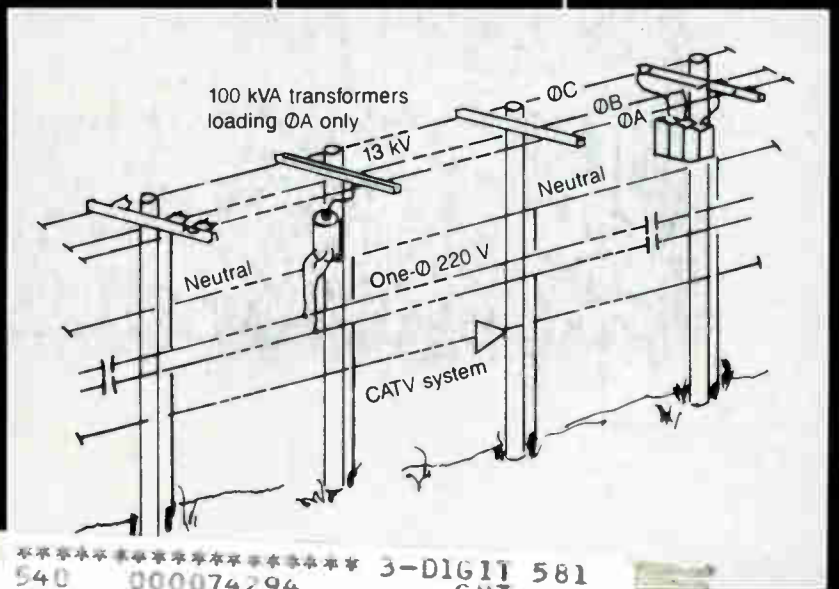
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Purchasing: A decision making task



The cable, power shared environment

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August 1987

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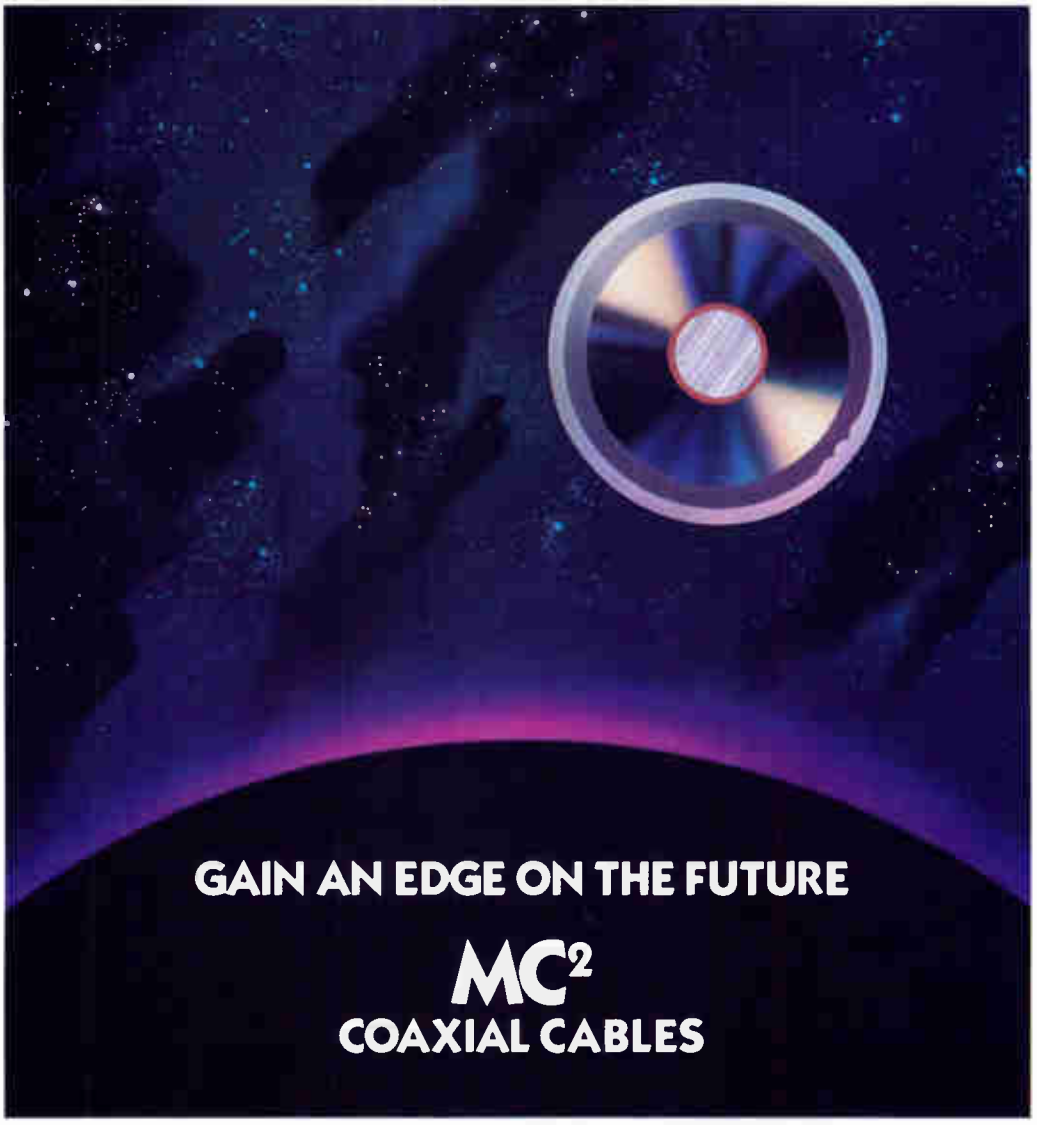
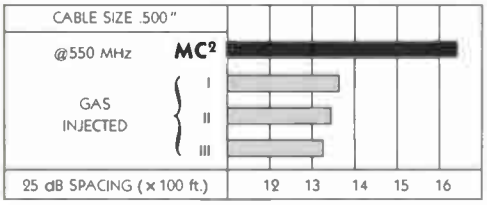


Follow the leader, that's what our competitors are trying to do in order to approach the superior attenuation characteristics of MC²coaxial trunk and feeder cable. But they succeed only by increasing the standard diameters of MC² — our familiar .500" must become .565" or .625"; and our .750" must become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



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

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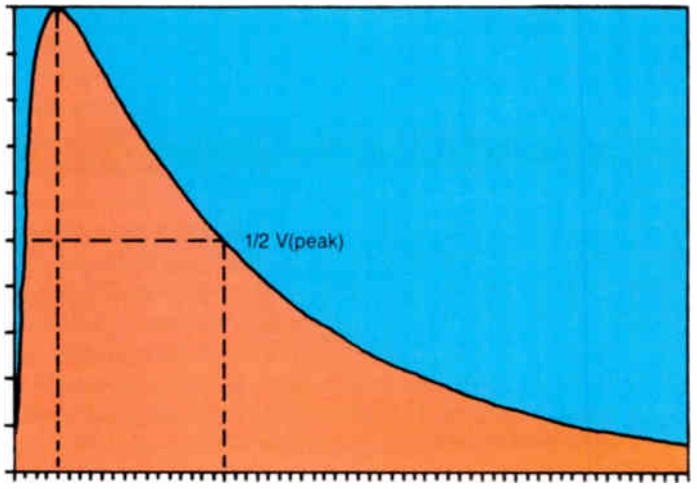
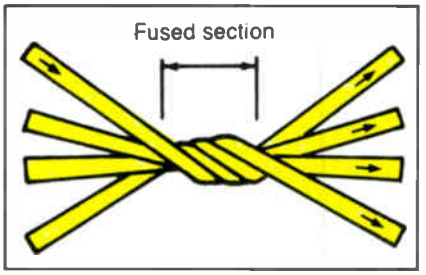
CONTENTS

Departments

Eastern Show 10



Lightning effects 26



Correspondent's Report 75

Features

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BEAUTY AND THE BTSC

Jerrold's COMMANDER® MTS Stereo Encoder

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

Sounds drab, doesn't it?

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

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

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

So do your subscribers.

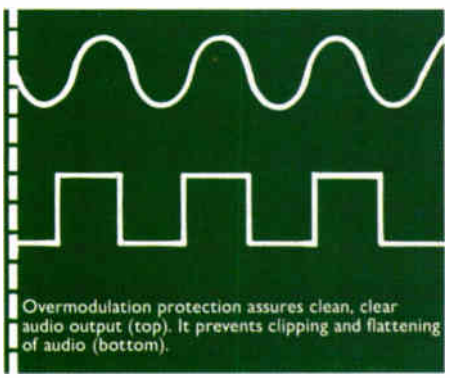
That's because Jerrold's COMMANDER MTS is the only stereo encoder with non-clipping overmodulation protection! There's no way the annoying pops, cracks and distortion that comes from erratic audio input levels can get through to your subscribers, because the CMTS just won't broadcast them. It's designed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

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

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

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

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



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

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

Both 41.25 MHz and 4.5 MHz output are provided.

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GENERAL INSTRUMENT

Reader Service Number 4.

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Nipping it in the bud

I recently received a call from a good buddy regarding a serious problem now confronting the cable industry. The problem is one of interfacing M/A-COM's VideoCipher IIC (VCIIC) descrambler with local commercial insertion equipment in conjunction with MTV.

With more satellite programmers scrambling their services, cable TV engineers and technicians are being faced with new terminology and equipment unfamiliar to them. As well, in addition to scrambling, more CATV systems are inserting commercials in the channels that offer local avails.

MTV seems to be the most complicated channel for systems to accommodate. There are several manufacturers that sell FM stereo processing equipment, however, the following information concerns only those using the Wegener Series 1600 FM stereo processor. The processor consists of three main components: a mainframe, demodulator with tone decoder installed and FM modulator.

The stereo processor is needed to receive the stereo and mono audio signals any time MTV is transmitting in the bypass or unscrambled mode and to obtain the commercial insertion control contact closure to start the local equipment for both unscrambled and scrambled modes of transmission. (Next month's issue will examine other manufacturers'/programmers' hookups).

With the commencing of MTV's test scrambling phase, the 7.4 MHz digital audio stereo subcarrier is no longer used. Therefore, the 7.4 MHz digital demodulator must be replaced with Wegener's Model 1712 analog audio demodulator to receive the bypass audio on MTV and have the Model 10011 VCR option installed to obtain the commercial insertion contact closure.

Stereo processor connections

When a commercial runs the following events will happen:

- The TV modulator will switch from network audio and video to commercial signals; and
- The FM modulator will switch from network audio to commercial audio.

To route the commercial audio to the FM modulator, the audio from the controller to the TV modulator also must be routed to both J7 and J9 of the 1601 mainframe. When the closure activates, this audio (which is commercial audio) through J7 and J9 is output by the FM modulator. If no audio is input to these terminals, no audio

will output during the break.

Also, when MTV is in the scrambled mode (it is unscrambled on Satcom F3R but scrambled on Galaxy III) two traces on the 1601 mainframe motherboard must be cut. This is because the stereo subcarriers are not transmitted during scrambling except during the commercial breaks. The traces involve route left and right audio from the 1712 demodulator to the 1691SW FM modulator. With no subcarriers present, noise instead of audio is routed, and so the traces must be cut. The interconnections that follow will route the audio around the cut traces so that the noise problem does not occur. (Contact Wegener for trace cutting procedures.)

Refer to the different types of J connections on the back of the Wegener stereo processor. References here to J2, J7, J9 and J10 are based on the 1712 demodulator being installed in position #1 of the Wegener 1601 mainframe. If the demodulator is installed in another position the J numbers will increment by 10 for each odd position to the right of position #1 (for example, if it's installed in position #3, J10 becomes J20, in position #5, J10 becomes J30). Baseband audio in the scrambled mode with baseband left and right and mono audio output signals will be obtained from the VCIIC. The left and right audio channels from the VCIIC should be connected to the left and right audio input pins of J10 on the 1601 stereo processor. This supplies left and right audio directly to the FM modulator. (It should be noted that the FM modulator in the stereo processor must be a 1691SW. Wegener's earlier 1691 version cannot be interfaced in this application.)

The left and right and mono audio outputs from the 1712 audio demodulator need to be wired to the appropriate bypass input terminals on the VCIIC. The mono audio outputs from the VCIIC should be connected to the audio input of the commercial insertion controller. The mono audio output from the commercial insertion unit is then connected to the audio input of the channel modulator.

Composite video is demodulated, unclamped and unfiltered. The composite baseband video connection from the satellite receiver to the stereo processor will remain unchanged. Remove the 75 ohm terminator on J2 of the stereo processor and connect the 75 ohm RG59 cable from J2

(Continued on page 33)

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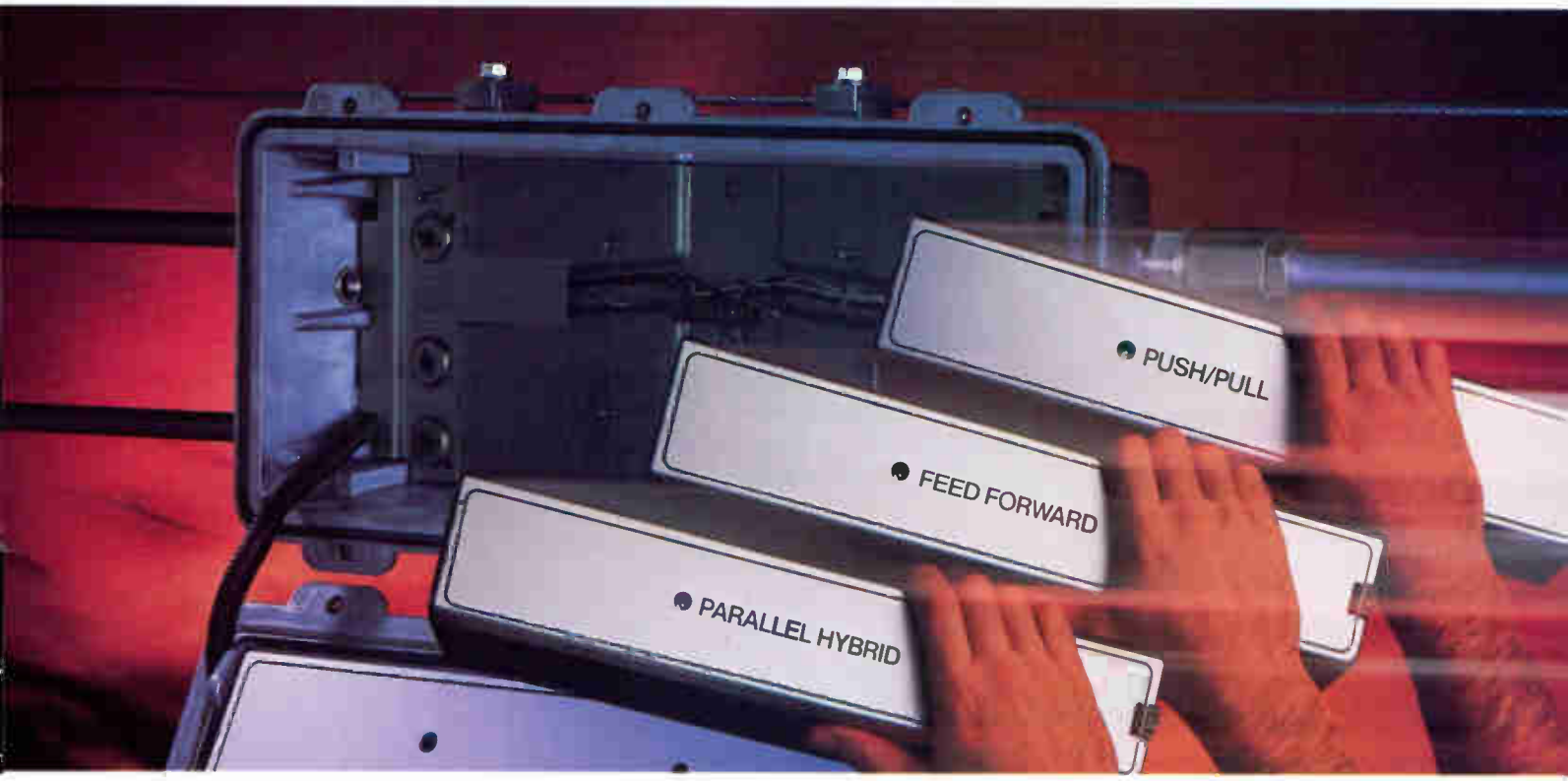

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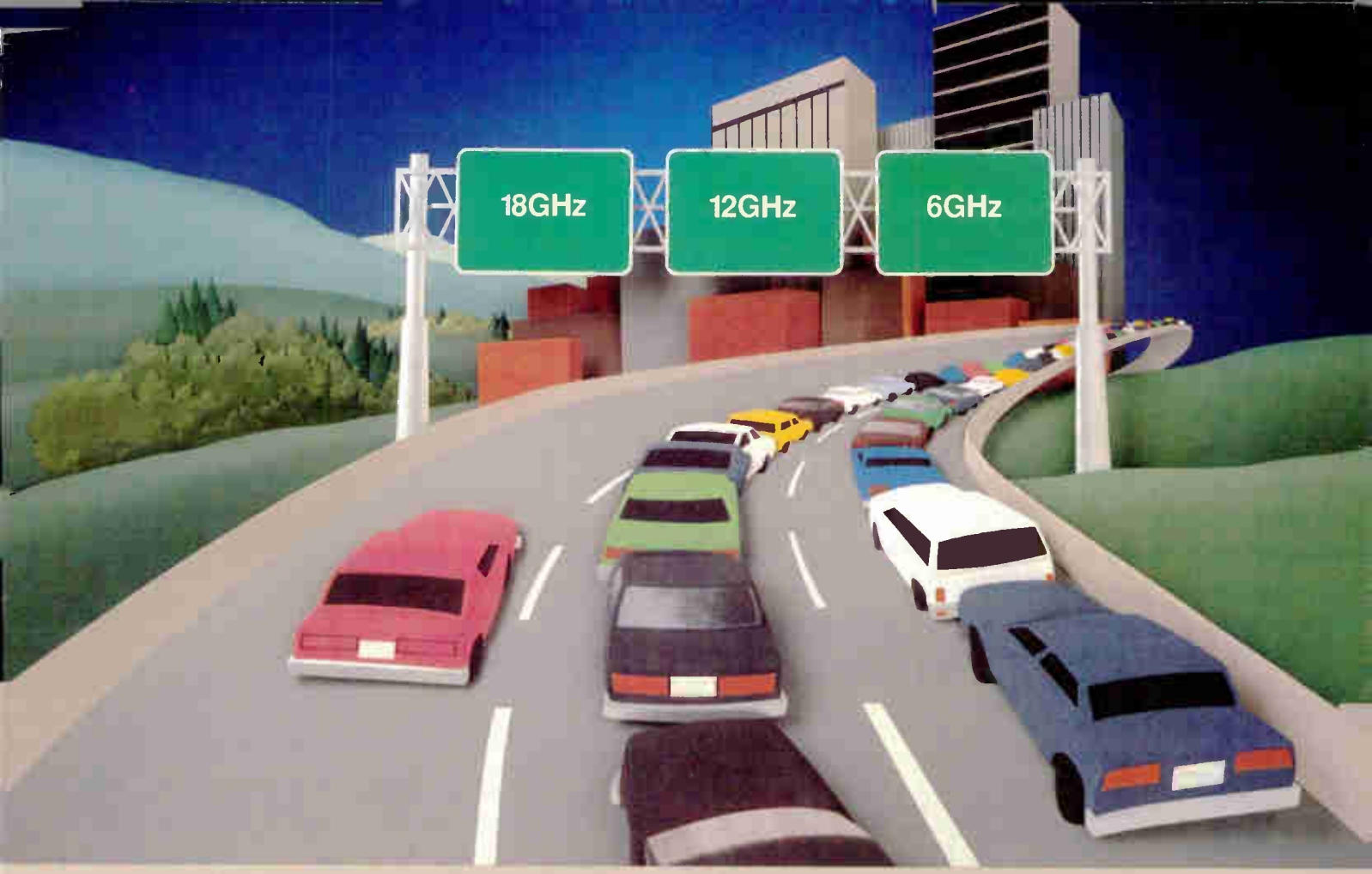

Beat the traffic.

M/A-COM opens up a new lane for cable operators with our new 18 GHz microwave system.

If you've been looking for an open frequency at 6 or 12 GHz, you're not alone. In many areas, they simply aren't available: there's too much traffic and not enough spectrum.

M/A-COM's new 18 GHz microwave system gives you another option: a wide-open band which the FCC has assigned to cable operators. It gives you 50% better link availability (or 40% longer range) than 23 GHz, and none of the congestion of the lower frequencies.

The MA-18CC is a fully-featured microwave system, designed to meet or exceed all RS-250B short-haul performance specifications. It is field tunable, and a single gunn oscillator covers a wide selection of frequencies so spare parts can be kept to a minimum.

For over 20 years M/A-COM MAC has specialized in providing microwave radio equipment to cable operators and broadcasters. Every unit with our name on it is built in our own factory, so we not only control the quality, but we know how to service it.

For more information on how you can streamline your microwave needs, contact M/A-COM MAC, Inc., 5 Omni Way, Chelmsford, MA 01824, (617) 272-3100.

M/A-COM

Reader Service Number 8.

Eastern Show 'magic' will include BCT/E

ATLANTA—The 1987 Eastern Show, sponsored by the Southern Cable Television Association (SCTA), will offer BCT/E Certification Program review courses, as well as an afternoon of testing in all seven BCT/E categories. With its theme "Go for the Magic," the show will be held Aug. 30-Sept. 1 at the Merchandise Mart/Peachtree Plaza Hotel in the Atlanta Market Center.

Coordinated by the Society of Cable Television Engineers, the BCT/E Program was recently endorsed by the SCTA (*CT*, 6/87, page 11).

The complete technical agenda for the show is as follows:

Monday, Aug. 31

8:45 a.m.—Introduction by Bill Riker, executive vice president of the SCTE

9-9:30 a.m.—FCC update, with Cliff Paul (consultant)

9:40-10:30 a.m.—Headend maintenance and measurement, with Richard Covell (General Instrument/Jerrold)

10:40-11:30 a.m.—Amplifier technology, with Bob Loveless (Scientific-Atlanta)

11:40 a.m.-12:30 p.m.—Test equipment, with Terry Bush (Wavetek)

Tuesday, Sept. 1

8:45-10:15 a.m.—BCT/E tutorial on Category VI—Terminal Devices, with Jim Farmer (Scientific-Atlanta)

10:30 a.m.-12 noon—BCT/E tutorial on Category I—Signal Processing Centers, with Alex Best (Cox Cable Communications)

1-4 p.m.—BCT/E exams on all seven categories

Chyron completes training facility

MELVILLE, N.Y.—Chyron Corp., a manufacturer of character generators and other video equipment, announced completion of a new three-classroom facility here, designed to provide hands-on operator and maintenance training with its Models 4100 EXB, 4200, Scribe, RGU-2 and VP-2.

Operator training includes basic message

It's 2 a.m.

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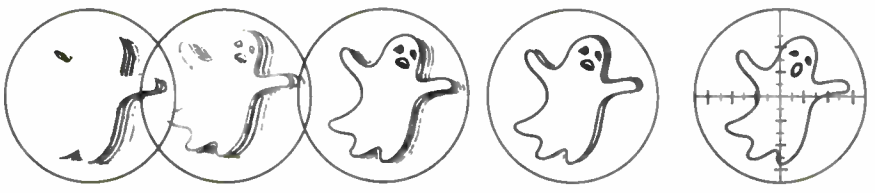

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composition, multicolor techniques, font and logo creation, display plane mixing and so on. Maintenance courses require knowledge of digital electronics and microprocessor systems and include systems architecture, components, peripherals, functions, software testing and troubleshooting.

Delegation seeks high-tech firms

WASHINGTON, D.C.—The U.S. Department of Commerce is once again seeking U.S. high-tech companies not currently selling in the United Kingdom or France to join its Matchmaker Trade Delegation Nov. 2-6. At the delegation in London and Paris, participants will learn the requirements for successful marketing in each country and will meet with agents, distributors and potential licensees or joint venture partners.

According to the Commerce Department, the British and French markets are very receptive to American products. For example, in the U.K. market, over 60 percent of the high-tech electronic products sold are either imported from the United States or manufactured locally by subsidiaries of American-owned companies.

Current major areas of opportunity in the United Kingdom include local and wide area networks, test equipment, fiber-optic and microwave networks and DBS equipment. In France, electronic components, cable TV, video and satellite technology are expanding markets.

For more information, contact Matchmakers, U.S. Department of Commerce, International Trade Administration, U.S. and Foreign Commercial Service, HCH8 2116, Washington, D.C. 20230.

