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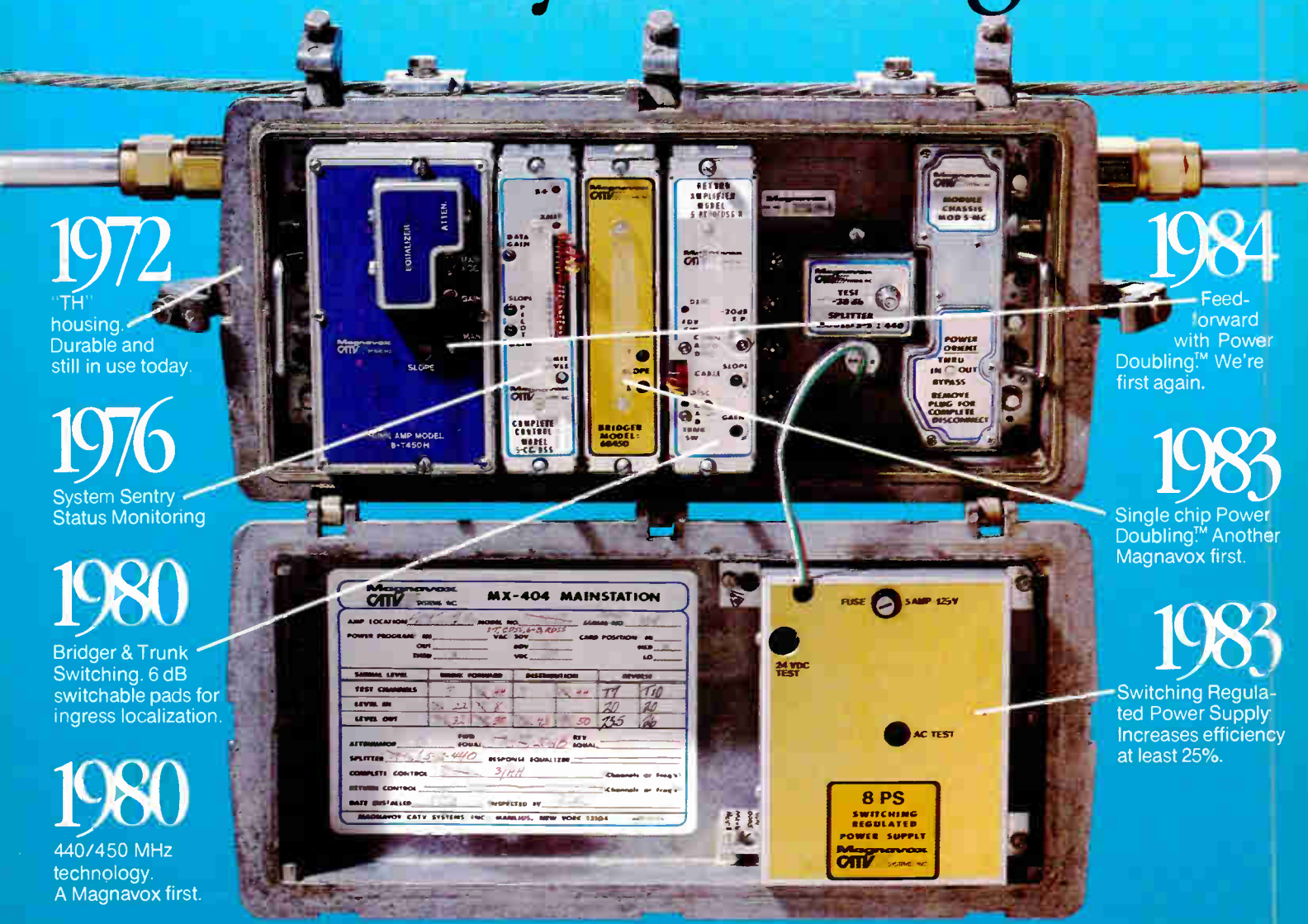

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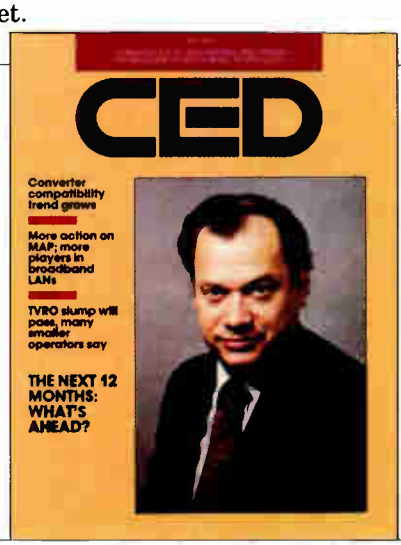
About the cover

Walt Ciciora, vice president, new technologies, at ATC, is the new chairman of the NCTA Engineering Committee.



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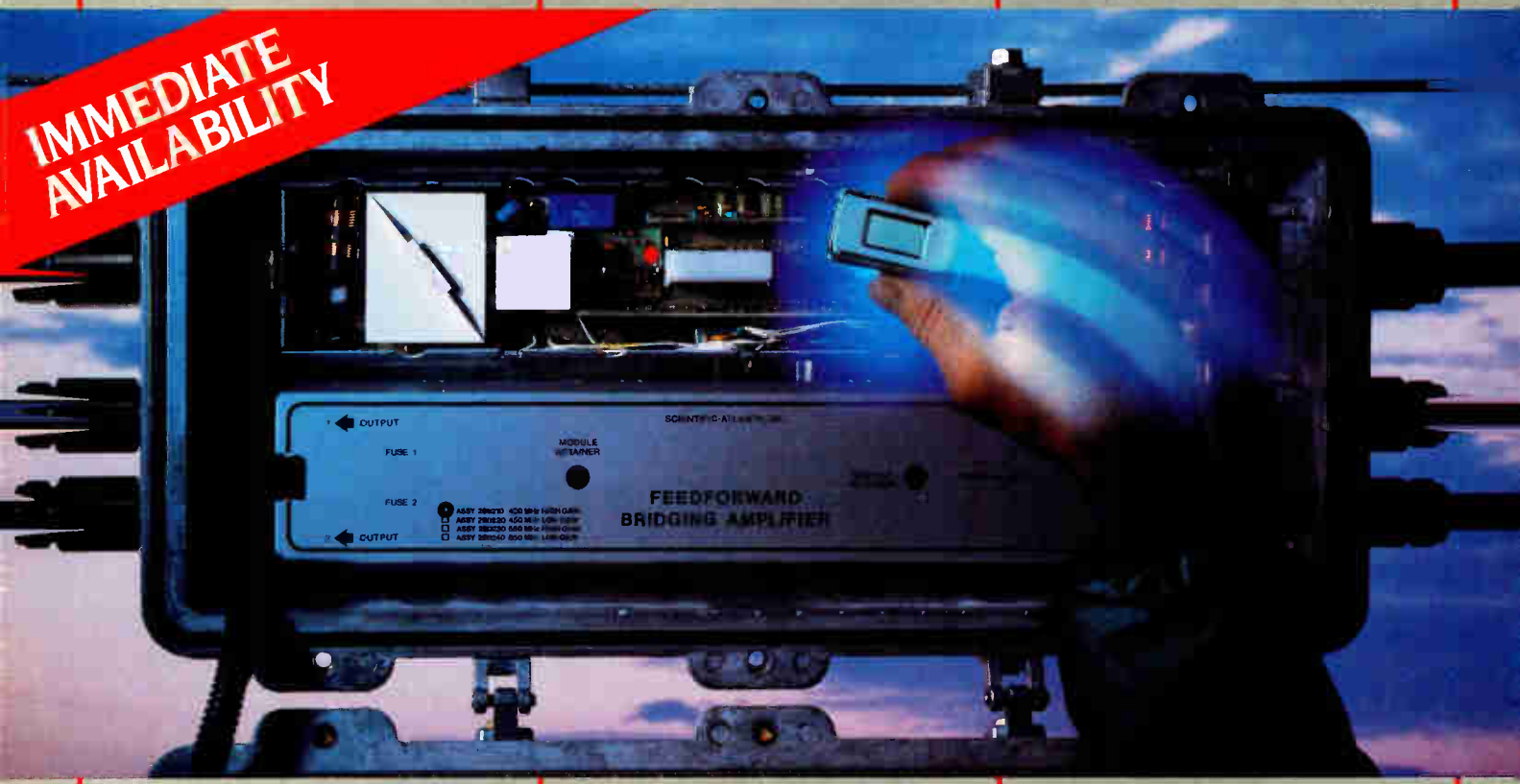

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John Kurpinski: Stressing training for the future

"You'd be surprised at the number of techs who don't have the background, the basic knowledge needed to perform in day-to-day operations," says John Kurpinski, director of sales and marketing for Cable Services Company Inc. "There were a couple of surveys done last year in the trade publications on problems facing operators," Kurpinski says. "And the number one problem, the biggest headache, was getting and keeping qualified people.

CATV is a complex technology. That's part of the problem. Also, "I don't know of any college or learning institution in the country that you can go into and walk out four years later with a degree in cable television," says Kurpinski. "The industry right now is a hybrid of RF, digital and audio technology. It's tough to go to a school where you can learn all the technologies in one swoop."

This lack of training is what motivated Kurpinski to start a meeting group of the Society of Cable Television Engineers (SCTE). "I noticed there weren't too many technical people coming to the shows. Mostly high level engineers were attending the technical sessions, and they aren't the ones who need training—it's the grass roots, day-to-day technician who needs the information." So Kurpinski founded a group in the Philadelphia area which later became the Delaware Valley Chapter of the SCTE.

A member of the SCTE since 1974, Kurpinski was elected SCTE Member of the Year for 1983. He is past president of the Delaware Valley Chapter of SCTE and currently serves as the chapter's secretary/treasurer. Kurpinski also heads the chapter development committee and has served on the Broadband Communications Technician/Broadband Communications Engineer (BCT/BCE) and relocation committees. He is the author of *Guide to Chapter Development* and, as associate director of the Atlantic Cable show, is responsible for the technical programs. Kurpinski was part owner of a small cable system in upstate New York and served on the board of directors of the New York Chapter TV Association for five years.

Currently an at-large-director, and eastern vice president of the SCTE, Kurpinski sees his role as "sort of giving a helping hand to the regional directors. I help meeting groups and chapters get started and help with their technical programs and problems. I also try to encourage membership at the national level.

"One thing we can't figure out," Kurpinski says, "is why, when the industry needs so much training, is there so little involvement in the SCTE? There are approximately 30,000 technicians and engineers in CATV and only 3,000 are members of the SCTE. The lack of training causes a snowball effect in the industry. Instead of going right to the problem, an unqualified tech spends time looking for what's wrong. Then the subscribers get irate because it's not quick enough and it reflects back on the entire operation.

"A cable operator," he adds, "will gladly spend $5,000-$10,000 on a marketing effort to get more subscribers. But ask him to pay that same amount for test equipment to do a better job, and he'll balk." As systems are rebuilt to 450-550 MHz and more sophisticated services are introduced, better training and higher qualifications are a must.

Some 23 years ago, when he first got into cable, Kurpinski was working with 12 channels and transitor type equipment. But there's always something new: 550 MHz, hybrid circuits and sophisticated programming." It's unbelievable," he says.

But Kurpinski feels there's room for even more growth and expansion. "Look what's happened with pay-per-view—they're the glory people in the industry. There's only so much revenue you can get out of a subscriber, and the way to get more income per subscriber is PPV. You just can't hammer them year after year with rate increases in basic. I think cable operators will realize more money on a PPV basis, than if they were to sell an additional pay to the subscriber."

Another area Kurpinski sees as a good revenue source for cable is in selling data services, although he feels many cable operators are mom-and-pop operations and scared of the data technology. "But to run data you need a good cable system," Kurpinski says. "It has to have a good maintenance program and be very reliable."

In his present position with Cable Services, he is responsible for complete turnkey system sales: from strand mapping and design, purchasing of equipment, sales, marketing, advertising and inventory control. "I guess over the years I've gotten away from the real in-depth engineering, more into administration and sales. But I've always been involved with the technical end of sales.

"A problem we face," he notes ironically, "is communication. For an industry that bases its whole technology on communications, we don't communicate. There are many groups that have problems and just as many organizations trying to solve those problems —but everyone's working on different levels. The NCTA is an effective organization but doesn't represent the entire industry in a rule-making capacity. The FCC makes a decision, and we have a number of different groups all fighting to solve it but not as a total group.

"We've come a long way in cable, and we're starting to turn the corner as far as training goes. But we still have work to do. The more sophisticated our services become, the better we have to make our basic systems—and our industry."

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The state of the art

Engineers can do anything (almost), if they have strong enough motivation and an adequate supply of time and money. We learned to fly, not quite as freely as the birds, but faster and farther. We have learned to use machines to magnify our limited muscular and sensing capabilities and to perform incredibly complex mental exercises with enormous speed and precision. Only 50 years ago, the very idea of flying to the moon was so preposterous as to be entertained only by poets, writers of fiction and dreamers. The engineers did it, at great cost, motivated in much the same way as George Mallory who wanted to climb Mount Everest—simply "because it is there."

It has been written that "disinterested intellectual curiosity is the lifeblood of real civilization." And so it is, with the scholars, astronomers and scientists in the great universities, observatories and laboratories of the world, whose motivation derives more from insatiable curiosity than the prospect that serendipity may yield practical results. Without the study of the behavior of electrons in quartz crystals or the development of the esoteric mathematical theory of numbers, the computer revolution could not have happened.

Entrepreneurial engineers, which most of us are, do not have the liberty to pursue "disinterested intellectual curiousity." Innovation in entrepreneurial enterprise is necessarily motivated almost exclusively by the bottom line. Innovation in this arena is necessarily intended to improve the product (or its perception), reduce costs or generate new or enhanced revenue. New ideas may grow slowly out of trial and error or they may explode in brilliant flashes of inspiration. Sooner or later, however, new ideas have to be tested against the bottom line of the P&L statement.

Development is the process of converting an innovative idea into state-of-the-art technology. Research is the gathering together of information and knowledge which may or may not lead to the development of a useful idea. Both R&D are essential contributors to the state-of-the-art.

Most of us have promised at one time or another to build state-of-the-art cable TV systems. Probably a good many of us claim, and truly believe, we have done just that.

Just what does "state-of-the-art" mean? To a researcher studying plasma physics, the term is likely to mean the threshold of knowledge or, perhaps, the limit of what can and has been accomplished in the laboratory, at least once. Cost is not part of the definition, although lack of adequate funds certainly can inhibit accomplishment. In space travel or nuclear power generation, safety is, or should be, a necessary criterion, while cost is given much lower priority. In the laboratory, in space or in nuclear power plants, ready availability of components "off the shelf" is of virtually no concern, so long as what is needed can be fabricated or custom built. In the automotive industry, is the state-of-the-art represented by the futuristic, twenty-first century sketches in the popular magazines?

If the state-of-the-art is what people want, why is it that so many cars are sold with ordinary, old-fashioned, skid-prone braking systems, idiot-light dash boards and ordinary carburetors without fuel injection? Could cost have something to do with it?

The state-of-the-art truly is a moving target. What was experimental yesterday may be state-of-the-art today and obsolete tomorrow. Ten years ago, 35 channels (300 MHz) was the state-of-the-art. Five years ago, 55 channels (400 MHz) met the criteria, soon followed by 63 channels (450 MHz). If 80 channel technology (550 MHz) is not yet considered state-of-the-art, it probably soon will be.

It is quite interesting to note, however, that there is increasing demand for 46 channel (350 MHz) equipment—apparently for upgrades. Like the demand for cars without state-of-the-art features, consumer demand for cable service requires an adequate choice of programming and reliable service, but not necessarily today's version of the state-of-the-art.

Qualifications & suggestions

To qualify as the state-of-the-art in cable television, I believe new systems, new hardware or new software should meet the following criteria:

- Production models should be readily available with reasonable delivery schedules (not more than a few months from placement of the order), preferably from more than one supplier.
- Capability to perform the intended functions effectively and reliably should have been demonstrated in the field under actual operating conditions.
- The effective net cost to subscribers should be acceptable in the consumer marketplace.

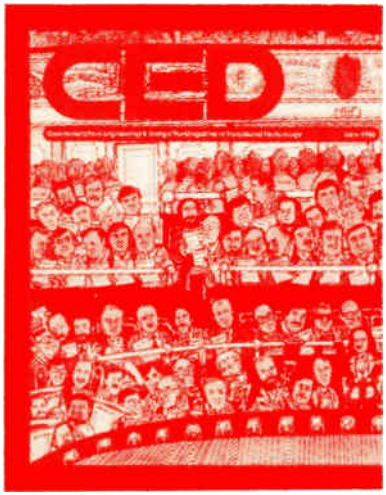
Ideally, engineers would prefer to field test new technology under actual operating conditions long enough to not only detect the effect of weather and temperature but also to pick up subtle and often overlooked operational defects. In the real world, such luxury may not be affordable. Innovation for us is something like a crap shoot. The odds depend on engineering evaluation of hardware, operational evaluation of concepts and manufacturing quality control. If a new idea is successful, the inventor is a certified hero. Otherwise, the roof may fall in on him. We need something better.

