CED

THE MAGAZINE OF BROADBAND TECHNOLOGY / OCTOBER 1988

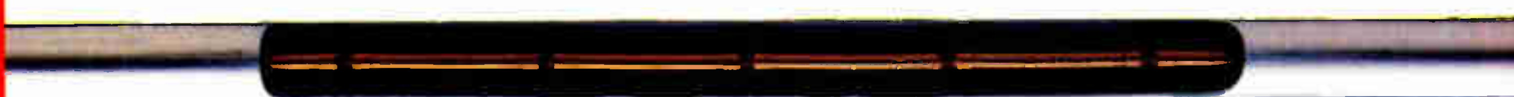
Set-top converters: Repair or replace?

Addenda to NCTA Interconnect Guide

Anixter reveals its new AM fiber optic system


Impressive Inventory

ALL GUTS = SUPERIOR ATTENUATION



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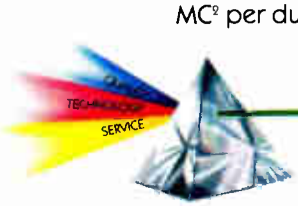

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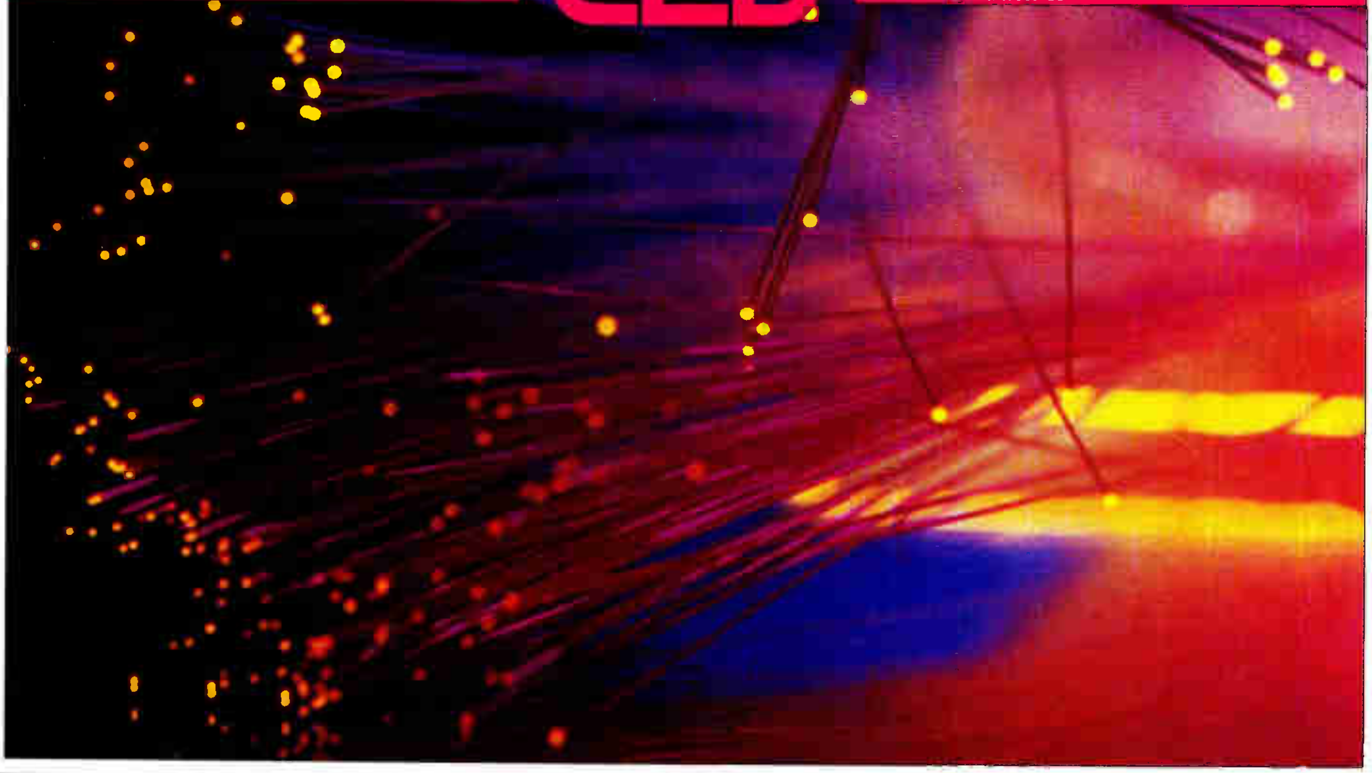

About the Cover:
The pace of development in the fiber optic marketplace is accelerating so fast it's hard to keep up. News this month from Anixter and ATC are examples of what's happening. Photo by Dominique Sarraute for The Image Bank.

DEPARTMENTS

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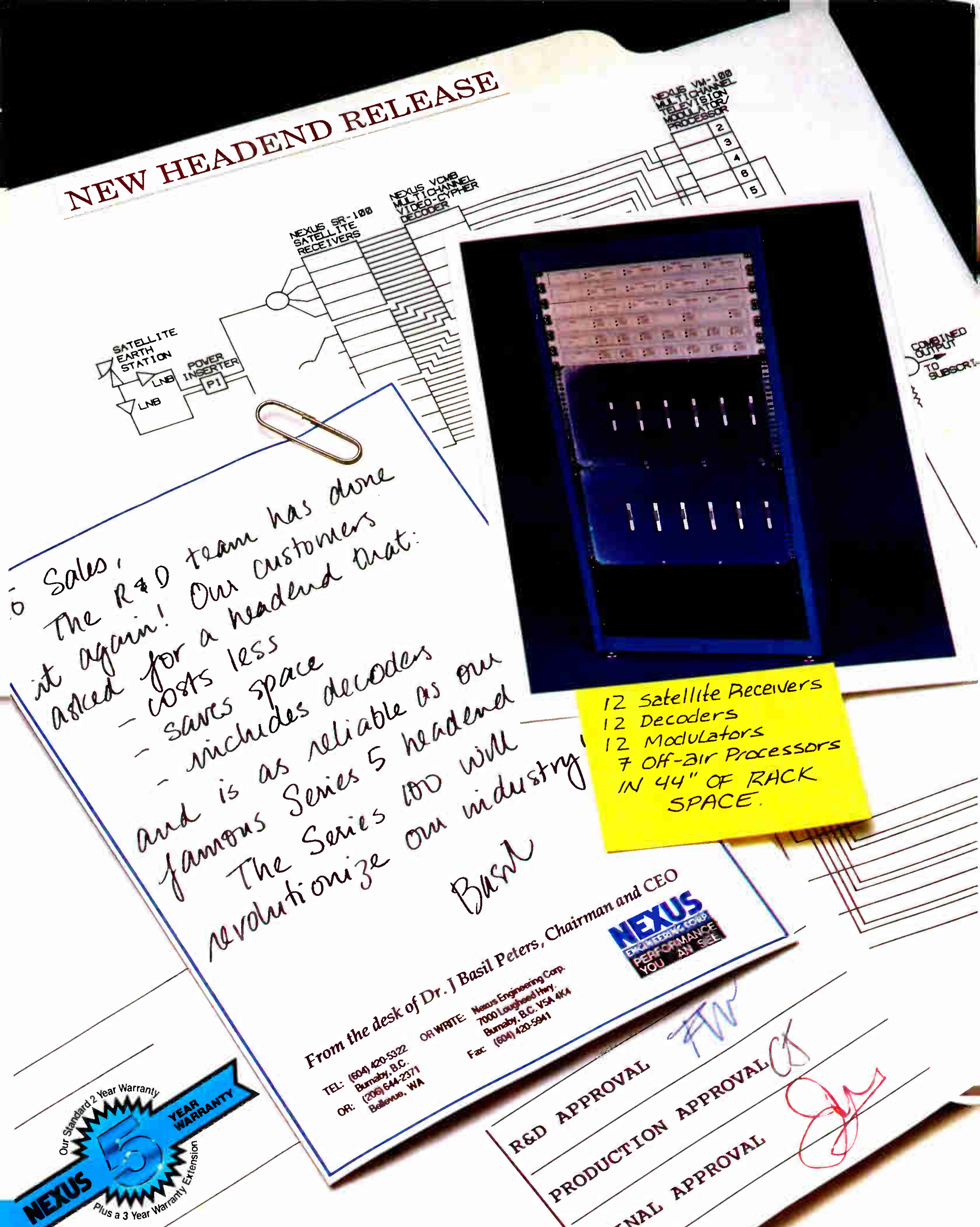

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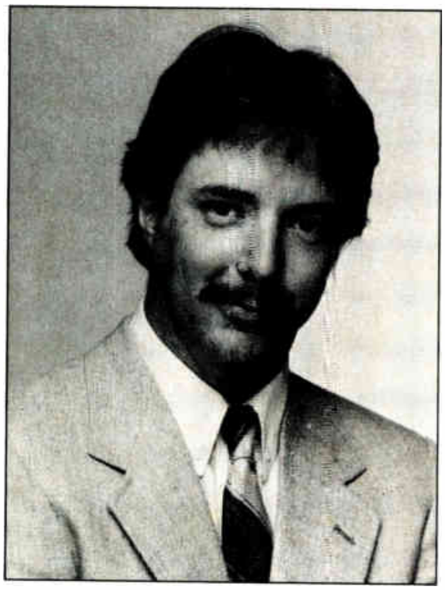


Perez had effect that will be missed

It isn't often that someone outside the CATV engineering community has such a profound effect upon so many of the industry's forward thinkers that he changes the way they look at their competition. It's even more rare when the person who makes that impact is, essentially, a salesman.

Paul Perez was an audio and video products sales expert second to none. But he was more than that; he gave leading cable engineers their first look at such up-and-coming products like Super-VHS, high definition television, Surround Sound and a host of other consumer electronic "toys." What's most surprising about that is that he didn't have to; he sold products to the general public, not cable operators. But as director of marketing for Recoton, Perez was motivated to give consumers better pictures with better sound and knew they'd pay for it.

Unfortunately, this great motivator and visionary was lost forever when he suffered an apparent heart attack and died in a London, England hotel room on Sept. 5. He deserved better, and he deserved more time to get his message across. He was just 36 years old.

A proud man

The gravel-voiced Perez was proud of his success as a salesman (for an in-depth look at Perez thoughts and experiences, see "Spotlight" in the April 1988 issue of *CED*) and the fact he "made it" in the world outside of East Los Angeles, his birthplace.

"He had more drive than anyone I've ever met," says Wendell Bailey, vice president of science and technology at NCTA. "He talked the cable TV industry into paying attention to Super-VHS. He convinced us better pictures were coming sooner than we thought; and that was extraordinary because he wasn't selling (products) to the cable TV industry."

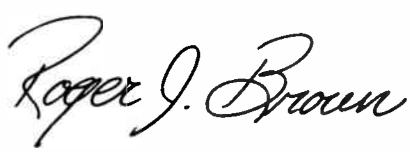
Perez was truly an "electronic eccentric," says Robert Borchardt, Recoton's president and Perez' boss for the past six years. "He had an intelligence that bordered on genius and he often went out of his way to give information to anyone who needed it."

Perez' charm and personality will be sorely missed by the engineers throughout the industry who respected his opinions, says Bailey. His activism, which often sparked interest and debate in a wide number of areas, will not be forgotten for years to come.

Awarding excellence

As part of our effort to recognize outstanding effort put forth by cable technical personnel, we are putting out the call for nominations for what we have deemed our "Passion for Excellence Award." Do you know or work with someone who is committed to excellence in the workplace? Send the person's name and phone number, along with a brief explanation of what this person has accomplished and we'll consider awarding him.

What we'll be doing, on a monthly basis, is publishing the person's photo and a brief writeup about the person. What we hope to do is give a little recognition to system-level persons who are committed to doing a good job all the time. See page 98 for full details about how to make your nomination.



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David Fellows

Fellows anchors S-A's fiber team

In the world of competitive sports, it's often said that the one thing that puts one athlete ahead of another is mental strength. "Mental toughness"—the ability to remain focused on the task at hand while ignoring any physical impediments— can mean the difference between a first-place finish and just plain finishing.

If that same spirit and attitude spills over into the business world and becomes the criteria to decide who wins and who loses, it will be difficult to bet against Scientific-Atlanta and David Fellows.

The rangy Fellows has been at S-A for about 18 months and was recently given the lengthy title of director of marketing for distribution and headend/earth station products in the Broadband Communications Business Division. What all that means is that Fellows is responsible for deciding what products cable operators need most and providing those products.

Olympic medalist

But he does more than that. With a dozen years of experience in both fiber optics and telephony, Fellows will provide Scientific-Atlanta with a strategic perspective that will become more important as the telco and fiber issues get even hotter over the coming months.

And he knows what competition involves—he has medals from past Pan Am Games and Olympic Games.

Fellows received his education in the Northeast and holds sheepskins in applied physics and electrical engineering from Harvard and Northeastern, respectively. In 1976, he began his career as a research scientist at GTE Labs. At that time, three research efforts were underway: high-frequency (Ku-band and Ka-band) satellites, fiber optics and digital telephone. He joined, and eventually led, the latter team. His group's work led directly to Integrated Services Digital Network.

He was later assigned to GTE's corporate headquarters and worked on the company's response to the breakup of the Bell System. In 1983, Fellows went to GTE Lenkurt in the transmission products division as vice president of research and development. While there, he oversaw production of GTE fiber optic products, analog-to-digital media, digital microwave research, and even a single-channel, point-to-point analog fiber optic system.

More marketing oriented

Soon thereafter he became less of a scientist and more of a businessman when he was named vice president of technology. Suddenly, he became more interested in the marketing side of the hardware business. Then, in late 1985, Lenkurt was purchased by Siemens, becoming Siemens Transmission Systems.

Fellows' first taste of the cable industry came in the spring of 1987 when he joined S-A's satellite group. By using his computer communication background, Fellows helped put the company in the VSAT data business. While doing that, he consulted Perry Tanner and Steve Havey of S-A's Broadband division on where to go with fiber optics.

"I understand what ISDN is and what Broadband ISDN is and how various telephone companies are viewing themselves as the bandwidth supplier of the local loop," says Fellows.

So what's his view on the state of fiber optics and its use in CATV? Arguably much more conservative than some of his competitors. "From 12 years of watching fiber...(I think) less is going to happen in the next year than you think and more is going to happen in the next five years than you think. People are just now trying to understand what (fiber is); they're not ready to commit to it on a full-scale basis.

"We had ISDN technology that worked 12 years ago, yet I don't know of any homes in America that actually have two B plus D (two voice/data channels and one signaling channel) coming into the house."

Is coax doomed?

One thing Fellows is not concerned about is that fiber spells doom for traditional coax components. "My view is that fiber will come, but I'm convinced...it will just be another technology in (a cable operator's) bag of tricks. You'll have push-pull, Power Doubling, AT, Feedforward and you'll have fiber. When you go to design or upgrade a system, you'll use fiber when it makes sense."

Fellows has two teams exploring fiber optics; one team each for AM and FM approaches. He wants to avoid introducing a "me, too" FM product and digital approaches are still too costly. Instead, S-A plans to field test an AM product in several systems in the next six to 12 months, Fellows says. "I think FM products will find a niche in supertrunking and perhaps AML augmentation, but in order to revolutionize the way cable signals are distributed, you need an AM system."

That kind of thinking might be counter to some people's thoughts, but Fellows is used to rowing against the tide. He has captained seven U.S. rowing teams (capturing a bronze medal in the 1976 Olympics, a silver in the 1975 Pan Am Games, and his Harvard team was undefeated), has run across the Grand Canyon "for fun," yet is committed to his family and career as well.

What about the future?

When will fiber go to the home? Fifteen years, says Fellows. What about competition from the telcos? "They know the digital switched world, but cable operators have learned to be real competitive because people don't *need* to buy their service." Will AM delivery work? Probably, but a lot of work has yet to be done to make it a proven delivery mechanism.

All of that adds up to a lot of uncertainty—and a lot of work for Fellows. But he's undaunted. After all, competition is in this man's blood. ■

—Roger Brown

Competition

CATV, as it was known 40 years ago, has always lived with competition. Originally, in places where TV could only be received on the hilltop or mountain ridge outside of town, it provided the only realistic way for anyone to get TV, and the price per viewer was well below that of the chief competitors, the movie theaters and drive-ins. Almost everyone hooked up to cable TV.

When one or more TV stations came to town, CATV had to compete with roof-top antennas or rabbit ears which were very much cheaper than a cable connection. Then, it was discovered that more than half the people were satisfied with what was available on antennas. Breaking the 50 percent penetration barrier has been difficult. So, cable tried to compete by using microwave relay and elaborate antennas at great distances or on high, inaccessible mountain peaks to bring to customers programs that were otherwise unavailable.

Then came satellites

Then, in 1975, came the dawn. For the first time, HBO relayed movies, by satellite, to cable systems in Florida and Mississippi. But half of the homes passed still choose to view only the television programs they can receive on their own roof-top or rabbit ear antennas.

It is apparent that the major competition is still antennas. VCRs certainly take some of the play from premium cable TV; but you cannot watch the evening news, or Monday night football, or any real-time events on cassettes from the video store.

The classic strategy in competitive situations is to provide the quantity and quality of the product and service at a price that consumers perceive to be a good value. Inferior and overpriced products and services can only be sustained, against competition if at all, by extravagant advertising and marketing gimmicks.

Quality is suspect

The industry has done well as to the quantity of its product. No competitor can match it. It has not done so well with quality. Reception of local off-air signals near the extremities of the cable network, in many cases, is better on antennas than on cable. Extended service outages are still a major source of irritation.

Then, there is the threat of competition from the giant telephone industry. David has met Goliath before. One unidentified executive, close to telephone industry strategy, is quoted in CED's sister publication *CableVision* (8/15/88) as follows:

"Our problem is that if we depend on a POTS only (plain old telephone service) evolution to fiber, the CATVs will have taken advantage of the technology long before our networks are sufficiently evolved to permit installation of a broadband overlay. So, how much service revenue can we count on as a result of our offering advanced technology, if others are already there with that technology?"

Wish-list of features

David could not have dealt with Goliath without a slingshot. If the cable TV industry is to compete successfully, it is likely to need the following weapons:

- Deliverable signal quality equal to or better than available directly off-the-air, or directly from DBS satellites or MMDS or fiber telephone service drops, including ATV and HDTV.
- Elimination of the need for an intrusive set-top converter/descrambler that conflicts sharply with the user-friendly features of modern TV sets.
- Continuity of service approaching that of present-day telephone service.
- Rate schedules that allow the subscriber greater freedom of choice among the programs offered.
- Effective marketing.

The signal quality requirement must include not only whatever Advanced TV (ATV) standards are eventually adopted for broadcasting, whether terrestrial or DBS, but also the standards, *de facto* or mandated, by which high quality videotape cassettes or discs find public acceptance in the marketplace. It is hard to imagine any way to deal with this issue without resorting to optical fiber technology. Sooner or later, it may be feasible to replace VSB/AM transmission with FM, or even digital, in order to take advantage of much greater transparency. The IS-15 MultiPort is one encouraging approach to the elimination of the set-top converter/descrambler. Eliminating many trunk amplifiers, and limiting power line connections to the hubs in the hybrid fiber-coaxial networks can go a long way toward improving continuity of service.

Change is coming

The competitive situation is changing, and more change is ahead. No longer can cable TV claim to be the sole source of certain programs. Instead, the industry should concentrate on doing what it has claimed to be doing all along; namely delivering high quality video signals at reasonable cost. It can be done.

To succeed in the new environment will require new investment in plant improvement. For systems already prepared to rebuild in the next five years or so, or for systems recently rebuilt to 450 MHz or 550 MHz standards, the new investment is not likely to exceed $1,300 to $2,100 per total aerial plant mile for the ATC type fiber backbone retrofit. If Catel can actually meet the $250 per channel figure for transmission on an FM fiber backbone, the incremental cost of retrofit (aerial) would still come in under $3,000 to $5,000 per total plant mile, over and above normal rebuilding cost.

Cable TV can compete successfully. But, let there be no illusions that it can be done without significant changes in the existing cable TV infrastructure and operational strategies. ■

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

Do cable systems ignore needs?

It's hard to go anywhere these days, read any magazines or attend any conferences without hearing endless discussions about the deterioration of service provision in this country. What people are talking about is what you and I have talked about before in this column; providing common, basic service to our customers.

Several days ago I had occasion to call my automobile dealership and ask to make an appointment to have my car towed in for repairs. Under most circumstances, requests like this would be met with some sympathy and the earliest appointment possible. I was told, however, that the earliest appointment I could have was four weeks away. I was appalled. As it happens, there is another nearby dealership for the same make of vehicle I own and since the warranty period had already expired, I called them. They offered me an appointment that was over five weeks off.

Unscientific survey

Although I became instantly depressed about the possibilities of getting my car repaired, I also became interested in the issue of service department responses to customer needs.

By Wendell Bailey, Vice President Science and Technology, NCTA

Thinking that perhaps automobile dealerships are as good a place as any to make a random, though quite unscientific survey, I opened the phone book and called 22 other service departments. These were for different makes of cars and in different parts of the city.

You might expect that I'd say that all of the dealerships gave me the same kind of response, but in fact what I found was that no other dealership gave me lead times as long as four or five weeks. The next longest one was two weeks and several other dealers could take me right away.

This caused me to ask some questions about why a business involved in the intensely competitive world of automobile service would let their customer service schedules get so far out of whack. I was especially interested in this aspect since I had heard that people typically don't pay much attention to the serviceability of a car when they first purchase that brand, but are unlikely to ever buy the same brand a second time if they've been burned by poor reliability and poor service from dealers. Assuming that the average person would keep a car 5 years and perhaps own their first car when they are 25 years old, an average person will purchase at least eight vehicles over their lifetime. This made the casual attitude displayed toward this source of future business, future security and future prosperity for a dealer rather shocking.

'Sign up and stay on'

The cable TV business is also interested in getting customers and keeping them over the long haul. What we want is each customer to sign up and stay on. We count on a program mix of attractive choices, generally better quality pictures than other delivery modes and good quality service to deliver this type of long-term stability.

Getting back to the car dealers, though, I called the first dealer I had spoken to (the one with a four week lead time) and thought I'd ask a few questions to get me closer to the reasons behind this disparity in lead times. We had a nice long discussion with the service manager but the answers to my questions boiled down to this—too many things to fix and too few mechanics.

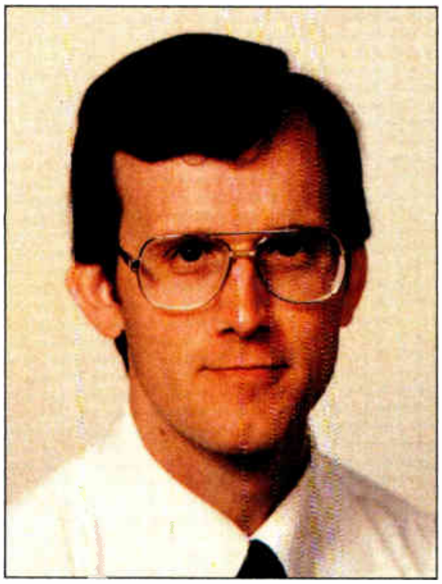
I asked whether there was a shortage of mechanics and he said, "yes." Did they have a training program of some kind to secure their future supply of mechanics? Their answer, "unheard of." My next question was how they got more mechanics. Their response was that they would just run ads in the newspapers and take what they got. The manager was quick to point out to me that they did have a screening process and that they checked for credentials and experience and other such factors, but there's no farm system and no training program to get these mechanics.

He told me that after they hired a mechanic they'd send him out to the company school. He also said that this particular brand of car had a history of being difficult to service. (It makes one wonder why, if he has sent many mechanics off to the company school, the message about the difficulty in servicing the vehicle didn't get back to the designers of the vehicle, but that, of course, is another discussion altogether.)

Pay attention to details

What I am getting at here is that if you look at a survey of the average American consumers about what they hate most in life, way up toward the top of the list is difficulties with car dealerships in servicing their vehicles. There are other interesting things high up on this list concerning service. Luckily I don't see cable TV up there yet but my feeling is that we could be lumped together with car dealers if we don't pay close attention to our customers' needs for prompt, quality service. The best way to get that service is to pay attention to system maintenance and employee training.

I am encouraged by what I see around the cable industry these days. I see more efforts in this regard almost everywhere I go. I'm not going to say it's not enough because I don't think we've focused on this particular aspect of our business long enough yet to make an assessment about what is enough, but one thing I can say is that, while I see a lot more of this attitude in some cable systems I don't see it everywhere. I am hopeful we're getting to the time when I will see it everywhere. The next time one of your customers calls in, think how you feel when your car is broken and you take it to a dealership. See if you and your people can't sympathize with a customer who just wants to sit and enjoy the programming we make available. ■



ICPM detection and measurement

In last month's column on Incidental Carrier Phase Modulation (ICPM), we dealt with its theoretical aspects and were not able to discuss the more practical aspects of its detection and measurement. This month we'll concentrate on those two areas.

ICPM, as explained last month, can be described as any unwanted phase modulation of the video carrier. Such phase modulation can be of the differential-mode type, as might occur in a broadcast transmitter or CATV modulator where the phase modulation is imparted only to the video carrier; or it might be of the common-mode variety where the ICPM is conveyed to both the audio and video carrier simultaneously, as might occur in a set-top terminal (STT), or the tuner in a TV set. Regardless of the type of ICPM (and remember that different types of TV sound detectors will behave differently to each type of ICPM), its ultimate result can be the pollution of the audio signal with video-related artifacts in the form of sync buzz.

Some control is available

While we can do nothing (but complain) about the existence of ICPM in a broadcast transmitter, we do have some control over the ICPM content of satellite-delivered programming to our subscribers. The BTSC recommended operating practice (EIA Bulletin No. 5, Section 2.1.2) recommends that ICPM be kept below 3 degrees in broadcast transmitters. This same recommendation should be considered for CATV modulators as well. Some of you might even have the resources and equipment required to make such a measurement (Tektronix 1450 Demodulator, or equivalent, with quadrature output capability). For those who might not be so fortunate, however, there is a relatively simple way to get a good feel for how well your modulator is performing.

One "seat-of-the-pants" way to check your modulator for ICPM is to simply listen to it.[1] Here's how: First, disconnect audio from the input to the modulator under test (yes, unfortunately the modulator should be out of service for the test), and connect stereo headphones to the output of your stereo decoder or stereo monitoring system in the headend. Crank the volume down on your stereo and place the headphones on your ears. Slowly bring the volume level up on your stereo system until you begin to hear the characteristic sync buzz that ICPM can produce.

Remove the headphones

Now, *remove the headphones from your ears*. Then reconnect the audio to the input to the modulator and ensure that all input levels are set correctly. Then *try* to put the headphones back on. If the audio is too loud or too uncomfortable when trying to replace the headphones, then you should not worry about ICPM in your modulator. If, on the other hand, the audio is at a reasonable listening level, and/or, if during quiet passages you continue to hear the characteristic sync buzz that you heard when the audio was completely removed from the input to the modulator, then your modulator could be contributing to the buzz in the form of ICPM.

Fortunately, some modulators are equipped with a variable capacitor in the video modulator section, usually connected directly to one junction of the quad diode modulator, which can be used to minimize ICPM. The "tweak" was probably not placed there by the manufacturer specifically with ICPM in mind, but instead to improve video performance. Fortunately, the point for optimum video performance should match that for minimum ICPM. If you're the adventurous type, try varying the capacitor while listening for a dip in the buzz level, and then verify that the video performance has not been adversely affected.

Other sources of ICPM

Keep in mind here that ICPM is not the *only* cause of audio sync buzz. There are others as well, and scrambled signals are especially susceptible, so this procedure will not completely eliminate the buzz. As always, when in doubt, consult the manufacturer.

If you're one of the lucky ones who can get your hands on a TV demodulator similar to a Tektronix 1450 that has both an in-phase *and* a quadrature video output port, then you should be able to measure ICPM directly.

Another technique that can give you a feel for the ICPM performance of your modulator is to demodulate its video using a high quality CATV demodulator that has both synchronous and envelope modes of demodulation. Ideally, without any amount of ICPM present in the system, the amount of differential phase distortion, as measured with a Vectorscope, should remain the same when the CATV demodulator is switched between the synchronous and envelope modes. When ICPM is present however, a synchronous demodulator will have a tendency to remove the ICPM before demodulation, while an envelope detector will not.

Don't be fooled

Since the ICPM is not removed in the envelope detection process, it has a tendency to show up as differential phase distortion in the baseband video. Therefore, as you switch between the synchronous and envelope modes of operation in the demodulator, part (or all) of the difference in measured differential phase between the two modes might be attributable to ICPM.

Exactly how much distortion (in degrees) is due to ICPM is certainly open for debate. However, if the differential phase measurement tracks within a couple of degrees as the demodulator is switched between its synchronous and envelope modes of operation, chances are that the modulator doesn't have a problem with ICPM. ■

[1] Robbins, Clyde, "BTSC Performance Measurement in the Lab and Field," NCTA Technical Papers, 1987.

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

Networks as MSOs?

One of the broad areas of regulatory concern that we'll be returning to again and again in these monthly columns is the cluster of issues regarding the ownership of cable systems. There are issues, for example, of concentration of ownership—whether there ought to be a limit on how many systems can be owned nationwide by each cable operator. We'll also talk about "vertical integration"—whether cable programmers ought to own or be owned by cable operators. And, of course, there is the persistent question whether telephone companies ought to be allowed to enter the television business by becoming cable operators.

Most of these issues are unlikely to go away for awhile. But the Federal Communications Commission may now be on the verge of putting one ownership issue finally to rest—the issue of ownership of cable systems by broadcast networks. Eighteen years ago, the FCC adopted two rules restricting ownership of cable systems by broadcasters. First, the FCC prohibited broadcast television licensees from owning cable systems in their television service areas. Second, it barred broadcast television networks from owning cable systems altogether.