SCTE appoints chapter director

EXTON, Pa.—In order to coordinate the growth of new chapters and meeting groups, the Society of Cable Television Engineers named Richard Cole as its director of chapter development, a new position. Prior to his appointment, Cole was plant manager for Comcast Cablevision of Indianapolis. He was co-founder and served as the first president of the SCTE's Central Indiana Meeting Group. Cole will be temporarily based in the Indianapolis area.

The SCTE recently added three new meeting groups, bringing the total number of chapters and meeting groups currently operating in the United States to 36. For more information, see this month's *Interval*.

Cole

Who was that cable TV man

DOLTON, Ill.—During a light rain, as he drove through the neighborhood checking lines for illegal cable hookups, Curtis Krause, lineman for Continental Cablevision, recently saw lightning

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strike a nearby two-story house. From his location, he saw the bolt hit a rooftop TV antenna.

"There was a big glow on the roof and the roof hopped off like a sheet of paper," he said.

As a result, fire and smoke emerged from the second floor window. Immediately, Krause reported the incident by radio to his dispatcher. A woman, covered with insulation, and others evacuated the house. Then Krause and a neighbor used a ladder and garden hose to douse the fire until the Dolton Fire Department arrived. After which, Krause moved his truck, checked on the residents again, then went back to work. (Rumor has it he left a silver connector behind.)

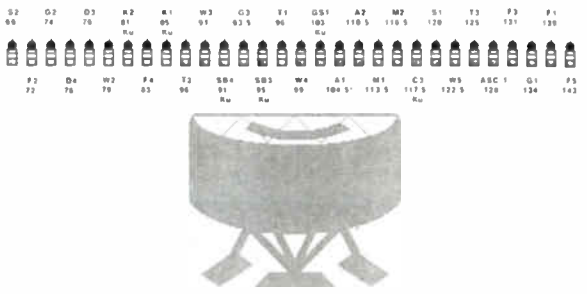
Meter readers form new organization

PHILADELPHIA—The Automatic Meter Reading (AMR) Association was formed at the annual Meter Reading Conference June 23. The purpose of the new organization is to advance the state of telemetry technology for meter reading, distribution and control. According to Dr. Donald Schlenger, vice president of United Water Resources, among likely members of the association would be utilties companies, communications carriers, equipment manufacturers, other users of telemetry services, vendors, consultants, regulators and policy makers.

For more information, contact AMR Association, P.O. Box 961, 345 Kinderkamack Rd., Westwood, N.J. 07675.

- Over $1.3 million in gifts and pledges have been contributed to the National Museum of Cable Television as of April 20, 65 percent of its $2 million goal. Those interested should write to: National Museum of Cable Television, Pennsylvania State University, Mitchell Building, University Park, Pa. 16802.
- Tempo Cable, a wholly owned subsidiary of Tempo Enterprises, plans to establish Douglasville, Ga., as the site of its new national cable system headquarters. The MSO currently owns and manages 16 systems serving approximately 16,000 subscribers.
- Creative Management Systems has expanded its San Francisco sales office to provide complete regional installation and training services. CMS also opened a new sales office at 16496 Bernardo Center Dr., Suite 210, San Diego, Calif. 92128, (619) 487-6140.
- Pirelli Communication Systems has moved to a new, expanded headquarters to provide the company with greater manufacturing capacity, an expanded R&D area and a new QA lab. The new location is 2 Tower Dr., P.O. Box 5031, Wallingford, Conn. 06492, (203) 284-1680.
- Eagle Cable, based in Tulsa, Okla., recently finalized the purchase of five more Oklahoma cable systems. The acquisition encompasses about 600 subscribers and nearly 1,400 homes passed.
- NCS Industries of Willow Grove, Pa., recently signed an agreement to represent Monroe Electronics of Lyndonville, N.Y. NCS will represent the Monroe line of remote control/tone signaling and modular commercial insertion equipment in the middle Atlantic states area.
- Panasonic announced that Jones Intercable is offering the company's Model VCS-1 RF routing switch free of charge to the 18,000 subscribers in the MSO's Sarasota Springs/Glenville, N.Y., marketing areas. The offer is for those subscribers who have VCRs and have signed up for either HBO and Cinemax or HBO and The Disney Channel.
- C-COR has signed a contract with Storer Communications to provide distribution electronics and system design for its 400-mile new-build in Salisbury, Md. Storer also will use the company's field engineering services to provide technical training and assistance during startup.
- Sacramento Cable recently signed a contract with Times Fiber for the future supply of all aerial and underground cables as well as drop cables.
- SecaGraphics Inc. of Golden, Colo., announced a contract with Rogers Cablesystems totalling over $1 million in computer-aided design and drafting systems in six Canadian locations in the Toronto and Kitchener areas.
- Zenith filed a registration statement with the Securities and Exchange Commission for the sale of 2 million shares of common stock. Proceeds will be used for general corporate purposes, including the reduction of short-term borrowing.
- First Data Resources, based in Omaha, Neb., announced the completion of an agreement to provide management information and subscriber billing services for Haefele TV of Spencer, N.Y.

Telstar 303. . .Galaxy 3. . .What's Next??



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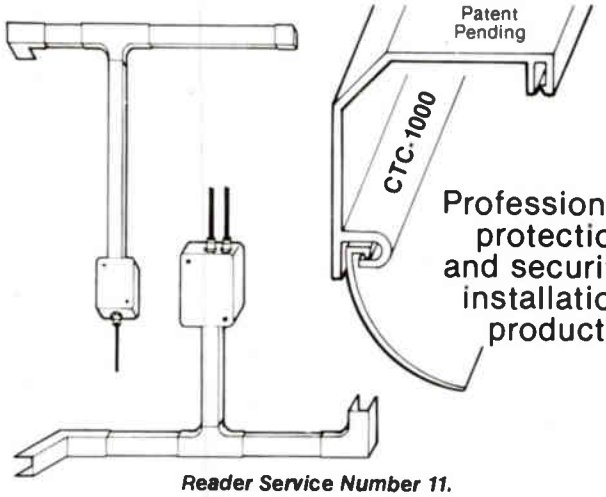

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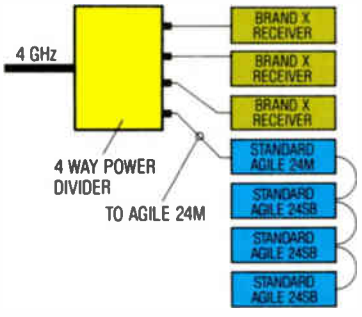

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Reader Service Number 12.

I like Ike

By Isaac S. Blonder
Chairman, Blonder-Tongue Laboratories Inc.

Presidents come and presidents go. We, the average citizens, while under the direct influence of everything political, are not intimately tied to any one administration. In my case, Roosevelt was a minor player, although he did pledge to England—before Pearl harbor—500 radar officers (myself included) to serve in the British armed forces. In contrast, Eisenhower left behind a legacy of good ideas and deeds that have influenced my thoughts and spare time activities ever since.

When I arrived in England in February 1942, we were the first uniformed Americans to serve on detached duty with the British armed forces and our initial superior officers were British. Come June, the American brass arrived in London, and we were soon subject to the usual flood of directives from headquarters. One, however, on the 9th of October 1942, caught my attention so vividly that I retain a copy to this day. Subject: "Negro Troops." Quoting from Eisenhower, it stated, "The spreading of derogatory statements concerning the character of any United States troops, either white or coloured, must be considered as conduct prejudicial to good order and military discipline and offenders must be promptly punished." It continued, "Coloured soldiers will have the same furlough and pass privileges and will have equal rights to places open to white soldiers. General Eisenhower desires that in cases where it is necessary to impose any restrictions that they shall apply to both races." It was no wonder that these sincere lifetime beliefs led to President Eisenhower's sending federal troops to Little Rock, Ark., in 1957.

Another tribute to Eisenhower's unerring instinct for human foibles was the reason for his visit to a death camp in Ohrdruf, Germany. "The things I saw beggared description . . . I made the visit deliberately, in order to be in a position to give first-hand evidence if ever in the future there develops a tendency to change these allegations merely to 'propaganda.' "

For a man with a military education that was neither scientific nor business oriented, Eisenhower, in my opinion, was far and away the most perceptive president in his advocacy for science, education, democracy and peace in this century. Look at his strong support for science. Truman in 1947 vetoed the original bill to create the National Science Foundation, which was thus delayed for three years in starting. Eisenhower in 1954 convened a panel of leading scientists, the Technological Capability Panel, chaired by Dr. Killian of MIT to study the growing Soviet military and technical powers. When the Russians launched Sputnik in 1957 the president responded by creating a permanent committee of science advisers with Killian as chairman and special science advisor to the president. In Killian's own words, "Eisenhower's receptivity to technological innovation and his use of the committee to resolve interservice and interdepartment rivalries was the high water mark in government-science relationships and its invigorating effort on American science and engineering." Soon thereafter Eisenhower signed the Space Act of 1958 that created NASA.

From a publication of People to People International, "The roots of the Citizen Ambassador Program reach back to 1956 when President Dwight D. Eisenhower founded People to People." Eisenhower said, "I have long believed, as have many before me, that peaceful relations between nations require understanding and mutual respect between individuals." People to People was administered by the State Department until 1961 when it became a private non-profit organization. In April, I joined with other engineers from the American Society of Mechanical Engineers in a trip to China organized by the People to People foundation. We visited four cities, several universities, power plants, shipyards and heavy machinery factories with the primary task of exchanging views on engineering management. There were no restrictions on any subjects for discussion, our criticisms were gracefully received and our hosts were unfailingly open and hospitable.

President Eisenhower was certainly vindicated in his belief that face-to-face meetings lessen the likelihood of armed conflict. (Parenthetically, we saw ample evidence of trade with the Western countries, none with the Soviet bloc!)

"If we are to preserve our place in history and our status as a nation, it will be through the quality of our science education."

If we are to preserve our place in history and our status as a nation, it will be through the quality of our science education and our practicing scientists. Eisenhower, a non-scientist, understood this as well as anyone and initiated many major programs to stimulate American science. One of his unpublicized acts, with which I have been involved since 1970, was his 1958 directive to the Army Research Office in North Carolina to fund and continue a Junior Science contest initiated by Dr. Githens the previous year. The Academy of Applied Science, in which I am a director, now administers this program.

The Junior Science and Humanities Symposia provide the opportunity for young people to rub shoulders with noted scientists on college campuses and to present student papers on their own experiments and research. Each year 7,000 high school students compete at 46 universities throughout the United States and Puerto Rico. The winners compete once more at West Point and the finalists compete in London against American students from our worldwide network of military-based civilian schools. Since 1957, 160,000 students have entered these contests.

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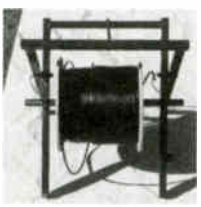

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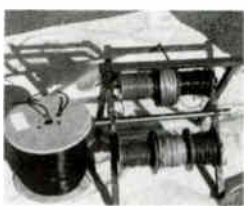

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Reader Service Number 14.

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Shared environments and sheath currents

By J. Richard Kirn
Wire Tele-View Corp.

Whether we like it or not, the CATV system is an integral part of the power network. Our system, in addition to being powered by the power company, is bonded to the power company neutral at frequent and various intervals. But is the power company neutral *really* neutral?

First let's take a quick course in power distribution. This will give us an insight into many of the problems we have experienced and never fully understood. The power system is similar to a CATV system in the following ways:

CATV system	Power system
Supertrunk	Super-high voltage transmission lines 500 kV and up
Trunk	Delta connected three-wire (35-250 kV)
Distribution	"Y" connected four-wire (5-35 kV)
Drop	120/240 volt single phase three-wire

Normally a communication system would not share facilities with a super-high voltage transmitting line, so let's begin by looking at the basic power trunking system: three-phase, three-wire delta. The three-phase delta system (Figure 1), is used to transmit power between substations. No neutral wire is used and all three load currents (I_{L1}, I_{L2}, I_{L3}) are equal. Typically, lightning arrestors (air gap) are placed at each end of the three conductors and occasionally at internment locations if it is a long transmission line. These lightning arrestors and their associated grounds will receive every lightning strike for miles of transmission line and should be avoided.

Drive your own grounds and bond at the pole before and the pole after. In high lightning areas (e.g., Florida), some power companies will run a static line above the three-current conductors. This line is not a neutral but simply a continuous lightning rod to protect the transmission system. The static line is normally grounded at each pole and the CATV system would be required to bond to it. However, since it is grounded at each pole, lightning currents are dissipated with much less effect.

Y-connected systems

Virtually all modern distribution systems serving residential, small commercial and small industrial loads are Y-connected four-wire, multigrounded, common-neutral systems (Figures 2 and 3). The fourth wire of these Y-connected systems is the neutral for both the distribution (primary) system and the drop

"The more grounds and the better the ground, the more current is diverted to the Earth."

Figure 1: Three-phase delta

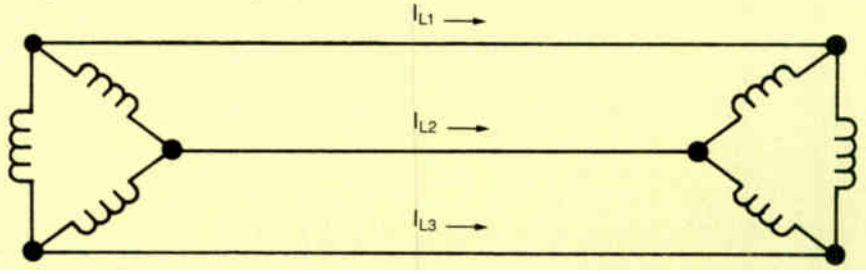

Figure 2: Three-phase Y-connected power primary

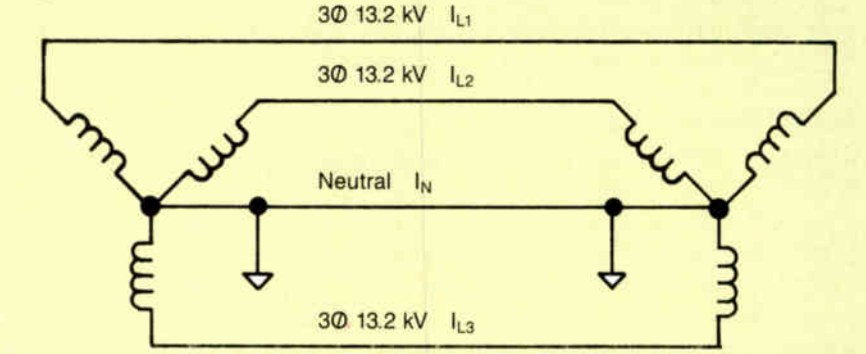

Figure 3: Typical primary distribution feeder

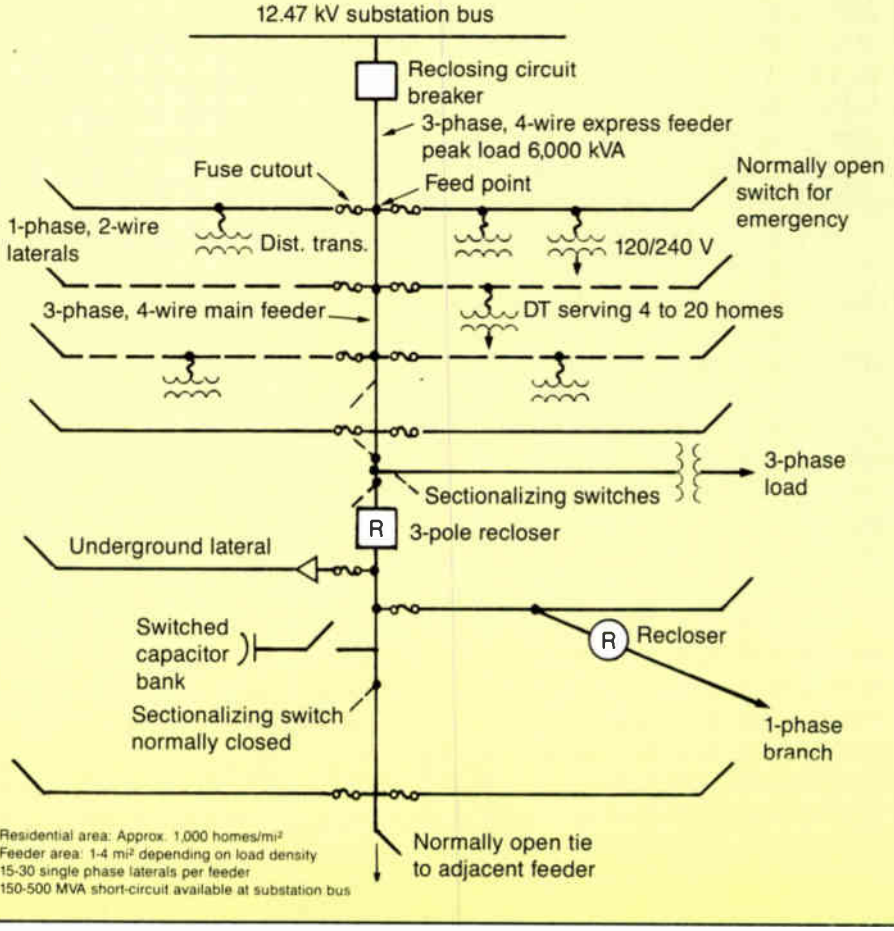

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Figure 4: Single-phase power secondary (balanced)

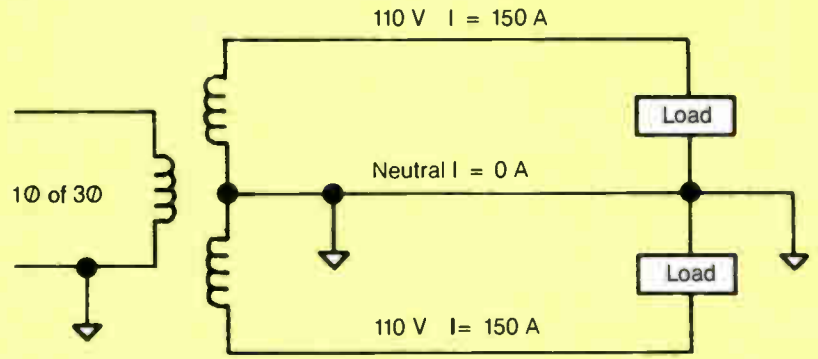
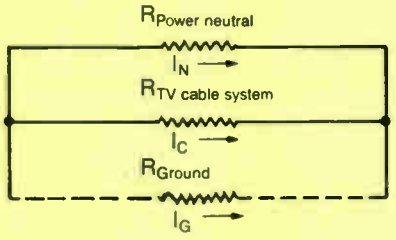


Figure 6: Current distribution in shared environment bonded to earth ground



(secondary) system. It is grounded at many locations and bonded to the CATV and telephone system at many locations. The distribution transformer that feeds individual drops is fed from one leg (phase) of the distribution line; one, two or all three of the phases may run down a particular street along with a neutral. The four-wire system is particularly economical for distribution systems since each branch circuit consists of only one insulated phase conductor and a bare uninsulated neutral. Also, only one primary fuse and surge arrestor is required at each transformer.

The power company cannot know or predict with certainty the load on any of the three phase legs. It will depend on who has the air conditioner running, water heater on, lights on, etc. Thus in Figure 2, the three-load currents (I_{L1}, I_{L2}, I_{L3}) will not be equal and the imbalance will produce a current in the neutral (I_N). The actual neutral current will depend not only on the varying loads but also upon the power factors and equivalent line impedances. The power company considers neutral current of less than 50 amps normal with currents up to 150 amps not uncommon in areas with uneven growth patterns or uneven loading from industrial plant shutdown at night. Short-term neutral current may exceed 300 amps from the loss of one or two of the three phases from an accidental pole knockdown, wire down, current breaker tripping, etc.

To further complicate matters, the 120/240 volt drop system (Figures 4 and 5) generates additional unbalanced currents that add to the common neutral current. The net result is that the power neutral we are bonded to throughout our system is not that inert ground that we thought it was, but an integral current-carrying part of the power system along with the cable system that is bonded to it.

Figure 6 depicts the current distribution between the power company, the cable system and the earth ground. The current will be inversely proportional to their equivalent resistance. Tables 1, 2, 3 and 4 provide some typical resistance values. From these values, it can be deduced that the conductors will carry a good proportion of the neutral current rather than the ground and that the cable plant will be carrying about half the power company's neutral current.

To determine how all this affects our cable plant, refer to Figures 7 and 8. The 50-amp current (the CATV system share of the neutral current) will induce an IR voltage on the cable as one moves away from the cable power insertion point, which will increase the farther that one is from the power insertion point. At amplifier #3, 6,000 feet from the system power supply, the induced voltage will be 35 volts. This voltage added to the normal raw AC power of 45 volts would result in 80 volts input to amplifier #3, which may be high enough to destroy the power supply. If not, the additional heat generated will result in premature failure of the amplifier station. Many times during a storm the power company will lose one or two legs of a three-phase distribution circuit, causing very high neutral currents and the

Figure 5: Single-phase power secondary (unbalanced)

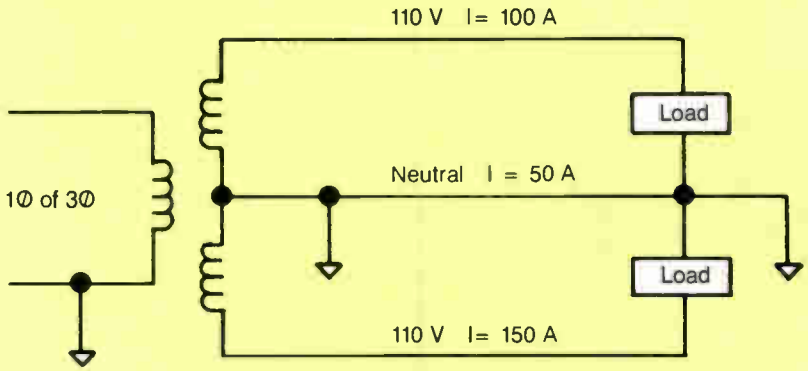
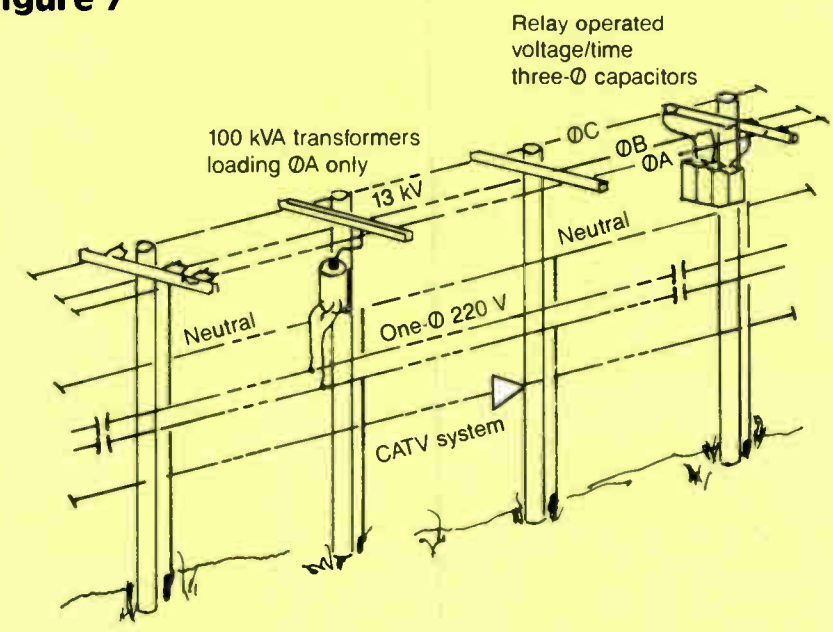


Figure 7



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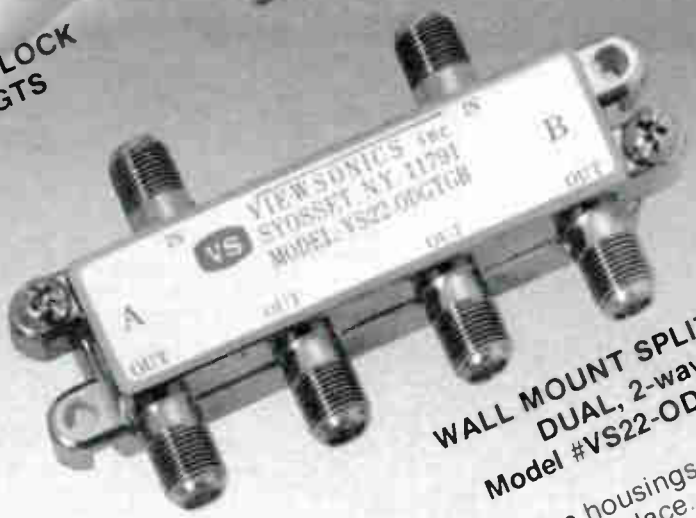

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failure of an amplifier.