The MSOs, no one of which claims as much as 10 percent of the total subscriber count, cannot be expected to individually support an R&D effort any where near the scale of the Bell Labs. On the other hand, if there is a legally acceptable way to do it, why not a joint R&D effort by operators, although on a much smaller scale than Bell Labs? Competition among operators for franchises is in substantial decline. All operators could benefit, to the detriment of none. Let the suppliers compete to produce, or improve upon, the innovations developed by the operators.

Six hundred years ago, Chaucer wrote: "For he that naught n'assaieth, naught n'acheveth." Nothing ventured, nothing won.

Why not develop our own state-of-the-art? Engineers can do it, you know. ■

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



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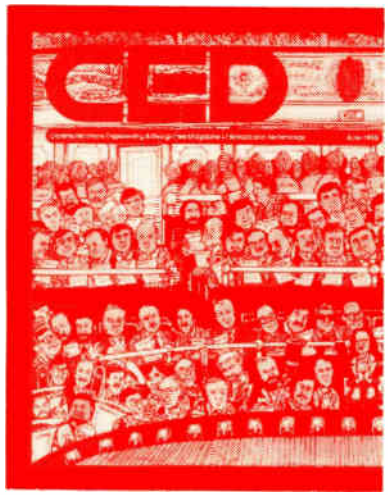

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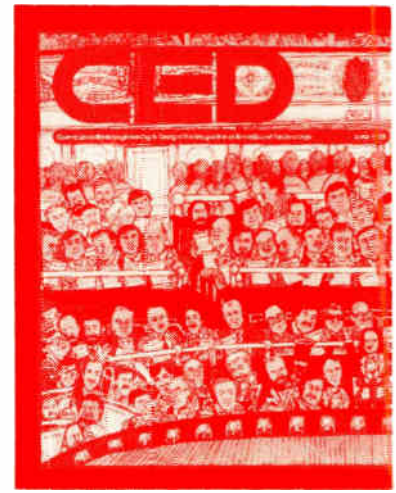

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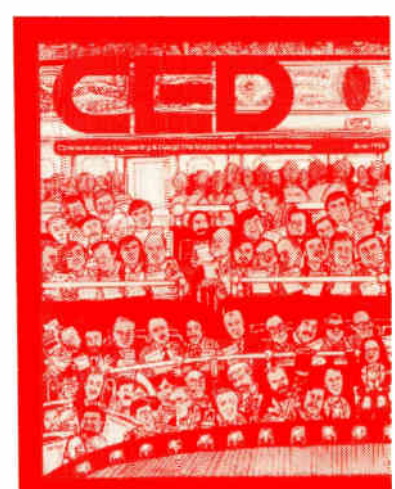

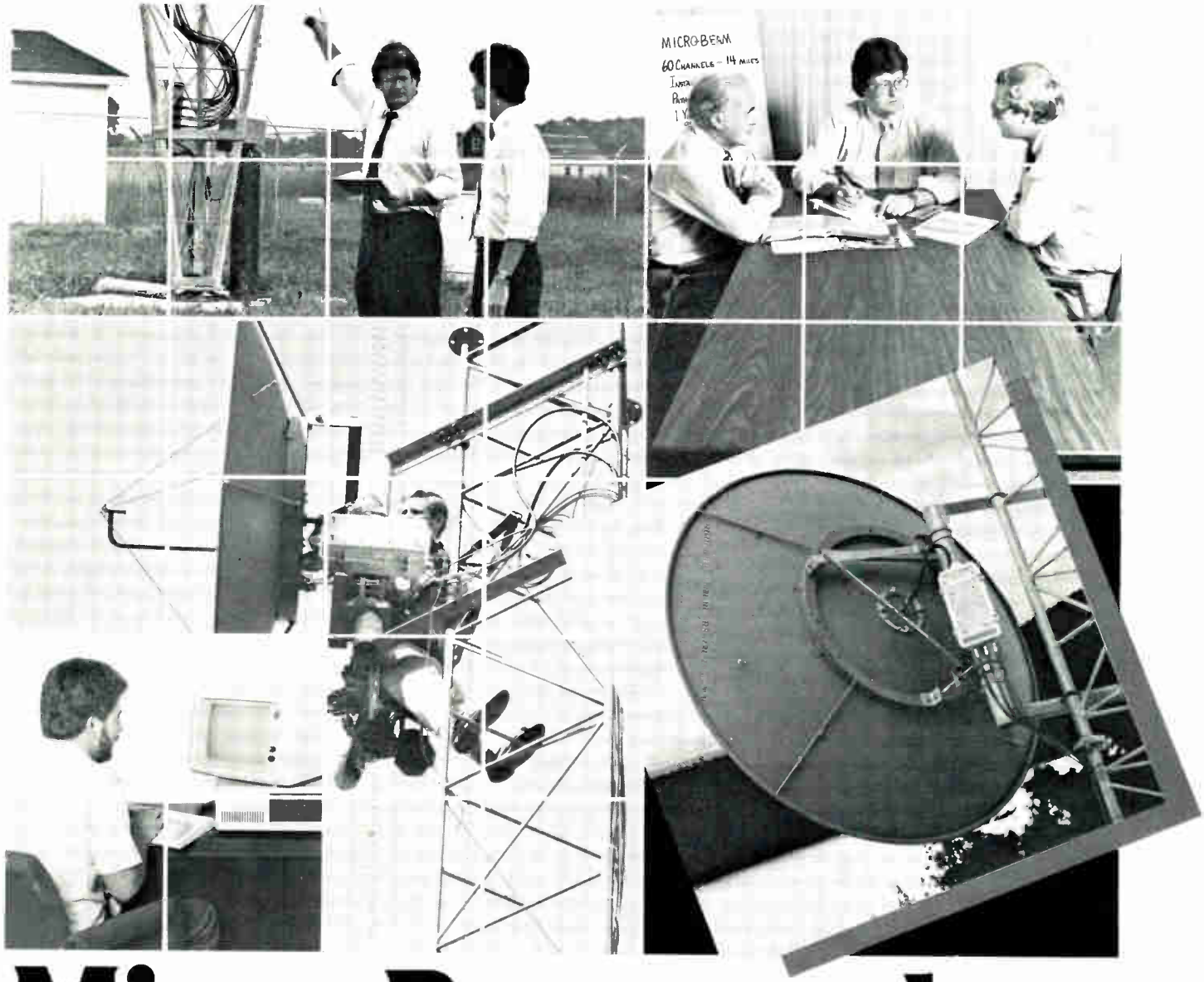

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Reader Service Number 5

return path

Dunbar's article discussed

The March *CED* was particularly interesting, not only because of the excellent coverage of the status of broadband LANs, but also the article by R. Dunbar on the calculation of system noise figure. The latter subject is an area that I investigated in considerable detail a few years ago. Although Mr. Dunbar's paper presents modified equation 1 above, F_e would actually be slightly less than 2 (3 dB) because of not, as he claims, the correct analytical description of the noise figure for a cascade.

Equation 8 in the article is not an exact equation for the network under consideration. Rather than M devices in cascade, as noted by the author, there are actually 2M devices since each amplifier is followed by a cable with a specific attenuation. Although the cable is a passive device, it too has a noise figure, i.e. the cable is a source of noise due to its attenuation. The noise figure of a cable with attenuation 1/L is exactly equal to L as derived in a paper presented at a previous NCTA convention.[1] (In the more conventional notation, the attenuation in dB would be -10 log L.)

A section of the network, shown in Figure 1, consists of an amplifier with power gain G and noise factor F in series with a cable with an attenuation 1/L. The exact expression for noise factor F_e for the two devices in tandem is:

$$F_e = F + \frac{L-1}{G} \qquad (1)$$

The units of F, L and G are in absolute value—not in dB. Equation 8 in Mr. Dunbar's article assumes that the noise factor is equal to F (the noise factor of the amplifier alone). The assumption is valid in practical cable networks, where the second term in equation 1 is usually much smaller than F. For example, with $L >> 1$, $L = G$ at unity gain, $F_e = F+1 \cong F$ for $F >> 1$.

The concept of a noise factor for a passive component does become important when low noise amplifiers are encountered—as in satellite receivers. For tutorial purposes, it is interesting to consider the case in which the amplifier is noiseless, i.e. $F = 1$ and $G >> 1$. According to Mr. Dunbar's equation, the noise factor of the unity gain network in Figure 1 would be equal to one, or i.e. 0 dB. However, as shown in equations for a cascade of amplifiers and cables, his initial formulation is the noise contributed by the lossy cable. See referenced papers 1 and 2 for more detail.

The derivation of Mr. Dunbar's equation 19 appears unnecessarily complicated. The output noise power N_o of an amplifier with a noise factor F and gain G is:

$$N_o = N_T FG \qquad (2)$$

when N_T is the input thermal noise power at a given reference temperature.

The contribution to the output noise power caused by N_T, the input noise power, is:

$$N_T G \qquad (3)$$

Therefore, the difference between equations 2 and 3 is the noise power caused by the amplifier:

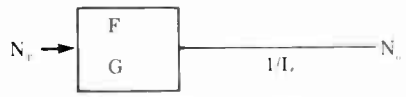
$$N_a = (F-1)\ N_T G \qquad (4)$$

Equation 4 becomes Mr. Dunbar's equation 19 when it is expressed in logarithmic terms. It should be noted that equation 4 is also the expression for the noise added by a cable with $G = 1/L$ and $F = L$.

I hope that these comments will be of value to *CED* readers and, perhaps, generate further discussion on this topic.

Dr. H. W. Katz,
Program Director,
Communications Technologies,
Trintex

FIGURE 1



Dunbar replies

Dr. Katz does not identify the errors correctly. The first error is that the cascade picture on page 72 (March *CED*) should have the cable length before and not after the amplifier. Dr. Katz assumes that the picture is correct and proceeds on that basis, which is not the case. The "devices" are the cable plus amplifier sections and, therefore, there are M, not 2M, sections.

The second error is that nf is defined in the article as the amplifier noise factor, which is incorrect. It should have been defined as the section noise factor (cable plus amplifier). For calculation purposes, nf on page 72 should be replaced with g (nf_a) where nf_a is the amplifier noise figure.

Equations (12) and (14) are noise figures and must be added to N (-59 dBmV) to get the values in Table 1. Although the equations included the noise factor of the cable, the calculation on Table 1 did not. I apologize for the errors.

Dr. Katz's derivation of equation (19) is indeed a better approach. I had been attempting to use an arbitrary input noise level, in which case his equation (2) would be:

$$N_o = N_{i_s} FG \frac{1 + T_e/T_s}{1 + T_e/T_o}$$

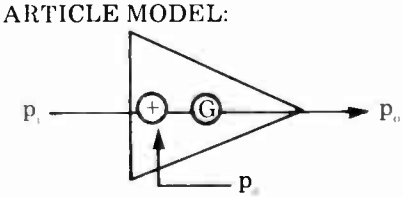
where T_o is the temperature at which F was measured.

When $T_s = T_o$, then this reduces to his equation (2) and the rest of his analysis follows. Since the amplifier noise contribution is independent of the input noise level, there is no loss of generality by making $T_s = T_o$. It just never occurred to me that this generality was not lost.

Dr. Katz's equation (4) differs from equation (19) by a factor of G. This is because he has chosen a different, but equivalent, model of the device.

All variables are in linear units. p is the noise power (in watts) in a small band df, g is the gain and nf is the noise factor of the device ($p_{T_o} = kT_o df$).

ARTICLE MODEL:



Continued on page 66

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Reader Service Number 6

More stringent plenum/riser cable rules on the way

Sometime this fall, it appears, new provisions of the National Electric Code will mandate tougher standards for CATV cables used in risers and plenums: vertical airshafts and horizontal air conditioning ducts in high-rise and commercial structures. Although the proposed new regulations won't be unveiled until the May 19-22 convention of the National Fire Protection Association in Atlanta, it's expected that they will require the use of Teflon-coated or similar flame- and fume-resistant jacketing by July 1, 1988, in all commercial buildings wired for CATV or local area networks using 75-ohm coax.

The details aren't cast in stone yet, and some vociferous opposition has to be expected at the May meeting and afterward, according to Jim Stilwell of TeleServices R&D. But he has no doubt the rules will stick. Stilwell is the official NCTA representative to code panel 15, which has responsibility for weighing changes to section 820 of the NEC, dealing with CATV. The new rules would apply only to cables not enclosed in conduit, Stilwell says. "I-nets and MDUs will be most affected, although the in-home portions of subscriber drop cables also are covered by the new rules."

And although the telephone industry will have to comply with the new rules as soon as they're published, in July or so of this year, both the data communications industry and the CATV industry likely will get a longer transition period. Computer room wiring running at low voltage won't have to be switched over to the new standard until July 1, 1988. The CATV industry will have the same deadline.

Lively discussion

Stilwell says there was "lively" discussion about the proposed new rules at the December panel meeting. At issue is the quality of cables that may be installed by telephone, data and CATV contractors in the wake of the AT&T system breakup. The immediate trigger for the new rules was a switchboard fire at a Bell operating company office in New Jersey recently. Firemen there were injured by fumes caused by burning cables. The larger backdrop, though, is a recent flood of cheap wire and cable into Canada, many of them having "horrible" smoke and flame properties, Stilwell says. There's some concern these cables might migrate to the United States.

Although the primary impetus to stop the installation of such cables

Opposition expected over economic consequences of plenum/riser cable rules.

probably comes from the insurance industry, which sponsors the NFPA and would bear the brunt of liability arising from the use of flammable and toxic cables, AT&T representatives also made clear their view that deregulation could possibly lead to less-careful installation procedures. "It's largely true that AT&T did an honorable job of self-policing when they had a monopoly," Stilwell says.

There are some differences in the rules governing CATV and telephone cables. "Telephone companies can't use cables with greater than one-quarter inch diameter," Stilwell says. "CATV, because it needs the higher frequencies, can go up to three-eighths of an inch. One-half inch would have been nice, but we couldn't get it."

Squawking expected

"A lot of people are going to raise hell about the economic consequences, but the cost factor per foot of cable shouldn't be measurable," Stilwell argues. "We'll simply have to inventory a few new types of listed cables, tested for compliance with the new standard by some independent testing agency, like Underwriters Laboratories. In fact, we should have an evolution to the new standards by suppliers long before the mandatory deadline of compliance."

The rules for plenum cables are the most stringent; the rules for drop cable, the least stringent, Stilwell says. Riser cables and plain cables in walls fall in between. "Drop cables, in fact, are hardly affected by the new rules," Stilwell adds. "Once you're in the house, there's a limitation on the distance you can run polyethylene or PVC, depending on whether it's in conduit or not. Generally, you'll have to terminate the drop as near as possible to the point of entry into the house." Still, he thinks the cost differential should be negligible for residential homes. The real impact could come if a series of MDU or commercial units with non-rated cables is acquired by a new owner. It's possible the old cable bundles would have to be pulled and replaced.

In any case, it's an issue to watch because there doesn't seem to be any likelihood of stopping the new rules.

The code panel sees safety as paramount, and it's not likely the new rules would be abandoned just because they're a bit inconvenient or add a little to the cost of construction. And, remember, Stilwell doesn't think the changes really will amount to much on the cost side.

New NCTA chair examines cable issues

As the new Chairman of the NCTA Engineering Committee, I would like to take this opportunity to review some of the technical issues facing the cable industry and enlist your support in the efforts to work toward solutions. This discussion is not intended to be comprehensive. Rather, selected important topics are explored. Other significant topics are left for another forum, another time.

The technical issues facing the cable industry can be viewed in three broad categories: short term, for instance BTSC stereo sound; longer term, which includes the state of R&D in the industry and High Definition Television (HDTV); and continuous issues such as FCC liaison and professional affairs. The continuous issues have been with us for as long as anyone can remember and will continue as long as cable exists.

In the short term, by far the most important technical issue is the consumer electronics interface. There has been more difficulty, debate and frustration over this issue in the last few years than any other topic. The essence of this problem is the subscribers' frustration over the loss of functionality and convenience when cable employs certain kinds of program protection techniques. The reason for the importance of this issue is simply that cable subscribers enjoy nearly all of their cable services through personally owned consumer electronics devices. These devices have shown two important trends: they are increasing in number and in variety. Whatever the solution(s) may be, it must be applied in many places in the home and accommodate many different features. The frustration of those working on this problem is that there have been no simple, universally applicable solutions. Nearly every proposed approach applies to only a small segment of the market, has some disadvantage—such as substantial expense—or will take a long time to implement.

