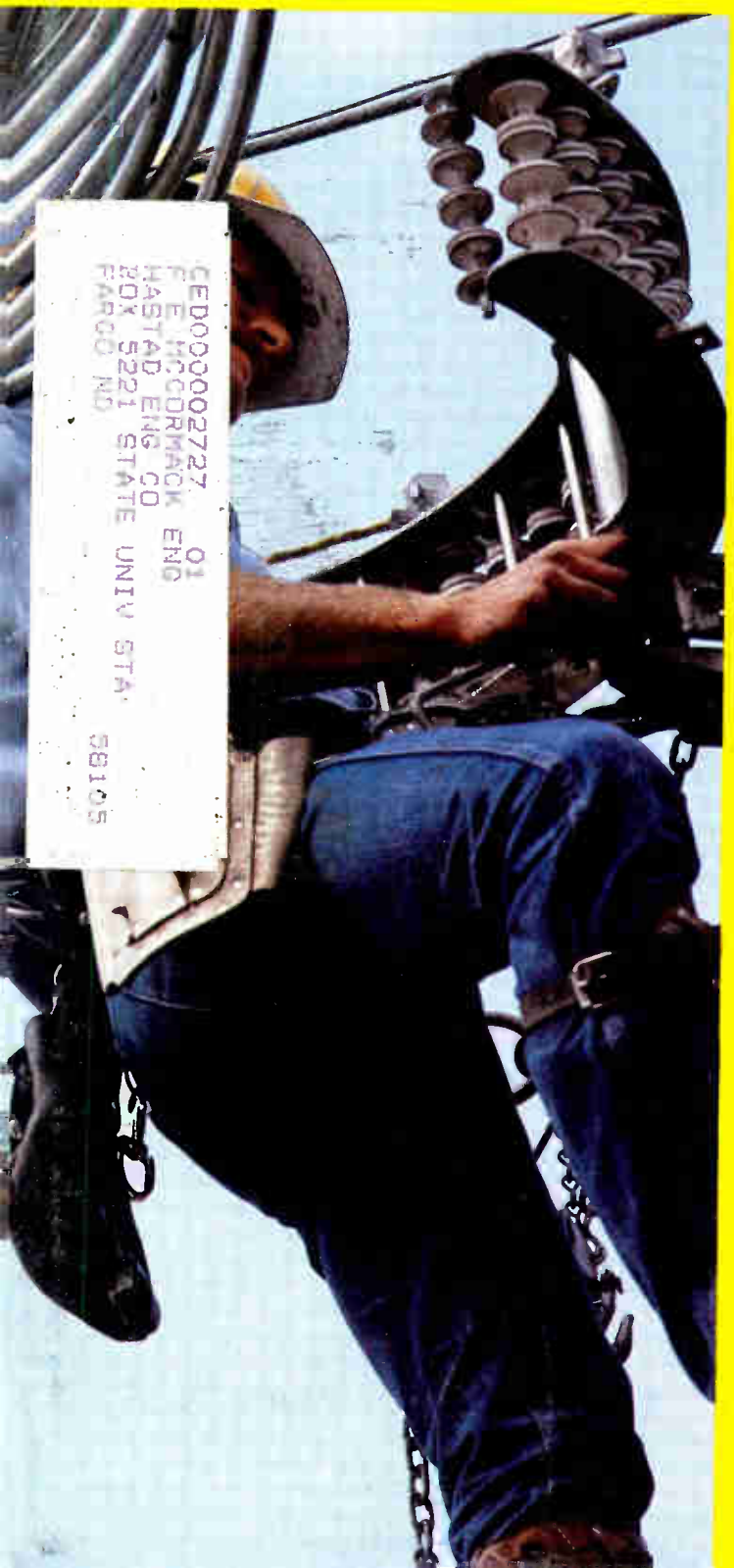
CED

Construction issue

Communications Engineering & Design/The Magazine o ™ ...Y

November 1984



2°/off-premises/ digital audio?

Return loss/rebuilds/ contractors/ pedestals/ trenchers/tools

Our friends told us "Sure Vitek makes the best traps. But even you aren't perfect." So we listened.

And we built a better trap.

Introducing Thermalok.®

Thermalok is the new Vitek Trap that incorporates the most advanced technology in the world. It addresses the two major concerns of our customers... frequency drift and weathering.

We solved the first concern... *frequency drift with temperature variation*... by introducing Thermalok.® with its unique dielectric assuring that the signal remains trapped regardless of temperature extremes (from 0°F to 100°F).

We solved the second concern ...*deterioration by weathering* ...with our truly revolutionary "Molded Strain Relief Connector." The weakest link in the installation "chain" was the juncture of trap and strand. From its first day aloft, this joint began to deteriorate from the inevitable motion of the winds.

Reader Service Number 1

AUGAT® VITEK

Quality and Innovation

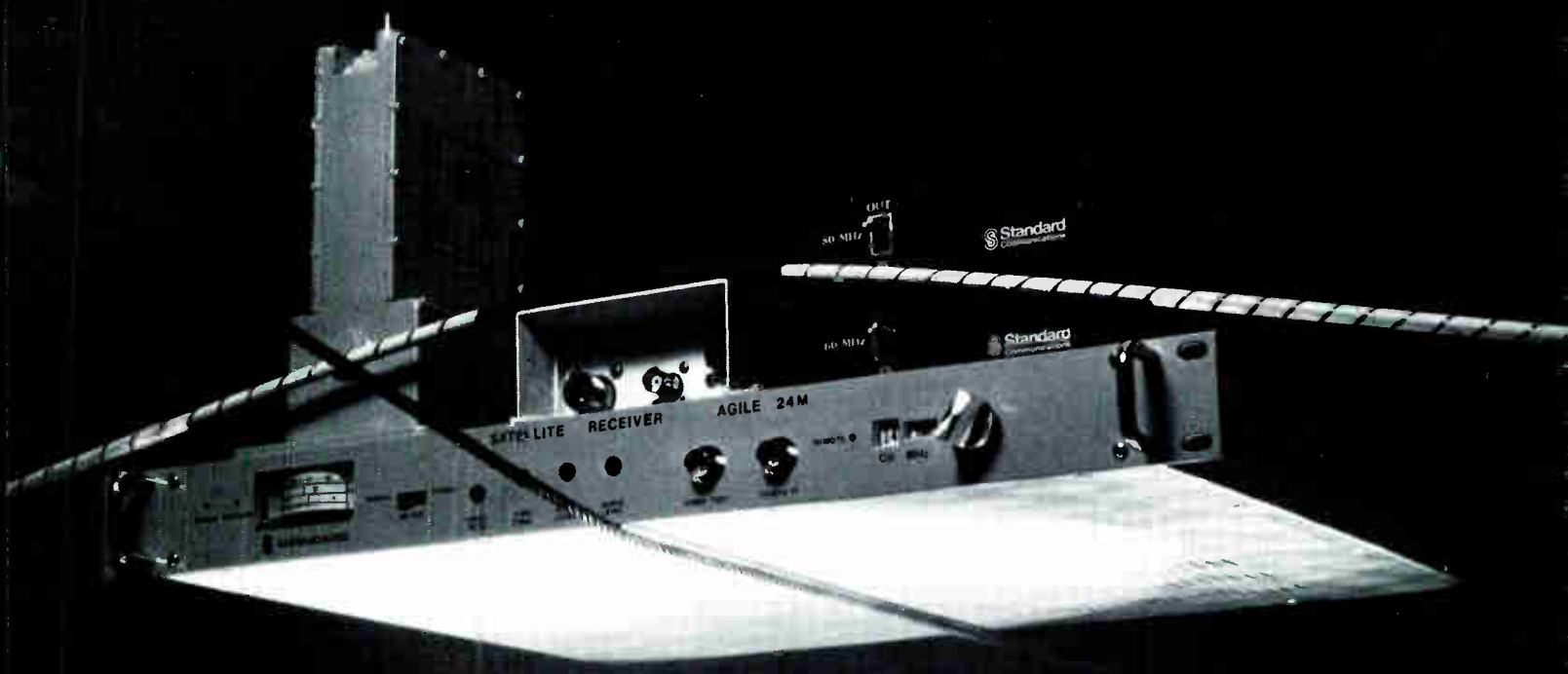
The "Molded Strain Relief" Device, applied over the back end of the Connector, now adds sufficient mechanical strength to greatly lengthen the effective life of the trap. It also provides a highly improved seal against ingress by water, humidity or salt spray.

Incidentally, the Molded Strain Relief comes in a variety of highly visible colors, so it provides added service as a color indentification tool in auditing.

Find out why it pays to add some life to your security system. Get more information on Thermalok.® Write or Call Augat/Vitek Inc., 901 South Ave., P.O. Box 111, Horseheads, N.Y. 14845.

The First Year's On Us

We'll take the risk.
If any Standard TVRO component malfunctions we won't just repair it, we'll replace it immediately.



Just a simple phone call. And an immediate replacement is on its way. That's the replacement option you have on all Standard TVRO Agile 24 satellite receivers and low-noise amplifier/block-down converters (LNBC).

It's part of the one-year warranty Standard offers on its TVRO equipment. And for years two through five, Standard's warranty allows for next-day replacement for a total cost of only $100, plus freight.

If avoiding downtime and the risk of annoyed customers is important to you, this warranty is another good reason to go with Standard for your TVRO needs.

Of course, the best reason has to do with why we can offer this kind of warranty in the first place.

It's because our failure rate is a mere one-half percent. With this low rate we're not taking much of a risk and neither are you.

For full information on Standard's complete line of TVRO components, write or call Telecommunications Division of Standard Communications Corp., P.O. Box 92151, Los Angeles, CA, 90009-2151. (213) 532-5300.

Standard Communications

...the TVRO System people

Reader Service Number 2

CED™

November 1984

About the Cover
Photographer Earl V. DeWald captures ATC Construction crews at work on the Mile Hi Cablevision build in Denver. Our thanks to John Dawson, Mile Hi director of engineering, and Don Williams, ATC Construction project manager.

 CED. (USPS 300-510) (ISSN 0191-5428) is published monthly by International Thomson Communications Inc., 600 Grant St., Denver, CO 80203. © November 1984, Volume 10, Number 11. Subscription Price: 1 year, $26.00; 2 years, $43.00; 3 years, $63.00. OUTSIDE USA 1 yr. $64.00; 2 yrs. $89.00; MUST BE PREPAID IN US FUNDS ONLY! Second-class postage paid at Denver, CO. *CED* is published on behalf of all parties, including the Society of Cable Television Engineers (SCTE). POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.

BPA

Talk to Magnavox immediately. We have years of rebuild-upgrade experience from working with hundreds of different cable systems. Plus, we have very advanced, yet economical drop-in modules you can depend upon.

Our modules are designed to help you save money, make money and win refranchise battles.

For example, our exclusive single hybrid Power Doubling™ and Feedforward electronics provide optimum distortion/noise performance. With high output levels so you'll invest in fewer amplifiers; and high gain for a longer, more economical reach.

And everything you need to rebuild is available from Magnavox which guarantees hardware compatibility, simplifies ordering, and saves time and money.

Make sure your rebuild turns out to be a bowl of cherries. Instead of a can of worms. Please contact your Magnavox account executive, or write, or call us toll-free.

Magnavox CATV SYSTEMS, INC.

A NORTH AMERICAN PHILIPS COMPANY
100 FAIRGROUNDS DR., MANLIUS, N.Y. 13104
TOLL-FREE 800-448-5171 (IN NY, 800-522-7464)

How to prevent your rebuild from turning into a can of worms.

Reader Service Number 3

Bob Dickinson

If he's not kicking the mud out of his shoes, plowing a field or checking his altimeter, you might find Bob Dickinson in front of his HAM radio barking out his call number to other radio amateurs or in E-Com's R&D Lab designing new cable products.

Dickinson is the mind behind E-Com's Tier Guard off-premise addressable and True-Net 100 and 500 videotex and home computer interface systems. He also is the man on top of the signal leakage issue.

As a pilot, HAM and cable engineer, Dickinson stands on all sides of the signal leakage fence. He flew the plane used in the original NCTA signal leakage investigation and currently chairs the joint American Radio Relay League/NCTA committee. He also was chosen as the NCTA's official liason to the ARRL.

Dickinson entered the cable industry in 1971, when he formed Robert V.C. Dickinson Consulting Engineers. Before that, he worked as assistant to the president for an international non-profit Christian broadcasting effort and as engineer and manager for several military and space electronics companies.

In 1972, he worked as a consultant for Manhattan Cable and developed what he says was the first commercially viable cable data system. In 1973, he incorporated his consulting enterprise into E-Com. "When most people think of E-Com, they think of electronic communications, or something like it. I chose the name because it tied into the business we were doing, but didn't restrict it," Dickinson notes.

At first, Dickinson admits E-Com was sort of a bootstrap organization, with little financing behind it. For a while, he and his son and a member of his son's graduating class pursued the Japanese word processor business, although their principle thrust was cable product development, primarily RF modems. Dickinson also continued to consult and authored several cable data franchise proposals, some of which were even winners, he says. In 1982, AM Cable TV Industries bought E-Com and Dickinson became senior vice president of AM Cable and director of E-Com Labs.

As a member of CTAC, the predecessor to the NCTA engineering committee, Dickinson got involved in the signal leakage issue at the beginning, when the Hershey, Pa., leakage incident threatened to stymie cable's future. "When the FAA got into it, they started calling cable a huge phased-array antenna," he says. As a pilot, he knew leakage from cable systems almost never interfered with aeronautical receiving equipment.

Convincing the FCC and FAA of this was not an easy task and then, the Flint, Mich., case occurred in 1980, and set back Dickinson and three other cable members' work by about five years. The FCC fined three cable systems for violation of aeronautical frequency use rules.

Interference with HAM radios is an entirely different matter, because the equipment is much more sensitive, Dickinson says.

Thus, when the NCTA chose Dickinson as their official liason to the ARRL, they chose someone who embodied the spirit of cooperation as well as someone capable of fostering it. "When we picked Dickinson as liason, we showed the league we held a person in high regard that they also held in high regard," says NCTA Vice President of Engineering Wendell Bailey.

And Dickinson says the joint committee is "making progress." Known as a tireless worker with a wonderful sense of humor, Dickinson continues to see cable as a big challenge. "We've seen a misdirection of effort in the ancillary, shop-at-home area. In the past, subscribers were charged for these services. That's small potatoes. You have to offer services that are of interest to merchandizers who'll advertise. Then you're talking big money," he says.

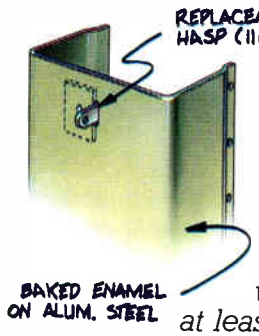
Besides chairing the joint ARRL/NCTA committee, Dickinson is a member of the NCTA Engineering Committee, and a senior member of the SCTE. He also is affiliated with the IEEE, SMPTE, Audio Engineering Society, and Institute of Navigation.

Dickinson received the NCTA Outstanding Engineer Award for Development in 1982, which Bailey says is not lightly given.

So, when you can't find Dickinson residing over a joint ARRL/NCTA committee or busy contemplating the latest addition to the True-Net 500, you might catch him in the air or at home, barking out, over the crackle of his HAM radio, "This is Whiskey 2CCE, do you copy?" —*Constance Warren*

We put the cable industry on its own pedestal

While others were adapting telephone pedestals for cable television applications, CWY was designing pedestals exclusively for the cable industry...a complete line of pedestals built to *your* specifications ...not someone else's.



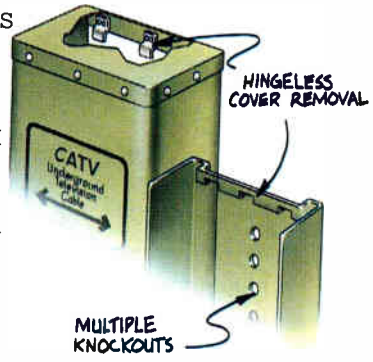
For example, CWY pedestals feature 16- and 18-gauge T2 aluminized steel construction, which tests show outlasts unpainted galvanized steel *at least five-to-one*. Plus, the rectangular design assures ease of installation and maximum use of interior space. CWY pedestals are easier to service, too; the positive, secure, hingeless cover removal system allows the front cover and top to lift off as one unit, giving you full exposure of the pedestal interior.

And while other manufacturers bend out a piece of steel and call it a hasp, CWY pedestals feature tough, 11-gauge plated steel hasps that are rugged and fully replaceable.

Multiple knockouts for ease and flexibility in equipment mounting...interior lid guides for extra security...an innovative stake lock that keeps the pedestal right where you planted it...and a whole lot more. All at prices you'll find *very* competitive.

So why buy pedestals made for someone else? CWY designed them just for you. For more information about CWY's complete line of pedestals and other cable TV solutions, call or write today.

Standard sizes: 4"x5", 5"x8", 7"x7", 6"x9", 10"x14". Call with specifications for custom sizes.



Not just supplies. Solutions.

CWY electronics

P.O. Box 4519—Lafayette, IN 47903—Call Toll Free: 1-800-428-7596—Indiana: 1-800-382-7526

Reader Service Number 4

Seminars

November

1: Atlantic Show, Atlantic City Convention Hall, Atlantic City, N.J. Contact (609) 848-1000.

1-2: The second of three two-day tutorials on "The Technological Underpinnings of Communications Policy" sponsored by **The Washington Program of The Annenburg Schools** will be held in Washington. Contact (202) 484-2663.

1-3: The First International Cable Television Congress, CATCOM '84, offered by the **Union of Swiss Cable Television** will be held at the Kunst & Kongresshaus in Lucerne, Switzerland. Contact 041-41 85 33.

6: The **Bay Area Chapter of Women In Cable**, the **Society of Cable Television Engineers**, and the **Bay Area Cable Club** are holding a seminar on the challenges facing the cable industry at Gallaghers Restaurant, Jack London Square in Oakland, Calif. Contact Sharon Kellogg, (415) 828-8510.

8-9: The third of three two-day tutorials on "The Technological Underpinnings of Communications Policy" sponsored by **The Washington Program of The Annenburg Schools** will be held in Washington. Contact (202) 484-2663.

13-15: Technical seminar for CATV technicians, sponsored by **C-COR Electronics**, Tampa, Fla. Contact Debra Cree, (800) 233-2267, Ext. 301.

15: Papers for the 1985 High Definition Television Colloquium sponsored by the government of **Canada** must be submitted. Contact Dr. Elmer Hara, (613) 993-6460.

29: A seminar on terrestrial interference in TVRO systems sponsored by the **Microwave Filter Co.** will be held in East Syracuse, N.Y. Contact Bill Bostick or Carol Ryan, (800) 448-1666 or collect (315) 437-3953.

29-30: Blonder-Tongue SMATV/MATV/CATV/TVRO seminar, Cherry Hill, N.J. Contact Sharon Leight, (201) 679-4000.

30: This date is the deadline for entries in the **JVC** Professional Video Competition.

December

4: A **Paul Kagan Associates** seminar on "Cable TV Security" will be held at the Marriott Hotel in Anaheim, Calif. Contact Genni O'Connor, (408) 624-1536.

4-6: abc TeleTraining Inc. will offer a course in "CATV management, engineering, and operating principles" in Tampa, Fla. Contact (312) 879-9000.

5-7: The **Western Cable Show** will be held at the Anaheim Convention Center in Anaheim, Calif. Contact (415) 428-2225.

Looking ahead

Dec. 4-6: abc Tele Training CATV management, engineering and operating principles, Tampa, Fla.
Dec. 4-7: Antenna Measurement Techniques, sponsored by Technology Service Corp., Atlanta.
Dec.5-7: The Western Show, Anaheim, Calif.
Jan. 10-14, 1985: NATPE '85, Moscone Center, San Francisco, Calif. Contact (212) 949-9890.
Jan. 30-Feb. 1: Texas Cable Show, San Antonio Convention Center, San Antonio, Texas. Contact Bill Arnold, (512) 474-2082.
June 2-5: National Cable Television Association convention, Las Vegas Convention Center, Las Vegas. Contact (202) 775-3550.

Volume 10, No. 11

CED

EDITORIAL OFFICES

Denver

Gary Y. Kim
Publisher/Editor

Constance Warren
Production Editor

Lesley Dyson-Camino
Administrative Assistant

Gary Arlen
Contributing Editor

John Dawson
Consulting Engineer

PRODUCTION

Denver

Kathy Berlin, Production Director
Brad Hamilton, Corporate Art Director
Diane Krensky, CED Art Director
Earl V. DeWald, Tim Sherman, Artists
Judith Ferland, Circulation Director
Madeleine Lyle, Circulation Manager

ADVERTISING

Denver

Cathy Wilson, National Sales Manager
Suzanne Sparrow, Classified Sales
Pam Berke, Marketing Manager
Shelley Epstein, Marketing Assistant
Maureen Scance, Marketing Artist
Kevon Storie, Traffic Manager

International Thomson Communications Inc.

Thomas J. Corcoran, President/Chief Executive Officer
Michael McCready, Publishing Vice President
David Carlton, Chief Financial Officer

OFFICES

Denver International Thomson Communications Inc., 600 Grant St. Suite 600, Denver, CO 80203 -or- P.O. Box 5208 T.A., Denver, CO 80217, (303) 860-0111
Washington Bureau 1701 K Street, N.W., Suite 505, Washington, D.C. 20006, (202) 835-0900.
New York Bureau 101 Park Avenue, Fourth Floor, New York, N.Y. 10178, (212) 661-7410.
West Coast Bureau, 101 North Robertson Boulevard, Suite 206, Beverly Hills, CA 90211, (213) 659-3965.

NCTA needs your help

Congratulations are in order for Bill Riker, who has left his post as Director of Engineering for NCTA to become Executive Vice President of the Society of Cable Television Engineers. Of course, this leaves Wendell Bailey with a slight problem—that of finding a high-powered replacement for Bill.

If you can throw your hat in the ring, or if you know somebody who should, it's time to do so. This industry deserves no less than the best person we can find.

"It's a critical position for the industry as a whole and for the technical community in particular," Wendell says. "It's a very, very high visibility post and will hold the individual in good stead."

Keep in mind that the Director of Engineering might someday be called upon to take Wendell's spot as NCTA Vice President for Science and Technology.

"The job involves a large amount of day-to-day writing. We need somebody who's articulate, able to write and represent the NCTA and the industry to a large extent in many other forums," Wendell says.

NCTA is looking for a candidate with a BSEE or equivalent. Solid writing skills are a must, and experience in a regulatory environment paired with working ability in day-to-day cable engineering is a plus. Ability to make engineering calculations normally used in cable, radio and video is required.

It's also important that the applicant explain complex engineering matters in a clear manner to non-technical audiences.

To apply, send a resume and letter of interest with your salary requirements and references to Wendell H. Bailey, Vice President, Science & Technology Dept., NCTA, 1724 Massachusetts Ave. NW, Washington, D.C. 20036.

And believe it or not, NCTA is already at work on the 1985 annual convention, the show's technical sessions and the prestigious technical papers volume. You can help brighten everyone's day by thinking about a technical piece you'd like to have considered for the technical papers volume—Now!

NCTA's Science and Technology Dept. really needs to hear about it by Jan. 4, 1985. They'll need two things from you: a short outline or summary of your idea running about 200 words; and a 30-word abstract.

The field is wide open at the moment: papers on any communications engineering topic of interest to the cable industry will be considered.

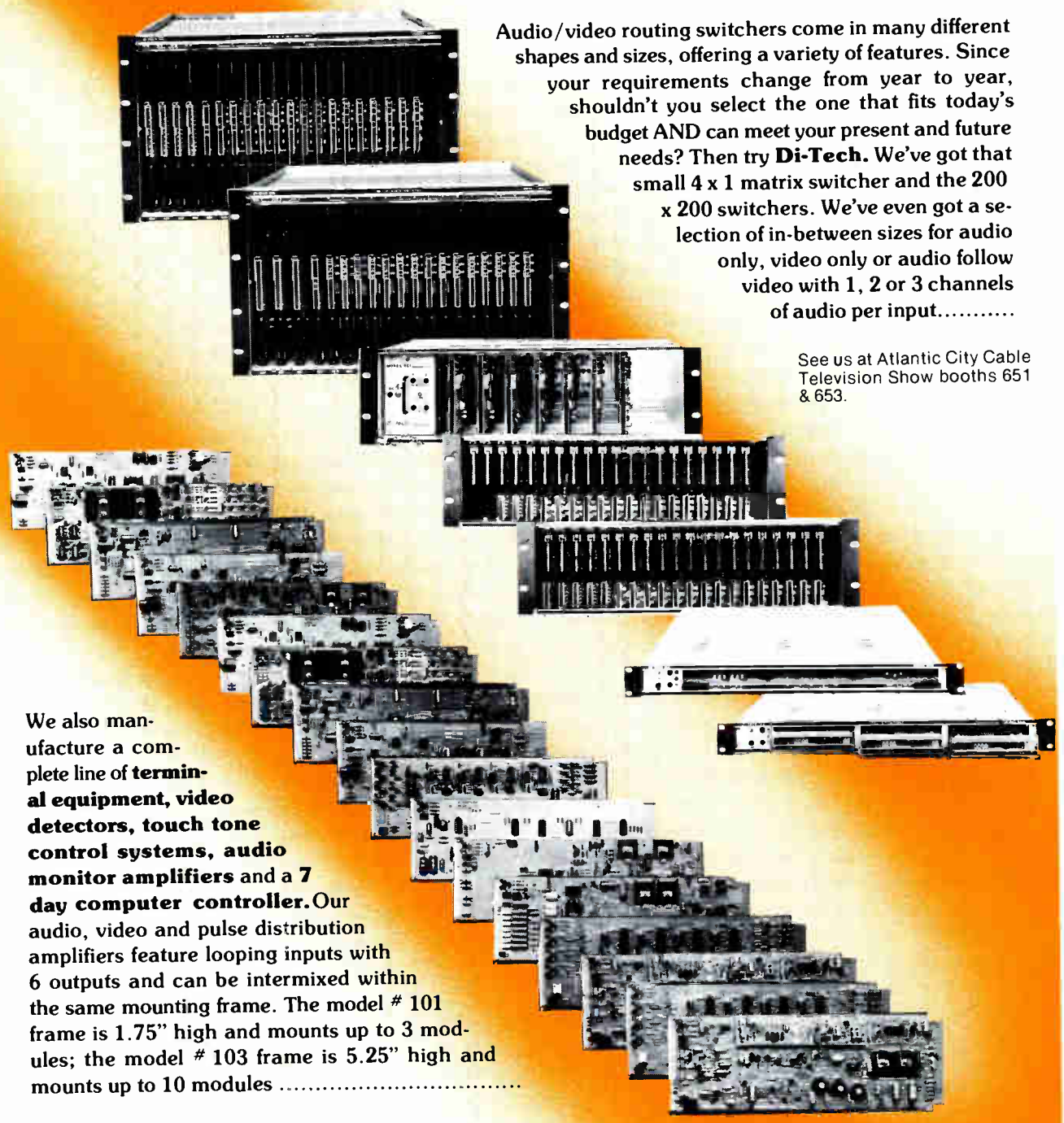
Mail your ideas to Katherine Rutkowski at 1724 Massachusetts Avenue N.W., Washington, D.C. 20036.

Now for the speculation: By the time you're reading this, the FCC will have reopened the signal leakage docket that has been hanging over the industry since about 1978. We're unable to provide any prior hints about the likely outcome, but suspect that the Commission will not simply codify the existing rules without change. Beyond that, we're not sure. We'll be following this closely and will report everything we can as soon as we can.

We're also planning a major announcement at the Western Cable Show in early December. We're excited and very pleased, so be looking for the news in this column and elsewhere in the magazine next month. We hope you'll be pleasantly surprised—we are thrilled!

Also, as the year draws to a close, we want to say "thank you!" to our many friends in the industry. It has been a difficult year for us, as it has been for many of you. We've had to work extraordinarily hard, and really appreciate the help so many of you have given *CED*. You'll see the pay-off quite soon, and we won't forget your support. You've proven that our love for this industry is well-founded. Thanks.

Imagine The Features That Will Answer Your Present And Future Needs ... Then Call **Di-Tech**



Audio/video routing switchers come in many different shapes and sizes, offering a variety of features. Since your requirements change from year to year, shouldn't you select the one that fits today's budget AND can meet your present and future needs? Then try **Di-Tech.** We've got that small 4 x 1 matrix switcher and the 200 x 200 switchers. We've even got a selection of in-between sizes for audio only, video only or audio follow video with 1, 2 or 3 channels of audio per input.....

See us at Atlantic City Cable Television Show booths 651 & 653.

We also manufacture a complete line of **terminal equipment, video detectors, touch tone control systems, audio monitor amplifiers** and a **7 day computer controller.** Our audio, video and pulse distribution amplifiers feature looping inputs with 6 outputs and can be intermixed within the same mounting frame. The model # 101 frame is 1.75" high and mounts up to 3 modules; the model # 103 frame is 5.25" high and mounts up to 10 modules .....

Whatever your present or future needs are, call **Di-Tech** for the high quality, reliable, easy-to-operate answer.

di-tech

*our **NEW**, bigger location:*
48 JEFRYN BOULEVARD
DEER PARK, N.Y. 11729
TEL. # (516) 667-6300

Reader Service Number 7

New SCTE veep

WASHINGTON—The SCTE has gained a new executive vice president and the NCTA has lost its director of engineering.

William Riker, who served as the NCTA's engineering director for the past year-and-a-half, began his tenure with the SCTE on Oct. 22. He succeeds Stephen Cox, who was the society's interim executive vice president.

In his new post, Riker will be the only full-time official at the SCTE, with responsibility for day-to-day operations and long-range planning as well as for organizing the society's annual Cable Tech Expo, to be held here in March. Riker also will be in charge of coordinating the association's professional engineering certification program, which will replace the FCC's recently cancelled engineering licensing program.

Eight exams and corresponding training programs will be administered by the society, and the tentative target date for the first exam is April 1985, Riker said.

The training programs will be offered at local seminars, chapter meetings and by satellite, using space on HBO transponders. When and how long the programs will be cablecast on HBO has not been determined yet, Riker added.

When announcing Riker's appointment, SCTE President James Emerson said, "Bill was selected by a unanimous vote of the Society's Board of Directors. We are very pleased to have someone with his diverse background in the cable industry to assist in shaping the future direction of the society."

Riker said the time has come for the SCTE to take a more active role in the industry, particularly with the winding down of new building and increased interest in economizing on system operations.

Bill Riker leaves NCTA to become SCTE's new executive vice president.

NCTA Vice President of Engineering Wendell Bailey said the association was in the process of searching for someone to replace Riker. "It's a hard job to fill. There are not a lot of people with Riker's particular blend of qualities. They're tough shoes to fill," he added.

Bailey said he was most impressed with Riker's work on the American Radio Relay League signal leakage issue, Advanced Television Standard Committee, NCTA multichannel sound testing and 2 ° spacing issues.

