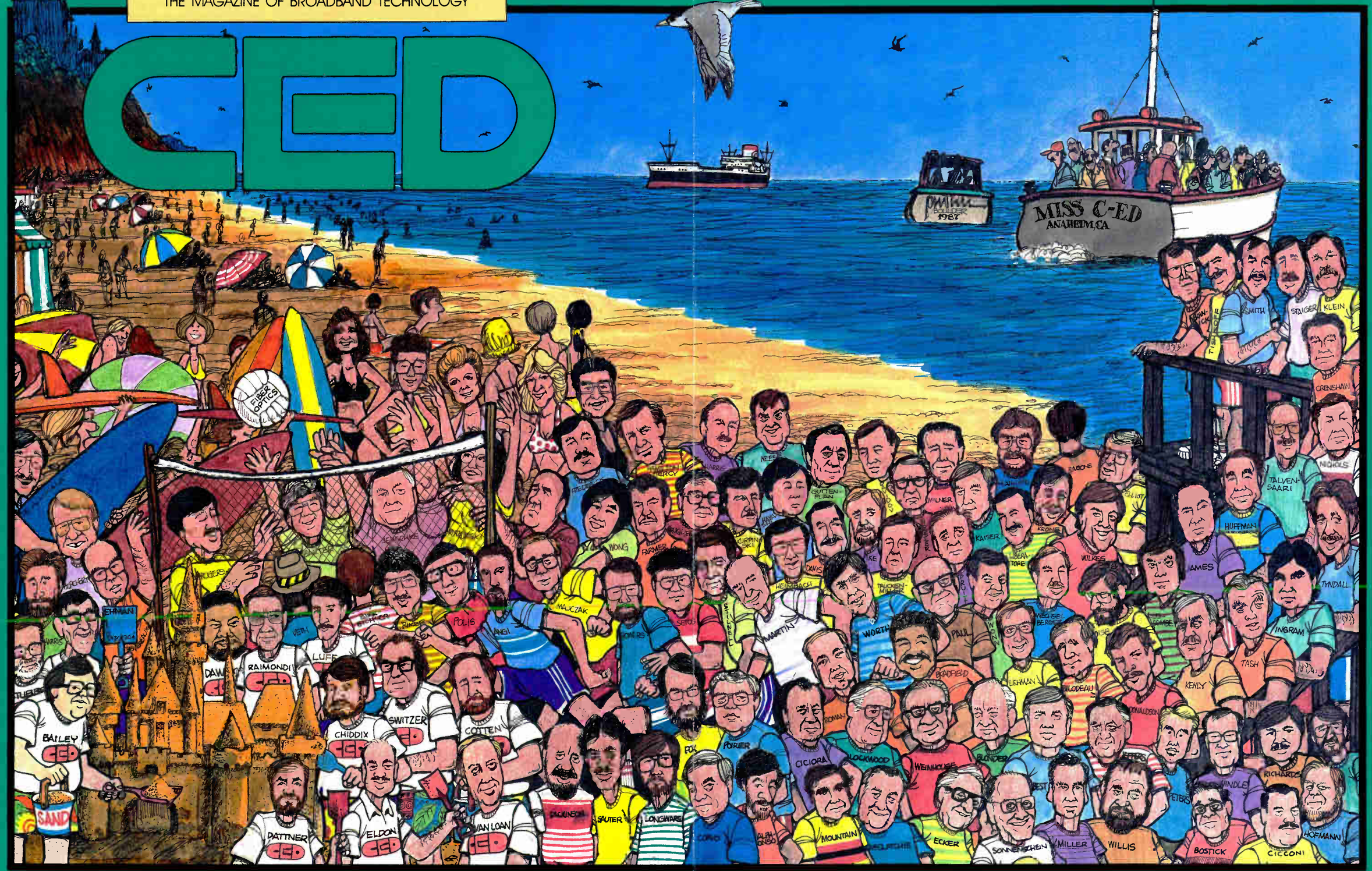
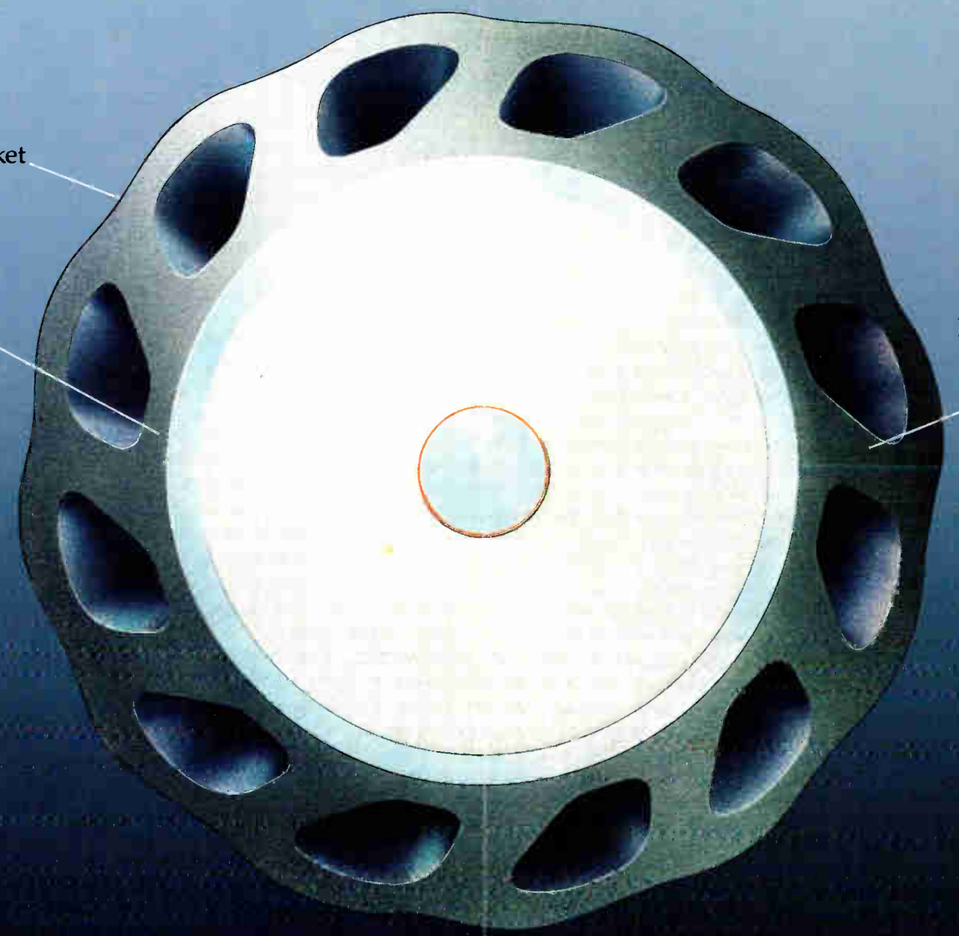
DECEMBER 1987

COMMUNICATIONS ENGINEERING AND DESIGN
THE MAGAZINE OF BROADBAND TECHNOLOGY

C-ED



INTRODUCING CABLE GUARD.™



Until now, if you needed extra protection for cable, you had only two choices.

You could pay the price and buy armored cable. Or you could settle for less protection and buy standard jacketed cable.

New Cable Guard gives you a welcomed alternative—extra protection at an economical price.

Cable Guard starts out with the same fine electrical properties as all our cable. Then we add a flooding compound and a Linear Medium Density Polyethylene jacket. Next we add 80 grit splines, angled at 60 degrees for maximum resiliency. And finally we encase it in a second Linear Medium Density Polyethylene jacket.

Believe it or not, Cable Guard outperforms armored cable in most impact tests. Yet, it's as flexible as standard jacketed cable.

So, the next time you're running cable through rough terrain—under gardens and lawns, through roadside right-of-ways, or in tough urban environments—ask about Cable Guard.

It's a small price to pay for a lot of protection.

For more information, please contact your CommScope Representative or call us direct at 800/982-1708 (in NC 828/324-2200).

GENERAL INSTRUMENT

Reader Service Number 1

SOMETIMES STANDARD JACKET IS TOO LITTLE PROTECTION AND ARMOR IS TOO MUCH.

CED

December 1987 Volume 13, Number 12

CED. (USPS 300-510) (ISSN 0191-5428)is published monthly by International Thomson Communications Inc., 600 Grant St., Denver, CO 80203. ©December 1987, Volume 13, Number 12. Subscriptions free to qualified industry readers. All other one-year subscriptions are $26, prepaid in U.S. funds only. Second-class postage paid at Cleveland, OH. and additional mailing offices. CED is published on behalf of the cable television and broadband communications industries. POSTMASTER: Please send address changes to P.O. Box 5208 T.A., Denver, Colorado 80217. MEMBERS OF THE BPA.

What's the best medium for supertrunking? **24**
Industry consulting engineer Israel (Sruki) Switzer compares the different mediums available for supertrunking applications (fiber, microwave and coaxial cable) and comes to a conclusion which may surprise many readers.

Right on cue **60**
Need to make sure your headend commercial insertion equipment is set to roll at the proper time? This list of the latest cue tone codes used by satellite programmers, provided by Monroe Electronics, will help.

BROADBAND LAN
Preventing losses **62**
Despite all your preventive maintenance, your system is only as good as the power company serving it. This article explains the difference between uninterruptible and standby power supplies and who makes them.

Time domain reflectometry **66**
If you've got impedence mismatches in your network, you may have real problems. How to test the integrity of your system's cabling is the focus of this article by Gary Kim.

It's not as easy as it looks **74**
With cable systems putting so many pieces of hardware in the signal path, setting up a budget for stereo separation becomes a major task. Luis Rovira of Scientific-Atlanta explains how it's done.

Is your billing vendor responding? **84**
More and more cable systems are using audio response units to smooth out their operations and most of the top billing vendors are working to adapt.

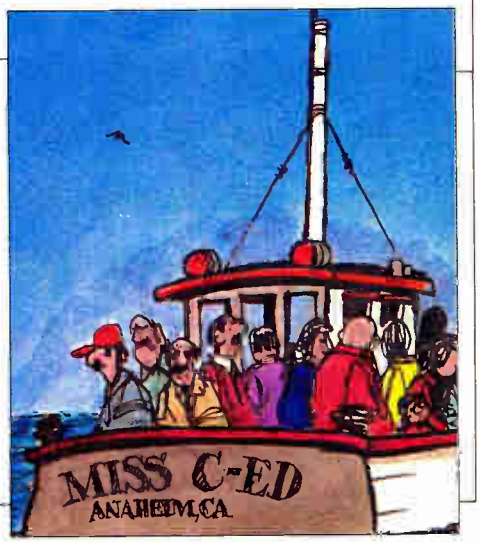
An ounce of prevention... **90**
Richard Shimp of ComSonics takes a creative look at a state-of-the-art cable system of the future—after the CLI war has been waged.

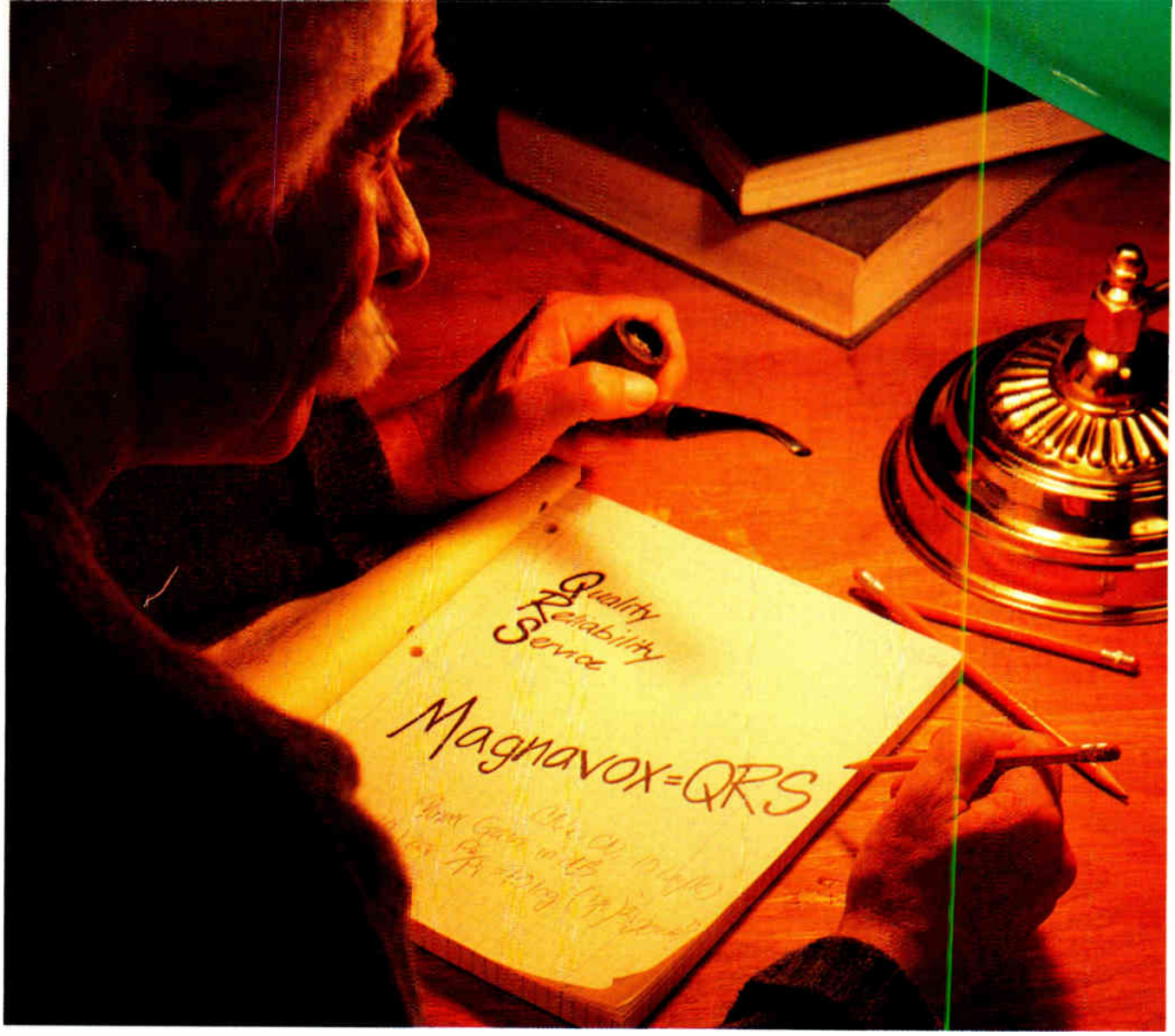
SERVICE PROFILE
Converter repair **97**

DEPARTMENTS

Spotlight	**8**	**Looking Ahead**	**18**
In Perspective	**10**	**Return Path**	**20**
My Turn	**12**	**Ad Index**	**83**
Frontline	**14**	**Classifieds**	**87**
From The Headend	**16**	**In the News**	**103**

About the cover:
That fun bunch at the beach includes engineers from the Top 50 MSOs as well as members of the NCTA Engineering Committee and SCTE board.





The Genius of Magnavox

$E=MC^2$: Einstein's deceptively simple equation changed the way we think about the universe.
Closer to home, Magnavox CATV had developed its own formula for excellence: **Quality + Reliability + Service = Magnavox.**

Magnavox manufactures only the highest quality products for use in your broadband network. We design them reliably and efficiently to improve system performance and save you money. And we provide a wide variety of services to help you keep pace with the expanding industry.

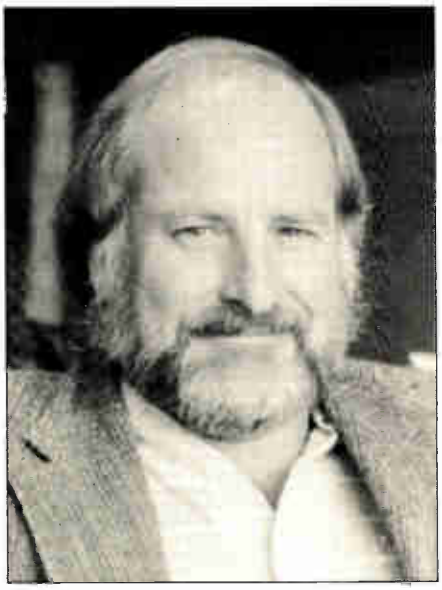
Quality + Reliability + Service: The Magnavox formula just might change the way you think about your broadband network.

For more information talk to your Magnavox account representative, or call toll-free: **800/448-5171** in NY State **800/522-7464**, Telex **937329** Fax. **315/682-9006.**

Magnavox CATV SYSTEMS, INC.

A NORTH AMERICAN PHILIPS COMPANY
100 Fairgrounds Dr., Manlius, NY 13104

Reader Service Number 2



Ron Cotten

For Cotten, life is an adventure

It isn't often that a cable-TV engineer's life is decribed as "adventurous" or "exciting." But then again, most engineers aren't like Ron Cotten.

As vice president of engineering for Daniels and Associates, Cotten has 23 years of industry experience from which to draw. Yet he remains an enigma to many. Why? Because he prefers it that way.

"I'm not a public person," says the bearded Cotten in explanation for why his name doesn't appear more often in the trade press and he isn't "seen" more frequently. "I have a lot of interests that take up a lot of my time. Cable is one of them, but only one of them."

But he doesn't discount the value of his professional responsibilities. He belongs to the NCTA Engineering Committee, but isn't able to attend as many meetings as he would like; and he's been active on the SCTE scholarship committee. "It's important to do those things," he says, "but I don't have as much time to devote to it as I would like."

Cotten's demeanor is relaxed; he's rarely seen wearing a coat and tie. Something about his persona makes him immediately likable, and he's quick to produce a smile and a laugh. But he also isn't afraid to tell it like it is—often peppering his conversations with four-letter words. The swearing increases in frequency when he begins talking about issues he feels are important.

His no-nonsense approach to conversation is by design. "Life is finite; and it really is precious. So, getting bogged down in a lot of bull---- is crazy," he says.

Cotten got his start in cable by chance. After being discharged from the Air Force in 1964, he landed a job as an installer for the cable system in Lafayette, Calif. In 1965, he started attending night school, all the while moving up the ladder in the Lafayette system, eventually becoming chief technician. In 1967, Western Communications was granted a franchise in Concord and Cotten was brought on board to build it. "That's the first system I ever built from scratch," he recalls.

After earning an Associate's degree in 1968, Cotten started engineering school. "I had to start all over again. If I strung it (education) all together, I'd probably have a doctorate," he jokes. In 1972, about the same time his patience with school ran out and just months before graduation, Cablecom General of Denver made overtures to him. "I had lived in New Mexico and was chomping at the bit to go back to that part of the country," says Cotten. So, in 1972, after he graduated, Cotten moved to Denver.

He stayed with Cablecom, where he set up the engineering program, for five years before the entrepreneurial spirit took over and he started his own full-service consulting business. During that time he even had his own system in the small, western Colorado town of Paonia. "It's one of the most beautiful places in the lower 48 states," according to Cotten.

After seven years of consulting, Cotten was recruited for the corporate engineering slot by Bill Kingery, who had taken over the operations of Daniels. In a way, Cotten still functions as a consultant in the highly decentralized company, but with the luxury of a steady paycheck. "I'm real happy here," he says, referring to the MSO that bears cable pioneer Bill Daniels' name. "This is one of the best managed companies in the business."

Cotten gets a lot of support from the corporation to make his systems technically sound but he still feels the biggest challenge facing him—and the industry at large—is locating adequately trained personnel.

"I know this has been said over and over, but it's absolutely goddamn true. Many operators don't see the wisdom of providing their workforce with the tools they need to do their jobs," he says. He's not talking about crimping tools, wrenches and screwdrivers, Cotten is referring to *attitude*: taking the time and spending the money to hire trained people who show leadership skills, get excited about doing a good job and are team players instills the proper attitude in other employees.

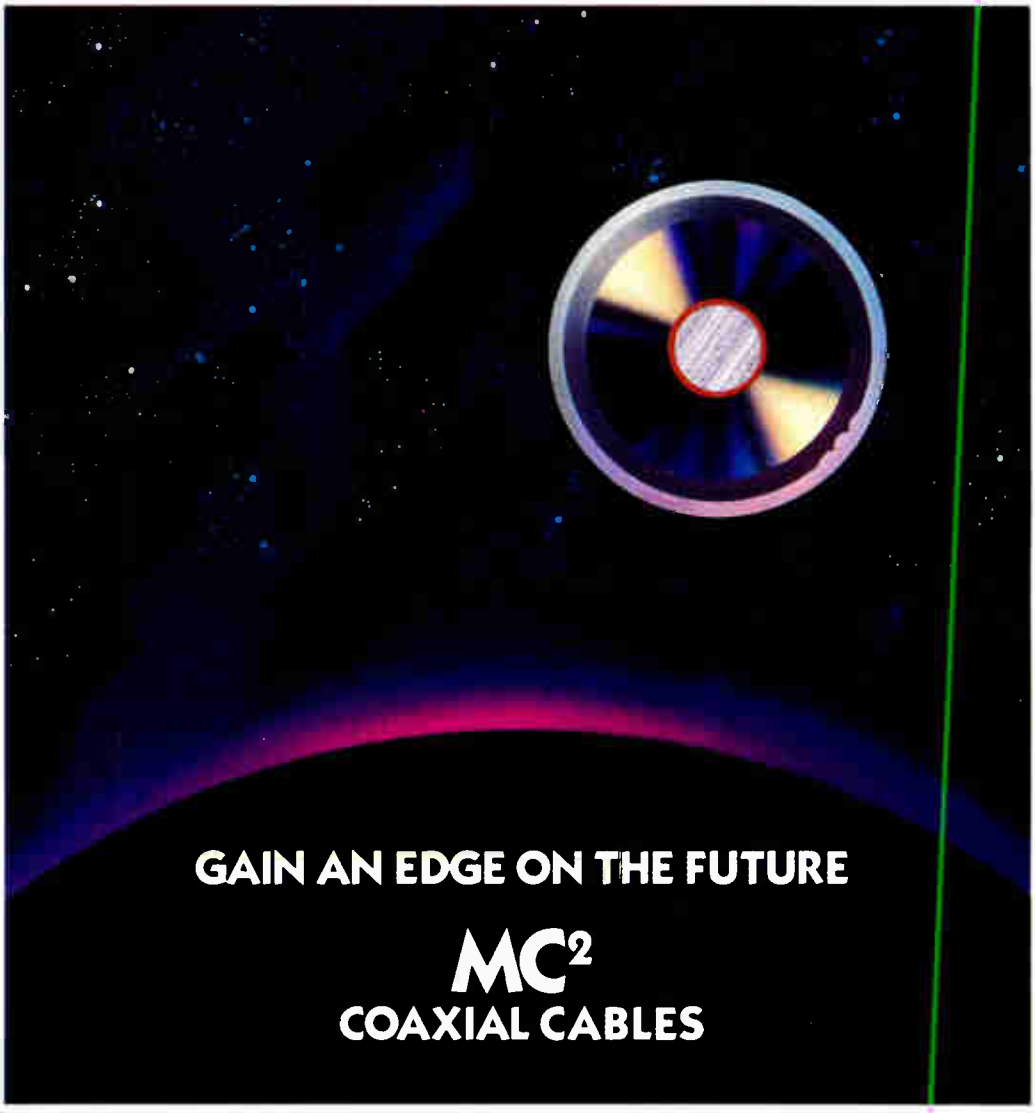
"The attitude that money spent on the outside plant is just pouring money down a rat hole doesn't show a good understanding for how this industry really works," says Cotten. Because Daniels management understands the importance of hardware and is committed to providing its subscribers with quality service, Cotten's job is made easier than some of his colleagues'. "This company, more than most others, supports the idea of fixing a problem vs. getting around it politically," he says.

But it's still a busy life. Cotten has more outside interests than most people can count, including his family, earth sciences, outdoor activities, fossil hunting ("My brother and I found a dinosaur once," he laughs), woodworking and music. In fact, if he wasn't in cable, he'd probably be a geologist, he says.

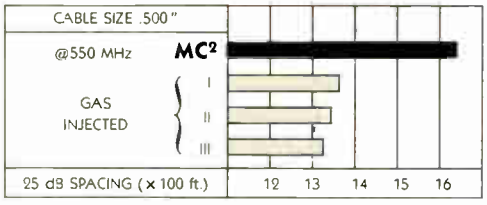
"I've had a real adventurous life," he says. "I've had adventures most people would watch on TV and say, 'That sucker's crazy.' I've been charged by a number of bulls, a full-grown moose, a buffalo and a wild horse." While his life is unpredictable, he's not the type to throw caution to the wind. "I'm not afraid to take on a challenge, but I exercise a lot of common sense when I do things. I'm too busy to get busted up."

—Roger Brown

FOLLOW THE LEADER



Follow the leader, that's what our competitors are trying to do in order to approach the superior attenuation characteristics of MC²coaxial trunk and feeder cable. But they succeed only by increasing the standard diameters of MC² — our familiar .500" must become .565" or .625"; and our .750" must become .840" or .860" or .875". The space-saving benefit of MC² is now even greater than before.



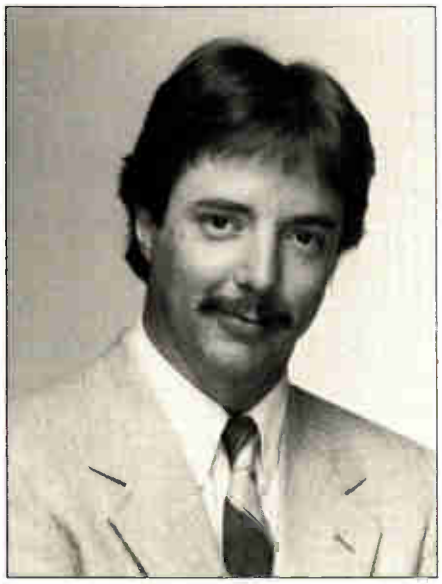
The competition is also making a lot of noise about their new medium density jacketing. The MC² jacket has always been medium density. Trilogy leadership is clear.

TRILOGY LEADS IN TECHNOLOGY

Trilogy
COMMUNICATIONS INC.

Call or write for a free sample and brochure:
TRILOGY COMMUNICATIONS INC., 2910 Highway 80 East, Pearl, Mississippi 39208
800-874-5649
601-932-4461

Reader Service Number 3



You get what you pay for

For some reason, there seems to be a growing feeling these days that a limited amount of signal theft—call it "controlled theft" for lack of a better euphemism—by cable subscribers is tolerable, even OK. The rationale goes something like this: As long as the subscriber is a legitimate customer of basic cable and perhaps one premium pay channel, why not "let" them steal additional pay channels as long as they continue to be basic subscribers? That way, the cable operator gets the money he's entitled to and the subscriber perceives more value with his cable service because in addition to paying for 35 or 40 channels, he's getting a free "bonus" channel, too.

Talking to people privately, it's disturbing to discover how many really don't see anything wrong with this kind of thinking. Rather than irritate a subscriber by charging him separately for basic service, two or three premium channels, a converter and a handheld remote control unit, it's easy for operators to look the other way and "give away" a pay service—as long as the basic service is paid up.

For operators of trapped systems, letting payment for premium services slide is easy because it's expensive to conduct regular audit campaigns in addition to the truck rolls and man hours consumed by the process of properly trapping out services when a disconnect order is received.

The problem with this approach becomes obvious when the cable industry's overall mission is examined, however. Right now, cable executives are working ceaselessly to show that cable programming is "different" or "better" than the broadcast fare that is available for free. "Cable-exclusive programming" have been the buzzwords passed around by heavy hitting cable industry representatives for some time now. Home Box Office and Showtime spend a lot of money to nail down agreements with Hollywood studios for rights to show certain films exclusively on their respective channels. And they shell out even more for first-run series, blockbuster sporting events and one-time performances like concerts and comedy specials.

If that's true—that cable programming is better and/or different than that served up by broadcasters—giving it away for free or reduced prices doesn't make sense. In the mind of the consumer, if he can get HBO or Showtime for free, it must mean the cable company agrees that premium services aren't worth the premium prices that are charged for it. So instead of being shown that cable is worth the prices operators are charging, the public begins to perceive it as just another form of free entertainment, like the broadcast networks.

What's going to happen when High Definition Television becomes a reality? Certainly, the first HDTV channels will have an extra charge attached so the developers of the technology can recoup some of their research and development costs. Consequently, cable operators are going to charge additional fees for HDTV service in order to get back the investments they made in additional bandwidth. As soon as it becomes a "free" service, the novelty wears off and the marketing draw is disarmed. When that happens, an HDTV channel will be just another channel.

That's the risk now facing the pay services. Is HBO, Showtime or Cinemax just another channel or is it worth $10 a month? If cable operators don't think enough of those services to charge the going rate and keep a lid on unauthorized viewers, the message being sent is that they aren't worth the extra charge. That's dangerous.

When you're marketing the best product around, you can afford to charge a premium price. If you resort to wheeling and dealing or giving something away, you've cheapened the entire product. With cable fighting to be a contender on a scale with the broadcasters, that could be a fatal blow.

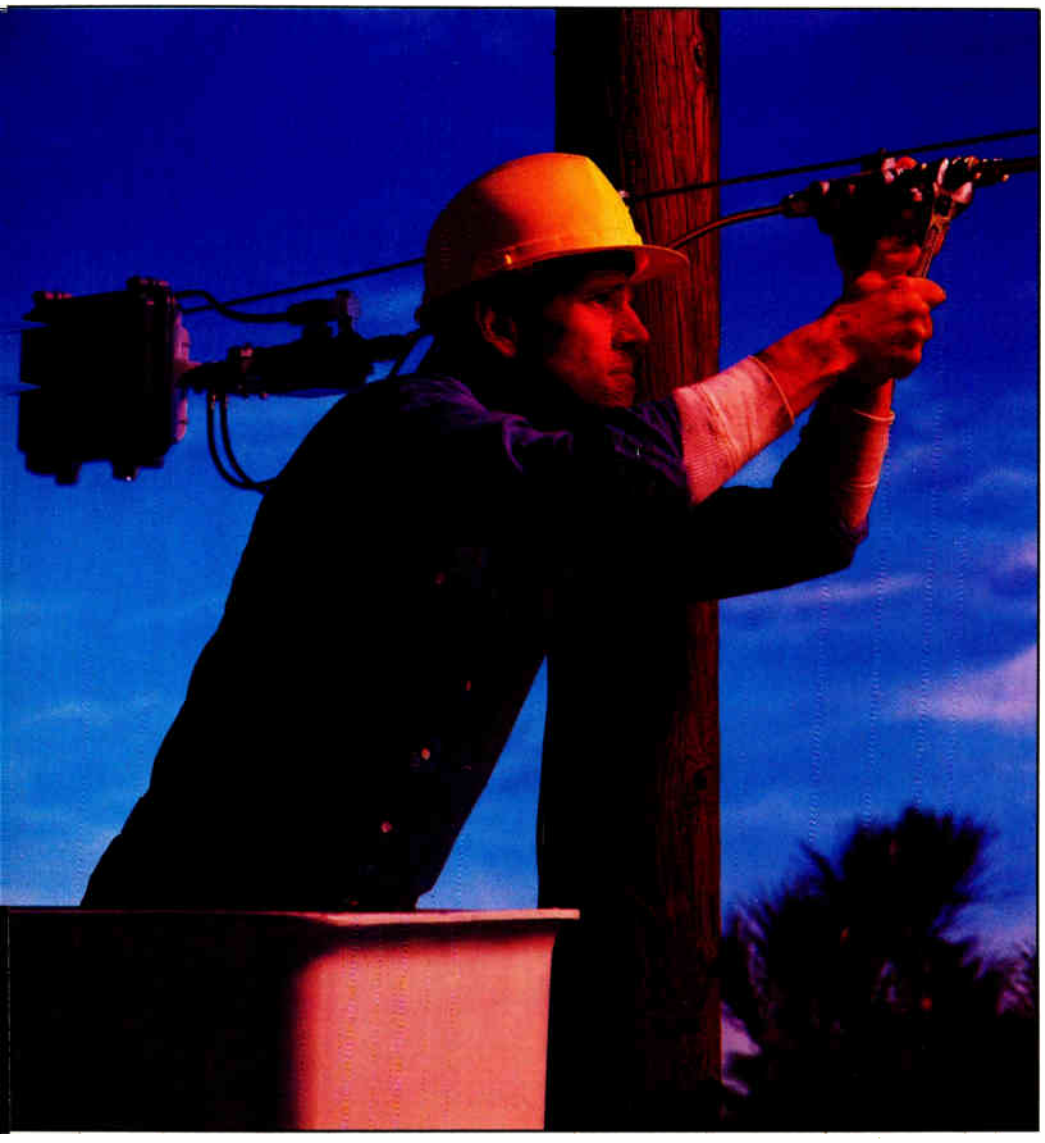
Speaking of HDTV, a major portion of the technical sessions at this year's Western Show will examine various forms of production and transmission of HDTV and what it all means to cable operators. On Thursday, Dec. 3, from 1:45 p.m. to 5:45 p.m., representatives from the David Sarnoff Research Center, NHK, North American Philips, National Association of Broadcasters, HBO and others will discuss how their respective systems work and results of various tests that are being conducted. Anyone with an eye toward future developments won't want to miss this meeting.

If you are concerned about delivering a good quality video signal to all your subscribers, you might already be considering the idea of multiple hubs to serve your franchise area. In our centerpiece story this issue, industry gadfly and guru Israel (Sruki) Switzer examines the various approaches to supertrunking, including fiber optic cable, coaxial cable and microwave methods, and concludes that microwave is the way to go. That might surprise readers who are considering the fiber alternative.

Meanwhile, thumb through this issue—you'll find it full of helpful information about hot topics like fiber optics, signal leakage, BTSC stereo and billing. And we've included two helpful service provider roundups: one on converter repair facilities and one on cable TV contractors. You'll want to save these lists for when you need them.

Roger J. Brown

HOW TO AVOID SPLITTING HEADACHES.



OUR NEW MULTIPURPOSE AMP TAKES THE HEADACHES OUT OF DISTRIBUTION.

Scientific-Atlanta introduces quick relief for a whole host of distribution aches and pains. Our new multipurpose distribution amplifier features built-in splitters and couplers that make installation a breeze. And where can you install it? Just about anywhere. When we say multipurpose, we mean it.

THREE WAYS TO WORK BETTER.

We gave our new distribution amplifier four ports for multiple outputs. And they're not there for looks. This versatile product performs. It can be configured as a line extender, but it also makes an ideal terminating bridger amp because it's small, simple and more reliable. Additionally, when used with optional AGC, it costs less than a trunk station of similar configuration yet offers equivalent performance, quality and features, such as a switching regulated power supply.

EASY ON YOUR SYSTEM.

Forget the hassle of splicing in splitters and couplers. We've redesigned them to plug into the inside of the amp housing. That means fewer external connections, easier installation and less maintenance. Not to mention fewer chances of cable suck out, signal leakage and level adjustment error. So you save on installation and repair costs.

FAST RELIEF ANYTIME.

Our multipurpose distribution amplifiers are as perfect for upgrades as they are for new builds because they easily integrate into your current system. In low-density applications, they have the flexibility to let you start small and then grow with the population. Snap-in modular components provide push/pull, feedforward or parallel hybrid capability at two different gain levels and in bandwidths from 300 to 550 MHz.

We know you could use a few less headaches. So call us toll-free at **1-800-722-2009** or write to Scientific-Atlanta, P.O. Box 105027, Atlanta, GA 30348 for more information.

Scientific Atlanta

SEE US AT THE WESTERN SHOW, BOOTH 1130.

Reader Service Number 4

my turn

The path to self-regulation

While culling through files in preparation for moving to new (and larger) offices, I came across a brief monograph that seems as relevant today as when it was written by Delmer Ports. In 1971, Delmer left the presidency of Jansky and Bailey, once the leading firm of broadcast engineering consultants, to become director of engineering at NCTA. One of his major achievements was shepherding through the Engineering Advisory Committee the Standards of Good Engineering Practice for Measurements on Cable Television Systems *(NCTA-008-0477), most of which has since been incorporated into the* NCTA Recommended Practices.

Of even greater significance, however, was his quiet but persistent lobbying to bring about the introduction of sound engineering principles to the issue of potential interference to aviation radio, instead of wholesale prohibitions of large chunks of the cable spectrum. The intense emotional pressures generated by this issue, involving public safety and human lives, bore heavily on Delmer. Late in 1976, he suffered a massive heart attack and died.

The following monograph is dated Aug. 28, 1975.

Archer S. Taylor

Technical standards can be either imposed by law and enforced accordingly or generated cooperatively by industry associations, government agencies, and professional societies and implemented voluntarily. In electronics and communications, the great majority of technical standards are voluntary.

They perform three functions:

1. Protect others from harm.
2. Insure compatibility and interoperability.
3. Provide a means of judging quality and rating performance.

Any of the above three may be either legally imposed or voluntarily accepted. For realistic reasons, those involving protections are frequently regulated by law. The remaining two are most frequently generated by industry and voluntarily adopted in circumstances where they apply.

There is a tug of war between those favoring self-regulation and those for legally imposed regulation, and it is rather deeply rooted. Those for voluntary industry-sponsored technical standards argue that arbitrary, legally imposed regulations pre-empt management. The opportunity to make choices in order to optimize tradeoffs are eliminated by the regulation. Those favoring legal regulations claim they are necessary to avoid abuses and to compensate for incompetence. Both sides prove their points by specific examples.

The best solution is not to prove which side is correct but to minimize both of the above situations to the lowest possible profile.

Pre-emption of management and irritating abuses can both be reduced by effective use of comprehensive voluntary standards of good engineering practices. By being voluntary, they are adaptable and dynamic, and acceptance places the authority where the responsibility is—with company management. They are educational since they are specific creditable guidelines. They offer a means of rating oneself since they furnish a valid basis for comparison. They will work in the cable industry because there is a powerful motive pressuring almost all cable operations. The product sold by cable television is basically a service operating in a competitive market.