One of the most promising solutions, the Decoder Interface Standard (IS-15) will take awhile to achieve its full impact. This Electronic Industries Association (EIA) interim standard spells out the technical details for facilitating the plugging in of a descrambler module into the back of a TV receiver or VCR. Several years of effort went into achieving this standard. When the work started, this was a long-term technical issue. Over time, it has become a short-term priority.

Consumer electronics interface biggest short-term technical issue.

To harvest the benefits of this work, the cable industry must motivate the manufacturers of consumer electronics equipment and decoders to make available equipment with the proper plugs and internal circuits. This will require the manufacturers to make a substantial investment in design, tooling and marketing. Cable must help these manufacturers appreciate the value of these efforts to their future businesses.

Two related standards are the EIA/NCTA RF Cable Interface interim standard (IS-23) and the EIA/NCTA Recommended Cable Television Channel Identification Plan (IS-6). The RF Cable Interface standard defines the requirements for successful technical operation of consumer electronics devices in a cable system. The most important and difficult topic has been the device's immunity to direct pick-up. IS-6 defines the relationship between channel numbers and frequencies. It is up for transition from an interim standard to a permanent standard. There are a few issues to be resolved before it can be promoted. Each of us must become a soldier in the struggle to promote the realization of the standards which will make our cable services more consumer friendly.

The EIA Home Bus committee's principal potential impact on cable will be the expected creation of industry standards for infra-red remote controls and standards for hard wire and wireless communication between devices such as residential security modules.

A related consumer electronics interface technical issue, which deserves separate attention, is multi-channel television sound (MTS), as defined by the Broadcast Television Sound Committee (BTSC) of the EIA. At one time it appeared that BTSC would be an unmitigated disaster; it was feared that the subscriber's new stereo sound TV receiver would yield annoying and unacceptable noises and distortions when connected to cable. This was particularly troublesome when the specter of a must-carry situation was upon us. Now we appreciate that what we have is a difficult, expensive problem, but not an impossible task. Significant implementation and clarification work lies ahead. One of the strongest needs is for standard, cost-effective, user-friendlytest equipment. Another priority is affordable, reliable encoding equipment so our satellite-delivered signals will play through the subscriber's new MTS TV receiver.

We must make our industry and our industry association, the NCTA, more technology aware. The pace of technology's advance is accelerating. It is difficult for technologists to comprehend the consequences, let alone communicate them to the non-technical decision maker. But we must increase our sensitivity to the threats and opportunities offered by advanced technology. When cable fails to take advantage of an opportunity which others grasp, cable loses two ways: first, cable misses an opportunity to become stronger; secondly, a potential competitor gains additional strength.

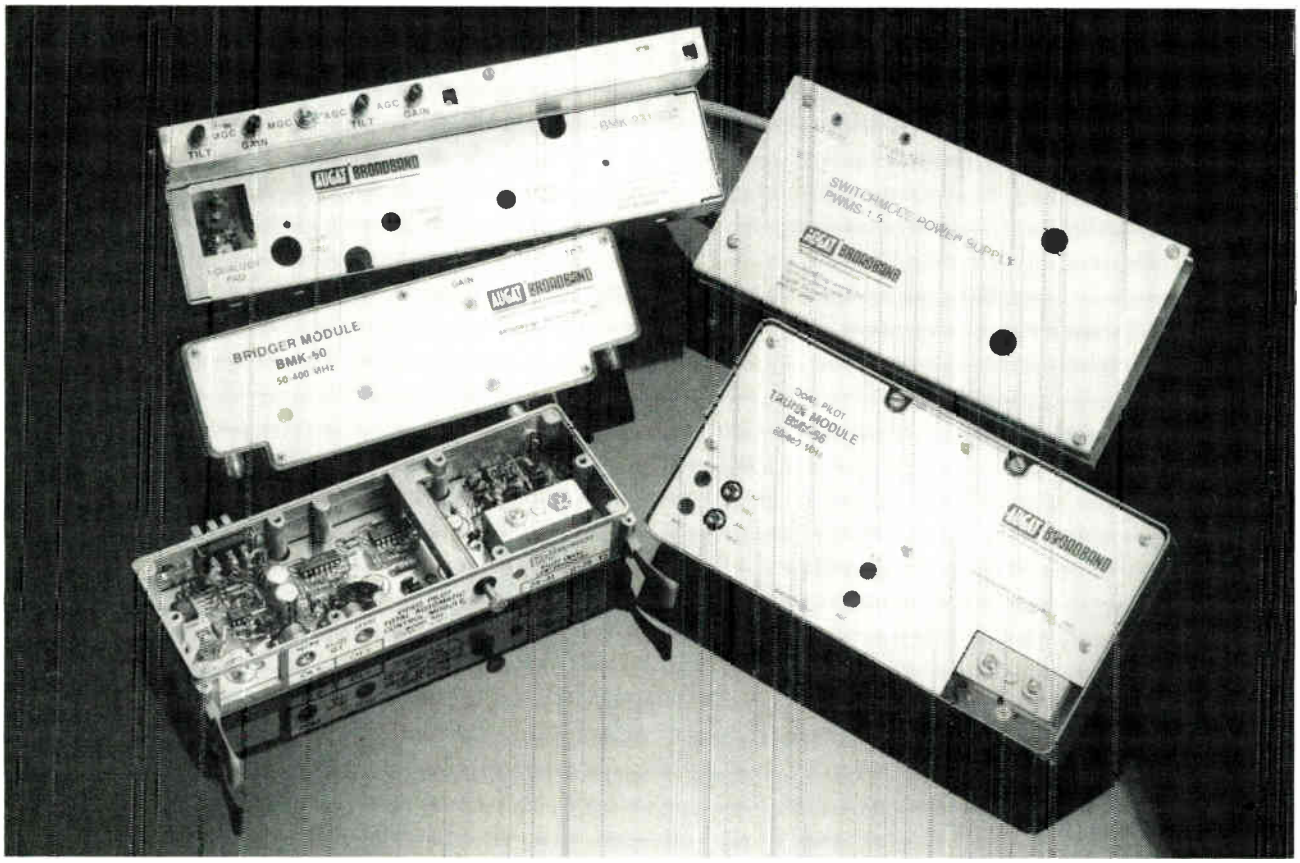
There is a need for increased technical cooperation between cable companies. Much can be gained from a sharing of experience and learning.

At least four new business opportunities have strong technological components: pay-per-view, commercial communications services audio services, and residential security. In all cases, technology exists to make a start at the businesses possible. But cost-effectiveness, reliability and user-friendliness need improvement.

Potentially competitive technologies include DBS, MMDS and VCRs. The customer isn't buying technology; she is buying programming and convenient access to that programming. It would be a mistake not to realize that the competitor is not a technology, but rather better signal quality, more convenience or more cost-effectiveness. Better signal quality involves not only

Continued on page 61

By Walter Ciciora, Ph.D., Vice President, New Technologies, American Television and Communications



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Reader Service Number 9

Bode's variable equalizer

The Bode equalizer, an adjustable equalizer circuit long used in the telephone industry at voice carrier frequencies, is finding its way into the cable industry at VHF frequencies.This type of circuit provides superior cable tracking accuracy and ease of adjustment compared to circuits used in the past. The design of these equalizers can be accomplished by a straightforward bench procedure or by computer aided design techniques. The theory, design and application of the Bode equalizer are discussed in this paper, and a sample CAD program used in its design is presented.

The CATV industry has borrowed terminology as well as technology from a number of other fields. One obvious source is the telephone industry, especially carrier telephony. This paper will discuss one recent acquisition.

In the April 1938, *Bell System Technical Journal*, H. W. Bode described a type of variable equalizer circuit which has come to be known as the Bode equalizer. (Bode's name is familiar to engineers through his many other contributions to electrical engineering.) The original application was for telephone carrier systems, with top frequencies of a few Megahertz or so. A number of articles have appeared in print on the subject over the years, usually related to the same frequency range. The technique is readily adaptable to the VHF range for CATV purposes, and this has been done in recent years.

Equalization

In any cable-repeater amplifier system, equalization of the cable attenuation is a fundamental requirement. For the frequencies and transmission lines of interest in CATV, the decibel attenuation is very nearly proportional to the square root of the frequency. In order to maintain uniform signal levels over a long cascade of cable spans and repeater amplifiers, unity gain must be preserved. The repeater amplifier must complement the cable loss, i.e. the amplifier must have high gain at high frequencies and low gain at low frequencies. This can be done by arranging the active devices themselves to have the desired gain-versus-frequency characteristics. But the more common pattern, nowadays, is to use a more or less flat broadband amplifier with a separate passive equalizer. This equalizer usually is a bridged-T circuit, and may have any number of adjustments available to achieve system flatness.

The major concern of this article is the need for variable equalization. The need arises because, as the cable temperature changes, its attenuation changes in a fashion also proportional to frequency. The normal rule of thumb is that attenuation changes by 0.2 percent per degree C (0.11 percent per degree F), at any frequency. A 22 dB span of cable at 20°C will be a 23 dB span at 43°C and a 21 dB span at −3°C. To preserve unity gain, the corresponding amplifier must change its gain by +1 dB or −1 dB at the top frequency and by lesser amounts at lower frequencies with the same frequency characteristic. This needs to be done automatically, simply and reliably.

The usual passive equalizer is designed with minimum loss at the top frequency and a variety of controls for the loss at lower frequencies. It does not lend itself well to the thermal compensation problem described above. A variety of "handles" is desirable for setting-up a system, but a simple and reliable control system for automatic operation of a number of controls is difficult to conceive.

What is needed then is a separate network to perform the gain adjustment function. It should have a single control point and be capable of precise gain-versus-frequency control. The Bode equalizer fills this need.

Bridged-T networks

First, a brief review of some pertinent network theory. The bridged-T network is a familiar circuit in CATV. Frequently used for equalizers and attenuators, it has the property of showing a purely resistive input impedance of R_0 ohms if the series network and the shunt network are duals of each other and the network is properly terminated. Referring to Figure 1(a), this means that the product of the series network impedance and the shunt network impedance must equal R_0^2, and the network must be terminated with R_0. Another way of saying this is: if the

Bridged-T equalizers have been used in cable equipment for many years, but did you know that other forms of equalizers also have been used? Do you know that it is possible to make an adjustable equalizer with only one or two controls? Or that an equalizer can be designed to compensate for bow and sag in frequency response?

By Donald E. Groff, Senior Development Engineer, Flam & Russell Inc.
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Cable Classics

Cable attenuation is (in addition to the physical parameter of the cable material and construction) a function of frequency—and temperature. Equalizers, which automatically and accurately compensate for the variation of attenuation with temperature, are a particular challenge to the equipment designer.

Bridged-T equalizers have been used in cable equipment for many years, but did you know that other forms of equalizers also have been used? Did you ever hear of the "Bode Equalizer"? Do you know that it is possible to make an adjustable equalizer with only one or two controls? Or that an equalizer can be designed to compensate for bow and sag in frequency response?

This paper by Donald E. Groff describes a form of equalizer offering superior tracking accuracy and ease of adjustment compared to circuits used previously.

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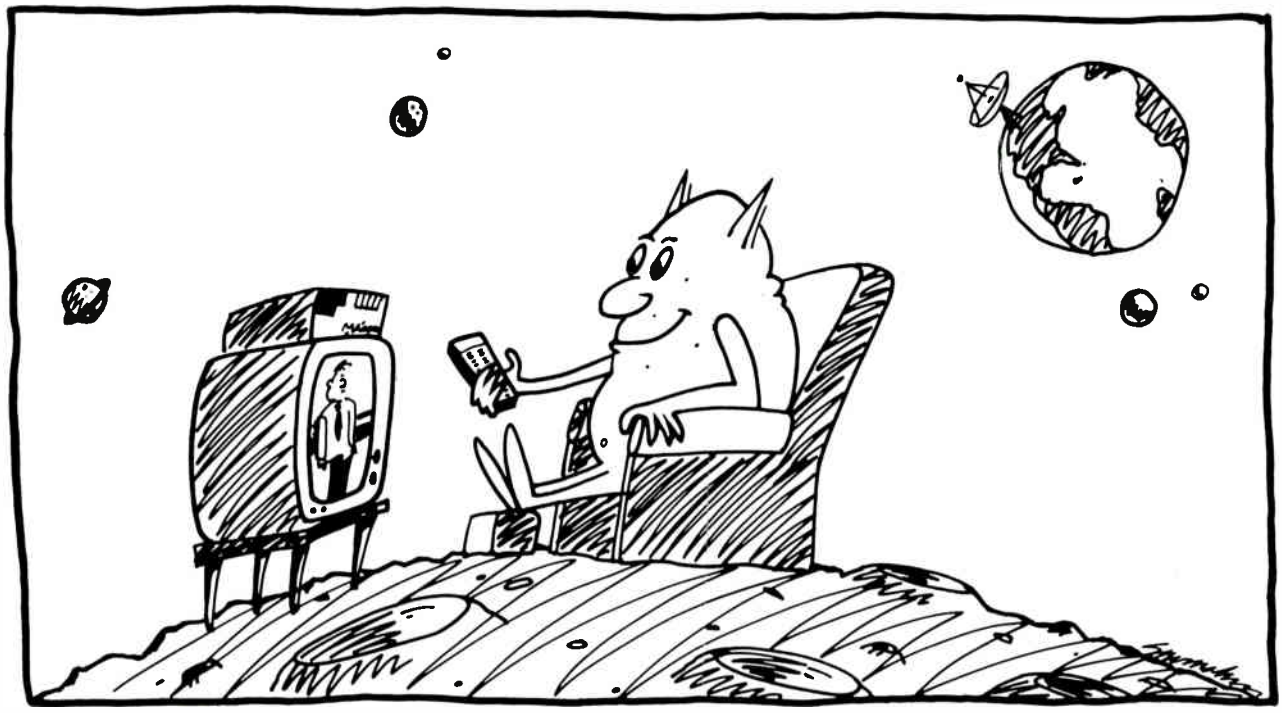

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Reader Service Number 10

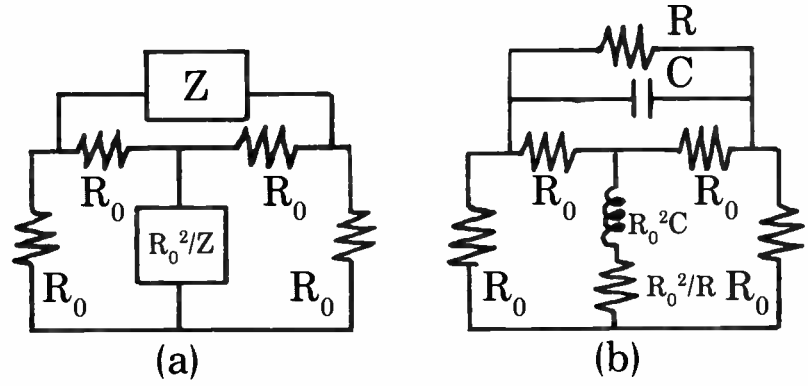
Bode equalizer fills need of a separate network to perform gain adjustment function.

series network impedance is Z_0, then the shunt network impedance must be R_0^2/Z_0. For the usual case of $R_0 = 75\Omega$, this might be as simple as a 68Ω resistor for Z_0 and an 82Ω resistor for R_0^2/Z_0, in which case you would have a 5.6 dB flat pad. Figure 1(b) shows a simple kind of equalizer circuit. The parallel RC network in the series leg and the series RL network in the shunt leg are duals.

Sometimes it is stated that the series network controls the response of the entire bridged-T network. This is true and can be carried even further: the series network of a bridged-T network in an R_0 ohm system can be lifted out and placed in series in an $R_0/2$ system to yield exactly the same insertion loss characteristic. Moreover, the shunt network likewise can be taken out and placed in shunt in a 2 R_0 ohm system, also with the same insertion loss.

Of course, the new networks will not

FIGURE 1
Bridged-T networks



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If bridged-T network isn't terminated correctly, its input impedence will not be equal to R_0.

be matched; they will not have the R_0 input impedance of the bridged-T circuit. But the notion is very useful for analysis and discussion and, with due caution, for bench testing.

