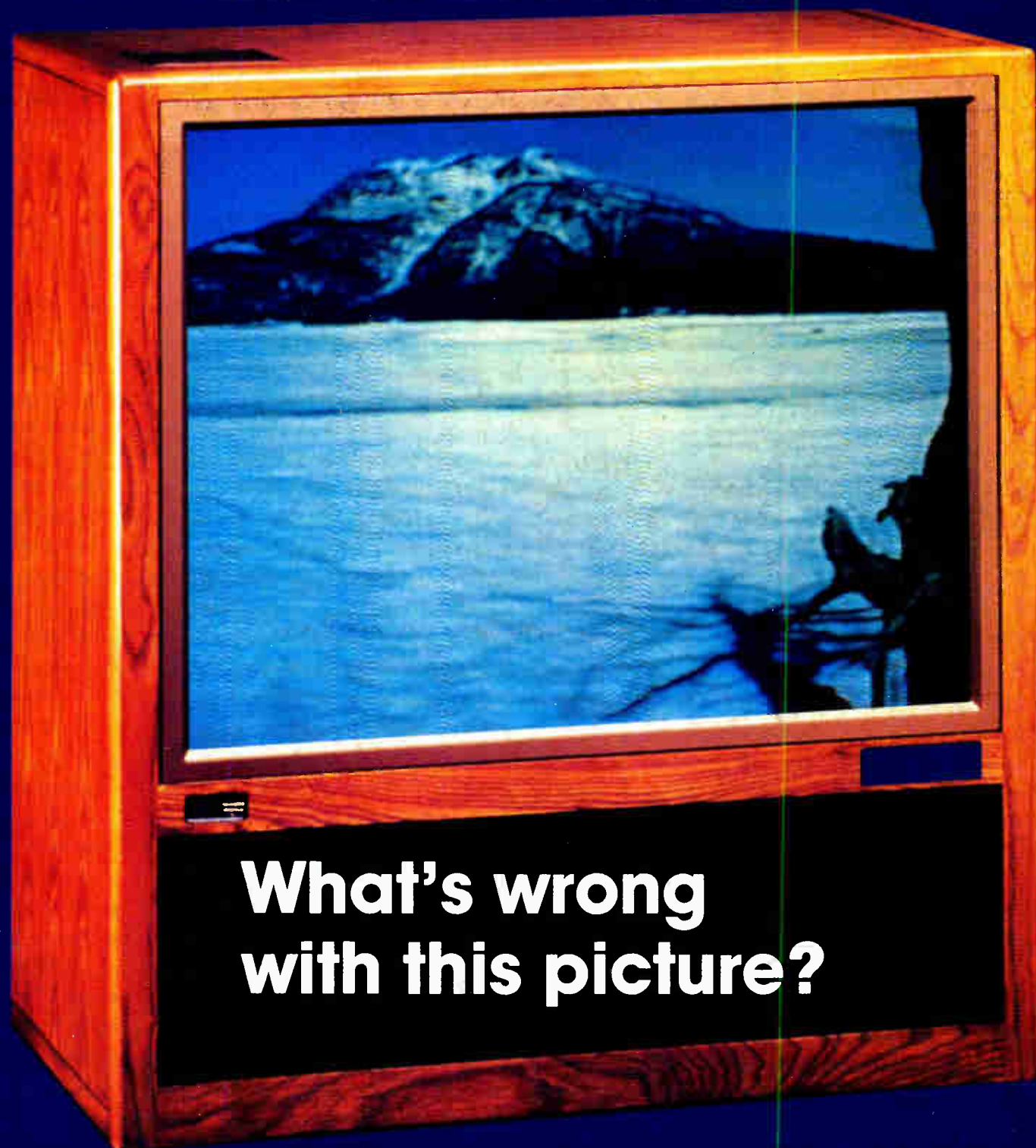


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COMMUNICATIONS ENGINEERING AND DESIGN
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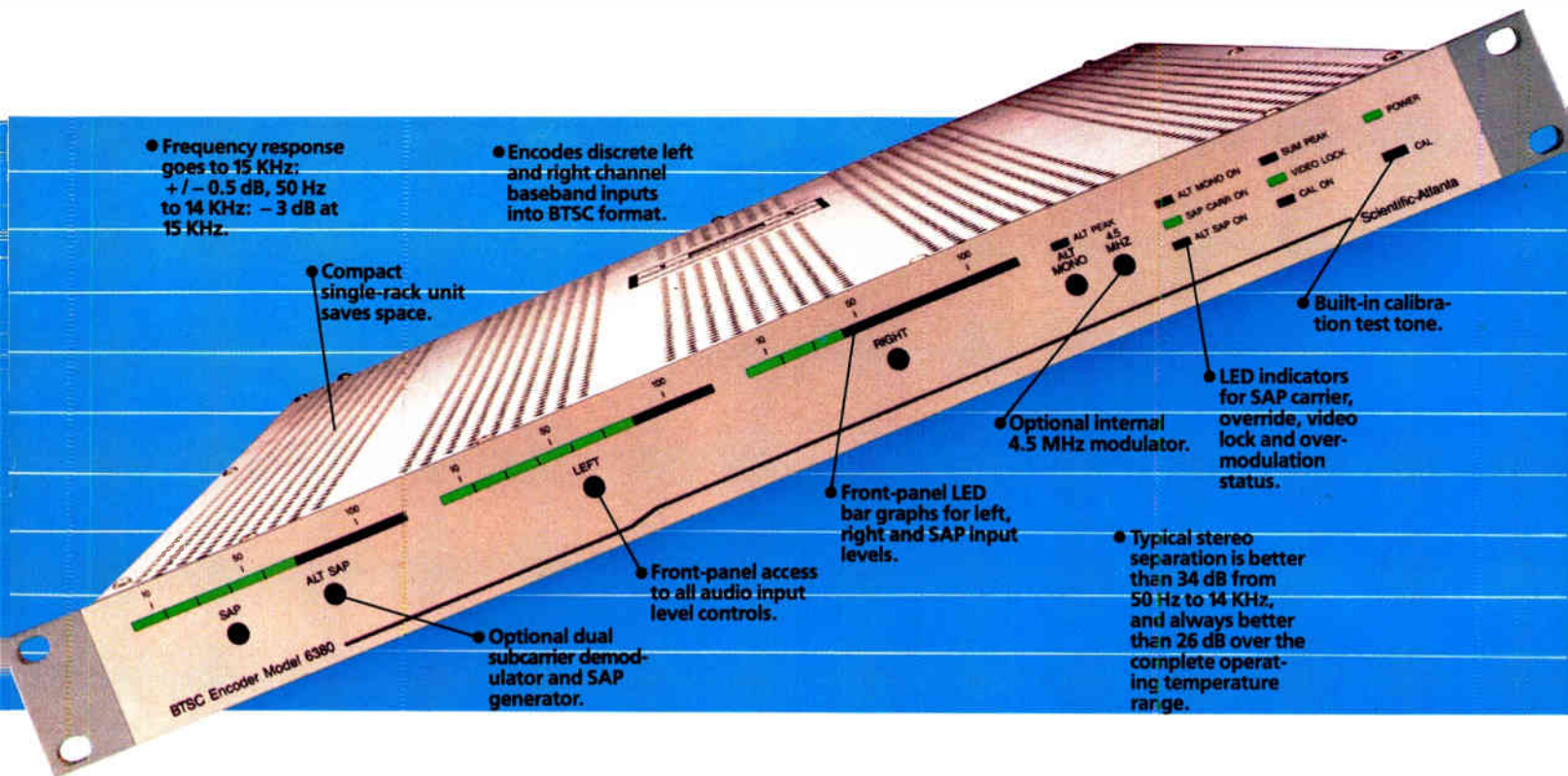
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About the cover:

If you don't think there's something wrong with this picture, read the story starting on page 18. Photos courtesy of Zenith Electronics and Scientific-Atlanta.



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Scientific Atlanta



Sally Kinsman

New direction sets Kinsman on right track

Going home.

After 17 years in Denver, Sally Kinsman is going home to Seattle.

The 42-year-old owner of Kinsman Design Associates Inc. isn't giving up her business, she's taking it with her. It will mean a new staff and some problems, but she isn't too worried about that. She's already started one successful business, now it's just a matter of relocating.

This is an idea that's been slowly developing over the past few years. She has waited long enough for most of her staff to move on, on their own, although some are considering going with her.

"I want to go home," Kinsman said, but she realizes it isn't something she can do in a weekend. "It's like an ocean ship, you can't just turn it around overnight."

She may not be moving at top speed, but she is up to a reasonable cruising speed. "There's a whole little network that is falling together," on this, she said, which is definitely convincing her that it's the right thing to do.

She decided recently to put her

house, where she's worked for the past year, on the market the first of next year. "There are a lot of design companies in Denver. Home (Seattle) will be new territory," she said.

Kinsman has accomplished a lot since she came to Denver 17 years ago with her former husband. In 1972 she started working for American Television and Communications in the design/drafting department and in 1976 was promoted to manager of that department. A year later she got her business degree. Upon graduation she was offered a 1,500 mile design job for United Cable.

When she first started doing design work on her own, most cable companies were still in the process of laying new cable, but that's not the case anymore. "Upgrades have really become the thing now," she said. Her company recently finished a 1,200 mile upgrade for Jones Intercable, a project that took about a year to complete.

"Upgrades take longer," than new builds. "You have to create from what's (already) there. A good designer should be able to do two miles an hour," she said.

Running a business and staff is never easy, especially when you've had little training for such an undertaking. When Sally Kinsman started Kinsman Design, she had to do everything herself by trial and error.

"I had to do everything. I didn't have the money to hire people to do the programming and the bookkeeping," she said. But she'd done a little computer programming while at ATC so it wasn't impossible to learn.

And, while she didn't have the help of a staff, she had the support and help of other engineers in the business.

"I was lucky," she said. "People kept giving me work," almost to the point where there was too much work and not enough people or time to complete everything. But she did, completing more than 15,000 miles of system design since she started.

"I've just always done things I've never done before," she said. In 1966 she started working for Boeing in Seattle as an engineer's aid. "But I never dreamed I'd get into engineering myself." After coming to Denver, she answered an ad in one of the papers for

a draftsman, designer for ATC.

"I didn't even know anything about cable... If only I'd bought stock back then," she mused.

For the past few years she's been trying to give something back to the industry. She's very involved with the SCTE. In 1983, she was elected to the national board. And last year, she was on the restructuring board.

She works both with the SCTE and Women in Cable, "sharing what I've learned over the years."

In 1985, she was named SCTE's member of the year. "It's one of the biggest honors I've ever gotten," she said. That same year, she received WIC's Accolade Award for Woman Entrepreneurs in the technical category.

"The whole reason I've worked so hard for the SCTE," she said, "is that it's my way of thanking all the engineers who helped me. We've all had to teach ourselves," the business. When she started there weren't many effective groups for helping the new kid on the block.

Kinsman said the past years haven't always been easy and she's had some physical problems, she says as a result of the stress she was under.

"I grew up in an era where there were no women's sports, no competition," she said. "I've been learning all the things things I never did (before). It's been an incredible experience and I'm glad I've done it."

But now it's time to concentrate on what makes her happy, including a little more time off to relax.

"If I had some time off I would write a book about what to do and what not to do to start your own business," she said. "It made me really sick over the last three years." She's gotten better and has a new outlook on life and work.

"I started looking at what would make me happy," she continued. "I have a feeling that's going to have something to do with the water and the beach."

She said she will miss the skiing in Colorado, but there's no reason she can't come back now that she's going to slow down and do what's best for her. But don't expect Kinsman to get out of the business. Like any true entrepreneur, she's here to stay.

—Linda J. Johnson

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Local oscillator isolation

The International Electrotechnical Commission is the primary agency recommending technical standards for cable TV abroad. IEC Publication 728-1 (second edition, 1986) specifies that the isolation between any two subscribers shall be at least 46 dB; or 22 dB if frequency assignments have been planned to avoid interference from local oscillators. The FCC specification for the U.S. (now a guideline) is 18 dB, without conditions.

Most converters effectively block the local oscillator signal generated in the TV receiver to which it is connected, and converter local oscillator frequencies are too high to cause interference. Any TV set that is not connected to

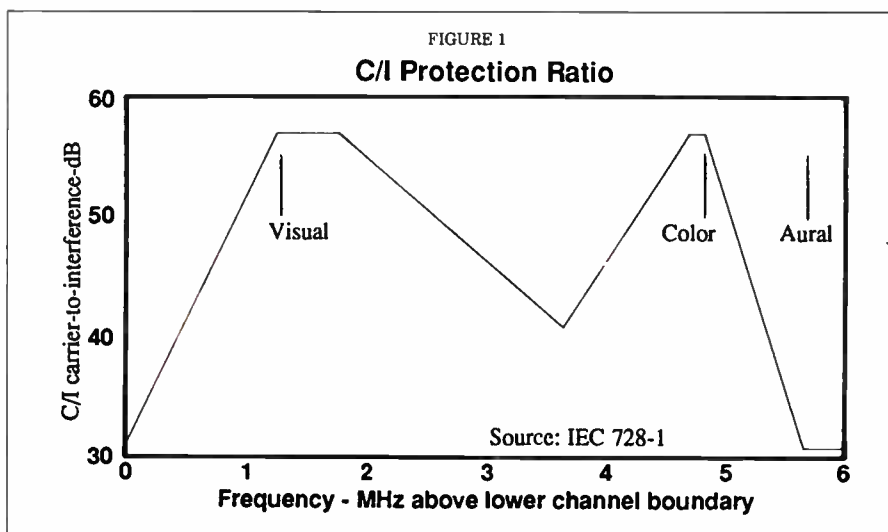
generated in a neighbor's TV set which is not connected through a converter.

TV receiver local oscillator frequencies, throughout the world, are universally above the visual (or vision) carrier (f_v) by an amount equal to the visual intermediate frequency (IF). See Table 1.

An assignment plan that only uti-

the spectrum needed for satellite-relayed programs, and the anticipated spectrum needed for enhanced TV and interactive services. Thus, isolation is a more immediate issue here than in Europe, where they can still afford alternating channel assignments.

Overall isolation between receivers connected to the same multi-tap is the



lizes every other channel would automatically avoid any possibility of local oscillator interference, since the L.O. frequency would fall in the idle space between each pair of non-adjacent channels. Most European countries discourage or prohibit adjacent channel

sum of the tap port-to-port isolation and the losses in the two service drop cables. Isolation between receivers connected to adjacent multitaps is the sum of the tap-to-output isolation of one tap and the forward attenuation (input-to-tap) of the adjacent tap, plus the losses in the two service drop cables and the intervening feeder cable.

The disturbing effect of the interference is a function of its relative magnitude and frequency separation from the desired visual carrier. Figure 1 indicates the protection ratios specified by IEC for 525-line NTSC. This is practically the same as the BP-23 curve published by the Canadian Department of Communications.

Required isolation is the ratio expressed in decibels by which the level of the local oscillator signal (L.O.) measured at the antenna port of the interfering TV receiver must be attenuated in order to meet a specified carrier-to-interference protection ratio (C/I) for a specified carrier level (C) at the desired TV set terminal.

TABLE 1

International IF

	Channel Width	Visual IF	L.O.
North America	6 MHz	45.75 MHz	$f_v + 7 \times 6 \text{ MHz} + 3.75 \text{ MHz}$
Europe	7 MHz	38.90 MHz	$f_v + 5 \times 7 \text{ MHz} + 3.90 \text{ MHz}$
U.K.	8 MHz	39.50 MHz	$f_v + 5 \times 8 \text{ MHz} - 0.50 \text{ MHz}$
Japan	6 MHz	58.75 MHz	$f_v + 9 \times 6 \text{ MHz} + 4.75 \text{ MHz}$

cable through a converter, including so-called "cable ready" sets, could send L.O. signals back through the service drop and tap to other subscribers. Obviously, a converter at one TV set cannot block an interfering signal

assignments in cable TV, unless all subscriber TV sets are connected to cable through a converter. They are not, therefore, subject to the IEC 46 dB isolation standard, and there is really no need to apply even the 22 dB standard.

The situation is different in the U.S. We cannot afford the luxury of alternating channel assignments in view of

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

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



In recent years, local oscillator leakage signal levels have become substantially lower than in 1970-71.

Protection ratio =
 $C/I = C - (\text{L.O. Isolation}) \text{ dB}$
 Isolation = $C/I + \text{L.O.} - C \text{ dB}$

In recent years, local oscillator leakage signal levels have become substantially lower than in 1970-71. Interim Standard IS-23, developed recently by a joint NCTA/EIA committee, recommends relatively low maximum L.O. levels, with a warning that they must be met with significant margin by basic design, since there is no ready repair or realignment to correct units that exceed the limit.

Most, but not all, multitaps available in the U.S. are rated at 25 dB or more tap port-to-port isolation. Total isolation between TV sets connected to adjacent taps can range from 30 dB to 95 dB or more. Of course, there may still be significant numbers of older TV sets in use in the U.S. that do not comply with the L.O. specifications of IS-23. The average L.O. level measured in some 30 receivers in 1970-71 was about -8 dBmV, ranging from -45 dBmV to +25 dBmV. Obviously, 30 dB isolation could not avoid interference in most of these cases. In fact, 70 dB isolation would be required to prevent interference in the worst cases.

The probability of local oscillator interference depends on the highly unlikely coincidence of the limited circumstances in which such interference is even possible. Consider the following for a typical 450 MHz system that does not carry channels A-2 or A-1:

1. The probability of L.O. interference to any particular TV set depends almost entirely on the L.O. generated by a TV set connected to an adjacent port in the same tap.
2. Minimum tap port-to-port isolation is generally greater than specified.
3. L.O. interference between two receivers can only occur when both happen to be turned on, and happen to be tuned to channels whose visual carriers are separated by 42 MHz to 44 MHz.

4. L.O. interference cannot occur to a TV receiver tuned to channels 2, 3, 4, 5, 6, 16, 17, 18, 19, or 20.

5. L.O. interference to one TV set cannot be caused by another that is tuned to channels 2, 3, 54, 55, 56, 57, 58, 59, or 60, since the L.O.s for channels 2 and 3 fall in the FM band;

on which L.O. interference cannot occur or be caused, will be favorite channels. There are not many TV sets connected today without a converter. Most "cable-ready" TV sets probably comply with IS-23.

Calculating the actual probabilities is an extremely complex task. A comprehensive study in 1980, by Fernand Bouchard of the Canadian DOC, indicated 0.023 percent chance of interference, or about one in 4,000, assuming 30 dB tap-to-tap isolation. However, this study was based on a number of overly

TABLE 2
Required Isolation

Frequency	50-300	300-450	450-650 MHz
Protection Ratio (C/I)	51	51	51 dB
Max. L.O. per IS-23	-26	-20	-15 dBmV
Cable loss - 200 ft RG-6	-3 to -7	-7 to -9	-9 to -11 dB
Tap port-to-port isolation required			
at 0 dBmV minimum	22 to 24	24 to 27	27 to 25 dB
at +5 dBmV recommended	17 to 19	19 to 22	22 to 20 dB
at +20 dBmV maximum	2 to 4	4 to 7	7 to 5 dB

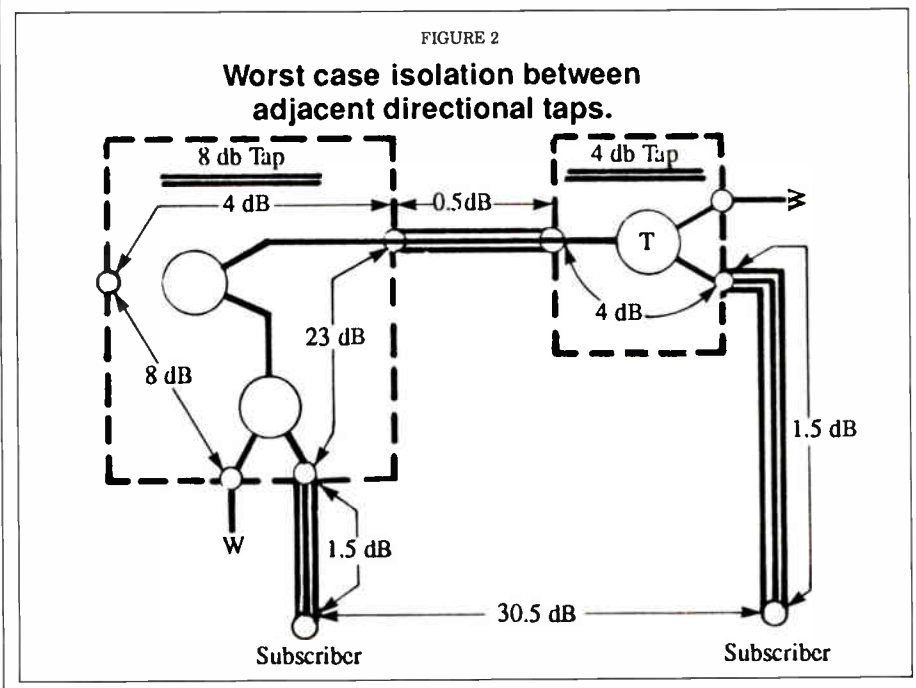
and L.O.s for channels 54 through 60 are above 450 MHz.