Riker's replacement will be a competent engineer who is articulate, has a good public presence, speaks well, can translate engineering and technical information into layman's terms and can lobby effectively, Bailey said.

When asked if he was surprised by Riker's departure, Bailey said, "At the NCTA you're never surprised. The visibility is such that qualified people almost invariably are lured away."

Riker's last day at the NCTA was Oct. 12.

—Constance Warren

Sytek Inc. offers data modems

In the July issue, we inadvertently omitted Sytek from the product profile on modems.

Sytek's LocalNet 20/100, 20/220 and 20/201 packet communications units (PCUs) are microprocessor-based, packet-mode network interface units manufactured by Sytek Inc. Specifications for the series are: CSMA/CD mode of operation; compatibility with sub-split, mid-split, high-split and dual cable; transmitter power output up to 46 dBmV; up to 120 subchannels broken out in 6 groups handling 20 subchannels each; user selectable channel spacing of 300 or 400 kHz; carrier harmonic content of 55 dB down; standard receive frequency range of 226.25 to 232.25 MHz; standard transmit frequency range of 70 to 76 MHz; receiver dynamic range of -6 dBmV ± 10 dB; receiver sensitivity better than -16 dBmV or 20 dB of quieting on all channels; data rate of 126 kilobits per second; and bit error rate of 1 in 10^{12}. Other features include single-channel support of up to 200 devices, frequency agility across up to 20 subchannels and DES encryption.

The 20/100 can support two serial user ports, the 20/200, eight serial user ports, the 20/220, 32 serial ports, and the 20/201, up to eight subchannels.

Standards work continues

WASHINGTON—After an eleventh-hour clearance from the Justice Department, the Direct Broadcast Satellite Association's Standards Committee held its first meeting Oct. 15. The engineering group expects to set industry standards for complete DBS systems and met later in October to weigh criteria.

In mid-November, the technical group hopes to begin reviewing competing systems. The objective will be a standardized system design with encryption, signal, data and audio formats specified.

"We're trying to look at things from the standpoint of the consumer," says Direct Broadcast Satellite Corp. Vice President Harley Radin. "There should be one piece of hardware that the consumer can use to pick up all signals desired—no matter which DBS firm is involved."

Radin is optimistic about the group's prospects. So far, there has been less wrangling than there had been on an earlier FCC advisory committee weighing similar issues. "Of course, things could get more controversial as we begin to close in on a single recommended system," Radin says.

The DBSA technical group is a successor to the advisory committee that submitted initial recommendations on standards for DBS to the FCC in June of this year.

Other standards-related work took place elsewhere on Oct. 17 as the FCC decided to establish an industry advisory committee on antenna specs. Affirming its order of last year calling for satellite spacing of two degrees, the commission hopes the industry committee can develop criteria by which to judge non-conforming antennas. The intent is to certify dishes that meet FCC requirements in practice, although not on paper.

Commission officials expected it would be several months before an organizational meeting of the new group could be held.

The Advanced Television Systems Committee also held October meetings on the 17th and 18th. Although no decisions were reached, several of the ATSC's technology groups continued discussions begun earlier on such topics as production, origination, transmission, test, receiving and distribution methods for enhanced 525-line video systems.

—Gary Kim

Connector return loss measurement

By Bradford S. Kellar, Raychem Corp.

Reprinted with permission of the NCTA and author. The article originally appeared in the 1983 NCTA technical papers volume.

As cable systems and local area networks using 75 ohm coaxial hardware extend to higher frequencies, problems with unwanted reflection of signals become more severe. System designers must rely on manufacturer's specifications to ensure adequate design margins, but in some cases these specs are based on measurements made with systems that contribute a high degree of uncertainty to the measurement. Worse yet, measurements made with "tuned" systems may make a product look better than it actually is. This paper will cover the theory of transmission line reflections, their measurement, uncertainty analysis, design of a fixture for connector reflection measurement and experimental results.

Transmission line theory

The characteristic impedance Z_0 of any lossless transmission line is given by

$$Z_0 = \sqrt{\frac{L}{C}} \qquad (1)$$

where L is the inductance in henrys per unit length and C is the capacitance in farads per unit length. In a coaxial transmission line,

$$L = \frac{\mu\mu_0}{2\pi} \cdot \ln\left(\frac{b}{a}\right) \qquad (2)$$

and

$$C = \frac{2\pi\epsilon\epsilon_0}{\ln\left(\frac{b}{a}\right)} \qquad (3)$$

where ϵ = Relative Permitivity of the Dielectric
ϵ_0 = Permitivity Constant = 8.85×10^{-12} farad/meter
μ = Relative Permeability of the Dielectric
μ_0 = Permeability Constant 1.26×10^{-6} henry/meter
a = Diameter of Center Conductor
b = Inner Diameter of Outer Conductor

Incorporating equations (2) and (3) into equation (1) gives

$$Z_0 = \sqrt{\frac{\mu\mu_0}{4\pi\epsilon\epsilon_0}} \cdot \ln\left(\frac{b}{a}\right) \qquad (4)$$

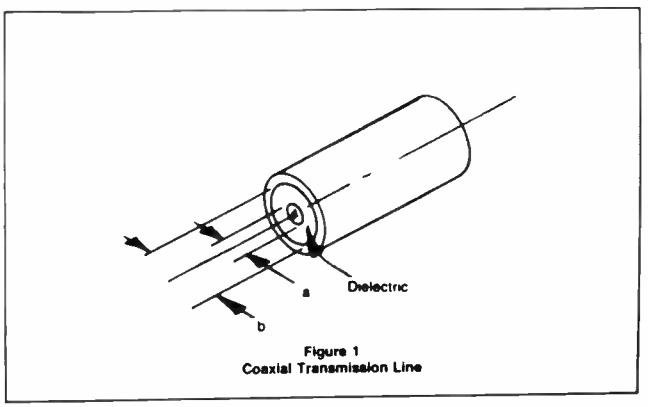


Figure 1
Coaxial Transmission Line

Since the dielectric usually has relative permeability = 1 (non-magnetic), we may write

$$Z_0 = \frac{59.96}{\sqrt{\epsilon}} \cdot \ln\left(\frac{b}{a}\right) \qquad (5)$$

Equation (5) is extremely useful in the design of coaxial connectors and transmission lines. It has been used extensively for the design of the standardized return loss fixture.

Cable systems have a characteristic impedance Z_0 of 75 ohms, partly because this gives a convenient ratio of center conductor to outer conductor size, and partly because this is close to the optimum impedance for minimum signal attenuation. If a, b, or ϵ in Equation (5) are suddenly changed so that the impedance is no longer 75 ohms, a discontinuity is created which affects the performance of the transmission system.

Discontinuities

Any discontinuity in impedance along a transmission line causes power to be reflected back from the discontinuity.

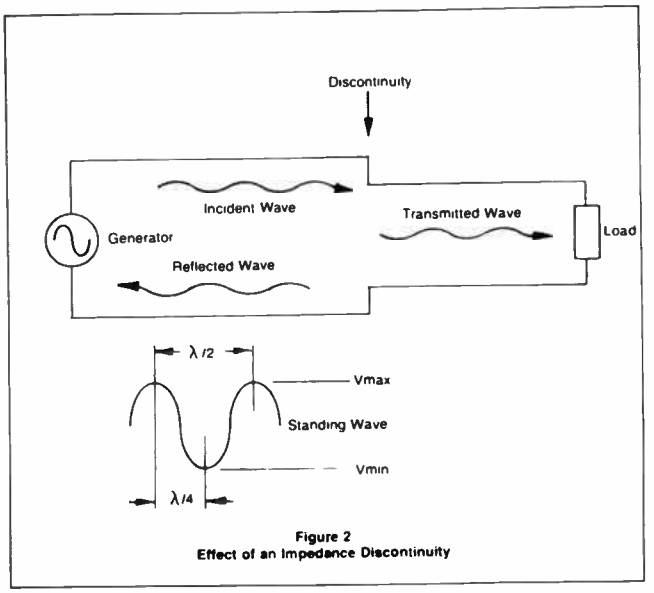


Figure 2
Effect of an Impedance Discontinuity

The magnitude of the reflected wave is expressed by the *reflection coefficient* ρ:

Reflected Wave Voltage =

$$\rho \cdot \text{Incident Wave Voltage} \qquad (6)$$

where

$$\rho = \frac{Z_2 - Z_1}{Z_2 + Z_2} \qquad (7)$$

If $Z_2 = Z_1$, then $\rho = 0$ and no wave is reflected. If Z_2 is an open circuit (impedance = infinite), then $\rho = 1$ and the incident wave is totally reflected. Similarly, if Z_2 is a short circuit (impedance = 0), then $\rho = -1$ and the incident wave is again totally reflected but 180 degrees out of phase with the open circuit reflection. The logarithmic expression of ρ is known as return loss, defined as

$$\text{Return Loss} = -20 \cdot \text{LOG}_{10}|\rho| \qquad (8)$$

SELECTING SUPERIOR™ IS A JOINT VENTURE. YOU PROVIDE THE SERVICE SUPERIOR SECURES IT.

At Superior Metal Products, we believe that protecting your facilities from the elements and unauthorized entry is our most important responsibility.

Whatever your needs might be in metal enclosures, either round or square, large or small, Superior is your choice for pedestals, wall mounted security enclosures, dual cabinets and encapsulating vaults plus a complete line of accessory items.

Superior guarantees the highest quality products, features factory direct service, **on-time delivery** and sells at factory direct prices.

Call or write for our complete product line catalog, TODAY!

Reader Service Number 8

SUPERIOR™

Superior Metal Products, Inc. *P.O. Box 5044* *Bellevue, Washington 98009* *(206) 455-9159*

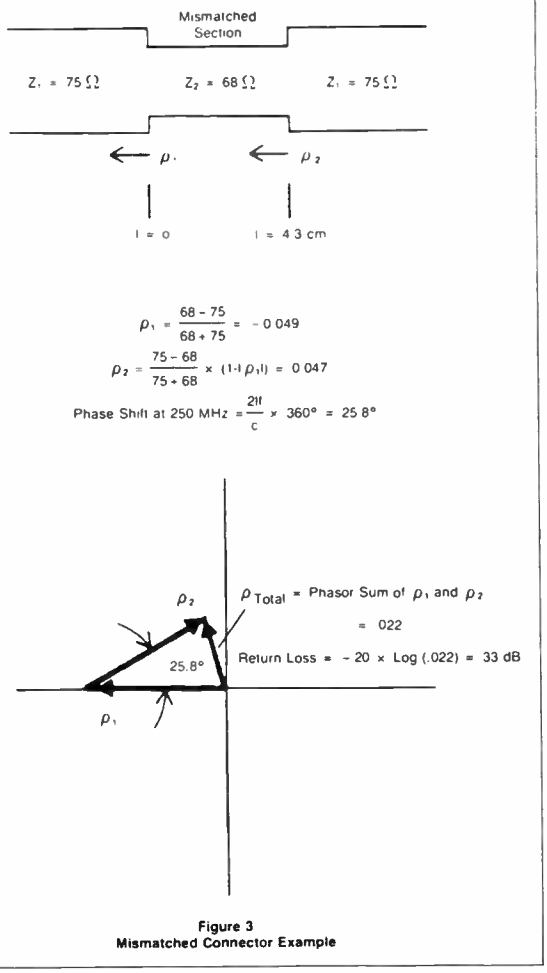


Figure 3
Mismatched Connector Example

Return of loss varies from 0dB (100 percent reflection to infinity (zero reflection), so the higher the return loss, the better the impedance match at the discontinuity.

The combination of incident wave traveling to the left and reflected wave traveling to the right forms a standing wave on the line. The amplitude of the alternating voltage varies with position along the line as shown in Figure 2, and the ratio of V_{max} to V_{min} is called the standing wave ratio, or SWR.

$$SWR = \frac{|V_{max}|}{|V_{min}|} \qquad (9)$$

The relationship between SWR and ρ is

$$SWR = \frac{1 + |\rho|}{1 - |\rho|} \qquad (10)$$

The impedance seen looking into a mismatched line varies with position as the SWR so that

$$Z_{max} = Z_1 \cdot SWR \qquad (11)$$

and

$$Z_{min} = Z_1 + SWR \qquad (12)$$

If a cable system has poor SWR, the signal level will vary unpredictably along the line and the impedance that an amplifier sees on its output may vary substantially from the load it was designed to drive. Good system design practice, therefore, dictates low SWR connections.

Multiple reflections

Systems with multiple reflections can be analyzed by representing each reflection as a polar quantity with magnitude ρ and phase shift 0. The magnitude of the overall reflection is the magnitude of the phasor sum of the individual reflections. A simple example is worked out in Figure 3, which illustrates the effect of a mismatched connector section inserted in a 75 ohm line at 250 MHz. As the frequency increases, the phase shift between ρ_1 and ρ_2 increases, increasing the overall reflection from this section. High frequency operation places more stringent requirements on connector design. (Incidently, computers are invaluable for keeping track of modelled systems with many reflections, and "sweeping" the model by varying ℓ to predict broadband performance.)

In reflection measurement set-ups, the effect of multiple reflections is to increase the uncertainty of the measurement. For example, if a device with $\rho_1 = .05$ is connected through an adapter with $\rho_2 = .02$, the measured reflection coefficient could vary between .03 and .07 since the phase difference between the two reflections is unknown (Figure 4). This is the principal problem with measurements where the connector being measured is seen through adapters and cable lengths which have reflections of their own that can exceed the reflection from the connector under test.

Reflection measurement techniques

All reflection measurement techniques require a means of producing test signals and measuring their amplitude accurately. We selected a Hewlett Packard 8754A Network Analyzer for this task. It includes a sweep generator to produce 4 MHz to 1300 MHz signals, two calibrated receiver channels and a logarithmic CRT display of signal amplitude. Several other manufacturers produce similar instruments. In addition to the Network Analyzer, some means of monitoring the reflections is needed.

A **slotted line** is a transmission line section that has a narrow slot or groove running its length. A probe can be inserted in

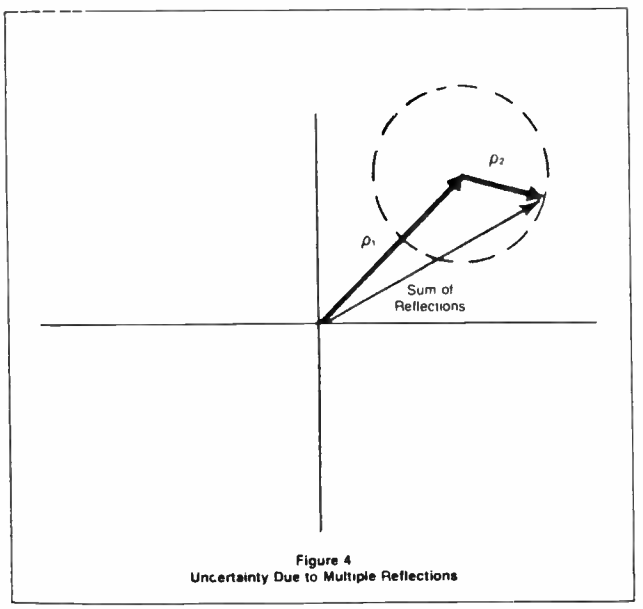


Figure 4
Uncertainty Due to Multiple Reflections

the slot and slid up and down the line until V_{max} and V_{min} (Figure 2) are found. Thus, SWR is measured directly, and ρ and return loss can be computed.

Slotted lines are very accurate, but they must be longer than a quarter wave length to ensure finding the peak and trough of the standing wave. At 50 MHz, the length must be greater than 1.5 meters, making the precision fabrication difficult. That is why they are generally reserved for use above 500 MHz.

The **directional coupler** provides a means of separating the forward-traveling and backward-traveling waves through controlled interaction of parallel transmission lines (Figure 5a). Modern coaxial directional couplers are small and cover a broad frequency range, making them widely used. The signal labelled "R" is the coupled wave, which is proportional to the reflected wave. In use, a short circuit is placed on the test port (100 percent reflection = 0dB return loss) and "R" is measured. Then the short is removed and the device under test is connected. The drop in reflected signal expressed in dB's is the device's return loss. Since most network analyzers have a log display, return loss can be read directly.

The range and accuracy of small reflection measurements made with directional couplers is limited by the **directivity** of the coupler. The signal labelled "D" in Figure 5a is the unwanted leakage of the incident wave into the coupled line. This combines as phasor with "R" and directly affects measurement uncertainty, just as the adapter did in Figure 4. Most precision directional couplers have a directivity of 40dB,

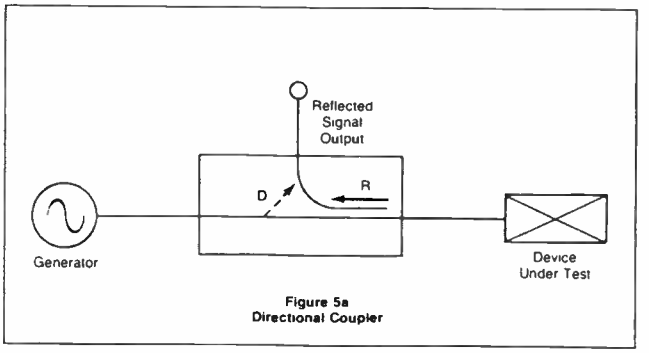


Figure 5a
Directional Coupler

which is adequate for many applications. But if the return loss of the device under test has a return loss of 40dB, the measured return loss could vary between 34dB (both signals add) and infinity (both signals exactly cancel). Techniques such as short circuit/open circuit averaging can improve the accuracy, but generally require extra computation on a frequency-by-frequency basis.

The **VSWR bridge** schematic is shown in Figure 5b.

Through precision transformer winding, higher directivity than a directional coupler can be achieved. The Anzac model RB-3-75 is specified to have 48dB minimum directivity from 3 to 1,000 MHz. Since the higher directivity improves the measurement accuracy, this model was used for our tests.

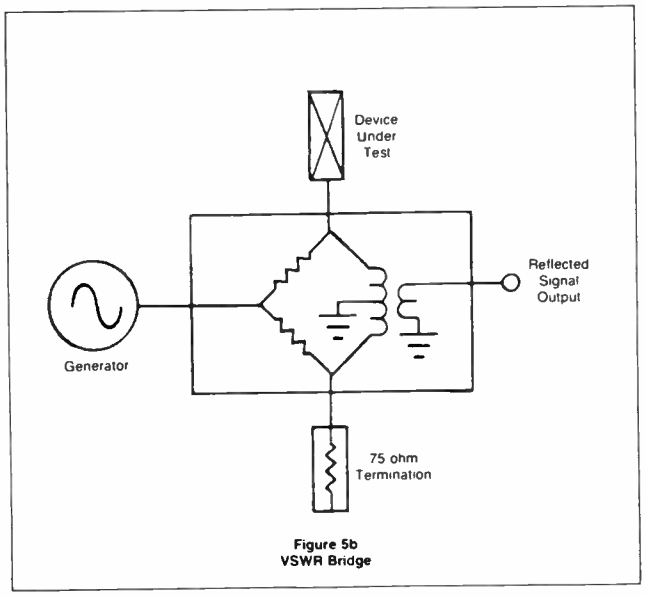


Figure 5b
VSWR Bridge

The complete measurement set-up is shown in Figure 6. The HP 8502B Test Set is used to apply a reference leveling signal to the network analyzer. The HP 8750A Storage Normalizer provides a means of "remembering" the short circuit reflection calibration so that plotted calibration traces are unnecessary. The HP 11852A 75/50 Pad provides a means of adapting the 75 ohm bridge to the 50 ohm network analyzer input. Finally, there is the test fixture, the subject of the rest of this paper.

Feedthrough connector measurement

There are three major problems hindering accurate feedthrough connector measurement:

1. Connector reflection measurement assumes that no reflections come from beyond the connector (i.e., the load). "Homebrew" loads may have their own reflections which contribute uncertainty to the measurement. Furthermore, designs for these loads are not widely available and have not been standardized by the industry.
2. Feedthrough connectors are designed to work with cable, but the introduction of cable into the measurement loop contributes uncertainty and non-repeatability to the measurement.
3. Precision lab test equipment usually uses Type N connectors. The adapters available to go from Type N to cable have reflections of their own similar in magnitude to those from feedthrough connectors, making accurate measurement impossible.

To solve the load problem, we decided to use a commercially available 75 ohm termination, the Wiltron 26N75. It has a specified return loss of ›52dB to 1,000 MHz, and a male Type

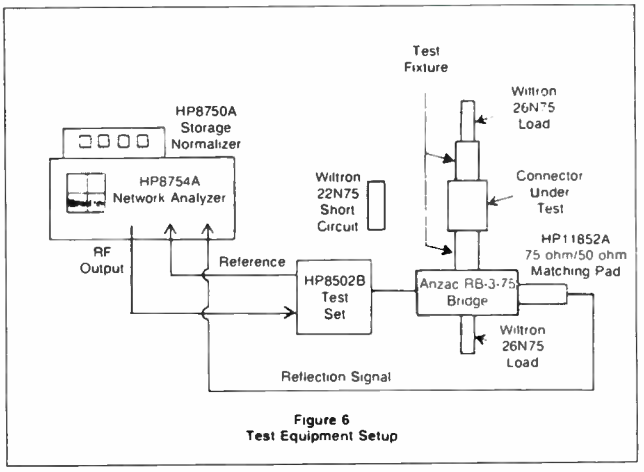
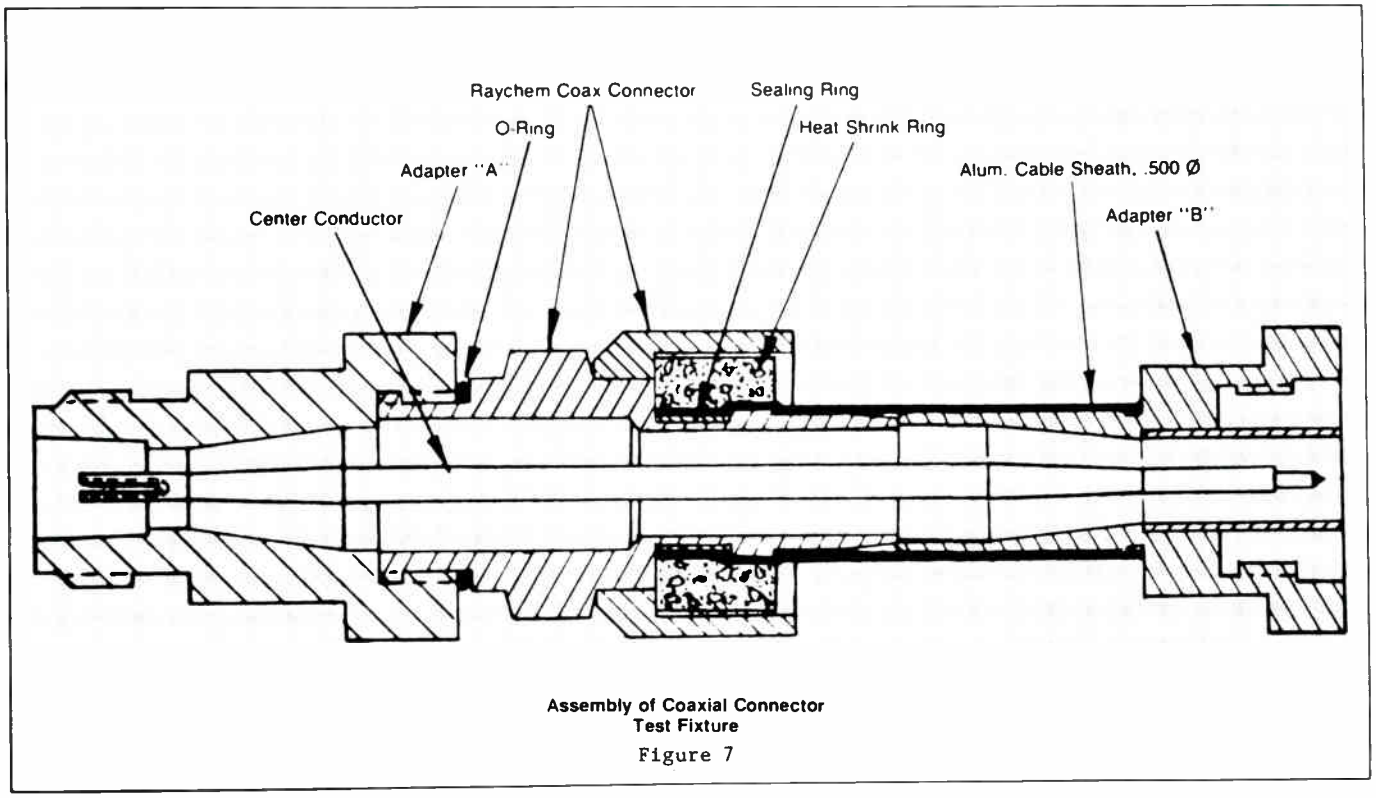


Figure 6
Test Equipment Setup



Assembly of Coaxial Connector
Test Fixture
Figure 7

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

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

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

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

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

For information on how to supply your cable system with Panasonic CATV converters, call (201) 392-4109.

Panasonic
Industrial Company

Reader Service Number 10

N connector. We then designed a fixture that (a) mates with the 75 ohm Type N connectors on the test port of the VSWR bridge and the load, (b) tapers to the dimensions of half inch cable TV coax with a .111 inch center conductor, (c) allows for mounting the feedthrough connector on the transmission line, and (d) maintains 75 ohm impedance throughout, per Equation 5. The center conductor is suspended only by its ends so that the impedance is not disturbed by supports or "beads". Figure 7 shows the fixture assembled with a Raychem feedthrough connector.

The center conductor must be held to tight tolerances for good performance. In particular, the line's impedance is sensitive to the center conductor's diameter, and the taper sections must begin and end on the same plane for center and

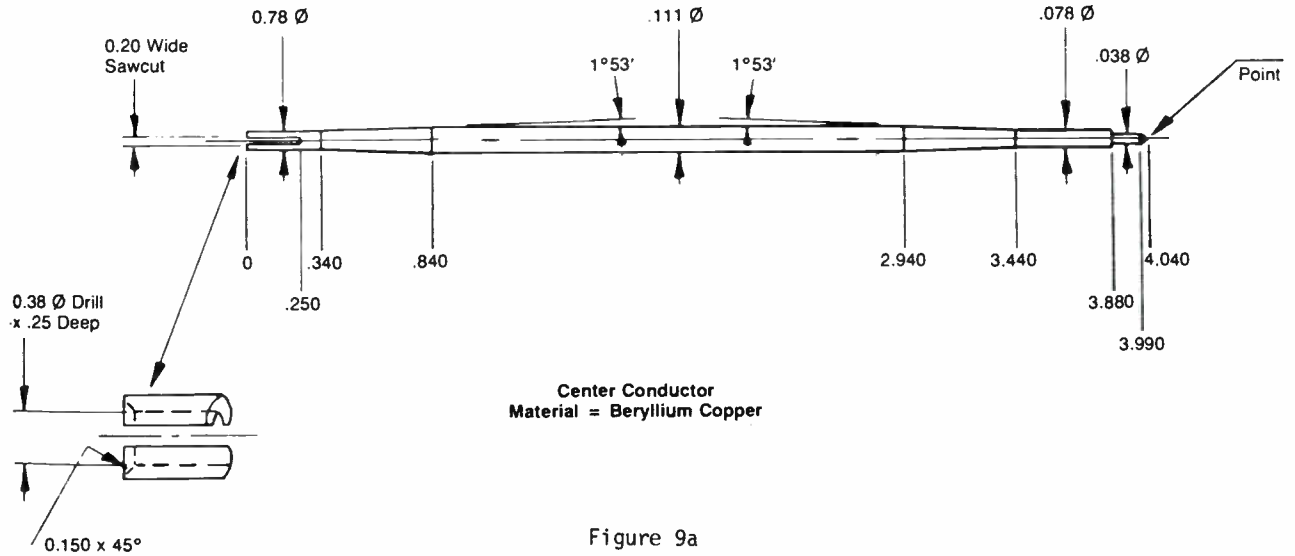


Figure 9a

outer conductor sections. Type N connectors have a specified "pin depth," that is distance between the shoulder or end of the center conductor and the reference plane in the outer conductor section. Therefore, the overall length of the fixture and center conductor must be accurately controlled.

Detailed drawings for the fixture are shown in Figure 9. The center conductor is made from beryllium copper so that the female pin fingers will be springy; the outer sections are brass. The connector is aligned with adapter "B" by a section of aluminum CATV outer conductor, which has been straightened to keep the components on axis. There is nothing tricky about this approach to connect measurement. It relies only on well known standards, formulas and commercially available products.

Evaluation of the test fixture was done with a dummy connector section designed to maintain exactly 75 ohm impedance. The return loss of the fixture is <50 dB to 750 MHz, 43 dB @ 1,000 MHz. This is actually the combination of reflections from the fixture, the load and the directivity error signal, and comprises the effective directivity of the set-up. Since this effective directivity signal combines with the reflections from the connector under test with an unknown phase shift, it is the major contributor to the uncertainty of the measurement (Figure 4). Other lesser sources of error include the network analyzer's detector linearity (±0.5dB) and the repeatability of the connections.

Results

Eight samples each of the Raychem ThermoCrimp connector, Brand "A" connector and Brand "B" connector were tested. The averages are plotted in Figures 10, 11 and 12. The

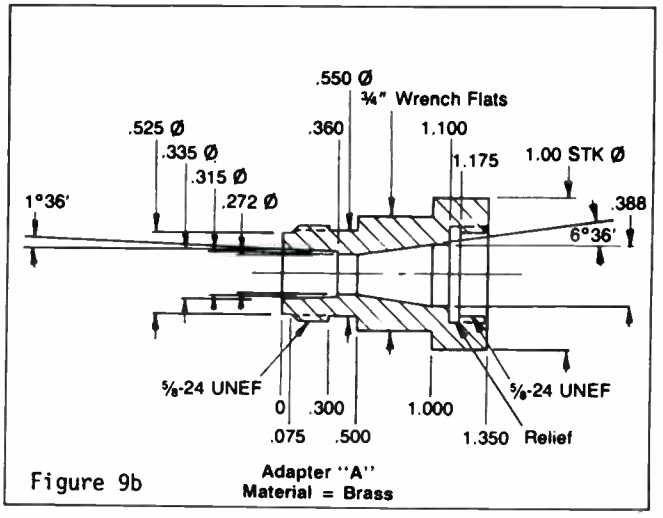


Figure 9b

standard deviations were generally about 1.5 dB, indicating fairly good repeatability. Brand "B," one of the most widely used connectors in the industry, clearly has inferior electrical performance compared to Raychem and Brand "A."

To illustrate the utility of the fixture, a mismatched connector with a uniform impedance of 68 ohms and length of 4.3 cm was produced and measured. Figure 13 shows the predicted return loss based on a computer model and the measured return loss. The agreement between predicted and actual results indicated a reliable test.

