COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Construction: From the ground up

'More choice, more value' in Dallas

- **BCT/E certification program**
- **Cable-Tec Expo registration**

March 1986

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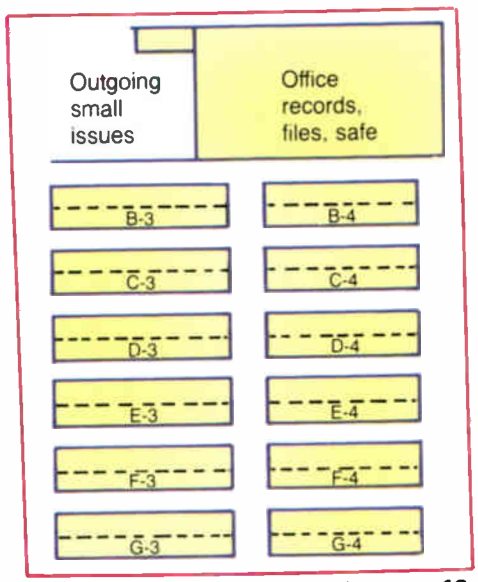

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GENERAL INSTRUMENT

PUBLISHER'S LETTER

(un)Conventional expectations

With many of the industry's key personnel meeting in Dallas March 15-18 for the National Show, it's interesting to contemplate on just how, during that time, all those systems and businesses will manage back home. Perhaps this is where addressable, downloadable remote-control comes into play?

The National Cable Television Association and the Texas Cable Television Association have done some good planning; from the Texas-style barbecue on Saturday, March 15, to the final track and technical sessions and dinner dance with awards presentation on Tuesday, March 18, there promises to be an outstanding variety of speakers and exhibitors. And with all that's planned, there will still be time to see the exhibits—a period of 12 and one-half hours over three days of the convention have been set aside for viewing those exhibits with no competing activities planned.

The opening session of the convention will feature executives from major corporations with extensive holdings in communications, who will discuss how consumer trends of recent years have led them to position their businesses for the next decade. It will also feature a special address by Congressman Jim Wright (D-Texas), majority leader of the U.S. House of Representatives.

Appearing on the panel will be Bob Marbut, president of Harte Hanks Communications Inc.; Nicholas J. Nicholas Jr., executive vice president, Video, Time Inc.; and Francis Vincent Jr., president of the Entertainment Business Sector, The Coca-Cola Co. NCTA Chairman Edward Allen, president, Western Communications Inc., will be host and moderator of this session. In another special session on Tuesday, March 18 at 9:30 a.m., FCC Chairman Mark Fowler will speak.

Communications Technology will have a number of staff members at the show, so please plan to stop by our booth (#1345 and #1346) to give us your latest news—or just to say "hello." We'll again be putting out our *Communications Technology Daily*, geared for the engineers attending the show. It will be distributed three days—March 16, 17 and 18—so, if you have any late-breaking news be sure to let us know and we'll get the word out.

SCTE on the move

In other convention news, the SCTE's own Cable-Tec Expo, June 12-15, in Phoenix, is only a couple of months away. For information on the expo as well as a registration form, see *Page 121* of this issue.

Finally, I'd like to mention the BCT/E Certification Program, developed by the SCTE to help fill the technical training and certification needs of the cable engineering industry. Both technicians and engineers will benefit greatly from such a program of standardized testing and recognition, not to mention the benefit to the companies they work for.

Outlines of the material covered in two of the seven categories of the test appears in this month's *Interval*. Upcoming issues of *The Interval* will continue to give information on the program.

Paul Beeman, MTV Networks, is the chairman of the Curriculum Committee for Category II of the BCT/E program. In appreciation of his support, the SCTE will be awarding him a plaque. We hope that individuals like Beeman and the industry as a whole will continue to support the program.

The BCT/E program isn't all that the SCTE has done in regard to education and training, however. In 1985, the society awarded $1,000 for scholarships through the national group and local chapters. This year Rex Porter, now with Times Fiber Communications, has donated $2,500 towards technical scholarships. Byron Leech and Roland Hieb have announced that the National Cable Television Institute will match that generous donation, thus enabling the SCTE to award one technical course through the institute per month for a period of 12 months. This is the type of effort that will help everyone in our industry, and we applaud all those involved.

At the SCTE booth (#1475), a new video will be introduced at the NCTA show. The production, arranged by Audio Visual Telecommunications, promotes SCTE membership and explains its benefits.

Looking forward to seeing you in Dallas. . . and Phoenix.

Paul R. Levine

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FCC staffers to speak at NCTA convention

WASHINGTON, D.C.—Federal Communications Commission Chairman Mark Fowler and Commissioners Mimi Dawson and Dennis Patrick will take part in the National Cable Television Association's annual convention March 15-18 at the Dallas Convention Center.

Fowler will make a special address in the Convention Center Arena March 18 at 9:30 a.m., immediately preceding the general session.

Commissioners Dawson and Patrick will speak at a session entitled "FCC Commissioners' View of the Future of Telecommunications: Where is Cable?" on March 17 from 10:45-11:45 a.m. The session will be moderated by Marc Nathanson, president of Falcon Communications. The commissioners' panel will be followed by an open meeting and reception from 11:45 a.m.-12:30 p.m. with the FCC staff attending the convention.

The convention program will open March 16 (Sunday) at 9 a.m. with a general session entitled "More Choice, More Value," the theme of the 1986 show. Exhibits of cable hardware will open at 10:30 a.m. March 16. During the three days of the convention the exhibit floor will be open for 21½ hours, 12 of which have been set aside for exclusive viewing when no competing activities are scheduled.

NCTA and the Texas Cable Television Association are combining efforts to present the convention this year. A Texas-style barbecue will open the event in the Convention Center at 6 p.m. March 15.

WVL alters strategy

FORT WORTH, Texas—World Video Library Inc. (WVL) has announced that its impulse ordering technology, The Impulser, now will be available for cable operators to use in conjunction with other pay-per-view movie operations.

"WVL will continue to market its own total pay-per-view service, The Home Video Club, to those systems with the capacity to provide multi-channel pay-per-view," said WVL President John Ratliff. The company also is talking with the other pay-per-view suppliers about how to provide impulse pay-per-view on a national basis.

United Artists doubles Futurtek holdings

SAN MATEO, Calif.—United Artists Communications Inc., San Francisco, has exercised options to purchase from existing shareholders 3 million shares of Futurtek Communications, San Mateo, Calif., at prices up to $.50 a share.

As a result of the transaction, United Artists now owns approximately a 32 percent interest in Futurtek. The company made an initial investment in the company of 3.4 million shares in September 1985 through a private placement.

Futurtek provides voice and data long distance services and is also a principal shareholder in two manufacturing companies—KTI, Dallas, and Myriad Concepts, Milpitas, Calif.

R.L. Drake files $11 million suit

MIAMISBURG, Ohio—The R.L. Drake Co. has filed a lawsuit seeking $1 million in compensatory and $10 million in punitive damages in a U.S. District Court in Ohio. Drake charges that on Dec. 3, 1985, American Standard Appliance Protection Inc., a Wichita, Kansas-based supplier of extended service contracts for consumer electronics products, circulated a written statement to its franchises throughout the country that Drake had filed a petition in bankruptcy court.

"We have chosen to file this lawsuit to make a strong statement that it's not acceptable to spread unconfirmed rumors about a company's financial well-being," said Thomas Gardner, Drake's senior vice president of finance. "We feel that Drake is entitled to recover damages suffered as a result of this malicious—and totally unfounded—rumor."

Gardner noted that it was ironic that this rumor originated at a time when Drake was performing particularly well in the marketplace. Fiscal 1984 and 1985 were the company's two best years—in terms of both sales and profits—in its 42-year history, he said.

Gardner also pointed out that in late 1985 Drake was named for the first time to the "Inc. 500" list of the fastest-growing, small to medium-sized private firms in the United States, published annually by *Inc. Magazine*.

Oak relocating satellite group

SAN DIEGO—Oak Communications Inc. will merge all engineering and marketing functions for its satellite product line into its cable TV product group in San Diego, John Donohue, president, has announced. No changes are planned in the product lines.

Along with this move, Donohue said manufacturing operations for satellite products now at Oak facilities in Sterling and Crystal Lake, Ill., will be transferred to the company's large facility in Taiwan. Manufacturing will continue in the United States during the transition.

The transfer of the engineering and marketing functions to San Diego is scheduled for completion during the second quarter of 1986.

SCTE meeting at national show

WEST CHESTER, Pa.—The Society of Cable Television Engineers' membership meeting will be held on March 15, 1986, at the National Cable Television Association's convention from 4-5 p.m. in the Brisbane Room of the Hyatt Regency Hotel in Dallas. Included at the meeting will be a discussion of the present status of SCTE projects, an introduction of newly elected board members, and the announcement of officers for the 1986 term. An official board of directors work session will precede the meeting.

If you are attending the NCTA convention, stop by and meet the SCTE staff at Booth #1475.

In other SCTE news, plans and preparation for the society's Cable-Tec Expo '86, to be held in Phoenix, June 12-15, are progressing well. For more information on the expo, please circle #1 on the Reader Service Card in this issue and drop it in the mail.

Microdyne's modification instructions now available

OCALA, Fla.—Microdyne Corp. has announced the availability of modification instructions for TVRO systems using Microdyne receivers and the VideoCipher II descrambler. Microdyne spokesman Earl Currier said, "All of our newest receivers are fully compatible with the VideoCipher II descrambling system. However, in some systems with older model receivers and low C/N ratios at the receiver, a minor modification may be necessary."

Modification instructions for the Microdyne receivers are available directly from Microdyne or through M/A-COM Linkabit customer support. Any questions regarding the compatibility question should be directed to Microdyne customer support at (904) 687-4633.

Open letter to NCTA: Support the IEC subcommittee SC-12G

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

Gentlemen: This letter is a plea to provide modest financial, and strong technical support for a continuing U.S. presence at the International Electrotechnical Commission (IEC) subcommittee SC-12G meetings. The charge of this subcommittee is *Cabled Distribution Systems*, which "deals with standards for television and sound signals modulated on a carrier, taking into account the possible need for data and reverse transmission."

The IEC was born in 1906 as an outgrowth of meetings at the International Electrical Congress in St. Louis, Mo., in 1904, aimed at stabilizing international electrical trade. The first president was Lord Kelvin, and the headquarters were placed in Geneva, Switzerland, their present home.

A prophetic paper titled "International Standardization—Interface with the Future," by Alexander C. Grove, *IEE Spectrum*, August 1966, describes with precision and passion the case for U.S. participation on international standards commissions. In all my research, I could not find a better exposition of the world marketplace and the pending U.S. negative trade balance.

As Americans, we must realize that we are no longer the sole innovators of technology nor the premier masters of mass production.

Free trade is a philosophy espoused by the strong democratic nations of an era long gone, a now rag-tag parade led by the U.S. contingent, followed by countries fading into their own shelters of trade barriers and carefully crafted protective standards for products.

Leon Podalsky, technical assistant to the president of Sprague Electric Co., warned, over his many dedicated years of service on Electronic Industries Association (EIA) committees, that the U.S. electrical industry is under constant threat of being engineered out of the market by standards that are partial to products of other countries. I attended many EIA meetings chaired by Leon, marshalling the facts on foreign trade, begging industry and the government to represent American interests on all the international standards committees—to no avail.

Within the United States proper, every industry association sponsors some standards activities principally directed towards blunting or influencing government standards to benefit the members of the industry. In rare cases are any fundamental research or long-range studies funded as an integral expense item in the budget. Research, the lifeblood of our technical society, is left to the wandering eyes of our university professors and a minority of the manufacturers in each field. Our tax dollars are spent on esoteric subjects for graduate theses and military matters—none for commercial products. As an example, in the cable TV field, as more and more of the electronics are manufactured overseas, less and less research on cable technology happens here.

EIA has tried and failed, through lack of funds, to represent the United States in every area internationally. NCTA, in the early '70s, briefly commissioned Ken Simons to attend some IEC meetings but a long-term commitment was never made.

Jerrold and Blonder-Tongue contributed financially just once to bring a meeting of the IEC subcommittee 12A, working group 3, to Washington, D.C., at EIA headquarters on March 11-13, 1968. Jerrold assigned Max Kraus as the U.S. representative. Attending this meeting were the permanent members from Sweden, Switzerland, France, Netherlands, Norway, UK, Germany and Italy.

Documents and meeting reports of the SC-12G committee are received by only 11 U.S. companies, some no longer in cable, and no government agencies. Probably the majority of the SC-12G meetings take place without a U.S. member. For example, at the May 1985 meeting in Montreal, the members present were: Belgium, Canada, China, Denmark, Finland, France (3), East Germany, Germany (2), Ireland, Italy (2), Japan (3), Netherlands, Switzerland (2), South Africa, Sweden, UK (3) and Yugoslavia (3).

'As Americans, we must realize that we are no longer the sole innovators of technology nor the premier masters of mass production'

The qualifications of the individuals that I met, representing their governments, were impeccable, as was their dedication to their task. Most of the research behind the standards was original, financed by public funds, and largely independent of American experience.

If you are a non-technical member of NCTA, and have not been made aware that the recent developments in television and cable technology are of foreign origin, i.e., high-definition TV, digital TV, smart cards, MAC, switched star optical cable, quality TV stereo sound, etc., just keep an eye on your cable system; it too will be designed and manufactured overseas.

A minimum budget for a permanent U.S. representative on SC-12G would entail under $10,000 for travel and around $40,000 for the part-time services for a consulting engineer at the same academic level as the foreign committee members.

Hoping for a standing vote of support on this budget item.

Data communications and CATV

This is the fourth and concluding article of our series on data communications and CATV. This month we will look at some of the opportunities that the future may hold for the cable industry. Some of our projections may seem a bit farfetched, but our goal in this article is not to analyze, but to stimulate thinking. We are convinced that there are ample rewards waiting for those who have imagination and are prepared to press their creative ideas to fruition with diligent hard work.

By Richard J. McKeon
Director of Data Products

And Terry A. Standard
Dumbauld & Associates

Cable television has, for the last 30 years, been a medium for delivering television signals to subscribers who could not receive them because of obstructions to the signal path. The same is true today. The reason subscribers opt for cable television service is to receive signals they cannot otherwise obtain, but today the reason may be more economic than physical. This may not be true in the near future. Competing technologies are moving in on cable television. VCRs, STV and MDS are already worthy competitors, and DBS will soon be making its presence known.

So where do we stand? Does this mean the end of cable television? Not at all! But new revenue producing uses for cable television need to be developed if we expect to achieve the growth that any business requires. RF data transmission is certainly capable of filling the role, and it fits the basic concept of delivering a signal to a location that otherwise could not receive it because of physical or economic limitations.

To be successful, our industry must be more than just knowledgeable regarding RF data transmission. We must be professionally qualified in all aspects of data communications. This applies to more than just the technicians. Sales, marketing, administration and management all must know how to apply their talents to data communications. Not only will customers be able to size you up pretty quickly, they are usually looking for some direction from the vendors that they deal with. If we possess this knowledge and apply it effectively to gain customer confidence, we will be able to grow into new, exciting and profitable business ventures.

Where do we go from here?

As with any marketing effort, we need to assess the product and service we have to offer, and define a target market. In the previous three articles we have developed some background theory and presented some typical applications. The following are possible target markets.

- City governments should be a prime target for applications such as data, telemetry and control of municipal responsibilities such as water and traffic signal management, and remote PBX gateways using T1 or greater capacity RF modems. The frequency pairs assigned by the FCC for 23 GHz short-haul microwave communication will probably become rapidly saturated. Even now many organizations are considering cable as a backup to microwave radio instead of a hot standby. Thus, the backup can be a completely different technology from the primary communication link. Also, for many applications, high-capacity circuits are already more economically achieved using cable than short-haul microwave or leased T1 circuits.

Another plus is the apparent favor and support that the FCC is showing toward cable-based bypass. With increasing demand for high-capacity circuits and the requirement of free and open competition, I expect that we will see many more favorable rulings in the future. RF data communications is actually still an emerging technology. Things will be different two years from now than they are today, but we can't afford to wait around for years just to see what is going to happen. The technology is available now.

- Large industrial and business customers such as manufacturing companies, banks and hospitals comprise another prime target. Here the possible applications include local area networks (LANs), robot and machine control, image transfer and security. This category of customer often has funds already budgeted and the project may not need to go out to bid. Even if it is a bid situation, they often specify it as best bid instead of strictly lowest bid.

'For many applications, high-capacity circuits are already more economically achieved using cable than short-haul microwave or leased T-1 circuits'

It is a natural progression from CATV to RF design for local area networks. We are a rep for one of the major LAN equipment vendors, but are finding that design, construction, consulting and training are just as profitable as selling the hardware. Each company has its areas of specialization and its limitations, but the broader the package you are prepared to offer, the more opportunities you will be able to take advantage of. We have found that conducting fee-based seminars is not only a good revenue generator, but also makes a good inroad for design and consulting.

- Schools and universities are especially active in communications and networking at this time. Most major universities are installing LANs or expanding existing facilities. Even high school districts are often linked with individual leased lines or dial-up circuits back to a central host. More and more, data processing is a critical factor in the field of education. Communications is necessary for many and varied activities from attendance to instruction.
- At the consumer level there is potential for functions such as home banking, consumer data services and satisfying the needs of those who like to work at home and need access to their company's computer facilities.
- Within the CATV industry there is much room for innovation. As mentioned in article three of this series, we are in the process of expanding our automated testing and remote headend telemetry systems. Besides monitoring the headend for signal levels, we hope to incorporate other telemetry functions such as alarm conditions for intrusion, fire, over voltage or over current conditions, and level sensitive alarms. The next step after monitoring is control. It is possible to remotely adjust amplifier levels, to switch in or out various levels of attenuation and, with a matrix switch, to restore a channel that has gone off the air.

Much more business could open up as cable operators become more open to interconnecting their systems. For example, a company may have plants that lie in areas served by two different operators.

Imagination and hard work

In this series we have presented an overview of data communications and networking theory, and examined some typical applications. Hopefully we have been able to stimulate your thinking and have made suggestions that will help you expand your business. We are always interested in exchanging ideas and discussing applications. We are very optimistic about the future of cable-based systems, but considering the phenomenal explosion in technology and the competitive nature of business, we must realize that the continued health of this industry depends on imagination and hard work. We have to find new applications and new markets for the technology that we have such an investment in. There is a great entrepreneurial spirit at work in America today, which will ensure success in this endeavor. It is our hope that this series of articles has been interesting and useful toward the goal of expanded markets and profits for the CATV industry.

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Power passing:	6 Amp AC/DC	Subscriber ports:	F-Type female (brass)

Reader Service Number 14.

Inventory management

This article conceptually describes each task related to inventory management then attempts to provide some practical guidelines that may be of help to the person whose job it is to manage the warehouse.

By Barbara L. Lukens
Division Manager, Construction Division
American Television & Communications Corp.

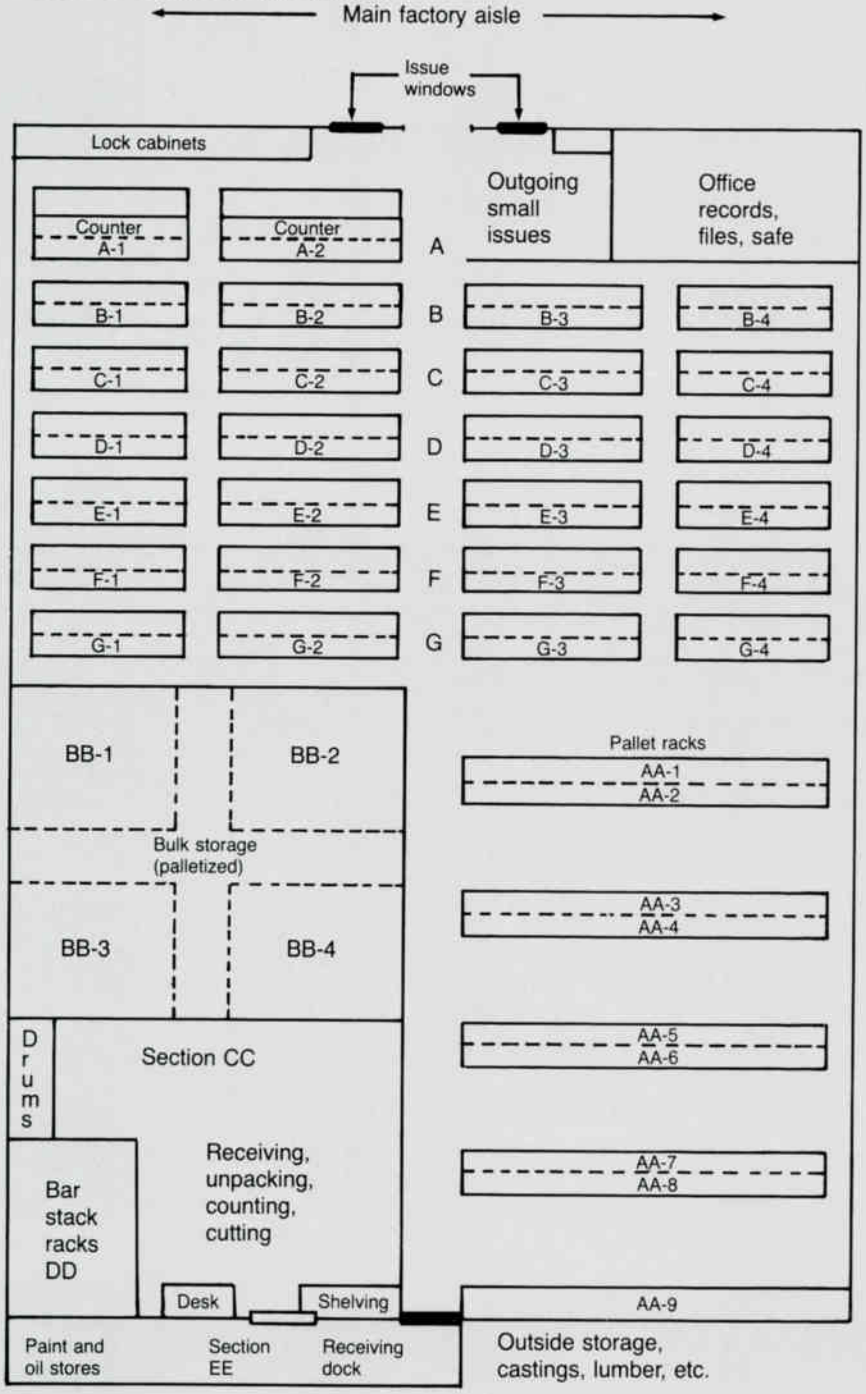
One facet of CATV construction that has a significant impact on costs, yet frequently is not managed or controlled well, is construction materials inventory: i.e., the management of the materials with which the system is built. Materials account for about 25 percent of the total cost to build underground plant and about 50 percent of the total cost to build aerial plant. While these percentages may vary depending on the specifics of your situation, they are not insignificant. A company can waste a great deal of money by mismanaging these materials.

In theory, inventory management involves the following:

- Accurate estimating of needed materials.
- Material ordering (with shipments on demand or as needed).
- Comparing goods received against packing slips and purchase orders and logging receipts "in" on stock cards or on a computer.
- Storing materials.
- Issuing requisitioned materials and logging them "out" on stock cards or a computer.
- Periodically checking to see that the materials on hand (by count) equals the stock card or computer balance.
- Making sure you don't run out of materials, but also that there are no materials left over when the job is complete.
- Preventing theft and damage.

Essentially it is detailed record keeping, and the tracking of every item. Each of the tasks listed above is important to the success of containing costs on a project and avoiding a large stock of "excess" materials when construction has been completed.

Figure 1: Warehouse layout



Source: Green, James H., Ph.D., editor in chief, *Production and Inventory Control Handbook*, McGraw-Hill Book Co., USA, 1970, p. 15-16.

Bill of materials estimating

Estimate as closely as possible, using as much information—historical as well as current information about the project—as can be obtained. This estimate is to be used for ordering materials. Overestimating and therefore obtaining an over supply of materials will create excess inventory, which is undesirable. The goal is to have an empty warehouse at the end of the project—having purchased exactly the right amount of materials needed.

The procedure for estimating material needs for a project should include:

I) Get as much information about the project as possible from the sources listed here.
 A) Strand maps
  1) Total miles aerial

Figure 2: Sample purchase order log

PA number ______________________

PA description ______________________

____

PO #	Date opened	Vendor	Description	Date closed	% complete

a) Homes/mile
b) Poles/mile
c) Check the number of passings/pole to estimate taps

2) Total miles underground
a) Homes/mile
b) Pedestals/mile
c) Check the number of passings/pedestal to estimate taps

B) The engineer responsible for making decisions regarding the project.

1) Vendor and series for:
a) Amplifiers (including line extenders)—have him provide a list of all parts/modules required for each amplifier type.
b) Taps
c) Passives
d) Connectors (all types)
e) Power suppplies (stand-by or regular)
f) Cable—include the sizes needed and the feeder-to-trunk ratio.

2) Obtain a copy of all design specification sheets that may apply.

3) Ask if there's anything unique about the system that would affect the ordering of materials.
a) I-nets
b) Hubs
c) Interconnects
d) Separate trunks to separate franchise areas
e) Unusual span lengths, etc.

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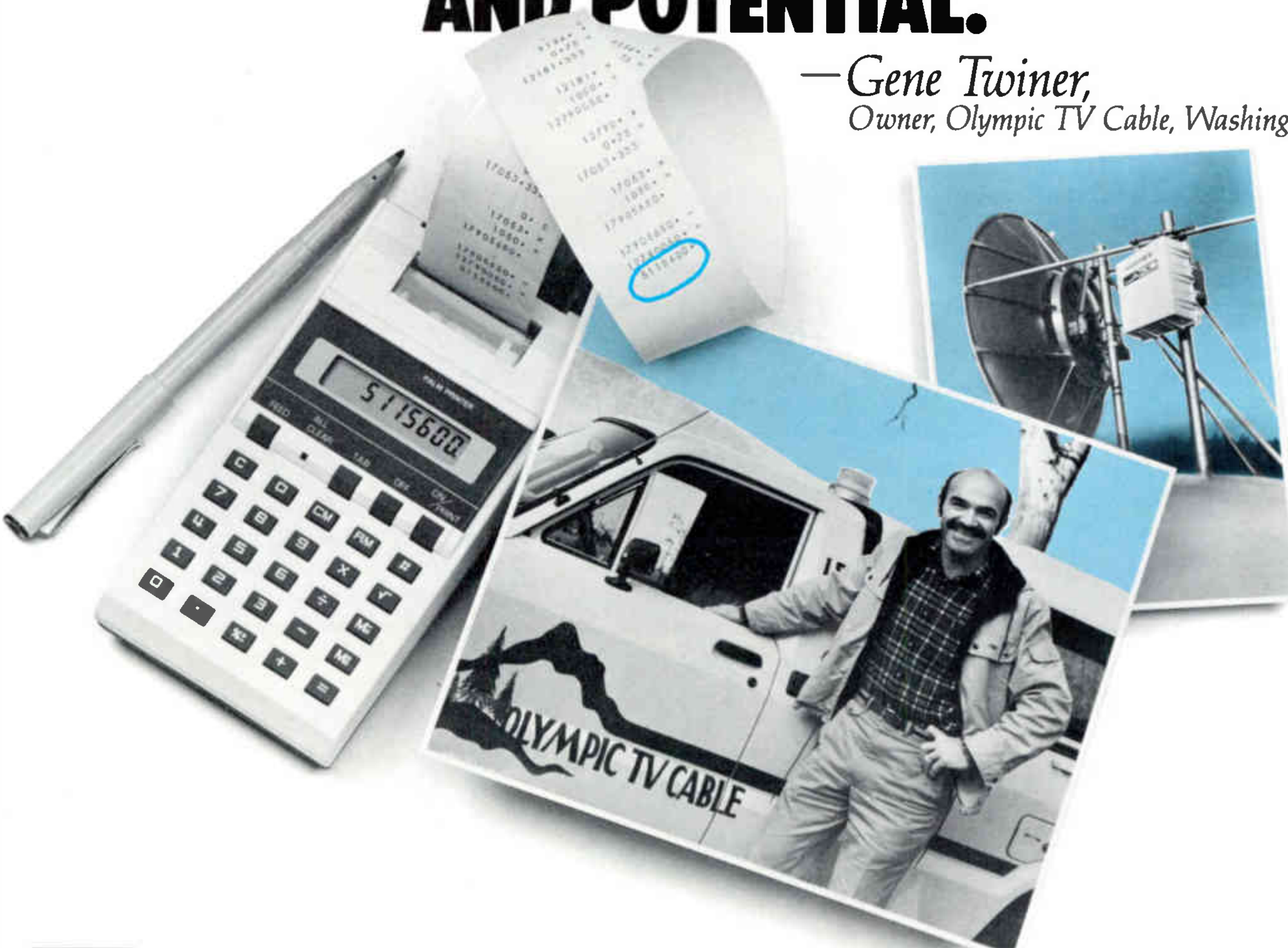

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4) Channel capacity desired
5) Rebuild, upgrade, new-build or a combination?
   a) What items are to be retained and which replaced?
   b) If a combination, get areas for each defined (preferably on strand maps or as-builts).
   c) To what extent will poles need to be reframed?
   d) Answers to a, b and c will help you quantify material needs.

C) Visually check the area to be built, rebuilt and/or upgraded.
   1) Average pole diameter (for bolt lengths)
   2) Estimate the number and type of anchors to be used

D) Design
   1) Find out if any design (actual or test) has been completed. If so, request a copy of the bill of materials (BOM).
   2) Request "model mile" bills of materials for systems with similar densities, channel capacity and equipment (these can be used as a guideline along with other information being gathered).

E) Usage records from previous similar projects, if such records exist.
   1) "Model mile" information on hardware (apply strand map and visual check information to this to correct the model mile for the specific project).
   2) "Model mile" usage information on other items from similar past projects.

II) Compare all the information gathered, make any pertinent adjustments and derive an estimated bill of materials.

Once the estimated BOM is complete, it's time to do the ordering. This article assumes prices have been negotiated by other individuals and does not effectively address this subject. However, suffice it to say that the purchase price of materials will have a major impact on the cost to construct. Obviously you want to buy quality products at the lowest prices attainable.

Purchasing

Materials should be purchased in accordance with the estimated bill of materials. Since the BOM is an estimate and will therefore not equal actual needs, it is best to monitor the timing of shipments from the vendors. Shipments should be staggered to accommodate warehouse space, the build rate and any other factors affecting the ease of handling and/or record keeping. It is probably better to avoid having 100 percent of all purchase orders (POs) filled until actual usage rates on the project can be determined and compared to the quantities ordered. You want to avoid excess at the project's end and you must balance that with avoiding a shortage of materials, which could cause down time.

Procedures we have found useful in the purchasing phase include the following:

I) The estimated BOM is the vehicle used to inform the purchasing agent of the items that need to be purchased for a given project.

II) Purchase order log
   A) A PO log can used to help keep track of open purchase orders.
      1) It's important to know at all times, the status of each purchase order
         a) Are there more materials to be shipped (and do you require them or should the remaining order be cancelled in whole or in part)?
         b) When should you expect delivery?
         c) Have you released the items for shipment by the vendor?
         d) If all materials on a PO have been shipped you should:
            (1) Not accept further shipments inadvertently shipped on that PO
            (2) Authorize additional purchases if more materials are needed
      2) The percent complete column should be filled in using pencil (as you receive materials, this column can be updated).
      3) A PO is closed only when:

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Reader Service Number 20.

a) All materials have been received.
b) The orders for any remaining materials on the PO have been cancelled.

B) A sample PO log form is exhibited in Figure 2.

III) Reorder levels

A) As stock is depleted and as long as the purchase orders for items needed have not been exhausted, the vendors can be authorized to ship additional materials upon verbal request.

B) Projects should establish a minimum reorder level for every item in inventory to avoid "stock outs" (shortages). The minimum inventory level on hand before reorder should be sufficient to allow for purchase documentation and processing by the purchasing agent and shipment by the vendor. It is necessary to check vendor lead times. Periodically, the warehouse staff should review reorder levels to determine their adequacy.

C) As a project draws to a close, reorder levels should be abolished to prevent having leftover or excess materials when construction is complete.

Once orders have been placed and the first delivery dates have been established, you need to make sure you have a place to store the materials.

The warehouse

A warehouse should be clean, orderly and well organized. Like items should be stored in proximity to each other and all bins/shelves should be labeled according to the contents.

It is helpful if the warehouse is gridded off with an alphanumeric grid (Figure 1). The location of items, according to the grid, can then be written on the stock cards, making it easier to find a needed item. (In a small warehouse this may not be necessary.) At this point, the warehouse person should prepare to receive materials.

Receiving

It's important to make sure that all items delivered and received are counted. The information on the packing slip must be accurate. Record all receipts immediately and put them away (warehouse storage and organization).

You are not obligated to accept overshipments or damaged materials. You should, however, know if shipments are arriving as scheduled—don't get caught with a shortage of materials because a vendor defaulted on a shipping date, or allow shipments to be made too far ahead of schedule causing warehouse overload. The procedures to follow for inventory receipt are outlined here.

I) Receipt of inventory

A) When a shipment is received, the packing list should be compared to the contents. The packing slip is then date stamped and signed by the warehouse person examining the shipment. If the vendor fails to submit a packing list, the warehouse person calls the vendor for shipment verification. The warehouse person should indicate on the bill of lading the date the vendor was contacted and then generate a packing list.

B) If type or quantity discrepancies exist, the vendor is contacted and the discrepancy is recorded on the packing slip. Overshipments may be kept or returned.

C) If damaged merchandise is received, the vendor must be notified. The merchandise is returned to the vendor freight collect.