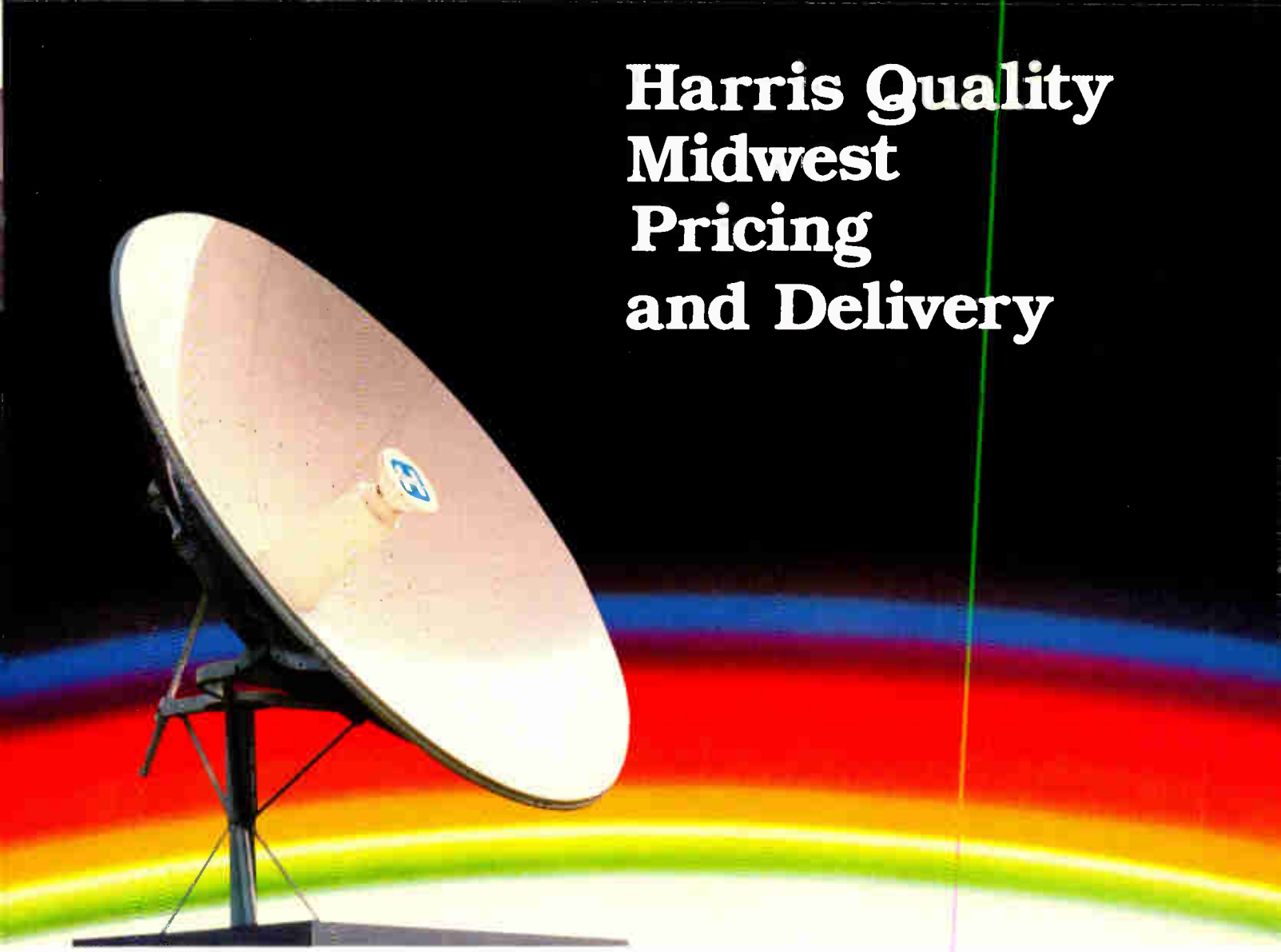
There is a new added impetus now for a technical standards development program. The FCC Cable Technical Advisory Committee has completed most of its work, and the reports of the 10 panels contain a wealth of partially digested information heretofore unavailable to any but very select groups. These standards can address the questions of compatibility, performance and reliability.

Standards for cable systems present a special problem due to the extreme variety of systems. One of the main attractions of cable TV—the fact that it can be adapted to an infinite variety of situations to fit each particular locale—creates a major difficulty in developing standards. A degree of perfection for some particular detail that just barely meets the requirements for one situation may be beyond practical realization for some other system. This automatically suggests having not one standard attempting to identify a compromise but grades of standards, each rated for a corresponding function to which they would apply. For example: premium TV carriage should meet different standards than a weather channel for time base stability.

Standards in any of these subjects implies an obligation to measure. Any technical standard, to be useful, must have a practical method of measuring the related quantities. For the measuring standards, emphasis must be on the objectives of the data to be obtained rather than on a specific detailed measuring procedure. Encouraging options for testing encourages development. These options can include visual testing and type acceptance tests at the source as well as the conventional measuring procedures now in use. Realism in the measuring and the ability to interpret the results are the most important characteristics. More measurements by simpler methods are most useful in many cases. ■

By Archer S. Taylor, Senior Vice President, Engineering, Malarkey—Taylor Associates Inc.

Harris Quality Midwest Pricing and Delivery



$1,295.00

Model 5115-AZ includes AZ/EL mount and dual polarity feed.

The Harris 3-meter C-Band Delta Gain™ Antenna gives you more than an impressive 41 dB gain. It's also rugged enough to withstand 120 MPH winds. Plus, it's easy to install and available with either an Az-El Mount or a Polar Mount with optional motorization.

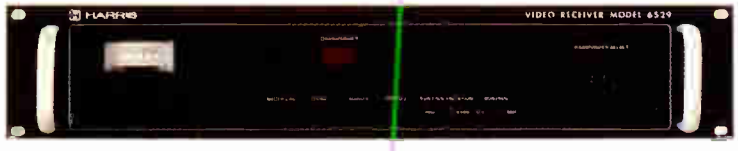
The Harris 6529-2 Frequency Agile Receiver is the updated version of the popular 6529. It is a 4 GHz input receiver, so if you have an older system you can get the excellent picture quality of the 6529-2 without the added cost of installing an external down converter or new plumbing. Plus you get one of the best warranties in the industry – two years on parts, labor and workmanship.

As one of the world's largest stocking distributors of Harris equipment, Midwest has these, and other Harris products, on hand and ready to ship – instantly. Midwest provides complete systems or individual components for either C or Ku-Band, fixed or mobile, Up-link or TVRO.

For the best prices and fastest delivery in the industry, contact Midwest at 800-543-1584.

$695.00

Model 6529-2



MIDWEST
Communications Corp.
One Sperti Drive
Edgewood, KY 41017

800-543-1584
(In KY 606-331-8990)

Reader Service Number 5

Professionals get job done even with few resources

A couple of months ago I was asked to be the luncheon speaker at a meeting of chief engineers in Denver. The MSO headquarters group that invited me had all of its chief engineers from all of their systems on hand for a full week of workshops and seminars on skills that would directly benefit its systems. One theme came out time and time again in the conversations I had with this group: quality service.

It became clear that the group was impressed by headquarters' efforts to improve their understanding of quality service. It was also apparent that quality was held in high regard by the chief engineers. I say this because the conversations all around me (privately and publicly) had to do with the problems of motivating employees; of instilling in co-workers as well as subordinates the idea of the customer's right to quality service and prompt attention; and the problems that this group had in convincing upper management of their need for resources to accomplish the goals set for them.

Later on, when talking with the MSO's senior management, I mentioned this odd paradox. That is, a group of 100 or so chief engineers, all of whom seemed deeply committed to do the right thing, who nonetheless felt they didn't have resources or support to get it done while they were at a paid-for seminar sponsored by the management of their own company. I think it's safe to say that the top management of this company was surprised by my comments and by my observations. But more than surprised, they were concerned. How could an outsider have detected such things when they, as employees and managers of this company, had not understood that this particular group of employees had detected a failing from the top down?

Later on, when I gave my address, one of the things I stressed was that the kind of person I would like to hire is the kind of person I have written about so many times in these articles in *CED*—the professional. I can distinguish professionals every time by their ability to accomplish a job with creativity and innovation when they lack the brute force that adequate resources represent. What I mean is that even mediocre people can accomplish lots of things with unlimited resources. Only professionals can accomplish good things when they have meager resources to meet big challenges.

An example of this occurred during the recent HDTV tests conducted at the Alexandria cable system (Jones Intercable) in Virginia. We had engineers from two equipment companies; Scientific-Atlanta and General Instrument. The General Instrument people made equipment that would allow us to upconvert an IF signal (the output from a modulator loaned to us by ITS) and then upconvert it again to feed into a demod made to NHK specifications. While this was being set up, two of the GI guys were at the Alexandria headend putting together, on a crash basis, a Ku-band receiving dish to receive the HDTV signal. There was no time to pour concrete for a proper mount. The GI men and the chief engineer of the Alexandria system, found a way to put the dish together and support it with temporary structures.

Equally amazing was the work done by the Scientific-Atlanta people. The modulator and demodulator built by NHK and ITS were built based on intimate knowledge of the MUSE HDTV signal and, thus, could have been expected to work pretty well. The modulator and demodulator built by Scientific-Atlanta was built with almost no hard information to go on and it was built by rebuilding existing cable equipment, modifying it in subtle ways.

At one point, when the Scientific-Atlanta equipment was being tested, it became clear that there had been some clamping information needed. Because Scientific-Atlanta had no access to the information about where this clamping would be, clamping errors were noted. I had no sooner seen this clamping error detected when I found the S-A guys huddled over a packing crate (work bench) with a soldering iron in hand and bits and parts borrowed from the workbench of the PBS laboratories. They were building a new clamping circuit and modifying their equipment even further based on what the signal had looked like on the display screen. This was engineering and design on the run. The most amazing thing was that when they finished, the signal through the Scientific-Atlanta gear looked every bit as good as the signal through the equipment built by and for NHK.

These two groups of people displayed what I call professionalism. They didn't have all of the tools, they didn't have all of the information, they were not in their comfortable laboratories, but instead were in a strange facility (a dark corner trying to work while a demonstration was going on in the front of the room). Yet by focusing on the issue at hand and by applying the skills and knowledge they had with creativity and with a view toward getting the job done, they managed to produce. That's what professionals do and that's how you recognize professionals when you see them.

I think the chief engineers at the MSO meeting all understand how to go about accomplishing what I've just described. I also believe that the upper management of the company is sincerely committed to making sure they have adequate resources to perform quality service. The real test will come in those cases where resources are not available, but the job has to be done anyway. ■

By Wendell Bailey, Vice President, Science and Technology, NCTA

EFFICIENCY EXPERT

New SUPER SENTRY Standby Power Is 92% Efficient

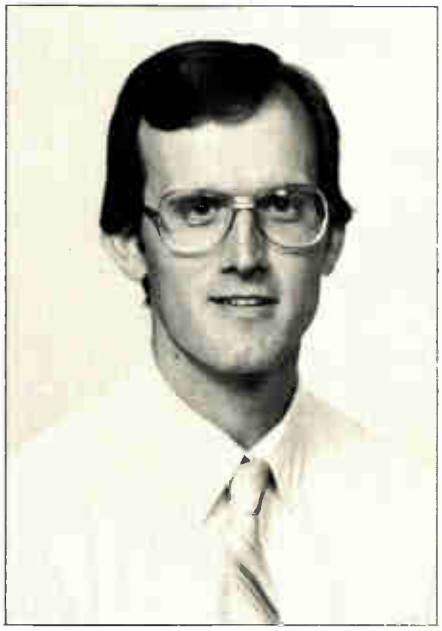
If an inefficient power supply has been robbing you of profits, it's time to call in the efficiency experts, LECTRO. The new SUPER SENTRY standby power supply operates at 92% efficiency in normal full load mode. And that can mean significant savings on your electric bill. As much as 10% over other power supplies.

The SUPER SENTRY is the newest innovation in Lectro's Super Line. To get all the facts about the Super Sentry, the Super Ferro, and the Super Brute, call 1-800-551-3790. Ask for the efficiency expert.

LECTRO

A Burnup & Sims Cable Products Group Company

92%



Stereo encoder listening evaluations

In October, I had the opportunity to speak at one of the technical sessions during the Atlantic Show. The subject was stereo television. Because there have been numerous articles on the subject in industry publications, and because I have given numerous speeches on how to "hook-up" stereo encoders in the headend, I decided that rather than address the overworked subject of how to install encoders I would instead try to answer one of the most often-asked questions we have received over the last few years on stereo encoders. That is, how to perform an equitable, objective, listening evaluation on two or more encoders. Since it continues to be a subject of interest, I thought I would cover it here.

We've had numerous operators call to ask advice because they were in the process of performing "listening tests" on various stereo encoders. They were performing these tests because they were unable to afford the expensive test equipment required to adequately measure each unit's separation, frequency response and distortion. During these tests, which are usually uncontrolled, their findings are sometimes inconclusive, or puzzling, and they ask, "why?"

The usual answer is that they are not performing a true A/B comparison between the two encoders. Or they are not exercising the system, or the encoders under test, to their fullest capability. In fact, there have been some cases of "A/B testing" being done where "Encoder A" and "Encoder B" were each set up for comparison in the headend on completely different channels. The problem with such a set-up is that, in addition to the likelihood of loudness variations between the two channels (a topic I covered last month), variations in the source material itself becomes a problem. We have actually seen one encoder, for example, with a documentary as its source material being compared to one carrying music from a music video! It's obviously not a fair comparison.

How then can you adequately judge the relative performance of two competing encoders by a set of simple listening tests when you absolutely cannot afford the necessary test equipment for performance specification measurement?

First of all, try to ensure that a true A/B comparison is being done. Try to find audio source material that does justice to the capabilities of the encoders that you are trying to listen to, and try to supply that same source material to both encoders simultaneously. Use source material that will exercise each encoder's dynamic range and frequency response. For example, try to perform the listening tests off-line so that perhaps a classical compact disc can be used as the source. Believe it or not, you will be able to hear the difference between 15 kHz and 13 kHz of frequency response.

Set loudness levels between the two encoders under test to be exactly equal. If you don't, the louder encoder will have a tendency to sound better, even though what you are hearing might be misleading. Compression and/or limiting can artificially raise the loudness level of an encoder, creating the impression of a more robust signal while clouding the issue of fidelity. FM radio stations use this technique to "boost" their loudness levels in order to be the "loudest" station on the band. This is sometimes accomplished at the expense of fidelity, in the hopes of attracting listeners.

True A/B switching is mandatory, preferably with a switch that doesn't "pop" each time you toggle between the two encoders. This will allow you to have observers hear the actual differences in sound quality between the two encoders rather than differences that are perceived once they hear the click of the switch. This is precisely the reason why loudness levels between the two encoders must be set exactly equivalent.

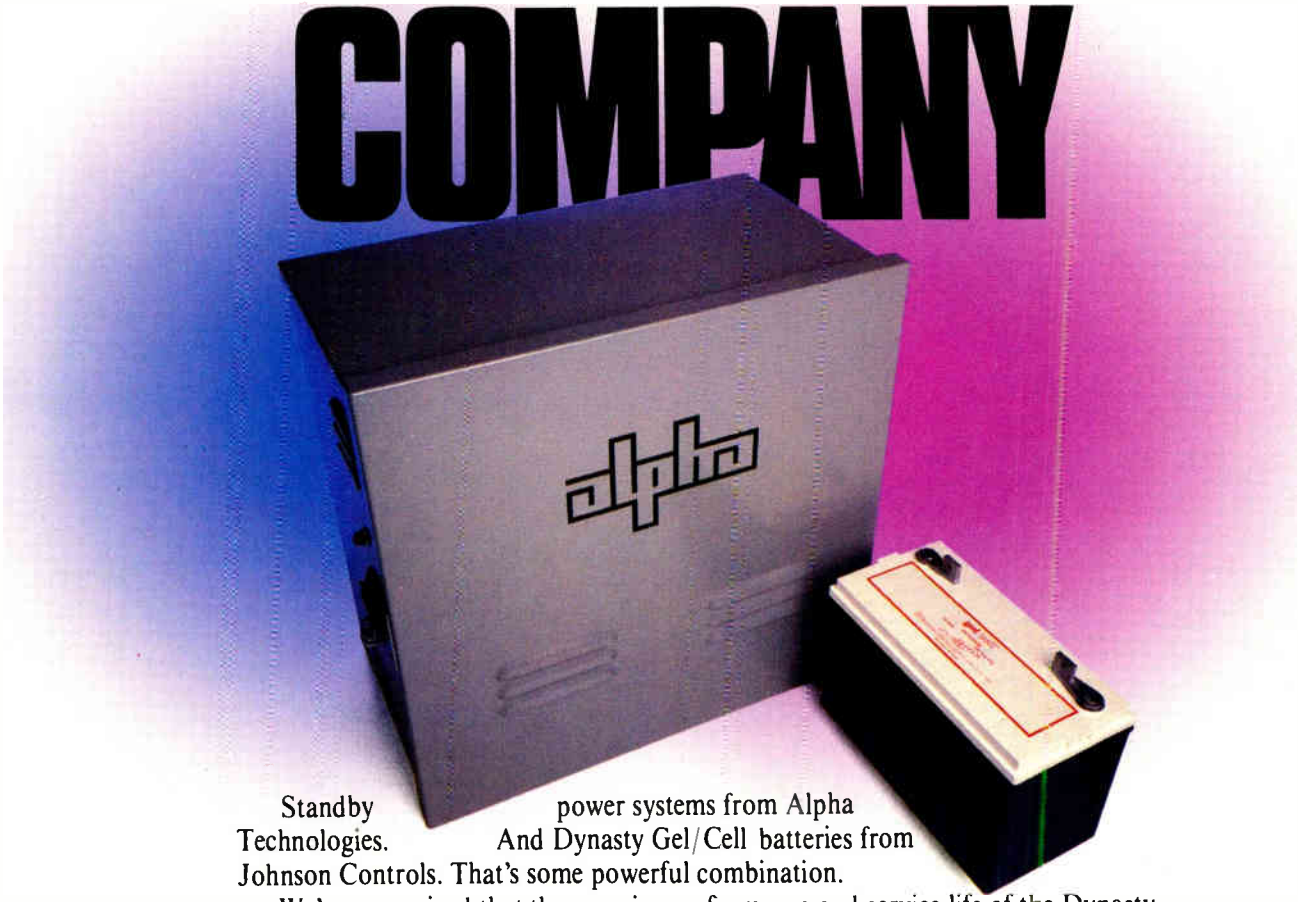
If at all possible, and this is crucial, don't perform audio listening tests with a consumer decoder or stereo TV. Use a precision decoder that will allow you to hear the frequency response and dynamic range of the encoder. If a consumer decoder is used, what you will hear are the limitations of the decoder, not the limitations of the box you are trying to test.

One could argue that a consumer decoder is precisely what is required for these tests, since it is similar to what the consumer is actually using. Therefore, the tests will give an accurate indication of what the consumer hears. Unfortunately, while this statement is true, it's a bit short-sighted. Consumer boxes are getting better every day. In fact, we can expect these boxes to improve substantially in the next several years. It would be a shame to pick a supplier of encoders, based on listening tests performed with one of today's consumer boxes, only to find out two years hence that your encoder has become the limiting factor in your system's stereo performance, and that the new consumer decoders are capable of far better performance than your encoder.

While it is to everyone's advantage to adequately test any piece of equipment that you intend to put into your systems, sometimes, for monetary reasons, it simply cannot be done. If the equipment is not available to thoroughly measure the relative performance of encoders, and therefore listening tests must be accomplished, ensure that a true A/B comparison is set up which will adequately exercise the full dynamic range and frequency response capabilities of each encoder. ■

By Chris Bowick, Engineering Dept. Manager, Scientific-Atlanta

POWERFULL COMPANY



Standby power systems from Alpha Technologies. And Dynasty Gel/Cell batteries from Johnson Controls. That's some powerful combination.

We've recognized that the superior performance and service life of the Dynasty Gel/Cell matches well with the superior reliability and technology of the Alpha standby system. So we're getting together. You might say our relationship has gelled. And that means we can provide you with the finest products for the CATV standby market.

The Dynasty Gel/Cell is the battery of choice for those who want the most for their money. For example, the GC12V100 delivers more capacity, and up to 50% longer service life than previous batteries. Of course, the fact that the Dynasty Gel/Cell never needs maintenance is one of the main reasons for its popularity in the cost-conscious cable world.

New Alpha standby power supplies are equipped with the Dynasty Gel/Cell battery. And, you can order your replacement Dynasty Gel/Cell batteries directly from Alpha Technologies. Alphas' and Johnson Controls' reputation for service, support and technical assistance stand behind every Dynasty Gel/Cell battery and Alpha power supply.

Long life, maintenance-free batteries and the full support of the industry's technology leader. Dynasty Gel/Cell batteries from Johnson Controls and Alpha. That's powerful company.

JOHNSON CONTROLS

alpha ALPHA TECHNOLOGIES

3767 Alpha Way Bellingham, WA 98225 206-647-2360 FAX: 206-671-4936
7033 Antrim Ave. Burnaby, B.C. V5J 4M5 604-430-1476 FAX: 604-430-8908

Reader Service Number 7

The sky is falling

Can it be true? Is the cable television industry nearing the end of a perfect summer? Some claim to see signs of that; a few geese flying South, a few cool gusts from the North, a few leaves dropping from the trees—foolish alarmists, no doubt. Most of us are reveling in the industry that is the darling of the '80s. For the last decade and more, countless fortunes have been made as systems have been built, sold and bought. It's been relatively difficult to lose money in cable.

Even operators who have treated employees shabbily and customers with contempt have found reward, and the recent stock market gyrations notwithstanding, there has been a speculative frenzy in cable properties based in fair measure on that fact. Certainly there has been some recognition that there may be competitive threats out there in the distant future, but relatively few are putting great energy into restructuring their businesses to meet them.

What are we to make then of the Cassandras who cry out that doom is approaching, that overbuilds will fragment the business, that direct broadcast satellites will steal customers and that in the long run the telephone industry will build fiber networks which will make our systems superfluous?

By Jim Chiddix, Vice President Technology and Engineering, ATC

At the CTAM meeting last August, Sumner Redstone said, "Anything that's economically and tecnhologically sound is going to happen." That provides an interesting hypothesis. It is difficult to believe that if good alternative delivery systems exist they won't get used. Our present position with programming rights notwithstanding, product will, in the long run, probably find its way to the customer through every available avenue and the most efficient avenue will become (or remain) the mainstream.

Where then are our competitive threats? Surely the cable operator who seeks excellence in what he does today, is responsive to the consumer, carries sufficient channels and builds out his franchise promptly will not leave fertile ground for overbuilds. Direct broadcast satellites with their national coverage certainly have the technical ability to serve consumers not adequately served in other ways, but the economics are as yet unclear, and the slight DBS technical edges of reliability and transparency can be offset by foreseeable CATV technology. CATV is also well positioned against DBS competition through its potential to continually increase channel capacity, an area where the steady advancement of amplifier technology will be helpful. DBS cannot be dismissed, but it does not appear to be a mortal threat to a thoughtful CATV operator.

What about the telephone companies then? There's a quiet revolution underway in telephone technology in the form of optical fiber transmission. Over the last few years an enormous amount of long distance capacity has been installed with fiber optics. In addition, many, perhaps even most, neighborhood central switching offices have been interconnected with fiber. In the next few years it seems highly likely that the economics of fiber all the way to the home will become more attractive than copper in new installations and facilities replacement, based solely on the provision of *voice* services. At that point it is almost inevitable that fiber to the home will begin to proliferate.

The movement will be slow at first, almost glacial. I have no doubt that five years from now we will see a relatively small number of homes provided with telephone service via fiber. However, I also believe that we will each be keenly aware of a few new towns or subdivisions in our areas where fiber is being used. Sometime between five and 10 years in the future, we may wake up and find that our business is beginning to be eroded by video delivery over fiber. For just as it is nearly inevitable that fiber will be run to more and more homes in the future for basic telephone service, technology is also certain to provide the owner of that same fiber with the cost-effective means of delivering video. And over the course of perhaps the next two decades or more, America *will* be rewired with optical fiber by the telcos.

Fiber has enormous bandwidth and terminal electronics will continue to evolve to make more and more of it usable. It is a transparent, low loss, low cost, long life medium, and digital delivery of video services, including exceedingly high quality High Definition TV, will obsolete the networks on which we have built our business *unless we change*. I believe the truth is that simple. Thus, in the long run, our present plant faces *real* competition. The telcos' fiber capacity for video carriage may ultimately be operated by them or may be leased to us and/or other video providers, but our present marketplace "franchise" will be unalterably changed.

Is there no hope for our systems in the long run? Should we be focusing on lease-back deals or the ultimate sale of our subscriber bases to the R-BOCs? Obviously, we will explore all business options open to us. But from a technical standpoint the future need not be grim at all, for the technology which may compete with our present delivery systems when used by others also has great potential for application to the evolution of our own systems.

We should not minimize the significance of the fact that we have constructed coaxial cable plant in front of most of the homes in America. We

Continued on Page 106

COMMITMENT

There's more to this race than just reaching the finish line first. In the cable industry, even being a contender takes hard work and commitment — in the best and worst of times.

Pioneer Communications knows first-hand about industry commitment. For the last 10 years, we've stood behind our products. Always ready to make the kind of research and development investment required by a leader.

The risks were plenty. But it all paid off.

We were the first to successfully implement a two-way addressable system. And we introduced quality and reliability to the industry by incorporating PLL tuning, SAW filters, SAW resonators and capristors into our converters. All this setting the standard for today's standard and addressable converters.

When you asked for consumer interface solutions, we were there again. A VCR timer and a programmable SmartRemote® are just two examples of products you asked for, and we supplied.

Why all this commitment? Because the Pioneer name has been synonymous with innnovative, quality electronics in the United States and worldwide. And we're not about to sacrifice this reputation.

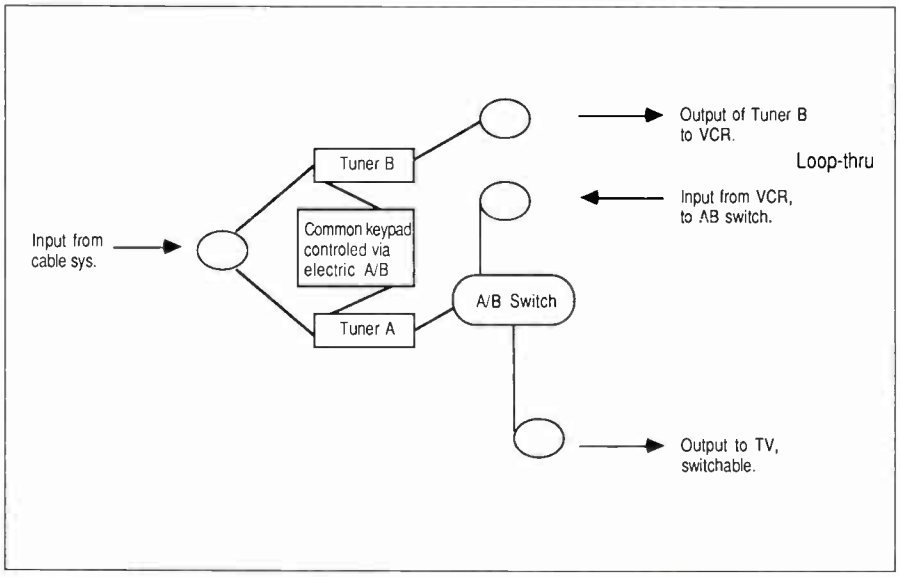
So in the best of times, and the worst of times, you can count on Pioneer Communications to go the distance...for you and your subscribers.

PIONEER®

PIONEER COMMUNICATIONS OF AMERICA, INC.

600 East Crescent Ave. • Upper Saddle River, NJ 07458 • (201) 327-6400
Outside New Jersey (800) 421-6450

Reader Service Number 8



Dual outputs?

Premium scrambled signals delivered via CATV converters not being compatible with a subscriber's VCR is an ever increasing problem.

While at the NCTA show (earlier this year), I observed the downsizing of many converters and thought of an idea. How about producing a converter featuring two separate outputs sharing a common input?

Output A would work like an existing converter. Output B would hook up to the VCR and then loop back into the converter and on to the TV via Output A. Subscribers would control what they are watching on Output A and the source for their VCR on Output B.

The converter would share a common housing, power supply, data board and subscriber controls, looking and working much like an existing converter. A/B switches would control outputs rather than inputs.

Separate tuners and modulators, along with a splitting and combining network and switches, would add to the cost of the converter. But I would think nowhere near the cost of the second converter and associated hardware that the industry provides to customers at the present time. More importantly, it would eliminate the manual A/B switch and the mess of wire customers complain so much about.

What is the feasability of such a unit and how much would it cost? If there is an engineering problem, what are the specifics?

Peter Sclafani
Cable Resources

The dual-output converter proposed by Mr. Sclafani appears to be a technically sound approach to compatibility with a VCR. The addition of an electronic A/B switch within the converter to switch between the VCR output and the "tuner A" output would eliminate the need for manual switching between the VCR (for example, while playing a tape) and the "tuner A" (used for normal viewing of all channels). Presumably, the "TV/VCR" switch on the VCR would always be left in the "VCR" position. This way, if a tape was being played, it would appear at the output of the VCR, while if a recording was being made or the tape was stopped, the signal at the input of the VCR would appear at its output, allowing monitoring of the recording process.

The "output of tuner B to VCR" would preferably be at baseband video and audio to attain the highest recording quality possible. This would also eliminate the need for tuning the VCR to channel 3 (for example) and the possibility for error that introduces.

A single remote for controlling both "tuner A" and "tuner B" would be very desirable. This would require a change to the normal converter remote to include an additional key to select which "tuner" is being accessed.

While such a product would be attractive to some subscribers, the cost of such a dual converter would, unfortunately, be quite high. Each signal path requires not just a tuner, but authorization and descrambling hardware and firmware. In the case of a baseband converter, each path would also require an IF section, video and audio demodulators and an output modulator. Because the descrambling on each channel is asynchronous, descrambling functions (microprocessor, firmware, custom timing ICs, etc.) must be duplicated.

The only sections of the converter that could be shared are the power supply, (which would need to be redesigned and would cost more), the IR receiver, the LED display and the case (which would become larger, hence more expensive). Given the relatively small volume of such a dual product, its cost might very well be even more than two single converters.

Several converter manufacturers are prototyping electronic A/B switches to support the FCC requirement for off-air antenna switching. These provide a means to route either the output of the converter or an antenna signal to the television, and are controlled by the converter remote control. Such a switch could be used to experiment with this idea, by feeding the output of the VCR to the "antenna" input. This input to the VCR would be from a second converter. Tocom also offers the VCR-Mate, which allows remote switching between the output of the VCR and the output of the converter. It will not, however, allow recording and watching two different scrambled signals.

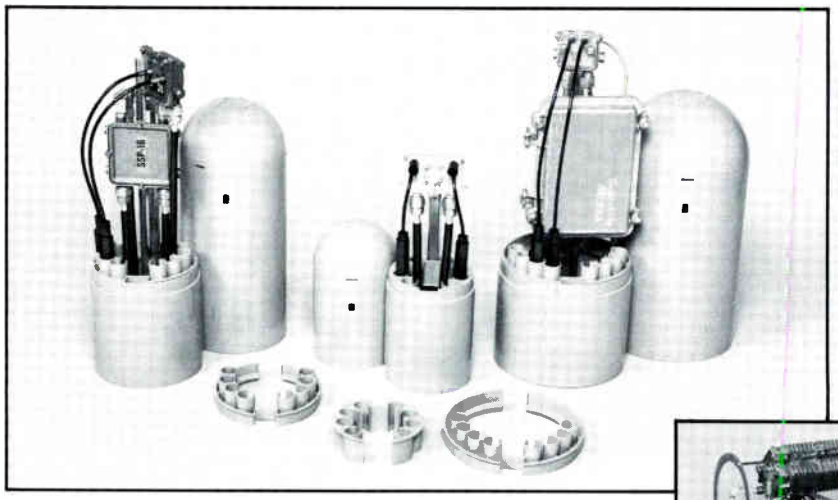
Tom Martin
Director, Research and Development
General Instrument, Tocom Division

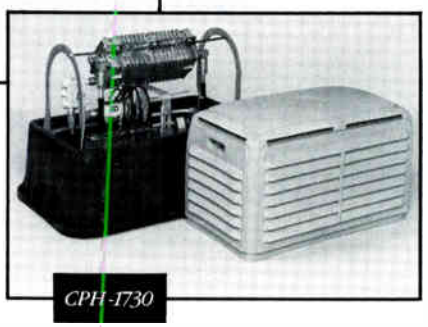
Rebuild tips

Many operators are facing a system rebuild, either because the plant is old, service is costly and quality is poor or limited channel capacity is restricting profits from newly available services.

ENCLOSURE ACCESSORIES

C H A N N E L L *by*





CPH-1730

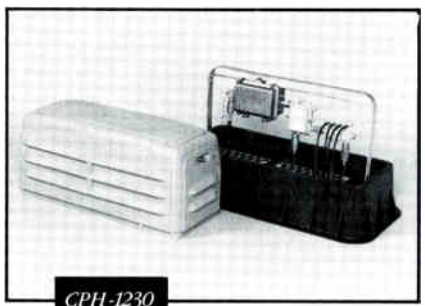
Trap Holders by Channell

Channell's innovative new KTH Series of trap holders permit all types of cylindrical-style traps currently used in the CATV industry to be mounted in Channell pedestals. Designed to permit retrofitting of existing pedestals in the field, the trap holders can be installed into the bases of pedestals without the need to disconnect any equipment.

The trap holders eliminate the need to increase the size or diameter of the pedestal when installing traps, and their use results in trap installations which reflect good housekeeping procedures. They also prevent undue stress from being placed on the coaxial jumpers, thereby eliminating RF leakage.

Please turn the page for a special offer on Channell's KTH-600 6″ trap holders. For information on 8″ and 10″ versions, and trap holders for Channell's low profile CPH-1230 and CPH-1730 enclosures call Channell toll free.

Trap Holders

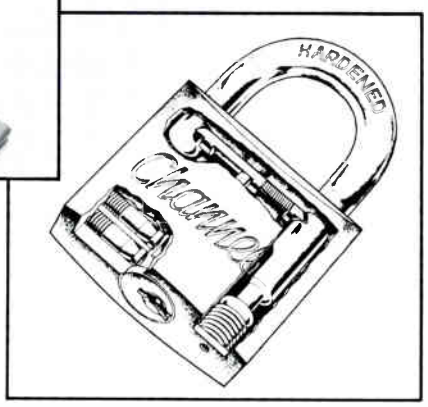


CPH-1230

CPL-125 Padlocks

Security Locking Devices from Channell

In addition to Inner-Tite high security barrel locks, Channell now offers high quality padlocks for hasp-design enclosures that are superior to anything currently on the market. Manufactured exclusively for Channell, these new CPL-125 padlocks offer hardened steel/chrome plate shackles; all brass and stainless steel internal workings; "heel and toe" shackle locking; 5-mushroom pin tumbler locking mechanisms; custom keyway/key blanks; solid brass bodies; and dust caps.

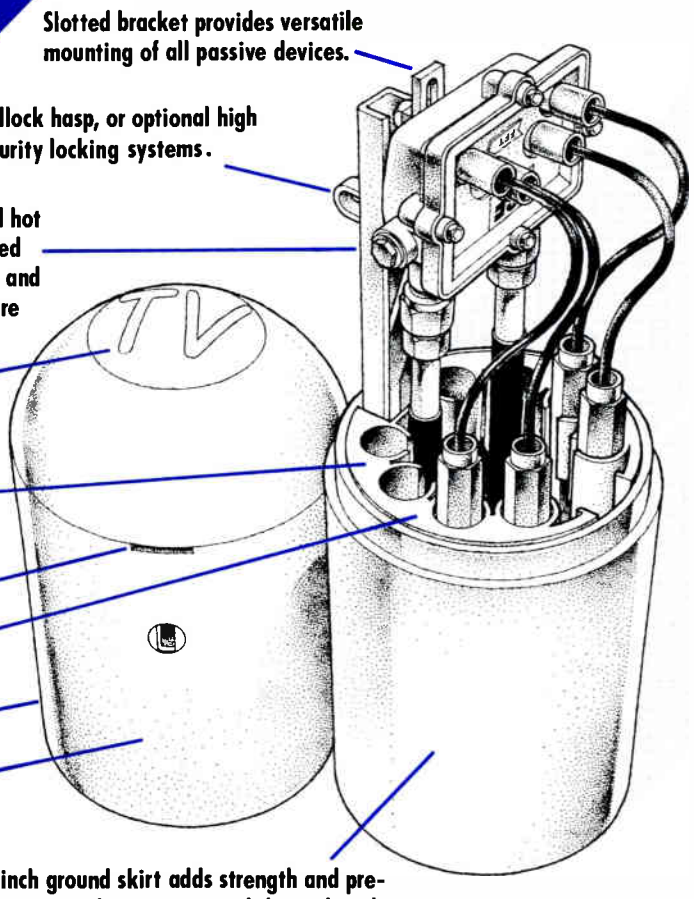


See back of page for Special Fall Construction Offer!

Reader Service No. 10
See us at the Western Show, Booth #1472

SPECIAL INTRODUCTORY OFFER!

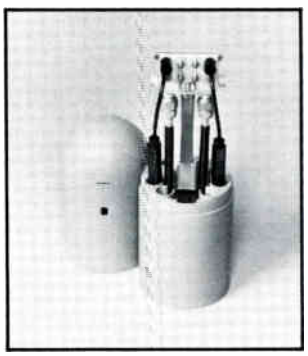
October 1- December 31, 1987



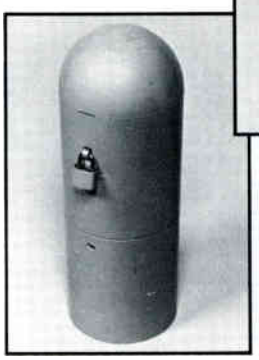
Here's your chance to purchase Channell's popular CPH-658B pedestal at a reduced price ***and*** try Channell's new trap holders and padlocks at special introductory prices! Channell CPH-658B pedestals are shipped 8 to a carton and there are no minimum pallet quantities. Just pick the offer that's right for you and call Channell toll free with your order:

Offer No. 1: ►
CPH-658B pedestal with stake, hasp and bracket pre-assembled:
$13.35 Regularly $15.75

Offer No. 2: ▼
CPH-658BT pedestal with stake, hasp and bracket pre-assembled, ***plus*** KTH-600 cylinder trap holder:
$15.95 Regularly $19.25



Offer No. 3: ▼ ►
CPH-658BLT pedestal with stake, hasp and bracket pre-assembled, ***plus*** CPL-125 padlock ***and*** KTH-600 cylinder trap holder (includes padlock key with every 8 pedestals):
$18.60 Regularly $23.90



Retrofit Offer:
Purchase KTH-600 trap holders and CPL-125 multiple-use padlocks at reduced prices now for retrofitting, or place them in stock for installation when needed.