Not all half inch cable coax has the same diameter center conductor. The most commonly used cable has a center con-

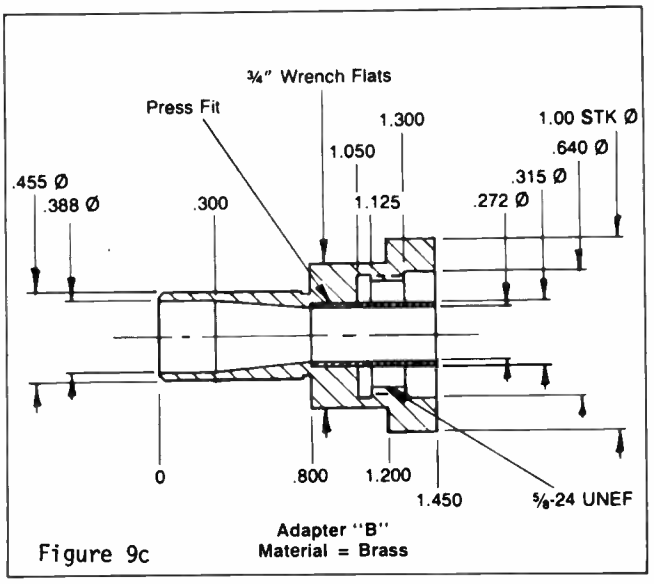


Figure 9c

ductor diameter of .111 inches, but some older cables have a .099 inch center conductor and some recently introduced cable (Comm/Scope QR-500) and a .117 inch center conductor. Since the impedance of a coaxial line is sensitive to center conductor diameter, special center conductor sections of .099 inch and .117 inch diameter were designed for the test fixture. The measurement data for the Raychem connector with these sections, and for an alternate Raychem connector designed for a .099 inch center conductor, is shown in Figure 14. (A slight impedance mismatch is present because the tapered outer conductor sections were designed for a .111 inch center conductor and new sections were not made for this test.)

Loss of signal in connectors can be due to lossy dielectrics, resistive connections, or signal egress. It can be easily and accurately measured using the fixture by feeding the transmitted signal back to the network analyzer rather than terminating it in the load (Figure 15). None of the connectors measured exhibited insertion loss greater than .05 dB, indicating that that this is not a service connector performance issue.

Most connectors use an insulating "bead" to center the center conductor. The effect of variations in raw material, molding processes, dimensions, etc., can be accurately assessed using the fixture described. Quality control of finished parts is also simplified.

The fixture design can be modified to allow testing of connectors for the different cable sizes. The tapers should remain gradual, pin depth controlled, and the fixture's performance verified using dummy sections.

Pin-type connectors and in-line splices can also be tested by this method. The center conductor will be split and it is suggested that the connector's pin be cut short and totally engulfed by the fixture's center conductor so that uniform impedance can be maintained. Again, fixture performance verification must be done to ensure accurate results.

Figures 10 through 15 follow on page 29.

Comm/Scope's Plenumax™ Plenum Cable. Now you can do it without conduit- and still have money to burn!

The Cable TV industry now has a new channel to go through that can eliminate costly conduit cable applications – forever!

If you're still protecting your cable with conduit in low power commercial applications, your time and money could be going up in smoke. Because the installed cost of new Plenumax Plenum is lower than that of traditional cable and conduit systems. Which is important when you consider that more and more cities are incorporating safer, more stringent rules to their fire codes.

Comm/Scope's Plenumax Plenum cable saves installation time and labor, requires less installation space plus no special tools or training are required. It eliminates conduit costs forever, simply because there's no need for it! UL-approved Plenumax cable has a tough, Teflon* jacket to protect the cable from fire and smoke damage. It's strong, durable, corrosion resistant, abrasion resistant and flexible enough to take the toughest bumps, curves and corners. And the high dielectric performance of Plenumax Plenum is not affected by time and temperature. Comm/Scope's Plenumax Plenum cable is also available in a variety of cable types: RG-59 (shown in illustration) and RG-6, RG-11, Dual RG-59, and Dual RG-6.

So give us a call today. And take the heat off your next installation budget with Comm/Scope's Plenumax Plenum cable.

*DuPont's registered trademark for its fluorocarbon resin

M/A-COM

Comm/Scope Marketing, Inc.

Box 199-A
Catawba, N.C. 28609
Contact Specialty Cable Sales at
1-800-438-3335

Reader Service Number 14

AND SOMEWHERE OUT THERE THE COMPUTER'S JUST TOTTING UP PROFITS.

DBC addressability pays.

The computer may be in the basement, across town or across the country. But it knows who's watching what in this building. It's taking orders and itemizing bills.

Home-run or Loop-through, DBC can design an addressable system that will turn any building into a money machine.

PLAY IT AGAIN SAM.

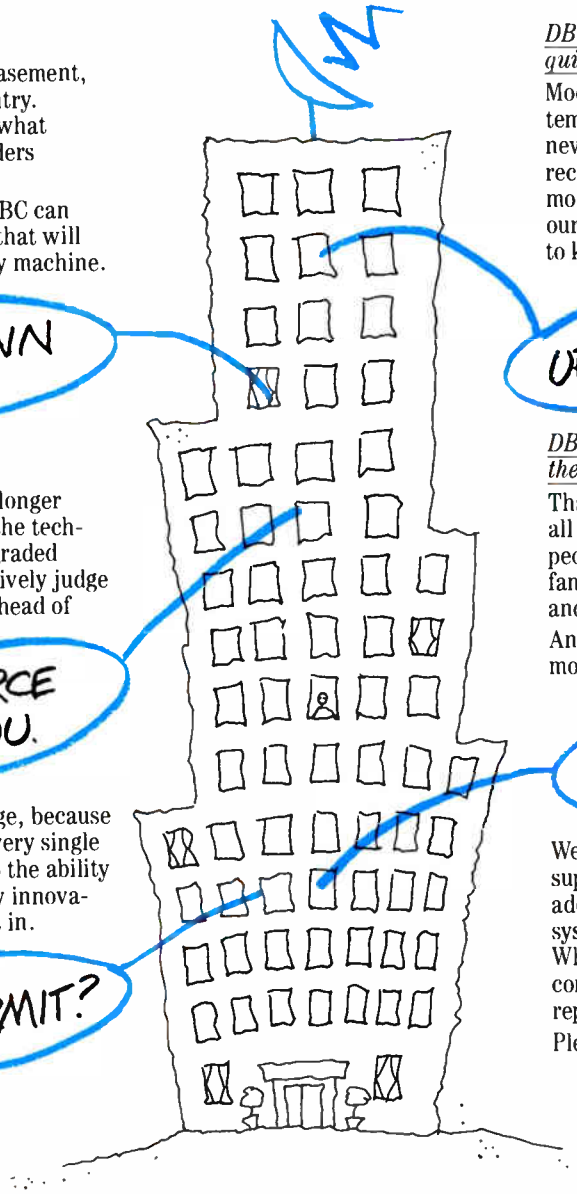
DBC leads in addressability.

We've been at this quite a bit longer than anyone else. And while the technology of addressability is upgraded almost monthly, we conservatively judge ourselves to be easily a year ahead of any competitor.

MAY THE FORCE BE WITH YOU.

We know we'll retain that edge, because we design and build almost every single component in our systems. So the ability to expand and to add on every innovation that comes along, is built in.

MOI, KERMIT?



DBC addressable revenue comes quicker, smoother.

Modernizing or replacing existing systems is quicker with DBC, and installing new ones is a breeze. We have a proven record of smooth, trouble-free, easily monitored performance. And although our technology is superior, we're eager to keep our prices competitive.

UP-UP-AND AWAY!!

DBC trouble-shooters know what they're doing.

That's because we do design and build all the components. So our service people are second to none...totally familiar with every piece of equipment and its function.

And those people are yours at a moment's notice.

HI-YO, SILVER!

We are the biggest and most experienced supplier in the profitable field of addressable TV. You do not have a systems problem we cannot address. Which simply means, DBC must be considered when you plan to set up or replace any addressable system.

Please contact us.

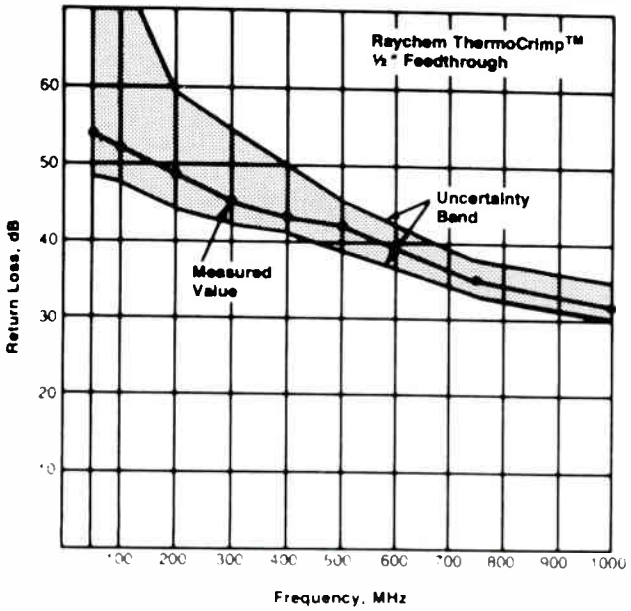
DBC TURNS ALL YOUR TV'S INTO PAY TV'S.

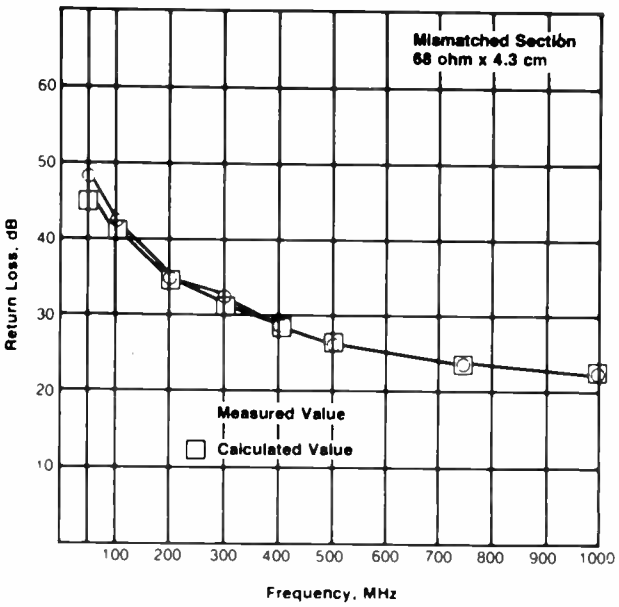
DBC

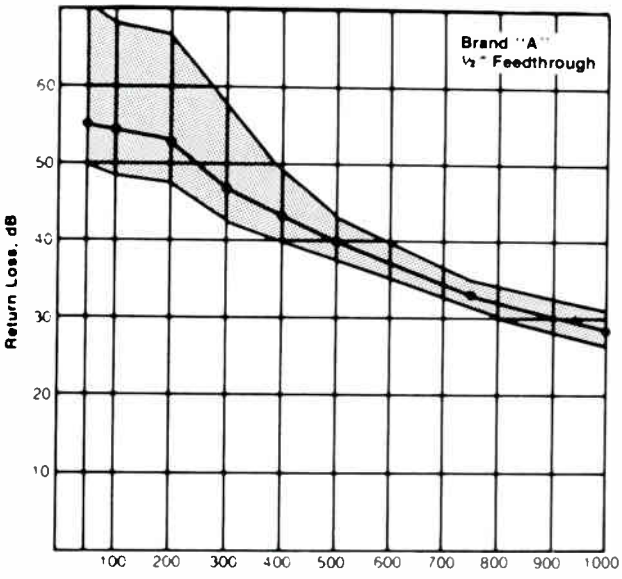
Addressable Systems

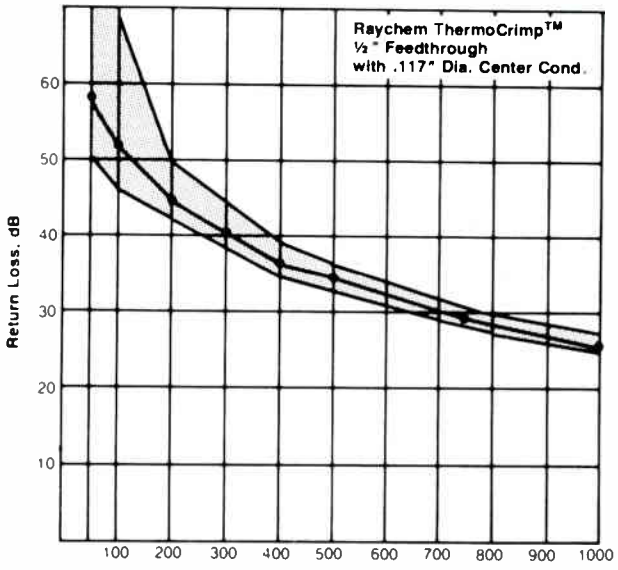
Don Atchison
Route 3, Box 536 Lakeside Drive
Decatur, Alabama 35603 Tel: 205-355-8577

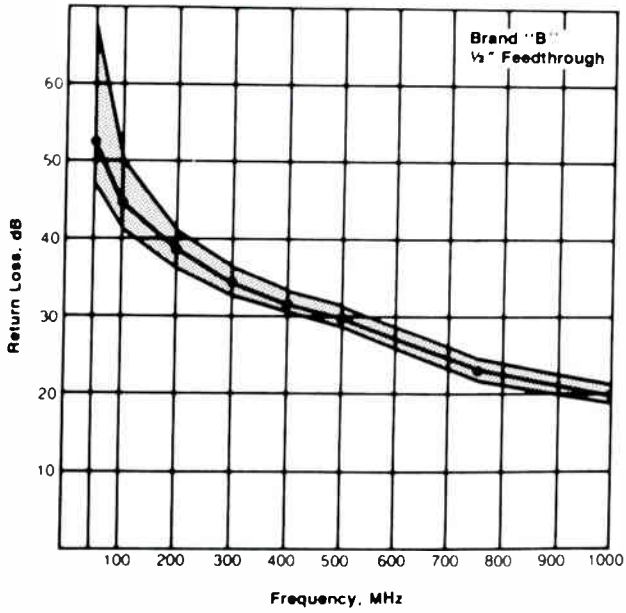
124 Belfield Road
Rexdale, Ontario Canada M9W 1G1
Tel: 416-241-2651 Telex 06-989357

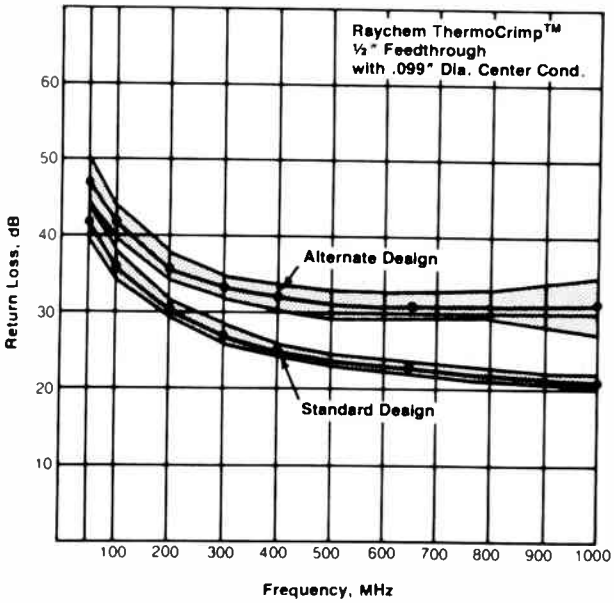

Raychem ThermoCrimp™
½" Feedthrough
Uncertainty Band
Measured Value
Return Loss, dB
Frequency, MHz


Mismatched Section
68 ohm x 4.3 cm
Measured Value
Calculated Value
Return Loss, dB
Frequency, MHz


Brand "A"
½" Feedthrough
Return Loss, dB


Raychem ThermoCrimp™
½" Feedthrough
with .117" Dia. Center Cond.
Return Loss, dB


Brand "B"
½" Feedthrough
Return Loss, dB
Frequency, MHz


Raychem ThermoCrimp™
½" Feedthrough
with .099" Dia. Center Cond.
Alternate Design
Standard Design
Return Loss, dB
Frequency, MHz

2° satellite spacing a mistake

By Norman Weinhouse,
Norman Weinhouse Associates

A well-informed cable operator should be aware of government regulatory actions that affect his operations even indirectly. When one considers the vastness of space, a seemingly esoteric item like how far apart communication satellites are spaced doesn't appear to affect cable operations, *but it does*. The FCC is currently inundated with applications for satellite construction permits and licenses for space stations. If the Commission grants more space station licenses than were allocated in their 1983 Orbital Deployment Plan[1], cable operators will probably be forced to upgrade their receiving earth stations or be subject to what most engineers in the industry consider objectionable interference.

The position of the industry, as expounded by the NCTA, has been to recognize the inevitability of closer spacing between satellites and in principle, encourage greater availability of product through more satellites. However, the NCTA has consistently urged that cable operators be given a reasonable amount of time to amortize the present investment in earth stations [2,3].

This paper reviews the brief history of U.S. domestic satellites; describes how satellites can interfere with one another, and explains how cable operators might be affected.

Background

The first artificial earth satellites for communications were launched in the late 1950s and early 1960s. This was a period of experimentation and infant development, and it soon became apparent that the "geostationary orbit" was the appropriate location for communications satellites. This geostationary orbit is a unique orbit such that, if an object is placed in it, it will rotate in synchronism with the rotation of the earth and appear to be stationary from all points on the earth. The advantages are immediately obvious. It means any antenna on the earth with a line of sight view of the object can remain fixed (or have limited motion) and maintain constant communication with or through the object. This geostationary orbit is a line (circle) 22,300 miles above the earth's equator. It is, therefore, a very limited resource and represents some valuable real estate, to use a phrase to which we earthlings can relate.

From the mid-1960s up to the end of that decade, there was uncertainty as to how to use that resource. The Commission issued a Notice of Inquiry[4] from which most of the current rules and policy evolved. Broadcasters and the monopoly carriers (AT&T and Comsat) all considered it their private domain, and several proposals were made to the FCC. In an historic precedent, the Commission declared an "Open Sky Policy" where any entity that was legally, technically, and financially qualified could own and operate domestic satellites[5]. Eight applications were received by the Commission, and this open entry policy was carefully defined[6]. Open entry was described as "multiple entry" but not unlimited or unrestricted entry. Restrictions were placed on the monopoly carriers such as AT&T, Comsat and GTE. Some restrictions also were placed on satellite manufacturers such as Hughes, RCA, Fairchild and Lockheed.

From the original eight bids, Comsat dropped its own separate proposal, and there were various realignments in response to the Second Report and Order[6]. Seven construction permits were issued, but only three of the applicants followed through and launched domestic satellites. Some of the old-timers in the cable business might remember that one of the proposals was for a system totally dedicated to the CATV industry. This one was originally proposed by Hughes Aircraft Co., and later modified as one from National Satellite Services, a joint venture of Hughes Aircraft and Time Inc. All of these original proposals were for C-Band operation (6 GHz up and 4 GHz down). This band was used in the international satellite arena and space-qualified hardware existed. Furthermore, a great deal of technical information existed relating to coordination procedures with terrestrial facilities. Since the orbital arc was virtually virgin territory, the commission made assignments generally in accordance with the requests of the applicants. Generally speaking, the first assignments were spaced roughly 5° apart.

After the initial round of grants, and the grant of Ku-Band satellites to Satellite Business Services, the commission took action in 1981 on a group of applications that had accumulated at the Commission[7]. There were no refusals, and a spacing plan of 4° at C-Band and 3° at Ku-Band was instituted. The applications kept coming and in November 1981, the Commission opened docket 81-704[8]. No further allocations were made until Aug. 12, 1983[1], based on an application cut off date of May 12, 1982. All of the applicants were given orbital slots and construction permits. Three applicants for Ku-Band satellites were required to provide financial justification before being allowed to proceed. This plan is the one currently in effect. It is characterized by uniform spacing of 2° at Ku-Band, and a mixture of 2°, 2.5°, and 3° at C-Band. In this plan, there are four unassigned slots at Ku-Band, two unassigned slots for C-Band, and one unassigned slot for Hybrid (combined C- and Ku-Band) satellites. Table 1 shows this current plan (as modified).

The Commission instituted a cut off date of Nov. 2, 1983, for the next batch of applications or modifications to applications previously submitted. On March 12, 1984, a list of applications which the Commission found initially acceptable for filing was published[9], and public comment was requested. Incredibly, there are 21 entities (10 new ones) requesting construction permits and licenses for 72 satellites (14 replacement satellites), although there is room for only seven in the current allocation plan. Comments were submitted by only three entities representing CATV interests. They were NCTA, Home Box Office and The Weather Channel.

Earth stations affected

Again, going back in the history of U.S. Domsats, a nine-meter minimum diameter was established as a guideline[4] for earth station antennas

Microdyne's Multiple Satellite Feed System lets you add to your programming instead of your debt

Saves the cost of a new dish

With new programming constantly being added, you may want to pick up programs from several satellites. Previously, this would involve the expense of another dish. Now with Microdyne's multi-feed system you may be able to add programming from additional satellites at about 1/5 the cost of a new dish.

The Multiple Satellite Feed System can receive up to five satellites on the same parabolic reflector when the satellites are located in close proximity. In a TVRO system designed with adequate margins, the MSF will provide quality pictures on all feeds.

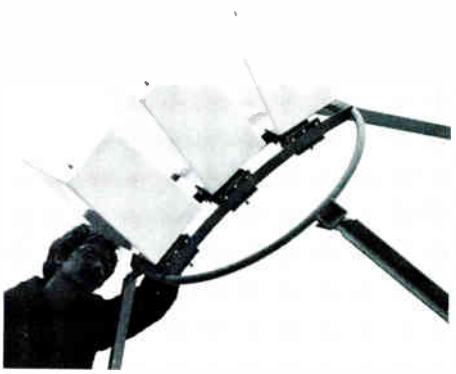
Easily retrofitted

Existing Microdyne antennas can be easily retrofitted to accommodate this new system. Only the struts and brackets of the feed support hardware must be changed—no other antenna changes are required. This simple modification can be done by the user or by Microdyne field service personnel.

Even if you purchased your existing antenna from another manufacturer, it may still be possible to modify it for use with the Microdyne Multiple Satellite Feed System. Please give us a call.

Increases Capability

So, whether you are planning a new system or expanding an existing installation, the MSF can provide increased capability while saving both the cost and the real estate required by a second dish.



When installed on a 5-meter antenna, isolation between beams is better than 20 dB, with a loss of about 1 dB at 4°off boresight.

Free Information

If you would like more information on our Multiple Satellite Feed System, contact your nearest Microdyne distributor, or give us a call at (904) 687-4633.

Microdyne Corporation

P.O. Box 7213 • Ocala, FL 32672 • (904) 687-4633 • TWX: 810-858-0307

Reader Service Number 16

used in U.S. Domestic Satellite Service. This guideline is still in effect for transmitting uplink signals, although in some cases this minimum antenna diameter requirement has been waived where the uplink power is low compared to a saturating signal. For video uplinks, waivers have been granted, but only on "special temporary authorization." Early CATV receive-only antennas followed this guideline, and satellite delivery of programs started in 1975. Only 100 or so of the very largest cable systems were equipped with 10-meter antennas and business development was slow.

On Jan. 7, 1977, the Commission ruled[11] on two conflicting petitions. Both petitions involved the nine-meter guideline discussed above. American Broadcasting Co. petitioned that the 4/6 GHz C- Band be reserved for services utilizing large high-gain antennas of nine meter diameters or more, and that all other services using smaller dishes be accommodated in the 12/14 GHz Ku-Band. The Community Antenna Television Association petitioned to allow antennas with 4.5-meter diameters to be licensed routinely. But the ABC petition was denied, and CATA prevailed. That ruling opened up satellite programming to cable facilities at reasonable cost.

The 1983 orbital plan[1] had a companion ruling that changed part 25 of the rules and set new standards for antenna performance[12]. All *new* antennas installed after July 1, 1984, are to meet these new standards. All antennas must meet the new standard by Jan. 1, 1987. An antenna meeting this new standard is sometimes called the 2° compatible or 2° compliant antenna. These terms are misleading, and cable operators should be wary of advertising that makes such claims. The standards were developed by the FCC based on an idealized space segment and some assumptions on the level of protection required.

Massive costs

When satellites were spaced 5° or 4° apart, the FCC rules on antenna performance didn't mention protection from other space stations, although the threat was always there. It was always properly assumed that the old antenna standard would protect against adjacent satellites to a level where the interference would not be harmful. Protection against terrestrial interference was of utmost importance. Defining this harmful level for satellite TV transmission has been difficult since it involves a subjective evaluation. Time and space does not allow a full treatment of the subject here.

Table 1
1983 FCC Orbital Assignment Plan

	Orbital Location Degrees West Longitude	User	Frequency Band(s)
	67	Satcom	4/6
*	67	RCA	12/14
	69	Spacenet	4/6 and 12/14
	71	Unassigned	12/14
	72	Satcom (II R)	4/6
	73	Unassigned	12/14
	74	Galaxy (2)	4/6
	75	Unassigned	12/14
	76	Telestar	4/6
	77	RCA	12/14
	78.5	Westar	4/6
**	79	Rainbow	12/14
	81	Amsat	4/6 and 12/14
**	83	ABCI	12/14
	83.5	Satcom IV	4/6
**	85	USSI	12/14
*	86	Telestar	4/6
	87	RCA	12/14
*	88.5 - 89	Spacenet	4/6 and 12/14
*	91	Westar	4/6
	91	SBS	12/14
	93	Unassigned	12/14
	93.5	Galaxy 3	4/6
	95	SBS	12/14
	96	Telestar	4/6
	97	SBS	12/14
	98.5	Westar	4/6
	99	SBS	12/14
	101	Unassigned	4/6 and 12/14
	103	G Star	12/14
	105	G Star	12/14
*	120	Spacenet	4/6 and 12/14
**	*122	USSI	12/14
*	122.5	Westar	4/6
	124	SBS	12/14
	125	Telestar/Comstar	4/6
	*126	Unassigned (RCA moved to 67°)	12/14
	128	Amsat	4/6 and 12/14
**	130	ABCI	12/14
	131	Satcom III R	4/6
**	132	Rainbow	12/14
	134	Galaxy I	4/6
	137	Unassigned	4/6
	139	Satcom IR	4/6
	141	Unassigned	4/6
	143	Satcom V	4/6

* Represents changes from original assignments.
** Assignments conditioned on supply of financial data.

But it is generally agreed by most engineers in the cable industry that the minimum protection ratio must be 18 dB. Some more conservative members insist that 20 dB is required. This means that the ratio of the desired carrier power to total interference power from all sources, within the passband of the receiver, be at least 63 (18 dB) or 100 (20 dB).

I presented a paper at the 1983 NCTA convention[13] demonstrating that with a practical space constellation, an antenna conforming to the FCC standard would have to be about seven meters in diameter if there was polarization interleaving in the space segment, and about 10 meters in diameter if there was no polarization interleaving. This represents a massive upgrade—not a trivial one. NCTA has estimated this massive upgrade cost at $200M to $400M.

There are also massive intangibles associated with such an upgrade. In fact many communities would object on environmental grounds. In the same article, I made recommendations to the antenna manufacturers on antennas with sidelobe response better than the FCC standard. I have the utmost faith that this can be done, but it will take time, and that is precisely what the cable industry is asking for, and deserves. The real question is, after licensing earth stations serving such a huge segment of the public, will the FCC place a massive financial burden on the cable operators providing this service before their investment is sensibly amortized?

Why more satellites?

The FCC has a monitoring program that periodically measures satellite use. The results have shown a consistant surplus transponder space. Use runs between 40 percent and 60 percent, and continues in a downward trend. In fact, if the two popular satellites which are dedicated to cable operations (Satcom IIIR and Galaxy I) were omitted, utilization figures would be embarassingly low. Where is the demand? I am aware of the various studies made for satellite transponder demand, but they are consistently off the mark after the 1980 time frame. In fact, there is no doubt that a glut in capacity currently exists as just one article in the popular press indicates[14].

Satellites are most efficient when operated in the "broadcast" mode, that is, point-to-multipoint rather than point-to-point. Although FCC monitoring activity only measures the nature of the modulation (FDM, SCPC, FM/TV, etc), it is certainly a fact that video and virtually all SCPC transmissions are point-to-multi point. Satellites also prove out economically for very long distance telephone service because costs are distance insensitive. However, technology trends favor fiberoptic transmission in the future. Terrestrial microwave transmisson growth patterns already show the incursion of fiberoptics. As this technology moves toward higher capacity and longer distance between repeaters, it will undoubtedly be more cost-effective than satellite transmission for high density long haul trunking of data and telephone service. This discussion does not by any means intend to denigrate satellite use for telephone and data. Satellites can provide new entrant carriers and resale carriers with instant national networks. Large private networks also can efficiently be established by satellite.

But spacing satellites close to each other can produce an effect opposite from that desired. Although capacity may increase with closer spacing, use might actually decrease because the cost of earth stations makes the service unattractive. Services that have proven to be commercially successful are those using the broadcast mode as men-

Continued on page 82

Satisfaction guaranteed.

We stand solidly behind every piece of cable equipment we sell.

Head-end through drop materials, it performs the way we say, or we'll correct it — immediately.

All items carry the manufacturer's full warranty.

We'll also compete with any distributor on price, selection, delivery, and service.

We stock all major brands, and can tailor packages to your needs.

Items arrive when you need them, not sooner or later.

And our engineers and technicians can answer any questions you have about design, installation, or field performance.

Call Cable Services with your next order, or for a free catalog: 1-800-233-8452. (In PA, call 1-800-332-8545)

Cable Services Company/Inc.

Reader Service Number 17

2113 Marydale Avenue, Williamsport, PA 17701

Underground construction tips

By General Cable Co., Woodbridge, N.J.

To prevent damage during construction of an underground plant, as well as assure maximum life to the plant, sound installation practices must be followed. The object is to prevent kinking, dents and other forms of damage that may occur during the underground installation process.

This article covers methods of construction used for the different types of cable, terrain and obstacles that may be encountered.

An underground build may require several different construction methods. These methods include trenching, vibratory plowing, direct plowing, boring and conduit installations.

The trenching method is the best way to avoid damage while burying cable, provided a proper backfill technique is used. It is best applied when there is a need to prepare for conduit or where there are front yards with frequent driveways. It also is a good choice when trunk, super trunk and multiple cables are being installed.

The equipment required would be, in most cases, a tractor with or without a reel pay off unit. The tractor is equipped with a trenching arm, which resembles a chain saw blade, that is lowered into the earth to cut the trench. A backfill plow blade is attached to the front of the tractor to push dirt back into the trench after the cable has been placed.

The first step when trenching or burying cable is to obtain locates. This is done by calling other utility companies in the area, well ahead of the dig, to mark the lines for you. Existing coaxial cables to remain for CATV use should also be located. Exploratory holes should be dug to your maximum depth to ensure that any cables in your path will not be cut.

After the path has been established, the trench is opened from pedestal to pedestal. If obstacles such as fences or driveways are involved, the trench should be dug as close as possible. After boring or hand digging under the obstacle, the trenching may resume. Once the trench is completed, all foreign objects, such as large stones, should be removed to prevent damage.