II) Purchase orders

A) All warehouses should receive copies of all appropriate POs from the purchasing agent. The warehouse files the open POs until the merchandise is received at the warehouse. When the inventory is received, the packing list and bill of lading are compared to the appropriate PO. A receiving memo (Figure 3) is completed for the items received. If the shipment completes the PO (i.e., all items ordered on the PO are received), it becomes a "closed PO" and a copy of the PO and receiving memo are moved to the warehouse's closed PO files. Match the receiving memo and the PO and submit them to the person or department responsible for payment of invoices. The packing slip and the bill of lading are filed at the warehouse.

B) If the shipment does not complete a PO, compare the packing list to the PO and check off the line items received. Prepare a receiving memo for the inventory received and stamp or write "Partial" on the face of the receiving memo. Make a copy of the PO and the receiving memo. Send the copy of the PO and receiving memo to the accounts payable person or department to be matched against the invoice. Maintain the original PO, packing list and receiving memo in the open PO file until the order is complete.

C) The accounts payable department should be able to match all invoices to receiving memos provided by the warehouse person. In this way there should be no difficulty with invoice approval or subsequent payment.

D) Posting to records: The receiving memos are used as source documents for completing stock records. Stock records are maintained as materials are received and/or issued to perpetually reflect the correct quantity on hand of each item stored in the warehouse. Stock records may be kept on cards (in a cardex file) or on computer files. The accuracy of the records is dependent upon daily record keeping and the accuracy of counting rather than on the storage medium. See Figure 4 for a sample stock card and the information that should be recorded. The forms used by projects may vary; however, each form serves to record and track the perpetual inventory system. Inventory records should be updated daily to maintain inventory quantities on a current basis.

Now that the materials have been received, the records updated and the receiving memos filed, it is time for materials storage.

Storage procedures

I) Inventory

A) Once inventory shipments have been examined and accepted, they should be stored in the warehouse with like items. The warehouse person who checks in the inventory should complete the receiving procedures.

B) The warehouse is arranged with like items kept in one bin or the same area. An identification card containing a description of the item and the vendor or manufacturer's number is attached to the bins or items.

C) Sufficient space should be maintained between the various items in inventory to allow easy access by warehouse personnel.

II) Warehouse access and security

A) Only authorized employees should be allowed access to the warehouse and adjacent grounds.

B) Limit the number of employees who have keys.

C) Each project should implement a security system to safeguard the warehouse whenever it is closed.

III) Warehouse organization: The warehouse should be arranged so that all items, especially electronics, are stored within a caged area. Large, bulky items such as strand, cable and anchors may be stored outside the caged area if space becomes limited, or in a fenced-in area outside of the warehouse.

With the warehouse now organized and stocked, you are ready to begin issuing materials to the crews or to a subcontractor.

Issuing materials

Materials issued out to either a subcontractor or to crews should have back-up paperwork (a signed stock requisition). The signed stock requisitions should be kept on file. In addition, it is important to control material issuance in accordance with production rates (i.e., there is no reason to issue five miles of cable, if only one mile of plant is to be built within the issuance period).

No materials should be removed from the warehouse without a signed requisition or

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Figure 3: Receiving Memo — 113827

System name ____________ Sys. no. ______ Purchase order no. ________

System city, state ____________ Date received ________

Vendor ____________ No. of packages ________

PO item no.	Quantity	Model no.	Description

Comments: ____________

Purchase Order ☐ Complete ☐ Incomplete Received by ________

without the presence and knowledge of the warehouse person. The following procedures should be adhered to when issuing inventory.

I) Issuing inventory
   A) Authorized employees (including installers and techs) and contractors should complete a stock requisition form to obtain inventory items. The stock requisition form should contain the receiver's name along with the pertinent information about the materials requested. The form is signed by (1) a representative of the contractor requesting the stock, (2) a supervisor or employee authorized to approve stock requisitions and (3) the warehouse person who issues the inventory.
   B) All materials that have been requisitioned are logged daily in the cardex file or computer by the warehouseman.
   C) After the inventory record system has been updated, the stock requisition forms are filed.
   D) The crew foreman or contractor's representative is responsible for ensuring that items requisitioned are received. The signature on the requisition so signifies.
   E) The number of partial reels of cable that are allowed to accumulate should be controlled by the construction supervisor.
   F) The warehouse person should ensure all reels issued are returned for scrap.
   G) Stock requisitions should be reconciled to production reports on at least a weekly basis. This procedure will check whether or not materials are being issued at approximately the same rate at which they are being used.
   H) As-builts of the work should be done on a continuing basis right from the beginning of the project. These as-builts will allow you to determine wastage on a current basis by comparison to issuance records. Steps should be taken to minimize material wastage.

II) Materials issued vs. production
   A) Standard production quantities should be developed prior to the beginning of construction. Issuance of materials should be based on these standards until actual usage on the project dictates a change in the standards. Large variances in the materials required versus the materials requisitioned should be accounted for and corrected.
   B Periodically it is necessary to return to stock all of the materials on the vehicles and re-issue it. This will ensure proper utilization of all materials as well as verify quantities outstanding. In addition, all inventory in the warehouse should be counted periodically.

Physical inventory

Basically, physical inventory is the counting of materials on hand, especially those in the warehouse. A simple formula to use is: receipts – issued materials record balance =

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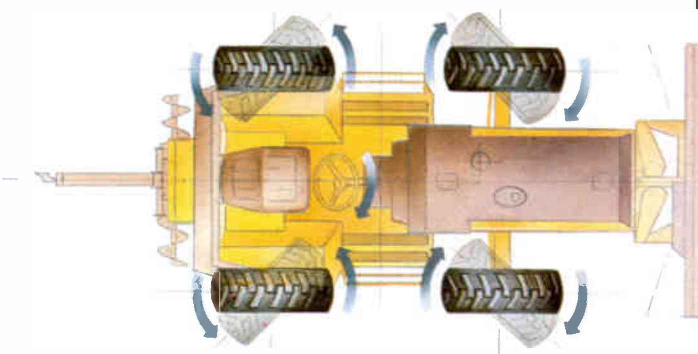

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warehouse stock physical inventory. The actual count for each item is compared to the cardex or computer balance and should match the balance. Whenever the count and the record differ, the record must be adjusted. When that difference is beyond the specified tolerance, an analysis should be made to determine the cause.

Frequency of counting should be related to the risk or importance of an error. The items directly involved in the following three steps should be counted at the times the procedures are executed: 1) when an order is placed, 2) when a shipment is received and 3) when the inventory record is zero or negative.

Some helpful controls for monitoring your inventory are listed here.

I) A complete physical count of the warehouse inventory should be performed at least quarterly. The physical inventory should be taken when the warehouse is closed if possible. The warehouse staff should not conduct the physical count of the warehouse, but often this cannot be avoided. A warehouse inventory counting slip (Figure 5) or similar form is completed on all items of inventory.

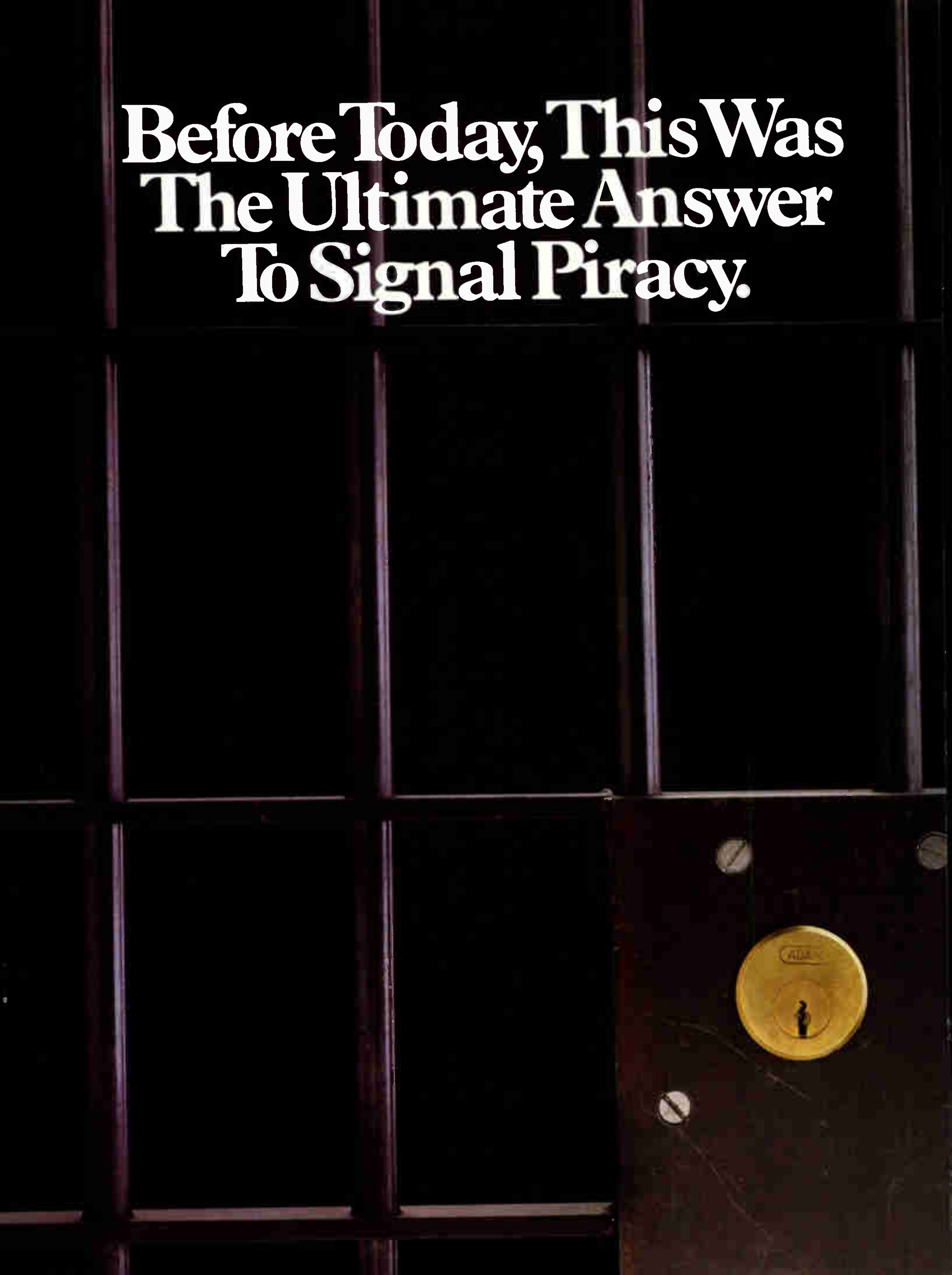
II) Inventory reconciliation: After the physical count is performed, the inventory count slips are retrieved. The counts on the slips are compared to the stock records (manual systems or computer files). If a difference exists, the stock cards or computer files are reconciled to agree with the physical count slips. Care must be exercised that a count slip exists for all items in inventory. If any count slips are missing, the item should be located and counted. Projects using a computerized inventory system should obtain a printout of the inventory and check off the items from the count slips.

III) Test counts

- A) During the month, the warehouse staff should randomly select inventory items and test count them. The test counts should be compared to the stock cards or computer files. If a discrepancy exists, the stock cards or files should be adjusted. If excessive discrepancies exist, a physical inventory should be taken.
- B) As the project nears completion, the warehouse person must make a physical count more frequently, being careful not to order more materials than can be used.

IV) Adjustments: While it is customary to correct the recorded balance (stock cards or files) to match the physical count, this is not to be done arbitrarily or taken lightly. If there is a discrepancy it must be accounted for. Can you determine:

- A) Were materials stolen?
- B) Were materials mis-shelved?
- C) Were issued or returned materials recorded on the wrong card or file? (There also should be an error on the corresponding card or file.)
- D) Were materials issued or returned and not recorded?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Reader Service Number 29.

Figure 4: Sample stock card

Model no. ________ Description ____________ ☐ Drop materials ☐ Repair & maint. ☐ Construction

Lead time (mos.) ________ Usage/mo. ________ Reorder point ________ Reorder qty. ________ Vendor ________

Ordered			Received and Issued					Received and Issued					Received and Issued				
Date	PO #	Qty	Date	Stock req. or PO #	Rec'd.	Issued	Balance	Date	Stock req. or PO #	Rec'd.	Issued	Balance	Date	Stock req. or PO #	Rec'd.	Issued	Balance

Figure 5: Warehouse inventory count slip

Date:

Line item # ________

Description ________

Model ________

1st count ________

Signature ________

2nd count ________

Signature ________

Qty. on stock record ________

Overage-shortage ________

Verified by: ________

Miscellaneous considerations

I) Usage reconciliation
- A) There should be few materials, if any, remaining in the warehouse upon completion of the project.
- B) All materials purchased should be accounted for:
  1) As usage
  2) In the physical inventory
  3) Scrapped
  4) Transferred to another project
  5) Returned to the vendor
  6) Out for repair

II) Material losses: Shrinkage of inventory occurs for many reasons. It is the responsibility of the project manager to ensure that there is no shrinkage of materials. Some of the reasons for shrinkage are:
  1) Poor record keeping practices
     a) Counting errors
     b) Recording errors
  2) Improperly stored materials that are then lost or stolen
  3) Damage to materials
  4) The direct tracking of small items may not be cost-effective.

While it may seem costly to perform this paperwork, the majority of the cost is for one individual's salary and benefits (perhaps two people on a large project). A high estimate of these loaded costs might be $30,000. Many companies have misused (lost, wasted, etc.) much more than this in material costs due to a lack of proper inventory management techniques.

Only you can do a realistic cost benefit analysis for your company, but if you don't have a good system for controlling materials, it is probably safe to say that your material costs are higher than they need to be. Monitoring inventory is worth considering when you are faced with the ever present pressure to reduce construction and plant costs.

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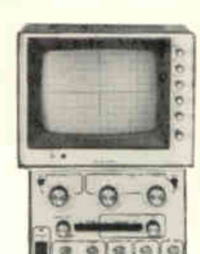

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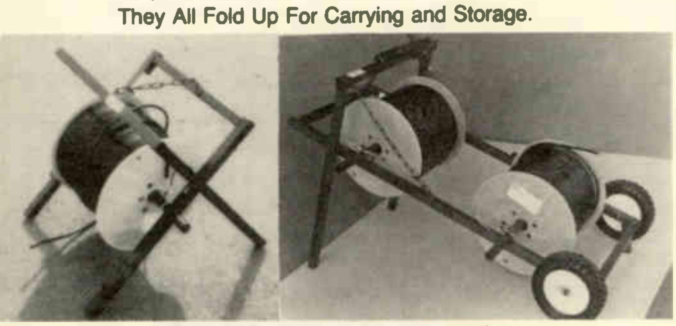

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Construction considerations for CATV aerial plant

No part of the CATV system has been more subject to pragmatic approaches than has the construction of aerial plant. While construction techniques yield generally satisfactory results, they reflect an art rather than a science. Stress analysis of aluminum-sheathed cables lashed to hanging steel strand outlines problems germane to CATV systems. The effects of temperature variation, sag, span loading and lashing wire tightness are discussed from both theoretical and practical standpoints. Stress and strain may be factors in cable permanence, maintenance costs and overall system reliability. Span changes are analyzed as a function of imposed stresses. These lead to practical considerations of axial movement of cable, restraint imposed by lashing wire, permanent set of cable, and other phenomena inherent in these structures.

By Eric Winston

In an actual cable system, the entire aerial plant may be hundreds of miles in length and composed of many assorted components; the system here is defined in its very narrowest sense, in fact, as a single span of hanging cable or cables.

The elements of the typical system are: a galvanized steel strand wire, typically ¼" diameter having a tensile rating of 4,750 to 6,500 lbs.; one or more aluminum-sheathed cables; and a .045" diameter stainless steel lashing wire (tensile strength 100 to 120 lbs.) applied helically, which serves to bind the strand and cable together so that a length of the resultant combination hangs between two supporting poles.

The strand, fixed by clamps, is tensioned according to the amount of sag desired. The lashed cable is supported, relatively stress-free, by the pre-tensioned strand. For the purpose of this analysis, the cable will be considered to have a center conductor tightly bonded to the dielectric. The sheath is, by far, the strongest element of the cable and will be considered as the essential load-bearing member. It has a yield point of approximately 10,000 lbs./square inch.

This assemblage of strand, cable and lashing wire has some complex overtones. To some extent a tight, intimate contact is caused by the lashing wire wrap. Therefore, there is a tendency for the hanging assembly to behave as a loosely defined steel-aluminum bi-metal system. This assumption will be explored in some detail.

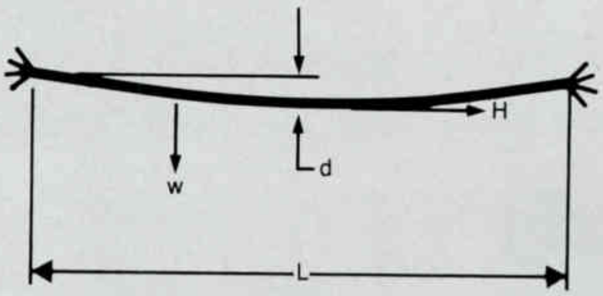
Stresses in the cable system

Three significant stresses commonly act on the cable system. Of these, thermal stress is the most pervasive, being caused by daily ambient temperature changes in the range of 10 to 50 F, and seasonal ones from 25 to 120 F. Cycling thermal stresses constitute the greatest threat to longevity of the installed system. If they result in uncontrolled or unpredictable axial movement, they may cause deformation and breakage of cable loops and lashing wire, sheath abrasion, and excessive strain on cable connectors.

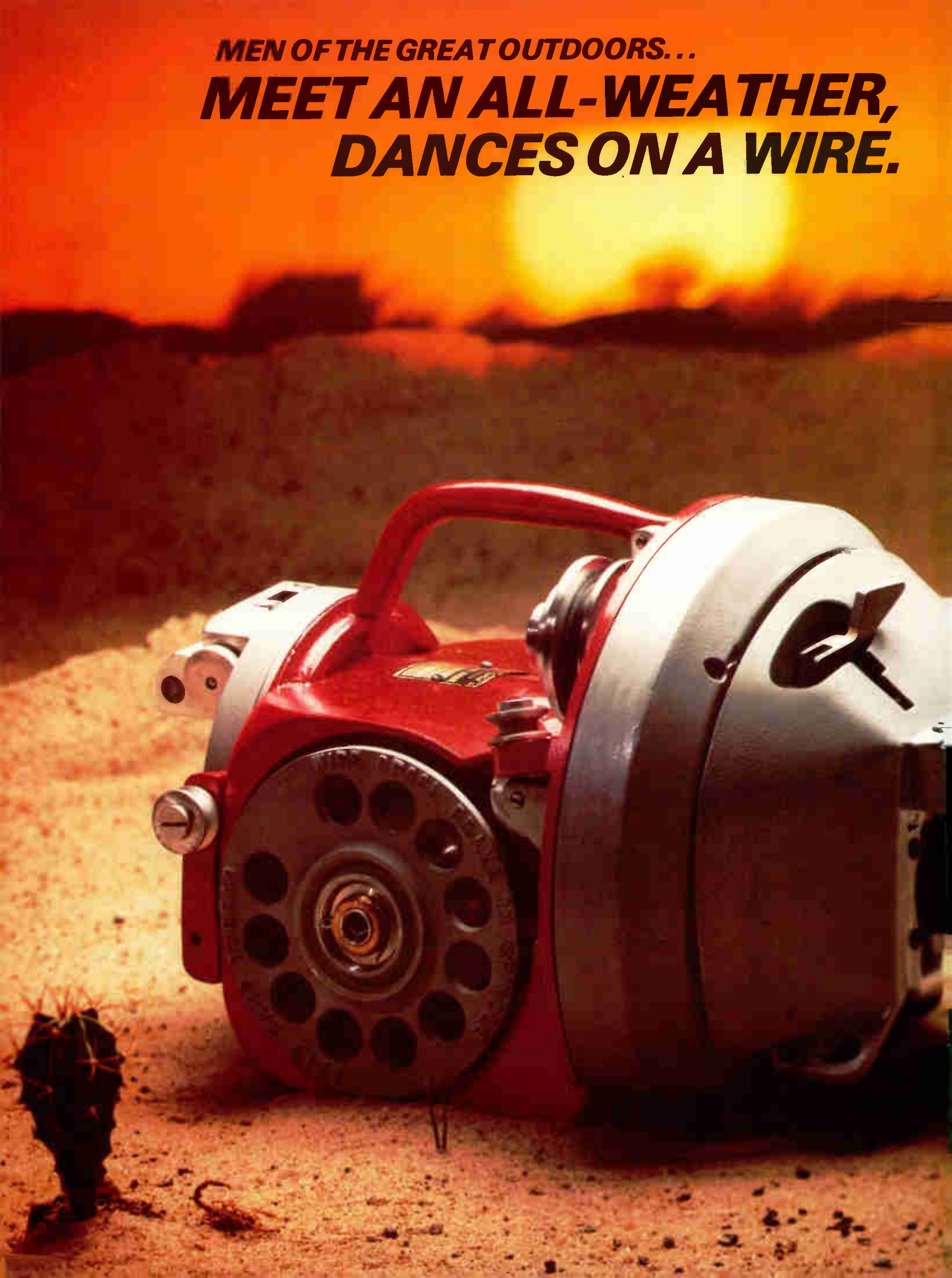
Of lesser significance, except in certain geographical areas, is stress due to induced vibration. Wind may vibrate the cable span affecting connector-cable-housing junctions. Rapid cycling stress, although sometimes serious, is readily controlled by supports or restraints at strategic places.

A third stress is due to weight and changes in weight caused by ice-loading. To this we may add stress caused by crosswind, a factor in

Figure 1: The basic catenary



s = Length of arc
L = Span length
d = Sag, midspan
H = Horizontal component of tension
W = Weight per foot
A = Cross sectional area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the tension experienced by the strand. These stresses are particularly considered in National Electrical Safety Code (NESC) calculations for various types of loading conditions. Ice-loading may result in intolerable stretch of strand and cable.

Of course, random catastrophic stresses occur, which are the bane of a system operator's existence. These are caused by storm-tossed tree branches or by wayward vehicles shearing poles. Such distressing disasters defy rational analysis.

Catenaries and other concepts

The catenary is the general mathematical form of hanging flexible wires suspended at both ends, as shown in Figure 1. When the sag (d) is small compared with length of span (L), the curve approximates a parabola and the following relationships apply:

1) $S = L + \frac{8d^2}{3L}$

2) $H = \frac{WL^2}{8d}$

2a) $P = \frac{WL^2}{8Ad}$

where:
S = length of hanging wire in ft.
L = distance between supports in ft.
d = sag at midpoint in ft.
W = weight per unit length of the system in lbs./ft.
H = horizontal component of tension in lbs.
P = load per unit area in lbs./in.^{2}
A = cross sectional area in in.^{2}

From 1), for any change in d due to a change in S, it follows:

3) $S - S_0 = \Delta S = \frac{8}{3L}(d^2 - d_0^2)$

For any ΔS in strand due to a temperature change ΔT:

$\Delta S = \alpha \Delta T L$ (where α = coefficient of expansion)

and for any strain, ΔS in strand due to stress change,

$\Delta S = \left(\frac{P - P_0}{E}\right) L$ (where E = modulus of elasticity of steel)

Figure 2: Span changes as a function of initial sag—100 ft., ¾" cable, ¼" strand, ΔT = 100 F

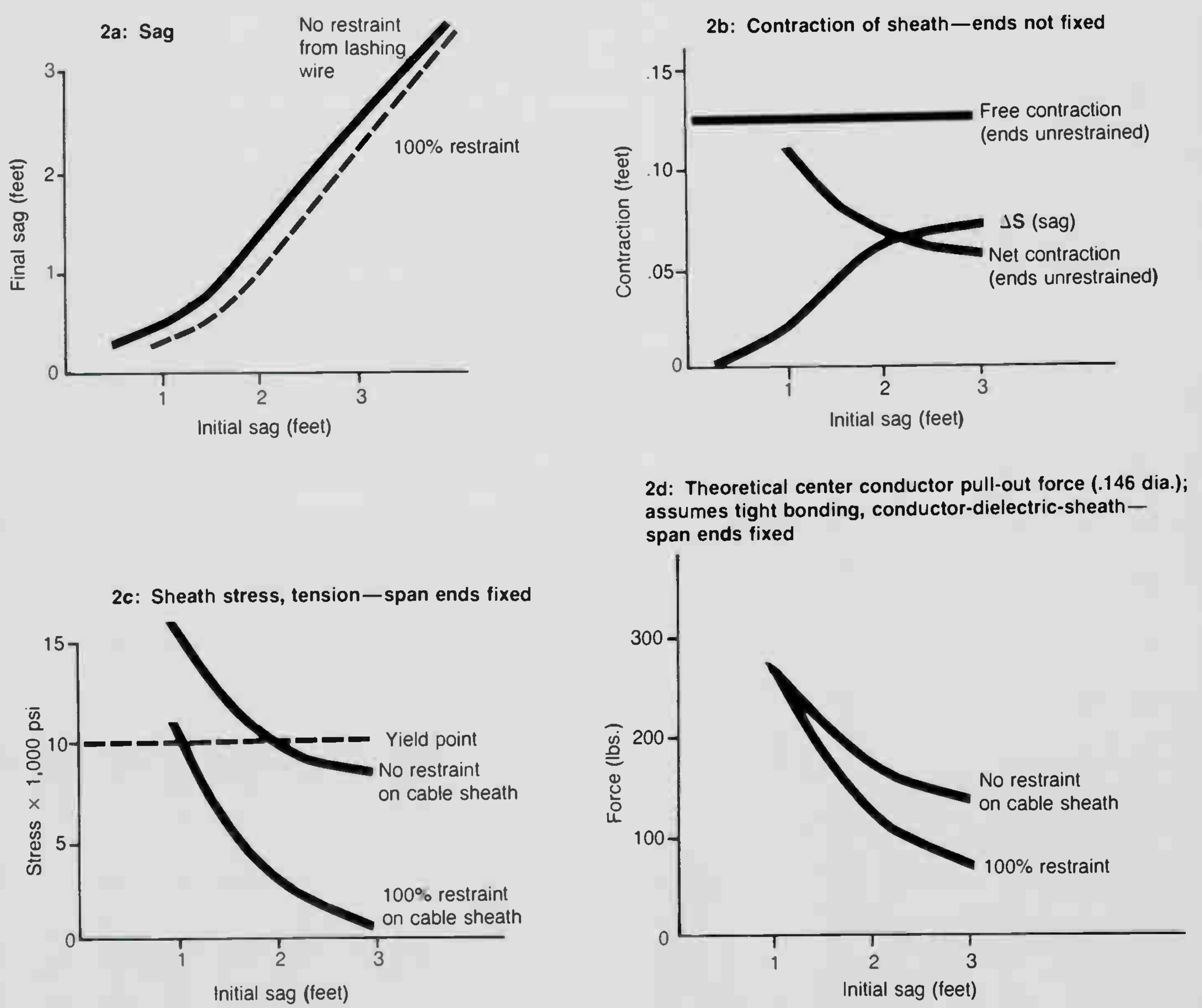

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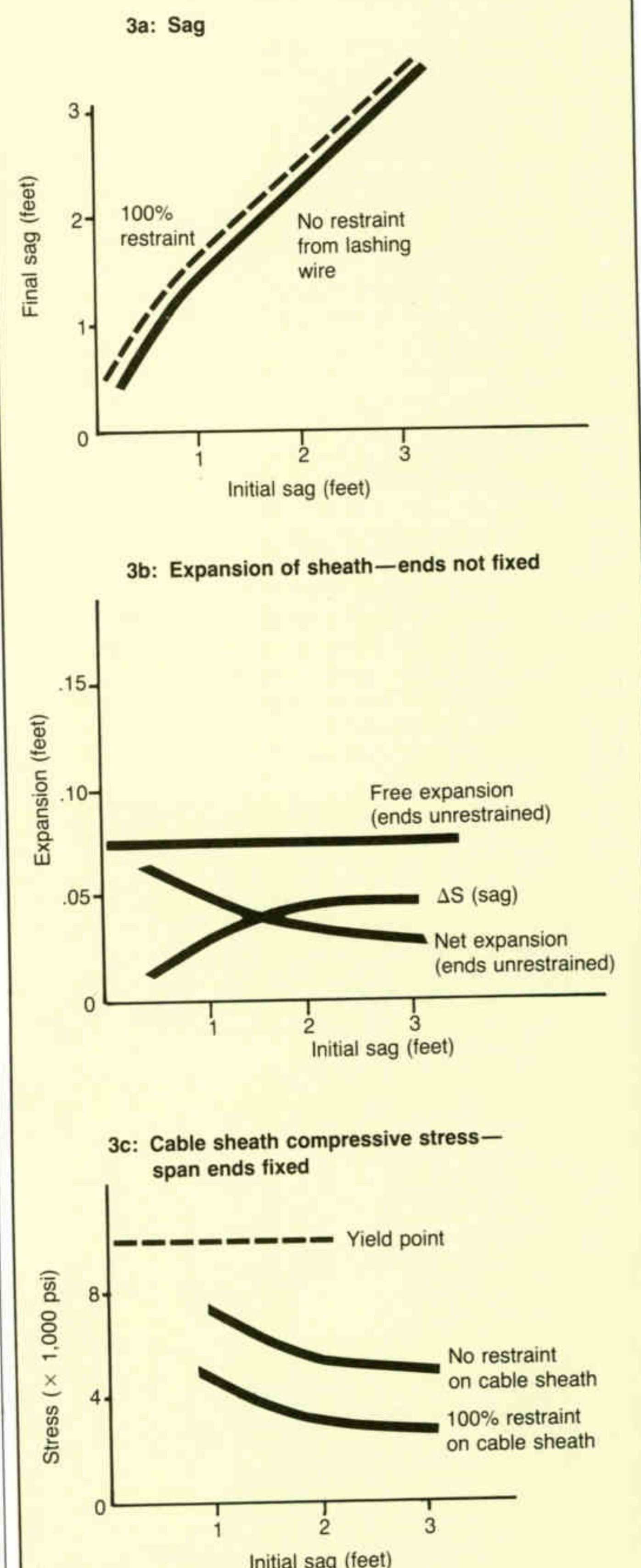
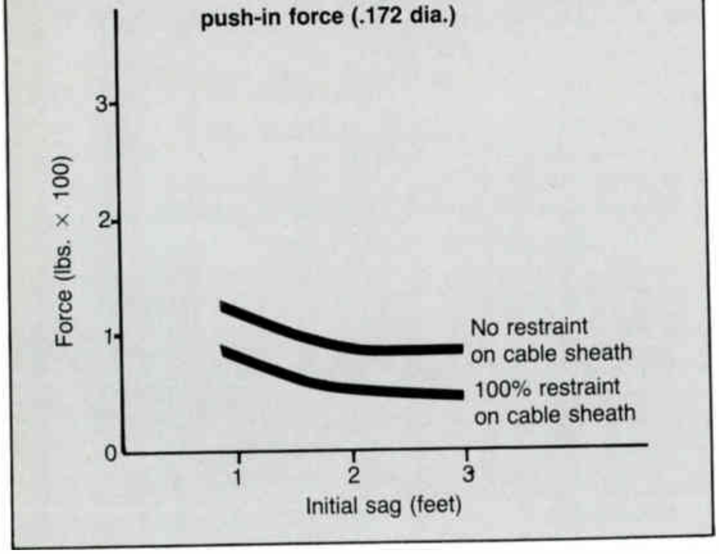
Figure 3: Span changes as a function of initial sag—100 ft., 3/4" cable, 1/4" strand, $\Delta T = +60$ F





3d: Theoretical center conductor push-in force (.172 dia.)

The total change in steel wire length due to a change in temperature is the sum of thermal and strain changes. Therefore:

$$\Delta S = L\left[\alpha\Delta T + \frac{P - P_0}{E}\right] = \frac{8}{3L}(d^2 - d_0^2)$$

and since $P = \frac{WL^2}{8Ad}$ (from 2a),

$$4)\ \frac{3}{8}\ L^2\left[\alpha\Delta T + \frac{L^2}{8AE}\left(\frac{W}{d} - \frac{W_0}{d_0}\right)\right] = (d^2 - d_0^2)$$

For steel: $E = 30 \times 10^6$
$\alpha = 7.2 \times 10^{-6}$ (Fahrenheit)

We have previously alluded to the intimate contact of cable and strand caused by tight wrapping of the lashing wire resulting in a loosely defined steel-aluminum bi-metal system. The inexact definition is due to the fact that we don't know the precise amount of restraint obtained by the lashing wire. However, we may logically assume that actual conditions must lie between certain extremes. These are: a) there is no lashing wire restraint whatever, so that all stress due to thermal changes results in sag changes and axial cable movement; and b) there is total lashing wire restraint, as if every element of the cable is bonded to an element of the strand, so that all stress due to thermal changes results in sag change and strain in the cable with no axial movement.