FCC reviewing one ban

In 1984, Congress determined that the broadcast station-cable system cross-ownership prohibition was still necessary to promote diversity of expression and foster competition between local broadcasters and cable operators. It codified the ban as part of the Cable Communications Policy Act. Congress did not, however, include the network-cable cross-ownership prohibition in the 1984 statute, allowing the FCC to retain or rescind that rule as it saw fit. Now, the FCC is proposing to get rid of the rule and to let networks own cable systems.

Protecting cable's potential

The FCC had good reason to enact the ban on network ownership of cable systems in 1970. When it adopted the rule, the Commission was seeking to protect what was then just a prophetic vision of cable's potential. Although the first use of satellites to distribute cable programming was still five years away, the Commission saw cable as some day providing a multitude of alternatives to the three networks provided by broadcast television. And the Commission understood that those three networks, therefore, had incentives to acquire and operate cable systems in a manner that slowed down or prevented this development of alternative program services and new nonbroadcast networks.

For example, the networks would have been reluctant to finance, support or carry new program services that would have siphoned viewers and advertisers away from their broadcast programming. And, for similar reasons, they would have resisted technological developments that expanded channel capacity and made new services such as pay-per-view feasible. Existing 12-channel systems would have been just fine for their purposes, limiting cable's role to retransmitting and extending the coverage of local and nearby broadcast stations.

Vision fulfilled

As it turned out, the FCC's vision was fulfilled. Increases in cable systems' channel capacities, coupled with the development of satellite-delivered programming, have resulted in the current availability of more than 50 program networks. And precisely because the rule has been so effective in nurturing these developments, the FCC now suggests that it may no longer serve a useful purpose.

Even if broadcast networks would still be happier in a world without cable—and without cable networks—they no longer have the means to achieve this objective. It's impossible to undo what's already done. Cable, with its multichannel capabilities, is now the medium by which more than half the nation's television viewers receive their programming. It's too late in the game for the networks to try to nip cable in the bud by acquiring systems and stifling their development, even if they could buy every cable system in the country. And, of course, at today's prices, the networks couldn't buy a fraction of the systems they might have acquired earlier.

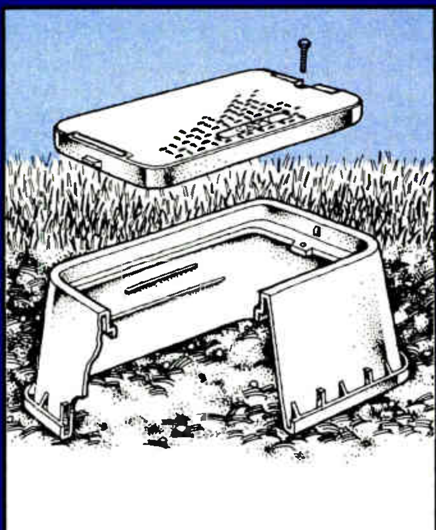
Also, the development of satellite-delivered program services has spawned a number of alternative technologies for delivering such services. If a broadcast network were today to acquire a cable system and refuse to provide a desirable array of services, consumers would simply turn to MMDS and SMATV operators or to backyard earth stations. The cable system might suffer, but the satellite program services would continue to flourish.

So, a broadcast network would be foolish to purchase cable systems with the objective of stifling competition from cable program services. Indeed, at least two of the broadcast networks have already chosen to become cable programmers themselves by acquiring cable program services. Their most likely objectives in acquiring cable systems, therefore, would be to diversify further by becoming cable operators and, with the efficiencies of vertical integration, to compete more effectively in the cable programming business.

Review makes sense

Given these changed circumstances, it makes sense for the FCC to reexamine the issue. If the evidence in the FCC's proceeding were to indicate that the networks no longer had the means to use their ownership of cable systems to thwart the development of nonbroadcast program services and, instead, would use such ownership to augment the diversity of the competitive cable programming market, then the FCC might reasonably conclude that the network-cable crossownership rule has served its purpose and is no longer necessary. ■

By Michael Schooler, Deputy General Counsel, NCTA



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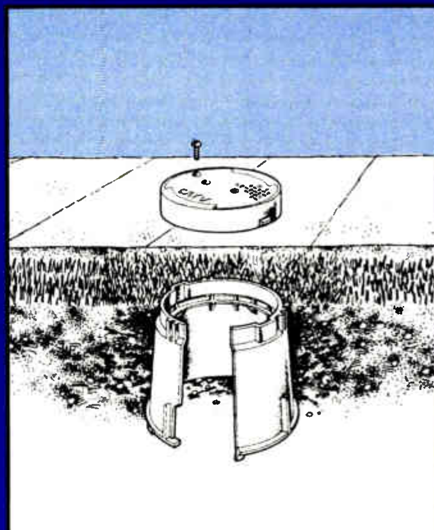

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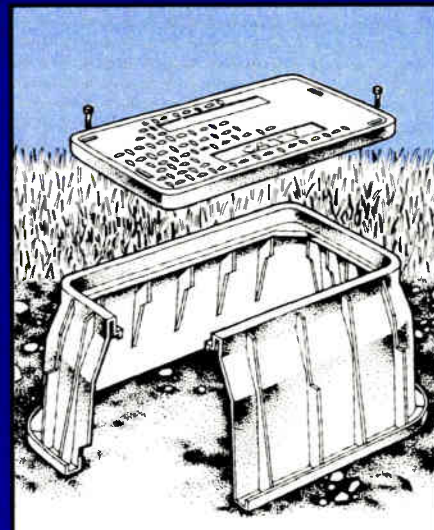


GLB-1324-15B

The Transhub—multichannel video hub

The traditional CATV distribution trunk is coaxial cable-based. It contains a series of amplifiers placed approximately every half-mile along the signal path. These amplifiers are needed to maintain the proper operational signal level. At selected locations, the signals are tapped and further amplified to bring them to the customer premises (see Figure 1).

Role of CATV supertrunks

Headends themselves are frequently connected with other remote video sources such as satellite-received signals or with other headends.

Linking headends with satellite signals or with other headends has traditionally been done with supertrunks. Because of the very high quality of the transmission required, the supertrunk is typically an FDM-FM based distribution system. Present day state-of-the-art supertrunks can carry up to 16 channels per supertrunk.

Early supertrunks used coaxial cable as the transmission media. Recently, fiber optic-based supertrunks have been used to avoid the problems associated with the conventional coaxial cable-based supertrunks.

Fiber-based supertrunks not only deliver video transparently (with no system-added degradation), but they also offer the system designer totally new system capability—the fiber offers wide bandwidth capability, low losses, very small weight and size, no RFI or EMI and rapidly dropping cost. Currently, 16 channels using FDM-FM can be transmitted over 40 km of fiber with no repeaters and with very high performance (S/N ratios of 65 dB or better).

FDM-FM supertrunks have excellent video performance but have limitations especially with non-standard video signals. If scrambled signals are transmitted over the supertrunk using FM, the demodulated baseband video will not have the sync or other suitable clamp reference signals and this makes it virtually impossible for the following AM modulator to operate properly.

By Mircho A. Davidov, Vice President of Engineering, Catel Telecommunications Inc.

Thus, in the traditional CATV architecture the supertrunk terminates in a hub, where the signal is first FM demodulated and then descrambled to recover the proper sync and other missing reference signals. Following the descrambling operation, the video signal is VSB-AM modulated for transmission over a CATV distribution trunk.

This results in a bulky multirack equipment configuration and high cost per channel.

The TransHub concept

Instead of serial tree-and-branch signal distribution, a parallel method of signal distribution is proposed (see

Figure 1. Conventional CATV trunk

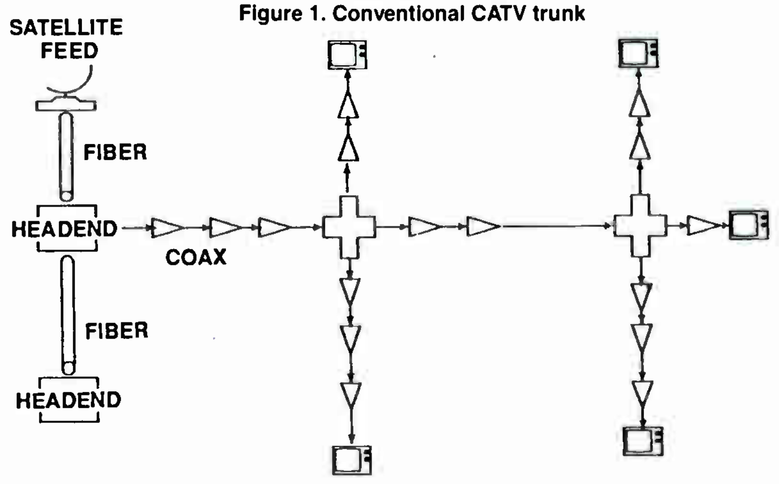
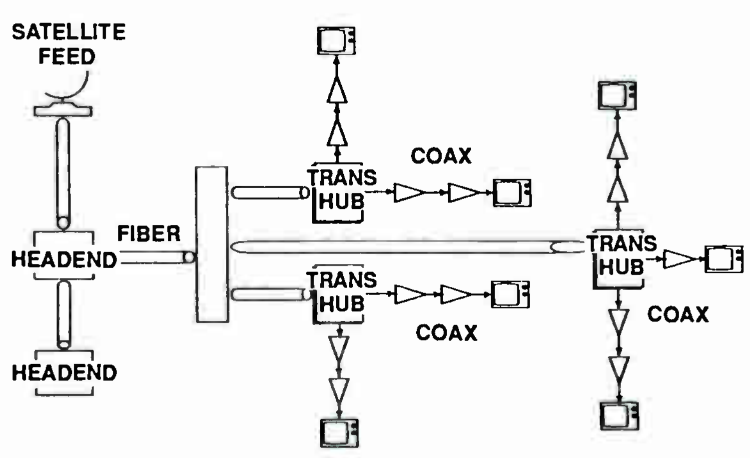


Figure 2. TransHub-based CATV trunk



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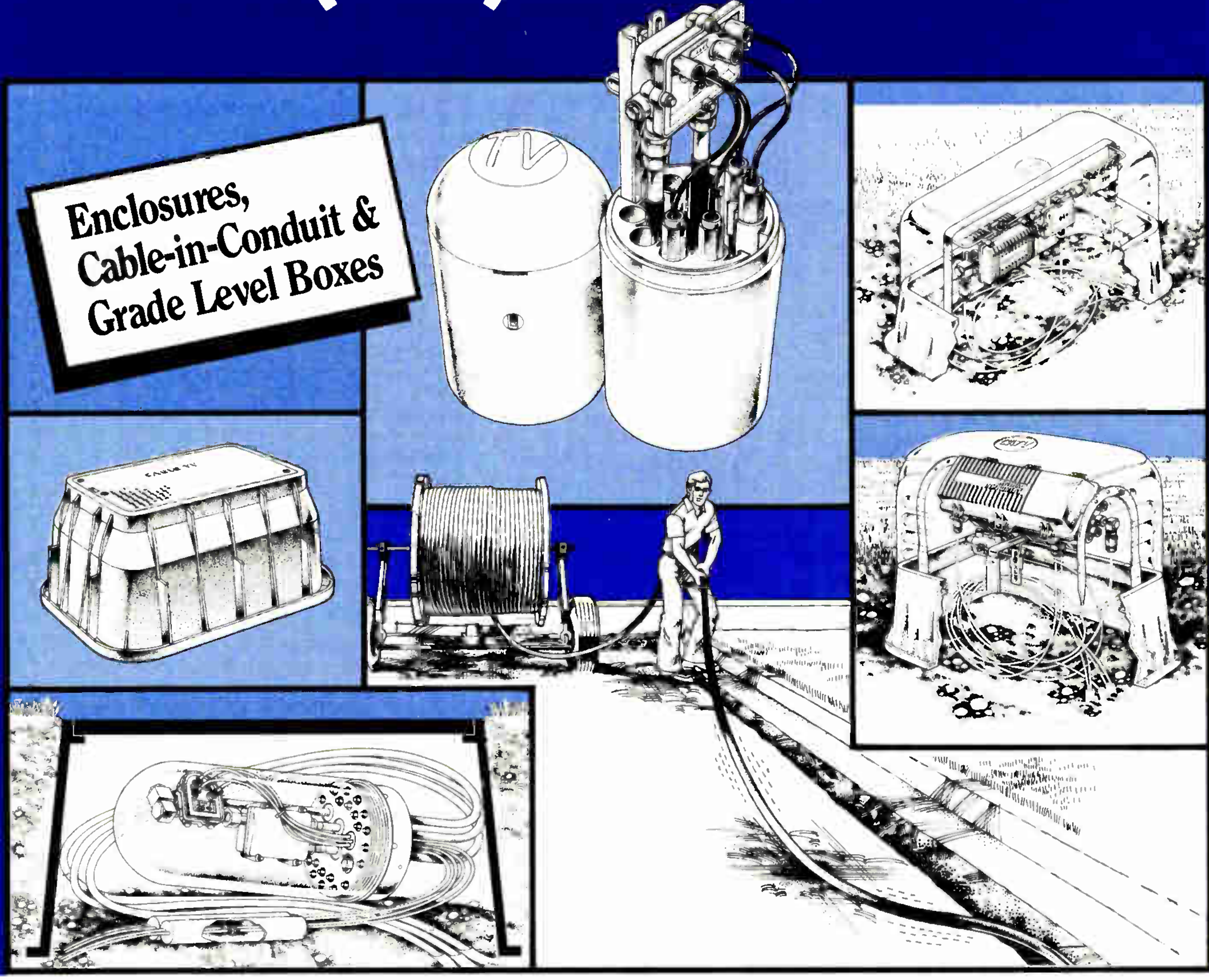

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Figure 2).

From a headend the baseband video and audio signals are FM modulated and the multichannel signal is transmitted to a hub. At the hub, the signals are individually FM demodulated and converted to AM signals. Two methods of signal conversion are proposed, depending on whether the signals are scrambled or not.

As can be seen from Figure 3, at the headend site the baseband video and audio signals are transmitted as conventional supertrunk input signals. The video signals are amplified and pre-emphasized in the input processor module. The audio signals are FM modulated at twice the normal deviation on a 9 MHz subcarrier in an audio subcarrier modulated module. The composite baseband signal (pre-emphasized video and 9 MHz double deviation audio subcarrier) is FM modulated at an IF frequency (typically 70 MHz).

The IF frequency is then upconverted to an RF frequency and is combined with the other FM modulated channels to form the composite RF video signal. To this signal reference and control FSK carrier signals are added. The reference carrier signal is a lower frequency signal (typically 4 MHz) and is the global reference to which all hub carriers are locked. This FSK carrier is needed to carry any control or the channel mapping data to the TransHub individual channel synthesizers or control various channel parameters such as output power, video or audio carrier levels.

The composite FM modulated RF signal occupying the frequency band of 5 MHz to 550 MHz (lower limit determined solely by the frequency response of the optical portion of the system) then intensity modulates the optical transmitter (laser diode). Future expansion of number of channels transmitted is handled with a block conversion of an additional bank of channels (occupying 5 MHz to 550 MHz) to 600 MHz to 1150 MHz frequency band. The two frequency bands are then combined for intensity modulation of the optical transmitter.

This method permits an incremental increase of the number of the channels transmitted (limited only by the frequency response or the output power/noise floor of the optical transmitters and receivers), while maintaining full compatibility with all existing and subsequent phases of capacity expansion.

At the hub, the optical signal is received and converted to an electrical signal by an optical receiver. Then an inverse operation is performed by the TransHub (as shown in the block diagram on Figure 3 and in more detail in Figure 4). Each video carrier is selected and downconverted by an input converter to a high IF for FM demodulation.

SAW filtering used

The synthesizer for each FM input converter receives serial data over the internal bus and can change the local oscillator frequency upon command from the common microprocessor controller. Selectivity and adjacent channel rejection is accomplished with a narrow cavity or SAW IF filter. After FM demodulation the baeband video is recovered with a lowpass filter. The audio carrier is filtered with a bandpass filter and divided by two to obtain a 4.5 MHz normal deviation audio

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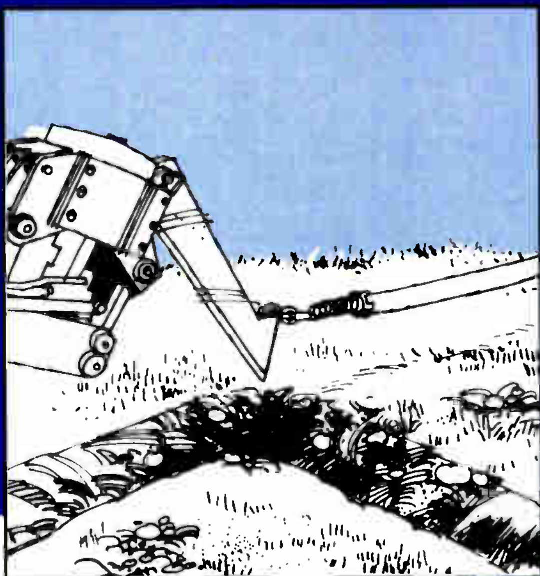

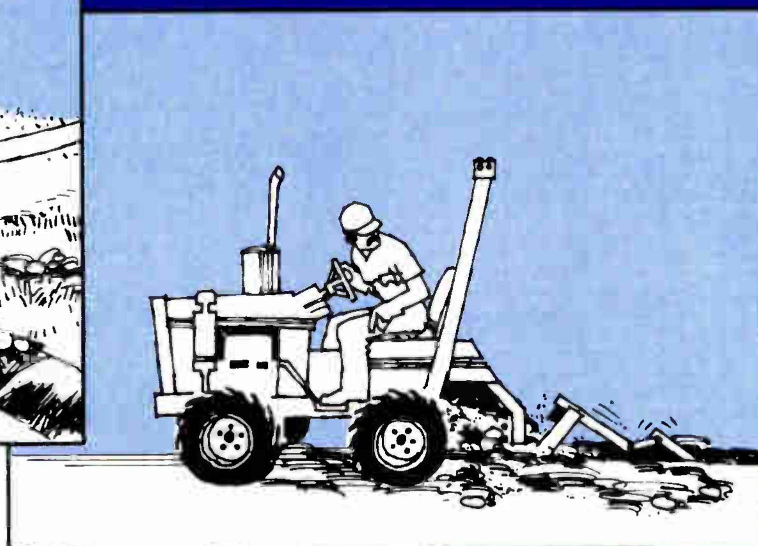

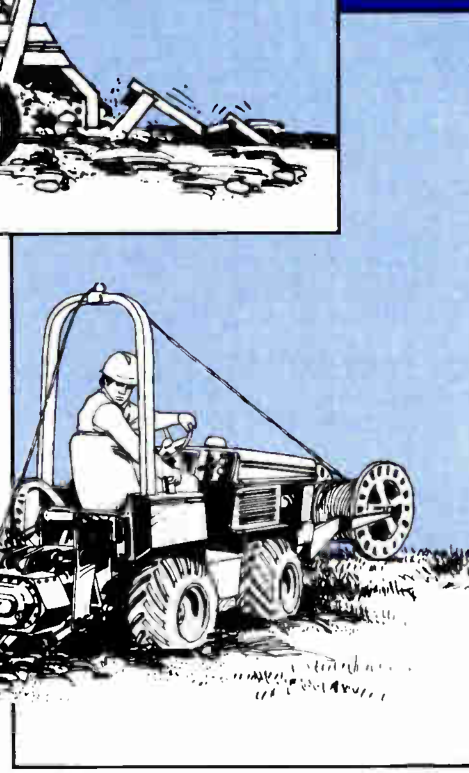

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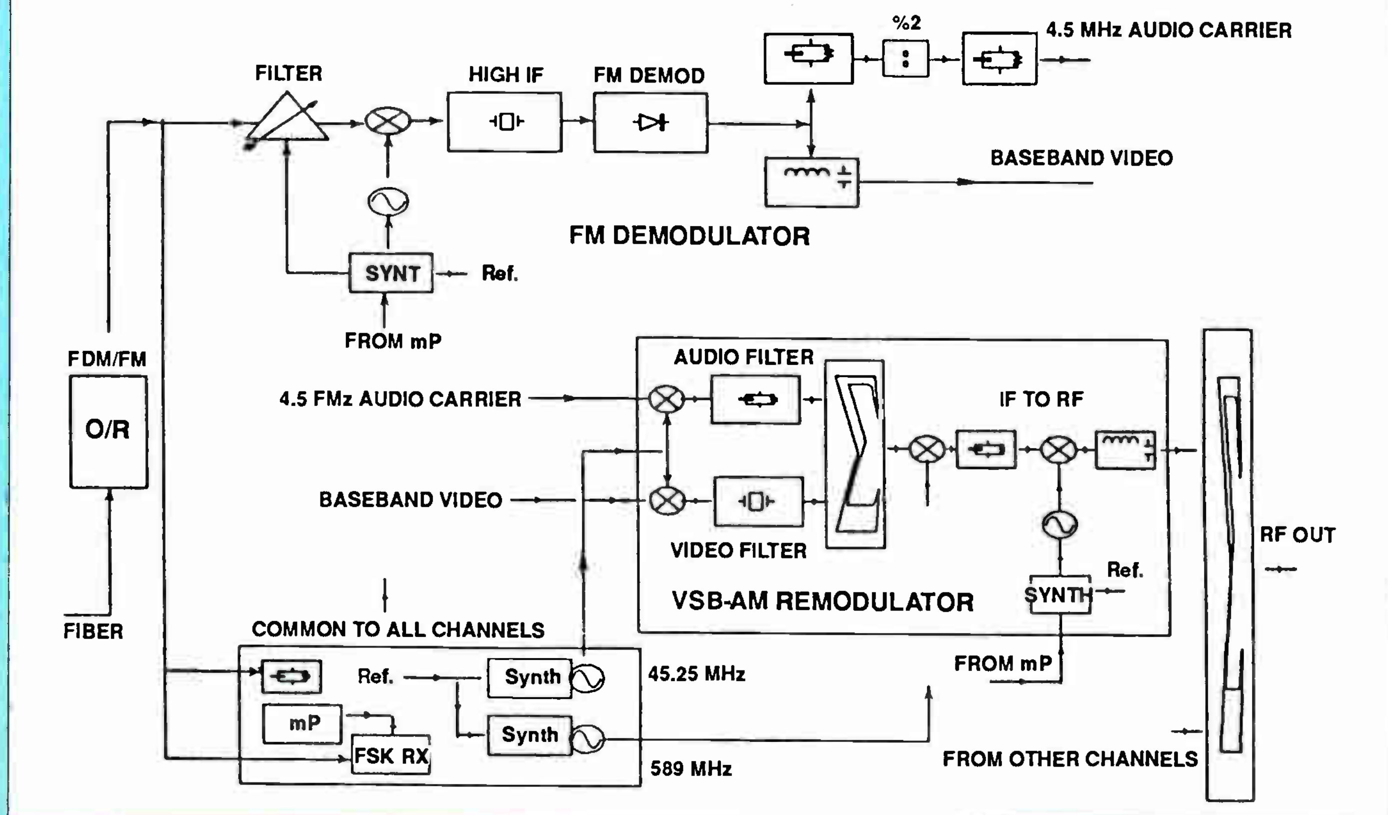
Figure 4. Block diagram of a TransHub clear card



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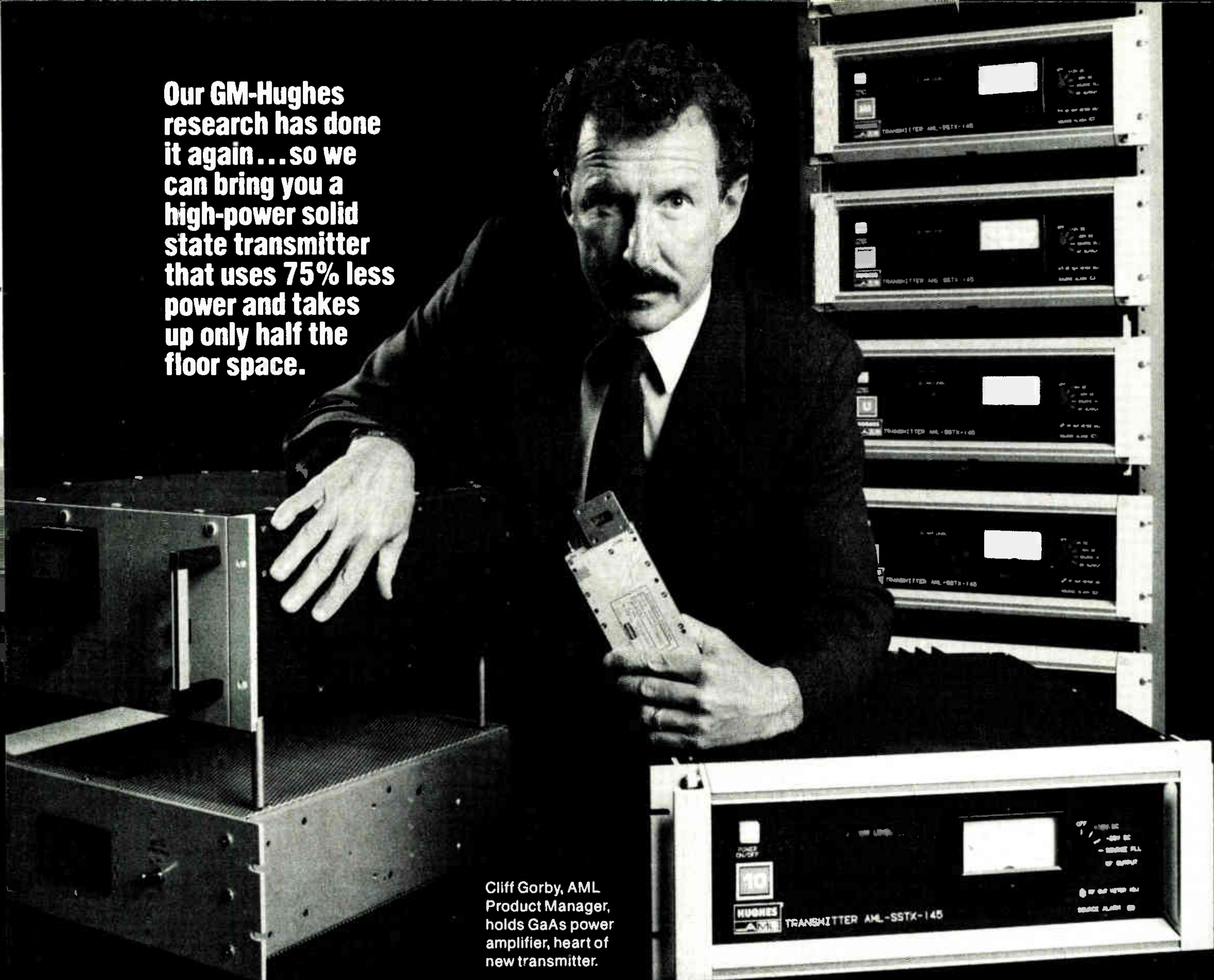

Cliff Gorby, AML Product Manager, holds GaAs power amplifier, heart of new transmitter.