6. L.O. interference cannot be caused by a TV set connected to cable through a set-top converter.

7. L.O. interference cannot be caused by a TV set meeting the requirements of IS-23 (with a significant margin) if the tap-to-tap isolation exceeds 20 dB.

There is a high probability that at least some of the channels listed above,

conservative assumptions. Thus, taking into account the 1987 distribution of TV receivers complying with IS-23 "with significant margin," the tendency of most viewers to concentrate on a few "favorite channels," and the widespread use of converters, the likelihood of local oscillator interference with at least 20 dB tap-to-tap total isolation must be low enough to be considered negligible. ■



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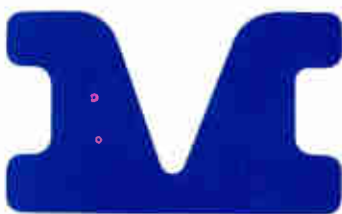
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Are you ready for tomorrow's technology?

Frequently, when I've been traveling about, speaking to private groups in an advisory capacity, I am asked how they can expect their employees, who are trained at a certain level of technical expertise, to keep up and advance as technology generates new and mysterious products.

By the same token, when talking to engineering students at universities and colleges, they seem to be painfully aware of the fact that immediately after graduation they will have learned one set of skills and disciplines for a technical world that will change before their very eyes.

The students' fears, of course, are more akin to the fears of people who have jobs on the line when technology changes. I remember, for instance, concern when transistors began to replace vacuum tubes (this should give you a rough idea of how old I am). Those who guessed that the introduction of transistors would very quickly lead to a world that had no recognizable vacuum tubes began to worry whether they

would have the necessary skills to continue to be employable.

There were even some who began to fear their chances for advancement would go out the window as the next generations of college students trained in these new and marvelous devices came out of a school and leapt ahead of them on the ladder of success.

This whole subject and the discussion thereof is faintly reminiscent of the issue of automation and whether or not it costs jobs. But I think the lessons in that situation apply equally well to potential lessons in this situation.

While I have known people who allowed themselves to be bypassed by the introduction of digital electronics and other technical improvements, I know far more people who, when asked at what point their training, understanding and knowledge, progressed from older technologies to newer technologies, cannot give you a precise time or even time-frame. In fact, they seem to have absorbed the knowledge without any conscious effort. I suspect that they absorb knowledge and gain the appropriate understanding quite simply because they were interested in performing their job.

The plain fact is that technology will leave no one by the wayside who cares about and works at their profession. In any profession as the disciplines, rules, technology and equipment changes, you can either fear that change or embrace it. The same is true of the training that our installers and technicians receive in cable technology as this industry moves forward into better signal quality based on new products, the introduction of fiber optics and that mysterious process into day-to-day use of distribution systems, digital circuitry and Ku-band technology.

Lessons were also learned about tube-based processors, 230 MHz systems, various types of coaxial cable designs by the engineers and technicians who are still with us today. They learned about these things, applied them and, when the next generations of equipment came along they embraced those, learned about those and applied the lessons learned in the provision of service to their subscribers. Technology does not make anyone

obsolete. Technology just is. Those who wish to apply it will study it. Those who wish to make a living at it will master it. Those who don't have the energy or the interest or the imagination to do those things will be left behind by the changes caused by the technology, not by the technology itself.

Sometime in the not too distant future, perhaps in my lifetime, the world will be populated for the most part by people who do not understand any of the mechanisms for most of their daily lives. That is to say that only a small percentage of the world population will understand the technology that turns on their lights, powers their kitchens, controls the fuel flow in their car or that provides their entertainment, be it television or otherwise.

That does not make any of these services or products less beneficial, useful or enjoyable. It does mean, however, that there will be a small group of people with special knowledge. Those people with special knowledge will understand how things work in their world and will be called on time and time again for special jobs and special functions in the society of the future. These people will not always be the smartest, the oldest or even the best trained. For a guess at who they will be, just consider what happens when any family gets a new electronic device like a VCR. The children in the family are the first to master it simply because they are not shackled by previous training. They are not stymied by belief that the skills and knowledge they acquired to do a job are the only skills and knowledge that can be acquired.

New technologies are coming to cable. New competitors are coming, new ways of doing things are here now. Some of the people in our technical core will never grasp or understand how to deal with these changes. Most, however, will, especially those who take advantage of training offered by the SCTE and other groups.

Those that master them will go on to be the leaders in the technical community in the future and in time they will pass on their way of thinking and their imagination as attributes which will enhance the next generation to come.

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

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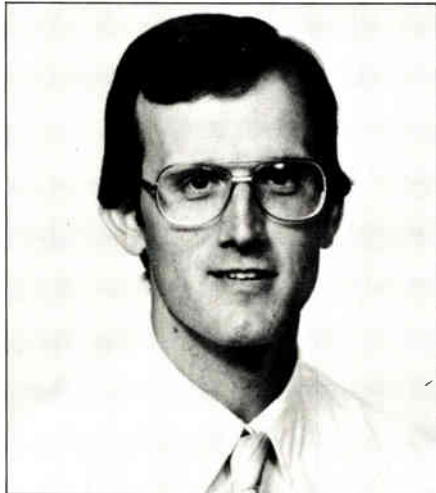
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Headend audio loudness control

Loudness is a very subjective phenomenon. It is a frequency-dependent, non-linear perception of the density or strength of sound as experienced by a listener, and it varies from individual to individual. But have you ever wondered why it's so difficult to set and maintain consistent perceived audio loudness levels from channel to channel on your cable system? Come on, admit it, just like me, you have probably blamed our friendly uplinks, or even our own headend technicians, for having audio deviations "all over the map." In reality, while the uplinks and headend techs might possibly share in some of the blame, they are by no means the only cause of our woes. What, then, are the causes of loudness differences in our systems and what can we do about it?

Sedacca¹ points out that there are many different reasons why the loudness levels at the output of a headend might vary. While it is true that audio deviations for each channel may be set incorrectly, or at least differently, somewhere in the system (either at the uplink, or at the headend), there are other factors to consider as well. Program content, for example, might simply be different from one program to ano-

ther, or from one scene to another. This can result in obvious loudness differences between an action oriented scene on a freight train and a scene where "sweet nothings" are being whispered. In addition, the absolute level at which an audio soundtrack was originally recorded could also vary from program to program. Any variation in absolute recorded level, since uplink and headend audio deviations are not continually set for each new movie or program, would show up as a loudness variation at the output of the headend.

Some programs, on the other hand, are compressed and/or limited when they are originally produced and are therefore actually recorded on the original soundtrack with a reduced dynamic range. This compression of the signal reduces the instantaneous peak (loud) levels of the signal while increasing the loudness of the quieter passages. This results in higher average loudness levels as perceived by the listener, without allowing the peaks of the signal to overdeviate the audio carrier.

In some cases, compression or limiting will occur somewhere else in the transmission path even if the program was not originally recorded in a compressed form. Some uplinks do, in fact, use compressors to ensure consistency in loudness levels as transmitted from their facility. This may account for the fact that certain specific programmers always seem to have a higher perceived loudness level than the others.

So now we have a list of reasons why the headend techs are not solely to blame, but what can be done about it?

As with most things, there are no easy answers. We could try to force all of the uplinks into submission and require that they compress all of their audio signals prior to transmission. In fact, there have been many discussions through the years between CATV operators and programmers in an attempt to get the programmers to do just that. For various reasons, they have refused. Audio purists are, of course, horrified by the thought. Terrestrial broadcasters however, have been doing it for years. In fact, on the FM radio band, broadcasters have been compressing their signals substantially in order to force their average loudness levels higher than their competitors'. They

simply want to be the loudest station on the band. To heck with audio "as it was recorded." Yes, as with anything, abuse is possible.

If the programmers won't do it at the uplink, we could compress all satellite-delivered channels at the headend. This solution would require every modulator or stereo encoder in the headend to be driven by a compressor (in the case of stereo, by two compressors). Instead of one compressor at each uplink, every headend receiving that uplink's signal would require a compressor. Not very efficient, but possible.

We could simply crank up average levels so that the peaks of the signal cause overdeviation of the audio sub-carrier (overdeviation light turns on more often). While broadcasters aren't allowed to do this, we can get away with it. This solution could cause distortion to the signal on peaks.

The use of existing limiters in all headend modulators (for mono) or in all stereo encoders is also a possible, though incomplete, solution. While a limiter is not meant to function as a compressor, but is only meant to restrict the peaks of modulation from exceeding 25 kHz deviation, it does provide the "effect" of a compressor in that it allows the operator to raise the average level of the audio without "turning on the red LED" or causing overdeviation of the audio carrier. In fact, if you set two stereo encoders side-by-side, one with an internal limiter and one without, and if both encoders are set up as per the instruction manuals to "keep the red LED's just OFF," the encoder with the internal limiter would most likely sound louder.

And of course there's the old saying, "If it ain't broke, don't fix it." Leave it the way it is right now, and force the customer to use his remote volume control (if he has one, that is).

So, what's the correct solution? Well, go ahead and pick one, and I'm sure I could find several "experts" who will disagree with you. One thing's for sure, let's not place total blame with our headend technicians. It just might not be their fault.

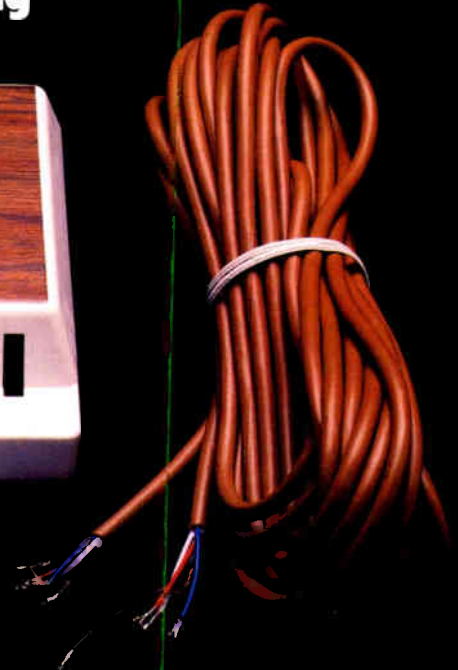
1. Sedacca, David, *Practical Considerations for BTSC Stereo in the CATV Plant*, 1987 NCTA Technical Papers.

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

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"In this corner the defending champion of home TV delivery, CATV. Has defeated Broadcast Ghosting and Rabbit Ears. And in this corner, the challenger, Super VHS. Weighing in at 400 lines resolution vs. the champ's 330, and lacking the champ's artifacts, the kid is given a chance."

But seriously, how good is the new kid, and what does he need to live up to his advanced billing? Before we as an industry can answer these questions we need to know more about this new development. We won't answer the questions posed above, but we will attempt to shed some light on what is going on technically.

We'll show that Super VHS, VHS and NTSC compare with each other with the relative rankings shown in Table 1. We make no quantitative judgements here, but we do attempt to rank the three in order from best to worst. The primary characteristics covered include picture sharpness (resolution), signal-to-noise ratio and freedom from artifacts. These relationships are explained below. When we show NTSC, we take this to be representative of the best CATV can deliver, sadly recognizing that we often settle for much worse than the best.

There are many ways to judge picture quality, but one of the universal characteristics is sharpness. Figures 1 through 3 show an interesting contrast in the sharpness of conventional VHS, the best NTSC can do, and Super VHS (S-VHS). These figures are monoscope patterns, used to measure picture sharpness. We'll explain in more detail, but first we need to discuss sharpness. We all know what a sharp picture looks like, but how do we put a number on sharpness? Television engineers have long done this by counting the number of horizontal lines in a picture, calling the measure of sharpness, "resolution."

Since a picture is divided vertically into many (525 to be exact) scanning lines, we might say that the vertical resolution is 525 lines. (Hold on—I'll fix the misrepresentation soon enough.) That is, we can discern one black or one white line for every scanning line of the

And in this corner ...

picture. If you will, imagine a stack of lumber with alternating black and white boards and the camera pulling back, showing us more and more of the pile of lumber. As each board gets smaller, we can continue to count the individual boards (if we're good enough), until each board occupies one scanning line on the screen. As the camera pulls back farther we can no longer discern individual boards. Thus, we arrive at a figure of resolution of 525 lines.

Not so! For several reasons, we would lose sight of one board long before we got to 525 lines. Up to about 24 lines of each field (at two fields per frame) are taken up by vertical retrace,

pulling us down to 477 lines.

Now enter a mysterious factor without a definite number I can write down. I find if I look at the pile of lumber, I can't even discern 477 individual pieces, thanks to a resolution robbing thing called the "Kell factor," (K).¹ In order to see 477 individual pieces of lumber, the camera would have had to line up each piece precisely with one of its scanning lines. Since this is not likely to happen in practice, I take a beating on resolution.

Worst case, I'd probably have to allow for one piece of lumber occupying equally two scanning lines, in which case my resolution would be half of the above, or 238.5 lines, and my Kell factor would be 0.5. But this worst case is not too reasonable, so maybe my actual K factor is somewhere between 0.5 and 1.

There are other things to hurt Kell factor, too. Interlace used in television for flicker reduction causes resolution to be even lower. This is the reason for the interest in sequential scan for enhanced television. Another explanation

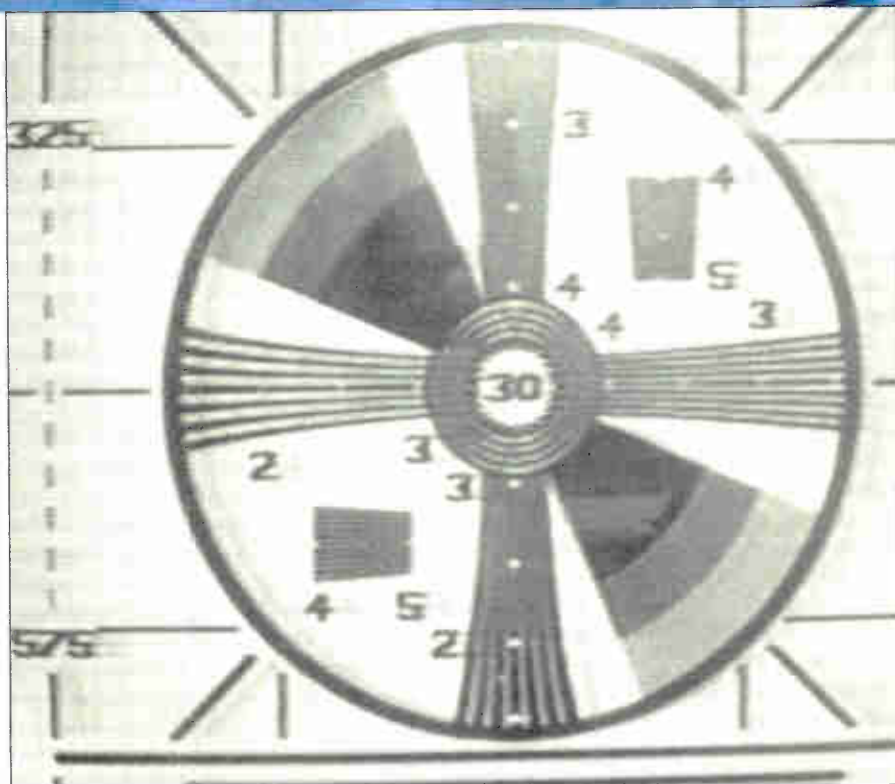
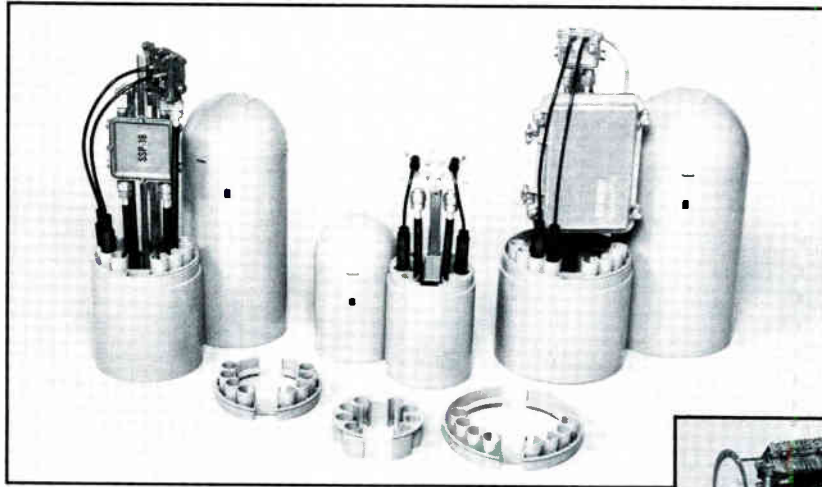


Figure 1: VHS monoscope

James O. Farmer,
Scientific-Atlanta Inc.

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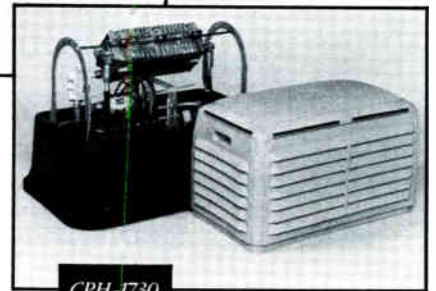


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Trap Holders



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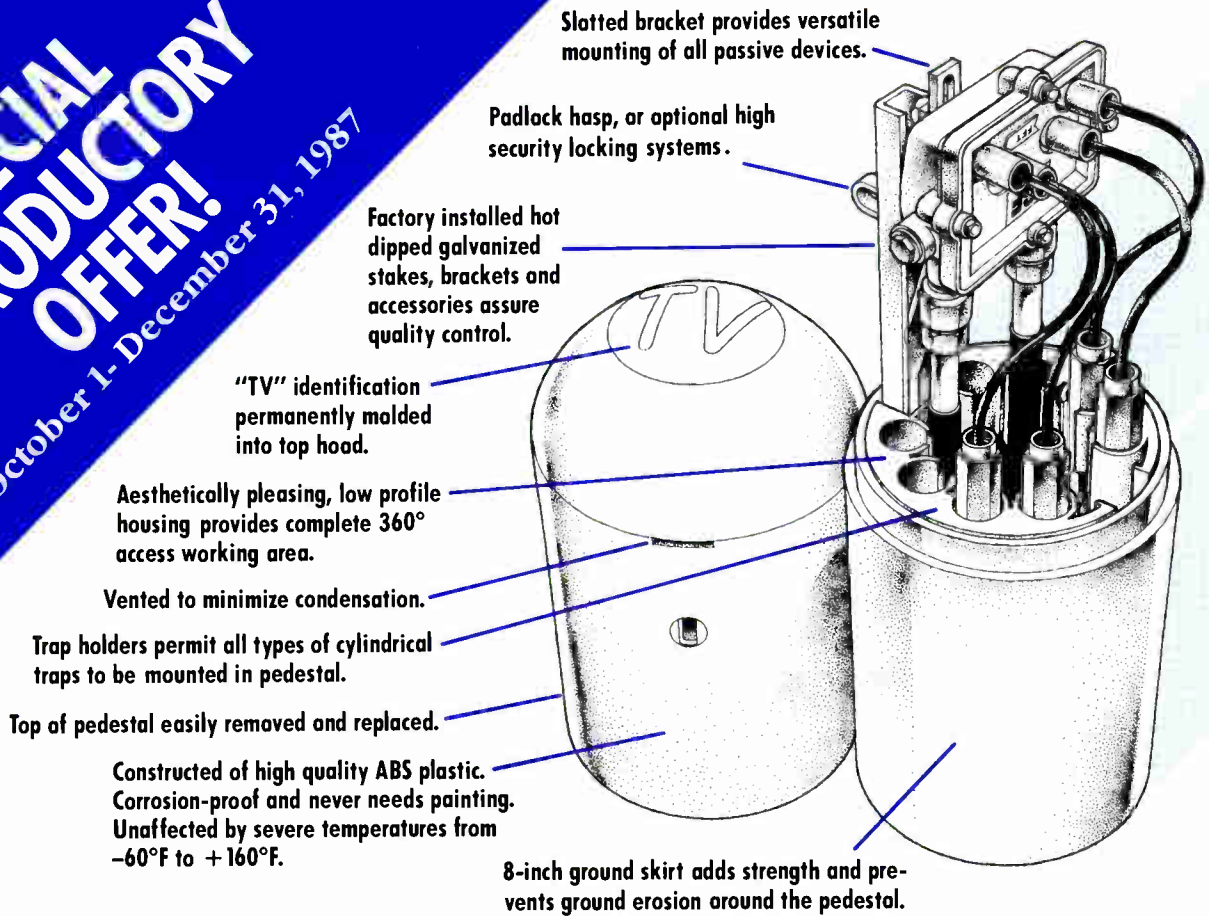
currently on the market. Manufactured exclusively for Channell, these new CPL-125 padlocks offer hardened steel/chrome plate shackles; all brass and stainless steel internal workings; "heel and toe" shackle locking; 5-mushroom pin tumbler locking mechanisms; custom keyway/key blanks; solid brass bodies; and dust caps.