For case a, equation 4 suffices. For case b, we must consider a factor for differential strain, i.e., equal and opposite strains imposed by the difference in coefficients of expansion between steel and aluminum. Hence:

$$5)\ \alpha_a\Delta TL - \alpha L_a = \alpha_S\Delta TL + \Delta L_S$$

where:
α_a = coefficient of expansion, aluminum (12.7×10^{-6})
α_S = coefficient of expansion, steel (7.2×10^{-6})
ΔL_a = length change, aluminum sheath
ΔL_S = length change, steel strand

From equations 5 and 2, the stress due to differential strain may be derived as follows:

$$6)\ P_d = \frac{\Delta T(\alpha_a - \alpha_S)}{A_S\left(\frac{1}{A_S E_S} + \frac{1}{A_a E_a}\right)}$$

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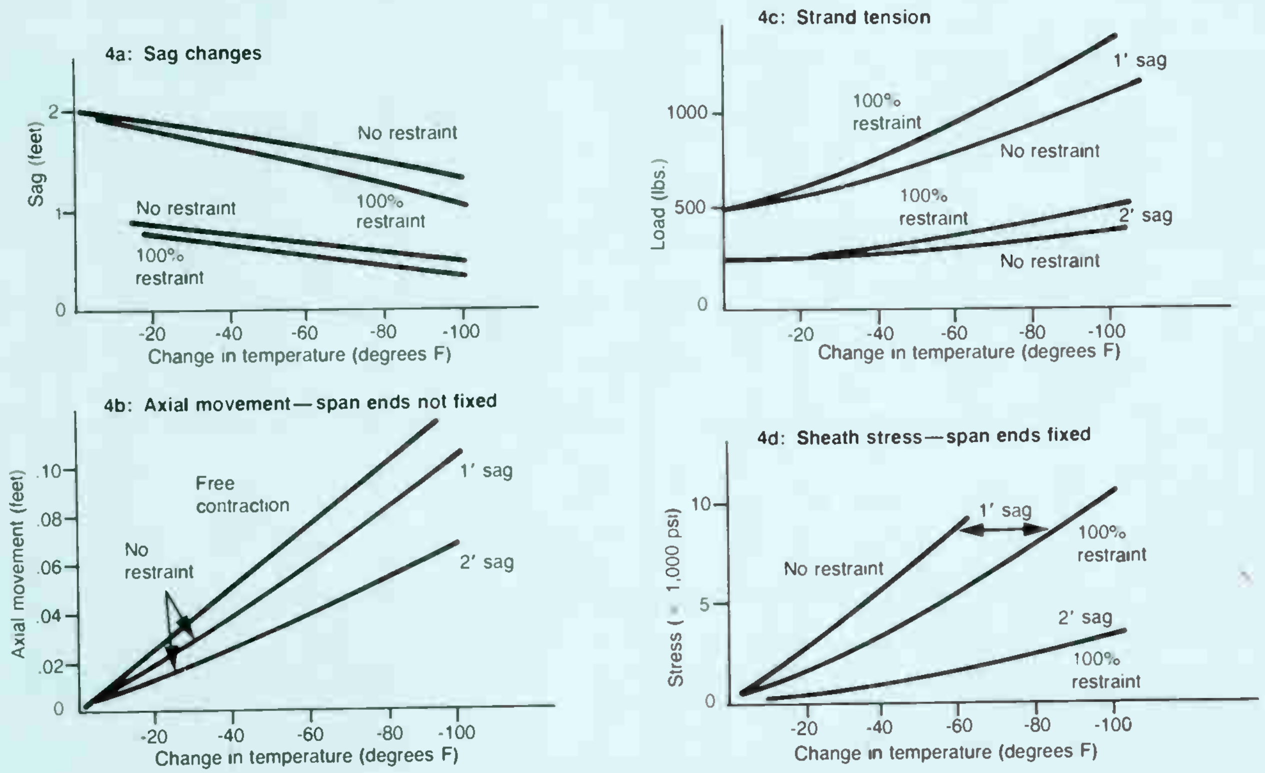
Figure 4: Span changes as a function of temperature—¾" cable, one-ft. and two-ft. sag, 100-ft. span for assumed extremes of lashing wire restraint on cable sheath



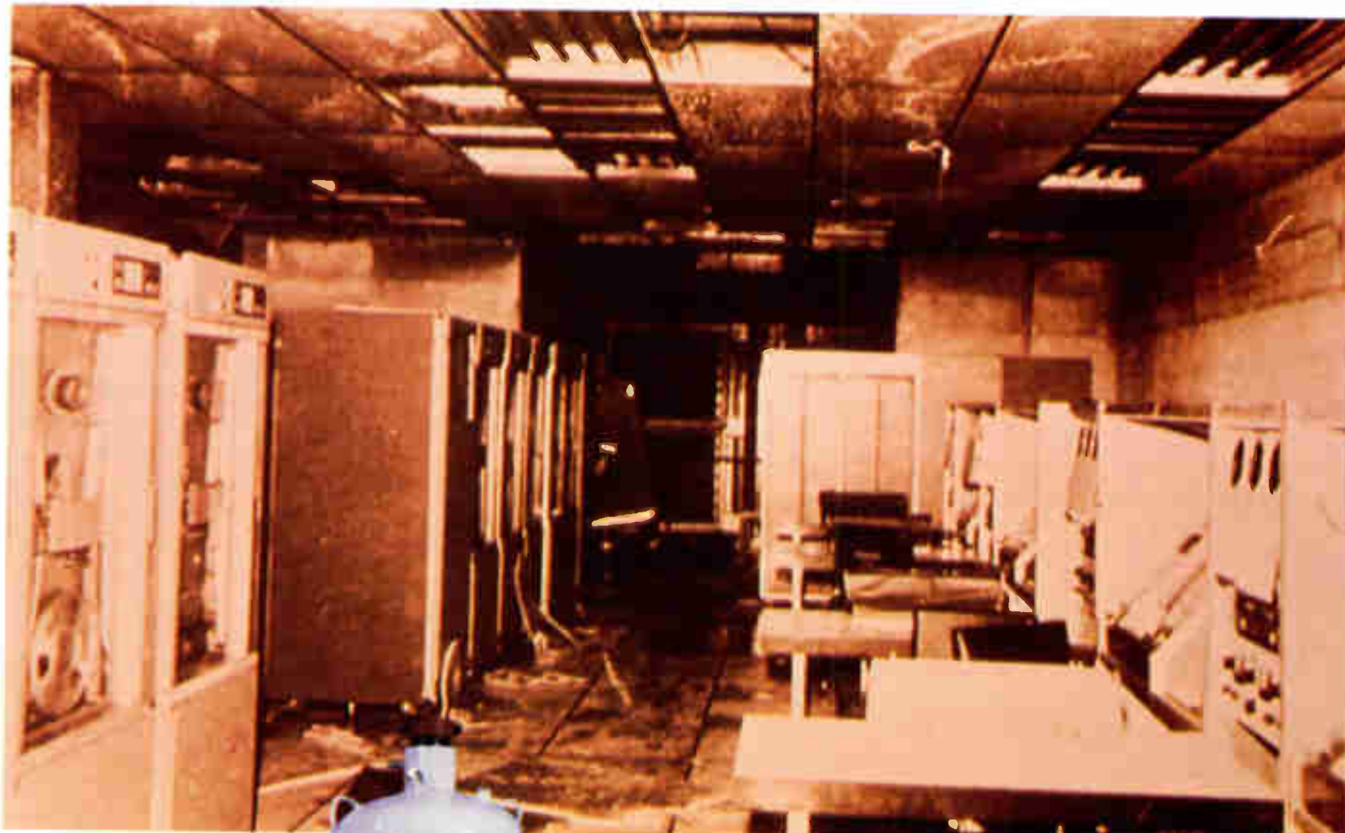



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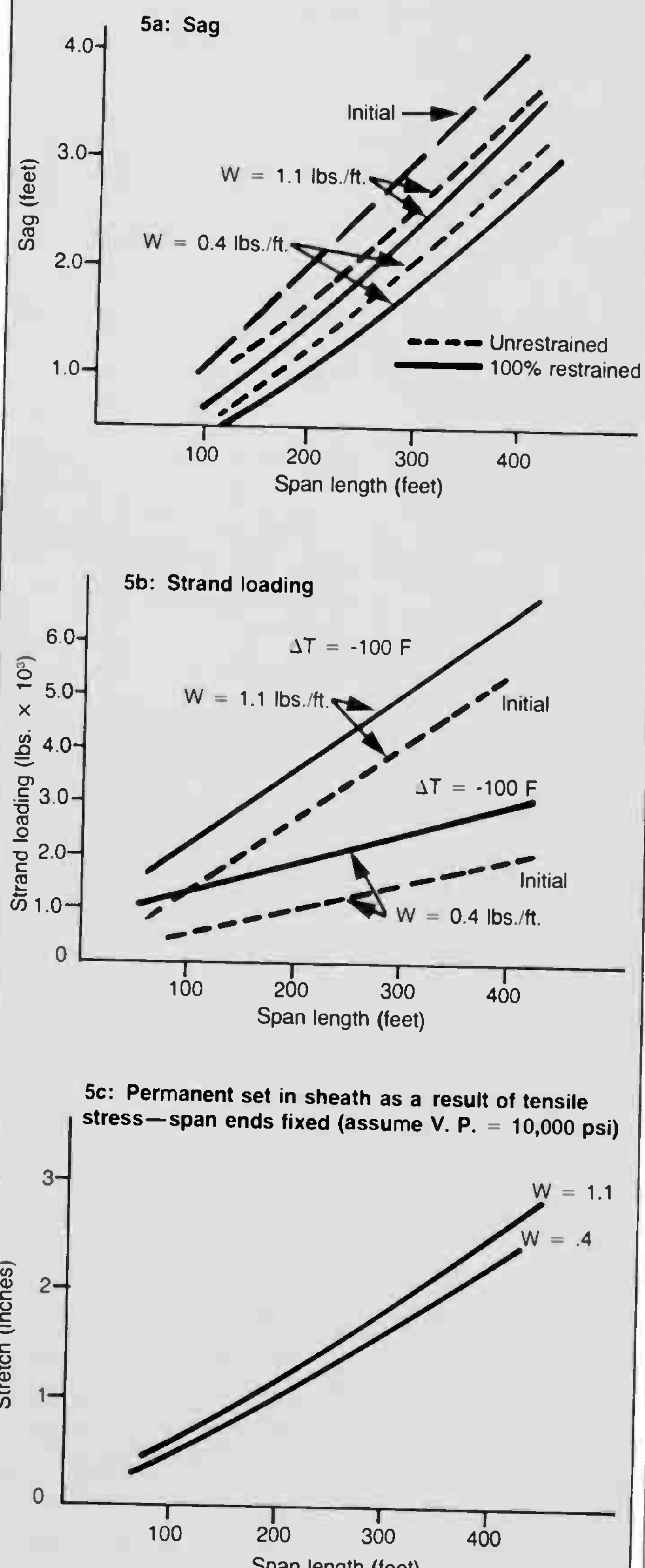
Figure 5: Span changes as a function of span length—1% sag, ΔT = -100 F, W = 0.4 and W = 1.1 lbs./ft.



and the general equation for a tightly restrained cable, as defined above, becomes:

$$7)\quad \frac{3}{8} L^2 \left[\alpha_S \Delta T + \frac{L^2}{8 A_S E_S} \left(\frac{W}{d} - \frac{W_0}{d_0} \right) + \frac{\Delta T (\alpha_a - \alpha_S)}{1 + \frac{E_S A_S}{E_a A_a}} \right] = d^2 - d_0^2$$

Equations 4 and 7 represent the extremes of cases a and b. Given S, L, d_0, W and T, then the new sag, d, may be calculated, which is key to deriving resulting load or stress on the system as a function of temperature change.

We may now study the following relationships:

1) Sag vs. temperature change, assuming both extreme conditions of no lashing wire restraint and 100 percent restraint.
2) Stress in cable jacket, center conductor and strand tension as a function of temperature change.
3) All of the above as a function of weight change, i.e., ice-loading.

Figure 2 shows various theoretical span changes as a function of original sag. The specific case is a single ¾" diameter cable, a temperature decrease of 100 F, and span length of 100'. Weight, including strand, is 0.4 lbs./ft. Note (Figure 2a) that final sag (at ΔT = -100 F) is greater for the assumption of no cable restraint due to lashing wire, since the strand contracts normally, proportional to $\alpha \Delta T$. If, however, 100 percent restraint is postulated, then the strand contracts more since the coefficient of thermal change is greater for aluminum than for steel. Hence, there is less final sag. Assuming the span ends not fixed, that is, free to move into an expansion loop, the net contraction is seen to be the difference between the free contraction of the sheath less the change in length due to the sag change (Figure 2b). Net contraction is least when the initial sag is greatest. Figure 2d shows similar analysis for the center conductor pull-out force, assuming span ends fixed.

The net conductor strain is the same as that induced by change in sheath length due to change in sag. Figure 2c shows the tensile stress that develops when the span ends are fixed. Stress is minimized for assumption of 100 percent lashing wire restraint. In either case stress increases rapidly for low values of initial sag, probably exceeding the yield point. (Indeed, this is a condition observed in the field; its corollary is a tendency for the stretched cable to depart from the strand catenary when the temperature eventually increases, since the cable length is now longer than the strand length.)

Figure 3 shows the span changes for a cable similar to Figure 2 except that ΔT = 60 F (increase). Note that the final sag is less for the assumption of no lashing wire restraint. If 100 percent lashing wire restraint is assumed, the normal strand expansion is now increased since the aluminum sheath tends to "pull" the steel strand. Other relationships follow patterns similar to those observed in Figures 2b through 2d.

Figure 4 shows span changes for a single ¾" cable, 100' span and one- and two-foot original sag, as a function of temperature decrease. Figure 4b is instructive. The actual axial movement is shown as a function of temperature for given sag, and compared with the free contraction of the equivalent length of aluminum not subject to span stresses. For a one-foot original sag, net axial movement is 82 percent of free contraction; for a two-foot sag it is 53 percent. Figure 4c shows the difference in strand loading. Two-foot initial sag shows 50 percent of the loading of one-foot original sag at ΔT = 0 but only 35 percent at ΔT = 100 F, since the tighter original sag tension increases at a faster rate with decreasing temperature.

Figure 5 shows initial and final sag for W = 0.4 lbs./ft. (typical of a single ¾" diameter cable) and for W = 1.1 lbs./ft. (two one-inch jacketed cables) as a function of span length, assuming 1 percent sag and ΔT = -100 F. The effect of the greater weight per foot loading is to increase the final sag and thus increase stresses in strand and cable. Strand loading becomes significant as shown in Figure 5b. For spans over 200' and 1.1 lbs./ft., a 6,000 lb.-rated ¼" strand would not be adequate. Cable sheath tensile stresses easily exceed the elastic limit resulting in permanent set. Figure 5c shows the approximate amount of stretch in inches as a function of span length.

Figure 6 shows the effect of assumed NESC heavy loading conditions. These specifications are a conservative and useful guide for

aerial plant reliability. The main stress added is ice weight, which causes a large increase in sag, particularly for long spans. Strand tension is shown in Figure 6c. For long spans, tension approximately doubles in the case of a single ¾" cable.

Lashing wire restraint

The preceding mathematical formulations have been predicated, in part, on the assumption that the lashing wire exerts a restraining force in the cable, limiting expansion and contraction of the aluminum sheath to some degree. What are the realities of this assumption?

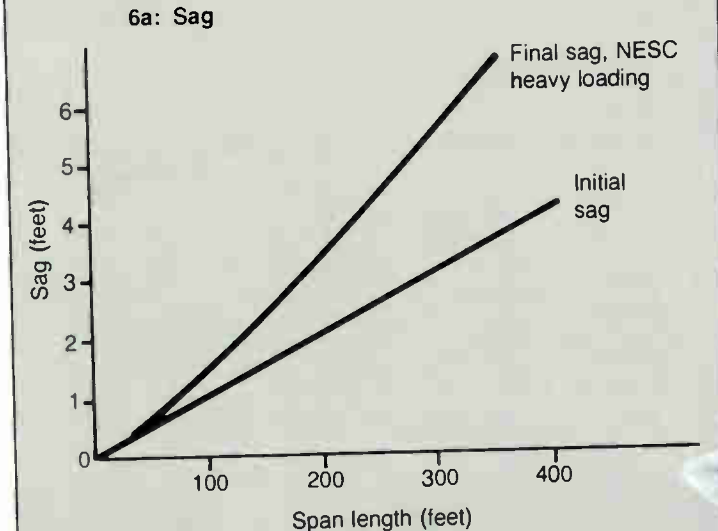
Lashing wire is known to suffer breaks when the ambient temperature decreases, particularly in construction experiencing its first cold snap. These ruptures are unquestionably due to tension stress, since they show the characteristic necking down that occurs as the yield point is exceeded. For .045" diameter lashing wire, breaking strength is approximately 110 lbs. Known tensile forces acting on the wire are thermal contraction, weight of cable load, and initial pull imparted by the lashing machine.

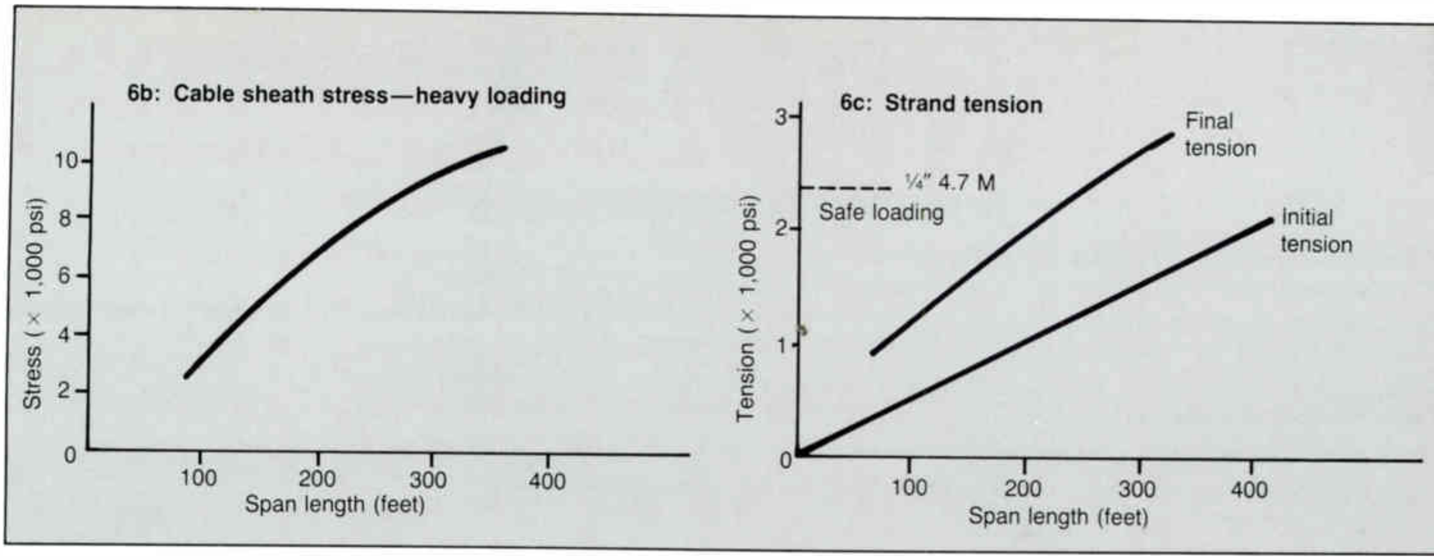
For tightly applied lashing, thermal contraction for 100 F change would calculate to be about 30 lbs. Cable weight is insignificant, even for large cables. The pull of the lashing machine varies with the number and size of cables and the number of pulleys supporting the cables in the unlashed span. Actual tension is 10 to 20 lbs. for one or two small diameter cables. Initial, or starting, force has been measured at about 50 lbs. for two one-inch cables. Therefore, field experience would tend to support the thesis that axial load is applied to the lashing wire for decreasing temperatures, since the sum of all other known forces is far less than the breaking strength.

A laboratory experiment was conducted to measure the actual friction forces which could be developed by lashing wire wrap. A three-foot length of ¼" strand was hung vertically, having a length of cable lashed to it by three wraps of the lashing wire (12-inch pitch) applied by 10-lb. constant force. The lower end of the cable was then pulled, parallel to the axis, until the first movement between cable and strand was observed. For ½" diameter cable, average force was 7.8 lbs.; for ¾" cable, force was 12 lbs. Friction forces of this magnitude probably apply in actual spans. Cable restraint is apparently obtained from friction against both lashing wire and strand. While the precise amount of tension on the lashing wire from differential strain is difficult to evaluate, some is always present when the ambient temperature decreases, depending on lashing wire tightness.

(Continued on page 71.)

Figure 6: Span changes for NESC heavy loading conditions for varying span lengths—¾" cable, 1% sag, ½" ice-load, 0 F (ΔT = -60 F), 4 lbs./sq. ft. wind load





(Continued from page 54.)

Conclusion

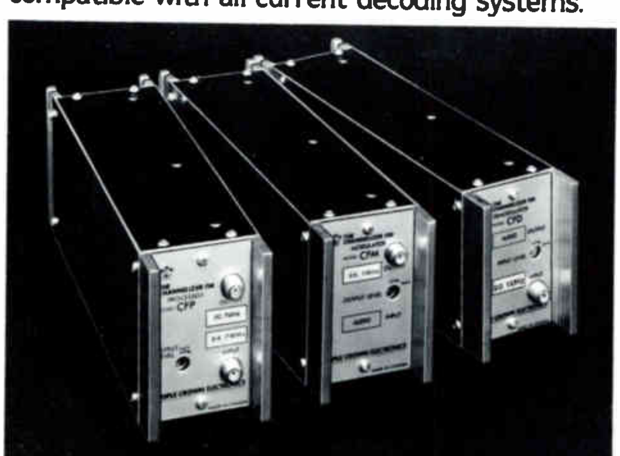
The preceding analysis has served to formulate some theory about stress in cable spans, and to help describe the magnitude of forces on the elements of the system.

A casual study of the cases presented would lead to the conclusion that stresses are least when sag is greatest. Practical considerations, of course, forbid the indiscriminate advocacy of excessively large sags. However, it would seem as if 1.5 to 2 percent sag would be optimum. Conversely, tight sags, less than 1 percent, should be avoided.

Lashing wire serves not only to suspend the cable but also, to some degree, to restrain it from axial movement when the temperature changes. Recognition of the magnitude of potential load on the lashing wire ought to direct energies toward finding a higher strength material or better methods of application to diminish chances of rupture.

To maximize aerial plant reliability, all spans should be carefully checked for proper percentage of sag, particularly if relatively heavy cables are used. Long spans should be engineered to ensure safe loading of strand for given National Electrical Safety Code loading conditions.

At the writing of this article, Eric Winston was an engineer with Jerrold Electronics Corp. He is now retired and living in Pennsylvania. He holds a number of patents in CATV technology.



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Min. Full Gain dB	28	29	28	29	28	29	28	29
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Oper. Range dB	—	—	—	—	—	—	—	—
Return Loss dB	16	16	16	16	16	16	16	16
Noise Figure dB	9	9	9	9	9.5	9.5	10	10
Typical Oper. Level dBmV	49/42	49/42	49/42	49/42	49/42	49/42	48/42	48/42
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levels 2nd order	-72dB	-69dB	-72dB	-69dB	-70dB	-67dB	-71dB	-68dB
AC Requirement 66 VAC mA	.505	.286	.505	.286	.505	.286	.505	.286
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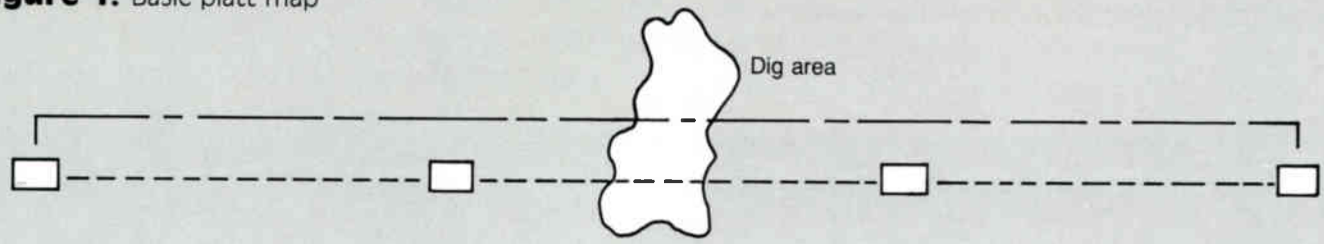
Figure 1: Basic platt map



Cut cables: What it costs and how to avoid them

By Ron Knittle
President, Utility Locate Service Inc.

Good management and engineering of a cable system are dependent upon knowledge of operating costs vs. revenues. Sometimes, even with the most advanced accounting techniques and sincere advice of accounting personnel, these figures can be misleading. This is exemplified by the question, "What does it cost the cable company for a cut cable?"

The surface costs are very definable and clear to management. It is easy to place a figure on the cost of cable, splices, shrink tube and add to this labor costs and vehicle costs. There are, however, many other costs that are not as clear or visible, which many times remain "out of mind" of management.

When a cable is cut sometimes thousands of customers are left without service. Sometimes this happens during prime-time viewing, and as all engineering departments are aware, people do not like their service interrupted. These subscribers do not care who cut the cable or for what reason. Even if service is restored within a short period of time, not all of your subscribers will be content; especially if they happen to miss the end of the playoff game or their favorite soap opera. Still the phone calls and letters are volleyed to city officials and even congressmen. Now, even the lowly city official does not appreciate an interruption of Madonna's latest on MTV, no less the thousands of complaints received in his office the following day. When this happens, the threat of franchise revocation can become a reality for the cable company.

The number of voluntary disconnects climbs with every outage. There also are hidden losses with these disconnects. Lost revenue can be manifest in costs to receive complaints, process and perform disconnects, and adjust bills for unhappy customers.

Another hidden cost is the cost of investigation and collection of amounts billed to the person responsible for the damage to the cable. If a homeowner is responsible it is sometimes better to write off the damage than to make an enemy of the potential or current customer. If the city or a utility company did the damage, a bill for damage may be reciprocated by an even more expensive bill for damage by your people to their facilities.

In any case, the only way to collect for damage is to prove beyond doubt who did the damage and that they were negligent in their digging activities. This means that the cable company is responsible for marking its cable and letting the homeowner or the contractor be aware of the location of the underground cable. The cable company also must be able to combat "tricky" contractors who erase paint marks and remove or move stakes to make it look as though the cable operator did not locate the cable correctly.

A combination of all these increased costs and lost revenues could have a substantial impact on your system's bottom-line profitability. Thus, it is necessary to place as much emphasis as possible on the protection of the cable system. A good "blue stake" system is mandatory. An investigative staff to verify, document and pursue responsible persons for damage can be well worth the expenditure. Many systems across the nation have opted to contract their protection to companies designed for and proficient in this area. Others do this work in-house. In either case, prevention of cut cable can more than pay for protection expenses.

There are five common mistakes made consistently when locating cable.

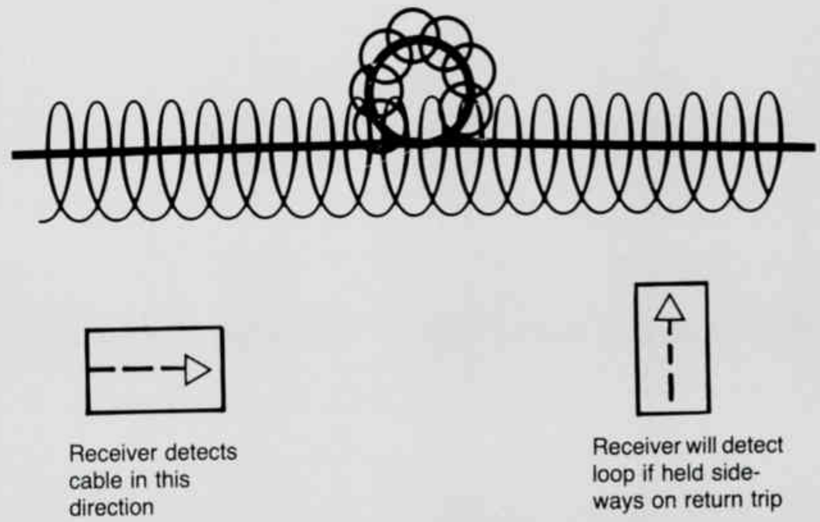
1) The locator does not review his platt maps.
2) The locator does not check for loops or

perpendicular runs of cable.
3) The locator does not check for signal being drawn away to the side.
4) The locator does not connect to every cable out of every vault or pedestal.
5) A circle of safety is omitted around vaults, pedestals or manholes.

In order to correct or prevent these mistakes we must first understand how they are made and how they relate to the excavator and actual locate signal.

- Platt maps—It is very important that the platt maps (Figure 1) are consulted on every locate request. The reason for this is simple: We cannot see what is underground, which is why we are doing the locate to begin with. If there is a trunk run or a very long span of cable buried next to a series of short cable spans, we might assume that there is only one cable in the ground if we only open pedestals and locate the cable in the pedestals in close proximity of the dig area. A long span of cable may not surface into a pedestal for a half-mile down the road. This does not mean that the cable is not there and will not be damaged if not marked. A careful look at the platt maps will tell the locator that the cable is there and exactly where he may hook up to it for signal induction.
- Cable loops—We have found that there exists in every communication system loops or perpendicular extensions that elude the locator and are the source of many damages and outages of service. These loops or extensions exist for a number of reasons. A loop can be the result of a less than honest contractor who, being paid by the number of feet of cable placed in the ground, will loop the cable in a circle to make more money. It also

Figure 2: Looped cable location



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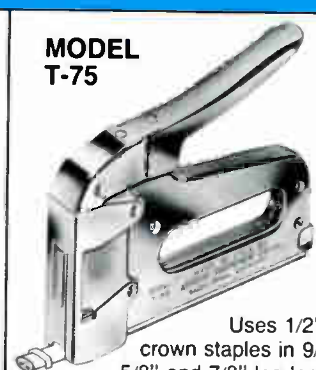

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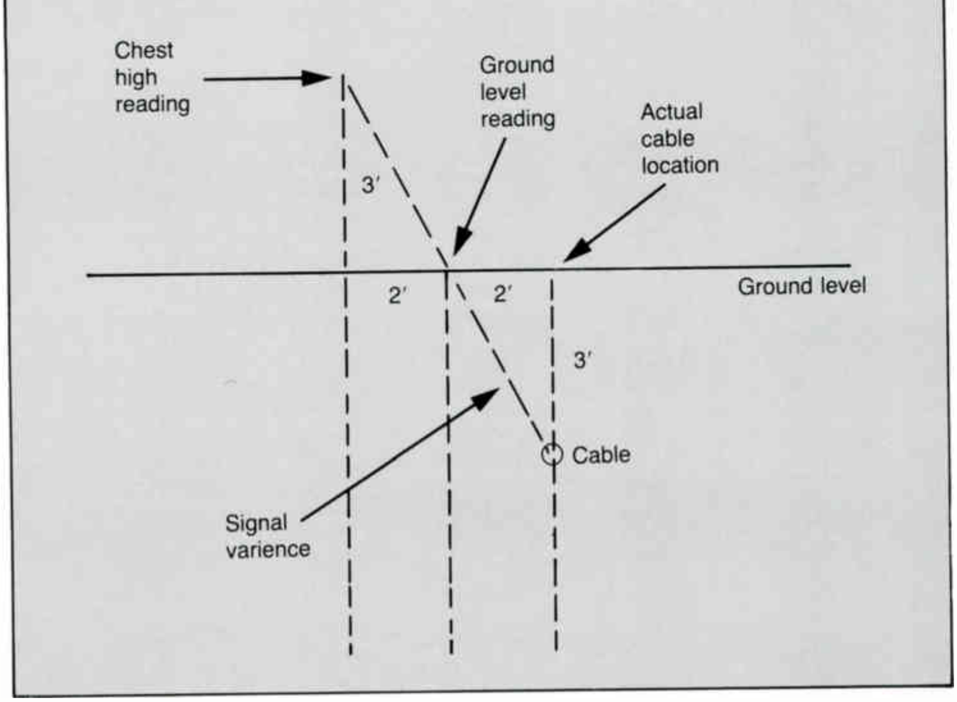
may be a deleted pedestal that had been spliced, sealed and buried, but the splice sticks out perpendicular to the cable run.

There also may be two cables running together then one turns and goes perpendicular to the other, which continues to run straight. In most cases, these quirks and loops are not shown on a platt map and must be detected by the locator in order to save the cable from possible damage. We have found that the best way to detect these irregularities is to institute a regular procedure that will detect these loops.

To understand the procedure, you must first understand a basic theory of locating. Figure 2 shows that the location signal that is transmitted through the cable by the transmitter is represented by lines of flux much the same as a magnet has. The receiver detects the spot from which these signals are originated and that is how we know where the cable is. If there is a loop in the cable, the person who is locating the cable will not be aware of this loop unless he turns his receiver sideways and receives signal from the perpendicular signal. A good policy to follow, then, is to locate your cable as you normally would. As you return to your transmitter, turn your receiving unit sideways, travel back over the top of your locate marks all the way to your transmitter. If your receiving unit detects cable, there is probably a loop or perpendicular leg to the cable. You can then dig this up to find out what is there, or you can mark a "circle of safety" around the spot where you think there may be a loop.

Figure 3: Compensating for signal draw



- Signal draw—There are many external objects that can affect and distort the cable signal. Railroad tracks, overhead power lines or even other underground utilities can draw the signal off to one side or the other. There is a quick and easy method to detect and correct signal draw, which should be done on every locate request *within the dig area.*

First, establish a good solid transmission

signal. Locate the cable with your receiver at ground level and mark it with your toe. Then locate it at chest level. If the marks are different, your signal is being drawn off to one side. If the marks on the ground are directly under the receiver at chest level, your locate is correct.