The system technician may think the failure is a result of lightning when in fact it was a secondary effect of a lightning strike that blew circuit breakers on two phases of the power company circuit. CATV amplifiers are powered by regulated power supplies and are protected from transients and surges by a number of devices. Most of this protection is only effective against transient anomalies; long-term overvoltage will destroy protective devices and eventually the amplifier itself.

How do we measure LSC (longitude sheath current)? We can use a clamp on an AC voltmeter and measure the current on the CATV cable bundle. Or we can use a clamp on scope probe, which allows us to compare the phase relation between the sheath current and the cable AC square wave power. Figures 9 through 11 show the waveform of the cable square wave voltage and the resultant complex waveform at the amplifier in the presence of LSCs. These complex waveforms cannot easily be measured with a conventional voltmeter but can be gauged indirectly by measuring the raw DC voltage in the amplifier power supply before any regulation. This DC voltage is proportional to the RMS (root mean square) AC input voltage and most manufacturers specify it as minimum and maximum voltage for proper operation of the regulator. Keep in mind that this is a phase-related phenomenon. It is possible to have voltage cancellation if the LSC is out of phase with the CATV square wave power, resulting in lower than expected amplifier voltages and producing hum, noise and distortion in the amplifier.

There are a number of things that the CATV engineer can do to combat sheath current problems. First is to improve and/or increase grounding. The more grounds and the better the ground, the more current is diverted to the Earth. While Table 4 shows that typical 8-foot driven grounds measure 100-200 ohms, if we paralleled a large number of grounds (one at each pole)

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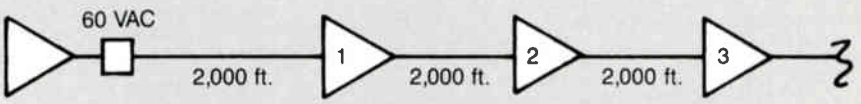
Figure 8

Given: .750" trunk
.500" feeder
125 amp neutral current divided:
25 A ground
50 A power neutral
50 A CATV system

15 volt IR drop in CATV system to amplifier #3
(45 volt AC square wave input to amplifier #3)

CATV plant resistance (trunk, feeder, strand) 0.12×10^{-3} ohms/ft.



(1) Cable system resistance 6,000 ft. cable $\times$ 0.12×10^{-3} ohms/ft. = 0.72 ohms

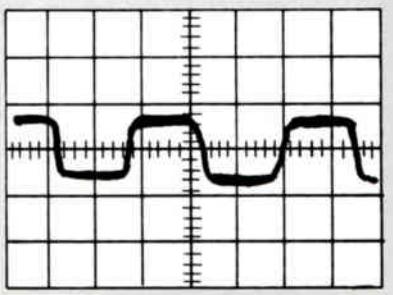
(2) Induced voltage on CATV system due to 50 amp longitudinal sheath current

50 amps $\times$ 0.72 ohms = 35 volts

(3) Combined voltage at amplifier #3

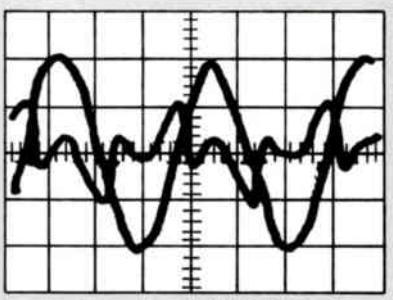
45 volts (from system power) + 35 volts (2) = 80 volts

Figure 9



50 V/division

Figure 10



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Reader Service Number 17.

Table 1: Resistance of annealed copper wire

Conductor size	Ohms per foot × 10^{-3}
14	2.5
12	1.6
10	1.0
8	.63
6	.40
4	.25
2	.16
0	.098

Table 2: Coaxial cable resistances

Cable type	Resistance ohms per foot × 10^{-3} Shield
.412	.50
.500	.40
.625	.23
.750	.19
.875	.13
1.000	.06

Table 3: Resistance per foot

Configuration	Ohms/foot × 10^{-3}
.750 trunk – .412 feeder – ¼" strand	.13
.750 trunk – .500 feeder – ¼" strand	.12
.750 trunk – .625 feeder – ¼" strand	.10
.875 trunk – .625 feeder – ¼" strand	.08
1.000 trunk – .625 feeder – ¼" strand	.06

the ground resistance can be drastically reduced—the effect of paralleling resistance. The use of power supplies that will handle large overvoltages (e.g., switching power supplies) will yield improved reliability. If the problem is long term resulting from improper load balancing, you may be able to negotiate with the power company to correct the problem.

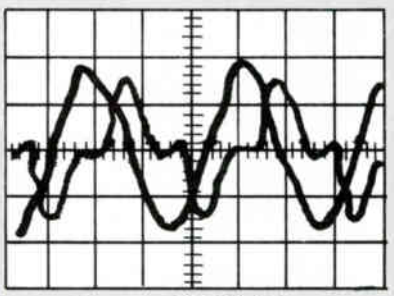
The following general conclusions may be made with regard to potential problems with LSCs.

- Amplifier power supplies farthest from the CATV power supply are the most likely to fail.
- One expects the voltage to drop relative to the distance away from the CATV power supply; LSC (in the proper phase) reverses this trend.
- If the LSC is out of phase it may drastically reduce the voltage at the amplifier station—producing hum, noise and distortion.
- Total power consumption of the amplifiers will not balance the power output of the CATV power supply.
- Measurement of raw DC voltage is more accurate than measuring AC voltage input to the amplifier station.
- Switching regulators will withstand more overvoltage than series-pass regulators.

Table 4: Typical resistance readings obtained with deep-driven grounds

Depth Driven	Resistance (measured as each section is installed) A	B	C	D	E	F	G	H
8′	29	270	140	75	50	200	45	200
16′	14	230	45	45	23	22	30	55
24′	8	48	15	21	18	11	9	40
32′	4.5	13	5.5	8	8.5	9	2	33
40′	3	10		4	5.5			16
48′	3	6			2.5			
56′	3							
64′	3							
Kind of soil	Clay	Clay	Clay	Clay	Clay	Sand and Clay	Clay	Sand

Figure 11



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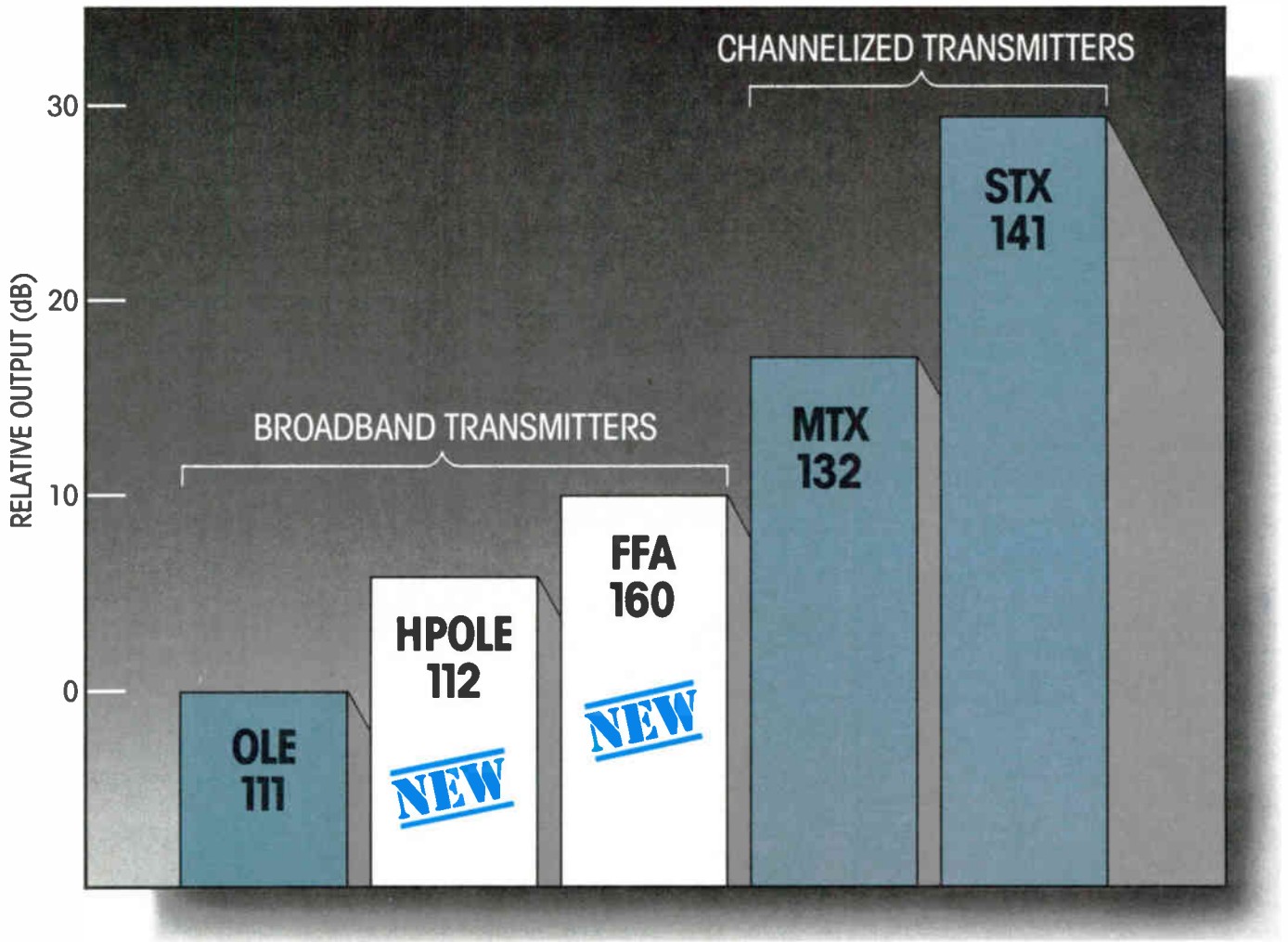

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Reader Service Number 19.

Lightning effects on converters

Overvoltage in home wiring may develop from a variety of causes: lightning, momentary changes in power needs within the subscriber's home and power line failures during storms. Whatever the cause of the overvoltage, the converter needs to be designed with these considerations in mind. Non-momentary overvoltage conditions can easily be protected against by using readily understood design practices. This article will concentrate on momentary overvoltage conditions caused by lightning and discuss ways to design in overvoltage protection and test for susceptibility to failure.

By Emory McGinty
Scientific-Atlanta

Lightning can enter the home two ways: through the AC power lines or through the CATV cable. Either way, the converter can be adversely affected. On the AC power lines, the electrical utilities have some protection against momentary overvoltage but it is primarily for the purpose of protecting their equipment on the telephone poles. In a study done in 1969 where 400 locations in 20 cities were surveyed for lightning surge voltages, the most severe surge was limited to about 2,500 volts[1]. Unfortunately, the voltage is only part of the problem. As the voltage surge hits the converter, the voltage increases rapidly to its peak voltage (see Figure 1).

The time it takes to reach its peak voltage is called *T(peak)*. After the peak is reached, the voltage will return to its normal voltage at typically a much slower rate. A common term used in measuring this "tail" is by measuring the time it takes to reach half its peak voltage, called *T(tail)*. Table 1 shows how much these times can vary.

Lightning surges that reach their peaks in only 1-2μs and have short tails are called *cold surges*. Their energy is high for a very short time and is responsible for arcing and even explosions if the lightning strike was very close. Lightning surges that have low amplitude peaks, 100-1,000 volts and long tails have the potential for causing components to fail that were not designed to handle the high voltage. Therefore, the duration of the lightning surge energy is just as important as the peak voltage that was reached.

Surge protection

When voltage surges occur on the AC input of the converter, most of the surge is absorbed by the line transformer. The transformer's ability to absorb energy depends on its internal resistance, inductance and capacitance. If the transformer cannot absorb the energy, then damage to the transformer results. If the transformer can tolerate the energy, then the energy is transferred to the transformer's secondary and on to the power supply circuitry. The most likely failures in the power supply circuitry are the rectifier diodes, voltage regulators and capacitors. Metal oxide varistors (MOVs), spark gaps, AC line capacitors and filters placed before the transformer can be used to help reduce the energy of the surge. The accessory jack on the rear of the converter also should have some type of surge protection so that surges passed onto the accessory device. e.g., a television, will not be blamed on the converter or cable operator.

There are several methods to protect the AC input of converters. The AC input is protected by a spark gap, filter capacitor and special transformer designed to withstand high voltage surges. The spark gap provides protection from high voltage surges between the hot and neutral line, the hot and chassis ground, and neutral line and chassis ground. The accessory plug is protected in the same manner. The effectiveness of these countermeasures has been shown by repeated testing and the few lightning-related complaints.

However, even the most prudent attention to lightning protection is only as good as the grounding methods used at the subscriber's home. All too often, ground blocks are not used between the telephone pole and the RF input to the cable converter, even though the National Electrical Code Article 820-7 specifically requires the ground[2]. Even if ground blocks are used, the ground wire can pull loose of the ground bar and go unnoticed. Visual inspection of the ground block at each subscriber's home should be done each year. Otherwise, the amount of protection provided by these techniques will be reduced.

Voltage surges, called *sheath currents*, occur on the RF input of the converter[3]. They are caused by excessive currents on the power line neutral during lightning storms, inducing voltages between the inner and outer conductors of a coax cable. The RF input of the converter must be protected against these excessive voltages, otherwise damage could result causing the RF performance to be seriously degraded or completely inoperative. Some commonly used methods to protect the RF input include: spark gaps, gas discharge devices and inductive filters. A special spark gap built into the RF input and an inductive filter can be used to absorb the lightning surge and to protect the sensitive RF circuitry.

There are many ways to specify the amount of lightning protection provided to a cable converter. As previously mentioned, it would not be

Figure 1: Typical lightning strike

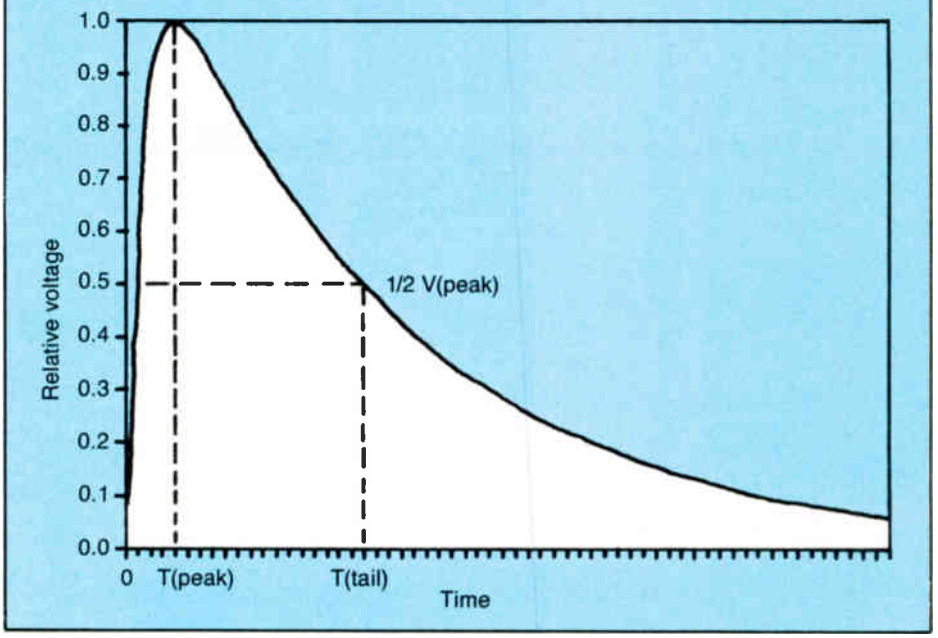
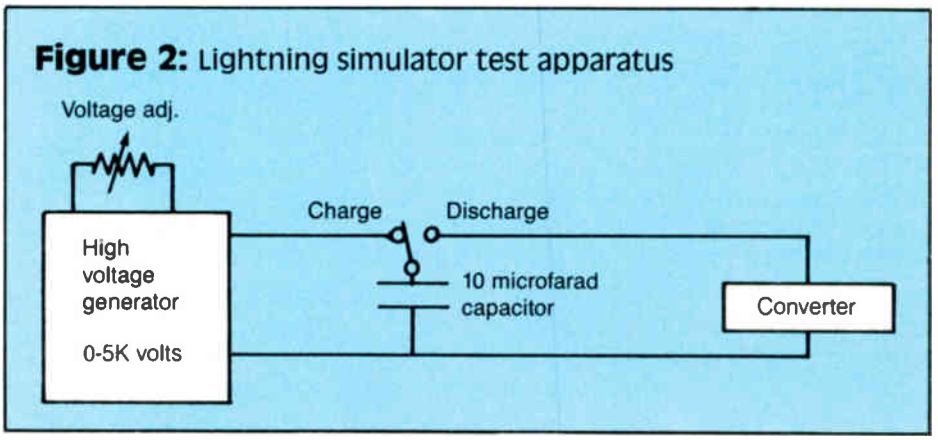


Figure 2: Lightning simulator test apparatus



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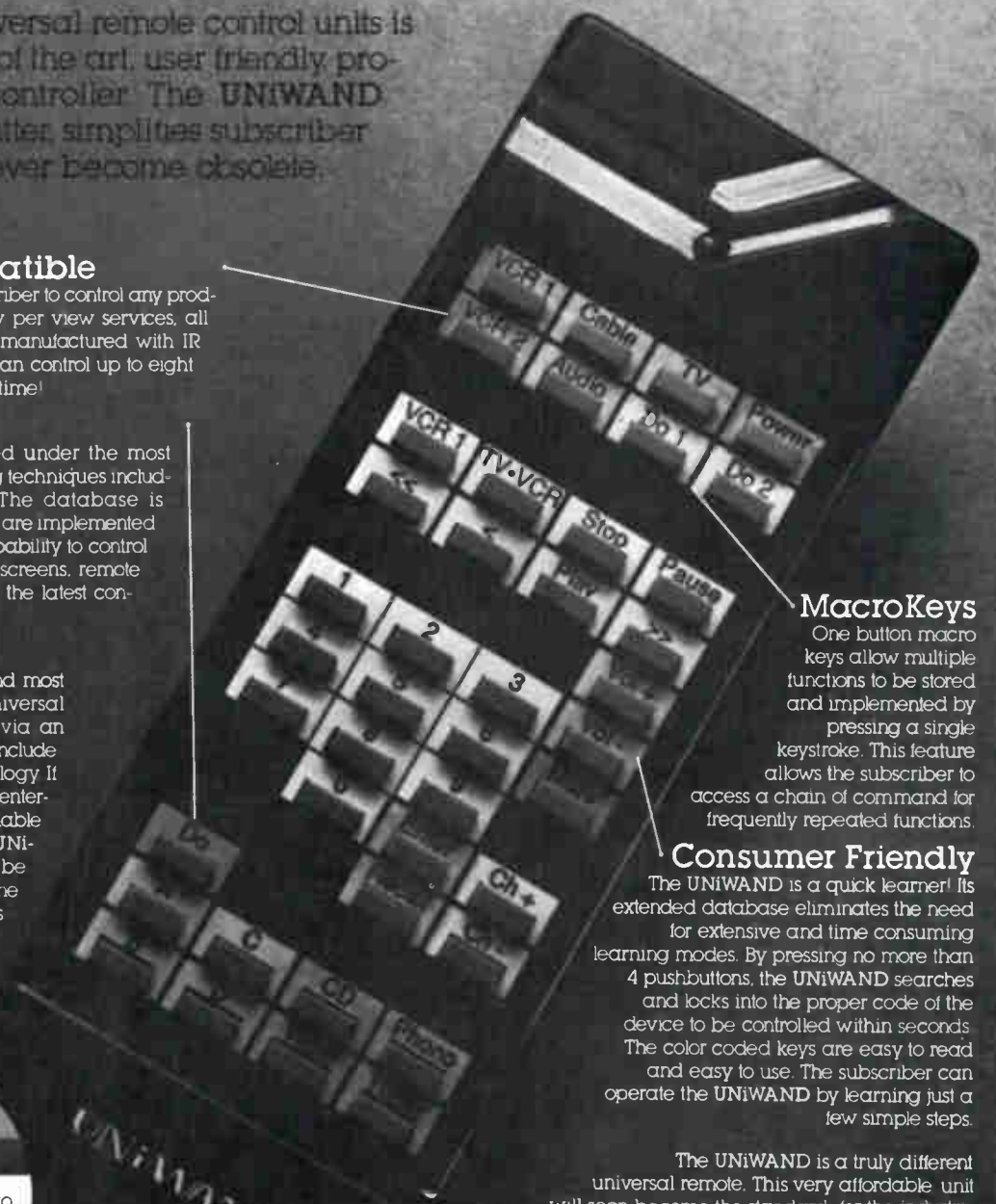

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reasonable to specify the amount of lightning protection of a converter by simply stating a maximum voltage level of protection. How well a converter handles lightning is a function of the source of the surge, the duration of the surge, input transformer in the converter, the converter's power supply, any lightning protection that was used and the effectiveness of the grounding present at the subscriber's home. Do not be misled by published specifications that only address voltage levels. Ask the manufacturer for details on how the converters were tested and exactly what protection techniques were used in its design.

Table 1: Variations in voltage times

	Min.	Avg.	Max.
T(peak)	1μs	2μs	30μs
T(tail)	10μs	40μs	250μs

Testing to avoid a failure

We studied the causes and effects of lightning failure on converters in order to define a test that could be used to determine how safe a converter was before it was shipped to a customer. Converters of all types were collected that had failed due to high voltage surges. The amount and duration of the overvoltage was determined by experimentation in an effort to duplicate the damage seen in the converters. Once the cause of the overvoltage was understood and could be duplicated, a test method could be defined that would protect the converters. The results suggested that a test voltage of 3,000 volts across 10 microfarads was more severe than would be expected in the field. In order to provide a large degree of safety margin, we chose 3,500 volts as a test criteria for both the RF input and the AC line input. The test circuit is shown in Figure 2.

The capacitor is charged by a high voltage supply of 3,500 volts. Once the desired voltage across the capacitor is obtained, the high voltage supply is removed from the capacitor and the test is ready to begin. The capacitor is connected to either the AC input or RF input and the switch is thrown to discharge the capacitor into the converter. The same test circuit could be used for both the AC input as well as the RF input. A high voltage surge into the low impedance of the RF input causes the voltage across the input inductor to reach ±6,000 volts or higher. The tail reaches half the peak voltage in approximately 4 μs. The RF input circuitry must be capable of handling momentary high voltage of this type. How the high voltage surge reacts to the AC input depends to a large extent on the impedance, inductance and capacitance of the transformer being used. We have used this test with several transformers ranging from 50 to 150 ohms series resistance with success.

All models of our converters are tested to multiple hits at 3,500 volts during the initial design and during production on a sample basis. The 3,500 volts across the 10 microfarad capacitor is a good compromise between hot and cold lightning surges. It tests the integrity of the filter components below the voltage thresholds for a spark to occur and tests the spark gap at higher voltages.

Cable operators should be careful when selecting a converter based on its lightning protection. The voltage rating alone is not an accurate indicator of the converter's lightning protection. When comparing cable converters, find out how each manufacturer verifies its converters against lightning. Obviously, no test will protect against hits close to a house or poor grounding protection. This test will provide an early indicator for the potential for a problem.

It must be stressed that working with high voltages can be very dangerous. Normal safety precautions used around 110-volt house current are not adequate for the high voltages previously discussed.

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[2] "National Electrical Code, 1987," National Fire Protection Association, Massachusetts, 1986, pg. 70-710.

[3] James C. Herman and Jacob Shekel, "Longitudinal Sheath Currents in CATV Systems." *Transactions on Broadcasting*, Vol. BC-21, No. 4, December 1975, pg. 54-63.

[4] "Proper Grounding of Cable TV Systems," *CED*, June 1982, pg. 41-47.

[5] Raymond G. Capek, "Cable Isolation," *CED*, March 1985, pg. 52-54.