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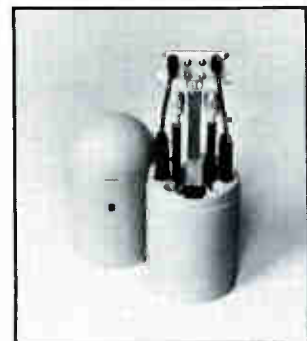
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Hsu complains that a Kell factor of 0.7 is 'widely cited and, unfortunately, often misrepresented.'

tion is that I violate Mr. Nyquist's sampling theorem and I get artifacts long before I get to one picture sample

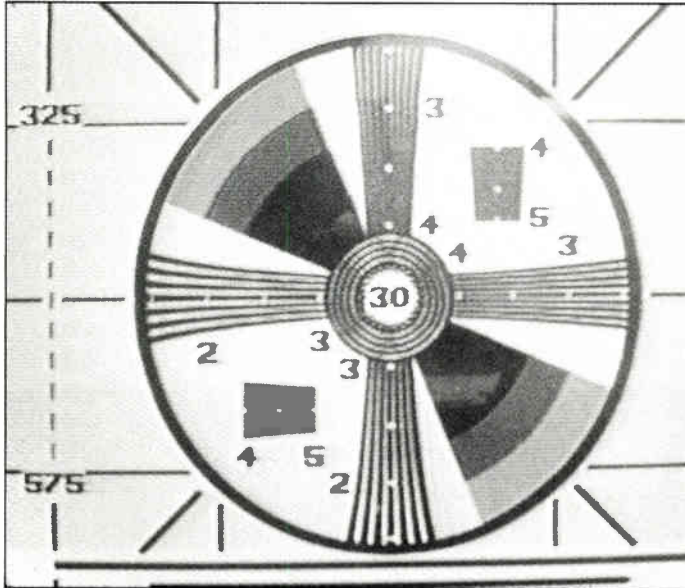


Figure 2: NTSC monoscope

per line.

In the above cited article, Hsu complains that a Kell factor of 0.7 is "widely cited and, unfortunately, often misrepresented," even for sequential scanning systems. Nonetheless, I'm going to use $K=0.7$ because it is commonly used and makes the numbers come out cleanly. Bear in mind that this makes things somewhat worse than I claim them to be. If $K=0.7$, then my 477 scan lines are reduced to $0.7(477)=333.9$, or about 330 lines of actual picture resolution. This is the number of resolution lines often ascribed to NTSC. Super VHS doesn't change the number of lines of resolution vertically, there being no change in the scanning pattern from that of NTSC. However, it does increase the number of horizontal resolution lines.

Horizontal resolution lines? The alert reader has by now observed that the TV picture isn't made up of vertical lines (which would cause us to measure horizontal resolution in scanning lines). However, if we are to compare the horizontal and vertical resolution of a picture, using the same units, we must fabricate an apples to apples measure for horizontal resolution. We can do this by counting the number of cycles

of a signal that could be passed during one horizontal line, by a system having limited frequency response.

Suppose the boards of the previous example were stood up and I wanted to count the total number of boards (alternating black and white) across the face of the picture. Each pair of boards, black and white, would make one cycle of the video waveform as the beam scanned the picture. As the camera pulled back and showed more boards, the frequency of the picture information would increase

until the system couldn't pass it any

more, at which point I would cease to be able to resolve individual boards.

By thinking about the maximum active scan time on a line of NTSC video (about 52.8 microseconds) and the maximum frequency passed by the system, you can calculate the equivalent lines of horizontal resolution. Be sure to take into account the fact that the picture is wider than it is tall, so multiply by $\frac{3}{4}$ to get the horizontal resolution to compare with the vertical.

The right answer is:

$$f = (\text{resolution}/80),$$

where f is the maximum frequency (in MHz) required to pass the desired resolution. For a resolution of 330 lines, I need a maximum frequency of 4.13 MHz, which is close to the actual baseband width of a transmitted NTSC signal (hang on, though, the news gets worse).

Figures 1 through 3 show a monoscope pattern. This is a common pattern for reading resolution from a TV screen. These patterns were made from a Super VHS tape furnished by JVC. Notice the vertical wedge-shaped pat-

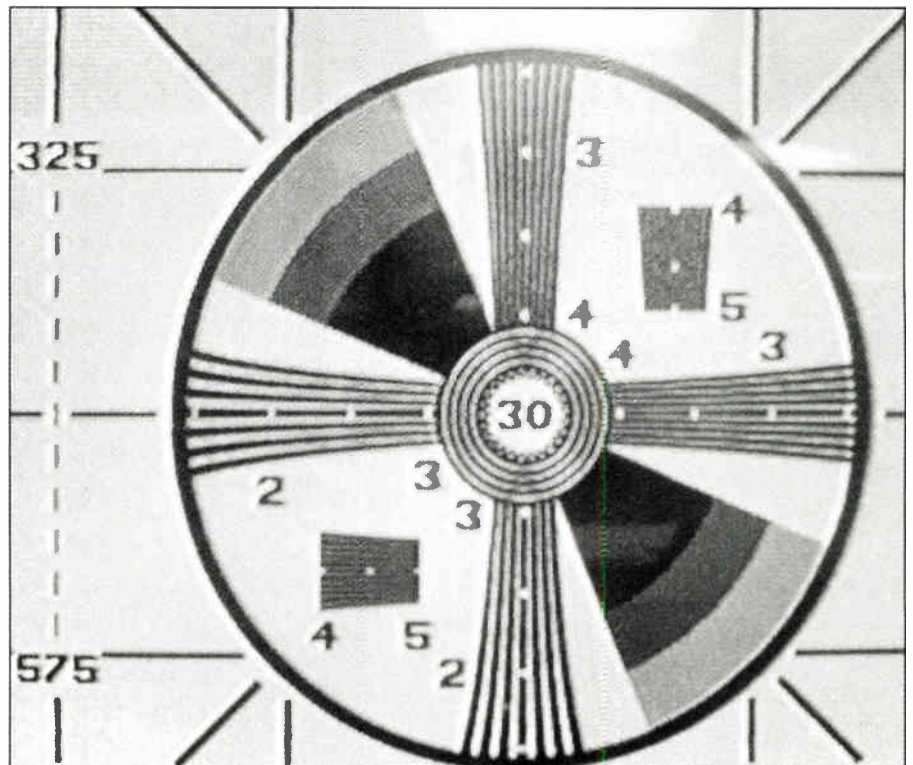


Figure 3: S-VHS monoscope, Y-C input

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Reader Service Number 9

22 Communications Engineering and Design November 1987

SUPER VHS

The scale to the side of the wedge calibrates the number of lines you are able to resolve.

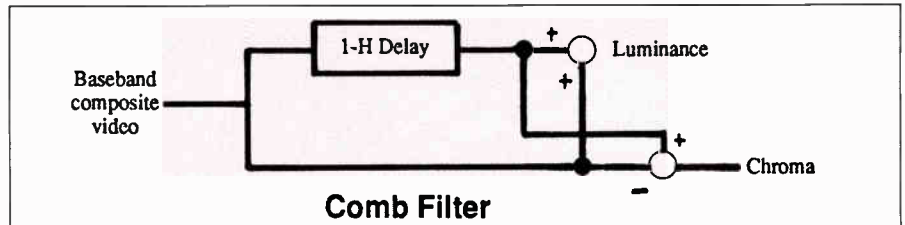


Figure 4: NTSC baseband spectrum showing overlap between luminance and chrominance

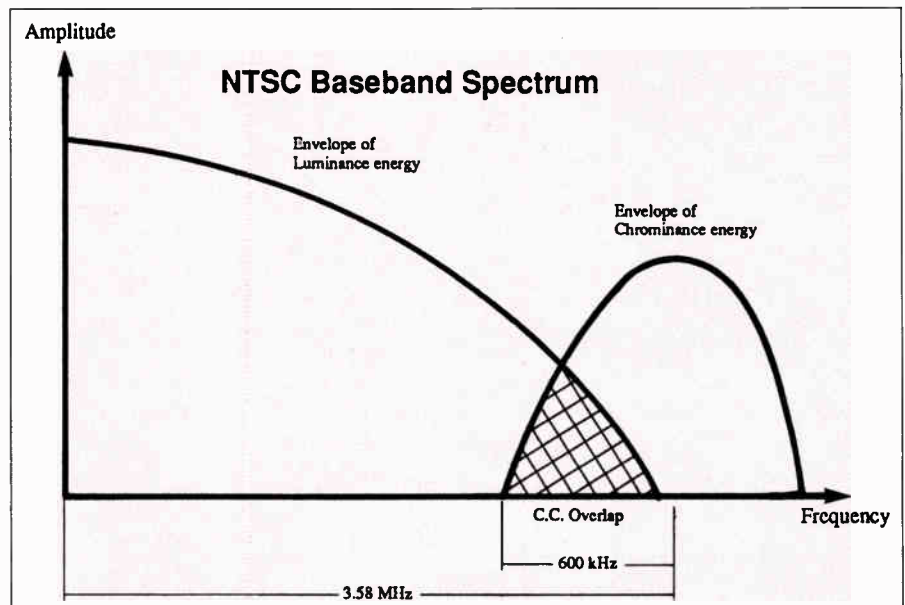


Figure 5: Block diagram, comb filter

tern. This is used for judging the horizontal resolution of the picture. From the top of the wedge, read down to the point where you can no longer discern individual lines on the wedge. The scale to the side of the wedge calibrates the number of lines you are able to resolve.

Figure 1 was taken from the S-VHS tape dubbed to standard VHS using a VCR in good condition and a standard quality new videotape. We measure about 220 lines of resolution, which is about the number of lines we expect from specifications of the VHS system. When you compare this with the horizontal resolution of NTSC, 330 lines, you see that the horizontal resolution of VHS is only $\frac{2}{3}$ that of NTSC.

Figure 2 shows the Super-VHS tape played back on the S-VHS machine but through the RF connector. Thus, the picture transmitted is representative

of the best that can be obtained using NTSC transmission. It also represents the best that CATV can do, since we transmit NTSC. We can do worse if we introduce amplitude and/or delay distortion into the system, but we can never do better. The resolution of the NTSC signal is 330 lines, as we expected from the above discussion. Thus, at our best, we are capable of transmitting a signal that has more horizontal resolution than does VHS. Now comes the kicker.

Figure 3 is a photograph of the same monoscope pattern on the same tape, but played back through the Y-C connector on the S-VHS VCR and on the TV. Use of the Y-C connector is necessary in order to get around the limitations of NTSC transmission, as we'll explain shortly. The Y-C connector is a baseband interface at 1 volt peak to peak, with the luminance

The luminance occupies the spectrum from near zero frequency to, ideally, 4 MHz.

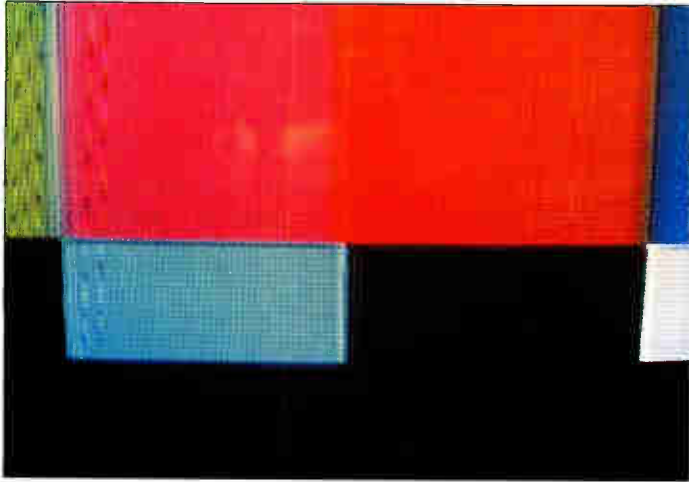


Figure 6: NTSC color bars with comb filter

(black and white) and chroma (color) on different pins. Note that the resolution exceeds 400 lines, the cutoff of the central wedge. Thus, S-VHS yields a horizontal resolution 21 percent better than CATV can at its best.

Applying the above formula relating resolution to bandwidth, we need a bandwidth of at least 5 MHz in order to support the observed resolution. With an NTSC signal modulated into a 6 MHz channel, we are doing well to achieve 4 MHz bandwidth.

By the way, if you notice the horizontal wedges, which measure the vertical resolution, you will notice

that the resolution seems to contradict the arguments I made above about vertical resolution, showing over 400 lines of resolution compared with 330 promised. The reason for this is that the S-VHS system employs certain other signal processing in the vertical direction. Reference 2 describes some of the processing involved. Suffice it to say that today, your subscribers see less than 330 lines of vertical resolution.

So far, we have concerned ourselves only with the luminance signal. The

region. This gives rise to what we call "cross color." You've seen someone on a TV set wearing stripes or plaids and a rainbow appears around vertical components of same. The stripes gener-

plot thickens considerably when we throw in color. Figure 4 shows how NTSC adds chroma. The luminance occupies the spectrum from near zero frequency to, ideally, 4 MHz. The color information is carried on a subcarrier centered at 3.58 MHz. Note the color and luminance information overlap in the cross-hatched

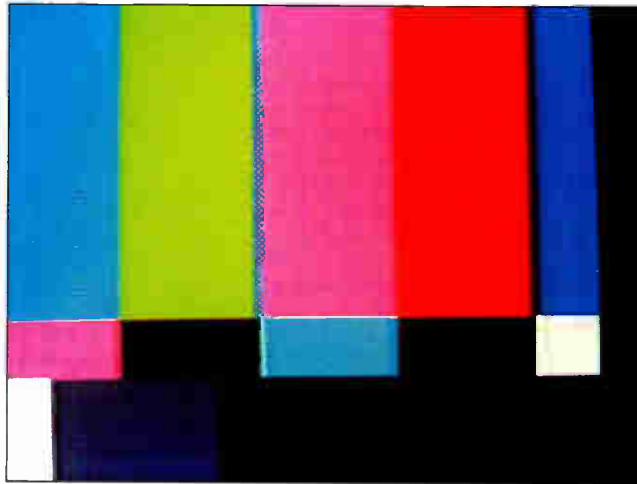


Figure 7: NTSC color bars without comb filter

ate high frequency luminance energy which spills over into the spectrum occupied by the color information.

It beats with the chroma signal, and we have instant rainbow. One way to avoid this problem is to limit the frequency response of the luminance to less than 3 MHz, so that little luminance will appear within the chroma passband. This corresponds to a horizontal resolution of about 240 lines, and all of a sudden we in CATV and broadcast cannot deliver any better resolution to a TV than conventional

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A better way would be to not combine the chrominance and luminance on the same signal path.

TABLE 1

Relative ranking of VHS, NTSC and S-VHS

Resolution	Signal-to-noise	Freedom from artifacts
S-VHS		S-VHS
NTSC	VHS/S-VHS/ NTSC	NTSC
VHS		VHS

The three are ranked from best to worst. 'We take NTSC to be the best CATV can deliver, sadly recognizing that we often settle for much worse than the best.'



Figure 8: Mountain and trees, VHS

VCRs.

A better way would be to not combine the chrominance and luminance on the same signal path (i.e., piece of wire). Now you see the reason for using the separate connections in S-VHS's Y-C connector. By not combining the luminance and chrominance on the same pin, the TV does not have to

filter one from the other. This means that cross color cannot occur, because no path exists for the luminance to get in the chrominance or vice-versa.

This is not a very practical approach for CATV delivery, unless one wants to use dual cable—one for luminance and one for chroma. But Yankee ingenuity has provided a partial solution. The color subcarrier is 455/2 times the horizontal line frequency. This relationship was initially chosen in order to make the residual chroma the luminance channel minimally visible. That trick works because the color subcarrier goes through an odd number of half cycles during one scan line.

Expensive TVs take advantage of this by comb filtering the signal in order to separate the luminance and chrominance. If a set delays the video signal for exactly one line, then adds the delayed signal to the non-delayed signal of the next line, the chrominance component cancels out. Similarly, if the delayed signal is subtracted from the non-delayed signal, the result is the chroma signal, with the only luminance signal being the difference in luminance from one line to the next. Since there normally is little difference in luminance from one line to the next, the separation is pretty good. Figure 5 illustrates the comb filtering process.

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Reader Service Number 13

By using a comb filter, a TV can recover close to 330 lines of resolution.

The delay is variously realized with delay lines of CCD shift registers depending on the manufacturer.

By using a comb filter, a TV can recover close to 330 lines of resolution assuming the combing process is perfect (which it isn't). Further, since the luminance is combed out of the chrominance, cross color essentially goes away. Compromises are just that, and with the advent of comb filtering we encounter another problem. Figure 6 shows a close-up of part of the screen of the TV set having the Y-C connector, though the Y-C input was not used for this picture. The set was fed the baseband output of an NTSC color bar generator, so the comb filter had to be switched in. Note the overlap in signal at the horizontal demarcation between the red and blue bars. This is caused by the comb filter. Two lines rather than the expected one line are involved because interlaced scanning is used, and the two "adjacent" lines operated on by the comb filter are really separated by



*Figure 9:
Mountain
and trees,
NTSC*

a line from the other field. Compare Figure 7, which was taken on a different TV not having a comb filter. Thus, a comb filter, while giving back lost resolution horizontally, robs from the vertical resolution. S-VHS with its Y-C connector doesn't require a comb

filter, so cross color is avoided without the introduction of comb filter artifacts.

Perhaps the most convincing demonstration of the difference S-VHS makes is seen in Figures 10 through 12. Note particularly the snow in the bark on the trees. It is very blurred from the

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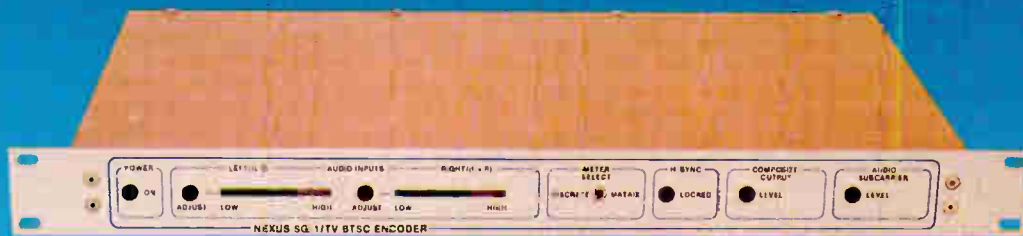
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**Thanks to Paul Perez of Recoton
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Figure 10: Mountain and trees, S-VHS Y-C input

conventional VHS tape, is somewhat clearer from the NTSC input, but is much clearer still from the S-VHS Y-C input. The increase in sharpness comes from the higher luminance bandwidth possible in S-VHS and lack of cross color without the introduction of combing artifacts.

