COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

Exhibiting consumer friendliness

'88: Seeing is believing

May 1988

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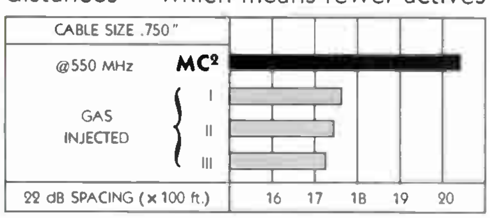

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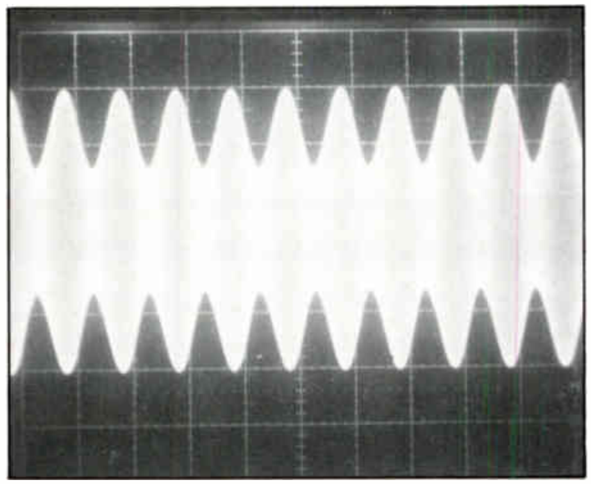
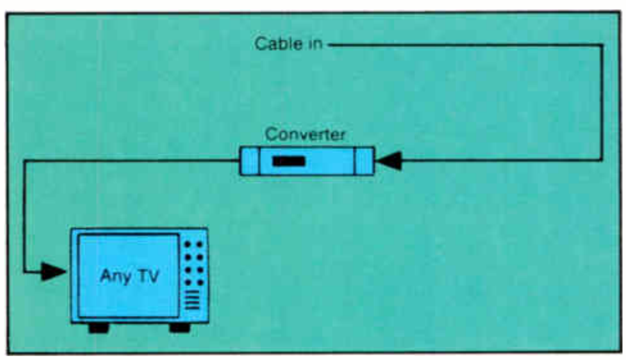
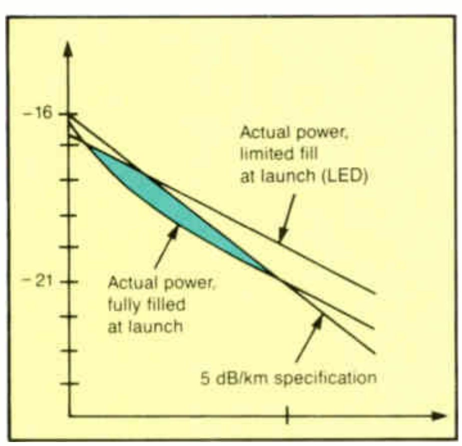






Features

Cover
Photo of sculpture by Bob Sullivan. City photo courtesy of the Greater Los Angeles Visitors and Convention Bureau.

Communications Technology™ (ISSN 0884-2272) is published monthly by Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112 — or — P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023. May 1988, Volume 5, Number 3. Office of publication is 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112. Change of address notices should be sent promptly; provide old (or copied) mailing label as well as new address, including ZIP code; allow 6 to 8 weeks for change. Second-class postage paid at Englewood and Denver, Colo. POSTMASTER: Please send address changes to Communications Technology, Box 3208, Englewood, Colo. 80155.

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.

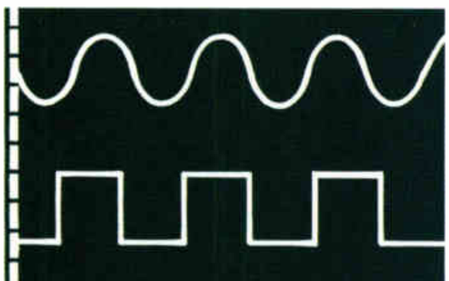
That's because Jerrold's COMMANDER MTS is the only stereo encoder with non-clipping overmodulation protection! There's no way the annoying pops, cracks and distortion that comes from erratic audio input levels can get through to your subscribers, because the CMTS just won't broadcast them. It's designed 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

See it, believe it

Here we are again, at cable TV's annual big event—the National Show, the convention everyone goes to (or would like to). This year's theme is "Seeing is believing" and as usual there are many things to see on the exhibit floor and the technical panels. Nearly 300 exhibitors will display their products or services; 10 technical sessions with about 50 speakers will cover fiber optics, HDTV, impulse ordering technologies, HDTV, signal leakage, HDTV, improving customer service, HDTV, tests and measurements, and (last but not least) HDTV.

It's not difficult to see (or believe) why high-definition television is one of the highlights of this show: This new technology is knocking on the door of our industry. It is threatening us with crisper and brighter TV pictures, better than we can presently achieve. Anyone who hasn't yet seen NTSC and HDTV side-by-side should not miss the opportunity at the show.

"Transmission design considerations for advanced television systems," Monday, May 2 from 12:30-2 p.m., is the first of three HDTV sessions. Nick Hamilton-Piercy of Rogers Cablesystems will moderate a panel of experts on the effects of various advanced TV transmission approaches on existing coaxial systems and vice versa. Panelists include ATC's Walt Ciciora, Rezin Pidgeon of Scientific-Atlanta, Jerrold's Clyde Robbins and Archer Taylor of Malarkey-Taylor Associates.

Later that afternoon, from 4:30-6 p.m., the session "HDTV and cable: A review of the possibilities" explores technical and regulatory issues facing the cable industry in the carriage of HDTV. S-A's Chris Bowick will moderate the panel, which features ATC's Bill Thomas, Yves Faroudja of Faroudja Labs, FCC's Lex Felker and S-A's Gerald Robinson.

On Tuesday at 9-10:30 a.m., Wendell Bailey, NCTA's vice president of science and technology, will give HDTV format inventors a chance to pitch their transmission system's advantages in an "HDTV transmission systems proponents' forum," featuring Richard Iredale (Del Rey Group), Arpad Toth (North American Philips), Yves Faroudja (Faroudja Labs), William Glenn (New York Institute of Technology) and Masao Sugimoto (NHK).

In addition, at the NCTA Services Booth will be copies of the *1988 NCTA Technical Papers* and updates from the NCTA Engineering Committee's subcommittee chairmen and liaisons. Also available are order forms for reprints of special HDTV articles form IEEE and SMPTE publications and the *NAB Engineering Handbook* and conference proceedings.

As usual, it won't be all work and no play. For one, there's Sunday evening's Welcome Party. And the System Awards for Cable Excellence (ACE) will be presented Monday evening in the California Ballroom of Bonaventure Hotel. The

gala dinner dance and national awards ceremony will occur Tuesday evening. (And let's not forget all the great things to do and see in Los Angeles.)

We'll be there in force with copies of our *CT Daily*. If you have any late-breaking news or information on a product you're exhibiting, catch us on the exhibit floor. You'll be glad you did.

Look in the bins for the premiere of our new publication, *Installer/Technician*. This is the one you've been waiting for—the only magazine with features for all levels of CATV installers and technicians. The first issue highlights towers and antennas, as well as logarithms made simple, a factory tour of a drop cable manufacturer, ladder safety tips from the SCTE and much more.

Next stop, San Francisco

Just when you thought you'd seen enough of California, the SCTE Cable-Tec Expo '88 (June 16-19) will be right up on the coast in the city by the bay at the Hilton. Those of you who have not yet preregistered, your deadline is May 13; don't waste time—this is the show you'll be talking about until next year's expo. (See this month's *Interval* for more details.)

Next month, we'll be announcing the winner of the *CT*/SCTE photo contest. We received a number of interesting photos on the topic "technical trials and tribulations." Thanks to everyone who entered.

So have a devil of a time in the city of the angels!

Paul R. Levine

"It's not whether you win or lose. It's how you play the game."

WRC

ONG.

And win you will, with Scientific-Atlanta. We're committed to it. To help you satisfy your customers, and do so efficiently. With value-added, user-friendly solutions from us which help you generate revenue, improve penetration and retention, and run your system better. We're committed to you being a winner.

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WIN THROUGH VOLUME CONTROL

Our new 8590 is the friendliest and fullest featured volume control addressable in the industry. A unique display lets your subscribers *see* sound on a volume level indicator. And it guides them easily through the VCR programming process. The 8590 keeps a secret better, too. With a choice of 50 security modes, utilizing three advanced security technologies: dynamic sync suppression, dropped field, and video and sync inversion. It includes easy-to-implement, plug-in IPPV. It's compatible with the rest of the set-top family. And, since it's also compatible with Oak and a long list of others, the 8590 can help you out with the old and in with the new.

WIN THROUGH VALUE

The new 8570 addressable set-top is the value packed younger brother of the industry standard 8580. It comes with all the subscriber features of its older brother. And then some. It shares the same new advanced VCR timer with the 8580 and 8590, taping twice as many events as before. It simplifies impulse like the 8590, with a one-touch buy key on both the remote *and* the set-top.

Scientific Atlanta

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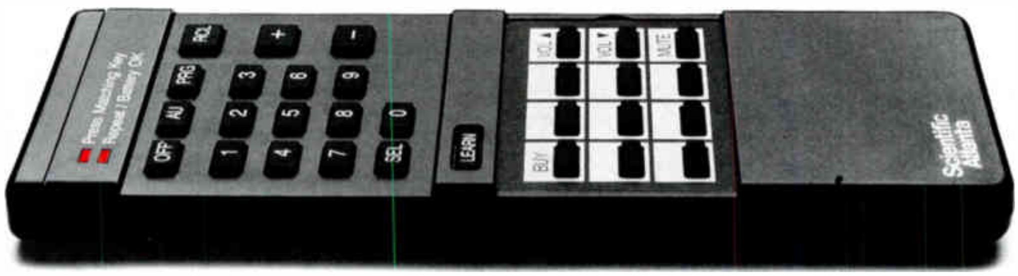

WIN THROUGH FRIENDLINESS

Our Complete Remote Control is so smart it generates revenue while solving problems. Ninety percent of subscribers with set-tops have two or more remotes per set; thirty percent have three or more. That's a problem! The CRC eliminates multiple remotes by quickly and easily learning their functions, without the obsolescence risk of preprogramming. And, if your subscriber has a remote control TV–it can provide volume control *without* a volume control set-top. That's friendliness your subscriber will pay for.

WIN THROUGH CONVENIENCE

Our plug-in Micro-Pulse Module makes IPPV easier. Because the easier we make things, the more they're used. And it's backward compatible to over 70% of our cable installed base. That puts our experience with 300,000 IPPV set-tops in hotels, processing ten million transactions per year, to work for you.

Winning today in cable depends on delivering value. Delivering friendly and convenient solutions subscribers will pay for. And stay for.

WIN THROUGH EFFICIENCY

Our new 9650 IRD beats today's rack space squeeze by cutting space needs in half. The 9650 integrates the leading CATV receiver–the 9640–with a satellite descrambler in one package the size of the receiver alone. Result: You get twice as many channels in the same rack–with perfect compatibility.

wit

win

WIN THROUGH AGILITY

Our new Frequency Agile Drawer gives you agility when you need it. And only when you need it. One drawer that backs-up an entire head-end, eliminating costly spare parts inventories. It provides quick and dependable slide-in convenience for the industry standards, the 6350 modulator and 6150 processor. Its 550 MHz range makes it compatible with every cable system.

ed

WIN THROUGH STEREO

Our 6380A stereo encoder maximizes your customer's listening pleasure. Its peak limiter assures consistent audio levels across all channels, while its alternate audio inputs now let you run local ads in stereo.

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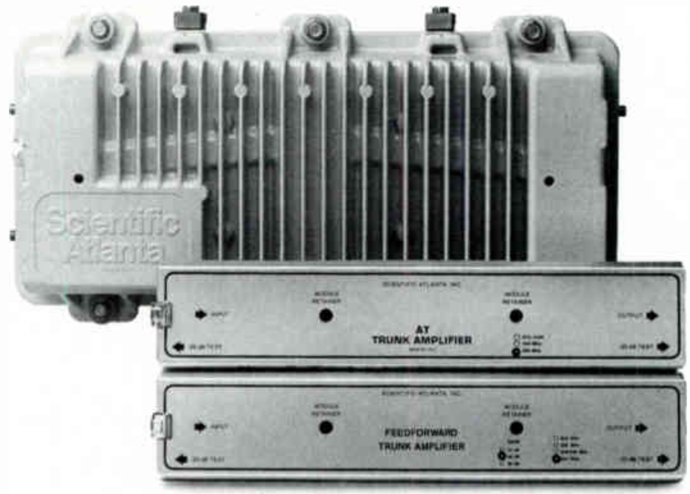
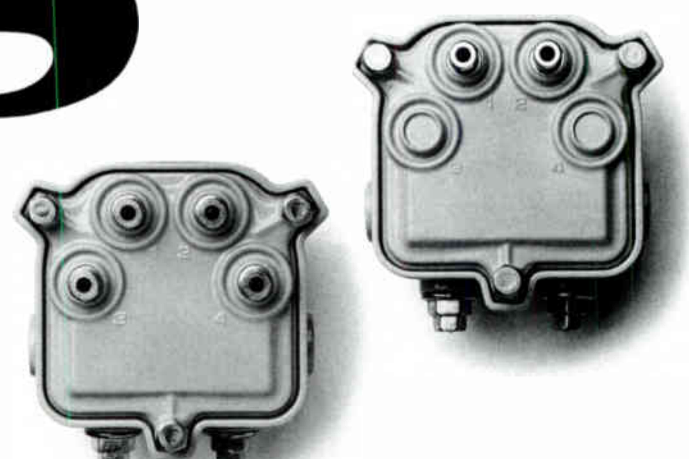


WIN THROUGH REACH

Our AT and feedforward amplifiers give you a full line of "drop-in" upgrades. So you can mix and match to grow capacity more economically. The AT outdistances conventional power doubling and stretches spacing while maintaining high picture quality. Our feedforward amplifiers have sustained over 99% reliability and earned us the industry's largest installed base.



WIN THROUGH TOUGHNESS

Our new taps are easier to install, almost impossible to break, and prepared to face any environment. Like the rest of our distribution line, they will fit any housing we've ever made.

WIN THROUGH TEAMWORK

Play to win with a winning edge. With Scientific-Atlanta. Because we not only solve problems, we create opportunities. And work with you to make the most of them. That's because at Scientific-Atlanta we're committed. Committed to making sure that. . .

Cable '88 to feature advanced TV system

LOS ANGELES—A proposed new broadcast television system for the United States is one of the many new developments that will be presented and discussed here at Cable '88 (The National Show) April 30-May 3. The advanced compatible television system being developed by the David Sarnoff Research Center with active participation by NBC and RCA promises higher definition pictures and a wide viewing screen and can be delivered by all methods of transmission.

In addition to this presentation, about 300 companies will exhibit and 10 technical sessions will be held at the Los Angeles Convention Center.

S-A to unveil products at '88 National Show

LOS ANGELES—Scientific-Atlanta will unveil six new products here at the National Show April 30-May 3. Among the introductions will be two new addressable set-top terminals, an integrated receiver/descrambler, a frequency-agile drawer for modulators and signal processors, an enhanced stereo encoder and new taps.

Details on the new S-A products will appear in the June issue of *CT*.

Cable '88 agenda

Saturday, April 30
12-5 p.m.—Registration open

Sunday, May 1
7:30 a.m.-6:30 p.m.—Registration open
10 a.m.—Grand opening, exhibit hall
10 a.m.-5 p.m.—Exhibit hall open
11 a.m.-12:15 p.m.—Track and technical sessions
2-3:30 p.m.—Opening general session
5-6:30 p.m.—Welcome party

Monday, May 2
7 a.m.-6 p.m.—Registration open
9-10:15 a.m.—Track and technical sessions
9 a.m.-6 p.m.—Exhibit hall open
12:30-2 p.m.—Technical sessions
4:30-5:45 p.m.—Track and technical sessions
6:30 p.m.—System ACE celebration

Tuesday, May 3
7 a.m.-3 p.m.—Registration open
9-10:15 a.m.—Track and technical sessions
9 a.m.-1 p.m.—Exhibit hall open
1-3 p.m.—Closing general session and lunch
6:30 p.m.—Gala dinner dance and awards

Engineering Committee: Toward the future

"CT" is presenting a report of the bimonthly meetings of the Engineering Committee of the National Cable Television Association, written by Brian James, NCTA director of engineering.

WASHINGTON, D.C.—The Engineering Committee's bimonthly meeting was held here Feb. 24-25 with more than 70 engineers from operating, manufacturing and programming present. Improving picture quality and high-definition TV were the major topics of the meeting.

Wendell Bailey updated the members on the recent happenings in Washington. The A/B switch requirements remain in limbo. The court stated that it did not intend to remove the requirement that A/B switch information is to be provided to the cable subscribers. The FCC has requested clarification of the clarification and in the meantime the educational requirements are stayed. The FCC, responding to a petition from the Electronic Industries Association, has stayed the technical requirements for A/B switches. No action has been taken by the commission on the petition for reconsideration regarding terminal devices, but a notice of proposed rules by the commission would replace the rules just issued by the commission. Reply comments in that docket are due in early May. The commission may not act on the petition until all responses are in on the new rule-making.

No action has been taken by the commission regarding automatic identifiers for video uplinks. The proposed dispersal waveform system has the major problem of not being fully developed and, therefore, not testable. HBO has proposed an alternative system using a subcarrier to carry the identification information.

Committees working on Advanced Television Systems continue to meet in and around Washington. Major activity is in the Planning Subcommittee. The working parties of this committee will develop the tests and requirements of an advanced TV system or systems. The Systems Subcommittee, whose working parties are starting to meet, will perform the tests and analysis of proponent systems and recommend a system or systems. The Implementation Subcommittee will then recommend the best method of implementing the proposed system(s).

The Supreme Court has agreed to hear the technical deregulation case. Oral arguments would be heard in late March, and NCTA would be working with the FCC lawyers in preparation for the arguments.

In new business brought up at the meeting, ESPN stated that it was working on implementing an improved ad insertion cueing system. The audio tones will be moved to a new subcarrier and a new cueing system also will be implemented to provide additional information. Initial implementation will take place by the end of the year.

The final report of the Consumer Interconnect Subcommittee was submitted and the subcommittee disbanded. Dave Large was thanked for his efforts in preparing the various reports of the subcommittee.

The HDTV Subcommittee is continuing to prepare test procedures and gather data to describe the cable distribution environment. A questionnaire has been mailed to the top 50 MSOs asking for information on the technical operating parameters of their systems. This information will be used to determine the parameters of a typical system. Tests will then be performed on a number of systems to determine the operating characteristics not normally tested by operations but which could cause problems with an advanced TV signal.

The Super Cable Task Force met at Faroudja Labs to observe a system for delivery of separate color and brightness information using a 12 MHz channel. The results were impressive, but the requirement for a second channel is a serious drawback.

Smart House is an undertaking by homebuilders to provide the homeowner with a computer-controlled home. Appliances indicate their power requirement and only that amount is provided by the outlet. This feature prevents accidental injury to children if they contacted the outlet. In addition, a cable distribution system allows the distribution of cable and other video and data services throughout the home. The designers of the home have a limited knowledge of cable operation and are designing equipment that may cause serious problems when implemented. The cable industry must get involved in the specification of the cable in the home to ensure that the customer is able to use the equipment developed by Smart House.

The development of product with the EIA multiport installed is very slow in coming to market. There are presently TV sets available with the port but not descramblers. The set manufacturers are not happy with the situation, as they have spent money in an attempt to improve the consumer friendliness of their product but the decoder manufacturers have not produced product. This is a great opportunity for the industry to improve consumer friendliness, which will disappear if decoders are not introduced soon.