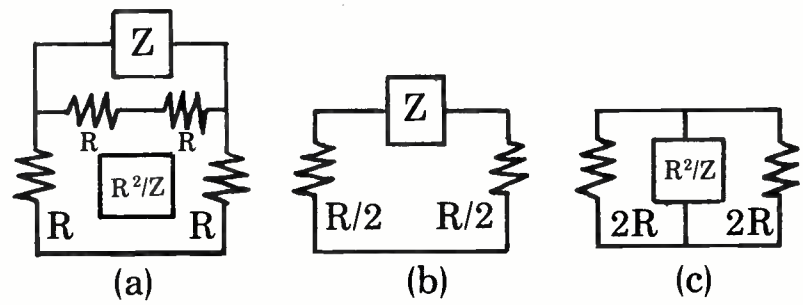
Another point to mention is that if the bridged-T network is not terminated in its characteristic impedance, its input impedance will not, in general, even be resistive, let alone equal to R_0.

The Bode equalizer

The curves of Figure 3 represent a sweep system display of an equalized length of cable at three different temperatures. The coordinates are chosen to correspond to a conventional scope display. The idea here is that the cable has been perfectly equalized by a passive network at a nominal temperature. For low temperature, the loss decreases in a manner proportional to √frequency; for high temperatures, the loss increases in a similar fashion.

We now look for a network capable of keeping the transmission flat across the band by some simple control. Figure 4 shows what kind of characteristics this network must have, considering only series attenuator networks, as discussed earlier. For low temperatures, a series RL network of 4(a) will attenuate the high frequencies more than the low—in effect simulating cable, because of the increasing reactance of the inductor with frequency. At midrange, the resistor of 4(b) causes

FIGURE 2
Three networks with the same insertion loss



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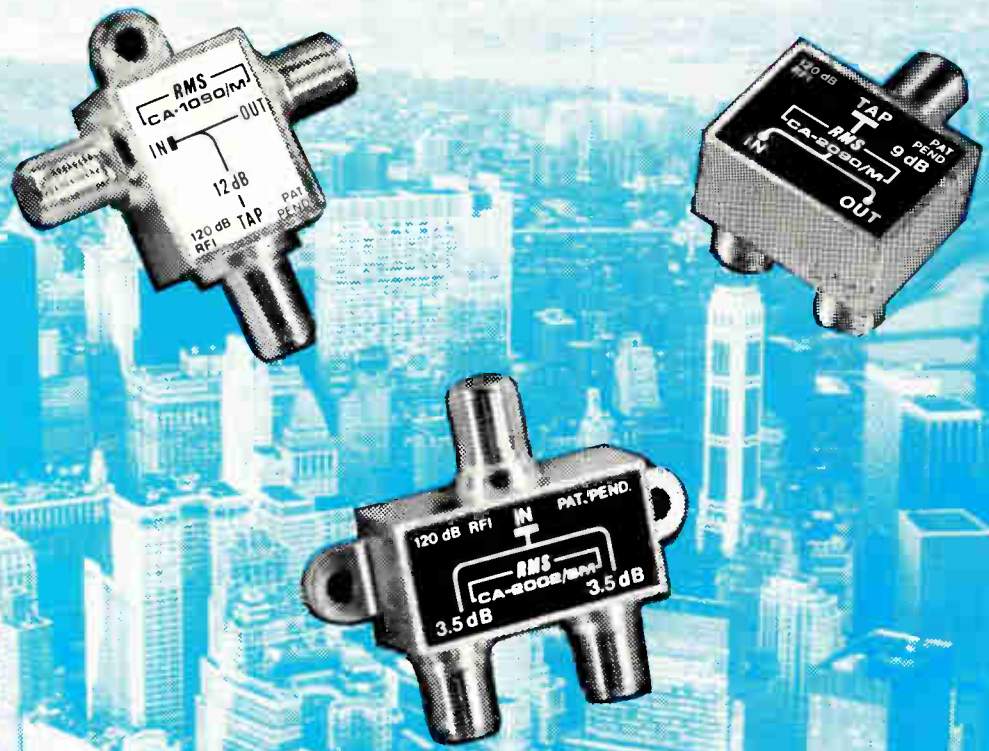

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Bode equalizer simplifies task of choosing the reactances to yield desired equalization.

($R_x + R_2$) which determines what fraction of the total range of the equalizer is brought into play. Figure 6 indicates the behavior of a Bode equalizer for various terminations.

A proof that the statements of the previous paragraph are true was performed and indicates how R_1 and R_2 are to be chosen; but if one accepts on faith the symmetry property, it is not difficult to see how to pick R_1 and R_2.

Design procedure

The starting point is the desired flat loss of the network, called $\propto$ on Figure 6. This usually will be somewhat more than half the total range of control desired. Going back to Figure 5, the equalizer will be flat when $R_x = R_2$. The input impedance to the R_2 bridged-T network will be R_2 ohms, and this will be in parallel with R_1. This establishes that R_2 in parallel with R_1 is the resistance which determines the flat loss of the Bode equalizer.

Also from Figure 5, notice that for $R_x = \infty$, at very high frequencies, the series inductor takes everything out of the picture except R_1. Now back to Figure 6 and the realization that, for that situation, the symmetry condition requires that R_1 be associated with $2\propto$, twice the flat loss. In other words, if this circuit is to be symmetrical about a flat loss of $\propto$ dB, then its two extremes have to be 0 dB and $2\propto$ dB.

To sum it up, pick R_1 to yield twice the desired flat loss, and pick R_2 such that $R_2 \parallel R_1$ yields the desired flat loss.

The more difficult part lies ahead: how to choose the reactances to yield the desired equalization. But the theory of the Bode equalizer simplifies this task enormously. With R_x set to zero, you design an equalizer by your favorite method: "tweaking" at the bench, calculating breakpoints or computer programs. Once the equalizer is designed on a Bode basis, one can be confident that varying R_x will produce the desired symmetrical behavior.

The Appendix is an example of a CAD program used to design a Bode equalizer. Of course, if we are dealing with broadband VHF, the accuracy of the final result will depend on how well the stray impedances are dealt with. And that is a significant qualification.

The equalizer based on a parallel RC described above is about as simple as possible. The need for wider bandwidth, increased precision or wider range may require a more complex network to start with, e.g. two parallel RCs in series or a series LC.

The Bode equalizer is by no means limited to the specific usage described above. Any variable gain versus frequency characteristic which is symmetrical about a flat loss can be accomplished this way. Figure 7 shows some of the possibilities. Figure 7(a) shows what is usually called a slope control, normally used to interpolate between fixed values of main equalizer for setup purposes. Another conceivable version is shown in 7(b), which is an ad-

FIGURE 4
Desired variable equalizer characteristics

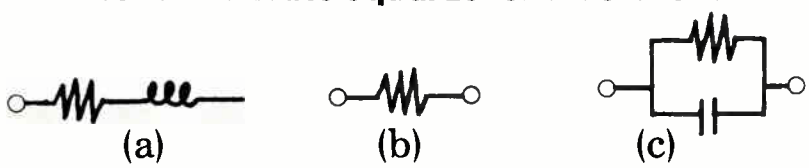


FIGURE 5
Bode equalizer—series version

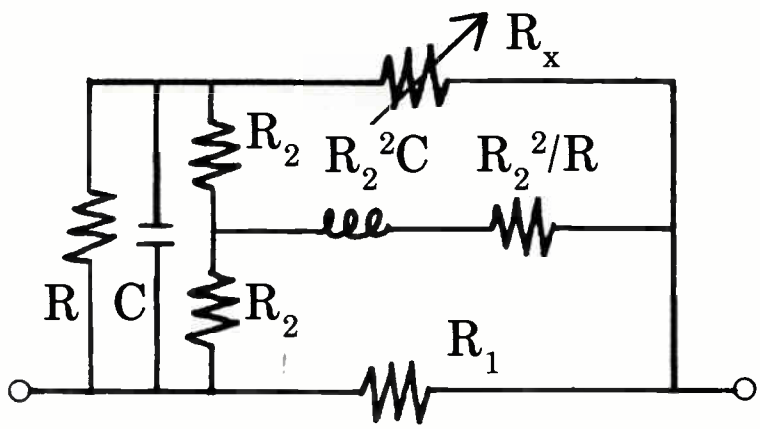
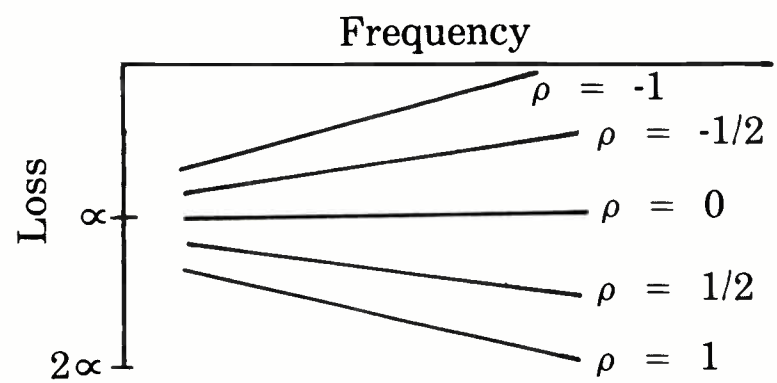


FIGURE 6
Loss of a Bode equalizer



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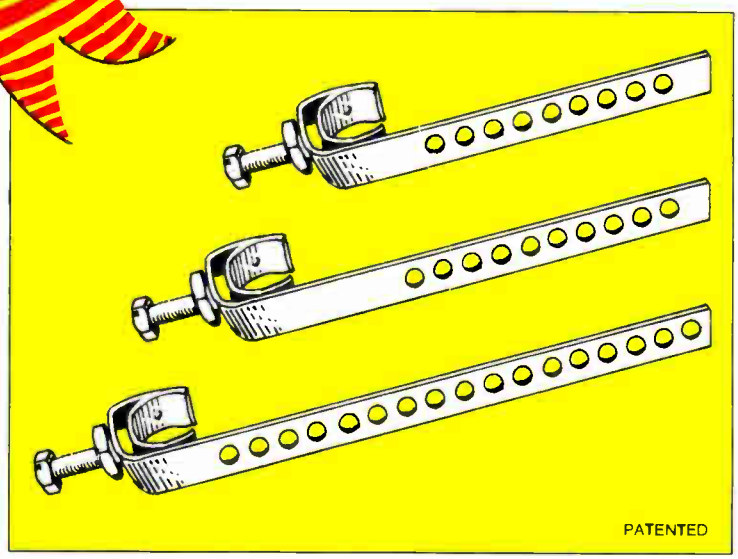

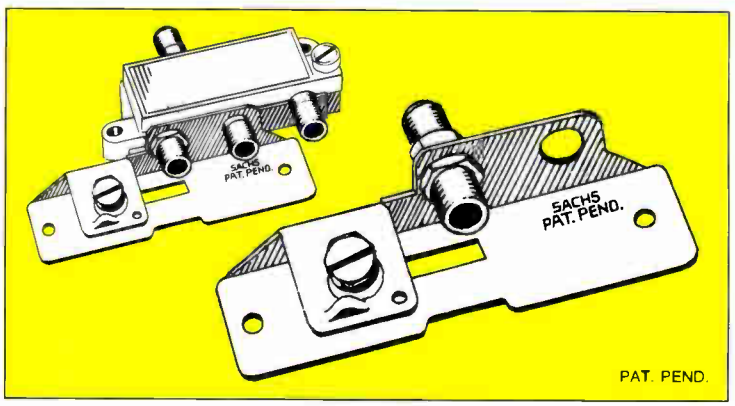

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To be useful in CATV, Bode equalizer must be used in impedance matched version.

justable bow or sag.

To be useful in CATV, the Bode equalizer must be used in an impedance matched version. This is accomplished by providing the 75 Ω dual in the shunt position of a 75 Ω T. The dual of a bridged-T network is itself a bridged-T network. The dual of the terminating resistor must also be provided. Figure 8 shows a full dual version of the circuit in Figure 5.

In a fully matched Bode equalizer, the terminating resistor also must be provided dually. There are a variety of ways of doing this. Dual potentiometers are available but are not suitable for automatic control. PIN diodes and thermistors are candidates for R_x. The PIN diodes may be controlled by an AGC loop or perhaps by a thermistor.

FIGURE 7

Other Bode type equalizers

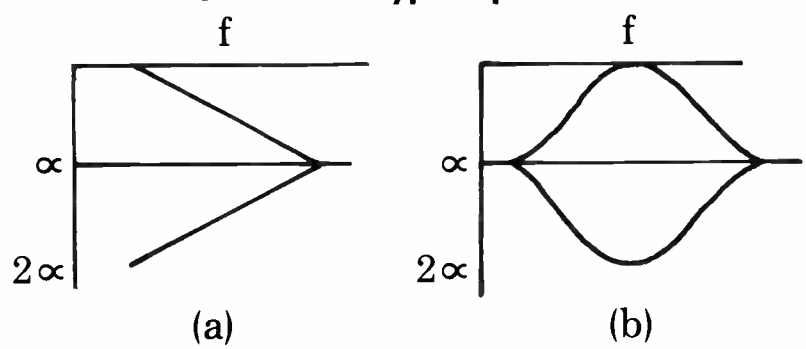
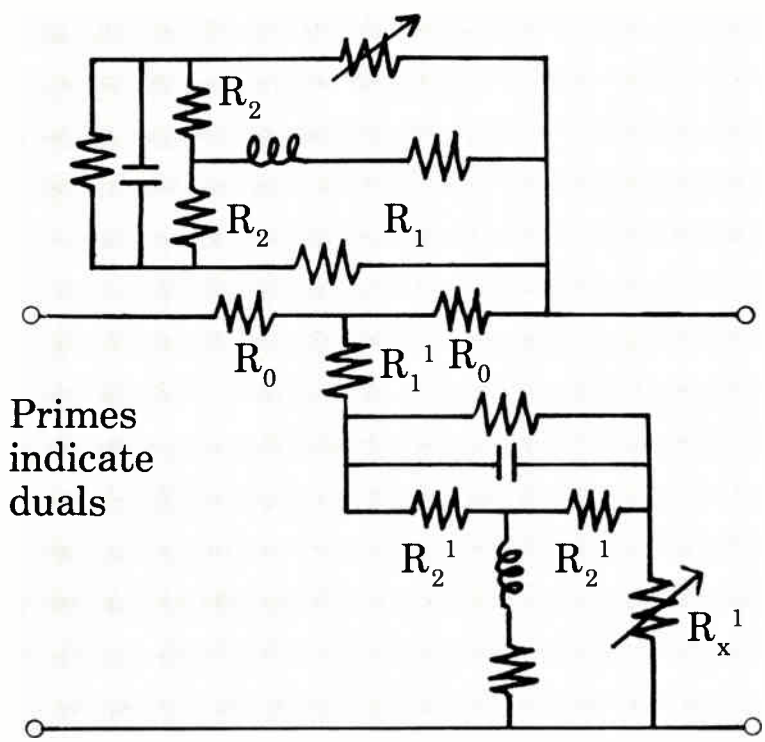


FIGURE 8

Full dual Bode equalizer



To achieve the full range of the Bode equalizer, R_x must vary very widely—from a short to an open circuit. ■

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- Bode, H.W.; Variable Equalizers, *Bell System Technical Journal*, April 1938.
- Haas, W.; Theory and Design of an Adjustable Equalizer, *Electrical Communication*, February 1965.
- Hakim, S.S.; Bode's Variable Equalizer, *Electronic Technology*, June 1961.

Appendix

This is a CAD program used for designing a Bode equalizer. It is written for COMPACT, a network analysis and optimization program available on UCS timesharing and elsewhere. This equalizer uses two parallel RC networks in series. They are assigned in lines 100-120. In line 190 the terminating resistance is set to 10 ohms. Line 250 puts 4.5 dB of cable in series with the equalizer, and lines 290 and 320 instruct the program to look at 5 to 115 MHz and make the total loss 5.7 dB.

```
00100 PRC AA SE -75 -100
00110 PRC BB SE -33 -240
00120 CAS AA BB
00130 RES BB PA 204
00140 RES CC SE 110
00150 INV DD AA 110
00160 RES EE SE 110
00170 CAX BB EE
00180 PAR AA BB
00190 SBR AA AA 10
00200 RES BB SE 75
00210 INV CC AA 75
00220 RES DD SE 75
00230 CAX BB DD
00240 PAR AA BB
00250 CAB BB SE 4.5 .05 .0007
00260 CAS AA BB
00270 PRI AA S1 75
00280 END
00290 5 115 10
00300 END
00310 0.1
00320 0 0 10 -5.7
00330 END
```

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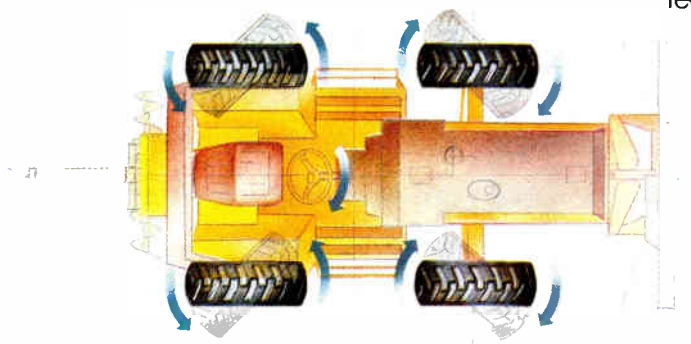

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Home TVRO slump will pass. . .