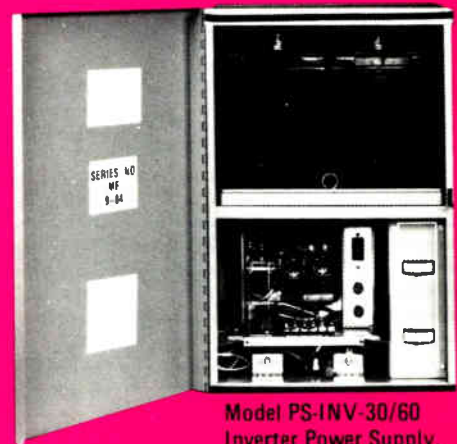
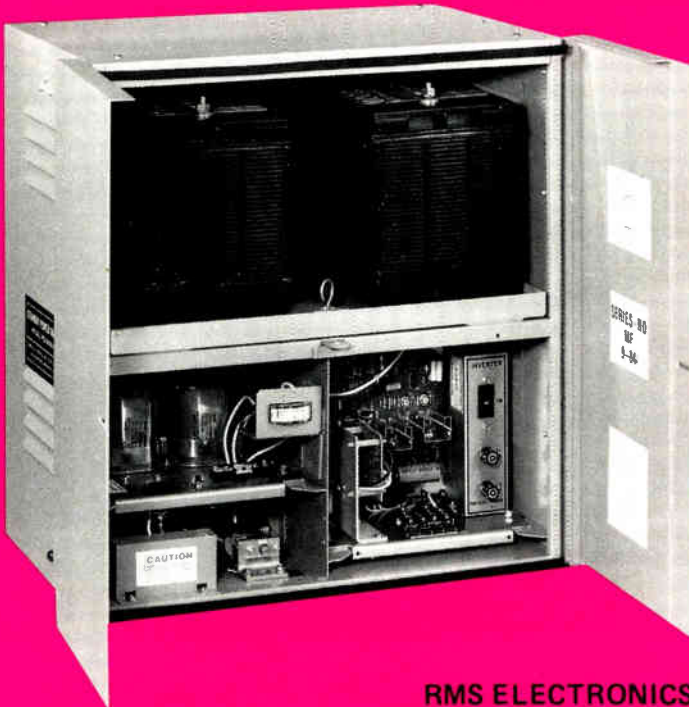
Acknowledgements

Thanks to Paul Perez of Recoton, who arranged loan of the Super VHS equipment for analysis, and to JVC for providing it. ■

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Economic pressures make rebuilds harder than ever

The name is still the same, but the game has changed.

No, we're not talking about the strike-busting National Football League players and the games they played in place of the "real" football players this fall. We're speaking of cable system rebuilds and upgrades.

Over the past decade, rebuilds have traditionally been easy to accomplish—designers had the necessary engineering expertise available, operators knew how many channels they wanted to load, what kind of converters they needed and parts were easy to find. In fact, since many of those systems being rebuilt were of the "classic" variety, it was easy to make the system better than it had been.

These days, however, operators are faced with a dizzying number of decisions even before a rebuild is started: Number of channels needed now vs. the near future; how much of the system needs to be rebuilt; will new converters be needed; should the system be two-way or conventional; should security be approached through addressability, traps or some of both; etc. Once those preferences are made, one more critical criteria has to be met. It has to be affordable.

With more and more MSOs emphasizing the bottom line, the technical side of the industry is often looked upon as a huge abyss into which millions of dollars are poured with no hope of

On time and under budget is a must.

return. As erroneous as that notion is, it shows how important fiscal responsibility has become. Making sure rebuilds come in on time and within the budget can make or break careers.

As if the process weren't already complicated enough, new obstacles to getting rebuilds done are beginning to appear. With the newbuild market shrinking every day, electronic equipment suppliers are stocking fewer components, forcing operators to think way ahead so they don't get hit with shortages. Off-shore influences sometimes hold up shipments in order to achieve more favorable exchange rates. And construction crews are getting hit with a lot of turnover, forcing slowdowns as new workers are "trained" to meet each MSO's requirements.

"Products that were never in short supply are now often out of stock," says Bob Luff, vice president of technology at Jones Intercable. "Vendors who were reliable are now unable to deliver what you need. You find sometimes that everyone's shelves are empty."

In order to keep things straight, most MSOs use a computer to track product orders and deliveries. For instance, Jones uses software they've

dubbed CMS (Capital Management System) that displays which products were ordered, when they were ordered, which system they were ordered for, the vendor it was ordered from, and how much was delivered. Whenever deliveries don't match the amount ordered, the line item is flagged. "These days we have eight or 10 items that are regularly flagged," he says.

"Planning ahead for each job is critical," says Dave Willis, director of engineering at Tele-Communications Inc. And he should know. By the time 1987 closes, TCI will have rebuilt, upgraded or extended about 8,000 miles of plant this year. And 8,000 more are scheduled for 1988, says Willis. A lot of autonomy is given to the local construction supervisor, but because TCI has no in-house construction crews, a system occasionally gets behind.

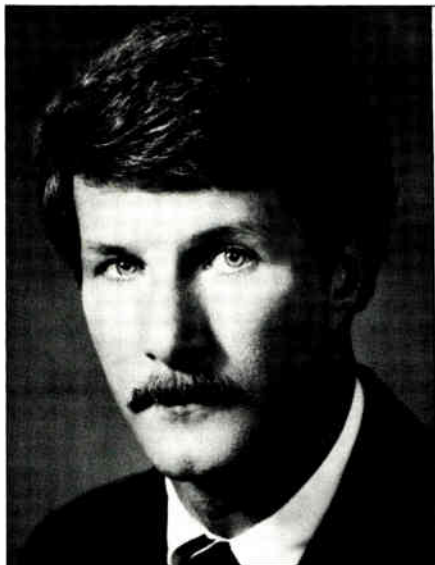
To combat shortages encountered at the parts counter, TCI has a couple of manufacturers warehouse parts for them. "Generally, we have anything that's needed electronics-wise," says Willis.

United Cable is also spending more time tracking materials, according to Pat McDonough, corporate chief engineer. A computer program tracks material and labor invoices vs. the budget. "With things getting more expensive we need to control the flow of materials," says McDonough.

Joe Van Loan, vice president of engineering at Viacom, also focuses on the fiscal considerations, but from a different angle. "Inventory is driven by the cost of money and we watch our inventory carefully," he says. "We once had \$5 million or \$6 million worth of inventory and at 12 percent interest, it's expensive."

If the resources needed to do a rebuild aren't planned for properly, it can breed additional problems. With the number of rebuilds occurring, a good worker can often pick and choose where to work. So if a delivery is late or if orders come up short, workers may leave and find a busier site, says Luff.

"Construction crews are not prisoners to your system," says the Jones VP. "If you have two or three days downtime, because these guys get paid by the piece not by the hour, you might lose 50 percent of your crew overnight." That only exacerbates the problem



'Vendors who were reliable are now unable to deliver what you need. You find sometimes that everyone's shelves are empty.'

*— Bob Luff,
Jones Intercable*

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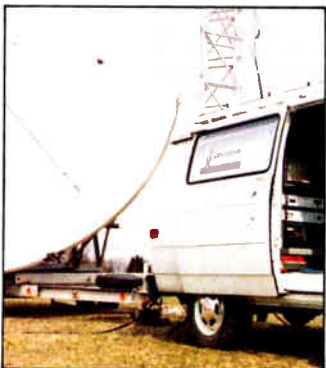
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Keeping MSOs stocked is the name of the game for Terry French, vice president of CWY Electronics.

because new crews have to be trained.

"Many systems are designed to be two-way capable, so there's much more attention given to details," Luff says. "Workmanship is much more important than ever before. With high turnover and new people coming in, there's more potential for bad habits to develop, like using the wrong connectors, setting components up to the wrong specs and the like."

Keeping MSOs stocked is the name of the game for Terry French, vice president of CWY Electronics, a Midwest supplier. He offers to keep his customers continually stocked with the products they regularly need by rolling a truck to their sites every five weeks. Dubbed "Sync" in accordance with the dictionary's definition of "an arrangement marked by regularity and balanced proportions," the service operates the same way the bread man and milk man did.

Operators fill out a menu of items



Joe Van Loan

and when the parts truck arrives, the product is delivered and stocked for him in an orderly fashion, says French. Regular menu items consist of mostly crop commodity devices "in order to relieve an operator of the expense of maintaining 10-cent items," he says. In addition, "exceptional" items like outdoor taps and other parts are available. "It's not a unique idea, it's only unique to this industry."

In fact, the service has proved to be so popular to the operators serving the Midwest, French says he's identified 11 hub sites in order to make the service national in scope. Since there are no penalties for returned goods, "operators feel easy about aggressively stocking certain items during the times when they're doing aggressive marketing campaigns," says French. "And the operator still has control over his inventory."

So, after the rebuild is complete, where does the scrap go? In most cases,

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Engineers will be held more accountable than ever for making sure projects go as planned.

a local scrap dealer is contacted, a deal is made and everything is fine, right? Not necessarily, according to Tom Wood Jr., accounts manager at Houston-based Resource Recovery Systems. Many times, operators are being cheated out of significant amounts of money by unscrupulous dealers who don't deliver on all their promises.

"Operators are losing thousands of dollars a week," says Wood. "This is a real cut-throat part of the industry that nobody wants to talk about. It's a very important phase of the construction process that's often overlooked."

While local dealers often promise higher paybacks, they often don't haul away everything generated from a rebuild. Or if they do, they may not pay the operator for everything they took. By performing a reputable service and upholding his promises, Wood is one of a few contractors trying to change the stigma associated with scrap dealers.

"Being such a small service com-



Terry French

pany in a large industry, it's easy to get lost in the shuffle," he says. "But we're making inroads to some MSOs."

Wood says those MSOs are becoming more aware that a 10 percent waste factor built into a large newbuild can add up to hundreds of thousands or even millions of dollars.

But clearly dealers like Wood face a long, uphill battle in convincing others.

"I haven't focused on (the merits of shopping around for a scrap dealer) as much as I should," says Jones' Luff. "My perception is that you might save enough money to have a really nice Christmas party at the end of the year. Maybe if salvage companies were a little more liberal in what they paid (for scrap) it would stand up on its own two feet."

Regardless of the outcome of that argument, one thing is certain: engineers will be held more accountable than ever for making sure projects go as planned. Keeping on top of each and every project isn't as easy as it once was, but there are ways to do it.

—Roger Brown

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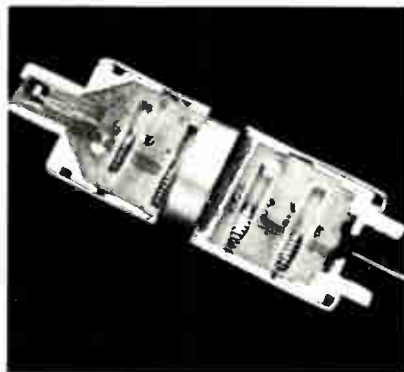
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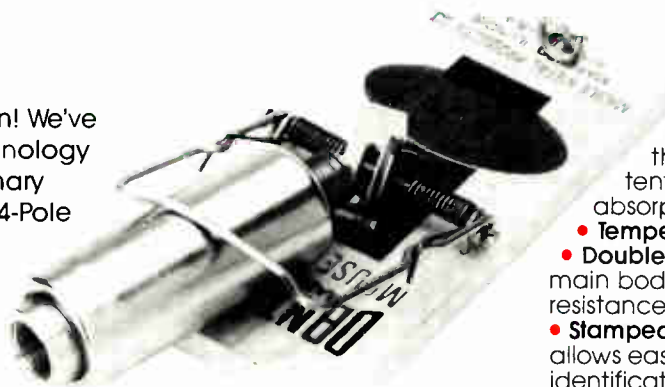
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Introduction to fiber optic media

Fiber optic systems are not oddities. They are common and are very similar in function, design, installation, use, and architecture to systems based on other types of media. The principal difference between fiber optic systems and those using metallic media is that fiber optic systems transmit and receive photons, while other systems do the same with electrons.

A basic fiber optic system looks like the model in Figure 1. Any fiber optic system, regardless of its size or level of sophistication, can be reduced to such a model. As is readily seen, the model is exactly like a model for a metallic media system—there is a fiber optic analog for every component of the system, just as if the system were a metallic media system.

Dispelling the myths

It is useful for the newcomer to fiber optics to forget all previous assumptions about fiber optic systems and concentrate on these:

- Fiber is in common use
- Fiber is easy to use
- Fiber is cost effective
- Fiber goes anywhere
- Fiber is very reliable
- Fiber is the future for terrestrial communications.

Fiber optics have been in telephony use since 1979. Its use in this application has reached the point where engineers must justify using other than fiber media when planning new routes or rehabilitating old ones. Fiber optics have been in common use for data communications since 1984, and second generation fiber-ready datacom products are being designed today. Video applications (closed circuit security monitoring as well as cable TV trunking and distribution feeder) have been introduced in the past few years.

Fiber is easily adopted and used. Like any technology, one must learn how to do things properly, but the

Forget your previous assumptions and start fresh.

learning is easy because fiber optic systems are so similar to their metallic counterparts. The products, techniques, and training commonly available today make the systems reliable, easy to install, and easy to maintain. If one is familiar with coaxial cable or twisted pair, engineering or installation, he

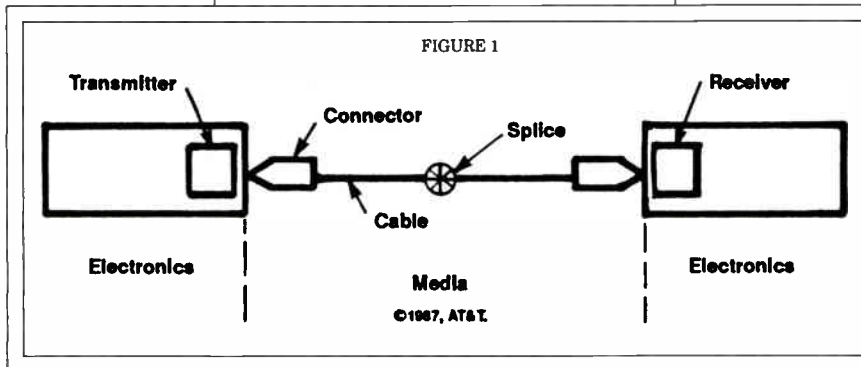
Over 2.5 billion fiber meters have been installed since 1980, using millions of connectors and splices. Most fiber based systems operate at bit error rates of $10E-9$ to $10E-12$. Most are designed to operate faultlessly for decades. Thousands of systems are in operation, and service outages due to equipment or media failure are very rare.

Currently available fiber media have nearly unlimited bandwidth. The raw material for the fiber is sand. Therefore, the fiber optic medium offers the prospect of a nearly inexhaustible supply of nearly infinite information capacity.

The benefits of fiber optics

Most people are familiar with the much touted advantages of fiber, such as small size, low weight, low loss, etc.

However, what one should really be concerned with is what those advantages do for him, that is, the benefits. Consider that fiber optics offer the following benefits over metallic media systems: lower installation cost; lower maintenance cost; lower operating cost; lower life cost; easier upgrade of system services and addition of users; easier rearrangement of the physical plant;



can easily become proficient with fiber. Fiber optic systems can be used anywhere—in buildings, over mountains, under sea, buried, underground or aerial. There are fiber optic media components that can cope with almost any environment, whether it is the high temperatures of a jet engine or the sterile environment of an operating room.

Table 1

Fiber Optic and Coaxial Cable Media Cost Examples

2 Fiber Cable, indoor, multimode, graded index	\$0.70/ft.	\$0.35/ft. conductor
2 Fiber Cable, plenum, multimode, graded index	1.07	0.54
24 Fiber Cable, outdoor, single mode	1.76	0.07
48 Fiber Cable, outdoor, single mode	3.44	0.07
RG-59/U Coaxial Cable	0.08	0.08
RG-59/U, plenum	0.52	0.52
RG-11/U	0.22	0.22
1/2 inch Aluminum Coaxial Cable	0.40	0.40
7/8 inch Helical Coaxial Cable	2.00	2.00
Fiber Optic Connector, 0.5 dB, multimode		7.50/each
BNC Coax Connector		0.75
1/2 inch Al Coax Connector		12.00

Cable TV Line Amplifier (500 meter spacing) \$600 - \$1000/each
 Note: These costs are examples only. Actual costs will vary depending on vendor, performance and quantity.

By J.E. Denny, AT&T Technologies Inc.

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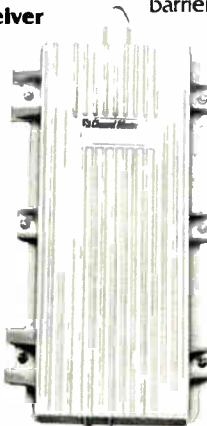
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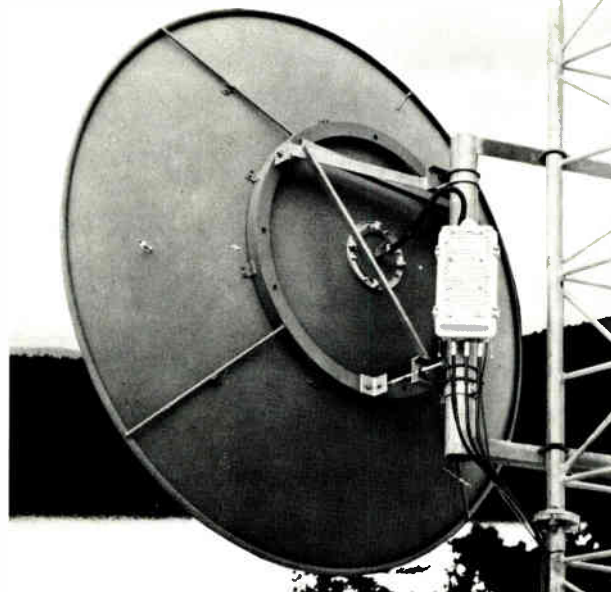
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as an alternative to the more expensive systems on the market today. They know that a MICRO-BEAM™ CARS-band system will put their money to work profitably.

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MICRO-BEAM™ reaches isolated subscriber pockets and spans natural barriers without additional remote headends, adapting to your entire service including audio, video, data and addressability signals and commercial insertion capabilities. MICRO-BEAM™ also saves you that \$500 per-channel descrambling cost by allowing you to descramble each channel at the main head-end. In fact, MICRO-BEAM™ is so compact, it allows you to transmit from a weatherproof unit that mounts behind the antenna. It can even be mounted on water towers, and can be placed anywhere in your system, not just at the headend!

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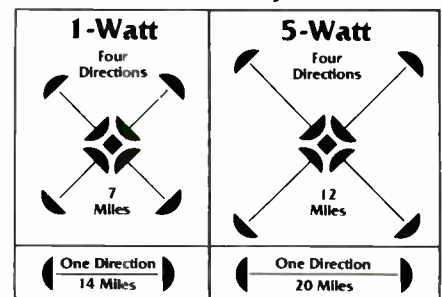
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Fiber optic systems are usually multiplexed so as to take advantage of the high capacity.

greatly reduced interference to other services; greatly reduced susceptibility to lightning or other electrical damage; greatly reduced susceptibility to interference from other services; and greatly reduced susceptibility to ground loops,

hum, and line driver matching problems.

A 1/2-inch diameter fiber optic cable can hold up to 144 fibers and weighs only 1 1/2 ounces per foot. To have the same number of conductor links, one

would need 144 separate coax cables. The 144 RG-59 cables would occupy about a 13-inch diameter and weigh about 4 1/2 pounds per foot. The fiber optic cable could easily be installed because it is one cable, is light, and easily manipulated. Each of those 144 coax cables would likely have to be pulled one at a time or, in any case, because of the weight and bulk, would be much more difficult and expensive to install. It is useful to remember that an additional link conductor for a fiber optic cable will usually not noticeably increase the cable size or weight.

Fiber optic media are extremely low loss; 0.5 dB/km is commonplace. Fiber optic systems have very large bandwidth. This combination of low loss and high bandwidth makes it easy for fiber optic systems to go 30 km carrying 500 Mb/s of data, without repeaters. Therefore, fiber optics systems greatly reduce the need for between-central-office, headend or any kind of in-line or remote electronics. The absence of these electronics greatly reduces system maintenance, not just for the electronics, but also for the power systems to support them, and the connectors that connect them to the system.

Further, the media components available today are well designed, thoroughly tested, and well made such that they are extremely reliable and can easily withstand the rigors of indoor and outside environments. Fiber optic components have to be extremely reliable because they are used in systems that carry high densities of valuable information, which cannot be lost to failures of the media.

Fiber optic systems are usually multiplexed so as to take advantage of the high capacity. This multiplexing further reduces the amount of electronics used in a system. With fewer electronics, there is less demand for power and less need for people to oversee the system. These lower costs coupled with the lower maintenance cost mean a fiber optic system has the potential of offering its owner lower operating costs over a comparable system operating on metallic media.

The technology is rapidly approaching the point where, for data links over a few hundred meters and data rates over 10 Mb/s, a fiber optic system will

Our ground crew is now **UL LISTED**

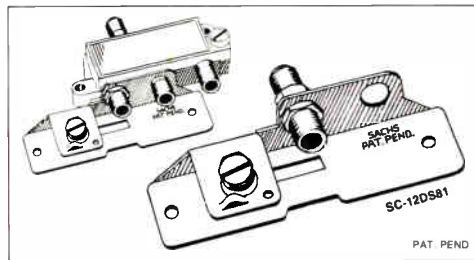
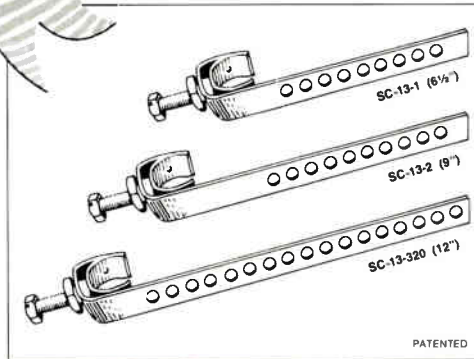


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Reader Service Number 25

Because fiber optic media are generally small and lightweight, if it is necessary to rearrange the media, it is easy to do.

have a lower initial cost (engineering, installation and materials). A lower initial cost along with lower operating costs means a fiber optic system offers the potential of lower life-of-the-system cost.