A questionnaire has been sent to the top 50 MSOs to obtain information on the direct pickup characteristics of cable-compatible TV sets. Set manufacturers do not admit to a problem with direct pickup on these sets and they need a showing that sets located near transmitters suffer from direct pickup.

NCTA has not received any complaints of interference from amateur operators recently. This is due to a better working relationship between the cable operators and local ham operators. This cooperation must continue to ensure both cable operators and hams can continue to co-exist. Cable operators should attend local ham meetings to help develop this relationship. Any complaints for ham operators should be acted upon quickly. In addition, the amateur operators should be informed of action taken.

PTS, Brad Cable announce merger

BLOOMINGTON, Ind.—PTS Corp. and Brad Cable Electronics merged April 1 to form BradPTS. This merger completes the consolidation of PTS, Brad, Katek and RF Analysts into one firm with 13 nationwide repair and sales centers to serve CATV systems in the United States, Canada and Mexico.

Jack Craig, president of PTS, was named president of the new organization. Jeff Hamilton, PTS vice president of marketing, will serve as executive vice president. Robert Price will continue as senior vice president of sales. Ben Price, president of Brad, will assist in the merger transition to facilitate the change in management.

SCTE membership surpasses 4,000 mark

EXTON, Pa.—The Society of Cable Television Engineers recently announced that its membership surpassed 4,000. It also reported that a record 298 new members joined in February. The SCTE now has 42 chapter and meeting groups, allowing it to bring training opportunities to those unable to attend national events. The Society gained more than 1,000 new members in the last two years, indicating a steady trend of growth. Contributing to this growth are its BCT/E Certification Program, Satellite Teleseminar Program and Cable-Tec Expo, as well as the new Installer Certification Program planned for this summer.

For more information on the SCTE's growth, see the article in this month's *Interval*.

GTE Labs develop laser for fiber optics

WALTHAM, Mass.—Scientists at GTE Laboratories recently set a world speed record by developing a laser that operates at 22 billion cycles per second—fast enough to send 200-400 separate video channels over an optical fiber. The development tops the previous laser speed record of 18 billion cycles per second set by GTE in 1986.

Tiny diode lasers are essential to optical fiber systems because they generate streams of light pulses to carry voice, data and video signals at high speeds through the glass fiber, making it a preferred medium for carrying video signals. GTE recently demonstrated that high-speed lasers, when combined with traditional satellite techniques, can be used to send 60 video channels over a single fiber. GTE is currently developing lightwave systems that will use the new lasers to carry as many as 300 video channels.

- Booth Communications will purchase Pioneer's BA-5000N series multi-vendor compatible addressable converter for its Salem Cable TV system in Salem, Va. These converters will replace the Regency converters presently used in the system.
- The General Instrument/Jerrold Division dual cable redundant local area network installed at Walter Reed Army Medical Center in Washington, D.C., by R & E Electronics has successfully employed the new advanced status monitor (ASM) since last May. According to R & E, the ASM has enabled the hospital to maintain the system with virtually no downtime. Jerrold also was chosen to supply equipment for Manhattan Cable TV and Paragon Cable Manhattan, which jointly pass 700,000. Both systems are upgrading to 550 MHz.
- Scientific-Atlanta recently installed its 2,000th one-way and two-way addressable site in the CATV and private cable markets. Also, Continental Cablevision of Jacksonville, Fla., signed an agreement with S-A to purchase $3 million of its distribution and headend equipment, for upgrade of its 3,000 mile system; S-A will provide technical training and engineering help as well as on-site training for Cablevision's personnel.
- United Cable Television agreed to purchase $50 million worth of impulse-capable addressable equipment from the Jerrold Division of General Instrument to be used in subscriber upgrades in Denver; Tulsa, Okla.; and Hartford, Conn. In addition, four major metropolitan systems are installing the Jerrold impulse technology in almost 500,000 homes; the systems are Scripps-Howard in Sacramento, Calif.; Continental Cablevision in Jacksonville, Fla.; and Comcast's two Philadelphia areas.
- For the three months ending Jan. 31, Texscan Corp. reported net sales of $8.6 million and net income of $1.35 million. Texscan also has been granted authorization to be listed on the National Association of Security Dealers Automated Quote system under the symbol TXCN.
- The Gentec Corp., parent company of Irwin Industries, acquired Superior Cable Construction. The new company will be renamed Superior Communications Construction.
- RMS International, formerly RMS Electronics, moved its corporate headquarters, warehousing and production facilities from Bronx, N.Y. to 621 Route 46, Hasbrouck Heights, N.J. 07604. The new phone number is (201) 288-8833.
- Pirelli Cable Corp. recently started construction of a new research and development facility in Lexington, S.C., designed to concentrate largely on fiber optics as well as medium-voltage power cables. The center is being built in part with the help of a $3.8 million grant to Lexington County from the U.S. Economic Development Administration.
- Eastern Instrumentation of Burtonsville, Md., will represent Marconi Instruments' test and measurement product line in the Maryland and Washington, D.C., area.
- Zenith Electronics Corp. announced a loss of $19.1 million for 1987, compared to a loss of $10 million for 1986. Total sales for 1987 were $2.4 billion, up 25 percent from 1986 sales of $1.9 billion.

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5	19	33	47	61	75	89	103	117	131
6	20	34	48	62	76	90	104	118	132
7	21	35	49	63	77	91	105	119	133
8	22	36	50	64	78	92	106	120	134
9	23	37	51	65	79	93	107	121	135
10	24	38	52	66	80	94	108	122	136
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You and me and the IEC

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

Back in March 1986, by way of this magazine, I addressed an open letter to the National Cable Television Association: "Support the IEC Subcommittee SC-12G." At that time, I was on the IEC (International Electrotechnical Commission) mailing list as an interested American manufacturer and a member of EIA (Electronic Industries Association). I played a necessary role in EIA and Federal Communications Commission standards bodies as a means of anticipating new product trends for our company, as well as aiding the American competitive posture in the electronic world marketplace.

Again, in July 1986, another of my editorials treated the subject of cable television standards, both domestic and foreign, from a historical and personal viewpoint. Just in case you are one of the rare engineers who have not kept all past issues of *CT* close at hand, here is a repeat and update on the current scene in domestic and world standards committees relating to the cable profession.

The FCC, Underwriters Laboratories, National Electrical Code and rulings by state and local agencies more or less supervise the construction and operation of cable companies. In our democratic manner (and I am not recommending a stronger bureaucratic approach), cable customers are serviced with widely varying levels of picture quality, safety and reliability. I was a member of the Cable Technical Advisory Committee (CTAC) for five years, at the behest of the FCC, in the company of well-motivated and public-spirited engineers, who delivered an excellent document to the FCC. The CTAC study group has vanished, but cable and its technical progress continues to require guidance by all concerned.

A vacuum exists that is drawing its life's breath from foreign study groups, manufacturers and engineers with rare puffs of oxygen from American manufacturers and the financially limited studies of NCTA engineering committees. Let us face the fact—there are virtually no laboratories in the United States today with the budget and staff dedicated to television and cable systems research on a continuing basis that can match even some of the smaller European members of IEC.

In 1918, the privately funded, non-profit American National Standards Institute (ANSI) was founded by five societies and three federal agencies to coordinate the development of voluntary standards in the United States and to approve standards as national consensus standards. In 1946, 25 countries formed the International Organization for Standardization (ISO). IEC was founded in 1906 by national committees from each country. ANSI administers the coordination with IEC through the U.S. National Committee (USNC).

A loose mix

Our country is practically the only member with its loose mix of government regulations, sporadic technical studies and voluntary industry compliance with standards. Until the '60s, we dominated the world television scene with technology and manufacturing. There was little incentive to participate in international harmonization of standards in order to facilitate world trade. Since then, not only have the other countries exceeded our technical accomplishments, but our products are now being rejected because they cannot meet the new, higher standards set by ISO, IEC, GATT (General Agreement on Trade and Tariffs), ACOS (Advisory Committee on Safety), IECEE (IEC System for Conformity Testing to Standards for Safety of Electrical Equipment), CCB (Committee of Certification Bodies), CTL (Committee of Testing Laboratories) and the biggest hurdle of them all, CENELEC (European Committee for Electrotechnical Standardization). There are others! The new U.S. trade agreement with Canada implies the need for all products sold in Canada to meet world standards.

The United States participates in some 2,200 international standards committees and subcommittees. IEC has as its particular charge electrotechnical standards. The IEC subcommittee 12G sets the standards for wired cable distribution. USNC as a participating member (P) carries out its obligations with the help of voluntary technical advisory groups (TAGs). A technical advisor (TA) is appointed by USNC to coordinate and develop the U.S. viewpoint on standards under study by the IEC. The IEC procedure for setting standards is lengthy, complex, fair, intelligent and strict. As of December 1986, USNC appointed me to the post of TA (Pro Bono) to IEC SC12G. And what did I find when I undertook the awesome responsibilities of this prestigious position? Deafening silence! *You* are not involved.

"You" includes what should be the mirror images of the other members of IEC—well-funded and staffed government laboratories, 54 percent R&D budgets in every television enterprise, mandatory compliance with standards and thorough and ongoing standards committees. I hold high my lamp and search, but you are nowhere in sight! Perhaps in the future, as I reveal some of the current standards deliberations, you will appear from the shadows. Let us pray.

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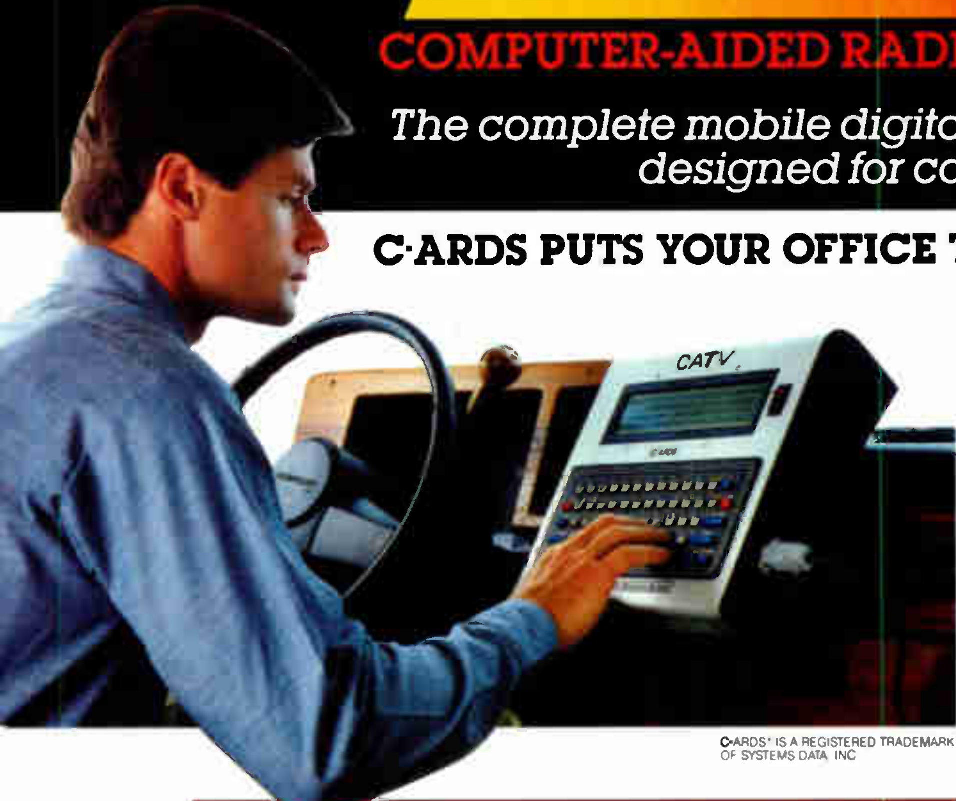

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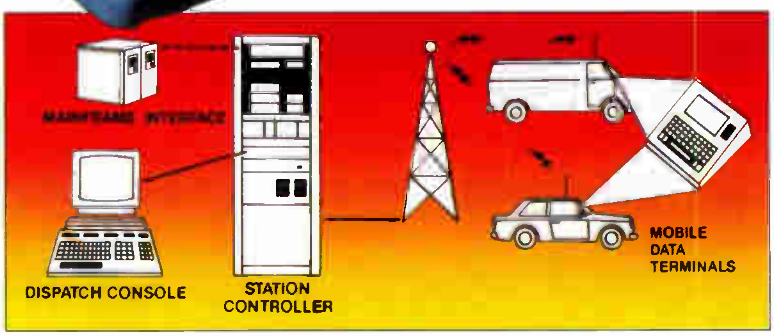

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Consumer interfaces

By Earl Langenberg
Director of Engineering and Technology
American Television and Communications Corp.

From a cable operator's perspective, consumer interfaces involve customer-related equipment required to deliver entertainment television along with peripheral devices that are perceived by customers to enhance the value of cable TV. Some of the more prominent include converters, EIA IS-15 addressable decoders, off-premise addressable taps, universal remote controls, routing switches, cable-compatible TVs and other video.

- *Converters* are for the most part required to accommodate cable channels that cannot be tuned directly on a TV set. Some operators view them as a cost of doing business and as such offer low-cost set-top converters with no remote control capability. Others view converters as luxury devices that enhance the value of cable and generate premium rental income. Luxury converters include baseband video converters that can remotely control channel changes, volume, a favorite channel memory, parental control and a myriad of other features.

Signal security can become an interface issue when converters incorporate a decoder to unscramble signals that have been encoded (scrambled) at the headend. The issue develops when a converter/decoder operates in conjunction with a cable-compatible TV and some remote control features are disabled. This issue can be resolved by either making available a converter/decoder with built-in features that are comparable to the cable-compatible TV or by using an IS-15 multiport decoder. Signal security systems that incorporate passive traps or employ local jamming techniques outside of the home are considered user-friendly and as such are not an issue with customers.

- The Electronic Industries Association (EIA) *IS-15 multiport* is a 21-pin baseband connection developed to accommodate scrambling decoders without inhibiting the remote features of a TV set or VCR. It is important to have this device available because many system operators will be forced to scramble signals indefinitely. Scrambling is required where the cable operator has no control of the outside cable plant. Examples of this include inaccessible and high crime areas in large urban cities, highly transient multiple dwelling complexes and where flush-to-grade vaults are used. In each of these examples signals are easily accessed by would-be illegals, difficult to audit and as a result require highly secure scrambled signals to protect services. It is essential, therefore, that the cable-compatible TV and decoder be equipped with IS-15 multiport connectors.

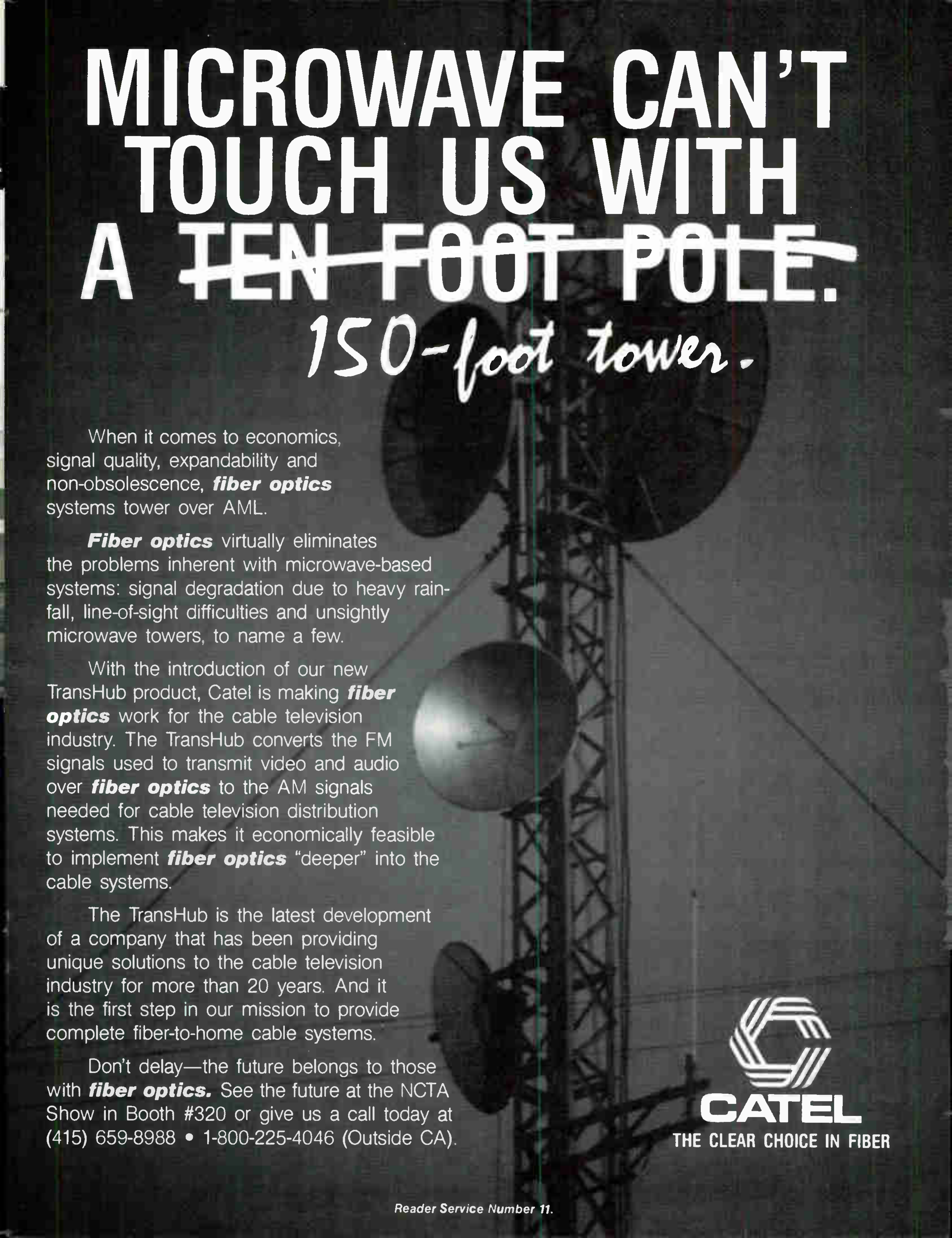
- *Off-premise addressable taps* have long been viewed as the most desirable way to deliver and secure services. They are inherently consumer-friendly and can improve a system's technical operating efficiency. They are consumer-friendly because authorized services subscribed to by a customer are delivered unscrambled and can be connected directly to a television or VCR. Unauthorized signals are simply not available in watchable form. System technical operating efficiency is improved because truck rolls for reconnects, disconnects and changes of service are eliminated. Until recently, reliable cost-effective off-premise devices have not been available. Indications are that this is changing and that reliable, secure, cost-effective devices will soon be available.

- *Universal remote controls* were developed to reduce the number of product-specific remotes typically found in homes today. Varying in complexity and compatibility, these devices are either programmed by the customer or come preprogrammed from the factory to emulate devices they are intended to replace. Some operate by sending a single command and others can be programmed to invoke complex macros. One example of a program macro might, with a single push of a button, turn on the television, cable converter and VCR, tune in the channel to be viewed and begin recording.