KTH-600 6" Trap Holders (20 minimum): **$2.60 ea.** Regularly $3.50

CPL-125 Padlock
(includes 2 keys with every carton of 20): **$2.65 ea.** Regularly $3.30

Offer ends December 31, 1987
Blanket orders must be shipped by January 31, 1988

CHANNELL COMMERCIAL CORPORATION
620 W. Foothill Boulevard
Glendora, CA 91740
Telex: 670-368
(818) 963-1694
(800) 423-1863
(except CA)
(800) 345-3624 (in CA)

Channell COMMERCIAL CORPORATION
Technology you can trust!

The first move is to hire a good rebuild manager who is experienced with design and construction procedures.

Whatever the reason, the primary question asked by management is how much is it going to cost and how can it be controlled. Palmer Cablevision of Naples, Fla., has been involved in a rebuild program for two years. If you're facing a rebuild, some of these suggestions may prove helpful.

The first important move is to hire a good rebuild manager who is experienced with design and construction procedures. His only responsibility should be to control quality and costs. A small fortune can be lost or saved in the field and his or her salary can be made five times over.

The next step is to have a meeting with key management personnel and establish a rebuild policy. Some of the questions that need to be answered include:

1. How many channels do we need?
2. How many will we need five to 10 years from now?
3. How much of the system shall we rebuild and in what areas?
4. How much capital per year should we commit?
5. Are our converters adequate or will we need to update?
6. Should we consider a two-way system?
7. Should we consider one-way addressability?
8. With expanded channels, what will our maximum amplifier cascade be?
9. What equipment should we buy?

Once these questions are answered the next project will be system design. Many cable operations have adequate design personnel who know the basics and can do a fair job, but a design professional can save up to 30 percent in equipment costs. By the proper placement of amplifiers, they can utilize every spare dB and the cost savings on equipment can be much more than the charge for their service. Large value taps at the ends of distribution lines is the most obvious indication of poor design.

If you have a choice of going aerial or underground, most operators would agree the advantages of aerial plant far exceed underground. Foremost is cost. Aerial plant will run 40 percent to 60 percent less than underground. Underground construction is where your costs can vary significantly depending upon your control procedures.

The following are suggestions that have proven themselves by experience. The first concern is customer relations. We certainly can't plow up people's lawns without giving them notice. Newspaper ads and 30-second spots on the cable system are excellent ways of informing your customers of your plans. A week to 10 days before construction crews start an area, have a door knob placard placed at each residence informing the occupant that crews will be coming across the easements with new cable and that restoration will follow. The placard should have a positive tone, be brief and describe the advantages of this rebuild.

Once the crews have installed cable, a second door placard should be used to explain what happened, with a phone number to call to report any damage and assure the occupant he is not being abandoned. The phone number we use is a line to a separate office that is set up and staffed by the contractor. Their people answer all trouble calls and complaints. Most systems do not need the extra burden of handling these calls. Of course, disruption of service is turned over to system dispatch for the service techs to follow up.

There are several methods of getting the cable into the ground. The fastest, easiest and most cost efficient way is to plow it in. Most cable operators are very particular about what condition the cable will be in once it is in the ground. Plowing cable in poor soil or rock conditions can stretch and skin the cable, resulting in a poor rebuild job. What we opted to do was order our cable inside intergal before we plow.

There are many advantages that far outweigh the additional cost. The cable is protected when it is plowed. It is harder to kink when handling and the intergal gives it adequate protection from a shovel or the prodding of the water or gas company when they search for their lines. It is also very handy if you need to replace a span. It can be pulled out of the intergal and a new one pulled in with very little effort. One word of caution, if you decide to use intergal with this method of installation, a kellum grip must be used if pulling directly off the reel, otherwise cut the proper cable length from the reel and then attach it to the plow. The cable must float free within the intergal so it will not be stretched.

During the installation procedures it is very important that your rebuild manager or inspector be in the field daily. This will make the difference between a good job that is cost efficient or a poor job that is expensive. The per-foot rate of installing cable will jump four to six times when a contractor has to bore under concrete or cut and patch asphalt. Many times minor field changes can be made to areas where the plow can go, saving hundreds of dollars. These add up to thousands over a period of months. It is also important to check each span with a measuring wheel for plow footage and bore footage and record them for invoicing. Mistakes are made that can add up to a sizable amount of money.

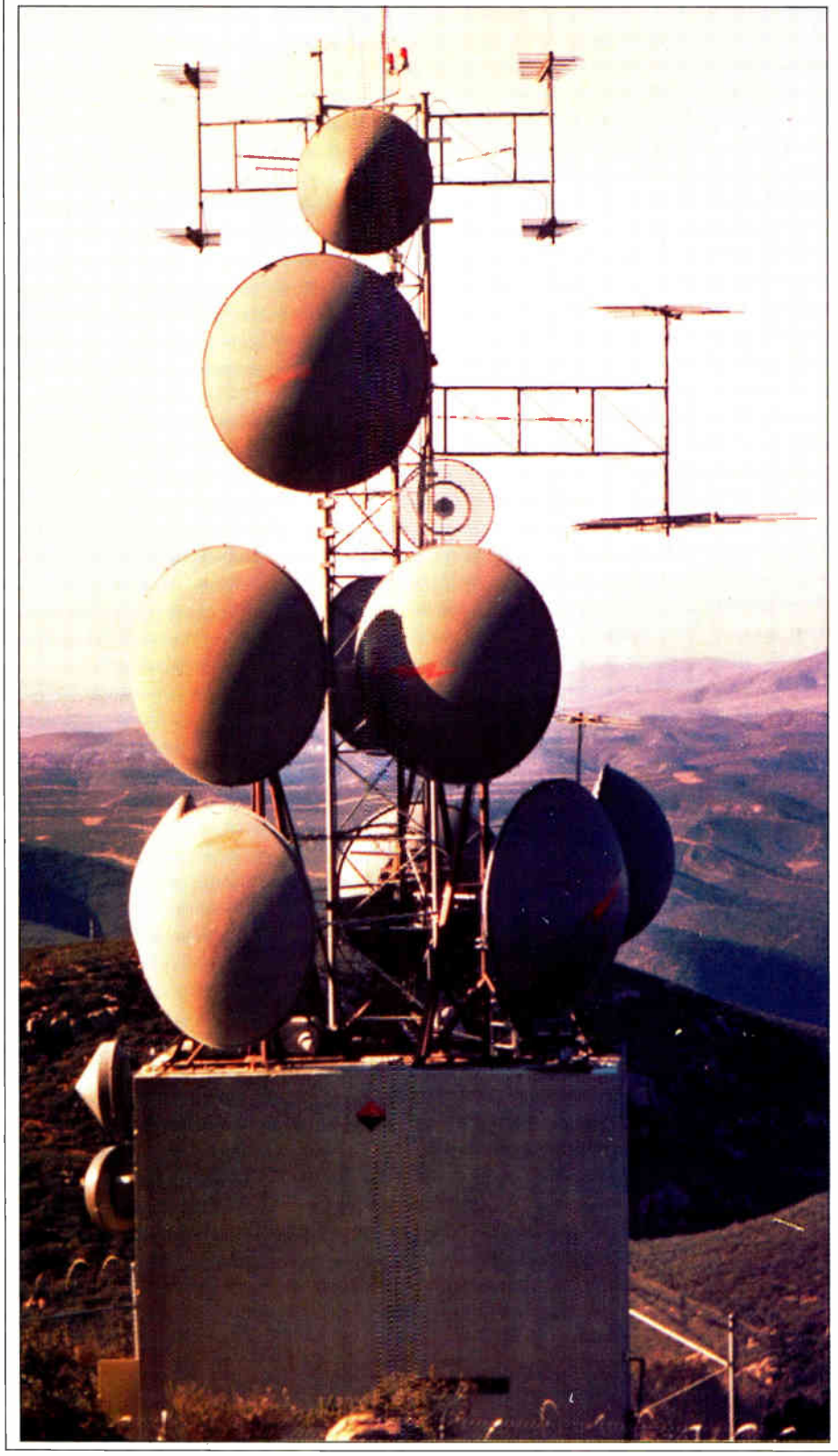
The expense of running new drops can be eliminated or postponed if in the initial design the new pedestal locations are the same as the old design. Instruct the contractor to set the new pedestals right next to the old ones. When the time comes to switch drops they can easily be routed into the new can.

Once the contractor has finished an area, sweep crews should sweep all trunk lines and spot check the distribution. After this is accomplished the distribution is then ready for taps. We have saved approximately 50 percent from a contractor's bid price by letting our own experienced people cut in taps and line extenders at a per-piece rate on their own time. It has paid them better than time-and-a-half and we are happy with the result. We have dedicated two senior service techs to cutting in the trunk amps, power supplies and activating the new lines. At this point both systems are running side-by-side.

When this is complete we turn the old system off, giving customers time to call in to report hookups that have been overlooked and not switched. If all is well, our junior man goes back and wrecks out the old system and does a final inspection for restoration, leaning pedestals, etc. The other aspect that is important to the success of this effort is to accurately track the rebuild progress on a set of maps. I find color coding the progress very helpful.

Jim Merriam
Palmer Cablevision, Naples Fla.

Video transport systems for optimizing CATV systems



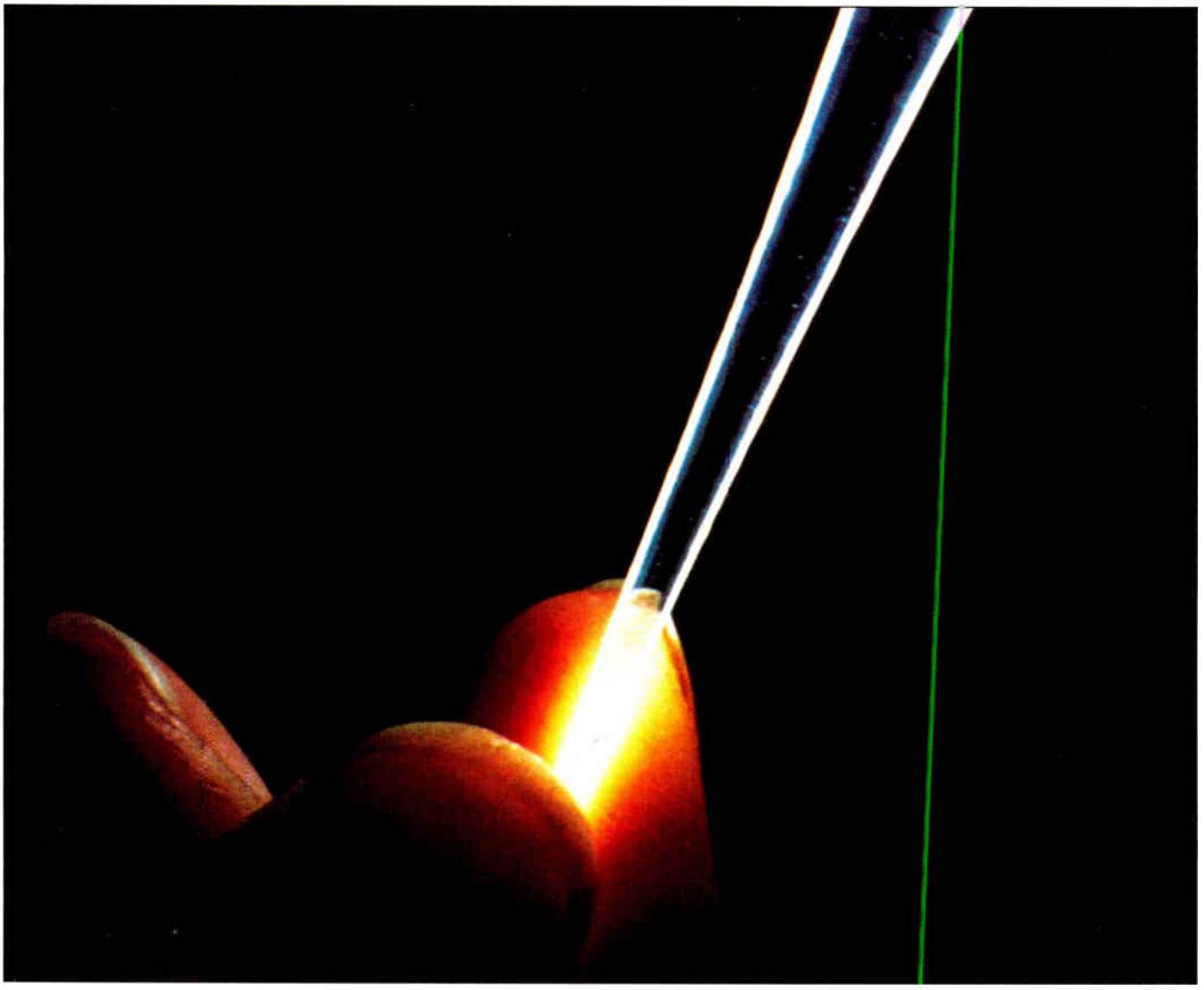
Microwave, fiber and coax are compared.

Abstract

Current cable system architecture is reviewed with emphasis on the role of supertrunks. Supertrunk technologies are reviewed and compared. Because the specification and performance of the cable distribution system is nearly always less than that of the other major cable system components, the distribution system severely limits overall cable system performance. The ability of a supertrunk technology to support a multi-hubbed distribution system is therefore more important than the ultimate specification of the supertrunk itself. FDM/VSB-AM microwave provides good transmission performance and encourages multi-hubbed distribution systems with improved specification and performance due to the shorter amplifier cascades.

By Israel (Sruki) Switzer, Consulting Engineer

Developments in new transmission technologies are also forcing reviews of system architecture.



Recent developments in cable television have spurred interest in improved picture quality, reliability and reduced maintenance costs. Competition from direct-to-home satellite services, new super-VHS videocassette systems and other alternative television media is forcing a re-examination of these issues in existing cable TV systems. Existing systems are being rebuilt and/or upgraded, occasioning serious examination of system architecture. System architecture is also being reviewed under the pressure of economic restructuring as many smaller systems are being "clustered" into larger entities. Developments in new and existing transmission technologies are also forcing reviews of system architecture.

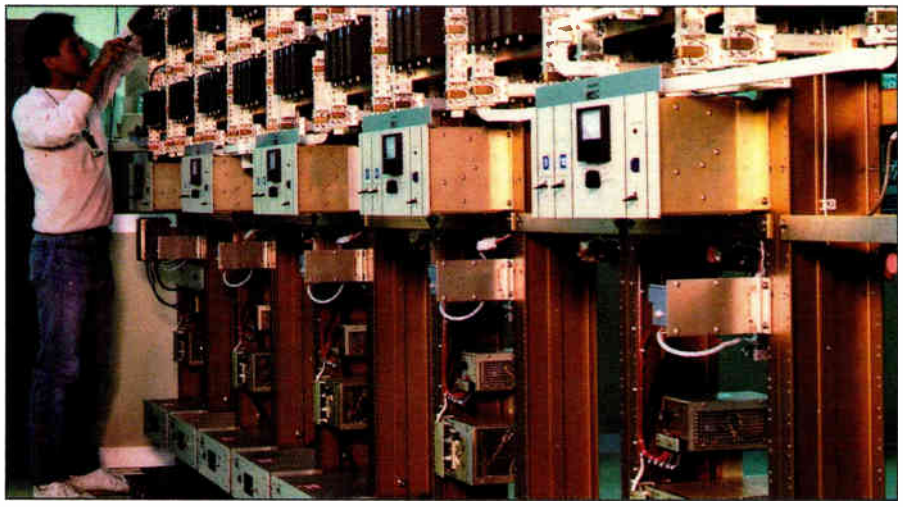
Several cable system architectural principles are firmly established and are not likely to change during the next few years:

- A single master headend will serve a substantial service area. Considerations such as insertion of local advertisements in many program services, localized generation of stereo audio, premium service scrambling and addressing requirements, local community service programming, etc. favor a single master headend to serve even very large communities.
- Tree and branch architecture will be used. T/B systems provide low cost "broadcast" service, i.e. simultaneous distribution of the same TV channels to many destinations. Systems will continue to operate broadband, i.e. using a broadband distribution medium for frequency division multiplexed operation.
- Coaxial cable will continue to be the preferred distribution medium. T/B-coaxial is a mature technology, well suited to the principal function of cable TV systems—efficient, controlled, broadcast distribution of multiple entertainment-type TV channels.
- There will be some variation in

The concept of 'hubbing' has been developed in response to the growth of cable systems into larger units.

service delivery techniques, i.e. control of selective channel and selective access. Addressable descramblers and negative traps will continue to be popular options.

The concept of "hubbing" has been developed in response to the growth of cable systems into larger and larger units. The trend toward larger systems has accelerated as larger communities have been franchised and as smaller systems are clustered. Increased system bandwidth (new system and some rebuilds operate to 550 MHz) has reduced amplifier spacing, increasing the number of amplifiers in cascade, and has increased the loading on amplifiers with a consequent increase in amplifier distortion. Amplifier performance has been improved by the use of improved transistors, and feedforward and parallel transistor amplifier designs, but it has still been necessary to use "hubbing" to keep amplifier cascades within reasonable bounds.



"Reasonable bounds" needs definition. Line-extender cascades are usually limited to two amplifiers, so that the "feeder" system is considered to be a bridging amplifier and two line-extenders. Trunk amplifier cascades vary considerably. Some systems have as many as 50 trunk amplifiers in cascade. Extended-bandwidth systems (400 MHz or more) must use shorter cascades—24 might be a "reasonable" maximum for such systems, with 16

Channel Master® Unveils New Micro-Beam® Microwave Relay Products At The Western Cable Show

Booth No. 555 - North Hall

Channel Master® Division of Avnet, Inc.

P.O. Box 1416, Industrial Park Drive, Smithfield, N.C., 27577, (919) 934-9711

Reader Service Number 11

Frequency division multiplexing using VSB-AM modulation is the most attractive multiplexing option.

amplifier cascades more desirable.

A "hub" is in effect a cable system headend to which all the required signals have been delivered from the master headend. The assumption is made that the link between main headend and hub is "transparent" so that nearly all the allowable distribution system noise and distortion occurs between the hub and the subscriber. This link is usually called the "supertrunk."

Supertrunk options

Coaxial cable: VSB-AM and FM modulation. Microwave: AML—VSB-AM modulation; and FML—FM modulation. Lightguide (Optical Fiber): FM modulation and VSB-AM modulation.

This list of supertrunk options can be studied from the viewpoint of "medium"—coaxial cable, light-guide or microwave, or from the viewpoint of "modulation"—FM or VSB-AM. "Baseband" is not a viable option for supertrunking even though many signals come into the main headend as baseband.

Frequency division multiplexing using VSB-AM modulation is the most attractive multiplexing option for a number of well established reasons:

- The subscriber receiver is part of an established FDM/VSB-AM system. Television broadcast transmitters share "space" on an FDM basis and VSB-AM is the standard modulation for television broadcast transmission. Subscri-

Strongest link.

Your satellite receiver is the first link in the transmission chain. And one thing you can always count on—the headend signal never gets better than it is at the receiver.

Which is a very good reason to specify Standard's Agile 40 C/K Satellite Receiver—but it's not the only reason.

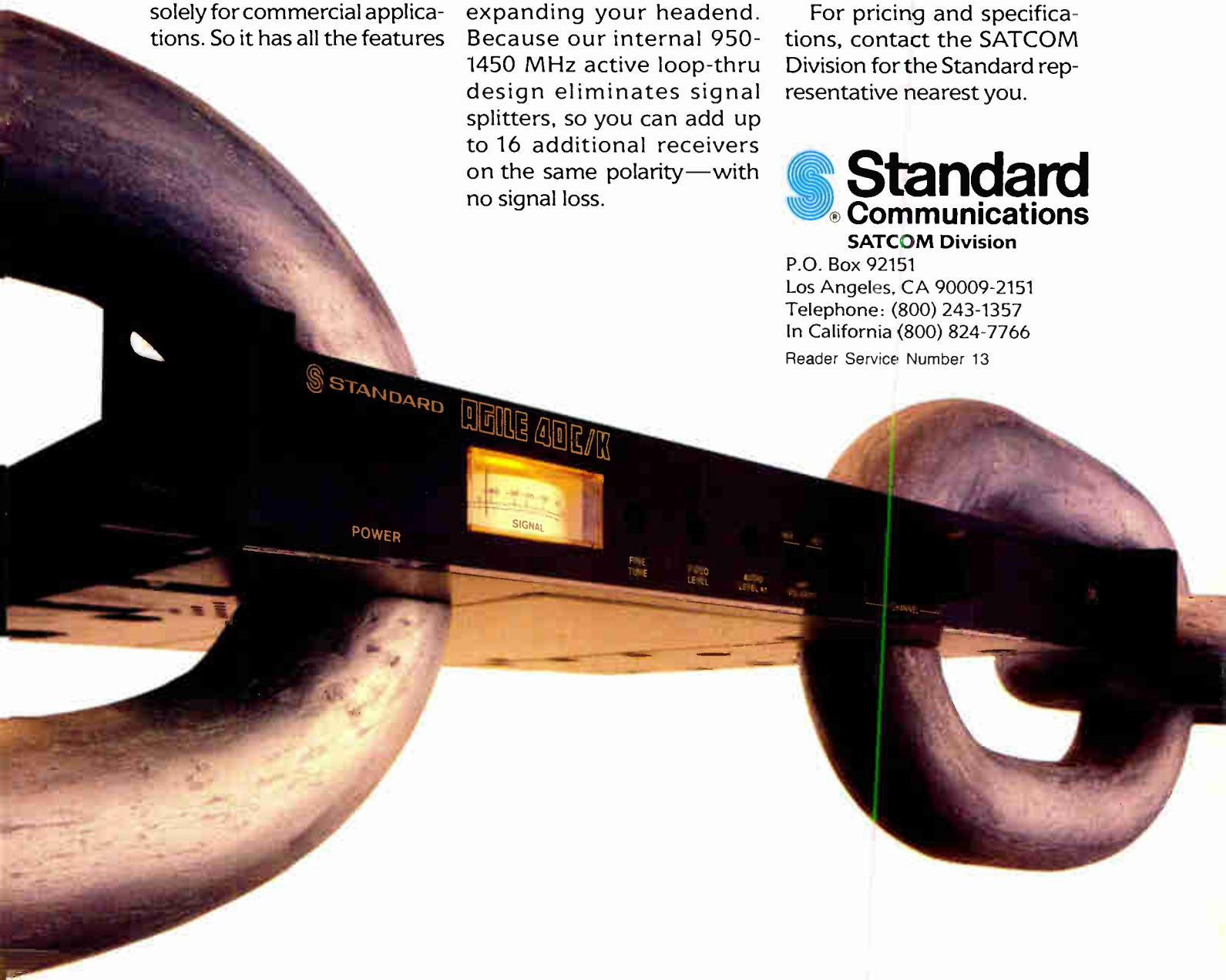
The Agile 40 C/K was designed from the ground up solely for commercial applications. So it has all the features cable operators need most: rock-solid 100 kHz PLL tuning and total flexibility for the most accurate C/Ku-band operation; 70 MHz IF with a front-panel test point to minimize terrestrial interference; and a power supply built for the demands of 24-hour-a-day operation.

The Agile 40 C/K is also the receiver to have when you're expanding your headend. Because our internal 950-1450 MHz active loop-thru design eliminates signal splitters, so you can add up to 16 additional receivers on the same polarity—with no signal loss.

And because it draws only 32 watts maximum, the 40 C/K runs cooler, lasts longer, and saves money year after year. So you'll probably never need our five-year replacement/warranty program.

To get the best signal, start with the peace of mind that only quality equipment can give you. Link up with an Agile 40 C/K.

For pricing and specifications, contact the SATCOM Division for the Standard representative nearest you.



Standard Communications
SATCOM Division
P.O. Box 92151
Los Angeles, CA 90009-2151
Telephone: (800) 243-1357
In California (800) 824-7766

Reader Service Number 13

VSB-AM uses available bandwidth in a very efficient manner—much more efficiently than FM.

bers' receivers are therefore already equipped for FDM/VSB-AM operation. Cable systems have evolved over the years as an efficient bridge between these established television broadcast transmitters and receivers. The use of any other form of modulation means that the signal will have to be demodulated and remodulated to VSB-AM to connect to the subscriber's receiver.

- VSB-AM uses available bandwidth in a very efficient manner—much more efficiently than FM. VSB-AM modulation, however, is more subject to transmission system deficiencies.

Some other forms of modulation, such as frequency modulation, offer greater immunity to noise and other transmission problems. FM in supertrunks more easily achieves the desired near-transparency of transmission but has several disadvantages:

- FM uses more bandwidth than VSB-AM. Even low-deviation FM uses 12.5 to 14 MHz per channel, compared to 6 MHz per channel for VSB-AM.
- FM signals require demodulation to baseband and remodulation to VSB-AM to connect to the subscriber's receiver.

Time division multiplexing using digital modulation is available for use in light-guide systems. This technique uses much more bandwidth than either FDM/VSB-AM or FDM/FM.

The choices of transmission medium and modulation technique are related. Coaxial cable and microwave can be used with either VSB-AM or FM. Light-guide systems do not now have the linearity to support multi-channel FDM/VSB-AM transmission. The principal source of linearity shortcomings in light-guide transmission systems is in the laser diodes used as light sources. Practical light-guide supertrunks are therefore limited to FM or digital transmission techniques that can operate quite well in a "non-linear" transmission system. The prospect of a light-guide

Put the box office a phone call away.

The Panasonic PC-200 Addressable Converter.

Offer more than just the basics...

The Panasonic PC-200 Addressable Converter lets you provide more than just basic cable services to your subscribers. It gives you the tools necessary to deliver a new and profitable service to your consumers — pay-per-view television. Naturally, the more services you offer — the more subscribers you'll maintain. Not to mention the additional revenue you'll be generating for your own business.

The PC-200 Converter offers you the convenience of instantaneous control of every channel in your system. Plus, an independent Panasonic scrambling system which helps increase system security. What's more, the PC-200 is compatible with gated 6 and 10 dB sync suppression scrambling which means you can hook it up to your present Jerrold system. And, it allows purchase of converters from more than one source.

In addition, you also get a host of downloadable parameters. Like channel map, barker channel number, IR enable/disable, and force tune of the converter just to mention a few.

Put the Panasonic PC-200 Addressable Converter to work in your system — we're ready to help you deliver entertainment that's a phone call away. And, address your bottom line, of course.

For more information call:
East Coast: (201) 392-4109 West Coast: (415) 672-2592

Panasonic
Industrial Company

Reader Service Number 16

It is instructive to examine the contributions of various parts of the overall program distribution system to the 'noise budget.'

supertrunk operating in FDM/VSB-AM mode is, however, enticing. Such a light-guide supertrunk could support multiple low-cost hubs. Practical realization, however, requires a great deal of further development of optical devices optimized for this application. There might be some very basic obstacles in the course of the required development.

In a multi-channel system the costs of an FM-based hub can be high. A 60-channel FM-based hub can easily cost $500,000 when the cost of the hub site building and climate control are included. Consider a 60-channel supertrunk system (coaxial cable or light-guide). At each hub there must be 60 FM demodulators, 60 VSB-AM remodulators, adequate floor space to house this equipment and provide room for technicians to work on the equipment and, finally, climate-control equipment to allow all of this equipment to function properly.

The costs and implications are substantial even for lower channel-count systems. Maintenance requirements should not be overlooked. The remodulation process requires close monitoring. Although the better quality VSB-AM modulators are quite stable, the video levels being fed into them often vary to some degree. This variation compels the system operator to monitor baseband levels and modulator setting carefully; otherwise depth of modulation will vary. Overmodulation will clip whites and cause sync buzz. Undermodulation causes pasty-looking pictures. This maintenance task cannot be avoided in main head ends where many program services are received from satellites and other baseband sources, but multiplying the task by installing a battery of demodulators and remodulators for every channel in every hub is probably not prudent.

The cost and complexity of FM-based hubs pressures the system designer to reduce the number of hubs and consequently to use longer trunk cascades from the few hubs that are installed. Much of the benefit of the high-performance supertrunk is wasted in the reduced performance of the longer distribution systems. The cost of an FM-based hub might not seem great when amortized over the very large number of subscribers that a few such hubs might serve, but the cost per subscriber is very significant when amortized over the smaller number of subscribers per hub that good design practice dictates.

FM-based hubs are very expensive because of the cost of the demodulation/remodulation process. Since these FM-based hubs tend to serve relatively large numbers of subscribers, it makes no sense to skimp on specification of the hub equipment. An FM-based hub in a "big-city" system will often serve as many subscribers as the main headend in smaller communities will.

'Transparency'

Noise. It is instructive to examine the contributions of various parts of the overall program distribution system to the "noise budget." These tables were prepared using a simple LOTUS 1-2-3 spread-sheet. This is the formula we use for "adding" two C/N ratios expressed in dB:

```
-10*@LOG((10^(-1*E5/10)+
(10^(-1*E7/10))))
```

In this example cells E5 and E7 contain the two C/N (dB) to be "added."

It is convenient to discuss overall system noise budget in terms of carrier-to-noise ratio (C/N), even though some parts of the system are usually measured in terms of video baseband signal-to-noise ratio (S/N). In typical cable TV practice these two expressions of noise performance are numerically almost the same. I will use the term C/N throughout the discussion even though this is not rigorously correct.

I will use these system components in a discussion of overall noise performance:

- Satellite reception. Many services are received from satellites. For discussion purposes I assume 54 dB C/N for the overall satellite system.
- Headend signal processing. In

If inexperienced salespeople have ruffled your feathers, make a wiser choice. Contact MIDWEST CATV.

Why waste time with salespeople who don't give a hoot about your problems? Make a wise choice and call Midwest CATV. Our people know the cable industry and provide solutions to customers' problems every day.

Are you having problems finding the necessary inventory? Do you need assistance in selecting the right products? At Midwest CATV, we have the *supplies and the solutions.*

We provide a full line of products, including several brands of cable, distribution gear, converters, accessories and test equipment from a number of suppliers.

Regional warehouses and a computerized inventory system enable us to speed your order to you in the blink of an eye.

Don't waste time with a birdbrain. When you need complete, full-line inventory, call Midwest CATV. Your nationwide distributor with *supplies and solutions.*

Reader Service Number 18

Charleston, WV (1 304 343-8874)
Sewell, NJ (1 609 582-7222)
Outside NJ (1 800 521-6243)
Virginia Beach, VA (1 804 468-6444)
Within VA (1 800 421-2288)
Outside VA (1 800 643-2288)
Ocala, FL (1 904 854-6511)
Within FL (1 800 433-4720)
Outside FL (1 800 433-3765)
Clarksburg, WV (1 304 624-5459)
Outside WV (1 800 532-2288)
Lafayette, IN (1 317 448-1611)
Within IN (1 800 382-7526)
Outside IN (1 800 428-7596)

MIDWEST CATV

A division of Midwest Corporation

More than supplies. Solutions.

When set-top converters were introduced about 20 years ago we accepted their high noise figure.

many cases this is a VSB-AM modulator. These modulators have intrinsic noise limitations. A good modulator would have 57 dB C/N.

- Supertrunk. This is the principal variable parameter in this discussion.
- Distribution. Distribution includes the trunk and feeder system. This is a secondary variable parameter in this discussion. A typical distribution system noise objective is 43 dB C/N.
- Set-top converter. Many cable systems use set-top converters. Their contribution to overall system noise performance is often overlooked. When set-top converters were introduced about 20 years ago we accepted their high noise figure without readjustment of typical service drop levels to compensate. Most set-top converters have noise figures in the 12 to 14 dB range even though most subscribers' TV sets have noise figures of 7 dB or better. A simple calculation of C/N in a set-top converter can be seen in Figure 1.

FIGURE 1

KTB Noise in 4 MHz BW / 75 ohms	-59 dBmV
Noise Figure	12 dB
Signal	0 dBmV
C/N	47 dB

The low gain of the set-top converter, typically 3 dB, causes some further noise degradation in the subscriber's receiver (about 0.5 dB in a 7 dB NF receiver).

In Table 1 the C/N of the supertrunk is varied from 53 dB to 62 dB to show the effect in this typical system. Note the small effect of supertrunk C/N on overall C/N in Figure 2.

The subscriber gets a C/N of 41 dB (within about one-tenth of one dB) whether the supertrunk is "good" (53 dB C/N) or "superlative" (62 dB). The noise contribution (C/N) of the distribution system is dominant. This example is illustrative of many FM supertrunk situations. Supertrunk performance would be "superlative" (C/N 62 dB) but the longer trunk cascades typical with FM supertrunks will usually hold distribution system C/N to 43 dB.

Table 2 shows the effect of improvement in the noise performance of the distribution system. In this case the supertrunk is assumed to be "good" (C/N 53 dB) and the distribution system C/N is varied from 40 to 49 dB.

Note that the overall system performance improves significantly as the distribution system performance is improved as shown in Figure 3.

Table 3 shows the effect of prospective system-design requirements for HDTV transmission in cable systems. Preliminary studies of transmission requirements for HDTV services in cable systems suggest that a C/N of 49 dB (4 MHz BW) at the subscriber's receiver will be required for satisfactory HDTV service. Achieving this C/N at the subscriber's receiver requires an improve-

Make no mistake—IPPV is big business. Even systems using phone ordering schemes have pulled in pay-per-view revenues of over $1 million in a single month. Now the equipment needed to *fully* tap this potential gold mine is at last available: Oak's Automatic Self Authorized Purchasing system—*SIGMA ASAP.*

DON'T ACT ON IMPULSE

'til you've seen *SIGMA ASAP.* It's cable's hottest new IPPV system—and a whole lot more.

With *SIGMA ASAP*, all the elements are finally present to make IPPV a continuous contributor to your revenue stream:

INSTANT PURCHASING. Buy programs right up to the time they start, or even in progress.

ADVANCE ORDERING. Buy in advance from a menu of upcoming events, or use the *SIGMA* decoder's built-in programmable timer.

IMPULSE MADE EASY. As simple as pressing two buttons. No phone calls, no mail-ins, no hassles.

SUBSCRIBER SECURITY. At the subscriber's option, *ASAP's* user-selectable electronic PIN lets subs prevent unauthorized purchases. And *SIGMA* encryption keeps credit and billing information accurate and private.

COMPLETE HOME MERCHANDISING. With *ASAP*, Subscribers can "impulse buy" from home shopping services or automatically "sign up" for additional premium channels. You can even offer merchandise for sale yourself and let your subscribers order it *automatically.*

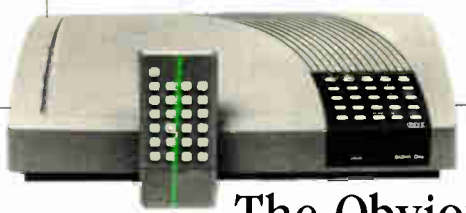
SUPERIOR STORE-AND-FORWARD TECHNOLOGY. Advance only as much credit as you want, individually, or use *SIGMA's* exclusive group addressing feature to match credit limits to system demographics.

GOT A SERVICE BOTTLENECK? Let your subs use *ASAP* to report trouble or request operator callbacks for service or billing questions.

FORGET ABOUT OBSOLESCENCE. *SIGMA* was designed to expand to meet new opportunities as they arise. Planning for two way cable? *ASAP* can report over phone lines or upstream over two-way cable systems.

The cost of all this capability? Get ready for a surprise. Because *ASAP* builds on the flexibility and software-driven power of the Sigma baseband addressable system, no other supplier can deliver so much for so little. Check the math and you'll see why *SIGMA ASAP* is the best equipment value on the market.

SIGMA Asap



OAK Communications Inc.

16516 Via Esprillo, Rancho Bernardo, CA 92127 (619) 451-1500

The Obvious Choice

Get a close look at *SIGMA ASAP* at the Western Show. Stop by and see us at Booth 200.

Reader Service Number 20

It seems very likely that noise bandwidth will be greater than 4 MHz.

FIGURE 2

Supertrunk	53.00	56.00	59.00	62.00
Sat & H-E & Sr-tk & Distr & Set-top	40.91	41.05	41.12	41.15

TABLE 1

System component noise summation

	C/N dB	C/N dB	C/N dB	C/N dB
Satellite receive	54.00	54.00	54.00	54.00
Headend signal process	57.00	57.00	57.00	57.00
Satellite & headend	52.24	52.24	52.24	52.24
Supertrunk	53.00	56.00	59.00	62.00
Sat & H-E & supertrunk	49.59	50.71	51.41	51.80
Distribution system	43.00	43.00	43.00	43.00
Sat & H-E & Sprtrnk & Distribution	42.14	42.32	42.41	42.46
Set-top converter	47.00	47.00	47.00	47.00
Sat & H-E & Sprtrnk & Distr & Set-top	40.91	41.05	41.12	41.15

FIGURE 3

Distribution system	40.00	43.00	46.00	49.00
Sat & H-E & Sprtrnk & Distr & Set-Top	38.83	40.91	42.51	43.61

ment in all the major subsystems. Performance of the subscriber terminal equipment (HDTV receiver) must also be improved to 55 dB C/N (equivalent) or better. This will probably require an increase in subscriber drop signal level.