Home TVRO sales have been in a steep tailspin since the confusion over scrambling intensified early this year, undoubtedly causing second thoughts among some CATV operators who might have been looking at getting into the business. Larger MSOs with major urban franchises seem particularly hesitant. But out in the cornfields of Iowa, the hills of Tennessee and pine forests of Georgia and Mississippi, many small system operators believe the slump will pass, a *CED* survey indicates. They may not be pushing sales very hard, and present sales volumes are small, but they haven't put their plans on hold.

Charles Vaccaro, for example, manager of Clover Cable Systems in Port Norris, N.J., is a new entrant into TVRO. He recently ordered 20 Channel Master systems. He's got two orders on hand. Marshall Martin, owner of Luverne TV Cable Service, Luverne, Ala., on the other hand, has been in the business since 1980 or so. His business was "pretty good until scrambling." He's still carrying and installing systems, but isn't pushing it right now. Neither is Ted Derby, manager of Preston Cable TV of Preston, Minn. He got started in 1983 and still sells "a few" dishes to customers outside the franchise area.

> . . .say many independent CATV operators and smaller MSOs scattered widely throughout the more rural areas of the country, a recent CED survey finds.

Neither do many operators seem to be moving descramblers or making any money at it. And some don't want to sell descramblers. Opal Chadwell, for example, has been selling Winegard and Channel Master systems for a year and a half. But only to people who really understand the scrambling issue and can get their own descramblers. Neil Webster, co-owner of Guttenberg TV Cable System in Guttenberg, Iowa, plans to keep only one VideoCipher unit on display. He'd rather refer buyers to two TVRO retailers in town and stick more to the programming and financing ends of the business.

Business to increase

But all seem to agree that—once the major programmers scramble, packages and prices are set and the air clears—sales will pick up again, possibly in early summer. Some indicate sales already are turning back up, and a few say they never experienced a real downturn. Take John Jackson, for example. He's manager of Jackson Cable Systems in Eaton, Ohio. There are

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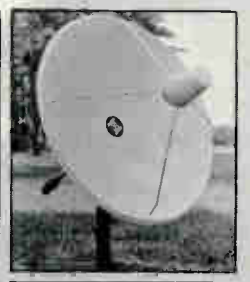

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A few operators have been burned by buying gear from companies that have gotten out of the business.

about 75,000 homes in his areas, but only 24,000 lie within his franchise. He's been in business about a year, and by the second month was putting in 20 to 25 systems every 30 days. After scrambling? "I'm still selling about two a day," he says. What he thinks has happened, though, is that his growth rate is nil.

Likewise, two months after Rolla Cable in Rolla, Mo., got started selling TVRO systems, sales dropped off. "But things are already picking back up, especially on the rental side of the business," says manager Doris Barton. And Scott Witcher, owner of Evant TV Cable in Evant, Texas, says his own desire to wait until the scrambling picture clears up is the cause of the slowdown in his sales. "I'm just holding off pushing it until everything's settled," he says.

Howard Lock, owner of seven rural Wisconsin systems also expects sales to rise. He sells 99 percent of his systems outside the actual franchise areas and really saw his sales fall off in January of this year. He was selling a system a day in November 1985. He sold a total of 10 systems in December and only one in January of this year. But his April numbers should reach eight or so.

Slump or not, more small and rural system operators say they'll be getting into the business by early summer. Ed Blewett, manager of the Cortez, Colo., system, is looking at early May. He says he's still getting lots of inquiries about systems from people outside his franchise area and plans to limit his initial sales there. Between now and May, he wants to make sure the technical staff is trained on dish assembly and installation.

And whether they're already in business or plan to be, almost all are a bit restive about selling programming. Most think they ought to be able to sell programming outside their franchise areas, since in most, but not all cases, that's where the hardware is going. But some operators, like Southwest Missouri Cable, are selling even inside their franchise areas.

The timetable for basic service scrambling also may have an impact. Jerry Kittelson, manager of the Spirit Lake, Iowa, system, says, "Everybody's kind of waiting. I've talked to 14 people, and they're waiting to see what Congress does," referring to a possible scrambling moratorium some interests have asked for. "If nothing like that happens as a result of the Tim Worth hearings this spring, we'll get going this summer."

He's still waiting for the basic programmers to announce terms, rates and conditions for basic packages. "So far I've only heard from CNN."

A few have gotten burned by buying

Once the major programmers scramble, sales will pick up again—possibly in early summer.

gear from companies that have gotten out of the business, and most are sticking with names they know: Channel Master, M/A-COM and Scientific-Atlanta. Drake, Uniden and Chaparral also seem favored. Lock, for example, had Automation Techniques gear, but AT has closed its TVRO business. Jackson started out with Wilson receivers but is switching to Scientific-Atlanta. He doesn't know whether Wilson will be around for the long haul. Thomasson used Amplica gear, but they're out of this end of the business.

Retailers fleeing market

The slump already has driven many retailers from the market, and that could leave CATV operators in stronger positions once the slump ends. Gary Wright, manager of the Village of Marlboro, Mo., system, near St. Louis, says, "Most of the dealers in the St. Louis area are out of business. It behooves me to keep pushing TVRO because, when it does come back, we could be the largest dealer in St. Louis. The question is whether the other guys can hold on until the market picks up. We can."

Likewise, when Ron Thomasson, manager at Coast Communications, Ocean Shores, Wash., started selling home systems 18 months ago, "Some local distributors were saying scrambling would never happen." Today, Thomasson is "the only one left" selling in his small town environment.

Telling the truth also helped Tele-Cable, of Borrego Springs, Calif., put in about 100 dishes since November 1985. "We had a local guy selling home systems, and he wasn't giving the straight story. We did," says Dorothy Barnett, sales manager.

By way of contrast, John Watkins, manager of the Blue Rapids, Kan., system, has almost no competition. On the other hand, he's only been selling dishes for about three months and has but a few sales to date. Of course, he's not really pushing them very hard. "I got in because I was sort of curious about how many people out there really wanted them," he says.

And the relationship with local TVRO dealers isn't necessarily competitive. Greg Curry, director, marketing, for North American Cable System in Hector, Minn., is giving cash incentives to TVRO dealers when they refer customers who want programming packages. Webster has excellent relations with the two local TVRO retailers; both used to work for him.

Few changes reported

Surprisingly few systems reported major changes in the way they do business as they moved into TVRO. Aside from training for the technical staff

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Reader Service Number 25

Few systems reported major changes in the way they do business as they move into TVRO.

and CSRs, few mentioned starting separate retail businesses, opening new offices or adding staff. Some did remodel their offices, like Charlotte Dalton, manager of Twin Valley Cablevision of Germantown, Ohio. Steven Guest, manager of the Davenport, Okla., system, was one of the few who actually set up a new company to handle the retail end of the TVRO business. Cable Brazil, in Brazil, Ind., and Tele-Media, of Hillsboro, Ohio, were two systems that did hire additional staff to sell, install and maintain TVRO gear.

Maybe business isn't booming the way it was. But when the dust has settled on the scrambling issue, many smaller cable operators in rural areas are going to find themselves well positioned for programming and hardware sales to a home TVRO market.

By Gary Kim and Kathy Berlin

Where to find them

Opal Chadwell
Blanco Cablevision
Blanco, Texas
(512) 833-4886

John Watkins
Blue Water Cable
Blue Rapids, Kan.
(913) 226-7678

Edward Blewett
Cable TV Investors
Cortez, Colo.
(303) 565-4031

Wanda Schraedley
Cable Brazil
Brazil, Ind.
(812) 448-8308

Charles Vaccaro
Clover Cable Systems
Port Norris, N.J.
(609) 785-0072

Ron Thomasson
Coast Communications
Ocean Shores, Wash.
(206) 289-2750

Scott Witcher
Evant TV Cable
Lampasas, Texas
(512) 556-6673

Neil Webster
Guttenberg TV Cable
Guttenberg, Iowa
(319)252-1343

Gary Wright
Heritage Cablevision
St. Louis, Mo.
(314) 962-8600

John Jackson
Jackson Cable Systems
Eaton, Ohio
(513) 456-1183

Marshall Martin
Luverne TV Cable Service
Luverne, Ala.
(205) 335-5059

Howard Lock
North Cable Co.
Marinette, Wisc.
(715) 735-9532

Greg Curry
North American Cable
Hector, Minn.
(612) 848-6231

Ted Derby
Preston Cable TV
Preston, Minn.
(507) 765-2712

Doris Barton
Rolla Cable System
Rolla, Mo.
(314) 364-5206

Ruth Kolpin
Southwest Missouri Cable
Carthage, Mo.
(417) 358-2063

Jerry Kittelson
Spirit Lake Cable TV
Spirit Lake, Iowa
(712) 336-5151

Dorothy Barnett
Tele-Cable
Borrego Springs, Calif.
(619) 767-5607

Margaret Stroumer
Tele-Media of Tri County
Hillsboro, Ohio
(513) 393-2936

Charlotte Dalton
Twin Valley Cablevision
Germantown, Ohio
(513) 855-3559

Steven Guest
Vi-Tel
Davenport, Okla.
(918) 377-2347

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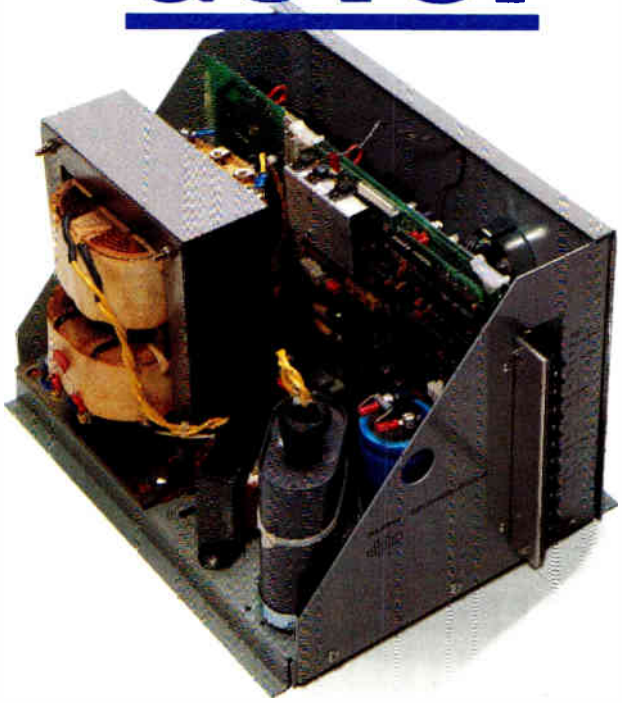

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Reader Service Number 27

Multi-vendor compatible converters: a new approach

Multi-vendor compatibility (MVC) is a new term in the industry, used to describe a converter's ability to descramble more than one vendor's scrambling method. The basis of the technology lies in the converter's descrambling module, which consists of separate descrambling circuits for each compatible type of scrambling. While this technique is new to the industry, large MSOs such as Group W, Times Mirror and Storer already have analyzed the benefits of an MVC converter and, early this year, began integrating them into specific systems.

But the importance of the multi-vendor concept cannot be fully realized without some brief background. For the past 12 years, an operator has had one opportunity to choose an effective converter and scrambling method to secure his cable system. And once this decision was made and his system dedicated, the operator was locked into that converter and its particular scrambling technique.

Today, MVC converters mean an operator can integrate, for example, a Pioneer brand converter into a system currently using Jerrold converters and Jerrold's Tri-mode scrambling. A relatively simple concept, but one that has just recently been aggressively applied to the cable industry.

Multi-vendor compatibility offers operators second source availability in converter decision.

By Jennifer Miller,
Marketing Manager, Pioneer Communications of America

The MVC converters became essential because of three main factors. First, all-descrambling and PROM boxes had become extremely susceptible to theft-of-service, and operators were looking for a way to thwart cheaters without immediately changing out the system's entire subscriber base.

Second, high failure rates among some converters created a need for operators to integrate a more reliable converter—again, without immediately changing out all converters in the field or even changing scrambling methods.

And finally, operators wanted a way to slowly integrate converters into their system which had enhanced functions such as remote control, VCR timers and other consumer-friendly features.

Among the hardware manufacturers that have jumped on the MVC bandwagon are Pioneer Communications, Regency, Zenith, Scientific-Atlanta and Jerrold. Each hardware manufacturer differs in the competitive scrambling technique(s) with which they are compatible. Also, some converters are compatible only with certain scrambling techniques of a particular vendor.

FIGURE 1
Multi-vendor compatible converter

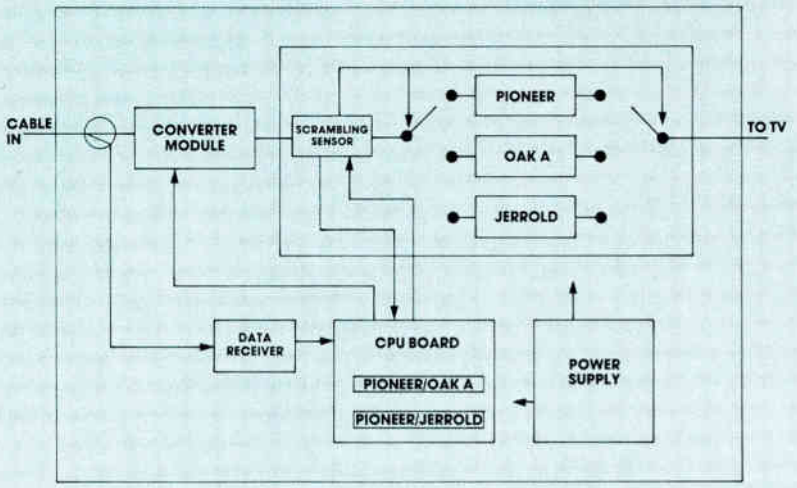

Figure 1 depicts the process in which an MVC converter reads and processes scrambling information. In this example, the converter is compatible to Oak A-mode, Jerrold Tri-mode and Pioneer VCS scrambling.

The descrambling process

Figure 1 depicts the sequence in which MVC converters read and process the scrambling information. First, the operator must download the system parameters which include the scrambling method or methods the operator wants to utilize. (The converter's logic is told which scrambling methods are available for descrambling.) In this case, the converter has been downloaded to accept Pioneer VCS™ scrambling, Oak A-mode and Jerrold Tri-mode scrambling.

As the scrambled signal is received by the converter, the converter's logic uses its decision-making process to determine if that particular scrambling method has been authorized by the operator. If the signal has been authorized, the logic tells the descrambling module to switch to the corresponding descrambling circuit, thereby providing the subscriber with a clear, descrambled picture.

In this example, the converter would descramble either Oak A-mode and Pioneer VCS™, or Jerrold Tri-mode and Pioneer VCS™. Any other scrambled signal would be denied, protecting against potential subscriber piracy.

Although the theory of operation for an MVC converter is simple, in practice, an MVC converter design must take into account numerous variations of similar scrambling systems. To illustrate this point, let us focus on sync-suppression type scrambling. An MVC converter, as illustrated in Figure 2, first determines whether the selected channel is scrambled or not. For most RF type scrambling, this is determined by the presence of the descram-

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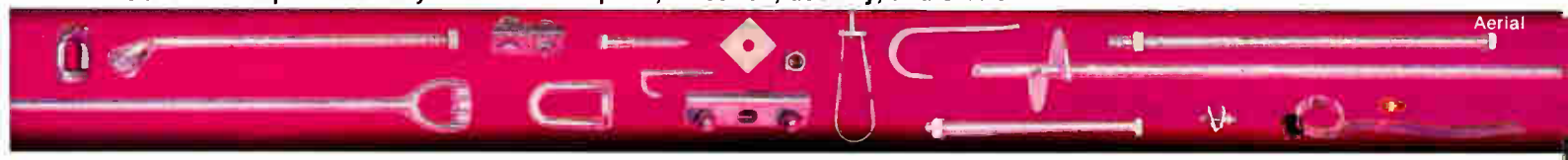

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An appropriate billing interface is needed to complete the integration process.

bling key signal on the aural carrier.

The second decision will be what type of sync suppression should be used. Today, two basic forms of sync-suppression scrambling are available: sine-wave sync suppression (SSS) and gated sync suppression (GSS). The two fundamentally differ in the basic scrambling waveform. For this reason, regeneration circuits are different, although a certain degree of sharing is possible.