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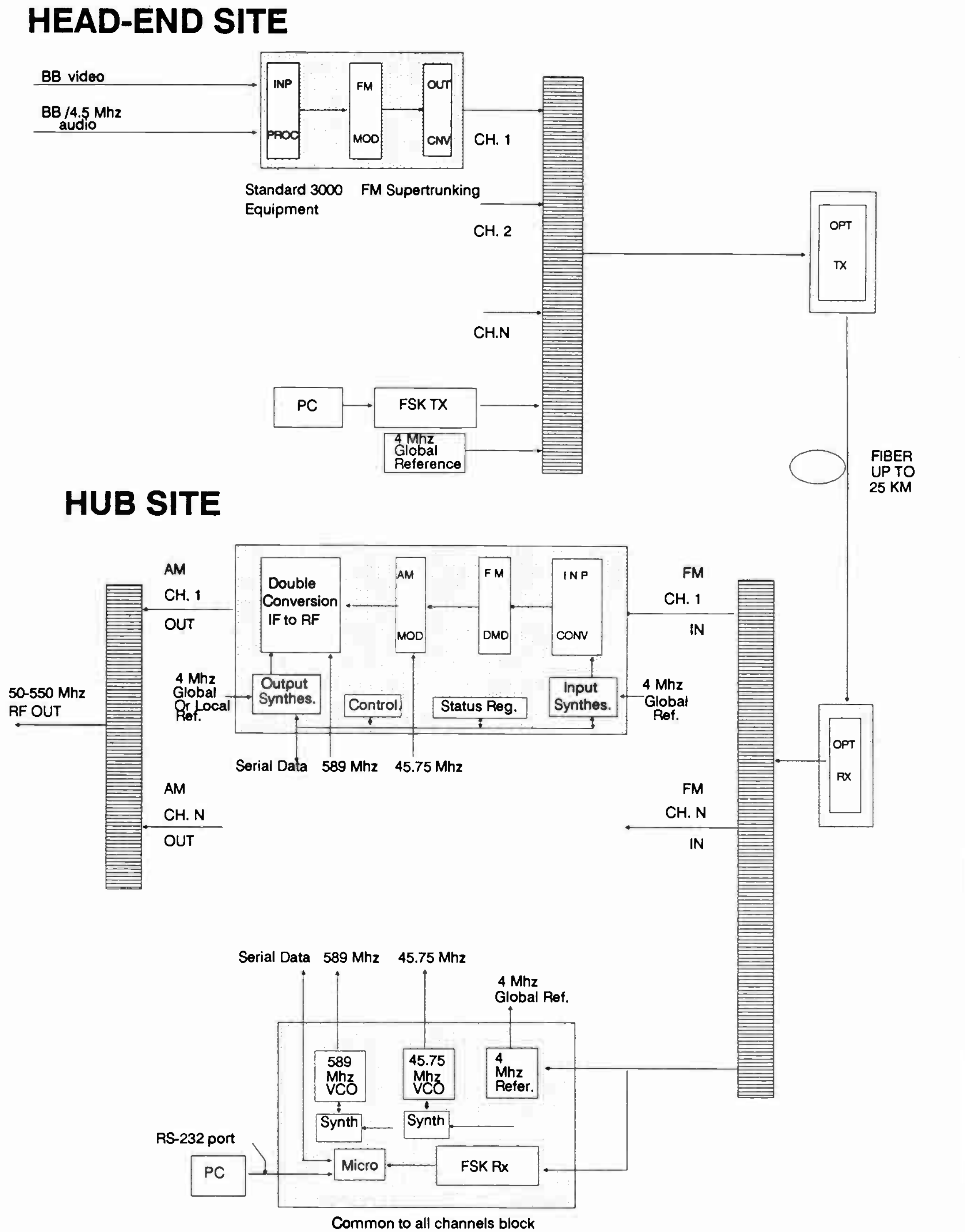
Figure 3. Block diagram of a TransHub-based CATV trunk



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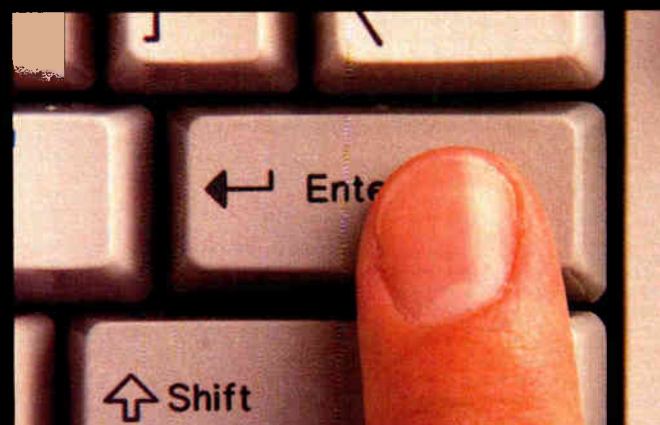

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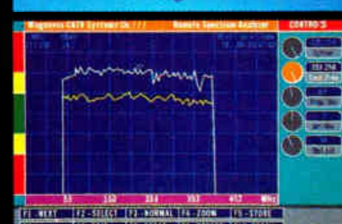

MLM display showing sweep response. White is actual response; yellow is stored response.

MLM display showing the video, color and sound carriers of Channel 3 with upper adjacent channel picture carrier and lower adjacent sound and color carrier also shown.

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carrier. This method achieves less interference between the video and the audio signals, makes it easier to separate them with simple filters and offers better noise immunity of the audio signals (due to their double deviation) as they are transmitted over the fiber. Also, carrying the audio as a subcarrier instead as a discrete carrier alongside the video carriers makes it insensitive to phase noise in the headend output conversion and hub input converter circuits.

Once the baseband video and the 4.5 MHz audio carriers are recovered, they are remodulated for transmission over the coaxial cable as shown in the bottom half of Figure 4.

The baseband video is passed through clamping and video processing circuits and AM modulated with a 45.75 MHz carrier signal to a standard video IF frequency (45.75 MHz). The 4.5 MHz audio carrier is upconverted with the same 45.75 MHz carrier signal to form the standard audio IF frequency (41.25 MHz). The audio IF carrier is bandpass filtered (to clean the unwanted byproducts of the conversion) and combined with the video carrier. The composite IF signal is then filtered with a VSB SAW filter to form the composite VSB-AM IF frequency. Then the composite IF frequency is upconverted to the required RF frequency by way of a double conversion IF to RF converter.

First conversion uses a common to all channel high frequency carrier signal (589 MHz) and converts the composite IF frequency to high IF frequency (640 MHz) where most of the signal gain and channel selectivity is accomplished. Then the final conversion is performed from this high IF frequency to the desired RF carrier frequency with a synthesized oscillator which receives the data and commands from the hub microprocessor controller over the internal serial bus.

Each channel card has a unique address associated with it. Upon address identification the received data is downloaded to the synthesizers registers or control D/A registers. To determine the status of each channel, a polling sequence is initiated by the microprocessor and the content of the status registers (input synthesizer, output synthesizer, FM demod and AM remod RF output) are transmitted back to the microprocessor and out to a remote location over the bidirectional RS-232 port hooked to it.

The synthesized local oscillator for the output converter uses either the 4 MHz global reference signal received or a local 4 MHz reference carrier locked to a local source. This method permits phaselocking of an individual AM output channel to a local channel (or to a comb generator) and reduces the interference from this strong local source to a minimum.

Global offsets

In addition, there are instances where all (or almost all) output frequencies must be offset by a small amounts (12.5 kHz) to meet FCC requirements. This can be done globally for all channels by offsetting the 589 MHz oscillator frequency (common to all the channels) by the required amount. Then a combination of global/local channel offsetting can provide any frequency plan desired and satisfy any regulatory requirements at the same time.

Each incoming video carrier is FM demodulated and then VSB-AM remodulated in an identical manner. All of the output VSB-AM video carriers and audio carriers are then combined together to form one broadband output signal that can then be distributed over the conventional coaxial trunks.

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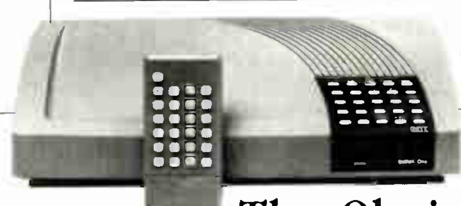

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To reduce the size, increase the efficiency and reliability and reduce the cost of the system, subsystems common to all of the channels in the system are concentrated in one common system block. This block is made of:

1) 45.75 MHz local oscillator (used in all VSB-AM modulator sections),

2) 589 MHz local oscillator (used in all VSB-AM IF to RF conversions),

3) 4 MHz global reference carrier receiving circuits,

4) FSK receiver for receiving downloadable commands and data,

5) a microprocessor with standard RS-232 interface for processing of the data or commands received and controlling the individual channel characteristics such as frequency mapping (on the FM side or the AM side) or RF output power on or off.

The common 45.75 MHz and 589 MHz are synthesized and use the global 4 MHz reference received over the fiber. The microprocessor can receive data either locally from a RS-232 port or remotely from the output of the FSK receiver. The microprocessor communicates with the TransHub channel cards over the internal bidirectional serial bus.

Scrambled signals

The block diagram of a headend to TransHub trunk is shown in Figures 5 and 6. At the headend, the inputs are baseband video and either baseband audio or 4.5 MHz FM-modulated audio. This time, however, they modulate a VSB-AM modulator in the conventional way. The VSB-AM modulator video and audio IF output signals (45.75 MHz and 41.25 MHz) are now hooked up through an IF scrambler which produces scrambled IF video and audio carrier signals from the incoming clear video and audio carriers (and in some cases baseband video inputs would be necessary).

The descrambling and set-top converter control information is transmitted along with the video or incorporated with the audio in various ways: the most common method is to be carried as an AM-modulated signal on the audio carrier. Other means include use of vacant lines in the VBI or HBI portions of the baseband video signal, use of subcarrier alongside the video or audio carrier, etc. The composite in-band scrambled video, audio and descrambling information is now present in the scrambled video and audio carriers and in conventional CATV trunking applications it would be converted from IF to RF frequency for transmission over the coaxial cable-based trunks.

More processing needed

In order to transmit scrambled signals over a fiber-based CATV trunk where FM modulation must be used for transparent deliver of the signals, further processing of the signals is required. The 45.75 MHz scrambled video carrier is mixed with a 41.25 MHz locally-generated carrier to a 4.5 MHz video subcarrier frequency. The composite signal – 4.5 MHz video and 10.7 MHz audio subcarriers are FM modulated at an IF frequency.

Again, carrying both the video and the audio as subcarriers make them insensitive to phase noise at any point where there is a frequency conversion involved and the local oscillators' phase noise is no longer critical.

The IF is then converted to the desired RF frequency by a conventional output converter. The other scrambled channels are processed in an identical way. The composite FM RF signal then intensity modulates the optical trans-

mitter. As with the clear signal case, this ensures compatibility with existing supertrunking equipment.

The conversion process

At the hub site the optical signals are detected and converted to a composite electrical signal. In an identical (to the unscrambled case) way the FM-modulated carrier is selected and downconverted by an input converter to a high IF frequency for FM demodulation.

The synthesizer for each FM input converter receives serial data over the internal bus and can change the local oscillator frequency upon command from the common microprocessor controller. Selectivity and adjacent channel rejection is accomplished with a narrow cavity or SAW IF filter. After FM demodulation the audio carrier is filtered with a 10.7 MHz bandpass filter. The 4.5 MHz video carrier is filtered with a low-pass filter. In this process the overall video performance is not degraded, however, significant improvements in carrier-to-noise and carrier-to-beat performance is achieved.

Following the filtering operation, the video and the audio carriers are upconverted with a locally generated carriers (41.25 MHz and 30.55 MHz) to 45.75 MHz and 41.25 MHz respectively. Again, to maintain high accuracy in the conversion process, these carriers are sythesized in a common system block and locked to the global 4 MHz carrier signal transported over the fiber. The composite scrambled video and audio IF are then filtered by the VSB-AM SAW filter to remove the undesired mixing byproducts and provide the necessary shape.

Just as in the case of clear signals, then the composite IF frequency is upconverted to the required RF frequency by way of a double conversion IF to RF converter. First conversion uses a common to all channel high frequency carrier signal (589 MHz) and converts the composite IF frequency to high IF frequency (640 MHz) where most of the signal gain and channel selectivity is accomplished.

Then the final conversion is performed from this high IF frequency to the desired RF carrier frequency with a synthesized oscillator which receives the data and commands from the hub microprocessor controller over the internal bidirectional serial bus. Each channel card has a unique address associated with it. Upon address identification the received data is downloaded to the synthesizers registers or control D/A registers.

Interference reduced

The synthesized local oscillator for the output converter uses either the 4 MHz global reference signal received or a local 4 MHz reference carrier locked to a local source. This method permits phaselocking of an individual AM output channel to a local channel (or to a comb generator) and reduces the interference from this strong local source to a minimum.

In addition, there are instances where all (or almost all) output frequencies must be offset by a small amounts (12.5 kHz) to meet FCC requirements. This can be done globally for all channels by offsetting the 589 MHz oscillator frequency (common to all the channels) by the required amount. Then a combination of global/local channel offsetting can provide any frequency plan desired.

Each incoming video carrier is FM demodulated and the demodulated 4.5 MHz VSB-AM video carriers and 10.7 MHz audio carriers are upconverted in

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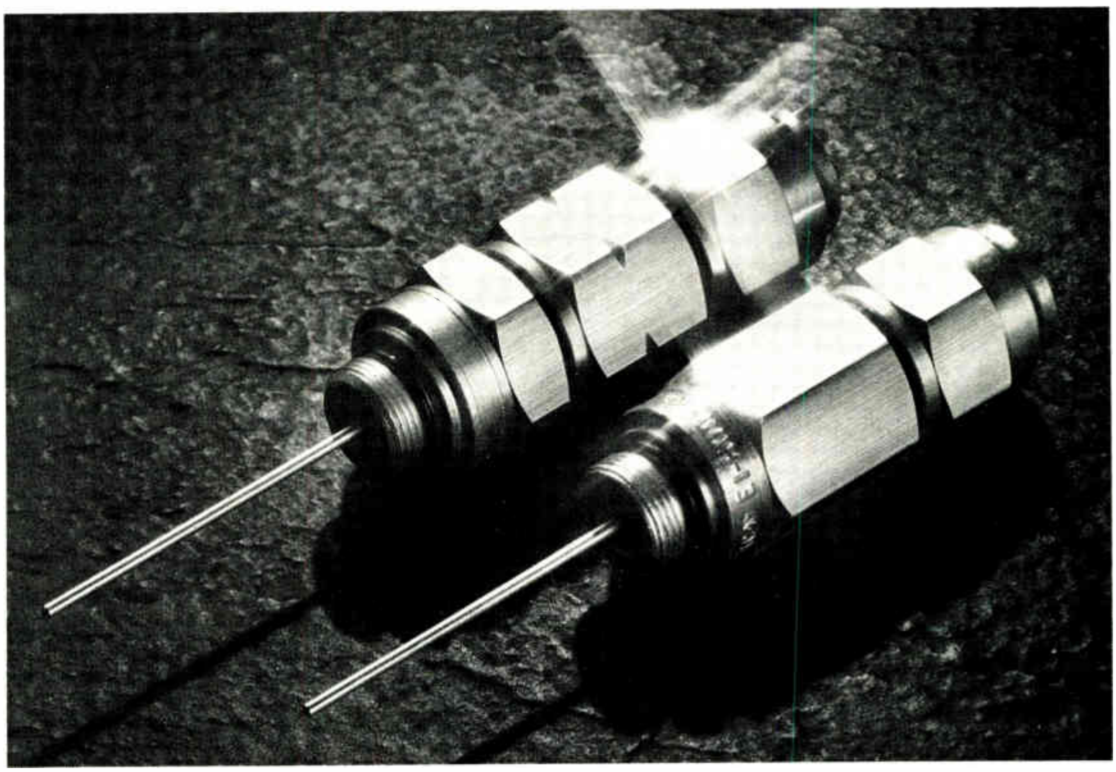


WE'RE AUGAT COMMUNICATIONS GROUP. WE TIE IT ALL TOGETHER...WITH EASE.

Reader Service Number 25

Figure 5. TransHub-based CATV trunk for scrambled signals

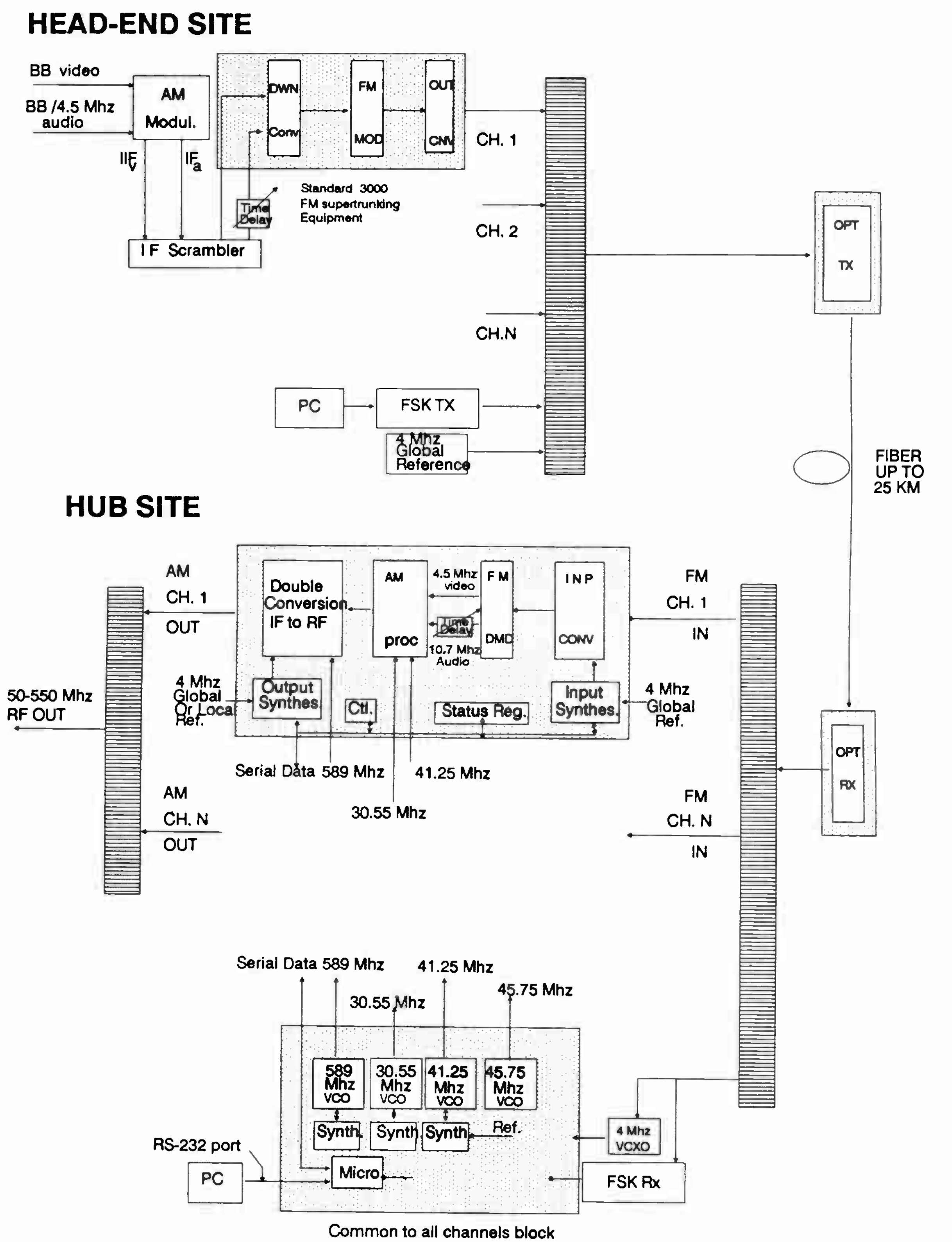
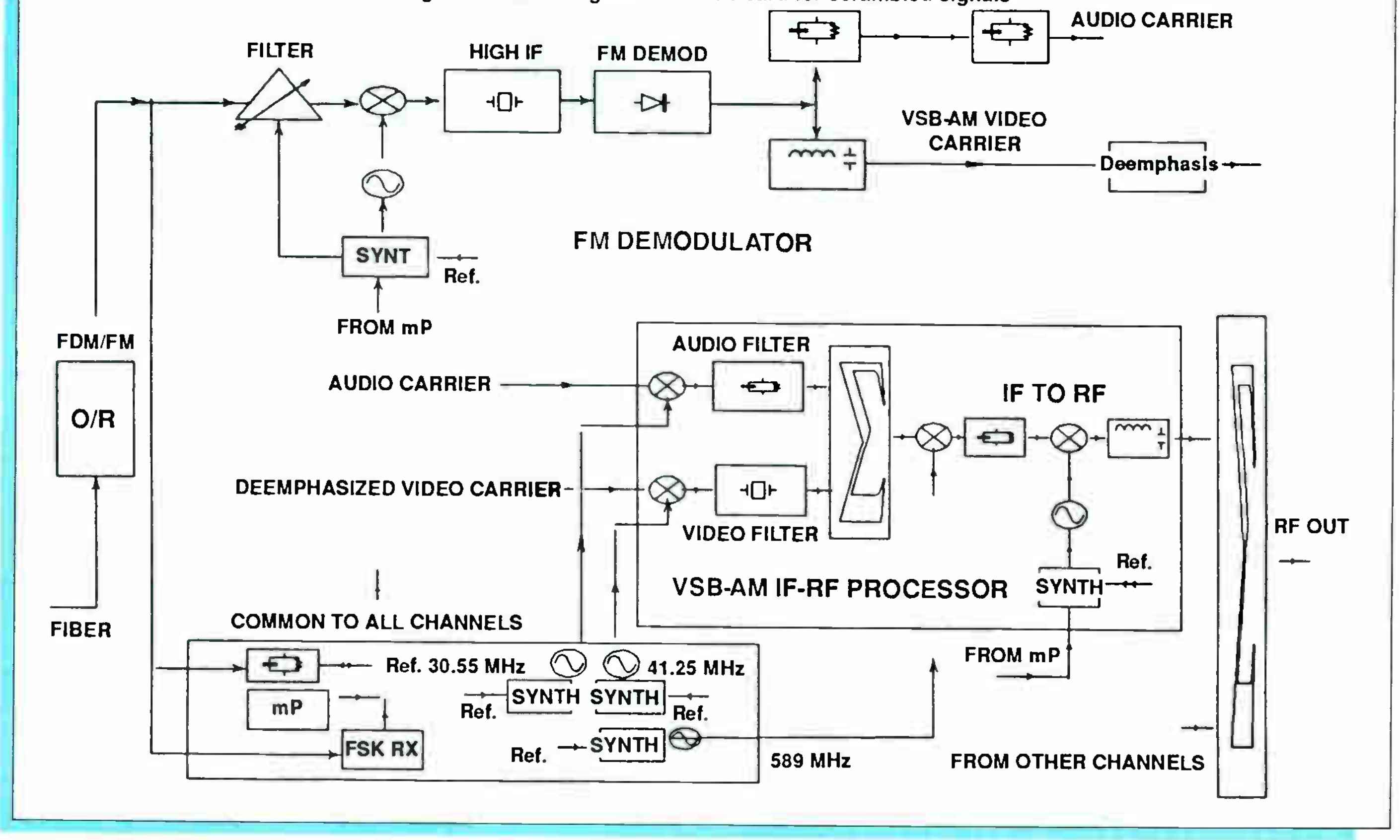
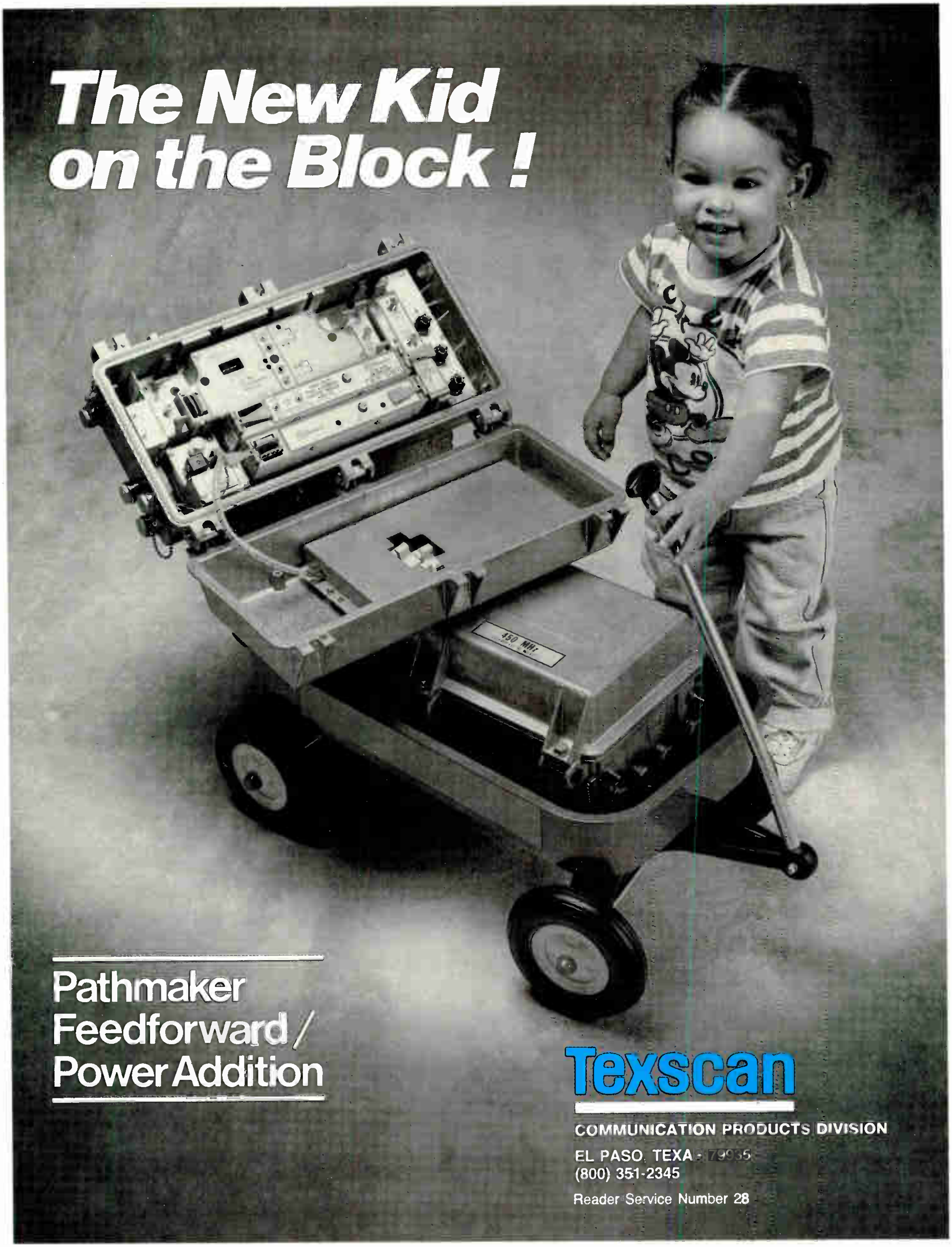


Figure 6. Block diagram-TransHub card for scrambled signals




The New Kid on the Block !
450 MHz
Pathmaker Feedforward / Power Addition
Texscan
COMMUNICATION PRODUCTS DIVISION
EL PASO, TEXAS 79935
(800) 351-2345
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an identical manner. All of the output VSB-AM video carriers and audio carriers are then combined together to form one broadband output signal that can then be distributed over the conventional coaxial trunks.

To reduce the size, increase the efficiency and reliability and reduce the cost of the system, subsystems common to all of the channels in the system are concentrated in one common system block made of:

1) 41.25 MHz local oscillator (used in all 4.5 MHz to 45.75 MHz video upconversion),

2) 30.55 MHz local oscillator (used in all 10.7 MHz to 45.75 MHz audio carrier upconversion),

3) 589 MHz local oscillator (used in all VSB-AM IF to RF conversions),

4) 4 MHz global reference carrier receiving circuits,

5) FSK receiver for receiving downloadable commands and data,

6) a microprocessor with standard RS-232 interface for processing of the data or commands received and controlling the individual channel characteristics such as frequency mapping (on the FM side or the AM side) or RF output power on or off.

The common 41.25 MHz, 30.55 MHz and 589 MHz are synthesized and use the global 4 MHz reference received over the fiber. Since 45.75 MHz local oscillator is used for VSB-AM modulation when clear signals are transmitted, a practical common system block will include all the oscillators and the differentiation will be done by the actual scrambled or clear card layout and mechanical implementation.

The microprocessor can receive data either locally from a RS-232 port or remotely from the output of the FSK receiver. As before, it can communicate with the TransHub channel cards over the interal bidirectional serial bus.

Other TransHub cards

In certain areas there is a need to phaselock the VSB-AM output of the TransHub to either strong off-air signals or to a comb generator. A special phaselocking card that can be used with either clear or scrambled cards has been developed. Another card developed is a controller card common to all the hub channels.

Individual channel phaselocking of a TransHub channel is shown in Figure 7. Individual channels can be phaselocked to an off-air source by comparing the IF frequency of the TransHub channel to the IF frequency of a downconverted off-air channel. The downconversion is done with the same IF to RF converter used in an individual channel (except the signal flow is now reversed). The phaselock card downconverts to high IF frequency with a synthesized oscillator locked to a locally generated 4 MHz frequency. The 589 MHz oscillator (locked to the global reference) further downconverts it to the video IF frequency (45.75 MHz) where it is compared to the TransHub video IF.

If there is frequency difference, the phase detector will generate an error voltage which will shift the frequency of the local 4 MHz reference oscillator. Since the input conversion of the phaselocking card synthesizer uses the local 4 MHz oscillator as its reference, its 45.75 MHz IF frequency will follow the 4 MHz oscillator until frequency lock has been accomplished.

And since this same 4 MHz local oscillator is used as reference in the TransHub output conversion, its output frequency will also follow the changes in the 4 MHz local oscillator and will therefore be locked to the off-air station as well. ■

AN OPEN LETTER FROM COMM/SCOPE

GENERAL INSTRUMENT

Cable Home Communications Group
General Instrument Corporation
P.O. Box 339, 1375 Lenoir-Rhyne Blvd.
Hickory NC 28602
704/324-2200 • 800/438-3331
Telex 802-030 • Fax 324-2760

July 26, 1988

Dear Comm/Scope Customer:

In the recent past you have been acutely aware of escalating prices of the component materials of our products. Recent discussions I have had with key source industry executives indicate that this trend will continue at least for the near term, particularly in the aluminum and plastic markets - two of our most critical raw materials because of the composition of coaxial cables.

There are even rumored shortages of these crucial materials.

I am especially proud of our reputation that we have earned as a quality manufacturer with a commitment to the highest level of service possible. This commitment continues.

What this commitment means to you is that through our long-term relationships with the leading suppliers of raw materials, we are doing all that can be done to hold these increases to a minimum and that adequate supplies are available to insure uninterrupted deliveries to you.

Unfortunately, these pricing and supply pressures are coming at a time of heavy demand for our products so you may experience some inconveniences in scheduled deliveries. I apologize for this and pledge our continued efforts to keep these inconveniences to a minimum.

Thank you for your understanding and continued support.