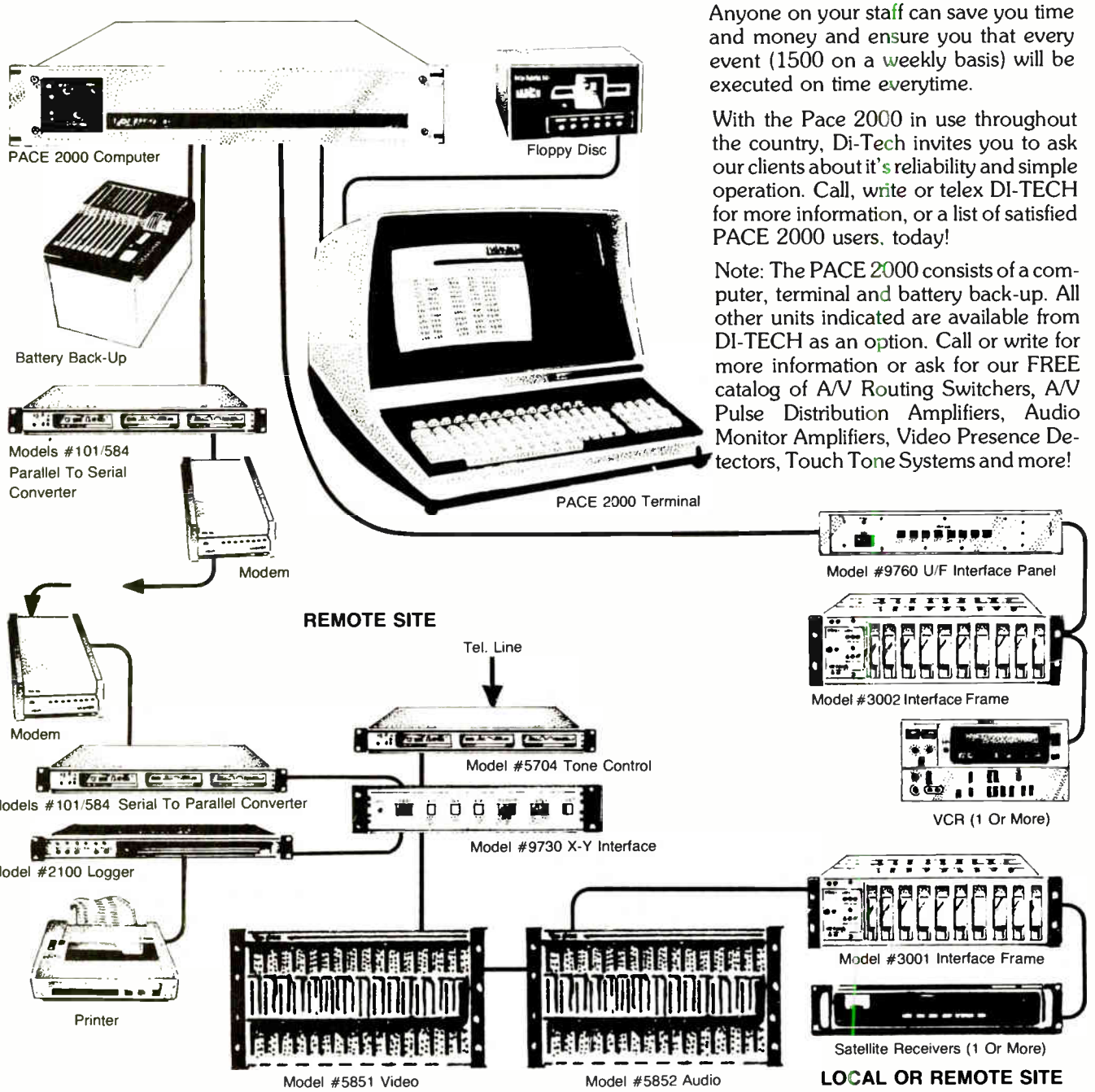
A simple calculation of C/N in a receiver can be seen in Figure 4.

It is not certain just what effective noise bandwidth and noise figure HDTV receivers will have. The 5 dB noise figure might be optimistic. It seems very likely that noise bandwidth will be greater than 4 MHz, implying higher signal levels than the +1 dBmV used in this sample calculation.

To achieve 49 dB at the subscriber's HDTV receiver the satellite receive system has been upgraded to 57 dB, the supertrunk has been upgraded to 56 dB, and the distribution system must be upgraded to 55 dB. Fifty-five dB distribution requires short cascades. Short cascades require multiple hubs. Multiple hubs require cost-effective,

Let Di-Tech's Pace 2000 Simplify Your Local Origination, Remote And Multiple Headend Requirements

With Real Time Automatic Control



5850AFV SWITCHING SYSTEM

Di-Tech's Pace 2000 is everything you want in an affordable weekly controller. Anyone on your staff can save you time and money and ensure you that every event (1500 on a weekly basis) will be executed on time everytime.

With the Pace 2000 in use throughout the country, Di-Tech invites you to ask our clients about it's reliability and simple operation. Call, write or telex DI-TECH for more information, or a list of satisfied PACE 2000 users, today!

Note: The PACE 2000 consists of a computer, terminal and battery back-up. All other units indicated are available from DI-TECH as an option. Call or write for more information or ask for our FREE catalog of A/V Routing Switchers, A/V Pulse Distribution Amplifiers, Audio Monitor Amplifiers, Video Presence Detectors, Touch Tone Systems and more!

di-tech

48 JEFRYN BOULEVARD DEER PARK, N.Y. 11729
TEL. #(516) 667-6300 TELEX #971806

Reader Service Number 22

Three transmission media are generally available for supertrunks: coaxial cable; microwave; and light-guide.

TABLE 2

System component noise summation

	C/N dB	C/N dB	C/N dB	C/N dB
Satellite receive	54.00	54.00	54.00	54.00
Headend signal process	57.00	57.00	57.00	57.00
Satellite & headend	52.24	52.24	52.24	52.24
Supertrunk	53.00	53.00	53.00	53.00
Sat & H-E & supertrunk	49.59	49.59	49.59	49.59
Distribution system	40.00	43.00	46.00	49.00
Sat & H-E & Sprtrnk & Distribution	39.55	42.14	44.42	46.28
Set-Top converter	47.00	47.00	47.00	47.00
Sat & H-E & Sr-tk & Distr & Set-Top	38.83	40.91	42.51	43.61

TABLE 3

System component noise summation

	C/N dB	C/N dB	C/N dB	C/N dB
Satellite receive	57.00	57.00	57.00	57.00
Headend signal process	57.00	57.00	57.00	57.00
Satellite & headend	53.99	53.99	53.99	53.99
Supertrunk	56.00	56.00	56.00	56.00
Sat & H-E & supertrunk	51.87	51.87	51.87	51.87
Distribution system	46.00	49.00	52.00	55.00
Sat & H-E & Sprtrnk & Distribution	45.00	47.19	48.92	50.15
HDTV receiver	55.00	55.00	55.00	55.00
Sat & H-E & Sprtnk & Distr & HDTV RX	44.59	46.53	47.97	48.92

FIGURE 4

KTB Noise in 4 MHz BW / 75 ohms	-59 dBmV
Noise Figure	5 dB
Signal	+1 dBmV
C/N	55 dB

high-performance supertrunking. VSB-AM microwave can fulfill this supertrunk requirement.

Distortion

There are similar considerations in overall system distortions, e.g. composite triple beat. Only supertrunks using FDM/VSB-AM will contribute distortions of this kind, but most of the supertrunk techniques contribute negligible distortion compared to the distribution system.

Supertrunks using VSB-AM

Three transmission media are generally available for supertrunks: coaxial cable; microwave; and light-guide.

Coaxial cable supertrunks using VSB-AM. A coaxial cable supertrunk can be considered a supertrunk only if it has significantly better performance than the distribution plant it serves. Otherwise it is really only part of the distribution system and has done nothing to improve overall system performance. Achieving the required performance in supertrunks of useful length requires amplifiers with extraordinary characteristics or cables with extraordinarily low loss.

Calculations of the noise accumulation in coaxial cable supertrunks suggest that cascades must be short or amplifier input and output levels must be raised considerably. (See Figure 5).

If the C/N for the supertrunk is to be at least 53 dB the cascade will be limited to six amplifiers—not a practical coaxial cable supertrunk in most circumstances. Increasing the cascade to 12 amplifiers requires increasing input signal level by 3 dB. This will increase output level by 3 dB and bear on the distortion performance of the supertrunk.

Feedforward amplifiers are available with low distortion but the designer might already be using these in

If the C/N for the supertrunk is to be at least 53 dB the cascade will be limited to six amplifiers.

the distribution plant and have used up available distortion "boudget" in the distribution system design.

Coaxial cable supertrunks must be considered as part of the main distribution system from system performance and reliability perspective. The problems of maintaining flatness of frequency response and control of system operating levels create a substantial maintenance burden. The reliability problem is compounded because the supertrunks add a significant number of amplifier stations and power-feed points to the system.

Microwave supertrunks using VSB-AM. Equipment and spectrum (12.7 to 13.2 GHz) has been available for this purpose for some years. Hughes Microwave Products is the principal manufacturer of this equipment ("AML"). Almost 1,000 multi-channel microwave systems have been installed and are operational in this country and other countries throughout the world. AML transmitters take a VSB-AM channel at "cable-VHF" frequencies (54 to 550 MHz) and heterodyne the channel into the 12.7 to 13.2 GHz band for transmission. Higher-power transmitters are channelized and combined into multiple multi-channel feeds, each directed to an individual receive site. The received signal is downconverted to cable-VHF frequencies in a single broad-band downconversion process. A phase-locking technique assures that the received downconverted multi-channel signal is coherent with the original input signals. No demodulation and remodulation is required. Broadband transmitters are now available. The broadband transmitters have broad-band upconversion to convert a multi-channel block from VHF to microwave. These broad-band transmitters have intermodulation and power limitations that restrict their use to shorter links and links with less critical distor-

FIGURE 5

KTB noise in 4 MHz BW / 75 ohms	-59 dBmV
Noise figure of typical trunk amplifier	9 dB
Amplifier input level	11 dBmV
C/N (single amplifier)	61 dB

AML advantages

Lightguide comparison

1. Headend processing and AML transmitters can be amortized over many hubs. AML transmitters have sufficient power to feed several transmit antennas. Overall cost of headend and hubs is lower than light-guide system for a multi-hub multi-channel system.

Laser diode light sources do not have sufficient power to permit power division to drive the several light-guides required to serve multiple hub sites. Individual lightguide cables are usually required to serve each hub.

2. No signal reprocessing required at hub sites. AML accepts VHF cable channels as input and delivers VHF cable channels as output.

Practical light-guide systems use frequency-modulation of an RF carrier which then intensity-modulates a laser-diode light source. Each hub requires a full complement of FM demodulators and VSB-AM remodulators—very expensive! A 60-channel light-guide served (FDM/FM) hub costs almost $500,000.

3. Transmission quality is adequate and can be adjusted to any reasonable standard as required. Cost/quality trade-offs are practical.

Transmission quality is excellent, but there are no significant economies if deliberate cost/quality trade-offs are desired, as may be the case in small systems.

4. Low cost of multi-channel, multi-hub system permits reduction of coaxial cable network cascade by facilitating multi-hub architecture.

The high cost of light-guide served hubs pressures system designers to use fewer hubs with consequently longer cascades than prudent design suggests. The superlative transmission quality of light-guide supertrunks is then wasted on the mediocre coaxial cable distribution out of these hubs.

5. AML requires no poles, ducts, make-ready or other problems and costs of cable system installation. No pole and/or duct rental or right-of-way expense. AML easily overcomes geographic obstacles—rivers, freeways, etc.

AML requires line-of-sight. Some climatic conditions (frequent heavy rainfall) can cause excessive fading. Light-guide systems can overcome these microwave path problems.

6. AML serves small isolated communities economically, as the incremental cost of adding a hub site is low. AML provides a low cost means of clustering small systems into more viable, more valuable economic units.

Light-guide served hubs are very expensive. Their cost is virtually independent of the number of households served by the hub.

The broadband transmitters have broadband upconversion to convert a multi-channel block from VHF to microwave.

AML advantages	Lightguide comparison
7. AML service can be restored quickly. Facilities are concentrated in main headend and hub sites.	A light-guide cable failure must be located, reached by service vehicles and repair (splice) effected.
8. Hub sites can be easily relocated if desired.	AML transmission quality is quite adequate—53—56 dB. As part of a lengthy transmission chain the difference between the "superlative" quality of lightguide transmission and the "adequate" quality of AML is negligible—less than one decibel.
9. AML permits "leapfrogging" where appropriate. Service sequence can be optimized to serve better prospects first.	AML can provide transmission capability consistent with current 550 MHz distribution systems. In most situations this can be doubled with frequency re-use. Several 120 channel AML systems are in service.
10. Superior transmission quality. S/N can be 60 dB or more. Intermodulation distortion can be quite imperceptible.	AML has years of favorable experience with subscriber tolerance of such fades in the very high proportion of the country in which AML propagation is satisfactory. AML systems can be designed to reduce such fades to almost any degree desired. Light-guide systems are subject to interruption due to dig-ups or other catastrophic damage to cables.
11. No channel capacity limitation. Channel capacity can be increased without limit by adding light-guide fibers.	Light-guide operated in digital mode is indeed state-of-the-art. Light-guide operated in analog mode is a special "niche" technology. The mainstream of light-guide technology and application is digital. Microwave has continuing important advantages for cable-TV supertrunking.
12. No transmission fades due to precipitation or other microwave propagation problems.	
13. Light-guide transmission is perceived as state-of-the-art. AML microwave is perceived as obsolete.	

tion specifications. Most microwave supertrunk applications use the Hughes "medium power" and "high power" channelized transmitters.

An AML transmitter installation can easily feed many hubs. The Hughes MTX-132 series ("medium-power") has up to 16 output ports, depending on the number of channels. The channelized "high-power" also has up to 16 output ports, depending on the number of channels. These ports provide sufficient power to permit further power-splitting to feed additional outputs. Transmitter cost is therefore independent of the number of hubs to be fed (for most practical situations). Additional waveguide and transmit antennas are required for extra hubs. Some situations requiring maximum power to a large number of receive sites might require the use of transmitters of higher power transmitters than would be needed to serve fewer sites. If a transmit tower is used instead of a roof-top or other existing adequate support structure there might be some extra cost for the added tower strength required to carry additional transmit antennas. These costs are, however, minor compared with the cost of establishing more hubs through cable supertrunks.

AML receivers are broadband downconverters that block-convert the microwave channels to VHF cable channels ready for direct connection to a broadband coaxial cable network. Hub site cost is low, as no channelized reception and modulation-conversion equipment is required. In many cases the AML receiver can be outdoors near the receive antenna. Where indoor operation is desired, the floor space requirement is modest and special climate control is usually not required. A typical AML hub site costs $15,000 to $40,000. AML receive hubs can economically serve communities as small as 100 homes.

The low cost of AML hubs encourages multi-hub designs with consequent short distribution cascades and improved distribution system performance. The use of improved distribution amplifiers—feedforward and power-multiplied types—enhances short cascades just as it enhances longer cascades. A short cascade with im-

A short cascade with improved distribution amplifiers will provide superlative performance.

proved distribution amplifiers will provide superlative performance. Subscriber S/N can be brought up to the high 40s from the low 40s. Preliminary studies of transmission requirements for HDTV services in cable systems suggest that a C/N of 49 dB (4 MHz BW) at the subscriber's receiver will be required for satisfactory HDTV service.

There are geographic situations in which microwave supertrunks provide a transmission advantage and those in which coaxial or fiber optic cables have an advantage. Microwave easily crosses geographic barriers that block cable routes. In some cases microwave routes can be blocked and more easily cleared by cables. Experience shows that it is usually easier and cheaper to coordinate and license an AML system than to clear rights and make-ready equivalent cable routes.

AML equipment is contained compactly in the transmit site and in the receive sites. An AML failure is either at one site or the other and can thus be easily traced and repaired. Coaxial or fiber optic cables are stretched across many miles of exposure to risk.

AML relocation requires relocation of hub site equipment, redirection of the microwave beam and rearrangement of the distribution links to the hub. Relocation of a coaxial or fiber optic cable served hub requires relocation of the terminal equipment, rearrangement of the distribution connection and extension and/or rearrangement of the coaxial cable.

Coaxial cable service is "linear"—i.e. to get from here to there the cable must traverse all the areas in between, whether the in-between areas have subscriber service potential or not. An AML microwave beam traverses these uneconomic areas without cost.

AML systems have successfully matched the expansion of channel capacity of broadband coaxial cable systems up to the current 550 MHz level. The FCC often makes some additional contiguous CARS band spectrum available. Some ingenious frequency re-use plans have been used and have proven economic where the extra channel capacity is required. Several dual cable 120-channel systems are currently using AML.

AML propagation characteristics have been proven satisfactory in all regions of the country if the systems are properly engineered and maintained to take account of rain-fade problems. Experienced operators of cable supertrunk systems now speak of "backhoe fade" as being more serious than the "rain-fade" that microwave systems occasionally experience. "Backhoe fades" cause much longer cable system outages than any microwave propagation rain-fade.

Light-guide supertrunks using VSB-AM. Light-guide supertrunks using FDM/VSB-AM have been demon-

'Backhoe fades' cause much longer cable system outages than any microwave propagation rain-fade.

strated with reduced channel loadings—in the four to six channel range. Intermodulation is a severe problem, principally because of the linearity limitations of the infrared light sources and the susceptibility of VSB-AM to intermodulation interference. Because VSB-AM does not have the noise-immunity advantages of other modulation techniques, the optical power requirement is increased, further aggravating the light source linearity problem. As the number of channels is increased, the linearity requirement becomes more stringent and the available light power is divided among even more channels, aggravating the noise budget. Light-guide supertrunks using FDM/VSB-AM are therefore not a practical option at this time. The enticing prospect of such trunks is, however, prompting development efforts in this field. The main body of worldwide light-guide development, however, is in non-linear modulation techniques, particularly digital modulation. Practical light-guide supertrunk application might well await a future major restructuring of cable TV systems to deliver digitally modulated TV signals direct to the subscriber's home.

Some special situations can effectively use light-guide supertrunks with non-linear modulation. A recent supertrunk design proposed for a cable TV system in Hong Kong uses digital (PCM) modulation for TV program transmission in a light-guide supertrunk system serving 14 hubs. AML frequencies (12.7 to 13.2 GHz) are not available in Hong Kong. The extremely high residential density in Hong Kong allows each hub to serve an average of 100,000 households with short-cascade, high-performance coaxial cable distribution from each hub. The same light-guide system would also be used to provide general purpose telecommunications services in the future. But, a very reliable, convenient cable route is available for this supertrunk—Hong Kong's modern rapid transit tunnel system. Hong Kong represents a very unusual situation, seldom encountered in cable systems in this country.

Conclusions

FDM/VSB-AM supertrunking, directly compatible with coaxial cable distribution from multiple hubs is the most cost-effective supertrunking technique. Rising performance expectations are imposing higher performance requirements on supertrunks. FDM/VSB-AM coaxial cable supertrunks have difficulty meeting these performance requirements, however FDM/VSB-AM microwave supertrunks can provide the required performance at affordable cost in most situations. Light-guide supertrunks using FDM/VSB-AM are an enticing prospect, but much development is required before such supertrunks become practical. ■

Contractor's callbook

AM Comm. Inc.. . . . . .(215) 536-1354
1 AM Drive
PO Box 505
Quakertown, PA 18951
PERSONNEL: Tom Saldi, President; Phillip Verruto, VP/Sales & Marketing; Mark Gross, National Sales Manager; Roger Stevens, Product Manager.
DESCRIPTION: Design, installation, certification, monitoring and maintenance of broadband CATV and LAN systems, telephone and fiber optic. Design, development and manufacturer of an off-premises addressable control and delivery system (TierGuard), and a broadband technical monitor and control system (LANguard).

Abcon Associates Inc.. . . .(516) 349-7760
45 Executive Drive
Plainview, NY 11803
PERSONNEL: Michael Zenobio, President; Frank Wedl, Vice President.
DESCRIPTION: Abcon Associates Inc. provides design, construction, and construction management of cable operation facilities, programming facilities, office buildings, etc.

Adderley Ind. Inc.. . . . . .(609) 227-8296
1405 Chews Landing Road
Laurel Springs, NJ 08021
PERSONNEL: Herb Adderley, President.
REGIONAL OFFICES: PO Box 16030, Philadelphia, PA 19114, (215) 638-1420.
DESCRIPTON: Adderly Industries, Inc. is an installation company operating in the Mid-Atlantic marketing area with the capability of operating nationwide. We do aerial and underground cable TV installation work, MDU's (Multiple Dwelling Units) as well as security and CCTV installations. We are a fully owned and certified minority company with excellent credentials.

American Cable Contractors.(303) 340-4620
(800) 521-9916
1700 Jasper St.
Ste. APO Box 110279
Aurora, CO 80011
PERSONNEL: Carl Occhionero, President; Mike Occhionero, Vice President.
DESCRIPTION: Experts in all areas of maintenance and construction for SMATV, CATV and TVRO systems. No job too large or too small.

American Earthstations, Inc..(503) 222-6000
0696 SW Bancroft St.
Portland, OR 97201
PERSONNEL: Norman Hotz, President.
REGIONAL OFFICES: 1140 Industrial Way, Tukwila, WA 98188, (206) 575-8888.
DESCRIPTION: Sell, install and service interactive cable systems along with terrestrial and satellite communications systems and local area networks.

American Utility
Construction Inc. . . . . .(318) 487-1352
1217 Texas Avenue
PO Box 7939
Alexandria, LA 71306
PERSONNEL: Delson Ryland, President; Fred Wilkes, Vice President.
DESCRIPTION: Construction of underground and aerial CATV facilities.

B-Line Construction. . . . .(704) 649-2853
75 Ammons Branch Road
Marshall, NC 28753
PERSONNEL: Bobby Ballard, Owner.
DESCRIPTION: Installation of underground cable television, buried house drops and aerial house drops. Also do system audits, trap installation, weather proof (drop connectors) and underground horizontal boring (any size).

145 N Wilson
Burleson, TX 76028
PERSONNEL: James Barker, President.
DESCRIPTION: Offers CATV construction. Includes: system activation, sweep and proof of performance, and total turnkey construction service. Electronic up-grade.

Bigham

Bigham Cable. . . . . .(904) 932-6869
Construction Inc.
PO Box 903
Gulf Breeze, FL 32561
PERSONNEL: Harold Bigham, President; Herb Biddle, Vice President.
REGIONAL OFFICES: 738 NW Renfro, Burleson, TX 76028, (817) 447-1960.
DESCRIPTION: Need your system rebuilt, upgraded, or new build, call: Bigham Cable Construction, Inc.

Burnup & Sims. . . . . .(404) 482-7612
Cable Comm. Inc.
6440 Hillandale Dr.
Lithonia, GA 30058
PERSONNEL: Robert S. Long, President; Larry Wallace, Executive Vice President; Phil McDonald, Vice President.
REGIONAL OFFICES: Smith Flat, CA (916) 622-7762, Mike Gepford/Vice President.
DESCRIPTION: Construction services including aerial, underground and conduit. Also do LAN installation and construction. Call us first for any of your construction needs.

C & S Construction Inc.. . .(412) 935-1553
PO Box 260
Northgate Dr.
Warrendale, PA 15086
PERSONNEL: William Summers, President; John Costick, Vice President; Richard Piltz, Sales Manager; Jim Scanlon, Operations Mgr. Netcon Div.
DESCRIPTION: Services provided for the CATV, MATV and CCTV industry. Includes aerial and underground construction, splicing and activation and performance testing. Netcon Div. specializes in local area network, broadband, baseband and fiber optic cabling and splicing. C & S construction is also a distributor for Jerrold electronics and cable.

CATV Subscriber
Services, Inc. . . . . (919) 273-5553
808 Summit Ave.
Greensboro, NC 27408
PERSONNEL: Raymond Galtelli, President; Josephine Galtelli, Vice President; Fred Robertson, VP/Operations.
DESCRIPTION: Providing full-service capability for mapping, design/engineering, construction marketing/sales, installation and consultation on individual or turnkey contract basis. Providing professional results in marketing for both new and remarket campaigns, and in both aerial and underground construction.

Cable Comm.. . . . . .(404) 376-5259
Construction, Inc.
(800) 342-4103
PO Box 1009
Hartwell, GA 30643-1009
PERSONNEL: John Williams Sr., President; John Williams Jr., Vice President; Marie Spaulding, Project Manager.
DESCRIPTION: A privately held, very responsive full service CATV technical support company located in Hartwell, GA. Currently, operations are conducted in the Southeast, however expansion programs are in progress which hopefully will result in nationwide activity. We provide aerial and underground construction, multi-unit prewire and building interconnect as well as communication internetting for voice, data, video and other local area services. Also offering a full range of technical services, from bench repair of outside plant equipment, to system sweep and analysis. We can

We won't walk away

'til it's turned on, and you're satisfied.

Cable Services can do your entire construction job, including design and field engineering. But our responsibility doesn't end there. We're also a full-line supplier of everything from the head-end to the drop materials. If you need service, we have a complete repair facility. And, if you need something overnight, we'll get it to you. All of this means fewer headaches for you.

We do the whole job. And we guarantee all of it.

Call TOLL FREE: **800-233-8452**
(In PA:) **800-332-8545**

Cable Services Company/Inc.

2113 Marydale Ave., Williamsport, PA 17701 • 717/323-8518

provide turnkey or labor services at competitive prices in both rural and urban markets.

Cable Constructors Inc.. . .(906) 774-6621
(800) 338-9292
105 Kent St.
PO Box 190
Iron Mountain, MI 49801
PERSONNEL: James Klungness, President; James Brandt, Executive Vice President; Charles Henry Senior, Vice President; John Jamar, Director of Marketing; David Sanders, Vice President/Engineering.
REGIONAL OFFICES: 505 Charlotte Road., Auburndale, FL 33823, (813) 965-2847; 149 Iroquois Ct., Lexington, KY 40503, (606) 278-7692.
DESCRIPTION: Complete turnkey construction, design, engineering and home installations.

Cable Consultants, Inc.. . .(404) 761-0854
PO Box 441
East Point, GA 30364
PERSONNEL: Gregory Bostwick, President; Michael Jones, Vice President; Mike Sullivan, VP; Cecil Halbert, Project Manager; Robert Williams, Project Engineer.
DESCRIPTION: Engineering and construction firm serving the communications industry. Engineering services: design, strand mapping, make ready and drafting. Construction services: aerial construction, underground construction, conduit construction, fiber optic installation, multi-unit construction, earth station and headend installation.

Cable Services Company Inc.

Cable Services Co. Inc.. .(717) 323-8518
(800) 233-8452
(800) 332-8545
Marydale Ave.
Williamsport, PA 17701-1498
PERSONNEL: John Roskowski, President; George Ferguson, VP; Robert Brantlinger, Dir. of Mktg; Harry Wahl, V.P./Trnky Sales.
DESCRIPTION: Complete turnkey supply and construction including pole walking, strand mapping, design, engineering and installations, both aerial and underground. Stocking distributor of all major manufacturers, plus on-premise repair facility.

Cable TV Contracting. . . .(816) 966-1736
9321 Fairwood Dr.
Kansas City, MO 64138
PERSONNEL: Ken Hathorn, Owner.
DESCRIPTION: CATV design, splicing, activation, pre-wire and post-wire installations. Speciality installations and digital RF communications, training and consulting. (See Clearvision Cable Const., Inc.)

Cablemasters Corp.. . . . .(814) 774-2616
2184 Rice Ave.
Lake City, PA 16423
PERSONNEL: Bernie Czarnecki, President; Tom Dow, Vice President.
DESCRIPTION: Aerial and underground construction services residential and MDU installations, strand mapping, make ready engineering, system design LAN networks. Turnkey available.

Cablevision Services Inc.. .(602) 833-2214
1064 S Center St.
Mesa, AZ 85202
PERSONNEL: Robert Boucher, President.
REGIONAL OFFICES: 205 S Berkeley Circle, Fullerton, CA 92633, (714) 525-5184; 762 Hwy. 121, Lewisville, TX 75067, (214) 221-5714.
DESCRIPTION: Full service CATV contractor; offering the CATV industry specialization in underground construction and all phases of installation. Special emphasis on multiple dwellings. Services also include system design, and turn-on balance.

CARPENTER CABLE CONSTRUCTION

Carpenter's Cable Const..(606) 598-6517
Route 3
Box 503B
Manchester, KY 40962
PERSONNEL: Cartis Carpenter, Owner.

BURNUP & SIMS

50 YEARS OF EXPERIENCE & SERVICE

Burnup & Sims earned its reputation in the telecommunications and cable television industries for full service, state-of-the-art cable installation. Fifty years of experience spanning a period of rapid development and radical change produced... a level of experience... an innovative business philosophy unmatched in our service industry.

CABLECOM, INC.

A BURNUP & SIMS COMPANY

6440 HILLANDALE DRIVE
LITHONIA, GEORGIA 30058
(800) 241-2105

Reader Service Number 28

Cavision Comm.. . . . . .(513) 667-4416
PO Box 308
Tipp City, OH 45371
PERSONNEL: John Gaston, President; Craig Gaston, Vice President; Andy Ruffin, Vice President/Aerial Const.; Doug Brown, V.P. LAN & Multi Dwelling; Frank Harkelroad, V.P. Underground Const.
DESCRIPTION: Complete CATV contractors; aerial and underground construction, strand mapping and design, and installation of residential multiple dwelling units.

Cecon, Inc.. . . . . .(814) 445-8921
PO Box 125
Berlin, PA 15530
PERSONNEL: Alan Charlton, President.
DESCRIPTION: Builders of cable TV and telephone systems. Services include drop installations, balancing and engineering, underground and aerial construction, make-ready and strand mapping.

ClearVision Cable. . . . . .(816) 966-1736
Constructors, Inc.
9321 Fairwood Dr.
Kansas City, MO 64138
PERSONNEL: Ken Hathorn, President; Gary Dixon, Vice President.
DESCRIPTION: Cable TV construction, splicing and activation. Complete construction services including aerial and underground construction turnkey services.

Clover Cable Systems. . . .(609) 785-0078
PO Box 2246
S Vineland, NJ 08360
PERSONNEL: Joseph O'Donnell, President; Roman Rakowsky, Vice President.
REGIONAL OFFICES: PO Box 43363, Las Vegas, NV 89104, (702) 384-8722.
DESCRIPTION: Engineering, design, drafting, and underground/aerial construction for the cable TV industry.

Coaxial Construction Corp..(303) 770-7700
4582 S Ulster St. Pkwy.
Ste. 1301
Denver, CO 80237
PERSONNEL: George Taylor, Executive VP; Blake Williams, Director of Operations.
DESCRIPTION: Total aerial and underground CATV construction services; stranding; cabling; splicing; activation; headends; microwave. Newbuilds and rebuilds. Related services through Coaxial Analysts, Coaxial Capital Corp. and Videophile Inc.

Cochran Comm. Const.. . .(619) 328-6778
36-630 Cathedral Canyon Dr.
Cathedral City, CA 92234
PERSONNEL: Mike Cochran, General Manager; Greg Williams, Engineering Manager; Vicki Cochran, Office Manager.
DESCRIPTION: Cochran Communications Const. is a broadband communications contractor serving the southern California area. Cochran has installed and serviced antenna, cable and satellite systems for the military and various CATV, SMATV, LAN and teleconference network companies.

Cra-Mac Cable Services, Inc..(919) 764-2764
PO Box 420
Welcome, NC 27374
PERSONNEL: Gary Craven, President; Martha Craven, Vice President; Steve Stone, VP/Sales Manager.
DESCRIPTION: Complete construction services for aerial and underground, apartment wiring, and turnkey services.

D.E. Gerrity Assoc.. . . . . .(714) 960-2491
CATV Services
PO Box 3359
Huntington Beach, CA 92605
PERSONNEL: Don Gerrity, President; James Scott, Vice President.
DESCRIPTION: Post-construction contract labor services.

Dinsmore Comm. Corp.. . .(603) 436-6344
(800) 238-2338
600 State St.
PO Box 4253
Portsmouth, NH 03801
PERSONNEL: Dennis Dinsmore, President; David Walters, Vice President; Peter Little, Sales Manager.
DESCRIPTION: Complete turnkey construction services for underground, aerial, and apartment pre- and post-wiring.

Early & Sons, Inc.. . . . . .(617) 374-8033
58 S Kimball St.
Bradford, MA 01830
PERSONNEL: Richard Early Jr., Vice President.
DESCRIPTION: Underground cable TV specialist.

English Enterprises. . . . .(305) 898-7134
Box 6494
Orlando,FL 32853
PERSONNEL: Gary English, President.
DESCRIPTION: Contract services to the cable industry; residential installations, underground drop buries, underground construction, MDU wiring, MDU design, pre- and post-wires, apartment activations, nonpay converter collections, tap audits, rebuild drop swings. One million installs since 1974. The professional choice.

Excalibur Cable Comm. Ltd..(703) 777-5905
(703) 451-7584
6 Loudon St. SW
Leesburg, VA 22075
PERSONNEL: Konrad Poth, President; Larry Gibson, Secretary/Treasurer/Chairman; Christopher McCarty, Vice President; James Connors, Vice President.
REGIONAL OFFICES: 8906 Telegraph Road, Lorton, VA 22079, (703) 339-8800.
DESCRIPTION: Excalibur is a CATV contracting and construction company specializing in residential installations, multi-unit, post-wires and pre-wires, turnkey high-rise construction and installations, underground construction and all related rough balancing and splicing. Field engineering and design work on apartment complexes is also provided.

Henkels & McCoy, Inc.. . . .(215) 283-7600
Jolly Road
Blue Bell, PA 19422
PERSONNEL: Joseph Barnett, Engineering Div. Mgr.
DESCRIPTION: All phases of engineering,

From basic to deluxe

ANIXTER® stocks the complete line of Jerrold convertors


Jerrold JSX


Jerrold Starcom VI DQN


Jerrold Starcom VI DP5
(DPV5 with volume control)

From the basic, to the most sophisticated model, Anixter has a Jerrold convertor to meet your requirements.

Jerrold JSX
The most widely-used non-addressable convertor in the industry. Basic 36-channel, electromechanical model offers durability and convenience at a reasonable price.

Jerrold Starcom VI DQN
An 82-channel digital convertor with all the latest subscriber features: parental guidance, channel wrap-around, barker channels, channel mapping, remote control, and last channel recall.

Jerrold Starcom VI DP5
Offers many addressable, impulse-ready, subscriber-pleasing features such as time-controlled programming and last channel recall. Also available is the Jerrold Starcom VI DPV5 with volume control.

No matter what features your subscribers desire (require), you can find the right Jerrold convertor at Anixter. To order, call toll free 1-800-323-0436.

ANIXTER® COMMUNICATIONS

CORPORATE HEADQUARTERS
ANIXTER BROS., INC., 4711 Golf Road, Skokie, IL 60076 (312) — Telex 289464

ANIXTER **DEPT. JERR.**
4711 Golf Rd., Skokie, IL 60076

☐ Please send me more information on Jerrold Convertors.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____ CED121

construction, and training. Presently our services include the following: Feasability studies, strand mapping, application/make ready survey, bills of materials, technical and engineering consulting services in all phases of cable TV, as-builts and post surveys, permit preparation, system activation/proof of performance, on-site maintenance personnel, training services (lineman to technicians), aerial and U.G. construction, make ready construction, tower and building foundations.

Interstate Dropline. . . . .(201) 535-9798
Installers Inc.
PO Box 128
Livingston, NJ 07039
PERSONNEL: Philip Collins Sr., President; Jerry Rufft, Operations Manager.
DESCRIPTION: Supplier of contract installations throughout the United States... providing drop installations, churn/service work, trapping, audits, MDU overwires, sales and marketing, collections, converter recovery, and drop rebuilds. Turnkey service available.

Irwin Industries Inc.. . . . .(213) 595-4747
2679 Redondo Ave.
Long Beach, CA 90806
PERSONNEL: Joe Crabtree, General Manager; Dennis O'Brien, Installation Manager; Sandy Sanders, Projects Manager.
DESCRIPTION: "Committed to service excellence." Customer installations, multiple dwelling units, plant construction and maintenance. Additional services: Engineering, RF Design, projenct management, equipment brokerage, rent a technician service, teleconferencing.

Kennedy Cable

Kennedy Cable. . . . . .(912) 557-4751
Construction, Inc.
(800) 841-4361
Hwy. 280 W
PO Box 760
Reidsville, GA 30453
PERSONNEL: Roger Kennedy Jr., President; Robert West, Vice President; Bob Skelton, Vice President.
REGIONAL OFFICES: Florida, (813) 439-3621.
DESCRIPTION: Aerial and underground line construction services, splicing and balance, strand mapping, engineering and design, splicing upgrades and rebuilds.

Knight Construction Co.. . .(313) 689-4030
1931 Austin Ave.
Troy, MI 48083
PERSONNEL: S.K. Knight, President; J.C. Hanley, Executive Vice President.
DESCRIPTION: Installs turnkey underground cable systems. Has installed over 2,000 miles of underground CATV in the last six years.

Lakeshore Cable. . . . . .(616) 759-4594
Contractors, Inc.
851 W. Laketon Ave.
Muskegon, MI 49441
DESCRIPTION: Aerial and underground construction, rebuilds, upgrades, strand map and design, as-built design, apartment post and pre-wires, complete residential box conversion programs, radiation and CLI, audits, drop transfers, splicing, drop installations and complete tap cap installation program.

Lightning Electric of Pennsylvania, Inc.

Lightning Electric. . . . .(717) 533-4983
of PA Inc.
RD 1 Box 148-B
Hershey, PA 17033
PERSONNEL: Joann Brong, President; Anthony Brong, GM/Lightning Elec. of PA Inc.; Paul Light, GM/Walton Towers.
REGIONAL OFFICES: Walton Tower Inc., Road 1, Box 148-B, Hershey, PA 17003 (717) 533-4983; SE Cable Construction Corp., PO Box 177, Callahan FL 32011, (904) 879-1311.
DESCRIPTION: Construction services including new, rebuild, line extension, underground and tower work, also pole line,

NaCom

A Full Service Communications Contractor
Specialists in: Installation, Construction, LAN

BUILDING COMMUNICATION SYSTEMS THROUGHOUT AMERICA

For more information about THE NACOM TEAM, please contact Eli McKay or Jerry Evans for CATV installation and construction contracts, or to join our team as an installer or construction worker with an excellent future, contact Judy Basham.

NaCom

1900 E. Dublin-Granville Rd.
Columbus, Ohio 43229

614/895-1313 · 800/848-3998 · FAX 614/895-8942

Reader Service Number 32

hardware, tap, traps and filters and house drops, installations, consultants in engineering, finance, earth stations, strand mapping and surge protection.

Lowe's Construction Co.. . .(214) 398-0725
1624 Murdock Road
Dallas, TX 75217
PERSONNEL: Mary Gonzales-Lowe, Owner.
DESCRIPTION: All phases of CATV construction, specializing in boring and trenching.