The next step, which is probably the most complicated, is the detection of subtle differences within GSS (or SSS). Variations such as depth of sync suppression, vertical suppression and timing of sync suppression separate one vendor's scrambling from another. Thus, an MVC converter system must be able to activate the correct scrambling combination. Typically, a custom LSI, which incorporates all the variations, is used to eliminate extensive increase in discrete circuits.

The final step, which is common to all addressable converters, is the confirmation by the converter as to whether the particular subscriber is authorized to receive this channel.

An economical phase-in

Multi-vendor compatible converters are especially benefical to an operator who is dissatisfied with his current converter or scrambling mode. Without removing any existing converters, an MVC converter can be phased into a system which uses a scrambling method compatible with the converter.

Take for example, an operator who is using Brand X and is dissatisfied with its security (See Figure 2). He can take Brand Y, which is multi-vendor compatible, and begin to integrate it into his system. The operator continues to use his existing scrambling method and encoders during the phase-in procedure. Once Brand Y is completely phased in, the operator can replace the scrambling method in the headend to Brand Y's and render useless any unauthorized converters trying to defeat the system.

Any Brand X converters that were effectively pirating service can no longer descramble Brand Y's scrambling method. Plus, the operator now has given his subscribers a state-of-the-art converter with improvements such as SAW filters, SAW resonators and phase lock loop technology.

In most cases, the operator does not need to purchase new encoders to phase in the MVC converter, nor does he have to run duplicate channels of scrambled programming for each converter type.

For an existing addressable system, a new addressable controller must be purchased prior to the phase-in. But the integration process would not be complete without an appropriate billing interface. Brand X and Brand Y

Benefits of compatibility go beyond flexibility.

addressable controllers must both be tied directly to the billing host. This is a relatively simple procedure whereby the appropriate communication interface is added to the billing host by the billing company.

The time and degree with which the MVC converters are phased into an existing system is the operator's choice. Experienced operators have done the phase-in on a new install basis or even as replacements for converters brought in for repair. The replacement procedure can be completed as quickly as several months, or an operator may choose to stretch it out for several years—depending on the magnitude and urgency of the operator's system problems.

The benefits

But the benefits of multi-vendor compatibility go beyond flexibility. Operators purchasing these converters stress that MVC gives them the benefit of second source availability. Prior to MVC, the operator was locked into only one supply source, even though the converter purchase is traditionally his biggest capital expense.

Additionally, multiple types of scrambling schemes provide a moving target for subscribers who are attempting to cheat the system. Operators have the option to periodically switch between the compatible modes. Finally, the operator will, in may cases, experience an improvement in the subscriber's picture quality and reliability due to the technological improvements discussed earlier.

System operators who are managing more than one system will discover that MVC creates inventory and operational consolidation among his different systems. Take for example Pioneer's multi-vendor addressable converter, the BA-5000. If an operator utilizes Jerrold Tri-mode scrambling in one system and Hamlin in another, the BA-5000 can serve as a second source to consolidate both systems.

Even operators planning to upgrade to addressability should strongly consider a converter with MVC. Problems such as idle inventory and theft-of-service mean today's cable operators simply cannot afford the expense and headache of being locked into one con-

Converter Compatibility Chart

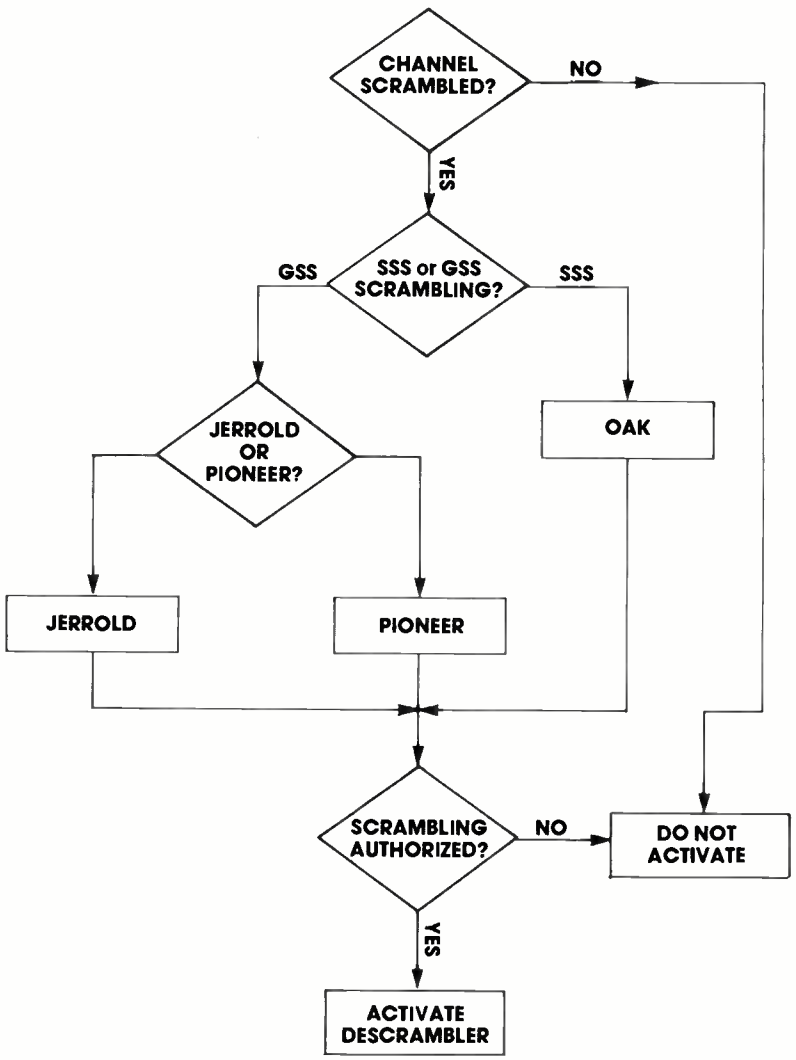
Manufacturer	Model	HAMLIN	JERROLD			M/A-COM	MAGNAVOX	OAK			PANASONIC	PIONEER	REGENCY	SCIENTIFIC-ATLANTA	SYLVANIA	TEXSCAN	W&S SYSTEMS	ZENITH
			6 dB	10 dB	Trimode			A	B	Clear								
Jerrold		•	•	•	•	3020 RF	6400				TZ-PC 200	BA-5000	LC32R RC32R	8550 8555		4040	VM 2000	
M/A-COM	3025 Baseband 3020 RF		•					•	•									
Magnavox	6400		•										6 dB		•			
Oak	Sigma																	ZTAC Version
Panasonic	TZ-PC 200 Series Avail. June/July		•	•														
Pioneer	BA-5000	•		•	•			•	•	•								
Regency	LC32R RC32R		• •	•	•													
Scientific-Atlanta	8550 and 8555	•	•	•											•			
Telease	MAAST	Compatible with any inverted sync mode with software, compatible with sync modification systems																
Texscan	4040		•															
W&S Systems	VM2000		•	•	•													
Zenith	ST5000 Series							TC 56 earlier series TC 35 unit										

* Single bold line represents blocks where manufacturers are compatible with themselves.

MVCs give purchasing control back to the operator —exactly where it belongs.

FIGURE 2

MVC descrambling flow chart for a converter which is Jerrold, Oak and Pioneer compatible



verter. MVC also means that, for the first time, operators can purchase the best converter for their dollars instead of the one mandated by their scrambling method.

Perhaps MVC's most important benefit is that it gives purchasing control back to the operator—exactly where it belongs. The cable operator is trying to give his subscribers good programming with reliable service and a quality picture. He should have the flexibility to pick and choose the technology that best suits his needs. Multi-vendor compatibility can improve reliability and security, without inconveniencing subscribers or disrupting an entire system. ■

Interface '86

Interest in broadband LANs continues to grow. Zenith Electronics and Viacom Telecommunications get into the act.

If there were few blockbuster announcements involving broadband local area networks at Interface '86, a major data communications show held March 24-27 in Atlanta, that's understandable. Those cannons would have been shot at Communications Networks '86, a trade show held in January. But a few salvos were fired, and a couple of "first-time-ever" appearances by CATV vendors showed people are expecting some hits in LANs.

Two new players sharing booth number 2355 were notable. **Viacom Telecommunications**, a subsidiary of Viacom International, is now prepared to build, test and certify local area networks—75-ohm coaxial cable and fiber optic, as well as microwave nets. What the company's doing is leveraging existing assets: it's ability to buy CATV equipment and cable in vast bulk, a "point-of-presence" in many parts of the country (CATV systems, broadcast TV stations, MTV networks and Showtime/The Movie Channel offices); installation and maintenance experience with over 13,000 miles of broadband plant, 15 regional microwave nets, fiber and DTS links. Of Viacom's 2,500 employees, 25 percent are technical.

Says General Manager Dave Archer, "We've been dabbling in data for a long time—on and off since 1978—hoping to get into the 'data over cable' business. But the Cox-Omaha decision wasn't as clean as we wanted. There's still too much room for state regulation."

Here Archer is referring to the 1985 FCC decision that gave a go-ahead for Cox Cable's Commline service, offering voice and data services to business customers in Omaha, Neb. The state public utility commission has tried to assert jurisdiction over the service as a common carrier, but the FCC disagreed. The decision was hedged a bit, since the commission declined to extend the ruling in blanket fashion to every other similar service.

But it was a major victory, nonetheless. For the first time, the FCC ruled that cable companies could provide communication services without the burden of PUC regulation, so long as portions of the traffic were destined for out-of-state carriage. The decision even okayed data and voice traffic intrastate, so long as the intent to expand to interstate service was there.

But it wasn't enough to soothe Viacom's nerves. Fortunately, the LAN business isn't regulated. And, luckily, Viacom never dismembered its new business development unit, which had data communications experience. The move into LANs was logical.

And here's a switch: Viacom Telecommunications has a distributor relationship with **Zenith Electronics**, nearly finalized, under terms of which Viacom installs the new Zenith Z-LAN 500, a local area network system that supports as many as 10,000 users at 10 Mbps. Z-LAN subdivides each of five 6-MHz channels into four 500-kbps sub-channels. Capable of supporting nodes over a 30-mile distance, Z-LAN uses the CSMA/CD signaling technique. Remote diagnostics and network management are built right into the system software, as is frequency selection.

The new system can operate over a single or dual cable system, with sub-, mid- or high-split frequencies. Compared to many other products on the market, Z-LAN features "much lower C/N ratios," according to Semir Sirazi, director of communications products for Zenith. "It's also suitable for operation over existing CATV I-nets or existing sub-split broadband networks," he adds.

In the works for about two years, Z-LAN is another example of leveraging existing assets. "It's based on our experience with Z-View, teletext and two-way communication," Sirazi says. That's given the company extensive experience with remote diagnostics. Another outgrowth of Zenith's work with Z-View: the need for automatic adjustment of power levels, which can vary widely on CATV systems. "The system has power level adjustment automatically built in," Sirazi says. "There are 16 steps of 1.5 dB each."

The system also appears to be positioned as a very low cost broadband alternative. The Z-LAN-500D, a dual-port network communication unit, with asynchronous RS-232C interfaces, is priced at $795—offering a per-port connection cost considerably less than comparable gear on the market today. Eight and 16-port versions are on the way, and they'll offer a significantly lower price, Sirazi says. In es-

Today, General Motors has about 40,000 programmable controllers in its plants. By 1990, it will have 400-500 percent more. CATV-type networks will tie them together on a plant-wide basis.

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Multi-vendor sourcing is needed to give the customer what works best in each situation, at the best price possible.

sence, it's now possible to get broadband capabilities at about the cost of baseband connections. Limited shipments should begin in June, and quantity production should occur by the third quarter of this year.

The system also uses the Z-LAN-06FTR, a frequency translator priced at $1,995; and the Z-LAN-500BRG, a bridge priced at $9,900. What the bridge does is connect different NCUs operating on different frequencies, so the network is totally user-transparent in terms of channelization. All devices on the network communicate as though they were sharing a single frequency.

Viacom Telecommunications, by the way, has firmly decided against exclusive distribution agreements with Zenith or any other vendors. Viacom wants the freedom to give the customer what works best in each situation, at the best price possible. That means multi-vendor sourcing.

More interfacing

C-COR Electronics was at Interface. Cliff Schrock wasn't. It seems he left the company about a week or so before the show. We wish him the best. Among the products C-COR was showing were its new intelligent A-B switch, which allows forced or automatic switching of RF signals in sysems that require redundant cable paths. For the IBM PC Network, there's the model 5141 translator, a low-cost way to support 72 modes. For larger nets, the 5200 series is also available. The newer 7800 series of high-speed, synchronous modems are available for T-1 applications (both voice and data). The 7100 series offers analog audio, asynchronous data up to 19.2 Kbps or synchronous data up to 19.2 Kbps. C-COR also has a camera control system designed to monitor as many as 255 cameras on one to five video channels. That's possible because there's a dedicated telemetry link.

Bob Dickinson, by the way, has decided to strike out on his own again. Founder of E-Com and most recently with the **Network Technologies Division of AM Cable**, you can be sure he won't be sitting still. My guess: his next project could well be a switching system for voice over broadband LANs. That would knock a linchpin out of the argument that a PBX network is better than a LAN, since it can handle voice switching and data traffic. Network Technologies division was one of the broadband vendors exhibiting at the show.

LanTel, the Norcross, Ga.-based supplier of broadband frequency translator, data and voice modems, said it would be introducing a synchronous,

Manufacturing Automation Protocol products were prominent at the show as many companies committed to the MAP marketplace.

19.2 Kbps point-to-point modem in May, rounding out its existing six-product line, which includes two frequency translators: the model 168, designed for the IBM PC Network; and the model 156 for other general purpose LANs. LanTel also has two voice modems: the model 500T, which connects two telephone circuits point-to-point; and the model 500DC, which provides telephone-to-PBX connections. The modem line includes the 500A asynchronous data modem, transmitting up to 9600 bps; and the 500S asynchronous modem, transmitting up to19.2 Kpbs.

Magnavox CATV Systems was attending Interface for the first time this year and, like many of the companies, was showing its amplifiers and status monitoring systems.

Manufacturing Automation Protocol products also were prominent. **Concord Data Systems** was showing its Token/Net line of MAP-compatible products, including a headend remodulator, MAPserver network interface modules, Terminal Server for synchronous device attachment to MAP networks and Token/Scope network analyzer. The company also was showing its broadband and carrierband modems and MAPware, a set of modular hardware and software designed for connecting OEM products to a MAP network.

Scientific-Atlanta, which also is committed to the MAP marketplace, was emphasizing its general purpose and IBM PC Network line, showing the PC Network translator, 6402 modem, 6822 distribution amp, taps, passives and cable.

Ungermann-Bass likewise was putting the emphasis on other products than MAP compatibles, among them the company's micro-to-mainframe software and token ring system.

Veteran exhibitor **Zeta Labs** was showing its point-to-point line of modems and suggested its ZT 1 modem would be out this summer. The company doesn't seem to be hurting for business and clearly expects dramatic price drops in modems over the next year or two.

Allied Data Communications has a solution for smaller companies and buyers who want to test an actual broadband system but don't want to commit lots of money to the effort. Allied's solution is a mini-headend selling under the name of Mod-LAN. The model on display at the show was a high-split version with six ports and designed for about 100 feet of cable. The rack includes combiner, amplifiers and a test panel and lists at $2,995. Martin Marietta and Lockheed plants in Georgia already have versions of the Mod-LAN, which Allied ships in pre-certified form: sort of a plug-and-go

Products that allow Ethernet signaling over broadband networks also were shown by several companies.

package. Full IEEE 802 compatibility is guaranteed.

General Instrument's RF Systems Division had one of the larger displays of actual distribution gear and, apparently, learned something from the last show it attended: display the mainstations with the housing open, not closed. Cosmetically, CATV amplifiers still look somewhat out of place at a data communications show, but showing the electronics helps. In addition to its point-to-point modems, RF Systems was showing mid- and high-split amplifiers, line extenders, power inserters, splitters, an internal distribution amp, taps, splitters, status monitoring gear and equalizers.

Allen-Bradley Co. was showing both its MAP network, the VistaMAP, and its general purpose net, the VistaLAN/1. The company also has an IBM PC Network-compatible network called the VistaLAN/PC.

Fairchild Data Corp. also supports MAP and was showing its M8024 Map-Link modem, as well as general purpose, frequency agile modems. The M505 is agile from 5 to 400 MHz, while the M505(M) is agile over the 1 to 20 MHz band.

Products that allow Ethernet signaling over broadband networks also were shown by several companies. Needham, Mass.-based **Chipcom** introduced its Ethermodem Repeater, which connects a baseband Ethernet system to a broadband Ethernet network. A maximum of two repeaters can be placed in a path between two Ethernet nodes. The unit is priced at $6,250 and June delivery is promised.