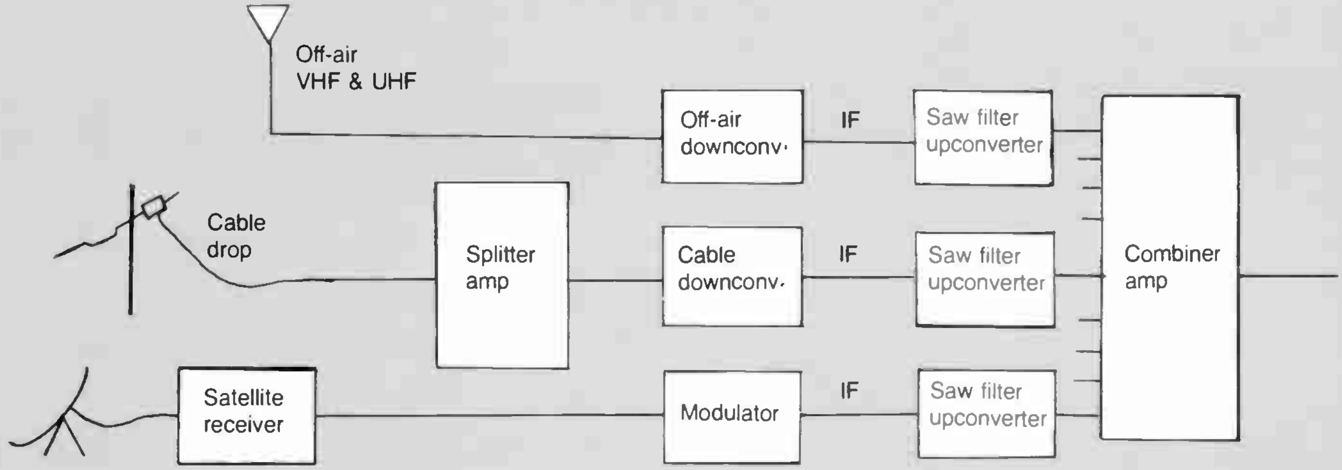
Assuming your signal is being drawn off to one side, you must be able to compensate for this draw. To do this, simply find the depth of your cable and bring the receiver off the ground the same distance as the cable is deep. Put a small mark on the ground exactly where your receiver is showing cable. Now find the cable at ground level and place a small mark on the ground where your receiver indicates that there is cable at ground level. Measure the distance between the two marks. Traveling in the same direction, the same distance as between the two marks, place a third mark on the ground. This is the exact location of your cable. This signal will be drawn off at varying degrees so when you find your signal is off, you must compensate about every other mark to make sure you stay accurate. Refer to Figure 3.

- Locate every cable—As mentioned previously, a locator must look at platt maps in order to know what is in the ground. This will enable him to possibly locate cables that are not visible in the pedestals in the dig area. On the other hand, we have found that the platt maps are not always as accurate as we would like them to be; they often are not updated with recent construction. Thus, additional cables may be in the ground but not on the platt maps. For this reason it is important to locate every cable out of every pedestal, vault or manhole. You must connect to every cable and not just assume that they are in a joint trench or traveling in a logical direction.
- Circle of safety—As cables converge to a connection point such as a pedestal, vault or manhole, the signal from the locator transmitter becomes jumbled or confused. The receiver cannot distinguish one signal from another and often times the signal is transferred from one cable to another. This situation can cause serious error in your markings on the ground. It is therefore almost impossible to get an accurate locate close to a pedestal, manhole or vault. As a solution to this problem, we always put a circle of safety around the enclosure. This protects the enclosure and cable by forcing the contractor or excavator to hand dig within three to five feet of the pedestal.

It is important that this circle of safety is enlarged as the enclosure gets larger. For example, a small pedestal would require a circle with a three-foot diameter while a large manhole would require a 20-foot diameter circle. The size of the manhole should be determined by looking at the inside dimensions of it, not just the manhole lid. It would be appropriate to paint the manhole lid, paint the perimeter of the actual manhole, then paint your circle of safety around the manhole perimeter.

By following these simple rules, your instances of mislocates will be held to a minimum. Thus, your damages and service outages due to cut cables should be minimal.

Figure 1: Basic SCS system with input options



Economic MDU service

By Bill Smith
Sales Manager, CADCO Inc

The race to cable most major and smaller cities is now nearly over. Most industry leaders agree that the present emphasis is on developing larger subscriber bases in operating systems. A larger subscriber base takes on even more importance as the number of multiple pay units dwindle, and in most systems, a basic service moves more revenue to the bottom line.

As that race was run, the tendency was to service single family dwelling units while bypassing multiple dwelling units (MDUs)—apartment and condo complexes, hospitals and other high-density facilities. At the time there was good reason. MDUs were difficult and time consuming to wire. Furthermore, in-

Figure 2: Off-air phase-lock

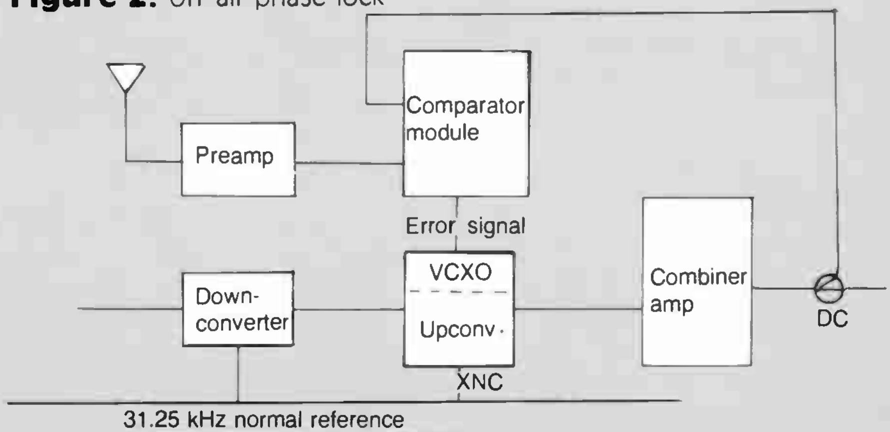
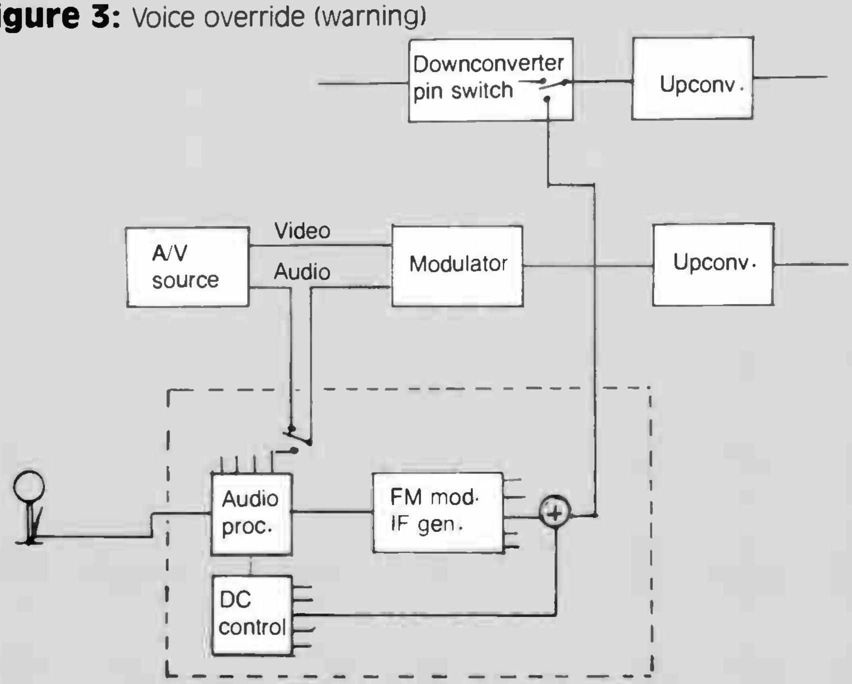


Figure 3: Voice override (warning)



terfacing with previously installed master antenna distribution systems invited disaster, and controlling service tiers meant theft of service, heavy maintenance schedules and loss of converters—headaches most cable operators just did not need.

Most of those problems are now solvable, and if cable systems are to expand their customer base, cable must face the competition now presented by non-cable sources of service.

Research has shown that although the fantasy land of multiple channel capacity systems is attractive at franchise time, many cable viewers rapidly settle on a half dozen or so favorite satellite-delivered services plus local network stations. A selectively customized 12-channel MDU service becomes a saleable product easily controlled by the cable operator. In addition, equipment designed for cable system interfacing makes customized MDU service simple to deliver.

A piece of equipment dubbed Select Cable Service (SCS) was developed by Cadco Inc. to be a drop-in interface between cable systems carrying up to 54 channels on multiple cables and the MATV systems commonly found in MDUs such as hotels.

Figure 4: Descrambling for bulk sales

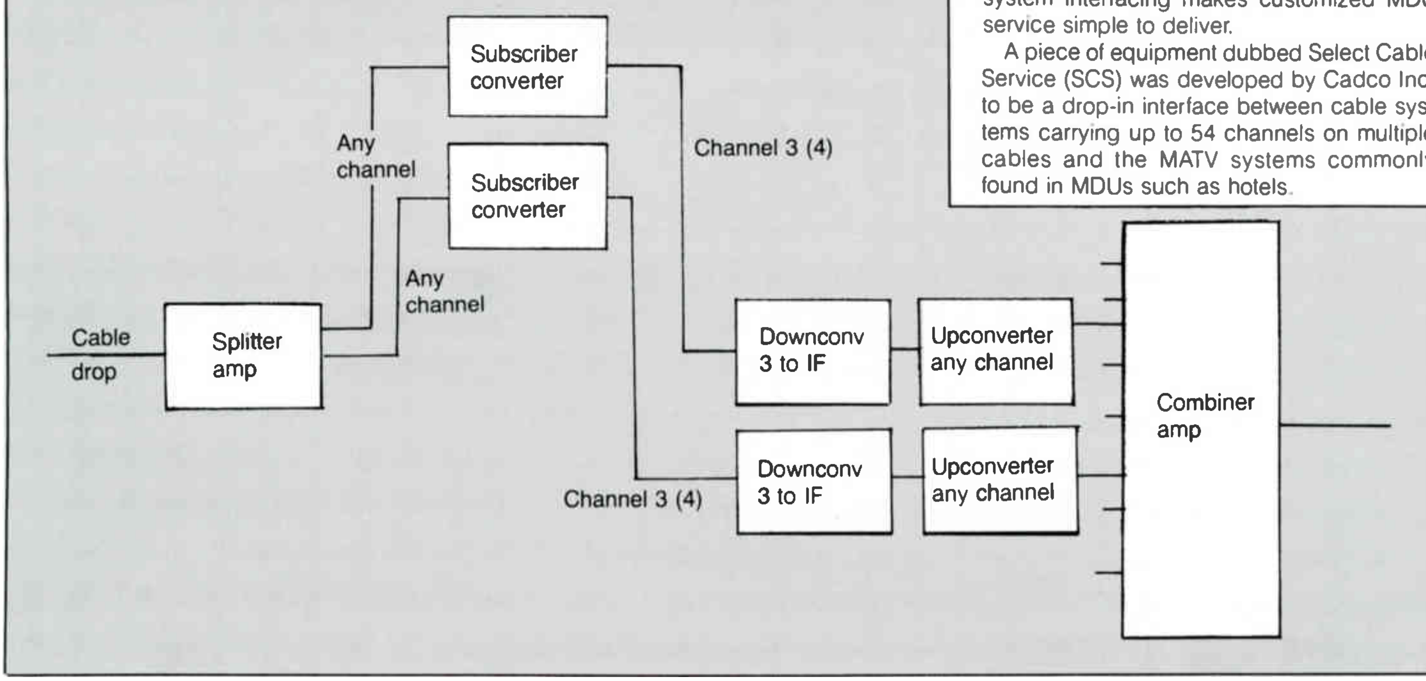


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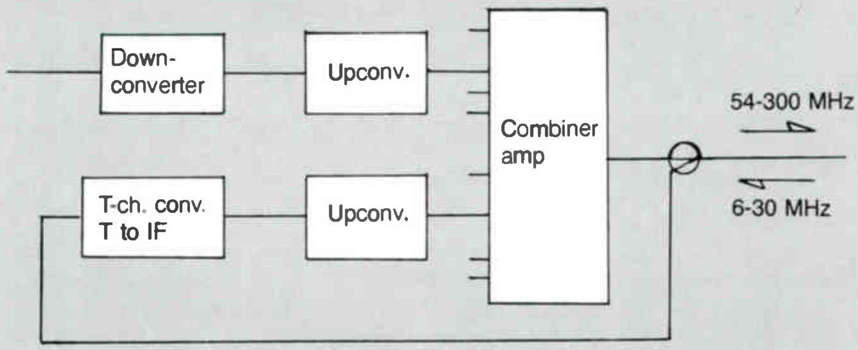
Figure 5: Turn around of local programming (security)



The concept of "cherry-picking" the cable system channels and eliminating converters led to packaging SCS in 12-channel increments. However, the SCS cabinet can accommodate up to 18 channels with space remaining for additional equipment. Fundamentally, SCS is similar to most top-line heterodyne headends (Figure 1), including its many options for special situations.

Input/output modules

The most commonly used input module is the cable-input downconverter. The input filter of this unit selects one 6 MHz channel between 54 and 440 MHz. The signal is amplified and downconverted by a phase-locked oscillator locked to the master reference oscillator discussed later. The signal is AGC controlled to a 10 dB operating window. Top-line models like the SCS differ from standard heterodyne signal processor inputs in extra input filtering and the use of hybrid amplifiers used in line distribution equipment, both necessary to prevent overload when interfacing a fully loaded 54 channel cable system as an input.

An input splitter/amplifier is normally used with the cable input modules to preamplify the input signal overcoming 13 dB of splitter loss. This hybrid amplifier has flat gain to 440 MHz.

A second input option is a modulator module, plug-in interchangeable with other input modules. It is not channelized, since the output is standard IF. The modulator modules accept .25 to 2.0 volt peak-to-peak video for 87.5 percent modulation. AM video modulation is accomplished by a double-balanced diode hybrid. White sync clip is included factory set to 95 percent and FM aural modulation accepts .2 to 2.0 volt peak-to-peak audio for full ±25 kHz deviation. The FM modulator is a phase-lock loop (PLL) type for long-term stability. Video modulation, FM deviation and the video/audio ratio are set by front panel controls.

The modulator module is used primarily to provide local origination programming, security monitoring unique to the MATV system, or additional satellite programming not carried by the cable system.

A third interchangeable input module is the off-air downconverter. This module has more gain for operation, down to −10 dBmV input on all VHF and UHF channels and an expanded AGC range. Overload protection is reduced to improve the input noise figure. Pin diodes are used to adjust the depth of the 41.25 MHz aural carrier traps to set the A/V ratio. This control is on the front panel and allows setting the aural carrier 13 to 17 dB below the video carrier. This module and the modulator module may be used as a mini-headend independent of a cable system input before actual cable service might reach the MDU site, as well as a permanent headend.

The channelized output module accepts standard IF signals from its associated input module, and passes the signal through a high rejection 5.2 MHz SAW filter, thus eliminating adjacent channels or the unwanted modulation sideband. The IF is upconverted by a phase-locked oscillator referenced to the

Reader Service Number 57.

master oscillator. The output is filtered to remove mixer products and amplified to 45 dBmV. The output modules are available for all channels between 54 to 300 MHz.

Safeguards and options

The output channels are combined with 3.5 dB hybrid splitters. The output amplifier is a high-gain hybrid with push-pull output, providing a net gain over-combining of 15 dB. The output level must be adjusted down in accordance with channel loading rules for line amplifiers. SCS may be operated at 54 dBmV output on 12 channels with acceptable intermodulation products.

To preserve frequency relationships established at the CATV headend, all downconverter and upconverter oscillators are locked together by a common reference. Therefore, if the inputs are HRC related, the outputs on-channel will be IRC. Likewise, if the channel is off-air phase-locked at the headend, it remains so through the heterodyne headend. The reference module located in the upper left slot of the SCS case is designated as the master reference. A 31.5 kHz reference signal is distributed horizontally across the case to the converter modules and a 62.5 kHz reference signal is distributed down the cases to other cases. The reference oscillators are of the voltage-controlled crystal type, so should a reference be lost, frequency stability is maintained.

If local off-air phase-locking is needed for a particular location, an SCS option is available, (Figure 2). An off-air phase-lock case is added along with a comparator module for the particular channel. An off-air signal from a local antenna or a signal from the cable, phase-locked to the local broadcast channel is fed to one side of the comparator and the opposite side receives a signal from a top off of the SCS output. A difference error signal is also fed back to a voltage-controlled crystal oscillator (VCXO), replacing the standard PLL oscillator in the output converter.

SCS may be equipped with voice override (Figure 3), which permits a voice message to be simultaneously transmitted on each channel from an in-house source like a dedicated telephone or push-to-talk microphone. The override system generates a 45.75 MHz video carrier and modulated 41.25 MHz aural carrier plus DC control signal. This signal is applied to the IF output of each downconverter, where it switches pin diodes located there. Voice override capability is useful in situations such as a fire or threatening weather conditions.

The SCS can be a versatile interface headend. A unique application (Figure 4) is to use standard subscriber type converters between the input splitter and the downconverters in order to descramble or use other addressable features of the CATV system. The high adjacent rejection allows use of all the converters outputting on either Channel 3 or 4.

Another application is to use the T channel and IF input converter in order to reverse a local origination channel and at the same time isolate the MATV reverse from the system reverse path (Figure 5).

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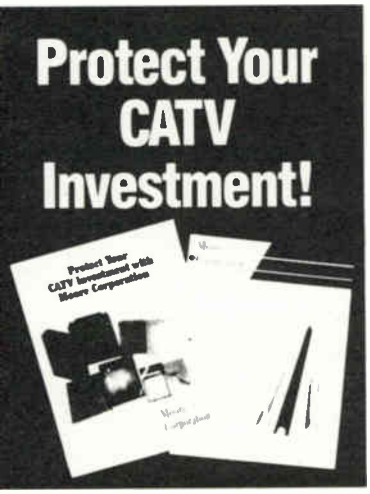

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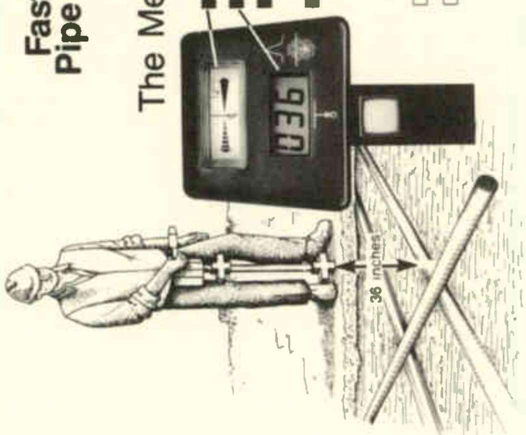

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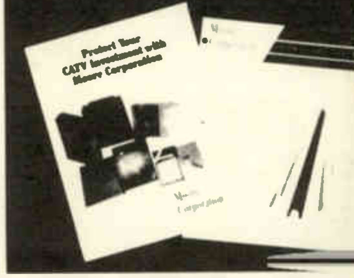

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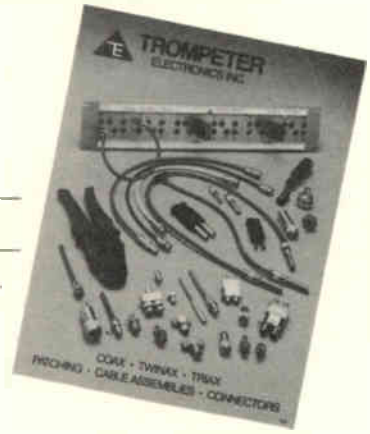

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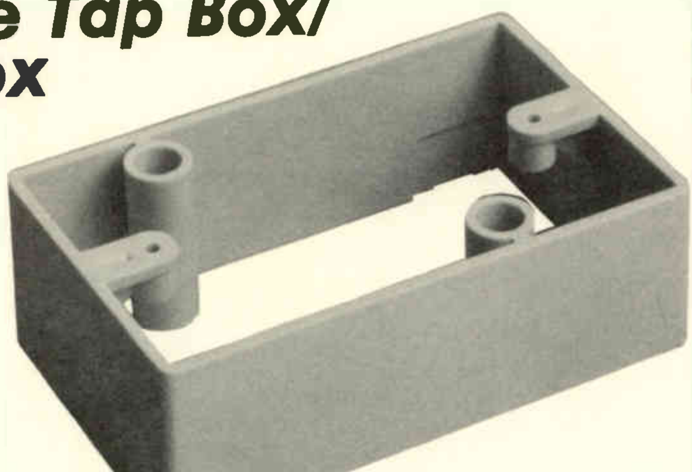

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Installing underground conduit

This article, used with the permission of RCA Cablevision Systems, is an excerpt from Design and Construction of CATV Systems. *RCA prepared the manual to be a handbook for use by their own engineers and technicians. This section on underground construction gives guidelines on the many considerations involved in installing underground conduit.*

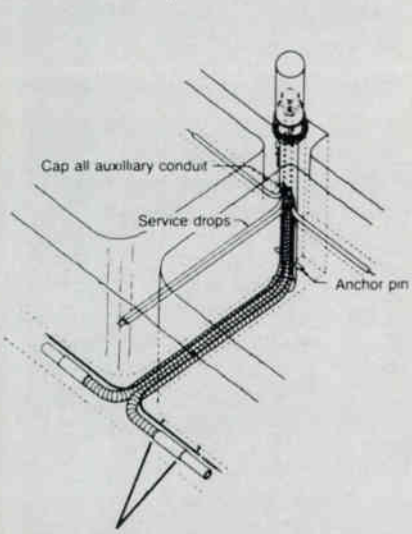
By RCA Cablevision Systems

Conduit runs usually are classed as main or lateral (or subsidiary). A conduit run that follows a primary route from which branch runs extend is considered a main conduit. The branches extending from such a conduit are called lateral or subsidiary runs. A main conduit run may branch in two or more directions to large areas of the system, each branch of which is considered a main run.

For our purpose we will refer to this main conduit as trunk conduit. Placing conduits of sufficient size to house the present system, as well as future needs, will prove to be an economical measure. The practicality of placing two conduits side by side has been considered, one 2-inch as trunk conduit, the other 1½-inch as distribution. This method is common in new construction where open trenching is not a problem, boring under streets is not necessary, and driveways do not exist.

If your construction is going to require many bores under the streets, driveways and across private property, placing conduits side by side would require making double bores and be very costly. For these reasons one conduit is recommended to act as common carrier of both trunk and distribution along primary runs. A 3-inch trunk conduit is required for the above mentioned reasons.

Figure 1: Above ground pedestal



Note: When conduit changes direction, splice with flexible conduit to semirigid and make all turns with flexible conduit or appropriate conduit sweeps.

This conduit should be of semi-flexible material, of sufficient strength not to collapse under compaction, and of a smooth wall construction. A.B.S. duct has been proven to be the superior material in use for communications underground systems. (Other duct materials are available, however, and can be used depending upon local government restrictions and/or personal preference.)

Ducts should be straight in order to handle the cable installation and radius bends required to couple amplifiers and other devices. The various vaults under study have been designed to very tight dimensions and are based on entering the duct at a prearranged fixed location. Any deviation from these set positions, like an up-swing radius or slight bending to the left or right, would put a strain on the cable radius bends that have been set to maximum limits. This could become critical and put unnecessary strain on the cables and couplings.

Experience shows that the single 3-inch diameter duct will carry all the cable inserts that two 2-inch diameter ducts can handle. The single, larger duct will be much simpler for cable pulling, save costs on initial installation, and in spud boring simplify vault and splicing hole settings. As well, it will provide for 100 percent expansion of cable pulls in the duct system after the double 2-inch diameter duct system would have been filled to capacity.

Conduit routing

The route of the proposed conduit should receive careful consideration. In general, it should be laid out to provide the most direct feed possible. The actual location of conduit runs should be in other than paved streets or alleys, in order to facilitate future repairs or reconstruction and eliminate expensive paving conditions.

When planning the location of the conduit run, consideration should be given to the following: subsurface digging conditions; present and future underground construction for sewers, water, gas, power, telephone, etc.; number and length of subsidiaries to each side of the street; nearness to trees that would make the construction work difficult and might later result in the roots entering and obstructing the ducts; the possibility of trees being planted over the conduit runs; and the possibility of future landscaping or grading reducing the earth cover over the conduit.

Lateral or subsidiary ducts should be planned to occupy the main conduit trench as

far as is practical, especially where street crossings are involved, in order to reduce trenching as much as possible. This also applies where two or more subsidiary ducts extend in the same direction.

Care should be taken, however, to plan lateral conduit runs so that they will enter buildings at the most logical place. Conduit entrances into buildings sometimes are provided and should be used if practical. In most cases the conduit should extend to that particular point of the building that will necessitate the least amount of conduit construction. However, where it is necessary to drill through a number of partitions, beams, etc., in order to place the house cable properly, consideration should be given to extending the outside underground conduit so as to enter the buildings as near the splitter location as is practical. Entrance to attics may be desirable in many cases. This can often be done by conduit entry into the garage. When crawl space is available under the house for distribution, the conduit can enter at any desirable point. For maintenance purposes the splitter for distribution should be placed as close as possible to the crawl entry point.

Lengths of sections

The lengths of conduit sections generally are governed by the location of manholes in the run as required at main points of distribution, such as street intersections, alley entrances, etc., which usually permit spacing of

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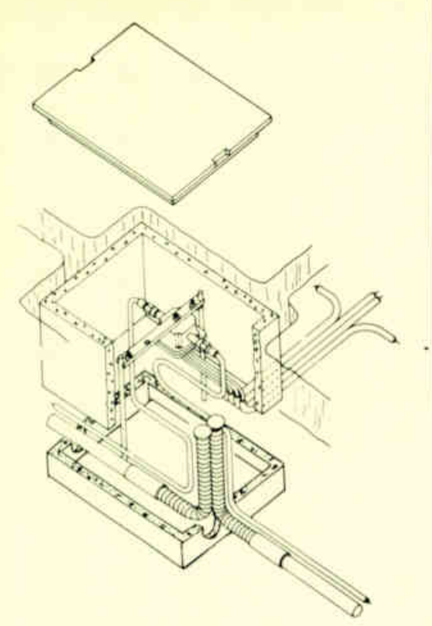
manholes approximately 200 to 300 feet apart. Where conduit sections are not limited by distribution requirements, as for example in the case of underground trunk cables or cables connecting two sections of the system, it usually is economical and feasible to plan conduit sections approximately 600 feet in length, provided no appreciable bends are involved.

The longer sections reduce the number of manholes and cable setups required, with a corresponding decrease in the number of main splices and possible underground cable troubles.

The permissible length of a conduit section containing a bend or curve depends upon the angle between the straight runs on each side of the bend and the radius of the curve along which the conduit is laid. When the length of a conduit section exceeds the allowable limits, a manhole should be provided in the curve or the manholes adjusted to shorten the section.

All conduit should be installed in such a manner that future plant can be placed at any time with no problems of entry or access. All conduit ends should be plugged and every effort must be made to keep all conduits and pull boxes clean.

Figure 2: Underground vault



Recommended standards

In the following discussion, directions and recommendations for the direct burial of plastic conduit and fittings will be covered. Table 1 gives the specifications for basic materials. This standard provides minimum placing instructions.

During preparation, make certain that all foreign matter has been wiped from both the conduit and the fittings at the joints. The conduit, when dry, should not insert over three-quarters of the way into the fitting to make a good interference cement weld. Also, where practical to do so, change conduit sizes at manholes, splice boxes, pull boxes, etc.

Exposure to sunlight during normal construction is not harmful to the mechanical characteristics of the conduit. However, conduit stored for periods of longer than 30 days should be protected from sunlight according to manufacturer's recommendations. *Do* provide support for the full length of conduit when transporting long lengths, and *do not* permit unsupported overhangs.

Cementing conduit

1) Apply a liberal and uniform coat of cement to the conduit for the full length of the depth of the socket and apply a uniform coat to sufficiently wet the socket of the fitting. Excess cement on the fitting should be avoided as it is wiped into the joint and tends to weaken the pipe.

2) Work fast!

3) If cement should partially dry before the joint is made, re-apply it.

4) Slip conduit straight into fitting with a slight twist until it bottoms. Hold the joint for 15 seconds, (1 minute in extreme cold weather) so that the conduit does not push out of the fitting. *Do not twist or drive* after insertion is complete.

5) The joined members must be cured undisturbed for five minutes or more before they are handled or transported. After this initial cure, care must be exercised in handling or transporting to prevent twisting or pulling the joint. (In cold or damp weather, this interval should be increased to allow for the slower evaporation of the cement.)

6) Be sure to wipe off excess cement that is left on the outer shoulder of the fitting. Plastic bristle brushes should not be used. On large diameter conduit the brush should be approximately the width of the fitting socket.

7) Use only small cans of cement since it dries rapidly. Keep container covered when not in use and away from excess heat and flames.

Table 1: Basic materials

Nominal size (inch)	Outside diameter (inch)	Tolerance O.D. (inch)	Minimum I.D. (inch)	Diameter of test mandrel or ball (inch)	Minimum thickness (inch)	Length (feet)
3.500	4.000	±.010	3.500	3.500	.120	30

Backfilling must be made in layers of 6 inches until a 9-inch cover is achieved over top of duct bank, if flooded, or 6 inches if tamped. Backfill should be compacted to prevent future settling and must meet local ordinances. A hydrohammer with a maximum setting of 2,000 foot pounds may be used only when a minimum of 48 inches of cover is maintained over the top of the duct bank.

Sand slurry backfill may be used where required by local ordinances or where compaction must be gained within a short period of time. However, sand slurry may make construction of a planned reinforcing duct structure difficult.

If sand slurry is used or material flooded, time should be allowed for the mass to solidify until it will support the weight of a man walking on the structure or 36 hours drying time. A 30-inch cover must be maintained before wheelrolling.

Governmental requirements usually specify that all conduit must clear other substructures by 12 inches when crossing or paralleling, or 3 inches if encased in concrete.

Municipal, county, state or federal regulations may specify backfilling procedures that differ from those outlined. If such is the case, local regulations should be followed.

Substructure damage prevention

Some damaged facilities can be repaired with a minimum of service interruption if they are discovered immediately. Of greater concern are those cases of damages that are not discovered until later. A broken protective covering on a pipe that is not repaired at once may later develop leaks from corrosion. A damaged sheath of a telephone cable might go unnoticed until the first rain soaks into the ground and puts hundreds of lines out of service.

All contractors, utility companies and public agencies who build or maintain facilities under the streets are responsible to the public and to each other for maintaining uninterrupted service. Because this responsibility is so vital to all and damage to underground plant is of such magnitude, continuing efforts must be made to find solutions to the problem and methods to minimize damage to substructures.

Prior to field operations, as an exavator, you should consult the "sub-structure" maps, maintained by most cities and the county, on which an attempt is made to show installations in the street. This is one source from which you can make a quick check on many substructures. However, these records may not be completely accurate. If you suspect the presence of any installations, regardless of any other information, you should contact the probable owner for accurate data.

Many different owners of substructures are found in your area and their locating and marking services to you will vary from one another in some respects due to their varying size, resources and the physical nature of their installations. At your request, the owners will give locations of their substructures or will send copies of their maps, and in many cases will locate and mark their facilities in the field within the area of your work. These services are free of charge. Make your requests for maps or field marking at least one week in advance of the start of your construction work.

Field marking to indicate the approximate location of owner's facilities should be made as follows:

- In paved areas, the symbol indicating the location size and type of installation should be painted on the pavement surface. Yellow paint is recommended. Each type of owner will use a different symbol to identify the location of their installations. The following symbols are those that are recommended for general use:

D—Storm drain
FA—Fire alarm
G—Gas
L—Street lighting
Tel—Telephone
(Co. Name)—Oil
TV—Television cable
P—Power
R—Railway
S—Sewer
T—Traffic signal
W—Water
WU—Western Union

- The letters should be approximately 4 inches in height and underscored with a line indicating the general direction and location of the utility.
- In areas where there is no paving, a stake with the symbol of the owner shown thereon should be driven in the earth above the utility or at designated offets.
- Field markings of substructures will be done from records, or through the use of a radio frequency pipe locator. In either case, the locations as marked may not be exact. Therefore, the indicated location should be considered as approximate only.

Care should be taken to protect and maintain substructure location markers to avoid the needless cost and waste of time required to relocate and mark. However, it is important that the utility be requested to re-establish obliterated markers. Proceeding without such marking almost invariably results in substructure damage.

The telephone companies do not make a practice of field marking. The size, type and shape of their conduit presents a very vulnerable structure and electronic detectors are not effective in locating clay conduits. Therefore, the telcos prefer to handle their substructure protection by direct field contact between their representative and the construction forces doing the work.

Make arrangements for a meeting between your representative and the substructure owner's representative to discuss your starting location and date, direction in which the work will proceed, the anticipated rate of progress and other pertinent information.

Upon your request and when feasible, the utility owners will negotiate an agreement for the temporary removal (cut and reconnect) of their installations to expedite your construction work. The provisions of this agreement will be dependent upon the factors involved on each job.

Normally, a minimum vertical clearance of 6 inches between substructures is planned. Where this condition cannot be met in the field, the owners whose substructures are affected should be notified so that a mutually agreeable installation can be arranged.

All of the larger pipeline (oil) companies have dispatchers on duty around the clock. Furthermore, the dispatchers of the various companies have a cooperative arrangement whereby trouble reports are identified as to map location and immediately relayed by telephone to companies having pipelines in the vicinity. Thus, in an emergency, a call to any one pipeline dispatcher will result in the warning reaching the company concerned within a very short time.