Mucip Cable TV Services. .(718) 712-3302
115-62 Dunkirk St.
New York, NY 11412-3043
PERSONNEL: Paul Mucci, President; Robert Cipolla, Vice President; Terence Mahon, Sales Manager.
DESCRIPTION: Established 1973. Contractor for residential installation, trapping, audits, electronic design, system construction of apartment buildings, underground construction and splicing.

Nacom Construction Corp.. .(614) 895-7307
(800) 848-3998
1900 E Dublin-Granville Road
Columbus, OH 43229
PERSONNEL: Bob Powelson, Chairman; Len Gibson, Vice Chairman; Larry Linhart, President & CEO; Jerry Evans, Vice President; Larry Brown, Vice President.
REGIONAL OFFICES: Phoenix; Houston; Dallas; Washington DC; Los Angeles; St. Louis; Louisville; Minneapolis; Columbus.
DESCRIPTION: Full service system installation services for CATV, LAN, and other telecommunications industries; plant and drops, indoor and outdoor; construction and engineering certification; aerial and underground coax, fiber, twisted pair; labor only or turnkey. LAN Division specializes in broadband and Ethernet LAN cabling systems design, installation and certification.

Overland Cable. . . . . .(303) 337-0876
2855 S. Ursula Court
Aurora, CO 80014
PERSONNEL: Matt Mays, Co-Owner; Tom Randolph, Co-Owner.
DESCRIPTION: Quality CATV construction specializing in aerial rebuilds and new-builds.

Pearl, J.C. Ltd.. . . . . .(716) 882-0500
50 Brayton St.
Buffalo, NY 14213
DESCRIPTION: Cable TV sub-contractor.

Professional Line. . . . . .(616) 924-6405
Construction
3250 Van Wagoner Ave.
Fremont, MI 49412
PERSONNEL: Charles Lathrop, President.
DESCRIPTION: CATV aerial construction.

Pyramid Cable Services Inc..(305) 729-8803
7805 Ellis Road
W Melbourne, FL 32904
PERSONNEL: Joseph McCool, President; Robert Abbott, General Manager; Bob Black, Operations Manager; Skip Dawsey, Account Representative.
REGIONAL OFFICES: 760 Warehouse Dr., Unit E, Toledo, OH 43615, (419) 382-5152, (800) 433-1129.
DESCRIPTION: Complete turnkey contractor, installations, pre-wiring, post-wiring, underground and aerial construction, splicing, headend set up, earth station and tower construction.

Quality Cable Underground.(303) 693-0457
PO Box 4835
Englewood, CO 80155
PERSONNEL: Daniel Levad, President.
DESCRIPTION: Underground installation for cable TV, phone, joint and wrench. Street crossings, boring, post-and pre-wire, splicing, construction.

R & L Cable Installation. . .(419) 229-3400
702 E Michigan Ave.
Lima, OH 45801
PERSONNEL: Rodger Wauben, President; C. Lynn Wauben, Vice President.
DESCRIPTION: Aerial and underground drop installations, systems service work, post- and pre-wires, drop rebuilds and systems audits.

RFI Comm., Inc.. . . . . .(408) 298-5400
360 Turtle Creek Ct.
San Jose, CA 95125
PERSONNEL: Lawrence Reece, CEO; Dale Kirkland, COO; Dale McComb, VP
K REGIONAL OFFICES: 6195 SW 112th St., Beaverton, OR 97005, (503) 626-6387; 3031 E. Coronado, Ste. G, Anaheim, CA 92806, (714) 666-2330; 20425 258th Ave.

SE, Maple Valley, WA 98038, (206) 432-2455.
DESCRIPTION: RFI Enterprises and its subsidiaries, RFI Communications, RFI Electronics and RFI Security, is a total systems integrator which provides engineering and consulting, materials supply and installation, customer service and systems maintenance for the following systems: CATV, MATV, CCTV, broadband LAN, Ethernet LAN, fiber optics, video, security, card access, fire alarm, fire suppression, life safety, audio, multi-media, telephone and various baseband computer systems.

Ross Comm. Inc.. . . . . .(215) 776-7330
1633 N. 26th St.
PO Box 413 (Zip 18105)
Allentown, PA 18104
PERSONNEL: William Ross, President.
DESCRIPTION: Provide aerial and underground construction services, MDU, splicing and engineering.

SDI Services Inc.. . . . . .(305) 791-3451
2521 NW 6th St.
Fort Lauderdale, FL 33311
DESCRIPTION: Full service cable TV company. Feasability studies, site survey, engineering, design, strand mapping, make ready, headend and system construction, aerial and underground construction, post- and pre-wiring, system management and maintenance.

SJC Cable Splicers Inc.. . .(517) 821-5900
9142 W Higgins Lake Dr.
Roscommon, MI 48653
PERSONNEL: Steve Collini, President.
DESCRIPTION: Experienced with all types of cable, connectors, and equipment associated with modern cable systems; dual or single with institutional; aerial or underground. "We do one job and do it best." Experienced with "hot" upgrades or rebuilds of CATV plant.

Satellite Cable Specialists. .(802) 773-4006
PO Box 1807
Station A
Rutland, VT 05701
DESCRIPTION: CATV construction company serving the CATV industry since 1979. Specializing in overhead construction, rebuilds and newbuilds. Pre-wiring, installations, audits, mapping and design.

Schenck construction

Schenck Construction. . .(206) 867-9694
15042 NE 95th
PO Box 3159
Redmond, WA 98073-3159
PERSONNEL: Ed Schenck, President; Bud Longnecker, VP; Imel Wheat, VP.
DESCRIPTION: Aerial and underground cable TV constructinon; turnkey.

Sigmacom. . . . . .(416) 666-1991
111 Indunstridal Dr. Unit #5
Whitby, Ontaorio Canada L1oN 5Z9
PERSONNEL: Randy Zedic, President; Mike Taylor, VP; Al Smelko, Sales Manager.
DESCRIPTION: Cable MA-CATV-SMATV, design, engineering, special audio up- and down-linking, data carrier systems.

Sir Enterprises. . . . . .(804) 845-8722
(800) 759-4242
2459 Campbell Ave.
Lynchburg, VA 24501
PERSONNEL: Elbert Yeatts, President; Gary Irvy, Chief Engineer.
DESCRIPTION: Full service CATV construction specializing in aerial and underground construction, system activations, upgrades, rebuilds, maintenance, design, etc.

Southeast Cable. . . . . .(904) 879-1311
Construction Corp.
PO Box 177
Callahan, FL 32011
PERSONNEL: Joann Brong, President; Anthony Brong, General Manager.
DESCRIPTION: Construction for cable TV companies.

Southland Underground
CATV Inc. . . . . .(800) 228-2151
#28 Industrial Loop
Ste. 176
Orange Park, FL 32073
PERSONNEL: Richard Barnett, President; Roger Barnett, VP; Jon Eckert, Mgr/Titusville; Donnie Damico, Mgr/Clearwater; Martin Wakula, Mgr/Turnersville, NJ
REGIONAL OFFICES: 12570 66th St.. N

Largo, FL 33540, (813) 576-0204; 2313 Mountain Road, Pasadena, MD 21122, (301) 437-9101, Joseph Hamil, Manager; #28 Industrial Loop, Orange Park, FL 32073, (904) 264-1003.
DESCRIPTION: Provide all phases of CATV construction strand mapping, design, turn on etc., for both underground and aerial; unit prices as well as turnkey.

Stark & Associates. . . . . .(404) 962-4800
490 Buford Dr.
Lawrenceville, GA 30245
PERSONNEL: James Stark, President; Jack Walker, Vice President.
DESCRIPTION: Engineering consulting to SMATV and CATV; industrial manufacturer rep for major lines. Feature nationwide construction capacity.

Superior Cablevision. . . . .(201) 992-1792
Installers Inc.
PO Box 128
Livingston, NJ 07039
PERSONNEL: Phillip Collins Sr., President; Jerry Rufft, Director of Operations; Cheryl Collins, Controller.
DESCRIPTION: Superior provides drop installations, multiple dwelling overwires, trapping, service changes, drop changeovers (old to new plant), sales and marketing through its various contract installers. With regard to drop installations, both aerial and underground are completed either with or without a turnkey approach.

System Services Cable. . . .(805) 688-7720
Construction Inc.
3681 Sagunto Road
PO Box 755
Santa Ynez, CA 93460
PERSONNEL: R. Scott, President; Valerie Scott, VP; Jeff Williamson, Engineering.
DESCRIPTION: Specializing in a full line of services. Overhead, underground, installation, pre-wiring, post-wiring, and general maintenance. Engineering services, walk-out and design, auditing and management consulting.

Technetronics Inc.. . . . .(914) 561-7880
192 Route 9W
New Windsor, NY 12550
PERSONNEL: Andrew Healey, President; Donald Davidson Jr., Vice President.
DESCRIPTION: Full service communications construction engineering company. Specializing in rebuilds, upgrades and turnkeys. All services available EFI.

U.S. Cable Inc.. . . . . .(414) 733-3321
2911 N Ballard Road
Appleton, WI 54913
PERSONNEL: Glenn Mullen, President; Jerry Wood, Vice President; Robert Frazier, Secretary.
REGIONAL OFFICES: 421 Terra Lane West, O'Fallon, MO 63366, (314) 272-2020.
DESCRIPTION: Utility contractors for cable TV, telephone and LAN networks.

U S Television Systems Inc..(512) 454-5779
(800) 252-9742
914 Banyon St.
Austin, TX 78757
PERSONNEL: T. Burger Jr., President; Howard Kay, Vice President.
DESCRIPTION: Provide system design, system alignment, proof of performance, FCC compliance testing, amplifier repair, construction, aerial and underground.

Underground Piercing Inc..(612) 425-4172
PO Box 225
Osseo, MN 55369
PERSONNEL: Virgil Dittes, President; Jim Dittes, Vice President.
DESCRIPTION: We specialize in boring streets, driveways, sidewalks, lawns and shrubs, etc. We have mobile units designed specifically for underground boring and pipe or conduit installation.

White Mountain Cable Construction Corp.. . . . . .(603) 736-4766
PO Box 459
Epsom, NH 03234
PERSONNEL: Dennis Nolin, President; David Pouliotte, Vice President; William Hinton, VP/Operations.
DESCRIPTION: Total service cable construction. Modified turnkey and retrofit of electronics. White Mountain covers the eastern United States.

Williams, L.W.. . . . . .(502) 651-5638
Contractor Inc.
Rte. 3 Box 46-A
Glasgow, KY 42141
PERSONNEL: L. Williams, President; James Myers III, General Manager.
DESCRIPTION: CATV contractor: aerial, underground, splicing, installation, etc.

Wrubel Construction Co..(317) 299-4507
PO Box 53140
Indianapolis, IN 46253-0140
PERSONNEL: Jay C. Wrubel, President; Joe J. Wrubel, Vice President; Ginger Auel, Office Manager.
REGIONAL OFFICES: Saint Louis Area, 2210 North Illinois St., Suite A, Belleville, Illinois 62221.
DESCRIPTION: Complete aerial and underground construction from strand map to activation and system audit. Quality construction built to accepted industry standards and specifications in new build, rebuild or upgrade situations.

Take A Closer Look At The New Commercial Inserter With Everything You Need

The ComSerter-192

The Best Just Got Better

Texscan MSI presents the latest advance in commercial insertion: The ComSerter-192. Like its predecessor, the popular ComSerter-92, the new model CSR-192 provides single channel integrity, full random access, complete logging, affidavits and compatibility with all other ComSerter models. As all other Texscan MSI products, the CSR-192 is setting the standard for quality and reliability. But there's much more...

Texscan MSI CORPORATION

New Features

- Full Stereo VCR Capabilities
- CMOS Non-Volatile Memory
- Auxiliary Source Input for Secondary Video
- Preview Before Air
- Simplified Tape Marking
- External Video Processor Loop
- Streamlined Single Board Design
- Full Audio and Video A.G.C.

See us at the Western Show, Booth No. 228

No Increase In Price

And best of all, the CSR-192 gives you these many added features without adding to the price.

For more information on the ComSerter-192 and our complete line of commercial insertion products, call 800-367-6011, 800-777-2227, or write to Texscan MSI Corp., 124 Charles Lindbergh Dr., Salt Lake City, UT 84116.

Reader Service Number 37

Cue tone code list

This is the most current list of audio cue tone codes used by satellite programmers to signal local commercial insertion equipment. List provided by Monroe Electronics.

Source	Code Use	Code
ABC	Spare	015*/#
ABC	Commercial	807*/#
ACTS	Program On/Off	905*/#
ACTS	Commercial	925*/#
ACTS	Local Orig	935*/#
ACTS	Program On/Off	945*/#
AETN	Program On/Off	194*/#
AETN	Spare	516*/#
AMC	Program On/Off	329*/#
American Value	Program On/Off	086*/#
Arts	Program On/Off	637*/#
BET	Program On/Off	406*/#
Bravo	Program On/Off	513*/#
Cable Vision Sy		256*/#
Cable Vision Sy		381*/#
CBN	Commercial	414*/#
CBN	Commercial	568*/#
CBN	Spare	715*/#
CMN	Program On/Off	043*/#
CMN	Commercial	867*/#
CNN	Spare	017*/#
CNN	Commercial	024*/#
CNN Headline	Spare	541*/#
CNN Headline	Main	635*/#
College Sports	Commercial	013*/#
Country MTV	Commercial	468*/#
CSPAN	Program On/Off	195*/#
CVN	Program On/Off	135*/#
Daytime	Program On/Off	307*/#
Discovery	Program On/Off	491*/#
Discovery	Commercial	826*/#
Discovery	Aff. Breaks	970*/#
Discovery (G/W)	Program On/Off	164*/#
Disney Channel	On/Off-East	617*/#
Disney Channel	On/Off-West	834*/#
Entertain. Mktg.	Program On/Off	420*/#
ESPN	Commercial	048*/#
EWTN	Program On/Off	762*/#
Fashion Channel	Program On/Off	187*/#
Fashion Channel	Commercial	658*/#
FNN	Commercial	401*/#
FNN	Program On/Off	738*/#
FNN	Commercial	975*/#
Galavision	Program On/Off	453*/#
HBO	Program On/Off	729*/#
HBO	Scramble	835*/#
Hit Video	Commercial	316*/#
Home Sports	Commercial	156*/#
Home Sports Ent.	Program On/Off	392*/#
Home Sports Ent.	Dallas/Time Share	604*/#
Home Sports Ent.	Houston/Time Share	943*/#
Home Team Sports	Commercial	632*/#
Home Team Sports	Commercial	740*/#
HSN1	Local Avail	075*/#
HSN1		243*/#
HSN1		421*/#
HTN Plus	Program On/Off	207*/#
Learning Ch.	Program On/Off	192*/#
Lifetime	Commercial	361*/#
Movietime	Commercial	386*/#
Movietime	Program On/Off	716*/#
MSG	Program On/Off	019*/#
MSG	Commercial	767*/#
MTV		152*/#
Nashville	Spare	514*/#
Nashville	Commercial	674*/#
Nashville	Spare	743*/#
Nashville	Program On/Off	866*/#
NCN	Program On/Off	073*/#
NCN	Spare	108*/#
NESN	Special	103*/#
NESN	Program On/Off	472*/#
Nickelodeon	Commercial	749*/#
Nostalgia Ch.	Program On/Off	872*/#
Ontario	Program On/Off	306*/#
Ontario	Spare	470*/#
Playboy Ch.	Program On/Off	869*/#
Prime Ticket	Program On/Off	125*/#
Prime Ticket		786*/#
Pro Am Sports	Program On/Off	173*/#
S.F. Giants	Program On/Off	182*/#
S.F. Giants	Commercial	279*/#
Select TV	Roll Thru	539*/#
Select TV	Spare	619*/#
Select TV	12 Hr In/Out	721*/#
Select TV	Adult	840*/#
Showtime	Sports	186*/#
Showtime	Program On/Off	576*/#
Showtime	On-Line	679*/#
Showtime	Off-Line	753*/#
Sky-Merchant	Program On/Off	193*/#
Sky-Merchant	Commercial	603*/#
Spanish Intl.	Spare	624*/#
Spanish Intl.	Program On/Off	819*/#
SPN	Commercial	429*/#
SPN	Spare	517*/#
Sports Ch. N.E.	Commercial	038*/#
Sports Ch. N.E.	Program On/Off	290*/#
Sports Ch. N.E.	Program On/Off	523*/#
Sports Ch. N.E.	Spare	876*/#
Sports Ch. Plus	Commercial	536*/#
Sports Ch. Plus	Program On/Off	983*/#
Sports Channel	Program On/Off	143*/#
Sportstime	Spare	904*/#
Sportstime	Commercial	915*/#
Sportstime	Spare	936*/#
Sportstime	Program On/Off	987*/#
Sportsvision	Commercial	023*/#
Sportsvision	Program On/Off	205*/#
Sportsvision	Spare	412*/#
Sportsvision	Spare	756*/#
Tulsa	Program On/Off	426*/#
Tulsa	Commercial	423*/#
University Net	Spare	579*/#
University Net	Spare	777*/#
University Net	Spare	895*/#
University Net	Commercial	937*/#
UPI	Program On/Off	276*/#
USA	English Net	168*/#
USA	Blue Net-On/Off	295*/#
USA	Program On/Off	438*/#
USA	Commercial	601*/#
USA	Baseball	706*/#
Warner-Amex Sat	Nick/Arts-East	311*/#
Warner-Amex Sat	Nick/Arts-West	519*/#
Weather Channel	Commercial	350*/#

"Our goal was simple: to create the most capable ad insertion tool ever devised. I don't mind saying, we've succeeded."

— Bill Killion, President, Channelmatic, Inc.

The ADCART 2+2
Random Access Ad Insertion System

★ A Quantum Leap

We weren't looking for a few enhancements or improvements. We were aiming for a quantum leap. We wanted new hardware running new software that would redefine the way systems managed and executed their local ad sales programs. Above all, we wanted a system virtually anyone could set up and operate, and at a price less than any other full-featured random access system. From now on, when people define what a system should do for the insertion of ads into cable programming, they will point to the ADCART 2+2 system.

★ Vertically Integrated Software

With ADCART 2+2 everything you need to set-up and program a random-access schedule is integrated into the software system. Starting with the first screen you see on the CRT terminal, every step and function flows naturally from the previous step, guided by simple, plain English statements and headings. The step to our traffic and billing software package flows just as naturally and easily by virtue of system architecture that was designed from the outset to do exactly that.

★ Flexible Channel Assignment

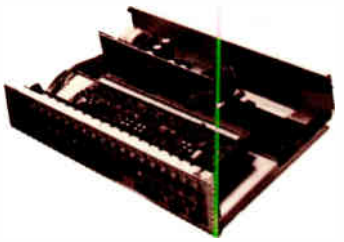
Flexibility is the byword for ADCART 2+2 systems. Insert on virtually any number of channels. Assign VCRs to fit your avails: two on two channels, four on one channel, or share four between two channels without overlapped avails.

★ Modular System Design Aids Trend Toward Interconnects

State of the art software running on state of the art hardware — ADCART 2+2 uses the latest 16-bit CMOS microprocessors and real-time, multi-tasking software developed by experts in advanced traffic and scheduling concepts. Open-ended modular system design enables operators to easily adapt system configuration to new requirements of a rapidly-evolving cable environment. ADCART 2+2 is already becoming the de facto standard in new interconnect designs.

★ ADCART 2+2 Benchmarks

- ★ Full stereo audio
- ★ New proprietary tape encoding technique allows full stereo even with current VCRs or allows full Sony® frame-code addressability
- ★ Compact size (3 1/2" rack height)
- ★ Front panel status display
- ★ All-channel CRT status display
- ★ Computer-adjusted audio levels
- ★ Full stereo audio/video preview bus
- ★ Memory backup without batteries
- ★ Latest A/V IC multiplexing and switching circuitry
- ★ Critical system configuration files stored in non-volatile RAM
- ★ User-friendly user interface
- ★ Full error reporting
- ★ Audio and video processing equipment inputs for TBC and stereo simulator
- ★ Unlimited system expansion capability
- ★ Extra auxiliary inputs for message generators, etc.
- ★ Lowest cost per benefits of any unit available



CHANNELMATIC, INC.
821 Tavern Rd. Alpine, CA 92001
(800) 231-1618 or (619)445-2691

The recognized leader in ad insertion.
More than 4500 channels in operation

®Registered trademark of Sony Corporation

Reader Service Number 38

Also introducing a new standby supply for computers and peripherals is Power Technologies.

Power Technologies of Redmond, Wash. makes both standby and UPS versions of its power supplies. Circle Reader Service number 102 for details.

Power Guard of Hull, Ga. also has standby units, with a switching time of about 15 milliseconds. Circle Reader Service number 103 for details.

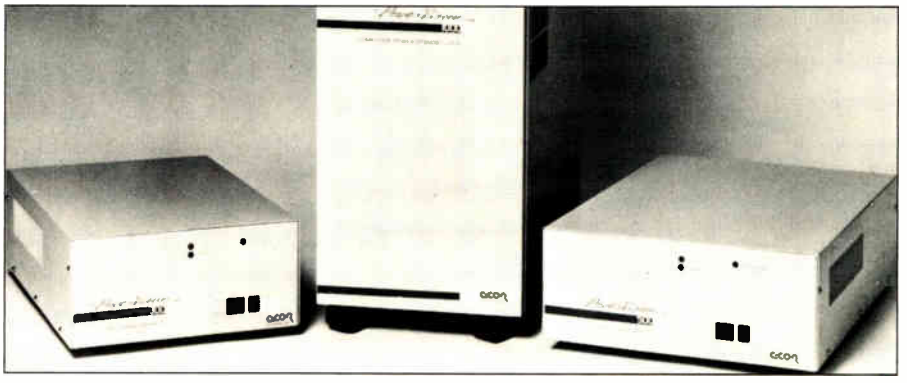
RMS Electronics, based in the Bronx, N.Y., has a standby unit that switches in 16 milliseconds. Circle Reader Service number 104 for details.

C-Cor Electronics has renamed its network powering equipment after briefly flirting with the idea of getting out of the business. The Model 1543 standby supply offers four hours of 15 amp service at either 30 or 60 volts. Transfer time is 16 milliseconds. The Model 1546 offers eight hours of standby time at full load. The Model 1142 and 1142-100 units are compact units offering 2.25- and two-hour standby powering at full load. The Model 5343 is an uninterruptible supply furnishing 60 and 120 VAC outputs with zero transfer time. The Models 4340 and 4440 are redundant rack-mount and wall-mount supplies. Circle Reader Service number 104 for details.

Some of these vendors, Alpha Technologies, Burnup & Sims, C-Cor Electronics and Cable Power Technologies, for example, also make UPS/SPS systems designed to power computers or other peripherals connected to a broadband network.

Alpha's 125, 250, 500 and 1000 models provide continuous power, line conditioning and surge suppression for PCs, telephone systems and other equipment. The model numbers refer to output in watts. The model 1000 has automatic self-testing, remote status and alarm monitoring capabilities. The company's newer line of ferroresonant UPS units are designed to cover the critical range between 500 and 1,000 VA useful for minicomputers, an entire broadband headend or a rack of equipment, for example. For higher power applications there are 1,500, 2,000 and 3,000 VA units as well. Circle Reader Service number 105 for details.

C-Cor Electronics also has introduced a new line of standby systems in 300, 500 and 1,000 watt versions. All versions come with a standard three-year warranty. Equipped with audible alarm features and LED displays for AC output, overload and battery output conditions, the units transfer in less than 4 milliseconds. The new standby units also offer surge suppression and noise filtering for normal and inverter modes. Marketed under the "PowerVision" label, 1 KVA, 2 KVA and 3 KVA on-line UPS versions also are available for higher power applications. Circle Reader Service number 106 for details.

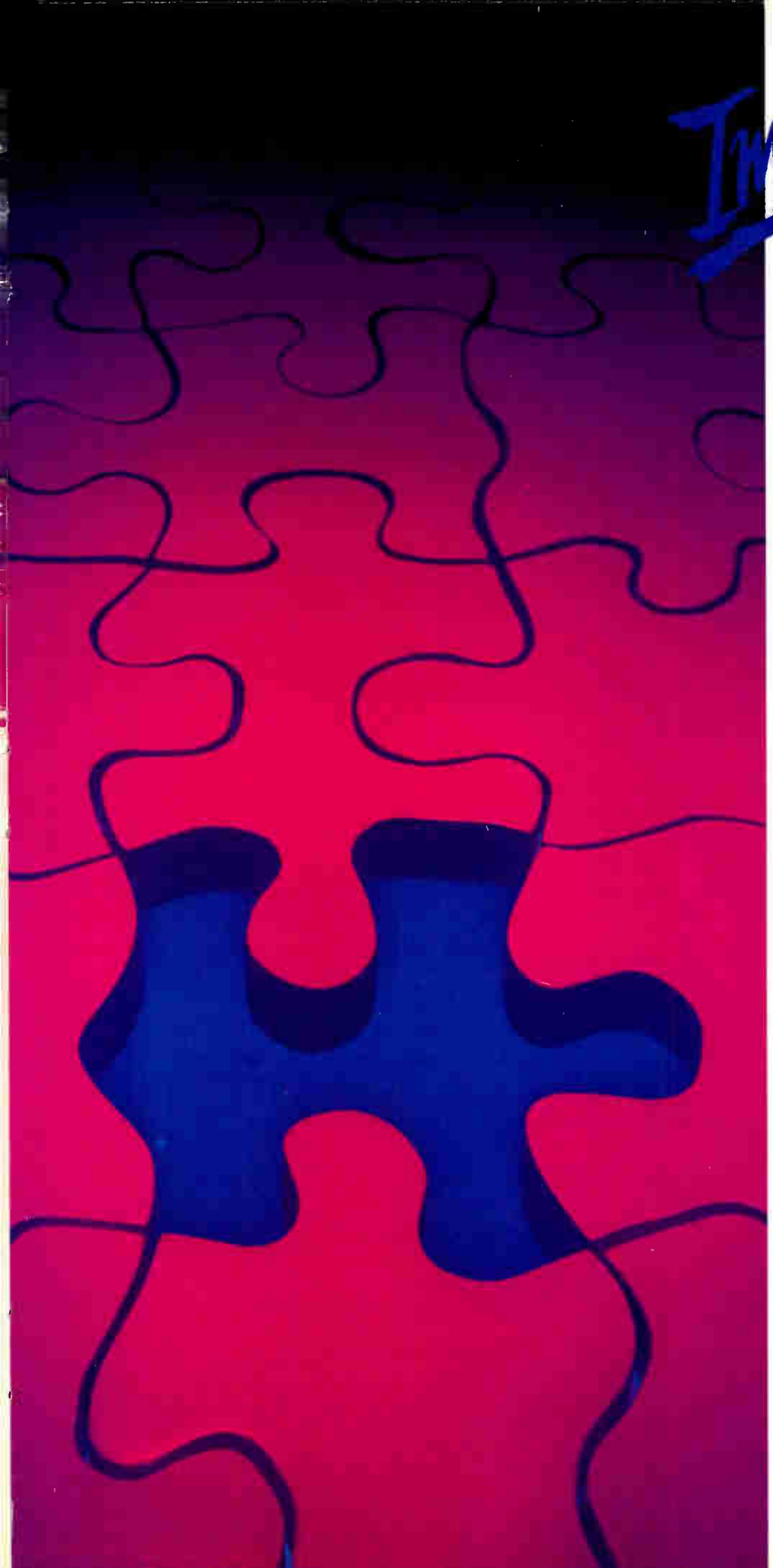


C-COR's 1,000 watt standby system

Also introducing a new standby supply for computers and peripherals is Power Technologies of Redmond, Wash. Its new UPS unit provides surge, short circuit, blackout and brownout protection. It uses a maintenance-free battery and produces true sine wave output. Circle Reader Service number 107 for details.

The Lectro division of Burnup & Sims also has manufactured for some time a backup supply designed for computer and other office device powering. Circle Reader Service number 108 for details.

—Gary Kim



Impulse solves the pay-per-view puzzle.

Pay-Per-View is here and growing fast. Last year alone, the number of homes able to receive PPV service doubled and PPV revenues soared.

If you're considering Pay-Per-View but are puzzled about which technology is right for you, consider the benefits of Impulse Pay-Per-View with General Instrument's TOCOM 5503-VIP converter:

- TOCOM 5503-VIP addressable converters are impulse-ready NOW, eliminating converter obsolescence.
- Instant access to PPV programming via the TOCOM 5503-VIP remote gives subscribers the convenience of arm chair ordering, generating higher buy rates.
- The TOCOM 5503-VIP uses field-proven store-and-forward technology, providing last minute ordering capability without peak load constraints.
- TOCOM's fully integrated software and system support is compatible with most major billing systems, PPV programming services and PPV ordering methods.

Get in on PPV profits now with the TOCOM 5503-VIP — the Impulse converter that easily solves the Pay-Per-View puzzle.

TOCOM Impulse can be implemented in your system today! To find out how, contact your Jerrold Account Executive or call the General Instrument/TOCOM Marketing Department at 214/438-7691.

GENERAL INSTRUMENT

Reader Service Number 41

Time domain reflectometry

How to test the integrity of your cabling.

Structural return loss, also referred to as simply return loss, is a measure of how much signal will be reflected back toward a transmission source as that signal travels through a broadband cable. SRL refers to reflections caused by the inevitable mechanical irregularities that any given cable will have as a result of the manufacturing process. Also known as voltage standing wave ratio, it is a more general measurement of the reflection coefficient for a given transmission line or device inserted onto the transmission line.

Typically, return loss will be lowest for cable, moderate for passives and highest for amplifiers. Mismatches in cable might typically cause reflections that are 30 dB below carrier level while mismatches in passives such as taps might cause reflections that are 20 dB below video level. Amplifiers might cause reflections that are 16 to 18 dB below video level, for example.

Impedance mismatches, which typically are caused by unterminated ports, physically damaged cable, moisture in the cable or corroded connectors and fittings, are the cause of the reflected signals. In fact, it's almost impossible to prevent some degree of mismatch as signals move from cable to circuit boards or discrete components; from cable to taps, splitters or couplings. The reflections will not only cancel transmission energy but also cause distortion of the carrier waveforms and therefore bit errors.

Impedance is the opposition to an alternating current offered by a length of cable, tap, connector, terminator or other device through which a signal passes on a broadband network. When all cabling and devices on a broadband LAN have exactly 75 ohms impedance no signal will be reflected back toward a transmitter on the network because all signals generated by the transmission source are fully absorbed by the load. But whenever a mismatch occurs, some portion of the signal is reflected back toward the source because it is incompletely absorbed. A cut cable has an impedance of infinity and reflects 100 percent of the signal, for example.

Periodicity can affect the severity of reflections. If reflection-causing devices are spaced in such a way that they fall at odd multiples of the wavelength, the reflections may be out of phase and will tend to cancel each other. On the other hand, if the reflection-causing devices are spaced such that the wavelengths are even multiples, the reflected signals may tend to be in phase and hence will add to each other.

To ensure cable integrity, an SRL test should be made before drop or

We don't follow anybody's footsteps. We make 'em.

One of the ways we are leading the industry is in the production of high-quality components at truly competitive costs. Another is in providing a truly one-step answer to all your CATV, MATV or SMATV problems, ranging from individual components to complete systems.

We will customize your headend system, decision by decision. And in one week, you'll have a complete, easy-to-set-up package, at unbeatable cost efficiencies and not just pre-assembled, but practically pre-installed.

Take advantage of our years of experience in Cable TV, Master Antenna and Private Cable headend applications. Call us for a quote on your particular headend needs, or, for our free 750-item catalog. Toll-free (800) 252-7889. In California, (800) 572-6262 or (818) 706-1940. Or write P.O. Box 6579, Westlake Village, CA 91359-6579.

QINTAR

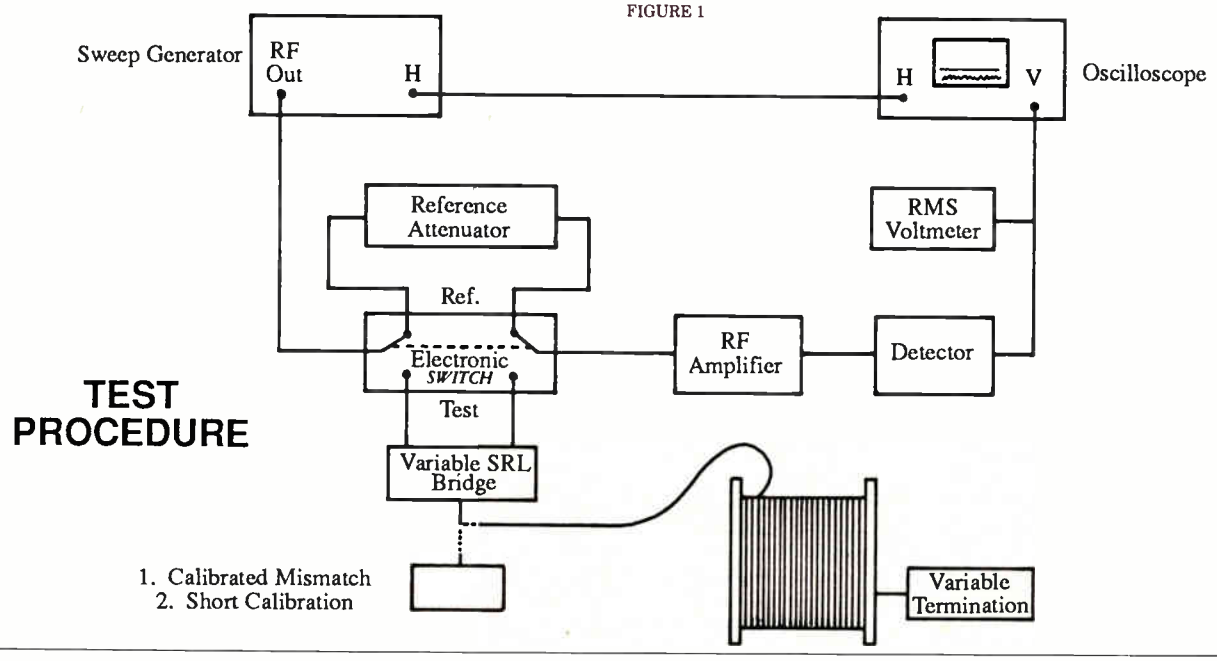
THE LEADING EDGE IN COMMERCIAL HEADEND SYSTEMS.

See us at the Western Show Booth #128.

Reader Service Number 43

Typically, return loss will be lowest for cable, moderate for passives and highest for amplifiers.

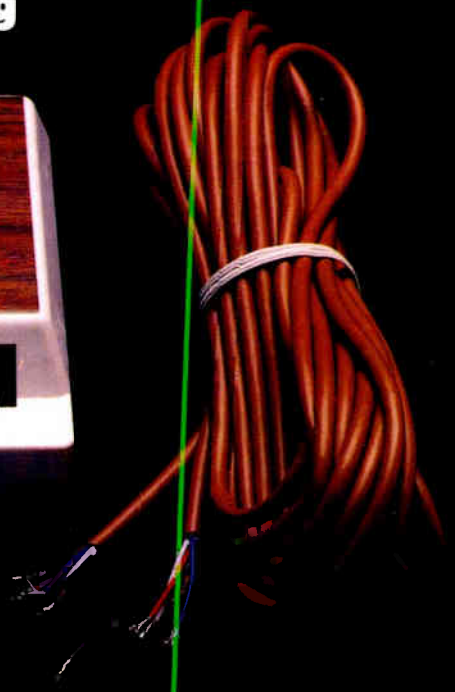
FIGURE 1



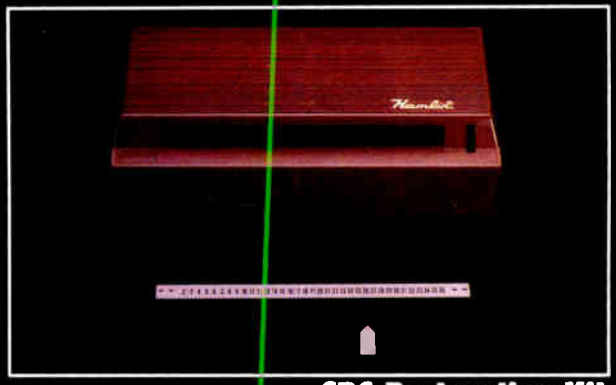
Limited Time Sale

Old Convertors Never Die! They're Shelved Because:

They're Scuffed, Cracked or Broken
Or... Cords are Cut, Parts Missing



MCC Restoration Kit



SPC Restoration Kit

MAKE YOUR TEN YEAR OLD HAMLIN LIKE NEW! HERE'S $10.31 IN COSMETIC PARTS FOR ONLY $4.95.

Extend life of Hamlin Convertors. Cut out shelf time with this easy-to-use kit. For only $4.95 you can replace the remote control case, umbilical cord, bezel, channel selector knob and tuning knob on the MCC-2000, MCC-3000 or MCC-4000 during this limited time sale. Save more than 50% off the total parts list price of $10.31! A similar kit is available for the SPC Convertor series, also at only $4.95.

Hamlin Cosmetic Restoration Kits are available for **immediate** delivery.

Genuine Hamlin Parts are Available for All Hamlin Convertors Dating Back to 1966. Genuine Hamlin Replacement Parts are Available Only From*

Hamlin®

Genuine Parts for Genuine Performance

***And Authorized Distributors**

13610-1st Avenue South • P.O. Box 69710 • Seattle, WA 98168 • (206) 246-9330

Reader Service Number 46

FINAL CALL FOR PAPERS

Synopses for planned technical papers due

by Jan. 1, 1988

NCTA, in preparing for the Cable 88 technical program, invites readers to submit synopses of planned technical papers -- on any communications engineering topic of interest to the cable television industry -- for consideration by the Cable '88 technical program selection subcommittee. Forty to fifty paper ideas will be selected on January 6th for placement in ten convention technical sessions. Judges look for reference value and originality (although updated works are acceptable) in the context of operations or design problem solving treatments. Product pitches will not be considered.

If your paper proposal is accepted, you must complete a camera-ready manuscript within six weeks for inclusion in the 1988 NCTA Technical Papers volume -- 29th in the NCTA conference proceedings series. Oral presentations, based on the papers, within the technical sessions will be limited to 15 minutes generally, but the manuscripts may be from three to 15 pages long. To qualify for the jurying process, send a synopsis to:

Katherine Rutkowski
Director, Technical Services
National Cable Television Association
1724 Massachusetts Avenue, NW
Washington, D.C. 20036
(Telecopier: 202-775-3604)

With your synopsis include complete name, job title, work address, and telephone number for the primary author and any co-authors; the paper synopsis should be from 200 to 300 words long. Provide the judges with enough specifics about your planned [not previously published] paper to show its reference value. Call Katherine Rutkowski at 202/775-3637 if you need further details.