Sincerely,

GENERAL INSTRUMENT, COMM/SCOPE DIVISION

Frank M. Drendel
President
Cable Home Communications Group

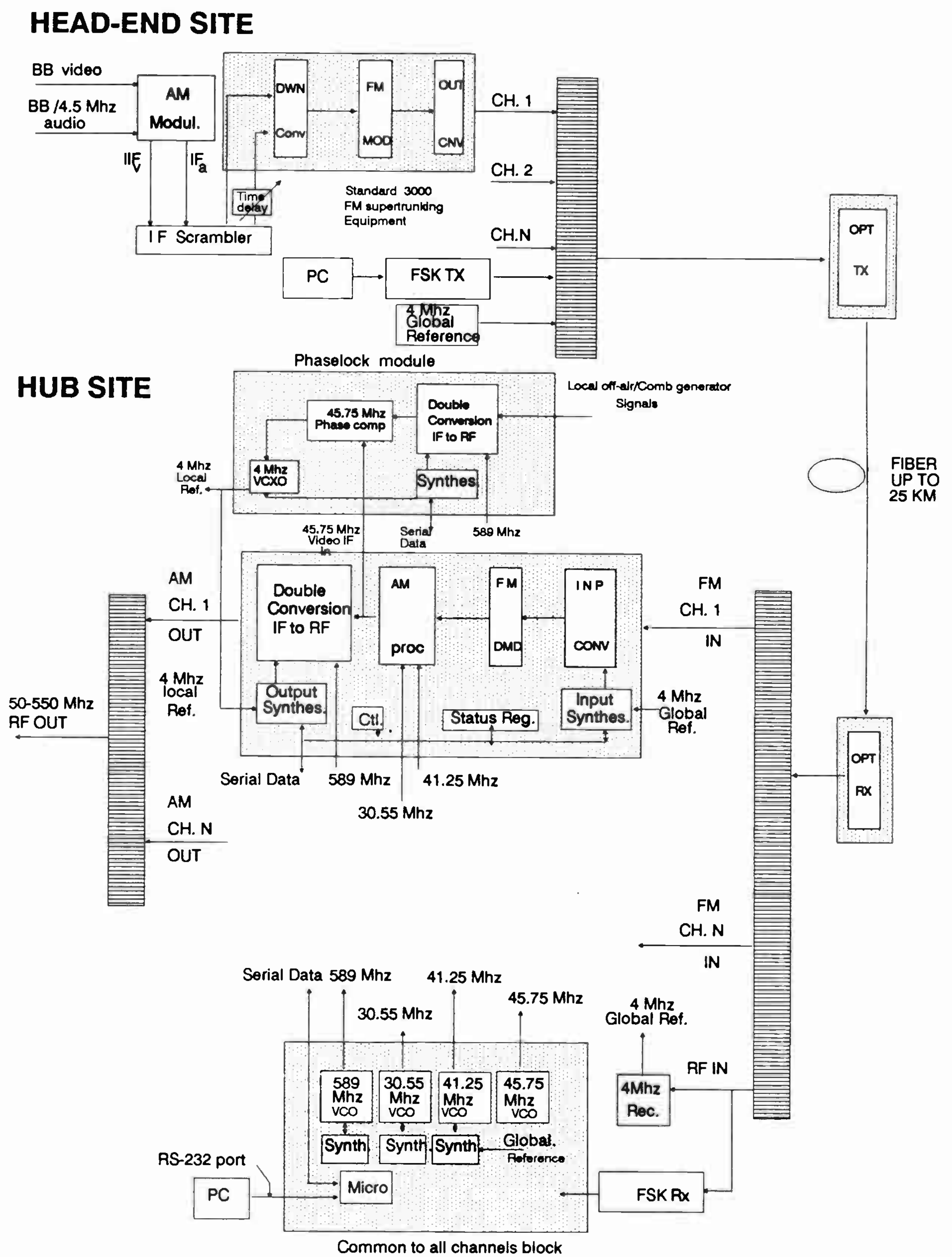
jk

Reader Service Number 31

Cable/Home Communication, Inc., A Subsidiary of General Instrument Corporation

GENERAL INSTRUMENT

Figure 7. Phaselocking to an off-air channel



Introducing the Sony FSR-1100 high-performance C/Ku satellite receiver.

Better signal reception means more satisfied viewers. And whether it's CATV, SMATV, broadcast or business television, a better picture starts with the FSR-1100 satellite receiver from Sony.

Performance/Feature Highlights
- Typical threshold extension: 7 dB
- Selectable 24/31 MHz IF bandwidth
- 3 audio outputs: 2 tunable plus 1 fixed subcarrier
- Easy-to-use 10-key tuning plus video fine tuning
- 2-digit strength indicator for precise antenna positioning
- 24 preset C band channels. Programmable memory for presetting of Ku band channels plus audio subcarrier frequencies, polarization and IF bandwidth
- Composite and auxiliary outputs for compatibility with most external decoders
- Input frequency band: 950 MHz–1450 MHz

Simply put, the FSR-1100 is one of the most flexible, reliable, high-performance commercial satellite receivers for the money. And that's a claim backed by Sony's unparalleled experience in professional broadcast and industrial video equipment.

Whether you're operating in Ku or C band, the FSR-1100 delivers superb video and audio reception. Sony's unique adjustable detector bandwidth can provide improved picture quality under adverse signal conditions. And advanced operating features provide unsurpassed ease of use.

HEMT LNB's

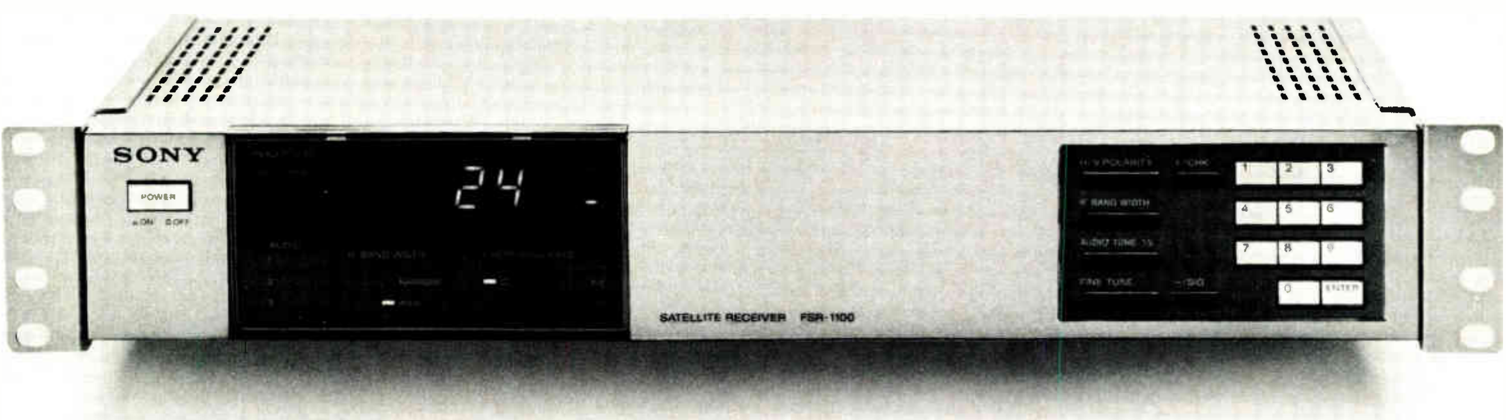
For heightened Ku band performance, look into Sony's ultra-low-noise block down converters. The first LNB's in the U.S. to utilize Sony's advanced HEMT (High Electron Mobility Transistor) technology, Sony's LNB's achieve exceptionally low noise figures, to 1.6 dB (typical). For sensitivity, stability, reliability and uniformity, they establish new standards of performance, surpassing all currently available GaAs MESFET units.

Sounds impressive? Just imagine how impressed your viewers will be. Write or call for more details on these and other Sony Satellite Communications products.

SONY®

Satellite Communications, Information Systems Company, Sony Corporation of America, Sony Drive, Park Ridge, New Jersey 07656 (201) 930-7022; Or contact the following authorized Sony Satellite Communications Dealer: Midwest Communications Corp., One Sperti Drive, Edgewood, KY 41017 (800) 543-1584 (606) 331-8990

SONY BRINGS A BETTER PICTURE DOWN TO EARTH.



Converter maintenance vs. replacement

Converters are an absolute necessity for signal delivery in systems with more than 12 channels and their selection merits close scrutiny because of the sizable capital investment and reoccuring operational expenses. The optimum converter selection would minimize both costs while providing a reliable state-of-the-art converter for years to come.

The economics of replacement versus repair must be evaluated for each converter model to identify the most economic long term option.

The following article presents an economic comparison between converter replacement and repair. To accurately perform this comparison, inventory and failure rates, by make and model, are needed. In most cases however, neither are well tracked and in certain instances such data may not exist. As CATV operators, how can we function and expect to enhance our profitability without this information? This information is crucial for the growth of a large company and survivability of a small company.

By Fredrick Rosales, Staff Engineer, United Artists Cable Systems

Actual values vary

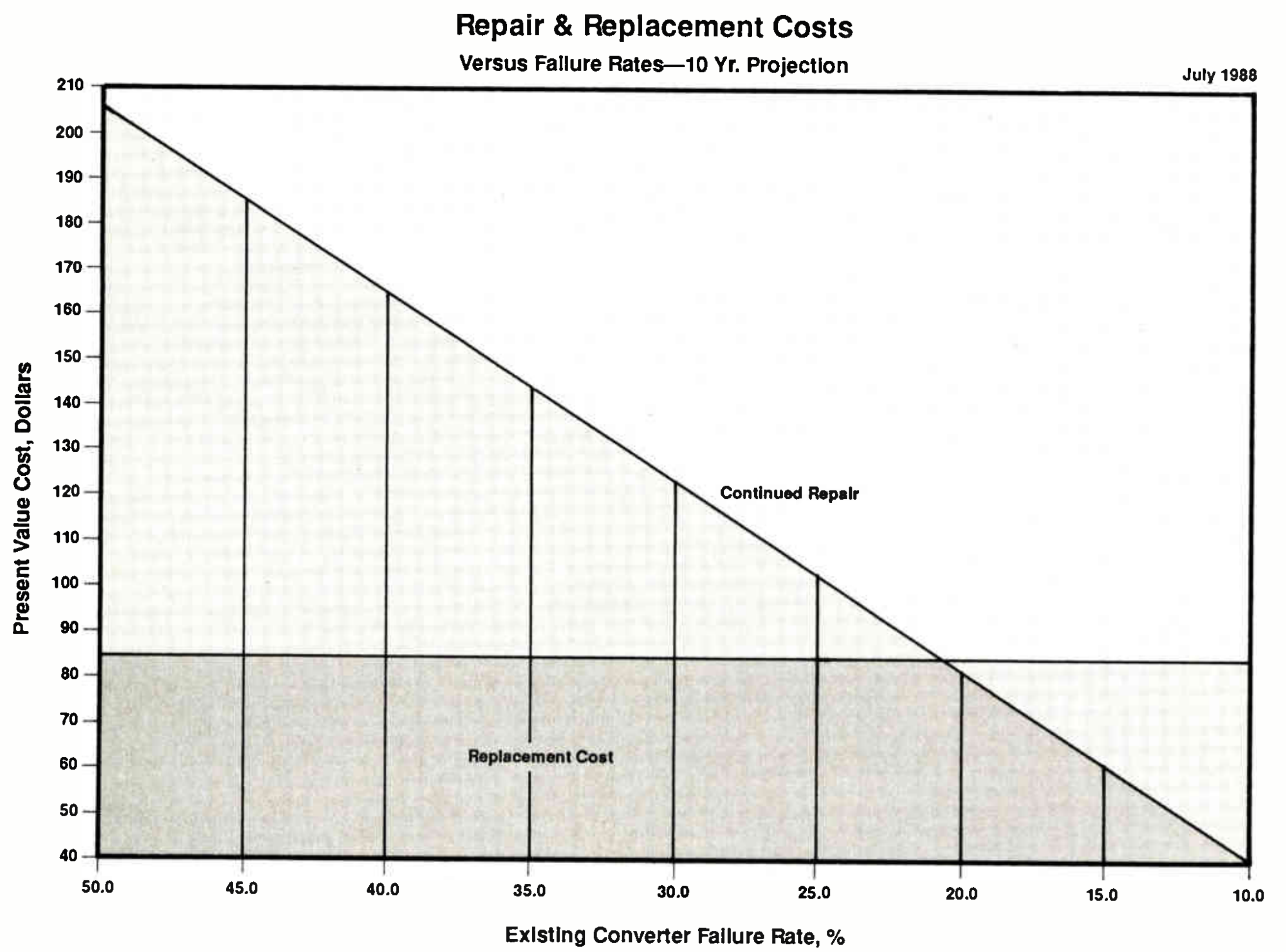
All calculations in this article are based on nominal values presented in the premise. Actual values will vary between systems and geographic locations; the results therefore are general and not universally applicable without refining the calculations.

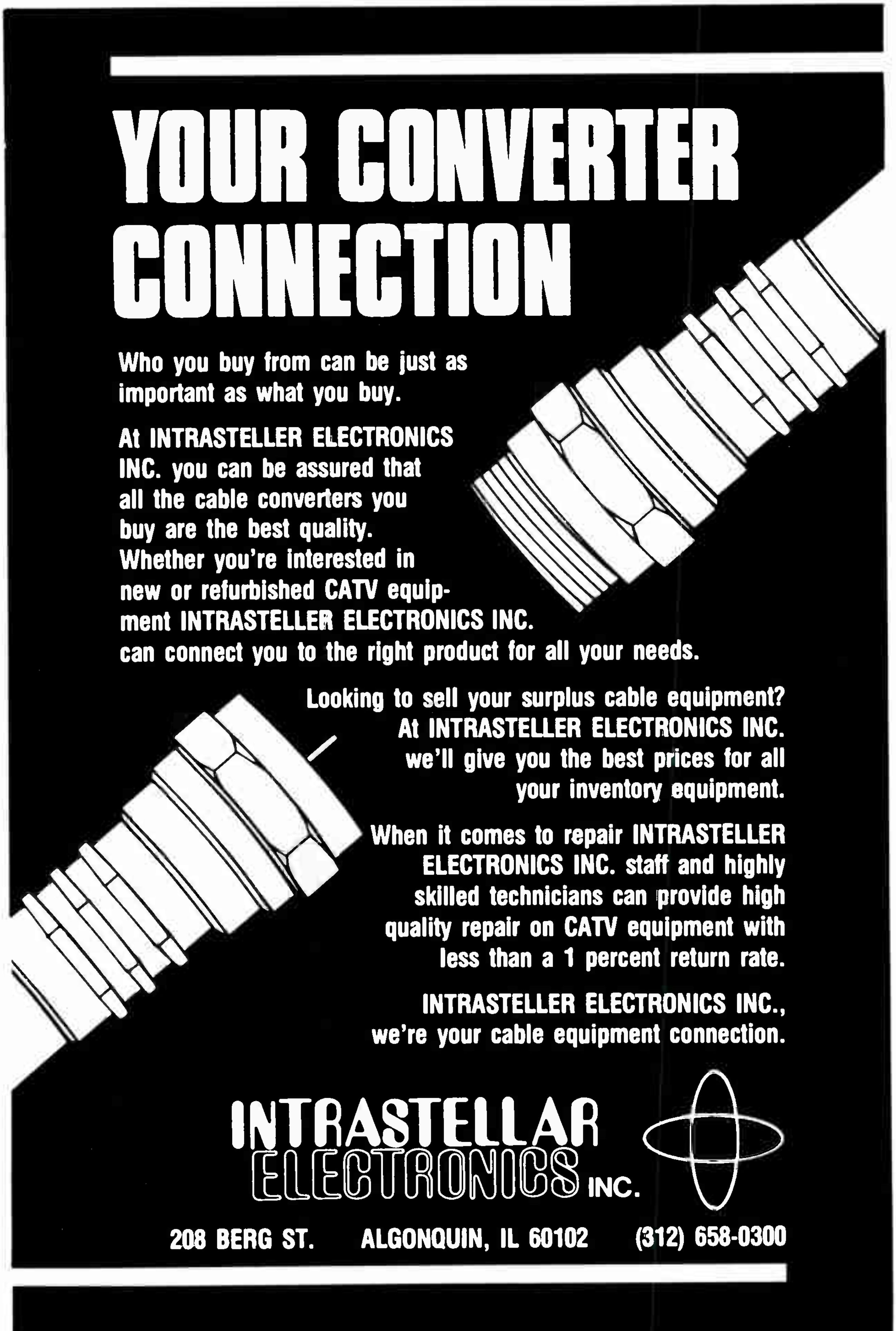
Premise

The economic merits between repair and replacement can be compared by determining the present value cost of each option with a 10-year forecast of operational costs. This analysis considers several important economic barometers such as inflation and the cost of money. Because future values are unpredictable and unknown, best estimates are used.

Table I tabulates typical labor and material costs, failure rates and esti-

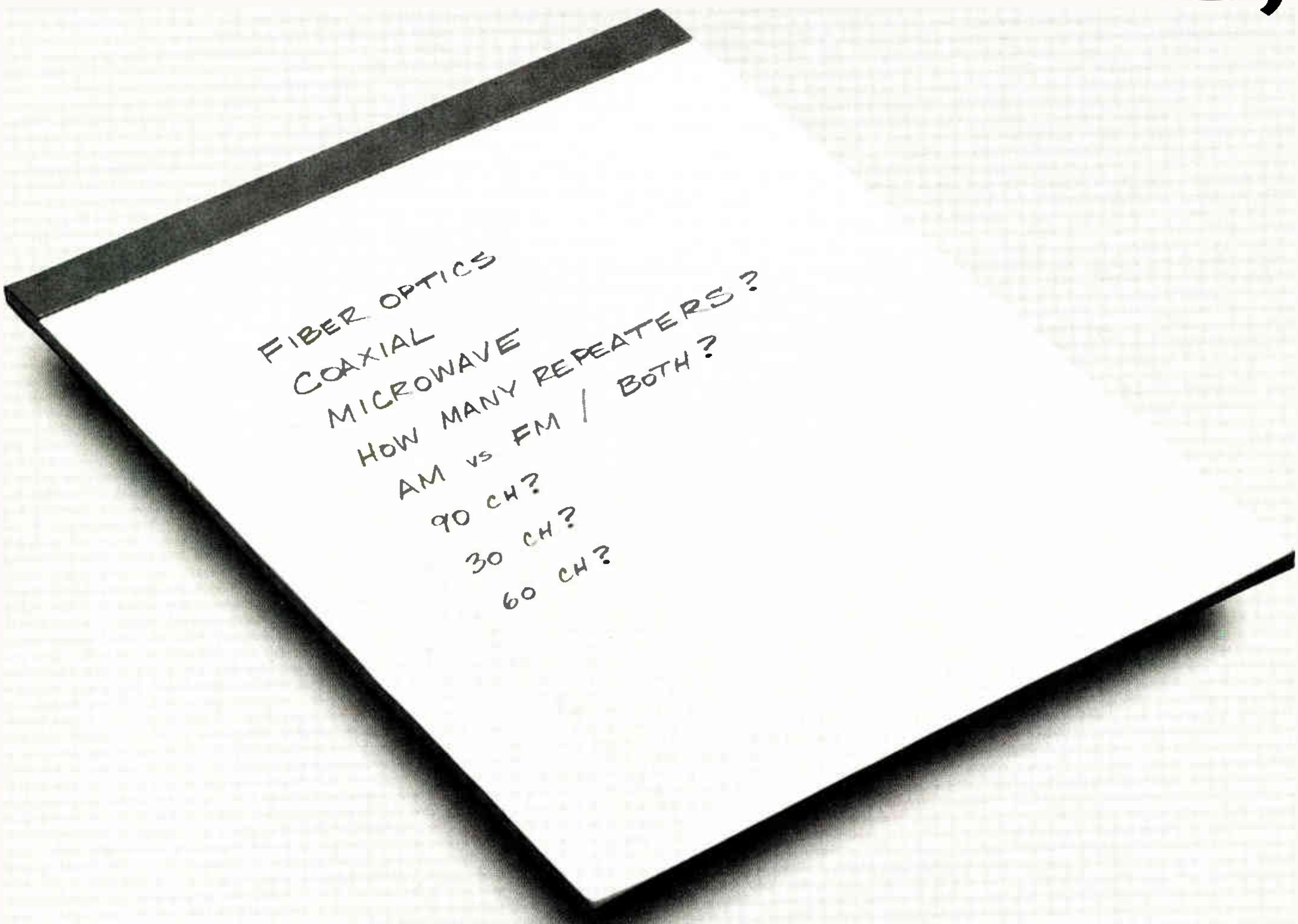
Continued on page 64





Reader Service Number 33

KNOWING WHERE YOU WANT TO GO,



You know where you want to go.

You want to stay competitive. And in the cable television industry, that means using the best, most cost-efficient technology. Maybe a new build is in order. Perhaps a system upgrade. Either way, you face a perplexing situation.

You know where you want to go. But how do you get there?

Making it Easier

At Catel, we realize that finding the answer isn't easy. There's a lot of talk and a great deal of confusion regarding CATV technologies—fiber optics, microwave, and coaxial.

Catel can make the decision-making process easier by examining your specific network requirements. Together, we can determine your cost, network distribution, and overall system objectives.

Then—and only then—can a particular technology be considered.

The Best Route

Oftentimes, the best route may consist of more than one technology. Eventually you'll realize that Catel's fiber optic technology has several distinct advantages over the others—superior quality, future expandability, and maximum channel capacity, to name a few.

Connecting Cable Systems to Subscribers' TVs and VCRs — Guidelines For The Cable Television Industry

Supplemental Reports

by the NCTA Engineering Committee's Subcommittee on Consumer Interconnection

Chairman: David Large

Published by
The National Cable Television Association
Washington, D.C.

Distributed and printed in cooperation with
International Thomson Communications Inc.
Denver, Colorado

Table of Contents

January 1988

SUPPLEMENTAL REPORT ON BASEBAND AUDIO AND VIDEO CONNECTIONS

Background of the Consumer Interconnect Subcommittee

In 1985, the Engineering Committee of the NCTA perceived a need for short-term solutions to assist cable operators in dealing with problems related to connecting home video equipment to cable television service. It was felt that long-term issues were being addressed by various EIA and joint EIA/NCTA groups, but that such solutions as the Homebus and IS-15 MultiPort jack would have to await a development and deployment cycle of several years, at least, before becoming commonplace. Meanwhile, cable operators and subscribers were being frustrated by the seemingly simple task of connecting a converter, VCR and TV in such a way that the features of all the equipment still functioned. Accordingly, the Consumer Interconnect Subcommittee was formed.

The subcommittee set about defining the technical requirements for connecting today's cable systems and existing subscriber equipment. In late 1986, a report was submitted to the parent committee containing an extensive tutorial on the issues and many recommended solutions for specific situations. That report was published in four parts in *CED* magazine (March through June 1987), and is available in reprint form from *CED* or from NCTA.

In an effort to keep the first submission of manageable size, it was directed primarily to the issues of signal leakage and converter/VCR/TV VHF connection problems. This supplemental report will focus on issues related to baseband video and audio connections.

The baseband issue

Baseband audio and video connections are provided on home video equipment for two reasons: lower distortion of audio and video and stereo compatibility. Additionally, they may allow more switching flexibility.

The distortion issue arises from the fact that, while TVs and VCRs internally must use or create baseband signals, external connections are usually made at VHF. When a prerecorded tape is played back, for instance, it is picked up from the magnetic pattern on the tape, amplified and processed to create a baseband audio and video signal, then modulated onto a VHF channel for output to the television set. The television set receives the signal, then demodulates it back to a baseband signal for display (see Figure 1).

Connecting the baseband output of the VCR directly to the baseband input on the TV eliminates the noise, distortion and bandwidth reduction involved in the additional modulation and demodulation process. The internal modulator in a VCR (representing less that $50 of the retail cost) cannot be expected to match the performance of a headend modulator costing $1,000 to $2,000!

The stereo issue is more complicated due to the sequence of developments in stereo television. So-called "stereo" VCRs have been on the market for several years—long before the development of over-air stereo broadcasting (MTS). These VCRs were provided with baseband stereo audio inputs and outputs which allowed direct recording of stereo audio and playback of prerecorded tapes through *external* sound systems. If connected to a television set through the normal VHF input, only monaural sound was heard. It had to be additionally connected to a stereo sound system to realize the benefit of stereo.

Unfortunately, the development of MTS stereo has only added to the confusion. Customers can now buy "stereo" VCRs with or without MTS decoders and, in any case, none of the VCRs on the market today contain an MTS encoder. As a result, *connecting an "MTS stereo" VCR to an "MTS stereo" television set's VHF input terminals will not result in stereo sound from prerecorded stereo tapes.*

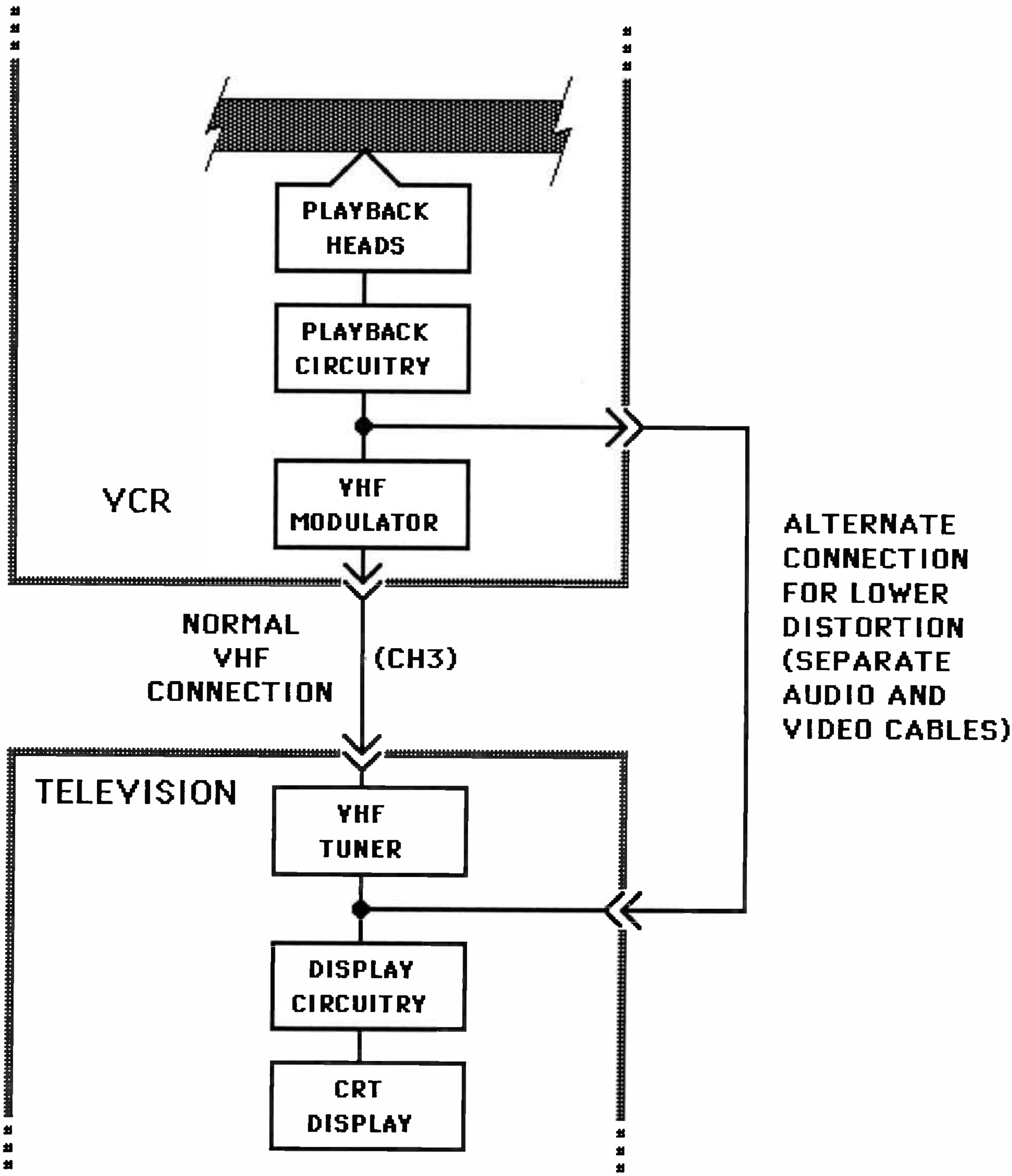
It is still necessary to provide baseband audio connections from the VCR to either an external sound system or to baseband audio inputs on the television set, if it is so equipped. The cost of an MTS encoder, at least at this date, is still too great to make it an internal part of VCRs. The fact that this incompatibility has nothing to do with connecting to cable television may very well be lost on a subscriber.

Finally, increased operational flexibility due to the additional baseband connections on equipment may be difficult to realize in fact. It is certainly hard for the cable operator to provide standardized recommendations to technicians and customers when there is so little commonality on which connectors are provided and what equipment is in the subscriber's home. For example:

- The television set may be monaural, stereo upgradable (with external adapter) or full MTS stereo. It may have one or more baseband video and/or audio inputs and/or outputs. The internal sound system may be stereo or monaural
- The VCR may be monaural, stereo without MTS decoder, upgradable with external MTS decoder, or full MTS reception. In any case it will not have an MTS encoder for playback. It may have one or more baseband inputs and/or outputs
- The cable converter may or may not have video, monaural audio or stereo audio outputs. It may pass MTS stereo (most RF converters), may pass MTS stereo at full volume only (newer baseband descramblers), may not pass MTS at all (older baseband descramblers), or may have an internal MTS decoder and have stereo available only at audio baseband
- The subscriber may need a converter (or converter/descrambler) for all channels, for all channels above 2 through 13, for premium channels only, or not at all
- The cable operator may provide pass-through stereo on broadcast channels only, on other basic channels and/or on premium channels. Stereo on cable-exclusive channels may be encoded MTS, may be provided by FM-band simulcasting, or may be transmitted on the cable in an encrypted form for signal security.

Obviously, the number of possible permutations of equipment and service levels is mind-boggling. What this document will attempt to do is recommend configurations for a few of the most common situations.

Figure 1



SIMPLIFIED VCR AND TV SIGNAL PROCESSING DIAGRAM

Selection guide

The selection guide below provides a functional index into the hookup diagrams which follow. The appropriate diagram will be found by finding, on the left side, which customer equipment is in the home and then moving right to the column that corresponds to the cable equipment provided.