Bridge Communications of Mountain View, Calif., introduced the GS/6 Gateway Server, an internetwork router that connects Ethernet subnets over a broadband trunk. As many as 255 subnets can be supported on a 6 MHz channel. The GS/6 is the first of a family of RF products that will probably be introduced in the third quarter of this year. It's expected that the line will mirror the company's existing stable of Ethernet gateways and servers. And although MAP products aren't expected this year, token ring products are. The broadband gear will use CSMA/CD acces control protocols.

Also showing Ethernet over broadband products was **Communication Machinery Corp.** of Santa Barbara, Calif. Its family of EtherCast modems come in single- and dual-cable versions, with two and eight ports. Also available for shipment now is the EtherCast 10 Frequency Translator. Prices for the modems begin at $5,525. The translator costs $5,850.

Irvine, Calif.-based **AST Research** was showing its new AST-SNA/BSC gateway, linking IBM mainframes and PC networks running NETBIOS.

Almost 20 companies attended Interface '86 to show latest equipment.

Zyplex of Concord, Mass., displayed a broadband version of its DEC VAX compatible switching system for PC or terminal communications with a host computer. The system also can access IBM mainframes or allow IBM PCs to access an IBM host.

—Gary Kim

Where to find them

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Allied Data Communications Group
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AST Research
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Irvine, Calif. 92714
(714) 863-1333

Bridge Communications
1345 Shorebird Way
Mountain View, Calif. 94043
(415) 969-4400

C-COR Electronics
60 Decibel Road
State College, Pa. 16801
(800) 233-2267

Chipcom
31 Thorpe Road
Needham, Mass. 02194
(617) 449-7666

Communication Machinery Corp.
1421 State St.
Santa Barbara, Calif. 93101
(805) 963-9471

Concord Data Systems
397 Williams St.
Marlborough, Mass. 01752
(617) 460-0808

Fairchild Data Corp.
350 N. Hayden Road
Scottsdale, Az. 85257

General Instrument
RF Systems
2200 Byberry Road
Hatboro, Pa. 19040
(215) 674-4800

LanTel Corp.
3100 Northwoods Place
Norcross, Ga. 30071
(404) 446-6000

Magnavox CATV systems
100 Fairgrounds Drive
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Network Technologies Division
of AM Cable TV Industries
1 AM Drive
P.O. Box 505
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Ungermann-Bass Inc.
2560 Mission College Blvd.
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Viacom Telecommunications Inc.
5924 Stoneridge Drive
Pleasonton, Calif. 94566
(415) 463-0870

Xyplex Inc.
100 Domino Drive
Concord, Mass. 01742
(617) 371-1400

Zenith Electronics Corp.
1000 Milwaukee Ave.
Glenview, Ill. 60025
(312) 391-8181

Zeta Laboratories Inc.
3265 Scott Blvd.
Santa Clara, Calif. 95054
(408) 727-6001

"What's good for GM is good for the country"?

Let's hope so. If the company's MAP effort succeeds, broadband notches a big, big win. Vendors are scrambling to comply with the standard, but obstacles remain.

Somewhat prophetically, Charles E. Wilson told the Senate Armed Forces Committee in 1952 that "What is good for the country is good for General Motors, and what's good for General Motors is good for the country." Hopefully, that's true for MAP, the company's major standards-setting effort. Because if the Manufacturing Automation Protocol becomes a commercial success, the broadband community gets a big financial shot in the arm. And there's reason to think it might. MAP has some awfully big guns behind it: GM, Boeing, Deere & Co., DuPont, Eastman Kodak, Ford, the U.S. Air Force, Inland Steel, McDonnell Douglas, Proctor & Gamble, TRW and perhaps 50 other sizable end-users. And vendors of all sorts have been scrambling to proclaim their support for the standard. Some products are already on the market, and the trickle looks to become a flood later this year.

But the enormity of the undertaking isn't to be taken lightly. MAP seeks nothing less than an open architecture for broadband local area networks in the factory environment: plug-in compatibility between modems, network interface units, headend remodulators and other devices on the network. It hasn't been easy to achieve, even at the lowest physical levels. Furthermore, the development effort has required a major cultural shift in the way companies do business.

Kevin Hughes, manager of MAP product marketing for Allen-Bradley, a major player in factory automation, recalls that at the very early MAP meetings, engineers from competing companies didn't even sit in the same room. Messages were shuttled back and forth between them. Today, companies cooperate in ways that would have seemed unthinkable back then. They have to. GM has made absolutely clear its intention to purchase only network products that conform to MAP specifications. So companies must demonstrate interoperability of their devices at increasingly higher levels of functionality.

Potential dangers

And, there's potential danger lurk-

Big guns behind MAP may help lead to its commercial success.

ISO/OSI reference model	Map layer functions
Application (Layer 7)	Program-to-program Communications
Presentation (Layer 6)	Format Translation
Session (Layer 5)	Connection Establishment and Maintenance
Transport (Layer 4)	End Node-to-End Node Error Checking
Network (Layer 3)	Internetwork Message Routing
Data Link (Layer 2)	Intranetwork Error Checking
Physical (Layer 1)	Signaling and Physical Connection to Media

ISO OPEN SYSTEMS INTERCONNECT REFERENCE MODEL

ing behind the MAP effort. It isn't just that communication between different devices consumes processing time as the various protocol layers are addressed. It's not that the effort to do so requires prodigious investments of time and resources, although perhaps 10 companies have each committed $10 million to the MAP research and development effort. A few of the companies may have ponied up twice to three times that amount.

No, the real problem is that MAP has been a moving target so far. MAP has evolved over the past few years, and newer versions are coming. Version 2.2 is scheduled for release in the third quarter of this year, with a 3.0 version slated for first quarter 1987 introduction. That's because the standard began at the physical level and has been progressively refined at higher and higher levels of the Open Systems Interconnection model of the International Standards Organization. The OSI is a seven-layer reference model governing data communications.

And, without question, an undertaking of this sort takes time. It can't emerge full-blown overnight. But here's the economic problem. How many vendors can afford to invest heavily in MAP-compatibility at one spec, only to watch the spec change before they've had time to sell product and recover their costs? That's happened already. To date, GM has only promised to buy products at certain specs for two years or so. That may not be enough time.

Also, even when companies have time to put out compatible versions of MAP gear, those versions need to be out on the market at roughly the same time. Otherwise, there's the real possibility that various "MAP-compatible" or "MAP-compliant" devices won't talk to each other because each is using a different version of MAP. How many end-users are going to have confidence in MAP if the devices won't communicate? That could jeopardize the entire project and, with it, broadband's chances for serious market inroads in the local area network market.

MAP was the word

But MAP was the word on every-

MAP was the word on everyone's lips at Internat'l Programming Convention.

body's lips at the International Programmable Controllers convention, held April 8-10 in Detroit. MAP clearly was the glamour topic there, and the roll-out of MAP-compatible products continued. Just as clearly, the question on vendor minds was "when?" When will MAP products begin moving in serious quantities?

There seems to be no clear answers to the question now. Not a surprising situation, perhaps, considering that production quantities of MAP-compliant gear won't be on the market until later in the year. Allen-Bradley's VistaMAP LAN modems, for example, have successfully demonstrated interoperability with a Concord Data System headend remodulator. The A-B modulator also has been successfully tested with Scientific-Atlanta and Fairchild Data Corp. modems.

But the VistaMAP headend remodulator and terminal server units still are in beta testing. Production quantities won't be shipped until the end of July or so. By September, A-B hopes to be shipping a four-port version, in addition to the initial eight-port version. Other companies announcing MAP-compliant gear at the controller show are in similar situations.

Still, Allen-Bradley, for example, clearly is planning to move ahead aggressively. MAP products currently represent only about 5 percent of the Communications Division's sales. But in five years that figure could be 50 percent. The present staffing of the division is about 100 people. But that should grow to about 200 or so this year. And it may triple in the next several years.

Carrierband is next

For many of the vendors at the show, including Allen-Bradley, carrierband sub-networks attached to a broadband MAP backbone make a lot of sense. Known as "Mini Map," carrierband sub-networks use a less expensive signaling technique: 5 Mbps single-channel FM. The idea is to lower cost and lessen the chance of a catastrophic failure of the system. Since carrierband is a baseband technique, it doesn't need the more complex broadband modems. Also, the system provides some protection against total system failure. If a sub-net goes down, the broadband net would still be functional.

Carrierband also suits the particular requirements of factory-based communication. Speaker Wendy Gibbons, senior systems engineer with A-B, pointed out that a variety of needs exist. Distributed control messages are sent frequently, usually need a rapid response and are limited in message length. Typically, communication between different programmable controllers is involved.

Factory monitoring, on the other hand, isn't as dependent on response time—except for alarms. Generally, data collection can be done in non-real time. Data acquisition, likewise, only needs to be done a couple of times per shift.

Supervisory control messages might only have to be downloaded once every few weeks, while program support and factory management also involve large blocks of data transmitted in loosely coupled fashion.

Broadband is well-suited to some of these applications, said Susan Baumann, communications product specialist with General Electric Co. Supervisory transmissions involving lengthy messages sent out to many hundreds of devices are well served by the MAP broadband format. Programmable controllers at the sub-net level, by way of contrast, must have real-time communication, but generally only exchange short messages. So a carrierband sub-net is ideally suited to cells of about 20 devices, communicating frequently and briefly. "Mini AP is the level of MAP standard to which vendors of programmable controllers will conform," said Keith LeFebvre, product marketing manager with Gould Electronics.

Square D, for example, although showing a MAP-compliant gateway called Sy/Gate, also was very inter-

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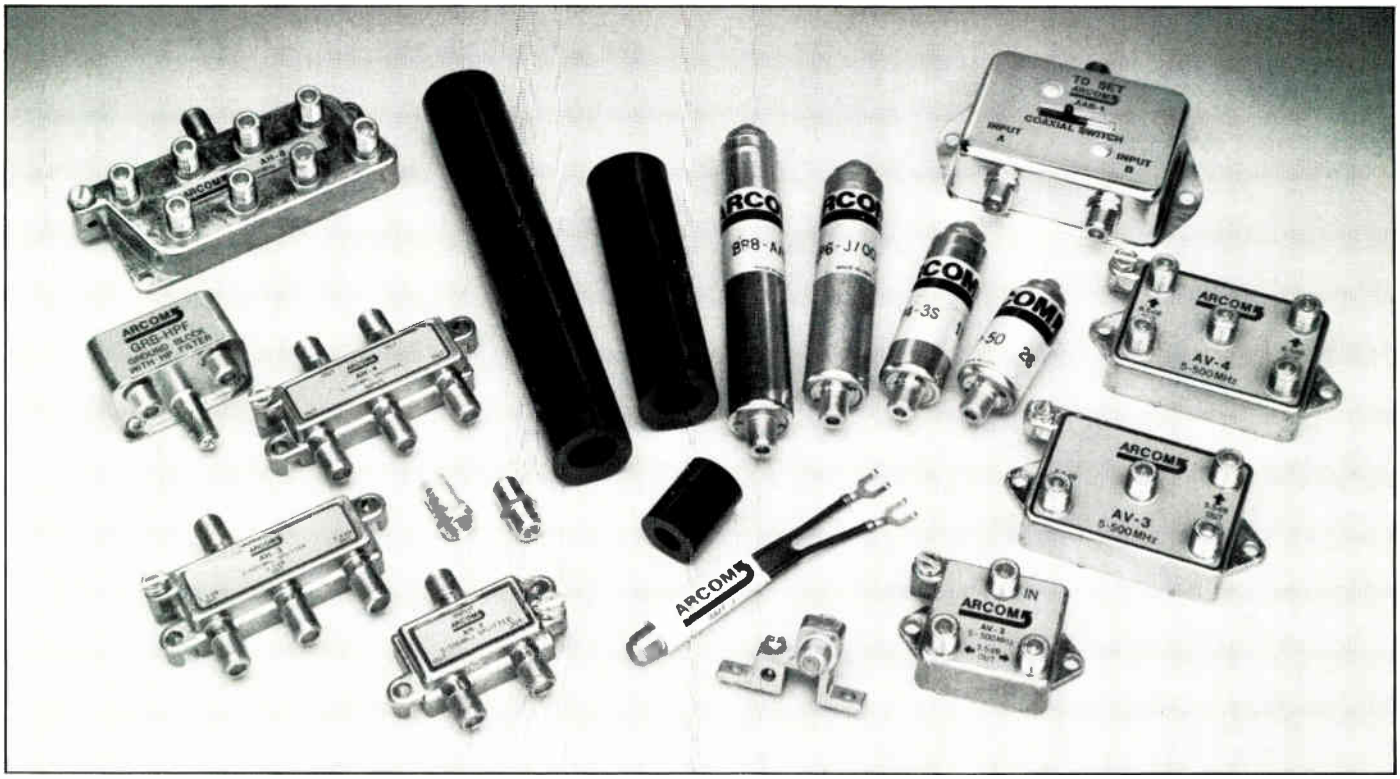

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Carrierband sub-networks use less expensive signaling techniques than regular broadband MAPs.

ested in carrierband standards, since so much of the company's work is at the cell level: a group of automated machines that must be closely coordinated in real time to function properly.

Compatible with MAP version 2.1, Sy/Gate actually incorporates three functions into a single unit. It acts as a cell controller for up to eight devices, is a MAP gateway and also can serve as a network interface unit for factory floor equipment.

General Electric was demonstrating its new MAP-compliant GEnet factory LAN. The 10 Mbps token bus system includes a bus interface unit, headend remodulator, a network management console and software packages for device attachment. In essence, GE has added software to Industrial Networking Inc. components. INI is a joint venture between Ungermann-Bass and GE. Beta testing begins in May, with full production expected in July. The remodulator will be priced at about $5,800; the interface unit will sell for $4,500-$5,000 in a two-part configuration supporting eight controllers from each port. Like other vendors at the show, GE is interested in carrierband, and the company's next announcements will be for carrierband products.

Gould Electronics was showing its NW 0200 MAP Gateway, operating at MAP 2.1. Orders will be taken in June. The company also was showing its Modbus II interface module, a MAP-compliant device allowing attachment of Gould 984 controllers to a MAP network. Beta testing begins in July, with production on a full scale in September. Later, an interface for IBM PCs will be rolled out. The new interface is compatible with Mini-MAP, 802.2, 802.4 and 5 Mbps phase coherent carrierband standards.

Universal Computer Applications announced its offering of MAP training courses and design consulting.

Motorola was showing several of its MAP products: the MAP Network Developer's Kit, the VMEmodule MAP network interface and the MC68824 token passing bus controller. The Developer's Kit includes a headend remodulator, drop cables, return cables, diplex filter, connector adaptors, 75-ohm terminator and two-way tap. The VMEmodule connects a MAP net and a VMEbus. The MC68824 is a chip-level device that provides media access control functions for devices to be attached to a MAP network.

—Gary Kim

Where to find them

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General Electric Co.
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Gould Electronics
Programmable Control Division
P.O. Box 3083
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(617) 475-4700

MAP/TOP Users' Group
Society of Manufacturing Engineers
One SME Drive
P.O. Box 930
Dearborn, Michigan 48121
(313) 271-1500 ext. 521

Motorola Literature Distribution
P.O. Box 20912
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Designed exclusively for the cable industry, the pedestal line from CWY Electronics is constructed from 18-gauge T2 aluminized steel followed by a four-stage process including: washing phosphatizing, baked vinyl wash primer; and electrostatic application of baked-on polyester enamel. The rectangular design of CWY's pedestals allows for maximum use of interior space. Each unit features a fully replaceable 11-gauge hasp, a hingeless front cover and top removal system for full exposure of interior and is flush-mountable directly to buildings. Multiple equipment mounting knockouts, hipped lid and interior lid guides, and an optional cam lock knockout are also included features in CWY's PED line.

The Omni-Rack™ system from CWY simplifies connections, disconnections and changes in subscriber status in multiple dwelling enclosures. The Omni-Rack rails are punched and threaded, thereby eliminating the need for plywood. Universal 16-gauge perforated panels accept No. 6 self-tapping screws and are designed to accommodate all makes of splitters. Once leads are connected to the underside of Omni-Rack's punched panels, connecting, disconnecting or changing sub status involves changing only the jumper cables between splitters and F81 D-type connectors on the punched panels. The Omni-Rackapartment box is available in two sizes: 12 x 18 x 18 inches and 18 x 24 x 8 inches.

The APB line of apartment security boxes from CWY is constructed of 16-gauge aluminized steel and features a hingeless lid removal system with security stops welded inside the front cover to deter unauthorized entry.

For more information on CWY's complete enclosure line, contact (800) 428-7596, in Indiana (800) 382-7526.

Channell Commercial

Channell Commercial Corp. is a privately held company that has been developing and manufacturing CATV pedestals for over 20 years. The materials used by Channell in its CATV products were developed in the 1960s for use in the "Minuteman Missile" project through extensive government-funded laboratory research and testing.