- *Routing switches* are used by subscrib-

Channelization plan

Cable channel designation	STD (MHz)	HRC (MHz)	IRC (MHz)	Cable channel designation	STD (MHz)	HRC (MHz)	IRC (MHz)	Broadcast designation	MHz
1 A-8		72	73.25	65	469.25	468	469.25	14	471.25
2	55.25	54	55.25	66	475.25	474	475.25	15	477.25
3	61.25	60	61.25	67	481.25	480	481.25	16	483.25
4	67.25	66	67.25	68	487.25	486	487.25	17	489.25
5	77.25	78	79.25	69	493.25	492	493.25	18	495.25
6	83.25	84	85.25	70	499.25	498	499.25	19	501.25
7	175.25	174	175.25	71	505.25	504	505.25	20	507.25
8	181.25	180	181.25	72	511.25	510	511.25	21	513.25
9	187.25	186	187.25	73	517.25	516	517.25	22	519.25
10	193.25	192	193.25	74	523.25	522	523.25	23	525.25
11	199.25	198	199.25	75	529.25	528	529.25	24	531.25
12	205.25	204	205.25	76	535.25	534	535.25	25	537.25
13	211.25	210	211.25	77	541.25	540	541.25	26	543.25
14 A	121.25	120	121.25	78	547.25	546	547.25	27	549.25
15 B	127.25	126	127.25	79	553.25	552	553.25	28	555.25
16 C	133.25	132	133.25	80	559.25	558	559.25	29	561.25
17 D	139.25	138	139.25	81	565.25	564	565.25	30	567.25
18 E	145.25	144	145.25	82	571.25	570	571.25	31	573.25
19 F	151.25	150	151.25	83	577.25	576	577.25	32	579.25
20 G	157.25	156	157.25	84	583.25	582	583.25	33	585.25
21 H	163.25	162	163.25	85	589.25	588	589.25	34	591.25
22 I	169.25	168	169.25	86	595.25	594	595.25	35	597.25
23 J	217.25	216	217.25	87	601.25	600	601.25	36	603.25
24 K	223.25	222	223.25	88	607.25	606	607.25	37	609.25
25 L	229.25	228	229.25	89	613.25	612	613.25	38	615.25
26 M	235.25	234	235.25	90	619.25	618	619.25	39	621.25
27 N	241.25	240	241.25	91	625.25	624	625.25	40	627.25
28 O	247.25	246	247.25	92	631.25	630	631.25	41	633.25
29 P	253.25	252	253.25	93	637.25	636	637.25	42	639.25
30 Q	259.25	258	259.25	94	643.25	642	643.25	43	645.25
31 R	265.25	264	265.25	95 A-5	91.25	90	91.25		
32 S	271.25	270	271.25	96 A-4	97.25	96	97.25		
33 T	277.25	276	277.25	97 A-3	103.25	102	103.25		
34 U	283.25	282	283.25	98 A-2	109.25	108	109.25		
35 V	289.25	288	289.25	99 A-1	115.25	114	115.25		
36 W	295.25	294	295.25	100	649.25	648	649.25	44	651.25
37 AA	301.25	300	301.25	101	655.25	654	655.25	45	657.25
38 BB	307.25	306	307.25	102	661.25	660	661.25	46	663.25
39 CC	313.25	312	313.25	103	667.25	666	667.25	47	669.25
40 DD	319.25	318	319.25	104	673.25	672	673.25	48	675.25
41 EE	325.25	324	325.25	105	679.25	678	679.25	49	681.25
42 FF	331.25	330	331.25	106	685.25	684	685.25	50	687.25
43 GG	337.25	336	337.25	107	691.25	690	691.25	51	693.25
44 HH	343.25	342	343.25	108	697.25	696	697.25	52	699.25
45 II	349.25	348	349.25	109	703.25	702	703.25	53	705.25
46 JJ	355.25	354	355.25	110	709.25	708	709.25	54	711.25
47 KK	361.25	360	361.25	111	715.25	714	715.25	55	717.25
48 LL	367.25	366	367.25	112	721.25	720	721.25	56	723.25
49 MM	373.25	372	373.25	113	727.25	726	727.25	57	729.25
50 NN	379.25	378	379.25	114	733.25	732	733.25	58	735.25
51 OO	385.25	384	385.25	115	739.25	738	739.25	59	741.25
52 PP	391.25	390	391.25	116	745.25	744	745.25	60	747.25
53 QQ	397.25	396	397.25	117	751.25	750	751.25	61	753.25
54 RR	403.25	402	403.25	118	757.25	756	757.25	62	759.25
55 SS	409.25	408	409.25	119	763.25	762	763.25	63	765.25
56 TT	415.25	414	415.25	120	769.25	768	769.25	64	771.25
57 UU	421.25	420	421.25	121	775.25	774	775.25	65	777.25
58 VV	427.25	426	427.25	122	781.25	780	781.25	66	783.25
59 WW	433.25	432	433.25	123	787.25	786	787.25	67	789.25
60 XX	439.25	438	439.25	124	793.25	792	793.25	68	795.25
61 YY	445.25	444	445.25	125	799.25	798	799.25	69	801.25



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ers to interconnect their televisions, VCRs and converters. Without a routing switch, customers would require a separate converter for each TV set and VCR. Routing switches can be external or built into a television or VCR. It is important to note that if a routing switch is not used to interconnect a television, VCR and converter, and full functionality is to be maintained, five A/B switches and a signal splitter would be required. Less flexible systems are possible, the simplest being a single A/B switch and splitter.

- Cable operators have long encouraged the development of *cable-compatible TVs*. Set manufacturers have attempted to meet both consumer and cable industry expectations; initial efforts simply replaced twin lead 300-ohm antenna input terminals with a coaxial cable F-type connector. Soon after introducing the F connector, sets appeared on the market with expanded tuning capability, and more recently some have added the IS-15 multiport connector.

There are three major areas of concern that must be addressed by TV manufacturers before cable-compatible sets can be universally accepted by the cable industry:

1) *Channel capacity*. Today's state-of-the-art 54 MHz to 550 MHz cable system is capable of delivering 83 cable channels (Chs. 1-78 and 95-99). Cable-compatible sets in service today tune between 12 and 125 cable channels. In addition to the 12 standard VHF broadcast channels there are 58 more that are tunable between VHF cable Ch. 1 and UHF broadcast Ch. 14. UHF Chs. 14-69 overlap in frequency with cable Chs. 65-125 (see accompanying table). The video carriers of UHF broadcast channels are 2 MHz higher than those of standard cable channels. Some cable-compatible sets use this common UHF tuner spectrum, tune 2 MHz below the UHF carriers and make available a total of 125 cable channels, as follows:

1	cable Ch. 1
12	cable Chs. 2-13
5	cable Chs. 95-99
52	cable Chs. 14-65
+55	cable Chs. 66-94, 100-125
125	total cable channels
+56	UHF broadcast channels (Chs. 14-69)
181	total UHF broadcast and cable channels

In addition, tuners must be capable of electronically or mechanically switching between HRC, IRC and conventional assignments as specified in EIA Standard 6. Some cable-compatible sets now incorporate this feature.

2) *Distortion*. When single conversion tuners used in cable-compatible sets are subjected to many contiguous cable channels, second- and third-order distortions will be difficult to suppress to a level not visible in TV pictures. Converters utilize a double conversion tuner to solve this problem. At least one tuner manufacturer reported that the incremental cost of a double conversion tuner is approximately $3.50 over that of a single conversion tuner.

3) *Isolation*. Many cable-compatible sets are inadequately shielded from direct off-air pickup of broadcast channels. Direct off-air pickup of broadcast channels transmitted on frequency through cable plant can result in ghosting. When cable channels are offset in frequency this deficiency can manifest itself as beats in the picture. This is a problem with the set, yet customers will blame the poor picture quality on the cable company. Converter manufacturers learned early of the importance of adequate shielding.

- *Other video* sources available to our customers are becoming more diverse and of higher quality. Examples include:

1) *Super-VHS (S-VHS)*. Super-VHS and extended definition Beta are videocassette recorders that incorporate specialized circuitry to enhance video quality. In addition, a luminance/chrominance (Y/C) interconnect, known as a super "S" output, is provided to display the video on a television equipped with a similar input. Special S-VHS camcorders round out the system, making a high quality, cost-affordable system. S-VHS VCRs will play conventional tapes; however, they are designed to record using S-VHS tapes.

2) *Laservision/compact disc video (CD video)*. Devices are available that display a combination of music video and CD audio or a full-length movie on a built-in or external monitor.

3) *High-definition television*. HDTV delivery over cable is two to five years off in the United States. However, knowledge of its existence is important as it could substantially impact a cable system's future plans. The Japanese Broadcasting (NHK) production format has become the de facto standard for the United States; however, the transmission standard is not nearly as clear cut.

A number of compatible NTSC and non-NTSC compatible HDTV systems have been proposed. Compatible NTSC single-channel systems include ACTV-Advanced Compatible Television (David Sarnoff Labs/GE/NBC); HD-NTSC (Richard Iredale/Compatible Video Consortium); Massachusetts Institute of Technology (Schriber/Committee on Advanced Television Systems); and MUSE-Multiple Sub-Nyquist Sampling Encoding (NHK). Two-channel compatible systems are ACTV; HD-NTSC (North American Philips); and GLENN (New York Institute of Technology).

Non-NTSC compatible single-channel HDTV systems include one from Massachusetts Institute of Technology and four MUSE: NTSC MUSE-6 (6 MHz), NTSC MUSE-9 (9 MHz), Narrow MUSE (6 MHz) and MUSE (8.6 MHz). The only two-channel non-NTSC compatible system also is a MUSE.

Our cable customers' perspective of consumer interface issues has not changed, they simply want cable to be user-friendly. Cable systems should deliver quality services in a way that complements home electronics, not compete with them.

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* Based on generalized parametric cost comparison (6 Paths/15 Years) between low power, single channel AML microwave system and Fiber Optic cable system, as reported by Comcast Cable Communications, Inc., in Communications Engineering and Design, March 1988. ** In Continental U.S. Only

Reader Service Number 13.

Interfacing in the year 2000

By H. Mark Bowers
Director, Technical Planning
Centel Cable Television Co.

The intent of this article is built upon several suppositions. The first premise: The television business and its technology is and should be rapidly evolving into a full *broadband telecommunications* environment. The cable system of 10 to 20 years hence will be drastically different than today's. The telephone industry is undergoing a similar evolution—perhaps revolution—and it, too, will become a broadband telecommunications environment instead of today's narrowband one.

A second premise: Both technologies are on intersecting evolutionary courses and will converge at some future date. How can we prepare ourselves for the broadband telecommunications system of tomorrow? By better understanding where both industries are heading, their long-term goals and purpose and by how their technologies are evolving.

A third premise: The consumer interface issues both industries face today are important and should be addressed very carefully. We must keep our eyes to the future as well as the present if these issues are to be adequately confronted in a rapidly evolving industry and technology. Some parallels between both industries are now in order.

The telephone industry

The telephone industry for many years existed to provide one basic service: POTS or "plain old telephone service." Those days are gone. A specific example would be the evolution of ISDN (Integrated Services Digital Network). ISDN is perceived as the service that will lead to the broadband environment of the future. From its inception in the early 1970s it has held the promise of wider bandwidths allowing voice, data, audio and video signals to use the same transmission path. Advances in digital switching are allowing ISDN to become a reality with numerous private trials being conducted. The establishment of ISDN in the public switch network will occur sometime in the near future, although it will occur at first in isolated areas rather than generally throughout the nation. ISDN as originally envisioned is still basically a narrowband copper-based service and does not address broadband demands or requirements.

Further, the current availability of low-cost fiber-optic cable has already provided the means to far surpass the two 64 kbps B channels and one 16 kbps signaling D channel transmission rates of present ISDN. It is apparent that even if ISDN becomes popular, it may not satisfy the growing communication requirements of the future. A data rate of 565 Mbps is now found frequently on long-haul telephone fiber routes and transmission equipment operating in the 1 to 2 Gbps range is becoming a reality. Estimates for individual user requirements range from today's 64 kbps to high-resolution computer graphics needs of 100 Mbps in the future. Business bandwidth requirements range from 10 Mbps to 1 Gbps. Future (local area network) and video requirements help drive these high bandwidth needs. HDTV alone could require as much as 200 Mbps per channel if a digital transmission mode is ultimately used.

Obviously, ISDN will have to evolve to remain a viable service in a future broadband environment. It is anticipated that ISDN will eventually develop into a broadband service. Much of the telephone network access in the next 10 years will still remain with the copper-based analog network. ISDN will provide access for low- and medium-speed data transmission, but a broadband ISDN (B-ISDN) will evolve for high-speed access. The proposed B-ISDN will incorporate performance characteristics of fiber optics with new standards that are 150 Mbps per individual B-ISDN channel and 600 Mbps per B-ISDN aggregate channel. Continued development of standards will allow layers in the network to work together. Telephone company networks have already introduced broadband characteristics on an interoffice basis using DS-3 (OC-1) level signaling over fiber. This will continue to develop as broadband switching capabilities are introduced into the central office environment.

The local loop (subscriber drop) carries a different set of problems in terms of evolution into a broadband medium and delivery system. To provide quality broadband services to the customer calls for fiber optics in the feeder routes, distribution and local loop. The current trend is for broadband capacity to continue to evolve toward the customer. Fiber was initially installed in large quantities by interexchange carriers providing high capacity, long distance voice and data transmission. Interoffice use of fiber followed next, allowing broadband high-speed data transmission rates between central offices. Now fiber is being used extensively for feeder and distribution routes, particularly to remotes.

The next step, depending on the development of switching and interface capabilities, is fiber optics to the subscriber. Fiber optics in the local loop is highly dependent on continued price declines in fiber technology.

"The continued decline of the cost of fiber... will further drive and expand its use."

It is essential that the price/performance ratio of fiber exceed that of copper before general use will be achieved. Broadband services go beyond the present standards for ISDN; fiber in the local loop will be required. An important point to all this—and a parallel with our industry—is that the introduction of fiber is following a path that makes the local loop or service drop the last area of introduction. The length of time necessary to get fiber into the loop will depend on fiber costs and the development of economic optical customer premise equipment.

The cable industry

Cable television's technical evolution—or revolution—is taking place along similar lines. Cable TV for many years existed as a delivery medium for entertainment video and audio only. But times are changing. Many cable systems already carry voice and data for their own internal use. Some are beginning to exploit and develop data carriage for outside establishments. Addressable converters and data carriage are causing our technical staffs to have to regroup and train themselves as broadband data technicians. The similarities between local area networks, wide area networks, and the modern cable system are striking and must be developed and cultivated.

Let's examine the early provisional use of fiber optics in cable TV. Although cable TV has been a broadband network for years, fiber-optics application is still in its infancy. Price declines in fiber combined with recent advances in fiber technology and splicing, plus advances in analog and digital electronics available, have attracted much attention in our industry. Current focus is on the use of fiber-optic cable for long distance super-trunking applications between headends but recent developments are causing us to take a new look at our distribution plant as well. Driving forces behind the expanded use of fiber optics in the cable industry include:

- The *lowering of maintenance costs* is projected by some to be as much as 90 percent in some instances. Some factors are reduced amplifier requirements, reduced powering requirements and elimination of signal leakage, which could be a large portion of future maintenance budgets. Distance and equipment cascade limitations attributable to coaxial cable are no longer significant problems. Since glass is not subject to electromagnetic interference, impulse noise and signal ingress are no longer issues. Fiber is a very secure medium. These factors, as well as many others, will contribute to this overall maintenance decrease.
- Fiber optics that connect system areas or headends offer *connectivity* at a scale and convenience level not previously experienced. Signals are easily passed back and forth between centers while maintaining superior quality. As the cable industry expands into new domains (such as expanded adver-

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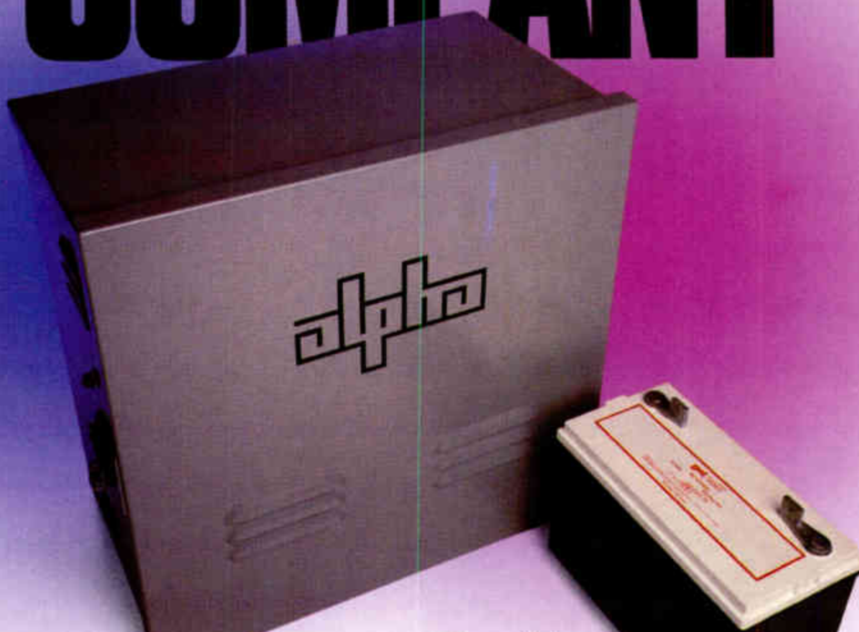

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tising revenues on our channels), the connectivity issue and advantages of fiber become very important.

- The continued *decline of the cost* of fiber and associated electronics will further drive and expand its use, particularly as its advantages become more apparent.
- The extremely low transmission line loss of the fiber will allow future *evolution of system design and architecture*. These evolutionary changes will produce a more reliable, versatile system for our industry. If we are to compete in the broadband telecommunications arena, we must change the opinion of some in other industries that our systems lack reliability and cannot be taken seriously in a business or data delivery environment.
- Some recent analysis done at Centel Cable show that while costs for a particular fiber application may still be higher than other methods, the initial *system capacity gain* would be many times greater. And the new limitation is a function of the associated electronics, not of the single-mode fiber. The most important advantage of fiber probably is that it provides the large bandwidth necessary to integrate numerous communications services into our future systems and operations.

Fiber-optic cable is emerging as the communications medium of the foreseeable future. Once fiber advantages become more apparent and as the price of fiber plus associated electronics continues to fall, the cable industry will implement fiber into our technology rapidly.

This raises new issues. Fiber is not well-suited to the tree and branch architecture of the modern cable system. Tree and branch has served the cable industry well, offering economic design and construction and excellent one-way distribution techniques. It also *requires* ease of splicing and high-quality directional couplers. However, the fiber medium presents problems in both splicing and directional couplers. Beyond that, the broadband telecommunications system of the future will require interactive two-way switching capabilities beyond our present techniques. The switched-star or switched-multistar topology (present telephone system design) would seem to be one possible logical evolution of our system architecture as fiber is integrated and continues to drop in price.

Since coaxial cable is a broadband delivery medium, it could be used for final delivery to the home in a hybrid approach. In the long term the inherent advantages of fiber will ultimately triumph as its costs continue to decline. It is anticipated that by the early to mid-1990s, cable costs will become equivalent using either medium. As stated before, it is essential that the price/performance ratio of fiber exceed that of coax before general use will be achieved.

Future services will go well beyond our present standards, and fiber to the home will require higher transmission and quality standards. Our current introduction of fiber is following a path that makes the subscriber drop the last area of introduction for the cable industry as well. Much of the timing is dependent upon development of economic interfaces for distribution to the customer's premise.

Interface issues

Much of the cost factor of fiber optics, beyond the fiber itself, is dependent upon development of economic interfaces to and in the customer's premises because this further fuels fiber's use. The introduction of these additional fiber-optic interface devices will presumably not simplify the already complex consumer interconnect and compatibility issue. The challenge lies in producing fiber interfaces that are consumer-friendly with each other and with existing equipment.