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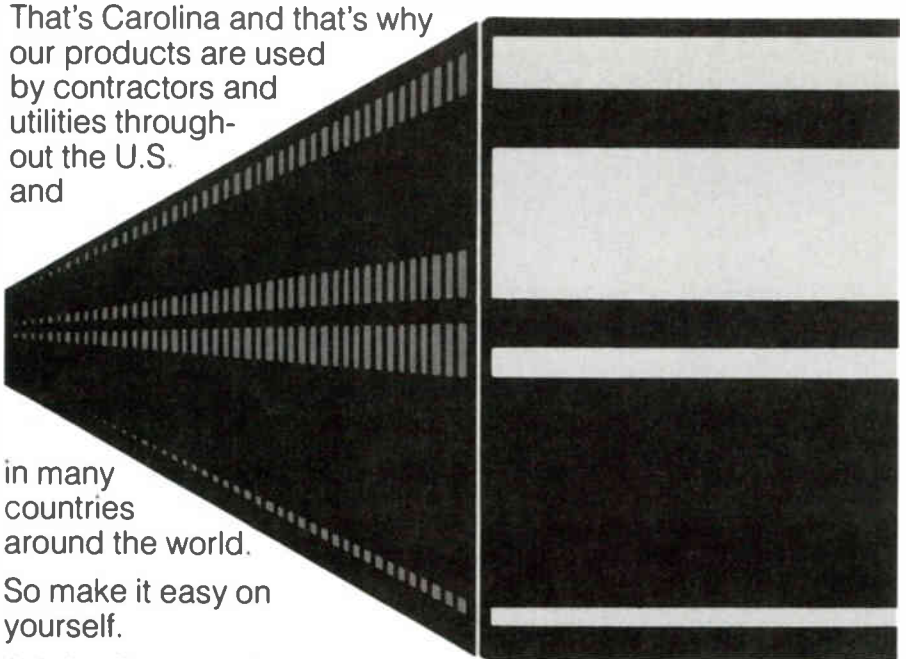

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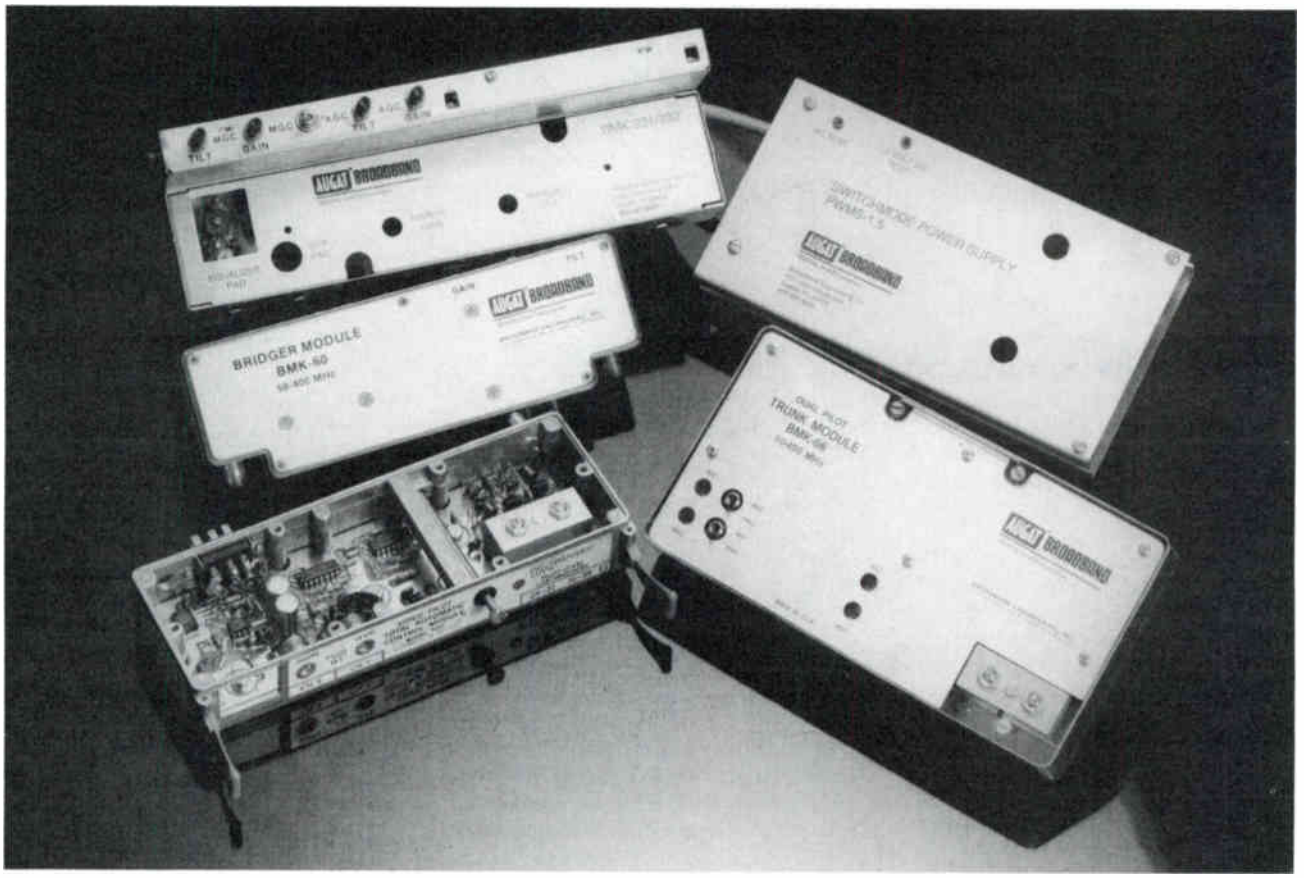

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The purchasing process

By David Willis
Tele-Communications Inc.

Complex, fraught with detail and vital to the functioning of the business: This is an accurate (if somewhat simple) description of "purchasing." This task involves the determination of the specific product needed, the accurate assessment of proper pricing, the timing of need and availability, and the selection of the proper mode of transport from vendor to field site. Assuming all these have been accomplished in good order, the purchase then must be tracked to verify delivery of the proper product at the proper time to the right place and in the right quantity.

To determine the proper product, many companies employ an evaluation approach that tests new products and periodically reverifies old ones. This department is normally charged with establishing specifications and parameters of use for products. Obviously this activity performs the function of rejection as well as acceptance of equipment. There is almost never a "perfect" product; hence, testing frequently does not find a clear-cut, first-place entry—rather, several acceptable items.

Products should be placed in widely separated field environs and assessed through empirical data. Factors that also affect selection are such matters as the need for Underwriters Laboratories approval, safety considerations, required longevity and a host of other requirements. Evaluation should be performed by a single entity within the company. This ensures that comparative testing is done fairly since it uses the same test equipment and procedures. It also minimizes the duplication of effort.

Selection also means that the item is priced so that it is economically viable for the task proposed. Assume Product "A" is superior to competitive products by 10 percent. If it is priced higher by 50 percent, serious consideration must be given to the real value of its advantage. While price is always a major consideration in selecting products, it should never be the sole factor; quality as well should be a criterion.

"There is almost never a 'perfect' product... rather, several acceptable items."

Useful life

Price also should be correlated to the useful life of the product. "A" might have a 50 percent longer life than its competition, which could make it a wiser choice. And perhaps "A" takes less time

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to install. Again, this could dramatically affect the comparative long-term cost of the competing products. In other words, all aspects must be considered to arrive at a realistic cost comparison.

It is imperative to accurately assess the timing of product delivery. For example, it is extremely wasteful to buy, ship and have on hand large quantities of materials on July 1 for a project that begins in September. It is also wasteful to have 100 miles of equipment on hand on July 1 for a project that contemplates a build rate of 20 miles a month for August through December.

Equipment deliveries should be staged to coincide with usage. The trick here is to be aware of lead times and project schedules, and time the delivery of all materials to precede the need by a safe margin. Remember, while it is wasteful to acquire materials too early, it is disastrous to have construction personnel standing idle while awaiting delivery. Most vendors can provide lead times and it is to their benefit to give such timing accurately. (A vendor with a reputation for candor has a most valuable asset.)

In attempting to provide materials on a timely basis, the purchaser has other problems to resolve. It is not always possible to make all purchases from a single vendor. In the extreme, you might buy electronics from one vendor, cable from another, power supplies from yet another, converters from a fourth and drop materials from a fifth. Each and every one of these lines must be coordinated to fit the project. All deliveries must be timely, in the proper amount and must meet the overall project needs.

"While it is wasteful to acquire materials too early, it is disastrous to have construction personnel standing idle while awaiting delivery."

Special care must be taken to ensure that items in a given product line are delivered so as to be totally usable for the project. Almost every purchaser has encountered the situation where all amplifiers, housings, power supplies, etc., were delivered on time only to be rendered useless for want of equalizers, pads or some other low-cost item.

A manufacturer looks to achieving a high dollar volume of produced goods. It seldom considers that, while amplifiers might make up 98 percent of its dollar volume, they cannot be placed in service without pads and equalizers (which are only a fraction of the company's output dollar volume). Many manufacturers have become much more conscious of this in recent years and try hard to avoid this trap.

It will still occur, however, unless the manufacturer has the proper input from the purchaser; the ordering of materials must be complete and comprehensive. The answer to this is, of course, the BOM (bill of materials). It is essential that the BOM encompass every aspect of the job to be performed and give complete details.

Transport of materials can be held to minimal cost through the correct timing of material deliveries. In general, surface shipments are relatively inexpensive by truck. When poor timing occurs, there is frequently a need to send shipments by express or air, generating extremely high shipping costs.

Freight costs as compared to purchase volume is a good barometer of planning efficiency. If the need for materials becomes so acute that alternate shipping must be used, one can almost guarantee that proper receiving documentation and logging in and out of materials will not be accomplished. When shipments are made by routine methods they can be logged in, counted, warehoused and tracked.

Accurate and complete

As a purchaser, you must have accurate and complete information from all contacts, vendors, evaluation personnel, field engineering, designers and carriers. You must have accurate project scheduled and projected start and completion dates. The purchaser is dependent on others for much of the information required to make decisions. Performance depends to a great extent on the accuracy of decisions. ■

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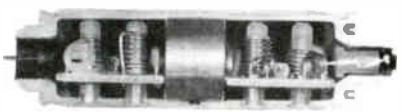

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(Continued from page 6)

of the stereo processor to J1 of the VCIIC. Place the 75 ohm terminator on J2 of the VCIIC.

The video output of the satellite receiver is connected to J3 of the VCIIC by a suitable RG59 coax cable. The video output connector J4 of the VCIIC is then connected to the video input of the commercial insertion equipment. The video output of the commercial insertion unit is then connected to the video input of the channel modulator.

The preroll control circuit contact closure output is obtained from pins 8 and 10 of the 24-pin connector on the Wegener stereo processor. The commercial insertion equipment must provide a continuous closure output for the length of the local avail. This closure should begin at the point between network programming and the start of local commercial insertion (eight seconds after beginning of preroll command). Finally, this closure is wired to J10, pins 16 and 24 of the 24-pin connector of the Wegener stereo processor.

If you need additional information, contact Paul Beeman of Viacom at (212) 713-6646; Wegener Communications' service department at (404) 623-0096; or Allen Kirby, vice president of sales and technical services for Falcone International, at (404) 427-9496.

SCTE happenings

We would like to welcome aboard Rick Cole, the SCTE's new director of chapter development. He is co-founder and first president of the SCTE Central Indiana Meeting Group. We know he'll do an excellent job for the Society.

The SCTE also announced the formation of three new local meeting groups—bringing the total number of chapters and meeting groups to 36. The three new meeting groups are: the Southeast Texas Meeting Group out of Houston; the North Country Meeting Group from Minneapolis/St. Paul; and the Tennessee Meeting Group from Nashville.

The Society also is seeking nominations for potential board members to fill vacancies in eight of its 12 regions and one at-large position.

Monthly, the Society uplinks videotaped programs on technical training. These teleseminar programs may be received by any cable system. (See this month's *Interval* for dates and programs.)

Last, but far from least, the 1987 Eastern Show, Aug. 30-Sept. 1, will feature BCT/E Certification Program review courses and testing in all seven BCT/E categories. Technical workshops also will be conducted. (See "News," page 10.)

The SCTE is pumping stronger than ever. A lot is being accomplished by the Society to better the technical community. If you're not an SCTE member, join now. If you are already a member, participate in your local chapter or meeting group.

Toni J. Barnett

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To upgrade or to rebuild

By The Engineering Staff
American Television and Communications Corp.

The multimillion dollar question: Should we upgrade or rebuild? The intent of this article is not to answer the question but to provide enough information and examples to stimulate thought in the area of options that should be evaluated before a major decision is reached.

First let's establish the major points of an upgrade vs. a rebuild. An *upgrade* is a modification of the existing cable plant. During this process you retain some major portion of the plant. For example, changing all the electronics, taps and passives, but retaining the cable, strand, hardware and spacing. A *rebuild* is a replacement of existing cable plant. During this process you seldom retain parts of the plant other than (possibly) strand, hardware and subscriber drops.

With the point that many cable systems have reached in their franchise life, a common dilemma they are now facing is that of analyzing the current channel capacity of the plant and what economically viable options exist to increase that capacity. As in many other areas in the communications industry, technological advancements over the last five years have occurred at a rapid pace. There are now many options available to the system operator to increase plant capacity that were not available as little as five years ago, as well as some new fiber-optic technology that many feel will be economically viable in the next three years.

The challenge now in front of many system management staffs is to determine a means to increase plant capacity in a manner that fulfills current marketplace and franchise requirements, yet does not create a debt load that precludes them from taking advantage of new technology.

Let's look at an example of what a cable operator may be faced with today. We're going to deal with a system that has 1,000 miles of plant, is 10 years old and operates currently at 270 MHz. It is refranchising and has a need to extend the bandwidth to at least 330 MHz. The plant has had moderate maintenance problems for the past few years.

Two choices

The first idea was to rebuild the plant to 400 MHz. This would involve replacement of everything except the strand. Once the plan was completed and the bill of material assembled, the cost was about $13 million. This included the removal of the old plant. Another choice was to upgrade to 330 MHz. The bill of materials was completed and a cost of $3 million was arrived at. The upgrade can be accomplished by modifying the existing electronics and replacing any passives that will not properly pass 330 MHz.

So where do we want to go? As we can see, there is a $10 million difference in these examples. (While they are not accurate to the exact dollar amount, they do represent the kind of variances found between an upgrade vs. a rebuild.)

In order to make an intelligent decision we must first examine what our objectives are. Do the dollars spent on the project make good sense? If our 1,000 miles of plant had 60,000 subscribers and we could raise the basic rate $1, we would have an additional $60,000 a month to pay for the upgrade or rebuild. (There is more involved in where the $1 goes, but this is just for discussion's sake.) This equals $720,000 a year. To pay off the upgrade would take 4.17 years; to pay off the rebuild would take 18.06 years.

Other questions: Do we want to create immediate capacity for new business ventures, or can we live with an interim step that will allow future plans to be implemented on an incremental basis? How confident are we that technology will continue to develop to a point that our existing facilities will be able to be upgraded again in the future? If past history is any indication, it seems apparent that the manufacturers of electronic devices will continue to push the envelope, and we will see a continuing trend of new devices with higher gains, lower distortions and greater bandwidths being introduced to the marketplace.

A common statement used in the justification of a rebuild is that by replacing the plant many problems that are caused by the condition or quality of the existing facilities will be overcome. While this may be true, the replacement is only a temporary fix since the condition of the plant is usually a direct reflection of the technical staff who maintains it. Even in situations where the original quality of construction or design created operational problems, the innovative system with aggressive maintenance programs has found ways over time to improve the system to a "better than new" condition with limited expenditures.

Will we be required, now or in the near future, to rebuild the system because of franchising implications? This trend seems to have diminished recently, thereby placing this decision back in the hands of the operator. It is reasonable to assume that if we are doing a good job of meeting the demands of our marketplace and providing

(Continued on page 47)

Active equipment upgrade

Utilizing existing amplifier spacings, the accompanying tables illustrate worst-case conditions. While these conversions will work in the majority of cases, it is often possible to use a less expensive technology than indicated on the chart. For example, converting from 220 MHz to 330 MHz shows feedforward equipment specified. Under certain more favorable conditions, it may be possible to use power doubling or even high-gain push-pull instead. All less expensive alternatives should be exhausted first.

Assumptions: Original design uses push-pull amplifiers, spaced at 22 dB with a maximum cascade of 25. The table assumes that all attenuation is due to cable loss, which is worst case. The presence of significant flat loss will change the results for the better.

Table 1: Upgrade conversions

Converting from \ Converting to	270	300	330	400	450
220	PD	PD	FF	FF	—
270	—	HG	PD	FF	FF
300	—	—	HG	PD	FF
330	—	—	—	PD	FF

PD=power doubling; HG=high-gain push-pull; FF=feedforward.

Table 2: Attenuation conversions

Converting from \ Converting to	270	300	330	400	450
220	24.6	26.1	27.5	30.4	32.4
270	22.0	23.3	24.6	27.2	29.0
300	—	22.0	23.2	25.7	27.4
330	—	—	22.0	24.3	25.9

Based upon 22 dB loss at the original design frequency.

(Continued from page 34)

the proper degree of customer service, we should be able to obtain franchise renewals and extensions without having to commit huge capital resources to rebuilds.

The key issue therefore becomes whether the short-term requirements can be satisfied through an upgrade of existing plant assets vs. a total replacement of plant assets—that is, a complete rebuild. It is a safe bet if the system undergoes a complete rebuild today, the capital expenditure debt incurred will exclude them from being able to consider utilizing any new technology for at least the next seven to 10 years. The tendency to decide on the rebuild route is certainly an understandable position, since it is a very straightforward plan of attack.

By comparison, the upgrade analysis requires a much more tedious planning and thought process. There are many different upgrade options available, and to choose the best one is a very difficult project since it requires evaluating the condition of nearly every aspect of the plant. Upgrade analysis also requires many more iterations of the design process, and therefore takes longer to formulate the final plan.

We are not trying to say that you should never rebuild a plant, but rather, that there are options available that may be more attractive and, at any rate, need to be discussed and debated before a decision is made.

Microwave and rebuilds

AML microwave may be considered as an alternative to shorten existing trunks and expand into new franchised areas. For existing AML systems, recent technology improvements in receiver noise figures and additional low noise preamps allow one some flexibility when adding channels to multihub system configurations.

Some of the older broadband receivers have noise figures (NFs) of 13 dB. These systems can be modified for 10 dB NFs or a 3 dB improvement. This allows doubling the number of existing channels and available transmit output ports with no net loss in performance. A single low noise amp (LNA) is now available with a noise figure of 7 dB. Dual-stage LNAs can bring the receiver NF down to about 5 dB. These modifications should be considered before a decision is made to switch to an AML high-power transmitter array.

FM microwave should be considered to carry video signals from remote studios to the central headend or AML x-mit site. These systems can be designed using CARS frequencies or 23 GHz for paths of three to five miles in length. There is a new microwave line extender that accepts up to 60 channels at VHF, block converts to microwave and can be used to extend the system three to five miles or power split the output to feed several multifamily high-rise units.

A solid-state broadband RF repeater also has become available that can turn the corner in order to clear a tall building or extend the path in a different direction; it works like an active beam bender.

Contributors to this article were: David Pangrac, Perry Rogan, Steve Johnson, Ron Wolfe, Jay Vaughan, Jack Sanders and Bob Schumacher.

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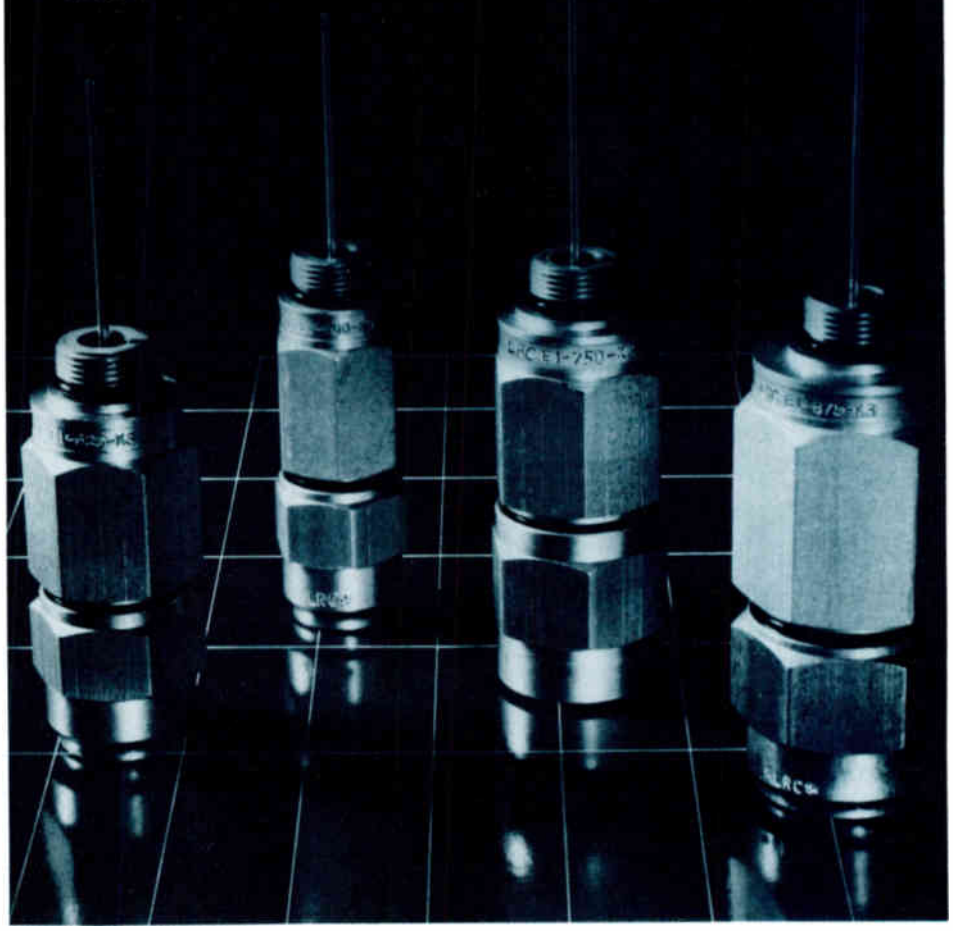

Reader Service Number 29.

The choice is yours

By Thomas J. Polis
Communications Construction Group Inc.

Purchasing of material and equipment commonly employed in cable TV systems used to be relatively simple. You would first determine your needs and then search for the best prices, terms and delivery from the manufacturer or distributor of the products that were required. While the basis of good purchasing procedures has not changed, the complexity that has been added to each area has and purchasing a simple component can be like a trip down the Amazon—fraught with danger and unseen hazards.

Trunk amplifiers are a perfect example of the complexity that has been added. Trunk amps used to be purchased as a single unit, specified by the function that was to be performed. This usually meant a maximum of five choices:

1) Trunk only,
2) Trunk with bridger,
3) Trunk with automatic gain control,
4) Trunk with bridger and automatic gain control, or
5) Terminating bridger.

It was understood that when you would order these amplifiers they would include a housing for strand mounting and the required DC power source. A single nomenclature and part number was all that was required on the purchase order and the packing slip was easily matched to the order. Other components necessary for the operation of the equipment—such as attenuator pads, equalizers and feeder splitters—were also pretty straightforward. Each amplifier needed one of each, thus only values were to be determined.

Technology has dramatically improved and as a result we now have *choice*! We can now select not only the functions to be performed but the technology to be used in performing that function. As a result we are no longer able to specify a trunk amplifier as a single line item, but must break it down into the modules that are used to "build" an amplifier. Additionally, the optional parts list has grown to include not only the equalizer, pads and feeder splitters, but also interstage equalizers and pads, response equalizers, circuit breaker options, programming cards, plug-in filters and pre-selectors, test switch boards and internal power director cards. It is not uncommon to see as many as 10 to 14 line items on a purchase order to identify a single trunk station. Some manufacturers still provide a nomenclature for a trunk amplifier by function but they, for the most part, ship by modules (thus packing slips are difficult if not impossible to match to the purchase order).

In addition to the basic purchasing problems that have been created by the advance of technology, the new selection of modules can impact the cost vs. performance at a system level. For example, one can now choose at least three technologies in each of the three modules—trunk, bridger and line extender. The technologies are:

- Conventional push-pull,
- Parallel or power doubling IC, and
- Feedforward IC

This factor means that you can now build a matrix of possible module configurations, each of which has a quite different price tag but all can probably meet the same system performance at varying output levels. The following analysis was performed for a typical system using the various configurations of the available technology.

Desired performance for 78,736 feet of trunk system (losses based on 860 QR cable for trunk):

1) Carrier-to-noise = 44.5
2) Carrier-to-composite third order = 55
3) Carrier-to-cross modulation = 52.5
4) Channel loading = 60
5) Tap output specification = +13
6) Temperature range = 68°F

- *Configuration 1* uses power doubling trunk amps, bridgers and line extenders.

A) Operational gain = 22
B) Cascade = 34
C) AGC/ASC = Every station
D) Operating levels:
1) Trunk output = 32.5 w/6 dB slope
2) Bridger output = 43 w/8 dB slope
3) Line extender output = 40 w/8 dB slope

- *Configuration 2* uses feedforward trunk amps with power doubling bridgers and line extenders.