In addition, Channell's pedestal line is designed with a rounded lid to reduce the need for increased material quantities and to ensure durability. The round design also appears smaller than a square design of the same size, company spokesman Bill Channell Jr. states. All Channell pedestals are injection molded with a TV identification symbol on the cover, eliminating the need for stickers that may peel over time.

Constructed of acrylonitrile-butadiene-styrene plastic (ABS), Channell's enclosures are flame retardant and capable of withstanding high-impact blows, according to the company.

The metal components of Channell's pedestal products are hot dip galvanized after fabrication, and all pedestal products are shipped pre-assembled with factory-installed stakes, brackets and locking accessories. These features can reduce the contractor's installation cost.

Suitable for all single- and dual-plant underground CATV projects, the CPH and DCPH enclosures from Channell are available in a variety of sizes.

For more information, contact Channell, (800) 423-1863 or (818) 963-1694.

Coil

The PEDLOCK series of closures from Coil Sales & Manufacturing Co. is constructed of specially formulated rigid polyvinyl chloride (PVC), which resists deterioration from chemicals, fertilizers, ground acids and salt conditions. Special additives in the PVC material provide high impactibility and shield against ultra-violet light degradation.

All PEDLOCK closures are available with an optional integral stake base, which eliminates the need for

Coil's PEDLOCK series, steel enclosures from ComPedCo and Diamond's fiber glass pedestals. . .

separate metal stake and mounting hardware.

The PEDLOCK line is available in five sizes (4-, 6-, 8- and two 10-inch). All standard closures feature dual security for protection against unauthorized entry. This security system includes a 7/16-inch hex bolt and 1/4-inch hasp. Locking systems are optional.

A 2-inch overlapping area created by the dome and base of all PEDLOCK closures keeps out environmental problems. The overlap is designed with an air space which, working in tandem with a series of small openings at the top of the dome, provides proper air circulation.

Also from Coil are apartment house boxes—available in heavy-gauge galvanized steel, aluminum or stainless steel. Each apartment box comes with two 2-inch knock-outs at the bottom for cable entry and a removable, treated plywood backboard for mounting of components. The baked-enamel finish is available in beige, brown, green and grey. High-security and standard styles are offered in six sizes.

Coil's line of closures also includes two models designed to house and protect large amplifiers and auxiliary equipment. The 10- and 14-inch amplifier closures feature screened, louvered openings in the dome for additional air circulation.

For more information, contact Coil Sales & Manufacturing Co. at (312) 398-6774.

ComPedCo

A subsidiary of Milbank, **ComPedCo Inc.** has been fabricating sheet metal enclosures for over 50 years. Its CATV pedestal line is made from heavy-gauge zinc-coated steel finished with a hybrid polyester epoxy powder, electrostatically spray applied 1.5 to 2 mm. thick. These enclosures consist of a backplate/lower front cover assembly and an upper cover/cap assembly. Each unit features a knock-out provision for cylinder lock and/or padlock hasp. Accessory mounting brackets may be installed on the back plate.

The ComPedCo series of pedestals is available in five sizes, two of which feature screened louvers for ventilation.

Apartment boxes and a line of mounting accessories also are available from ComPedCo.

For more information, contact ComPedCo Inc., (816) 483-5314.

Diamond

The Pedestal and Closure Division of **Diamond Communications Products Inc.** manufactures CATV pedestals of pultruded fiber glass. Strand and mat glass fibers are fed into a bath of specially formulated resin that has been mixed with pigments, fire retardants

We must make our industry, and the NCTA, more technology aware.

Continued from page 16

better pictures and sound but, perhaps more importantly, better availability. We can argue all day whether the subscriber can see an improvement in picture quality, but there is no debate about the observability of an outage. Since DBS has much fewer electronics between the program source and the viewer, it can have an outage advantage. Convenience includes not only the consumer electronics interface issue but also ease of use, availability, variety and an ability to appreciate what is available. We must ensure that alternate methods of delivery don't gain or retain a competitive advantage over cable.

The continuous issues include FCC & legislative affairs, professional affairs, inter-industry relations and standards. FCC issues include signal leakage, frequency usage and must-carry. The legislative branch of government is currently pursuing satellite scrambling, copyright and compulsory license. Professional affairs include conferences, technical literature, training and technician certification support. We are affected by several other industries, among them: consumer electronics, broadcast, telephone and power. These important issues will continue to demand time and effort in order to win new ground and defend previous gains.

The cable industry doesn't have a tradition of dealing with its future because for most of its existence it *was* the future. This may no longer be the case. Our industry has always had such an all-consuming present that there have been little or no resources left to apply to the future. This, in itself, is the most important long term technical issue. Cable must become more technologically strategic. It is hard to cite another industry of similar size and technological dependence that has less R&D. We have no strong university ties. There is no college with a graduate research program in cable technology. MSO investment in R&D has been limited. Cable has traditionally left R&D to its vendors. The depressed economic state of the industry's vendors has drastically reduced development and essentially eliminated research. Unless this is changed, there will be few technological choices from which to build our future. Others, particularly the telephone industry, are not similarly at risk; they are investing in advanced technology and strategic planning on a comparatively grand scale. This cannot fail to yield them advantages.

HDTV and its related approaches, such as enhanced television techniques, would appear to be natural opportunities for a relatively bandwidth-rich medium such as cable. But cable's bandwidth has certain technical restrictions which could work to our disadvantage if we don't actively participate in the standards setting process. Onerous standards could result in the need for another $100 ugly box on top of the "standard" HDTV receiver to accommodate the special needs of cable transmission.

Program protection technology is yet another important long-term iussue. It is not possible to predict the ultimate solution(s). Two candidates answer the consumer electronics interface issue: off-premises interdiction and an advanced IS-15 compatible scrambling standard. In the latter case, the desire is for a method so secure that the hardware can be owned by the subscriber. The cable industry would be better off with standardization. An industry standard would allow vendors to compete on features, service and price. If, in addition, the standard could accommodate VCR recording in the scrambled mode, only viewing devices would require a decoder.

Two way capability could become the salient difference between cable and many of its would-be competitors. Two way communication is the key to a future home information business. Cable must invest in ways to realize this advantage and make it practical.

Productivity improving technology, such as Expert System software, needs to be encouraged if cable is to maintain its operational advantages.

There are certainly more technical issues to consider. This short review clearly indicates that we have our work cut out for us. I look forward to working with you over the next year in the NCTA Engineering Committee and hope we will have the satisfaction of achieving significant progress in these issues. ■

POLYPED from Federal Telecom, steel enclosures from Pyramid, Reliable & Superior.

and ultra violet absorbents. This mixture is pulled through a die, and the specified shape emerges. The parts then are cut to length. As a result of this process, Diamond pedestals will not rust or deteriorate and will maintain their shape indefinitely, according to a company spokesman. And because the color is molded in, the units never need painting. All models are electrically non-conductive and fire resistant.

Diamond enclosure products are subjected to a series of tests including: salt spray resistance, freeze/thaw, splashproofness, impact testing, firearms testing, temperature storage, humidity, thermal shock and flame resistance.

New from Diamond is the OPTIPED, a round fiberglass closure for fiber optic splices mounted on a concrete vault. The splice case with a fiber optic splice inside is mounted on brackets which allow the case to hang vertically with the in and out cables coming through the bottom of the case.

For more information, contact the Pedestal and Closure Division of Diamond Communication Products Inc., (201) 789-1400.

Federal Telecom

The POLYPED series of housings from Federal Telecom is manufactured in five sizes (4-, 6-, 8-, 10- and amplifier) of polyethylene using the company's No. 7420 resin. The POLYPED line is available with internal brackets, stakes, labels and airvents—all offered as accessories. Brackets and stakes are mounted on common centers, with the stakes mounted from the inside of the unit—eliminating outside obstructions.

POLYPED's removable cover permits 360-degree working access. This cover, when in place, results in a snug fit to the base with a 3-inch (5-inch in the amplifier housing) overlap that eliminates dust, water, insect and ultra-violet penetration. In addition, a molded-in hex head lock and hasp provide security protection against unauthorized entry.

The POLYPED family of closures is non-corrosive, non-conductive, nonporous, fire and thermal resistant and provides flood protection in high water areas because of its bell jar effect.

For more information, contact Federal Telecom Inc., (312) 381-8700.

Pyramid

Pyramid Industries manufactures a complete line of above- and below-ground cable television enclosures. Constructed of heavy-gauge steel with mill-galvanized coating, the Pyramid line is finished with phosphatizing and baked-on enamel. A wide variety of sizes are available, some featuring louvered covers for free-flow ventilation and 360-degree access to electronic components.

Most units are furnished with anchor posts and mounting hardware. Pole mounting kits and a complete selection of mounting plates, brackets, and accessories are also available.

For more information, contact Pyramid Industries Inc., (602) 269-6431.

Reliable Electronic/Utility Products

Reliable Electric/Utility Products manufactures over 19 different sizes and styles of CATV enclosures. Each closure features the company's five-step finishing process to guard against corrosion and weathering. This process starts with mill-galvanized steel which is bathed in an alkaline wash, then phosphatized and acid washed to create a bondable surface. This is followed with heavy-duty primer vinyl and polyester top coats, which are separately dipped and baked.

Many Reliable Electric/Utility Products' closures include screened louvers to guard against the environment, and each closure features a security locking system which includes temper-resistant bolts, padlock hasps and three-point locks.

Also from Reliable Electric/Utility Products is the Super SAFE, a multiple-dwelling enclosure designed to prevent cable theft. Made of 14-gauge mill-galvanized steel, SAFE features welded corners, an interlocking cap, no bolts or rivets, knockouts on the bottom of the unit, inner-tite barrel locks and a plywood backboard. SAFE is available in 10 sizes.

For more information, contact Reliable Electric/Utility Products, (312) 455-8010.

Superior

Cable television enclosures manufactured by Superior Metal Products are constructed of zinc-coated 10-, 12-, 14-, 16- and 18-gauge galvanized steel. In a four-step finishing process, the surface of the steel first is cleaned in a solvent bath. The surface then is treated in phosphoric solution to etch and prepare it for coating adhesion, then prime coated with a high-acid zinc-rich primer and finished with a coating of plasticized, chlorinated rubber paint.

Available in a variety of sizes, Superior enclosures are offered with a high-security tubular lock which uses a circular key. Enclosures are shipped without keys, which are forwarded to an authorized system agent designated to have key control. Keys are issued only to that individual and shipped via certified mail with a return receipt. Each cable system or MSO is assigned a unique lock and key code which is not duplicated with any other company.

For more information, contact Superior Metal Products Inc., (206) 455-9159.

CableData's "PEP" talk

While researching the article on voice response, "Let Your Computer do the Talking," for the March issue, CED was informed that CableData's PEP unit was not used for voice response applications. We have since learned that the PEP unit may, in fact, be used for voice response and that CableData also offers a Programmable Auto Dialer (PAD).

The PEP unit uses a voice synthesizer to let subscribers communicate directly with the on-line computer. Each PEP unit is microprocessor-based, accommodates up to 16 phone lines and uses two Tandem ports. PEP interfaces with CableData's on-line DDP software and works with all CableData addressable interfaces.

PAD is a telecomputer that interfaces with CableData's DDP software to place customer calls. PAD delivers messages and records selected responses.

For more information about PEP and PAD, contact CableData, (916) 636-5800. ■

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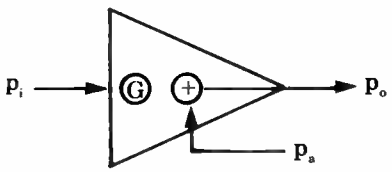
Advertiser's Index

Continued from page 12

$p_o = g(p_i + p_a)$
where $p_a = (nf-1)p_{T_o}$
so, $p_o = g[p_i + (nf-1)p_{T_o}]$

DR. KATZ MODEL:



$p_o = gp_i + p_a$
where $p_a = g(nf-1)p_{T_o}$
so, $p_o = g[p_i + (nf-1)p_{T_o}]$

Thus the models give identical total output noise powers but the device contribution differs by a factor of g depending on the model configuration.

Dr. Katz's comments lead me to realize that the analysis differs depending on whether the model has the cable length before or after the amplifier. However, the primary purpose of the article was to present the model, equation (20), which is correct as stated.

In addition, the following "errors" occurred because of the ambiguity of my PC printer:

In equation (2), the original manuscript was ambiguous because of the limitations of my PC printer. The correct expression is:

$$V_T^2 = V_1^2 + V_2^2 \qquad (2)$$

Equation (7) is missing a circle and should appear:

$$dBmV_T = dBmV_1 \oplus dBmV_2 \quad (7)$$

The "m" in (nf_M-1) should be capitalized in equation (8).

In the amplifier model figure, change N_i to N_1 for consistency and delete the two arrows pointing downwards.

Richard N. Dunbar

Ed: A revised Table 1 and supplemental equations are available from *CED*.

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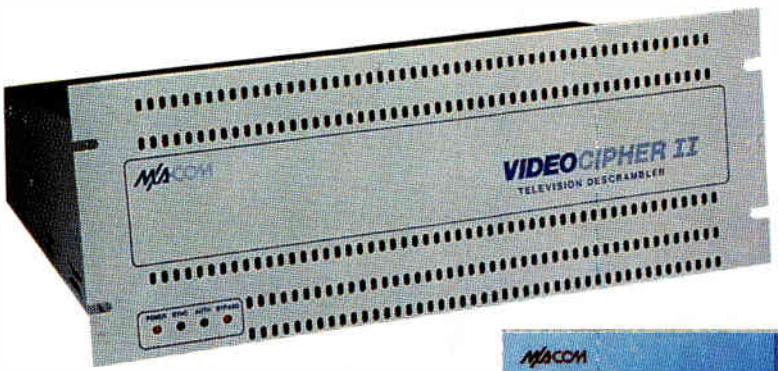

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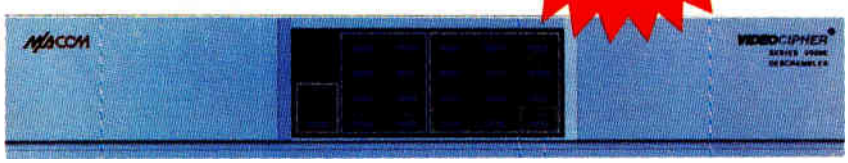

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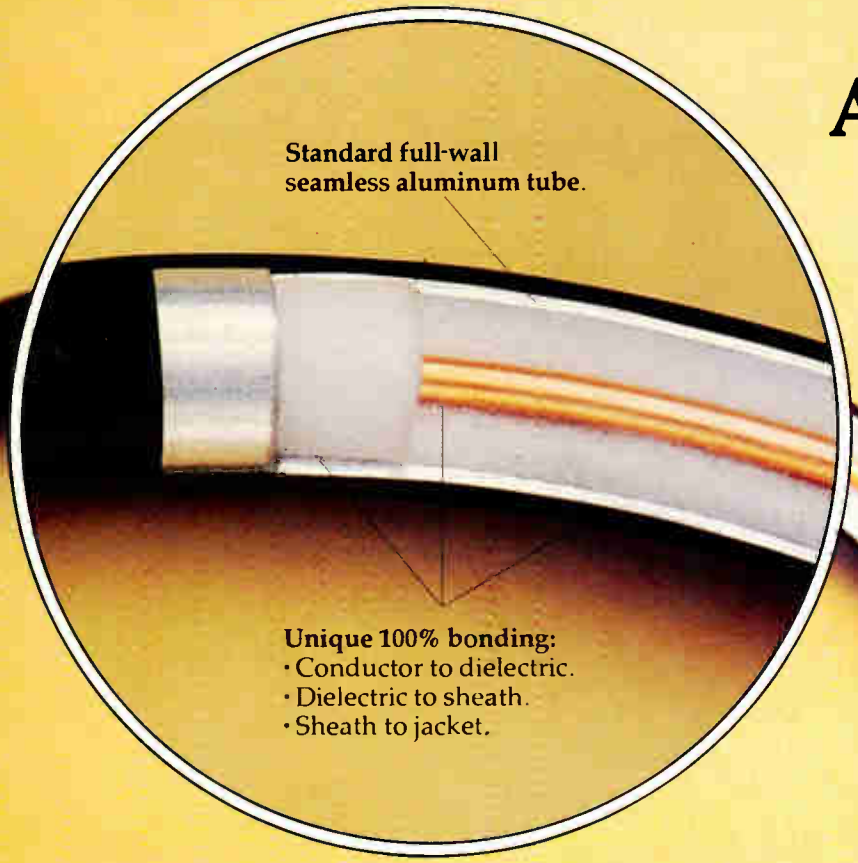

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