When ready to install the cable, position the reel at one end of the trench with the cable paying off from the bottom of the reel. Use reel brakes to prevent overrun. Seal the end of the cable with an end cap and tape to protect it from water and dirt. Carefully pull the cable through the trench, making sure the reel is not binding.

At the pedestal location, the cable is pulled six feet past if the pedestal is positioned over the trench, and more than six feet if there is an offset pedestal to account for. Apply a small amount of dirt at the bottom of the trench to hold the cable in position. If the pedestal is positioned over the trench, carefully bend the cable upward and reposition, cut and cap the tail for pedestal placement.

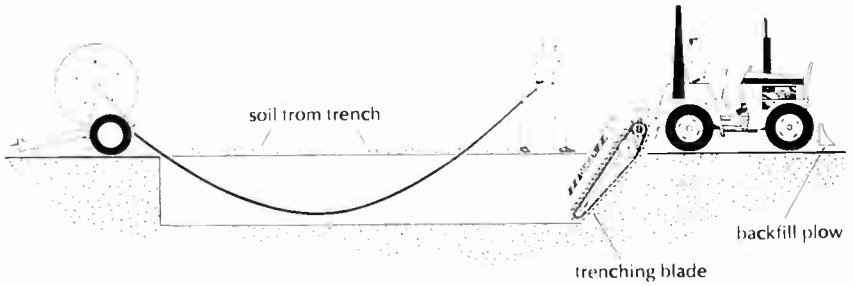
If the pedestal is offset, form the offset angle carefully around the trench wall by hand or with a cable forming tool. Carefully place cable in the offset trench and secure with a small amount of dirt. Bend the cable upward to the pedestal location. Install the pedestal over the tails, taking care to avoid damaging the cable. Always trim the cable off at the top of the pedestal. Cap the cable with an end cap and mark the input cable in some manner so that it is easily identified by the splicer.

A 2½- to 3-foot piece of Sealtight tubing or Armour Flex flexible conduit may help form cable for pedestal placement or make small bends. This conduit comes in various sizes that will conform with the outer diameters of the various cable sizes. The conduit is placed over the area to be curved by sliding it over the end of the cable. After the conduit has been carefully formed into the curve, it may be removed.

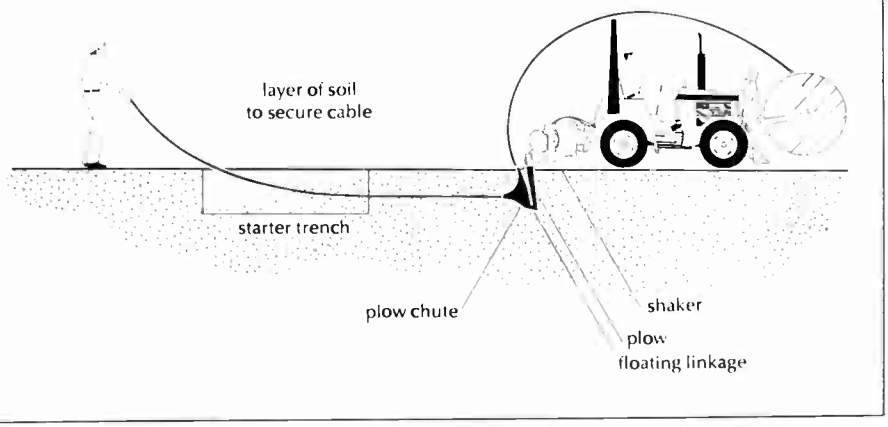
Once the cable is installed in the trench, carefully backfill with a six-inch layer of the fine soil. Complete the filling of the trench and then compact it along its length.

The vibratory plowing method may be the most popular form of burying

Trenching



Vibratory plowing



cable, since it is much faster than trenching and causes much less yard damage. It is also better than the direct plowing method because there is less chance of damaging the cable during installation.

This method is best for installation of feeder cables and for areas with rocky soil where the chute is needed for cable protection. Vibratory plowing may also be used to install trunk cables up to .750 inches provided the proper chute design is used.

The plowing machines used for this method range in size from small walk-behind units to large riding units with a self-contained reel pay off. Attached to the plowing machine would be a shaker, which is a device that imparts a vibrating motion to the plow blade. The plow, which resembles a large knife blade, cuts the earth to a given depth in preparation for cable insertion. These blades come in both vertical and forward angled versions.

The chute, which is attached to the back side of the plow, is a protective device for the cable to feed through. It may be attached to the plow in one of two ways. The fixed chute attaches rigidly to the plow blade and, therefore, vibrates along with the plow. The concept behind this method of attachment is to minimize frictional drag. The floating chute design attaches to the plow with a pivoting mechanical linkage, which allows the chute to remain steady while the plow vibrates up and down.

During the plowing process the cable rides against the gate through the entire radius. This increased contact area causes more frictional drag than there would be with a fixed chute, but gives less potential for damage in the chute since there is less movement.

The chute is designed to guide the cable through a gradual radius, in order to change the direction of the cable from that of entry to the final horizontal position in the ground. This radius should be approximately 20 times the cable outer diameter. Many chutes currently manufactured for CATV utilize a radius of approximately 10 times the cable outer diameter. Since the recommended bend radius of CATV cables of all manufacturers is 15 times the cable outer diameter, damage may occur when using this type of chute.

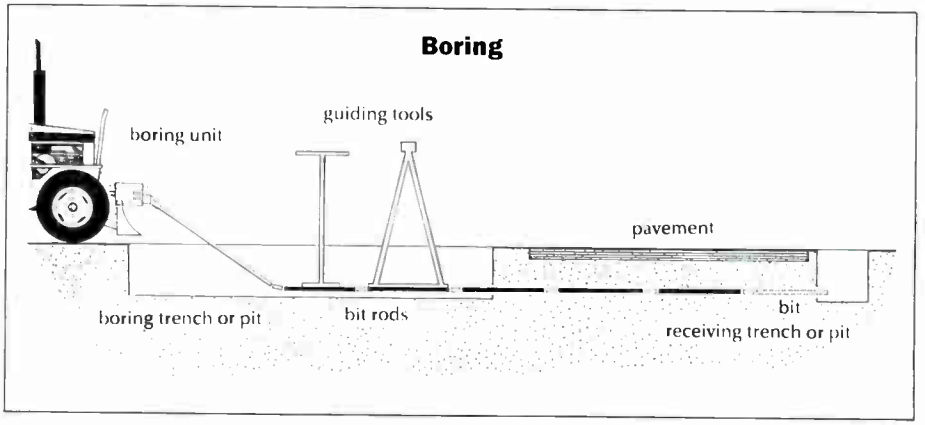
For this reason General Cable has designed a chute that has a radius approximately 19 times the O.D. for trunk cable and 25 times the O.D. for feeder cable (actual radius of the chute is 16 inches). The more gradual angle of entry into the ground helps eliminate damage and lengthens the life of all cable designs.

Before plowing starts, a small trench approximately 5 feet long and 2 feet deep is made at the first pedestal location. This allows for insertion of the plow blade and chute. The cable is then prepared to pay off the reel. If the cable reel is mounted and carried on the machine, make sure the cable pays off the top of the reel and into the chute free from any obstruction or sharp corners of the machine.

If the cable reel is to be mounted on a trailer or jackstands, a sufficient amount should be pulled off from pedestal to pedestal with an excess amount allowed for the tails. Reel brakes should be used and the reel should be carefully watched for binding.

To load the plow chute, the blade and chute must first be lowered into the starter trench. The chute gate is then opened and removed.

Using two hands located at the entrance and exit of the chute, carefully position the cable into the chute housing. The cable should conform roughly to the radius of the gate, and excess cable must be left exiting the chute to al-



Ditch Witch 255 SX debuted this year, but customers already are asking for more maneuverability.

Trencher technology plows ahead

The first small trenchers probably were developed in the late 1940s as a tool for plumbers. At that time, even utilities were keeping their plant aerial, because known telephone and electric cables would deteriorate underground. So the development of trenchers and plows familiar to the CATV industry had to wait for the arrival of better cable, says Jeff Griffin of Ditch Witch.

"The telcos started using trenchers and plows about 1955, and cable began to use them more heavily around the early 1970s," says Bill Schosek, president of Elephant Industries.

Over the years, there have been a number of changes in the machinery to accommodate the cable industry's needs. "Because the cable industry needed it, there's been a trend towards more compact equipment, especially more compact plows, than there would have been otherwise," Griffin says. "Manufacturers have come up with different blades with bigger bend radii, and designed plows small enough to work in backyards."

Because yard gates are fairly standard at 36 inches, the latest developments have included getting the machines down to a size that allows crews to get through without taking fences apart.

But size isn't the only change the equipment has undergone over the years. Line Ward Corp. has been selling the same basic model for about 14 years. But there has been a trend toward greater horsepower. "We've also gone from wheels to tracks, added a reel carrier and an electric starter, added off-balance wheels for steep grades and muffled the sound to about one-third of what it used to be," says Gene Ward, company president.

Because it is compact, the company's vibratory plow "can actually make a right angle turn without breaking the cable," says Jerry Ward, company vice president.

There's also a trend towards greater weight, in addition to greater horsepower. "In recent years, virtually everyone has gone after the market with greater horsepower and about 30 to 50 percent more weight," says Vermeer Manufacturing Co.'s Paul Hugen.

Better footage and the ability to dig deeper are the reasons for the new emphasis on power and weight, and many machines now on the market feature 35 horsepower.

The increasing number of urban builds has forced other changes as well. "We've added a new saw for our 30 HP plow specially designed for urban areas," says Griffin. "It features a smaller attachment and can work in tight areas."

Ditch Witch also is building a wider variety of blades for the cable industry. "And we've gone from a fixed trolley to a swing trolley so you can plow a tighter circle," Griffin noted.

And the changes seem to be made frequently. Ditch Witch's 255 SX is a 1984 model, but cable customers already have asked for more maneuverability.

Elephant Industries brought out its first machines in 1977, and "has had a new design roughly every two years," Schosek says. "We've gone to a harder rod material and higher strength steels for blades. We used to use a softer steel, but it would go dull in a few days, and we'd like to have a guy use it for a year without any problems." —*Gary Kim*

low for pedestal forming as well as to prevent pull out upon start-up. Reattach and secure the gate with the bolts or pins provided. The chute should then be adjusted into the start-up position.

When the plowing starts, the tail must be held in the upright position to prevent the cable from pulling out. Dirt can be thrown in the trench to help hold the cable in place and a pedestal also can be installed at this time. Do not stand on the cable in the starter trench since significant damage may result. The cable should be held for the first 15-20 feet of machine travel.

An experienced crewman should walk beside the plow carefully lifting the cable and guiding it into the chute entrance. Pushing the cable into the chute is not required or recommended. If the cable does not feed freely while being guided, stop the machine and vibrator, dig around the chute and open it to check for obstruction, such as small stones.

Once the plow has finally reached the pedestal location or receiving trench, stop the machine and the vibrator and leave the blade in the ground. If an obstacle is encountered where a bore is required, the plowing should stop about 10 feet short to allow room for a starter trench. Carefully dig around the chute in order to remove the gate.

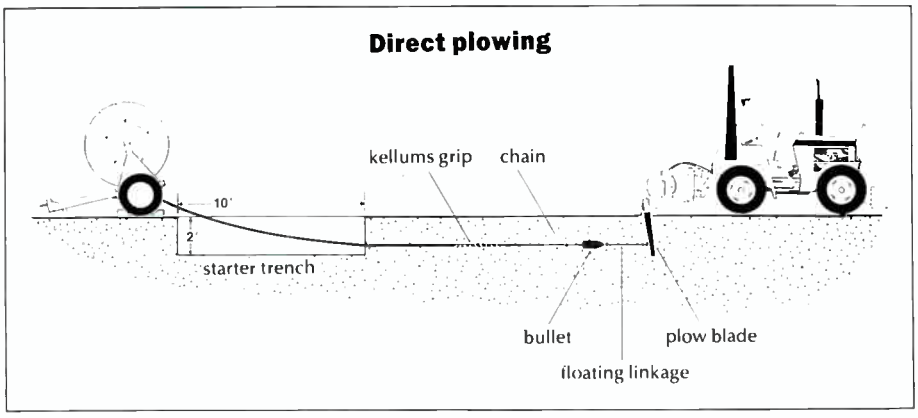
After the gate has been removed, hold the cable tail and move the machine forward without the vibratory motion. This will free the cable from the chute. Once the cable is clear of the chute, the blade can be lifted out of the ground. Position the cable for the pedestal as described in the trenching techniques, and compact the slit trench if necessary.

Direct plowing

The direct plowing method is the fastest method of installing feeder cable and may cause the least amount of ground destruction. But since it can only be used for moist clay soil and non-rocky soil, it usually has limited application. This method also leaves the cable vulnerable to damage, since the cable is pulled through the ground and might be scraped or flattened by foreign objects.

The equipment used for direct plowing is basically the same as for vibratory plowing. The chute, however, has been replaced by an attachment called a bullet, which is a swiveling tapered plug. The cable then attaches to the bullet with a kellums grip and a small length of chain.

The plow cuts the earth to the desired depth. The bullet then separates



the loosened earth and provides an oversized hole to pull the cable through.

Direct plowing starts with locates. Once the path has been established, the cable reel is positioned in line with the plow run with pay off at the bottom of the reel. Once again reel brakes should be used. A starter trench is opened to allow insertion of the plow and cable. Prepare for plowing by first attaching the bullet to the back of the plow blade. The bullet should be two times the cable outer diameter. A 6- to 12-inch chain should be attached to the back of the bullet in order to allow the plow to back up if necessary.

Next, attach a swiveling kellums grip to the chain. Before the cable is inserted, it must first be capped and tapped tightly. Once this is done, insert the cable into the Kellums grip, carefully lower the blade and cable into the starter trench and begin plowing. As the plow moves along, monitor the reel rotation and the cable entrance into the ground. Before the plowing machine reaches the pedestal, a small trench is made. This allows the plow to stop the previous run and also should provide excess footage for that pedestal location.

Once the plow and cable have reached this point, the cable should be inspected for damage that may have been caused during the pulling action. The cable is then detached from the bullet and the plow is removed. If an obstacle is encountered that requires a bore, a trench is made for the boring operation. The cable is then plowed into the trench and detached from the bullet.

After the plow is removed from the trench, a pulling line is fed through the bore and attached to the kellums grip on the cable. The cable can then be pulled or winched under the obstacle and plowing may resume on the opposite side. Use the procedure described in trenching to form the cable into the pedestal.

Boring

Since some obstacles, such as driveways, sidewalks and roadways, cannot be dug-up, it is necessary to bore under them to establish a cable path. This may be done with pneumatic units that resemble a large horizontal drill. These units push and turn a bit connected by long sections of steel rod in order to drill a hole for the cable.

Start by obtaining locates. In this case, it may be necessary to know the depth of any obstruction since exploratory digs may be impossible. After the path is established, open a starter trench to enable insertion of the bit,

The Best Kept Secret In
The Cable Plow Business Is
The B-30 Price.

Why Burkeen?

HERE'S WHY

- Compact & Maneuverable
- 30 Hp fuel efficient Hatz Air Cooled Diesel
- Exclusive spring isolated vibratory plow
- Exclusive "Replaceable Tip" Plow Blades
- Heavy Duty Gear Box Drive Trencher
- Heavy Duty Boring Attachment

PLOW - TRENCH - BORE
Burkeen Does It All

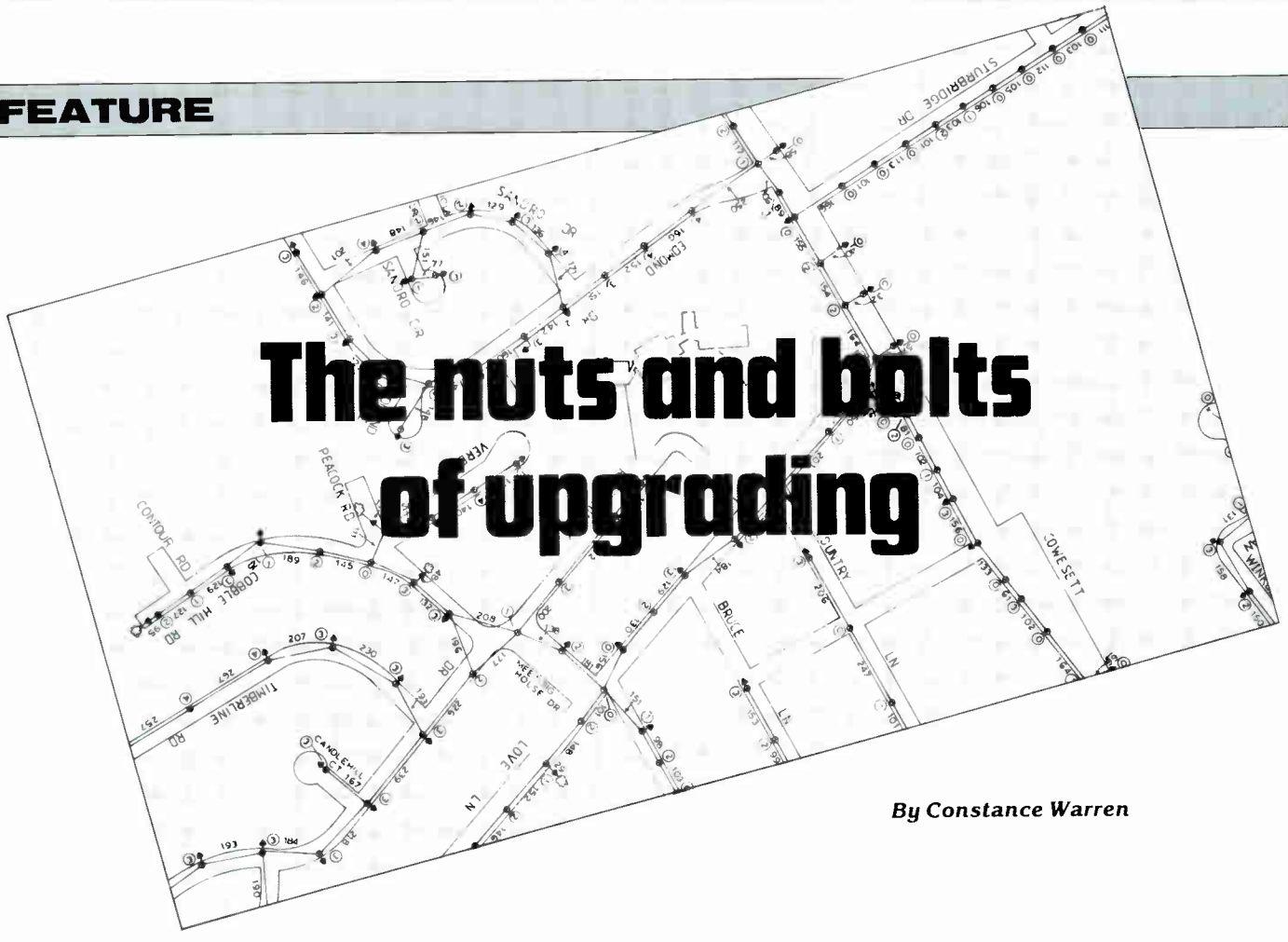
For the Dealer Nearest You
Call 1/800/647-9824

Burkeen B-30 "IT WORKS"

BURKEEN
Manufacturing
Company

11200 HIGH POINT COVE • OLIVE BRANCH, MS 38654

Reader Service Number 24



The nuts and bolts of upgrading

By Constance Warren

Upgrading is not a task to be taken lightly, warns Sally Kinsman, president of Kinsman Design Associates.

"It is more complicated than a new build because you're trying to salvage equipment. And you can't wait until the last minute to prepare," she adds.

She and Al Kernes, vice president of engineering for Jones Intercable, recommend six months lead time. Stephen Blossom, director of field operations for Signet Cablevision, suggests a 90-day period for as-built mapping, redesign, ordering of materials, assembling the construction crews and notifying both the franchising authorities and subscribers.

All agree the first step to a successful rebuild is a good set of strand and as-built maps. Frequently, operators don't include new house counts and mismark the type and how many cables are used in a particular distribution section, Kinsman says. Sometimes valuable information, such as swamp locations, is omitted.

Operators that contract the mapping out-of-house should check the map, Kernes advises. This takes more time, but it's not as time-consuming or as costly as redesigning during construction.

Engineering and marketing also should work together to establish the project goals. The number of new channels needed and the cost to add them are important. "If it's at all possible, the system should upgrade. But if the marketing people say, 'I need 108 channels', a complete rebuild probably will be required." Kernes says.

Once the project goals have been set, engineers need to determine the design parameters and distortion specs. Poleline and construction hardware must also be checked.

Most operators don't carry the staff to design the upgrade internally, so they use specialty design houses. But a designer can't do a good job unless he's supplied with the appropriate information, Kinsman says. Too often, it's like detective work, with the designer trying to find out what the operator will and won't do, she adds.

Besides good maps, Kinsman advises operators to provide system design and distortion parameters and a list of equipment to be salvaged. The designer also needs to know whether the operator will mix equipment—combining conventional, feedforward, power doubling and parallel power doubling—and if it wants to save existing amplifier locations.

Steve Raimondi, director of engineering East, United Artists, recommends techs be given an input in design since they work on the system. "A tech may prefer to have an amp moved because it will be easier to access," he explains. And that could mean lower operating expenses.

Raimondi also suggests operators inform subscribers in advance that they're going to be rebuilding. Service disruption, typically caused by accidental cable cutting or drop transfers, is inevitable during upgrades. It makes sense to tell subscribers there will be temporary blackouts, but the end result will be better picture quality, he says.

"The more things you change in a rebuild, the more it will cost," warns Kinsman. For that reason, she says most operators try to save cable and keep existing amplifier and line extender locations.

Mac Ferguson, corporate engineer for Bexar County Cablevision, says his system only replaces cable if it can't handle the additional channel load or if it's damaged or corroded.

Cable's longevity has surprised Kernes, who says Jones always begins an upgrade with the premise that the cable is good, unless visibly damaged. Once construction is completed and the plant activated, the bad cable is lo-

SUPERIOR QUALITY and we can prove it!

Poleline Corp. Proudly Presents the PRESTIGE™ SERIES

1. Independent laboratory tested (documentation upon request).
2. Complete proprietary hardware line, exclusively from Poleline Corp.
3. Maximum tensile strength, usually in excess of other leading brands.
4. Uniformly distributed galvanized coating, that meets ASTM and REA standards.
5. "Machine cut" threading, eliminates burrs and cross-threading problems.
6. Very attractively priced.
7. Same day shipments from three warehouse locations: Bronx, N.Y., Hoboken, N.J., and Santa Ana, California.

Write or Telephone for Complete Prestige Series Catalog

Poleline Corp.

Subsidiary of RMS Electronics, Inc.

EASTERN OPERATIONS: 20 Antin Place, Bronx, N.Y., 10462 — TOLL FREE: (800) 221-8857 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands)
Call Collect: (212) 829-1070 (New York State Only)

WESTERN OPERATIONS: 2901 W. Garry Avenue, Santa Ana, California, 92704 — Telephone (714) 662-1041
TOLL FREE: (800) 624-2511 (Continental U.S.A., Puerto Rico, U.S. Virgin Islands, Alaska, Hawaii) — In California: (800) 247-8435

Reader Service Number 28

cated and replaced. Very little cable actually has been removed, he notes.

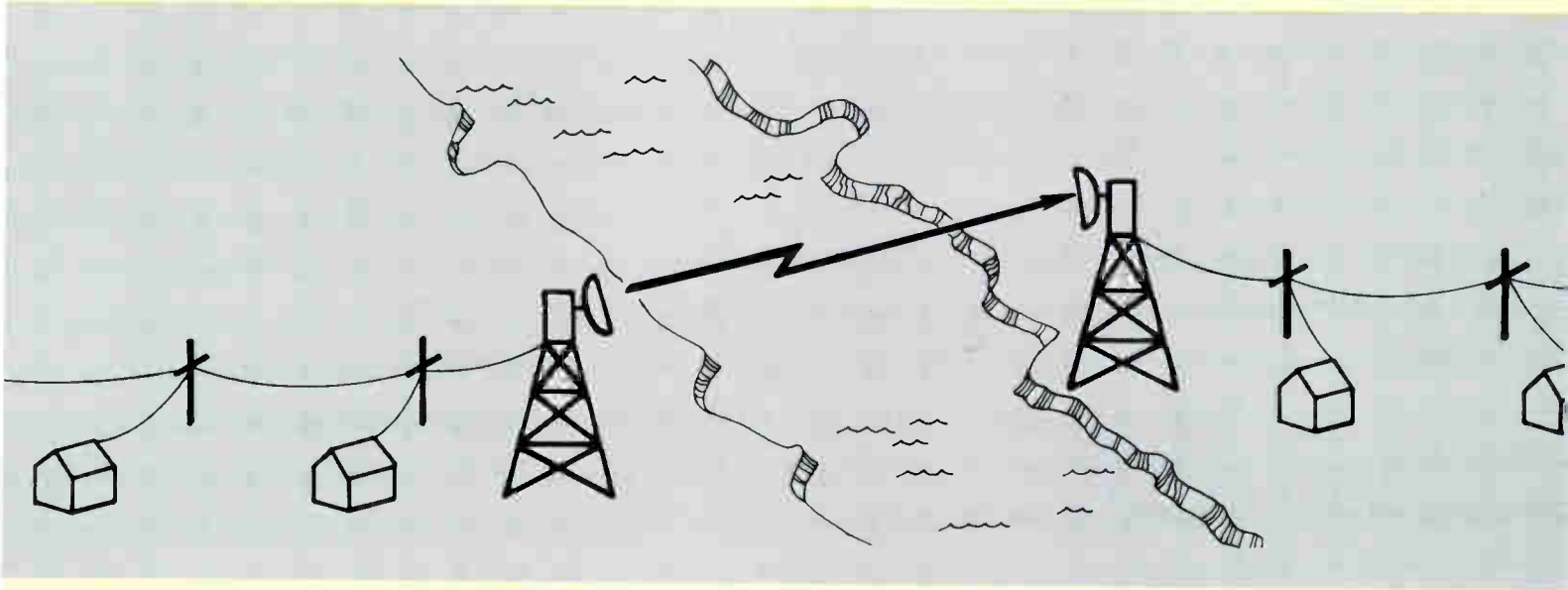
However, there are special cases where cable replacement is a sensible option. Ferguson cites an example where the operator decided to build a new supertrunk because it found an antenna site that could be shared by two of its systems. Since both systems were planning to implement addressability, the operator saved on computer costs as well.

Systems opt to save amplifier locations because it cuts down on labor costs, and saves time. "It's more expedient to use those existing locations," Ferguson argues.

Operators also shun respacing to avoid splicing, which can become a future source of interference, Kinsman says.

Staying with existing amplifier locations usually requires mixing amplifiers. Dropping new modules into amps is the least expensive way to upgrade, but new modules aren't available for all amplifiers, so sometimes new equipment must be purchased, she says. Various combinations of feedforward, power doubling and push-pull are used to stay within system spec. And, even then, amplifiers may be spaced too close, necessitating padding.

Our new low cost microwave line extender can extend your service and your profits



The new Hughes AML® line extender can solve a lot of problems which may be costing you money. Problems with natural barriers. Problems with long amplifier cascades. Problems serving small pockets of potential subscribers. Our microwave line extender can make it easy and economically attractive to offer cable services where cable can't go.

These new line extenders are multichannel transmitters which block upconvert one to 60 channels. They accept combined VHF input in the 54 to 440 MHz range directly from your cable. They allow you to reach new subscribers that have previously been uneconomical to serve.

Not only can they offer new services, they can protect your existing services during planned and unplanned interruptions. Our microwave line extender makes an excellent, frequency-agile hot standby. The Hughes AML line extender is cable powered, can be mounted indoors or out, and has a temperature regulated enclosure for extra stability and reliability. It shares spares and service techniques with all AML transmitters and is compatible with all Hughes AML receivers.

For more information on the new Hughes AML microwave line extender, contact **Hughes Microwave Products Division,** P.O. Box 2940, Torrance, CA 90509-2940 (213) 517-6233.

Hughes AML® Microwave Systems

AML—ANY MODULATION LINK

HUGHES
AIRCRAFT COMPANY

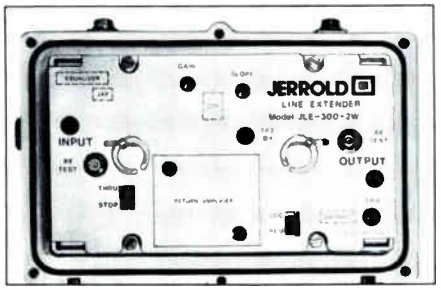
Kernes argues against saving amp locations, saying that in the past, many systems didn't understand design and put amps in at the wrong locations. Sometimes, operators also would add amps to solve a poorly performing cable problem. And the change in bandwidth may require respacing anyway. "Your cascades may be so great, you won't meet your distortion parameters without respacing," he says.

The only drawback with respacing is coordinating construction crews so subscribers won't be out of service too long, he adds.

Upgrading through electronic trunk drop-ins almost invariably requires feeder redesign, because the old plant, connectors and taps can't pass the extra load and meet the design distortion parameters, Kinsman says. "When you crank the bridgers up, taps that are close may get too much signal, and taps, far away, too little," she adds.

Sleeveless connectors and taps that can't pass more than 300 MHz will have to be replaced, and all taps should be checked and marked down if they are out of spec.

Pressure taps create other headaches. If the taps are installed mid-span and pierce the cable, it's best to overlash. Removing the taps and resealing the cable is more expensive than overlashing and there's a good probability moisture already has migrated into the cable, Kernes says.



Backfeeding saves line extenders.

Saving power supply locations should be another design objective, Kinsman says.

"If I don't save anything else but the power supply locations, I've saved a lot," she adds. Hooking up new power supplies with the utility company gets expensive and good locations aren't easy to find, she adds. However, expanded bandwidth typically means more power supplies. Ferguson says his system minimized new power supply hook-ups by inserting Magnavox DC switching power supplies in the amplifier housings. "These power supplies help reduce the number of AC power supplies needed," he maintains.

Older systems may have 30 volt power supplies that can't be upgraded to 60 volt operation. Replacing these power supplies would mean fewer power supplies and lower long-term operating expenses. But the benefits to be gained must be weighed against the cost of the new equipment.

Backfeeding also helps operators save on electronics. Most operators say they use it only if they can save an amplifier or line extender.

Underground redesign and AML installation are expensive and should be avoided if possible. "MSOs are more willing to get rid of aerial and to leave the underground alone. And usually underground areas deadend in suburbs, so you're not talking about a lot of signal loss," Kinsman says.

AML is rarely used in redesign, but there are special situations where it may be necessary. One example is if the cascades are too long. Jones plans to use a microwave shot to eliminate a water crossing problem in one of their systems, Kernes says.

Once the redesign and construction have been completed, Raimondi advises operators to follow up with a proof-of-performance and as-is rebuilt check. ■

Magnavox rebuild analysis

Raimondi, Blossom and Ferguson all have used the Magnavox Rebuild Analysis for redesign.