A) Operational gain = 29
B) Cascade = 35
C) AGC/ASC = Every station
D) Operating levels:

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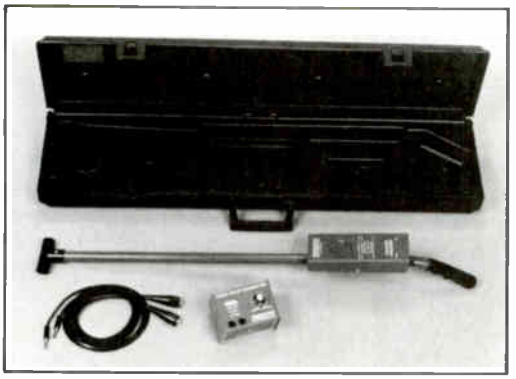

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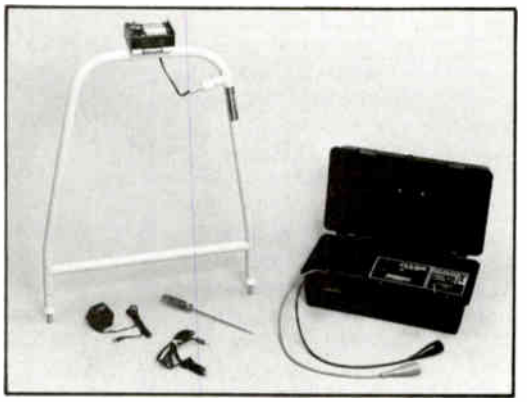

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1) Trunk output = 38 w/6 dB slope
2) Bridger output = 48 w/8 dB slope
3) Line extender output = 45 w/8 dB slope

- *Configuration 3* uses feedforward trunk amps, power doubling bridgers and conventional line extenders.

A) Operational gain = 29
B) Cascade = 25
C) AGC/ASC = Every station
D) Operating levels:
1) Trunk output = 38 w/6 dB slope
2) Bridger output = 47 w/8 dB slope
3) Line extender output = 44 w/8 dB slope

- *Configuration 4* uses feedforward trunk amps with conventional bridgers and line extenders.

A) Operational gain = 29
B) Cascade = 25
C) AGC/ASC = Every station
D) Operating levels:
1) Trunk output = 38 w/6 dB slope
2) Bridger output = 45 w/8 dB slope
3) Line extender output (based on two in cascade levels) = 42 w/8 dB slope

Other possible configurations were evaluated but they were either not cost-effective or could not obtain the desired specification for system performance.

After performing sample designs of each of the practical configurations and applying unit cost to the resulting bill of materials, configuration number three yielded the best cost vs. performance for this system. It is important to note that other systems with the same trunk length may yield a very different selection due to the system density of trunk splits or subscriber counts.

With respect to cost the analysis of the practical configurations displayed a cost variance of $400 per mile. It is not hard to see how a wrong decision could be very costly.

Selecting terminal equipment

While the line equipment is complex and requires an in-depth engineering analysis, the cost of a mistake is usually a one-time cost and does not impact the quality of the signal received by the subscriber. In the area of terminal products and devices the impact is usually much more dramatic and can be reoccurring throughout the life of the system. The subscriber terminal will set the stage for how the subscriber perceives the service and the company providing it. Engineering analysis will play a smaller role here as function is the driving factor. For this reason the marketing department will play a significant part in the purchasing decisions.

Again, the technology has greatly advanced and choice is one of the results. The total cost of the terminal devices is directly related to the number of subscribers. A single unit state-of-the-art converter, for example, sells in quantity at an average price of $95 to $100. In a 15,000-subscriber system with 30 percent second sets you will require 19,500 units or an expenditure of $1,950,000. If the plant serving these subscribers is 200 miles then the expenditure will be $9,750 per mile or approximately equal to the value of the plant itself! The big difference is that the plant will be carefully maintained by qualified technical staff while the converter will be in the hands of the home owner and will not be readily accessible for routine maintenance by skilled technicians.

Two factors will be very important in the decision process for converters or other terminal devices:
1) Durability under normal household use and
2) The initial warranty period and the availability of warranty extensions.

Additionally, many purchasing departments are now negotiating "catastrophic failure" protection for these devices and are executing purchase agreements rather than simple purchase orders.

Each area presents its own set of complications and they would be far too long to cover here; however, some basic rules do apply to all areas:
1) Choose your vendors carefully being sure to pre-qualify their expertise in the area they serve.
2) Carefully evaluate the technical aspects of the equipment you intend to purchase and be sure you are aware of all of the options that are open to you.
3) Be sure that any requests for proposal that you generate are clear and cover what you expect as a response.
4) Closely evaluate the policies of the vendors with respect to warranty services.
5) Use and involve engineering and marketing to make the proper choices in equipment function and performance.
6) After all else has been satisfied go for the best price.

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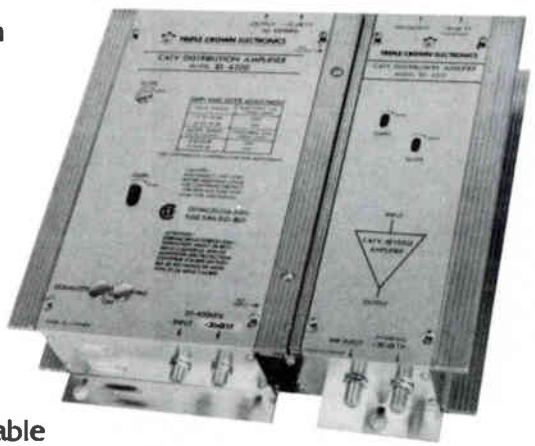

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Reader Service Number 31.

Purchasing by comparison

By Jim Shuttlesworth
New Mexico State Engineer, Tele-Communications Inc

Most purchasing decisions are made by cost comparison. The majority of the cities in the United States have been wired for cable. Many of these cities have had cable TV available for 20 years or more. In order to accommodate the needs of the people in these cities, technology requires that we upgrade or rebuild our systems. If your system is in need of expansion, you should do a cost comparison of a drop-in, an upgrade and a rebuild to decide which plan would be most economical for your needs and the viewing needs of your customers.

The question is "should I do an upgrade or a rebuild?" To answer this question there are certain things that must be resolved. It is essential that you have an accurate as-built map in order to make your decision. If not, you will be guessing with nothing with which to compare. When you are guessing, you are probably wasting money. If your design maps are accurate you will save yourself a sizable amount of money.

Once you have the as-built completed, you can start your comparison. If you are considering the drop-in or upgrade, you should know the condition of the existing cable in your plant. If all your cable has the correct attenuation, then you are ready to compare the cost of the drop-in with the cost of the upgrade. The accompanying table lists items that need to be compared. It would be impossible to consider all costs here since everyone's situation will be somewhat different. However, the approximate costs are as follows:

Drop-in—$1,200 to $2,500 per mile
Upgrade—$5,000 to $8,500 per mile
Rebuild—$8,500 to $10,000 per mile

Drop-ins

Changing only the electronics to make your system work at a higher bandwidth may not necessarily work out. When you are considering the drop-in, remember that even though your active devices have extended your bandwidth, your passives may not necessarily meet the bandwidth of your expectations. The passive equipment limits your bandwidth, so know your limitations before you make your decision. If you do not need super bandwidth, this is the most economical method.

Upgrade

By comparison the upgrade is less expensive to do than the rebuild. You will save money by replacing even limited amounts of strand and

Comparing the options

Drop-in	Upgrade	Rebuild
• Electronics (with the option of power supplies)	• Makeready • Passives • Connectors • Some cable replacement • Labor • Electronics • Power supplies	• Makeready • Passives • Strand • Hardware • Cable • Labor • Tear down • Power supplies • Electronics

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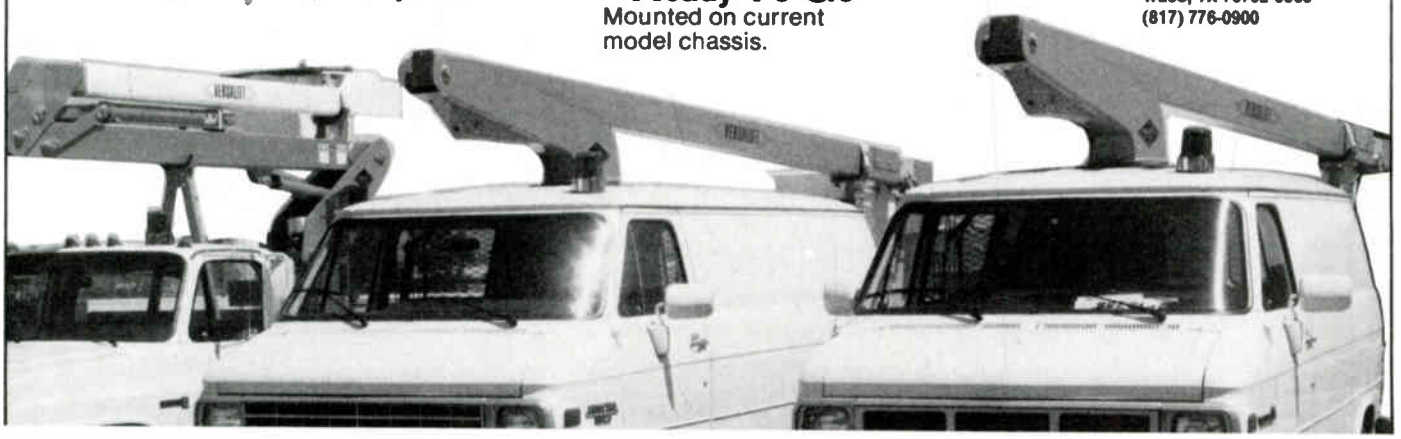

Reader Service Number 32.

"If you are respacing to 400 or 450 MHz be sure to check your distortion parameters."

cable to reduce the number of amplifiers in cascade providing you are using existing cable, strand and hardware. This option will save you the cost of the majority of strand, cable and hardware. You also will save the labor cost of installing the strand, cable and hardware as well as the wreck out cost. If you are respacing to 400 or 450 MHz be sure to check your distortion parameters for composite triple beat and carrier-to-noise. You could possibly build a system in which you cannot use the entire bandwidth that you have designed.

If your cable is in good shape, you can do an upgrade using the existing cable. Most plants that are upgradable are built with first or third generation cable. By respacing the new type of electronics and changing the passive equipment, you can achieve 85 percent of a rebuild at a lesser cost. You also will extend the use of your strand and cable by at least 10 years. This type of system is a little more difficult to take care of. The upgrade is the most difficult build for your customers because the system is on and off throughout the day.

Rebuild

As you can see in the table by the number of things you must do in a rebuild, it's the most expensive of the three options. However, a rebuild can be the easiest to accomplish and the most convenient for your customers. The old system is installed on J hooks and the new system is built above or below it. This type of build gives you the option to design your bandwidth to whatever you can afford. If the rebuild is done properly, the system could last 30 years.

Useful formulas

The following formulas can be used to help you in your comparisons and to help you figure the distortion in your drop-in, upgrade or rebuild. These formulas also will help to find your new amp spacings.

To find the new spacings for the new amps using existing cable, use this formula:

$$A_2 = A_1 \times \sqrt{\frac{F_2}{F_1}}$$

Where:
A_1 = attenuation of highest frequency of existing amp spacing
A_2 = attenuation of highest frequency of desired amp spacing
F_1 = highest frequency of existing amp spacings
F_2 = highest frequency of desired amp spacing

To find composite triple beat (CTB) of proposed new spacings and increased channel loading:

$$CTB = 20\log N + 20\log\left(\frac{NX-1}{MX-1}\right)$$

Where:
N = number of amps in cascade
NX = specification number of channels
MX = desired number of channels

To find carrier-to-noise of proposed new spacing:
C/N = 59.1 + input of amp − noise figure of amplifier − equalizer loss = noise of one amplifier − 10log N.
Where:
N = number of amps in cascade
Combination where + denotes log addition
Trunk + bridger + line extender (2) = combined CTB or carrier-to-noise

Increased gain to accommodate new spacing using existing cable:

$$G = A_1 \times \left(\sqrt{\frac{F_2}{F_1}}\right) - A_1$$

Where:
G = increased gain needed for new spacing
A_1 = original spacing
F_1 = highest frequency of original bandwidth
F_2 = highest frequency of desired bandwidth

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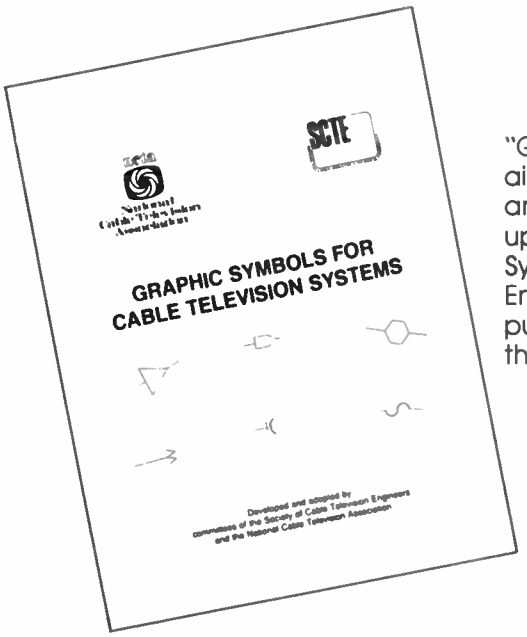

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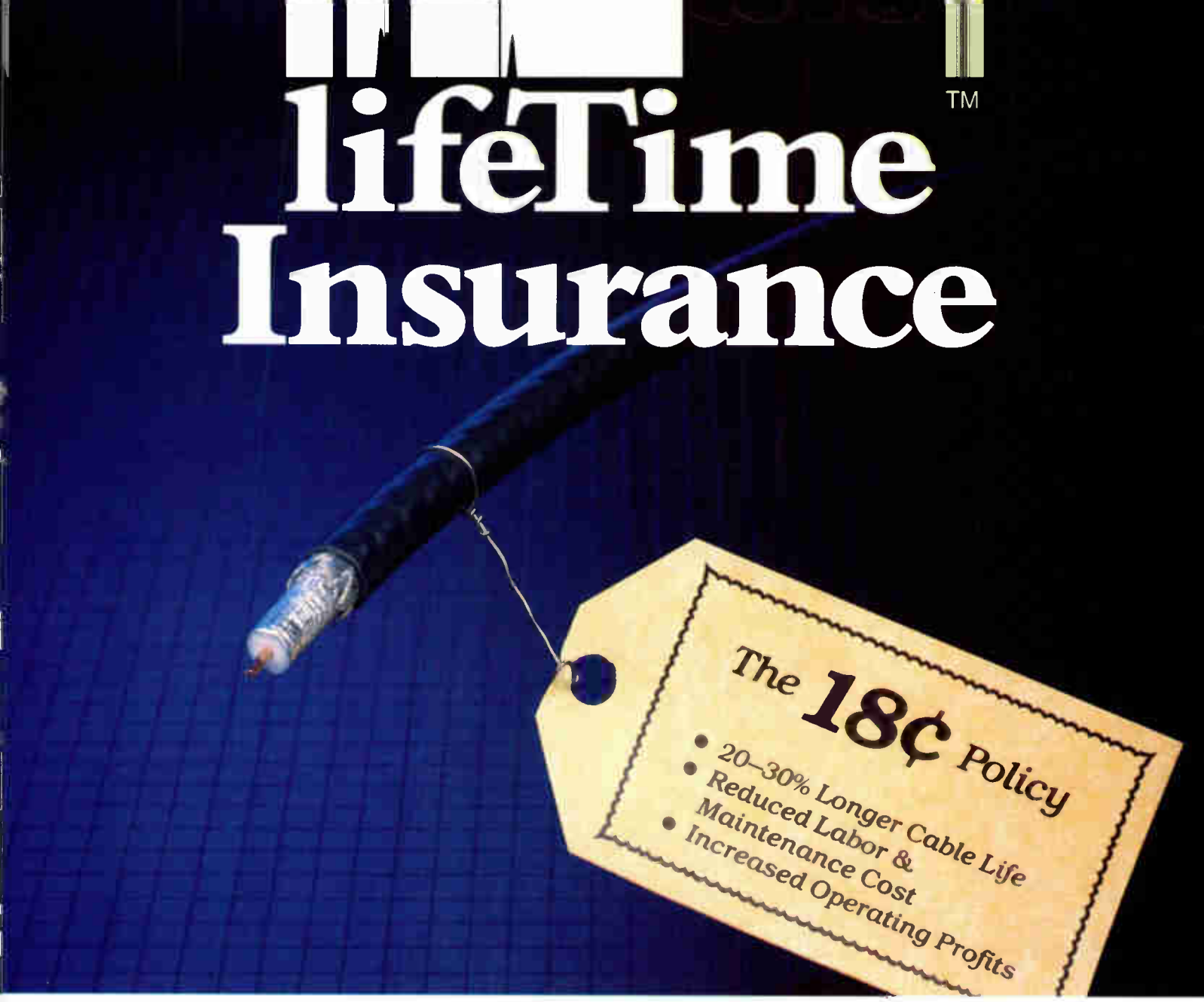

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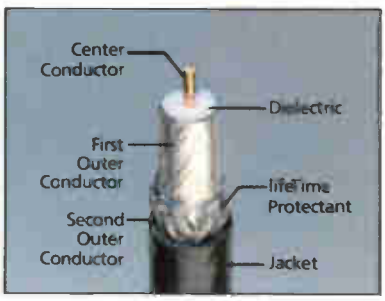

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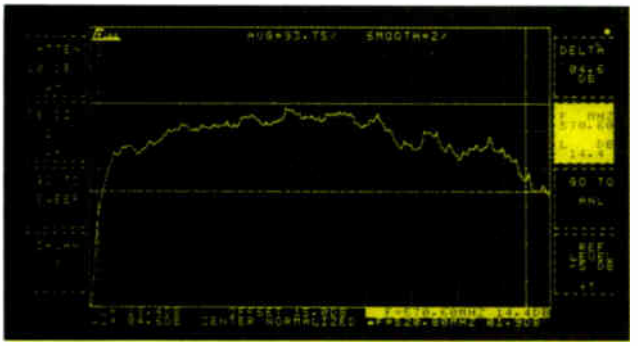

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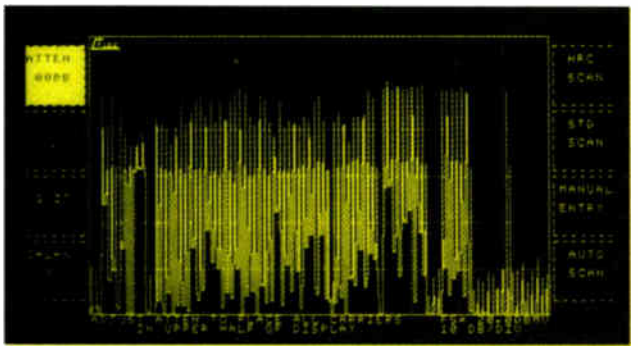

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To MBA or not...

By Chris Papas
Electrical Engineer, The MITRE Corp.

The pioneers of present-day communications companies started out with very small businesses and expanded them through lots of hard work and a little luck. They didn't have advanced business degrees and are probably the ones who scoff at the degrees. Yet, even *they* never envisioned that these small companies would become such large multinational corporations.

Along with growing corporations came growing complex organizational and financial problems. These companies are now considering business training as a way to learn techniques in better utilizing scarce company and employee resources. One solution to this type of training is the master in business administration (MBA) degree. Employees with a bachelor's degree in almost any area of study are eligible to pursue this option.

Employees at all levels of the industry from the staff engineer, who would like to know how the company operates, to the executive, who must know how the company operates, can benefit from this training. The new generation of leaders for these companies will need the MBA skills for corporations to survive and thrive.

Many like to make fun of the MBA degree, and much has been written about MBA degree programs and graduates. Some of it has been complimentary; however, most has not. Talk of MBA graduates wearing their "power ties" to work hoping to get quick riches, fast promotions to top management positions and, of course, the BMW in the driveway has overshadowed the educational value of the degree.

Not a cure-all

The MBA degree is not a cure-all for any problem nor is it a guarantee of fame and fortune. It is a basic foundation of courses that provides the student with advanced instruction in developing analytical, decision-making and problem-solving abilities in a business environment.

An exact definition of an MBA degree is difficult to state since each school has its own idea of what the degree is. A check of many graduate school catalogs reveals a wide variety of definitions depending on the particular course emphasis at that school. *MBA* is now more of a generic term since course curriculums vary greatly and all MBA degrees are not created alike.

A student who is interested in pursuing an MBA degree is faced with a bewildering choice of schools and curriculums. There are MBA programs with course concentrations in finance, accounting, marketing, economics, operations and human resource management. Also, course concentrations are available in industrial relations, statistics, information systems, health services, real estate and insurance, manufacturing management, and general management. This is not a complete list either. Course areas vary greatly from school to school.

There are full time, co-op, part-time day, part-time night and weekend MBA programs. Even MBA programs are available geared towards specific industries, such as a high technology MBA degree. There are also joint MBA/law and MBA/engineering degree programs. For those students looking to the top, there is also an executive MBA degree.

Other master's degree programs similar to the MBA but with a different emphasis or specialty are: master of science in management systems, master of science in engineering management, master of management, master of business, master of science in public administration and master of science in accounting, to name a few.

In the Graduate Management Admission Council's book *The Official Guide to MBA Programs*, there are more than 500 business schools listed worldwide. Which school to choose is highly dependent on the student's location preference, financial resources, curriculum choice, job prospects after graduation and personal preferences. There can be vast differences between similar degree programs at different schools, so both the school and the curriculum should be carefully evaluated. Unfortunately, some students have not spent enough time evaluating the schools and curriculums ahead of time and have become disillusioned when the situation was not what they had expected.

MBA degrees enjoyed their most popular period a few years ago. Companies demanded the degree and students lined up for courses hoping to get to the top quickly. Lately, though, the trend seems to be slowing down. There is a substantial number of MBA graduates in the job market-

place now, and employers in some industries can afford to be a little more selective and are looking for related experience in addition to the degree.

Many companies still view the degree as a valuable commodity and it is strongly desirable to their recruiters. These employers feel that the degree has exposed the student to an overview of the state-of-the-art managerial and analytical/strategic skills needed to make decisions in the changing marketplace. The degree also shows that the person has the necessary drive to complete the comprehensive program. Graduates still need to prove their "on-the-job worth" in the business world but will have an advantage over others who have not acquired the business skills in the MBA program.

Starting salaries for MBA graduates are higher than those with only bachelor's degrees and vary greatly with the school attended and the course areas studied. (As an example, 1987 MBA graduates at the Harvard Business School with experience related to investment banking are expecting to receive starting salaries up to $150,000 a year. Harvard is perceived to be one of the best business schools and its graduates are well sought after. This salary is far above what the average MBA graduate will receive but it does give you an idea of what is possible.) Those graduates with a financial background and those with a technical undergraduate degree seem to be the most in demand lately.

Although the Wall Street investment banker-type of MBA graduates seem to be getting the most notoriety, graduates can be found in almost every industry and every level of management. Graduates also can be found as: management consultants, accountants, corporate controllers, personnel directors, marketing consultants, in corporate finance, in government agencies and many have even taken the entrepreneurial route and started their own companies.

The MBA graduates, however, are not without their critics. Some of the criticisms of MBA graduates are: They are too bottom-line oriented, they understand the mechanics of business but not the products or customers of a business, they look for "quick fixes" to complex problems, they don't understand the social implications of their decisions, and they are in too much of a hurry to make it to the top. Some of these criticisms may be justifiable in specific instances but most are not a universal problem. Unfortunately, a few criticisms have come from associates who do not have, understand or like the MBA, which is basic human nature and can happen with any degree.

It's not for everyone

The MBA degree program is not for everyone. It involves a substantial commitment of time and money. Degree programs can last many years and can cost thousands of dollars, depending on the program and school chosen. Each person must decide whether the effort is worth it in terms of long-term career goals, salary potential and family commitments. People who are successful in an existing career might be better off taking non-degree training or courses, as the MBA program may seriously disrupt their present career.

Several graduate schools have responded to the needs of students who want to take advantage of the MBA courses but are unable to make a commitment to the full MBA program. These schools are offering certificate programs that contain a limited selection of courses in one of the previously mentioned MBA course areas. This gives the student competency in an individual area of MBA studies without taking the entire program.

There are also many non-credit short courses and seminars available in the areas of management, accounting, marketing, etc. These brief courses teach a portion of the subject without a major commitment of time but are limited in scope. They should be considered more of an introduction to the subject rather than conclusive training. To be truly effective, a course should be repeated after a period of time to reinforce what was learned.

The communications industry is in a constant state of evolution and the MBA skills will be needed to understand and direct the increasingly complex corporations. The MBA degree is not a guarantee of anything, but it does provide an employee with a far greater perspective of the business as a whole and how it operates in relation to the world business environment.