The availability of a wider range of services with greater capabilities, whether in cable or telephone, will lead to more complex and sophisticated terminal equipment in both the home and business. An existing example of this can be seen in present cable subscriber homes where the "attempted" interconnection of a television, one or more VCRs, a separate BTSC stereo decoder (in some instances with the stereo system), the addressable converter and perhaps an impulse pay-per-view (IPPV) sidecar can lead to scenes of frustration. Even if consumers manage to keep the equipment properly interconnected, they often no longer understand what it will and will not do, and are justifiably discouraged.

Proposed simplification of our systems and the elimination of all signals except unscrambled basic and several unscrambled pays to promote consumer-friendliness sounds good but neglects the broadband telecommunications environment evolving at the present time. It declines to address the expanding area and revenues of IPPV, which now talks in a voice too loud to be ignored. Broadband capabilities to the home and business must afford new video services such as high-definition television (which is creating a new generation of video equipment and new interface issues).

It may be that our future delivery of video will eventually be in digital format. This then implies that future consumer interface equipment must allow for digital-to-analog and analog-to-digital conversions (CODEC functions) and optical-to-electrical and electrical-to-optical (two-way) conversions. It is also quite possible that the means of splitting out signals and routing them to the appropriate consumer equipment will require demultiplexing capabilities as our future telecommunications environment becomes more networked and layered.

The present proposed IS-15 standard will go a long way toward the solution of some of these problems, as it will allow the interconnection of present televisions, VCRs and cable converters without losing remote control and multichannel recording capabilities. The standard also will help pave the way for the use of digital television in our industry.

Even in this area, however, many problems have arisen. Some converter manufacturers are having to fabricate multiple IS-15 models for different televisions and VCRs because of interconnect and AGC incompatibilities. How to handle IPPV functions in the IS-15 unit also is creating problems. New standards will not be incorporated into equipment until there is brisk consumer or industry demand for the functionality it provides. Broadband capabilities can provide exceptional video, audio and data transmission services, but consumers and our industry must be willing to purchase the necessary new equipment.

Hands on the wheel

As our systems become more technically advanced and gain in capabilities, the consumer interface problems and issues have become much more complex as well. The slope of that technology curve will continue to intensify in the coming years. We had all better keep our hands on the wheel; keep the lines of communication open between consumer demands, the cable industry and equipment manufacturers; and look to the future as we plan and cope with the present, so that our customers truly do reap the benefits of our expanding technology.

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The VCR/CATV interface question

By Michael Spratlin
National Sales Manager, Qintar Inc.

Electronics industry sources recently released figures that show sales of VCRs in 1987 as 13.3 million units, with a 52 percent penetration in American households, of which approximately 12 percent were first-time buyers. Closer to home, CATV industry publications have put VCR penetration for cable subscribers between 45 percent in some systems to 70 percent in others. Undoubtedly, the VCR is having one of the most dramatic effects on cable TV of any new technology in home video equipment in recent years.

Increasingly, with new technologies such as BTSC stereo, Super-VHS and high-definition TV, the cable operator (the retailer) is in a quandry as how best to interface these new technologies into the cable system while still maintaining the quality level of service delivered. Of all the product innovations, the VCR offers the operator the greatest challenge in providing the subscriber (the consumer) an easy-to-understand method of interconnecting the VCR with the converter/decoder without sacrificing any of the VCR's features.

More importantly, the opportunity is here for the operator to increase the perceived value of cable TV programming (the retail product) and to become more competitive with other entertainment sources, e.g., off-air TV and videocassette rental stores. The perceived value of cable TV programming to existing and potential cable TV subscribers is directly related to cost, quality and desirability, ease of access and (last but not least) ease of use.

What's the problem?

To fully understand the problem we must look, as an industry, through the eyes of the consumer. First, there was the introduction of the set-top converter, which offered the subscriber more channels of cable programming by utilizing the mid-band and super-band channels. Then, as innovations in technology within the cable industry progressed, scrambling was introduced, which, from the subscribers' viewpoint, neither improved the quality of programming nor of the signal delivered.

From an industry viewpoint, however, scrambling answered some serious problems within the cable industry while creating others. One of the problems for the home videophile created by scrambling is the availability of watching one program while recording another program. This capability in most cases is severely limited. Many of the expensive features of the state-of-the-art cable-ready TV and VCRs had been rendered useless. In addition, the difficulty faced by the consumer with the multitude of various hookups of converter/descramblers, VCRs and TVs is extremely intimidating and frustrating.

Many in the cable industry view the VCR as a problem that results in lack of premium or pay cable programming penetration and subscriber churn, while others see it as a valuable marketing opportunity. Whether a problem or an opportunity will depend on acceptance of the VCR by the industry as no mere phenomenon or fad, but as an extremely popular piece in the videophile's arsenal, and the development of a program to offer a low-cost, user-friendly VCR interface. The interface offered must allow the owner the following features: 1) restore remote capability to the television and/or VCR, 2) maintain CATV signal integrity and quality, 3) provide for timed VCR programming, and 4) allow as many of the view/record capabilities as possible.

Equally important to the success of a CATV/VCR program is the ease of use and the ease of installation of the interface by the customer. Ultimately, the program's success depends on the operator's marketing efforts to increase the customer's awareness of the need for the interface and to promote the ease of use and allay the fears of an additional piece of equipment.

A/B switch solutions

Initially, the most common approach to VCR interface solutions taken by the CATV industry is a configuration of standard A/B-type RF switches and splitters wired together with a plethora of jumper cables. Engineering departments view the A/B switch solution as technically correct and as the simplest way to deal with this bothersome problem. But for the consumer, even once the A/B switch configuration is installed correctly, the confusion of not knowing or remembering what position the A/B switches must be in to accomplish what function is frustrating.

Additionally, having a number of A/B switches, splitters and jumper cables hanging from the back of the customer's television is unattractive and does little to increase the customer's perception of the installation as a professionally installed job. For the equipment manufacturer it is difficult to design and package a consumer self-installable A/B switch VCR interface package due to the numerous configurations necessary for different cable system converter/descrambler situations. Cable systems also are finding that providing the consumer with A/B switch VCR interface packages for self-installation creates unnecessary service calls they had hoped to avoid by using this method.

Integrated switching network

Understanding that the perfect long-term solution to the VCR interface problem was neither at hand nor on the horizon, several manufacturers introduced an integrated switching network labeled with the various functions for simplicity of use by the cable subscriber. Referred to as a video control center (VCC), the device combines all of the switches and splitters necessary for a cable subscriber to watch any channel while simultaneously recording any other channel. The VCC accomplishes its job by taking the incoming cable signal and splitting it three ways. The first leg of the splitter feeds the TV set circuit of the VCC while the second leg feeds the VCR circuit of the VCC. The third leg feeds out of the VCC to the input of the cable converter where the wanted signal is downconverted (usually to Channel 3) and fed back into the VCC. The input and output of the VCR are then fed directly into the VCC. (Some VCCs offer an auxiliary input to accommodate a second VCR, videodisc player, video game or off-air antenna, which, of course, also would satisfy Federal Communications Commission A/B switch requirements.)

The VCC offers four *viewing* choices for the subscriber to choose what is to be watched on the television: 1) standard cable—for viewing Chs. 2-13 (also mid-band and super-band channels if the subscriber owns a cable-ready VCR or TV, 2) converter—for viewing premium channels by tuning the TV set to Channel 3 and setting the converter on the appropriate channel, 3) VCR—for viewing programming from the VCR, e.g., tapes recorded from premium channels, and 4) auxiliary—for viewing the auxiliary input, e.g., off-air antenna.

The VCC offers three *recording* choices for the subscriber to choose what is to be recorded on the VCR: 1) standard cable—for recording Chs. 2-13 (also mid-band and super-band if the subscriber owns a cable-ready VCR), 2) converter—for recording premium channels by tuning the VCR to Ch. 3 and setting the converter on the appropriate channel, and 3) auxiliary—for recording from the auxiliary input of the VCC, e.g., an off-air antenna.

While the video control center is by no means a state-of-the-art or long-term solution, it is the best the industry has to offer at present. Some improvements for the system operator to look for in the near future with VCCs are better port-to-port isolation specs and new packaging to make them more attractive and marketable as an additional piece of home video equipment. As well, color coding of jumper cables and ports on the VCC will make it more consumer-friendly.

Promoting a solution

It is to the benefit of the cable operator to develop a systemwide VCR interface program and market it extensively. There have been several approaches taken to the actual marketing of the video control center. Some systems have chosen to rent the VCC at a minimal monthly fee, looking for a payback in approximately a year with a positive cash flow thereafter. Other systems have decided on the direct sales approach of providing the VCC at a purchase price and making a comfortable profit margin. (Customers should be advised that less expensive switches available in discount electronic stores may not meet cable system or FCC specifications for RF signal integrity and may cause TV reception problems due to poor isolation.) Still other systems have used the VCC as a promotional giveaway during special events to sign up new premium service subscribers or increase the number of premium services taken by existing customers. Another method of marketing the VCC/VCR interface has been to package the VCC, the converter/descrambler and a number of premium pay services in a complete entertainment package provided for a base monthly charge.

The cable industry as a whole and the operator as the front line retailer of programming can continue to wait for engineering to come up with the perfect solution: a solution that will not have a need for another piece of equipment, has no possibility of creating any additional service calls, will have the capability of every view/record possibility conceivable and will have complete stereo capabilities. Or, the industry can seize the economic opportunity to make cable-delivered entertainment programming as readily accessible, easy to use and as desirable to the consumer who owns the VCR or wants stereo TV as any other competitive method of entertainment programming delivery. ■

Interfacing pay-per-view in the cable-compatible home environment

Figure 1: Hookup with converter

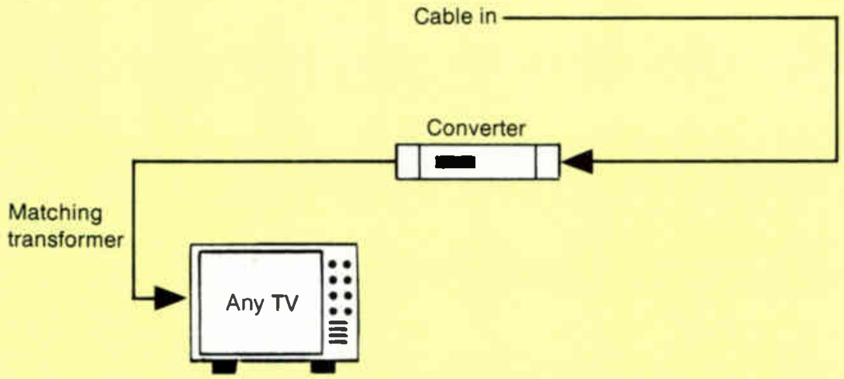


Figure 2: Hookup with VCR in front of converter

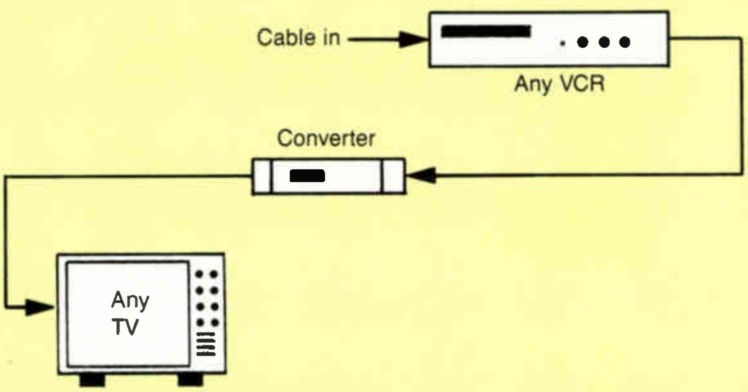
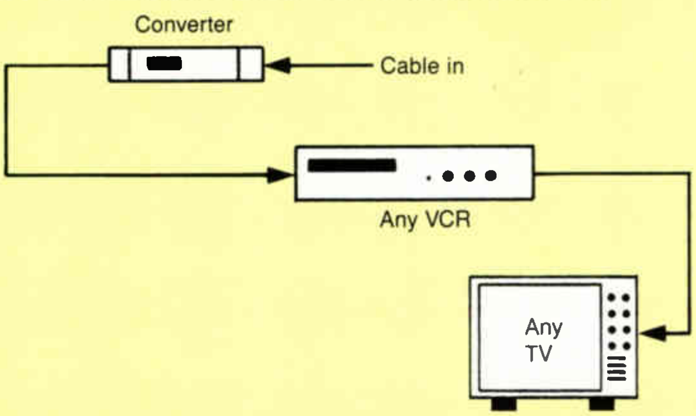


Figure 3: Hookup with converter in front of VCR



By David E. Wachob
Manager, Product Support Engineering
And Joseph Vittorio
Manager, Consumer-Related Products Marketing
Jerrold Subscriber Systems Division, General Instrument Corp.

Pay-per-view (PPV) and other impulse-driven services offer a wealth of exciting opportunities for today's cable subscribers. The expanding impulse universe now includes home shopping and a multitude of other services. The success of these services requires a fundamental understanding of the home environment in which they will be operating.

The popularity of sophisticated audio and video products has led to the increasing complexity of today's home entertainment center. Marrying sophisticated consumer electronics and a cable TV converter is not always a straightforward task. Many times it becomes a nightmare when a new subscriber can't clearly identify what should be done with the equipment configuration. This situation is particularly acute when it comes to interfacing a VCR and/or a cable-compatible TV with a cable service and converter.

The basic conflict arises from having multiple video generating devices and only one video receiver. The receiver might have its own tuning system or function strictly as a monitor, but the user generally hopes to achieve easy selection of an audio/video source. The various video sources could offer both baseband and RF signal outputs and the video receiver might accept both types of inputs. The devices also might intermix inputs and outputs with each other, such as the case of a cable converter and a VCR. The user then must decide on the optimum signal hookup configuration, trying to balance

"Marrying sophisticated consumer electronics and a cable TV converter is not always a straightforward task."

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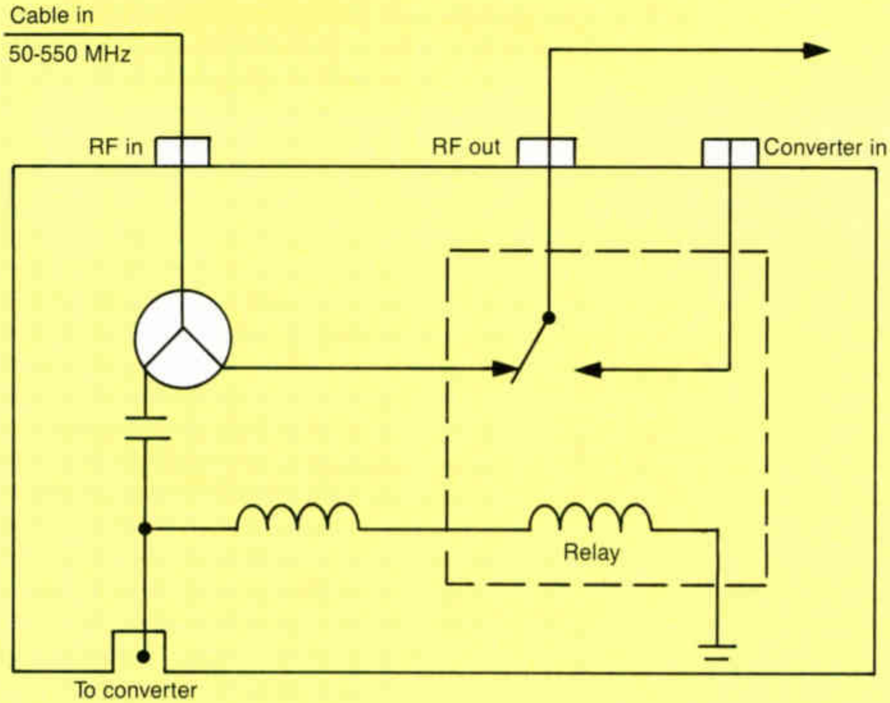
Figure 4: RF bypass option block diagram



convenience with the best signal quality.

A small audio/video patch panel that could be a central signal switching and mixing location for the entertainment system might be considered to maximize convenience and signal quality. The average user, however, is not inclined to get involved with a mini-production studio setup just to effectively operate an entertainment center. If the selection of some of the different signal paths becomes too difficult, the average user will avoid those paths.

One thing is generally certain: Any new addition to the entertainment system must fit in with the existing components so that it does not take away any previous functions or paths. A question that is frequently asked by a subscriber is, "Will I be able to do all the things I did before after I hook this up?" Getting past the customer's fears and misconceptions can be quite a task.

What can a cable operator do to make this encounter pleasant? First, be well prepared. The installer should be trained to interface a variety of home electronics products. Second, the installer should be prepared with a variety of equipment, including splitters, A/B switches and jumper cables. And third, the installer should be diplomatic in explaining to the customer what can or can't be done with the new equipment. These three ingredients are critical to the development of a profitable long-term relationship with a customer receiving PPV or impulse equipment for the first time.

Interfacing challenges

Interfacing PPV into an ever-expanding world of cable-compatible electronics presents some unique challenges, even for those familiar with the issues. The potential problems can be aggravated for systems that had previously only been exposed to minimal converter interface problems through the use of traps. For such systems, the addition of PPV also means the addition of a converter to descramble and credit the service. Several options are possible to facilitate this interface.

Recent National Cable Television Association consumer interface committees indicate no fewer than 27 possible ways to connect consumer electronics with cable TV without even considering stereo or Super-VHS hardware. With such a multitude of possible hookups, the potential for problems and subscriber frustration exists unless the basics are well understood. Once mastered, the addition of PPV to the home will significantly enhance the subscribers' appreciation of cable, as well as provide an additional revenue source for system operators.

In the most fundamental form, the addition of an addressable converter can be accommodated in three straightforward ways. In Figure 1, without any VCR, the addressable converter is placed in front of the television. This allows for viewing/billing of the desired PPV or premium descrambled service for which the subscriber is authorized and, if the television is not cable-compatible, expands its tuning range.

In Figure 2, the VCR is inserted in front of the converter, which is connected directly to the subscriber's television. This setup allows the user to independently record a clear channel while viewing a PPV/descrambled channel on either the same or different clear channel. This is made possible by the VCR's internal RF splitter. In addition, if the VCR is cable-compatible, all clear channels selectable by the VCR can be recorded.