Topics of particular interest= cable TV and: fiber optics, high definition television, customer service, signal leakage , PPV

A time domain reflectometer or variable RF bridge/sweep method can be used to check SRL performance.

distribution cables are put into service on a broadband network. A time domain reflectometer or variable RF bridge/sweep method can be used to check SRL performance.

General Instrument's Comm/Scope Division, for example, recommends the use of the variable RF bridge/sweep method. The equipment required includes a sweep generator; RF switch

and amplifier; detector, variable RF bridge; a reference attenuator and variable attenuator; jumper cables; an oscilloscope and voltmeter.

The equipment is set up as shown in Figure 1 and a 30 dB reference attenuator calibration is made. The bridge is matched to the average cable characteristic impedance and either sweep width or sweep speed is reduced (that gives the detector a better chance of producing response). With sweep controls set for full scale display, the reference trace and minimums of the display trace should match.

If using the reduced sweep width method, reduce width to no more than 10 MHz. The entire bandwidth of interest should be swept in turn (10 MHz steps). Maximum reflections should not exceed the reference trace of 30 dB. The test is then repeated for the other end of the cable.

If using the reduced sweep method, the entire bandwidth of interest is kept on the scope. Again, no spikes at any frequency of interest should exceed the 30 dB reference trace and the test is repeated for the other end of the cable.

Wavetek Indiana also recommends the use of a sweep generator and display scope, return loss bridge and fixed impedance bridge to test for return loss. Wavetek additionally suggests the use of an RF comparator to simplify the measurements. An RF comparator can toggle the sweep between the test device and a set of attenuators.

Equipment required for the sweep/variable RF bridge method is made by Wavetek Indiana, Texscan Instruments and Wideband Engineering, among others. Circle Reader Service number 109 for details on Wavetek Indiana; number 110 for Texscan Instruments; and 111 for Wideband Engineering.

The TDR also will provide similar evidence of cable SRL integrity. A TDR uses a principle similar to radar, injecting a signal burst into one end of a cable and timing the arrival of reflections. A portion of the injected signal will be reflected back to the signal source whenever it encounters an impedance mismatch. The greater the mismatch, the greater the reflection. An open or short, for example, will reflect all of the pulse back to the transmitter. Lesser impedance mismatches will send smaller amounts of energy back to the source. The TDR times the return of the reflections and calculates the round trip duration. It's possible to derive the number of feet between the TDR and the source of the mismatch within a few inches.

A TDR generally works with any constant impedance cable using two conductors.

Riser-Bond Instruments builds both digital TDRs in both positive (Model 2901B+) and negative pulse (921E) versions. Both models can be used in the LCD readout mode. Circle Reader Service number 112 for details.

Wavetek Indiana makes the FL-40 Cable Fault Locator. It comes in a weather resistant case. In the short cable mode it reads a pulse out to 1,100 feet. Circle Reader Service number 113 for details.

Biddle Instruments makes a handheld TDR as well as standard digital TDRs. Circle Reader Service number 114 for details.

Radar Engineers of Portland, Ore., also makes TDRs. Circle Reader Service number 115 for details.

—Gary Kim

New taps step up to LAN needs

Recently, tap manufacturers have been tightening up tolerances from the one-time CATV standard of 3 dB to meet the 1.5 dB demands of the LAN industry. 1.5 dB steps are virtually dictated by both MAP (Manufacturing Automation Protocol) and IEEE 802.7 in order to maintain the recommended ±3 dB tolerance for path loss variation.

According to Geoff Roman, vice president of marketing, distribution systems, at the **Jerrold division of General Instrument**, the company has "toleranced the tap tighter than is normally done because of the more extensive proofing requirements for LANs." Jerrold has "designated a separate eight-way tap specifically for LAN." Further, they now have, in effect, "a tap every 1.5 dB instead of the normal 3 dB," according to Roman.

Jerrold is not alone. A recent **C-COR** news release details plans for a joint venture with **Broadband Networks Inc.** to distribute Broadband Network's new adjustable Split-Band Taps. Joseph Preschutti, president of Broadband Technologies, explained that its new line allows a designer or installer to customize his LAN installation by providing the ability to "adjust the forward loss and the reverse loss independently," thus allowing for "precisely the correct value of taps forward, and precisely the correct value of tap reversed.

Preshutti went on to explain that Broadband Network's new adjustable split-band taps differ from the 1.5 dB taps available from other manufacturers in that Broadband's addresses unique variations in loss experienced in split-band LAN technology. The cable loss in the lower frequencies of a split-band LAN system (used to send data to the fileserver) is less than that in the higher frequencies (used to send data from the fileserver). This leads to situations where the designer/installer actually needs a tap that "has a different loss forward than it does in reverse," said Preshutti.

Commenting on the joint venture, Bob Beaury, C-COR's market manager-data products said, "C-COR is extremely pleased to offer the data taps to augment our broadband distribution product line. The taps are especially important for MAP and IEEE 802.7-based systems and are completely compatible with all our equipment for those types of networks."

A new line of uninterruptible power supplies for use in the LAN market was introduced by **Alpha Technologies** during the COMDEX Fall '87 Conference in Las Vegas. Bob Bridges, sales manager with Alpha, introduced the new line. Through targeting a specific segment of the LAN UPS market, one in which Alpha has developed extensive product knowledge through its CATV experience, the company hopes to provide an unmatched combination of product reliability and expertise to the growing LAN industry.

Alpha's ferroresonant UPS (FR/UPS) approach offers uninterruptible power output in three sizes (3 KVA, 2 KVA and 1.5 KVA). The units are available in rack-mounting or mobile-cabinet configurations. Various back-up times in the event of complete power blackouts are available through a choice of battery extender options. Circle Reader Service number 116.

Powermark has announced the availability of its SinePro Standby Power System for protecting small telecommunications systems against electrical noise and power outages. This portable, compact unit features economical off-line operation, sine wave output power and unlimited backup time.

SinePro consists of a power monitor, battery charger, noise-attenuation filter and a DC-to-AC sine wave inverter. When commercial power is present, the system filters out electrical noise signals that can disrupt programmed telephone functions. If a power sag or outage occurs, the system begins supplying distortion-free sine wave power from a user-supplied external battery source—in less that 10 milliseconds. When commercial power is restored, the SinePro system switches the protected equipment back to the power line and begins recharging the batteries. This fast-transfer off-line operation ensures a continuous supply of AC power, saves energy and minimizes component stress. Circle Reader Service number 117.

Bridge Communications has introduced "the first local area network communications server to implement the International Standards Organizations's (ISO) Open Systems Interconnection (OSI) protocol standard," according to a company spokesman.

Bridge's Communications Server/1-OSI (CS/1-OSI) is a modular communications processor that runs Bridge's internally-developed implementation of the full seven-layer OSI protocol specification. It connects up to 64 terminals, personal computers, printers, host ports and modems to a LAN, networking any combination of asynchronous, bit- and character-synchronous and IBM 3270 Category A or compatible devices.

Connection to terminals and other devices on the network is provided by the OSI Virtual Terminal Protocol (VTP, OSI layer 7), featuring the Telnet profile, which permits distributed access to any networked host computers compatible with this standard high-level protocol. Users attached to CS/1-OSI units placed at convenient locations throughout a customer facility can switch back and forth between OSI/VTP-based hosts using simple commands.

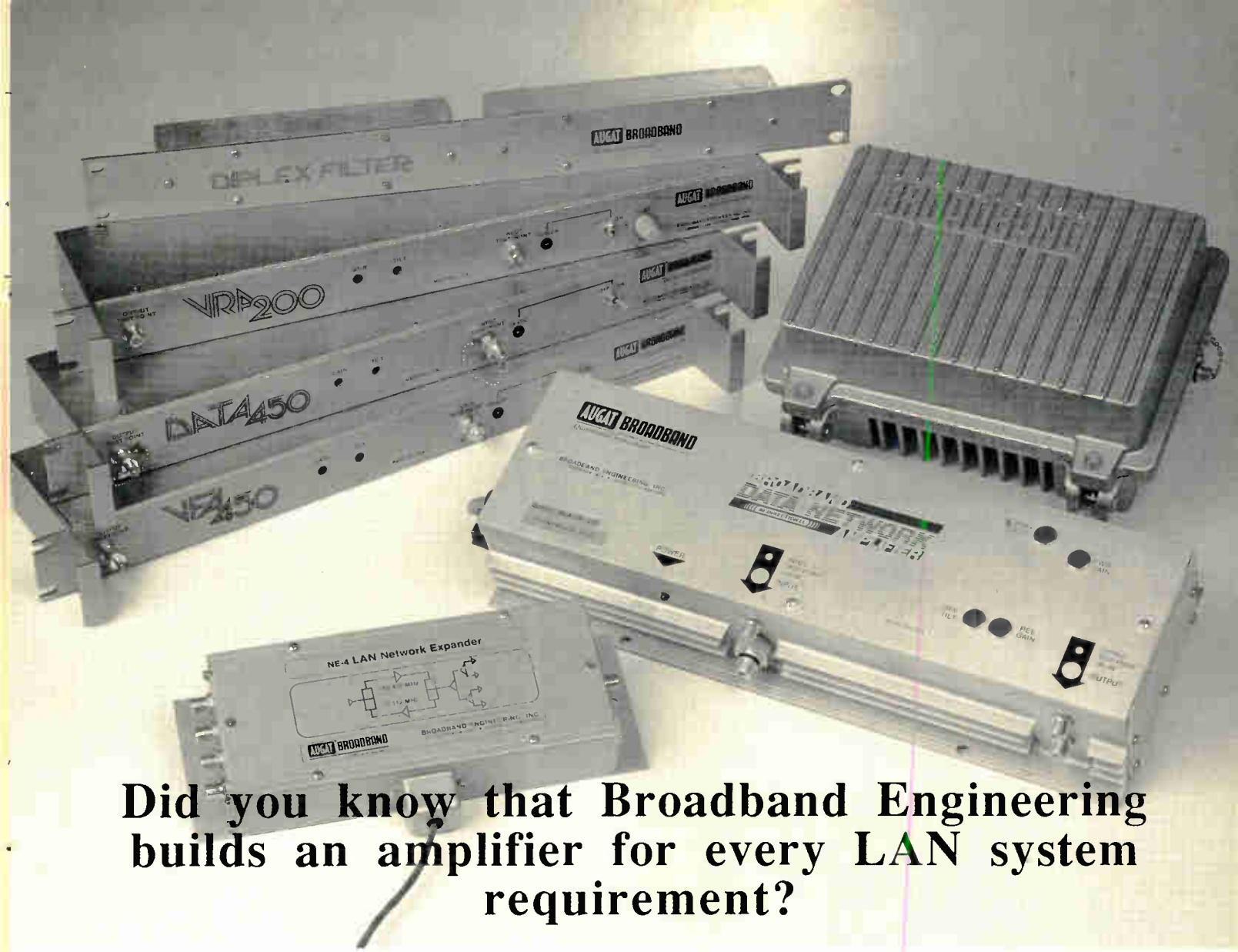
The CS/1-OSI is also compatible with the Technical and Office Protocols version 3.0, a specification of the OSI protocols layered over Ethernet (IEEE 802.3). Circle Reader Service number 118.

GammaLink unveiled the first PC-to-facsimile communications package for the IBM PS/2 personal computer during the COMDEX Conference in Las Vegas.

Called GammaFax MC, the new hardware/software product offers the same capabilities as the popular GammaFax: easy PC-to-remote-facsimile transmission and high-speed PC-to-PC file transfer.

The MC system, which consists of an easily installed printed circuit board and menu-driven communications software, allows users to send documents directly from their PCs to any digital facsimile device. Users may also perform PC-to-PC file transfers by sending any DOS file over ordinary telephone lines. Reader Service Number 119.

—Greg Packer



Did you know that Broadband Engineering builds an amplifier for every LAN system requirement?

It might surprise you to learn that we are the most innovative supplier of LAN amplifiers. That comes from listening to our customers and designing amplifiers that meet their requirements.

To meet our customers needs, we build rack mounted amplifiers for single and dual cable networks, a mid-split amplifier with a weatherproof housing and a highly efficient switchmode power supply. We also have mid-and high-split indoor distribution amplifiers.

Our rack mounted amplifiers are AC or DC powered. DC powered units are built for use with communications battery powering systems.

Another unique LAN product is our network expander for expansion from a single port to four ports. The network expander allows more terminals on an existing network without adding taps.

To find out about our full line of LAN products or for LAN application assistance, give us a call.

Call toll free at 800-327-6690. In Florida, call 305-747-5000 or write us at 1311 Commerce Lane, Jupiter FL 33458.

AUGAT® BROADBAND
Quality and Innovation

A part of the growing Augat Communications Group

Reader Service Number 48

Budgeting stereo separation...

...in a CATV system.

By Luis A. Rovira,
Scientific-Atlanta Inc.

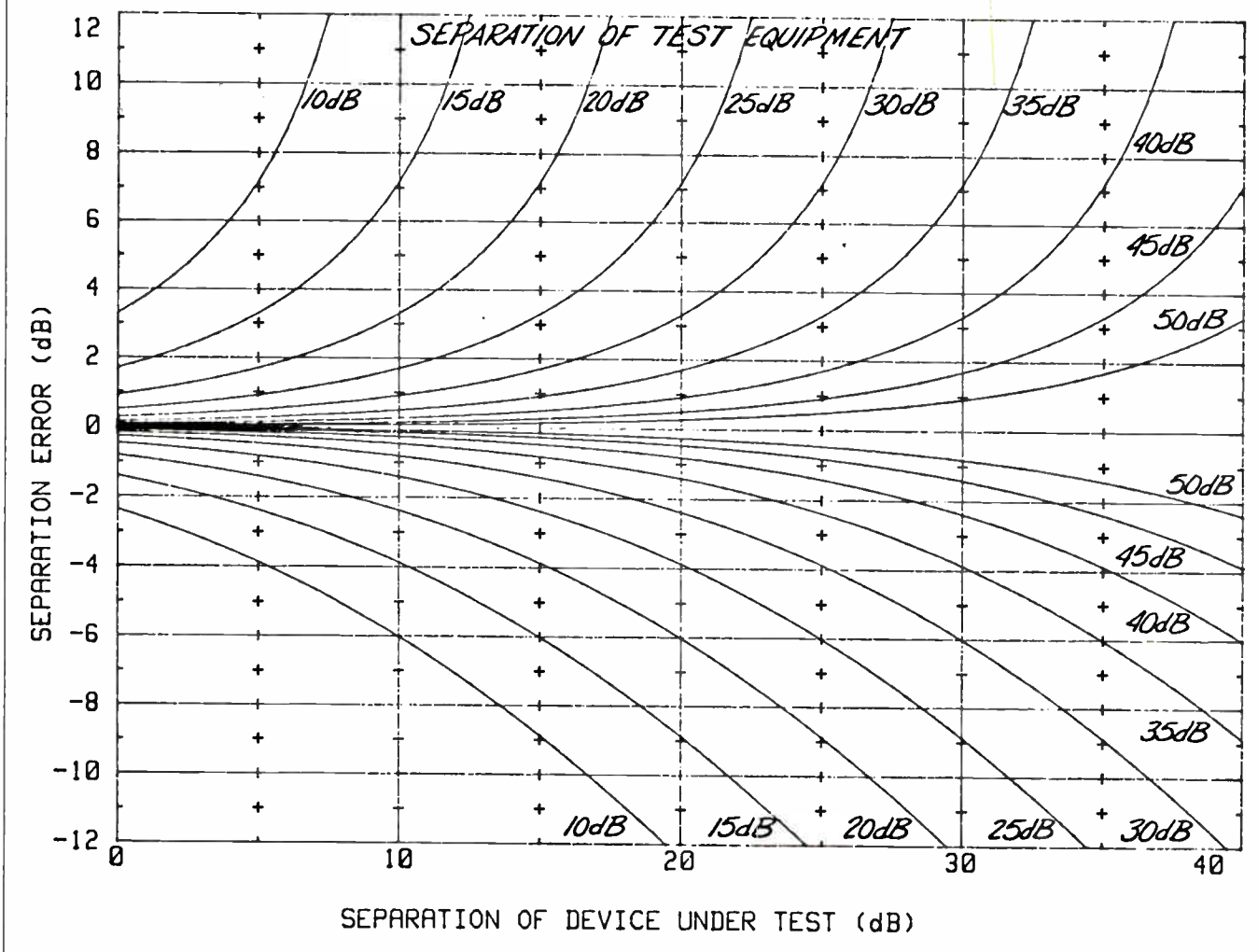
CATV systems use many more devices in the signal path than were ever anticipated in the creation of BTSC stereo. The problem of maintaining stereo separation in such a system is one that is presently being addressed by any system operator wishing to upgrade to stereo. Prior attempts at budgeting the degradation of stereo separation in such systems have concentrated on characterizing the amplitude and phase errors of the various devices. Measurement of these characteristics can be difficult. Further, factors not sufficiently considered by such an analysis can substantially degrade separation.

Introduction

The problem of budgeting stereo separation in a system as complex as CATV has been studied by Gibson.[1] In his paper a "composite gain-phase error" (E) is introduced. E is calculated from the measured gain and phase error between the sum and difference paths. The Es for each piece of equipment in a cascade can be added to get a total E for the cascade. This can be used to calculate the worst case separation for that system. A root-sum-of-squares combination of Es can also be done for a less pessimistic result.

There are two shortcomings to the application of this method. One problem is that it is very difficult to characterize the many different types of equipment used in CATV with regard to their sum and difference path amplitude and phase errors. The other

FIGURE 3



BEAUTY AND THE BTSC

Jerrold's COMMANDER® MTS Stereo Encoder

Black-and-white video on a color TV. Mono audio from a stereo TV.

Sounds drab, doesn't it?

Now there's a way to brighten up the situation: Jerrold's COMMANDER® MTS BTSC stereo encoder.

Any BTSC stereo encoder can encode your satellite-delivered signals into stereo. But only the COMMANDER MTS can guarantee both you and your subscribers the quality sound you want and deserve. It actually exceeds all broadcast performance requirements.

With the COMMANDER MTS stereo encoder you hear everything you're supposed to hear in clear, clean BTSC multichannel sound. And nothing else.

So do your subscribers.

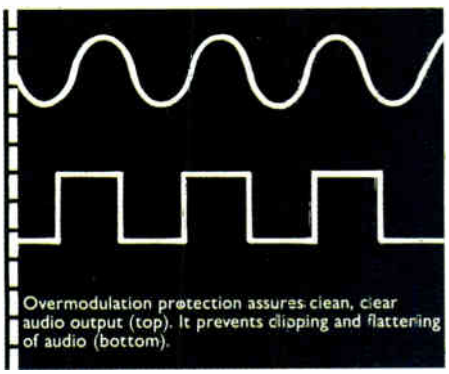
That's because Jerrold's COMMANDER MTS is the only stereo encoder with non-clipping overmodulation protection! There's no way the annoying pops, cracks and distortion that comes from erratic audio input levels can get through to your subscribers, because the CMTS just won't broadcast them. It's designed to deliver pure sound only—even when the signals it receives are something less than constant.

But that's not the only reason to install a Jerrold CMTS encoder. There's also the broad deviation range of the logarithmic LED metering which makes it easy for you to set—and maintain—correct audio levels. There's dramatically low power consumption. And, Jerrold is the only manufacturer to offer standard 41.25 MHz and 4.5 MHz output so that your encoder will work with almost anybody's modulator without modification.

Finally, when you're ready to upgrade to Second Audio Programming, the CMTS is ready. SAP is easily field-upgradable without adjustment.

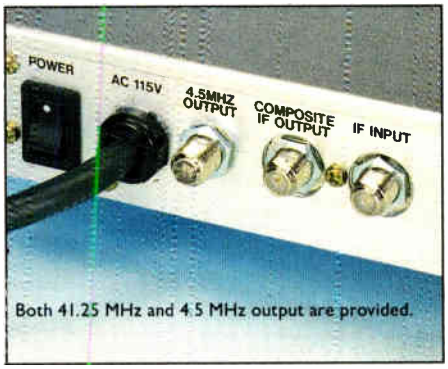
It's all there in one attractive package. The Jerrold COMMANDER MTS Stereo Encoder: your sound investment.

For more information on the Jerrold COMMANDER MTS Stereo Encoder contact your local Jerrold Account Representative or call or write Jerrold Division, General Instrument Corporation, 2200 Byberry Road, Hatboro, PA 19040 (215) 674-4800.



Overmodulation protection assures clean, clear audio output (top). It prevents clipping and flattening of audio (bottom).

Logarithmic parallel LED metering shows you sound separation at a glance.



Both 41.25 MHz and 4.5 MHz output are provided.

JERROLD

. . . where innovation is a tradition

GENERAL INSTRUMENT

Reader Service Number 49

To overcome these problems, a generalized error coefficient (E_g) can be introduced.

FIGURE 2

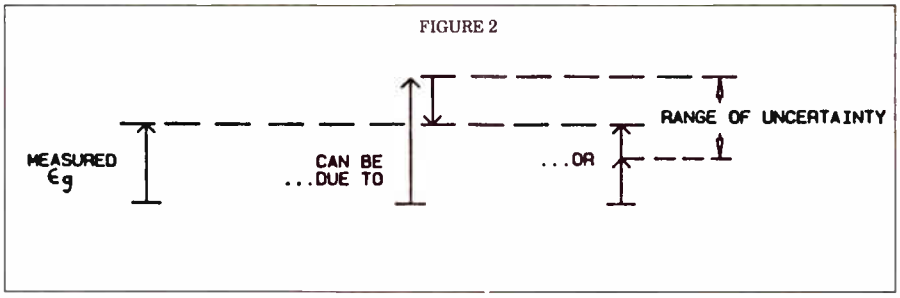
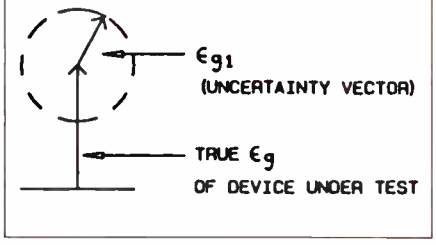


FIGURE 1



limitation is that even if all the equipment could be so characterized, other factors are not considered. These include companding, spurious pickup of f_H due to scrambling or radiation, spectral overflow of video, CTB and crossmodulation in distribution systems, cable reflections, FM filter bandwidth and group delay effects.

To overcome these problems, a generalized error coefficient (E_g) can be introduced.

Equation 1

$$E_g = 100 \times 10^{(-S/20)}$$

where S is separation in dB.

This error coefficient can be used to cascade the degradations caused by equipment, as was Gibson's E. Additionally, it includes all the effects listed above. Hence it cannot be calculated from gain and phase measurements.

Given the error coefficient, the inverse calculation yields separation

Equation 2

$$S = 20 \times \log(E_g/100).$$

E_g can be determined for any type of CATV equipment from measurements of separation. A technique of "successively embedding" unknown equipment between previously characterized equipment is used, while keeping in mind a mounting "range of uncertainty" in the measurement. Ultimately, all such measurements are referenced to a decoder that is verified to a mathematical standard as discussed by Chester.[2]

Measuring (E_g)

By way of example, let us suppose that an encoder-decoder combination yields a flat 35 dB of separation. From this the generalized error coefficient can be calculated using equation 1.

$$E_{g1} = 100 \times 10^{(-35/20)} = 1.78$$

E_{g1} can be considered to be the magnitude of an uncertainty vector of unknown angle. It can either improve or degrade the performance of a device to be tested that is installed between the encoder and decoder. See Figure 1.

Now, suppose that we embed such a device (or set of devices) to be measured within this encoder/decoder pair. We then measure the resulting separation to get 20 dB. Applying equation 1 again we get:

$$E_{g2} = 10$$

From Figure 2 we see that the true E_g of the embedded component(s) could be anywhere in the range

Equation 3

$$E_{g2} \pm E_{g1}$$

$$\text{or } 10 \pm 1.78 = 8.22 \text{ to } 11.78$$

and the range of the true separation is (using equation 2 on the limits of the above range)

18.6 to 21.7 dB.

If a further embedding is necessary, the uncertainty becomes ±10. This does not include a further uncertainty of ±1.78 because although the separation of the embedded device is not accurately known, the separation of the cascade is.

We can now begin to see that as more equipment is used in the cascade

INTRODUCING

Royal™

AN EXCLUSIVE LINE OF PRODUCTS FROM Toner

2 Way - 4 Way - 8 Way 5-550 MHz multitaps

NOW IN STOCK AT Toner

• Coming soon — Line passives and converters •

CALL NOW FOR PRICES AND ORDERING INFORMATION

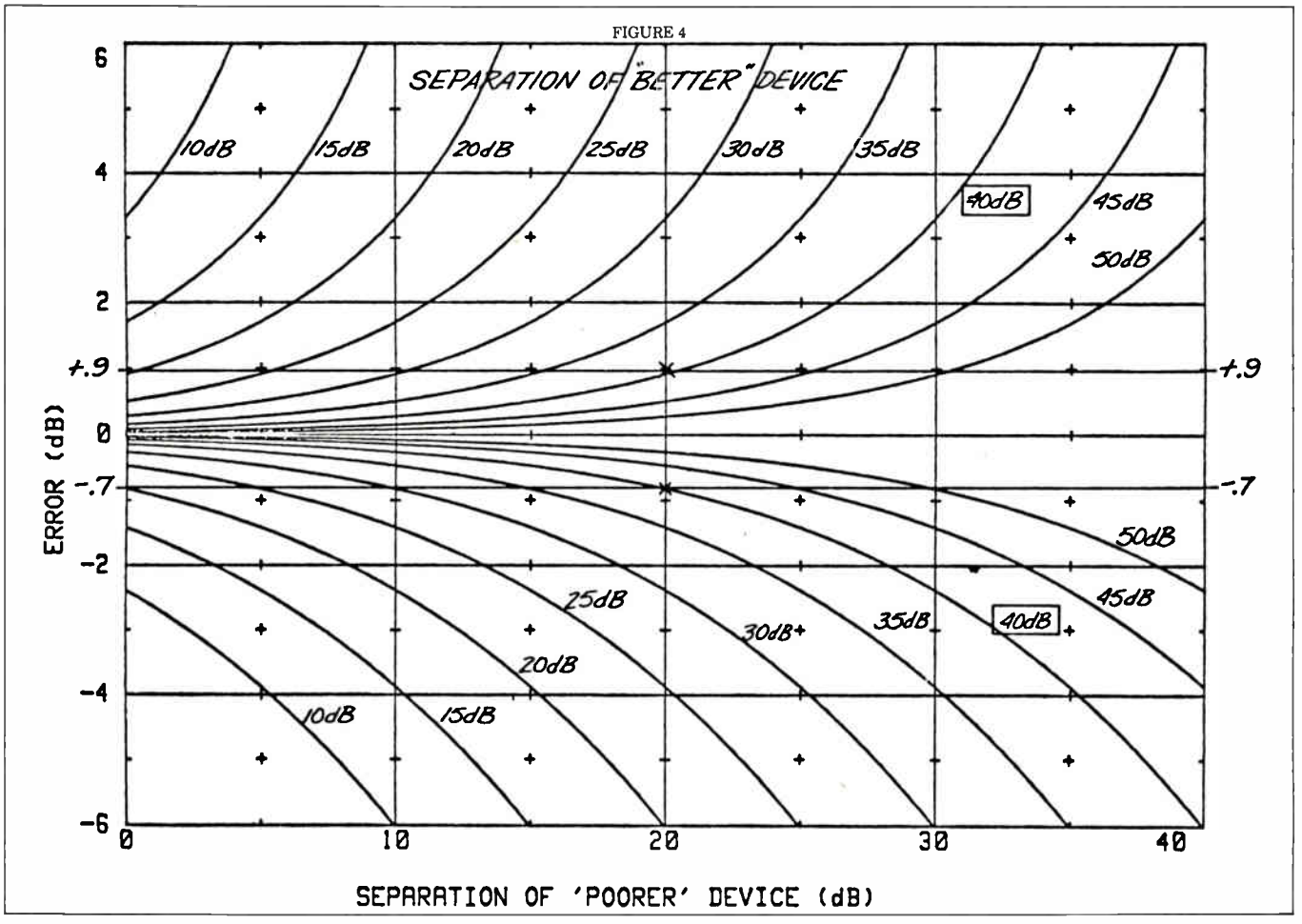
Toner
cable equipment, inc.

969 Horsham Rd. • Horsham, Pa. 19044-1278
Call Toll-free 800-523-5947
in Pa. 800-492-2512
FAX 215-675-7543

to test the unknown, the measurement becomes less accurate. This is illustrated in Figure 3. The horizontal axis in this figure represents the separation of a device under test. The curved lines represent the separation of the test equipment used. Note that there is a top and bottom curved line of each value of test equipment separation. The vertical axis represents the error involved in measuring a given device with imperfect test equipment. The plot is used in the following manner:

a. Locate the intersection of the vertical line corresponding to the device under test with the top curved line for the test equipment separation. Read the error to the left of this intersection.
b. Locate the intersection of the same vertical line with the bottom curved line corresponding to the test equip-

FIGURE 4

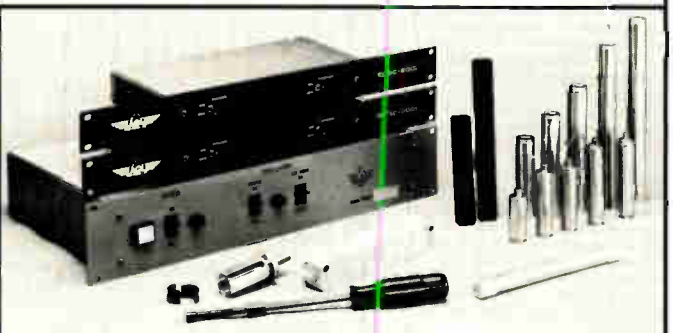


...the rest of us joined together to get the attention we deserve.

The Eagle trap is the biggest selling and best known product manufactured by Eagle Comtronics. In fact, since the advent of cable television, it has constantly held the spotlight as the most popular CATV security device in the industry.

But Eagle Comtronics manufactures an entire family of superior CATV security devices and distribution products. And though they may not be as well known to you as the trap, they are all cast from the same proven mold.

Programmable and Addressable Descramblers, Headend Scramblers, Remote Computer Slave Control, Test Equipment. MADE IN USA.



Traps, Decoding Filters, Multiple Channel Traps, High & Low Pass Filters, Brass & Plastic Shields, Security Tools, IF & RF Encoders and Lower Adjacent Sound Oscillators. MADE IN USA.

2, 4, and 8-way Brass "F" Port Directional Taps*-100% Pressure Tested & Polyurethane coated. MADE IN USA. Splitters. *Pat. #4,311,974

Batch Descramblers, Band Pass Filters and Video Amplitude Controller. MADE IN USA.

EAGLE COMTRONICS INC.

MADE IN U.S.A.

Meet the Family.

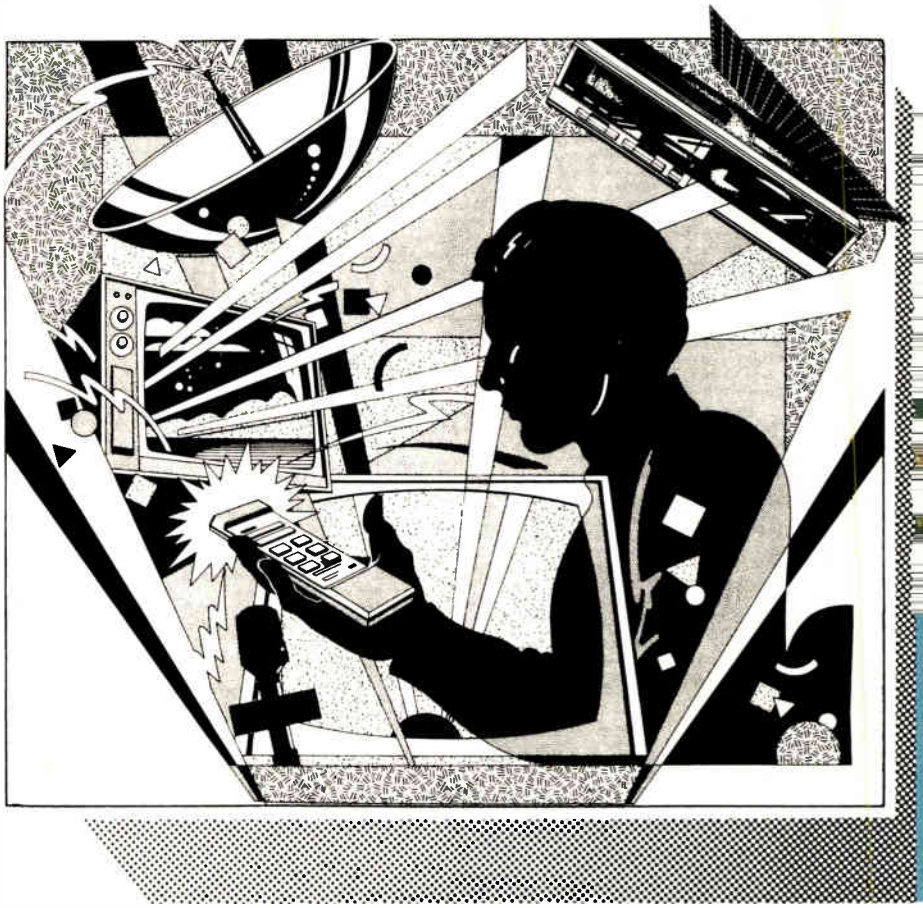
EAGLE COMTRONICS, INC. 4562 Waterhouse Road, Clay, New York 13041.
TO ORDER, CALL TOLL-FREE: 800-448-7474 In New York, call 315-622-3402 /In Canada, call Deskin Sales, 416-475-1412/ In Europe, call Electro Service, Brussels, Belgium, 011-32-15-209575.

Reader Service Number 53

SCTE

SOCIETY OF CABLE TELEVISION ENGINEERS

FIBER OPTICS SEMINAR



JAN. 18–20, 1988
HYATT ORLANDO HOTEL

PARTICIPANTS

- AT&T
- Bell Laboratories
- AMP, Inc.
- Stromberg Carlson
- Synchronous
- Bell South
- ATC
- American Lightwave

REGISTRATION FEE $150.00

Non-Member — $190.00
(Includes SCTE National Membership)

FOR CONFERENCE DETAILS, CONTACT:
FLORIDA SCTE
P.O. BOX 7835
SARASOTA, FL 34278

DICK KIRN
(813) 924-8541

PAT LUCKETT
(305) 660-5524

Another way to visualize the uncertainty involved in measuring separation is to use a 'reflectometer' slide rule.

ment separation. Read the error to the left of this intersection.

The errors read from this plot represent the boundaries of the range of uncertainty. For example, a device is to be measured which has a known separation of 20 dB, using test equipment with a separation of 35 dB. Reading from Figure 3, the error involved is approximately

$$-1.4, +1.7 \text{ dB}.$$

That is, the result of the measurement could be anywhere between 18.6 and 21.7 dB. This graph emphasizes the importance of using laboratory quality equipment in the measurement of separation, or E_g. As a rule of thumb, the combined test equipment should have a separation >15 dB better than that of the equipment under test. Using the technique described by Chester, laboratory quality decoders have been tested at better than 45 dB separation in the BTSC mode.[2]

Another way to visualize the uncertainty involved in measuring separation is to use a "reflectometer" slide rule. These devices are commonly used by microwave engineers to see the error involved in measuring return loss using a bridge with finite directivity. This is also a vector calculation similar to measuring separation.

In further considering the practical application of this test method we note that much of the equipment used in CATV systems will be expected to cause very little separation degradation. It may be necessary to cascade several such pieces of equipment to achieve a measurable degradation. Then divide the total contribution by the number of pieces in the cascade to determine the contribution of an individual piece.

Cascading two pieces of equipment

Figure 3 can also be interpreted in an alternate but equally useful manner. Suppose that two pieces of equipment are cascaded. Let the horizontal axis represent the separation capability of the equipment with the poorer separation. Let the curved lines represent the separation capability of the better equipment. The separation of the cascade will be equal to the separation capability of the poorer equipment, within a tolerance. The tolerance is seen in the following manner:

a. Locate the intersection of the top curved line for the "better" equipment and the vertical line for the "worse" equipment. Read the "error" axis at the left of this intersection. This is the tolerance in the positive direction.
b. Locate the intersection of the bottom curved line for the "better" equipment and the vertical line for the "worse" equipment. Read the "error" axis at the left of this intersection. This is the tolerance

The special case of cascading two pieces of equipment with equal separation is interesting.

TABLE 1

Equipment	% contrib.	ϵ_g	S(dB)	ϵ_g^2
Stereo Encoder	22	3.11	30	9.66
Modulator-Demodulator or Signal Processor	8	1.13	39	1.28
Scrambler-STT	7	.99	40	.98
Distribution	4	.57	45	.32
AML	4	.57	45	.32
Consumer Decoder	55	7.77	22	60.35
System Total	100	14.14		72.91

SQR(72.91)=8.54

in the negative direction.

For example, in Figure 4 is shown the results of cascading a 40 dB box with a 20 dB box. The cascade separation is approximately:

from 20-.7 to 20+.9

or somewhere between 19.3 and 20.9 dB. We note that when cascading a "good" device with a "poor" one the separation of the cascade is very nearly that of the "poor" device.

The special case of cascading two pieces of equipment with equal separation is interesting. Again, the E_g of each can be considered to be a vector of unknown angle.

If two vectors of equal magnitude and angle are added, the magnitude is doubled (6 dB). Note that along the bottom of the figure (-6 dB line) the vertical lines intersect with the curved lines of equal value. If two vectors are added that have equal magnitudes, but angles that are different by 180 degrees, the magnitude of the resultant is zero. In dB this would approach infinity. Hence, the upper curved lines for a given separation approach infinity at the vertical line for that same separation. This is the reason for the lack of symmetry in the plot.