To conclude with, we have compiled a list of considerations for underground construction that you can modify and customize to fit your particular needs. They are:

- The project
- The work
- Schedule
- Supervision of the work
- Inspection
- Permission to perform the work
- Public relations
- Construction and access roads
- Substructures
- Survey
- Indemnity
- Angles and bends
- Use and grading of working strip
- Damaged material
- Working strip
- Protection of property corner markers and survey monuments
- Excavations
- Cleaning conduit and protection of open ends
- Backfilling
- Compaction of backfill
- Substructure damage prevention
- Field practice
- Miscellaneous operations

Similarly, some considerations for procedures underground are:

- Planning, engineering and development
- Material research
- Drawings and plans
- Installation permits
- Selection of contractor
- Installation drawings and specifications
- Specific job acceptance by contractor
- Notify all utilities of intent to start work
- Request substructure identifications
- Public notification of intentions
- Materials to job site
- Public safety, road blocks, signs, barriers
- Inspection and acceptance of the work
- Public relations
- Compaction and backfill
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- Final acceptance of contractor's obligations
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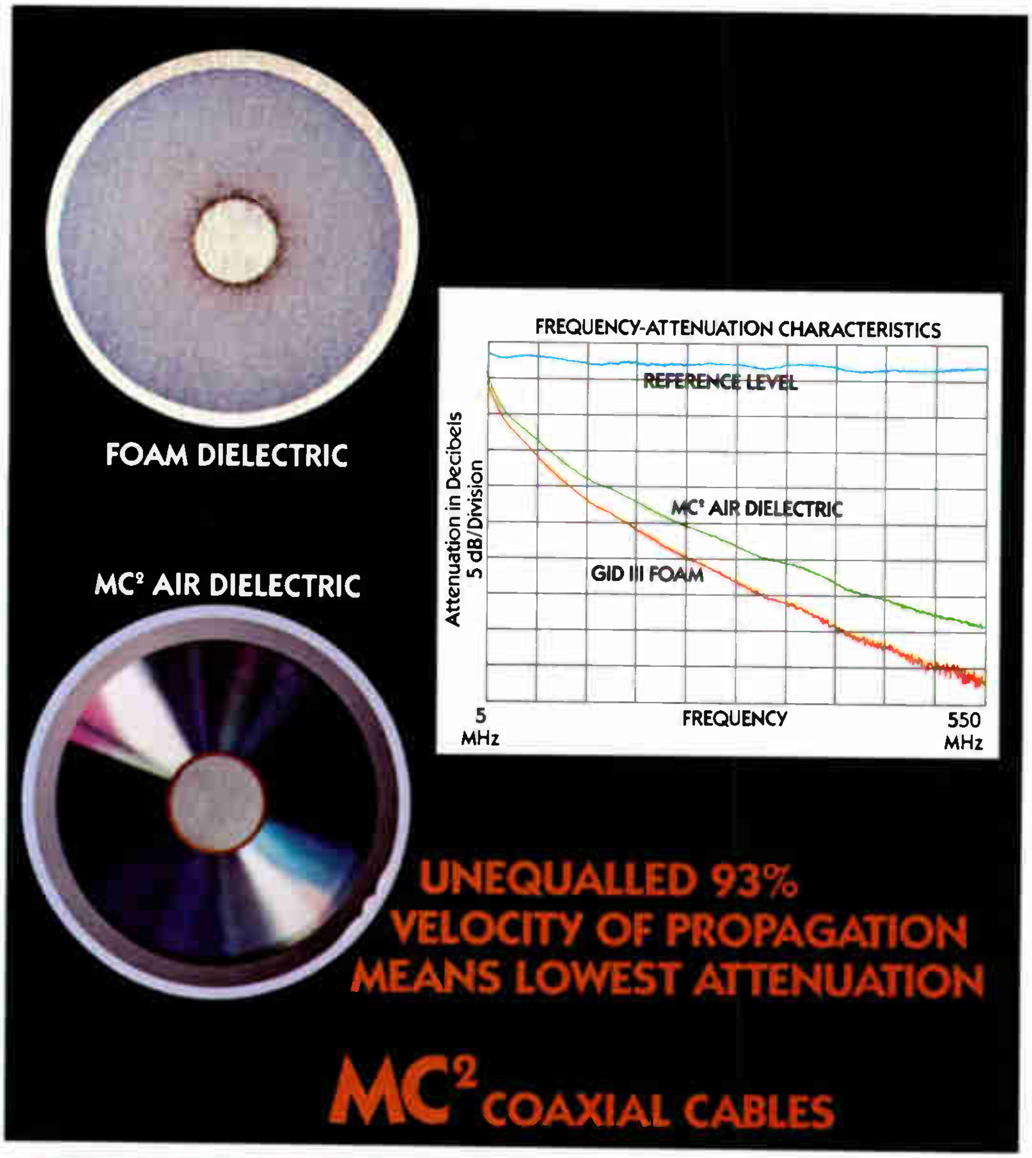

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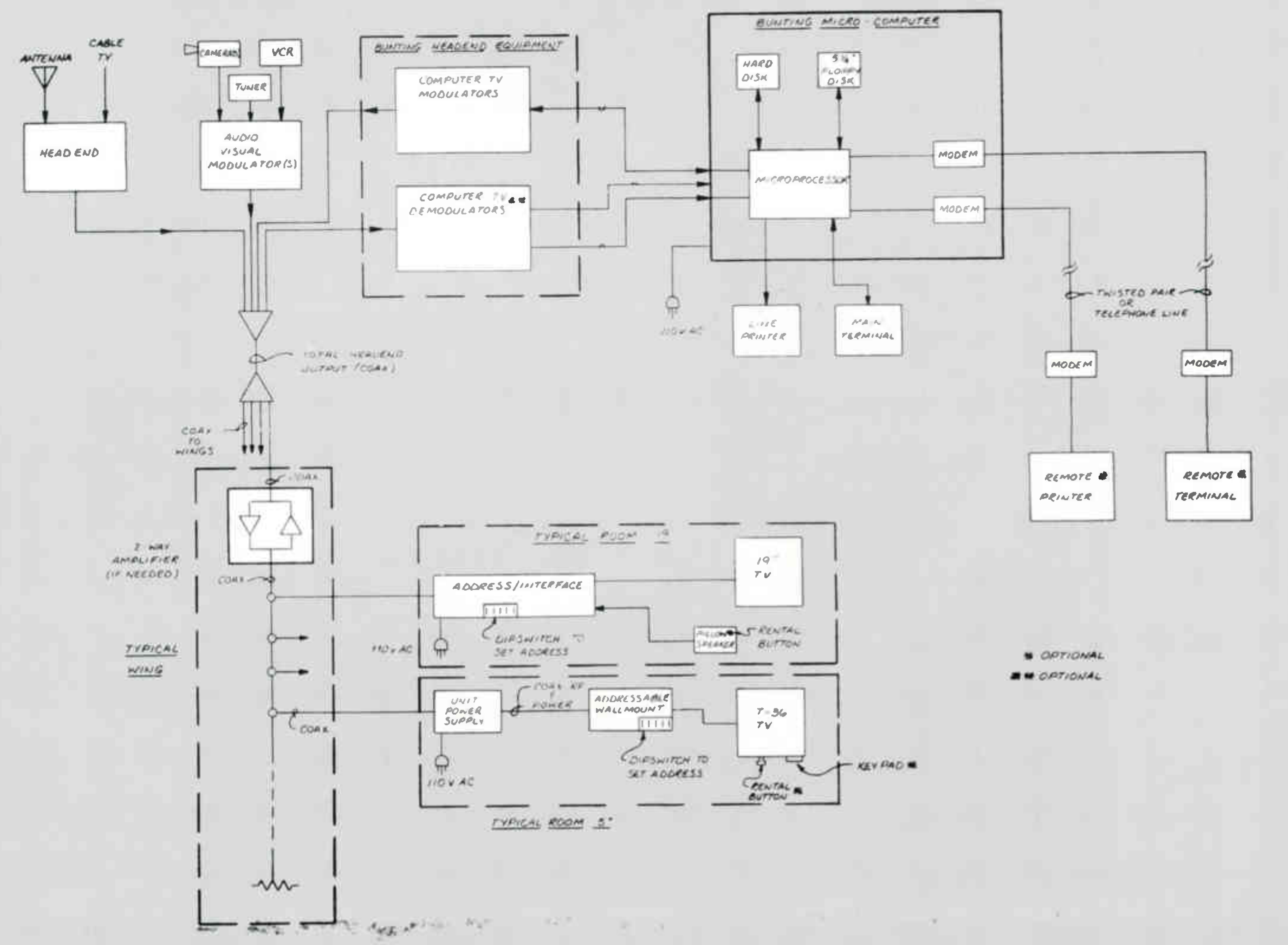
Figure 1: Hospital-based computer-controlled addressable TV system



Opportunities in the hospital television market

By Ed Miller
Product Manager, Hospital TV Systems, Bunting Inc

And John Larounis
Vice President, Marketing, Bunting Inc

The hospital market may well be an unsung hero in the cable television industry's efforts to expand its subscriber base. The hospital environment has one of the largest untapped captive-viewing audiences available. To date, the cable television industry has not had great success in attracting cable television to their institutions.

To give you some idea of the potential size and impact of this captive-viewing population, let's look at some industry statistics. There are roughly 1.2 million patient beds available to new television viewers entering hospitals throughout the United States every single week. Even when you exclude psychiatric hospitals and unoccupied beds, the total still nears 1 million. In addition to these television viewing patients, come their friends and family members, which stream into their rooms over a period of a week (one week is roughly the average length of a patient's stay in a typical hospital). Every week, these 1 million viewers leave their beds for home and a new group of patients enter the hospital.

If, in fact, cable television has been offered through the hospital, the patients' bedside environment may well be the first lengthy exposure for them to the cable medium. In the hospital, the only distraction (or link with the outside world) for patients is the television. Average television viewing time in the hospital is roughly *twice* that for the average home television viewer. When cable television is not present, patients are often frustrated with the lack of variety and poor quality of off-air television broadcasting. Certainly there is no place that U.S. citizens are more used to spending dollars than in the hospital.

Transition and opportunity

The hospital television market is undergoing a rapid transition. To date, most hospital television systems have been simple off-air VHF television systems operated on a pay-per-day or pay-per-stay basis. These pay television programs have traditionally been operated by local or national television rental service vendors and occasionally by the hospital itself, often through volunteer services. These television rental pay-per-day operations have provided tremendous profits to those few companies offering the service. Hospitals often gave away this revenue base because they considered themselves "non-profit" health care or charitable institutions and "not-for-profit" businesses.

Unlike businesses, hospitals have received reimbursement for their expenses based on their incurred costs, therefore never needing to look for profitable business opportunities. The revenues generated by patient television systems were considered "superfluous" even though an average size hospital could generate well over $1 million in revenues over the life of the system. However, in the past year, the mechanism by which hospitals receive their "pay check" has changed drastically due to the institution of Diagnostic Related Groups (DRGs). These DRGs require hospitals to be paid by insurers such as Medicare, based on the patient's diagnosis rather than the expenses they incur. If a hospital spends more than it gets paid, it must absorb the loss. If it spends less, it profits. Profits, if found, can now be kept, or at least used to defray unreimbursed expenses. This recent change has forced hospitals to re-define themselves as businesses often competing for patients in the marketplace. To hospitals, television service is one of the most visible services it offers to the patient/consumer, and cable service can provide a competitive edge.

Today, new systems are available that were designed specifically for the hospital environment. One such system utilizes computer-controlled addressable technology for total television control on a pinpoint basis for every patient in the hospital. Of particular importance is the fact that for the hospital environment, the selection of television sets is limited to those that specifically meet the hospital safety codes. This new system is designed for hospital-approved televisions. Previous cable television addressable tap-type systems have met with very limited success in the hospital environment. Hospital television systems are often required to provide pinpoint control for educational viewing on a "prescription" basis with verifiable billing, as well as for standard pay-per-day entertainment services. Fully interactive systems for entertainment and education are often required, utilizing single-coax cabling and existing hospital-approved television equipment, thereby limiting the type of equipment that can be installed to those meeting hospital safety codes.

'This new technology is unique in that television control is. . . obtained. . . by actual control of the microprocessor-tuned TV, turning each set into an intelligent receiver'

Although pay-per-view television for cable subscribers in the home has not had glowing success, in the hospital it has a history of acceptance. The hospital television market probably is unique in its use of pay-per-view television. For many years, prescription pay television for educational purposes, as well as movies-for-a-fee have been widely used. The patient in the hospital does not have the choice of whether or not to go to the movie theater. The potential for "impulse" buying is, therefore, very high.

The technology that allows for basic computer-controlled television functions required by hospitals has the built-in capability to handle pay-per-view at little or no additional cost. The otherwise enormous volume of pay-per-view subscribers required in order to be profitable in the home market is not needed to be profitable in hospitals. The system described herein is, in fact, a two-way addressable system, allowing for "interactive impulse" buying. Furthermore, the negative impact of the videotape movement on the home cable television subscriber market doesn't apply to the hospital television viewing market. Also, the problem of pay-per-view in the home based on a "crunch" of telephone call-ins is eliminated with this new hospital television computer system. Pay-per-view broadcasts can either be pre-programmed or bought on an impulse basis by the patient right through the television set.

Theory of operation

Bunting's hospital-based computer-controlled addressable television system is modeled after existing coaxial cable technology (see Figure 1). No telephone interface or second cable network need be installed. The system has been designed in this manner because virtually every hospital in the United States has an MATV coaxial cable system already installed.

The method by which interactive control is provided is called frequency division multiplexing. Because the frequencies for television control and the frequencies for TV-to-computer "talk back" are different, bi-directional communications can be established at the same time. The system's television control functions are placed between two low-band VHF channels and both talk back and addressability are in the "T" sub-channels (below VHF Channel 2). Although this design inherently lends itself to adaptability with sub-split type local area network (LAN) broadband distribution systems, adaptations can be made for different configurations of broadband coaxial cable-based LANs.

The heart of the system is the central television controlling computer. This microcomputer is designed around standard 8-bit processing technology. Memory for the system is provided in both hard and floppy disk with "modular" increases in memory easily available to fit the size and functional complexity of the system. This microcomputer can be linked to remote terminals throughout the institution or in a central control area off premises. Such remote links can be provided through hard wire or by modem depending upon the distances required between central and remote terminals. Multi-site facility control is therefore easily obtainable. In fact, a central office in a major metropolitan area could control every television in every hospital (and many other types of facilities such as hotels) with either billing on a local basis or centrally controlled. Upon installation of the microcomputer, the configuration of patient rooms is entered into a main data base, which is then utilized for purposes of both control and billing.

The microcomputer is tied into the RF distribution system through a series of command modulators. The modulators transform the digital information onto an RF carrier for distribution on standard MATV or CATV coaxial cable-based systems, within each institution. The central microcomputer system can address thousands of outlets. Once the digital signal is processed onto an RF carrier, it is distributed throughout the institution's MATV/CATV television system. This RF signal can be processed through a specially designed bi-directional amplifier, which allows for control from the computer to the television as well as for interactive talk back from the television to the computer. Although coaxial cable is, by its very nature, bi-directional, typical RF distribution amplifiers are one-way devices only. To eliminate this inherent limitation, the bi-directional amplifier is used.

When the digital signal has reached the appropriate outlet it then enters a uniquely designed addressable tap, which is activated to allow a subsequent television control frequency to pass through it into the television itself. Each addressable tap, whether it is designed for large- or small-screen television sets, is set right in the field. This is accomplished by a "dip switch," simplifying both installation and service procedures. Once the desired activity at that particular addressable tap has been accomplished, the central television computer continues its polling process until it reaches the next tap in which an activity is required. To the consumer, all of these events seem to occur instantaneously.

Central television computer control applies to either large-screen televisions or the more popular small-screen ones (5") at the bedside. In either case, once the digital television information is received inside the television, it is processed into a control signal for the microprocessor, which, in turn, controls all tuner function of the television set itself. This new technology is unique in that television control is not obtained through "jamming" a frequency at the tap through a series of oscillators, but by actual control of the microprocessor-tuned TV, turning each set into an intelligent receiver.

By this microprocessor-control method, each function of the television set can be controlled on a discrete basis. Total control of pay-per-view functions are therefore achievable. Additionally, a talk-back modulator in the television set allows the television controlled by the viewer to request a myriad of control functions to be implemented by the central television computer. This is what gives this hospital television system its unique ability to allow impulse pay-per-view buying of cable television channels, as well as pinpoint channel control for prescribed medical education programs. The interaction between patient and television is processed locally within the television. Once the television is polled by the central television computer, the information is uploaded. A special receive demodulator transforms the RF signal back to digital so the information can be processed by the computer for purposes of billing and tabulation. Interactive television systems such as these also allow for general system self-diagnosis, designed to simplify service in addition to locating malfunctioning or missing television sets.

Business considerations

Cable television service for hospitals in the United States may not only be a significant source of additional untapped revenues for cable television companies, but may in fact be one of the most significant marketing tools available today. Cable television service can be contracted for directly with the hospital or with existing television rental service companies. However, more often than not, hospitals look toward their local cable television franchisee not only to provide television programming service, but to recommend a vendor who can provide state-of-the-art equipment as well.

Even if the hospital asks the cable franchisee for a turnkey system, this should not pose a stumbling block to the cable television company, as administrative arrangements can easily be made with companies that function as television service management intermediaries. These management companies can provide all of the necessary in-house equipment financing and administration of the television rental programs, as well as collection of monies within the hospital for direct payment to the cable franchisee. A recent experience with one hospital requiring basic cable television service showed a minimal required increase to the patient of only 25¢ over their existing $2.50 per day rate for off-air television (a virtually negligible cost). The new computer-controlled television concept also allows for billing verification and on-site collection by the hospital if it chooses to do so with a minimal increment to current staff.

In fact, a desire for premium subscription service has generated a significant business opportunity for the local satellite master antenna television (SMATV) businesses, which have jumped at the opportunity. This alternative has generally been a last resort by the hospital, which may not feel capable of dealing with its local cable company. Manufacturers of automated tape-drive systems showing closed circuit in-house movies also have seen sales become quite brisk.

The hospital environment has never been more ready for cable than today. Flexibility in the way hospitals need to be approached will be a key to success. The time is now.

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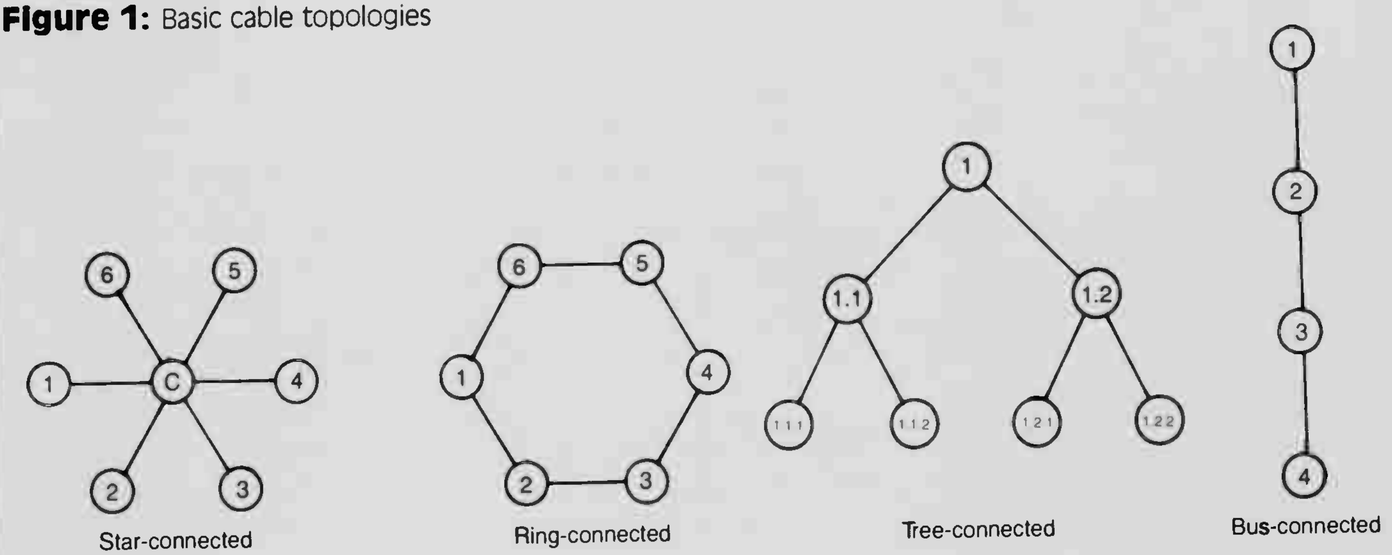
Figure 1: Basic cable topologies



Transmitting digital data on a broadband system

By Lawrence W. Lockwood
President, TeleResources

Use of broadband networks for data transmission is becoming more important because two industry giants have initiated the establishment of de facto standards. IBM, in connection with Sytek, has produced and standardized a network (IBM PC Network) employing RF broadband (CATV) technology. General Motors has also standardized a broadband network system, originally developed for use in its factories, offices, laboratories, etc., called MAP (manufacturing automation protocol).

Response to MAP has been astounding. A MAP user group has been set up under the sponsorship of the Society of Manufacturing Engineers. Currently over 200 companies, all customers for data processing and communications products, are members of that group and have endorsed MAP. MAP is racing to maturity at a speed indicated by the fact that

'Topology, cost and installation considerations favor single-cable . . . for the distribution of RF signals'

Figure 2: Simplified cable 'tree' system

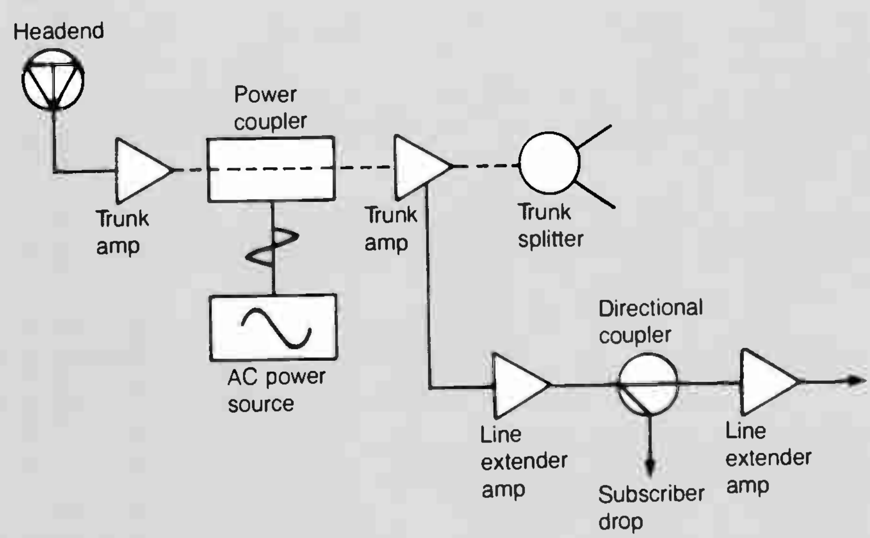
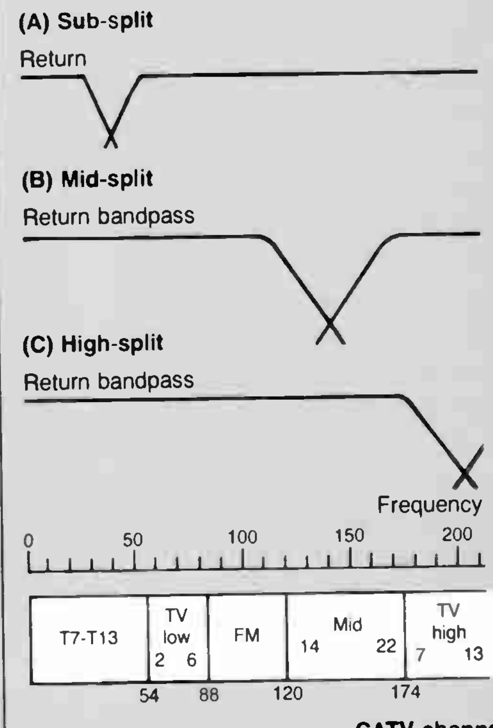
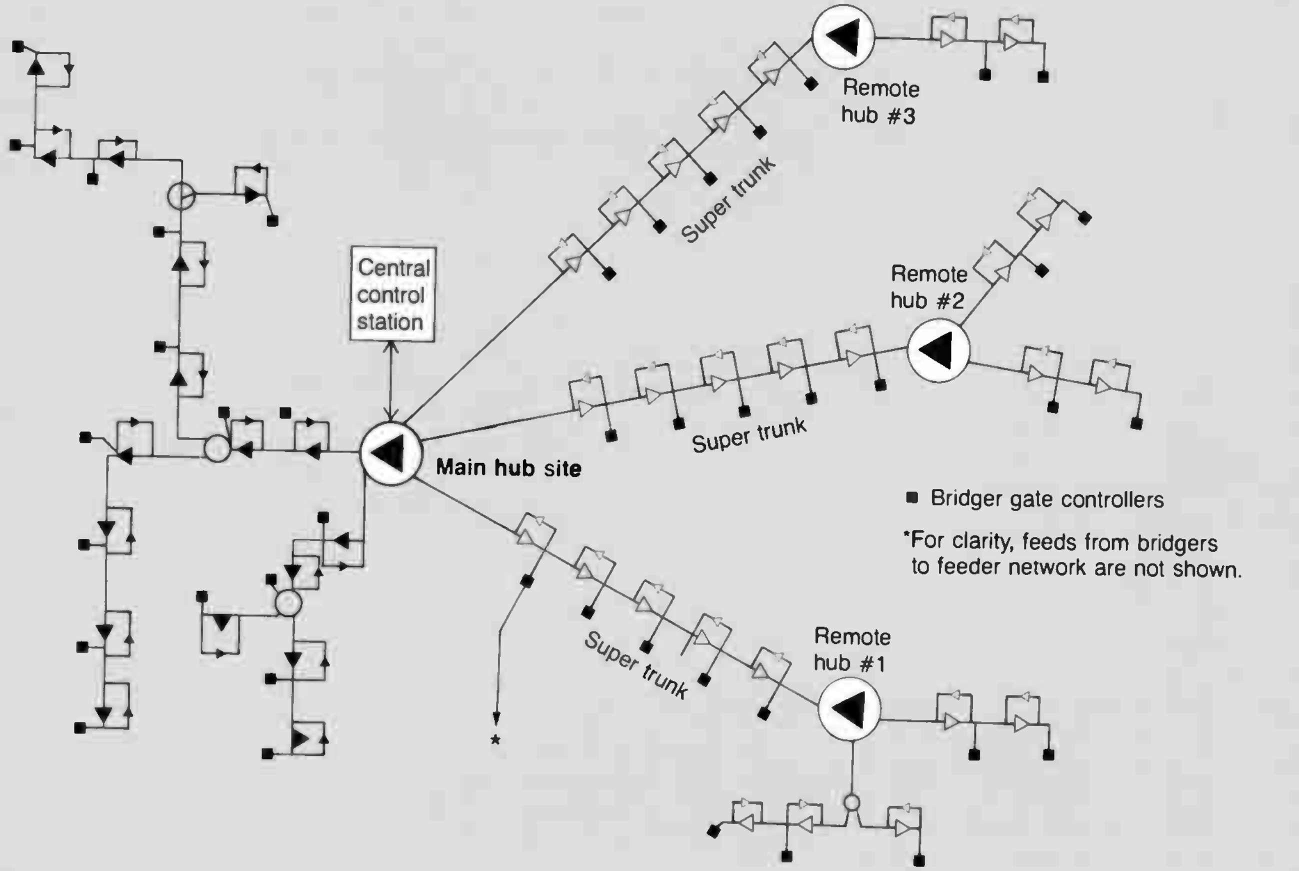


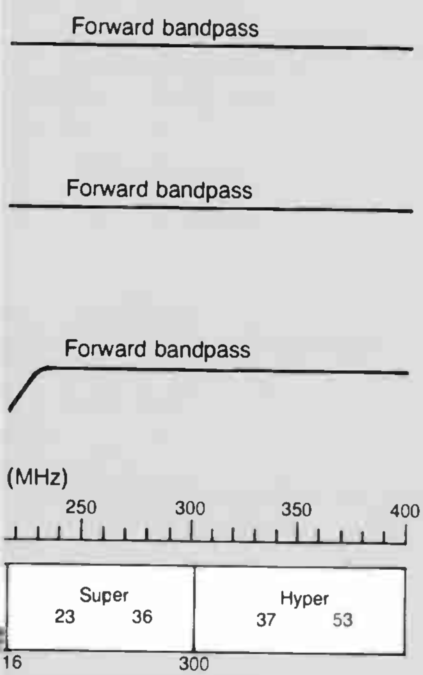
Figure 4: Single-cable schemes



Three different frequency schemes are typicall sub-split scheme offers the least amount of ban the headend—only about 25 MHz. The high-sp most.

Figure 3: Two-way CATV system

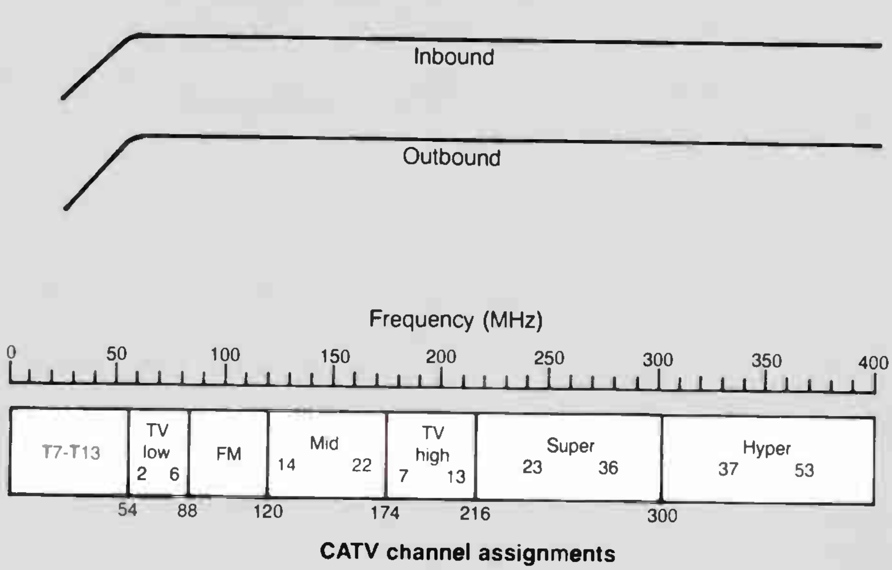




assignments

employed in single-cable networks. The width for signals traveling from the user to scheme, not yet standardized, offers the

Figure 5: Dual-cable bandpass



The available bandwidth for dual-cable topologies is shown. Because the cable is looped back at the headend, the full frequency spectrum is available for return (inbound) signals.

chips are in process and prices dropping. The current use of broadband technology in data transmission is increasing and its future is assured.

Throughout this article, references to a broadband network are generic—the reference is to a CATV network only when so noted. We'll begin our overview with a look at system parameters, including cable topology (network configuration), carrier-to-noise ratios (C/N), bit transmission rate, bit error rate and bandwidth. Then we'll finish with design practices and maintenance.

Cable topology

Cable topology, or architecture, concerns the physical arrangement and connectivity of the network's elements. For the uses considered here, the topologies are four basic types: star, ring (or loop), tree and the bus (see Figure 1).

The star topology is the one used by the phone companies. The center of the star is the local exchange and then trunks are used to interconnect many exchanges. In the past—and to a limited degree today, particularly in rural areas—the tree network was used. This was the "party line" phone system. There are distinct advantages (and disadvantages) to the use of the star topology in a broadband digital data distribution system. One most significant advantage is the lower C/N of this system as compared to the tree system. This is due to the fact that the return path of the tree system accumulates noise from all the branches of the tree. It acts as a funnel, collecting all the noise in the return and distributing it to the headend. This includes noise from many branches not used in a given data transmission.

Another advantage of the star system is security, both from data privacy and system operational reliability viewpoints. If one leg of a star fails, the system can still operate much nearer full system capability than if a portion of the trunk fails on a tree system.

The largest disadvantage to the star topology is initial cost. For a two-way CATV installation, the costs can run from approximately three to five times the amount per mile required compared to the use of the tree topology.

CATV systems generally use the tree system (Figure 2). The bus is simply a special case of the tree, in which there is only one trunk with no branches. The reason for the large use of tree topology in CATV was the logical use of this method in one-way (downstream) distribution of the only product under consideration at the time of CATV inception. This product, of course, was and is TV entertainment.

A representative diagram of a more complex two-way CATV system with several trunks and several hubs (such as would be required in covering a large area) is shown in Figure 3. Bridger switching is indicated in this diagram.

Single- vs. dual-cable considerations

All two-way broadband networks used for data distribution work similarly: transmitted carrier signals are sent to a central point (headend), where they are retransmitted to all points on the network. To accomplish this bidirectionality, two different cable schemes are used: single-cable and dual-cable. A dual-cable network uses one cable for the "inbound" carriers (towards the headend). The other cable, created through a physical loop at the headend, is used for the "outbound" carriers.

Single-cable schemes (widely used in CATV distribution) employ only one cable, which uses a frequency spectrum split to achieve bidirectional communications. Three frequency splits are used: sub-split, mid-split and high-split. The available frequency range is split into a "return" band (from the user to the headend) and a "forward" band (from the headend to the user). Figure 4 (A, B and C) illustrates the frequency allocations for each (assuming a 400 MHz system).

In the sub-split format, the total bandwidth of the return path is 25 MHz (5-30 MHz) and the total bandwidth of the forward band is 346 MHz (54-400 MHz), again given the 400 MHz overall design limit. This equates to 371 MHz of bandwidth available for communications services. The capacity, conforming to standard 6 MHz television bands, is 4 and 56 channels for the return and forward paths, respectively. All of the available bandwidth is not normally used with conventional video assignments; there are some bandwidth "gaps" that reflect other traditional channel uses.

Sub-split has been the most popular scheme with the CATV industry because it can support two-way communications and still offer the normal entertainment bandwidth.

Industrial or institutional trunks provided by the CATV industry are composed almost exclusively of single-cable networks. Both subsplit and mid-split are employed. (Rented bandwidth from CATV suppliers, incidentally, costs substantially less than similar Bell services.) Single-cable modems are typically required to interface directly to these industrial trunks, and gateways can be established to provide connections from privately owned local networks to the CATV network, both for dual- and single-cable formats (more about gateways later).

After a lengthy investigation, Atlanta-based Cox Cable Communications determined that the most efficient implementation for common communications user applications (such as sports briefs, stock market reports and news) and interactive applications (such as data transfers, home banking, home shopping and business) is a packetized data service employing a carrier sense multiple access with collision detection (CSMA/CD) protocol on a single-cable network.