For more information about MBA programs, these books are available at libraries and bookstores: *The Official Guide to MBA Programs*, published by the Graduate Management Admission Council; and Peterson's *Graduate Programs in the Humanities and Social Sciences 1986*. ■

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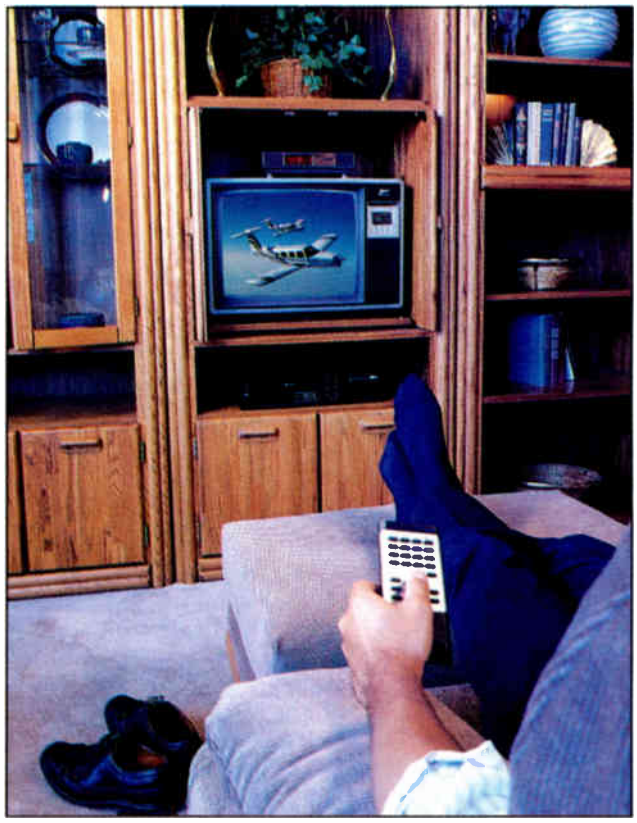

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Reader Service Number 36.

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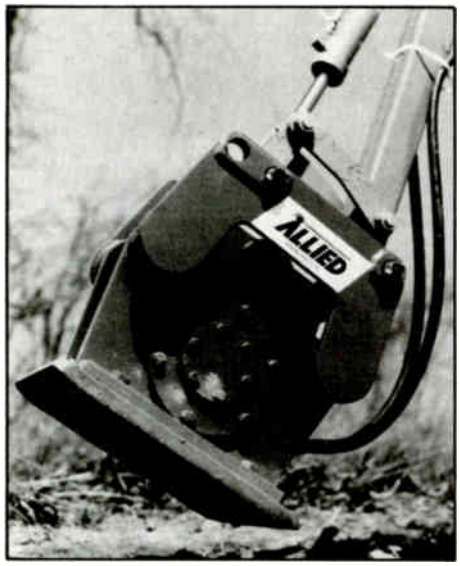

Compactor/driver

Allied is offering its new Model 4700 Ho-Pac, a boom-mounted vibratory compactor/driver. The product's 12 inch-wide base plate is designed for mini-excavators, small skid-steer loaders and rubber tire backhoes, and trenchers with a backhoe attachment, and used in narrow trench work and confined areas. It compacts with 3,000 pounds of impulse force and requires 7 gpm of oil flow at 2,000 to 2,200 psi.

According to Allied, the product is more efficient, less expensive and safer than workers with hand-held tampers. It allows compaction to follow closely behind backfill and pipe and cable laying operations.

For more information, contact Allied, 5800 Harper Rd., Solon, Ohio 44139, (216) 248-2600; or circle #120 on the reader service card.

Safety film

North Consumer Products is offering a movie describing recent improvements in its Saf-T-Climb fall prevention system. The nine-minute, full-color film shows how the company's rigid rail systems and components are said to provide fall prevention that cages cannot. Available in VHS, Beta, U-Matic, 16 mm film and MPO, duplication of the movie is both allowed and encouraged for inclusion in engineering libraries and company safety programs.

For more information, contact North Consumer Products, 16624 Edwards Rd., Cerritos, Calif. 90702-1480, (213) 926-0545; or circle #141 on the reader service card.

Route tracer

Biddle Instruments is offering its battery-operated cable route tracer for locating, tracing and measuring the depth of buried energized cables. Consisting of a compact, hand-carried electronic detector and wand for surface tracing, the product features a switchable filter that enables selective reception of either the 50/60 power frequency or another identifying tone up to 1,000 Hz from a separate generator.

For more details, contact Biddle Instruments, 510 Township Line Rd., Blue Bell, Pa. 19422, (215) 646-9200; or circle #118 on the reader service card.

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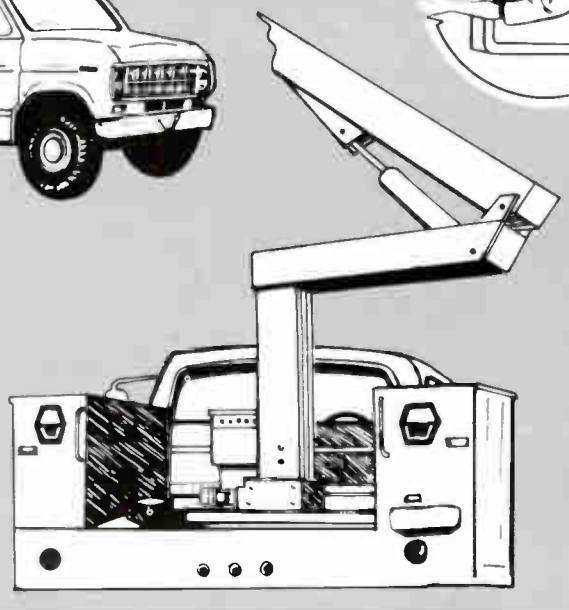
And Make Everyone Happy

Choosing an aerial lift that will satisfy the many different needs of your company's management team can be a difficult decision. And, unfortunately, it's a decision you'll have to live with for years.

Choose the wrong one and you'll hear about it—from everyone. Crews griping about jerky controls or how hard it is to reach a lot of poles and cables. Fleet service managers complaining about the way it seems to spend more time in the shop than on the job. And, when downtime records and maintenance costs start to pile up, financial management is going to start asking if that low-bid aerial was such a bargain after all.

The next time you're looking for an aerial lift, why not make it easy on yourself. Choose a Stel/Scope, the aerial lift designed and built to make everyone happy. Crews will like its smooth operation, the way it helps them get work done faster, with less fatigue and in greater safety. Fleet managers will like its low-maintenance dependability. Financial managers will appreciate the savings realized in long term cost of ownership. And you'll like the peace and quiet that comes from choosing an aerial lift that makes everyone happy.



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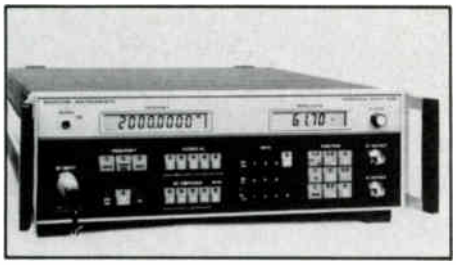


Modulation meter

The capability of Marconi Instruments' Model 2305 modulation meter has been improved from its original specification of a 500 kHz to 2 GHz range; it now covers the frequency range of 50 kHz to 2.3 GHz. Other specifications of the product include: accuracy of ±0.5 percent on FM and ±1 percent on AM; direct tuning to a known input signal or set to automatic to locate any signal in 500 milliseconds; and measurements of AM, FM and phase modulation, frequency noise, RF power, frequency response and signal-to-noise ratio.

For more details, contact Marconi Instruments, 3 Pearl Ct., Allendale, N.J. 07401, (201) 934-9050; or circle #121 on the reader service card.

Line extender

Hughes Aircraft Co.'s Microwave Products Division is offering its Model AML-HPOLE-112 high-power microwave line extender that is said to provide up to 5 dB more than its standard OLE-111 outdoor line extender. The product is a broadband multichannel transmitter that can deliver one to 60 channels of programming to small or specialized subscriber pockets in a CATV system. The transmitter accepts VHF inputs in the 54 to 450 MHz range and uses block upconversion to reach the CARS-band frequencies of 12.7 to 13.2 GHz.

Local distribution applications of the extenders by CATV operators include: rapid access to high-density subscriber areas, crossing natural barriers or interstate rights-of-way, temporary restoration of multichannel service in the event of planned or emergency interruption, and as a frequency agile "hot standby" to protect regular pay service.

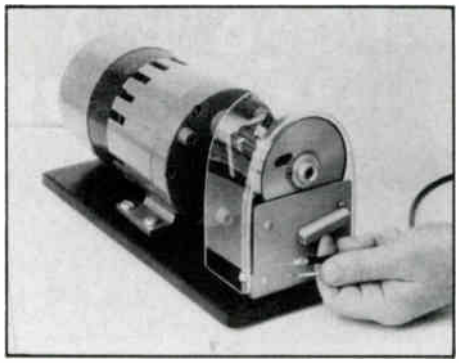
For more details, contact Hughes Microwave Products Division, P.O. Box 2940, Torrance, Calif. 90509-2940, (213) 517-6233; or circle #123 on the reader service card.

Controller software

Pioneer has announced two enhanced versions of its M3 addressable controller software, M3P-5.0 and M3P-6.0. The M3P controller operates Pioneer's addressable converters and can control up to 600,000 subscribers. Both versions of the software are said to offer additional operator flexibility in reporting functions, data base management and system operation.

The improvements include the ability to control multiple hub sites with different operating parameters. It also offers direct bar-code reading capability using a wand. In addition, the M3P allows the operator to access subscriber information through subscriber name, address or account number.

For more details, contact Pioneer Communications of America, Sherbrooke Office Centre, 600 E. Crescent Ave., Upper Saddle River, N.J. 07458-1827, (201) 327-6400; or circle #95 on the reader service card.



Cable stripper

The Model CX-2 motorized coaxial cable stripper from Western Electronic Products Co. prepares a three-level strip in a single action for any connector configuration and strips cables from under .100 to .430 diameter. Three rotating blades come into contact with the cable to a predetermined depth and length of cut. While the cutters are engaged, the cable is manually pulled out, thus removing the various layers and leaving a connector-ready cable.

For complete information, contact Western

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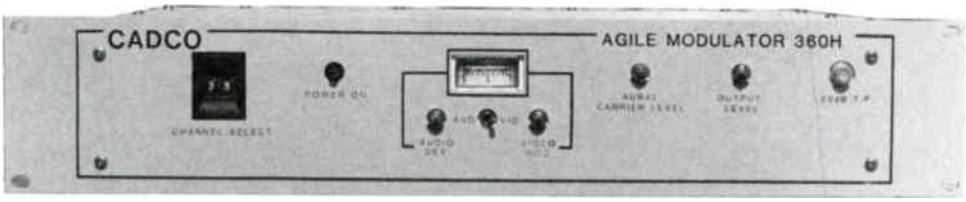

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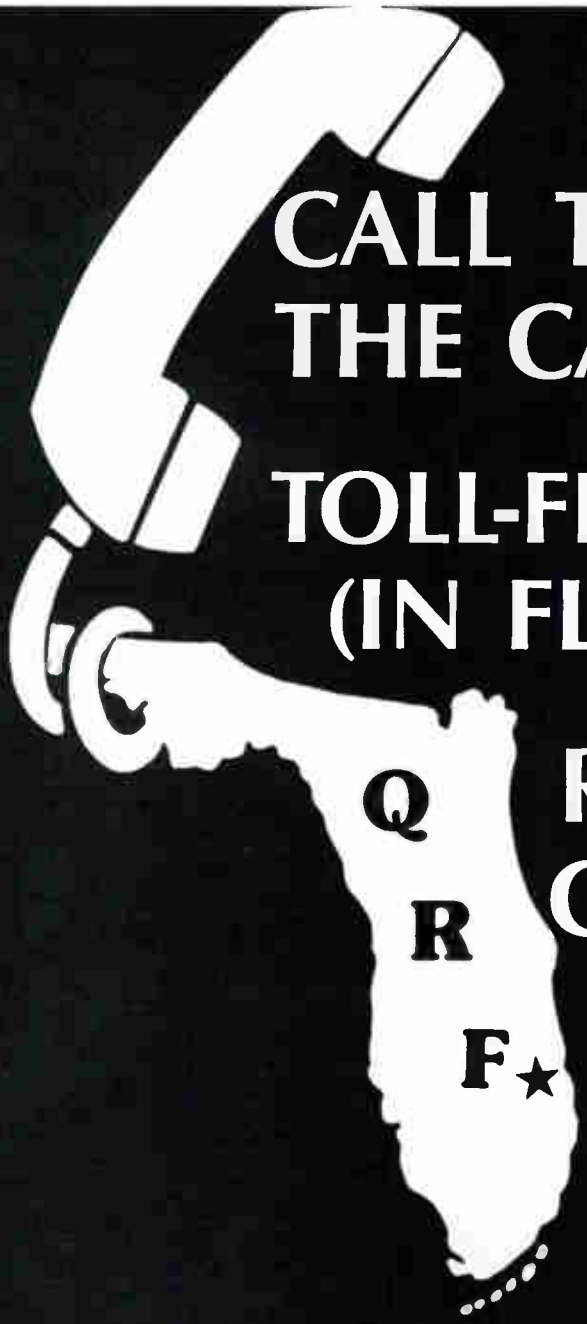

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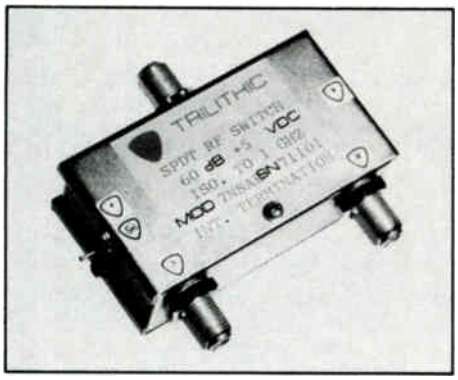
Electronic Products Co., 107 Los Molinos, San Clemente, Calif. 92672, (714) 492-4677; or circle #109 on the reader service card.

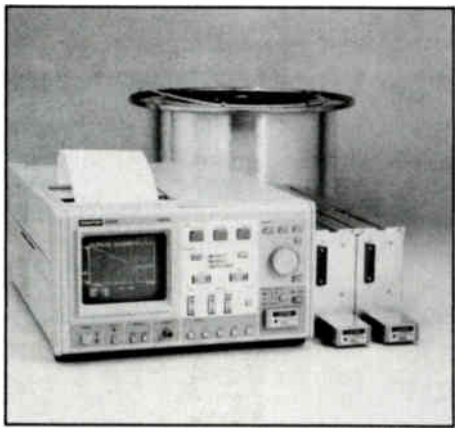


A/B switch

Trilithic is offering its Models 7LSAB and 7NSAB electronically controlled latching and non-latching A/B switch, used for switching between dual (redundant) local area networks, between cable drops and receiver antennas, and in automated and/or remote test equipment. They may be ganged to create 1 × 3, 1 × 4, 1 × 5, etc., switches for other applications.

Return loss (any port; connected port terminated) is 20 dB minimum; insertion loss is 0.2 dB maximum. Isolation between any unconnected ports is 60 dB minimum and 70 dB typical; the other port may be terminated or not. The A and B ports are internally terminated when not connected to the common port. The standard terminations are rated to handle a 75 dBmV level.

For further details, contact Trilithic, 6840 Winona Dr., Indianapolis, Ind. 46236-9506, (317) 823-4719; or circle #116 on the reader service card.



Optical TDR

The Model TQ8450 optical time domain reflectomer (OTDR) from Advantest America is designed to measure faults and light loss in fiber-optic cable runs. According to the company, it offers a wide range of applications with three optional plug-in modules for 1,310 ns graded index, 1,310 ns single mode and 1,550 ns single mode in pulse widths of 50 ns to 5 μs.

It is said to be ideal for long-distance testing analysis of graded-index and single-mode fibers in distances from 500 meters to 160 kilometers. In addition to a built-in thermal printer, the product features a general purpose interface bus for full remote operation capability as standard.

For more details, contact Advantest America, 300 Knightsbridge Pkwy., Lincolnshire, Ill. 60069, (312) 634-2552; or circle #113 on the reader service card.

Drop wire clip

Diamond Communication Products has announced its new aluminum CATV drop wire clip designed to secure drop wire runs. According to the company, the particular grade of aluminum chosen for the product provides a unique blend of strength and formability to accommodate a wide range of cable diameters. The clip also provides corrosion protection.

For more information, contact Diamond Communication Products, 500 North Ave., Garwood, N.J. 07027, (201) 789-1400; or circle #112 on the reader service card.

Signal processor

Pico Macom is offering its Model SP-60 signal processor with heterodyne circuitry. Features include SAW filtering for guaranteed 60 dB out-of-band signal rejection, spurious outputs down 60 dB, high adjacent channel rejection of 60 dB, low input signal capability, sync tip AGC for

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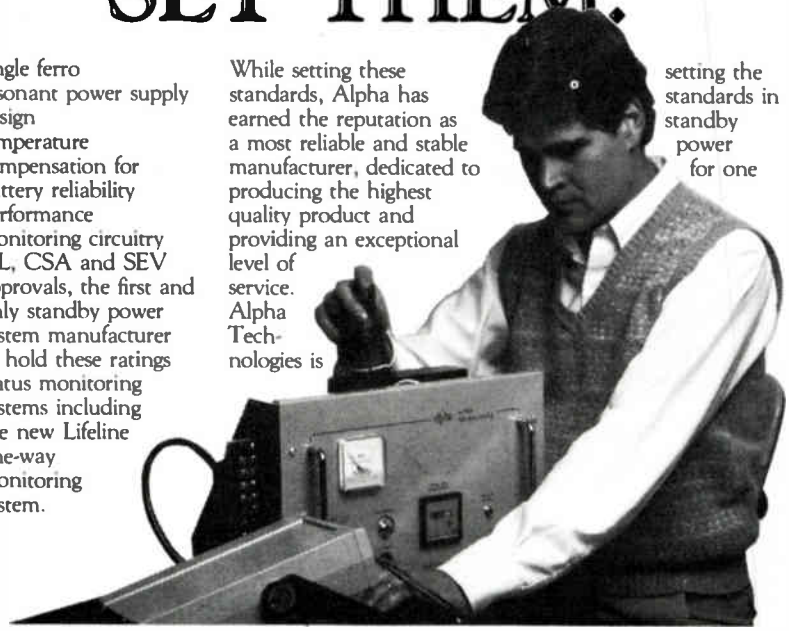

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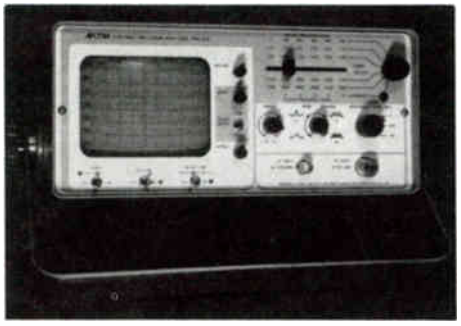
For more information, contact Pico Macom, 12500 Foothill Blvd., Lakeview Terrace, Calif. 91342, (818) 897-0028; or circle #110 on the reader service card.

Spectrum analyzer

Avcom of Virginia Inc. has introduced its Model PSA-35A portable spectrum analyzer. The new product features a standard center frequency calibrated from 1,250 to 1,750 MHz to cover European BDC frequencies and a switch selectable 2 dB/division or 10 dB/division sensitivity.

It also offers frequency coverages of 10 to 1,750



MHz and 3.7 to 4.2 GHz for checking signal strength, in-band attenuations, terrestrial interference, filter alignment, fault connectors, LNAs, feedhorn isolation and cable loss at all commonly used satellite frequencies.

For further information, contact Avcom of Virginia, 500 Southlake Blvd., Richmond, Va. 23236, (804) 794-2500; or circle #117 on the reader service card.

Addressable software

Computer Utilities of the Ozarks has announced the availability of its addressable interface software between the IBM PC and PC-compatible hardware and the Jerrold AI-O. According to the company, the software will allow the PC diskettes to function as a removable backup as well as providing a converter inventory data base report writer for the AI-O when the controller is operated in a stand-alone mode.

For further information, contact Computer Utilities of the Ozarks, 103 Suite C Industrial Park Rd., Harrison, Ark. 72601, (501) 741-1616; or circle #115 on the reader service card.

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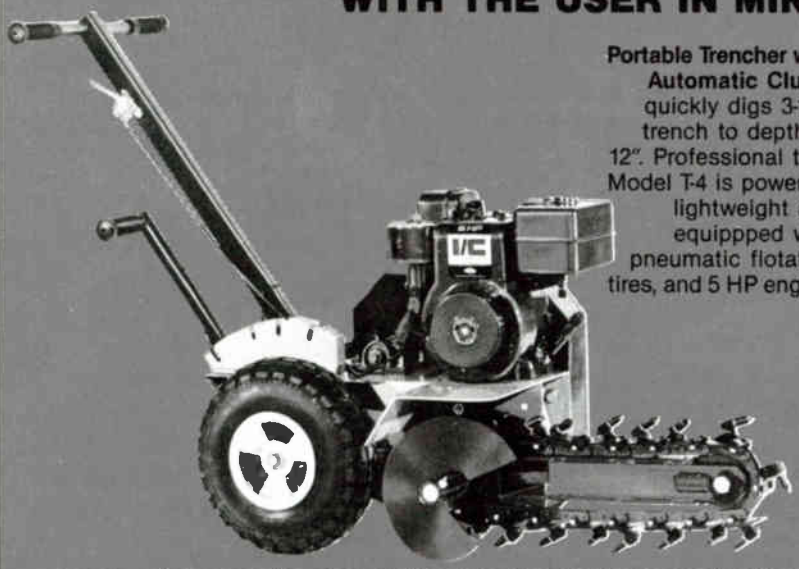

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Reader Service Number 44.

Portable RF tuner

Advanced Technical Products has introduced its Scramble Lock, a portable RF tuner and video detector with a built-in trigger pulse generator. Used with a converter and an oscilloscope, the product allows the user to accurately monitor the timing adjustment on scramblers and descrambling converters. It also allows amplitude measurement of scrambled satellite video without the need of a calibrated converter, spectrum analyzer or cross-point monitor.

For more information, contact Advanced Technical Products, 205 Sara Lane, Leesburg, Fla. 32748, (904) 787-1909; or circle #122 on the reader service card.

Power supplies

Sutton Designs has introduced its MM Series standby uninterruptible power supplies, available in 250-, 300-, 500-, 600- and 1,000-watt sizes. The products use the company's phase-locked pulse width modulated solid-state technology designed to provide a pure, filtered AC backup power source for small computer systems during a brownout, blackout or overvoltage situation.

During an emergency, the UPS output waveform remains phase locked with the AC power line waveform; the inverter switchover from line-to-inverter and inverter-to-line takes place. Another waveform is produced that is pulse width modulated or tightly regulated in frequency and width during inverter operation.

For more details, contact Sutton Designs, 300 N. Tioga St., Ithaca, N.Y. 14850, (607) 277-4301; or circle #114 on the reader service card.

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For more information, contact Jim Trenter, Technical Applications Manager, GNB Incorporated, P.O. Box 64140, St. Paul, MN. 55164. (612) 681-5000.

GNB Incorporated

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Reader Service Number 45.

Headend mechanical maintenance

By Steven C. Johnson
Senior CATV Project Engineer
American Television and Communications

The objectives of any CATV preventive maintenance (PM) program are: 1) to ensure that components of a cable system perform at prescribed operating levels and for projected life spans and 2) to avert problems, including outages, that would otherwise occur and become noticeable to subscribers. PM becomes particularly critical where the projected failure rates of parts increase with time. Further, PM procedures are important for all system links—the headend, hubs, earth stations, microwave systems, transportation trunks, system plant, etc. Well thought-out and ongoing preventive procedures can reduce the number of trouble calls and increase customer satisfaction.

Checks and corrective procedures should occur on a periodic, ongoing basis, as opposed to a once a year "crash" program. Realistically, the frequency of preventive activities reflects a component's predictable deviation from specifications, the ease of access to perform checks and the complexity of performing activities (fault location, fault isolation, disassembly, interchange, reassembly, alignment, checkout, etc.). Accordingly, it makes sense to stagger the schedule for different components—annually, semiannually, quarterly, monthly, weekly and daily.

Most of our cable signals originate from headends and hubs, either from off-air antennas, earth stations, studio feeds or character generators. It is extremely important to properly maintain the headend equipment because the pictures we deliver can be no better at the subscriber's location than they are at our headends. Once the signal leaves the headend the system amplifiers introduce noise and distortion into the pictures, so it is important to have the best possible pictures at the headend. Through proper maintenance, we can ensure that the quality is as high as possible at the input to our systems and therefore at the subscriber's location as well.