Four cable equipment configurations are listed: a no-converter situation, a converter alone, an integrated VCR switching unit (corresponding to Application A on page I-37 of this Subcommittee's earlier report) and a converter with external MTS decoder. This is a very limited list considering that 27 A/B switch diagrams plus five integrated switch diagrams were discussed in the earlier document, but it should be sufficient that cable operators can expand the diagrams to suit their particular situations.

The customer equipment configurations were chosen to represent the most common combinations out of many theoretical possibilities. An important assumption is that MTS stereo television sets are equipped with audio and video inputs and outputs. Although this is generally true today, it may not be in the future as stereo capabilities move into lower-priced models. The impact of that will be:

- That non-MTS stereo VCRs will not be able to record MTS programming using audio signals derived from the TV, and
- That external audio equipment will be required when playing stereo taped material.

A second assumption is that even MTS-equipped VCRs do not include an MTS encoder on their VHF outputs. While this is true today, it may not be true in the future if lower cost ways of MTS encoding are developed.

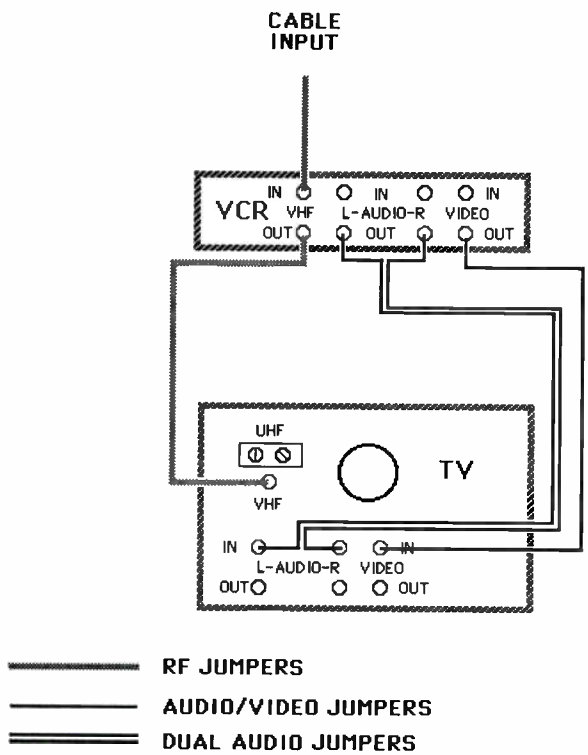
Third, it is assumed that converters will pass MTS encoded signals without serious degradation. This is generally true for RF converters but not for older baseband converters. Newer baseband converters vary in their ability to pass stereo.

SELECTION GUIDE

Customer's Equipment	Cable System Furnished Equipment			
	No Cnvtr.	Cnvtr.	Cnvtr. + RF Switcher	Cnvtr. + MTS Decoder
MTS Stereo TV MTS Stereo VCR	1	4	5	N/A
MTS Stereo TV Stereo, Non-MTS VCR	2	10	6	7
Monaural TV MTS Stereo VCR	3	11	12	8
Monaural TV Stereo, Non-MTS VCR	3	11	12	8
Monaural TV Monaural VCR	*	*	*	9

*No stereo programming or recording is available with this equipment configuration.

Diagram 1

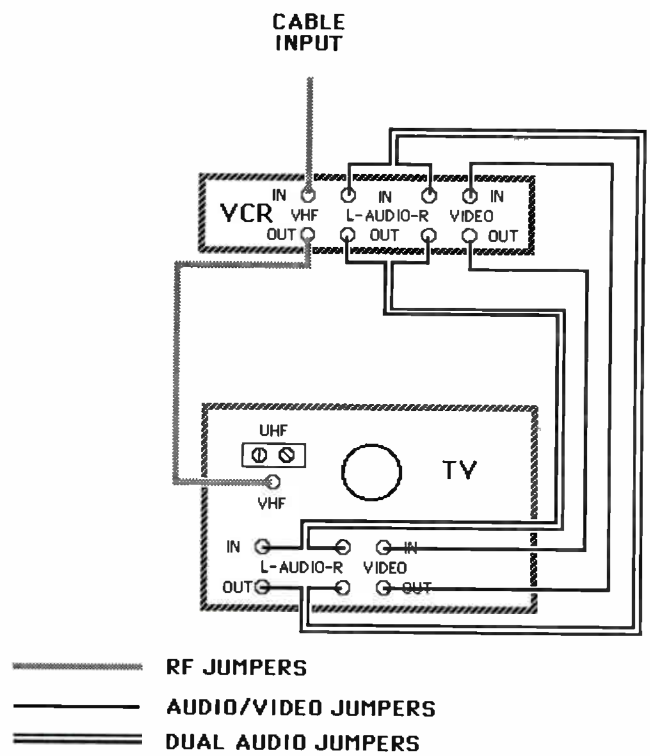


BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:
- MTS STEREO TV
- MTS STEREO VCR

ALLOWS:
- STEREO SOUND WHEN WATCHING STEREO PROGRAMS
- RECORDING OF STEREO TELEVISION PROGRAMS
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES
- SIMULTANEOUS RECORDING/VIEWING OF DIFFERENT STEREO CHANNELS

Diagram 2

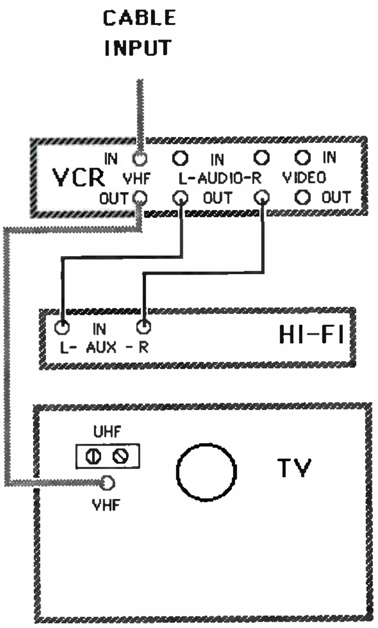


BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:
- MTS STEREO TV
- STEREO (NON-MTS) VCR

ALLOWS:
- STEREO SOUND WHEN WATCHING STEREO PROGRAMS
- RECORDING OF SAME STEREO TELEVISION PROGRAM BEING VIEWED
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES
- RECORDING SEPARATE (MONAURAL) CHANNEL WHILE VIEWING STEREO CHANNEL

Diagram 3



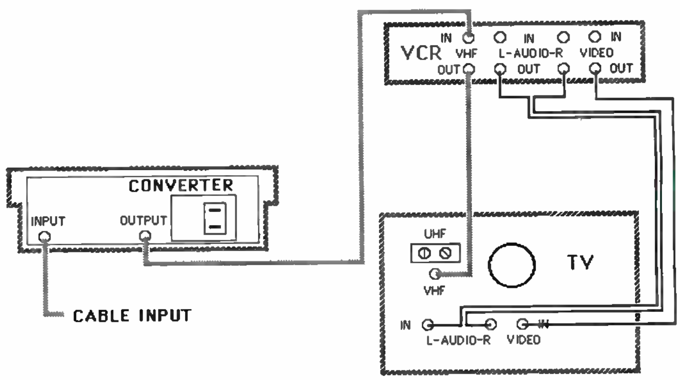
BACK PANEL VIEW OF ALL EQUIPMENT

RF JUMPERS
AUDIO/VIDEO JUMPERS

EQUIPMENT:
- MONAURAL TELEVISION SET
- STEREO VCR (MTS OR NON-MTS)
- AVAILABLE HI-FI SYSTEM

ALLOWS:
- STEREO SOUND WHEN WATCHING MTS STEREO PROGRAMS USING VCR AND HI-FI (IF MTS VCR)
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES
- RECORDING OF STEREO PROGRAMMING (IF MTS VCR)

Diagram 4



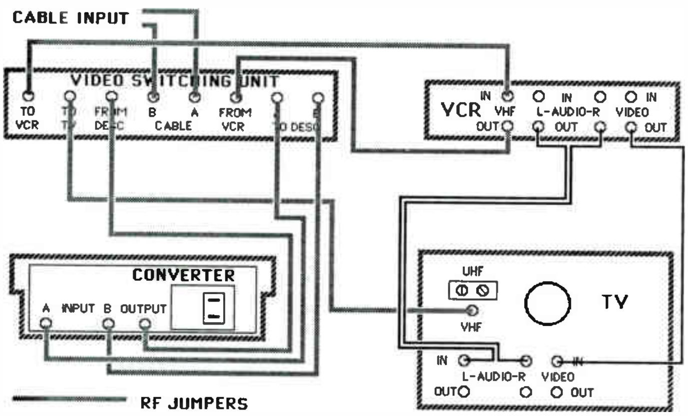
RF JUMPERS
AUDIO/VIDEO JUMPERS
DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:
- STEREO-COMPATIBLE CONVERTER
- MTS STEREO VCR
- MTS STEREO TV SET

ALLOWS:
- STEREO SOUND WHEN WATCHING MTS-ENCODED CHANNELS
- RECORDING OF CONVERTER-SELECTED STEREO PROGRAMS IN STEREO
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

Diagram 5



RF JUMPERS

AUDIO/VIDEO JUMPERS

DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:

- RF SWITCHING NETWORK
- MTS STEREO TV
- MTS STEREO VCR
- STEREO-COMPATIBLE CONVERTER

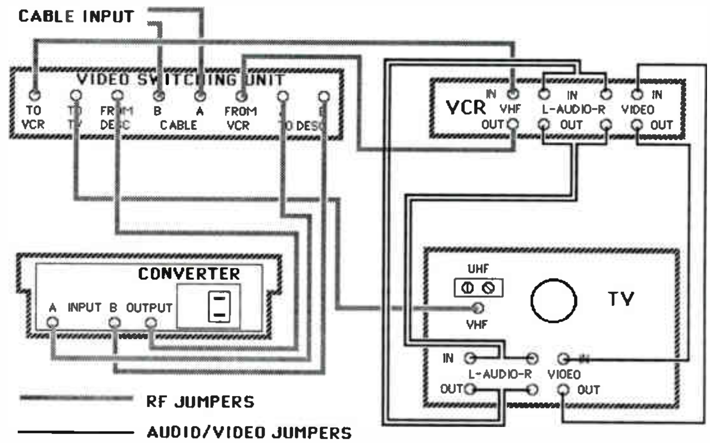
ALLOWS:

- STEREO SOUND WHEN WATCHING STEREO PROGRAMS
- RECORDING OF SAME OR DIFFERENT STEREO TELEVISION PROGRAM THAN THAT BEING VIEWED
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

NOTES:

- SEE PREVIOUS REPORT PAGE I-37, APPLICATION "A" FOR VIDEO SWITCHING NETWORK DIAGRAM
- DUAL CABLE APPLICATION SHOWN AS EXAMPLE. IN SINGLE CABLE CASE, SECOND INPUT MAY BE USED FOR OTHER VIDEO SOURCE

Diagram 6



RF JUMPERS

AUDIO/VIDEO JUMPERS

DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:

- RF SWITCHING NETWORK
- MTS STEREO TV
- STEREO (NON-MTS) VCR
- STEREO-COMPATIBLE CONVERTER

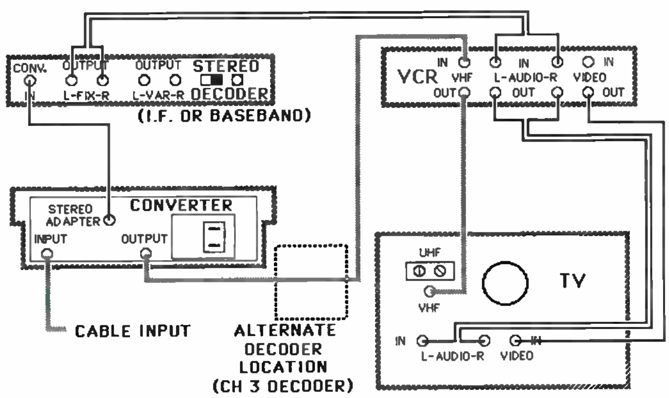
ALLOWS:

- STEREO SOUND WHEN WATCHING STEREO PROGRAMS
- RECORDING OF SAME STEREO TELEVISION PROGRAM BEING VIEWED
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES
- RECORDING OF SEPARATE (MONAURAL) CHANNEL WHILE VIEWING STEREO CHANNEL

NOTES:

- SEE PREVIOUS REPORT PAGE I-37, APPLICATION "A" FOR VIDEO SWITCHING NETWORK DIAGRAM
- DUAL CABLE APPLICATION SHOWN AS EXAMPLE. IN SINGLE CABLE CASE, SECOND INPUT MAY BE USED FOR OTHER VIDEO SOURCE

Diagram 7



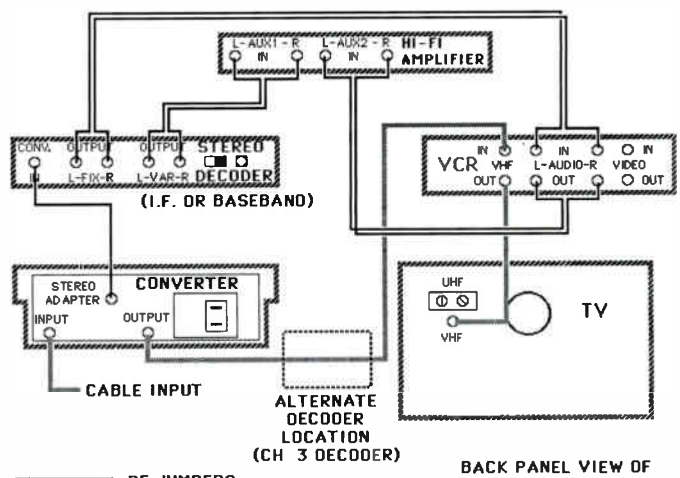
RF JUMPERS
AUDIO/VIDEO JUMPERS
DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:
- CONVERTER WITH STEREO ADAPTER
- STEREO (NON-MTS) VCR
- MTS STEREO TV SET

ALLOWS:
- STEREO SOUND WHEN WATCHING MTS-ENCODED CHANNELS
- RECORDING OF CONVERTER-SELECTED STEREO PROGRAMS IN STEREO
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

Diagram 8



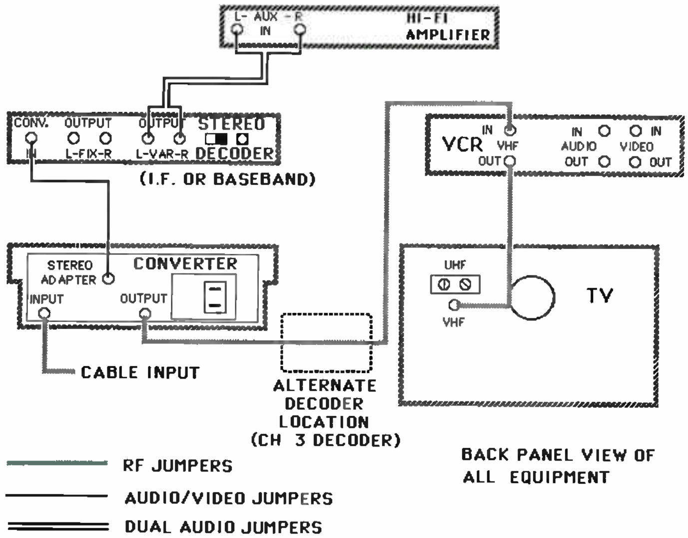
BACK PANEL VIEW OF ALL EQUIPMENT

RF JUMPERS
AUDIO/VIDEO JUMPERS
DUAL AUDIO JUMPERS

EQUIPMENT:
- CONVERTER WITH STEREO ADAPTER
- STEREO VCR (MTS OR NON-MTS)
- MONAURAL TV SET
- AVAILABLE STEREO SOUND SYSTEM

ALLOWS:
- STEREO SOUND WHEN WATCHING CONVERTER SELECTED CHANNEL
- RECORDING OF STEREO TELEVISION PROGRAMS, EVEN WITH NON-MTS VCR
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

Diagram 9



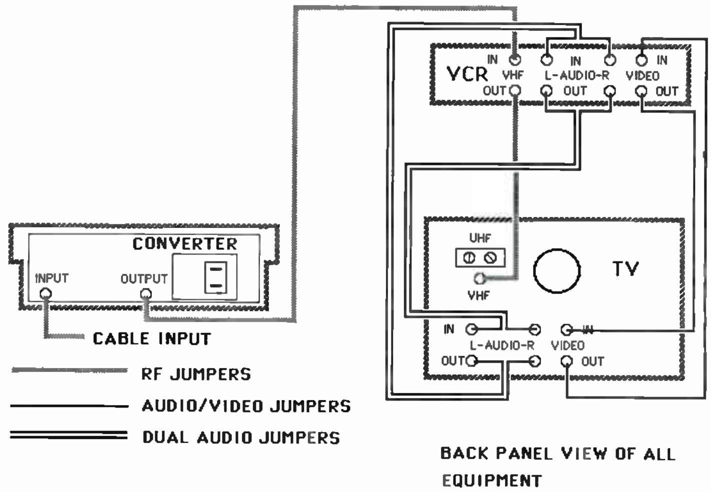
EQUIPMENT:

- CONVERTER WITH STEREO ADAPTER
- MONAURAL VCR
- MONAURAL TV SET
- AVAILABLE STEREO SOUND SYSTEM

ALLOWS:

- STEREO SOUND WHEN WATCHING CONVERTER SELECTED CHANNEL

Diagram 10



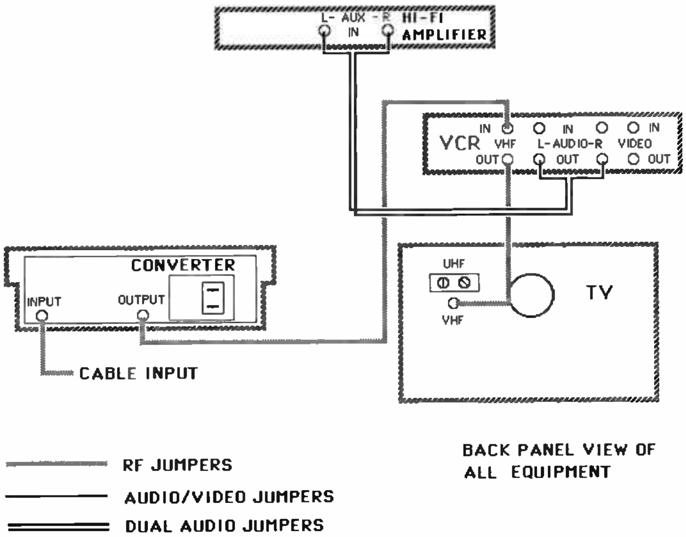
EQUIPMENT:

- MTS STEREO TV
- STEREO (NON-MTS) VCR
- STEREO-COMPATIBLE CONVERTER

ALLOWS:

- STEREO SOUND WHEN WATCHING STEREO PROGRAMS
- RECORDING OF STEREO TELEVISION PROGRAMS
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

Diagram 11



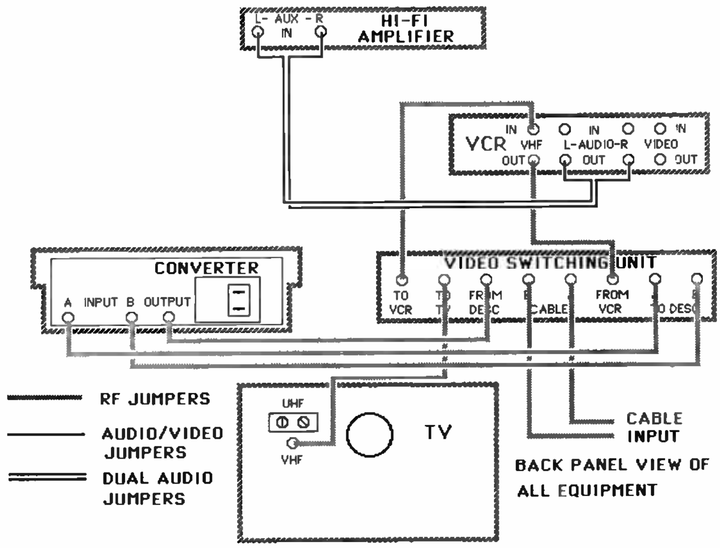
EQUIPMENT:

- STEREO-COMPATIBLE CONVERTER
- STEREO VCR (MTS OR NON-MTS)
- MONAURAL TV SET
- AVAILABLE STEREO SOUND SYSTEM

ALLOWS:

- STEREO SOUND WHEN WATCHING TV (WITH MTS VCR ONLY) USING VCR AS TUNER AHEAD OF TELEVISION SET AND USING VCR'S AUDIO SYSTEM
- RECORDING OF STEREO TELEVISION PROGRAMS (MTS VCR ONLY)
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

Diagram 12



EQUIPMENT:

- MONAURAL TV SET
- STEREO VCR (MTS OR NON-MTS)
- STEREO-COMPATIBLE CONVERTER
- RF SWITCHING NETWORK

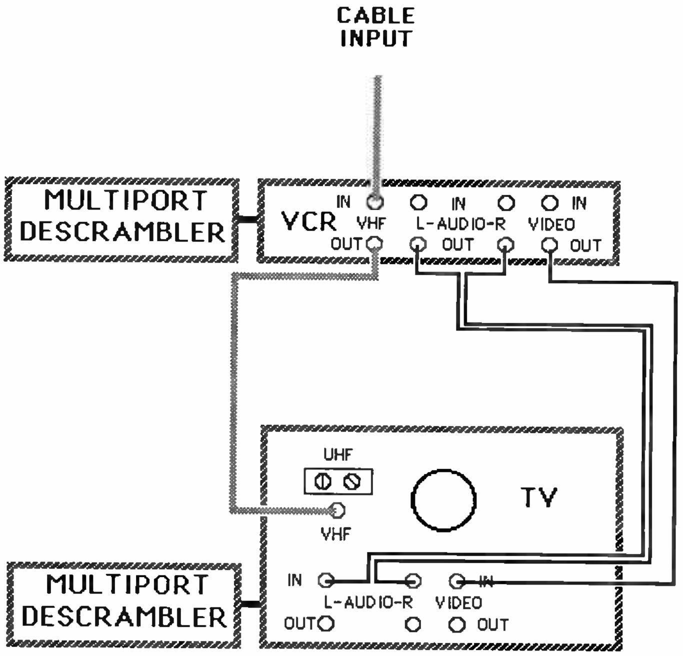
ALLOWS:

- STEREO SOUND WHEN WATCHING CHANNEL SELECTED ON VCR (MTS VCR ONLY)
- RECORDING OF STEREO TELEVISION PROGRAMS (MTS VCR ONLY)
- STEREO SOUND WHEN PLAYING PRERECORDED STEREO TAPES

NOTES:

- SEE PREVIOUS REPORT PAGE I-37, APPLICATION "A" FOR VIDEO SWITCHING NETWORK DIAGRAM
- DUAL CABLE APPLICATION SHOWN AS EXAMPLE. IN SINGLE CABLE CASE, SECOND INPUT MAY BE USED FOR OTHER VIDEO SOURCE

Diagram 2



RF JUMPERS

AUDIO/VIDEO JUMPERS

DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:

- MULTIPORT-EQUIPPED TELEVISION SET
- MULTIPORT-EQUIPPED VCR

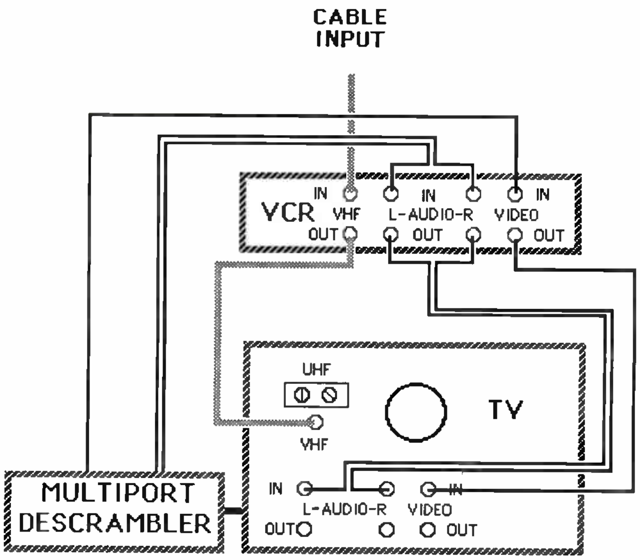
ALLOWS:

- TOTALLY INDEPENDENT SELECTION OF CHANNELS FOR VIEWING OR RECORDING, WHETHER SCRAMBLED OR NOT.

NOTE:

- AUDIO AND VIDEO CONNECTIONS FROM VCR TO TV ARE OPTIONAL FOR STEREO TAPE PLAYBACK

Diagram 3



RF JUMPERS

AUDIO/VIDEO JUMPERS

DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:

- MULTIPORT-EQUIPPED TELEVISION SET
- NON-MULTIPORT-EQUIPPED VCR

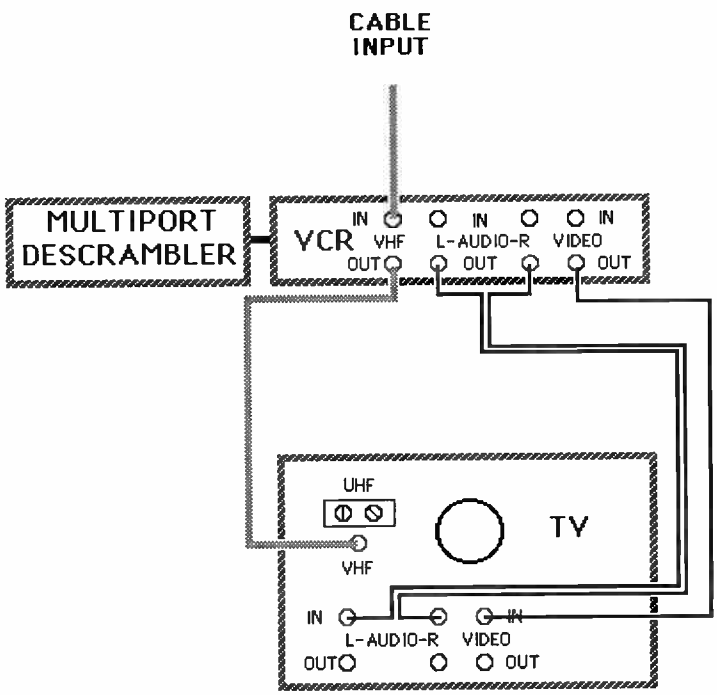
ALLOWS:

- VIEWING ANY AUTHORIZED CHANNEL, SCRAMBLED OR NOT
- INDEPENDENT CHANNEL SELECTION FOR RECORDING OF NON-SCRAMBLED CHANNELS
- RECORDING OF ANY CHANNEL WHILE VIEWING SAME

NOTES:

- AUDIO AND VIDEO CONNECTIONS FROM VCR TO TV ARE OPTIONAL FOR STEREO TAPE PLAYBACK
- AUDIO AND VIDEO CONNECTIONS TO VCR INPUTS MAY COME FROM DESCRAMBLER, IF SO EQUIPPED, OR FROM TELEVISION SET AUDIO AND VIDEO OUTPUTS. SOME TELEVISION SETS AND DESCRAMBLERS MAY NOT HAVE SUCH OUTPUTS.

Diagram 4



RF JUMPERS

AUDIO/VIDEO JUMPERS

DUAL AUDIO JUMPERS

BACK PANEL VIEW OF ALL EQUIPMENT

EQUIPMENT:

- NON-MULTIPORT-EQUIPPED TELEVISION SET
- MULTIPORT-EQUIPPED VCR

ALLOWS:

- RECORDING ANY CHANNEL, SCRAMBLED OR NOT
- INDEPENDENT CHANNEL SELECTION FOR VIEWING NON-SCRAMBLED CHANNELS
- VIEWING ANY CHANNEL SELECTED ON VCR TUNER

NOTE:

- AUDIO AND VIDEO CONNECTIONS FROM VCR TO TV ARE OPTIONAL FOR STEREO TAPE PLAYBACK

POSTSCRIPT

October 1988

The supplemental reports on pages I-59 to I-71 are additions to **CONNECTING CABLE SYSTEMS TO SUBSCRIBERS' TVs AND VCRs—GUIDELINES FOR THE CABLETELEVISION INDUSTRY,** published originally in 1987. Free copies of the first 58 pages are available from NCTA's Science and Technology department while supplies last.