A sample error budget

Using E_g instead of the measured separation of each piece of equipment in the cascade allows us to combine the contributions of the individual pieces to get the cascade separation, just as was done with Gibson's E. Because E_g includes all forms of separation degradation as well as companding effects, a practical error budget is possible.

Suppose, for example, that we choose 17 dB separation as a goal. This is equivalent to E_g = 14.1, which could be budgeted as shown in Table 1.

The goal of 17 dB represents a worst-case separation for this cascade. In general, as the number of elements in the cascade is increased, the root-sum-of-squares (RSS) is a more realistic estimate. For this cascade

RSS separation = -20 log(8.54/100)
= 21 dB

Subtracting out the contributions of the consumer's decoder, we see that such a CATV system would be capable of delivering a worst case separation of 24 dB, or an RSS separation of 29 dB, to an ideal decoder.

In systems using more equipment the budget can be divided further, requiring higher quality equipment.

References

1. Gibson, J.J., "Accumulation of Stereo Separation Errors in Cascades of Subsystems Conveying L+R and L-R Over Different Paths," publication of RCA Laboratories.
2. Chester J.K., "Measuring Static Performance Of BTSC Decoders," publication of Modulation Sciences, Inc.

Advertisers' Index

	Reader Service #	Page #
Ad Systems	.50	.76
Alpha Technologies	.7, 39	.17, 63
Anixter Communications	.30, 71	.51, 108
Arrow Fastener	.68	.102
Avcom of Virginia	.62	.94
Ben Hughes Comm. Products	.17	.32
Brad Cable	.65	.99
Broadband Engineering	.48	.73
Burnup & Sims/CableCom	.28	.49
Burnup & Sims/Lectro	.6	.15
C-COR	.55	.81
CMS	.57	.85
Cable Link	.66	.100
Cable Services	.26	.47
Channell Commercial Corp.	.10	.21, 22
Channel Master	.11	.27
Channelmatic	.38	.61
Computer Utilities	.58	.86
Data Transmission Devices	.40	.64
Di-tech	.22	.37
Diamond Communications	.31	.52
E-Z Trench	.36	.82
Eagle Comtronics	.52, 53	.78, 79
Federal Telecom	.33	.54
General Cable Apparatus Div.	.27	.48
General Inst./Commscope	.1	.3-5
General Inst./Jerrold	.49	.75
General Inst./Tocom	.41	.65
General Sealants	.54	.81
Hamlin	.46	.69
Kennedy Cable Construction	.29	.50
LRC/Vitek	.25	.44-45
Lemco Tool	.67	.101
Lightning Deterrent	.14	.30
Lindsay Specialty	.24	.41
Lineward	.23	.38
Magnavox	.2	.7
Merit Communications	.42	.66
Midwest CATV	.18	.33
Midwest Communications Corp.	.5	.13
Monroe Electronics	.56	.56
Nacom	.32	.53
Oak Communications	.20	.35
PTS Electronics	.64	.96
Panasonic	.16	.31
Pico Macom	.21	.105
Pioneer Communications	.8	.19
Power Technologies	.47	.71
Qintar Inc.	.43	.67
RMS Electronics	.9	.26
Radyne Corp.	.19	.34
Rainbow Satellite	.34	.98
Riser Bond	.44	.68
Sachs CATV	.60	.92
Scientific-Atlanta	.4	.11
Sencore	.61	.93
Signal Vision	.63	.95
Standard Communications	.13	.29
Telecommunications Prod.	.15	.68
Texscan/MSI	.37	.59
Times Fiber	.70	.107
Time Manufacturing	.35	.55
Toner Cable	.51	.77
Trilogy Communications	.3	.9
Triple Crown Electronics	.12	.28
Wavetek	.59	.91

Billing software playing new roles

Vendors scurry to mix with ARUs, other innovations

Cable systems with their own in-house billing systems that utilize software programs available from one of the industry billing vendors have a wealth of technical information built right into their programs. Inventory control, technician and installer productivity, dispatch and work order scheduling can all be taken care of with a good software program. That's been known for a long time. Now, however, it seems that the emphasis is off providing techs with more information and on speeding up the daily operations of the entire system.

In general, billing vendors have spent the last year concentrating on interfacing with various brands of audio response units in order to cut down on phone traffic to customer service representatives and speed up the scheduling process.

CableTEK

By calling in on a special telephone line, installers and technicians can key in the proper responses when prompted by the units to complete converter authorizations, check in with dispatch, receive work order information, etc. The units "allow a technician to be in touch with someone at the office without tying up the lines to the customer service reps," says Robert Noren, senior vice president of CableTEK. "That way, idle conversation is eliminated." And that translates into better productivity. Noren, who last year introduced a hand-held computer designed to track the productivity of technicians and installers (an idea that has been met with little acceptance), nevertheless believes more and more cable systems will look toward ARUs to smooth operations.

CableTEK interfaces exclusively with the Melita line of ARUs and other billing vendors are allying themselves with other manufacturers. "A year from now, I think the use of ARUs will be more commonplace," says Noren.

Another feature of the Melita units is their ability to generate outbound calls. This way, subscribers can be contacted and service appointments can be confirmed ahead of time. That eliminates wasted truck rolls. "If you roll a truck and nobody's home," says Noren, "it wastes the technician's time and the company's resources."

CableData

CableData also recognized the value of pre-confirmed appointments and built that feature into its DDP software Release 7.086, slated for a January roll-out. The software enhancement, which focuses specifically on CableData's own response unit, the Phone Entry Processor, allows a subscriber to confirm pending schedule orders. In addition, subscribers who have trouble entering the proper information are automatically rolled over to a CSR to keep subscribers from being completely frustrated. The new release will also allow a cable system to run its PEP machine 24 hours a day, says Rich Langan, sales software analyst at CableData.

In software Release 7.085, available since August, CableData users have had a box swap capability added to the trouble call complete function of the PEP. With this feature, a tech who has simply replaced a non-working converter box with one that works can call in, enter the code and the computer recognizes the event as a box swap.

In addition to other features, upcoming Release 7.09 will allow for mass credit application and rescheduling of pay-per-view events in the event of an outage in the system or other source of trouble in delivering the event.

Despite the fact that most of the enhancement efforts have been in the area of pay-per-view, marketing and management, "technical issues continue to be important to our users group," reports Nancy Frank, director of marketing at CableData. The company utilizes its users group to prioritize and review enhancement requests and then acts on them. "More than 200 software enhancements have been made over a recent 12-month period in areas all across the board," reports Frank.

Creative Management Systems

"Marketing information is getting the most interest, but engineering issues are right behind," says Gil Jacobs, vice president of sales and marketing at Creative Management Systems. Mostly, those issues revolve around the technical portion of delivering pay-per-view events to the home, he says. "There has been a renewed interest (by operators) in interfacing their systems with Automatic Number Identification, ARUs and Jerrold's Cable Video Store," says Jacobs. "There are more and more things going on that have forced the engineers to get involved because they have to keep the system running," he says.

CMS has steadily adapted its software to work in a variety of schemes, with most vendors now accommodated, reports Jacobs. Efforts now are being concentrated in two areas: telemarketing and automation in dispatch. New software is allowing telemarketers to automatically view information about various prospects. And using ARUs to automate the dispatch function by confirming appointments ahead of time "will be hot in cable in the next couple of years," Jacobs predicts.

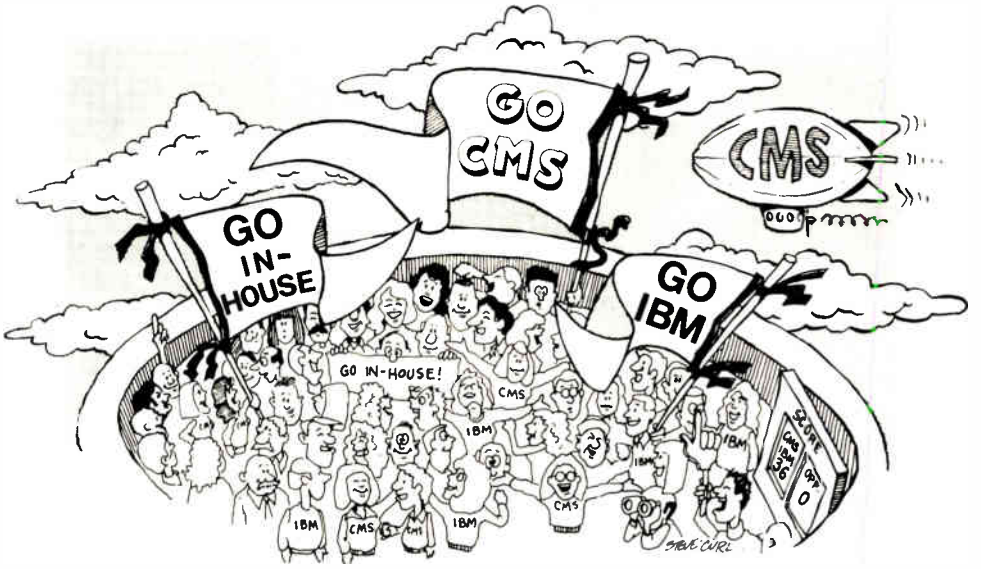
His prognostications shouldn't be taken lightly. With the addition of 750,000 subscribers over the past six months, Jacobs has taken the fledgling company past the 3.5 million-sub plateau; a growth rate of about 100 percent over the past year.

First Data Resources

David Scott, marketing manager at First Data Resources, said his company's focus has been on marketing, customer service and delivery of pay-per-view. By interfacing its software with ANI systems and ARUs, and providing screens with more information, systems are able to enhance their revenues.

Scott agrees that ARUs are being used more frequently for a variety of functions, including pay-per-view event ordering, reauthorization of converter boxes (which can be done easily by the subscriber without rolling a service vehicle), installer check-in and account balance inquiries by subscribers.

GO WITH THE WINNING TEAM
CMS AND IBM



CMS SYSTEM 1 **AND** **IBM SYSTEM/36**

THE COMPLETE SUBSCRIBER MANAGEMENT SYSTEM

THE COMPLETE FAMILY OF COMPUTERS

THE CABLE INDUSTRY'S BEST GAME PLAN FOR ON-LINE, IN-HOUSE, SUBSCRIBER MANAGEMENT/BILLING SYSTEMS.

THE CMS/IBM TEAM MEANS ... increased productivity with the lowest operating cost. With this unbeatable combination you'll leave the out-dated and over-priced service bureau alternatives defenseless. And, you will always be in control because you call the plays. With CMS on the line and IBM in the backfield ... YOU CAN'T LOSE!

CALL CMS TODAY FOR MORE INFORMATION.

CMS

Creative Management Systems, Inc.

An IBM Value Added Remarketer

Headquarters:
213 Washington Street
Toms River, NJ 08754
(201) 341-6165

Western Region:
50 Francisco Street, Suite 220
San Francisco, CA 94133
(415) 362-1345

Eastern Region:
Park 80 West, II, Suite 200
Saddle Brook, NJ 07662
(201) 843-4889

Reader Service Number 57

Clearly, the amount and type of of attention being devoted to issues of technical interest varies by vendor.

Besides adding an "on-line bulletin board" feature in an earlier software release (allowing important information, an outage, for example, to be instantly called to the dispatcher's attention), the company has not received many calls for technically related enhancements, Scott says.

Most of their systems seem satisfied with the variety of reports they already have access to, including technician productivity, a comparison of jobs scheduled, jobs completed, jobs cancelled, the time taken to complete them and repeat trouble calls. "There just isn't much emphasis in this area right now," says Scott. "The priority has been on marketing and management data."

Computer Utilities of the Ozarks

For the smaller vendors who service smaller systems, addressability has finally become the focus of new software. More and more small-system operators are rolling out addressability in their systems for the classic reasons: to capitalize on the revenue producing potential of pay-per-view events, to simplify plant operations and reduce operational costs, to increase signal security and prepare to sell to larger MSOs, reports Herb Lair of Computer Utilities of the Ozarks.

Now that addressability is becoming more affordable to the smaller systems (Jerrold's AI0 economical addressable controller brought addressability closer to smaller operators financially), those systems want their billing systems to serve as operations and marketing tools as well. An example of this is Essex, an MSO presently being sold to US Cable. Lair's firm recently did a lot of work on Essex systems to get them addressable, he says.

He doesn't see much movement toward increased use of ARUs. "I see most smaller systems using the phone lines to do things like poll store-and-forward sidecar units after pay-per-view events have occurred," he says.

Technical features and detailed management reports are often not what small operators look for when they come shopping for software, Lair says. "The systems are often too small to use that information. The additional information is great for a big MSO but it's just not needed in systems where people perform several different tasks," he says.

Clearly, the amount and type of attention being devoted to issues of technical interest varies by vendor. But one thing remains obvious: keeping on top of the technical needs of the cable industry remains of paramount importance to the billing companies. And given that systems will be using machines and technology to improve system operations, billing software will increasingly find itself having to adapt to a variety of uses.

classifieds

HELP WANTED

Baker Scott & Co. EXECUTIVE SEARCH
1259 Route 46 Parsippany, NJ 07054 201 263-3355
Specialists in the COMMUNICATIONS INDUSTRY
CABLE TV/BROADCAST DIVISION
TELECOMMUNICATIONS DIVISION
POSITIONS AVAILABLE AT ALL LEVELS OF MANAGEMENT, COAST TO COAST
Call or write in CONFIDENCE
FEE PAID
"WE DON'T TALK CABLE, WE KNOW CABLE"
PRINCIPALS DAVID ALLEN & JUDY BOUER

WE PLACE ENGINEERS, SALES, MGMT. & FINANCIAL PEOPLE
(all levels for the CATV Industry)
Nationwide Service – All Locations
America's Leading Source for a Decade
For information phone or write Mark Kornish
key SYSTEMS
479 Northampton Street
Kingston, PA 18704
Employer Paid Fees
(717) 283-1041

CABLE TELEVISION SUPERVISOR

105,000 subscriber system in Northwest Ohio is seeking a highly motivated and career oriented person to be responsible for service to subscribers and for supervising ten technicians in a designated area. Candidates should have at least a high school diploma or equivalent, two years experience with cable system design and operation, and two years of first level supervisory experience in cable television. Company offers competitive salary and benefits. Please send resume to:

The CableSystem
Personnel Director
5566 Southwyck Blvd.
Toledo, Ohio 43614
EOE/AA

CONSTRUCTION

Looking for qualified splicers, linemen, field engineers, supervisors and in-house CAD/D operators and designers. Must be willing to travel.

Send resume to:

P.O. Box 452
Kiowa, CO 80117
or call
303-621-2820

ROCKY MOUNTAIN

Warren & Morris, Ltd.
SINCE 1983

Executive Search & Recruitment
for the
Cable and Cellular
Industries

Marcia K. Larson
(619) 481-3388
2190 Carmel Valley Road
Del Mar, CA 92014

Highly regarded regional contracting firm needs top notch person to help "take us national" in aggressive expansion campaign. Qualifications should be: assertative, self-starting individual with industry contacts. Reply with resume to:

Pyramid Cable Service of Ohio, Inc.
760 Unit O Warehouse Rd.
Toledo, Ohio 43615

PYRAMID CABLE SERVICES OF OHIO, INC.

needs experienced personnel to perform in cable TV and fiber optics. Must be willing to travel and have good work references. Send resume to:

Pyramid Cable Services of Ohio, Inc.
760 Unit O Warehouse Road
Toledo, Ohio 43615

EQUIP. FOR SALE/RENT

DITCH WITCH FOR SALE

Model V252 used 25 hours with new trailer. No reasonable offer refused.

Call Bob
(904) 893-2582 (E.S.T.)

AERIAL BUCKET TRUCKS

Large selection geared for CATV
STANDARD TRUCK & EQUIPMENT CO.
1155 Hill St. S.E.
Atlanta, GA 30315
Phone: 1-800-241-9357
BUCKET TRUCKS

TENTH BRAD Anniversary

If you're not on our MONTHLY PARTS MAILING LIST you should be!
Here's why . . .

TC56 RCU Keyboard	$1.50
TC56 RCU Overlay	.75
DRX Bezel	1.50
RSX RF Case	2.00

Minimum Quantity 100 Pieces

Call
1-800-382-BRAD
In NY 518-382-8000
Ask For Parts Sales

CLEARLY BETTER
BRAD THE CONVERTER PARTS HOUSE™

EQUIPMENT FOR SALE/RENT

CHANNELCUE

Line equipment and meter repair

LEE ENTERPRISE
623 4th STREET • P.O. BOX 590 • OESHLER, NEBRASKA 68340
(402) 365-7520

FOR SALE

2 channel commercial inserter for cable TV. Automatic cue-up, insert and verify. 5000 Tele-Engineering System.

(916) 273-4163

TOWER SPACE FOR RENT

Prime site covers North Jersey and Rockland; 500 feet+ elevation. Call or write: Peter Psirogianes, UA Columbia Cablevision, 7 Fir Court, Oakland, NJ 07436. (201) 337-1550, ext. 205.

Bucket Trucks—Used

Telsta, Versa-Lift, Digger Derricks—10 in Stock. 30 other Utility Construction Trucks.
"We Buy and Sell"
Opdyke, Inc. (Philadelphia Area)
3123 Bethlehem Pike (215) 721-4444
Hatfield, Pa. 19440

Remote Installation Environment Monitors

Phone device monitors high and low temp, A/C outage, and any 3 relay closures and call you in alert condition and gives report in digitized voice.

*** METRODATA ***
*** BEI ***

Character Generator Repair

C.A.B. DIGITAL SERVICE
(516) 286-5822

QUALITY COUNTS

(Precision Converter Repair)

JUST IN TIME FOR CHRISTMAS

Act now and save 10%!

Send SGI your OAK™ Converters/Decoders NOW and receive a 10% discount* and a very fast turnaround.

Call 619-438-8919 Today

Special Free Offer

If you have never used SGI before, send us a small order of 50 or fewer converter/decoders and we'll fix 10% of your second order for free. Just for trying us, no matter how large the second order is.

- Only authorized OAK SIGMA™ addressable repair center
- Pioneer, Jerrold, Scientific/Atlanta non-data addressable converters/decoders
- All OAK™ products (decoders, head end, satellite)
- Six month limited warranty
- 99%+ perfect last 12 months

[See us at the Western Show — Booth Number 1807]

When Quality Counts . . . OUR QUALITY SHOWS

(619) 438-8919

SOUTHWEST GENERAL INDUSTRIES

SGI

2245 Camino Vida Roble, Carlsbad, California 92009

*Labor only, offer expires January 15, 1988.

NEW

CED PRODUCT SHOWCASE

- 1/9 page ad
- Black and white glossy photo of your product
- 10 lines of typed copy
- Headline of 32 characters maximum
- Ad size 2¼" x 3"

1x $350 **3x $325**
6x $300 **9x $275**
12x $250

For more information call Judy Medley at (303) 860-0111.

WANTED: SURPLUS CABLE EQUIPMENT

Jerrold, Oak, Hamlin & Scientific Atlanta equipment.
Highest Prices Paid
Cable Equipment Brokerage Co.

(818) 709-3724

"We are the better source."
USED EQUIPMENT
Bought—Sold—Brokered
See us at Booth 549 at the Western Show.

Main Line Equipment Inc.
1650 W. 180th St.
Gardena, CA 90248
(213) 715-6518
(800) 444-CATV

BUSINESS DIRECTORY

215-676-9161

TONY MESSINA
CATV CONTRACTOR
For All Your Design Needs, Big Or Small

9834 Dungan Rd.
Philadelphia, PA 19115

System Design
Drafting

Certified Woman Business Enterprise

(312) 523-6326
(312) 523-9019

"Quality Craftsmanship"
CABLE COMMUNICATIONS, INC.
L.A.N. CATV FIBER OPTICS
Installation Services

SUE HURLEY
President

4881 S. Archer Avenue
Chicago, Illinois 60632

Harold Bigham
President

"Specializes in Rebuilds"

Bigham
Cable Construction, Inc.
Complete CATV Construction

(904) 932-6869

P.O. Box 903
Gulf Breeze, FL 32561

CABLE SYSTEM SURVEY CO.

MAPPING • DESIGN • AS-BUILTS
COMPLETE DRAFTING SERVICES

Call and ask for our brochure of technical services.

17 Peddler's Row
Newark, DE 19702
(302) 368-2436

518 North Main Street
Tekonsha, MI 49092
(517) 767-4185

- Asset Appraisals
- Fair Market Valuations
- Bank Presentations
- Feasibility Studies

CHARLES E. WALTERS
(703) 661-8387

CABLE APPRAISERS, INC.

P.O. Box 17727 ■ Dulles International Airport ■ Washington, D.C. 20041

SIGNAL LEVEL METER REPAIR
Prompt, Professional Service at Reasonable Prices

JGL ELECTRONICS, INC.

4425 BLACKSTONE DRIVE
INDIANAPOLIS, INDIANA 46237
317/783-6130

CONTRACT CABLE TV INSTALLERS

CONTRACT INSTALLERS, INC.
UHF Radio Equipped Trucks • Uniformed Installers

HOUSE INSTALLATIONS
Aerial - Underground - Pre-wire
APARTMENT INSTALLATIONS
Post wire - Pre-wire - Commercial Building
Tap Audits

Install or Remove Traps and/or Converters
Drop change over for System Rebuilds

LENNY FISCHER
(414) 582-7087

P.O. Box 1564
Appleton, Wisconsin 54913-1564

CABLE CONSTRUCTORS INC. IRON MOUNTAIN, MICHIGAN

- PLANNING
- STRAND MAPPING
- SYSTEM DESIGN
- MAKE-READY
- OVERHEAD/UNDERGROUND
- TESTING
- TURNKEY HEADEND
- MATERIAL SUPPORT
- FCC PROOF OF PERFORMANCE
- MICROWAVE/ITFS SYSTEM PLANNING

If you are seeking a single source [illegible] Cable Constructors inc
105 Kent St., P.O. Box 190, Iron Mountain, MI 49801, telephone (906) 774 6621

CLI made easy

A trip through the 'past' gives insight to the future.

Denise and Rob were excited. They were anxious about spending the day with Hal, the senior headend engineer at MSO Cablevision's headend site. System manager and chief engineers had come and gone, but Hal had been with the company forever and it was rumored that he was famous for stories about the early days.

MSO Cablevision was happy to give both young trainees the opportunity seeing as how both just recently passed the distribution system portion of a certification program and were now ready to get a better idea of what makes a headend tick.

When they first came to work for MSO Cablevision, Rob was put on as an installer technician and Denise was placed as a fourth system mapper/designer. Each enrolled in the certification program for distribution systems and before too long found themselves responsible for maintaining their very own segment of the system.

But now the anxiety was building. After all, headends are mysterious, right? . . . and some others who had taken the exam didn't fare too well. Besides, they were to spend more than casual time with Hal and neither student really knew him all that well.

"Good morning, Hal," said the two in unison upon seeing him enter the office.

a"Hi," he replied. "I hope I haven't kept you waiting too long. About ready to get started?"

"Sure," said Rob.

"Give me a few minutes to put some water on any fires which might have popped up overnight and I'll be right with you," he said.

It was normally about a 20-minute drive from the office to the headend, 30 in the morning rush hour traffic. Hal made short work of any business he had to attend to before escorting his two trainees to the site.

"OK, folks, let's go," said Hal as he flipped off the light in his office, "my pickup is around back." The two youngsters followed Hal as he led the way to his parking spot where they arranged themselves in his truck, snapped their seat belts and were off.

"I hear that both of you have become certified distribution system technicians," said Hal.

"That's right," said Denise proudly.

Rob added, "It wasn't really so tough but I learned a lot."

"So did I," Denise agreed, "and I'm sure looking forward to your showing us the headend. Some of the other guys have been impressed with the complexity and how simple you make it all sound."

"Good," replied Hal. "Headends themselves aren't nearly as complex as the devices which make them play. And for sure, it isn't as impressive today as it was a couple of years ago."

"What do you mean?" asked Denise.

"Well," began Hal, "when you two sweep your portion of the system, what is the highest frequency used?"

Rob answered, "Channel J...223 MHz."

"And can you sweep all frequencies from channel 2 through channel 13?" asked Hal.

"No," replied Denise. "There's a hole in the sweep trace from about 108 MHz to about 136 or 137 MHz."

"That's right," exclaimed Hal, "And how many channels do we provide our subscribers?"

"Well, let's see," pondered Rob, "Channels 2 through 6 is five, channels D through H is five, channels 7 to 13 is seven, plus channel J."

"Makes a total of 19, not counting the FM radio channels," said Denise.

"Would you believe," Hal began, "there was a time when we had the capability of delivering 52 channels and there were some other plants that could carry as many as 83 channels on a single cable?"

By Richard L. Shimp, ComSonics Inc.

The right way for installers to figure out what's wrong.

The best time to discover a subscriber installation problem is at hook-up. *Before* you have to make an expensive service call.

That's why Wavetek developed MicroSAM, a new hand-held installer's meter that gives digital readouts of channel signal levels.

For instant trouble-shooting.

If an installer discovers a problem, he can track it down simply by retracing his steps. Testing every point from the TV to the tap. Until he finds it.

An LCD display gives the *exact* signal level (without dummy lights or needles to read.) At *three* frequencies, not just two. Frequencies *you* set, not the factory.

MicroSAM has programmable band ranges up to 550 MHz. At ± 1 dB accuracy, with 0.1 dB resolution.

And a suggested list price of only $369.

MicroSAM gets rid of the guesswork. So you get it right the first time.

Call Wavetek at 1-800-622-5515 (in Indiana call 317-788-5965) for more information and the name of the nearest MicroSAM distributor.

Reader Service Number 59

WAVETEK®

Hal's mind wandered back to his early years and experiences. He inhaled deeply and began.

"And, furthermore, some plants had two cables, each with at least 400 MHz . . . that's 52 channels worth of capacity. Some 450-MHz dual cable plants were contemplated, but the desire to build systems with two cables stopped when 550-MHz equipment became available and there was talk about 600 or 650 MHz."

"Wow," yelled Rob, "650 megs . . . how many channels is that?

Hal knew the youngsters wouldn't calculate the right number since they didn't have the background so he quickly helped them out. "About 93, not counting the reverse capacity. See, back during the '70s and '80s cable television operators were allowed to use the entire frequency spectrum between 54 and at least 650 MHz."

"What happened?" asked Denise.

Hal's mind wandered back to his early years and experiences. He was trying to arrange his answer so that it made some sense to the eager pair, realizing that he could make himself vulnerable to questions embarrassing to the CATV industry. He inhaled deeply and began.

"In the late '60s the CATV industry was undergoing some growth pains. Since the conception of transporting television signals on wires to remote areas that were shadowed from normal broadcast stations, operators were capable of delivering only those channel allocations available to the broadcaster. That meant 2 through 6 and 7 through 13 were the only available channels, not a whole lot different than today.

"As more and more systems were built, the number and size of the communities gaining and wanting cable service was growing rapidly. After a while, it became fairly apparent that in order to provide the larger communities with a useful service, the cable company had to deliver more channels, thinking that more is better. Hardware manufacturers were frantically trying to squeeze all they could from transistor circuitry.

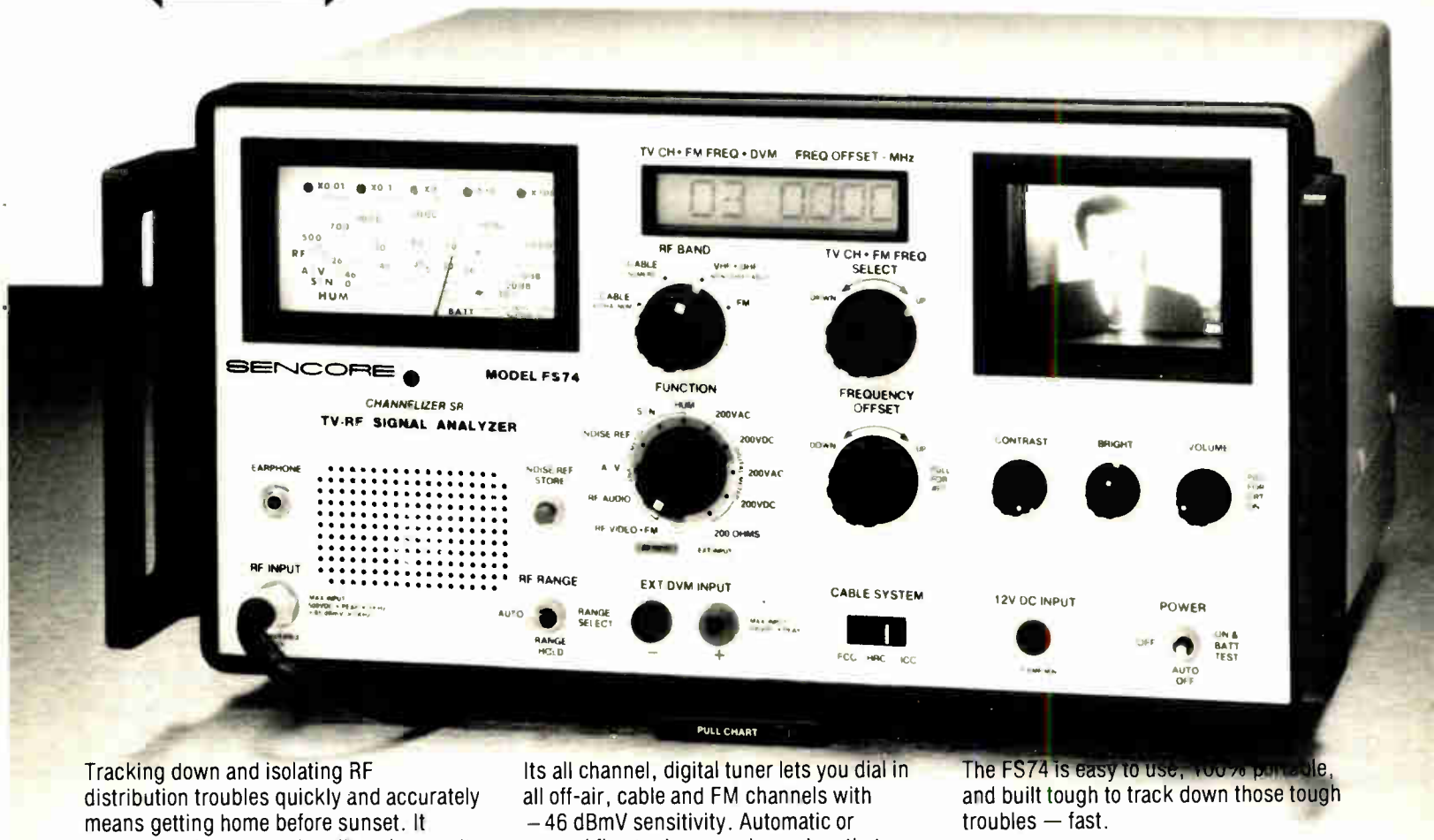
"Well, increasing bandwidth rattled some cages. In the early '70s, the Federal Aviation Administration became a bit wary of the potential interference."

Both trainees got a puzzled look on their faces because they couldn't figure out what the FAA had to do with cable television. But before either could interrupt, Hal continued. "About the same time, the Federal Communications Commission issued a set of technical criteria that cable systems were expected to meet. Among these was the requirement to maintain the amount of signal leakage within certain limits. The industry seemed to respond with an indignant attitude. For the most part, that attitude didn't make a great deal

Track Down Tough To Find CATV, MATV, And RF Distribution Troubles

100% American Made
FS74 CHANNELIZER SR.™
TV-RF Signal Analyzer
$3,495 Patented

IEEE-488 BUS-COMPATIBLE



Tracking down and isolating RF distribution troubles quickly and accurately means getting home before sunset. It means keeping your subscribers happy. It means you are more productive, and able to handle more of the day-to-day business. Bottom line, it means your business is more profitable.

The FS74 CHANNELIZER SR. is built exclusively for this purpose.

Its all channel, digital tuner lets you dial in all off-air, cable and FM channels with −46 dBmV sensitivity. Automatic or manual fine tuning reveals carriers that are shifted above or below FCC standards. Quick and automatic audio-to-video, signal-to-noise, and hum tests on in-use channels remove inaccurate interpretation in signal tests.

An exclusive wide-band monitor points you right to the source of interference or ghosting, quickly, and without guesswork.

The FS74 is easy to use, 100% portable, and built tough to track down those tough troubles — fast.

Next time, be prepared for that 5:00 p.m. phone call from your subscriber. Call **1-800-843-3338** and discover what 100% automatic testing can do for you.

SENCORE

Call 1-800-843-3338 today.
In Canada 1-800-851-8866.
Reader Service Number 61

CHANNELIZER SR. is a trademark of Sencore, Inc.

'What you must realize is that the trend in the industry was to deliver more channels.'

of difference since most of the existing cable systems carried only 12 channels with frequency allocations the same as television broadcast stations."

"Airplanes didn't use the same frequency allocations as television stations, did they?" asked Rob.

"No, the Commission had—and still has—the responsibility to ensure that broadcast services with overlapping allocations are compatible," Hal said.

"Then I don't understand the problem," continued Rob.

"What you must realize is that the trend in the industry was to deliver more channels. Since the only way to increase the number of channels was to place them into frequency slots which were *not* shared by broadcast television but *were* shared by aeronautical and other services, they had the *potential* for harmful interference."

"OK," conceded Rob, "I want to hear about 90 channels."

"Well, time went on and complying with the leakage rule was put on a back burner. The industry perceived the need for more and more channels in order to compete for larger community franchises and in preparation for the upcoming opportunity to bid for major markets."

"Major markets?" queried Denise.

"They're typically the larger metropolitan areas where more than one broadcast television station exists," Hal explained. "Because cable technology was so new, it was decided by the FCC that there was nothing to be offered by the industry to areas already served by a sizable number of broadcast facilities. So there was a temporary ban placed on franchising these areas.

"As I said before, the industry was in the middle of gearing up to compete for these lucrative areas. Semiconductor technology improved by the introduction of hybrid circuits and special single package arrays which allowed much better performance than discrete transistor amplifiers. And bandwidth shot to 300 MHz or about 35 channels; a lot in those days. Well, time went on and things were looking rosy when all of a sudden the cable industry got a black eye. The world found out that signals inside the cable weren't quite as secure as once thought."

"What happened?" asked Rob as Hal turned on to Main Street.

"A cable system in a sizable community in Pennsylvania was found to be the source of squealing in aircraft communication receivers. The system had been using multiple pilot generators on the same frequency to control amplifier gain for years without incident when, as it often does, the FAA changed a communications channel allocation to the very same frequency the system was using for automatic gain control."

"Could they do that?" asked Denise.

"They sure could—and still can," said Hal. "Those allocations were

assigned to the FAA long before cable started using them. Besides, the cable was supposed to be a secure method of signal transportation. The slight difference in frequency between pilot generators caused an audio beat which was detectable in aircraft communication receivers. This was really the beginning of a rude awakening within the industry. Studies were done and conclusions reached in an attempt to bring the leakage thing under control. Several more episodes followed; the Commission was granted authority to levy token fines and they did in a few instances. Ham radios got in and business radios just like this one," said Hal, pointing to the two-way in the truck. "Remember, sharing service shouldn't have been a problem since the cable industry was supposed to be tight. We were sharing frequency allocations with a lot of radio services and the number was growing."

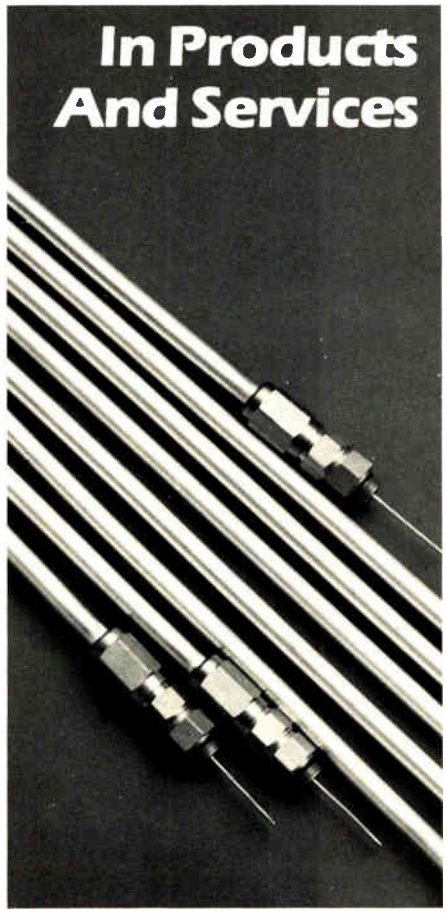
"Wasn't there any way to measure the leakage from the plant?" asked Denise.

"Sure, there were some really good devices available," said Hal. "but isolating the leak sources required a fair understanding of how radio frequency waves travel on the coax sheath and other conductors."

"Sounds like Propagation Theory 101," Diane said smugly.

'At first, the cable plants were so leaky that technicians simply threw up their hands in disgust.'

"You might think so, but doin' it ain't like sayin' it, believe me," replied Hal. "Funny things happen around cable bends. Sometimes the plant can act like an antenna, depending upon the location of the sheath fracture or loose fitting with respect to impedence discontinuities like amplifier housings.



Then complicate this with unknowns like ground wires, bonded neutrals, strand, guy wires; what a mess. Multiple drops were always a challenge. The only way to single out the bad one or ones was to use a near field pickup probe supplied by a couple vendors. Maybe it wasn't the only way—I suppose you could disconnect them one at a time until the leak stopped."

"But wasn't there a general procedure for getting some idea how badly the systems were leaking?" asked Denise.

"The Commission wanted the leakage to be measured with a field intensity meter and a horizontally polarized dipole antenna placed 10 feet from the ground, adjusting the distance from the ground if necessary. The rule did allow for alternative measurement technologies so long as a correlation could be made between the results obtained by using the selected methodology and the prescribed technique.

"At first, the cable plants were so leaky that technicians simply threw up their hands in disgust. They ran into some of the complexities we talked about earlier and were discouraged. After dealing with it for a while, the techs became more familiar with a systematic approach that almost everyone doing measurements adopted.

"The most effective equipment used a transmitter which emitted a unique signal which could be easily distinguishable from all other signals carried. There were numerous devices available for installers to ensure that the connections they made would not

'But the clause that stirred the most emotion was the requirement to comply with cumulative leakage index, or CLI.'

contribute to the plant leakage.

"Users normally found it necessary to reduce the level of the transmitter, or pad the input of the detector in order to first locate the very high level leaks, ultimately exposing low-level leaks, improving the probability of tightening the entire plant to specification. Eventually, those who took the measurements seriously installed leakage detectors into the service vehicles.