Three levels of service are offered: paper and field studies and system design.

In the paper study, present system information—such as existing amplifier performance, equipment and cable type, system description, headend and system type and system parameters—is gathered. New design criteria also are obtained. As-built maps of the entire system are reviewed and a trunk schematic drawn if none is provided. Possible system architectures—microwave, hubs, super trunk and fiberoptics—are examined for desired worse case system performance. Salvageable equipment also is identified.

Engineering evaluations and a map analysis then are performed to determine the feasibility of meeting the redesign criteria. A field study is performed if deemed necessary by the Magnavox service coordinator.

A field engineer tours the plant, performs bench and field tests and checks equipment documentation. Once a rebuild or upgrade option is chosen, old maps may need to be updated or, in some cases, the franchise area, completely remapped. If mylar and sepia copies are not available, they are prepared.

Table
Trunk upgrade/rebuild cost comparison using Power Doubling

Cost/description	Module swap-out	Station swap-out	Respace trunk	Units
Total # of trunk amps	.6	.6	1	per mile
Module replace price	311	540	900	$/mile
Cable replace price	-	-	2747	$/mile
Connector replace price	-	10.5	10.5	$/mile
Construction labor price	-	-	4900	$/mile
Engineering labor price	385	414.6	739.2	$/mile
Total	696	966	9296	$/mile
Percent savings over redesign	93%	90%	0%	

The cost comparison above is based on a 200 MHz, 12-channel system using push-pull equipment spaced at 21 dB for a 30 amplifier trunk cascade. The system wants to expand its channel capacity to 40 channels while maintaining present amplifier locations.

The system is then appraised of budgetary rebuild/wreckout and upgrade costs. It then has the necessary information to determine how the rebuild/

upgrade can be done most cost-effectively.

A summary of all costs and a sum total, including estimated construction costs, also is provided before system design begins.

If the system decides to upgrade exclusively with Magnavox equipment—via module change-outs and/or electronic change-outs, using various configurations of power doubling, parallel power doubling, feedforward and conventional amps—the $2,000 paper study fee will be credited toward the purchase of the equipment. Trunk system evaluation in excess of 100 miles costs $5 per mile and feeder evaluation beyond 100 miles, $50 per mile. The field study fee is $400 per day, plus expenses, and bench testing of existing field samples performed at a Magnavox facility, $30 per hour.

Ferguson said his system chose to use the Magnavox service because of the extended variety of equipment. And Blossom said 95 percent of the time the system adheres to the design that comes back from the design house. "Where we do make changes, it's to accommodate homes from different distances. The design people have no way of knowing that," he added.

—Constance Warren

ATC Construction: record Denver build

By Gary Kim

When your crews are building 120 or more miles of plant a month on a single job, sometimes you have to improvise. When Don Williams, project manager for ATC Construction, found Mile Hi Cablevision's cable bundles too large to handle the usual way, his crews used plastic traffic cones as guides. It's not spec, but it worked, and as a result the Denver build was finished a blistering two years ahead of schedule.

There's no single answer and no simple formula that explains how the build was completed so rapidly. ATC is one of the few MSOs with an internal construction division, so experience might be a factor. ATC's crews rotate from job to job and can expect to be working with the same equipment and same system at each site.

Still, this is largely true for other firms as well. Plus, Denver was a big build, so "we hired a lot of local workers," Williams says. Consequently, not everybody was experienced or familiar with ATC's system.

But they did have a major advantage—training at ATC's National Training Center, considered by many an industry standard. "They learned everything from customer relations to pole-climbing and safety," Williams says. "And it really paid off."

It didn't hurt that ATC did all its own engineering, strand maps and underground design in-house. Here again, familiarity with the system helped. Williams also may have had fewer lost days of work because of accidents. "We stress safety a lot," he says.

And tight inventory controls may have had advantages besides cost containment. His crews always knew where everything was and how much they had. A stricter-than-normal maintenance schedule might also be credited.

"Because of the build rate and amount of cable we were handling, vehicles and poleline equipment wore out twice as fast, so maintenance was really important," Williams says.

An unusual incentive program probably helped as well. "All of our crews had targets for each day's work," Wil-

Future Friendly.

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

One, your customers will want it.

And two, this system will welcome it.

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

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

We've really designed Z-TAC for the future. With features like our Redi-Plug™ option which allows you to tap into advanced technologies for tomorrow's customer services like TV stereo, two-way, and teletext.

So you won't have to worry about replacement for a very long time.

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

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

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

ZENITH® | cable products

THE QUALITY GOES IN BEFORE THE NAME GOES ON.®

Reader Service Number 57

ON A ROAD FU
QR™ BREAKS TH

ANIXTER
COMMUNICATIONS

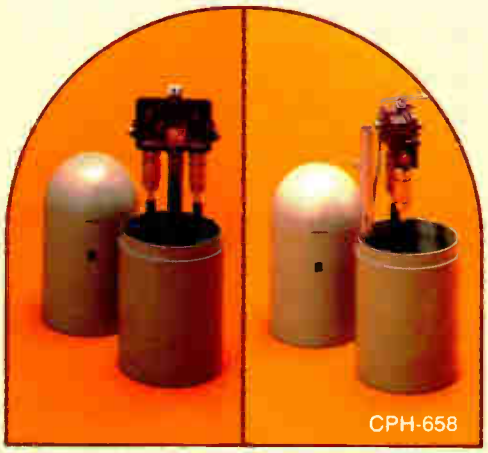
STOCKS

Channell
PEDESTALS

Channell

Channell pedestals are constructed of the highest quality, field proven ABS plastic and are designed to meet all the requirements of the CATV industry.

The extreme strength of ABS plastic (this is the same material used to produce such high impact items as football helmets, racing car crash helmets, automobile dash boards etc.) and the dome type structure of Channell pedestals provide incomparable durability in all phases of installation.



The CPH-658 will house any tap, filter, equalizer or splitter.

Dimensions: 6.5" diameter, 11" - 16" above grade
Weight: 4.5 pounds with stake
Shipping: 8 per carton
Basic Unit: Shipped complete with stake attached and hasp lock.

The CPH-1016 will house any tap, and line extender combinations or small amplifiers.

Dimensions: 10" diameter, 21" - 29" above grade
Weight: 11 pounds with stake
Shipping: 2 per carton
Basic Unit: Shipped complete with stake attached, hasp lock and designated drop holes in base.

The CPH-816 will house any tap and splitter combination.

Dimensions: 8" diameter, 21" - 29" above grade
Weight: 8 pounds with stake
Shipping: 4 per carton
Basic Unit: Shipped complete with stake attached, hasp lock and designated drop holes in base.

The CPH-1022 will house any tap, splitter and line extender combinations.

Dimensions: 10" diameter, 21" - 35" above grade
Weight: 13 pounds with stake
Shipping: 2 per carton
Basic Unit: Shipped complete with stake attached, hasp lock and designated drop holes in base.

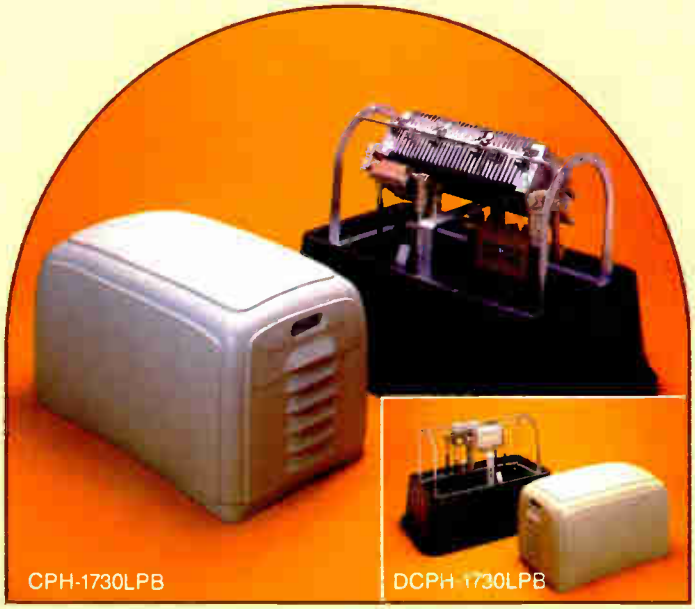
Channell pedestals provide the following advantages:

- Unaffected by severe temperatures ranging from – 60°F to + 160°F.
- Corrosion proof
- Will not draw and hold heat
- Extremely durable
- Vented to minimize condensation
- A very low profile

The dome structure facilitates 360° access, and is supplied to the field with **factory installed hot-dipped galvanized stakes.**

All Channell pedestals are available with hasp or the intertite locking system.

ANIXTER COMMUNICATIONS



The CPH-1730LPB is an extremely versatile low profile, trunk amplifier housing with enough room for taps and splitters. This asthetically pleasing pedestal sits only 17" above ground and will house any trunk amplifier.

Dimensions:	17" diameter, 16" - 24" above grade
Weight:	50 pounds
Shipping:	1 per carton
Basic Unit:	Shipped complete with ground skirt, hasp lock and mounting bracket.

The DCPH-1730LPB (INSET) will house any dual line extender combination. (Dimensions same as CPH-1730LPB.)

The DCPH-1006 dual plant pedestal will house two taps or two couplers.

Dimensions:	10" diameter, 11" - 19" above grade
Weight:	8.4 pounds with stake
Shipping:	2 per carton
Basic Unit:	Shipped complete with stake attached, hasp lock and designated drop holes in base.

The DCPH-1016 dual plant pedestal will house any two tap and splitter combinations.

Dimensions:	10" diameter, 21" - 29" above grade
Weight:	11 pounds with stake
Shipping:	2 per carton
Basic Unit:	Shipped complete with stake attached, hasp lock and designated drop holes in base.

ANIXTER COMMUNICATIONS...Your No.1 source for Channell pedestals

Call your nearest Anixter stocking location toll free or collect for immediate delivery

ANIXTER COMMUNICATIONS

Service is Our Technology

In an emergency, weekends and holidays or after 5 p.m., call toll free 1-(800) 323-8166

Corporate Offices: Anixter Bros., Inc.
4711 Golf Road, Skokie, IL 60076 (312) 677-2600

LL OF CURVES,
E SPEED LIMIT.

No matter how well you plot your course, installing miles of cable always throws you a few curves. And if you rely on standard low loss coax, it's easy to get stuck up a pole or bogged down in the trenches.

M/A-COM's new Quantum Reach® can put you back on the fast track. Since it's the most flexible trunk cable on the market, it takes curves with ease. You'll need fewer splices and there's less chance of connector pull out or signal degradation than with the cable you're using now.

QR comes in trunk and distribution sizes in a variety of standard, flooded and armoured configurations. It goes up a lot faster and costs only a little more than standard GID so you can probably afford to reach a lot of rural extensions you've had to disregard before.

If you're in a big hurry to try it out, call us toll free at 1-800-438-3331. Ask for QR, the fastest cable on the road.

M/A-COM

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

Reader Service Number 36

liams pointed out. "They didn't come back until it was done, however long it took. Of course, if they finished sooner they had some extra time." This particular practice was developed specially for the Mile Hi build, and hasn't been used elsewhere.

But it doesn't appear to have been a simple matter of technique that put ATC over the top. Communication and genuine concern for the employees were critical factors, Williams says.

Morale is key

"Morale's very important when you're building as fast as we were. Our people were out there working really hard and they needed to know we cared about them," he says. "They also needed to know equipment would be fixed promptly if there were problems in the field."

Morale can go right down the tubes if they have a really bad day, Williams emphasizes. "Since every problem we normally have was more extreme on this job, communication really was the critical thing on this build."

Regular meetings with the crews helped, as did the company-sponsored bowling and softball teams. Employee confidence also was bolstered by the knowledge that they could move with the company to the next build if they wanted to. And if they choose not to move, they knew ATC would help them find other jobs.

The importance the company attached to communication carried over to relations with the city, utilities, residents and Mile Hi itself. "We spent lots of evenings knocking on doors and talking to people, answering their questions and letting them know when and what we'd be doing in their neighborhoods," Williams says.

Mile Hi walked each section of the plant and signed off on it. Denver's telecommunications officer inspected the build every week, and ATC assigned special staff just to deal with complaints from residents. Prompt attention was the goal, William says.

Ingenuity helps

As always, there were some peculiarities to the build. "We hadn't encountered such large cable bundles before, and we had a fire that destroyed a major interconnect," he says.

"We had to run cables under a historic house overnight and not all the polelines were on public rights-of-way. We had to use three warehouse locations and there were an unusual number of 90-degree bends."

The company also had to resort to cross-alley timber construction in some places. The only way to run the cable was to place a cross member between sets of poles on opposite sides of the road, and hang the cable from the cross member. And in other areas ATC had to contend with sets of three 90-degree blocks.

But they still do it by the book. You name it, ATC has a spec for it. And the penalty for ignoring the specs is even in the book. "Repeated failure to comply with any part of these specifications shall be cause for immediate termination of the employee or employees responsible and continued disregard shall be cause to 'shut down' the entire project until the problem(s) are corrected."

Williams doesn't expect to see another build like Mile Hi. "It's been a lot of work and pressure for everybody, but I'm really happy with how it looks and plays. I can't stress enough how proud I am of everybody on this job."

His equipment and crew already are shipping out for the next job, a rebuild in Raleigh, N.C., but it isn't likely Williams will forget Denver. The 120-mile-per-week pace brought him in two years under schedule—apparently on budget and definitely up to spec. ■

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

Ken Swift
Executive Vice-President
USA TV

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

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

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

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

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

Specifications:
Band Pass
10Mhz–400Mhz
Trap Notch Depth
–50db
Functions per port
All channels on/off
3 Premium Channels on/off
Control Method
Pulse Modulated FSK
Data Message
ASCII
Power Requirement
30 or 60 Volt AC
50 MA, from system.

WADE COMMUNICATIONS
The Leader in off-premise, addressable tap technology.
3535 Briar Park, Suite 255
Houston, Tx. 77042
713-785-3143

Reader Service Number 38

How to choose a contractor

By Constance Warren

Choosing a contractor is a little like buying a suit: the cheapest one isn't always the best.

Look at the contractor's track record, experience in the industry and financial stability, contractors advise.

"It's a small industry; everyone knows each other," says Bob Bilodeau, chairman and CEO of RT/Katek Communications Group. But if you want to be sure, check his credit sources, he adds. Either use an agency, your broker or do it personally, recommends Robert Long, executive vice president of Burnup & Sims Cablecom Inc.

And ask for specific references and unsolicited letters, advises Carl Saunders, president of C-2 Utility Contractors.

Since the contractor inevitably will supply favorable references, it's a good idea to visit a completed job, says Anthony Fiorella Jr., president of JEN-MAR Construction Inc. Check for uniform loops, straight cable and straps on every pole, adds John Jackson, general manager of Jackson Enterprises.

Barker CATV Construction President Jim Barker and Vice President Herb Biddle suggest operators visit the job site while construction is in progress. That way the operator can see how the contractor works and if there's a lot of unnecessary clean-up mess.

Saunders also advises operators to get updated personnel lists and find out how many people actually will be working on the job. "Investigate personnel, get their names and phone numbers and talk to them," adds Long.

AM Cable TV Industries CEO and Chairman Mac Qurashi recommends operators "look at the resumes of the people who are going to build the system." The resumes should tell the operator if the crew is experienced in handling and installing cable and if it understands pole clearances and national electrical safety codes.

"One MSO even runs a security check on all workers," says Roger Kennedy, president of Kennedy Cable Construction Inc. The crews' driver licenses and social security numbers are taken to run background checks. If a person doesn't meet the security clearance, he can't work on the project.

Another tip Kennedy suggests is to talk to the construction manager. "Coordination of scheduling is very important, "says Bilodeau. And one way to assure a contractor runs a well-coordinated operation is to check its project manager. "The supervisor also should be able to do all phases of construction and have a high school education," Barker and Biddle say.

Bilodeau recommends checking contractor credit sources.

Operators also should investigate whether the contractor specializes in a particular type of construction or if it offers turnkey operation.

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

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

Reader Service Number 40

Specialties

"A company that does both aerial and underground construction usually started in one area and went into the other later. They usually do the part of the job they started with very well and the other half not so well, since they are less experienced in that type of construction," Jackson says. Aerial and underground construction require different type of equipment and different management techniques. Underground is slower and the contractor has to know underground specs, state and city laws, boring specs, how close to water and sewer lines it can go and how far to dig, he says.

Robert Mai Jr., vice president of finance for Mai Communications Inc., says his firm does both types of construction but has crews that specialize in one type of construction.

Fiorella says his company specializes in aerial and that construction crews go through a six month to a year training period to learn strand, distribution and trunk construction. Then they specialize in one of these areas.

Comparing cable construction to home building, Vice President of Cable Services Co. Inc. George Ferguson advises operators to hire a general contractor instead of a few independent firms. "When I tried to build a house on my own and started shopping for laborers, I realized building the house myself would be more expensive than hiring someone to do the whole job for me," Ferguson says.

A general contractor is more likely to be aware of the price of materials and, if the equipment doesn't arrive on time, the operator doesn't have to pay for down time, he adds.

If a contractor is going to be hiring subcontractors, Jackson says it's important they have proper insurance. RT Katek uses subcontractors in installation or for construction that is unsteady. Biloodeau requires subcontractors be bonded. "We want people who can be bonded, that means they're reliable and dependable. They also have to carry their own insurance," he says.

But subcontracting can get out of hand, cautions Kennedy. "A contractor who subs out work doesn't really have a commitment, he's just handling the paperwork," he says.

Another area to investigate is the contractor's splicing capabilities. "Call on previous jobs and talk to the construction manager for whom the contractor worked," Kennedy recommends.

Qurashi says there is a direct relationship between a company's safety consciousness and the quality of work it does. If the company takes care of its employees and equipment, it is careful in how it does its work. Ask the contractor if it has a safety program; if its trucks are properly equipped and workers, properly trained; and if it has a QC program, Qurashi advises.

A contractor also needs to communicate well. Before construction begins, the contractor needs to find out what the operator's franchise requirements are. That way, if one town was promised its system would be built at time X, it will be built at X, Ferguson says.

Besides maintaining constant communication with the operator, the contractor also needs to know what the city requirements are. Many large cities have equal employment opportunity requirements and it's helpful if the contractor knows what these requirements are, Qurashi says.

Customer relations

Since the contractor frequently is the first contact subscribers have with the cable system, it's important the contractor have good customer relations skills, Fiorella maintains. He requires all employees wear company I.D. cards

THE NEW MC² COAXIAL CABLE SAVES YOU MORE MONEY

Because MC² components are bonded together for maximum flexibility and minimum signal loss, you save more money on installation, connections, labor and on the cable itself.

MORE RESISTANT

Because each cell is an hermetically sealed compartment, MC² is more resistant to moisture ingress and migration. No other cable can stand up to its environment better than the new MC².

MORE SIGNAL STRENGTH

The new MC² Coaxial Cable's patented design of using air instead of foam means less attenuation and more signal strength. And that's with a signal load of 77 channels.

MORE economical. MORE reliable. MORE flexible. MC² outperformed the competition hands down and we'll be happy to show you the results anytime.

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

Reader Service Number 42

while on-site and use vehicles with company emblems. The subscribers then know to whom they can complain if something goes wrong, he says.

Public relations becomes key in drop installation, because installers work in subscribers' homes. Nacom Corp. has a quality control program that checks installers' public relations skills with subscribers as well as the quality of their work, Nacom Vice President Eli McKay says.

With major urban builds, Tele-Engineering Corp. Director of Business Development Gary Boot says it may be advantageous to hire a coordinator between the system, city and contractor. Some cities require they be notified of every single design change, he says. The operator usually doesn't have someone on hand who can run design changes back and forth from the city government to the construction site. A coordinator can do this for him, without interfering with construction, he says.

Most contractors believe bonding is a good idea. "If a contractor cannot be bonded, then he is questionable," Kennedy argues. A performance bond guarantees the operator the contractor will finish construction by a certain date, Mai says. But a letter of credit may be just as good, he adds.

Bid bonds protect operators from contractors who bid low and can't get the job done for that amount of money, McKay adds.

Jackson says bonding should work both ways. "If the operator wants a bond from us, we want a payment bond from them, guaranteeing us our invoices will be paid in 35 days."

Some contractors offer ancillary services, such as system audits and proof-of-performance testing. Ferguson recommends choosing a contractor that can do proof-of-performance testing.

Ferguson also believes contractors should supply the equipment. The manufacturer probably is more aware of changes in inventories and equipment specs than the operator, he says.

But the operator should keep tabs on what kind of equipment the contractor selects. "Sometimes contractors substitute equipment and don't use quite as good material as they should," cautions Long.

Another area worth investigating is whether the contractor owns or leases his own tools and trucks. Kennedy believes a company that owns its own equipment has shown a commitment to getting the job done, while a company that leases equipment may not be able to meet construction deadlines because it doesn't have control over the equipment.

If the contractor uses his own equipment, Saunders advises getting a complete updated equipment list.

Besides lashers, roller blocks, loop forming tools, cable reels, pulling equipment and trucks, Fiorella advises operators to check bending boards and make sure the contractor is equipped with two-way radio vehicles and pagers.

Another good idea is to have one person specially assigned to check the contractor's work on a daily basis. "Check to see if the contractor has left out downguys, bonds, anchors and overhead guys," he says.

The operator also should ask the contractor how it settles property claims and write it in the contract, Qurashi recommends.

Many contractors won't do drop installation because subscribers inflate the value of items damaged by installers. "We've found that the 29-cent ashtray bought at the corner store suddenly becomes an antique, Fiorella says. Nacom, which only does drop installation, has set up a damage program with a major insurance courier to handle these types of claims.

Underground, urban, rebuild, drop

We couldn't have produced the industry's best 1 GHz system analyzer without listening to you.

A key element in developing new Wavetek products is listening to the people that will use them. In this case, you said you wanted broader frequency range, more trouble-shooting capability, and a truly portable instrument that is easy to use.

The result is Model 1881 CATV System Analyzer—a unique combination of sophisticated performance and operational simplicity.

With this 4 MHz to 1 GHz instrument, you can quickly detect amplifier distortion all the way from headend to the subscriber—using the extended Composite Triple Beat measurement range. You can directly select any channel, from 2 to 183, for narrow-band analysis just by keying in the channel number. The analyzer automatically sets a 10 MHz span and centers the display.

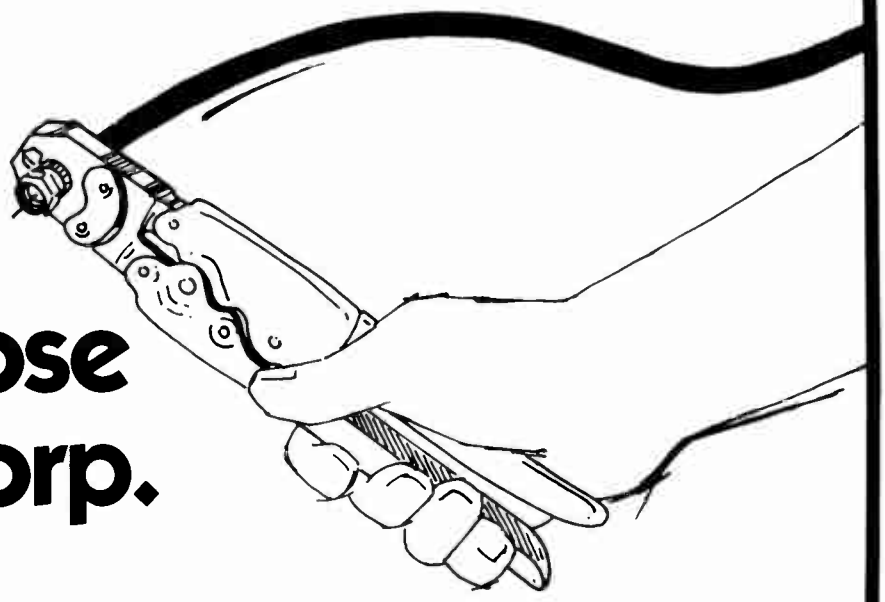
And tests are as simple as pushing a button, thanks to sophisticated microprocessor control. Besides composite beats, other built-in test procedures include carrier to noise, hum modulation, FM deviation, and cross modulation. Results appear in digital and scope form. You can split the screen for viewing a single channel and the full spectrum simultaneously. Or you can zoom in to any part of the display.

And by the way, Model 1881 calibrates itself automatically.

Performance alone is reason enough to buy a Wavetek analyzer. But there's more to it than that. Because our analyzer is so much faster and easier to use, it cuts way down on preventive maintenance time and, ultimately, on cost of ownership. What's more, Model 1881 is about half the price of instruments with anywhere near comparable performance.

To see how good the 1881 really is, phone us now for a demonstration. Call TOLL-FREE 800-622-5515. In Indiana, phone (317) 788-5965. Or write: Wavetek Indiana, Inc., 5808 Churchman (P.O. Box 190), Beech Grove, IN 46107. TWX 810-687-6038.

Reader Service Number 44



Why choose NaCom Corp. for cable installation?

We can give you 2,500,000 reasons...

Quality, reliability, and customer satisfaction are standard procedure at NaCom. Our record of accomplishments and service to our clients speaks for itself. With over 2,500,000 subscriber installations, we have the experience, staff and equipment to meet your needs.

We specialize in:

- Residential Installation— Aerial/ Underground
- Trapping
- Auditing
- Change-Outs
- Apartment Turnkey— Prewire/ Postwire, Design
- Construction, Splicing, Balance, Activation
- Rebuilds/Upgrade
- Fiber Optic, Splicing/ Installation

Serving only the CATV Industry

NaCom Corp.

The Installation People

1900 E. DUBLIN-GRANVILLE RD. • COLUMBUS, OHIO 43229

800-848-3998 614-895-1313
(Ohio Only) 800-848-0447

Reader Service Number 45

installation and MDU construction call for further investigation.

The underground contractor should be aware of different city, county and state specifications and know how far to dig. If the contractor doesn't know what it's doing, it can cut power, gas and telephone lines, Saunders says.

Underground construction requires special equipment, including trenchers, plows, boring tools and rock saws.

In urban construction, public relations is key, contractors agree. "In rural areas, you're not dealing with dual cable and there are less things to get a contractor in trouble," Jackson says. For urban builds, the crew needs to be able to deal with people, and property damages need to be taken care of immediately.

For rebuilds, an experienced crew is essential. "Handling old cable is almost an art. You have to be careful and know what you're doing," says Richard Mullen, vice president of Mullen Telecommunications Inc. Otherwise, you'll deactivate the old system.

Mike Houchen, operations manager for E.A. Schenck Construction, says rebuild contractors shouldn't subcontract or pay piece work. "Technicians working for piece work, work too fast." And, unlike a new build where the contractor has time to catch mistakes before the operator notices, "go backs" hold up activation of the new system. Mistakes also interfere with the operation of the old, activated system.

He recommends that contractors have an on-site inspector to coordinate construction and quality control. "In a rebuild, the activation schedule becomes more complex. The old and the new systems are laid out side by side and you either can turn on drops one by one or all at once," Mullen adds. Either way, the turn-on must be well-coordinated so service isn't cut off.

Crews should have take-up reels for efficient handling of the old cable and strand. If the contractor is supplying the rebuild equipment, it should cost less than new build equipment. "Generally, most of the old hardware can be reused," he says.

Ownership of the wreck-out material —cable and electronics—should be determined in advance, Mullen adds.

In local area network construction, an additional emphasis should be placed on splicing, Boot maintains. "Data is not as forgiving," he says. "You need a higher quality craftsperson." Quality control should be done on every splice, and system powering should be extremely reliable since valuable information can be wiped out if the system goes down.

Finding qualified drop installers is not an easy task. Installers must have good public skills and manual dexterity. The installer has to be able to handle the subscribers' as well as the system's demands and, frequently, has to put in long hours. The crew has to act as a team, otherwise orders will be missed and subscribers irate, McKay says.

"There is a different difficulty factor associated with MDU construction," says Long. MDU construction lends itself more to an electronics person, to someone who can work with conduit and who understands building distribution systems, building codes and what types of permits are needed. An MDU installer also needs to be able to read building permits.

Internal routing, molding, elevator shaft and duct experience and familiarity with national electrical codes are other qualifications an MDU installer should have, says John Gaston, president of Cavision Communications Inc. And, if any underground construction is required, the crew must be adept at restoration and reseeding, Mai adds.

"The potential for mass scale error is

Continued on page 92

Testing digital audio

By Will Wagner,
manager, systems engineering,
Oak Communications Inc.

With the advent of digitally based equipment, cable MSOs can look forward to a higher degree of signal security and much higher quality audio signals.

New digital audio technology also offers new upgrade opportunities. While digital techniques aren't new to the cable industry, digital audio encryption represents a new application of the technology, and may emerge as the next wave of cable television signal security.

Oak Communications Inc., which in December 1983 introduced digitized audio encryption to the industry in its Sigma System subscriber control equipment, has completed its first field test and evaluation program at Viacom Cablevision in Seattle. This intensive six-month test, which began in December 1983, provided both Viacom and Oak with more comprehensive information about digital audio and the successful Sigma application in an operational environment.

The test included comprehensive bit error rate (BER) testing and converter/decoder placement in subscriber homes.

Oak's objectives were to evaluate all functions of the Sigma headend, control computer and converter/decoders; verify that Sigma's design meets all requirements for transmitting high-speed data over a cable network; make certain the equipment could be properly used by operators and end users alike; and test the digital audio technology thoroughly in a diverse environment.

Because the application of digital audio technology to television is new, Oak had to be certain that an operator's plant was capable of handling a digital system.

According to Joe Van Loan, company engineering vice president, Viacom's objectives were to review the Sigma equipment and test system compatibility with the new digital technology. "We also were interested in seeing how end users responded to the subscriber features so we could gauge what kind of product package to buy in the future," Van Loan said.

Viacom/Seattle was selected as the test site because of the excellent cross-section of distribution systems within the network. A number of small systems are interconnected through an extensive microwave network and remote hubs incorporating signal processing. With a subscriber base of more than 135,000, the Seattle plant provided a good sample number of viewers on each of these systems.

Wagner says the most important part of the test was bit error rate testing.

Bit error rate testing

Before testing began, Oak engineers spent several weeks with Viacom technicians planning their test strategy prior to installing any equipment.

This stage included familiarization with the Viacom headend, analyzing the different kinds of plant and communication links in Viacom's system, determining test points where transmission signals would be weakest and selecting a sample number of homes serviced by the different plants for testing the converter/decoders.

For Oak, the most important aspect of the test was rigorous bit error rate testing. Common to digital transmissions are bit errors created by electrical disturbances. These errors, heard as audio "cracks" or "pops" coming out of the television set, are most prevalent where signal-to-noise ratios are weakest. And ratios are usually found at the last amplifier on each trunk.

So Oak engineers tested for worst case signal distortion, such as S/N. Then these signals were combined with other distortions like multipath at specific points throughout the system.