The main emphasis of a PM program usually focuses on maintenance of the electronics. But procedures are advisable for physical system components (nuts and bolts, mechanical connections, etc.) as well. While mechanical items are normally quite stable, especially when designed and installed properly, they are not trouble-free. Bolts rust or loosen, grounds become corroded and ineffective, and antennas become disoriented from strong winds.

Is there a regular PM program for your system's tower, antennas and earth stations? If you have a standby generator at the headend, are you maintaining it through proper oil changes, antifreeze checks, fuel level checks, etc.? How about tower maintenance? Doesn't it make more sense to climb the tower on a sunny day to replace connectors that may be starting to fail than to wait until the connections actually fail and the weather may be less than ideal for tower climbing?

Maintenance activities

Mechanical components should be inspected at least on an annual basis, and some more often—particularly those elements used for a number of years and having failure rate projections that increase with time. The following are some suggested PM activities for the mechanical components of basic headend items. The list is

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Reader Service Number 46.

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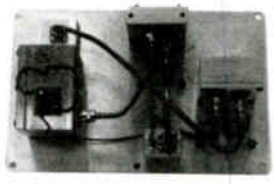
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AVCOM's new line of Microwave Frequency Converters can increase the capability of any spectrum analyzer, including the AVCOM PSA-35A. The MFC series is available in a wide variety of frequency conversion schemes and stabilities to meet specific customers requirements. AVCOM's MFC's cover MDS, CARS, MMDS, Industrial Microwave Heating frequencies, Satellite Communication (3.7 - 4.2 GHz), and other frequency bands up to 6 GHz. **Prices start at $695.**
MFC-3000 General purpose MFC with LO at 3 GHz designed to enable surveillance of frequencies from 1.5 to 4.5 GHz with a spectrum analyzer that tunes to 1.5 GHz. Great for Electronic Counter Measure (ECM) applications with PSA-35A.
MFC-2000 with LO at 2 GHz. The MFC-2000 allows the spectrum from 2-3 GHz to be translated to 0-1000 MHz. Ideal for MMDS (Educational TV) applications.
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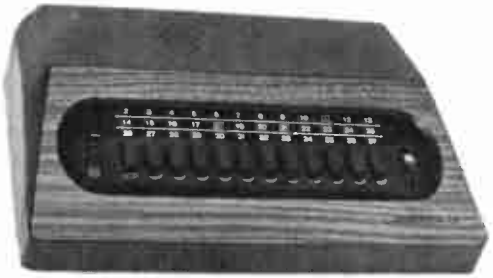
Old Socco Road
Cherokee, NC 28719



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Reader Service Number 48.

*Parts are not included in this offer.

not inclusive, but is provided as helpful ideas to include in a PM program:

I. Tower (annual)
   A. Antennas
      1. Check the orientation off-air antennas and microwave antennas. Strong winds, over a period of time, can move antennas from their desired bearings.
      2. Check connectors. Are they still in good mechanical shape or have they corroded? How is the waterproofing? Replace the heat shrink tubing, if necessary.
      3. Check the antenna mounting hardware. Replace if rusting or if it is corroded.
      4. Check all antenna down leads. Are they properly tied down to the tower? Are they free of kinks?
   B. Lighting
      1. Ensure that all lighting is operating properly.
      2. Check the lighting mounting hardware for signs of rust or corrosion. Replace if necessary.
      3. Is the tower lighting log up-to-date? Does it contain instructions to be followed in the case of failure of the tower lights? Is the nearest Federal Aviation Administration office's phone number included? Does the log contain the correct tower coordinates, elevation and tower height?

"Checks and corrective procedures should occur on a periodic, ongoing basis, as opposed to a once a year crash program."

II. Earth station (annual)
   A. Orientation
      1. Check the dish for proper azimuth, elevation and polarity. This should be done when the satellite is in the center of its "box." Major programmers should be able to give you this information.
   B. Mechanical
      1. Inspect waterproofing, grounding, mechanical and RF connections. Correct any rusting or corrosion problems.
   C. Specification
      1. Measure the dish's carrier-to-noise (C/N) ratio. This will help you determine if the earth station system is operating within the originally measured or calculated design parameters.

III. AC standby generator (monthly)
   A. Check and record the fuel level. Add fuel if necessary.
   B. Record the reading on the hour meter.
   C. Change the oil on the required intervals, based upon manufacturer's recommendations.
   D. Check the water level. Add water or antifreeze if necessary.
   E. Inspect the grounding, mounting hardware and electrical wiring for signs of rust or corrosion. Correct as necessary. You may be performing some of these activities already. If you are, you are probably starting to get some ideas of your own to add to this activity list.

Again, this list is not inclusive. It is provided to encourage thinking about starting a PM program or adding activities to existing procedures. A properly designed and implemented program can reduce downtime and service calls, increase customer satisfaction and, therefore, (what your managers love to hear) cut operating costs.

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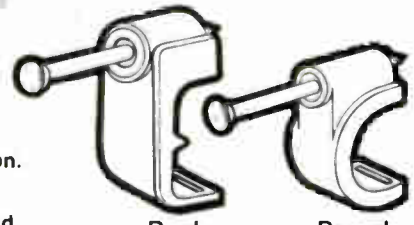

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Reader Service Number 50.

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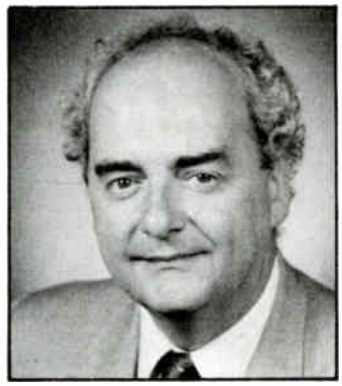
Dr. James Hood has been named president and chief executive officer of **Catel Telecommunications Inc.** He was previously senior vice president of Granger Associates. Contact: 4050 Technology Pl., Fremont, Calif. 99537-5122, (415) 659-8988.

Brauer

Dieter Brauer has been appointed director of engineering for **Magnavox CATV Systems**. Prior to this, he was business center manager of RF modules for M/A-COM PHI Inc. Contact: 100 Fairgrounds Dr., Manlius, N.Y. 13104, (315) 682-9105.

Buynak

Chyron Corp. announced the appointment of **William Buynak** to vice president of product evaluation for the Telesystems and Video Products Divisions. Prior to this, he was vice president of engineering for the company.



Agneta

Roi Agneta has been appointed vice president of engineering for the Telesystems and Video Products Division. Previously, he directed the Telesystems Division's engineering efforts. Contact: 265 Spagnoli Rd., Melville, N.Y. 11747, (516) 694-7137.

Norman MacLeod has been named president of **Metrotech Corp.** Prior to this, he served as director of engineering for the company.

Also, **Ed North** has been named

MacLeod

North

Reader Service Number 51.

All New

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Exclusive audio to video ratio test measures directly in dB for easy comparison to FCC specifications.

Exclusive automatic FCC accurate Hum level test. Eliminates customer down time, speeds your testing, instantly on any channel.

Exclusive signal quality check. Built-in 4 MHz wideband CRT monitor analyzes and pinpoints RF video troubles fast.

Exclusive built-in autoranging AC/DC volt and ohmmeter now measures trunkline voltage through RF input—hassle free.

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Battery operated for true portability, field tested tough for dependable ease of use and IEEE 488 Bus compatible for non-attended and remote testing.

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Call 1-800-843-3338 for your 10 Day Self Demo. Call us today for more information or better yet let us put an FS74 or FS73 at your site for 10 days! Discover just what 100% automatic, FCC accurate RF analysis will mean for you—Call today!!

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vice president of sales and marketing. Previously, he was manager of marketing and sales for the company. Contact: 670 National Ave., Mountain View, Calif. 94043, (415) 940-4900.

Scientific-Atlanta announced the election of **David McLaughlin** to its board of directors. He is currently managing principal of the consulting firm of Sibson & Co. and a member of its board of directors and management committee. Contact: 1 Technology Pkwy., Atlanta, Ga. 30348, (404) 441-4000.

Lambert

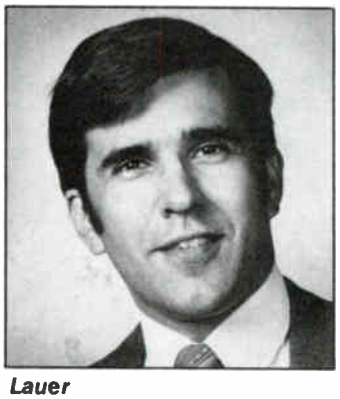
Jennifer Lambert has been named director of affiliate relations for new business development at **Jerrold**. She will be responsible for sales and marketing of the company's impulse technology. Prior to this, she was with Request Television. Contact: 2200 Byberry Rd., Hatboro, Pa. 19040, (215) 674-4800.

Rothschild

Paula Rothschild has been promoted to manager of national video sales for **Mycro-Tek**. She will direct the marketing, sales efforts and product development of character generators and video display systems. Prior to this, she was national product manager of audiotext products for the company. Contact: P.O. Box 47068, Wichita, Kan. 67201, (800) 835-2055.

Burg

Stanley Burg has been named director of marketing for **C&D Power Systems Inc**. Previously he was vice president of marketing for the Jerrold Division of General Instrument Corp. Contact: 3043 Walton Rd., Plymouth Meeting, Pa. 19462, (215) 828-9000.



Lauer

Kenneth Lauer has been appointed engineering manager for **LorTec Power Systems Inc.** He was previously senior project engineer at Sohio. Contact: 145 Keep Ct., Elyria, Ohio 44035, (216) 327-5050.

Soltysiak

Data Transmission Devices named **Alice Soltysiak** as national sales manager. Previously, she was Southeast regional manager for Pioneer Communications. Contact: 65 Walnut St., Peabody, Mass. 01960, (617) 532-1884.

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CALENDAR

August

Aug. 1-3: Idaho Cable Television Association annual convention, Templin's Resort, Post Falls, Idaho. Contact Gene Weston (208) 336-9121.

Aug. 5: SCTE Cascade Range Meeting Group technical seminar. Contact Randy Love, (503) 370-2770.

Aug. 6-7: Michigan Cable Television Association annual meeting, Boyne Highlands Resort, Harbor Springs, Mich. Contact (517) 351-5800.

Aug. 10-12: Magnavox CATV training seminar, Buffalo, N.Y. Contact Amy Costello, (800) 448-5171.

Aug. 11-12: Oklahoma Cable Television Association annual convention, Marriott Hotel, Oklahoma City. Contact Steve Lowe, (405) 943-2017.

Aug. 17-19: NTL Institute and **Quantum Associates** workshop on how to manage teams of engineers and technical specialists, Berkeley Marriott Marina, San Francisco. Contact Karen Parker, (703) 527-1500; or Arthur Freedman, (312) 440-0864.

Aug. 18-20: Magnavox CATV training seminar, Cleveland. Contact Amy Costello, (800) 448-5171.

Aug. 18-20: Jerrold technical seminar on applying problem-solving technology, Kansas City, Mo. Contact Jerry McGlinchey, (215) 674-4800.

Aug. 19: SCTE Greater Chicago Meeting Group technical seminar. Contact William Gutknecht, (312) 259-0600.

Aug. 20: SCTE Chesapeake Meeting Group technical seminar. Contact Thomas Gorman, (301) 321-6093.

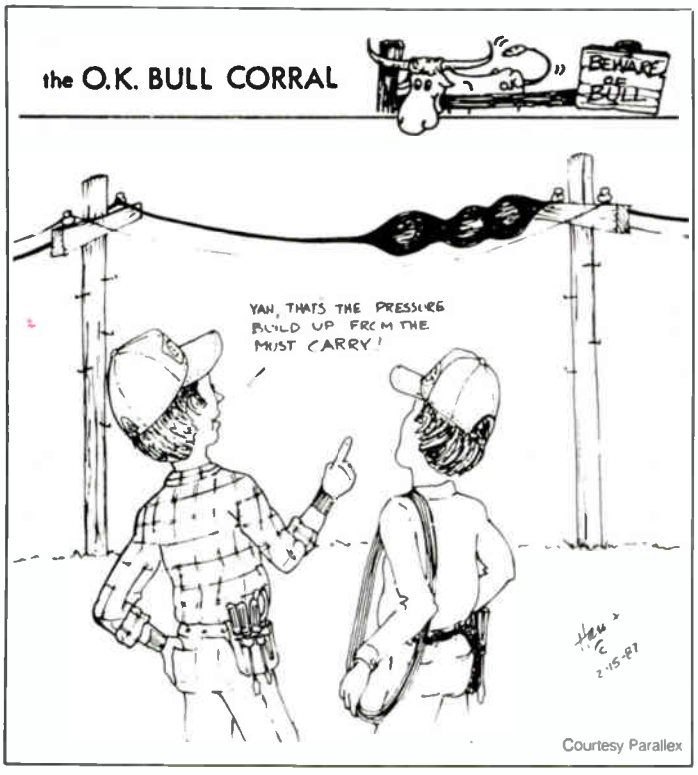
Aug. 21: SCTE Heart of America Meeting Group BCT/E review and testing on Category II–Video and Audio Signals and Systems, Holiday Inn Sports Complex, Kansas City, Mo. Contact Wendell Woody, (816) 474-4289.

Aug. 22: SCTE Great Lakes Meeting Group technical seminar, Hazel Park Community Center, Hazel Park, Mich. Contact David Spallinger, (313) 827-7330; or John Danekind, (313) 549-1100.

Aug. 25: SCTE Satellite Tele-Seminar Program, question-and-answer session with FCC engineers, 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

Aug. 25-27: Magnavox CATV training seminar, Detroit. Contact Amy Costello, (800) 448-5171.

Aug. 30-Sept. 1: Southern Cable Television Association's Eastern Show, Merchandise Mart, Peachtree Plaza, Atlanta. Contact Nancy Horne, (404) 252-2454.



Courtesy Parallex

Planning ahead

Aug. 30-Sept. 1: Eastern Show, Merchandise Mart, Atlanta.

Sept. 21-23: Great Lakes Expo, Indianapolis Convention Center/ Hoosier Dome, Indianapolis.

Oct. 6-8: Atlantic Show, Convention Center, Atlantic City, N.J.

Oct. 13-15: Mid-America CATV Show, Hyatt Regency at Crown Center, Kansas City, Mo.

Dec. 2-4: Western Show, Convention Center, Anaheim, Calif.

Feb. 17-19: Texas Show, Convention Center, San Antonio, Texas.

April 30-May 2: NCTA Show, Convention Center, Los Angeles.

June 16-19: SCTE Cable-Tec Expo, Hilton Hotel, San Francisco.

September

Sept. 1-3: Magnavox CATV training seminar, St. Louis. Contact Amy Costello, (800) 448-5171.

Sept. 2-4: Missouri Cable Television Association annual meeting, Lodge of the Four Seasons, Lake of the Ozarks, Mo. Contact Charles Broomfield, (816) 453-3392.

Sept. 7-9: Satellite Broadcast Communications Association and **Satellite Television Technology International** annual trade show, Opryland Hotel, Nashville. Contact Becky Seaton, (800) 654-9276.

Sept. 9: SCTE Rocky Mountain Chapter seminar with local broadcasters, Jones Intercable, Englewood, Colo. Contact Joe Thomas, (303) 978-9770.

Sept. 9-10: Wisconsin Cable Communications Association annual convention, Holiday Inn, Stevens Point, Wis. Contact Lynne Walrath, (608) 256-1683.

Sept. 9-11: Magnavox CATV training seminar, Memphis, Tenn. Contact Amy Costello, (800) 448-5171.

Sept. 15-17: Jerrold technical seminar on applying problem-solving technology, Kansas City, Mo. Contact Jerry McGlinchey, (215) 674-4800.

Sept. 15-17: UC Berkeley Extension course on telecommunications signal processing and ICs, University of California campus, Berkeley, Calif. Contact Bob Newton, (415) 642-3112.

Sept. 15-17: Magnavox CATV training seminar, Memphis, Tenn. Contact Amy Costello, (800) 448-5171.

Sept. 16-18: Alabama Cable Television Association annual convention, Wynfrey Hotel, Birmingham, Ala. Contact Mary John Martin, (205) 288-1821.

Sept. 21-23: Great Lakes Expo, Convention Center/Hoosier Dome, Indianapolis. Contact Daniel Helmick. (614) 461-4014.

Sept. 22-24: Magnavox CATV training seminar, Greensboro, N.C. Contact Amy Costello, (800) 448-5171.

Sept. 22-24: C-COR Electronics technical seminar, Des Moines, Iowa. Contact Tammy Kauffman, (814) 238-2461.

Sept. 27-29: Pacific Northwest Cable Association annual convention, Sheraton Tacoma Hotel, Tacoma, Wash. Contact Dawn Hill, (509) 765-6151.

Sept. 27-29: Microwave Communications Association annual convention, Ramada Renaissance Hotel, Washington, D.C. Contact Elena Selin, (301) 464-8408.

Sept. 27-29: Kentucky Cable Television Association annual convention, Radisson Hotel, Lexington, Ky. Contact Patsy Judd, (502) 864-5352.

Sept. 29: SCTE Satellite Tele-Seminar Program, "Ku-band technology and TVRO calculations," 12-1 p.m. ET on Transponder 7 of Satcom F3R. Contact (215) 363-6888.

Sept. 29-Oct. 1: Magnavox CATV training seminar, Greensboro, N.C. Contact Amy Costello, (800) 448-5171.

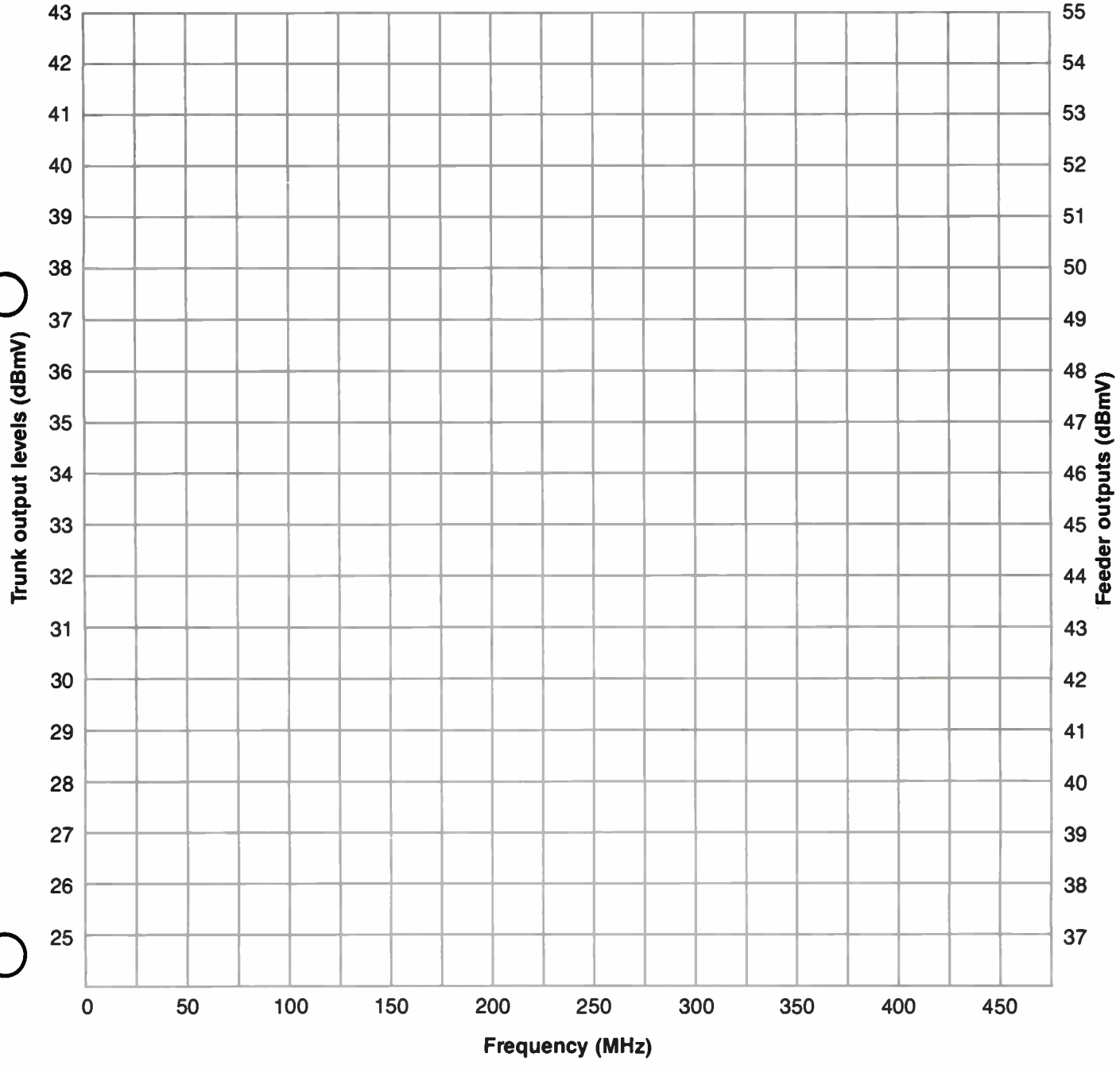
Sept. 29-Oct. 1: International Construction and Utility Equipment Exposition, Kentucky Fair and Exposition Center, Louisville, Ky. Contact (312) 321-1470.

Sept. 30-Oct. 3: Hawaii Cable Television Association annual convention, Royal Lahaina Resort, Maui, Hawaii. Contact Kit Beuret, (808) 834-4159.

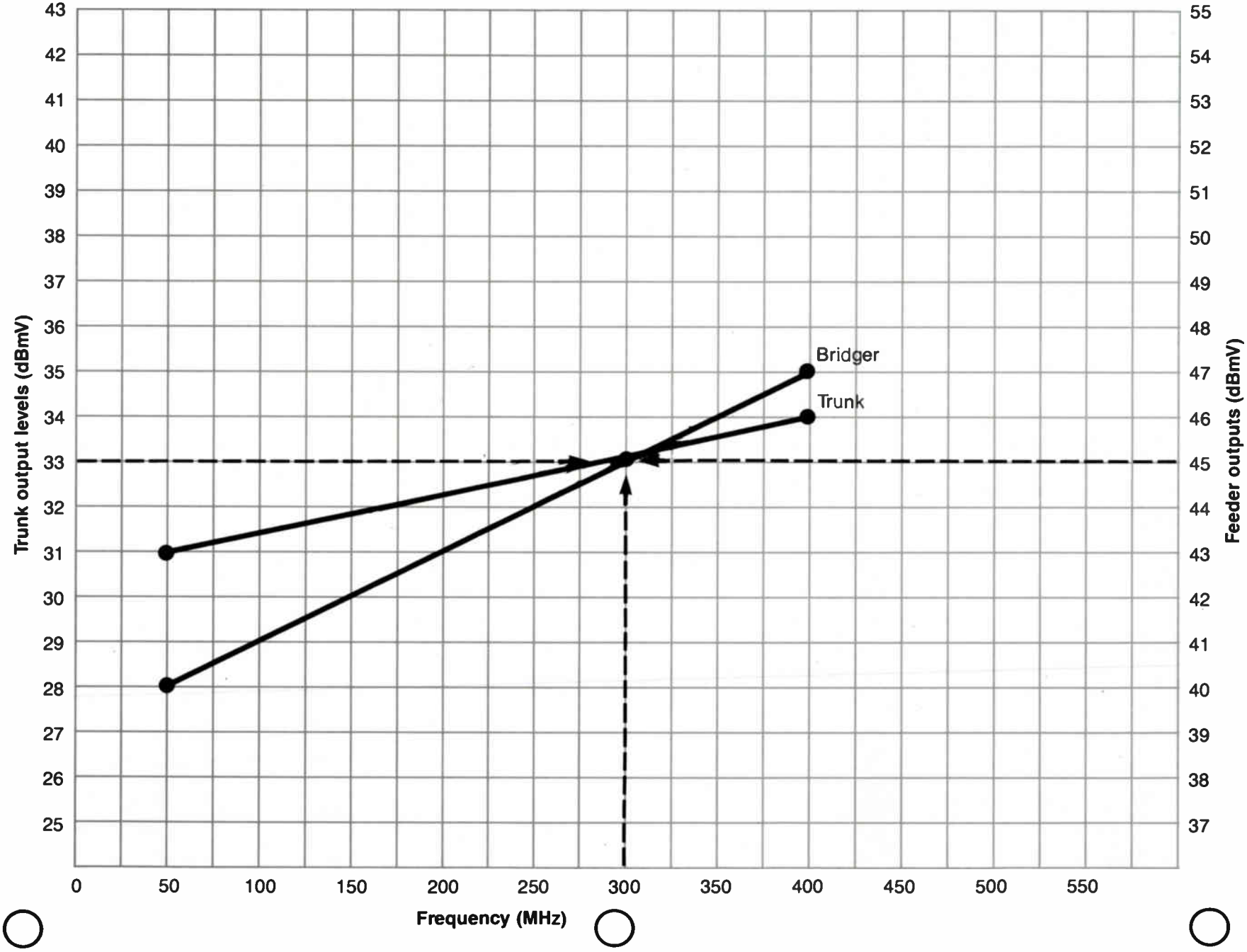
Broadband level and slope chart

By Bruce Catter and Ron Hranac
Jones Intercable Inc.