Other multiple system operators have tested frequency-agile CSMA/CD modems in networks with as many as 20 amplifiers arranged in a forward cascade. The results have been reliable bit error rates ranging from one in 10^8 to one in 10^9 with carrier-to-noise ratios ranging from 15 to 27 dB. With error detection and correction, the bit error rate can be reduced to as low as one in 10^{12}.

Figure 4(B) illustrates the mid-split format. The bandwidth of the return path is 103 MHz (5-108 MHz) and the bandwidth of the forward path is 226 MHz (174-400 MHz), equaling 329 MHz of total bandwidth (again with a 400 MHz system). The 6 MHz channel capacity for mid-split schemes is 14 and 38 respectively, for the return and forward paths (again, not all available bandwidth is used).

For local networks, the mid-split format has been the most popular because of greater available bandwidth for the return path. This increased bandpass allows for more duplex data communications links.

Figure 4(C) illustrates the high-split scheme. This format divides the available bandwidth into two equal portions for the forward and return paths. The return bandpass is from 5 to 174 MHz and the forward bandpass is from 234 to 400 MHz.

The advantage of high-split is an increased return path allocation. However, none of the high-band VHF channels (7 through 13) can be used in high-split schemes since these frequencies fall into the guard band, which separates forward and return channels. High-split networks are more appropriate for pure data communications applications than for mixed-mode services (including video).

Figure 5 illustrates the dual-cable bandpass. The normal bandpass is from 54 to 400 MHz, for a total of 346 MHz. Channel capacity is the same as the forward bandpass of a sub-split network, or 56 channels.

The determination of which cable topology to use depends on the network applications. For example, a modem with a bandwidth efficiency of 2 bits per hertz (relatively efficient), supporting a T1 channel rate (1.544 MBPS) requires only 772 kHz of bandwidth (or roughly three-quarters of a megahertz). Thus, mid-split can support about 140 such links (full-duplex) per network using fixed-frequency modem technology. If frequency-agile technology is employed through a shared-channel contention scheme such as CSMA/CD, additional data channels, and subsequently more users, can be supported.

If the purpose of the network is to take off-air television channels and retransmit them on normal CATV channels to TV receivers, then sub-split or dual-cable must be used.

Dual-cable networks normally are not as cost-effective as single-cable networks, mainly because they require twice the cabling, hardware and amplifiers to support the same number of outlets. Thus, the selection of cable topology must be based on the required bandwidth/applications, costs, and on which scheme is easier to design, install, maintain and integrate with other common carrier networks. The single-cable network has half the number of components of the dual-cable, and thus can be retrofitted into most facilities (Figures 6 and 7). The dual-cable scheme requires twice the amount of hardware to support the inbound and outbound cables. Because of this, it may be difficult to find the space to mount or service all the dual-cable network components.

Amplifier selection, implementation and options are also directly affected by which network scheme is chosen. For the single-cable topology, sub-, mid- and high-split options are available from a large number of manufacturers.

Amplifiers used for dual-cable networks cost less than bidirectional amplifiers because no filters or return amplifier modules are required. However, since the dual-cable network requires twice the number of amplifiers, the single-cable network costs less overall. This is due to the offset in equipment price and the additional labor required to install two cables versus one. Some savings are possible if the amplifiers can support both the inbound and outbound cables within one housing and several manufacturers currently offer such amplifiers.

Dual-cable networks have been used for many years. However, topology, cost and installation considerations favor single-cable topologies for the distribution of RF signals in data processing, video, control and audio applications.

In any cable configuration for digital data transmission, the specifications of the IEEE 802 local network standards should be considered very carefully, since most data systems will have to work with other local area networks (LANs). These standards are yet not fully completed. However, the IEEE 802.4 local network standard specifies a single cable using either a sub-split, a mid-split or a high-split configuration. The sub-split standard has 5 to 30 MHz reserved for the inbound frequencies and 54 MHz and up reserved for the outbound frequencies. The mid-split is 5-108 MHz inbound and 162 MHz and up outbound. The high-split is 5-174 MHz inbound and 234 MHz and up outbound. However, it should be noted that the IEEE 802.4 preferred standard is mid-split. A single cable requires that an up-converter be provided in the headend to translate the inbound frequency to the outbound frequency.

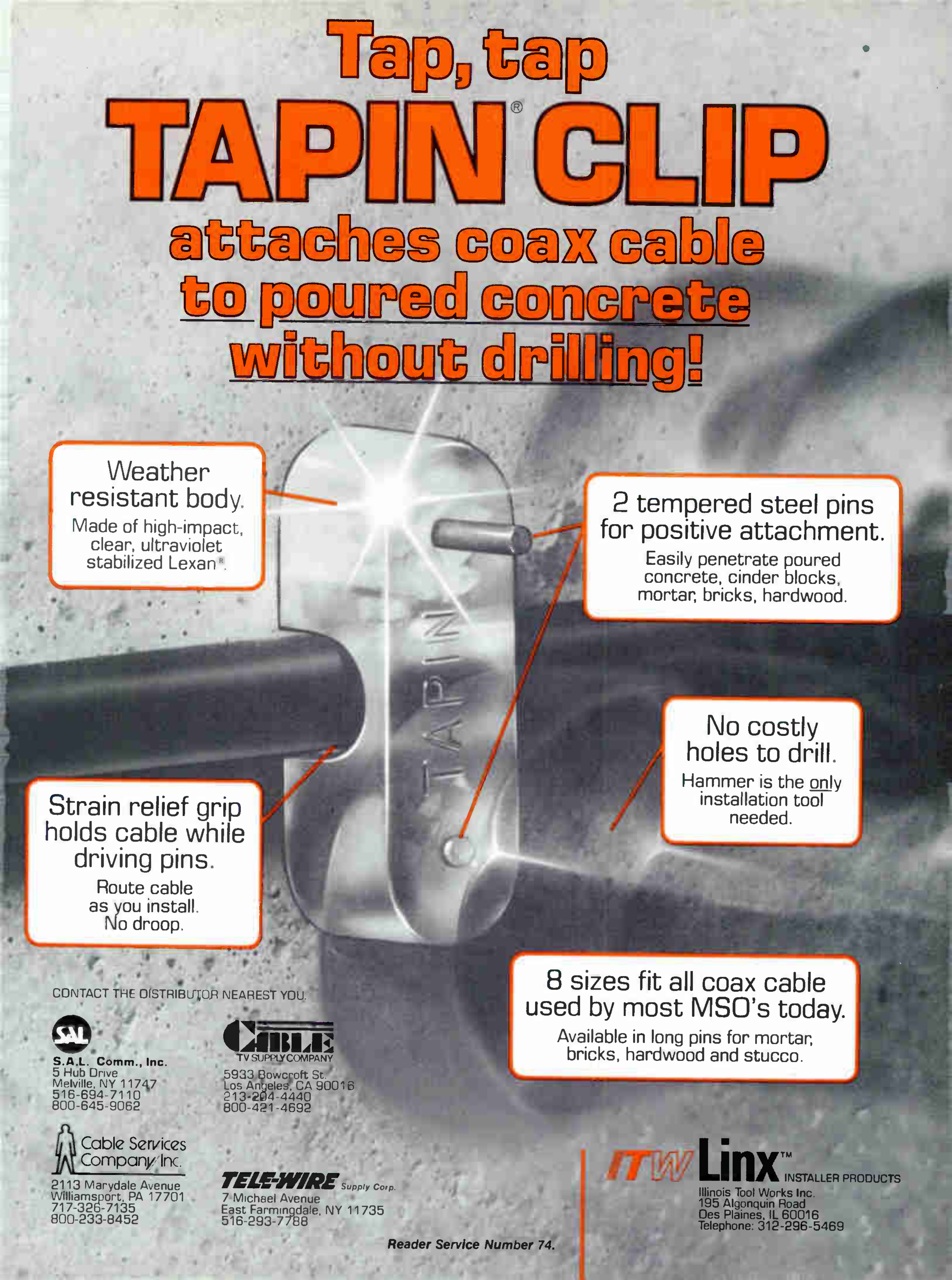
Gateways

Separate networks may be connected to a common trunk through devices called "gateways" (see Figure 8). These devices can be set to pass only a selected frequency band so that each user can be isolated from other users on the common trunk. One well-known system currently using this approach is in the New York area. Manhattan Cable Television provides a dedicated commercial trunk to serve the banking community in New York's financial district. This trunk is primarily used for passing data from one branch of a bank to another. Other gateways can connect to national data transmission networks such as TeleNet and Tymnet and extend the range of a local area network across the country. Any moderately sophisticated data network may also require interconnection of broadband and baseband networks. Different types of gateways will be used for these operations.

Transmission rates, bandwidth and C/N

Basically, there are only three ways an RF carrier can be modulated. Its amplitude, frequency or phase can be changed by the modulating signal. Since only modulation with pulses is being considered here, these would be referred to as OOK (on-off keyed), FSK (frequency-shift keyed) and PSK (phase-shift keyed). OOK is referred to here as AM (amplitude modulation) because in reality the modulation can be anything from an 80 percent to 100 percent change in the carrier amplitude.

The bandwidth required to transmit digital data on a pulse stream depends on the data rate (bits/sec) and the duty cycle of the pulse stream (pulse width). A pulse train having a data rate of n bits/sec occupies a bandwidth of approximately n hertz (in this treatment we consider only the fundamental frequency of the pulse and take a pulse duty cycle of 50 percent). However, when these pulses AM modulate a carrier, the occupied bandwidth is always equal to or greater than 2n hertz because the modulation process produces a frequency spectrum with sidebands. FSK, on the other hand, produces an occupied bandwidth that depends on how much the carrier is shifted. A commonly used expression for the modulated bandwidth (BW) of a periodic FSK signal is: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$$BW = 2\Delta f + 2B$$

where:
Δf = frequency deviation
$B = n$ = baseband bandwidth

If $\Delta f \gg B$, the bandwidth approaches $2\Delta f$. Thus, if one uses a wide separation of tones in an FSK system, the bandwidth is essentially just that separation. It is virtually independent of the bandwidth of the baseband binary signal. This is distinctly different from the AM case.

If $\Delta f \ll B$, the bandwidth approaches 2B. In this case, even with the tones chosen very close together, the minimum bandwidth is still that required to transmit an OOK (AM) signal; here the bandwidth is determined by the baseband signal.

The first case ($\Delta f \gg B$) is commonly called *wideband FM*, the second ($\Delta f \ll B$) *narrowband FM*. FSK is frequently used because it offers a signal-to-noise improvement over AM, but this is only true if Δf is large enough. We may specifically compare the FM and AM systems. We assume the same unmodulated carrier power and noise spectral density for both systems. (These quantities are measured here at the output of the IF amplifier.) With a 100 percent modulated AM signal, and the FM operating above threshold, the comparison is:

$$(S_O/N_O)_{FM} = 3\beta^2(S_O/N_O)_{AM}$$

where:
β = index of modulation = $\Delta f/B$

The results presented in the following examples are measured values and are somewhat lower than predicted by this theory. A commonly used criterion is that when $\Delta f/B = 0.6$, FSK is approximately equal to AM. Thus, in order to gain any significant improvement in signal-to-noise ratio using FSK, the occupied bandwidth must be greater than the bandwidth of an AM signal. If $\Delta f/B = 1$, the occupied bandwidth of FSK is two times that of AM and the signal-to-noise improvement is approximately 3 dB (the theoretical improvement would be expected to be $3\beta^2 = 3$, or 4.8 dB). Almost the same performance of non-coherent FSK can be obtained by using AM with a synchronous (phase-locked) demodulator.

Bit error rates

Another comparison can be made by comparing the differences in calculated bit error probabilities for the different types of modulation. AM has the poorest performance, and FSK with non-coherent detection (not using a phase-locked loop detector) has an improvement of about 2.5 dB in the C/N for the same bit error rate (BER). Coherent PSK, however, is 3.5 dB better than FSK. The problem is that PSK is sometimes difficult to demodulate, especially when a large number of non-coherent signals must be detected. This occurs when a receiver using a phase-locked loop (PLL) acquires the PSK signal. The PLL cannot tell if the phase it starts with is 0° or 180° unless some method of determining this is built into the data.

Complicating things further is the problem of acquiring a signal rapidly and then being able to remain at 0° when a long 180° data pulse is received. If only one signal such as that from a space probe is being received, this is not a problem because for these applications the phase-locked loop can have a very long time constant. When a new signal of unknown phase must be locked on to every few milliseconds, however, the loop must be relatively fast and also change phase and lock onto the 180° data pulse when it occurs.

These factors make PSK demodulation somewhat more difficult than other schemes. A plot of error rate versus C/N for a typical FM data transmission channel is shown in Figure 9. The C/N is measured in the bandwidth of the data modulated carrier and should not be confused with C/N specifications for a CATV system, since these specs are measured for the bandwidth of a TV modulated channel (much wider than the typical data modulated channel). This plot is representative of the general performance range of products on the market.

In many commercially available products, a 10^{-8} BER may be obtained in the products' normal operating range of C/N ratios.

In maintaining the BER during operations, two capabilities must be present: 1) the capability to *detect* that an error has occurred, and 2) the capability of *correcting* that error. There are many accepted methods of performing bit error control, ranging from simple "checksum" techniques to cyclic redundancy checking (CRC), Trellis coding and many more—some quite sophisticated. All error control methods, however, use "overhead," which really means bandwidth is used for control that cannot be used for data. Therefore considerable care must be taken, examining the C/N, bandwidth, bit rate, etc., before a BER control method is specified for a system.

Design practices

We have now addressed many considerations necessary in the design of a reliable two-way broadband data transmission system. However, in designing a broadband network of any size, the network engineer has to design for future expansion and ensure that the output level at all the network taps is at a specified amplitude and tolerance. As well, physical building layouts and conduits may dictate a very restrictive topology. Single-cable networks fit into the majority of buildings, especially if the network is to be installed in an existing facility.

Another important design consideration in the dual-cable versus single-cable choice is quite elemental. In the aerial portion of the system, if there is not physical room on the poles for another cable, can it be overlashed?

An important element in the design of a system is the specification of a bridger switcher system (more about this under maintenance).

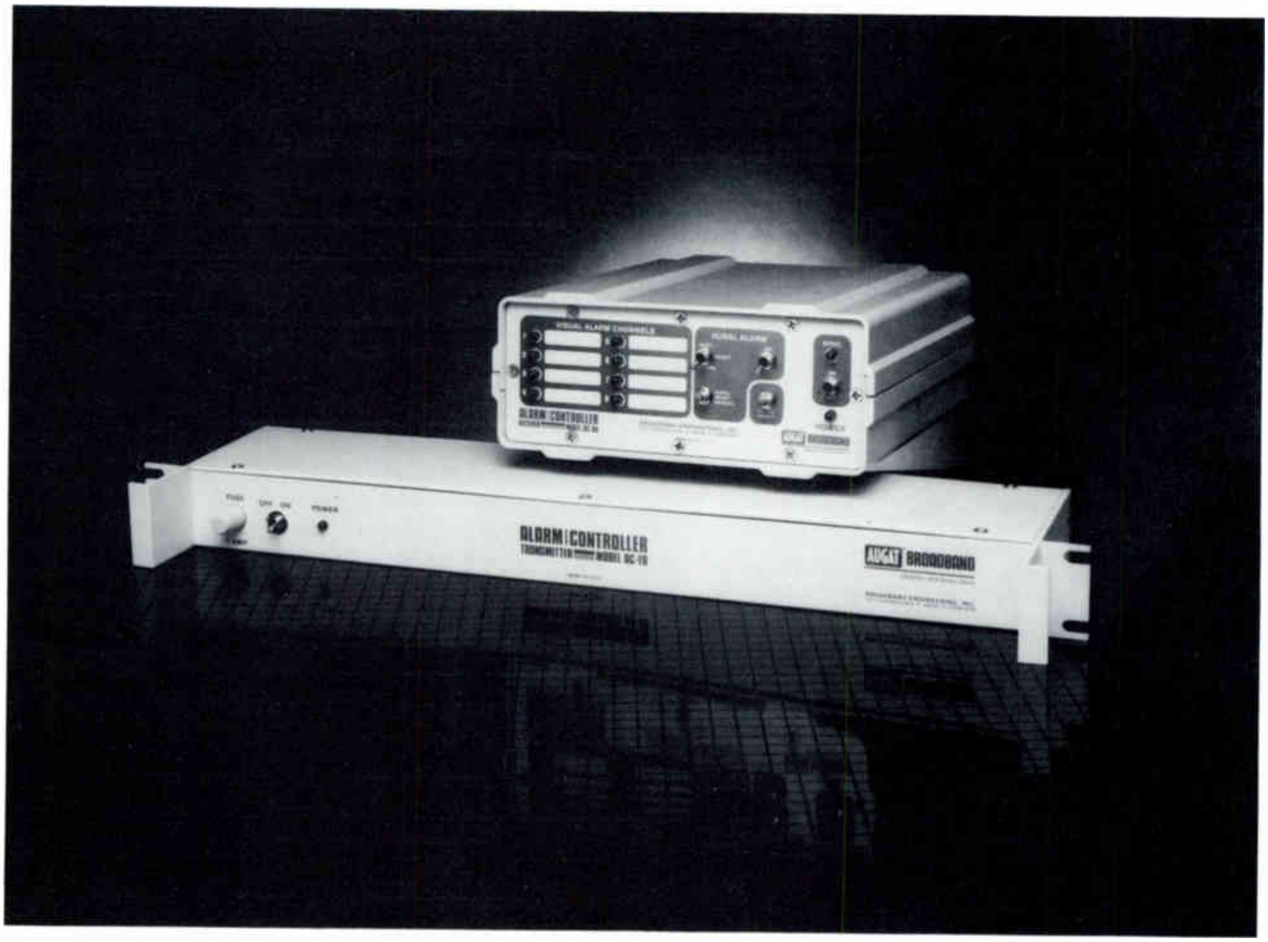
If voice or other sensitive data is to be used on the system, then security provisions should be considered. Presently, there are two methods in use on broadband systems that are adequate into the foreseeable future. The federally approved data encryption standard (DES), which is widely used in data transmission by many customers (e.g., banking and other financial transactions), may be specified. The other method supplied by some modem manufactuers is more analog in nature. In essence, it borrows a technique from the spread spectrum field—frequency hopping. These modems are usually termed "frequency agile."

Another factor to be analyzed in specifying system design is the practicability of the use of fiber optics in at least some portions of the system. If the system transmission is to be all digital, then fiber optics should be seriously considered, particularly for long trunk runs. Enough practical field experience in this area exists around the world to justify such a conclusion. The advantages are too numerous to list here and are generally well-known, but in a broadband system one of the most important is its immunity to RFI, and in a tree topology CATV system this is of great importance particularly regarding ingress. Recent laboratory work performed by Bell has shown that the practicability of use of fiber in the downstream entertainment services is closer to field use than many engineers realize. Using single-mode fibers, data rates have been demonstrated sufficient to carry 200 TV signals on a single fiber over a distance of 42 miles. It is also of some significance that an ANSI (American National Standards Institute) committee (X3T9.5) has developed a standard for a 100 MBPS fiber-optic data transmission token ring.

Maintenance

A good carrier-to-Gaussian noise ratio must be maintained at all times. Almost all CATV systems have some aerial portions and these portions are particularly subject to outdoor hazards, such as fallen trees or electrical storms. Experience has shown that interference caused by ingress from a 60 cycle power source is quite common (especially in sub-split systems). Power company equipment is often quite old and a bad storm can disrupt old and degraded grounding, put hair cracks in insulators, etc.; none of which generally interferes with the distribution of power but rather produces interference because of ground loops, corona and too many others to list. Therefore, in maintaining a two-way data system's performance, close and continuous work with the power company is required.

At this point a few remarks regarding bridger switching are in order. The use of a


ALARM CONTROLLER
AUGAT BROADBAND

switcher is shown in the block diagram in Figure 3. This system has a remotely addressable electronic switch at each trunk-bridger station. This configuration may be overkill (a switch at *each* station) depending upon the distribution system design. These switches allow the headend computer to interrupt reverse signal paths on each feeder in the system. These switches do not affect the reverse trunk in any way. However, reverse trunk switches may be used to minimize the number of reverse amplifiers converging at the headend.

Since the upstream path of the bidirectional CATV cable network collects and accumulates noise and ingress from all points in the system, these levels at the headend upstream output may be high enough to cause significant error degradation of upstream data messages. To minimize this effect, each trunk-bridger amplifier in the cable network may be provided with a gating switch in the return (upstream) signal path.

In one mode of usage of bridger switching, the switch will be normally left open in all trunk bridgers, thus disconnecting all feeders (except the one with the data source) and leaving only the trunk line as an upstream noise source. Upon command from the control center, the switch in a particular trunk bridger station will be closed to permit upstream response from this source. This mode of opera-

Figure 6: Single-cable topology

A typical single-cable plan for a four-building bidirectional, supporting channels on different central hub, or headend, receives all trans frequencies.

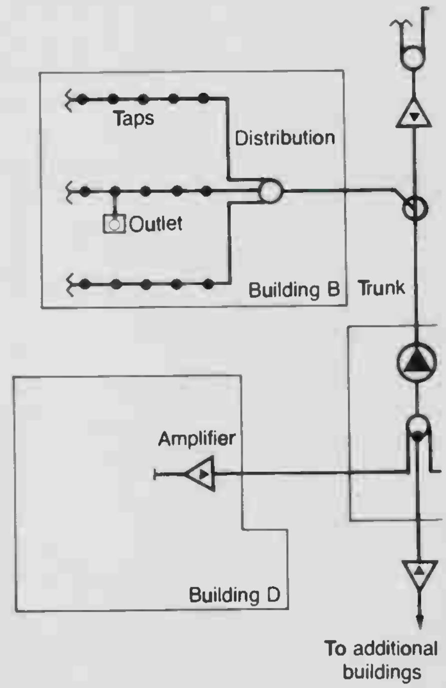
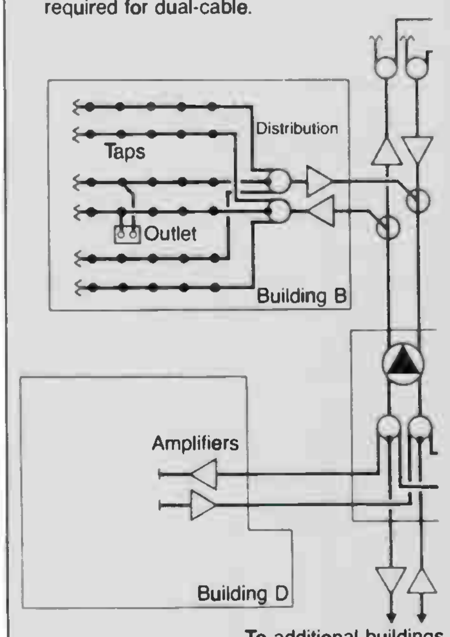
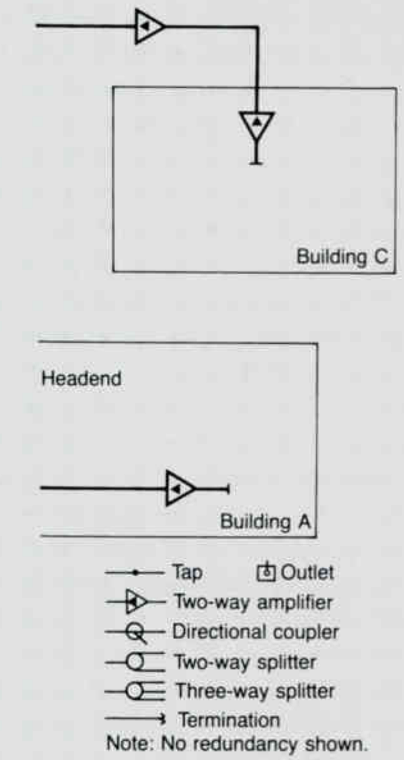


Figure 7: Dual-cable topology

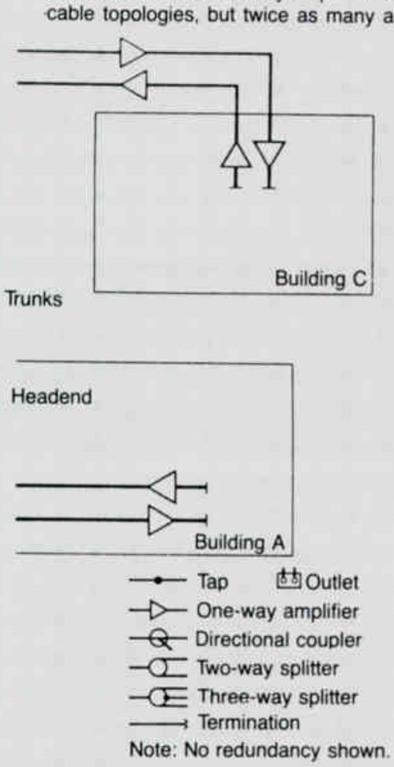
A comparison with Figure 6 shows the added dual-cable configurations in the same physical somewhat cheaper than those used in single-required for dual-cable.



local area network is shown. Each amplifier is
frequencies in both directions at once. The
missions and retransmits them on different



components, cabling and complexity of
environment. The one-way amplifiers are
cable topologies, but twice as many are



tion is most particularly effective in a system using a polling protocol. In some bridger switching systems available, the command does not cut off the extender completely but inserts a pad in the extender portion—usually about 6 dB.

In addition to the operational advantages, maintenance considerations are such that it is generally agreed that a good upstream data system cannot be maintained with any degree of confidence without the use of a gating switch. Whether the complete cutoff system or the pad insertion system should be used is open to debate. There are advantages and disadvantages to both. For maintenance purposes alone, the pad insertion method may suffice to locate the bad extender portion and use of it will not drop any portion of the upstream while maintenance is performed. However, if a bad extender portion is located, the cutoff system would be required to eliminate the offending extender portion while maintenance is being performed since the whole upstream system will be inoperable with just one bad portion (one of the disadvantages of the tree topology as opposed to the star topology).

Recommendations

Some general recommendations for the design of a broadband data distribution system may be drawn from the above. The most desirable topology is the star topology. Indeed in Europe many new CATV/data systems are being designed in this manner using fiber optics. However, if the tree topology is to be used for a data system, the best scheme to use is mid-split. It has generally been shown that in order to provide adequate service a bridger switcher system is necessary.

Figure 8: Interconnecting LANs with gateways

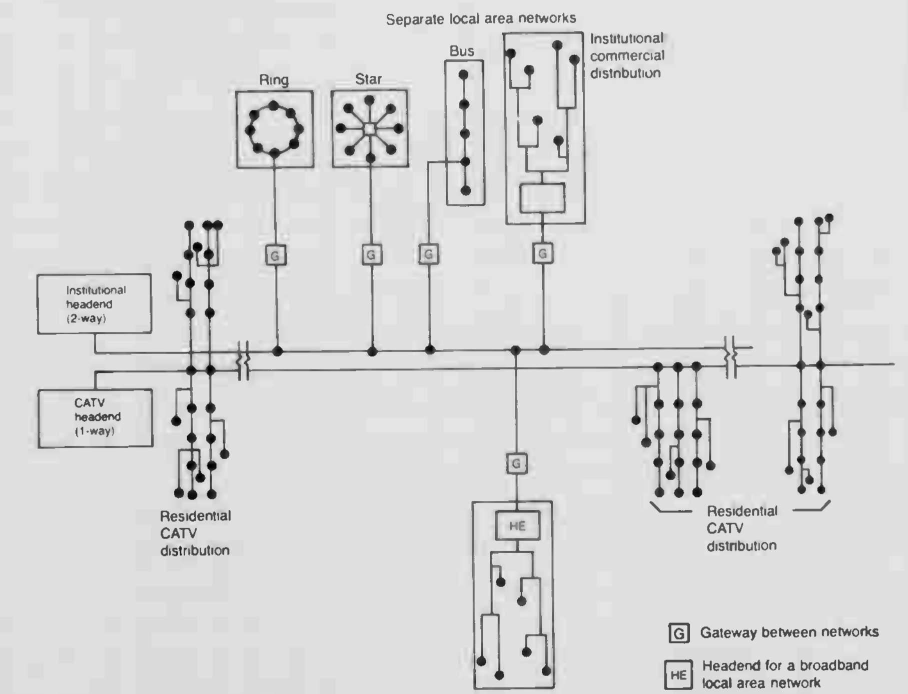
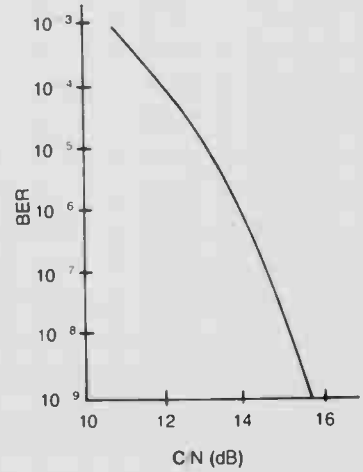


Figure 9: Bit error rate vs. C/N for FM transmission



Sources

1. *Computer Networks and their Protocols*, D.W. Davis, et al., Wiley-Interscience, 1979.
2. "Design Issues in Broadband Local Networks," E.B. Cooper, et al., *Data Communications*, McGraw-Hill, February 1983.
3. "Selection of an Optimum Modulation Scheme for CATV Data Transmission," J. Grosjean, *NCTA Proceedings*, 1982.
4. *Information Transmission, Modulation and Noise*, Mischa Schwartz, McGraww-Hill, 1980.
5. *Electronics Week*, McGraw-Hill, April 15, 1985.

Cable Tec-Expo '86 Exhibitors

Alpha Technology Inc.
Augat Broadband Communications Group
Brad Cable Electronics Inc.
Burnup & Sims Cable Products Group
Cable West Corp.
CableTech Center Products Inc.
Cardiff Publishing/Cable TV Business
C-COR Electronics Inc.
Channel Master
Communications Technology
ComSonics Inc.
CWY Electronics
Drop Shop, The
Durnell Engineering
Eagle Comtronics Inc.
FM Systems Inc.
General Electric Co.
General Instrument/Jerrold Division
Gilbert Engineering Co. Inc.
Hughes Aircraft Co.-Microwave
Jerry Conn Associates Inc.
Kennedy Cable Construction Inc.
Lemco Tool Corp.
Lode Data Corp.
M/A-COM Cable Home Group
M/A-COM Mac Inc.
Magnavox CATV Systems Inc.
Oak Communications Inc.
Pico Products Inc.
Pioneer Communications of America Inc.
PTS Corp.
Pyramid Industries Inc.
Quality RF Services Inc.
Regency Cable Products
Reliable Electric/Utility Products
RF Analysts Inc.
RF Technology Inc.
Riser-Bond Instruments
RMS Electronics Inc.
RT/Katek Communications Group
Sachs Communications
Scientific-Atlanta Inc.
Signal Vision Inc.
Standard Communications Corp.
Superior Satellite Engineers
Tele-Wire Supply Corp.
Telecrafter Products Corp.
Texscan Corp.
Times Fiber Communications Inc.
Toner Cable Equipment Inc.
Trilogy Communications Inc.
Triple Crown Electronics Inc.
Wavetek
Westinghouse/W&S Systems Co.
Zenith Electronics Corp.

CABLE-TEC EXPO 1986
AND ANNUAL ENGINEERING CONFERENCE
FACT SHEET

DATES: Annual Engineering Conference, June 12, 1986

Cable-Tec Expo, June 13-15, 1986

LOCATION: Phoenix Convention Center and Civic Plaza
Phoenix Hyatt Hotel

HISTORY: Cable-Tec Expo '86 is the fourth annual convention/tradeshow sponsored by the Society of Cable Television Engineers, Inc., combining a wide variety of technical programs, hands-on training, and breakout technical workshops with non-commercial hardware exhibits. The Annual Engineering Conference will be the SCTE's tenth yearly conference dedicated to current engineering issues, FCC compliance, and technical management. In addition, the Society has presented more than 55 technical programs in cities across the United States over the past fifteen years, attended by more than 10,000 engineering and technical personnel from the broadband communications industries.

ATTENDANCE: Attendance is open to individuals within the CATV industry as well as anyone involved in the broadband communications industries. Over 1,000 registered attendees are expected from all levels of the cable television and related businesses: Persons engaged in engineering, construction, management, design, installation, technical direction or administration of cabled broadband, microwave, broadcasting, satellite, institutional, telephone, data or closed-circuit communications systems; persons employed by educational institutions, federal, state, and local governments, regulatory agencies, and related trade organizations are invited.

PROGRAMS: The Annual Engineering Conference will be packed with six hours of technical and management papers presented by many of the industry's engineering leaders. The annual membership meeting, scheduled during the conference luncheon, will afford attendees the opportunity to meet members of SCTE's Board of Directors. Awards will also be presented at the luncheon for "Member of the Year" as well as the "President's Award".

The 2 ½ day Cable-Tec Expo follows the Annual Engineering Conference and combines practical workshops with "hands-on" technical training and hardware displays. The format features many schoolroom style workshops to choose from. Exhibits will be closed during workshop sessions in order to guarantee maximum attendance and participation.

EXHIBITS: The Exhibit floor has been designed to provide the industry's suppliers with the opportunity to present live technical demonstrations of their products in a relaxed and non-commercial atmosphere.

Approximately 100 hardware exhibitors are expected to participate in the 1986 Cable-Tec Expo. Exhibits will include all types of products, supplies, services, and equipment used in the design, construction, installation, maintenance/repair, and operation of cable television systems. The exhibit floor will also feature educational meeting rooms for further equipment demonstrations.

SPECIAL EVENTS: Phoenix area cable industry manufacturers will offer tours of their facilities to Expo attendees. Saturday night, June 14, features the main social event-the Expo Evening-a steak barbecue and hayride in the Phoenix desert. Dress for the Expo Evening will be western/casual. Sunday, June 15, is scheduled for administration of the Broadband Communication Technician and Engineer (BCT/E) Professional Designation Certification program examinations.