The incremental cost of installing fiber in an initial installation is small. By installing that fiber, one puts a very large information pipe in his network. If the media are chosen properly at the start, the network owner has the potential for easily upgrading his system at a later date. If additional users, higher data rates, or more video channels are required later, only the electronics need to be changed. It is easy to change the electronics in a fiber-based system because they are usually located only at the ends of the network. To upgrade a metallic media system, one usually has to upgrade both the electronics.

Because fiber optic media are generally small and lightweight, if it is necessary to rearrange the media, it is easy to do. For example, rearranging a computer system that uses coax for tag and bus communications would be laborious. If the system were a multiplexed fiber based system it would be easy—fewer and lighter cables to move.

Fiber optic media do not radiate radio frequency (RF) energy. Therefore fiber optic media cannot interfere with other RF services. Because fiber optic systems do not rely on RF or other low frequency electromagnetic radiation, they are almost immune to interference from sources of such radiation. If the fiber optic cables have non-metallic strength members and the electronics are well shielded and filtered, fiber optic systems are immune to interference from other services or noise sources. Such immunity permits using fiber in close proximity to large electric motors or furnaces, power lines, or other sources of electrical noise, without the added cost and headaches of heavily shielded cables and cable filters.

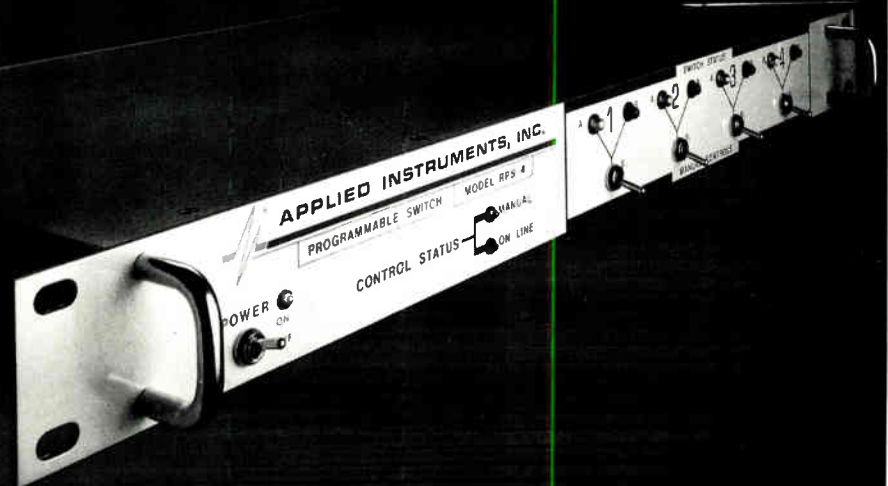
Optical fibers are non-conductive. Optical systems do not rely on electrical contact for signal transmission. Therefore, optical systems are much less susceptible to lightning damage, ground loops, and line driver mismatch problems than are metallic systems. If the fiber optic cable used has non metallic strength members, an optical

system is practically immune to lighting or other electrical contact problems.

Optical fibers are extremely difficult to tap, unless one is prepared to rupture the cable sheath and has very sophisti-

cated equipment. Again, fiber optic cables do not radiate usable energy. Therefore, information sent over fiber optic media are much more secure and much less susceptible to pilferage than that sent over metallic media. ■

Make the Switch



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BROADBAND COMMUNICATION INSTRUMENTATION

General purpose, MAP, Ethernet modems

System-specific modems offered by LAN vendors generally fall into three categories. There are modems designed to operate with the general purpose LANs made by companies like Sytek, Ungermann-Bass, TRW Information Systems Division and others. There are LANs specifically running the Manufacturing Automation Protocol and conforming to IEEE standard 802.4 (token passing broadband bus). Concord Communications, Allen-Bradley and Industrial Networking Inc., for example, are suppliers of MAP-spec modems. And there are modems specially configured to run Ethernet protocols over broadband. Digital Equipment Corp. and Chipcom, for example, make them.

Look for changes as vendors position themselves for future developments in the LAN market. Most likely, Halley Systems, a traditional supplier of modems, will in the near future move up to a systems integration role, offering both stand-alone modems and other networking solutions. Halley sees the market looking for complete network solutions, not components. Look for Concord Communications, which pioneered the Manufacturing Automation Protocol, to move into a broader broadband factory network arena. MAP is a solution for some companies, but certainly not for all, Concord is betting.

Sytek, which began life as a pure broadband vendor, already is moving toward connectivity with baseband networks such as Ethernet and has released a series of medium access, bridge and remodulator products supporting Ethernet. In fact, many of the broadband LAN vendors (and one or two of the stand-alone modem vendors) will be eyeing the bridge and gateway market for X.25 and T-1 network connections, MAP to Ethernet (and 802.3 network) connections, and broadband to baseband links. On the other hand you have Bridge Communications offering its own broadband network to run Ethernet and 3Com protocols.

General purpose networks

General purpose broadband networks and modems working with those networks are available from a number of

There's a LAN modem available for every need.

companies, among them Sytek, one of the earliest suppliers of broadband networks. Sytek, in fact, offers several different broadband networks. The LocalNet/20 is designed as a lower cost, lower speed network that still can

M8024/M8824 broadband modems

FIGURE 1

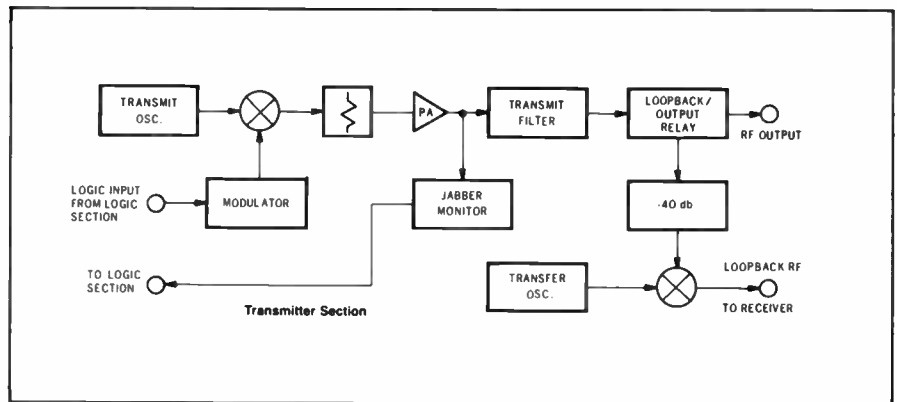


FIGURE 2

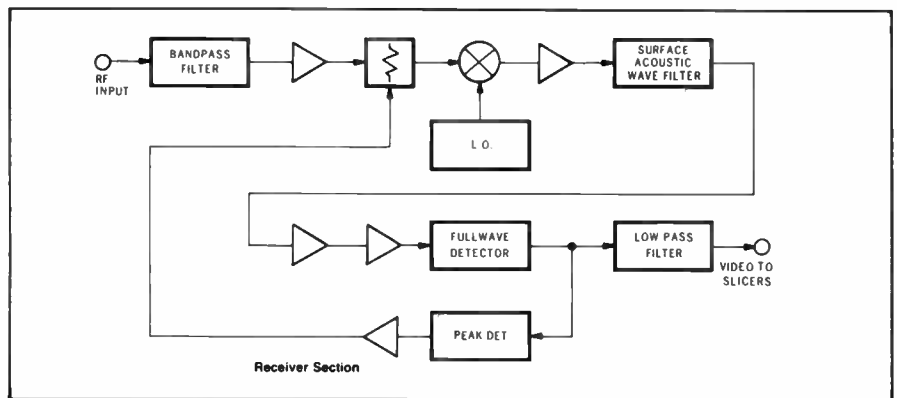
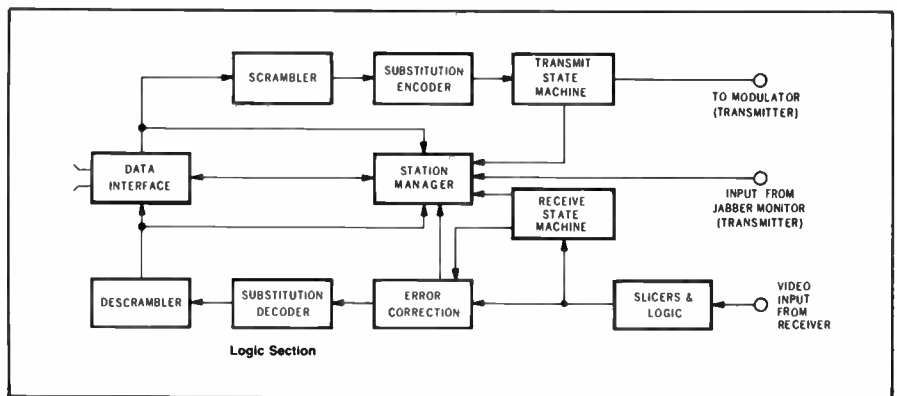
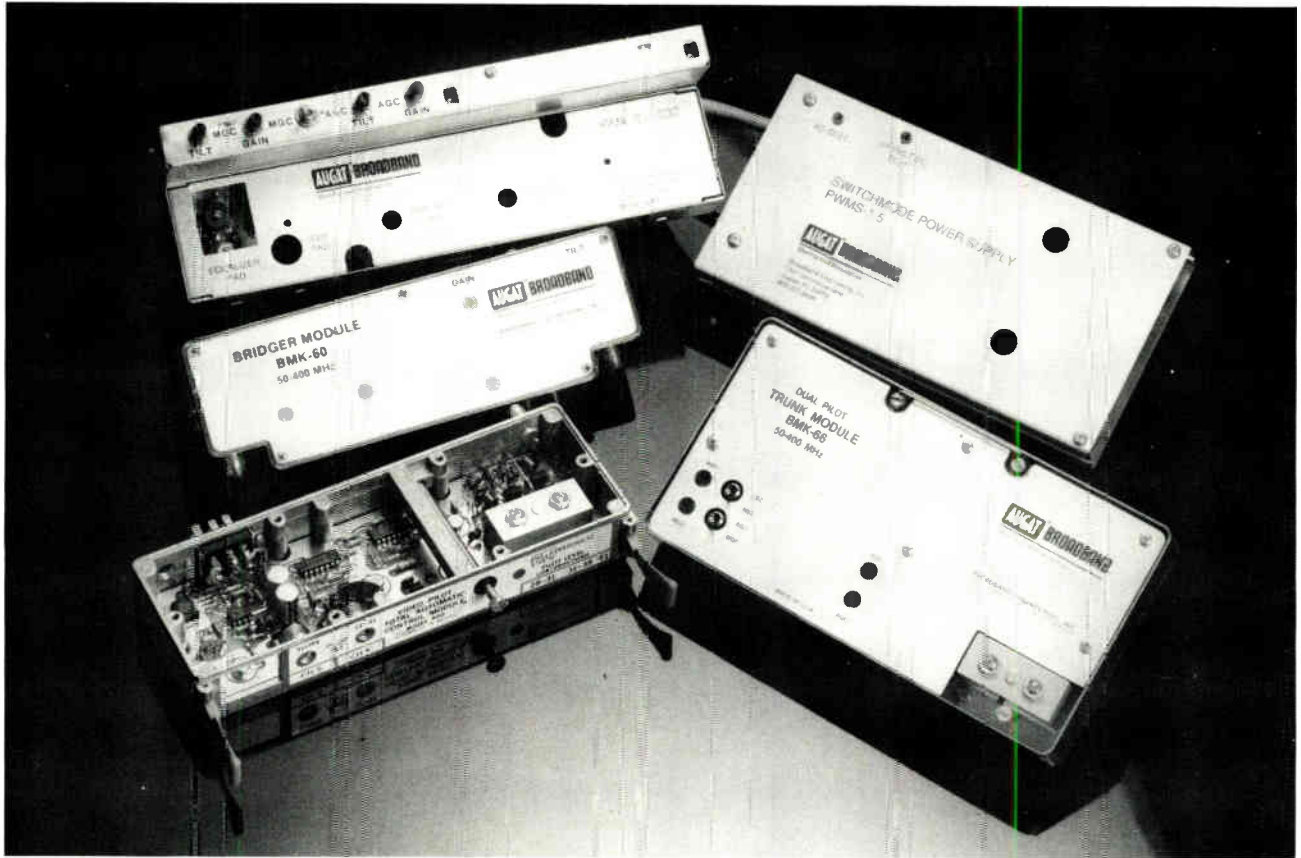


FIGURE 3





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Quality and Innovation

The idea is to get users into an initial network at low cost but preserve the migration path to full broadband.

support 20,000 users. Running at 19.2 Kbps, the LocalNet/20 uses the CSMA/CD (carrier sense multiple access with collision detection) access protocol. The 20/100 interface (Packet Communication Unit) supports one or two users; the 20/200 supports eight while the 20/220 supports 32 users.

The System 2000 is optimized to handle terminal-to-host asynchronous communications running at 19.2 or 128 Kbps. The System 2000 uses CSMA/CD access protocols. The network interfaces come in two-port, eight-port and 32-port versions. More than 65,800 nodes can be supported on a System 2000.

The System 3000 and System 7000 networks are specifically designed to support the IBM 3270 mainframe computer environment. Network interfaces, which come in two-port, eight-port or 32-port versions, run at 128 Kbps or 19.2 Kbps.

The System 6000 is an IBM PC network supporting 1,000 nodes and

running at 2 Mbps. The interfaces are standard System 2000, LocalNet/20, System 3000/7000 Packet Communication Units. The new System 4000 runs Ethernet on broadband and uses two-port and eight-port transceivers. Five frequency pairs are set aside for transmission and reception. Sytek also has point-to-point or multidrop modems. The model 1301 runs to 38.4 Kbps. For details circle reader service number 75.

Agile Systems offers a network based on nine-wire ribbon cable that is fully protocol compatible with the Sytek LocalNet/20 products. The idea is to get users into an initial network at low cost but preserve the migration path to full broadband. The AgileNet 20 RF modem comes in two-port and four-port versions. For details circle reader service number 76.

MAP modems

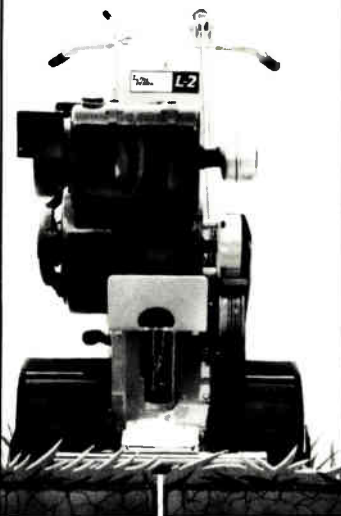
MAP modems differ from general

purpose broadband modems in the use of "jabber" circuitry that automatically shuts down any modem transmitting for more than half a second. Recall that MAP uses a token passing access protocol. About 500 microseconds are needed to pass a token and 8 kb is the largest data frame MAP allows, so the jabber circuit is a way of detecting transmitter failure. Concord Communications goes one step further than the MAP spec requires when a modem is powered back up for network insertion. Concord's boxes and cards are interrogated in a loopback mode "to see if the box is alive before we put it back on the network," says Concord's Manager, Modem Development Darrell Furlong. "We also are the only vendor offering a transmitter enable function." Basically, the receiver has to lock to the headend before the transmitter is enabled. That feature isn't vital in a point-to-point application. It's real helpful in a token environment, though.

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Reader Service Number 29

New MAP/TOP products out, standards settle

At last, the Manufacturing Automation Protocol (MAP) market is stabilizing. The broadband-based factory automation standard has been migrating from version 2.1 to version 3.0, presenting vendors with a moving target that has slowed sales. But in June, the 3.0 standard will be protected from major revision for a period of six years, the MAP/TOP Users Group has announced. That's good news for users, who are assured of an important degree of device and software stability, and important for vendors, who can now build products and hope to see a return on their investments.



The Series 4200 Bridge

Concord Communications, a leader in both MAP and broadband-based factory automation networks, has introduced the industry's first Ethernet-to-MAP bridge. The Series 4200 allows the connection of multiple Ethernets over a broadband backbone. The bridge also can be used as a MAP network/TOP network bridge. Unlike Ethernet-on-broadband networks, which use contention access on broadband media, the Series 4200 uses token, or controlled, access on broadband media. The difference is significant.

Performance on Ethernet LANs tends to degrade under conditions of heavy loading and linking multiple Ethernets over broadband simply increases the degree of load, causing more message collisions and retransmissions and resulting in reduced message throughput.

The Series 4200 gets around that problem by confining intra-network traffic to each separate Ethernet while transmitting only inter-network traffic

on the broadband backbone network. Also, since token passing is more deterministic than Ethernet under conditions of heavy loading, overall network throughput is enhanced. The Series 4200 costs \$10,200 in single quantities and delivery is 60 days ARO.

To ease transition from version 2.1 of MAP to version 3.0, Concord also is selling a starter kit supporting three IBM PC MAP nodes transmitting in either carrierband or broadband. The current software is 2.1 and the kit includes a compatible upgrade to version 3.0 as well as training.

For details circle reader service number 77.



Fairchild's TOP-Link modem

TOP modem

Fairchild Data Corp. has a new M8023 TOP-link modem used for Technical and Office Protocol (TOP) networks. TOP is an IEEE 802.3 type network and is seen as the front office companion to a MAP network. Operating at 10 Mbps, the M8023 can be used on either single-cable or dual-cable broadband networks running TOP, Ethernet or DECnet. For details circle reader service number 78.



Lan Tel's 840 voice trunk modem

LanTel voice modem

LanTel Corp. has a new Model 840 Single-Line Trunk Modem, allowing access to the public telephone network

from a broadband LAN. The Model 840 provides the RF interface between Model 810 voice modems operating on a broadband network and the telephone network. Using the Model 840, stations can place and receive calls from a telephone central office, between two broadband networks or through a PBX system. For details circle reader service number 79.

C-COR monitor

C-COR Electronics has a new power supply monitor for its Quick Alert status monitoring system. Used for both standby and redundant power supplies, the PSM monitors battery voltage, battery lockout, output current, main/auxiliary status, fault status, standby status, door status and charger control. Other features available are control functions for inverters, charge and float, force-to-standby, main/auxiliary control. Interfaces to the C-COR PowerVision supplies, Alpha Technologies AP660 and several other vendors' power supplies. For details circle reader service number 80.

New Ethermodem

Chipcom Corp. has a new Ethermodem transceiver compatible with DEC's DEMPR, running on thin Ethernet (RG-58) systems. The DEMPR modem allows connection of up to eight thin-Ethernet stations to a broadband Ethernet LAN. The new transceiver is compatible with all Chipcom Ethermodem products and is transparent of TCP/IP, DECnet, ISO, TOP, XNS higher level software. TCP/IP (Transmission Control Protocol/Internet Protocol) is a system for interconnecting computers and other devices made by many different vendors over a single LAN. It was popularized by the Defense Department but is gaining widespread support as a general purpose protocol for LAN use. DECnet is the protocol used by Digital Equipment Corp. for linking its computers and terminals over broadband and baseband networks. The International Standards Organization is a voluntary international standards-setting group for data communications. It has popularized the Open Systems Interconnection (OSI) model for local area networks. The IEEE 802 family

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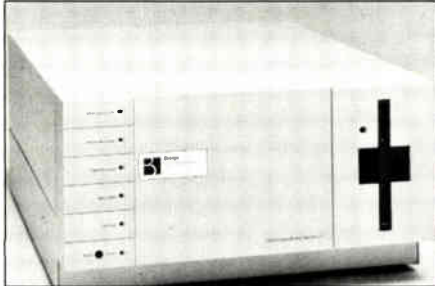
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Reader Service Number 30

Also new from Bridge: the Secure CS/50 Communications Server and Secure NCS/AT Network Control Stations.

of protocols, MAP and TOP are based on the OSI model. XNS is the Xerox Network Systems, a protocol for linking computers and other devices developed by Xerox Corp. For details circle reader service number 81.



