just an hour earlier and remained open until 8 p.m., the subscribers could more conveniently conduct their business with you and reduce those headache-producing peaks the following day. Saturday hours might be worth considering as well, especially during major promotions.

In closing...

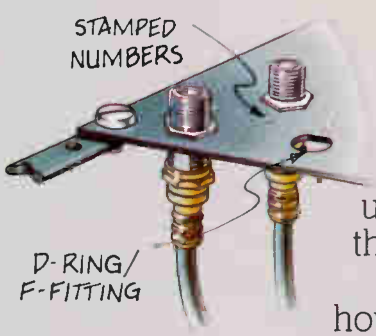
Unfortunately, space does not permit examples of actual customer service traffic engineering analysis and benefits, but anyone interested in more information is encouraged to consult the many books on the subject at any technical library. Advanced applications may be found in *Reference Data for Radio Engineers*, fifth edition, now published by Howard W. Sams & Co.

Finally, cable systems should more carefully review the quality and efficiency of their subscriber call handling procedures and equipment to ensure continued system growth and reduced subscriber irritation. Handling thousands of subscribers with relatively few telephone lines and staff efficiency can be guided by the application of traffic or Call Blocking Theory. The cable technical community should offer its assistance in applying traffic engineering theory to office telephone systems and procedures.

13 cents of sheer genius.

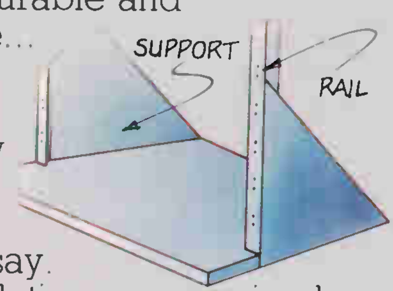
At first glance, CWY's Labelock is a simple little plastic doodad.

But our 13 cents' worth of plastic labels and locks drop cable better than anything else you can buy. Its size and color allow identification at a distance. Best of all, it has to be destroyed to be removed.



Chances are, you already use Labelocks. But the Labelock is just one example of how CWY has been addressing your problems with unique, cost-effective solutions for 25 years. Another is our new Omni-Rack™ system that uses a panel and rail design to make multiple dwelling enclosures more orderly, secure and serviceable. The Omni-Rack means quick and easy audits and subscriber status changes. Your service personnel save time, so you save money.

Or how about CWY's new headend rack: durable and easy to assemble... cost-effective to ship...priced 25 percent below competitive headend racks.



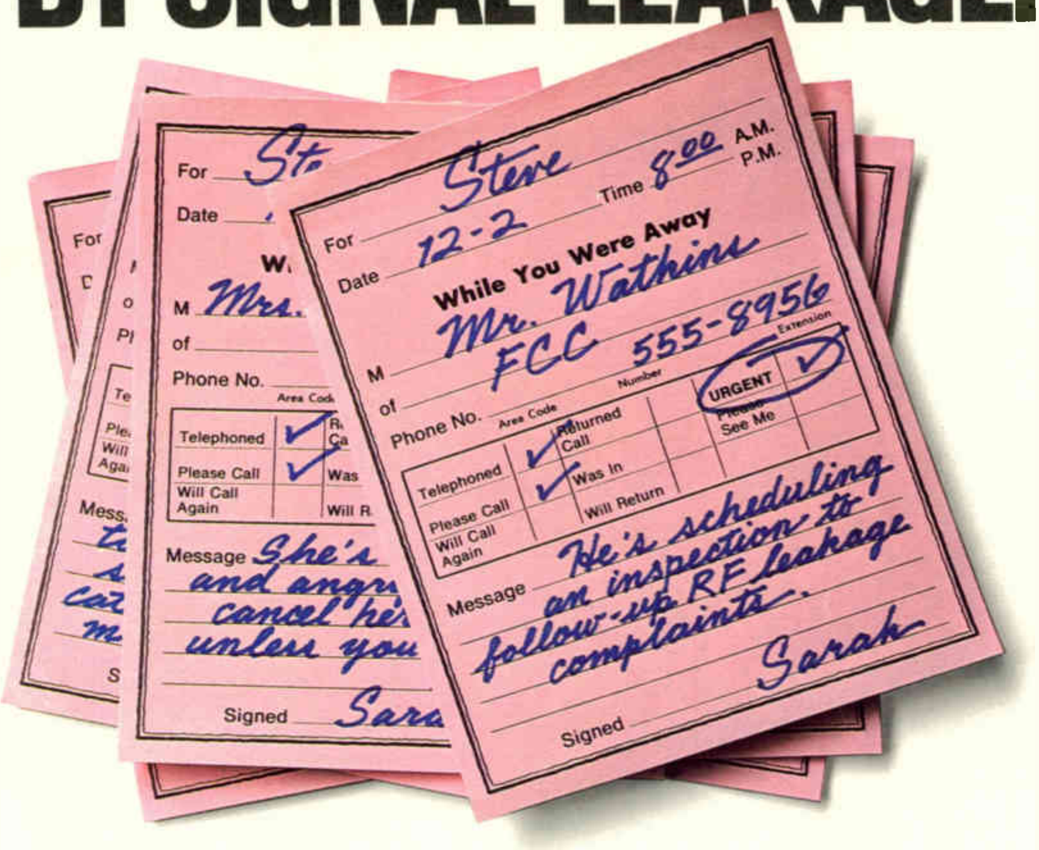
Simple, you say. Frankly, some solutions are so simple it takes genius to think of them. To find out more about these and other unique solutions from CWY, call or write today.

Not just supplies. Solutions.

CWY electronics

P.O. Box 4519 — Lafayette, IN 47903 — Call Toll Free: 1-800-428-7596 — Indiana: 1-800-382-7526

NOW YOU CAN STOP THE STATIC CAUSED BY SIGNAL LEAKAGE.



In the CATV business, RF leakage caused by cable damage can create all kinds of headaches. Like FCC code violations. Service complaints. Mid night repairs. And skyrocketing labor costs. Now there's a way to cut through the noise.

Introducing Raychem's new ThermoShield™ Cable Repair System, now in stock at Anixter. The system's special barrier prevents RF leakage and preserves the electrical integrity of all sizes and types of cable. Lined with hot-melt adhesive, the wraparound, heat-shrinkable sleeve reinstates mechanical strength while covering cracks and breaks with a long-lasting, waterproof seal.

And installation of the ThermoShield system is quick and simple. There's no cable cutting and splicing. So there's no service interruption. You can make repairs during prime time, at reasonable rates.

To find out how the ThermoShield system stops signal leakage, contact your local Anixter representative or call 800-323-0436. In Illinois, call 800-942-0905.

Western CATV Show Booth #625.

Raychem | ANIXTER COMMUNICATIONS