PRELIMINARY PROGRAM

Expo Workshops to Include:

·Developing An Effective Preventive Maintenance Program
Ron Hranac, Jones Intercable

·Audio and Video Baseband Signals (BCT/E Prep Course)
Paul Beeman, MTV Networks

·One-On-One With the FCC
Field and Cable Branch Engineers

·CPR and Industrial First Aid
American Ambulance Corp.

·Basic Electronics and Electricity
National Cable Television Institute (NCTI)

·Implementing Videocipher Descramblers and Stereo Headend Equipment
Dr. Mark Medress, M/A-Com
James Farmer, Scientific-Atlanta

Engineering Conference

·Technical Compliance in a Changing Regulatory Environment
Panel Chairman-Wendell Bailey, NCTA

·Increasing Communications Between Engineering and Management, Part II
Panel Chairman-Robert Luff, United Artists Cablesystems

·Lightning and Grounding
Dr. Rodney Bent, Chief Consultant for NASA

·Pay-Per-View Revisited
Panel Chairman-Dave Archer, Viacom

·Developing Technical Management Skills
Phoenix University Faculty

Plus: Two More Technical Workshops!

SCHEDULE OF EVENTS

Wednesday, June 11, 1986

6:00 P.M. - 8:00 P.M.	Engineering Conference Registration

Thursday, June 12, 1986

9:00 A.M. - 5:00 P.M.	Engineering Conference and Annual Membership Meeting
6:00 P.M. - 8:00 P.M.	Expo Registration

Friday, June 13, 1986

8:30 A.M. - Noon	Expo Registration Opening General Session Hands-On Workshops
Noon-5:00 P.M.	Exhibit Hall Open

Saturday, June 14, 1986

8:30 A.M. - Noon	Hands-On Workshops
Noon - 5:00 P.M.	Exhibit Hall Open
7:00 P.M. - 11:00 P.M.	Expo Evening featuring a steak barbecue and hayride in the Arizona desert.

Sunday, June 15, 1986

8:30 A.M. - Noon	BCT/E Certification Program Examinations Hands-On Workshops Chapter Development Meeting

INSTRUCTIONS

1. **Deadline:** Advance Cable-Tec Expo 1986 registration forms must be received by the SCTE National Headquarters on or before May 15, 1986. Forms received after that date cannot be processed and will be returned to sender. If you do not pre-register for the Cable-Tec Expo in advance, you must register on-site in Phoenix.
★ Use a separate form for each individual.
★ Appropriate registration fees must be enclosed for this form to be processed.
★ Hotel reservations must be sent directly to the Phoenix Hyatt and must also be received by May 15, 1986. Please use the enclosed reservation card for your convenience.

2. **Registration Cancellations:** All cancellations must be received in writing by the SCTE National Headquarters on or before June 1, 1986. Substitutions will be accepted until June 10, 1986. A $50.00 cancellation charge is applicable to all registrations cancelled after May 15, 1986. NO **REFUNDS WILL BE GRANTED AFTER JUNE 1, 1986.**

4. Telephone requests for cancellations and substitutions will not be accepted by the SCTE National Headquarters. All requests for cancellations must be submitted in writing and received before June 1, 1996 and all requests for substitutions must be received before June 10, 1986.

5. Return the Cable-Tec Expo 1986 pre-registration form and the appropriate registration fees to:
SCTE
P. O. Box 2389
West Chester, PA 19380
(215) 363-6888

6. Please make flight and rental car reservations through Prestige Tours at (215) 322-4140.

7. All correspondence concerning hotel reservations should be made directly with the Phoenix Hyatt Hotel at (602) 252-1234.

CABLE-TEC EXPO 1986 REGISTRATION RATES

Event	Until May 15, 1986		On-Site	
	Member	Non-Member	Member	Non-Member
Engineering Conference and EXPO★	$195.00	$350.00	$215.00	$370.00
EXPO only★	$145.00	$250.00	$165.00	$270.00
Engineering Conference	$120.00	$200.00	$140.00	$220.00

ADMISSIONS: Admission to all events will be by color coded badges received at the Registration Desk upon arrival

★Includes 1 ticket for the Expo Evening. Additional tickets will be available for $50.00 each.

Lunch Service at special prices will be available Friday and Saturday on the exhibit floor for your convenience.

TRANSPORTATION: SCTE has designated Prestige Tours as the Expo's official agent. Discounted and "Supersaver" air fares have been arranged and Alamo Rent-A-Car is offering special rates to attendees (see enclosed brochures). Transportation from the Phoenix airport to the hotel can be economically gained through taxi or airport limo for approximately $6.00.

PLEASE NOTE-Although you may be able to locate equally priced air fares through your local travel agency, SCTE receives credit for all flights booked through Prestige Tours. Your doing so will greatly help us cut costs in flying out engineers from the FCC and instructors for Expo workshops.

LODGING: The Phoenix Hyatt is offering special attendee room rates: ★Single-$50.00
★Double-$59.00★
★Double rooms shared by 2 for the unbeatable rate of $29.50 per night each. Please make room reservations directly through the Phoenix Hyatt. Use the enclosed reservation card for your convenience.

ENTERTAINMENT: The Phoenix Civic Center will provide attendees with guides to area dining, nightlife, and sightseeing activities.

SPONSOR: Society of Cable Television Engineers
P.O. Box 2389
West Chester, PA 19380
(215) 363-6888

MEMBERSHIP APPLICATION

SCTE

I hereby apply for membership in the Society of Cable Television Engineers, Inc., and agree to abide by its by laws. Further member materials will be mailed to me within 45 days. Payment U.S. Funds is enclosed. I understand dues are billed annually.

SCTE is a 501(c) (6) non-profit professional membership organization. Your dues may be tax deductible. Consult your local IRS office or tax advisor.

Make check payable to SCTE. Mail to:

SCTE
P.O. Box 2389
West Chester, PA 19380

*/** Applications without payment will be returned. Applications from outside U.S./Canada/Mexico, enclose additional $40 (U.S.) to cover mailing expenses. Sustaining Membership is non-voting and not corporate or group-type category.

APPLYING FOR:
_______ INDIVIDUAL @ $40*
_______ SUSTAINING @ $250**

Please print or type information. Data will be used exactly as it is submitted here.

NAME: ______________________________ (First / Initial / Last)
EMPLOYER: ____________ (Company Name) TEL.: ____________ (Area Code-Number)
CO. ADDRESS: ____________ (Street PO / City / State / Zip)
USE HOME ADDRESS? ____________ (Street/PO / City / State / Zip)
YOUR TITLE: ____________ FOR HOW LONG? ____________
YOUR SIGNATURE: ____________ DATE: ____________

Complete the information. Enclose full payment or charge to MasterCard/VISA shown below:

NAME ON CARD: ____________ EXP: ____________
MASTER CARD NO: ____________ IB No.: ____________
VISA NO: ____________
SIGNATURE FOR CHARGE AUTHORITY: ____________

SPONSOR (Check **One**)
☐ SCTE CHAPTER OR MEETING GROUP ____________
☐ INDIVIDUAL MEMBER
NAME ____________
MEMBER # ____________

OFFICE USE:

CABLE-TEC EXPO REGISTRATION

Everyone must register. ID badge must be worn and visible at all times in workshops and on the EXPO floor. To avoid delay, fill in all information requested. Full & complete payment must be sent with this registration form. Use Official Hotel Form for room arrangements.

Registration Fee includes technical workshops, EXPO and hospitality/entertainment event. SCTE individual Active, Senior and Charter Members must provide Member ID Number. New individual Members applying with registration, must attach SCTE Member Application and payment of dues. If you wish to register more than one (1) person, please make copies of this form.

Spouse registration may be made on-site.

PRE-REGISTRATION Form must be received before May 15, 1986.
REFUND/CANCELLATION: A $50 cancellation charge is applicable to all registrations cancelled after May 15, 1986. NO refunds given after June 1, 1986.

YOUR NAME: ____________ NICKNAME: ____________
TITLE: ____________ TEL. #: ____________
COMPANY: ____________ SCTE MEMBER #: ____________
ADDRESS: ____________ (Street/PO Box / City / State / Zip)

Fees: (Until May 15, 1986)	Member	Non-Member
Engineering Conference and Expo	$195.00	$350.00
Expo only	$145.00	$250.00
Engineering Conference	$120.00	$200.00

CHARGE CARD INFORMATION - Complete for MasterCard/Visa shown below:

NAME ON CARD: ____________ EXP. DATE: ____________
MASTER CARD NO: ____________ IB NO: ____________
VISA NO: ____________
SIGNATURE FOR CHARGE AUTHORITY: ____________

NOTE: There are no further discounts available. SCTE Sustaining Membership qualifies only ONE (1) person to register at SCTE Member rate. Additional personnel must be registered at Non-Member fee or submit application for membership with full payment.

MAIL TO: CABLE-TEC EXPO
P. O. Box 2389
West Chester, PA 19380
(215) 363-6888

YOUR TITLE:

Check one most appropriate

_____ Installer/Technician
_____ Technician
_____ Chief Technician
_____ Engineer
_____ Regional/Field/Staff Engineer
_____ Engineering Dept. Mgr.
_____ VP-Engineering
_____ Other: ____________

EMPLOYERS PRINCIPAL BUSINESS

Check one ONLY

_____ Cable TV Operating System
_____ Construction
_____ Consultant/Engineer
_____ Manufacturer/Agent
_____ Government
_____ Telephone Company
_____ Other: ____________

COMMUNICATIONS TECHNOLOGY

Name ____________________

Title ____________________

Company Name ____________________

Address ____________________

City ____________ State ____________ Zip ____________

Phone Number (   ) ____________________

FREE INFORMATION

Reader Service Card

March 1986 (Valid until May 1986)

Simply circle the number(s) below corresponding to products of interest!

1 **SCTE Cable-Tec Expo '86**

2	11	20	29	38	47	56	65	74	83	92
3	12	21	30	39	48	57	66	75	84	93
4	13	22	31	40	49	58	67	76	85	94
5	14	23	32	41	50	59	68	77	86	95
6	15	24	33	42	51	60	69	78	87	96
7	16	25	34	43	52	61	70	79	88	97
8	17	26	35	44	53	62	71	80	89	98
9	18	27	36	45	54	63	72	81	90	99
10	19	28	37	46	55	64	73	82	91	100

MARCH

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   __/__/__
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3. My firm's primary business activity is:
   - ☐ Independent Cable TV System
   - ☐ MSO (two or more Cable TV Systems)
   - ☐ Cable TV Component Manufacturer
   - ☐ Other ____________________ (Please describe)

CT 3/86

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Name ____________________

Title ____________________

Company Name ____________________

Address ____________________

City ____________ State ____________ Zip ____________

Phone Number (   ) ____________________

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4	13	22	31	40	49	58	67	76	85	94
5	14	23	32	41	50	59	68	77	86	95
6	15	24	33	42	51	60	69	78	87	96
7	16	25	34	43	52	61	70	79	88	97
8	17	26	35	44	53	62	71	80	89	98
9	18	27	36	45	54	63	72	81	90	99
10	19	28	37	46	55	64	73	82	91	100

MARCH

Is this copy of **Communications Technology** personally addressed to you?
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   - ☐ Cable TV Component Manufacturer
   - ☐ Other ____________________ (Please describe)

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RF/microwave engineering program

EEsof Inc. has introduced Touchstone 1.4, the newest generation of its linear simulator program for design, analysis and optimization of RF/microwave circuits. Touchstone 1.4 provides an extensive array of new element models, among which are asymmetric coupled-microstrip transmission lines; six and eight-finger interdigital (Lange) couplers; a proprietary VIA-hole model; a linear taper in microstrip; improved microstrip Tee junction; microstrip radial line; microstrip slit and gap models; and three additional microstrip bend models.

Engineers can construct circuits from a wide element catalog, including microstrip, stripline, MMICs, waveguides, substrates and electronic device models. The user can perform some 200 measurements, including noise figure; stability; impedance mapping; differential phase shift; group delay; gain and loss; and all S-parameter measurements. Algebraic calculation on networks can also be performed with results used for display and optimization. In addition, up to 25 variables can be optimized simultaneously.

For further information, contact EEsof Inc., 31194 La Baya Dr., Suite 205, Westlake Village, Calif. 91362, (818) 991-7530.

Addressable MDU system

AM Cable TV Industries Inc.'s E-Com Products Division has introduced a fully addressable subscriber-friendly tap for multiple dwelling units (MDUs).

The new two-way interactive tap devices are available in both 8-port and 16-port configurations. The TGT/MDUs are controlled at the antenna/satellite receive site by a master control unit (MCU) that systematically communicates with each tap by routine polling several times per minute. The MCU can be accessed through an IBM personal computer, which can be interfaced with existing cable billing systems.

For complete details, contact AM Cable/E-Com Division, AM Drive and Route 663, Quakertown, Pa. 18951, (215) 536-1354.

Receiver, antenna positioning system

The R.L. Drake Co., has introduced an antenna positioning system, the APS524. The new system can store up to 30 pre-programmed satellites, which are available for recall from the front panel or from remote control. When used with Drake's ESR524 earth station receiver, the APS524 also remembers the format and polarity skew condition programmed for each satellite.

The unit will accept either pulse-type motor drive actuators or potentiometer-controlled actuators; thus, it can be used with the actuators provided by virtually every manufacturer, according to the firm. It can also accommodate antennas that have horizon-to-horizon motor drive assemblies.

Drake has also introduced a new block conversion receiver. Microprocessor-controlled and Ku-band compatible, the ESR524 features the same features found in the ESR424, including full, infrared remote control, audio seek tuning (to automatically locate favorite audio channels) and easy-to-read fluorescent display. Descrambler compatibility is provided through a bottom panel, clamped/unclamped video switch.

Utilizing a 950-1450 MHz block input frequency, this block conversion model features dual input switching to eliminate the need for external relays or switching splitters. It is compatible with all Drake LNBs and its BDC24 block downconverter.

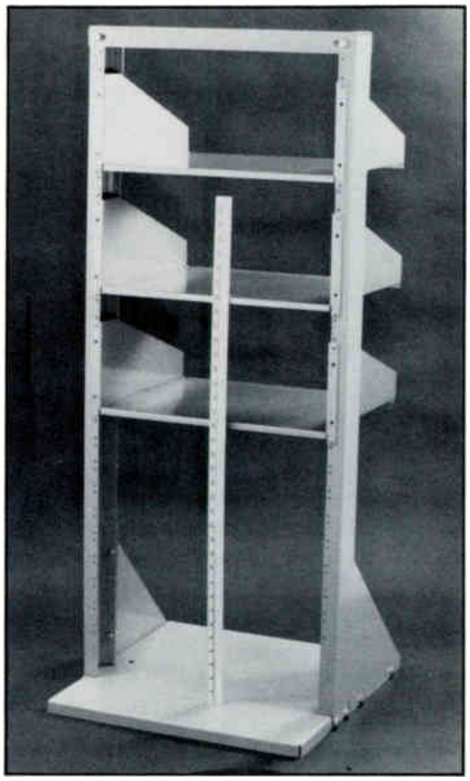
For more information, contact R.L. Drake, P.O. Box 112, Miamisburg, Ohio 45342, (513) 866-2421.

Fiber-optic ground wire

A new compact fiber-optic grounding wire that replaces static wire is being introduced by Pirelli Cable Corp. The fiber-optic ground wire (OPGW) features up to 24 fibers inside loose buffered tubes encircled by a protective seamless aluminum sheath. Suitable for voice and data transmission, the wire is available with single-mode or multi-mode fibers.

Supplied in multiples of 450′ span lengths, the overall diameter of the OPGW is 0.56″ and ultimate tensile strength is 15,000 pounds. Operating temperature is −30° to +180° C.

For more information, contact Pirelli Cable Corp., Communications Division, 700 Industrial Dr., P.O. Box 1048, Lexington, S.C. 29072, (800) 833-0049 or (803) 957-4200.



Equipment rack

CWY Electronics has introduced a new 48-inch high equipment rack suited for descrambler headend expansion. According to the company, the rack is comparable to its 72-inch model, priced below competitive racks, assembles easily and can be shipped UPS.

The RR48 rack provides 45.5 inches of rail space with 26 rail spaces. Panel rails are drilled and tapped for 10-32 screws on EIA/


THE ANATOMY OF A SUPER CABLE
Unique 100% bonding:
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• Sheath to jacket.
Tighter bend radius without kinking or flattening—reliable installations in small vaults.
Bend radius as tight as 4″ with ½″ cable.
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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.

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.

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

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.

An LPL Company

See us at the NCTA Show at Booth 1779

Reader Service Number 16.

Trenchers

E-Z Trench Manufacturing Co. Inc. is now including a dual belt drive on all its trenchers. The new feature allows the operator to trench at a much faster rate in heavy soil conditions and delivers twice the power as the previous models, according to the company. A conversion kit for older models also is available.

For additional information, contact E-Z Trench Manufacturing, Route 3, Box 78B, Loris, S.C. 29569, (803) 756-6444.

Filters, traps

Viewsonics has introduced a line of filters and traps. The new products include high-pass filters with up to 65 dB suppression, di-plex filters with up to 60 dB isolation between high/low, FM traps and band-pass filters, and low-pass filters. All of these products are available in a variety of mechanical configurations.

For more information contact Viewsonics, Box 36, Jericho, N.Y. 11753, (800) 645-7600 or (516) 921-7080.

Bypass, test switcher

Channelmatic Inc. announced the BBX-1A Billibox bypass and test switcher for cable television local commercial insertion systems. The BBX-1A is designed to replace audio and video patch panels used for commercial insert system testing and adjustment, and to provide an automatic bypass of a malfunctioning system. The BBX-1A interfaces with any manufacturer's equipment and any satellite cuetone format, according to Channelmatic. It monitors system video sync pulses and automatically bypasses the commercial insert equipment if any of the videotape players suffer a loss of sync. At the same time the unit sounds an internal (and/or an optional external) audio alarm to notify operating personnel of a system malfunction.

In addition, the unit allows external audio and video test signals to be routed through the insert system for setup and testing purposes with no interruption of service over the cable channel.

The BBX-1A contains an internal high-speed DTMF tone generator for testing and alignment of satellite cuetone decoding equipment.

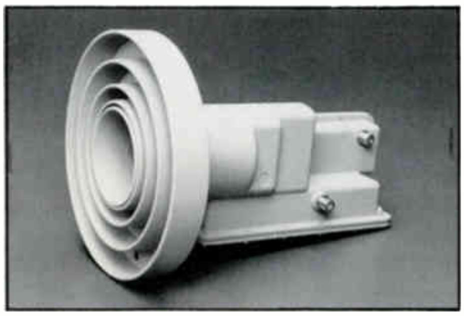
For additional information, contact Channelmatic Inc., 821 Tavern Rd., Alpine, Calif. 92001, (619) 445-2691.

TVRO/UHF noise filter

Microwave Filter Co. has introduced the 3278(2)-(IF-MHz) Series of bandpass filters. The filters are available for TVRO receivers with final IF frequencies in the UHF range 385-700 MHz. The typical 3 dB bandwidth is 14 MHz to restrict the noise bandwidth and, according to the company, produce clearer pictures in low signal situations due to small dish use, partial dish blockage or a weak transponder. The filter also will suppress "sparklies" due to mild downconverted terrestrial interference.

Connectors are type F and impedance is 75 ohms. Center frequency is factory tuned at prescribed IF but is field tunable to compensate for receiver local oscillator error, if any.

For more information, contact Microwave Filter Co. Inc., 6743 Kinne St., East Syracuse, N.Y. 13057, (800) 448-1666 or (315) 437-3953.



LNBs with feed

California Amplifier has announced a new line of Masterfeed products to add to its current TVRO microwave components. The Masterfeed single block low-noise amplifier with feed (LNBF) line incorporates a feed design integrated with the company's low-noise block converter (LNB). The first product in the series is a single LNBF design that couples feed horn technology with DRO/LNB. The configuration offers a servo-to-drive polarization changes and skew adjustment.

The second product in the series is the Masterfeed-Dual. Combining two LNBs (horizontal and vertical) with a single feed horn allows a dual receiver system to receive all 24 channels simultaneously. This configuration eliminates the need for a dual feedhorn, two separate LNAs, two downconverters and additional time and labor when installing a multiple receiver system.

Special features of the Masterfeed series are 64 dB gain; noise temperatures as low as 60°K, 150°C oven heat during powered up burn in to weed out weak components that might lead to early failure; single DRO (dielectric resonating oscillator), which provides downconverting capability to both boards; "O" ring seal for effective sealing against water leakage; and elimination of the extra hardware and gaskets needed to attach a feedhorn to the amplifier.

For more information, contact California Amplifier, 460 Calle San Pablo, Camarillo, Calif. 93010, (805) 987-9000 or (800) 621-4080.

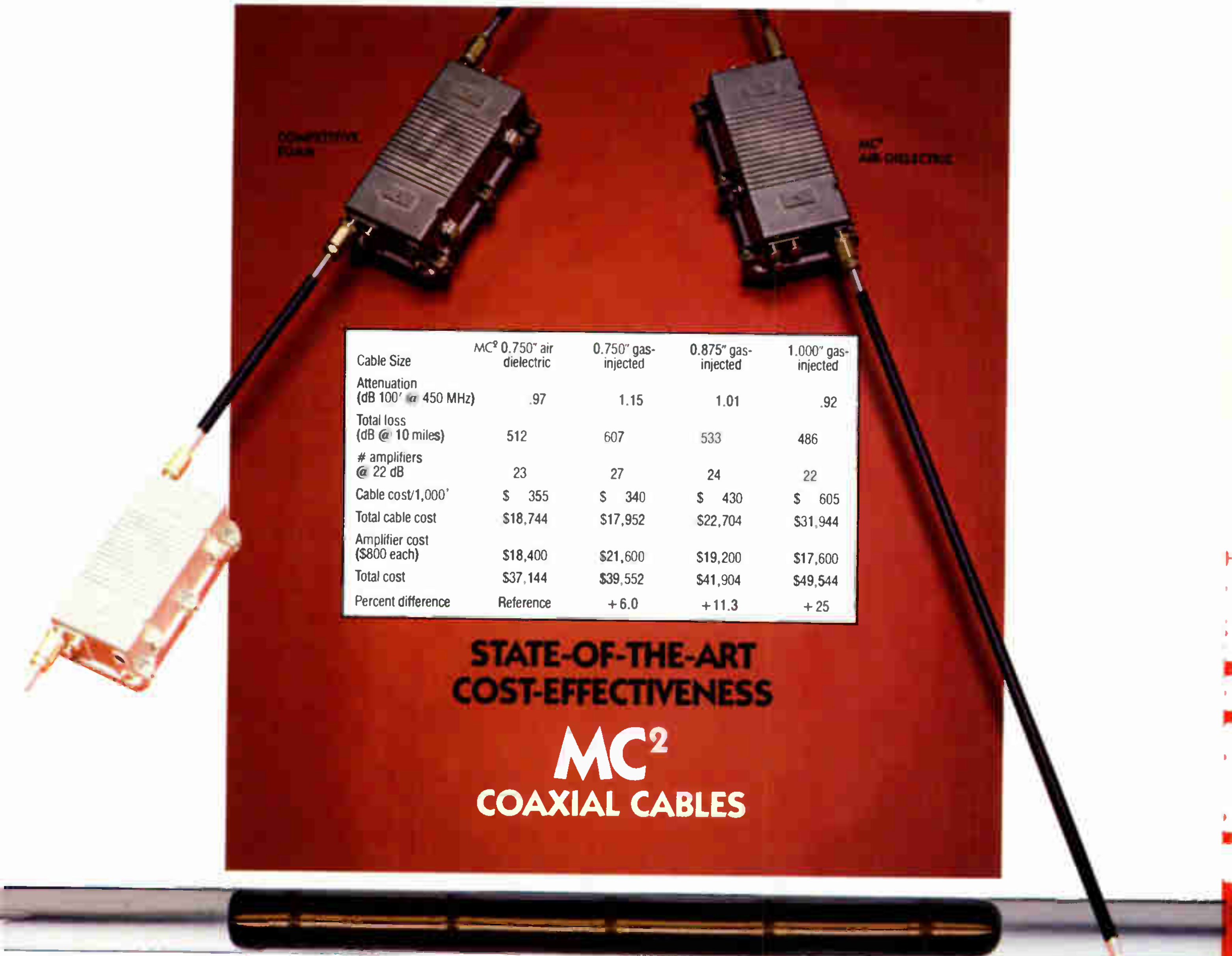
Satellite receiver, TVRO modulator

DX Communications, a subsidiary of C. Itoh & Co. (America) Inc., has introduced the Model DSA-644 commercial satellite receiver. The new receiver offers dual block downconversion; 30 MHz IF bandwidth; a SAW-filtered second IF; unclamped video and composite BB outputs with de-emphasis on/off switch for decoder interface; a clamp/unclamp video switch; 24-channel detent tuning; 8 dB threshold; and a video test point on the front panel.

Also introduced was the Model DSM-110, an economical satellite TV frequency-agile modulator designed to interface with all DX commercial receivers. The DSM-110 offers front-panel-select channels for VHF (2-13), mid-band (A-I), and super-band (J-W); IF loop through; +45 dBmV output; and low spurious output.

For further information, contact DX Communications Inc., Commercial Products Division, 10 Skyline Dr., Hawthorne, N.Y. 10532, (914) 347-4040.

TRILOGY LEADS IN TECHNOLOGY:



Cable Size	MC² 0.750" air dielectric	0.750" gas-injected	0.875" gas-injected	1.000" gas-injected
Attenuation (dB 100' @ 450 MHz)	.97	1.15	1.01	.92
Total loss (dB @ 10 miles)	512	607	533	486
# amplifiers @ 22 dB	23	27	24	22
Cable cost/1,000'	$ 355	$ 340	$ 430	$ 605
Total cable cost	$18,744	$17,952	$22,704	$31,944
Amplifier cost ($800 each)	$18,400	$21,600	$19,200	$17,600
Total cost	$37,144	$39,552	$41,904	$49,544
Percent difference	Reference	+6.0	+11.3	+25

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Reader Service Number 86.

Why? When? How?

By Steve Windle
Applications Engineer, Wavetek Indiana Inc.

Preventive maintenance is a much ballyhooed concept in the cable TV industry. Most current literature promotes the necessity of a preventive maintenance program, but everyone knows no one has the time to implement an effective program. The techs are too busy taking care of trouble calls!

It is a documented fact that when preventive maintenance programs are implemented, trouble calls come in less frequently. Of course you'd expect a person who works for a test equipment manufacturer to say that. But it's true!

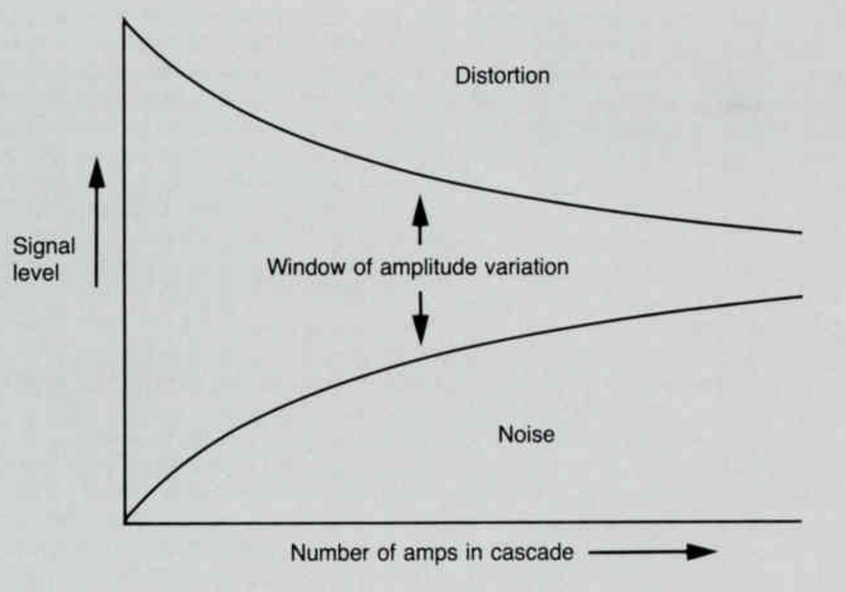
A preventive maintenance program should consist of various tests, performed regularly, with test equipment designed to fulfill the requirements of the program. Signal measurements should be performed to verify proper operating levels and locate significant changes *before* a perceptable change in the subscriber's picture quality occurs. System sweeping should be done regularly, cycling through different sections of the plant. System analysis should be performed at FCC test points to verify that performance is in keeping with system standards. Leakage monitoring should be done at all times, because it is important to keep leakage at a minimum to prevent interference with other communication services and to avoid ingress interference to subscribers. Plus, with the test equipment available today, leakage monitoring takes little technician time.

Certain system characteristics affect how frequently tests should be performed for an effective preventive maintenance program. This could be based on historical data, the number of amps in cascade, the frequency range for which the system was designed, and the number of channels on the system. Let's consider these factors and then the test equipment and procedures for performing the necessary tests.

Historical data could indicate that a system, or a portion of the system is notorious for intermittent problems or outages. Obviously this system would require more attention and a higher rate of testing frequency. You can see that the importance of historical data to the preventive maintenance program makes record keeping essential. Changes in system performance (signal level, carrier-to-noise) can indicate the approach of a catastrophic failure, or the beginning of intermittent problems.

The number of amps in cascade has a very direct effect on the performance of the system. The more amps in the cascade, the narrower the window of acceptable amplifier output level variation (see Figure 1). As the number of amps increases, the noise floor increases, and so does the potential for cross-modulation and second/third order distortion. If output levels are too high, distortion becomes a problem; if input levels are too low, the carrier-to-noise ratio is too low. A system with a large number of amps in cascade would need to be tested more frequently, because the window of level variation acceptability is narrow.

Figure 1: As cascade length increases the window of amplitude variation narrows



Two factors that are related to each other are system capacity (bandwidth) and loading (number of carriers on the system). If a system is loaded to the full extent of its capacity, the amplifiers will be operating closer to the limits of their specifications. This also narrows the window of level variation acceptability. As well, if a system has a very broad bandwidth, there will be more opportunity for frequency specific level variations and amplifier signature build up. These systems will need to be swept more frequently.

The equipment and measurements

A signal level meter (SLM) can be used to quickly measure signal level, carrier-to-noise and hum. If a SLM has been designed for ease of use and efficient operation it will take only a matter of moments to perform these essential tests. For instance, tune to a signal, measure its level (that's one test). If it is a CW (unmodulated carrier), switch to the HUM function and read the percent of hum, tune off the carrier into the noise, remove attenuation, flip the S/N switch and subtract the compensated noise level from the previous signal level measurement. With experience and good test equipment, tests in a well-planned PM program can be performed *very* quickly.

Automated testing is a more efficient method of signal level monitoring, and is ideal for preventive maintenance programs. Just set up your test points and parameters, and your testing and documentation are done automatically. A remotely controllable SLM provides measurements of the video and audio carriers, as well as a test of hum percentage or for the presence of video modulation, at the system hub sites. With the computing power of a PC, trend analysis is performed during each test. This allows the operator to store a reference and set up acceptable tolerance limits for deviation from normal readings. Only the parameters that are out of tolerance will be printed on the test document, which saves time in sorting out the problems. A graph of the trend analysis data shows the variations from the reference level. These tests can be performed automatically at specified times throughout the day and night. Automation is a real time saver for any preventive maintenance program.

Cable system sweep equipment should be easy to use in order to get accurate results and save valuable time. The sweep transmitter, or generator, doesn't usually consume very much of the sweep tech's time, but what time the tech does spend with it should be spent efficiently. The sweep parameters (start and stop frequency, sweep level, sweep rate and repetition interval) should be easy to set up. Keyboard entry of parameter information and a digital display of those parameters makes this a breeze. The sweep receiver, the instrument with which the sweep tech will spend the most time, should be designed with ease of use as a priority.

The most important thing to consider about a receiver is how it displays the desired information. (That's not to say you'll be happy to see the information you receive.) A CRT is the most common medium for display, but how does the operator interpret the information? The ideal would be to have markers that can be moved to different places in the displayed response, and alphanumerics to give frequency and level information. The dynamic range of the display, or the amount of level variation visible at one attenuator setting, should be as great as possible, without sacrificing amplitude resolution. With the use of markers the display need not be linear (so many dB per division), because the alphanumerics give the needed absolute and relative level information. This permits the display to have a greater dynamic range by having higher level resolution in the upper half of the display than in the lower half. The measurement information is accurate because it's not based on an eyeball, but on the markers. In order to be easy to use, the markers should be easily manipulated. Keyboard control greatly speeds the measurement, with keys designated to move the markers to the peak and valley of the response, and to calculate the difference in level.

System analysis, which should be performed as often as prescribed by the previously mentioned factors (historical data, system capacity and loading), should be done with test equipment designed to be easy to use, yet accurate. Tests that are normally done with a spectrum analyzer are typically complicated with many different setting requirements and calculations to be performed. An analyzer that relieves the operator of these time-consuming operations would be a great benefit to preventive maintenance programs. The use of microprocessor technology makes this possible.

The system analyzer can be programmed to set up the correct instrument parameters for any specific test. The test would be initiated by picking out the specific carrier upon which to base the test. This carrier is isolated by placing a marker at its peak. The displayed span can then be narrowed to view only that carrier. The alphanumerics will automatically indicate the carrier level and frequency. Any specific test function can then be initiated by pressing a few keys on the keyboard. The instrument will automatically set up the required parameters, based on what type of test it is, make a measurement, perform calculations if necessary, and display the result in the alphanumerics. Think about how much time this saves in relearning specific test procedures, or training new technicians.