Bridge Comm.'s CS/1-SNA Gateway

Bridge Communications

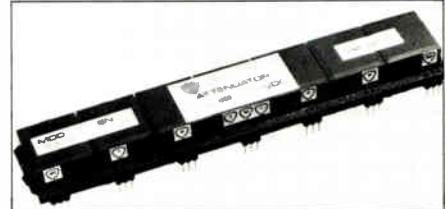
Bridge Communications has three new products: a new X.25 gateway, an SNA gateway and an encryption system for TCP/IP networks. X.25 is a standard for packet switching over the

public telephone network. SNA is IBM's Systems Network Architecture, a communications protocol used with IBM computers. The new GS/1-IP Gateway Server links three types of LANs with the telephone network or an X.25 private data network. IEEE 802.3 networks using either coaxial or fiber optic cable; Bridge's own broadband network; and 4 Mbps token ring networks conforming to IEEE 802.5 are supported. All networks connected using the GS-1-IP must use the TCP/IP protocol.

Bridge also has a new Communications Server 1-SNA that acts as a gateway for PCs, printers, ASCII terminals to SNA networks. Ethernet, token ring and broadband versions are available for both TCP/IP and XNS protocols. The CS 1-SNA is priced at \$10,500 plus a \$1,000 software fee.

Also new from Bridge: the Secure CS/50 Communications Server and Secure NCS/AT Network Control Sta-

tions. Both provide data encryption and access control for networks running TCP/IP over Ethernet, "thin" Ethernet and 5 Mbps contention-access broadband networks (CSMA/CD). For details circle reader service number 82.



Trilithic's 7L80P attenuator

Trilithic

A new switch initially built for Electronic Data Systems (EDS) to switch primary and redundant MAP/TOP networks is available from Trilithic. The Model 7RSABM RF Switch Bank consists of a mainframe and power supply, addressable control card and up to 16 individually controllable A/B switch

Reliability and LRC...



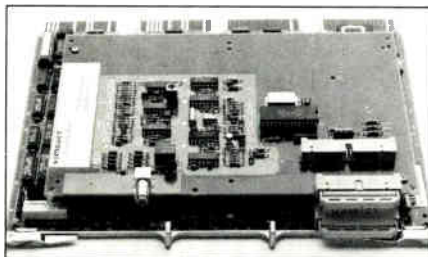
Simpact Associates has a new carrierband modem and interface for DEC computers and peripherals.

cards on a common parallel bus. All are mounted in a 5¼ inch rack-mount case. Return loss is 20 dB. Insertion loss is 0.15 dB. Isolation is 60 dB from DC to 650 MHz when used with standard "F" connectors. In small quantities the mainframe costs \$895; the control card \$199 and switch cards \$149. Delivery is 10 to 14 weeks ARO.

Also new from Trilithic is the 7L80P latching programmable attenuator operating over the DC to 1000 MHz frequency range and attenuating to 80 dB in 1 dB steps. The 7L80P is used for portable instrumentation in 75-ohm environments. Accuracy is ± 0.5 dB to 500 MHz and ± 1.0 dB to 1000 MHz. For details circle reader service number 83.

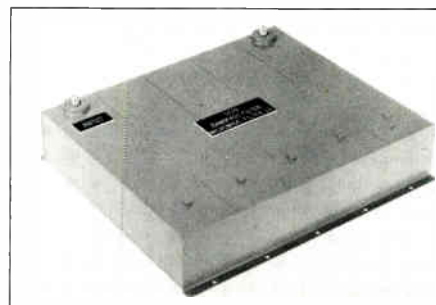
Carrierband interface

Simpact Associates has a new carrierband modem and interface for DEC computers and peripherals. Carrierband is a single-channel broadband



Simpact's carrierband modem

transmission system that is part of the MAP specification. Using standard 75-ohm components but transmitting only on a single channel at a rate of 5 Mbps, carrierband systems are designed as a low-cost sub-network technology for MAP networks. Because carrierband is a baseband transmission technology, no RF modulation or frequency translation is required. Carrierband subnetworks are available in two versions, one of which is designed to be upgradeable to full broadband MAP. For details circle reader service number 84.



MF's 5376 broadband filter
Bandpass filter

Microwave Filter has a new Model 5376 bandpass filter designed to reduce spurious signals from a LAN translator. Center frequency is 267.2 MHz with 3 dB bandwidth of 1.5 MHz. Selectivity is 40 dB at ± 2.23 MHz. Different center frequencies are available. The unit price is \$990 and delivery is 30 days ARO. For details circle reader service number 85.

—Gary Kim

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The commercial insertion dilemma

The San Francisco Bay area, like many other regions in the United States, is served by a multitude of CATV companies. These headends range in size from 5,000 to 150,000 subscribers and yield a total base of over half a million homes.

Truly effective cable advertising must be able to reach a large portion of the total base. The problem lies in designing an approach to manage ad sales, billing, accounting and commercial insertion in a cooperative and cost effective manner.

Smaller headends want to minimize their expenditures for equipment, but at the same time take advantage of the revenue opportunities presented by cable TV advertising. In some instances the smaller entities wished to have a fully automated remote com-

*By Jack Goldie, Chief Engineer,
Bay Area Interconnect*

How to reach the right people effectively.

mercial insertion site which was unstaffed at all times.

Larger headends want more of a role in the advertising market. They have a strong desire to market local ads or their individual cable system as well as continue to actively participate in the interconnect.

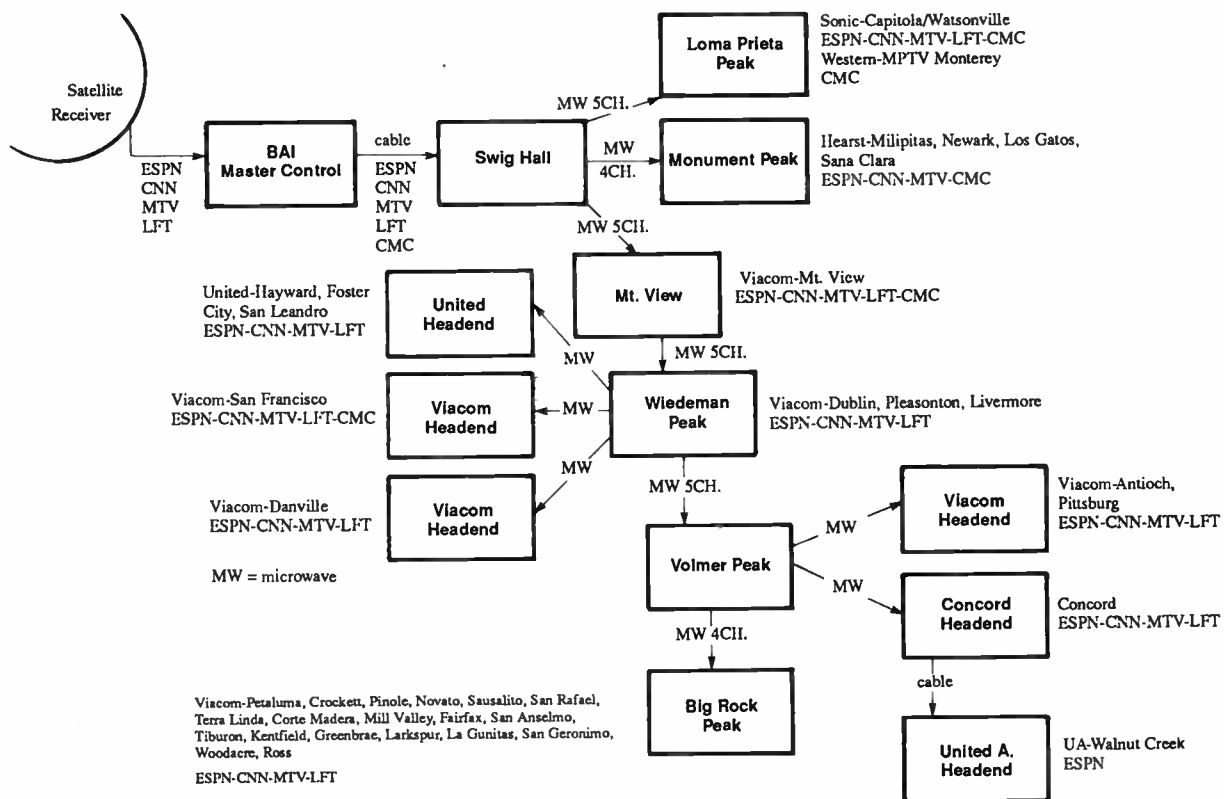
It was clearly obvious that to be a successful interconnect we required a comprehensive and flexible computer system to manage all the demands of all participating members now and into the future. In addition, our master control operations had to continue to reflect a professional broadcast image and be fully interfaced to the billing system. Each headend had to be able to receive a daily schedule of events and report on the status of those events.

Finally, we needed a responsible support organization. After all, our business is cable television, not computer technology. We wanted complete training for all operational aspects of the automation system as well as prompt service for all hardware and software concerns which might arise.

After examining the existing approaches to the interconnect requirements, we chose Grumman's AIS 5000. Grumman Electronics Systems took its broadcast technology and adapted it to the cable industry's needs. With its master control capability, computerized billing and switching control, the system is able to address the needs of every Bay Area Interconnect member.

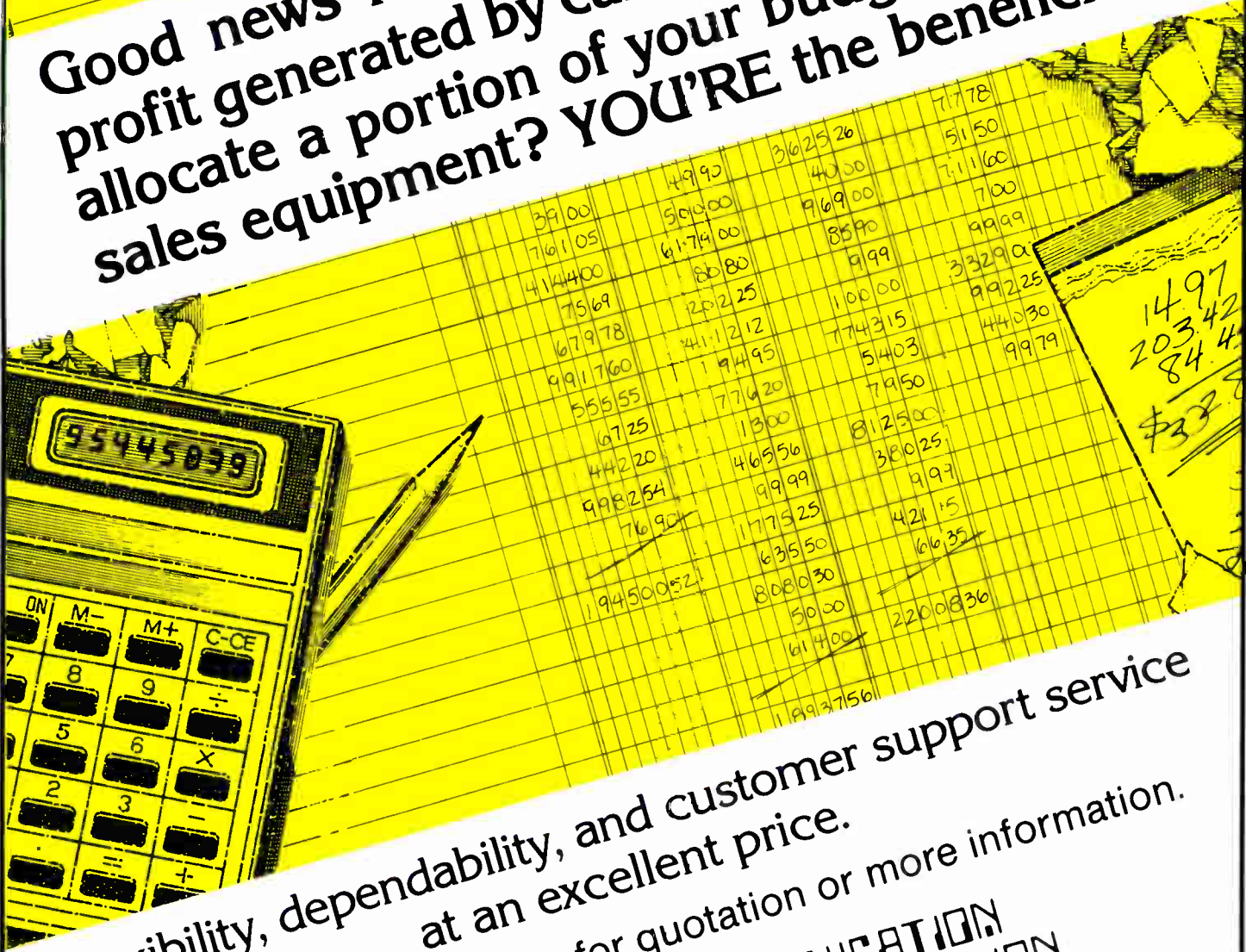
By using SMPTE time code on our spot reels, we were able to achieve frame accurate cueing. Combining this with the control of the 3M master routing switcher and a single frame synchronizer per channel, brought about clean, broadcast quality switching. The

FIGURE 1



1987 BUDGET

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Our advertising sales force is clearly far more effective because they now have the right tools to work with.

importance of this should not be underestimated. An ad sales department has one, and only one, product—advertising. If the product is presented in a slipshod manner with poor audio controls, sloppy switching or incorrect airing of spots, its integrity suffers tremendously. The quality of presentation is a significant factor affecting ad sales revenue.

Automatic schedule download to each site, using low-cost non-dedicated phone lines, comes directly from the central sales and billing computer. We finally have the ability to enter sales orders over any selection of headends the client wishes and have the revenue flow be accurately channeled into concise reports for management review.

Furthermore, verification of each event passing through the system is received back at the central billing site. This data contains exact run times and status information that is directly posted to our billing files. Invoices are

clear and precise, showing the client exactly where his advertising dollar has been spent. A complete accounts receivable system is incorporated in the billing software.

A scheduling priority plan even lets our large headends independently sell and air their own advertising without interference from the central site. Our advertising sales force is clearly far more effective because they now have the right tools to work with.

From an operational standpoint, we have been pleased with the flexibility and open-ended architecture of the system. Tape machines must be constantly brought on- and off-line; last minute schedule changes can bring strong demands on your airtime operation—not to mention your patience.

The master control room now contains a desktop-size computer that provides a single interface to the tape machines and switching equipment. A realtime status display constantly shows

the operator the condition of each tape machine and its associated schedule. A simple edit procedure allows any schedule changes to be entered up until just minutes before actual airtime.

Tape machines can either be dedicated directly to a network (such as ESPN) or freely shared among the channels. This function is software controlled and may be changed at any time by entering the desired parameters on the system management screen. Even the large 3M routing switcher can be easily reconfigured using this feature.

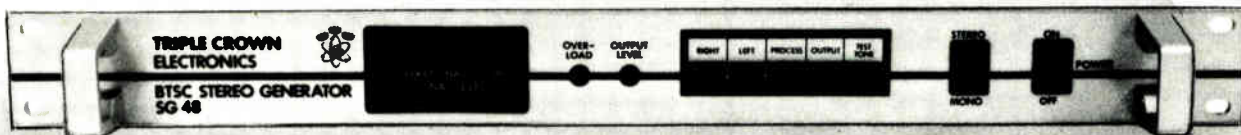
The software interface provided with the system has greatly simplified the control room operations. All schedule and advertisement data is readily available to the operator through a series of rapid screen displays and printed reports. As a cassette is placed in a tape machine, the system automatically

Continued on page 68

BTSC STEREO GENERATOR

**FULLY DBX® COMPANDED
INTERNAL 4.5 MHz MODULATOR
DEVIATION CALIBRATION TEST TONE
EXCEEDS ALL OST60/BS15 REQUIREMENTS
LOW PROFILE 19" RACK MOUNTING**

FOR YOUR FREE COPY OF "IMPLEMENTING STEREO TV" CALL OR WRITE TODAY!



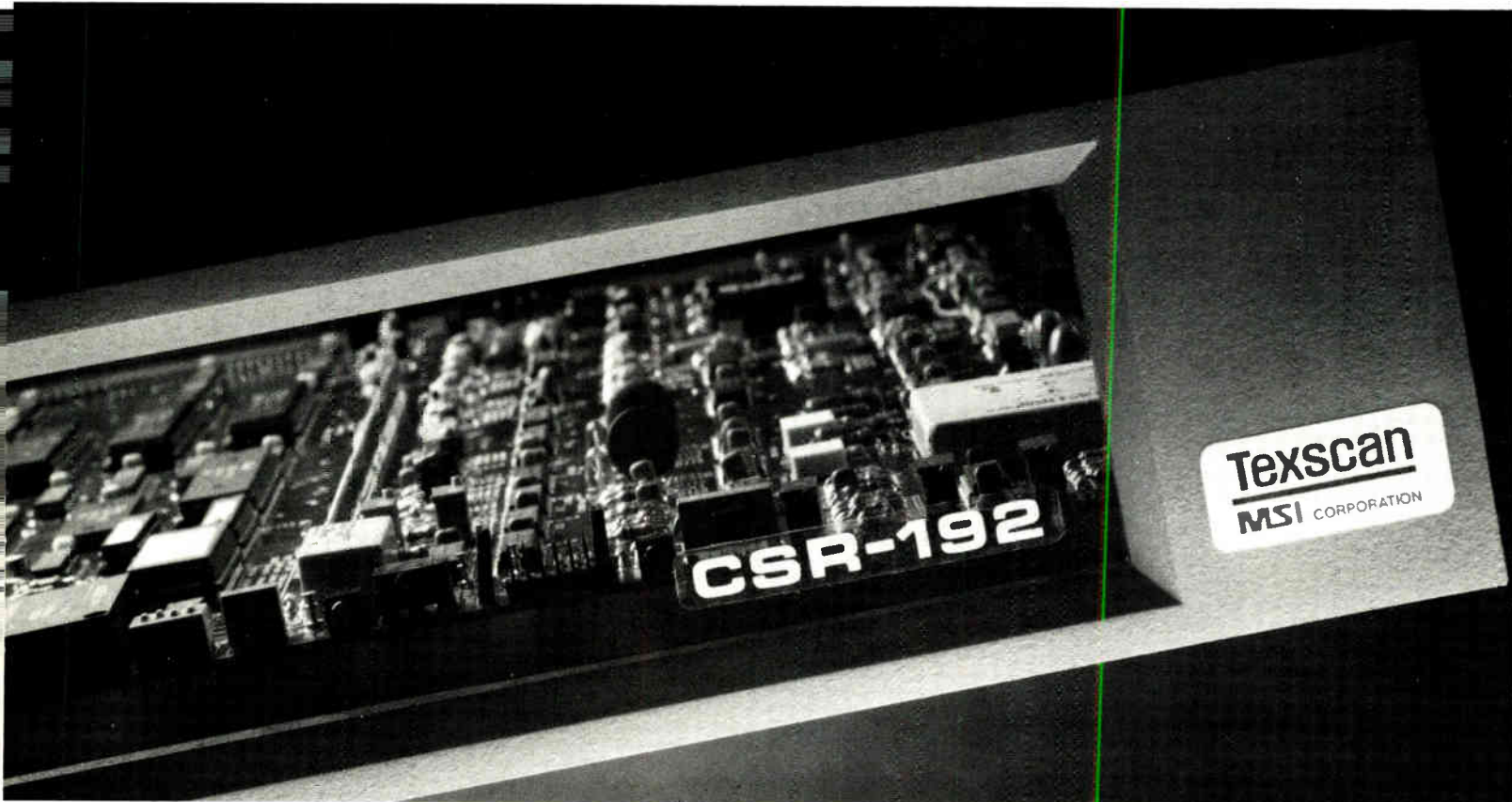
TRIPLE CROWN ELECTRONICS

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(416) 629-1111
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601 Fairway Drive,
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Reader Service Number 33

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



The ComSertter-192

The Best Just Got Better

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

New Features

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

No Increase In Price

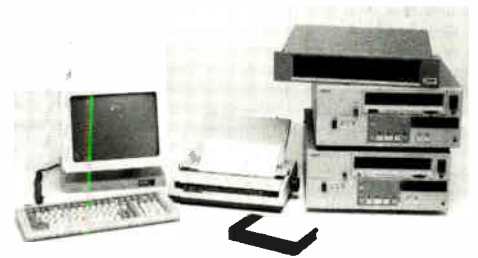
And best of all, the CSR-192 gives you these many added features without adding to the price.

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

Texscan
MSI CORPORATION

See us at the Western Show, Booth No. 228

Reader Service Number 34



A real-world test of air dielectric cable

Twenty-five to 30 years ago, cable owners built their systems with no idea of how long they would survive or the degree of performance to expect. Preventive maintenance programs were rarely implemented because this was a new phase of television. Very little was known about performance testing, consequently, the cable system itself suffered severely. Technical advances and studies have been a learning experience of trial and error which has stressed the importance of a professional maintenance program in order to maintain a system and keep it in like-new condition. Cables first used were designed for other applications and only through testing and usage has the development of present day cable come about. We have found that a good maintenance program is very cost effective. It is my desire to prove that through professional planning and effective cabling, the "no suck-out phenomenon" is possible.