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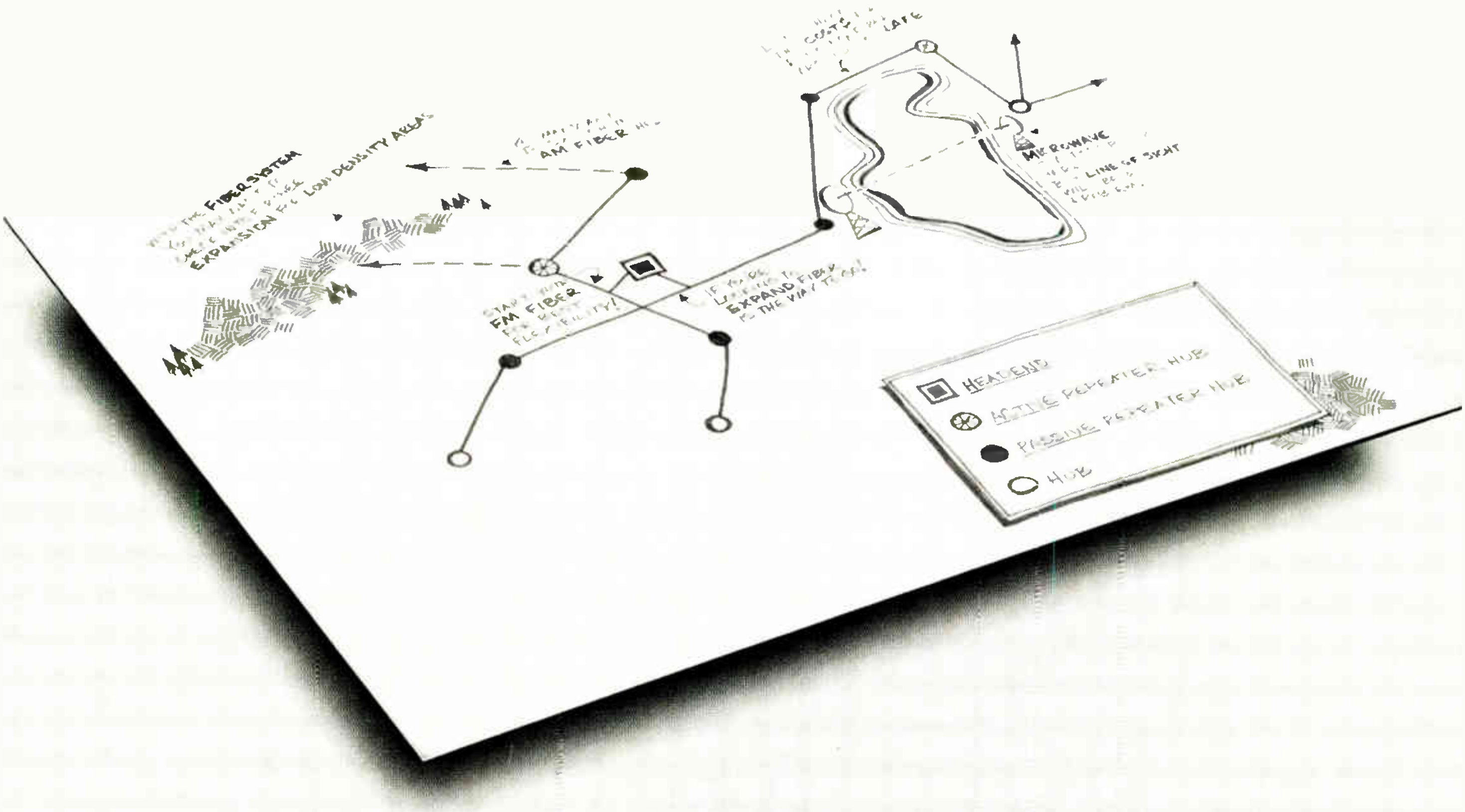

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THE CLEAR CHOICE IN FIBER

Reader Service Number 34

Continued from page 44
mated discount and inflation rates.

Discussion

The new converter cost of $45 per unit is for a "plain vanilla" 58-channel converter without infrared remote control. This is an average price and representative of the converter type. Though electronic converters are more reliable than their mechanical predecessors and have a annual failure rate of 2 percent to 3 percent, 4 percent is used in the 10-year projection to account for component aging, wear and tear and abuse.

The $25 trip cost, which is industry norm and compares well with known actual expense, is the operating expense that includes vehicle mobilization, equipment, technician base wages and fringes. Repair costs vary by region and between repair houses; some charge a flat rate while others itemize the cost per function performed. A typical cost of $14.50 is used in this article and in subsequent calculations. Both trip and repair costs are calculated with a annual 6 percent inflation and 5 percent discount rate.

The discount rate is the rate at which forecasted cash flows are weighed; i.e. discounted. High discount rates weigh early cash flow more than those that follow. For example, a high discount rate is used in situatiions where future cash flow is unpredictable and variable thus lending greater importance to early cash flow.

It must be remembered that failure rates cannot be taken at face value and must be carefully evaluated.

In a 10-year projection the present value cost of converter replacement and continued repair is the sum of the yearly expenses which are determined by the converter's failure rate, trip and repair costs, inflation and discount rates. Converter replacement only differs in that the new converter cost is absorbed the first year.

Scrutinize failure rates

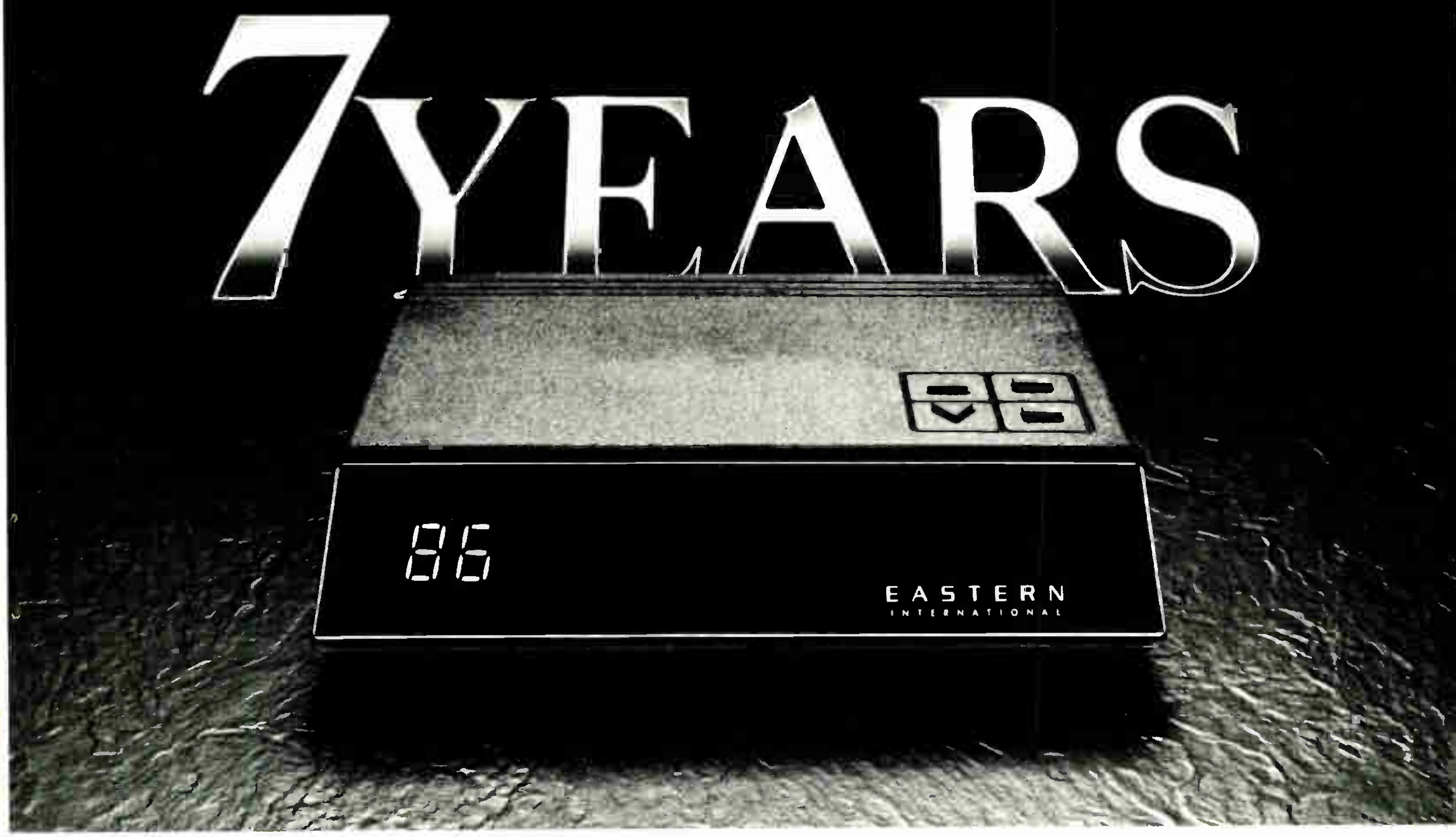
Though factual data may not always be available, a system typically knows which converter models cause the greatest problems and is most frequently repaired. It must be remembered that failure rates cannot be taken at face value and must be carefully evaluated to determine if the converter's useful life can be extended. An example is transforming converters with wired remotes and high failure rates to table tops. This can be accomplished by replacing the most common failure, the control cable, with shorter leads.

After evaluating a converter model and determining that its life cannot be extended, the analysis can proceed as previously outlined.

The availability and cost of capital dollars is a primary consideration and converter replacement should be planned with long-term corporate and financial goals in mind.

The present value costs of converter repair and replacement for various failure rates in a 10-year forecast is

There's A Name For People Who Make Big Claims, Then Back Them Up With A 7-Year Warranty.



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Reader Service Number 36

listed in Table II. All calculations are based on figures presented in Table I.

The present value cost represents the current dollar value of future expenditures (in this example for 10 years). The dollar difference between converter replacement and repair represents the per unit savings or additional cost. Accordingly the breakeven point occurs when both values are equal (in this example at an approximate failure rate of 20.5 percent). The breakeven point tracks the new converter failure rate almost one-for-one, i.e. if the new converter failure rate decreases by 3 percent, so does the breakeven point.

Usefulness demonstrated

The usefulness of the preceeding data is demonstrated in the following example.

Example:

10,000 Converters, same make and model

25% Annual Failure Rate

$84.91 Present Value Replacement Cost/unit

$103.09 Present Value Repair Cost/unit.

Table 1

Repair Cost	$14.50
Trip Cost	$25.00
New Converter Cost	$45.00
New Converter Failure Rate, %	4.0
Discount Rate %	5.0
Inflation, %	6.0

In a 10-year projection, the present value repair cost for these converters is $1,030,900, while the replacement cost is $849,100. Simple mathematics indicates initial converter replacement yields a savings of $181,800 over 10 years.

(Note, these calculations do not consider shipping and handling, operational costs associated with converter tracking, hidden office costs or other similar costs, which all increase the potential savings. Also note the potential savings is directly related to the failure rate and increases with the failure rate.)

Converter replacement also reduces the number of converter related service calls, which average 15 percent of all truck rolls. This fact reduces operating expenses and improves customer service with faster response time to service calls. In turn, this results in satisfied subscribers, our source of income.

The economics and effect to profitability of large capital expenditure vs. ongoing smaller operating expenditures can best be evaluated by system management after weighing the system's economic posture and future business plans.

Cut-off point cloudy

Because repair and replacement costs are affected by each system's unique factors and time, an absolute cut-off failure rate for converter replacement cannot be presented. However, a method to evaluate converters has been presented and should enable systems to calculate the potential savings converter replacement may offer. ■

Converter replacement also reduces the number of converter related service calls, which average 15 percent of all truck rolls.

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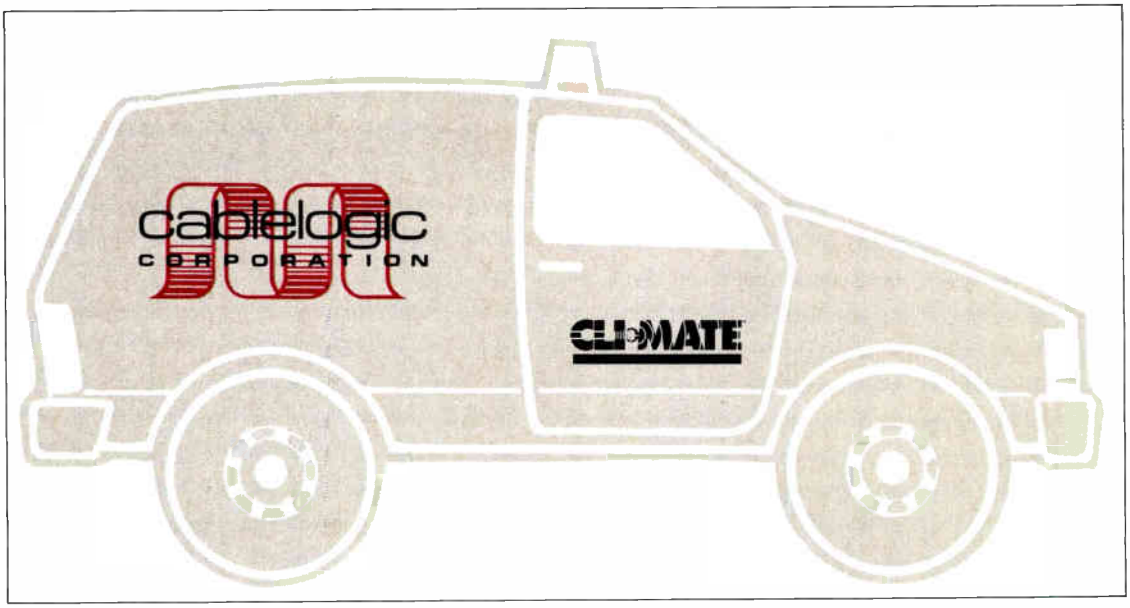

that should be inspected more closely on the ground. As such, fly-overs may be a convenient tool for satisfying the FCC's annual reporting requirements. Ground-based patrols still will be required to pinpoint and fix identified leaks, however.

Ground-based measurements, by way of contrast, require identification and measurement of every leak in excess of 50 microvolts per meter in at least 75 percent of the system. Again, that can take weeks or months unless the measurements are logged as part of routine system installation or audit activities.

Ground-based testing

Among the new products specifically developed for CLI compliance are software packages that will perform the required calculations, produce work orders, FCC-formatted reports, work records and repair statistics. Telecommunications Products Corp. of Chambersburg, Pa. has a $695 program called "CLIDE." The IBM-PC compatible program takes as input data from ground-based measurements and then calculates the resulting system CLI.

CLIDE generates FCC leakage report logs; drive-out reports showing leak locations, leak levels and dates of discovery; area reports showing mileage, miles driven, leaks per mile, largest and smallest leaks, signal strength of identified leaks and CLI pass/fail status.

Unrepaired leak reports also can be generated, showing signal intensity, location and date found. Repaired leak reports show leak locations and intensities, discovery and repair dates and leak sources. CLIDE also generates work orders and various other statistical reports.

Among the common leakage-producing culprits CLIDE provides for as part of its system of leak source codes are: defective or improperly installed drop connector; cut or damaged drop connector; defective TV receiver; defective A/B switch; subscriber tampering; CATV connected to antenna terminals; and defective converter.

San Diego, Calif.-based Long Systems has a CLI calculation program called LES (Leakage Evaluation System) that calculates the CLI, generates work orders and provides FCC-required logging.

Mobile detection

Not every system will want to do its own CLI measurements, preferring instead to hire a contractor. Cablelogic Corp. of Littleton, Colo. appears to be the first company specifically set up to perform CLI ground-based measurements for operators on a contract basis. Called CLI-Mate, principals Tom Moe and Mike McNeil already have run CLI tests on about 3,000 miles of plant for

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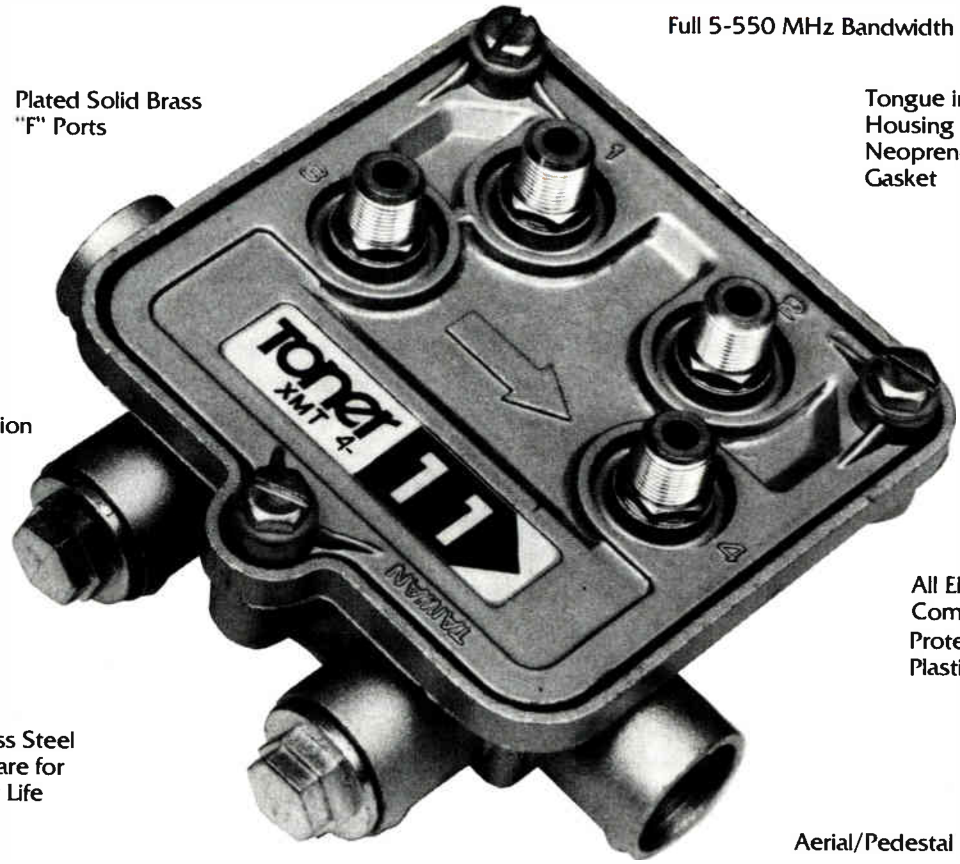

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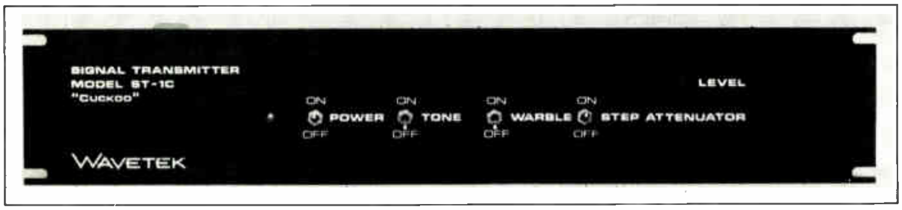
several customers, including Centel Cable of Michigan. They emphasize that CLI-Mate offers an unbiased source of information on whether a system is in compliance or not. To ensure the integrity of the testing, Cablelogic will not repair identified leaks. "It's a bit like coming home and having a plumber tell you he has replaced 100 feet of defective pipe. How do you know the pipe really was defective in the first place?" McNeil asks rhetorically.



Wavetek's Signal Transmitter Model ST-1C

The fee for CLI-Mate will depend on Cablelogic's costs. There is a per-mile charge for actual system miles driven. A more variable cost is how many jobs Cablelogic can group in a given geographic location. Today, all the company's vans and crews are based outside Denver. The cost for each job is smaller when a group of jobs can be arranged in a single geographic area.

CLI will be calculated

Software programs such as CLIDE and LES or fly-over services such as Dovetail's will calculate a system's CLI. The task of repairing identified leaks, however, is another matter. Some industry vendors are gearing up special leak repair services as a complement to leakage detection programs. Advanced Communications Industries of North Haven, Conn., for example, has rolled out a leakage detection and correction program that will be offered to systems nationwide. Among the more interesting angles is the firm's pre-purchase system audit.


Texscan's family of detection products

Assume a system is for sale. ACI will conduct a ground-based CLI analysis, identify problems and provide an estimate of how much it will cost to repair the leaks so that CLI rules are complied with. Says President Michael Johnson, "The FCC seems to be saying that if a buyer gets a 'lemon' system that doesn't comply with CLI, that's the buyer's problem." Obviously, sub counts, channel capacity, penetration rates, plant condition, business and political environment are important contributors to a given system's value. ACI suggests that ability to pass CLI—and therefore use the mid-band and superband—also are components of value.

ACI says it takes measurements from midnight to 7 a.m. to minimize disruptions to existing system operations.

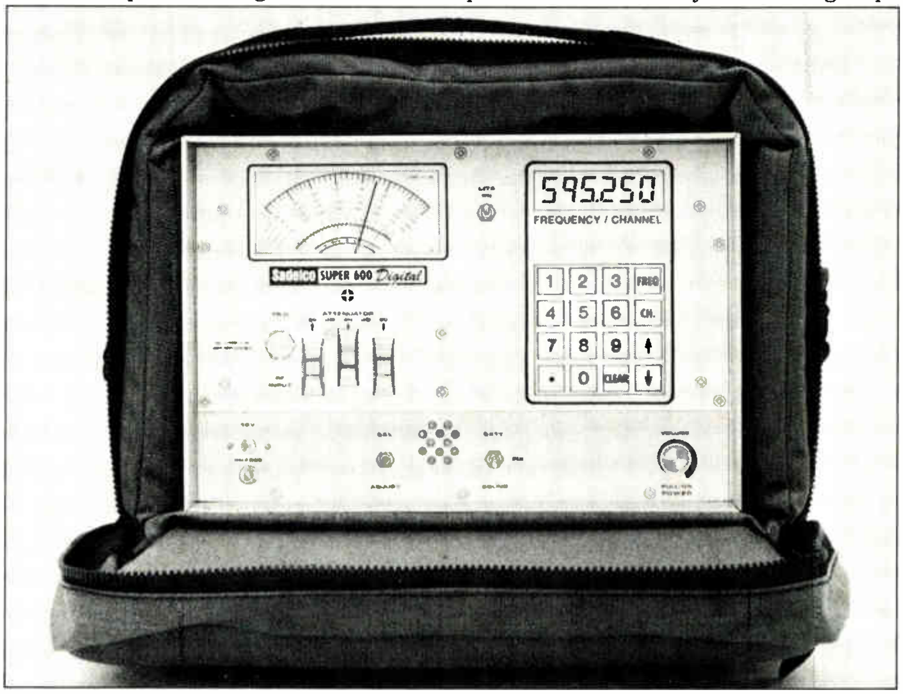
Not every system will contract for its CLI compliance efforts so some technical personnel will find themselves with new responsibilities for CLI efforts. Technicians with ground-based leakage detection and control responsibilities will find it takes about a year to get a CLI program up and running, say MSO technicians who've already done it. The most common leakage method involves a transmitter at the headend which injects a carrier into the system. Matched receivers, tuned to the carrier frequency, then are used in the field to locate egress sites. Another, newer method, is to detect egress of system video carriers. Less expensive because no headend transmitter is required, this method does potentially create the problem of confusing over-the-air signals with on-channel system signals.

In addition to this monitoring approach, which is useful for finding leaks, a measurement approach quantifies the leaks in dBmV. This method requires tunable signal level meters. Used in conjunction with a dipole antenna, leakage at all frequencies can

Augat's antenna and receiver

be detected and measured.

Look for announcements of new CLI test equipment from Wavetek sometime about November. Although details aren't available yet, it is safe to say the new gear will measure and log leaks while automating CLI calculations. In the meantime, the new CLR-4 leakage detector/locator already is available. An update and replacement for the company's older CR-6 detector, the hand-held CLR-4 scans four simultaneous frequencies or one frequency at a time. When a leak is detected the CLR-4 stops scanning and emits a locator tone which varies in pitch depending on the strength of the leak. The new locator comes in six versions, pre-set at the factory. Channel groups are:



Sadelco's Super 600 Digital attenuator

- 2, 3, B, R
- 2, 3, D, R
- 2, 3, G, R
- 2, 4, B, R
- 2, 4, D, R
- 2, 4, G, R

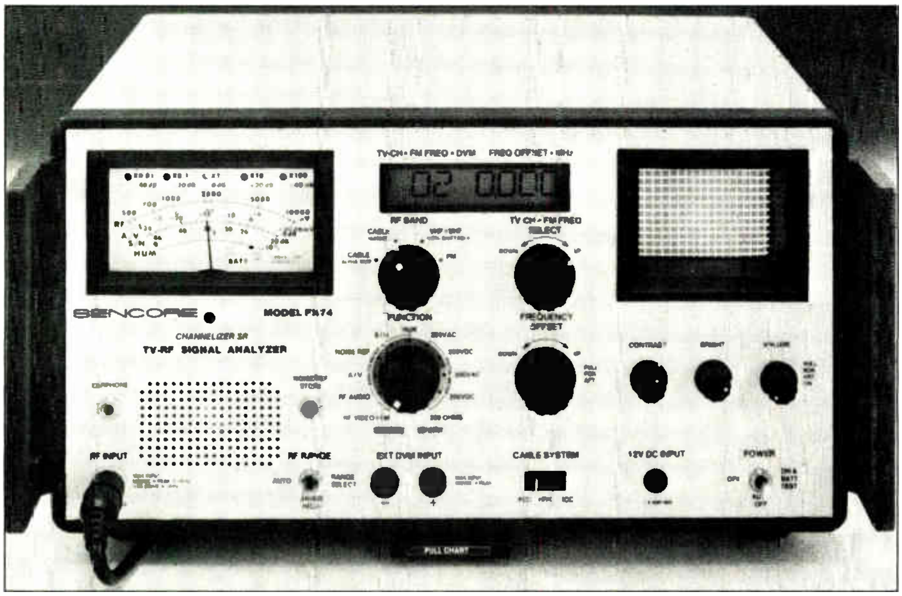
The CLR-4 is available in standard or HRC versions and accomodates all FCC frequency offsets in the aeronautical bands.

Wavetek also makes other leakage detection systems. The company's ST-1 "Cuckoo" injects an FM signal into the plant. The advantage is that an ordinary FM radio can be used as the receiver. The ST-1C is similar to the ST-1 but is crystal-controlled and is mated with the CR-1B receiver. The advantage: no tuning is required.

The RD-1 tunable dipole antenna is used when signal strength, not just location, must be determined (CLI rules require logging of leak intensities). The RD-1 has an amplifier to boost signals for convenient reading by a SAM I or SAM III SLM. For leakage monitoring purposes, use the ST-1 or ST-1C. For CLI purposes, use the RD-1 and a matching SLM.

Texscan Instruments

Texscan Instruments offers two leakage detection systems, the "Searcher,"



Sencore's FS74 Channelizer Sr.

which uses existing system video carriers, and the FDM system, which uses a headend transmitter. Either system will locate leaks. To measure leak strength, use the AFS-1 calibrated dipole in conjunction with an SLM or spectrum analyzer.

The FDM system uses a headend transmitter (FDM-5) programmable in 25 kHz steps and using phase locked loop technology to prevent drift. The FDM-3 portable receivers operate from 104 to 120 MHz, weigh 13 oz. and clip onto belts. The FDM-4 is designed for vehicle mounting.The Searcher operates on system video carriers from channel 14 to 18. For CLI measurements, use the AFS-1 dipole with an SLM or spectrum analyzer.

Sniffers, Tracers

The "Sniffer" system made by ComSonics uses a headend transmitter, dipole antenna and receiver to both detect and measure leak intensities. A popular system, the Sniffer uses fixed, rather than variable receiver tuning to improve the accuracy of readings.

Brand new from the Harrisburg, Va. company is the Sniffer III, which has incorporated a mirovolt display for simple, quick determination of the leak's strength.

Another long-time leakage detection system, the "Tracer," is made by Augat/LRC. The TR-1 leakage detector uses a dual-meter scale indicating both relative field strength and maximum allowable distance. The Tracer uses standard video carriers to detect egress, which triggers an audible tone when found. A companion dipole antenna is used with the Tracer and typically is vehicle mounted. A nice feature of the Sniffer is that the meter is calibrated for compliance with FCC leakage rules. It's a simple matter to determine whether a specific leak exceeds the rules for maximum emissions at a distance of 10 feet.

Sadelco's signal level meters also can be coupled with dipole antennas to locate and measure the intensity of leaks for purposes of CLI compliance.

Sencore's FS74 Channelizer Senior is more a signal analysis tool than a simple leak detection system. A handy feature of the FS74 is the device's display of leakage sources in microvolts, the units of measure the FCC uses to define leakage standards.

Where to find them

Following is a list of companies and phone numbers to contact:

- Dovetail Systems, (215) 967-4445
- Telecommunication Products Corp., (717) 267-3939
- Long Systems, (619) 530-1926
- Cablelogic, (303) 730-8885
- Advanced Communications Industries, (203) 281-7577
- Wavetek, (317) 788-9351
- Texscan Instruments, (317) 545-4196
- Comsonics, (703) 434-5965
- Augat/LRC, (607) 739-0106
- Sadelco, (201) 569-3323
- Sencore, (800) 843-3338. ■

—*Gary Kim*

Connectivity products unveiled by Fibronics International

A set of twisted-pair and fiber optic connectivity products to be marketed as one complete package for IBM AS/400 and Systems 3/X computers was announced by **Fibronics International** of Hyannis, Mass.

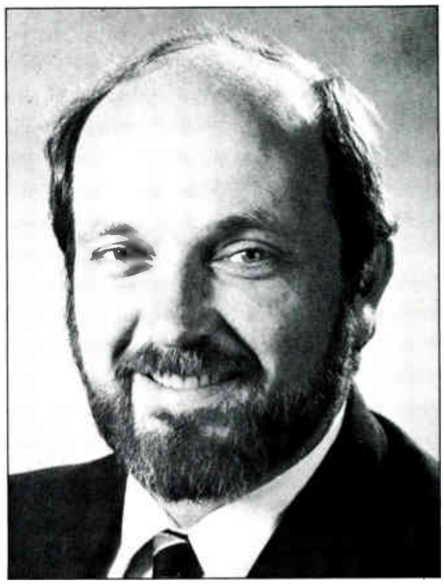
The package, known as the "SilverPak," is available in nine versions—four local, and five remote. The local versions, used for attachment of peripherals up to 1,000 feet from the computer, take advantage of the user's existing twisted-pair wiring and contain the hardware needed to connect all peripheral devices to the AS/400 and/or Systems 3/X host. The remote versions use fiber optics to connect AS/400 and System 3/X peripheral up to 2.5 miles from the computer.

Pricing for the SilverPak starts at $1,100 (local version) and $1,990 to $6,450 (for the remote). Call Fibronics, (508) 889-1200.

Alantec is a new company specializing in the LAN/WAN interconnectivity hardware and software that's based in Fremont, Calif. President Michael N. Kalashian (formerly a vice president with Sytek) conceived of the idea in 1987. Jagdish Vij (formerly with Bell Northern Research PBX data switch R&D department) joins Kalashian as the vice president of engineering.