Oak's mobile field test unit—a van equipped with test instrumentation—visited three or four test sites a day. At each location, Oak engineers first measured and recorded system carrier levels and video S/N ratios. The modified test signal was then applied to a Sigma converter/decoder.

The decoder's parity bit detector checked for disturbances in the digital audio data stream, and a frequency counter was used to monitor the parity error rate.

Noise from a test generator was intentionally added to the cable signal to decrease C/N. The noise was then reduced in regular increments to achieve a set of data from which a bit error rate curve could be constructed. The mobile unit's computer translated the parity error data into bit error rates, which were then plotted by the computer against S/N.

Oak had determined that an error rate of 1:10 (-5) was the maximum allowable for the audio to be considered listenable but not objectionable to the subscriber. In all tests cases, Oak's converter/decoders maintained a 3-6 dB margin better than this requirement.

However, the test was not without minor failures. There were mechanical and electrical problems due to shipping and handling of the equipment. This resulted in changes of a connector and cable arrangement and of alignment procedures to obtain sturdier, more reliable packaging.

Results of subscriber in-home use tests helped the Oak team design a better operating instruction manual.

Both operator and end user manuals are supplied with the Sigma System.

Test impact

According to Viacom's Van Loan, "The test gave us a chance to better understand the established boundaries of our own system. Should we decide to purchase a digital system, we are certain our system can support it."

The field test also gave Oak a chance to test its new technology in a real-world situation and to demonstrate how well it operates across a wide range of system conditions. It indicates encrypted digital audio will work on complex systems.

Oak is continuing to monitor Sigma, and has installed production equipment for 60-day demonstrations at sites including MacLean Hunter's Suburban Cablevision, which serves 163,000 subscribers in East Orange, N.J., and ATC's Oceanic Cablevision, with a 98,000 subscriber base in Honolulu. ■

Communications Engineering & Design

TECH II

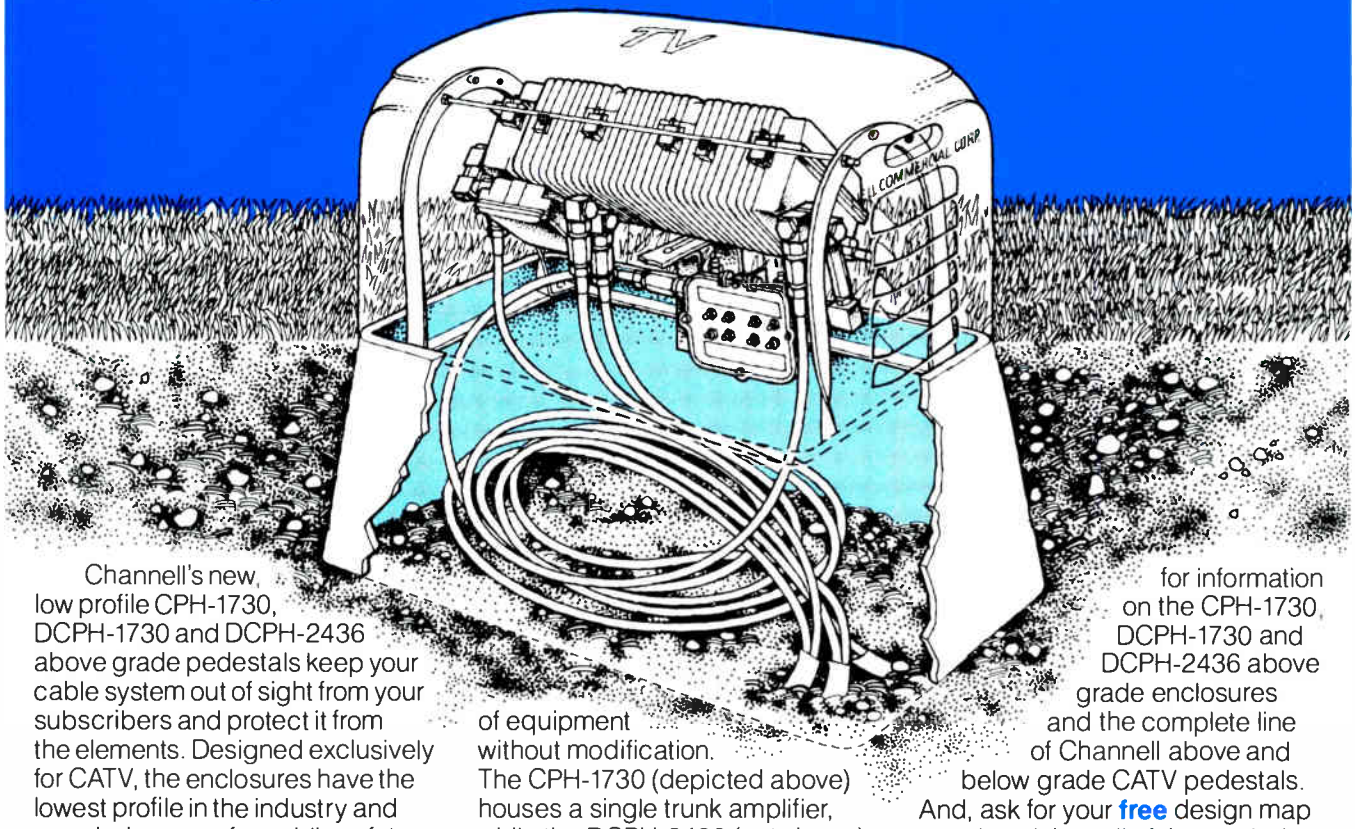
CED's feature supplement and Product Profile

November 1984

- **Off-premises trends and issues**
- **Product Profile: pedestals**
- **Off-premises on the books**
- **Technical training works**

Plastic and steel pedestals fight it out.

Maintain a low profile with Channell's high quality enclosures.



Channell's new, low profile CPH-1730, DCPH-1730 and DCPH-2436 above grade pedestals keep your cable system out of sight from your subscribers and protect it from the elements. Designed exclusively for CATV, the enclosures have the lowest profile in the industry and rounded corners for public safety.

At Channell, quality starts with design and is built into every enclosure. Aesthetically pleasing, they're constructed of field-proven ABS plastic, providing incomparable durability. Unlike other enclosures, Channell's low profile pedestals extend only 17-inches above grade (21-inches for the DCPH-2436). Corrosion-proof and unaffected by extreme temperatures, they never need painting and are available in light green or beige.

All enclosures come with ground skirts for storage of excess cable, security locks, and hot dipped galvanized metal strand brackets. The unique Channell bracket design permits installation of equipment without modification.

The CPH-1730 (depicted above) houses a single trunk amplifier, while the DCPH-2436 (not shown) houses dual trunk amplifiers. The DCPH-1730 (shown in photo below) houses dual line extender, tap and splitter combinations.

Keep your system protected, and your subscribers safe and happy with Channell's low profile enclosures. Call Channell today for information on the CPH-1730, DCPH-1730 and DCPH-2436 above grade enclosures and the complete line of Channell above and below grade CATV pedestals. And, ask for your **free** design map template. It has all of the symbols used throughout the CATV industry, plus Channell's special enclosure symbols that let you specify the exact size and type of enclosure needed at each location.

CHANNELL COMMERCIAL CORPORATION
620 W. Foothill Boulevard, Glendora
California 91740, Telex 670-368
(818) 963-1694
(800) 423-1863
Toll free outside California

Channell COMMERCIAL CORPORATION
Technology you can trust!

Reader Service Number 48

Off-premise trends and issues

By Larry C. Brown,
general manager, engineering
Pioneer Communications of America

Theft—of service and equipment—has spurred industry interest in off-premise addressability. It's true this approach gets hardware out of the home, but the pros and cons are still hotly debated.

What isn't debatable is the growing capital outlay subscriber devices represent. A few years ago, 12-channel systems were paying $35 or less for subscriber converters. At an average total investment per sub of $600, terminals represented less than 6 percent of the total capital outlay.

Then came addressability, 30-channel basic and multi-pay. Today it's not unusual to see a $200 per-sub investment in subscriber devices. One-way addressable converters run $90-140 each. Many homes have second sets and other units sit on trucks, in warehouses or on repair benches. So terminals account for 20 percent of the typical $1000 per-sub capital investment made by systems today.

But off-premise systems also can be expensive. In some cases, the entire cable plant has to be modified to justify the cost of off-premise system components. In this case, failure of the off-premise subscriber devices to do the job could render the entire cable plant useless.

In most types of outdoor off-premise systems, make-ready expense also will be increased. More hardware outside the home means bigger boxes, more pole rearrangement to meet required clearances and higher installation costs for pole-mounted equipment.

So cost is an issue. Subscriber devices are a large and growing part of the operator's capital outlay. But off-premise is an expensive and long-term investment as well.

A number of other trends also will affect the design of off-premise systems. Historically, CATV has delivered television signals to one TV receiver in about half the homes passed by the cable plant. That is changing.

Audio, data, telemetry

Recent reports indicate that FM audio services already are being delivered to about 1.4 million CATV homes. And a 1982 study by National Public Radio projects 15 million cable TV homes will subscribe to stereo audio services by 1990. In the last few years, new national audio services like SSS's Starship Stereo and Chicago audio superstation WFMT-FM have appeared.

The FCC also has authorized FM radio broadcasts of data and text. Already some TV broadcasters and common carriers are using the VBI to carry closed-captioning, Dow Jones Cable News and Keytax National Teletext Magazine.

Although its growth has been slow, home security can't be dismissed either. Plus, the rapid growth in personal computer-equipped homes, combined with the trend toward metered telephone rates, is making cable plant look like an awfully attractive alternate conduit into the home.

It is impossible to predict which trends will become significant businesses in the next seven to ten years. It's hard to believe none of them will. So any investment today should be expandable to accommodate the winner(s) among these possibilities.

Interface issues

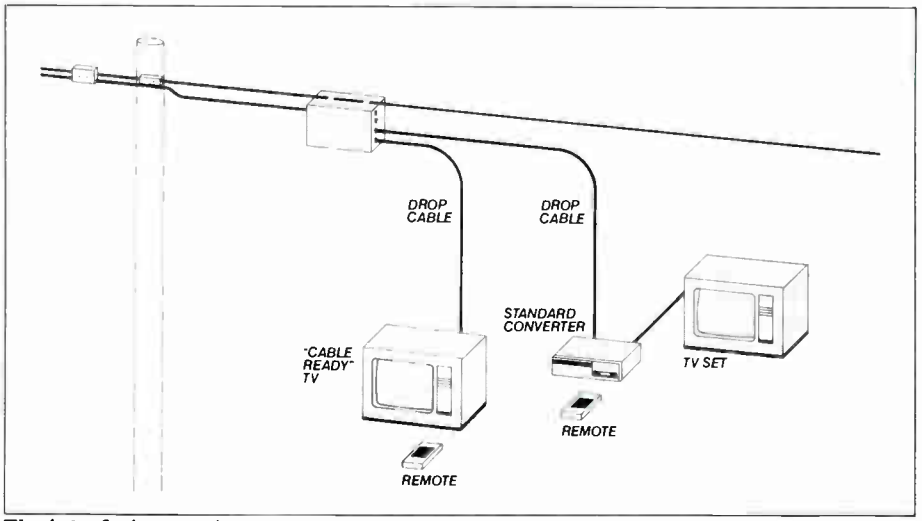
Another trend in the home is the number of TVs connected to CATV. Multiple-outlet subscribers have grown over the last 10 years from practically none to 25 percent or more. But additional outlets traditionally produce less revenue than the first connection. So the ideal off-premise system would easily accommodate additional outlets at a minimum cost. But services and outlets are not the only issues affecting off-premise design. TV receivers themselves are changing dramatically, too.

Some 40 percent of all TVs sold now are equipped with wireless remote control. And "cable-ready" TVs weren't an issue 10 years ago. In 1983, some 35 percent of TVs sold could tune the entire CATV midband and superband to 400 MHz, according to figures from the Electronic Industries Association. Considering that the average home changes TVs every seven years or so, it won't be long before most homes are equipped with "cable-ready" sets if this trend continues. A joint NCTA/EIA committee has already provided a tentative CATV channelization standard, which many cable-ready manufacturers are following.

"Stereo television" also may mushroom with the FCC's recent go-ahead on a stereo sound delivery method. Already, 14 satellite-delivered channels deliver programming to CATV operators in stereo, including MTV and The Disney Channel. Many systems in turn are then simulcasting the audio portion of the programs to subscribers' stereo systems through the FM band.

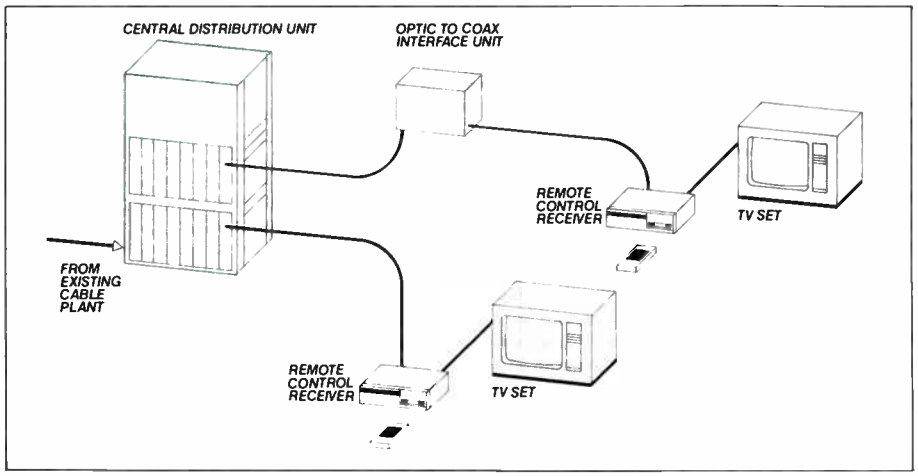
Also changing is the way CATV equipment gets installed. A 1984 survey by Wilson & Mason of 150 system managers with 10,000 or more subscribers showed that churn remains their biggest problem. As the cost of rolling trucks rises, many operators have taken a "converter store" approach to installation.

Patterned after a nationwide network of over 5,000 "phone center" stores now operated successfully by telephone companies, CATV subscribers pick up equipment at the operator's office, take it home, and install it themselves, saving the operator that expensive trip to the home. Certainly, an off-premise system should accommodate such self-installation.



The interfering carrier type addressable system integrates into existing plant with four tap points as standard.

The converter-type multiple dwelling unit serves as many as 16 subscriber drops per central distribution unit.



There are also more devices at the TV now. Since 18 percent of U.S. homes have video games, 25 percent have a personal computer and 16 percent have a VCR, an off-premise approach must avoid conflict with all these devices at the TV.

Addressability

If addressability eliminates one or two trips to the home in the life of an addressable converter, the incremental cost per subscriber for addressability has been recovered. Anything more is gravy. There is no technical reason why an addressable equivalent to a conventional converter cannot be built. As with most new technologies, it just is taking vendors a few product generations to do so.

Some 15 percent of CATV homes are now addressable, and progress also is being made in the area of PPV programming. So an addressable PPV business appears quite possible. Certainly, to be practical, an off-premise design must provide addressable control of subscriber channel authorization.

System design

A number of different off-premise system products have now been announced by at least 10 manufacturers. Most fall into one of two major design groups: off-premise converter and interdiction.

The converter system uses a digital keypad costing 25 to 33 percent of a typical one-way addressable converter. It may be a one piece unit atop the TV or a two piece wireless remote control. The keypad sends the subscriber's request to a companion subscriber module.

Subscriber modules are gathered together within a central distribution unit. A group of apartments within a building may contain one or more of these units indoors, located in a basement, hallway or janitor's closet. A cluster of individual homes may all be served from a central unit mounted outdoors on a utility pole, attached to cable plant strand, or located in a pedestal.

Each subscriber module contains a converter that verifies and tunes the requested channels.

In the off-premise converter approach, the tuning mechanism inside the subscriber's home typically remains fixed to channel 2, 3 or 4. The off-premise subscriber module does all the tuning.

The interdiction method uses the tuning mechanism of the TV or conventional converter. As with the converter approach, subscriber modules are gathered together in quantity within a central distribution unit installed remote from the subscriber residence. And again, this location may be indoors or outdoors. However, in the case of interdiction, no converter is associated with the subscriber module at the remote location. All authorized channels are always continuously delivered to the subscriber drop. Unauthorized signals are effectively blocked from reaching the drop. Some interdiction systems filter out unauthorized channels. Others inject interference on top of them.

Powering is one obvious design consideration. Opinions vary among operators and vendors as to who should pay the power bill for various portions of the system. Most agree the operator always should be in control of the powering of the central unit's addressable control portion.

In light of the architecture of both off-premise approaches, powering is one obvious design consideration. Opinions vary among operators and vendors as to who should pay the power bill for various portions of the system. Most agree the operator should always be in control of the powering of the central unit's addressable control portion.

So off-premise implies an additional power bill to pay. Depending upon how much of the off-premise system will be powered at operator expense, a metro system of 50,000 subscribers could have a new operating expense approaching $1 to $3 million per year.

Both off-premise approaches will encounter similar problems if partial or full back-powering from the subscriber is implemented: local electrical codes, voltage drop between subscriber and central unit and ground loops, for example.

Expansion is a complex issue. Naturally, the operator doesn't want to invest anything in subscriber hardware today that won't produce revenue immediately. What's needed is an easy upgrade. For example, FM audio service requires a path for the FM spectrum from the cable plant into the home. In the converter off-premise approach, the path is inherently blocked by the converter within each subscriber module.

One solution is to bypass the FM spectrum from the input of the central unit to all the subscriber drops. But providing such a new path has significant cost impact on the central unit. And since it's a separate service, shouldn't the FM service also be addressably controllable for each subscriber?

With the interdiction approach, the FM spectrum passes on to all subscribers, since no converter is involved at the central unit. But again, making FM services addressable would affect costs. New data services on an FM station subcarrier or in a TV channel's VBI may reach a subscriber connected to either type of off-premise system if the station in which the data is carried is otherwise authorized for the subscriber's reception.

Multiple-outlet connections, for subscribers using the converter approach, require a separate converter, back at the central unit, for each TV receiver served. They also require multiple drops feeding multi-set homes or frequency division multiplexing of multiple converter outputs onto one subscriber drop. Either approach is expensive. The former results in more operating expense and lessens the value of addressability. The latter requires more up-front capital for the additional electronics required.

Multiple outlets pose different problems for interdiction systems. Since all plant signals enter the home, the subscriber drop can be split as required and all TVs will receive all signals. But since the full spectrum, up to 450 or even 550 MHz, is delivered to the drop, signal level loss is much more significant. A 100 foot RG-59 drop cable will attenuate the highest-frequency TV signals to interdiction-method subscribers some 8 dB. Looked at another way, the same signal levels originating at the central unit could serve a converter-approach subscriber three times as far away as an interdiction-approach subscriber.

Interdiction-type subscribers equipped with cable-ready TVs may not require any operator-provided converter at all, a major potential savings in subscriber equipment investment. Also, their TV remote controls will tune all cable channels. While this is an advantage for the subscriber, is it for the operator?

Many operators have found converter-equipped subscribers willing to pay $2 to $4 per month extra to rent an optional converter remote control, just so they could get back the remote channel tuning capability they lost when the operator installed their set-top converter.

Converter-type subscribers will find their cable-ready feature unusable, as conventional converter subscribers have already found today. And the operator pays for each subscriber's converters included in the central off-premise portion of the system.

Stereo sound also could be a problem. The converter-type approach, with its additional processing of an authorized TV channel, would be affected the most. The interdiction approach, since it avoids any processing of authorized TV channels, would likely have the least problem accommodating in-band stereo transmissions.

For now, operators may do well to move cautiously toward off-premise technology. As we have seen, the benefit of an off-premise approach as far as theft is not without cost.■

FEATURE

Service call ratings improve with training

Technical training works, says Fritz Baker, eastern manager of engineering for Viacom Cablevision. And he's got the facts to prove it.

Baker has been monitoring the success of Viacom's technical training program by tracking service calls in several of the MSO's systems for more than two years. He began tracking the Cleveland system and gradually added the Milwaukee; Long Island; Dayton, Ohio; and Nashville, Tenn.; operators to his list.

His records show that service calls requiring a technician in the field have dropped 13 percent in one system over the last two years. Similar declines have been reported in other systems, he added.

Baker attributes these improved service call ratings to the synergy between training and tracking.

Tracking tells the operator where his techs are weak and where the technical program needs improving. But, "tracking doesn't do any good unless the operator knows what he's tracking," Baker warned.

For that reason, Viacom systems break service calls into five or more categories, including TV set, converter, distribution, subscriber drop and VCR-related groups. These categories are used to determine which complaints are most common and how the technician spends his time.

Once categorized, the system uses the tracking information to redefine the focus of its technical training program. For instance, if a system receives a large volume of subscriber drop calls, it knows its technicians need more drop installation training.

Baker says this type of targeted training has reduced the number of distribution-related calls from 9 percent of all service calls in 1982 to a projected 5 percent in 1984. This decline is directly related to better training and improved sweep and system maintenance, he said.

Tracking also tells the operator how his techs spend their time.

According to Baker, the technicians in the Viacom systems he's tracking spend 40 percent of their time handling subscriber education calls. Since an average service call takes 43 minutes, answering subscriber education calls is an inefficient use of a technician's day.

Baker believes this 40 percent can be reduced 30 percent by teaching customer service reps how to answer simple technical questions on the phone. "A properly trained customer service rep can take the subscriber through the steps necessary to fine tune his TV set in a matter of two to three minutes," he said. This obviously is a more efficient way to handle subscriber education calls.

Tracking also serves as a guide in buying decisions. By recording the cause of the complaint—equipment failure, poor installation or bad maintenance—the operator keeps track of equipment that continually needs repairing. He can use this information to direct his buying decisions.

Viacom supports its training and tracking programs with "pay for performance" merit increases, which, Baker believes, encourage interest in the programs. "Technicians are more serious about training when they know they're being monitored," he said. Monitoring also helps the operator discern the benefits of training.

Each system is "more or less" free to set up its own training system within certain guidelines. Regional engineers, such as Baker, monitor their progress and make sure "good" ideas are interchanged between systems. Every system also has its own full-time training staff, which trains customer service reps as well as technicians.

Training typically consists of two hours of group instruction, with the remainder of the day devoted to individualized training. When training is completed, the trainer files a report with both the technician and the plant manager. The operator uses the tracking system to determine when training needs to be implemented, Baker explained.

Systems also set up their own tracking programs. One of Baker's systems is using its computer to monitor service calls and technician performance. Three others are on-line with CableData. Tracking information usually is recorded on string or bar graphs, which are easy for the technician to interpret. "Technicians then can monitor their own, as well as the system's, overall performance," Baker said.

—Constance Warren

Technology Above the Rest

Product design and technology are often copied but seldom duplicated.
At Utility Products, we advance the state-of-the-art by designing better pedestals.

We are thinking of the future when taps, couplers, and amplifiers
may require a more compact designed closure.
Also, the environment is changing; acid rain, pollutants,
and coastal salt contaminants promote corrosion
so we've improved our already long-lasting finish.

In addition, all our closures feature increased mounting capacity
and variety through improved bracketry.
It is this attention to detail that keeps Utility Products above the rest.
Your future is assured with Utility Products.
Phone or write us at the address below.

Reliable Electric/Utility Products 11333 Addison Street/Franklin Park, Illinois 60131/312-455-8010

RELIANCE COMM/TEC

Reader Service Number 49

Off-premise on the books

There's no shortage of questions to be asked about off-premise addressability. Which approach is better—converter or tap/trap? Is the system compatible with scrambling, and if so, with which types of encryption?

Can the systems accommodate future signal expansion or are the number of channels and tiers limited? Is there some sort of fail-safe mode in case the system goes down? This might be critical with a tap or trap system if the full band is passed to the home on network default.

If special installation techniques are required, are additional costs involved? On the other hand, are there advantages to longer drops?

And of course, there is always the question of the second or additional sets hooked to the system. To which we might add the growing problem posed by "cable compatible" VCRs and TVs. If signals are denied to the house, what method is used?

System powering is already an issue. Some balance must be struck between the security represented by headend powering and subscriber drop backpowering. Also, there is the question of AC or DC.

Since greater intelligence is being moved to the outdoor plant, the effect of adverse weather and environment must be considered as part of the general issue of system durability.

One question that hasn't been widely discussed up to this point is financial, rather than technical, in nature.

"One thing off-premise approaches might change is the way systems account for their equipment," says Texscan's Bill Dawson, vice president for corporate development. "Typically, systems use a five- to seven-year depreciation schedule for their converters. Off-premise systems might offer the possibility of carrying the new electronics on the outdoor plant schedule."

It isn't clear what advantage this might offer, if any. Dave Willis, TCI director of engineering, isn't sure at this point whether the slower depreciation would be an advantage.

Sammons Communications Vice President for Finance Ron Holley says his company uses a 15-year schedule for its outdoor plant and a 7-year timetable for its in-home addressable converters. "But you could depreciate them over a five-year period. How you do it just depends on each company's situation. I'm not sure there's a benefit either way."

A company with large cash flow would most likely want a faster, rather than a slower, depreciation rate to lower its pre-tax earnings, says American Cable Television Inc. Director of Accounting Alan Tabin. "A longer schedule might help a company doing borderline-well."

Not everyone is convinced, at least at first glance, that active electronics would be considered outdoor plant for tax purposes. "I'm not sure active electronics would be construed as falling under the 12- and 7-year guidelines," says ELRA Group President Gerhard Hanneman. Electronic equipment, like computers, generally is written off at about five to seven years, he says. And generally speaking, most companies probably would be better off with the quickest possible depreciation.

"The impact would probably be minimal on a book basis," says a Viacom official. Viacom carries its passives and other electronics on 15- and 10-year schedules as far as book value, and off-premise electronics probably would remain on the 10-year schedule, he says.

"Perhaps you could create a class of outdoor plant with a seven-year useful life," he added.

But for tax purposes, Viacom sticks to a five-year schedule for all major assets aside for buildings and trucks. Its converters now are written off within five years according to the new Accelerated Cost Recovery System.

So now there's another question to ask about off-premise systems. So far, there aren't firm answers.

—Gary Kim

Off-premise addressable systems

AM Cable TV Industries Inc.
P.O. Box 505
Quakertown, Pa. 18951
(215) 536-1354
Tier Guard

Blonder-Tongue Laboratories
One Jake Brown Rd.
Old Bridge, N.J. 08857
(201) 679-4000
Guardsman

Jerrold Division/General Instrument
2200 Byberry Road
Hatboro, Pa. 19040
(215) 674-4800
Intranet

PICO Products Inc.
103 Commerce Blvd.
Liverpool, N.Y. 13088
OTAS

Pioneer Communications of America
2200 Dividend Drive
Columbus, Ohio 43228
(614) 876-0771

Texscan Corp.
El Paso CATV Division
10841 Pellecano Drive
El Paso, Texas 79935
TRACS

Times Fiber Communications
358 Hall Ave.
P.O. Box 384
Wallingford, Conn. 06492
(203) 265-8500
Mini-Hub

Ortech
297 Talmadge Rd.
Edison, N.J. 08817
(201) 287-2992
Oracle

ATC/Toshiba
(303) 799-1200
DST

Delta-Benco-Cascade
124 Belfield Road
Rexdale, Ontario, Canada M9W 161
(416) 241-2651
Addressable Tap System

Wade Communications
3535 Briarpark Drive,
Suite 255
Houston, Texas 77042
(713) 785-3143
STAT system

C-Cor Electronics Inc.
60 Decibel Road
State College, Pa. 16801
(814) 238-2461
SCAT system

Vitek Electronics Inc.
4 Gladys Court
Edison, N.J. 08817
(201) 287-3200
Vitap system

SAFE! FAST! EFFICIENT!

ARROW

WIRE & CABLE

STAPLE GUN TACKERS

FIT RIGHT IN

for doing the CATV installation job RIGHT!

Rugged, reliable Arrow Wire & Cable Staple Gun Tackers are made of all-steel for lasting durability and engineered for safety, speed and efficiency with these built-in high performance features:

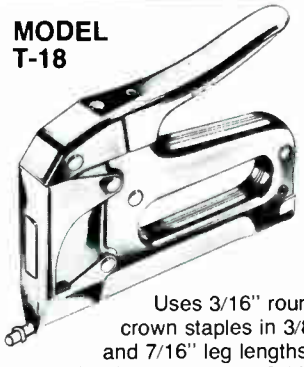
- **GROOVED GUIDE** positions wires and cables for proper staple envelopment and safe, secure fastening.
- **DRIVING BLADE** automatically stops at the right height to prevent staple from damaging or cutting into wire or cable.
- **AUTOMATIC, SINGLE-STROKE COMPRESSION ACTION** speeds up fastening, reduces installation time and minimizes hand fatigue.
- **PATENTED PRECISION-LOCKED MECHANISM** ensures smooth, uninterrupted trouble-free performance.

These outstanding features have made Arrow Wire & Cable Staple Gun Tackers the top choice in fastening tools of professional installation men in every field, including CATV, telephone, electrical, electronics, communications, alarm systems and many more.

Reader Service Number 50

4 Models Fit All Wires and Cables Ranging From 3/16" to 1/2" in Diameter.

MODEL T-18

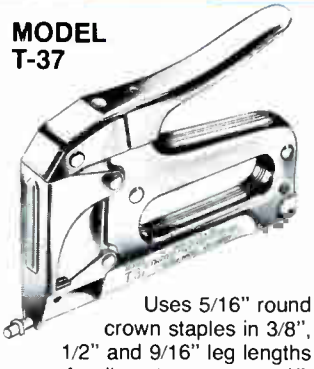


Uses 3/16" round crown staples in 3/8" and 7/16" leg lengths - for diameters up to 3/16".

MODEL T-25

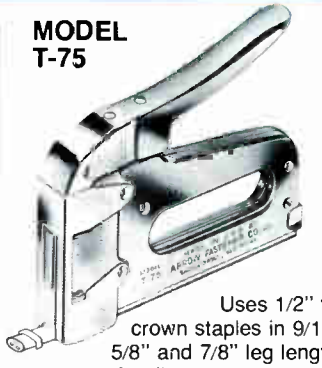
Uses 1/4" round crown staples in 9/32", 3/8", 7/16" and 9/16" leg lengths - for diameters up to 1/4".

MODEL T-37



Uses 5/16" round crown staples in 3/8", 1/2" and 9/16" leg lengths - for diameters up to 5/16".

MODEL T-75



Uses 1/2" flat crown staples in 9/16", 5/8" and 7/8" leg lengths - for diameters up to 1/2".

THE RIGHT ARROW TACKER AND STAPLE SIZE TO USE FOR THE RIGHT CATV INSTALLATION:

For fastening ground wire - use Model T-18 with 3/8" leg staple.	For fastening RG-59 - use Model T-25 with 9/16" leg staple.	For fastening RG-6 - use Model T-37 with 9/16" leg staple.	For fastening RG-11 - use Model T-75 with 5/8" and 7/8" leg staples.

Call your supplier or write for catalog & prices.

ARROW FASTENER COMPANY, INC.