The subject I am going to discuss is based on fact, not theory. This technical report is based on hands-on experience, not sales pressure.

Formerly a Group W Cable system, Century Communications of Liberal is the first system to build using entirely MC² cable from Trilogy (formerly General Cable).

Liberal was the first cable system built in Kansas. Like many other older systems, it has patchy areas of .412 and .500 where .750 size cable should be. Some systems have 59U jumper mid-span splices, figure-eights in midspans as well as pressure taps at many or all locations in a span of cable. This too was the dilemma Liberal faced.

Almost three years ago, Liberal's cable system was introduced to a unique cable—a cable from one of the variations in the fused disc patent (a patent that covered the disc in tube design). The core contains an adhesive material which, when activated by heat, bonds the core to the aluminum. The combination of the disc in the tube design and the bonding process yields a coax that combines the best points of all coaxial designs. This is the design behind Trilogy's MC² cable.

*By Kevin Collins, Chief Technician
Century Kansas Cable TV*

A case study of Trilogy's MC² coax

MC² cable used in the Liberal system has surpassed any and all expectations of a cable's performance. These performances leave us with no "suck-outs," no cracks or creases and no radiation leaks at the entry of passives, actives or splices. Keep in mind there is no cable made anywhere today that can perform in this manner by itself. At least three things must come into

The technical staff at the Liberal system had heard horror stories about air dielectrics.

play for this type of track record. First, proper factory-set installation procedures must be followed. Second, professional people must be competently trained to follow these procedures. Third, this type of professionalism must be continuous to maintain a system in a like-new condition for the entire life of the system.

The installation procedure of MC² cable is very different from foam dielectrics. When sleeves are put on the cable it actually makes a contact noise which tells you that the cable is butted up inside. Coring with plastic inlay eliminates the problems encountered in foam type cables.

Another characteristic of MC² cable is the handling. This cable has been rigorously bent back in excess of 49 times without cracking. These back bends were done on a 13-inch radius drum in our own facilities. There were no ripples or splits on the tested sections of cable. However, a same size foam dielectric cable did not withstand such tests 20 percent of the time. Many times, during the formation of expansion loops, a crease results because of

a lack of extreme care. With MC² cable, loops are less likely to crease because of its exceptional bending ability.

The staff at the Liberal system had reservations about the idea of heat shrinking MC² cable. However, normal heat shrinking had no effect on the inert material nor on frequency response. On a tested section of MC² cable, no deformity was noted.

Century Communications at Liberal has 499,700 feet of MC² cable, trunk and feeder combined. Of that amount, only 21 feet was scrapped at the onset of the rebuild because of forklift damage. No other footage or roll has since had any defects.

The technical staff at the Liberal system had heard horror stories about air dielectrics. Air dielectrics were first designed with one thing in mind—lower attenuation. The disadvantages included poor handling capabilities and water migration. But the first generation cable was replaced by a newly designed Fused II when it was discovered that Fused Disc I was not electrically stable at high temperatures.

Another area of concern with cable is water migration. However, water migration is practically impossible with MC² cable. We have not found any water migration since MC² cable was installed. We were also concerned about the design of MC² cable due to the welded seam instead of solid tube form design. But after thorough testing in the field, no splits or water migration have been discovered.

Since rebuilding with this cable we have had no 360-degree cracks, radiation leaks or suck-outs resulting from extreme hot or cold weather conditions. The Liberal cable system has enjoyed three years of trouble-free operation due to the use of MC² and proper installation and maintenance of plant. Yes, we do have radiation, but tests show this problem comes from drops and inadequate F-59 connectors. We have carefully monitored the system every winter however, the phone never rang with news of any outage.

A great deal has been learned about cable throughout the years. Century Communications has proof that thorough planning and testing of a product pays off. ■

TV EQUIPMENT MARKETPLACE

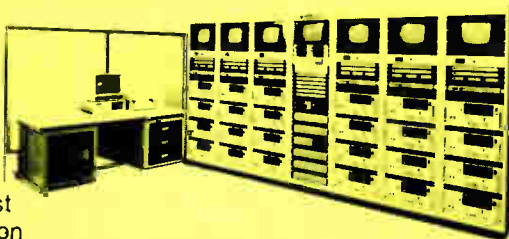
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The fact is that there are more SPOTMATIC systems in use today than any other type of ad insertion system. The reasons are simple: high quality, proven reliability, unparalleled factory support, and an unmatched array of features.

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- Expandable to 32 channels with 32 VCR's inserting ads
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- Front-panel keyboard or optional personal computer control
- Complete turnkey packages available
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- Automatic logging with advertiser-sorted printout
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Channelmatic, Inc., 821 Tavern Rd., Alpine, CA 92001. Or phone (800)231-1618 or (619)445-2691.

BROADCASTER I™ PROGRAMMABLE VIDEOTAPE CHANGER

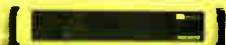
Access 15 cassettes to play in any order



- Uses one Sony VP-5000 series 3/4" VCR
- Easy to program, stores up to a full week's schedule
- Highly reliable mechanism uses no belts, chains, gears
- Suitable for broadcast, cable, industrial, educational, and government installations for any multiple-tape playback requirement

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A new concept in ad insertion allows low cost fully random access ad playback with one through four VCR's on one channel, two VCRs on each of two channels, or four VCRs shared between two channels. Features full stereo audio capability, preview bus, computer-adjusted audio levels, user-friendly CRT terminal interface for easy scheduling, advanced audio and video switching circuitry, front panel status display, and unlimited system expansion capability. Traffic and billing software available. Contact CHANNELMATIC, INC., 821 Tavern Rd., Alpine, CA 92001 (800)231-1618 or (619)445-2691

FREE CATALOG

Write for our brand new catalog of television and cable system equipment. Everything from automatic ad insertion to playback systems to audio and video switching to signal processing and control.

Complete product line listing with photos, block diagrams, and comprehensive descriptions and specifications. Enough detail to spec out your own custom system. Catalog will become a valuable reference. And it's yours just for the asking. Write, call, or circle the bingo number. But do it soon.

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ARE YOU THROWING MONEY AWAY?

Losing verification data is just the same as throwing money away, and who in their right mind would do that. Make sure when you run somebody's ad you get paid for it. The LOGMATIC™ and LOGMATIC JR.™ logging and verification systems always get their data when used in a system with SPOTMATIC JR. and LIL MONEYMAKER low-cost ad insertion systems.

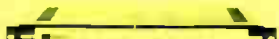


The LOGMATIC contains a 4000-event memory and interfaces to an 80-column printer or to a PC for data retrieval. The LOGMATIC JR. has a built-in 20-column printer and real-time clock. It prints the event record as the event occurs. Both loggers feature automatic operation, and they record insertions on four channels.

Call or write for more information. You don't have to lose money for unverified spots. Channelmatic, Inc. 821 Tavern Rd. Alpine, CA 92001. (800)231-1618 or (619)445-2691.

NETWORK SHARE SWITCHER

- Inserts ads into four networks from one ad source.
- Inserts ads one network at a time on a first come, first served basis.
- Four Digital DTMF cue tone decoders.
- Four preroll delay timers one for each network.
- Composit sync out put to facilitate vertical interval switching.
- Cue tone decoder disable switches.
- Power fail relay bypass.
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NSS-4A NETWORK SHARE SWITCHER

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LIKE GETTING YOUR MONEY FOR NOTHING AND YOUR CHECKS FOR FREE



Make Money the Easy Way — Put either SPOTMATIC JR.™ or LIL MONEYMAKER™ to work for you now. They are the lowest-cost tools you can use to automatically insert local ads into cable TV programming. You have one unit controlling one VCR to put ads on one channel. Equipment overhead is very low.

Switching occurs during the vertical interval for broadcast quality transitions. Once the system is programmed by the operator, it operates automatically.

The SPOTMATIC JR. has a built-in printer for verification records; however, both the LIL MONEYMAKER and SPOTMATIC JR. inserters connect easily to a LOGMATIC™ logging and verification system. With optional software, this enables computerized data retrieval and automated billing and report generation. Write now to see just how little it takes to get into automatic ad insertion.

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Does the high cost of monitor switchers have you behind the eightball? Then you need to

PUT AN EIGHTBALL™ UNDER YOUR MONITOR— 8x1 Very Low Cost Switcher



It is an integrated circuit-based monitor switcher featuring broadcast quality stereo audio and video switching. Lighted momentary contact pushbuttons are field-legendarily. Its cost is far less than any other comparable unit on the market. Write or call for information today.

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This ice is beginning to melt

Historically, relations between television broadcasters and cable system operators has been as icy as a mountain lake in the winter. But as the cable industry has begun to move in on broadcast's "turf" and address new challenges like passing stereo broadcasts, accommodating for high definition television and improving the education process for up and coming engineers, the two industries are slowly warming toward each other.

Clear evidence of that trend could be found at an open forum featuring broadcast and cable representatives in Denver recently. Organized by the Rocky Mountain chapter of the Society of Cable Television Engineers and sponsored by several industry vendors, the cordial dialogue centered around topics of parallel interest to both industries, including stereo, HDTV and co-education.

Perhaps of most interest to the 65 or 70 attendees was a presentation covering the latest HDTV developments, a subject discussed by Ken Skinner of North American Philips. Skinner noted the push for HDTV's development is being applied by the Japanese electronics manufacturers, who say they will have HDTV receivers for sale by 1991.

But just what is HDTV? There is no worldwide production standard yet agreed upon, although the Japanese and U.S. manufacturers both recommend the 1,125 line, 60-Hertz version invented by the Japanese, said Skinner. The Europeans prefer a 1,250-line, 50-Hertz standard. Although it's likely that the two production standards will co-exist, "there probably will never be a worldwide transmission standard" for HDTV, Skinner said.

In addition to improved resolution via higher pixel density, the HDTV standards call for fewer picture artifacts, digital hi-fi stereo sound, an aspect ratio of 16-to-9 and improved large screen display. However, all of those improvements force an increase

in bandwidth. Uncompressed, HDTV signals occupy 30 MHz of bandwidth vs. today's 6-MHz channels. The MUSE compression technique reduces the bandwidth necessary to just over 8 MHz, but even at that, two channels would have to be used to transmit one HDTV channel.

This can be accomplished in the same way that BTSC stereo is broadcast. By putting the essential information on one channel and the enhancement information on a second channel, HDTV would remain compatible with the huge installed base of NTSC receivers while those who choose to invest in a new HDTV receiver will receive the full signal, said Skinner.

But even if HDTV doesn't take off right away, we'll still see improved pictures via the newest NTSC TVs, Skinner said. Scan converters are being used to reduce or eliminate artifacts, frame comb color decoders eliminate cross color and dot crawl, recursive filters reduce noise and increased horizontal color resolution is achieved through an I,Q color demodulator. Studio improvements are also being made. Progressive scan sources offer 525 lines per field, spot size is reduced and signals are being generated in a digital form and held in that configuration longer before being converted to analog.

Also, Tom Piper of KCNC-TV led the group on a slide show tour of his station. The NBC affiliate has been broadcasting a significant portion of its local origination programming in stereo since February 1985. For programming available only in mono, the station synthesizes stereo with comb filters, Piper said. SAP is mostly "on the back burner for most people," he added.

Of note was Piper's comment about reception and transmission of signals via Ku-band satellites. The Denver station was the prototype of the Ku system and in three years there has only been two fades, both caused by hailstorms.

During the panel discussion portion of the program, Frederick Baumgartner, manager of technical operations at KWGN-TV in Denver, called for more interaction and knowledge sharing between broadcast and cable engineers. He suggested that SCTE chapters have

joint meetings in those cities where the Society of Broadcast Engineers also has a chapter, an idea advanced by Ron Hranac of Jones Intercable. Hranac said he would suggest that the SBE be allowed to make a presentation during this year's Cable-Tec Expo in San Francisco. "I'd like to try to knock down some of these barriers" that exist between the cable and broadcast communities, said Baumgartner.

Tom Elliot, director of research and development at Tele-Communications Inc., renewed his plea for more stringent A/B switch isolation standards. Elliot reiterated a need for 90 dB of isolation because, according to tests done by TCI, the switches deteriorate quickly through use.

The SCTE met major milestones recently in terms of growth and technical training. With the formation of five new meeting groups, there are now a total of 40 chapters and meeting groups in existence across the country. The new groups include: the Southeast Texas Meeting Group of Houston; the North County Meeting Group of Minneapolis/St. Paul, Minn.; the Tennessee Meeting Group of Nashville; the Four States Meeting Group of Miami, Okla.; and the Upstate New York Meeting Group of Rochester, N.Y.

Additionally, eight former meeting groups have been elevated to full chapter status. These new chapters are: the Cactus Chapter of Glendale, Ariz.; the Caribbean Area Chapter of Hato Rey, Puerto Rico; the Great Lakes Chapter of Palatine, Ill.; the Greater Chicago Chapter; the North Central Texas Chapter of Dallas; the Razorback Chapter of Jonesboro, Ark.; the Tip-O-Tex Chapter of Harlingen; and the West Texas Chapter of Big Spring, Texas.

Examinations covering the sixth and final category of the SCTE's BCT/E certification program were administered during the Eastern Show. With this final test on "Terminal Devices," the program has now been completed. "It is extremely gratifying to see this program, which may be considered a substitute for the FCC's discontinued first class license examinations...finally meet fruition," said SCTE Executive Vice President Bill Riker.

—Roger Brown

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THE 1987 WESTERN CABLE SHOW



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For the National Cable Industry

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- Join over 8000 cable industry leaders
- **Act Now!** Deadline for Advance Registration is November 13, 1987. For registration and housing forms call: The California Cable Television Association (415) 428-2225, extension 7



Stereo encoders and decoders

Up until recently, people who watched television were really only interested in one thing getting a good picture. Now, however, with the advent of BTSC stereo, audio quality has begun to take on new significance.

The Electronic Industries Association forecasts that 4.3 million TVs, nearly one-fourth of all the color receivers sold in 1987, will be equipped with built-in stereo compatibility. In fact, stereo may be responsible for the record pace of color TV sales. Of the 8.8 million sets sold in the first half of this year, 1.6 million were stereo units. Total sales are up 8 percent over the first half of 1986, when sales hit a record 18.1 million units annually.

Now that cable operators have the freedom to price their product at levels the market will bear, those operators nonetheless often enhance their product to give subscribers added value for each price increase. Now that many have already instituted expanded channel lineups with the last increase, many are looking at adding stereo capability for the next one.

To deliver stereo signals over a cable system, stereo encoders are used to convert locally generated and satellite signals into the BTSC format. One encoder is needed for each stereo channel. At the other end of the system, in the subscriber's house, a stereo-compatible TV or VCR is needed to provide true stereo reproduction. For those people who have monaural TVs and VCRs, low-cost decoders, also called adapters or sidecars, are available.

Listed below are the manufacturers of stereo encoders and decoders:



Cabletenna's SR-234 decoder

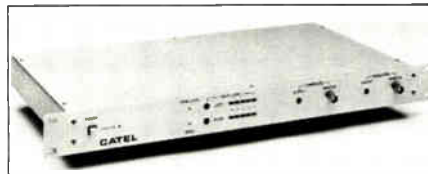
Cabletenna

A major OEM for a variety of products sold under the Unika moniker, Cabletenna has marketed its

products to the cable industry for the past eight years. Two stereo decoders are offered and two remote converters with built-in stereo decoders are also available.

Decoder models SR-234 and SD-20 offer true Hi-Q multiplex stereo. They also feature direct access via cable converter channels 3 or 4 or the VCR/TV MPX output; stereo left and right audio outputs; automatic stereo or SAP operation; automatic simulated stereo capability; and a Hi-Q video output for a color TV monitor. An LED indicator shows when stereo programming is being received and a spatial button on the front of the units increases audio clarity.

Converter models STV-140 and MR-702 can tune 140 and 72 channels, respectively. Each offers a built-in stereo decoder and a wireless remote control. For details circle Reader Service number 87.



Catel's VS-2000 stereo generator

Catel

Catel's TVS-2000 stereo generator generates BTSC stereo from baseband left and right audio. The audio is properly matrixed, encoded and modulated for true stereo transmission with full monaural capability. Primary signal requirements are a video loop through and left and right audio signals. It is available with either a baseband composite output for direct input to a stereo compatible modulator or a 4.5 MHz modulated output for application to either a modulator equipped with an aural separator or for transportation applications.

The front panel contains dual left and right channel LED modulation meters, and input and output level controls. Status indicators include power on, sync lock, and mono operation. Frequency response is listed as greater

than ± 1.0 dB from 50 Hz to 13 kHz and no more than -4.0 dB at 15 kHz. Main channel distortion is less than 0.5 percent from 50 Hz to 15 kHz. Separation is greater than 30 dB from 100 Hz to 8 kHz, declining to better than 20 dB at 14 kHz and better than 26 dB at 50 Hz. For details, circle Reader Service number 88.

CONVERTER & LINE EQUIPMENT REPAIR CONSUMER ELECTRONIC BROKERAGE SERVICE

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VICE-PRESIDENT SALES

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Chicago, IL 60646
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2446 Palm Drive
Signal Hill, CA 90806
213-424-9253

SERVING THE ELECTRONICS INDUSTRY

Chicago Trade Corp.

The Chicago Trade Corp. develops and markets decoders, models MTS-8610 and MTS-8700. Cable Business Associates services the decoders with more than 1,000 authorized repair facilities across the country, providing both warranty and repair work. The decoders, distributed by Burnup and Sims, are an amplified model (MTS-8610) and a non-amplified model (MTS-8700). The amplified model offers dbx noise reduction circuitry; SAP; auxiliary and MPX jacks; an external speaker terminal and a stereo headphone jack. Controls on the front of the unit include balance, bass and treble, power and volume. Frequency response (3 dB) is listed at 25 to 20,000 Hz; stereo distortion (1 μ V RF input at 1 kHz) is 0.8 percent and separation is 30 dB.

The non-amplified version also features dbx decoding; SAP; MPX; an MPX adjust control; and audio output (L/R). Just five pushbuttons, including power, appear on the front of the 8700 unit, which also offers the same frequency response, distortion and separation specs as the amplified model. For details circle Reader Service number 86.

"The 'universal' remote unit was taken one step further by Universal Remote Systems."
Communications Engineering and Design

The Universal *Difference.*

The difference in universal remote control units is **UNIWAND**. The state of the art, user friendly, programmable hand controller. The **UNIWAND** eliminates remote clutter, simplifies subscriber operation and will never become obsolete.

Audio/Visual Compatible

The **UNIWAND** enables the subscriber to control any product including CATV converters, pay per view services, all VCR's, all CD players and all TV's manufactured with IR remote capability. The **UNIWAND** can control up to eight completely different devices at one time!

Latest Technology

The **UNIWAND** is manufactured under the most recent state of the art manufacturing techniques including surface mount technology. The database is updated continuously as new codes are implemented by the manufacturers. It has the capability to control most special features such as split screens, remote color and tint controls available on the latest consumer electronic products.

Never Obsolete

The **UNIWAND** is the simplest and most cost-effective reprogrammable universal remote. This unit is programmed via an IBM PC or compatible computer to include any future advancements in technology. If a subscriber should purchase an entertainment product that was not available at the time he/she received the **UNIWAND** remote, the controller can be updated at the cable office or any one of the 820 CBA service centers nationwide. This feature will insure that the **UNIWAND** will never become obsolete as product lines change.

The RS 232 port built into the back of the **UNIWAND** enables its updated data library to control the latest products available!



MacroKeys

One button macro keys allow multiple functions to be stored and implemented by pressing a single keystroke. This feature allows the subscriber to access a chain of command for frequently repeated functions.

Consumer Friendly

The **UNIWAND** is a quick learner! Its extended database eliminates the need for extensive and time consuming learning modes. By pressing no more than 4 pushbuttons, the **UNIWAND** searches and locks into the proper code of the device to be controlled within seconds. The color coded keys are easy to read and easy to use. The subscriber can operate the **UNIWAND** by learning just a few simple steps.

The **UNIWAND** is a truly different universal remote. This very affordable unit will soon become the standard for the industry. To get all the facts about **UNIWAND**, call toll-free 1-800-422-2567 or (303) 694-6789 today!

**UNIVERSAL REMOTE
SYSTEMS, INC.**

A division of Cable Exchange, Inc.

Also available from Burnup & Sims, (303) 694-6446

General Instrument's Jerrold division offers the Commander MTS stereo encoder for use in any headend.