In order for test equipment to be a benefit to a PM program, it must be rugged and reliable. The test equipment manufacturer must be aware of the kind of use the instrument will receive, and design equipment that will work within that environment. The instrument should be able to withstand shock and vibration without damage to the measurement capability of the unit. There are limitations to how rugged an instrument can be, but if the equipment needs frequent repair, it is an indication that the design is inadequate for field use, or that the technicians aren't treating the test equipment with proper respect.

Test equipment should be easy to repair, so minor failures and routine calibration can be attended to in the field. A service manual should be available, which easily guides a technician through the calibration procedures. The service manual should be complete with a parts list and schematics. In the event that repair and calibration needs to be handled by the manufacturer or a service center, you should expect quick turnaround, so the PM program can continue to provide the results we all said it would.

Your PM program

Each preventive maintenance program is unique to its system characteristics. So, how often you perform signal level measurements, system sweeping and system analysis will depend on your system's history of problems, number of amps in cascade, system frequency range and the number of system channels. The objective of all PM programs however, is identical. It should reduce the cost of system repair by frequently monitoring system performance and identify potential problems before they become subscriber problems and threaten your revenue. It's easy to see that the bottom line of a preventive maintenance program is increased profit. By maintaining or increasing revenue and by reducing repair costs we can all help.

Robert W. Behringer, retired vice president and general manager of MetroVision Inc.'s Chicago area cable systems, died of cancer Feb. 1, 1986, in Phoenix, Ariz. He was responsible for the development and management of MetroVision's Chicago area cable systems.

Behringer was previously executive vice president and general manager of Anixter-Pruzan, Chicago. Prior to that he worked in the development of an addressable tap and its practical applications at Ameco Inc.

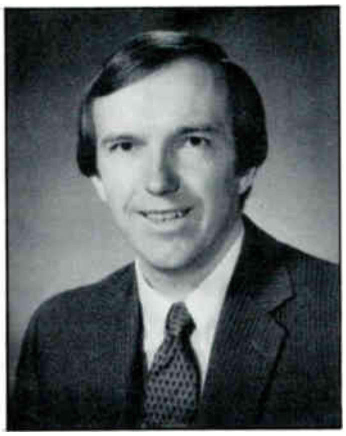
Active in industry affairs, Behringer served on the National Cable Television Association board of directors and headed the NCTA Associates Committee. He was also a member of the Institute of Electrical and Electronics Engineers.

Knowland

Charles Knowland has been appointed to the position of design engineer, digital systems, at **Regency Cable Products**. Prior to joining Regency, Knowland was employed by Syracuse Electronics. Contact: P.O. Box 116, 4 Adler Dr., East Syracuse, N.Y. 13057, (315) 437-4405.

C-COR has announced the appointment of **Arthur McGuire Jr.** as vice president, sales and marketing. Prior to joining C-COR, McGuire had been vice president, marketing, for FirsTel Information Systems Inc. (a U.S. West Co.), Denver. Contact: 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461.

Additionally, **James Rushing** has been named regional sales manager, South Central. Based in the Dallas area, he will be responsible for sales in Texas, Louisiana, Oklahoma, Arkansas, Missouri and Kansas. Rushing was previously employed by Hughes Aircraft Co., Microwave Products Division, Plano, Texas, as a regional sales manager. Contact: 1721 W. Plano Parkway, Suite 201, Plano, Texas 75075, (214) 578-4758 or (800) 233-2267.



Heidenreich

Hanemayer

Roger Heidenreich has been appointed general manager of **Video Systems Inc.,** the marketing arm for Channelmatic. The firm's regional offices in California, Colorado, Wisconsin, Georgia and New Jersey will now all report to Heidenreich, who has been with Video Systems serving as the Midwest regional sales manager since 1982.

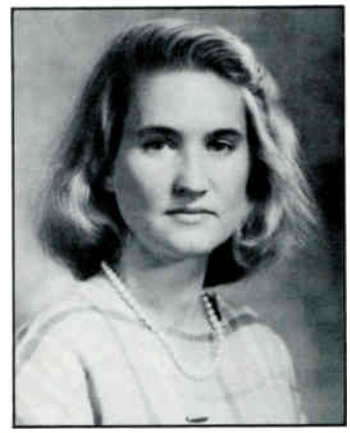
Video Systems also announced that **Wes Hanemayer** will be the firm's new Southeast regional sales manager. Hanemayer will take responsibility for sales activities in North and South Carolina, Tennessee, Arkansas, Louisiana, Mississippi, Alabama, Georgia and Florida. He will operate from a central office in Atlanta. Hanemayer has spent his entire business life in the broadcast and cable television industries; most recently serving with Cox Cable at their corporate headquarters in Atlanta. Contact 821 Tavern Rd., Alpine, Calif. 92001, (619) 445-2691.

Lashower

DX Communications, a subsidiary of C. Itoh & Co. Inc., has formed a commercial products division and appointed **Leonard Lashower** as its manager of new business development. Previously marketing manager of videotex and teletext at Sony Corp., Lashower also served as major accounts project manager at Executone and product manager for UHF transmission systems at RCA Broadcast Systems. Contact: 10 Skyline Dr., Hawthorne, N.Y. 10532, (914) 347-4040.

Saylor

Tom Saylor has been promoted to technical operations manager with **Comcast**'s Baltimore County, Md., system. Saylor joined the company in 1979 as manager of the headend and interconnect systems. Contact: 1830 York Rd., Timonium, Md. 21093, (301) 252-1012.



Smith

Weber

The Arvis division of **Adams-Russell Co. Inc.** has announced that **Tracey Smith** and **Lisa Weber** have been named customer service trainers, training end users in the use of Arvis commercial insertion equipment throughout the United States and the Caribbean.

Smith comes to Arvis from WQTV, Channel 68 in Boston, where she was sales/trafficking service manager. Weber was most recently with the ISYS Corp., where she was responsible for the marketing and promotion of a financial software package. Contact: 1370 Main St., Waltham, Mass. 02154, (617) 894-8540.

At **Tele-Engineering Corp.**, **David Heyrend**, formerly with

Daniels & Associates, has been hired as program manager, special projects; **Michael Musen**, formerly with Continental Cable, Campbell Communication, as deputy program manager; **Alan Burt**, formerly with Acton Corp., as material and production controller; **Jack Litherland**, formerly with Texscan, as Midwest project manager; **Jeff DeMora**, formerly with Mitre, as Midwest quality assurance; **Richard Gillard**, formerly with Group W, as Southwest project manager; **Kenneth Meeks**, formerly with Lone Star Construction, as Southwest quality assurance; **Jeff Kelley**, formerly with Commco Construction, as Caribbean project manager; **Cynthia Stebbins** as administrative assistant; and **Lisa Francesconi** as customer information liaison. Contact: 2 Central St., Framingham, Mass. 01701, (617) 877-6494 or (800) 832-8353.

Timothy Wyllie was named construction manager in charge of **McCourt Cable Systems**' Sacramento, Calif., project. Wyllie played a key management role in building Boston's cable system. Contact: 120 Main St., Sacramento, Calif. 95838, (916) 927-7799.

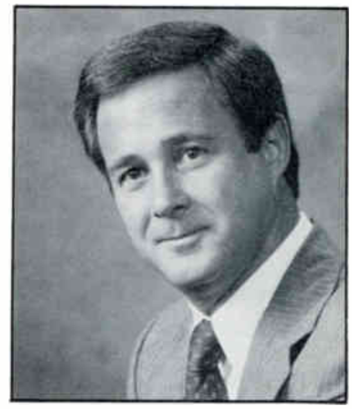
Wilson

Linda Wilson was recently named office manager for the Wickenburg system of **Cable Arizona**, a subsidiary of Cable America Corp. In her new position, Wilson will be responsible for management of the Wickenburg system. Wilson joins Cable Arizona from Rural American Cable TV Inc. Contact: 4350 E. Camelback Rd., Phoenix, Ariz. 85018, (602) 952-0471.

Ethereum Scientific Corp. has announced the addition of **Stanley Wood**, marketing manager, satellite systems, and **Becky Coyne**, marketing manager, satellite services. They bring a total of 27 years experience in communications to Ethereum.

In his new position, Wood will be responsible for the development, marketing and sales of uplinking from fixed teleports, transportable uplinking and the arrangement of transponder time. Coyne will be responsible for the development, marketing and sales of C- and Ku-band transportable and fixed satellite uplink facilities for domestic and international markets. Contact: 7641 Clarewood, Suite 336, Houston, Texas 77036, (713) 784-2630.

At **Wilcom Products Inc. Richard Gilman** has been appointed vice president, marketing and sales. Gilman was previously president of Tel-Link Systems Inc. of Manchester, N.H. Contact: Box 508, Laconia, N.H. 03247, (603) 524-2622.



DeRenzo

LRC Electronics has announced that **Leonard DeRenzo** has joined the firm as sales manager. DeRenzo has been vice president of LRC's advertising agency, Howell & Kendall Associates. Contact: 901 South Ave., Horseheads, N.Y. 14845, (607) 739-3844.

Reader Service Number 90.

AD INDEX

CALENDAR

March

March 6: SCTE North Jersey Chapter stereo-cable interfacing seminar and BCT/E exam, Holiday Inn, Wayne, N.J. Contact Virgil Conahan, (212) 512-5309.

March 10-12: Arizona State University course on fiber-optic communications, Arizona State University, Tempe, Ariz. Contact (602) 965-1740.

March 12-14: Information Gatekeepers second annual Integrated Services Digital Networks Exposition, Marriott Hotel Market Center, Dallas. Contact (617) 232-3111.

March 15: Reynolds/Rodriguez Group, pay-per-view workshop, Dallas Marriott-Market Center. Contact Art Reynolds, (619) 459-4149.

March 15: NCTA Minority Business Symposium in conjunction with the national convention in Dallas. Contact (202) 775-3629.

March 15: Texas Cable Television Association annual meeting, Convention Center, Dallas. Contact (512) 474-2082.

March 15-18: National Cable Television Association and **Texas Cable Television Association** combined convention, Dallas Convention Center. Contact (202) 775-3606.

March 19-21: Infotron Institute communications network design seminar, Omni International Hotel, Miami. Contact (800) 257-8352.

March 24-26: American Federation of Information Processing Societies Inc. seventh annual OAC, the Astrohall, Houston. Contact Catherine Shippert (703) 620-8926.

March 24-26: Infotron Institute communications network design seminar, Infotron Systems Corp., Cherry Hill, N.J. Contact (800) 257-8352.

March 24-26: North Central Cable Television Association annual convention, Radisson South Hotel, Bloomington, Minn. Contact Mike Martin, (612) 641-0268.

March 25-27: Magnavox CATV training seminar, Dallas. Contact Amy Costello, (800) 448-5171.

March 25-27: Infotron Institute communications network design seminar, Sheraton-Mockingbird West, Dallas. Contact (800) 257-8352.

March 26: Ohio Cable Television Association annual business meeting, Hyatt on Capitol Square, Columbus, Ohio. Contact (614) 461-4014.

March 26: SCTE Appalachia Mid-Atlantic Chapter, administering BCT/E exam covering distribution systems. Contact Ron Mountain, (717) 984-2878.

March 26-28: School of Lightning Protection Technology Inc. seminar, Sheraton Crown Hotel and Conference Center, Houston. Contact (815) 943-4005.

March 31-April 2: Magnavox CATV training seminar, Dallas. Contact Amy Costello, (800) 448-5171.

Planning ahead

May 13-15: Canadian Cable Television Association annual convention and cablexpo, Vancouver.

June 12-15: Society of Cable Television Engineers' Cable-Tec Expo '86, Phoenix (Ariz.) Convention Center.

July 15-17: Community Antenna Television Association annual convention, MGM Grand Hotel, Reno, Nev.

July 20-22: Eastern Show, Merchandise Mart, Atlanta.

Sept. 23-25: Great Lakes Cable Expo, Hyatt Convention Center, Columbus, Ohio.

Oct. 28-30: Atlantic Show, Convention Hall, Atlantic City, N.J.

Dec. 3-5: Western Show, Convention Center, Anaheim, Calif.

April

April 2-4: Infotron Institute communications network design seminar, Sheraton Plaza La Reina, Los Angeles. Contact (800) 257-8352.

April 3-4: Phillips Publishing presents Satellite V: Challenges & Opportunities in Satellite Communications, Marriott Crystal Gateway Hotel, Arlington, Va. Contact (301) 340-2100.

April 7-11: Datapro Research Corp. Communications Week '86, San Francisco. Contact (800) DATAPRO.

April 10-11: The **Society of Cable Television Engineers** and the **Florida SCTE Meeting Group** national seminar on computer-aided CATV testing, Sheraton-Twin Towers, Orlando, Fla. Contact Richard Kirn, (813) 924-8541.

Remember, back in 1951, when TV stations were low in power and antennas not very efficient? Milton Jerrold Shapp, the founder of Jerrold, didn't realize he was helping to create a new industry when he developed an amplifier that Bob Tarlton needed for his Lansford, PA community antenna system.

Cable was new, but it grew rapidly. And Jerrold grew with it, developing improved amplifiers, channel equipment, and numerous innovations that increased revenue potentials for operators, and established Jerrold as the leading supplier in the industry.

Remember when 20, 12-even 5 channels were your maximum potential? Now...

Rebuilding? Save Money With JERROLD

Expand the bandwidth of your system - and your revenue-producing channel potential - simply by dropping in Jerrold STARLINE® SJ-330 modules. This quick and easy upgrade to 330 MHz can help you maximize your revenues and requires:

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Regardless of the make or vintage amplifiers now in your system, Jerrold can show you how to rebuild economically. If you have STARLINE 20 equipment, you'll realize the biggest savings with Jerrold STARLINE SJ-330 drop-ins. Other amplifiers can be replaced easily and economically by a complete STARLINE SJ-330 station. Detailed information on what you will need and what savings you can achieve is contained in a new Jerrold STARLINE 20 SJ Series brochure - yours for the asking.

And Jerrold has other possibilities for you too. For longer cascades and greater channel capacity, there's Jerrold Century III Feedforward amplifiers and the Jerrold STARLINE X Series. Whatever your specific needs, there's a reliable, low-cost Jerrold product to satisfy them.

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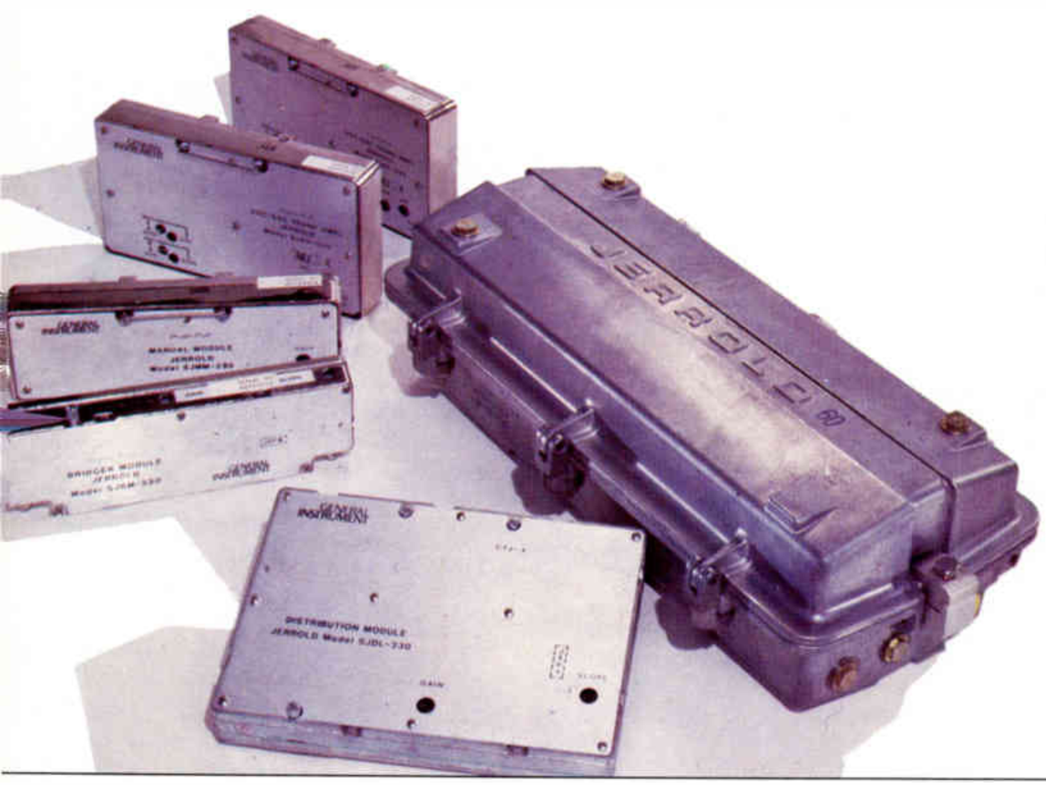

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Reader Service Number 91.

GENERAL INSTRUMENT

Scrambling: Are you ready?

Last month, in the first article of this two-part series, Bob Luff gave guidelines for making some of the many decisions that must be made by cable systems with regard to satellite scrambling. This month's column discusses questions surrounding headend spares and problems with authorization and deauthorization.

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

It is anticipated that the inherent ability of VideoCipher II to deliver studio quality stereo-program audio will trigger some satellite services, particularly premium pay programmers, to focus on stereo marketing soon after they have scrambled. Accordingly, systems may wish to plan some additional space flexibility for this likely occurrence. At present, two manufacturers are marketing BTSC stereo encoders: Scientific-Atlanta and Wegener. Production is limited and delivery times in excess of 120 days should be planned for. The Wegener unit is a 4½-inch high by (standard) 19-inch wide mainframe that can hold enough BTSC board sets for four separate premium TV channels in the single unit. The S-A unit is sized and configured more like a standard modulator.

It appears that all set-top manufacturers, including baseband vendors, have or soon will have BTSC-friendly set-tops.

Equipment arrangement

Of course, individual system technical staffs will decide how to best arrange and wire headends. However, the two primary options should be discussed: keeping all like equipment together, or keeping all equipment relating to a single channel together.

Up until now most headends have been arranged with the individual channel modulators and processors being primary and clustered together, and all other groups of similar equipment clustered together in separate racks or areas. There is, however, a growing argument for the other option. To minimize clumsy rack-to-rack back-and-forth wiring, it may now be more advantageous for as much equipment as possible associated with a single channel to be arranged immediately below the associated channel modulator—or at least in the same equipment cabinet.

While initially this is a somewhat radical concept compared to well-entrenched practices, the reasoning is that continued equipment type-clustering in 30 or more channel headends with VideoCipher II and very likely with BTSC, will require a maze of cross-cabinet wiring—jeopardizing practicality and reliability.

Spares

There is little long-term wide field experience with the VideoCipher II. Accordingly, it is difficult to determine the best policy for headend spares. So far, the units have proven to be very reliable. However, failure of any satellite decoder, especially one dedicated to a pay service, will be a serious problem that systems will desire to avoid. Lightning or severe power surges can occur any time to a headend causing even the most rigid complex systems to possibly fail. Because of this, all systems should develop a spare decoder plan, including perhaps maintaining an on-site spare decoder to ensure that subscribers receive reasonable pay-signal restitution. It would seem that no more than one spare, regardless of the number of decoders employed at a site, is called for without proof that the unit is far less reliable than is presently reported.

The "spare" issue can be easily administered during the roll-out period of satellite scrambling by simply ordering early enough to always be one descrambler ahead of the actual scrambling requirements. And later, the "spare" issue may be softened by greater experience and the fact that the headend will have at least seven, to as many as 20 on-site decoders. If a failure occurs to a primary pay signal, the system, although not the best alternative, does nonetheless have the ability to reassign a working decoder from a lesser service until a nearby spare or group spare is priority shipped.

It is important to identify and clearly label the decoders that are provided free by HBO from all others. The free HBO decoder is a special decoder known as a "red striper," because of a red identifying stripe on the rear of the decoder. This HBO "red striper" technically will not work on any service except HBO and Cinemax, regardless of authorization attempts. The units for all other services that are purchased have a white stripe on the back and are known as "white stripers," or universal decoders, and can be used after proper programmer authorization on any service, including HBO and Cinemax. Accordingly, systems should be careful to only assign the universal "white stripers" to ensure universal backup coverage.

'It would seem that no more than one spare, regardless of the numbers of decoders employed at a site, is called for'

Hot standbys and passwords

Two VideoCipher IIs are capable of being wired into a hot standby configuration. So far, however, HBO is publicly refusing to simultaneously authorize two HBO decoders for the same headend. Other programmers seem to be leaning in HBO's direction. If a system's spare policy allows a full spare and desires it to be wired as a hot standby, not so much to afford a chosen service additional failure protection but instead to allow a simple means of ensuring your spare tire still has air in it, you will have to do individual battle with your programmers.

Another caution to be aware of is that certain Microdyne satellite receivers must be modified to work with VideoCipher II decoders. The modification, while relatively easy, will require additional lead time. Any system using Microdyne receivers should contact M/A-COM or Microdyne directly.

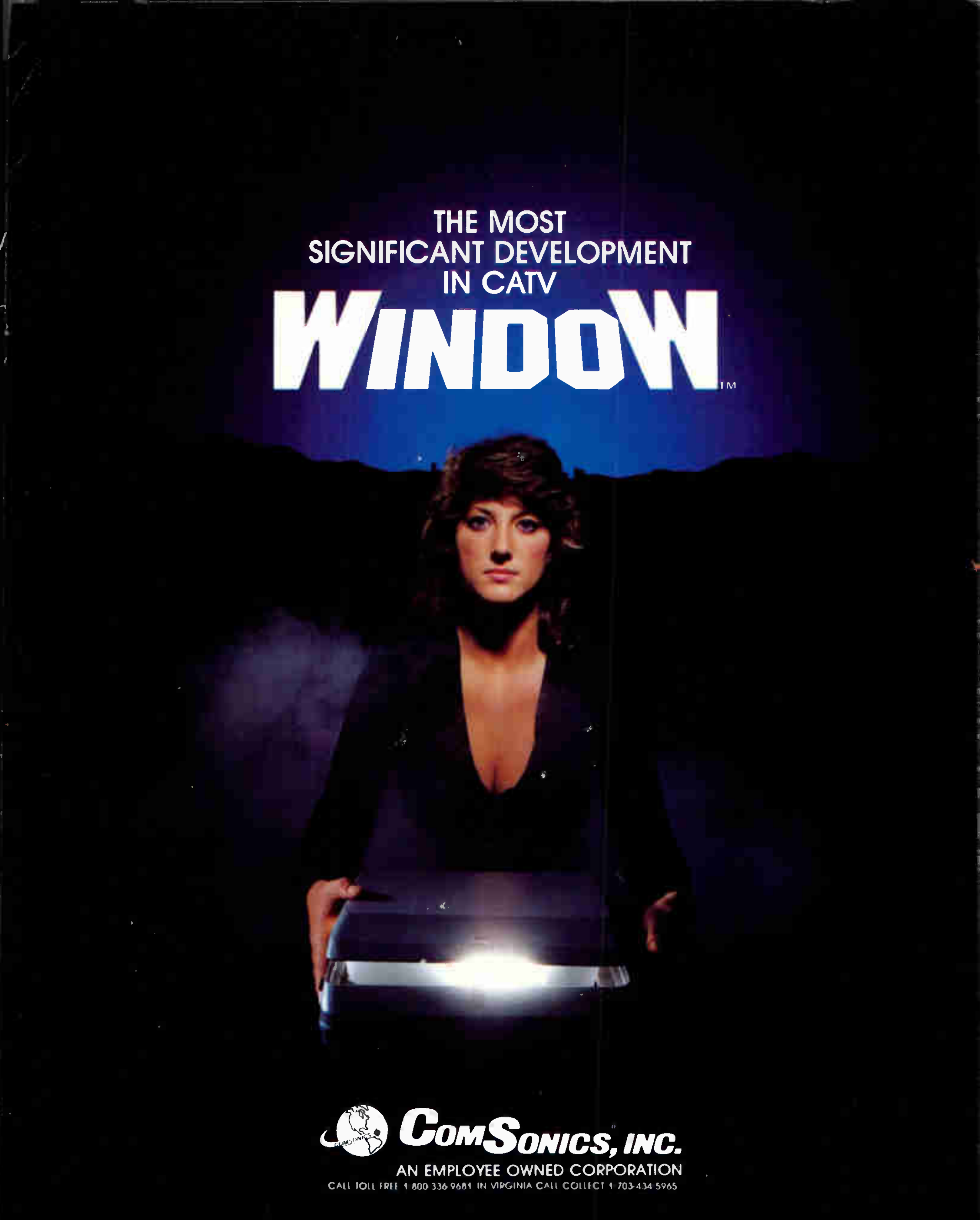
Perhaps the most important aspect of satellite scrambling to the system is password and ID management. Each VideoCipher II unit has a serial number stamped on the rear of the chassis. Each headend has a secret control number. It just takes both numbers to authorize a decoder from any telephone.

More importantly, anyone with both numbers and a telephone can deauthorize a system's premium satellite services (such as a disgruntled or discharged employee). The programmers and system will surely develop a fail-safe authorize and deauthorize system. But for now, each system must develop a means to protect its ID number from any misuse while ensuring that in the event of a failure it is readily accessible to quickly re-establish service. Even with just one satellite decoder this is a complex issue.

By August, systems may have to maintain many separate satellite emergency "hot line" numbers and different IDs, as well as knowing at the time of the call which specific decoder to deauthorize and which to authorize. Inadvertent errors could cause rejected authorizations and delayed restoration of service or sudden inadvertent deauthorization of another decoder in the headend. Even though a system may have a spare decoder, a failed channel will stay scrambled until someone with the proper ID and replacement decoder serial number calls the proper phone number. Murphy's Law is sure to be working overtime during such crises.

Immediate reporting of failures

Until systems develop more confidence in satellite decoder reliability, it is suggested that a failure of any satellite decoder should be immediately reported to NCTA's engineering department. Widespread satellite interference has already been reported. Immediate reporting and checking of outages by others may prevent wasteful system deauthorization and authorization of spares on universal glitches.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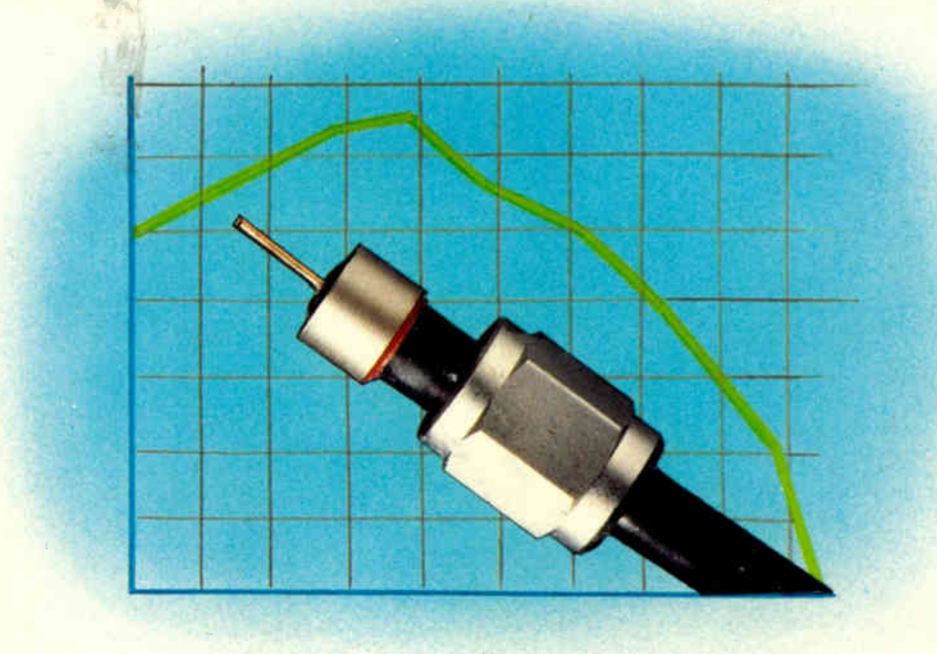
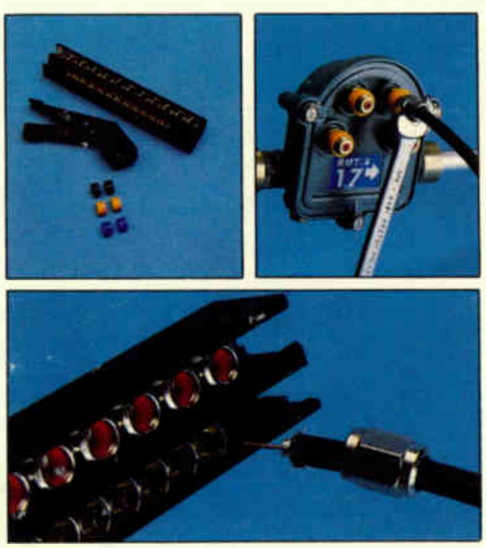


Raychem's new EZF Connector System addresses the problems of F-Connectors — RF leakage and moisture penetration — which are among the leading causes of maintenance problems for a cable-TV operator.

EZF is not just a connector, but a system that provides complete, long-lasting performance. Its new design assures superior mechanical strength, tight electrical connections and environmental sealing.

The EZF Connector System has gone thru extensive environmental testing. UV exposure, waterhead testing, thermocycling and salt spray exposure are some of the tests that the EZF System has been designed to pass and still provide exceptional RF shielding.



Features of Raychem's EZF Connector System.

1. One connector fits RG-59, cable and one connector fits RG-6 cable.
2. The only connector available today that provides RF shielding of 100 db at 300 MHz after thermal cycling and salt spray exposure.
3. The system provides an environmental seal at both the cable jacket and port thread interfaces.
4. Reduces finger tight connections and subsequent trouble calls.
5. Crimp tools are no longer needed. A common 7/16″ wrench does the final tightening and installation.
6. Cable preps are accurate each time with the EZF Cable Preparations Tool. (For use on both RG-59 & RG-6)
7. Identify customer service with different colored EZF Sealing Boots.

Raychem + ANIXTER®

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In an emergency, weekends and holidays or after 5 P.M. call toll free 1-(800) 323-8167.
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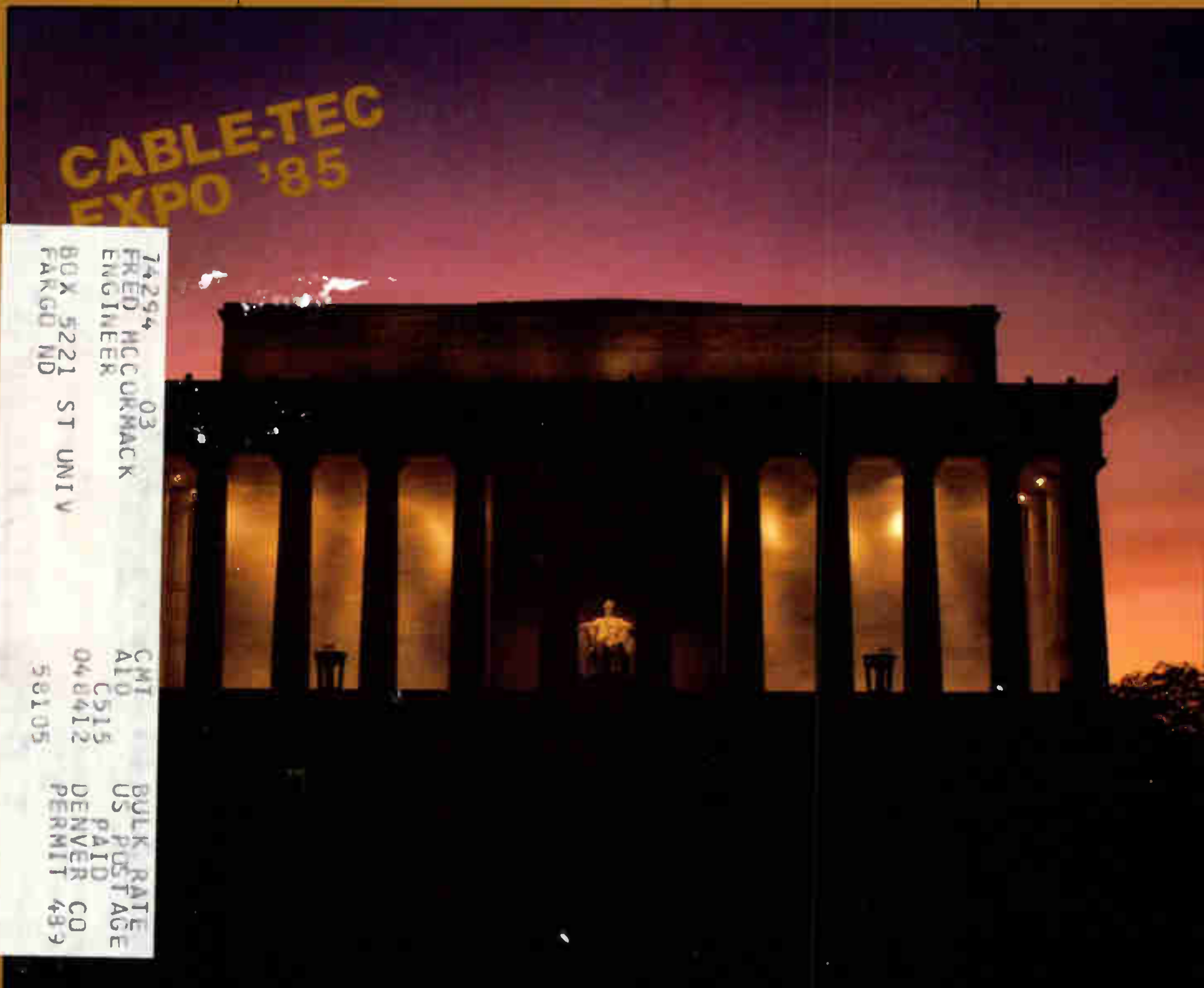

SCTE kicks off annual Tec Expo

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