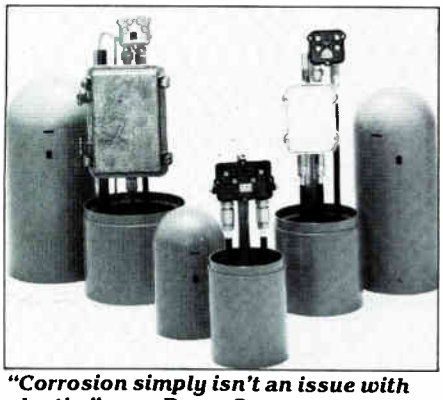
271 Mayhill Street
Saddle Brook
New Jersey 07662

Pedestals: steel versus plastic

The debate continues

By Lesley Dyson-Camino

Manufacturers agree that corrosion resistance and structural integrity are two important factors system owners must consider when selecting a pedestal. Still being debated, however, is whether galvanized steel, aluminized steel, PVC (polyvinyl chloride), ABS (acrylonitrile butadiene styrene), polyethylene or fiberglass is the best pedestal material.

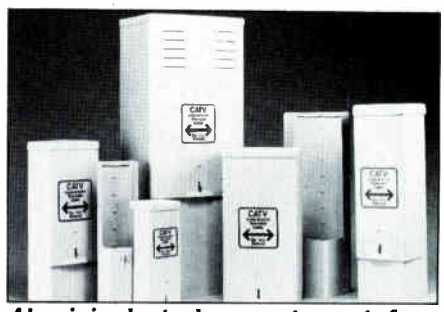


"Corrosion simply isn't an issue with plastic," says Roger Scommegna.

Gary Zuck of ZR Concepts feels that plastic pedestals are by far the best in terms of longevity and service problems. He objects to steel pedestals because of the *railroading* effect. "Any type of metal pedestal will eventually tilt," he says. "The square sides become literally cockeyed, and the door or lid is difficult or impossible to close properly." This can have a direct effect on security, Zuck claims, because a door that is difficult to close is less likely to get closed.

Roger Scommegna, product manager at Coil Sales and Manufacturing, prefers plastic as long as it is UV-stabilized. "All steel pedestals will ultimately rust. Just a little scratch will start it," he claims. Plastic pedestals do not require painting because their color is extruded in, not painted on. "Rust and corrosion are not issues with plastic simply because of the nature of the material," he added.

Bud Campbell of Federal Telecom also prefers plastic because of its immunity to corrosion. "Nothing can get to our plastic pedestals," he asserted. "We even had to order special glue for the equipment labels because the standard glue just wouldn't stick to our polyethylene surface."



Aluminized steel prevents rust from "spreading like fire," says French.

Diamond Communication Products' Gene Coll thinks differently. "Pound for pound, fiberglass is as strong as steel," Coll argues. Fiberglass, like other plastics, doesn't require painting because the color can be mixed in before the unit is formed. Coll also claims that Diamond's fiberglass pedestals will bounce back "up to a point," thereby minimizing dents and shape distortion.

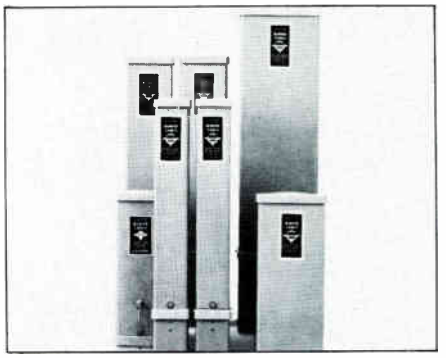
On the metal side of the fence stands Paul Rhodes of Pyramid Industries. Rhodes feels that some systems may have turned to plastic because of bad experiences with inferior-quality steel

pedestals. But Rhodes firmly believes that "properly treated steel is every bit as good as plastic."

Also favoring steel is Rob Mertz, product manager at Reliable Electric. He feels steel is superior to plastic because of its increased resistance to fire, heat, impact, ultraviolet rays, corrosion and fungus.

Terry French of CWY Electronics believes his company's aluminized steel pedestal is the best because it is "non-sacrificing," and one small area of rust will not "spread like fire." Although French admits that plastic pedestals may be better in areas immediately adjacent to the sea coast, he feels that, overall, aluminized steel is the best way to go.

Steel also is the choice of Tom Stewart of Edson Tool and Manufacturing. "It is tougher, not sensitive to light, and capable of withstanding wide temperature variations," he said. Edson manufactures a galvanized steel pedestal with an electrostatically applied polyester powder coating. Stewart feels that security is not a major factor in choosing between steel and plastic because "given the same locking device, accessibility is virtually the same."



"Pound for pound, fiberglass is as strong as steel," claims Gene Coll.

But Bill Channell Jr. of Channell Commercial Corp. isn't so sure pedestal material is so important. Design and engineering are more critical, he maintains. "The features a pedestal has are more important than what it's made out of or how it was made."

What's in store for pedestals? Opinions vary, but many manufacturers believe—for aesthetic reasons—low-profile pedestals will become the rule rather than the exception. Fiberoptics may eventually move pedestals completely underground, creating a whole new arena in which plastic and steel proponents can disagree. ■

Steel pedestal manufacturers

CWY Electronics
405 North Earl Ave.
Lafayette, Ind. 47904
317/448-1611

Edson Tool and Manufacturing
30 River Road
North Arlington, N.J. 07032
201/997-3100

Pyramid Industries
P.O. Box 23169
Phoenix, Ariz. 85063
602/269-6431

Reliable Electric/Utility Products
11333 Addison St.
Franklin Park, Ill. 60131
312/455-8010

Superior Metal Products
2110 116th Ave., N.E.
Bellevue, Wash. 98005
206/455-9159

U-TEL CATV Products
2900 East LaJolla Road
Anaheim, Calif. 92806
714/630-7500

Plastic pedestal manufacturers

Channell Commercial Corp.
620 West Foothill Blvd.
Glendora, Calif. 91740
213/963-1694

Coil Sales and Manufacturing
4902 Tollview Drive
Rolling Meadows, Ill. 60008
312/398-6600

Federal Telecom Inc.
114 Cass St.
Woodstock, Ill. 60098
815/338-6000

Fiberglass pedestal manufacturers

Diamond Communication Products
500 North Ave.
Garwood, N.J. 07027
201/789-1400

Corrections

In the October issue of *CED*, we reported that Kanematsu-Gosho's Sprucer II system used sync suppression. Actually, the company says it uses level shifting of synchronous signals, random turn-over of polarity and video inversion. Some engineers consider the technique similar to sync suppression, however.

In the September Product Profile, TV Watch's Stationmaster Level I should have been listed as having unlimited channels, with one VTR per channel and unlimited events/entries. The tone detecting method used is digital tone decoding. Programmable preroll, with VTRs prerolled from stop mode, verification printout and an EPSON printer are other features. Video input and output are 75 ohms. Memory specs are not available. The company's Stationmaster Level II and Level III models also have unlimited channel capacity. Level II operates with 1 VTR per channel and has the same programmable preroll capability and video specs as the Level I. The Level II balances the program audio line from VCR output impedance to 600 ohm, has 6K RAM and 4K EPROM memory and also features automated billing. The Level III operates with 4 VCRs per channel; can handle 2,400 events/entries per channel; has the same programmable preroll, video and audio specs as the Level II; and features remote verification and automated billing. Level III also offers three channels by 4 VTRs.

POLYPED

The Shape of Things That Last

The trademark "Polyped" is Federal Telecom's line of ultimate pedestals. Polypeds are molded of rugged, resilient polyethylene. Brackets are heavy gauge vinyl coated steel. Hardware is all stainless. Polypeds are available from Federal Telecom's 10,000 piece inventory in 4, 6, 8 & 10 inch sizes (C124 series) or Amplifier sizes (C1230 series). Most major MSOs have either approved Polyped for system use or are in the approval process. Try the best! Put the unique shape of Polyped into your outside plant. It truly is the shape of things that last.

Call today so sales material can be sent tomorrow. See the Polyped in Anaheim at the Western Show - Booth 182/183. Federal Telecom will be introducing its C3000 line of modular Polyped cabinets. Stop in and see this unique product.

Federal Telecom Incorporated
114 Cass Street
Woodstock, Illinois 60098
(815) 338-6000

Reader Service Number 54

"Blending Technology with Practicality"

Pedestal proof in the pudding

By Gary Kim

Perhaps it isn't ultimately so important whether a pedestal is made of one material or another. With enough care, a variety of materials will suffice. Construction and design, and certainly quality control, are arguably more important. But in the final analysis, the only thing that really counts is performance in the field. Claims of 10-20 year life are just that—claims—until enough operational experience has been gained.

"Only the field tests will prove what works and what doesn't," says Bill Channell Jr. of Channell Commercial Corp. Even test data can be misleading.

"A test run on PVC units clear state, without the color or ultraviolet inhibitor added, won't account for the chemical changes that occur once those elements are added," Channell says.

And all pedestal materials, whether steel, plastic or fiberglass; as well as all manufacturing methods, involve tradeoffs and choices. A stronger material costs more, but can be fabricated in thinner form. Structurally weaker materials can, with enough thickness, match the performance characteristics of competing substances.

Durability over time is not simply a matter of raw chemistry, however. The care exercised during the fabrication process can be critical. Electroplate and hot-dip galvanizing, for example, may make a real difference in performance over time—but they also add different prices to goods made either way. And however rigorous the protection a piece of metal receives on its face, rust can still attack the edges if they aren't protected as well.

Mill galvanized steel prevents rust, "but paint won't stick to it," says Rob Mertz, product manager with Reliable Electric. So the care exercised during the painting process could affect the life of a steel pedestal. Since basically the same process is followed by all metal pedestal makers, careful attention to detail is important. The wash, phosphate bath, primer and top coat finishing processes all have to be done completely.

CWY Electronics uses 16- and 18-gauge aluminized steel for its pedestals. It's a bit more expensive than galvanized steel, but the company feels it provides better protection against rust. Still, "the features and design are most important in a pedestal. The manufacturing process is simply done the most efficient way," says Terry French, CWY vice president and general manager.

Several common methods are used for shaping plastic pedestal parts. There's a low-pressure foam molding process that expands the material, yielding a honeycomb shape inside. The extrusion method pushes raw PVC through the mold. The most expensive method is injection molding, a high-pressure technique using heavy machinery.

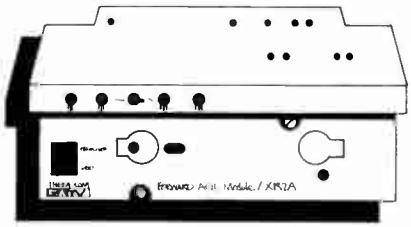
At Coil American Technology Co., the PVC arrives at the plant in pellet form. The green material is processed two ways. The pedestal caps are injection-molded, and every 30 seconds a

THETA-COM XR-2

300 MHz Push-Pull Equipment.

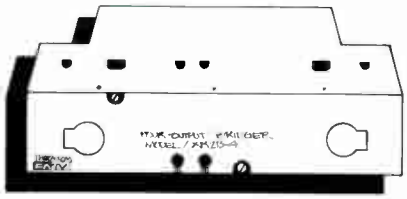
$15.00 EA.

XR2LAF-1
XR2LAF-2
XR2LAF-3
XR2LAF-4

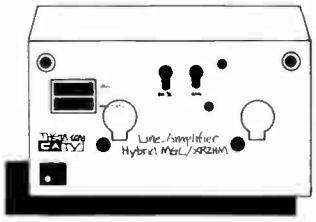


XR2M **$55.00**
XR2A **$60.00**

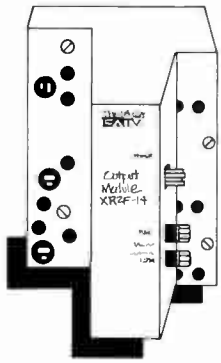
XR2LARA **$40.00**



XR2B **$40.00**
XR2B-2 **$40.00**
XR2B-4 **$45.00**

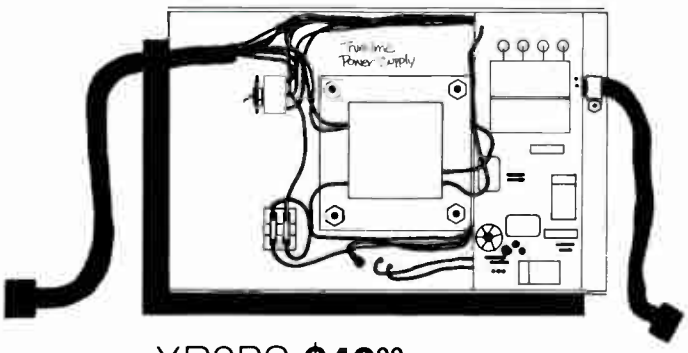


XR2HA **$40.00**
XR2HM **$40.00**
XR2DA **$30.00**
XR2DM **$30.00**



$20.00 EA.

XR2BF-1 XR2F-6
XR2F-2 XR2F-13
XR2F-5 XR2F-14



XR2PS **$40.00**
XR2LAPS **$30.00**

OUTSIDE CALIFORNIA
800/227-1200
INSIDE CALIFORNIA
800/223-3152

CATV SERVICES
3270 Seldon Court, Suite 5
Fremont, California 94539

Complete 2-Way Stations Available!

Reader Service Number 35

fully-formed part pops out of the machine. Every 50th cap gets an impact test. "We raise a five-pound weight up 10 feet and then drop it, generating a force of 50 pounds per square inch," says Roger Scommegna, company product manager.

Whatever type of pedestal is considered, manufacturers seem to agree on some basic criteria for choosing one. Longevity and wearability in the field are at the top of the list. A 20-year life expectancy isn't too much to demand. Impact, ultraviolet ray and fire resistance also are important. Ease of mounting and servicing also must be considered. Resistance to corrosion and fungi, price and ability to blend with the environment are also key.

Pedestal design has changed over the years. Channell Commercial totally redesigned its line in 1978 and has spent about $5.5 million in design engineering costs to keep its products up-to-date.

As cable technology changes, closures change with it. Terry French of CWY Electronics speculates that off-premises systems will need pedestals with more rear surface area and a wider back plate.

And Rob Mertz with Reliable Electric guesses the spread of fiberoptic cable will have some effects, although at the moment it's hard to predict exactly what those are.

Just about anybody who has been in the business a long time can tell a horror story about a pedestal make and model that just didn't work. Whether constructed of fiberglass, plastic or steel, some of the early models just didn't stand the rigors of life in the field.

Consequently, product testing and quality control have become bigger issues. Reliable Electric subjects its pedestals to salt fog and humidity chambers, for example. The 30-day apiece tests are designed to replicate in some fashion a field life of 20-30 years, Mertz says. And of course one of the survival tests the pedestals must withstand is impact—with a sledgehammer, to be precise.

Coil American Technology has subjected its PVC to a variety of tests. The plastic has been soaked in water, and then cooled to -28 degrees centigrade for 24 hours and brought up to 22 degrees for an additional day. This was repeated 25 times before the plastic was inspected for cracks, crazing and deforming.

Burn tests, load deflection, fungi and mildew tests also are typical methods of checking on material durability. Still, there's no substitute for experience.

Pyramid: the heavy metal behind the soft rock

Cable electronics have gotten sophisticated. Digital. Integrated. Modularized. But pedestals and connectors still bake in the sun; battle snow, ice and salt.

Computers may interrogate thousands of subscribers in milliseconds; antennas pick up signals bounced through 44,000 miles of atmosphere and space. But to get the signal into a house, somebody has climbed a pole, dug a trench, drilled a hole, driven a post or tightened a nut.

In short, cable technology spans a range of tool use. It's as old as metal fabrication and as young as the micro-

computer; mechanical as well as electronic; using "Sunbelt" ICs and "Frostbelt" equipment.

Ironically, Pyramid Industries, located in the heart of the Sunbelt, supplies the industry with goods more typical of the Frostbelt. Pyramid's raw materials are steel, aluminum and brass—not silicon. The pedestals and connectors, it turns out, are made the traditional way: punched, bored, bent, threaded and assembled with presses, lathes and drills.

Massive, heavy, high-speed tooling equipment, not microscopes, are the tools of the trade. If IC manufacture is like soft rock, then pedestal forming is like heavy metal—real heavy metal. Say 60 to 300 tons. It takes that much pressure to shear galvanized steel sheets into blanks before punching, cutting, stamping and forming them. Ear plugs, not earphones.

The Phoenix plant's products are shipped to customers ranging from cable OEMs to telephone companies, and long before a fitting becomes part of an MSO's outdoor plant, it's stacked up bar form in a fenced, outdoor holding area outside one of Pyramid's manufacturing sites.

The bars, about 12 feet long, are fed into high-speed single and multiple lathes whose spindles turn at 4,000 RPM. Every few seconds, a fitting drops into a basket, continuously bathed in 30 weight oil. The major by-products are noise and metal shavings. There are ample amounts of both.

In the grinding room, Journeymen machinists design and make cutting tools, dies and punches. Tools to make tools.

Overhead hooks hold buckets, suspended above a dozen vats, washed by chemical solutions. Plate aluminum connectors dip in and out, reaching the last vat chemically prepared to withstand 100 hours of salt spray.

Adding the final touches

Quality control, deburring, more QC, final hand assembly, counting, bagging and labeling will complete the process. Looking like cartridges on a bandolier, 10,000 parts an hour tumble from a circular conveyor belt. Perhaps typical of similar plants, soldering irons and sorting trays sit atop parallel rows of metal tables.

But some things aren't so typical, like the black, conductive molybdenum material found on the company's connectors, or the beryllium copper plating on Pyramid's pins.

The company is proud of its painting system, "probably the most sophisticated west of the Mississippi," says Paul Rhodes, company vice president.

Parts take a 96-foot, 10-minute ride through a washer before the first misting of paint. Alkaline and phosphate primer baths are followed by an acid rinse and another coat of primer. The parts emerge with a dull grey color and make a 180-degree turn as they head for the painting oven.

An electric eye measures each part, rotates the object 90 degrees and measures again. Two banks of spray guns are programmed based on these measurements. Moving through the hoods, 100 cubic feet of air are sucked out, venting the containment area.

A 17-minute bake at 200 degrees removes all solvents, while an additional 350-degree bake for another 17 minutes bonds the polyester paint to the underlying metal. As a result, all the painted pedestal parts conform to Western Electric, GTE and REA specs.

And they should have a 20-year life: 10-12 years for the paint and another 10-12 years for the metal, Rhodes says.

—Gary Kim

There was a time when communications were simple . . .

C-COR keeps it simple.

Power Products

C-COR Power Products keep you in control of your data communications or cable TV system despite utility power outages, brownouts, lightning strikes and transients. A PowerVision headend uninterruptible power supply (UPS) provides up to 900 watts of power at 115 Vac for up to 3.5 hours after the utility power fails. Standby power supplies of various output voltage ratings are available for pedestal, pole or strand mounting. Solid state transient suppressors achieve reliable, non-destructive surge arresting with automatic reset. A small surge protection module uses a voltage foldback phenomenon to most effectively protect amplifiers and similar equipment from overvoltages. All are cost-effective, sophisticated, yet simple.

Call or write today for the full story on C-COR Power Products.

C-COR® ELECTRONICS INC

60 DECIBEL ROAD • STATE COLLEGE, PA 16801 • 814-238-2461
Call toll free in continental U.S. (except PA) 1-800-233-CCOR • TWX: 510-670-3513
C-COR ELECTRONICS, INC., 8285 SW NIMBUS AVENUE, SUITE 131, BEAVERTON, OR 97005 TEL: 503/644-0551
C-COR EUROPE BV: P.O. BOX 3000, 1300 EA ALEMERE-STAD, THE NETHERLANDS 31-3240-32945 TELEX: 70277 NMBOMNL DATACABLE

Reader Service Number 60

Continued from page 32

tioned previously, or those that use small and inexpensive customer premise earth stations. For virtually all customer premise private networking, the limiting technical link parameter is interference from adjacent satellites. Even in C-Band (4/6 GHz), interference from terrestrial sources has not materially hindered the development of many networks since the antenna can be economically shielded if it is small enough.

Summary

Spacing C-Band satellites closer than 3° will most likely subject TVRO earth stations with 4.5- or 5-meter diameter antennas to harmful interference. The cable industry stands to be operationally and financially impacted by an FCC policy that has a goal of uniform 2° spacing of satellites. There doesn't appear to be satellite capacity demand to warrant an early implementation of this policy. In fact, adding more satellites to an already underutilized resource could have a reverse effect on the Commission's goal of providing for the greater good (of the public) through management of the radio spectrum. ■

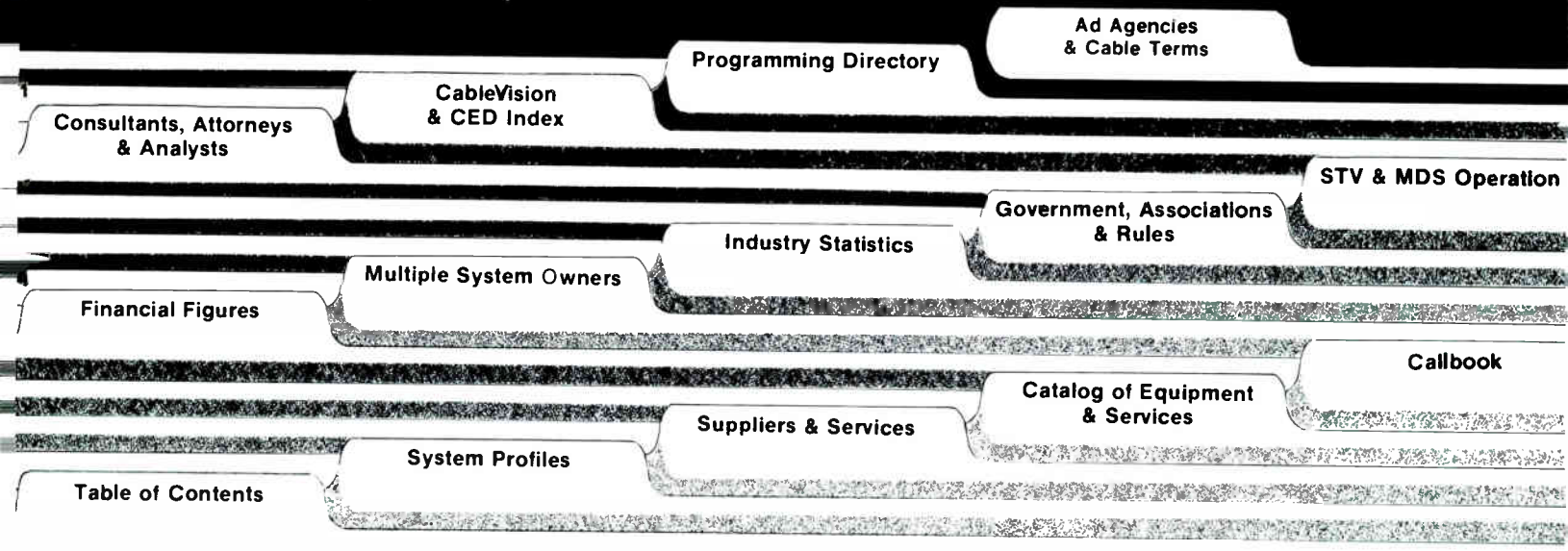
Bibliography

1) Memorandum Opinion and Order—FCC 83-186, Assignment of Orbital Locations in the Domestic Fixed Satellite Services, Released August 12, 1983.
2) Comments of National Cable Television Association in CC Docket 81-704, filed March 8, 1982.
3) Comments of National Cable Television Association in Report No. DS-265, filed May 15, 1984.
4) Establishment of Domestic Communications—Satellite Facilities by Non-Governmental Entities, Docket No. 16495, Notices of Inquiry—Dated March 2, 1966.
5) First Report and Order, Docket No. 16495, Dated March 24, 1970.
6) Second Report and Order, Docket No. 16495, Dated June 16, 1972.
7) Orbit Deployment Plan, 84 FCC 2d 584 (1981).
8) Notice of Inquiry and Proposed Rulemaking, FCC 81-466, Released November 18, 1981.
9) Public Notice, Report No. DS-265, Applications Included in New Domestic Satellite Applications Processing Group.
10) Docket No. CC 19465.
11) Declaratory Ruling and Order, FCC 76-1169, Adopted December 15, 1976, Released January 7, 1977.
12) Report and Order, FCC 83-184, Appendix D.
13) NCTA Convention Record, Technical Papers 1983, "Earth Station Design Considerations For 2° C Band Satellite Spacing," N. Weinhouse, page 156.
14) "Satellites Outpace Customers", New York Times, April 10, 1984.

Norman Weinhouse has recently formed Norman Weinhouse Associates, an engineering consulting firm, after 35 years experience in the microwave and satellite communications field. He was manager, technology, at Hughes Communications Inc., operators of the Galaxy satellite system. He was a long-time member of the NCTA engineering committee, and the chairman of its Satellite Subcommittee. In addition, he has served on many industry and association committees in establishing transmission standards especially for television.

Weinhouse has worked at Rantec Inc.—Calabasas, Calif., Collins Radio —Dallas, Texas, and Motorola Inc.— Chicago, Ill.

14 good reasons.*



CABLEFILE gives the information you need in easy-to-find categories. Accessible, complete and accurate, **CABLEFILE** *is* the industry at your fingertips.

*Now there is another good reason to order **CABLEFILE/85** today: The pre-publication price of $99.95.

EMPLOYMENT OPPORTUNITIES/HELP WANTED

JIM YOUNG & ASSOCIATES
"Leader in the Placement of Cable Television Professionals"
Nationwide Service

One Young Plaza
1235 Ranger Highway
Weatherford, TX 76086
(800) 433-2160
(817) 599-7623
Texas Collect

DIRECTOR OF ENGINEERING, NCTA

Experienced CATV engineer with strong analytical, interpersonal and writing skills needed for high visibility position. Responsibilities include engineering analysis and technical writing (for non-technical audiences) in support of FCC filings and Board directives as well as general industry interface. Submit resume, letter of interest with salary requirements and references, in confidence to:

Wendell Bailey
VP Science & Technology Dept., NCTA
1724 Massachusetts Ave. NW
Washington, DC 20036

ncta

National Cable Television Association

CABLE SEARCH ASSOCIATES
Professional Search and Placement

Engineering	Sales
Management	Marketing
Technicians	Construction

Call or Write
WICK KIRBY
(312) 369-2620
Telex: 720-462
P.O. Box 2347, Naperville, IL 60565

TECHNICAL MANAGER
CHIEF TECHNICIANS
LEAD TECHNICIANS

Immediate openings in Virginia, Maryland and Delaware. Candidates must have electronic background, minimum of 3 years experience in CATV industry and FCC General Class License preferred. Equal opportunity employer. Excellent salary and benefits. Please send resumes to:

Storer Cable Communications
P.O. Box 740
Lanham, MD 20706

BENCH TECHNICIAN

Must be able to repair various RF components used in the CATV industry. Send resume to:

Jeff Uhler
3270 Seldon Court, Suite #5
Fremont, CA 94539

ENGINEERING • MANAGEMENT
TECHNICIANS • MARKETING
• SALES
(MSO or Equipment)

CAREER MARKETING ASSOCIATES

ROBIN SQUIRES
Cable Television Specialist
7100 East Belleview, Suite 206
Englewood, CO 80111
(303) 779-8890

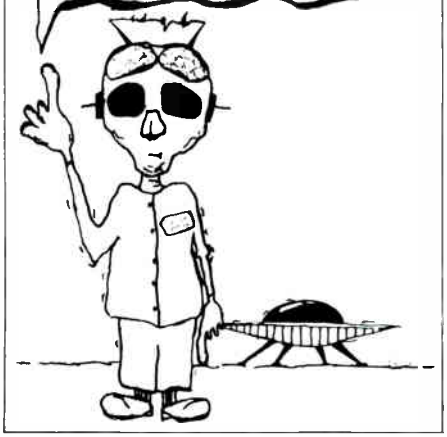
HELP WANTED?
EQUIPMENT WANTED?
EQUIPMENT FOR SALE?
POSITIONS WANTED?

Place a classified ad in CABLEVISION and CED.

Call or write Suzanne Sparrow for details. P.O. Box 5208 T.A., Denver, Colorado 80217 (303) 860-0111

Take a load off your . . . inventory

Place a classified ad in CABLEVISION and CED. Call Suzanne Sparrow for details. (303) 860-0111 P.O. Box 5208 T.A., Denver, Colorado 80217



Place a classified ad in CABLEVISION and CED Call or write P.O. Box 5208 T.A., Denver, CO 80217 (303) 860-0111

CED

CLASSIFIED ADVERTISING MADE EASY

To place your own classified ad, simply fill out this coupon and return it to: Suzanne Sparrow, CED Magazine, P.O. Box 5208 T.A., Denver, CO 80217. Be sure to let us know how many times you want to run your ad.

Ad Copy: _____

_____

_____

_____

_____

Bill to: Company _____
Address _____
City _____ State _____ Zip _____
Phone _____
Ordered by _____
Insertions _____

Rates are $50/per vertical column inch for line classifieds. Allow approx. 40 words per inch. There is a one inch minimum.

FOR SALE

USED
AERIAL BUCKET TRUCKS

Most units completely rebuilt.
Specializing in CATV use.
Telsta SU34s and T40s Plus other makes and models.

(Call toll-free)
1-800-343-4614

Leo LeBlanc
(617) 893-3900

Colvins Inc. AERIAL TRUCKS
185 Prospect Street
Waltham, Mass. 02154
(Boston)

USED TOWER FOR SALE

Dresser 200 ft. solid leg SS microwave tower. 14 ft. base —64 in. top. Good paint. Weight—67,000 lbs. $11,900.00.
Also have used waveguide for sale.

Contact: Walton Towers, Inc.
Box 148B, RD #1
Hershey, PA 17033
(717) 533-3635

FOR SALE:

Hughes low power 40 channel AML microwave - new, never used! Group C-Channels 2/3/4/5/6/7/8/9/10/11/12/13/PT/FM/C/D/E/F/G/H/I/J/K/L/M/N/O/P/Q/R/S/T/U/V/W/AA/BB/CC/DD/EE/. 2 receivers, LNA's, waveguide 3-10 ft, 1-8 ft antenna, AML/CATV interface, test box and accessories! Will deliver! $ Negotiable.

Call 219-996-1111.
Ask for GB.

FOR SALE:

300 Magnavox converters MXC 64-3-CO-R 64 channel with remote control units.

Call 219-996-1111.
Make Offer!
Ask for GB.

Better than ever—with a new company name.
INTERNATIONAL THOMSON COMMUNICATIONS INC.
(formerly Titsch Communications, Inc.)

Call Suzanne Sparrow Today For information on Classified Advertising (303) 860-0111

CABLEDEX CARDS

WANTED

EXPERIENCED UNDERGROUND FOREMAN—FOREPERSON

ESTABLISHED UNDERGROUND CATV CONTRACTOR SEEKS EXPERIENCED AND QUALIFIED FOREMAN OR FOREPERSON FOR PROJECTS IN FLORIDA, MASSACHUSETTS, NEW HAMPSHIRE AND NEW YORK. (TOP WAGES AND BENEFITS.) PLEASE SEND RESUME OR CALL:

EARLY & SONS, INC.
CONTRACTORS
BRADFORD, MASS.