The first products introduced by Alantec will be a series of MAC layer bridging products based on the ISO/IEEE 802.1, 802.3 and T-1 standards. Included in this initial group of products is the SmartBridge, described as a "robust interbridge protocol that provides redundancy through dynamic activation of network bridges acting as hot backups."

The SmartBridge is offered in three versions: the model 1000 (priced at $1,580) includes a two-port Ethernet card, bridge software and a basic network management package, the model 1010 (priced at $1,980) adds remote network management protocols and the model 1050 ($2,980) includes a PC-AT compatible CPU, floppy disk drive and monitor card. For more information, call Alantec, (415) 770-1050.



Zvi Alon

Cactus Computer Inc. of Carrollton, Texas recently announced a new high speed broadband LAN adaptor board for Apple Computer's Macintosh II. The add-in board occupies a single slot in the Mac II and uses standard Ethernet driver software. Named "BroadTalk" this broadband LAN product series is designed to enhance performance and connectivity for Mac IIs in wide area, campus networks.

The board operates within a single standard video channel using Manchester encoded data over a 2 megabits per second, plug-in broadband modem. The BroadTalk adaptor board with broadband module lists for $895. With the Ethernet adaptor module it lists for $745. The Broadband and Ethernet adaptor modules may be purchased separately for $350 and $200 respectively.

Advanced Computer Communications announced its ACS 4030 remote Ethernet bridge now implements IEEE 802.1 (also known as Spanning Tree Protocol, or STP). With STP, multiple ACS 4030s can bridge three or more remote LANs to create a single network with transparent connections between all the devices.

STP overcomes "looping," an inherent problem in linking more than two Ethernets. A configuration of three or more linked Ethernets creates a situation where data packets can travel in different directions and arrive out of order or continue to loop if a device is too busy to accept packets. With STP, one link is inactivated so the data stream can only travel in one direction.

The price for the basic ACS 4030 is $4,975. The optional STP implementation package for either X.25 or point-to-point applications is priced separately at $500. Contact ACC, (805) 963-9431.

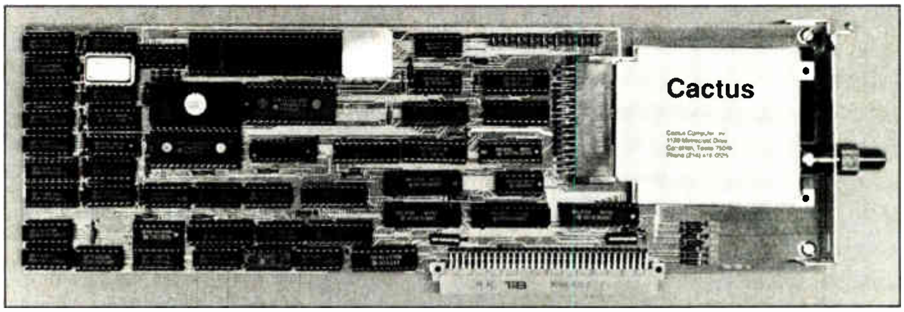
George Serventi has been tapped

> Flush with new capital, Halley Systems has introduced a new executive management team.

as the new manager of LAN Sales for the United States market for **Magnavox**. The announcement comes as Magnavox continues to expand its focus of supplying CATV-based network utilities to the LAN marketplace.

A new Ethernet to Broadband modem has been unveiled by **Lanex Corp.** Different models of the TRN8023 modem, which is consistent with the IEEE 802.3 10Broad36 standard, accommodate from two to eight Ethernet devices and allow them to operate on a broadband LAN. The new modem offers IEEE 802.7 cable plant capability and can coexist with other LAN architectures on any broadband system.

The TRN8023 allows greater distances between nodes than the 1,500



Cactus Computer's high-speed LAN adaptor board

meters offered by Ethernet. The broadband media allows the use of multiple voice, video and data channels. The two-port model is priced at $2,695; the eight-port unit costs $2,995. For details, call (301) 685-3626.

Flush with new capital from a recently completed round of venture financing, **Halley Systems** has introduced a new executive management team. The new capital will be used to expand marketing and customer support activities of the network integration and management systems supplier, said a company spokesman.

Members of the new Board of Directors include: Zvi Alon, president of Halley Systems; John Bosch, Bay Partners; Clifford Higgerson, Communications Ventures; and Michael Hone, HMS Capital.

The comapny's new executives, all data communications industry veterans, include: Diana LaTour, vice president of marketing (formerly with AST Research); Jeffrey Pierce, vice president of sales (formerly with Contel ASC and Vitalink Communications); Robert Craven, vice president of engineering (formerly of Novell); and Thomas Rota, vice president and chief financial officer (formerly of Network Equipment Technologies). ■

—Greg Packer


Thomas Rota

Modem emissions specs in broadband LANs

Broadband LAN equipment is designed to operate on CATV systems that use frequency division multiplexing (FDM) to allow for various types of information (i.e. video) to exist on a single cable system. Most LAN manufacturers include modem specifications as part of their complete product specificatiions. There are two modem emissions specifications that are extremely important to overall system performance.

The carrier on/off ratio

The carrier on/off ratio is simply the difference between the nominal output level of the transmitter in the "on" state and the small output level that is still present while the transmitter is in the "off" state. This specification is important because it may determine the upper limit of the amount of LAN nodes that can be attached to the system (independent of other criteria such as traffic volume). While in the "off" state, this small signal (noise) adds with the signals of all other nodes. The addition causes an increase in the noise ratio for all the receivers. Nearly all LAN nodes that process data require a signal-to-noise ratio of at least 20 dB, usually not less than 26 dB. The in-band noise level can be calculated as follows:

$$N = RXin - Con/off + 15\log(n)$$

Where:

N = the in-band noise level (dBmV)
RXin = the nominal receive input level (dBmV)
Con/off = the carrier on/off ratio (dB)
n = the number of nodes in the system.

The above formula suggests that the noise adds on a 15 log basis. If all transmitters were correlated (in phase) the noise would add on a voltage (20 log) basis and this would be a worse case condition. If all transmitters were guaranteed to be uncorrelated the noise would add on a power basis (10 log) and this would be the best case. A 15 log basis is a realistic compromise and, based on actual measurements in a very large LAN, it has proved to be an accurate estimation.

As an example, let's assume a LAN has 10 data nodes that have a nominal transmit level of +50 dBmV, a nominal receive level of 0 dBmV and a carrier on/off ratio of 65 dB. Assume that the S/N ratio measured without the data nodes is 45 dB, resulting in a noise floor of -45 dBmV. The additional amount of noise introduced by the data nodes is:

$$N = 0\text{ dBmV} - 65\text{ dB} + 15\log(10) = -50\text{ dBmV.}$$

The addition of a -50 dBmV noise level to the -45 dBmV noise floor will have a minimal effect on the overal S/N ratio. If the system were to expand to 100 nodes, the resulting in-band S/N ratio would decrease to 35 dB. The number of nodes now determines the in-band S/N ratio. Now suppose the system expands to 1,000 data nodes. Applying the same formula:

$$N = 0\text{ dBmV} - 65\text{ dB} + 15\log(1{,}000) = -20\text{ dBmV.}$$

This noise level is 25 dB stronger than the original noise floor. The in-band S/N ratio has now degraded to 20 dB, which, in many systems, causes a degradation in bit error rate that makes the system unusable.

The above example shows that, for a medium- to large-sized network, the carrier on/off ratio has a serious impact on the in-band S/N ratio for data nodes. This, in turn, degrades the bit error rate. In the above example, a carrier on/off ratio of 90 dB would support in excess of 10,000 data nodes and have an in-band S/N ratio of 45 dB.

Harmonic and spurious output

The effect of the harmonic and spurious output levels is similar to the carrier on/off level except that it applies to out-of-band signals. The effect is not on the in-band S/N but the entire system S/N. In systems where a S/N ratio for good quality video of 40 dB is required, the effect of spurious signals can cause unacceptable video quality. Video signals generally require a better S/N ratio than data signals for acceptable quality.

The effect of these spurious signals can be calculated as follows:

$$N = Rxin - SL + 15\log(n)$$

Where:

N = the out-of-band noise level introduced by the data nodes
RXin = the nominal Rx input (dBmV)
SL = the spurious level (dBmV)
n = the number of nodes.

Again, a 15 log basis is used for the same reason stated above. The signals are neither completely correlated in phase nor are they completely uncorrelated in phase. However, the above equation only applies if there is a correlation in frequency among the data nodes (i.e., a local oscillator) also. This assumption is valid for at least some frequencies because the data nodes are assumed to be identical. Frequencies such as local oscillators or crystal harmonics would be the same.

As an example, consider a system that has a nominal transmit level of 50 dBmV, a nominal receive level of 0 dBmV, and a 40 dB S/N ratio (noise floor = -40 dBmV) measured before the data nodes are added. Also assume that there is a spurious signal, generated by the data nodes, that is correlated in frequency and has a level of -60 dBmV (110 dbc). If 10 data nodes are added to the system:

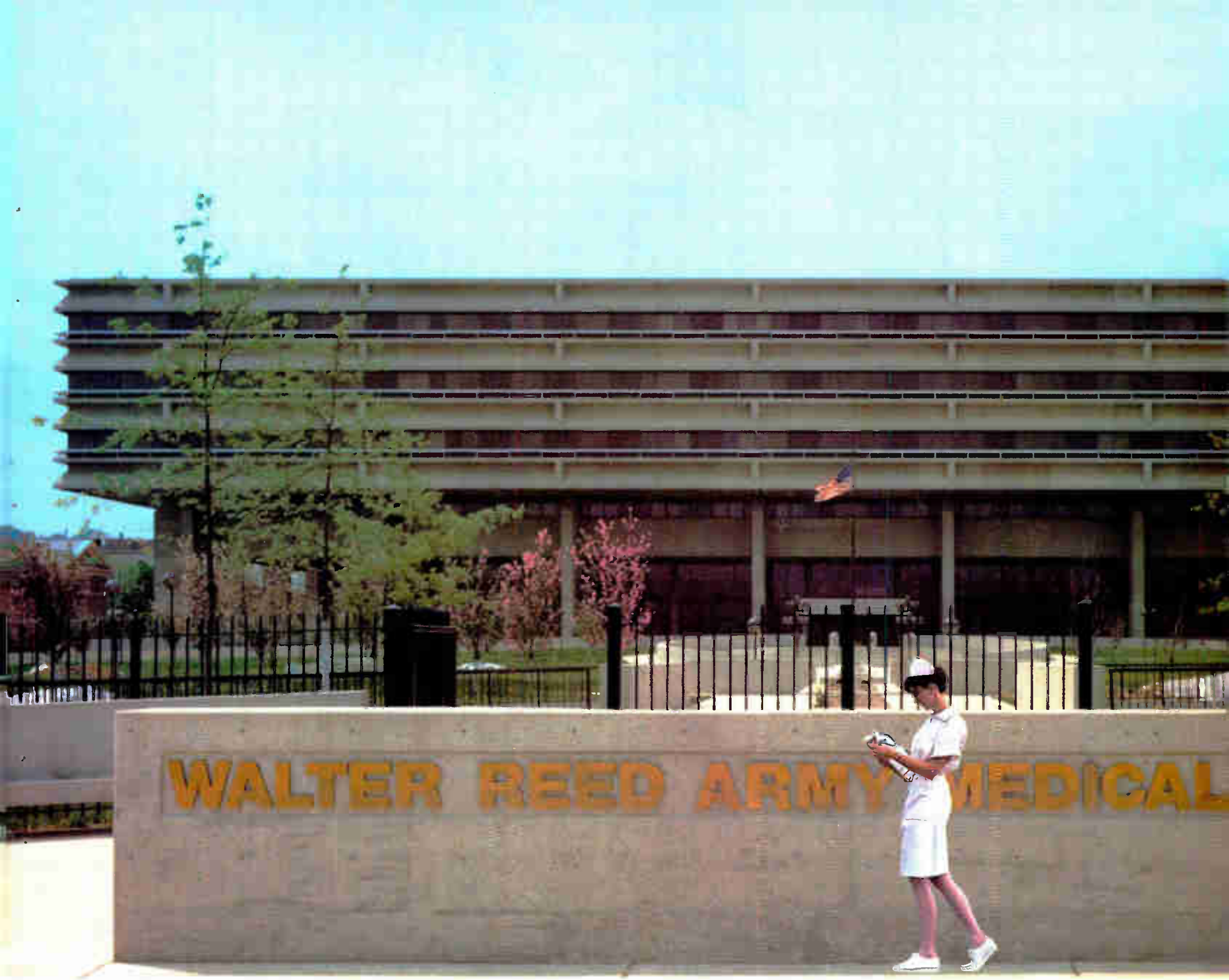
$$N = 0\text{ dBmV} - 60\text{ dBmV} + 15\log(10) = -45\text{ dBmV.}$$

This level is still below the noise floor, resulting in a minimal effect in system S/N. Now suppose 100 nodes are in the system:

$$N = 0\text{ dBmV} - 60\text{ dBmV} + 15\log(100) - -30\text{ dBmV.}$$

The system S/N is now determined by the data nodes and, more importantly, a 30 dB S/N for video is poor. The video quality for this channel is now unacceptable. If spurious signals are kept at levels substantially below the noise floor (i.e. below -100 dBmV) many more data nodes can be tolerated. ■

By Joe Greaney, Vice President, Engineering, Lanex Corp.



WALTER REED ARMY MEDICAL

How to implement a safety program

No one really knows how many CATV field personnel are killed or seriously injured while on the job every year, but even if there were only one, it would be too many. But, in fact, incidents ranging from electrocutions (touching power lines) to falling off poles to being involved in a traffic accident occur all the time, resulting in huge monetary and man-hour losses.

Conservatively, all these accidents cost the industry hundreds of millions of dollars in direct and indirect costs. That's a staggering number that directly affects the bottom line of a cable system and/or MSO. What can be done to control those losses?

If you don't have a good safety awareness program in place at your system or you have one but it doesn't work well, now is the time to consider implementing one or improving the program you already have.

Starting a safety program isn't difficult, but for it to work properly, it has to receive significant support from top-level executives at the system and/or corporate headquarters. It should be administered by a person who makes safety a high priority and policies must be followed through to the letter. That's at least part of the message delivered by a panel of safety experts at a recent seminar on safety training organized by the Golden Gate Chapter of the Society of Cable Television Engineers.

Important elements of any successful health and safety program are the "three Es—engineering, education and enforcement," says Ron Elliott, director of the Western regional office of the National Safety Council. Engineering consists of certain operational things that can be engineered into the program, such as the type of ladders, ropes and belts field personnel use. Proper and persistent education makes it easier for people to recognize hazards that exist in the workplace and enforcement keeps the program running smoothly.

Many companies start out with good intentions but fall short of achieving a good safety program because it doesn't remain a high priority, says Elliott. "If you don't have cooperation from the senior management...you're just spinning your wheels."

Starting a program

The first thing to do when implementing a safety or health program is to appoint a program supervisor and make the program a large portion of his job description. All too often, says Elliott, the person in charge of safety is a low-level employee who is given the safety program as a second (or lower) priority.

The keys to a successful program include the following elements:

- Determine what the program's objectives are. Why are you instituting the program? What do you expect to get from it? Review the safety problems you've had in the past.
- Assign responsibility and authority. How far can the program supervisor go to enforce the program?
- Provide adequate resources, both physical and economic, to ensure the program's success.
- Appoint safety committees for review and due process. Clearly outline the authority the committee has and provide recourse for an employee if something should happen to him.
- Clearly outline to new employees what is expected of them during the orientation process. If a new employee is trained with a "safety first" mentality, it will remain a high priority throughout the system.
- Provide adequate supervision. Is one person enough, or will he/she need help?
- Identify and evaluate existing hazards.
- Install monitoring programs. Inspect vehicles and equipment on a regular, planned basis.
- Investigate any and all accidents, determine their cause and adjust prevention methods accordingly.
- Evaluate the program's effectiveness and correct any mistakes on a regular basis.

No matter how hard you try, there will always be hazards in the workplace. Some to be aware of include polychlorinated biphenyls (PCBs), asbestos, cadmium and cadmium compounds, ethylene glycol, sulfuric acid, and others. The thing to remember is that these toxic or hazardous substances can be found in places you might not expect them.

For example, PCBs can be found in transformer oil in power supplies; as-

bestos was used as an insulator in old buildings; cadmium and cadmium compounds are found in batteries and as a plating on some connectors; used engine oil and antifreeze (ethylene glycol) must be disposed of properly; and sulfuric acid is present in batteries in standby power supplies.

One problem is that it's often difficult to find out how some of these substances should be treated, stored and/or disposed of. Getting a firm answer about procedure from the Environmental Protection Agency (or even finding the proper contact person) can be a frustrating and time-consuming exercise.

Nevertheless, it's important for safety supervisors and his designates to find out how to treat these substances. One place to go to for help is the state or federal Occupational Health and Safety Association representative nearest you.

The enforcers

OSHA is where enforcement of safety comes in. OSHA is a regulatory body that requires various procedures and equipment to ensure employee safety. At the federal level, OSHA looks at injury (downtime) records of various companies. If a trend toward excessive downtime exists, the employer and employees are queried as to whether a safety training program exists, says Rich Tapio, safety supervisor in the federal OSHA office in Walnut Creek, Calif.

> 'If you don't believe in it (safety), then what's the point?'
>
> —Rich Tapio

In fact, most citations from OSHA are in this area, says Tapio. Although OSHA tries to help companies with self-compliance, if an employer neglects his duty to provide a safe working environment, more citations can be issued. "Treat the people who work for you as human beings," says Tapio. "Keep us off-site."

It's important for supervisory personnel to set the example when it comes to safety. "If *you* don't believe in it (safety), then what's the point?" asks Tapio. "It's a waste of time.

"You can play the odds (of not getting caught), but if something happens, the problems you'll encounter from your insurance company are worse than (OSHA) penalties. Too many employers just play the (waiting) game and then pay the fine," Tapio adds.

His advice: be aware of what you as an employer are required to provide and make sure that it's done. Safety is not just the responsibility of the individual employee, he warns. "Even though the employee is required to comply with safety and health requirements, if an employee hurts or kills someone with faulty equipment, the *employer* will be cited," says Tapio. "It's the employer's responsibility to make sure the equipment is safe and working."

The important thing to remember is that both the state and federal OSHA programs are there to help you. If you're not sure what your responsiblities are or how to go about making your system a safer place in which to work, contact OSHA.

Safety saves money

Starting a successful safety program

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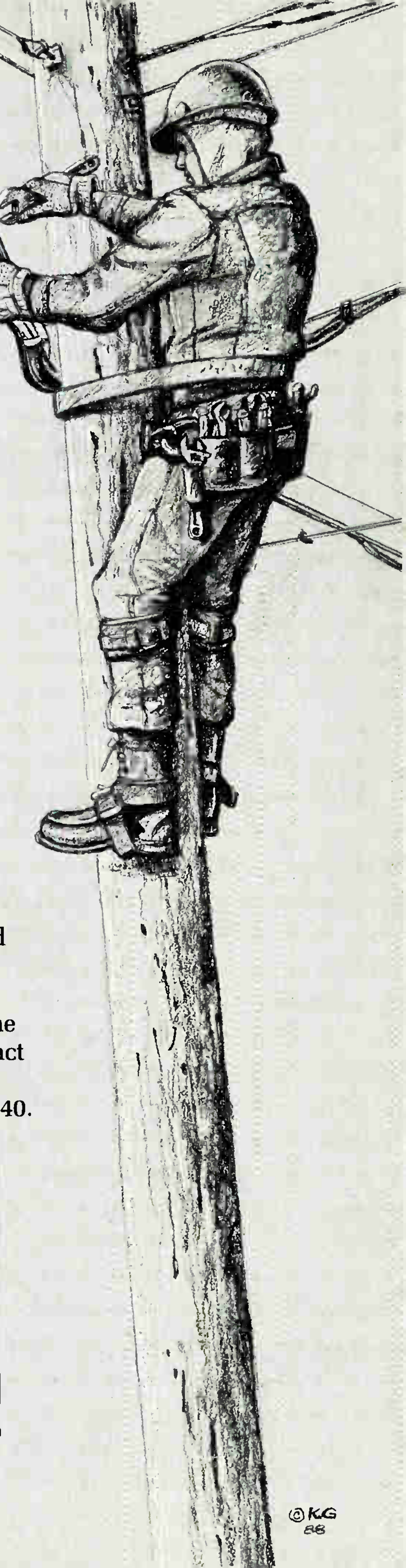

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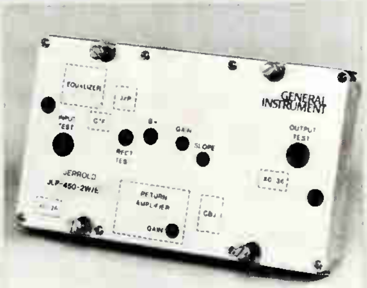

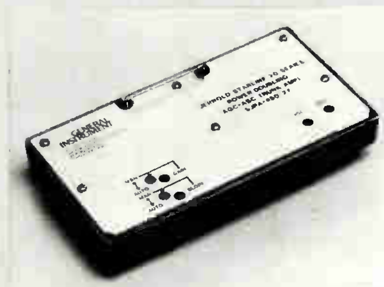

GENERAL INSTRUMENT

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Reader Service Number 50

will cost money up-front, but will save bundles of cash in the long run. "If a safety program is successful, it bears directly on the cost of worker's compensation insurance," says Dan Gomes of the California State Compensation Insurance Fund.

Costs of worker's compensation can be reduced by having a good return-to-work program, says Gomes. In other words, if an employee gets hurt, get him help quickly (don't be afraid to divulge an on-the-job injury, the law says you *must* report it) and stay in touch with him. It's important that he understands you're there to help him, so don't start an adversarial relationship that might result in litigation, suggests Gomes.

If an employee is injured and cannot perform his previous job, get him involved in vocational rehabilitation to train him for a new career.

By having a doctor who works for the employer examine the employee, the number of employees being falsely declared "unfit for work" might be reduced, Gomes says.

Finally, if you use subcontractors for any tasks, make sure you have original certificates of insurance from them. Ask to be notified of any cancellations, otherwise you'll pay for any injuries caused by him, says Gomes. "Make them meet your safety standards," he says.

Other loss control tips

When an accident does occur, there are typically two costs associated with each incident, says Marty Mason, a staff engineer from MetroVision in Atlanta. Direct costs (medical and compensation) are easily defined; but the hidden costs often are not.

According to Mason, some of those costs include:

- Time lost while the employee is being treated.
- Time lost while other employees "gossip" or talk about the accident, who was at fault, etc.
- Loss of efficiency associated with having one fewer employee.
- Tool damage.
- The cost of "breaking in" or training a new employee.
- The cost of "spoiled" work that has to be corrected, redone or finished.

In reality, for every $1 of actual cost per accident, the company/system spends $3 to $7, says Mason.

To avoid those major costs, systems must be meticulous and dedicated to investigating and preventing all accidents. Mason suggests using a detailed accident report form to help identify trends or perhaps flaws in procedures that can be corrected. Those forms should help you do three things: describe the incident fully, find the cause of the incident and show how to solve the problem.

Most accidents, says Mason, are caused by a person's behavior, so a good training program is essential for success. In order to prevent accidents, you usually have five options: eliminate the operation; change the operation; guard the machinery/vehicles associated with the operation; guard the worker or retrain the worker. The first three options cannot always be done, but the latter two can be accomplished with a little effort.

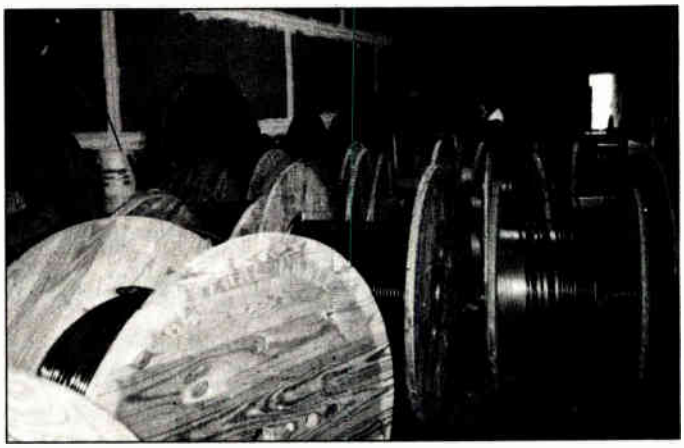
"Develop requirements to help prevent problems," suggests Mason. "Make (employees) wear and do things designed to avoid accidents and enforce the rules." ■

—Roger Brown

Reader Service Number 53

Rebuilding?

Resource Recovery can save you money



The disposal of the waste cable and reels from either a newbuild or rebuild system has historically posed a significant problem to the cable companies and their construction contractors alike. There exist, at present, few companies willing to service the needs of the cable industry when it comes to disposal of and payment for these materials. Of these there is only one, Resource Recovery Systems, that has the ability to handle all aspects of this waste material...cable, electronics, and reels...simultaneously from multiple systems across the country.

We specialize in the prompt removal of these salvageable materials from the job site, thereby eliminating the problem as well as generating revenue for the cable system which otherwise would not have been realized. Unlike certain salvage contractors that would shy away from handling the wooden coax reels or require that the cable system accumulate massive piles of scrap before handling, Resource Recovery Systems provides the necessary ongoing labor and transportation from day one until completion of the build.

We are a full SERVICE company with a proven track record of performance in dealing with system operators and their construction contractors across the country. We tailor our operations to fulfill the needs of our customers, regardless of their size or location. We provide for the efficient handling and pickup of all recyclables including providing suitable containers where needed to facilitate the regular removal of all coax scrap, on or off reels.

It is our desire to deal directly with those companies...cable system or contractor (if turnkey) who own the cable. It is our policy to pay fair market prices for scrap taps, passives, and amp housings as well as scrap trunk and feeder cable, both wreckout and unused cable from partial reels.

By utilizing local contractors at each location to handle all reel disassembly and scrap removal, we assure prompt attention to your systems waste-removal needs. We are experts in dealing with the waste from cable systems. Unlike local "scrap dealers", we deal solely with cable systems and are, therefore, sympathetic to their particular problems, such as the disposal of the wooden reels. As the largest Nationwide recycler of these materials, no one can beat our prices or our service.

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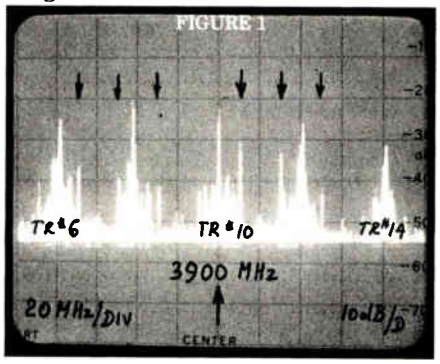
Reader Service Number 54

SATELLITE LOCATION

Step 2: Adjust the antenna to a convenient elevation angle, and rotate the dish until a satellite picture is received.

Step 3: Identify the received satellite by comparing the received program with those listed in a current Satellite Program Guide.

FIGURE 1



When pointing the dish toward a satellite, the transponders and the interference carriers are clearly displayed on the screen of the analyzer. The vertical arrows mark the interference carriers.

Step 4: Take your computer run and calculate the Azimuth angle difference between the received and desired satellite. Repeat the calculation for the elevation angle.

horizontal and vertical displacement to receive Satcom 4 (191.36 degrees Azimuth and 42.70 degrees Elevation Angle).

The difference in Azimuth Angle:
13.1 degrees

The horizontal displacement:

$$\frac{3.2\pi \times 13.1}{360} = 0.3658 \text{ meter or } 14.4 \text{ inches}$$

The difference in elevation angle:
2.35 degrees

The vertical displacement:
0.0656 meter or 2.58 inches.

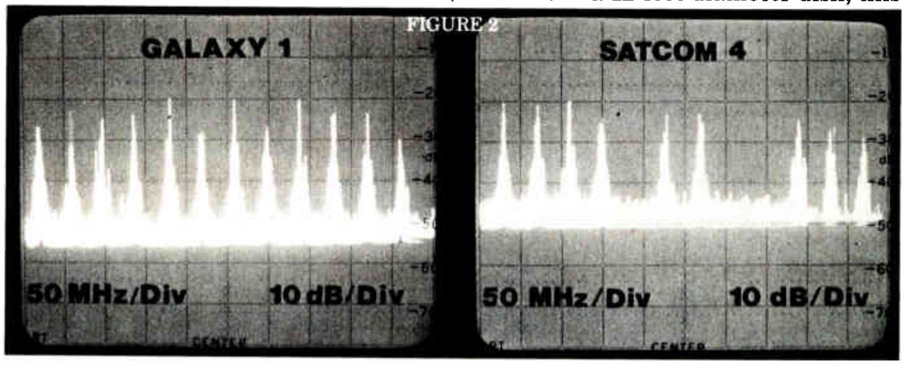
Displacements

Listed below are a few 1-degree *angular equivalent* displacements:

For 4-foot diameter (1.2 meter) the displacement is 1.064 cm or 0.419 inch; 6-foot (1.8 meter), 1.595 cm or 0.628 inch; 8-foot (2.4 meter), 2.128 cm or 0.838 inch; 10-foot (3.0 meter), 2.659 cm or 1.047 inches; 12-foot (3.6 meter), 3.191 cm or 1.256 inches; 15-foot (4.6 meter), 3.989 cm or 1.57 inches.

A displacement accuracy of one-quarter inch is an attainable goal. In the case of a 12-foot diameter dish, this is equivalent to an angular accuracy of 0.24 degree, which is rather difficult to obtain with a transit or an inclinometer.