The biggest limitation of this particular configuration, in addition to the signal losses

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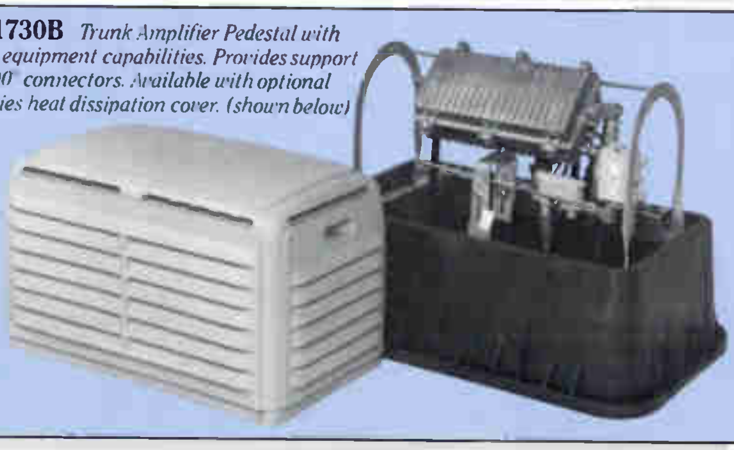

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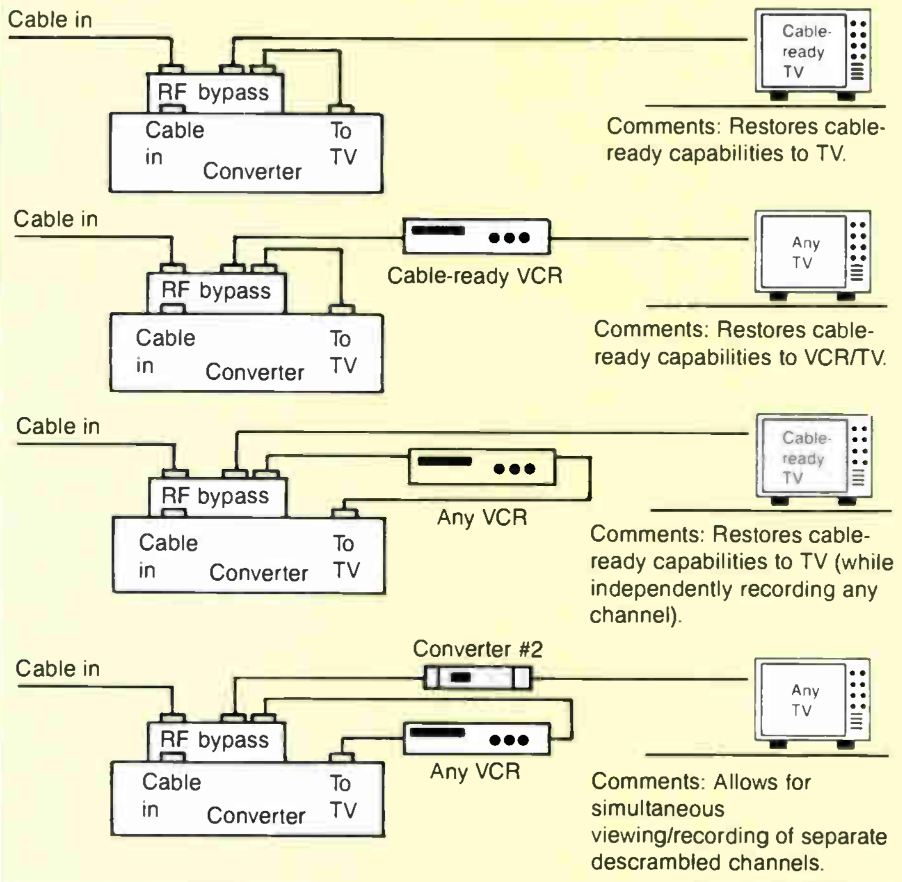
Figure 5: Possible RF bypass option configurations



associated with the VCR's internal splitter, is the inability to record a channel descrambled by the converter. This can be overcome through the use of a baseband converter by looping the converter's baseband outputs back into the VCR's baseband inputs. This approach, in addition to requiring a baseband converter, also requires selecting baseband inputs as the VCR recording source instead of the usual internal tuner source.

In order to record a descrambled channel using a non-baseband converter, Figure 3 is proposed, placing the converter in front of the VCR, which in turn is connected to the television. As in Figure 1, all channel tuning is performed with the converter, since only a single channel is output to the VCR or television. As such, only remote tuning using the converter is meaningful.

As mentioned previously, this approach allows for the recording of descrambled channels as well as clear channels. The limitation is that only one channel at a time can be recorded and/or viewed, due to the single-channel output of the converter. This applies also to unattended program recording, although some of the more advanced converters offer the capability for time-controlled programming of selectable converter channels.

Building on the capabilities and limitations of the three basic configurations, some improvements can be made to increase consumer friendliness. These enhancements use the A/B control signal built into many of today's converters to handle dual-cable

Figure 6: Output A/B switch option block diagram

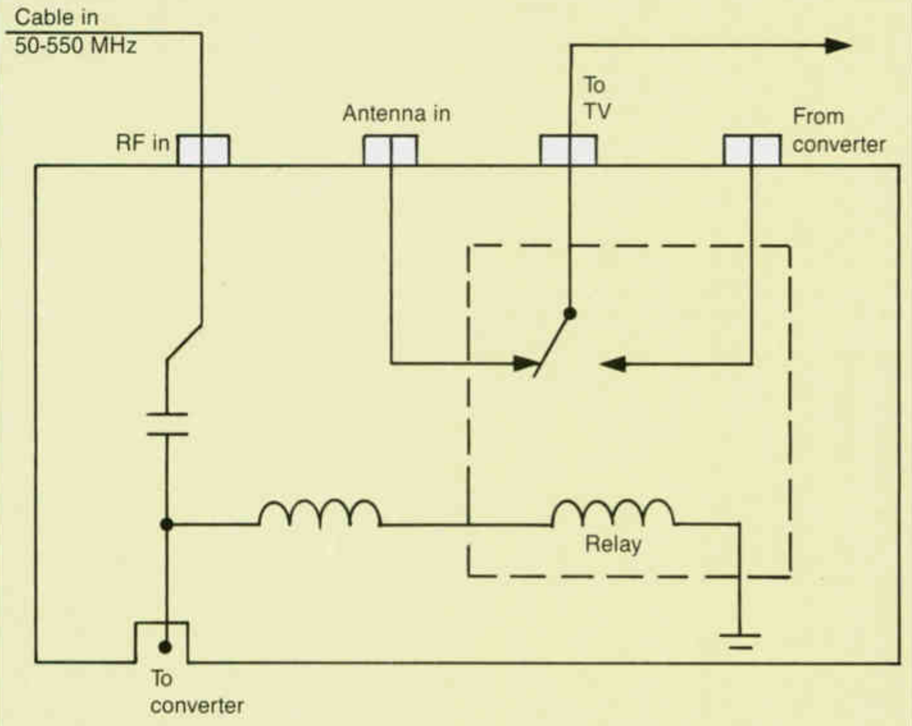
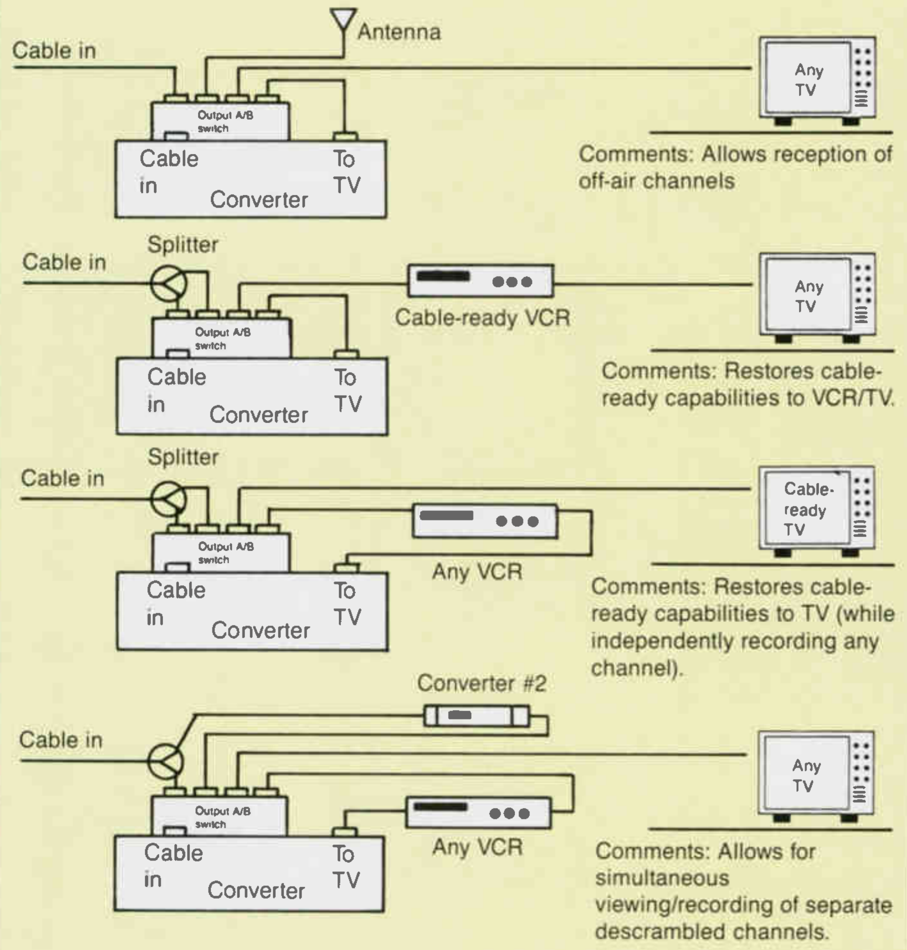


Figure 7: Possible output A/B switch option configurations



systems. While actual dual systems are in a minority, this control signal and its inherent capabilities can be used to benefit the majority of subscribers and minimize interface frustrations.

The majority of the A/B control signals on today's converters are present either as logical control signals on the RF input connector for an externally powered electronic relay or complete converter-powered A/B relay drives. In the latter instance, no additional relay powering is required and the A/B switch attaches directly to the converter. This is controllable via the converter (or remote unit) A/B control button. In the former, a wall-mounted transformer also may be required to provide the drive capability from the converter control signal. Using this inherent control and drive capability presents two possibilities to resolve the consumer interface issue.

The first, illustrated in Figure 4, adds a splitter and switch into a self-contained unit for attachment and powering directly off the converter. This approach, or so-called "RF bypass," allows the converter to be electronically switched in and out of the signal path via the converter or its remote control using the A/B switch button. This then returns full use of a television's cable-compatibility by making the converter transparent to the system when scrambled channels are not involved. Several potential uses are illustrated in Figure 5.

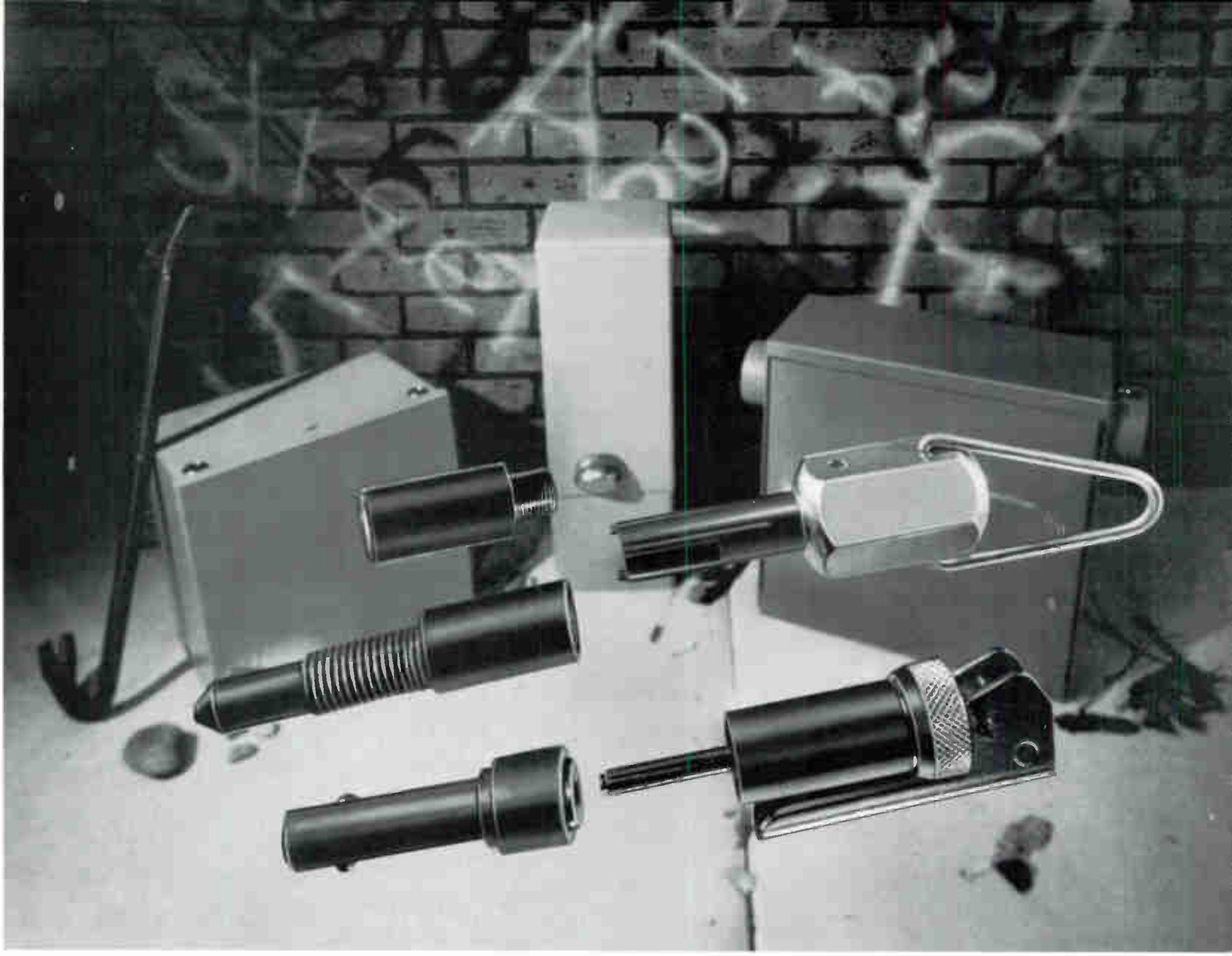
The second potential use for the A/B drive circuitry is shown in Figure 6 and functions as an output A/B switch. This concept builds upon the needs for recording/viewing separate descrambled channels where separate input to the television is required for the second converter. Use is not limited to a second converter, however, as illustrated in Figure 7, where several alternative uses are described.

Both concepts help minimize the wiring maze by reducing the number of necessary device interconnections. Remote control operation also is returned to the subscriber through remote switching of the converter A/B remote contol unit. For those converters with a built-in A/B drive, either of these devices are field-upgradable without opening the converter and can be installed by the subscriber on an as-required basis.

In the longer term, several other potential solutions to the interface problem are possible—the most notable being the IS-15 multiport and off-premise devices. At this time, however, it may be some while before either of these approaches gains market acceptance.

Best of both worlds

With the preceding concepts, it should now be possible to make the PPV converter "transparent" so the subscriber can retain all cable-compatible features, yet also access full PPV services when desired. This "best of both worlds" approach should provide the necessary solution to some of the issues system operators face today.



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Reader Service Number 21.

The elements of consumer friendliness

By Pam King
Technical Training Coordinator, Jones Intercable Inc.

Studies conducted at Jones Intercable indicate that more than 60 percent of its customers presently own a VCR, and this number is on the rise. Add this to other equipment a customer may want to hook up and we discover there are thousands of customer equipment and cable system interface combinations. Training of our customer service representatives and installers is also a major issue. The final product we should keep in mind is a customer satisfied with the local cable company.

One topic needing clarification is the term "cable ready." There is no television or VCR truly cable ready; there are many instances when a customer requires a converter for a cable-ready set. Because there is no real standardization among manufacturers, the meaning of "cable ready" may vary. For example, a cable-ready TV advertised for 82 channels may only be capable of receiving Channels 2 through 13 and UHF signals. Additional reasons for confusion include the possibility of poor shielding in the customer's equipment, causing direct pickup and requiring a converter.

The first idea that comes to mind when I think of a "consumer-friendly" cable system is training. If the cable system decides to be responsible for the connection of customers' equipment, the installer and CSR must be able to handle the issues of training the customers. In order to ease some of the customer's confusion, the installer should be prepared to install any configuration of equipment the customer may desire, as well as answer any questions the customer may have. Occasionally, this may require referring to the customer's VCR manual to properly program the equipment.

The cable customer can be unpredictable. After the installer has left the scene of a properly completed installation, the customer may purchase new equipment or decide to set up a different configuration—and be unable to achieve a picture. This is where the properly trained CSR takes over. In many situations the CSR can "walk" the customer through the problem on the phone, thus eliminating a truck roll. Possible questions a CSR can ask a customer include:

- Have you connected any new equipment, such as a VCR?
- Have you installed splitters, switches or cable from a source other than our company?
- Is all the equipment plugged in?
- Is the converter plugged into an outlet connected to a remotely located wall switch?

The most commonly asked question is, "Can I record one channel and watch another?" Unfortunately, this may not be possible. A converter is used to convert a spectrum of input channels to a common output channel and to sometimes descramble premium services. Since the converter only delivers a single output channel at a time, recording one channel while watching another is impossible with this configuration. However, solutions are possible, such as using two converters, two splitters or using an RF switcher. A CSR should be aware of options available for the system's particular security scheme and thus communicate the hookup configuration to the customer over the phone.

The service center

"How can we give our customers the best possible service?" is the question the Jones system in Saratoga Springs, N.Y., asked. To answer it, the system began to monitor the types of calls received from customers. A survey revealed that 50 percent were service- or picture-quality related. Because of this study, the "service center" was born. The system cross-trained its three best CSRs and included the dispatch function in the service center. The training included 16 hours of classroom study, as well as extensive field work.

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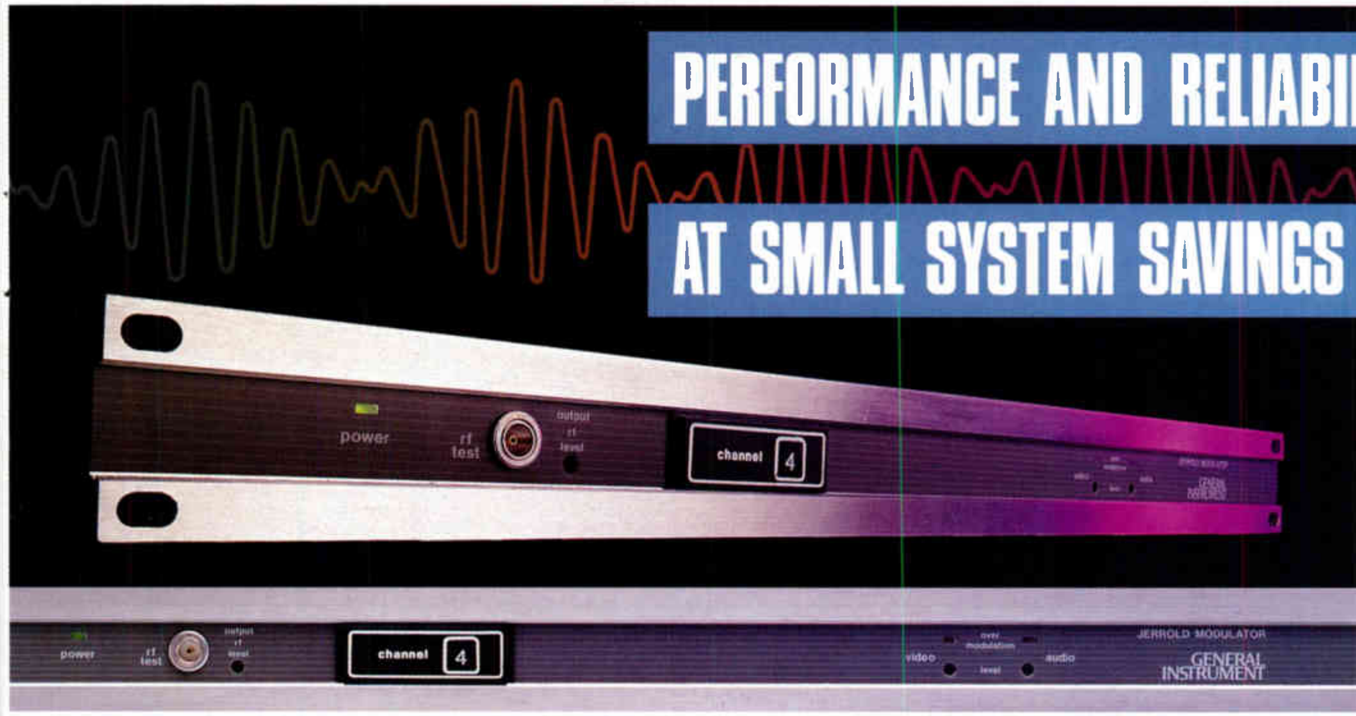

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Reader Service Number 24.