The chart on this page allows an engineer or technician to plot the slope and levels used for the trunk and feeder system. By doing so, one can find the level at which ASC and AGC pilot carriers must operate in order to maintain proper levels across the spectrum used. The chart is also useful in determining the proper level for the highest frequency used in the case where the highest frequency used is below the highest design frequency. An example can be found on the next page.



Example: New design: 400 MHz spacing
Operating levels: 300 MHz outputs: Trunk = 33 dB / 31 dB; Bridger and line extender = 45 dB / 40 dB



New IEEE LAN standard—Fiber/coax

By Lawrence W. Lockwood
President, TeleResources
East Coast Correspondent

A standard formulated by an Institute of Electrical and Electronics Engineers (IEEE) working group will have far-reaching effects on data communication on local area networks (LANs). It is the first standard establishing the requirements for fiber optics in LANs and most importantly defines how fiber optics and coax will work together in the same LAN. After final certification it will be an addition to the IEEE 802.4 standard—the token bus broadband standard for data communications on CATV-type networks. This new addition is 802.4H.

The 802.4H currently supports several protocols for the fiber: the "star topology" (both active and passive) and what are termed as the "active headend topology" and the "active tapped bus topology." (These are referenced later.) The data rates are 10 Mbps and 20 Mbps with a bit error rate of 10^{-9} or better. Although the standard specifies light of wavelengths between 800 and 910 nanometers, it does allow for the consideration of 1,300 nm light. One of the first significant applications of this new standard is its proposed use in the expanded standard (3.0 draft) for the Manufacturing Automation Protocol (MAP) LAN originated by General Motors.

IEEE 802.H and MAP

To easier visualize a proposed application of 802.4H in MAP it would be best to review the use of the single-channel portion of 802.4 in MAP, called "carrier band." This configuration is used in MAP to reduce costs; it uses less expensive amps and requires no headend translator. To review, the single-channel portion of 802.4 uses a single channel with data (either at 5 Mbps or 10 Mbps) frequency shift keyed (FSK) directly onto the cable (not FSK'd onto an RF carrier). The FSK frequencies are 5 MHz and 10 MHz for the 5 Mbps data rate and 10 MHz and 20 MHz for the 10 Mbps data rate. The control protocol, of course, is token passing.

A few words on the term carrier band: It was consciously originated by the 802.4 group to reduce confusion among some who had more computer-intensive than communications-intensive backgrounds. Systems using multiplexed, data modulated RF carriers are universally understood as broadband. But the use of the 802.4 FSK single-channel method started to be referred to by some as baseband. To strongly differentiate the method (it indeed is not baseband, but truly not broadband either) carrier band was coined. A typical carrier band configuration as it might be used in MAP is shown in Figure 1. A typical fiber configuration (employing 802.4H) as it might be used in MAP is shown in Figure 2.

As specified in 802.4H, a star can be either active or passive. The configuration of a network active star is generally well understood. In a fiber network the light signal enters the active star where it is converted into an electrical signal and then converted back into a light signal to be sent out the multiple outlets of the star.

A passive star performs differently. There are two general configurations of a passive star coupler (Figure 3). The transmissive star connects each input with all outputs, whereas there is isolation between different inputs. Typically, the inputs are connected to the terminals' transmitters and the outputs are connected to the receivers'. In contrast to the transmissive star, the reflective stars' ports are bidirectional, so they are used as inputs and outputs at the same time. Each port feeds each other port.

Excerpt from IEEE 802.4H

The following is an excerpt from the current draft of 802.4H and may aid in clarification.

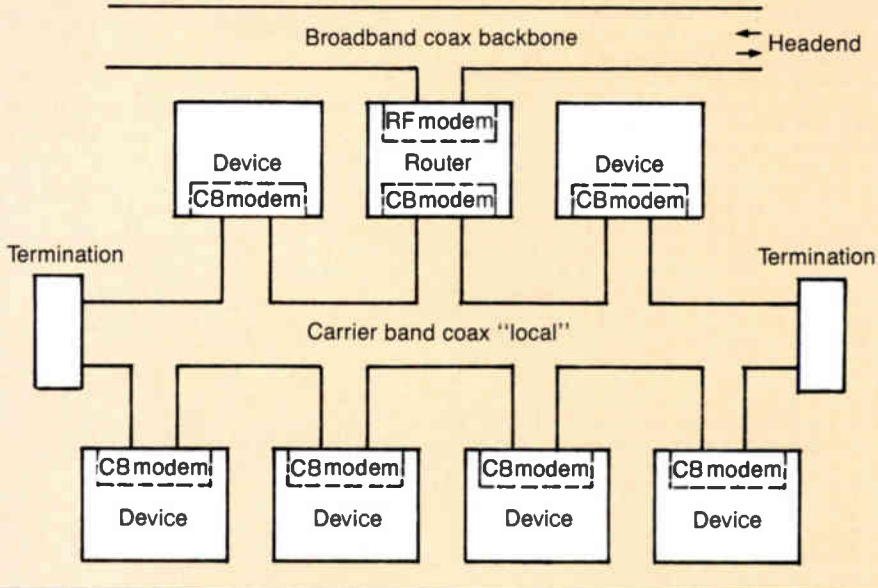
"Appendix
"Network Size and Configuration

"In order to give the network designer an idea of some of the configurations which are possible given the primitives which are described in the body of this working document, the following illustrations have been included. The presence of these topologies in this appendix does not imply that these are the only topologies compatible with this working document.

"The physical size of a network both in geographic length and number of stations which is desired will have a significant impact on the network topology which is utilized. When only a limited number of stations (five to ten for instance) are required almost any topology can be utilized. Figures 17A.1, 17A.2 and 17A.3 illustrate three possible topologies which meet the requirements. For situations which require a large number of stations located in widely separated geographic locations it is advantageous to combine elements of several of the topologies shown below to form a hybrid topology or a multi-tiered topology. Topologies of this type may grow to very large numbers of stations. In utilizing any of the listed topologies it is the responsibility of the network designer to assure that the overall system rise time and loss budgets are maintained. It is

"It is apparent that fiber use in (local area networks) will expand greatly."

Figure 1: Coax-based carrier band (CB) configuration of MAP



expected that practical networks will be possible using fibers which range in size for 100/140 micron to 50/125 micron."

PHY in Figures 17A.1, 17A.2 and 17A.3 indicates layer 1 of the Open Systems Interconnection/International Organization for Standardization (OSI/ISO) model. It is the physical layer, the one that performs the physical connection of the node to the transmission medium (as an example it could be a modem).

Current status of IEEE 802.4H

According to Robert Crowder, chairman of the 802.4H group and president of Shipstar Associates (Newark, Del.), 802.4H has been accepted both here and in Europe as an appendix in the specifications of MAP 3.0. Crowder also said that though 802.4H is not yet finally certified by the IEEE, its acceptance is possible by November '87, which would permit its inclusion in the 1987 edition of the 802.4 standard.

Though 802.4H and MAP 3.0 are not yet certified, several large fiber MAP installations are being made. At a GM Canadian subsidiary in Oshuwa, Ontario, a pilot optical fiber network was installed in 1980 that connects 20 workplace terminals. Now, it is installing a full MAP-like network that will connect at least 375 robots to a host computer. The cost is expected to be about $3 million. One more auto plant using a fiber-based network is the Nissan truck plant in Smyrna, Tenn. An additional MAP-fiber network is an AT&T/Concord Data system in an AT&T plant that is now being built, but neither company will comment at this

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Figure 2: Fiber star-based configuration of MAP

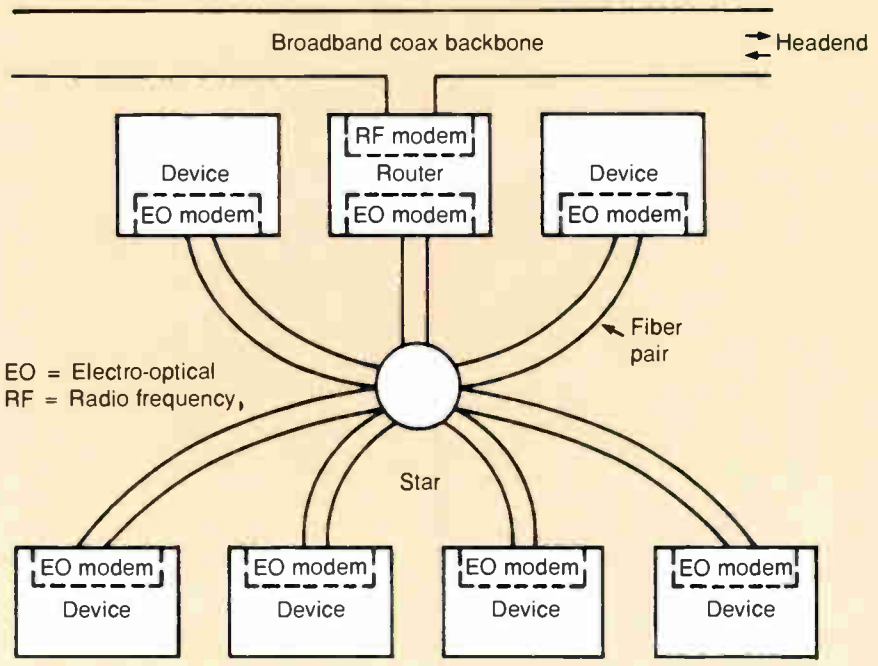


Figure 3: Passive star couplers

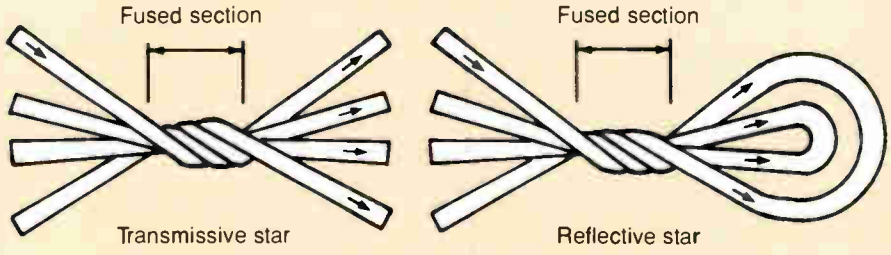
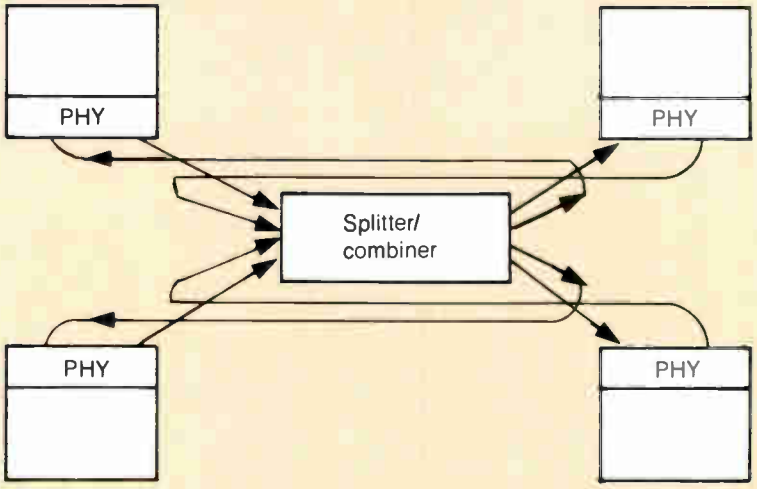


Figure 17A.1: Star topology



time. An influential corporation that also supports the fiber-MAP networking is the chemical giant E. I. Du Pont De Nemours (Wilmington, Del.).

Another important fiber LAN standard is also near adoption. It is the Fiber Distributed Data Interface (FDDI) standard generated by the American National Standards Institute (ANSI) Committee X3T9. FDDI is organized as a dual ring using a control protocol based on the IEEE 802.5 standard for a token ring. Its data rate is 100 Mbps using either 62.5/125, 85/125, 50/125 or 100/140 micron fibers and light of 1,300 nanometers. The FDDI specifications were developed on the basis of up to 1,000 physical connections and a total fiber path length of 200 kilometers.

The advantages of fiber over coax are well recognized: fiber has a much wider bandwidth/data rate (used only to 20 Mbps for the fiber 802.4H vs. 10 Mbps for the coax 802.4); fiber is impervious to electrical interference (e.g., not susceptible to RF interference, will not radiate, can be placed next to high voltage/current carrying cables with impunity); and of great importance, fiber has such low attenuation that very long cable runs can be made without repeaters. Use of fiber in wide area networks (WANs) has been expanding at a galloping rate. These WAN applications have largely been in telephone and/or large individual data nets where the early high costs for fiber systems could be justified. However, the falling cost of fiber-optic system hardware and rising data rate requirements are driving the development of these new LAN standards. It is apparent that fiber use in LANs will expand greatly and the IEEE 802.4H standard, which defines how fiber optics and coax will work together, will be of increasing significance.

Figure 17A.2: Active headend topology

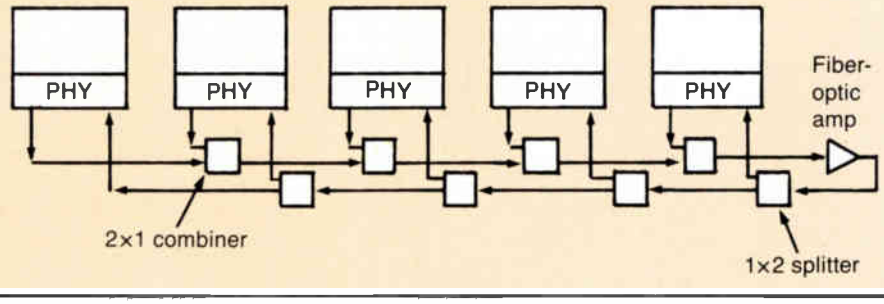
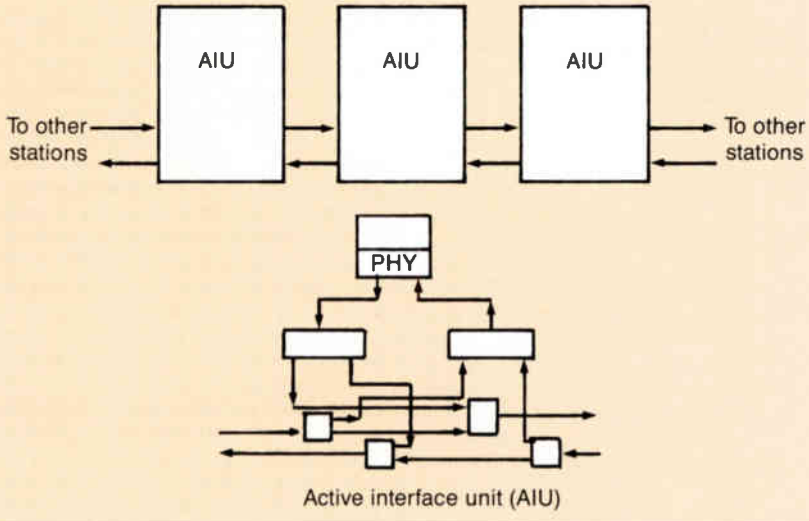


Figure 17A.3: Active tapped bus topology



AD INDEX

Consumer electronics on the move

By Walter S. Ciciora, Ph.D.
Vice President of Strategy and Planning
American Television and Communications Corp.

The first week in June was a fascinating time for those interested in consumer electronics. Two major conferences took place in Chicago: the Electronic Industries Association's summer Consumer Electronics Show (CES) and the Institute of Electrical and Electronic Engineers' International Conference on Consumer Electronics, (ICCE). For cable, there is both good news and cause for concern in the conferences' content.

The CES draws over 100,000 attendees and occupies acres of exhibition space. Very few cities are large enough to host this huge convention. New products—and new features on old products—are presented to distributors and dealers for purchase and resale to the public. Items that struck me as particularly relevant to cable included 1) CD video, 2) S-VHS and ED-Beta, 3) picture-in-picture adapters, 4) the homebus, 5) universal remote controls and 6) DAT.

CD video is an interesting evolution of the compact disc (CD). Instead of a maximum of 70 minutes of digital audio, nominally five minutes of video and 20 minutes of digital audio are packaged on a gold-colored disc. Larger formats include 8-inch discs with 40 minutes of video and audio suitable for full-length concerts and 12-inch discs for up to two hours of video. While the audio is digital, the video is analog. It's the old laser disc standard that's been around for a number of years with a relatively small but growing following.

This form held the lead for the best available video until S-VHS and ED-Beta came upon the scene. A significant industry push for CD video was evident. Not only did CD video appear in a variety of manufacturers' booths, but there was a special joint industry CD video exhibition accompanied by considerable flair and publicity.

The modern 45 rpm

The 5-inch disc is billed as the modern 45 rpm record with MTV-like music videos. While skepticism was expressed by those over 40, it would be foolish to ignore its importance. From a cable perspective, the 5-inch disc provides the sizzle from which the older 8- and 12-inch discs derive a new lease on life. The sale and rental of these discs adds to the competition cable experiences from the "physical distribution" of video.

The 5-inch disc will come into its own when the small-screen, portable liquid-crystal color TVs are combined with CD players. Kids with a music video orientation will be able to take this product anywhere. If the videodisc price is reasonable, this could be a significant winner. "Combi" disc players were shown that play all three sizes for video and audio. Some even have data outputs for playpack of CD-ROM disc into personal computers.

Lost in all the discussion was the new compressed video technology from the David Sarnoff Labs. When it was announced during the second Microsoft CD-ROM conference, some predicted that the CD video standard would have to be redrafted to accommodate this new technology. Apparently, the industry has decided to push through the older version of CD video.

Super VHS (S-VHS) was broadly displayed while Sony showed its Beta response, extended definition Beta (ED-Beta). Once again Beta beats out VHS from a technical perspective. But from a sale and marketing outlook, it is unlikely that Sony can make serious inroads into the VHS camp. VHS marketing momentum and greater availability of software will limit the impact from the higher resolution ED-Beta. The Toshiba exhibit had a side-by-side demonstration of two tape players, VHS and S-VHS, playing the same scenes. The difference between the pictures was substantial. While grass was a green blur on VHS, individual blades could be counted on the S-VHS display.

Just a short distance away, advanced TV receivers were on display with off-air Chicago signals. Ghosts spoiled what were otherwise excellent pictures. The images derived from videotape have no ghosts or co-channel interference. This comparison emphasized the importance of fighting coherent interference. For cable, this means a stronger emphasis on eliminating ingress, cross modulation, and beats and tweets.

Two manufacturers showed picture-in-picture (PIP) adapters. These devices attempt to provide a number of the features offered by digital television receivers in a set-top unit. PIP is a smaller picture from a separate source displayed as an inset in the normal TV picture. The importance of this for cable is that it further complicates the consumer electronics interface issue. There are more wires, more ways to get them wrong and a need for another descrambler if the subscriber would like both the main and the inserted pictures to come from scrambled channels. Also, the additional signal processing introduces further signal distortion and additional opportunities for direct pickup of interfering off-air signals.

Mitsubishi and NEC showed two different versions of the homebus. Neither of these demonstrations implemented the technology of the EIA Homebus Committee. However, they did demonstrate the intended functionality. The emphasis at CES did not encompass distribution of video in the home. For cable, this is the most sensitive area to watch. If homes do become cabled, the protocols for distribution of cable signals will become very important to us as well as the quality of the in-home distribution system. We must ensure that a major CLI source is not created.

Several additional "universal" remote controls were displayed. These devices have the potential to reduce the severity of the consumer electronics interface problems with cable. Included in this group was the CORE (controller of remote electronics) by Steve Wozniak, the inventor of the Apple computer. These devices have the promise of improving the consumer electronics interface with cable. However, before the promise is realized, some of the poorly designed implementations will have to be weeded out. Some of these devices are so complicated they actually make life more difficult rather than easy.

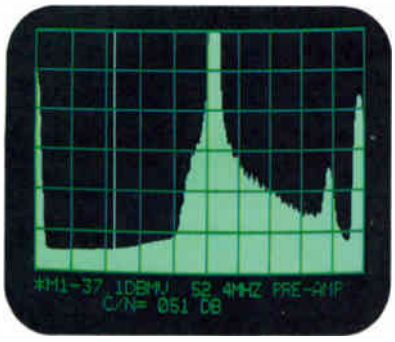
Digital audio tape (DAT) was on display everywhere at CES. Now that we've become accustomed to CD audio quality, DAT's equivalent sound performance doesn't cause much excitement. It's expected. DAT's future in the United States is threatened by the potential for legislation requiring an anti-copying feature. The EIA opposes it. Engineers argue that the proposed techniques distort the high-quality audio DAT was intended to provide and that the technique is relatively easily defeated anyway. Until this issue is resolved, the technology will be on hold. Both DAT and CD audio increase cable subscribers' sensitivity to quality audio.

Technical meeting

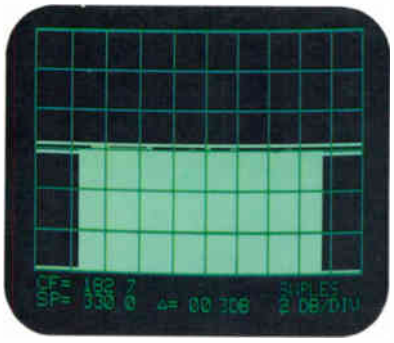
The ICCE conference is a technical meeting with a limited number of hospitality suites containing technical exhibits and literature. Less than 1,000 engineeers attend from all over the world. Japan, Korea, Taiwan, United Kingdom, Germany, Denmark, France, Italy and Sweden are among the countries represented. The primary emphasis of this conference is still television receiver and system design.

The CATV session was very well attended. TV and VCR designers were afforded an opportunity to better understand the implications of cable for their designs. The interface with cable was given considerable attention. The most popular sessions were those dealing with high-definition television (HDTV). This is definitely the subject of the hour. Numerous approaches and developments were described. North American Philips is a major player in this story and had several papers to contribute. There is a growing awareness of the importance of the cable compatibility of any new HDTV system. However, cable involvement in the standards setting process is critically important to avoid onerous standards. The papers from this convention will be published in the August 1987 issue of the *IEEE Transactions on Consumer Electronics*.

This year's CES and ICCE saw greater attendance by cable industry representatives. This is a good omen for the future compatibility of cable and consumer electronics. Increased understanding between the two industries is the secret to better subscriber service through the consumer electronics products they own.



Improve picture quality.



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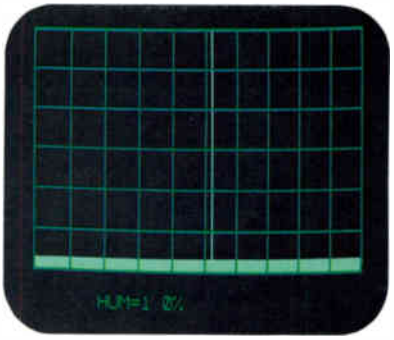
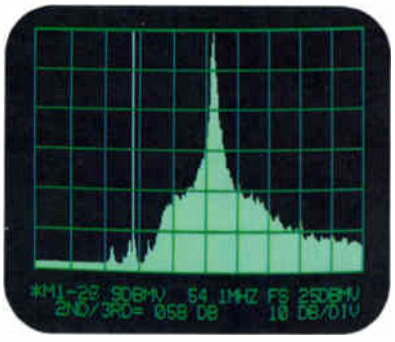
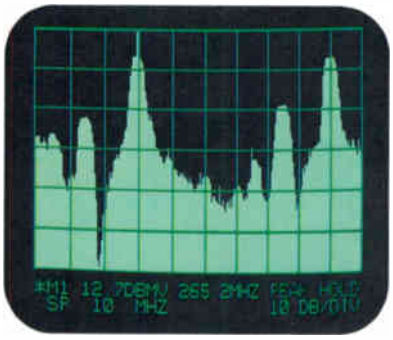


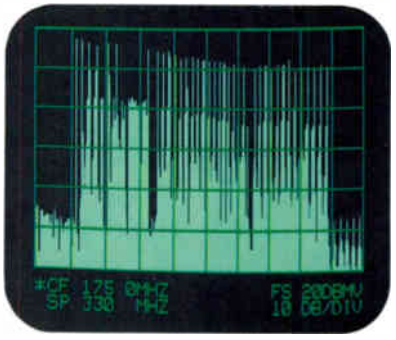
Minimize hum.



Pinpoint distortion problems.



Peak RMS of suppressed sync.



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