"As an alternative, the operator could prepare a predetermined grid at about one-mile intervals over the plant coverage area, then fly the grid with an appropriately outfitted aircraft. While the method didn't provide localization, it did satisfy the primary concern; determining if the level in airspace was less than 10 microvolts per meter at 450 meters or about 1,500 feet.

The latter was among three from which the Commission derived what it called a *cumulative leakage index*. Conclusions were derived from an analysis by the FCC Advisory Committee on Cable Signal Leakage, a joint effort involving the FAA, industry members and other interested parties. The remaining two methods use measurements made on the ground to statistically determine leakage levels in the airspace above a cable plant.

"The operator was required to monitor all portions of the system at least once a year, and maintain a log which detailed the date discovered, source of the leak, location, the date eliminated and the reason for the leak."

Hal continued. "Any interference reported to the operator was to be expeditiously investigated and eliminated or the Commission could shut him down. For those plants using the aeronautical frequencies—108 to 137 MHz and 225 to 400 MHz—a program of regular monitoring had to be performed so that a substantial portion of the plant was covered every three months. The monitoring equipment had to be capable of detecting 20 microvolts per meter at three meters.

"There were some notification requirements based on average operating power. The Commission had to be notified before using any aeronautical frequency allocation equal to or in excess of a tenth of a milliwatt or if that level could be achieved into a bandpass of 25 kHz on 160 microseconds.

"But the clause that stirred the most emotion was the requirement to comply with cumulative leakage index, or CLI. As I recall, there was a requirement to comply with CLI in a relatively short period of time. However, there was reason for reconsideration and the FCC placed a five-year moritorium on the requirement, which expired July 1, 1990.

"During the five-year grace period, some operators took the bull by the horns, but quite a few didn't. The Commission was watching closely and didn't like what it saw. Time was drawing near and the Commission was really up in arms. The industry had embarrassed the people who had given a heavy-duty break back in 1986 and despite all attempts, a large contingent of the industry decided to hold out."

"A conspiracy?" wondered Diane.

"Heavens no," said Hal as he made a right turn and rolled into the headend driveway. "Just individual stubbornness. Anyway, the day of reckoning came and the Commission amassed a huge force to check out a large number of systems. They were selective; it seemed like they knew where they were going."

The pickup rolled to a stop in front of the small building and Hal turned off the ignition.

"Well, then what?" asked Rob anxiously.

Hal hopped from the truck and his students scrambled after him. He stopped to remove the lock from the headend door and just before opening it, he turned and said, "You are about to enter a state-of-the-art cable television headend facility, delivering 19 high-quality channels into a cable plant, the maximum number allowable under FCC rules. There is no finer system anywhere in the United States." ■

Converter repair service profile

Authorized Parts Co.
(312) 658-6900
200 Berg St.
Algonquin, IL 60102
PERSONNEL: Bob Brannam, Midwest sales; Jerry LaFountain, East Coast sales.
REGIONAL OFFICES: 146 Berrett St., Schenectady, NY 12301, (518) 374-1113.
DESCRIPTION: Supply converter repair parts and equipment, for Jerrold, Jerrold addressable, Hamlin, Oak and others. We also buy and sell inventory.

Beta Tech Engineering Inc.
(602) 266-9389
4128 North 27th Ave.
Phoenix, AZ 85017
PERSONNEL: James Monroe, president; Don Walden, service manager.
DESCRIPTION: Repair of converters, headend and test equipment, line equipment. Converter brands serviced include Oak, Jerrold, Hamlin, Pioneer, Texscan, Eagle, Magnavox, Sylvania, RCA, Panasonic and Scientific-Atlanta.

Brad Cable Electronics Inc.
(518) 382-8000
(800) 382-BRAD
1023 State St.
PO Box 739
Schenectady, NY 12301
PERSONNEL: Ben Price, president; Robert Price, senior vice president; Richard Koonz, national sales manager.
REGIONAL OFFICES: 4630 Pacific Hwy. East, Ste. B-7, Fife, WA 98424, (206) 922-9011; 122 E. Ellen St., Fenton, MI 48430, (313) 750-9341; 1255 Boston Ave., W Columbia, SC 29169, (803) 794-3910; 5906 Breckenridge Pkwy., Tampa, FL 33610, (813) 623-1721.
DESCRIPTION: Sell new, used and rebuilt converters, converter parts and CATV parts. Service CATV equipment, converters, line amps, headend gear, field strength meters and related items. Jerrold Factory Qualified Service Center. Oak Factory Authorized Service Center.

CATV Services Inc.
(415) 651-4331
(800) 227-1200
(800) 223-3152
2211 Warm Springs Court
Fremont, CA 94539
PERSONNEL: Richard Richmond, president.
DESCRIPTION: Distributor of cable TV products. Specializing in repair and sales of reconditioned electronics. Authorized West Coast Wavetek sales and repair facility.

COM-TEK
(415) 785-4790
24209 Clawiter Road
Hayward , CA 94545
PERSONNEL: Nick Ferolito, owner/sales; Russell Brown, owner/sales; Darrell Rance, sales; Shelley Hammerly, sales; Roy Cooke, technical manager.
REGIONAL OFFICES: 21688 SW Klickitat Court, Tualatin, OR 97062, (503) 692-6669; Regional Repair Facility, Sedalia, MO 65301, (816) 826-3011.

CSI Technologies
(612) 354-2081
(800) 428-9267
Box 308100 W Central
New London MN56273
PERSONNEL: Curtis Sampson, president; Wendell Dietrich, COO; Don Carley, sales manager.
DESCRIPTION: CSI Technologies manufactures cable lashers, aerial plant placement equipment, data modems, and repairs and services electronic equipment.

Cable Link Inc.
(614) 221-3131
280 Cozzins St.
Columbus, OH 43215
PERSONNEL: E. Jack Davis, president; Bill Holehouse, director of sales; Stan Smith, account executive; Vonna VanHeemst, account executive; Fritz Juskalian, account executive.

converter repair

REGIONAL OFFICES: Southwest sales office; San Antonio, TX. (512) 650-3132; Michigan sales office, Drayton Plains, MI (313) 673-0813.
DESCRIPTION: Sales of new and refurbished converters, distribution electronics, passive devices and hardware. Large, centrally located repair facility for converters, distribution electronics, headend and test gear.

Cable Converter Service Corp.
(812) 829-4833
54 East Market Street
PO Box 407
Spencer, IN 47460
PERSONNEL: John Wright, president.
DESCRIPTION: Founded in 1977, Cable Converter Service Corp. buys, sells, and offers a full-service repair facility for CATV equipment, including converters and line equipment. Repairs: Scientific-Atlanta, Jerrold, Oak, RCA, Hamlin, Sylvania, Theta Com, Texscan, Pioneer and more. Locations nationwide.

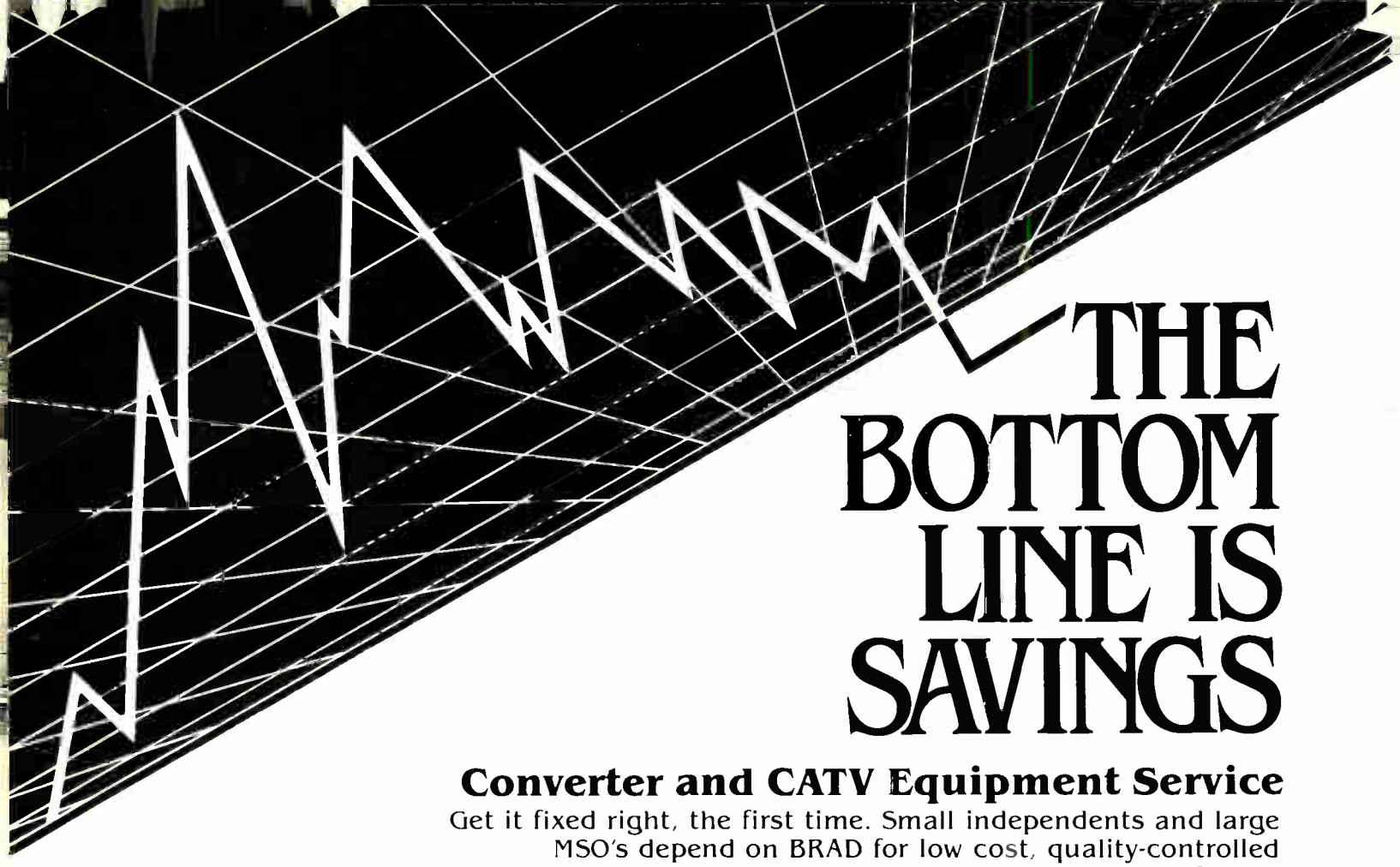
Cable Services Co. Inc.
(717) 323-8518
(800) 233-8452
(800) 332-8545
2113 Marydale Ave.
Williamsport, PA 17701-1498
PERSONNEL: John Roskowski, president; George Ferguson, vice president; Robert Brantlinger, director of marketing; Harry Wahl, VP/turnkey sales.
DESCRIPTION: Complete turnkey supply and construction including pole walking, strand mapping, design, engineering and installations, both aerial and underground. Stocking distributor of all major manufacturers.

Cable Television Services
(505) 292-7766
120 Berbee NE
Albuquerque, NM 87123
PERSONNEL: Don Quinton, president.
DESCRIPTION: RF converter repair facility.

Cable Terminal Services, Inc.
(512) 258-1606
505 Cypress Creek
Cedar Park, TX 78613
PERSONNEL: Jim Orwick, VP/general mgr.
REGIONAL OFFICES: 3430 Fujita Ave., Torrance, CA 90505, (213) 539-8030, (800) 551-2288, Bill Ewing.
DESCRIPTION: We service converters for cable systems throughout the United States. Authorized non-warranty repair for Jerrold, Hamlin, Scientific-Atlanta and Oak converters. New repair facility now open on West Coast.

Compu-Trace Inc.
(818) 886-3551
8803 Shirley Ave.
Northridge, CA 91324
PERSONNEl: M. Kim, president; Julie Kim, vice president; Pad Amarasinghe, operations manager.
DESCRIPTION: Set-top converter repair service and assembly manufacturer.

Digitrace Inc.
(313) 234-1301
(800) 443-1403
2040 S. Saginaw
Flint, MI 48503
PERSONNEL: Paul Hales, president; Ken Schwind, vice



THE BOTTOM LINE IS SAVINGS

Converter and CATV Equipment Service

Get it fixed right, the first time. Small independents and large MSO's depend on BRAD for low cost, quality-controlled service. BRAD works around the clock — ensuring the fastest turnaround possible, and also offers a 6 month limited warranty on parts and labor.

Converter Sales

BRAD stocks over 200,000 new and reconditioned converters for quick delivery. Each carries BRAD's 6 month limited warranty on parts and labor.

Converter/CATV Parts

With over two million dollars of parts inventory in stock, you are assured of next day delivery on most orders.

For Bottom Line Savings Call: **1-800-382-BRAD**
In NY, Call: **1-518-382-8000**

CLEARLY BETTER™

BRAD®

The Converter Marketplace™

Corporate Headquarters
1023 State Street
Schenectady, NY 12301
(518) 382-8000

4630 Pacific Hwy. East
Suite B-7
Fife, WA 98424
(206) 922-9011

5960 Breckenridge Pkwy.
Suite 1
Tampa, FL 33610
(813) 632-1721

Highway 19
Old Socco Road
Cherokee, NC 28719
(704) 497-5314

112 E. Ellen Street
Fenton, MI 48430
(313) 750-9341

1255 Boston Avenue
West Columbia, SC 29169
(803) 794-3910

2010 Pine Terrace
Sarasota, FL 33581
(813) 922-1551

Reader Service Number 65

converter repair

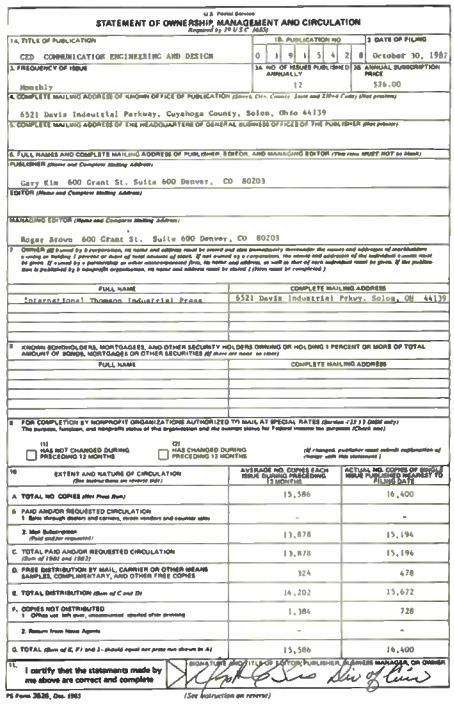
president; Al Winter, sales manager.
DESCRIPTION: Serving the cable industry in the repair and remanufacturing of converters and transmitters since 1983. Services include converter repair: Jerrold and Oak addressable and all basic converters. Converter modifications. Transmitter repair: all makes. Sale of new transmitters for Jerrold 400 and 450 converters. New repair parts.

ECTV Inc.
(718) 785-6996
3614 11th St.
Long Island City, NY 11106
PERSONNEL: George Legrand.
REGIONAL OFFICES: 44-45 Vernon Blvd., Long Island City, NY 11101, (718) 706-8057.
DESCRIPTION: Buys and sells reconditioned converters. Converter repair.

Independence Electronics
(816) 836-1094
119 S. Main
Independence, MO 64050
PERSONNEL: Douglas Jones, president; Colleen Jones, vice president.
DESCRIPTION: Independence Electronics does converter repair. We also tune positive traps for cable systems. We manufacture and design test equipment for the converter repair business, such as a converter test set.

Intrastellar Electronics, Inc.
(312) 658-0300
200 Berg St.
Algonquin, IL 60102
PERSONNEL: Mary LaLoggia, account representative.
DESCRIPTION: Authorized repair facility for CATV converters, including Jerrold, Sylvania, Hamlin, Pioneer, Scientific-Atlanta, RCA, Oak and block converters. Also repair of line equipment, head-end equipment and remote control units. Full service brokerage facility for all CATV equipment.

Island Cable Electronics
(516) 931-8484
(800) 431-5433
49 Bloomingdale Road
Hicksville, NY 11801
PERSONNEL: David Cohen, president; Toni-Ann Caferri, national sales manager; Joe Oliva, director of operations.



STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

1A. TITLE OF PUBLICATION: CED COMMUNICATION ENGINEERING AND DESIGN	1B. PUBLICATION NO: 0 1 9 1 5 4 2 8
2. DATE OF FILING: October 30, 1987	
3. FREQUENCY OF ISSUE: Monthly	3A. NO. OF ISSUES PUBLISHED ANNUALLY: 12
3B. ANNUAL SUBSCRIPTION PRICE: $24.00	

4. COMPLETE MAILING ADDRESS OF KNOWN OFFICE OF PUBLICATION (Street, City, County, State and ZIP+4 Code) (Not printers): 6521 Davis Industrial Parkway, Cuyahoga County, Solon, Ohio 44139

5. COMPLETE MAILING ADDRESS OF THE HEADQUARTERS OF GENERAL BUSINESS OFFICES OF THE PUBLISHER (Not printer):

6. FULL NAMES AND COMPLETE MAILING ADDRESS OF PUBLISHER, EDITOR, AND MANAGING EDITOR (This item MUST NOT be blank)

PUBLISHER (Name and Complete Mailing Address): Gary Kim 600 Grant St. Suite 600 Denver, CO 80203

EDITOR (Name and Complete Mailing Address):

MANAGING EDITOR (Name and Complete Mailing Address): Roger Brown 600 Grant St. Suite 600 Denver, CO 80203

7. OWNER (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual owner must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) (Item must be completed.)

FULL NAME	COMPLETE MAILING ADDRESS
International Thomson Industrial Press	6521 Davis Industrial Pkwy. Solon, OH 44139

8. KNOWN BONDHOLDERS, MORTGAGEES, AND OTHER SECURITY HOLDERS OWNING OR HOLDING 1 PERCENT OR MORE OF TOTAL AMOUNT OF BONDS, MORTGAGES OR OTHER SECURITIES (If there are none, so state)

FULL NAME	COMPLETE MAILING ADDRESS

9. FOR COMPLETION BY NONPROFIT ORGANIZATIONS AUTHORIZED TO MAIL AT SPECIAL RATES (Section 423.12 DMM only)
The purpose, function, and nonprofit status of this organization and the exempt status for Federal income tax purposes (Check one)
(1) ☐ HAS NOT CHANGED DURING PRECEDING 12 MONTHS
(2) ☐ HAS CHANGED DURING PRECEDING 12 MONTHS (If changed, publisher must submit explanation of change with this statement.)

10. EXTENT AND NATURE OF CIRCULATION (See instructions on reverse side)	AVERAGE NO. COPIES EACH ISSUE DURING PRECEDING 12 MONTHS	ACTUAL NO. COPIES OF SINGLE ISSUE PUBLISHED NEAREST TO FILING DATE
A. TOTAL NO. COPIES (Net Press Run)	15,586	16,400
B. PAID AND/OR REQUESTED CIRCULATION 1. Sales through dealers and carriers, street vendors and counter sales	-	-
2. Mail Subscription (Paid and/or requested)	13,878	15,194
C. TOTAL PAID AND/OR REQUESTED CIRCULATION (Sum of 10B1 and 10B2)	13,878	15,194
D. FREE DISTRIBUTION BY MAIL, CARRIER OR OTHER MEANS SAMPLES, COMPLIMENTARY, AND OTHER FREE COPIES	324	478
E. TOTAL DISTRIBUTION (Sum of C and D)	14,202	15,672
F. COPIES NOT DISTRIBUTED 1. Office use, left over, unaccounted, spoiled after printing	1,384	728
2. Return from News Agents	-	-
G. TOTAL (Sum of E, F1 and 2 - should equal net press run shown in A)	15,586	16,400

11. I certify that the statements made by me above are correct and complete. SIGNATURE AND TITLE OF EDITOR, PUBLISHER, BUSINESS MANAGER, OR OWNER: Gary Kim Vice President

PS Form 3526, Dec. 1985 (See instructions on reverse)

converter repair

DESCRIPTION: Distributor of cable TV converters, descramblers, line equipment and amplifiers, new and reconditioned. Also converter and line equipment repair.

MAI Comm., Inc.
(609) 547-1600
(800) 624-2288
141 Shreve Ave.
Barrington, NJ 08007
PERSONNEL: Thomas Girard, president; Robert Mai Jr., VP/operations; Barbara Kemery, VP/finance; David Mai, VP/construction; Kenneth Settar, account executive.
DESCRIPTION: Complete turnkey operation, converter repair, consulting, strand mapping, fiber optic construction, system engineering, design, equipment evaluation, engineering training and two way activation.

Northeast Cable Electronics Inc.
(203) 443-7675
61 Myrock Ave.
Waterford, CT 06385
PERSONNEL: William Mickle, president; Albert Dimmock, vice president; James Hapis, secretary/treasurer.
DESCRIPTION: Repair of converters and line equipment.

DESCRIPTION: Repair of converters and line equipment.

PTS/Katek
Cable Services Division

Gary Wilson
Cable Product Manager

PTS/Katek, Inc.
Corporate Headquarters
5233 South Highway 37
P.O. Box 272
Bloomington, IN 47402
(812) 824-9331
(800) 441-2371

PTS/KATEK
(812) 824-9331
(800) 441-2371
5233 S Hwy. 37
Bloomington, IN 47402
PERSONNEL: Gary Wilson, cable product manager; Joe Achors, cable sales; John Gelfer, cable sales; Jeff Hamilton, director of marketing.
REGIONAL OFFICES: 12 regional offices. Call for one nearest you.
DESCRIPTION: Converter sales and repair service with 13 nationwide locations. Buys and sells used converters. Jerrold distributor.

converter repair

RF Analysts Inc.
(313) 750-9341
112 E Ellen St.
Fenton, MI 48430
PERSONNEL: Jack Hooper, president; Dewayne Lip, director of engineering; Paul Bowsher, general manager-MI; Jon Kilcoyne, general manager-SC.
REGIONAL OFFICES: 1255 Boston Ave., W.Columbia, SC 29169, (803) 794-3910; 2010 Pine Terrace, Sarasota, FL 33580, (813) 922-1551.
DESCRIPTION: R.F. Analysts does converter repair, satellite equipment repair, line equipment, headend gear, test equipment repair, and also manufactures a computerized test system for headends and for remote locations.

RMT Engineering Inc.
(408) 733-4830
(800) 228-0633
625 E Taylor Ave.
Sunnyvale, CA 94086
PERSONNEL: Richard McLean, president; Patricia McLean, vice president; Michael Kleykamp, national sales manager.
REGIONAL OFFICES: Two regional offices. Call for location nearest you.
DESCRIPTION: Sales of new and remanufactured CATV products. Repairs of all CATV/SMATV electronics. Repairs of portable test equipment.

Tronitec, Inc.
604 Industrial Court
Woodstock, GA 30188
(404) 926-6104
PERSONNEL: Chuck Phillips, National Sales Manager; Rodney Smith, Operations Manager; Mike Futral, President.
DESCRIPTION: Specializing in the rebuilding of CATV electronics. Featuring flat rates, 120 day warranty and quick turnaround.

Western CATV Distributors, Inc.
(213) 539-8030
(800) 551-2288
3430 Fujita Ave.
Torrance, CA 90505
PERSONNEL: Bill Ewing, president; Dave Herman, VP/engineering; Chris Ewing, sales manager.
DESCRIPTION: Distributor of cable TV components. Total CATV repair center, authorized Magnavox warranty. Engineering services.

Wavetek intros new meter

Although there was plenty of talk about HDTV and fiber optics, this year's Atlantic Cable Show was mostly void of any new product introductions. Bucking that trend however, was **Wavetek**. The Indianapolis-based company showed off its new three-channel signal level meter, dubbed MicroSAM. Intended for installers, the new meter allows tuning of three frequencies at the push of a button. The frequencies can be configured and changed by the user, all the way up to 550 MHz. The LCD displays readings with 0.1 dB resolution and ±1.0 dB accuracy. Price is $369. Circle Reader Service number 120.

Wavetek's MicroSAM

It's been a busy summer for engineers at **Texscan MSI**, judging by the flood of new product announcements scheduled for display at the Western Cable Show in Anaheim. ComSerter-192, a new commercial inserter featuring full stereo capability, CMOS nonvolatile memory, simplified tape marking, auxiliary source input and dubbing without degradation, will be featured along with the new ConSert 2000 Series software. The new software introduces ComSerter control, full traffic and billing, and management reporting capabilities. MSI's SpectraGraph, MGG-2, will also be on hand. The graphics generator can digitize pictures from any NTSC video source, along with audio. It features 32,000 colors, multiple fonts, easy-to-use menus, off-line editing and random display sequencing. Circle Reader Service number 121.

In news from the stereo front, **Catel** unveiled its new TVS-2000 BTSC stereo encoder. The unit offers standard 4.5 MHz and 41.25 MHz RF outputs plus a simultaneous composite output, allowing it to work with different video modulators. The front panel contains dual left- and right-channel LED modulation displays and a horizontal sync-lock indicator. It boasts signal-to-noise characteristics of better than 60 dB and separation of more than 30 dB from 100 Hz to 8 kHz; 20 dB at 14 kHz; and 26 dB at 50 Hz. Circle Reader Service number 122.

Leaming's MTS-2B stereo generator

Leaming Industries' latest generation of BTSC stereo generators now incorporates LED bargraph metering and flat frequency response to 15 kHz. The MTS-2B and MTS-2A use dbx companding and include a built-in AGC. Circle Reader Service number 123.

And finally, **Wegener Communications** added two new BTSC encoder configurations to its product line. The 1601-56 incorporates up to four encoders in a single mainframe, while the 1602-95 is a low-profile single unit configuration. Both feature selectable high/low impedence, balanced/unbalanced audio interfaces, selectable stereo/mono local commercial insertion and barrier strip interconnections. Circle Reader Service number 124.

Belden's RG-6 and RG-59 cables

Belden Wire and Cable has expanded its product line to include new RG-6 and RG-59 cables. The RG-6 cables (1189A, 1190A and 1191A) have an 18 AWG solid copper covered steel conductor with a cellular polyethylene core. 1190A is designed for direct burial, 1191A for aerial applications and 1189A features an outer jacket of PVC in black or beige. The RG-59 cables (1186A, 1187A and 1188A) have a 20 AWG conductor and are cellular polyethylene insulated. 1187A is for direct burial, 1188A for aerial. Circle Reader Service number 125.

Standard's Agile 40 C/K satellite receiver

A new low profile satellite receiver is now available from **Standard Communications**. The Agile 40 C/K features 100 kHz PLL tuning; 70 MHz IF with front panel test point and fine tuning control; and a power supply built to handle 24-hour a day operation. Circle Reader Service number 126.

A heterodyne signal processor with UHF to VHF conversion capability was introduced by Pico Macom Inc.

RMS Electronics now offers a high isolation RF cable switch. The new A/B switch features shielded modular construction delivering a minimum of 90 dB isolation. It operates from DC to 300 MHz and has a return loss of 21 dB. Circle Reader Service number 127.

HP's 8592A spectrum analyzer

Hewlett-Packard announced the HP 8592A, a new portable microwave spectrum analyzer. It boasts a frequency range of 50 kHz to 22 GHz and an amplitude range of -109 dBm to 30 dBm. Frequency accuracy is ±2.7 MHz at 22 GHz. Three digital interface options provide full programmability. Circle Reader Service number 128.

Philips' 3296A oscilloscope

New high-frequency oscilloscopes from **Philips Test and Measurement** offer bandwidth capabilities beyond 400 MHz. The PM 3295A and 3296A also have a writing speed of 4 div./ns, and risetimes of 0.9 ns. The units feature full alphanumeric indications, memory for 75 settings and an Autoset function that automatically selects channels, sets the amplitude range, timebase speed, trigger functions and screen position for any input signal. Circle Reader Service number 129.

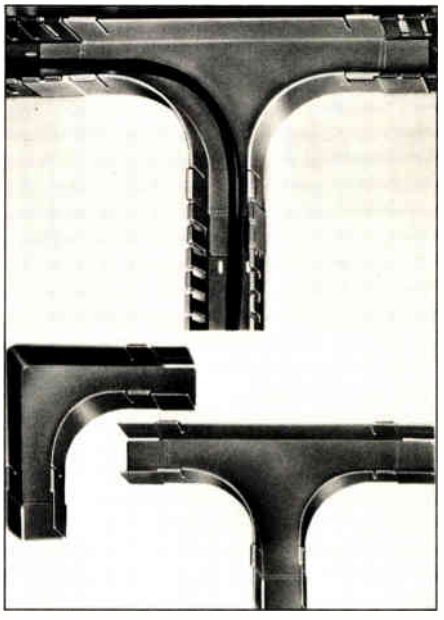
Viewsonics unveiled its Model VS-OSC-50-600 harmonic signal source. The battery-powered unit provides signals from 50 to 600 MHz in 50 MHz increments to help measure drop or feeder cable losses, correlate signal meter calibrations, check splitter losses, etc. Output level is approximately 40 dBmV to 30 dBmV. Circle Reader Service number 130.

A heterodyne signal processor with UHF to VHF conversion capability was introduced by **Pico Macom Inc.** The Model SP60-U features SAW filtering for a guaranteed 60 dB out of band signal rejection; spurious outputs down 60 dB; high adjacent channel rejection; low input signal capability; stereo compatibility; and more. Circle Reader Service number 131.

A series of new products is now available from **Microwave Filter Co.** The Model 6123 channel deletion network removes superband channels K through Q at the headend without affecting other channels. Deep deletion allows reinsertion of other programming. Model 5730 notches a block of CARS band channels from a point-to-point transmission. Notch rejection is 50 dB minimum. Model 5948 ENG channel bandpass filter is available for any channel within the 1990 to 2110 MHz ENG band. Center frequency insertion loss is less than 0.5 dB. Model 6072 is a feedhorn TI reducer that helps suppress terrestrial interference from either the forward or back sector. Price is $45. Notch filter model 6040A eliminates transmitter sideband interference to VHF receivers at the same site. Notch frequency is 74.15 MHz, other frequencies are available. Circle Reader Service number 132.

TIW's VHP-06 high-power amplifier

TIW Systems has added the VHP-06 to its line of high power RF amplifiers. It features a 40 to 400 MHz bandwidth, one watt continuous output and 44 dB nominal gain. The unit can amplify several combined signals while generating few intermod products. Circle Reader Service number 133.



Panduit's Tee and Right Angle fittings

Two new fittings designed for use with Panduct wiring duct for routing and protecting fiber optic cables are

Austin 'Shorty' Coryell was honored with a special engineering award in recognition of his career achievements.

available from **Panduit Corp.** Tee and Right Angle fittings provide a three-inch bend radius to prevent glass fiber cracking. Circle Reader Service number 134.

Meanwhile, **Fibertron Corp.** intro'd the Model 9400 multi-cure heater to improve and simplify the curing of epoxy used in the termination of fiber optic cables to connectors. Controlled curing of up to 24 connectors can be done at one time. It accommodates FC, ST, D4, SMA, biconic and other connectors. Circle Reader Service number 135.

Fibertron's Model 9400 multi-cure heater

A small group of cable technical experts has been named to serve as advisers to the NCTA blue-ribbon committee on **high definition television**. The members include: chairman, **Wendell Bailey**, vice president, science and technology, NCTA; **James Chiddix**, vice president, engineering and technology, ATC; **Edward Horowitz**, senior vice president, technology and operations, HBO; **Nick Hamilton-Piercy** vice president, engineering and technology services, Rogers U.S. Cablesystems; **Andrew Setos**, senior vice president, Viacom Network Group, MTV Networks; **David Willis**, director of engineering, Community Tele-Communications; and **Nick Worth**, vice president, engineering, TeleCable.

Alan Bowden has taken over as president of **Sencore Inc.** He took over the reins from company founder **Herb Bowden**, during a recent board meeting. Also, **Doug Bowden** was named vice president of marketing.

Austin "Shorty" Coryell, corporate director of vendor support at **ATC**, was honored with a special engineering award in recognition of his career achievements. During his 16 years, Coryell has authored numerous published technical articles and patents for concepts and technical design of cable hardware, implemented system addressability in various locales and assisted in the development of the installer training program.

Denes Ilkovics was named senior vice president for technology and product development for **High Resolution**

Ken Leffingwell was named manager, marketing services at Wegener Communications.

Sciences Inc.. He was formerly with ITT-Europe as chairman of the intelligent products steering group.

R.J. Smith was named vice president of national client support for **Creative Management Systems**. His responsibilities include installation, training and support of CMS clients.

Ken Leffingwell was named manager, marketing services at **Wegener Communications**. He was formerly sales engineer at Wegener.

C-Cor Electronics has appointed **Richard Taylor** national sales manager. He will supervise seven regional account executives and the inside sales force for the cable TV business unit.

David Nicholas has been named national sales manager at **Pioneer Communications of America**'s cable TV division.

Meanwhile, **James Slade** has been named marketing manager for CATV products by **Panasonic Industrial Co.**

Congratulations are in order for **Ron Hranac** of **Jones Intercable** for becoming the first participant in the SCTE's Broadband Communications Technican/Engineer certification program to successfully complete all seven category examinations. He becomes the first BCT/E candidate to be certified in the program at the technician level.

—Roger Brown

SCTE

Technical session schedule

The following is a list of technical seminars slated by the various SCTE chapter and meeting groups:

Dec. 8: The **Central Illinois Meeting Group** will meet at the Bloomington Normal Sheraton to discuss system design, construction, proof-of-performance and administer tests for BCT/E Category VII. Contact Tony Lasher, (800) 252-1101; or Ralph Duff, (217) 424-8478.

Dec. 9: The **Chatahoochee Chapter** will meet. Contact Guy Lee, (404) 451-4788. Also, the **Greater Chicago Chapter** will meet at the Embassy Suites Hotel in Schaumburg to discuss AML multi-link microwave systems with Dane Walker of Hughes Microwave. Contact John Grothendick, (312) 438-4200. And finally, the **Oklahoma Meeting Group** will meet. Contact Herman Holland, (405) 353-2250 for info.

Dec. 10: The **Central Indiana Chapter** will meet to discuss system powering concepts, lightning, sheath current, ground and surge protection with Ralph Haimowitz of American Cablesystems and Jeff Greer of Alpha. Contact Steve Murray, (317) 788-5968 or Joe Shanks, (317) 649-0407 for location info. Also, the **North Jersey Chapter** will meet to administer BCT/E exams. Call Virgil Conanan, (212) 512-5309 for info.

Dec. 16: The **Great Lakes Chapter** will meet. Call Vic Gates, (313) 422-2814 for details.

Jan. 18-20: The **Florida Chapter** is sponsoring a national seminar on fiber optic technology at the Hyatt Orlando. Representatives from various fiber vendors will host hands-on sessions, lectures and question-and-answer panels. An optional tour of the Hunter Creek system of Bell South and AT&T will also be conducted on the final day of the session. Call Richard Kirn, (813) 924-8541 or Pat Luckett, (305) 660-5524 for registration info.

Continued from page 18

should not underestimate the fact that the CATV industry today owns the only broadband signal delivery path available to most homes in the country. We do *not* have to scrap most of our investment and change out most of our plant in order to move toward a new system architecture. There are opportunities to apply optical fiber technology in ways which gain us immediate benefits and move us toward a competitive future.

There are a number of companies looking at ways in which this can be done. Irving Kahn's announcement of an overbuild using a hybrid fiber/coaxial system represents an opportunity for existing operators as well. A number of vendors are developing analog fiber systems for applications as mundane as supertrunking between headends, or as ambitious as fiber to the television set. ATC is working with a number of component and system vendors on a "fiber backbone" concept designed to overlay existing CATV systems and, by cutting amplifier cascades dramatically, to substantially improve reliability and signal quality, to make dramatic channel capacity upgrades cost-effective, to yield substantially more forgiving system operating tolerance and to improve the flexibility of CATV networks.

If these opportunities are pursued aggressively by the CATV industry, we have a wonderful opportunity to evolve our networks in a direction which pays for itself in terms of today's channel capacity, performance and operating efficiency needs. At the same time, we can position ourselves for a future in which we embrace digital transmission if that makes sense, utilize switching in the neighborhood if it supports profitable businesses and consumer needs, and ultimately construct fiber to the home if and when it is justified.

In the final analysis, if we are open to the application of new technologies to our business, we are very well positioned to deliver the telecommunications services for which tomorrow may call. What's more, we are positioned to grow and change our systems gradually in response to real needs. We do not have to scrap our present plant investment before it has served out its useful life.

No, the sky is not falling. The world is changing, and if we ignore the changes, we will most assuredly be left on the dead pages of history. However, if we understand and use the gifts that science brings us, we have every chance of being one of the pre-eminent communications media of the next century. ■

T4+
A Rebuild Ahead

Plan your future rebuilds with T4+, the fourth generation trunk and feeder cable designed to be ahead of its time. Extensive research by Times Fiber Communications led to the development of this triple bonded, gas injected foam core cable; a cable, which outperforms and outlasts all competitive products.

What makes T4+ such a high achiever? In a word—bonding. Times Fiber's proprietary adhesive continuously bonds the center conductor to the dielectric foam core, which in turn is bonded to the aluminum sheath and the sheath to the jacket. This heat activated adhesive is formulated to restrict movement, while facilitating coring. With all cable components secured together, T4+ acts as a single system. Simply, all parts of the cable expand and contract equally over temperature extremes. Pull-outs are now just a bad memory.

T4+ also features a full wall seamless construction. The aluminum sheath is continuously extruded, not welded or fused, eliminating the possibility of pinholes and wall thickness irregularities. This construction provides increased protection against moisture ingress and signal leakage, which improves reliability and extends life.

T4+ requires no special coring tools.

Due to Times Fiber's exclusive bonding process, T4+ exhibits a smaller bend radius and its handling is improved. No special tools or training is required and T4+ uses standard connectors. It goes up easier, expedites construction and therefore lowers your rebuild costs.

T4+ combines economic and time saving benefits with increased bandwidth capability to truly place you a rebuild ahead.

TFC TIMES FIBER COMMUNICATIONS, INC.
an LPL company
358 Hall Ave. · P.O. Box 384 · Wallingford, CT 06492

TFC ...Where technology meets the bottom line.

Reader Service Number 70

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.

See us at the Western Show Booth #436.

Reader Service Number 71