Richard P. Early, Jr.
58 So. Kimball St.
Bradford, Mass. 01830
(617) 374-8033

Bill Soucy
P.O. Box 10408
Pompano Beach, Fla. 33061-6408
(305) 971-6111

Titsch Communications Inc.
a subsidiary of International Thomson Business Press, Radnor, PA

Suzanne Sparrow
Classified Advertising Director

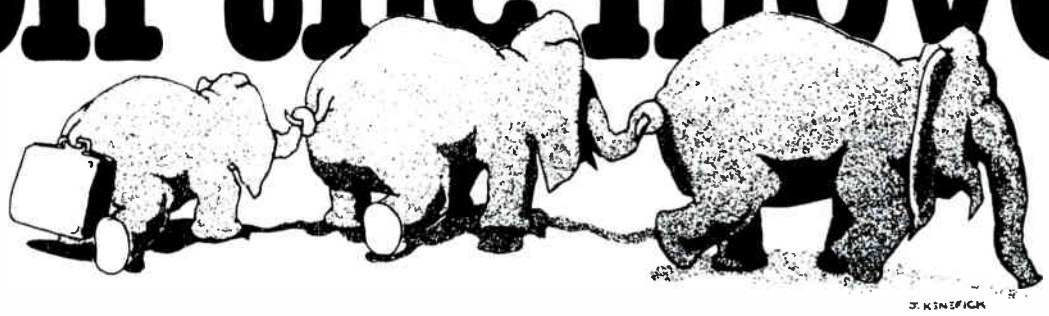
YOUR BUSINESS CARD HERE FOR ONLY $60 PER WEEK!
P.O. Box 5208 T.A.,
Denver, CO 80217
(303) 860-0111

Reprints Reprints Reprints Reprints Reprints

For more information contact Pam Berke, Customer Service Department, Titsch Communications, Inc., P.O. Box 5208 T.A., Denver, Colorado 80217 or call (303) 860-0111.

Reprints are a convenient, cost effective communication tool: designed to give your company high visibility in the marketplace. They are ideal for announcing new products and events to customers, suppliers and staff.

on the move?



Please let us know. We wouldn't want you to miss a single issue. Affix your mailing label to the coupon below and give us your new address. Allow six weeks for processing. Send to Circulation Department, c/o (Name of Magazine), P.O. Box 5208 T.A., Denver, Colorado 80217 or call: (303) 860-0111.

Affix
Label
Here

New Address:

Name _____
Title _____
Company _____
Address _____
City _____
State/Zip _____
Phone _____
Signature _____

Keyfax becomes free with venture restructuring.

SSS role in Keyfax escalates

Keyfax National Teletext Magazine will become a free service, and its promoters will try to lower the price of the World System Teletext decoder needed to pick up the cable-delivered signal. A major revamping of Keyfax Teletext, the joint venture between Satellite Syndicated Systems and Keycom Electronic Publishing, is underway. SSS will assume a larger role in and, perhaps, take over marketing and system operations.

Keycom wants to abandon the teletext business. Its major owner, Centel, which briefly marketed Keyfax teletext to cable TV systems, has dropped that role, leaving the task entirely to SSS. Keycom also had been handling editorial duties and may continue to contribute news material if the process is automated so information is fed directly into the system.

SSS wants to restructure the teletext magazine and make it fully ad-supported. SSS also hopes to develop a process encouraging cable operators—who have so far been unenthusiastic about Keyfax—to offer teletext on their systems.

Keyfax Teletext customers—barely 400 nationwide—pay about $20 per month, half for decoder rental and half for the service. Under the plan being considered, Greendale Electronics, the British decoder maker, will offer the devices to cable operators for $4.95 per month. SSS will encourage cable firms to lease the units to subscribers at or near that price. SSS will aggressively recruit advertisers to support the database, thus creating a new cash stream to replace the monthly subscriber fees.

SSS also plans to boost cooperation between World System Teletext operators, notably Taft Broadcasting and Metromedia. The objective is to blend teletext input and advertising efforts. In the process, SSS hopes that data from each editorial service can be used without unnecessary duplication.

In an effort to push World System Teletext format during the summer Olympics, SSS gave away Greendale decoders to 15 cable systems around the U.S., permitting them to carry cycled frames from the Los Angeles teletext database on empty cable channels. The systems reach about 130,000 homes. Keyfax Teletext carried the 100-frame Olympics magazine created in Los Angeles.

STC firms up text, data commitment

Satellite TV Corp., still scrambling to find a partner and meet its early 1985 direct broadcast satellite service launch date, is firming up its commitment to text and data services. A recent move by parent company Comsat further opens the door for STC to carry business data. Comsat dropped out of its partnership in Satellite Business Systems this summer, leaving ownership of that struggling firm to IBM and Aetna. Decisions still are being made about whether STC or Comsat General, a sister subsidiary, should handle domestic data transmission services.

STC has been examining teletext as part of its foundation service. At the very least, STC will offer a 50- to 100-frame news, information and advertising package on a text channel to be included in the basic home DBS service. In addition, STC is planning to transmit retrievable and cycled material (e.g. concert and record reviews, top ten lists and other material) on various channels. Equipment now being built for STC adheres to the World System Teletext format, but the company is reviewing plans to expand its capacity to NABTS as well. The baseband home terminal to be used by the service includes features for messaging, billing, emergency signals and other interactive services.

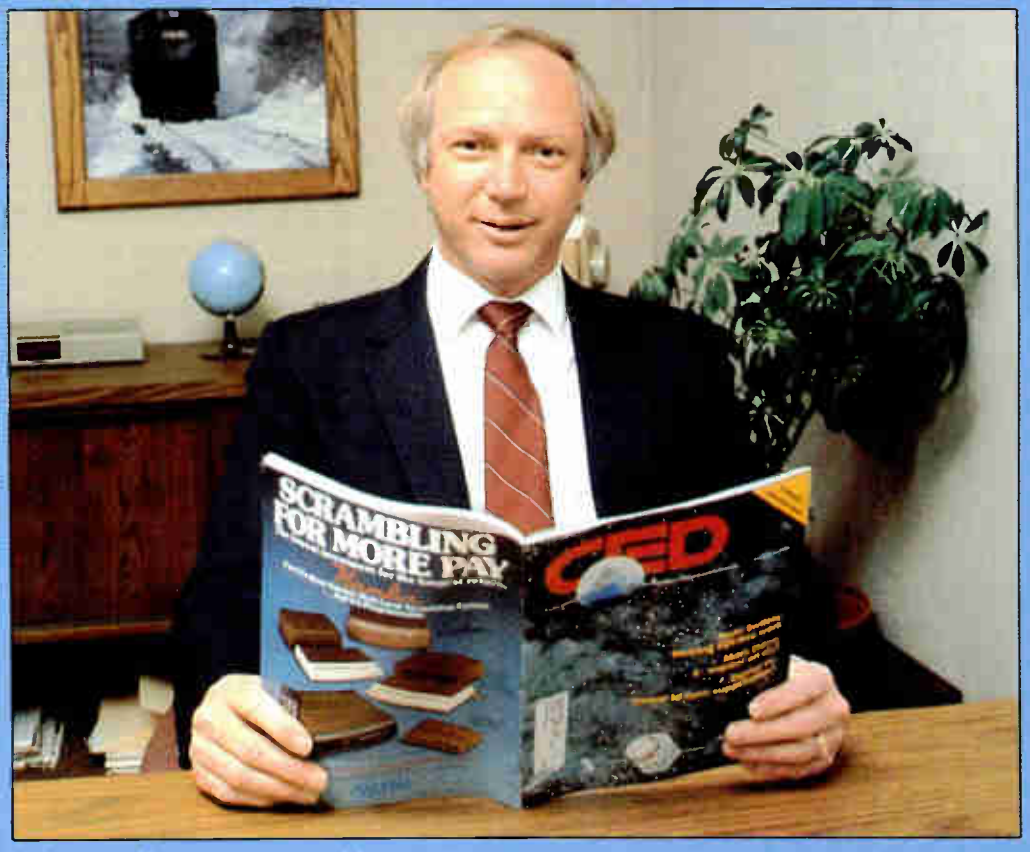
For business transmission—including teledelivery of software and private information—STC may develop an enhanced decoder with more addressable and privacy features.

More captioning

Line 21 closed captioning—the data service transmitting encoded material for hearing-impaired viewers—continues to expand its reach. Nearly 100,000 units are in use nationwide (somewhat below expected levels), and more cable and broadcast networks, as well as home video packagers, are transmitting material.

Showtime/The Movie Channel is escalating its closed captioning activity. More than 25 hours of programming, including feature films and made-for-pay TV programs, were captioned during a recent month. Movie captioning is bolstered by recent Hollywood developments. At least ten studios routinely put captions on major films when they are released on videocassettes and discs; those captions can then be used when the films are

Joe Van Loan
Vice President, Engineering
Viacom



"Viacom has saved millions of dollars on rebuilds by applying new technology. We learn about the new developments in **CED** magazine . . .which is getting bigger and better than ever."

CED

The Engineer's Most Valuable Tool

International Thomson Communications Inc.
600 Grant Street
Suite 600
Denver, CO 80203

transmitted on pay TV and cable channels.

ABC-TV, which has spearheaded much of the broadcast captioning activity (part of its effort to rebuff teletext), is also expanding its use of Line 21 material. Under a new grant from the U.S. Dept. of Education, the National Captioning Institute will close caption 14.5 hours of TV news and public affairs programs per week, including *ABC-TV World News Tonight* (30 minutes daily Monday through Friday), *Good Morning America*, *ABC World News This Morning* and the weekly *20/20* magazine plus ABC weekend news reports. In addition, the 212-member ABC-TV Affiliate Association has agreed to underwrite captions for some ABC network programs this fall, the first affiliate groups to participate in such caption funding. CBS also is using Line 21 captioning for the first time this fall, but only for programs that have been dual-mode captioned.

RCA stakes interactive market claim

With plans for a national interactive service, RCA has become the latest media conglomerate trying to stake a claim in the new interactive environment.

Like CBS's partnership with IBM and Sears in the Trintex venture, RCA's proposed service (part cable, part videotex and part home video) represents a company-wide effort to find new avenues in which to package and deliver information, entertainment, education and transactional services.

RCA's Home Information Systems, the division formed this summer to head the new program, envisions an ad-supported service, accessible through personal computers. The group hasn't yet set a launch date or made any decisions about how cable TV, satellite or other proposed system elements will fit into the venture.

RCA's tentative plan envisions information and transactional services offered through a network of local operators rather than through a nationwide system. The HIS team, headed by former NBC Radio President Michael Eskridge, is an outgrowth of RCA's Home Entertainment, Information and Transaction Services task force, which examined videotex options for more than a year. HEITS consisted of staff from several RCA subsidiaries, including NBC.

RCA has no immediate plans to develop videotex consumer hardware. However, its aggressive consumer electronics division is working on digital TV sets—certainly a form of computer. The sets will be on the market in a few years, around the same time the HIS venture is expected to launch.

As for technical standards, NAPLPS is a possible format, given NBC's endorsement of sister-standard NABTS for its national teletext service. NBC Teletext's role in the new group seems uncertain, with the two currently operating as separate units. However, NBC could become involved in HIS if the group decides to develop a hybrid system that would transmit data on NBC's vertical blanking interval.

Educational teledelivery system unveiled

Academic Microbroadcasting Educational Network, a new non-profit consortium of organizations that use microcomputers in teaching, has been set up to develop a "public teledelivery" system. The group is organizing The Public Microlibrary as an agency for teledelivery research and development and as a service center to maintain computer program collections.

AMEN intends to set up a Public Information Exchange Network, which will begin tests in early 1985. "Datatex" will be transmitted on the vertical blanking intervals of broadcast channels, for recording on videocassette or audio recorders. Plans also call for use of cable TV and direct broadcast satellites as delivery media. AMEN's second phase of activity will involve unspecified videotex services. Organizers envision using the system to preview and print high-resolution "videotex-based academic publications." A "MicroMall" subscription service will include monthly distribution of software, which will include interactive commercials. Other features of the project include use of a laser card (akin to the smart card) and compact laser disc technology.

The PIE Network project represents three years of preparation. Twenty-four academic institutions are involved in the venture, according to AMEN President Dennis Kulvicki, who unveiled Public Teledelivery plans at the recent National Computer Conference.

AMEN's ambitious plan is couched amidst clever phrase-making. The term PIE (as in Public Information Environment) is featured.

Metromedia eyes larger teletext ventures

Metromedia will continue operating its MetroText teletext service for at least a year in Los Angeles. The teletext transmission on Metromedia's KTTV (Channel 11) uses World System Teletext format and had a successful run during the Olympics. For the continuing service, KTTV will run a 100-page teletext magazine. Half the material—national news—will come from Taft Broadcasting's Electra service in Cincinnati; the other half will be created locally. KTTV plans to add concert information, job listings (developed in coordination with the state's employment services bureau), detailed sports reports and traffic information (obtained from the California transportation agency that participated in the Olympics service). In addition, KTTV is talking to educational institutions about developing a teletext instruction package for Spanish language lessons. KTTV also is considering a restaurant guide, stock listings and puzzles.

During the Olympics, nearly 20 southern California cable TV companies, reaching 500,000 homes, retransmitted Metrotext frames as a cycled text service. Cable systems taking part were owned by Group W Cable, Times Mirror Cable, Storer Cable and Cablevision Systems. They all were given headend teletext decoders and put the information on a blank channel. Metromedia hopes that the cable systems will continue to use Metrotext.

Metromedia's financing remains modest. The station will pay operating expense for staff and overhead, but it will continue to use equipment donated by British teletext firms as part of the Ameritext effort to recruit broadcasters to use WST.

Results are coming in from Metrotext's survey of users during the Olympics public access service in Los Angeles. More than 900 postcard response cards have been returned. According to KTTV, 82 percent of respondents said they'd like to have a teletext system in their homes, but most said they were willing to pay only about $100 for reception equipment.

Greendale Electronics, a British maker of WST decoders originally intended for use with cable TV decoders, plans to lease its units in the Los Angeles area for $3 to $5 per month.

By Gary Arlen

Cablematic
CABLE PREPARATION TOOLS

Write or call today for our FREE catalog.

Cablematic quality means performance, reliability and durability in a broader range of models and sizes—whatever the application!

Take the labor-saving Combination Stripping Tool (CST), for coring and stripping coaxial cable in *one* operation! Use with manual or ratchet handle, or 3/8" power adaptor.

For guided coring, Cablematic's Guided Coring Tool (CCT) eliminates lateral cable movement for precision coring—without scoring the center conductor or shield. The non-clogging blade assures fast, trouble-free coring.

Cablematic's Hex Crimp Tool (CR) is the perfect crimper for all CATV-MATV and STV applications. Available with compression adjustment for consistent crimping . . . and long tool life.

Strip it, core it, crimp it with Cablematic™

CABLE PREPARATION TOOLS

The performance leader in communications cable tools.

RIPLEY COMPANY, INC.
36 Nooks Hill Road Cromwell CT 06416
Tel (203) 635-2200
TWX 710 428 9567 RIPLEYCO CREL

Reader Service Number 63

CATV tool advances continue

By Gary Kim

As recently as 10 years ago, just about the only tools cable construction crews had available were the ones they made themselves or borrowed from the telephone industry, says Bob Brantlinger, sales manager for Lemco Tool Corp. "Some guys used to lay cable on the ground between each pole and climb up and down to put up the next section of strand."

Today, the industry has tools designed to meet its own needs, frequently developed in response to demands from construction managers and crews in the field. Adding a new twist, some tools originally developed for the cable industry are now bought by telephone companies.

Many of the innovations are intended to improve the handling of coax because "the last thing you want is a wrinkle or kink in it," Brantlinger says. "The ultimate aim for all cable tools is to gently handle the coax." Which isn't to say all cable tools look like they're meant to be handled by velvet gloves. Mechanical loop formers were invented because the heavier trunk cables coundn't be formed by hand, and as a by-product assure that all loops are identical.

Many tools used in aerial construction, such as cable pullers, cable blocks and corner blocks, were devised so that crews could handle more than two cables at one time. Although telephone crews normally work with a single cable at a time, cable pullouts can handle as many as 12 at a time, Brantlinger says.

Likewise, loop tools, positioners, straighteners and reel brakes are unique to the cable industry. "The telephone industry doesn't have to worry about keeping the tension on the reel at a constant pressure so it isn't driven into the ground unnecessarily, but the cable industry does," Brantlinger points out.

As the industry continues to evolve, its tools change with it. During the past year, Lemco has introduced eight new tools, usually created because somebody out in the field needed a device that didn't exist.

For example, engineers at Continental Cablevision in Springfield, Mass., once found it necessary to close down their splicing operation and asked Lemco for a tool that wouldn't damage the center conductor, Brantlinger says. "Our engineer worked for a month and sent Continental about nine center conductor cleaners for testing. We waited about six months until Continental reported that they worked," he says. The delayed reporting wasn't because of problems. The company just wanted to test reliability after repeated use.

It's a nice way to clean dielectric without scoring the center conductor, and sure beats using a pen knife.

Another system, in Roxboro, N.C., asked for a tool to remove broken F-ports on traps. The company reuses its traps, and the problem is that the traps eventually break off. Lemco didn't have any, but asked the system to send along a couple hundred broken traps. Prototypes were developed and modified before the reverse-threaded Trap Saver assumed its final form.

Another idea came from installers working in Oil City, Pa. The problem was how to install drop cable in the ground when there wasn't room for a mechanical plow to operate. What Lemco came up with was a "glorified spade," Brantlinger says. The Quick-Ditcher makes a narrow, six- to seven-inch deep slit just wide enough for the drop.

The company also came up with a drop reel jack holding four reels. Designed for wiring multiple dwelling units, the jack was developed after an installer called in and complained about having to lug the reels around, Brantlinger says.

A new dual pole bracket supports two 90-degree corner blocks for pulling as many as eight cables, while a new patented strand brake prevents sag.

Another problem construction crews have to contend with is wee-wahs, so Lemco came up with a cable straightener that sits in front of the lasher and takes the bends out.

Coring tools are another category of hardware produced specifically to meet the needs of the cable industry. Because jamming of the dielectric as it was shaved off was often a problem, Lemco redesigned its knives so the foam feeds out as the cut is made.

Simple but effective safety tools also have been developed for the industry. A new ground rod cap provides a better target when the rods are hammered into the ground, reducing the possibility of hammer deflection and preventing damage to the rod. A related tool, the post cap, fits over the top of sign and pedestal posts, providing a striking surface for sledgehammers.

Taking service wires through walls and floors can be a clumsy and time-consuming process, especially as MDU construction grows. To speed things up, Lemco has developed an inexpensive drop cable guide acting as a duct. The guide is fed through the wall or floor and the drop is pushed through. A slit running the length of the guide makes it easy to remove once the service wire is fed through.

Another useful innovation is a continuity tester. Although the electronics industry has been using them for years, this is the first model developed specially for the cable industry. Used alone, the beacon device checks line continuity, indicating the presence of shorts, splitters or other self-grounding devices on the line. Coupled with the beeper unit, the tester will locate specific drop terminations.

The tester can be used to locate illegal taps, check the quality of cable before and after installation.

Reel and strand breaks. Cable pullers. Blocks and corner blocks. Loopers, positioners, dividers and straighteners. Corers and cleaners. Hex crimpers and trap savers. They exist because the industry needed them.

"We can't know what tools will be needed 10 years from now," Brantlinger says. ■

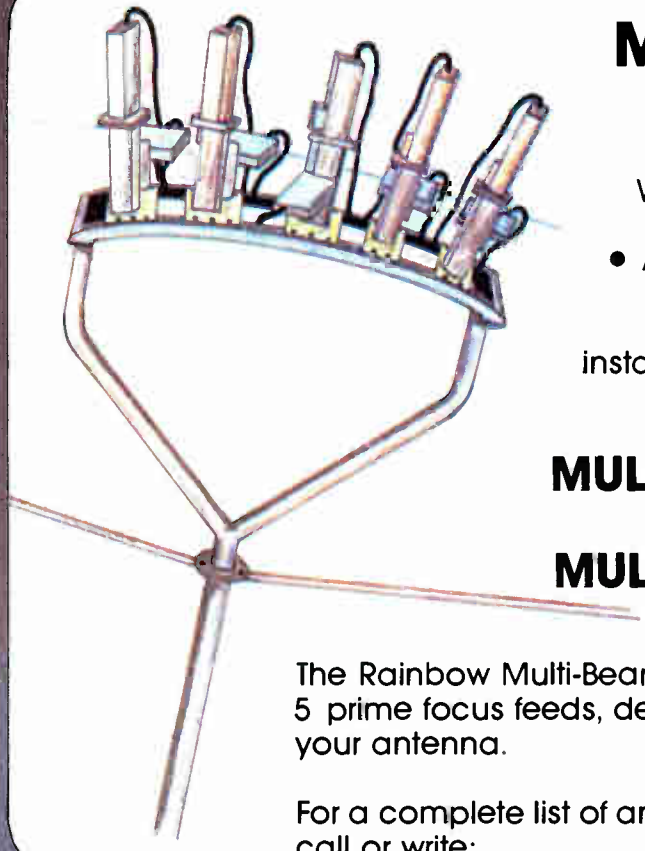
Continued from page 61

greater in MDU construction than in residential installation, since installers can hook-up more units in a given time," says English Enterprizes Operations Manager Shirley McGee. She recommends a system weekly walk-out.

Gaston and Long agree the contractor should be given responsibility for procuring the right-of-entry. "It's easier for one company to take care of the whole process," Gaston argues. But McGee disagrees. "That's not our job." However, she believes the contractor should be present when the wiring design is being discussed with the residential manager. "The more the contractor is involved in the design process, the more likely he is to do a better job. He'll understand the design and the residential manager's priorities," she says.

Contractors should use coring drills with diamond studded bits that can drill 1 to 2 inches in diameter in concrete, Gastons says. Air guns with hydraulic compression for driving control lock boxes into walls and dry wall stilts are handy. "When you use ladders to run wire along hallways, you scar the walls and there's a good chance you don't secure the molding that well. With dry wall stilts you don't damage the walls and it's easier to secure the molding. They also simplify the process," McGee adds. ■

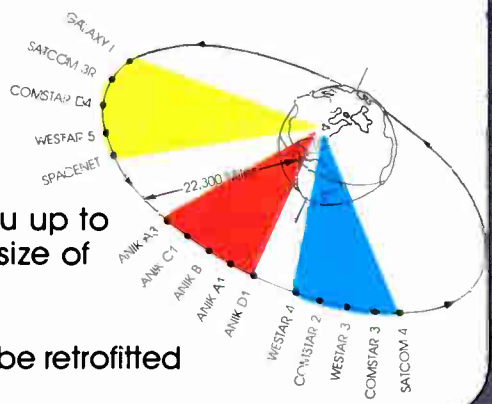
5 Star General



MULTI-BEAM FEEDS

- Maximize your programming capability, by receiving Galaxy I, Satcom III R, Comstar D-4, Westar 5 and Spacenet with the use of one dish.
- Add to system revenues, through tier expansion.
- Eliminate additional land acquisition and the installation costs of multiple dishes, while increasing your earth station investment.

MULTI-DISH? OR MULTI-FEED?



The Rainbow Multi-Beam Feed allows you up to 5 prime focus feeds, depending on the size of your antenna.

For a complete list of antennas that can be retrofitted call or write:

RAINBOW SATELLITE COMMUNICATIONS

Attn: Brian Wilkes
734 N. 3rd St. • Suite 417
P.O. Box 395 Leesburg, FL 32748
(904) 326-8030

Distributed by
Tele-wire Supply
7 Michael Ave.
E. Farmingdale, NY 11735
800-645-9510

Reader Service Number 64

Satcom 3R

Signal	Day	Start/ Stop	Alert Tone	Transponder
Showtime		24 hrs.	None	**(W) 10 (E) 12**
Satellite Radio Network		24 hrs.	None	**2**
SCAN		24 hrs.	None	**6**
Showtime		24 hrs.	576*/#	**(E,C) 12 (M,P) 10**
Sports Time Cable Network	Weekdays Weekends	7 p.m./1 a.m. 1 p.m./1 a.m.	987*/# 915*/#	**4**
UPI Cable News		24 hrs.	None	**3**
USA Cable Network		24 hrs.	601*/# 438*/#	**9**
USA (during blackout)		varies	295*/#	**22**
Video Concert Hall	Daily	4 a.m./6 a.m.	None	**16**

Major Communications Satellites Serving North America

Location	Satellite	
Degrees West Longitude	**Present**	**Future**
67		Satcom 6**(5/86)
69		Spacenet 2***(11/84)
72	Satcom 2R**	
74	Galaxy 2**	
86	Telstar**302	
76	Comstar D1/2**	
79	Westar 2**	
81		ASC 1***(9/85)
83	Satcom 4**	
87	Comstar D3**	
89	SBS 4* (late Aug.)	
91	Westar 3**	
93.5		Galaxy 3**(9/84)
95	SBS 3*	
96	Telstar 301**	
97	SBS 2*	
99	Westar 4**	
100	SBS 1*	
103		Gstar 1* (TBD)
104.5	Anik D1**	
105	Anik C2*	
105		Gstar 2* (TBD)
108.5		Anik C1* (2/85)
109	Anik B1***	
109		Anik D2** (11/84)
114	Anik A3**	
117.5	Anik C3*	
119	Satcom 2**	
120	Spacenet 1***	
123	Westar 5**	
127	Comstar D4**	
128		ASC 2*** (9/86)
131	Satcom 3R**	
134	Galaxy 1**	
136	Satcom 1**	
139	Satcom 1R**	
143	Satcom 5**	
TBD		Spacenet 3*** (TBD)
TBD		Telstar 303** (5/85)

* Ku-Band
** C-Band
*** Dual C/Ku-Band

Orbital slots and launch dates often change without notice.

Signal	Day	Start/ Stop	Alert Tone	Transponder
WFMT		24 hrs.	None	**3**
WGN		24 hrs.	None	**3**
WTBS		24 hrs.	024*/#	**6**
The Weather Channel		24 hrs.	None	**21**

Satcom 4

Biz Net	Daily	6 a.m./1 p.m.	None	**15**
Bravo	Weekends Weekdays	5 p.m./6 a.m. 8 p.m./6 a.m.	513*/#	**2**
Home Sports Entertainment (Dallas)	Daily	6:30 p.m.-1 a.m.	None	**4**
KKGO-FM		24 hrs.	None	**17**
KTVT		24 hrs.	None	**21**
National Christian Network	Daily	8 p.m./3 p.m.	073*/#	**7**
NCN	Daily	8 p.m./3 p.m.	073*/#	**7**
The Prime of Life	Daily	4 p.m./7 p.m.	527*/#	**7**
The Playboy Channel	Daily	8 p.m./6 a.m.	869*/#	**12**
Santa Fe Communications		24 hrs.	None	**23**
Silent Network	Sat.	10 a.m./noon	None	**16**
Trinity Broadcasting Network		24 hrs.	None	**17**
WPIX		24 hrs.	None	**21**

Westar V

Arts & Entertainment Daily	Daily	(E) 8 p.m./4 a.m.	637*/# 807*/#	**12D**
Hi-Life Channel	Daily	6 p.m./6 a.m.	None	**10X**
Meadows Racing Network	Fri.-Sun. Tues. & Thurs.	7 p.m./11 p.m.	None	**11X**
The Nashville Network	Daily	(E)9 a.m./3 a.m.	674*/# 866*/#	**9D**
The Pleasure Channel	Sun.-Thurs. Fri.-Sat.	11 p.m./5 p.m. 11:30 p.m./5:30 a.m.	None	**11X**
Pro Am Sports System	Daily	varies	None	**7X**
Sportsvue		varies	None	**4X**
University Network		24 hrs.	None	**1X**

Comstar D-4

Country Music Network		24 hrs.	468*/#	**9H**
ON TV		24 hrs.	None	**(W) 4H**
SelecTV		24 hrs.	840*/#	**(E)7V**

Galaxy 1

BET	Daily	8 p.m./2 a.m.	406*/#	**17**
Business Times	Mon.-Fri.	6 a.m./9 a.m.	None	**9**
CBN		24 hrs.	414*/# 715*/#	**11**
Cinemax		24 hrs.	None	**19**
CNN		24 hrs.	024*/# 017*/#	**7**
CNN Headline News		24 hrs.	635*/# 541*/#	**8**
C-SPAN (back up)		24 hrs.	None	**13**
The Disney Channel	Daily	6 a.m./1 a.m.	617*/# 834*/# (E)	**(E,C) 4 (M,P) 24**

Contact programmer's technical department for more information on transponder, use and alert tone.

EAGLE

TRAPS

SOME COMPANIES MAKE TRAPS CHEAPER . . .
ONLY EAGLE MAKES THEM BETTER!

UNRETOUCHED PHOTOGRAPHS

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

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

Only Eagle Traps are 100% foam-filled.

Eagle Trap quality starts inside. Every Trap is completely sealed for superior moisture resistance. That's why it's virtually fail-safe in preventing signal drift.

Result: an unmatched record for long-term performance. And the reason why Eagle Traps secure your pay TV channels better than any other in the industry.

Many systems install Eagle Traps to safeguard existing scrambling methods. What's more, our Trap can be used at high- and super-band frequencies, as well as low- and mid-band. That's your assurance it will meet both your present and *future* frequency needs.

In fact, our Trap—like all Eagle products—is specifically designed to help secure the future of your business. The last thing you need is a product that's just a short-term investment!

A Secure Investment for System Profitability

OTHER EAGLE QUALITY PRODUCTS . . .
Converters, Addressable Descramblers, Programmable Descramblers, Taps, Splitters

EAGLE COMTRONICS, INC.
4562 Waterhouse Rd., Clay, New York 13041
TO ORDER, CALL TOLL-FREE: 800-448-7474
In New York, call 315-622-3402/In Canada, call Deskin Sales, 416-475-1412

EAGLE
COMTRONICS INC.

Reader Service Number 65

The World's Most Reliable Cable-TV And Telephone Pedestals. Available Now From Anixter.

Start with the finish because that's where corrosion begins. That's why Reliable Electric/Utility Products gives each pedestal a unique 9-process finish. It makes these pedestals tougher than the trouble they'll face.

And that's why Anixter Communications stocks the full line of Reliable Electric/Utility Products pedestals throughout its computer-linked network of distribution centers in the USA and Canada.

ANIXTER COMMUNICATIONS

Corporate offices: Anixter Bros., Inc.
4711 Golf Road, Skokie, IL 60076
(312) 677-2600

CALL OUR TOLL-FREE HOTLINE 1-800-323-0436

or call your nearest Anixter Stocking Location for details.

In Illinois call 1-800-942-0905

In an emergency, weekends, holidays or after 5 p.m. call toll-free 1-800-323-8166.

Reader Service Number 66