STEREO PRODUCTS
for
CABLE TELEVISION

3877 South Main Street,
Santa Ana, California 92707

Phone 714/979-3355

FM Systems

The FMT633 stereo multiplexer and modulator accepts stereo or mono signals from audio baseband or demodulated subcarrier sources and converts them to 4.5 MHz or 41.25 MHz outputs. A built-in stereo synthesizer converts mono TV audio to synthesized stereo. Dynamic Noise Reduction is also built in and provides up to 14 dB improvement in audio signal-to-noise ratio. The FMT633S can transmit SAP when connected to the FMT631SAP modulator. Up to three modulators can be placed in a single PMS600 mainframe, which allows operators to offer three stereo channels in the same rack space that others take with one channel. For details circle Reader Service number 89.

ISS ENGINEERING INC. CATV Products

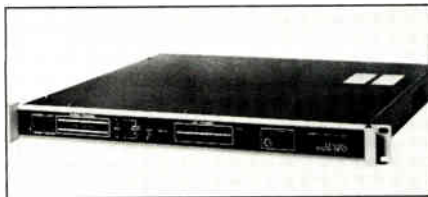
434 WESTCHESTER DR.
BIRMINGHAM, AL 35215
(800) 351-4477
(205) 853-6919
TELEX 383524

John Coiro
Vice President
Sales

ISS Engineering

The Model GL-2020 is a stereo encoder utilizing the dbx noise reduction system that offers 4.5 MHz and 41.25 MHz outputs. Frequency re-

sponse is listed as ± 1.5 dB at 12 kHz; -3 dB at 15 kHz. Distortion is 0.5 percent typical. Separation is 26 dB typical when used with GL-2610 modulators. Tone calibration is switchable on/off; mono audio input and ore-emphasis is added when in operation in the mono mode; stereo bypass control through barrier strip terminal block from VideoCipher normal open contacts puts it in the stereo mode while the closed connection puts it in the mono mode. For details circle Reader Service number 90.

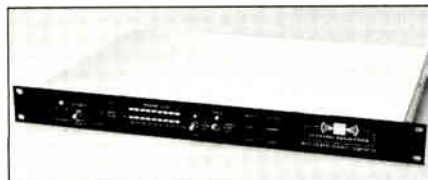


Jerrold's Commander MTS encoder

Jerrold

General Instrument's Jerrold division offers the Commander MTS stereo encoder for use in any headend. The Commander will encode both stereo and SAP into BTSC sound for delivery to subscribers. The unit features 4.5 MHz and 41.25 MHz outputs for maximum flexibility and SAP for bilingual transmission. A unique feature is the unit's automatic non-clipping overmodulation protection. It provides front panel access to all audio input level controls and includes bar graph indicators on the front for left, right and SAP channels that show true peak deviation metering of incoming audio signals.

Frequency response for left and right (50 Hz to 14.5 kHz) is ± 1 dB. Separation is greater than 26 dB from Hz to 100 Hz; better than 30 dB from 100 Hz to 8 kHz; and greater than 26 dB from 8 kHz to 14.5 kHz. For more details, circle Reader Service number 91.



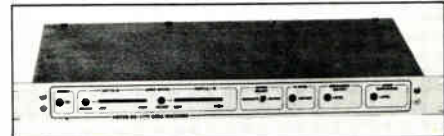
Leaming's MTS-2B generator

Leaming Industries

Leaming's MTS-2B and MTS-2A

stereo generators encode satellite or local programming into the BTSC format using dbx companding. A true automatic gain control is built-in to reduce the audio level adjustment routine from the technician's schedule. There are two pairs of left and right inputs (A and B; adjustable from the front panel) which may be selected by local or remote control. The built-in stereo synthesizer may be used with mono services or local ad insertion. A Bessel-null test tone generator is included to help set the deviation more precisely. Both 4.5 MHz and composite baseband outputs are provided with 41.25 MHz provided as an alternative to 4.5 MHz.

Frequency response is typically flat to 15 kHz. The MTS-2 also now offers a choice of L/R LED (MTS-2B) or VU-type (MTS-2A) metering. Overall frequency response is 20 Hz to 14.5 kHz ± 0.5 dB. Distortion is 0.5 percent maximum and separation is greater than 26 dB. Front panel controls include input levels; A/B input switch with remote position; AGC on/off with remote position; stereo/mono/test switch; video-audio sync phase; and 4.5 MHz carrier level. For details circle Reader Service number 92.



Nexus SG-1/TV stereo generator

Nexus Engineering

The Nexus SG-1/TV BTSC stereo generator provides video baseband and a 4.5 MHz stereo audio subcarrier output. Front panel indicators monitor either input audio levels or the output matrix levels, allowing accurate field set-up without costly measuring equipment. Other features include a sound notch on the video loop-through to eliminate interference; front panel LED indicators for power and H-sync lock; dual 10-segment LED audio level indicators; and switch selectable matrix/discrete input level monitoring.

Frequency response for the SG-1/TV is listed as 50 Hz to 14 kHz ± 2 dB. Distortion is less than 0.5 percent maximum at 1 kHz and separation is

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The Leaming MTS-2B BTSC Stereo Generator



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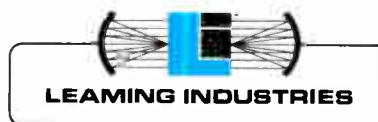
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Reader Service Number 45

Recoton markets its family of stereo TV decoders under the name FRED and offers three different units.

greater than 30 dB from 100 Hz to 8 kHz; better than 26 dB from 50 Hz to 100 Hz; and greater than 20 dB from 8 kHz to 14 kHz. For details circle Reader Service number 93.

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Long Island City, New York 11101
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1-800-223-6009
Fax: (718) 784-1080
TELEEX 236047 RCTN UR
CABLE: RECOTON NEW YORK

RECOTON®

Paul Perez, Director of Marketing

Recoton

Recoton markets its family of stereo TV decoders under the name FRED (for Friendly Recoton Entertainment Decoder) and offers three different units. FRED I/V622 is designed for use with self-powered speakers or a home stereo system and features dbx and DNR noise reduction. A stereo probe (antenna) is attached to the TV or VCR and receives the signals the TV radiates as it processes a broadcast through its IF circuitry and sends it to the box to decode the stereo channels. Other features include a spatial expander and automatic stereo synthesizer. Dual stereo audio line outputs permit playback through a stereo system while recording on a stereo VCR.



FRED III/V624 decoder

FRED II/V623 adds instant hookup capabilities to channel 3/4 cable converters and SAP capabilities. And FRED III/V624 is an amplified version of the decoder, allowing a viewer to enjoy stereo audio without a separate

stereo system. A built-in 12 watt amp with separate volume, balance, bass and treble controls is included. For details circle Reader Service number 94.

Scientific-Atlanta

The Model 6380 stereo encoder utilizes dbx noise reduction. All major controls and indicators are located on the front panel (including power, video lock, sum peak, SAP carrier, alternate SAP, calibration tone, alternate mono and alternate mono overdeviation). Factory preset levels for subcarrier modulation eliminates field set-up errors. A built-in calibration test tone allows simple set-up of the deviation of the TV modulator. Options include SAP channel, dual audio demodulator, and a 4.5 MHz subcarrier modulator.

Frequency response of the left or right channel is ± 1.0 dB from 50 Hz to 14 kHz; distortion is less than 0.5 percent and separation is greater than 26 dB minimum. For details circle Reader Service number 95.



Wegener's 1602-95 encoder

Wegener Communications

The heart of Wegener's system is the Model 1791-02 stereo modulator. It is a two-card set which plugs into any Wegener mainframe. The 1601-56 BTSC encoder system incorporates up to four stereo encoders in a single mainframe while the 1602-95 encoder is a low-profile single unit configuration. Both feature balanced, terminal strip inputs with 4.5 MHz subcarrier, composite video and audio baseband outputs.

Frequency response is listed as ± 0.5 dB from 50 Hz to 14 kHz. Distortion is less than 1.0 percent and separation is greater than 26 dB from 50 Hz to 100 Hz; better than 30 dB from 100 Hz to 8 kHz; and more than 26 dB from 8 kHz to 14 kHz. For details circle Reader Service number 96.

CHARLES EISSLER
VICE PRESIDENT, SALES
CABLE PRODUCT DIVISION
(312) 699-2110
TELEX NO. 25-4396
TWX. 910-233-2390



ZENITH ELECTRONICS CORPORATION
699 WHEELING ROAD
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Zenith

Zenith's Model ST-SD sidecar decodes MTS TV stereo and SAP. The unit has two audio outputs, a line level for connection to a VCR or external stereo components and internally amplified for use with speakers. It accepts input from RF converter channel output (channel 2 or 3) or 4.5 MHz intercarrier. The output volume can be controlled via a Zenith remote transmitter.

Frequency response is listed as 20 Hz to 13 kHz (+1 -3 dB). LED indicators show power on, stereo and SAP signal presence. For details, circle Reader Service number 97.

In the September issue of *CED*, the Product Profile of plain vanilla converters inadvertently overlooked Cabletenna, an OEM of Unika converters. Cabletenna offers a full line of plain converters, including the following:

The SC-60R has 60-channel capability, a 15-button wireless remote unit (including fine tuning and power on/off), synthesized tuning and a large LED display.

The VC-68 offers 68-channel capability, full remote control including volume and channel selection, parental control, favorite channel memory and microprocessor controlled PLL tuning.

The MR-702 offers 72-channel tuning ability, while the VC-140 can tune 140 channels and has remote volume control, parental lock-out and channel selection. The top of the line is represented by the STV-140 which is a remote converter with a built-in stereo decoder. For details, circle Reader Service number 98.

—Roger Brown

CATV services marketplace

Harold Bigham
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Bigham

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Reader Service Number 38

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Reader Service Number 40

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Reader Service Number 41

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Reader Service Number 44

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PPV systems, decoders among product roll-outs

Scientific-Atlanta finally took the wraps off its long-promised integrated pay-per-view system during the Eastern Cable Show. Slated for first delivery in December, the Model 8585 set-top converter/descrambler integrates the PPV circuitry within the terminal, making it unnecessary to attach a sidecar unit. Besides the aesthetics, S-A officials tout the added security that the integrated circuit provides. Operators can pre-determine the cost of programs, the amount of free preview time permitted and the number of channels offered. For details circle Reader Service number 99.

Zenith Electronics introduced its first integrated receiver/decoders for TVRO use. Both systems, Model ZS-5000 and stereo Model ZS-6000, contain a built-in VideoCipher II and electronic antenna positioners. Both are about the size of a VHS VCR. Both units are compatible with Zenith's Space Command remote control, feature on-screen displays and can receive up to 24 C-band channels and up to 32 Ku-band channels from up to 36 satellites. For details circle Reader Service number 100.

The first of a new line of IRDs carrying the C. Itoh brand was introduced by DX Communications at the SBCA Show. The new remote control Citation 900, with built-in VCIL, features an internal east/west antenna positioner. Antenna position is shown on a display which also shows channel, Ku-band frequency and C-band fine-tuning frequency. The unit permits scanning of 24 fixed C-band channels and up to 40 Ku-band and V/H programmable channels. For details circle Reader Service number 101.

Texscan MSI Corp. has introduced its new ComSertter 192 commercial inserter. The SCR-192 incorporates all the features of ComSertter 92 and adds full stereo VCR compatibilities, CMOS non-volatile memory and simplified tape marking. An auxiliary source input and preview-before-air features

have also been added.

Additionally, the company has completed a fully integrated software package for the commercial insertion product line. ComSert 2000 series incorporates full traffic and billing software and accommodates both the single-system operator and the large multi-system network. Finally, Texscan introduced a new product line for economical cross-channel and tune-in promotion insertion into local avails. The XCP automatically inserts promos on up to four channels with just one tape deck. Network breaks are played first-come, first-served and promo spots run sequentially. For more details circle Reader Service number 102.

Dickel Communications has intro'd its CMS-1 character generator. A powerful modified Radio Shack computer with 64K memory, the system features 60 pages, four character sizes, 12 color options, variable page sequence, variable dwell time, crawl lines, splash lines, battery back-up, remote communications and more. For more details, circle Reader Service number 103.

Pilot versions of Electronic Publishers' cable classified ad system, The AdMaker (formerly released as Cable-Show 2000), debuted at the Eastern Cable Show. The digital photography based system allows test editing at any time, full tracking of ads, production of billing documents, ad verification and management reports on demand. For more details circle Reader Service number 104.

Pico Macom announced the Model MPA-25 mast mounted preamplifier that enhances antenna performance, broadcast signal strength and television picture quality. Out-of-band interference filtering prevents picture degradation caused by reception of adjacent RF transmissions. Switchable FM traps prevent FM interference, too. The unit has been designed for home antennas, particularly those in fringe areas. For more details circle Reader Service number 105.

The Miralite 3.7-meter antenna from International Communications Associates is capable of multi-satellite reception with the Multisat retrofit and C-and Ku-band reception with the Multiband feed system. The unit has patterns on file with the FCC for

transmission at Ku-band. For more details circle Reader Service number 106.

An advanced digital time base corrector from FOR-A Corp. of America handles any analog component, Y/C dub or composite signal and provides full transcoding interface capabilities, including encoding and decoding. The FA-450 NTSC model offers full-frame TBC performance and is compatible with a range of studio equipment. It features full-frame correction, color picture freeze, dropout compensation and dynamic tracking.

Also, the TCR-3300 timecode reader offers auto or manual selection of longitudinal timecode and vertical interval timecode from still to 110 times normal speed. For details about either product, circle Reader Service number 107.

Pico Products introduced a complete C/Ku system and accessories at the SBCA Show. The new Dual TEN C/Ku 10-foot mesh antenna features 18 rib supports. It has a C-band gain of 40.7 dB and Ku-band gain of 46.5 dB. Efficiency is 70 percent and 32.2 percent, respectively. Also, a compact 2.0 dB Ku-band LNB and 400 MHz to 1500 MHz electronic A/B switch were unveiled. For details, circle Reader Service number 108.

A new field strength meter and RF distribution system analyzer was introduced by Sencore Electronics. The portable FS74 Channelizer Sr. has one-touch frequency offset. It also allows analysis of the audio/video ratio, on-channel auto signal-to-noise ratio testing, hum level testing, signal quality check and a host of others. For more details circle Reader Service number 109.

Two new members have been elected to the board of directors of C-Cor Electronics. Drs. Jack Strange and James Tietjen will fill vacancies created over the past year. Strange is director of DuPont's Electronic Materials Group; Tietjen is president and COO of the David Sarnoff Research Center (formerly RCA Laboratories).

Marcia Larson has joined Warren & Morris as a national accounts manager. She was previously regional sales manager at CableVision magazine.

—Roger Brown

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Another key factor influencing the decision to use the system was its ability to grow and expand.

Continued from page 50

reads its directory. Hence, it knows the exact "in" and "out" points for each spot. The operator is informed well before airtime if the wrong tape has been placed in the machine. This feature alone has virtually eliminated a major source of control room error.

Embedded in the standard software package is an extensive series of self test diagnostic features. Each component of the system can be interrogated via a functional test from the computer's keyboard. The tests check computer memory, storage, time clock and communications ports. In addition, they can exercise all tape machine functions and isolate any faults in an organized and efficient manner. Using the diagnostic software has streamlined our troubleshooting procedures and introduced an element of logic and rigor to what often turns out to be a hit-or-miss procedure.

Another key factor influencing the decision to use the system was its ability to grow and expand. Additional channels and tape machines may be brought on-line by adding computer cards to the machine control unit. If a large number of channels is required, several systems may be networked together to achieve that goal.

Additional headends may be linked to the interconnect by simply entering them into the central billing database. As these headends receive their schedule, the local control equipment switches back and forth between program and commercial.

Bringing the new equipment into a cable headend is a relatively painless operation. The system is fully rack-mounted. A technician arrives on location and sets cables for the machines and switcher. By using the self diagnostics, the equipment is brought through a final check-out procedure. That activity is followed by a comprehensive train-

ing program for the operators.

Automating a cable interconnect is a serious undertaking. To do so requires a well-planned approach supported by technology which is dedicated to the cable and broadcast fields.

The key to taking advantage of the burgeoning interest in advertising on cable TV is providing a quality service to the advertising clients and the cable companies themselves. Allowing advertisers to choose exact times and programming for their orders as well as the ability to select individual headends provides the flexibility needed to support the ad sales staff.

A broadcast-quality product with simple master control room functions and automatic data transfer brings cohesion to the daily traffic and scheduling process. When all of this is tied together with a cable oriented accounting system, we finally have the product we need to maintain our leadership in the cable advertising world. ■

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T4+ also features a full wall seamless construction. The aluminum sheath is continuously extruded, not welded or fused, eliminating the possibility of pinholes and wall thickness irregularities. This con-



T4+ requires no special coring tools.

struction provides increased protection against moisture ingress and signal leakage, which improves reliability and extends life.

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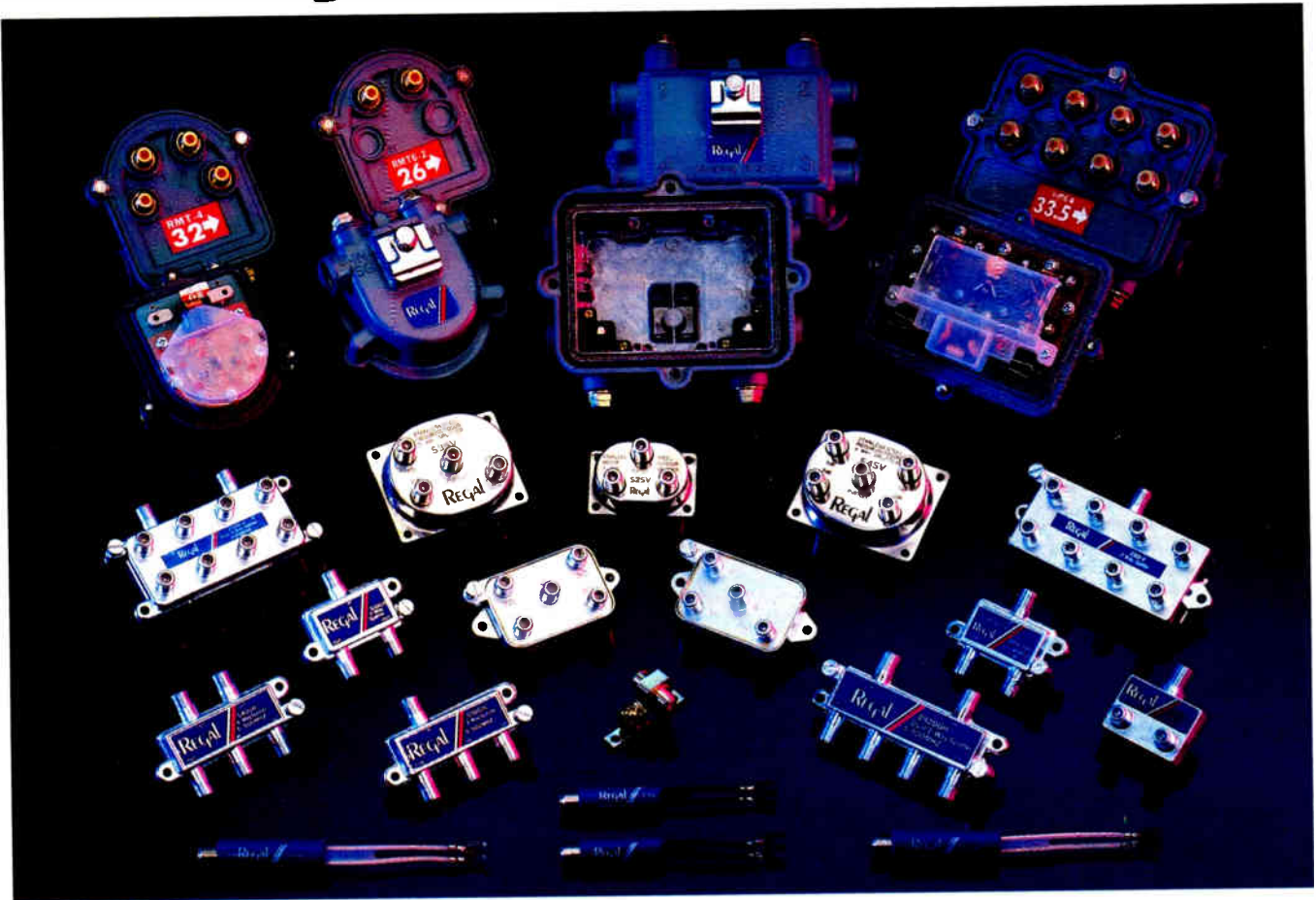
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