These CSRs keep a set of maps handy, so if there is an outage, they will know within two or three customer calls. The CSRs address trouble calls in the same manner as service technicians would, including problems such as VCR hookups and TV fine tuning, without actually being there. Although the main purpose of the service center is to supply the customers with the best possible service, it has been able to save an average of 20 truck rolls a week.

Some new philosophies suggest that the customers should be responsible for all equipment connections. Naczinski and Associates of Los Angeles has taken an interesting approach to training the customer. In conjunction with Home Box Office, the marketing firm created a training tape called *The Cable TV/VCR Hook-Up Guide.* The idea behind this is for the installer to leave the training tape with the customer at the time of installation.

Design considerations

A typical assumption made when connecting customer equipment to the drop is that plenty of signal is available. Low signal levels may be a problem, especially in an older system. Due to the large percentage of customers wanting to record one channel while watching another, it is not unusual to have two or more splitters or switches in series. Also, some customer equipment, such as VCRs, contribute an additional loss to the loop. A typical worst-case example for a 450 MHz system may be as follows:

Component:	150′ cable (450 MHz RG59)	2-way splitter	Converter	VCR
Loss (dB)	8.1	4	0.5	8*
Total loss =	20.6 dB			

*Typically, a DC-8 is used in VCRs

This may cause a problem for systems designed for a maximum tap output of 12 dBmV. In this case, an amplifier in the house may be necessary. For a new-build, design engineers should be aware of the customer's needs and adjust the tap output levels as necessary. For example, an area of the system with million-dollar homes may require additional signal for the additional equipment and outlets that these folks typically require.

Noise and distortion caused by customer equipment also should be a consideration. Many design specification objectives were established under the assumption that the only equipment connected to the drop is a converter. Adding additional equipment may substantially degrade the quality of the customer's picture.

It seems that the more sophisticated our cable systems get, the more complicated the converters become. There are many enhancements, including parental control options, programmable timer, last channel recall and programmed channel selection, all designed to be more appealing to the customer. In some instances, the large number of amenities may make the operation of the converter confusing to the customer.

An operations manual may be included with the new converter. The installer should become familiar with the operation of the converter and highlight the main features to the customer. Some manufacturers are writing instructions directed to the average user, so the customer doesn't need an engineering degree to understand it. One potential problem is the recycling of converters to new customers—there may not be an operations manual. Even if the installer is very familiar with the converter, the new customer may not be and needs the manual to fully understand the operation of the converter. Extra copies of the operations manual should be made available to the installer.

One manufacturer has included a new feature that indicates whether the use of a converter is necessary to watch or record a channel. This LED identifies when routing through the converter is necessary to record on the VCR. Any such feature makes the customer's life easier and happier with the cable company.

Another issue that arises among equipment manufacturers, especially converter manufacturers, is standardization. Technology is moving at a startlingly fast rate and without standardization this

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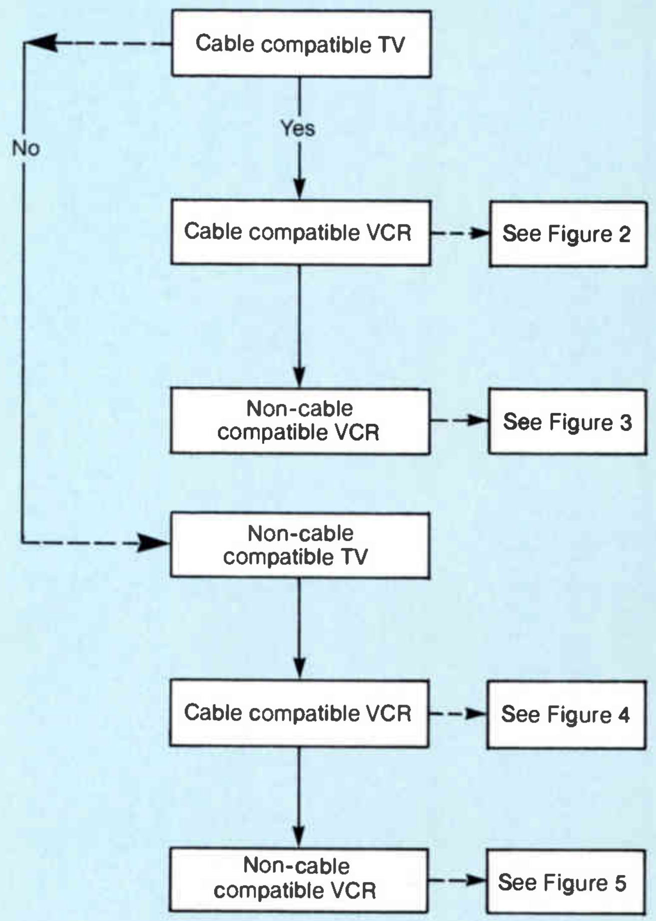
Figure 1: Converter/TV/VCR combination flow chart



technology may be moving in the wrong direction. In 1982, the National Cable Television Association and the Electronic Industries Association formed a joint engineering committee to discuss technical issues affecting both industries. Two of the topics of interest include the RF cable interface interim standard (IS-23) and the decoder interface (IS-15).

The RF Cable Interface Working Group is concerned with cable-compatible consumer products. This includes equipment such as the "cable-ready" TV. The Decoder Interface Working Group is dealing with an interface plug. The plug has been developed and is now available in some of the more expensive televisions.

The NCTA and the EIA do not have enforcement powers. This means that adherence to the standards is voluntary. Progress in these subcommittees is extremely slow and at times frustrating, especially when there is not a strong commitment from all parties involved. For example, the decoder manufacturers are reluctant to invest funds in the IS-15 until the plugs are made available. TV manufacturers are reluctant to modify their sets. MSOs are trying to speed the process by placing purchase orders. This has created sort of a stalemate situation: Everyone likes the concept, but nobody moves.

Equipment and installation

As mentioned earlier, there are thousands of customer equipment and cable system interface combinations. Possible contributors to these combinations include: televisions (cable compatible and non-compatible), VCRs (cable compatible and non-compatible), converters, games, burglar alarms, FM receivers and RF switch boxes (active and passive).

RF switchers, also called video switchers or video control centers, provide an interface between the cable and the customer's equipment. A few of the possible advantages of using such a switcher include:

Figure 2

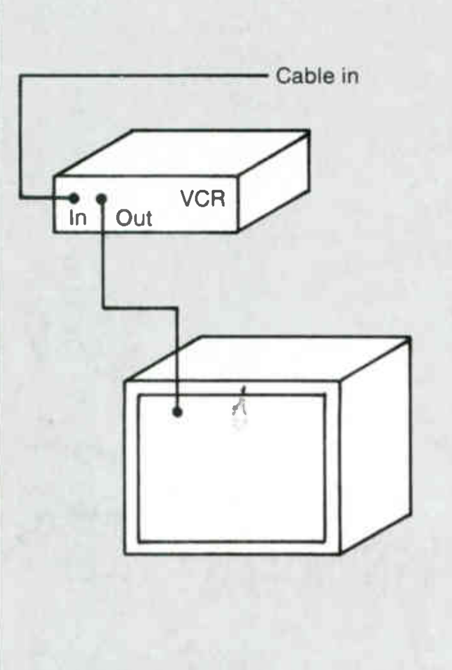


Figure 3

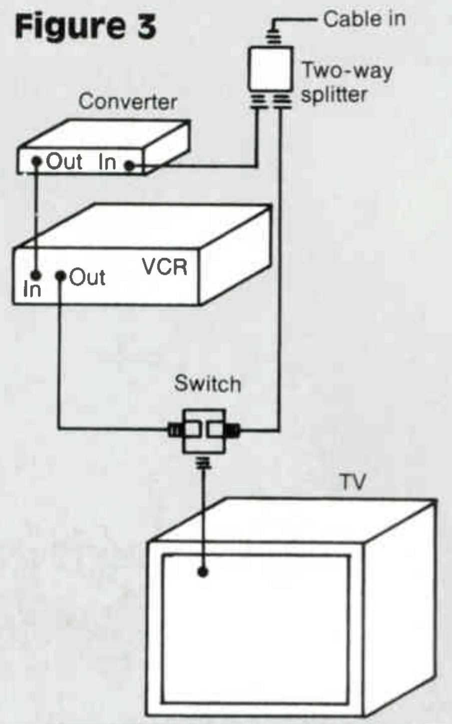
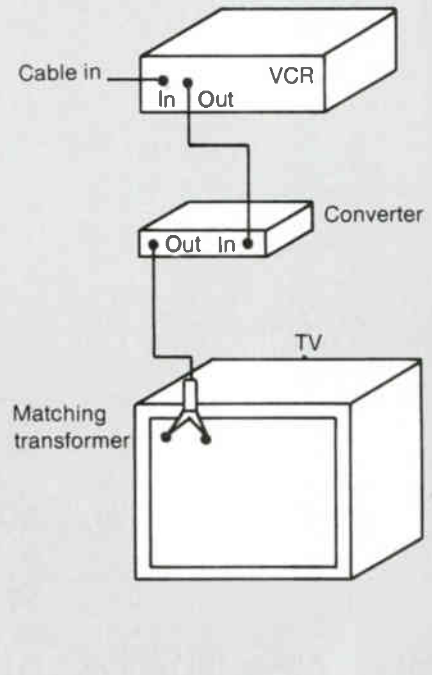


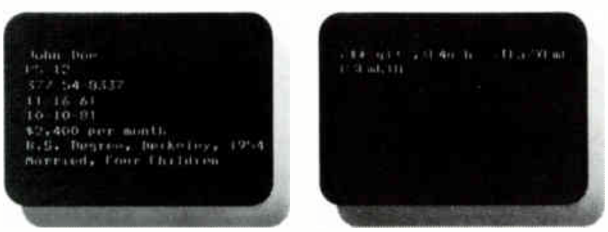
Figure 4



1) AC outlet on the back saves outlet space;
2) Amplifier option, for use if necessary;
3) Auxiliary port for games or a second VCR;
4) Internal transformer eliminates external transformer on electric outlet, thus permitting neater wiring; and
5) Easily understood by the customer.

Not all RF switchers include all the options mentioned, so examine a few vendors before deciding. Making this equipment available for the customer to purchase from the cable system at a reduced rate will provide good customer relations, as well to help eliminate the "mass of wires behind the entertainment center!"

There are three major cable/customer equipment configurations.



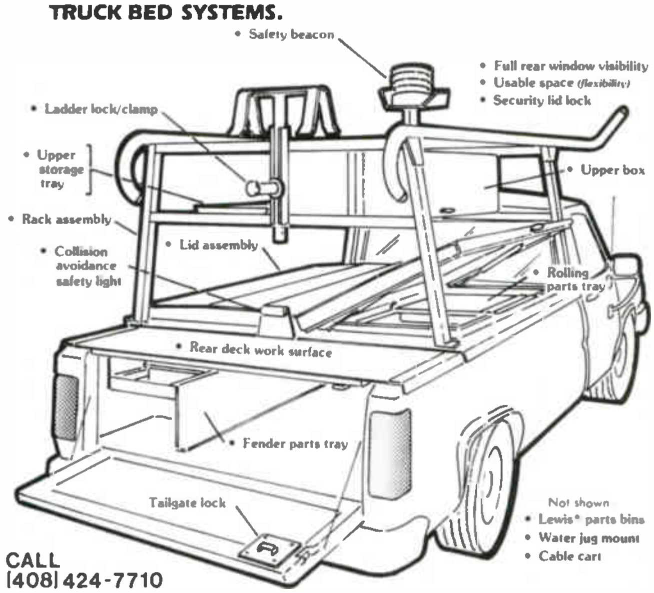
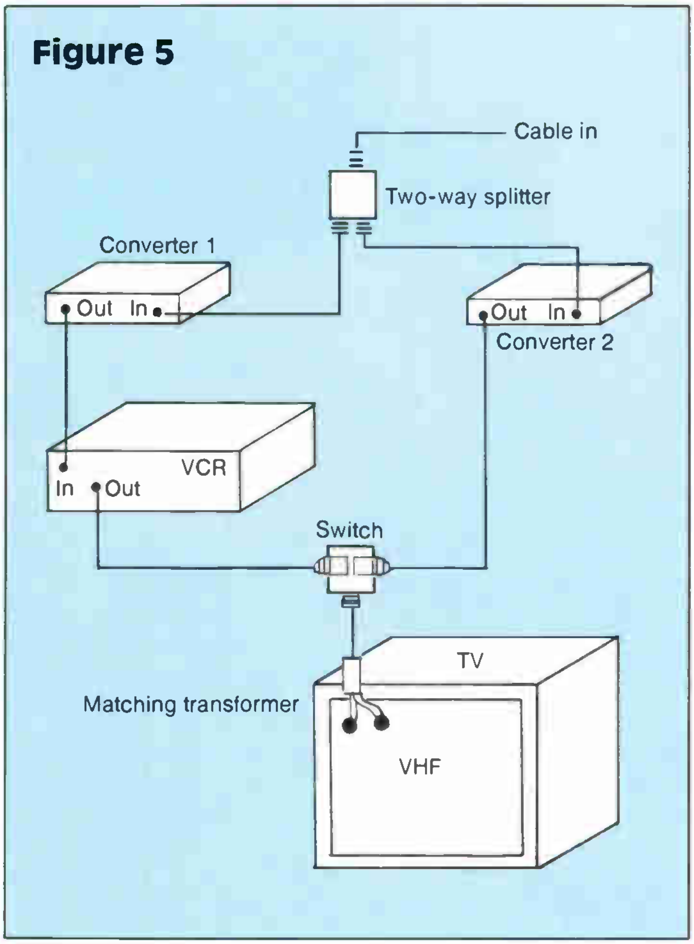


Figure 5



In each case, a general rule for using an A/B switch to be able to watch one channel and record another is noted: 1) non-cable compatible TV with non-cable compatible VCR—need A/B switch; 2) cable compatible TV with non-compatible VCR—need A/B switch; and 3) non-cable compatible TV with cable compatible VCR—don't need A/B switch. Remember to take into account whether your system is trapped, scrambled or addressable, as well as any variations within televisions and VCRs.

Figure 1 is a flow chart of the more popular converter/TV/VCR combinations. These few diagrams here by no means cover every situation; in fact, they barely scratch the surface. Use these drawings as a starting point for a more specialized description for your system. Figures 2 to 5 are some of the more commonly used VCR interface configurations recommended by the NCTA.

Retrain your customers

Is your system "consumer-friendly"? Aside from delivering good quality pictures, the next best way to retain your customers is by providing a consumer-friendly system. Ask yourself, "How can we give our customers the best possible service?" Start by training your CSRs and installers; training will give you the most benefits with the least effort. Then, start looking to the future. Review your design philosophy. Examine equipment that makes the customer's life easier. Remember, the final product is a customer satisfied with the cable company.

Reference

"Connecting Cable Systems to Subscribers' TVs and VCRs: Guidelines for the Cable Television Industry," *CED* March 1987. Copyright 1987 National Cable Television Association.

The author wishes to thank Carl Smith of Continental Cablevision, John Haag of Heritage Cablevision, Wayne Davis of Jones Intercable, Naczinski and Associates and Pioneer Communications of America for their assistance with this article.

The intelligent remote

By Michael T. Hayashi
Marketing Manager

And Dan Wiltshire
System Engineer, Pioneer Communications of America

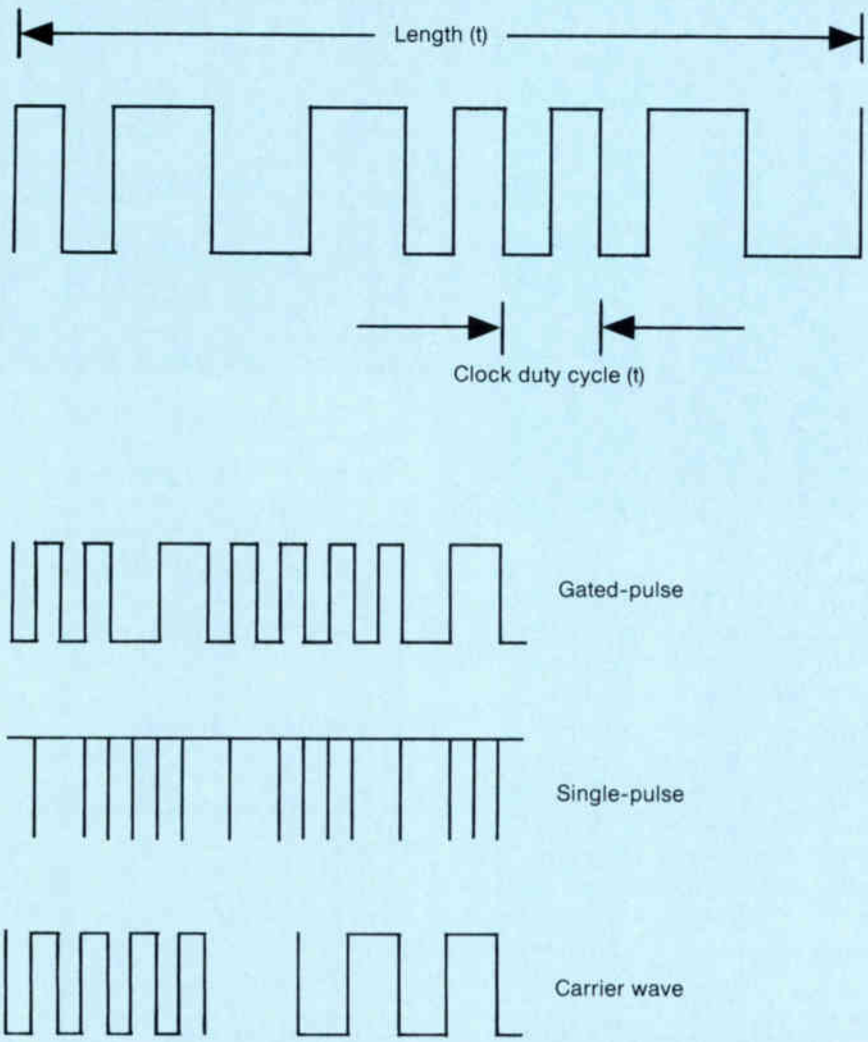
"In the beginning there was one. Then, one by one it replicated until it took over the coffee table and crushed it with its weight."

Of all the advances made in consumer electronics in the last several years, the most popular feature has been the wireless remote, providing the convenience of controlling the television from an easy chair. Having control of the television in the family room meant ultimate power.

There was only one problem. Every new accessory created to enhance TV viewing came with a different remote: a VCR remote, a compact disc remote, a stereo remote and so on. With the arrival of each new remote, a whole new learning experience began. Power over TV viewing soon rested in the hands of those who could master all the remotes, not to mention find them.

Complaints from consumers were heard throughout the industry. Consumer electronics manufacturers began to solve the problem by designing remotes that were compatible with every item in their own product lines. This was a great solution if the consumer bought products from only one company and threw away all the other equipment.

Figure 1: Infrared digital codes



Enter the cable installer, who showed up with yet another remote and said, "Use this cable remote to tune in the channel and use your *old* remote to control the volume." There were only two problems with this solution. First, consumers still had to manually turn on the television and even then there was no picture. Second, the default channel was Ch. 2, while Ch. 3 was the converter's output. To solve all these problems, several intelligent remotes were introduced by the consumer electronics and cable converter manufacturers in the last 18 months. Today, the market is filled with more than a dozen products.