FIGURE 2



At the Western end of the arc, only Galaxy 1 exhibits 12 operational transponders. On the Southern sector of the orbital arc, Satcom 4 may serve as a guide.

Necessary formulas

The formula, $D\pi = 360$, describes the relationship between the displacement of the perimeter and the angular rotation of the dish. Therefore, for one (1) degree of rotation the corresponding displacement will be:

$$1^\circ = \frac{D\pi}{360}$$

For example, a 3.2-meter diameter dish in Princeton, N.J. was pointed toward Westar 3. According to the computer run, the Azimuth Angle was 204.46 degrees and the Elevation Angle 40.35 degrees. Find the necessary

If the antenna was not pointed correctly toward the first satellite, the aiming error will be maintained during the entire orientation process.

When searching for the first satellite, the elevation angle setting is the dominant factor. Select a convenient angle from the computer run. Then, rotate the antenna in the horizontal plane until a picture shows up on the screen. If the first attempt is not successful, switch the satellite receiver to another transponder. ■

TOOL CALLBOOK

The following companies have paid a fee to have their listing appear in the Tool Callbook.

ARROW®

MADE IN U.S.A.

Arrow Fastener Co. Inc. . . . .(201)843-6900
271 Mayhill St.
Saddlebrook, NJ 07662

PERSONNEL: Allan Abrams, President; Barry Knispel, Vice President

DESCRIPTION: Stapling machines consisting of a full line of wiring tackers, monel and stainless steel staples; rivet tools, rivets; xpando anchoring attachments and fasteners.

Budco

Budco . . . .(918) 252-3420
(800) 331-2246
P.O. Box 3065
Tulsa, OK 74101

PERSONNEL: David Allen, Sales Manager

DESCRIPTION: Taplocks, single digit tags, panel tags, marking and identification products, barrell locks and retrofitting devices. Distributor for Lemo tools, Multilink, the W.H. Brady Company, Dennison, Tyton, Master Lock and Gilbert Engineering.

CP cable prep
BEN HUGHES COMMUNICATION PRODUCTS CO

Cable Prep . . . . .(203) 526- 4337
Ben Hughes Comm. Prod. Co.
207 Middlesex Ave.
P.O. Box 373
Chester, CT 06412-0373

PERSONNEL: Deborah Morrow, President; David Morrow, Vice President

DESCRIPTION: Manufacturer of Cable Prep® tools. Product line includes hex crimp tools for CATV, MATV, STV and standard RF connector applications; coring and stripping/coring tools for all major cables (Cable Flex, Times Fiber, Comm/Scope Pill and Quantum Reach); accessory tool items. Products are sold through major distributors. Call or write for information. Facsimile: (203) 526-2291.

CACAS
INTEL INCORPORATED

Cocas Intel . . . . . .(315) 455-9295
P.O. Box 714
Syracuse, NY 13088

PERSONNEL: Joe Brown, President; Hope Gerner, Vice President; Bill Shaver

DESCRIPTION: Manufacturer of a full line of coaxial cable strippers. Powered production and rechargeable handheld field units available with one step operation. Over a decade of supplying jumpers and cable kits to the industry.

Lemco

Lemco Tool Corp. . . .(717) 494-0620
(800) 233-8713
Rd. #2 Box 330A
Cogan Station, PA 17728

PERSONNEL: Glenn Miller, President

DESCRIPTION: Designer and manufacturer of mechanical tools, equipment and materials for the construction and maintenance of cable TV systems.

Cablematic
CABLE PREPARATION TOOLS

Ripley Co. Inc.
Utility Tools Division .(203) 635- 2200
46 Nooks Hill Road
Cromwell, CT 06416

PERSONNEL: Robert Clark, Marketing Manager; Pat Kracunas, Customer Service, Karol Paduch

DESCRIPTION: Manufactures a complete line of coaxial cable preparation tools.

J. L. Speckman & Associates, Inc.

J.L. Speckman Associates Inc. . . . .(419) 394-7890
(800) 826-4710
(800) 826-4711 in Ohio
1301 McKinley Rd. P.O. Box 2288
St. Marys, OH 45885

PERSONNEL: Jerry L. Speckman, President; Ronald F. Speckman, Vice President of Sales; Mark A. Smith, Sales Representative; Melissa B. Tangeman, Sales Representative.

DESCRIPTION: Full line distribution of cable TV products used to build and maintain cable TV systems, including a wide range of hand tools and distribution equipment.

Coaxial Cable Strippers

Western Electronic Products Co. . . . . .(714) 492-4677
915-G Calle Amanecer
San Clemente, CA 92672

PERSONNEL: Tony English, President

DESCRIPTION: Manufacturer of coaxial cable stripping tools and machines.

Filtering MDUs

This time we consider three types of networks for interfacing apartment buildings, motels, schools, hospitals and other multiple viewer complexes. The three functions most often encountered by the installer in these situations are channel "cherry picking," channel deletion for local origination and local channel reprocessing. The three networks discussed address these functions.

'Cherry picking'

Often, the MDU wants to "buy" only certain channels from the cable system. For example, a large motel may have its own SMATV system (off-air antennas combined with a TVRO input) and wish to supplement these channels from the local cable system. The new purchased channels are to be connected to the motel's headend combiner. All other channels must be deleted before combining to prevent co-channel with SMATV channels.

Figure 1 shows a general form of a suitable network. Very selective bandpass filters, for the purchased channels, are combined with splitters, amplifiers and pads to select the desired channels and put them on the combiner at the proper level. A number of alternative networks is possible, utilizing low and high pass filters and video traps, provided the desired channels are "conveniently" located in the spectrum. However, the network shown allows satisfactory selection of arbitrarily chosen channels, regardless of their individual locations in the spectrum.

Local channel substitution

Figure 2 shows a basic network for reusing an incoming channel, from the local CATV system to the MDU. A channel deletion filter deletes the entire spectrum of the chosen channel, to prevent co-channel with the internal modulator. Deletion level required is usually at least 50 dB and, ideally, the deletion filter must not adversely impact even adjacent channels. The internal modulator output (for movies, internal announcements, security, training, etc.) is inserted on the line through a directional coupler. Needless to say, the modulator output should be adjusted to place the new program on line at the proper level.

Figure 1: Channel 'cherry picking' network

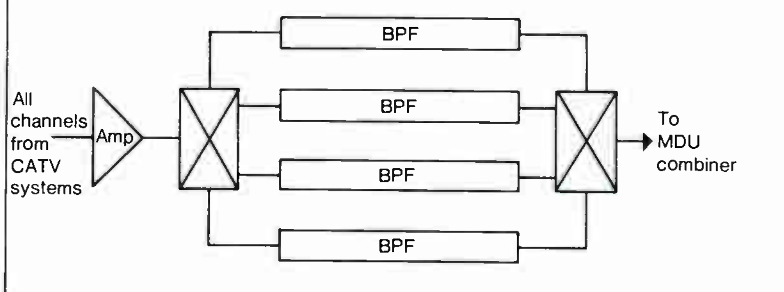


Figure 2: Deletion of channel for closed-circuit reuse

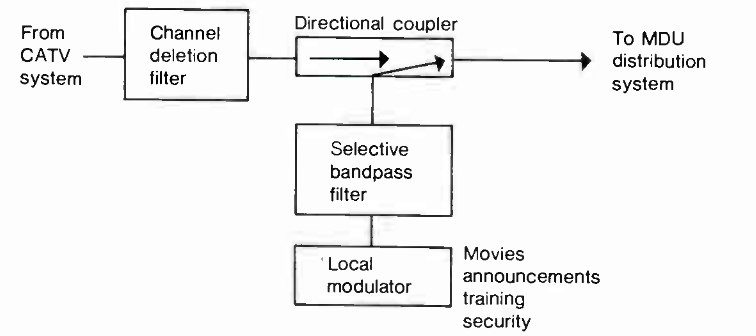
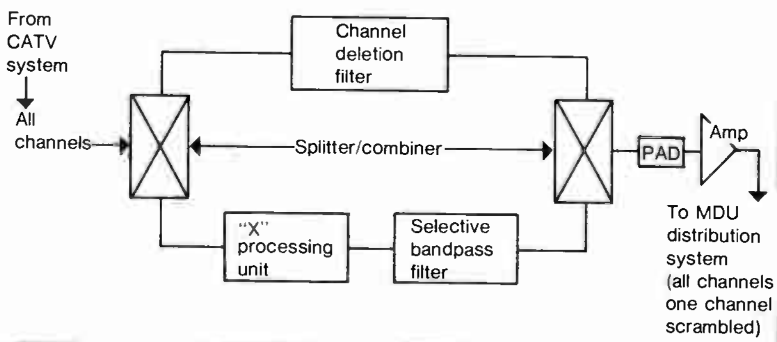


Figure 3: Network of channel local reprocessing



Channel reprocessing

Figure 3 shows a basic network for reprocessing an incoming channel from the CATV system to the MDU.

Often, it is desired to batch descramble a particular channel to provide the unscrambled signal to all TV sets in the MDU. In this case, a descrambler is placed at "X." In many cases, the MDU is not on a converter system and wishes to receive a midband channel. In this case, the network deletes the numbered channel (2 through 13) to be sacrificed and substitutes the converted midband channel. A channel converter is placed at "X." Sometimes it is desired to change the type of premium scrambling for convenience. For example, the premium may arrive at the MDU scrambled by the sync suppression method and it is desired to change over to positive trapping. In this case, a sync suppression descrambler followed by a positive encoder is placed at "X." ■

Installment 5 will discuss economic and technical aspects of negative trapping for pay security.

By Glyn Bostick, President, Microwave Filter Co. Inc.

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Reader Service Number 57

Product Showcase

Anixter intros fiber product; ATC 'test' called a success

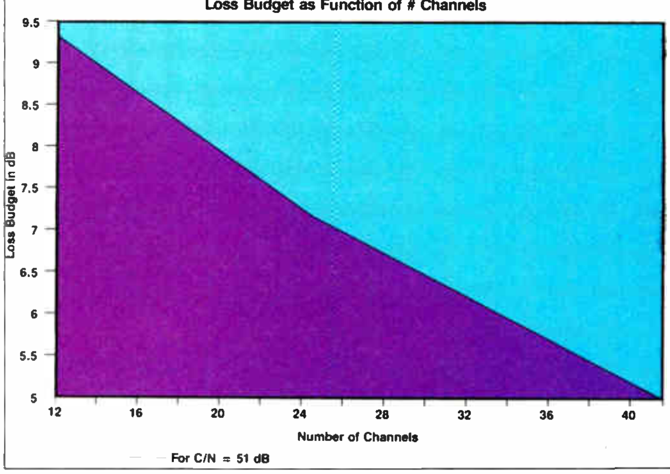
Anixter has joined the growing list of CATV industry suppliers of AM (amplitude modulated) fiber optic trunking systems. The wiring giant's new Laser Link system soon will be tested at 40 CATV system sites, beginning as early as this month (October).

American Television and Communications, Tele-Communications Inc., Cox Cable, Warner Cable and King Video Cable already have agreed to participate. The 42-channel system, developed in conjunction with AT&T, initially will shoot signals a minimum of 10 kilometers out from headends to modified Jerrold trunk amplifiers. From there, signals will be changed from light to standard RF signals and move in traditional fashion through the distribution plant to subscriber homes.

The first Laser Link already is operational at ATC's Cablevision of South Florida system (see below for more information on its performance). Cablevision has activated fiber runs of 11.8 miles and 10.1 miles to two of the system's 12 hub sites. Each of the runs carries 36 channels. Plans call for a full backup of the existing microwave system now linking the 12 hubs with the headend.

When finished, Cablevision will have 145 route miles of fiber supertrunk. While it will lay cables containing 30 fibers, it will activate only one fiber initially—enough to carry all 36 channels of programming delivered to the hubs.

FIGURE 1 **CATV TRUNK DESIGN**
Loss Budget as Function of # Channels



Will handle 42 channels

In fact, the system is capable of transporting a 42-channel spectrum over one fiber with a 5 dB loss budget. Transmission performance in this scenario is as follows: 51 dB carrier-to-noise; 60 dBc second order; 65 dBc composite triple beat; and 60 dBc cross mod. (See Figures 1 and 2 for performance trade-off information under different scenarios.)

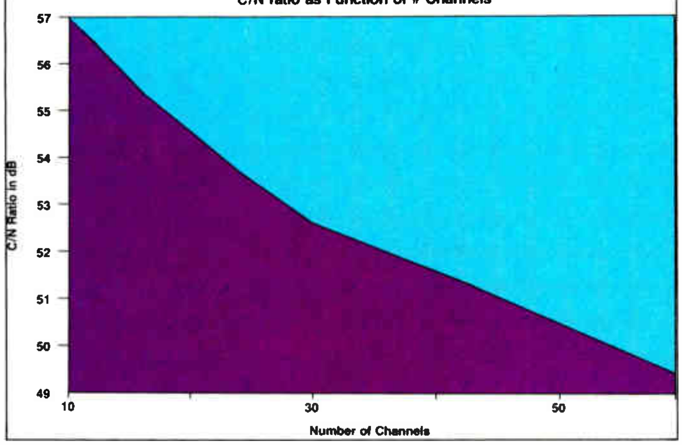
The fiber network will provide backup

to the existing microwave system, increasing system reliability and offering the chance to break the local advertising market up for advertisers who want to reach only a portion of Cablevision's entire metropolitan subscriber base.

FIGURE 2

CATV TRUNK DESIGN

C/N ratio as Function of # Channels



One logical application for Laser Link is a system upgrade from 300 MHz to 550 MHz. Using traditional techniques, operators must trade distance for bandwidth. For example, at 300 MHz a typical CATV system might have 30 amplifiers in cascade spaced at 2,000 feet for a total trunk run of 60,000 feet. To upgrade to 550 MHz using conventional electronics, that same system typically would be restricted to a shorter 20-amp cascade using 1,500-foot spacing for a total trunk run of only 30,000 feet. An operator using Laser Link conveniently could break the 60,000-foot cable run into two 30,000-foot runs, accomplishing the upgrade with minimal disruption to the existing plant.

Anixter's move is further evidence of the industry's growing interest in hybrid coaxial cable/fiber networks and suggests a serious re-thinking about the design of future CATV networks.

AM fiber optic systems such as Laser Link make possible more reliable networks that provide better pictures. Instead of broadcasting signals down long cascades of amplifiers, each of which degrades the picture, operators can use AM systems to slice cascades, thereby providing better pictures to subscribers. Shorter cascades also mean more reliable networks that confine outages to smaller portions of an operator's franchise.

Hybrids likely in future

In the future, CATV networks likely will be hybrids: using fiber optics for trunk runs from the headend to intermediate locations and coaxial cable for distribution to subscribers. Over time, fiber will extend further into the networks, getting closer to subscriber drops. Fiber-to-the-home is an ultimate possibility.

Furthermore, CATV networks of the future may not be tree-and-branch systems. Digital modulation techniques may make "mesh" or "star" networks possible. A mesh system would resemble a net; offering many possible routes for signals. A star network would look like the present telephone network.

Where's technology going? In two directions. Digital and AM. Digital

techniques today offer high quality but also high cost. Traditional FM techniques provide high quality and good cost. AM techniques currently are lower in signal quality but offer low cost. Over time this will change. Digital will become less expensive while AM develops good signal quality and good cost.

The logical implication: look for AM first, then digital fiber optic systems for CATV. Be alert for terrestrial delivery of signals to cable headends. AT&T will be testing this idea soon. If AT&T can provide nationwide digital delivery of video and a CATV operator can handle those digital signals locally, look for extraordinary changes in CATV system architectures.

Only recently has attention turned to fiber as a replacement for backbone cable runs that get signals closer to the subscriber. Why AM? Why not FM? In part, because CATV is an AM medium. Signals delivered over CATV distribution networks are in AM format because TV sets need to see AM signals. CATV amplifiers consequently have been designed to accept and reproduce AM signals.

So why haven't AM-format fiber optic systems been available before? Partly because there was no market for such products and partly because fiber optic technology had not advanced sufficiently. As Laser Link shows, that's rapidly changing.

Testing 'by accident'

There's other fiber optic news this month as well. In fact, there was plenty of new information all over last month's Eastern Cable Show in Atlanta. For instance, ATC found out that the above-mentioned system in Orlando (using an AT&T laser) performs so well that subscribers apparently cannot tell the difference between pictures delivered via AML and fiber.

According to Dave Pangrac, ATC's director of engineering and the man spearheading the number-two MSO's fiber field trials, the laser and fiber link were real-world tested long before they were "ready," but the system passed the test anyway.

ATC is presently building a redundant path around its 36-channel Orlando coaxial cable system by linking the headends with fiber cable. One of those links is a 19.7 km path that, although it was designed for FM electronics, was instead driven by the AT&T AM laser because Pangrac wanted to measure the performance the laser would give.

"We fired it up and the picture looked great," said Pangrac. Although the measured performance was not up to ATC specs, the system was left running as a backup to the AML equipment.

One Saturday morning, unbeknown to anyone, the fuse blew on the AML receiver. The system immediatey switched over to the fiber optic backup system and, surprisingly, there was no increase in service calls. "That tells us we can do things today with existing equipment," says Pangrac. And although the laser's price still hasn't reached the level where ATC can afford multiple units, the news is good because the technology works—even over trunk runs longer than they planned to use, adds Pangrac.

(In its Denver labs, ATC is presently testing a similar laser manufactured by Panasonic, says Pangrac. The laser is slated to be used in a test in the MSO's Hawaii system.)

Another test in the Orlando system also resulted in good news. After outputting the fiber optic signal into a cascade of 17 feedforward amps, 12 push-pull amps, one bridger and four taps, Pangrac and Orlando's Vice President of Engineering John Walsh viewed the resulting picture on a 45-inch TV. "It was all but impossible to tell" the difference between the fiber system and the AML system, said Pangrac.

Zenith unveils HDTV

Zenith engineers submitted that company's proposal for its "Spectrum Compatible HDTV System" last month to the FCC's Advisory Committee on Advanced Television Services. The system uses compression techniques to squeeze 30 MHz of video and audio data into 6 MHz channel allocations, thereby allowing broadcasters to remain in their present formats, says the company.

The system takes the low-frequency information in a 30 MHz video signal, converts it to digital form and transmits it with the high-frequency video in a 6 MHz space. The new technique reportedly reduces power needs by more than 90 percent, which will allow broadcasters to utilize previously unusable VHF and UHF channels to simulcast HDTV information.

For example, a broadcaster on one channel could send regular TV signals to existing televisions *and* transmit an HDTV version of the same program on another, unused channel to HDTV set owners.

The system will provide 787.5 line, progressively scanned 59.94 Hz display, comparable in resolution to a 1,000-plus line, interlaced display. It will also accommodate wide-screen images and will include CD-quality audio, according to Zenith executives.

VideoCipher to be revamped

In case you haven't heard by now, **General Instrument** plans to upgrade security in its VideoCipher units, beginning next year. With some estimates of piracy as high as 50 percent, the TVRO industry has recognized the need for an upgraded encryption system for some time.

The VideoCipher II-Plus will be introduced in June 1989 and will incorporate new high-security cards

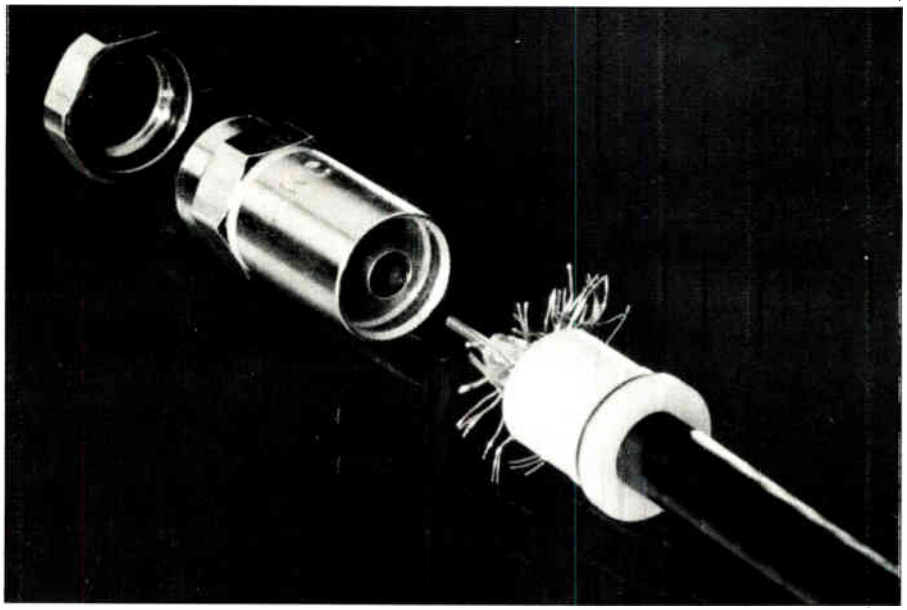
General Instrument's 2750R Integrated Receiver Descrambler that will be inserted by consumers into their integrated receivers/descramblers. Additionally, the cards will be distributed directly to dealers and consumers in order to more fully track their whereabouts.

Other features of VideoCipher II-Plus is an expansion in tier bits to 256 to allow for more subscription programming services available to the home dish market; and an increase in the addressing rate to allow for growth to up to 50 million TVRO households (presently, the system can handle about 5 million households).

In the meantime, VideoCipher is also offering new firmware, incorporating ICs on a "chip on board" system and a "super chip" that will consolidate multiple security chips into a single security chip. Also, a new pilot program designed to test direct distribution of descrambler modules to satellite TV dealers has begun. One hundred dealers will be allowed to purchase a limited number of modules for services and repair purposes (presently, all VC II descramblers must be sent to a GI-authorized repair center and dealers have complained about the slow turnaround time) and will be held accountable for their whereabouts. If the test is deemed successful, it will be expanded to 1,000 dealers by January 1989.

Other new products

General Instrument also announced it has added a fifth model to its line of VideoCipher satellite integrated receiver/descramblers. The 2750R IRD is fully featured and includes such improvements as on screen displays, improved hardware performance, better video performance and integrated VCR recording and playback connections. Other features include the EZ Sat Locater,



LRC Electronic's Snap-N-Seal™

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which automatically programs the locations of all C- and Ku-band satellites into memory after just two satellite have been programmed by the user; Direct Access Satellite Selection by remote or on-screen menu; built-in timer for use with a VCR; AutoPeak Tuning for assured high picture quality; and more.

The top-of-the-line product is slated to cost $1,349 each and includes a built-in VideoCipher II and antenna positioner/power supply. For info, call (619) 455-1500.

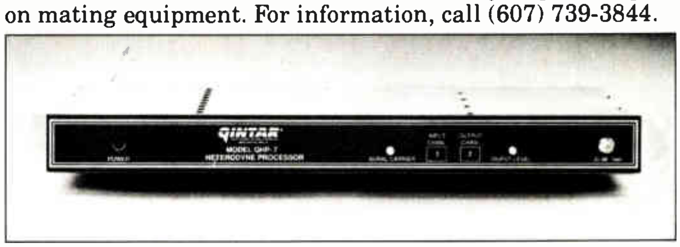
In other IRD news, The **R.L. Drake Co.** has developed a low-cost satellite integrated receiver/decoder that can be expanded into a full featured model at a later date. Designed for consumers interested in a basic IRD, the Model ESR 1024 is priced at less than $900 and is the first product developed for the new Series 2 line of equipment.

The ESR 1024 features a built-in VideoCipher II decoder, 30 channel preprogrammability and parental lock-out. The front panel of the unit has just six buttons because nearly all functions are controllable via the infrared remote control unit. Available as an option is the APS 1024 antenna positioning system.

Two more models will be added to the Series 2 line later in the year: the mid-priced ESR 1224 and the full-featured ESR 2450. Call (513) 866-2421.

Augat/LRC Electronics has designed an F-connector that eliminates two problems associated with present F-connectors: improper crimping procedures and moisture invasion.

The new Snap-N-Seal F-connector is triple sealed and snaps on instead of having to be crimped. A 360-degree compression on the cable jacket ensures a complete radial seal, eliminating the moisture migration path typical to convnetional connectors. It also eliminates problems encountered with rubber boots due to inconsistency of port lengths on mating equipment. For information, call (607) 739-3844.



Quintar's Model QHP-7 Heterodyne Processor

A new low-cost channel elimination filter is now available from **Qintar Inc.** The Model CEF single channel bandstop filter offers signal attenuation of -50 dB minimum to -55 dB typical at teh video carrier with adjacent channel loss of -4 dB maximum, according to Qintar.

The filter is designed to eliminate a full 6 MHz channel to allow for reinsertion of any program the user desires. Filters can be cascaded to multiple-channel elimination. The units carry a two-year warranty.

Also new from Qintar are the QSFM-45 and QHP matched modulators and processors, designed for use in adjacent channel headends of up to 35 channels. The SAW filtered modulator features output channels 2 through 13, midband and superband at up to 45 dBmV with adjacent channel interference of 57 dB down minimum. Output is crystal controlled at ±5 kHz and aural controls are set at 15 dB below video carrier.

The QHP heterodyne processor features input channels 2 through 13 VHF and 14 through 70 UHF. Both units feature independent internal power supplies and front panel controls and test points. Prices start at $399 each and FCC offsets are

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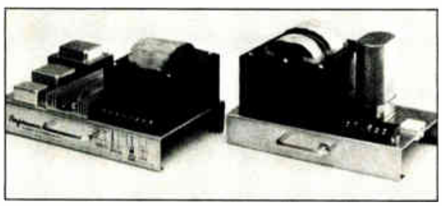
available at no extra charge. For details, call (800) 252-7889.

New from **Nexus Engineering** is the UM-5 UHF agile modulator. The unit accepts baseband video and audio inputs and modulates them onto any UHF channel from E21 to E52. The new unit features internal DIP switches for easy selection of output channels and double-sideband output for alternate-adjacent channel operation.

Nexus also announced its new Series 100 line of headend equipment. The modular system has multiple channel configurations, is compact in size (12 VideoCipher scrambled satellite channels and seven off-air channels will fit in 44 inches of rack space) and features a power supply located outside the unit.

Also, Nexus has published the second edition of book of headend design articles. For information, call (604) 420-5322.

A new power supply system featuring a ferro-resonant module and standby inverter has been developed by **Performance Cable TV Products**. The supplies deliver 14 amperes of current and each will fit into the same space as most other power supplies.



Performance Cable TV Products' Cable TV power supply system

Terminal strip screws are labeled to assist technicians in identifying the proper wiring connections to reduce field installation errors. The units were made rugged by deleting large printed circuit boards and delicate logic circuitry. PC connection have also been eliminated. Call (404) 443-2788 for info.

Blonder-Tongue Laboratories has added two new indoor amplifiers to its product line. Both models, the BIDA 300-30, with 50 MHz to 300 MHz bandpass, and BIDA 450-50, with 50 MHz to 450 MHz bandpass, are configured for one-way operation and can also be used as postamplifiers for headends using passive combiners.

BIDA-30 amps have a flat operation gain of 32 dB, which can be adjusted down to 22 dB with the unit's variable attenuator. Plug-in attenuators and slope equalizers are also available. Call (201) 679-4000 for information.

C-COR Electronics has expanded its line of line extender amplifiers with

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the introduction of the new E-517 LE. The E-517 utilizes fourth-generation hybrid chips to provide better performance. Typical performance enhancement is 4 dB in composite triple beat and cross modulation over amps using third-generation hybrids.

The E-517 is fully compatible with C-Cor's PHD line extenders and existing ancillary products. The LE carries a three-year warranty and is available from stock. Call (814) 238-2461.

Tired of having to dig up sidewalks? Making underground passageways just got easier with **Allied's** Hole-Hog piercing tool with quick-reverse. The positive-lock reverse feature makes it easy to retrieve the tool when it encounters an impassable object.

Although the Hole-Hog is able to break through many obstacles in its path, it can be reversed when a large object is hit. To reverse the unit, the air supply is turned off, the air hose is twisted one-quarter turn, and the air supply is restarted. Disconnection of the air hose, pulling cable or multiple turns are unnecessary.

The Hole-Hog is available is nine sizes, from two-inch to 16-inch diameters. They can be used to travel under roads, driveways, sidewalks, parking lots and foundations without disturbing pavement or landscaping. Call (216) 248-2600 for details.

FiberCom has introduced a new analog fiber optic communication link to transmit broadband signals between 50 MHz and 90 MHz over fiber optic cable. Applications of the IFL-70 include interfacility connections for satellite up-and downlinks, cable TV supertrunks, closed circuit TV systems and broadband LAN extensions. Transmitters and receivers are available for varying distance requirements.

The system was originally designed for connections between satellite dishes and user premises or signal distribution facilities. Additionally, the IFL-70 can be used to deliver multiple video signals and telemetry information in a closed circuit environment, deliver low-noise channels of data over a LAN or send multiple video channels point-to-point in cable TV applications. For details, call (703) 342-5961.

D.W. Electrochemicals of Canada has received U.S. and Canadian patents for its Stabilant 22, a liquid semiconductor. A non-toxic liquid polymer, Stabilant 22 is initially non-conductive when applied to an electro-mechanical contact, then switches to a conductor when placed inside individual contacts.

However, the substance remains nonconductive between adjacent isolated contacts, allowing it to be applied to contact and insulator without causing current or signal leakage across the insulator. For details, call (416) 889-1522.

News bits

- Researchers at **Bellcore** report they have discovered a way to compress HDTV signals onto a single B-ISDN channel for transmission on optical fiber. The digital coding compresses the signal to under 120 megabits per second.
- **Midwest** CATV officials have announced that the Matrix System off-premise addressable security box has been approved for production and will be tested in an Alabama cable system. Officials said the plastic enclosure and electronics were subjected to a 100-hour salt intrusion test and functioned without failure or degradation in specifications. ■

—Roger Brown and Gary Kim