Choosing the right remote

Choosing the right intelligent remote is a task in itself. With over a dozen manufacturers' products to choose from, most consumers are defeated before the quest.

From a cable operator's perspective it is important to determine which problem needs to be solved. The videophile with a $10,000+ system already has found a solution. However, for the more basic consumer inconvenienced by two remotes (i.e., one for volume and one for tuning), a simple remote is desirable. The following are points to consider when selecting an intelligent remote.

Simplicity: The degree of simplicity is the measure of how easily a consumer can learn to use the remote with a minimum amount of instruction. It also is important to note the quality of instruction available to the consumer. If the manual is complicated and/or if there are no prompters on the remote, the remote will be more difficult to use.

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Intelligence: Remotes carrying names such as "universal," "total," "smart," "control" and so on, are often misleading. Learning remotes and preprogrammed remotes all have restrictions limiting and qualifying the degree of intelligence. If one of the products is offered to the cable subscriber, a careful study of the technical limitations should be made to assess the degree of incompatibility.

Cost: Retail prices range from as low as $20 to $200, with the average around $100. Learning remotes tend to be more costly due to a larger memory requirement.

A majority of the intelligent remotes available today are learning remotes. Most manufacturers are marketing these remotes under licensing from General Electric, the company holding the patent for the remote "learning" technique. Learning remotes digitally sample incoming infrared (IR) signals, store the signals in memory and regenerate the signals from memory when needed. There are three basic restrictions arising from the digital sampling technique:

1) *Length of transmission:* The lengths of infrared data streams from other remotes are typically less than one-half second. Most learning remotes have a length limit of three seconds.
2) *Sampling duty cycle:* The resolution of digital sampling is determined by the frequency of sampling itself. If the original IR code's duty cycle is smaller, then the sampling frequency obviously cannot be recognized. Learning remotes typically have a minimum duty cycle of 100 microseconds more than sufficient for most IR codes.
3) *Data modulation method:* There are three fundamental modulation methods, as shown in Figure 1. In the gated-pulse format, the IR data are encoded by varying the lengths of time the infrared transmitter LED is on or off. In the single-pulse format, the data is sent by controlling the quantity of and the lengths of time between the individual pulses of infrared light. Each pulse is of the same duration. In the carrier wave format, each control code corresponds to a specific frequency of pulsation of the infrared light. For example, "off/on" may be 30 kHz, "volume up" may be 35 kHz and so on. The range of the carrier wave frequency often is restricted.

Learning remotes can be taught to read almost all infrared codes available today and in the future. Unlike the preprogrammed versions, a consumer can purchase a new TV set or VCR with minimum risk the intelligent remote will be incompatible. By minimizing the number of programmable keys, the memory requirement is greatly reduced resulting in the added benefit of simplified operation.

Preprogrammed remotes are gaining popularity primarily due to the cost advantage. They are less expensive because of the minimal amount of memory requirement necessary as compared to a learning-type remote. By ingeniously taking advantage of the similarity in the use of IR codes among various manufacturers, preprogrammed remotes are

"Power over TV viewing soon rested in the hands of those who could master all remotes, not to mention find them."

programmed for the most popular brands of televisions, VCRs and converters, although the number it can control is limited.

Typically, this type of intelligent remote is first set to a "programming" mode after selecting the device to be controlled. During this mode, switches or buttons are manipulated until the device to be controlled responds. This first step determines the header of the digital IR code. The header data usually differentiates one manufacturer and/or one device from the other. After the header is identified, the commands are assumed to follow a certain logical progression. However, if this assumption is wrong, a certain button may cause an undesired response.

The greatest benefit of preprogrammed remotes is the efficient use of memory, making the device more economical than typical learning remotes. But with the preprogrammed remote, fewer televisions, VCRs and converters may be controlled. There also is the possibility of future IR devices being incompatible should the IR encoding data change to something that is not preprogrammed.

Hybrid evolution

Technically, the learning remotes are far more complicated than preprogrammed remotes, requiring state-of-the-art sampling techniques and a large memory capacity. Preprogrammed remotes offer the benefit of being able to satisfy a majority of situations without the complexity associated with lengthy programming.

As a compromise, hybrid units are on the market that take advantage of the benefits of learning remotes with the ease of a preprogrammed remote. These units have a limited number of "learning" keys in addition to the preprogrammed keys used to operate only the converter. Programming is limited to the additional functions required by the consumer. For subscribers who only use the existing TV remote for volume control, this system is ideal. If the converter already has volume control, the additional learning keys may be used exclusively for the VCR.

The multiple remote problem is only part of the problem associated with consumer interface. Nevertheless, it is an important one. With the rapid growth in consumer electronics technology, the evolution has only begun. ■

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Berger-Braithwaite Labs, "One for All and All in One", *Video*, October 1987.

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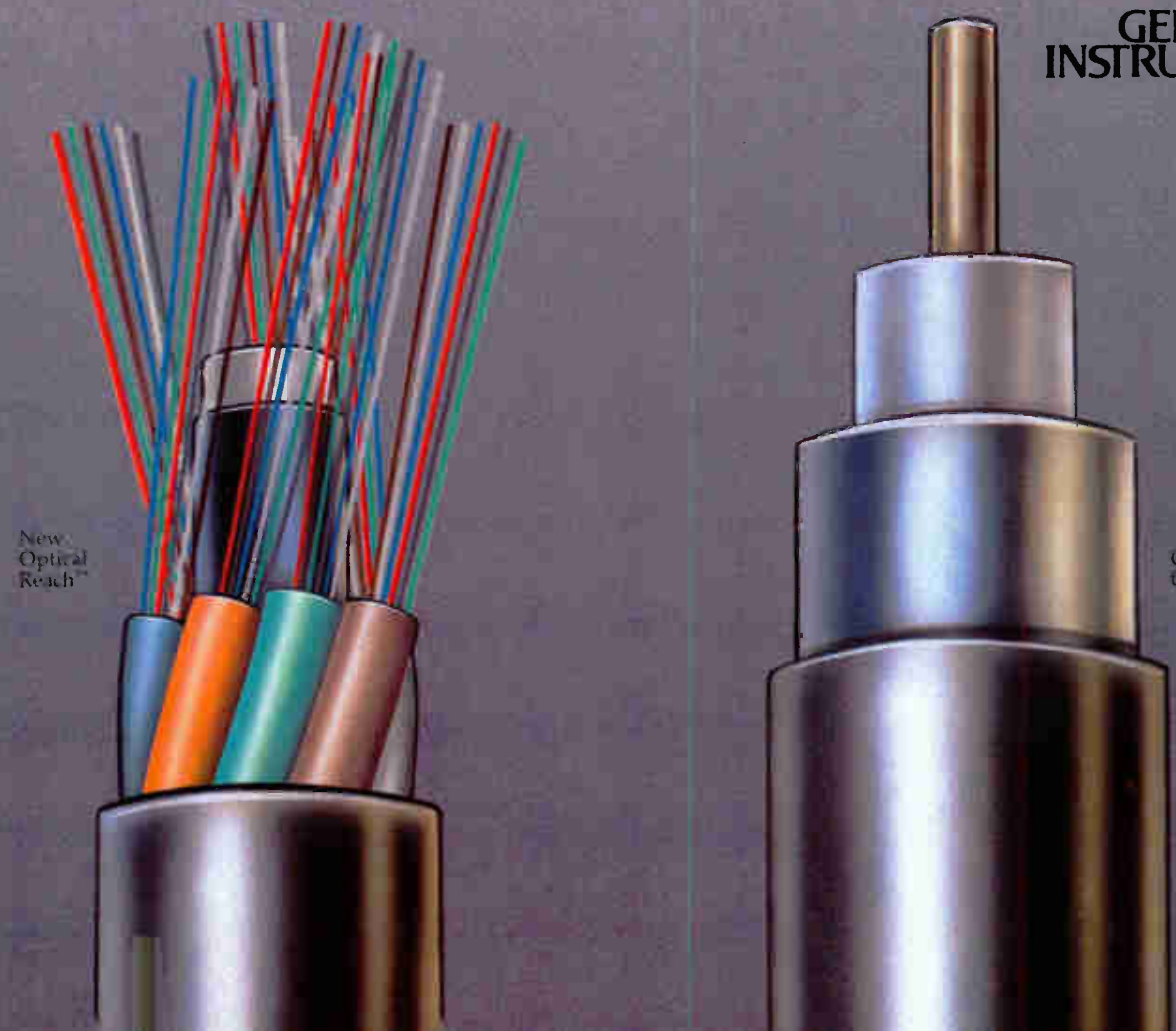
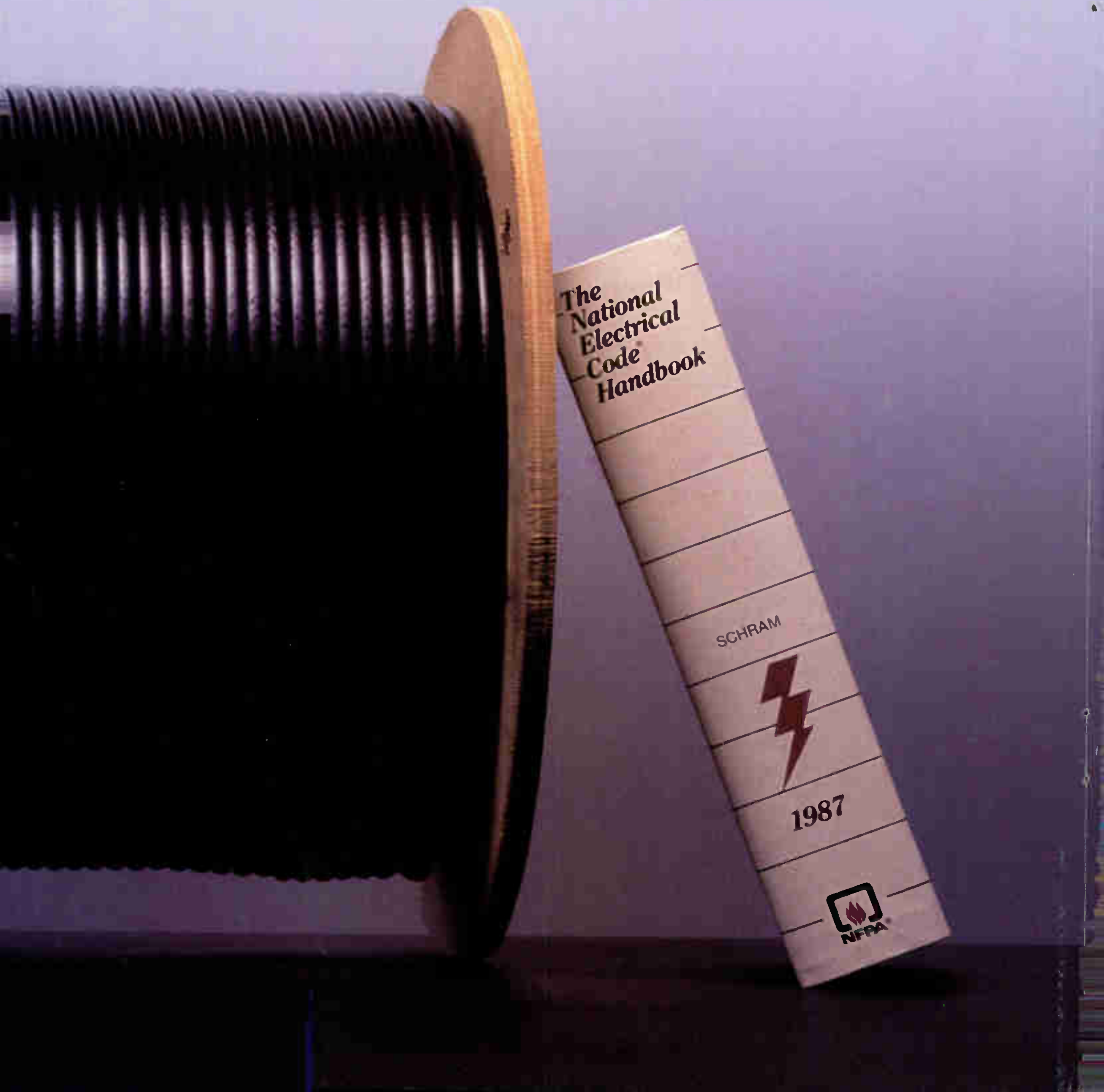


WE MEET



A case study of consumer friendliness

By John W. Dawson Jr.
Vice President of Engineering, Mile Hi Cablevision

The stipulations as outlined in the Denver franchise ordinance awarded to Mile Hi Cablevision in 1982 overcame some major obstacles that generated concern in a number of cable systems. This was mainly in response to the most unanswered question asked by subscribers: "Why can't I just receive and pay for the channels I want instead of having everything?" The fact that Mile Hi would be scrambled, addressable and tiered was a venture in future applications riding on the leading edge of technology.

The system was launched with four tiers of basic service and eight pay services. It was packaged to maximize channel grouping for viewing convenience, allowing subscribers to select the service level best adapted to their viewing habits. Naturally, this generated a great number of viewing combinations with thousands of prorates, but with the system being computerized, addressable and scrambled, this was manageable. The concept of addressability was a prelude to the ultimate step of cable television, pay-per-view. Not just from the standpoint of occasional blockbuster movies and special events, but perhaps pay-per-channel and pay-per-program, the pinnacle of total addressability.

From an operational point of view, there were numerous advantages to utilizing this technique of service delivery. Aside from multiple tiering, it allowed for the targeting of audiences based on their viewing choices. Changes of services did not require the subscriber to be home nor a truck roll. Delinquent accounts were merely downgraded to the lowest tier, and the subscriber was reminded of the account status when they called for service. Upgrades could be performed with a few keystrokes into the host computer. Promotions, previews and pay-per-view events did not require major preparations. Theft-of-service and illegals were of minimal concern, based on the fact that few people outside the industry had any concept of how scrambling and sync suppression functioned. Tap audits were unnecessary. Another major advantage allowed for the spinning of pay services, which some subscribers elected to do on a weekly basis.

All channels were scrambled, including the off-airs, allowing for soft disconnects. It also minimized the critical need to tag drops in multi-family dwellings and created an environment that allowed for inter-connecting into existing loop-wired complexes. This drastically reduced the capital investment required to home run wire all complexes before service could be made available.

Recognizing the problem

The level of sophistication of consumer electronics that the system had to interface with was not of major concern in 1982. Cable-compatible TV receivers and VCRs were penetrating the market but the Mile Hi system was one of the first to launch with a 450 MHz, 60-channel capacity. The channel capacity of televisions and VCRs at that time were only averaging 36 channels. The projections indicated that interfacing technology would be developed to allow for the addressable converter to appear transparent by the time the compatibility factor reached 60 channels and significantly penetrated the Denver market.

The first major problem that surfaced was the incompatibility between the cable converter and the consumer remote control units. Also, restrictions were imposed on the VCR when the subscribers desired to time-shift record a program when they were not home, due to the addressable converter's inability to be programmed to change channels. Compounding the problem was the subscriber attempting to record one channel and desiring to watch another program on a different channel at the same time. The installation of a second converter and A/B switch solved this situation, but the downside was a dramatic increase in telephone volume with increased average talk time per call caused by the customer service representative issuing more complex customer education instructions.

The progress of research, development and testing of the IS-15 multiport showed signs of relief except for the timeliness of the introduction of these devices incorporated into the consumer electronic equipment. The penetration in the market of such equipment had to primarily match and then exceed the number of total cable-compatible units that were presently in the subscriber base to be effective.

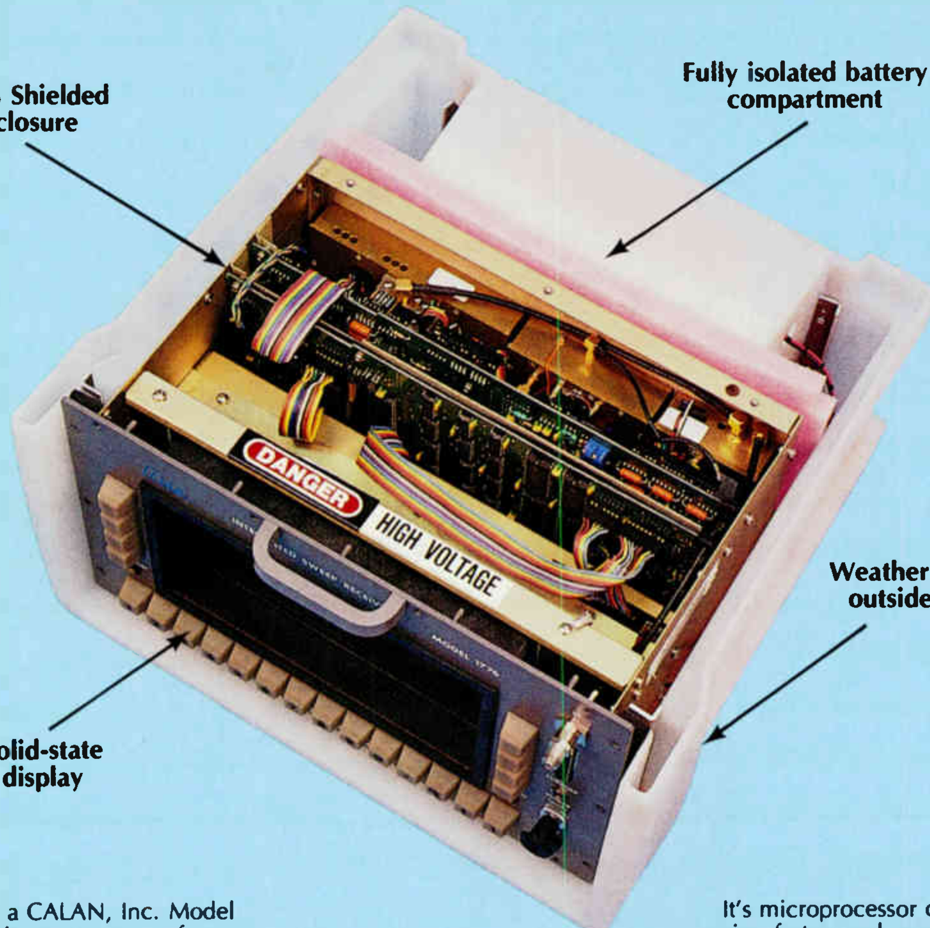
With the introduction of BTSC stereo it was known that the baseband converter would lose separation when the volume was improperly adjusted, and digital TVs proved to be an unsolvable problem. The first indication that the system was about to suffer severe consequences was in 1986 when the net subscriber gain for the 12-month period was only approximately 3,000. The stage was set to dramatically change the method of delivery to reduce the alienation factor between the system and subscribers.

In considering the mode of change required to create a more consumer-friendly atmosphere, numerous factors had to be evaluated and the resulting impact assessed; trapping was the most attractive mode of service delivery considered. The Denver system was originally designed with one headend and two hubs with dual multiple trunks distributed from each facility. The fact that the local utilities had expressed concerns about the pole load bearing factor and maintaining National Electrical Safety Code clearances, trap weight and size were significant factors during the determination of the number of channels the system would trap. Three traps (two negative and one positive) were considered manageable.

The process employed to select which services would be trapped was based on pay service penetration. The two most penetrated pay services received the negative traps and the least popular penetrated pay service received the positive trap. This constituted a quantity of approximately 80,000 traps just to begin the conversion process. Procedures were drafted to ensure that all of the auditors knew not to attach more than one trap to the tap spigot to avoid violating the clearances between the CATV facilities and the nearest utility.

The addressable system was maintained during the conversion period, and to reduce the number of truck trips due to changes of services, the pay services designated to be trapped were simulcast. The system, having no Federal Aviation Administration deletions and a fully loaded channel capacity, required that three channels be deleted during the trapping period to accommodate the duplication. The only under-utilized channels on the system were the access channels reserved for the city of Denver. After a presentation to the city, it was agreed to release the three necessary channels for the conversion, but for only 90 days. This meant that the system had only 90 days to audit and trap 52,000 drops and hard-disconnect an additional 45,000 dormant drops, of which 45 percent were in MDUs, and 50 percent of those either were not tagged or were loop-wired. The

The Inside Story on Reliability



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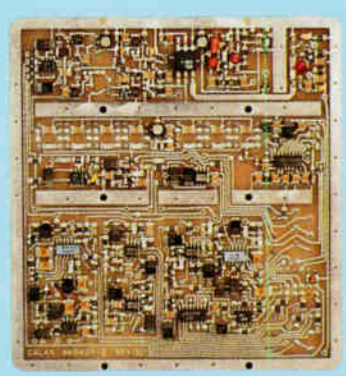

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multifamily units also required the exchange of 4,500 minimum security lockboxes to maximum security units.

A review of the channel lineup revealed that the alignment was least suited for a trapped system. An elaborate committee of marketing, programming and engineering personnel was assembled to resolve this obstacle, which also required a total rewiring of the headend. A plain converter was selected that best coincided with the existing channel mapping to eliminate the addressable units for those subscribers who did not retain any of the remaining five scrambled pay services and did not own a cable-compatible TV or VCR. This was estimated to number between 40 percent and 45 percent of the subscriber base. The necessary audit could not be performed by in-house staff based on the volume of the required work and the time constraints. Thus, a number of auditing companies were retained to perform this activity.

Implementation of the solution

Communication and coordination were the keys to success of this project. A task force of in-house personnel was designated to orchestrate all outside activities and to maintain a daily update log to keep the rest of the organization abreast of its progress. The headend was rewired in four days with crews working around the clock preceding the launch of the full audit. Since the Mile Hi system utilizes a very efficient trunk numbering scheme, localizing activities were easier to track than first anticipated.

The MDUs were the most difficult to convert due to lack of access into every unit to perform an ohm/tag of each drop. When untagged drops were encountered at a location, it was effective, although inconvenient, to immediately disconnect the entire complex; the tagging and reconnect occurred as the subscribers called to report service disruptions and generally were performed by the next day. Of course, it created a dramatic increase in telephone volume, but by controlling the number of units disconnected on a given day, the ability to maintain a fairly constant activity level of reconnects over the 90-day period was achieved.

During the height of the audit, audit crews converted, through trapping and/or disconnection, approximately 1,200 drops a day, seven days a week. This also included the removal of the high-pass filters initially installed on each drop when the system was totally addressable. Rewiring of loop-wired MDUs to home run wiring coincided with the lockbox change out. This included the implementation of a redesigned splitter configuration to allow for a splitter trapping, as opposed to individual drop trapping, which minimized the space required in each lockbox and the quantity of traps used.

The conversion process was completed around the first week of April 1987 and a service task force was created to complete the changes of service, upgrades, downgrades and disconnects that were generated during the 90-day period to bring the project to completion.

The results

Subscriber acceptance of the consumer-friendly environment created by the descrambling of the Mile Hi cable system has been positive. Simplifying the levels of service has reduced the telephone volume, the number of service calls and converter expenses associated with repair of descrambling converters. The incompatibility factor has been reduced in magnitude to allow for direct connection to cable-compatible televisions and VCRs without additional converters or equipment. The capital investment in the subscriber's home also has been reduced and in some cases totally eliminated. The lack of scrambling does create a vulnerability requiring an ongoing tap audit, but the value of service provided as perceived by the subscriber has been enhanced. The single base service tier that allows for the basic concept of service to the subscriber's house and not to the TV set has received widespread acceptance.

In the 8½ months remaining in 1987 after the conversion project was completed, we experienced a net subscriber gain of about 366 percent over and above the entire year of 1986, or approximately 11,000 subs. Mile Hi Cablevision was recognized by American Television and Communications Corp. to have the best subscriber penetration gain for 1987 of all of its divisions.


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Fiber-optic system design

This is the second installment of a three-part series on the design and application of fiber-optic technology. Part III will discuss transmitter and receiver circuitry.

By Robert K. Southard
Manager, Systems Technology, Electro-Optics Division, AMP Inc

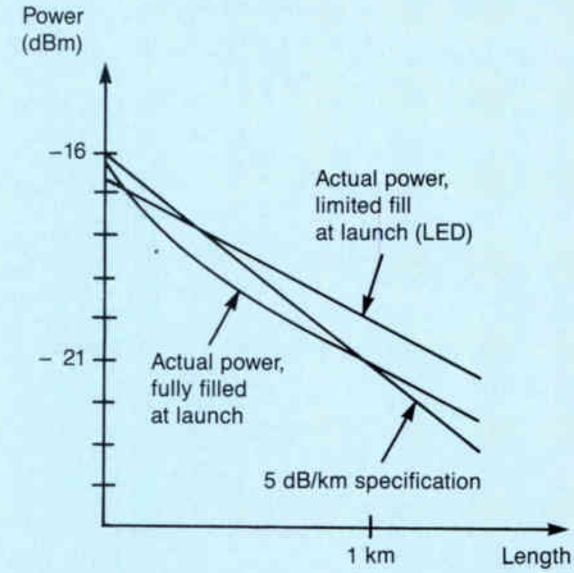
Multimode fibers and cables have stated dB/km attenuation specifications under certain optical launching conditions. A typical parameter test, referred to as the "cut-back method," involves the launching into a 1 to 3 kilometer length of fiber and then measuring the optical power at the other end. Then, most of the fiber is cut off and the optical power is measured on the remaining short stub. The derived attenuation value is accurate for the particular length and for the optical launching conditions but may not accurately reflect the loss under other conditions.

When launched power fully covers the area and numerical aperture of the fiber core, a relatively large amount of power is contained in high order modes. These modes are more prone to loss than lower order modes and may result in a loss of from 1 to 1.5 dB when they are removed from the fiber. Total power in the fiber drops quickly at first, and then more slowly as the higher order modes are dissipated. Loss due to the higher order modes is called *transient loss*; loss due to the lower order modes is called the *steady state loss*.

For sources that fully excite the fiber modes, larger attenuation will be experienced for short lengths than would be predicted by the linear attenuation assumption of using a constant dB/km. Conversely, other sources, such as LEDs with microlenses, do not fully fill the fiber and thus do not produce as large a transient loss as in the fully filled case.

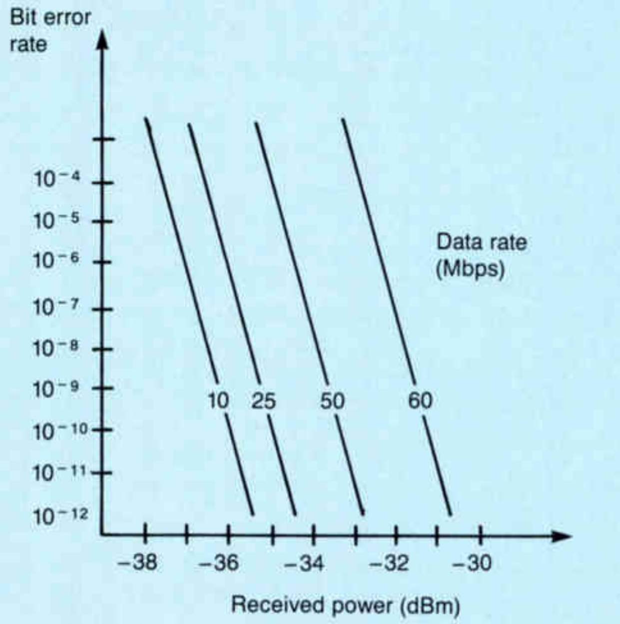
Connectors near the launching end of the link will tend to selectively attenuate the higher order modes, which would have been attenuated in the fiber anyhow. Conversely, connectors placed where a steady state mode distribution exists may cause some power to be coupled into higher order modes, thus causing additional transient loss in the fiber (Figure 1).

Figure 1: Attenuation loss curves



The minimum receiver sensitivity is based on several variables such as actual data rate, required BER (bit error rate) and duty cycle. The maximum data rate specification of the receiver is based on variables such as the front end bandwidth of the preamplifier circuitry. At maximum data rate, high frequency rolloff of the amplifier is attenuating the signal to some degree. At lower signal rates, the amplifier provides somewhat more gain and less signal is required to achieve the same output level (Figure 2).

Figure 2: BER and power variances for typical receiver



Receiver sensitivity at a particular BER is based on standardized or widely accepted values. However, certain applications may involve either higher or lower BER. Figure 2 also shows how signal power and BER vary for a typical receiver.

Duty cycle variations in the signal presented to the receiver will affect different types of receivers in very different ways (Figure 3). A DC-coupled receiver will handle any duty cycle without degrading the BER.

Bandwidth budget

Data rate capability of a link is obtained from the bandwidth budget. The receiver is usually the most bandwidth-limiting component in a fiber-optic link. In many instances, the transmitter, interconnection hardware and fiber will not have a major degrading effect on overall system performance. The bandwidth budget is an important technique to determine the effects of the transmitter and other system components on link data rate.

The information-carrying capability of a fiber-optic link can be determined in the time domain. Pulse broadening analysis is oriented toward rise time and fall time; the term *transition time* refers collectively to the rise time and fall time. Transition time should not be confused with propagation time or transit time (the time it takes signals to pass through a device or fiber).

If maximum NRZ (non-return to zero) data rate of the receiver is B, then bit time T, associated with this data rate, is:

$$T = 1/B \qquad \textbf{(1)}$$

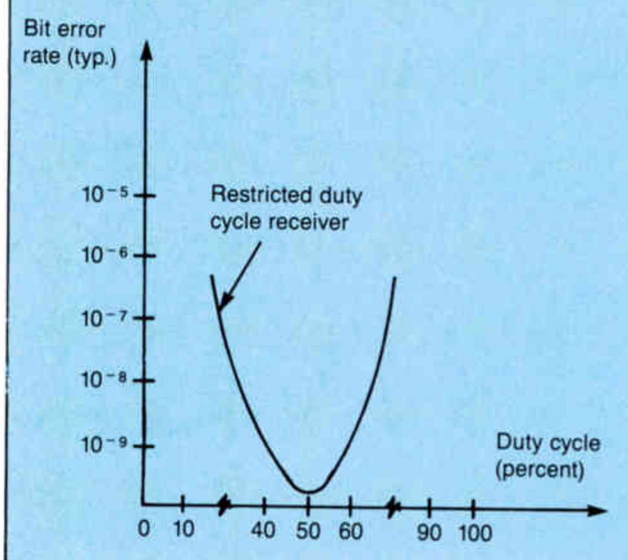
The following empirical rule checks system bandwidth: The effective transition time of the optical signal entering the receiver (t_S) should be less than 70 percent of the signal bit time; that is:

$$t_S = 0.7T = 0.7/B \qquad \textbf{(2)}$$

As long as t_S is shorter than this value, the full system bandwidth is limited by the receiver capability. If t_S is longer, link performance is limited by some element other than the receiver. When the signal into the receiver has a long transition time, the BER level will increase or sensitivity of the receiver will decrease for a given BER value.

Transition time of the transmitter, including the emitter (t_E), due to fiber modal dispersion (t_M) and due to fiber chromatic dispersion (t_C), are the major items that combine to degrade (lengthen) transition time. (Connectors and splices are not included in this analysis because they do not limit system

Figure 3: Duty cycle variations



bandwidth, and they may, in fact, improve performance somewhat by causing mode mixing.)

To determine a value for t_S, combine terms in the square root of the sum of the squares formula:

$$t_S = (t_E^2 + t_M^2 = t_C^2)^{1/2} \tag{3}$$

Transmitter transmission time (t_E) is included in the transmitter specifications.

The transition time due to modal dispersion in the fiber is given by:

$$t_M = D_{MOD} \times L^Q \tag{4}$$

L = the length of the fiber in kilometers
Q = a constant that indicates how the modal dispersion scales with length.

A reasonable value for Q in very long fiber systems is 0.7. An estimate for Q in a short system is 1. D_{MOD} indicates the amount of modal dispersion of a particular fiber. Since the above function is non-linear with length, it is important that a value for D_{MOD}, in units of ns/km, be obtained with a known fiber length.

When D_{MOD} is not available, estimate modal dispersion based on the bandwidth specification for the fiber, B_F. Estimates for the resulting transition time are obtained from:

$$t_M = 0.44\left(\frac{L^Q}{B_F}\right) \tag{5}$$

Since transition time, and thus bandwidth, may not scale linearly with length, specifying bandwith (B_F) in units of MHz.km is not a precise indication of actual performance. These bandwidth values are only valid if obtained on a 1 kilometer length.

If bandwidth is obtained with some other fiber length, L_O, then transition time due to modal dispersion is given by:

$$t_M = \frac{0.44}{B_F} \times \frac{L^Q}{L_O} \tag{6}$$

As an example, a fiber bandwidth of 200 MHz.km (obtained at 1 kilometer), a fiber length of 300 meters, and using Q = 1 gives:

$$t_M = (0.44)(0.3 \text{ km})/(200 \text{ MHz.km}) = 0.66 \text{ ns}$$

For multimode fiber in the 800 to 900 nm wavelength range, waveguide dispersion may be ignored. In this wavelength range, common glass fibers have a material dispersion (D_{MAT}) as shown in Figure 4. For positive values of D_{MAT}:

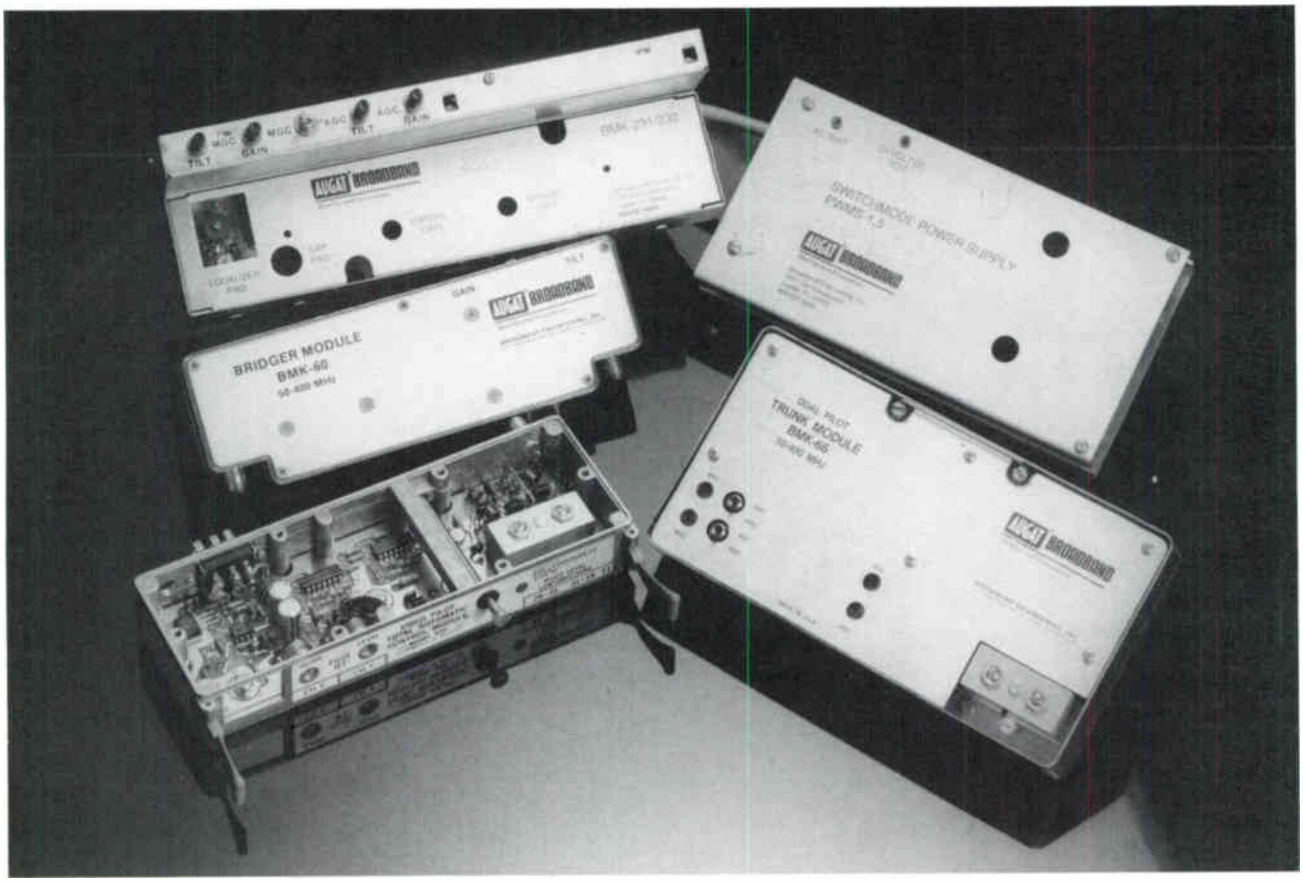
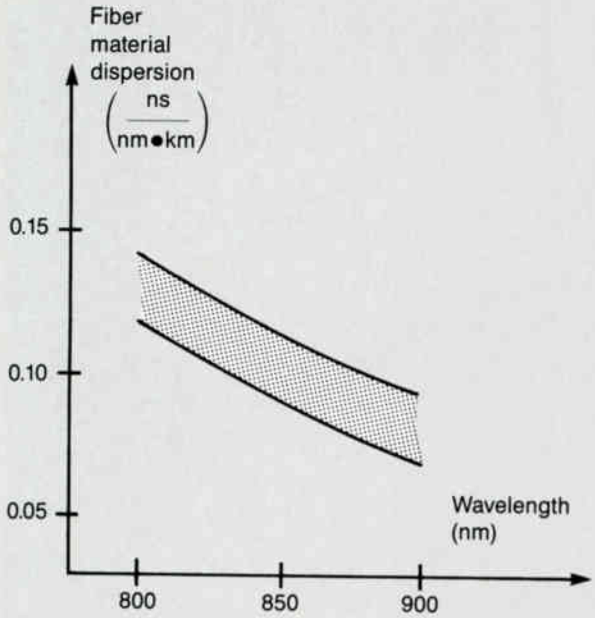

BRIDGER MODULE
BMK-60
SWITCHMODE POWER SUPPLY
TRUNK MODULE
BMK-66

Figure 4: Material dispersion



$$t_C = D_{MAT} \times \Delta\lambda \times L \quad (7)$$

where $\Delta\lambda$ is the spectral width of the source. For an LED transmitter with a 50 nm spectral width and 300 meters of fiber having a material dispersion of 0.1 ns/nm/km, the calculation is:

$$t_C = (0.1\text{ns/nm/km})(50\text{nm})(0.3\text{ km}) = 1.5\text{ ns}$$

Spectral width of LEDs is relatively large when compared to laser diodes, and material dispersion in LED systems operating in the range of 850 nm often will be more limiting than modal dispersion. At 1,300 nm, material dispersion is very low. Here, wavelength dispersion should be considered and an accurate value of modal dispersion is important. The spectral width of an LED source leads to more complicated calculations than indicated here.

With this information, the optical transition time into the receiver (t_S) is estimated. Assuming that the transmitter transition time (t_E) is about 4 ns, and using the previous examples:

$$t_S = (4^2 + .67^2 + 1.5^2)^{1/2} = 4.3\text{ ns}$$

For a 50 Mbps receiver, the permitted transition time into the receiver is given by:

$$0.7/B = 14\text{ ns}$$

The calculation shows that receiver performance is not degraded at 50 Mbps for the values chosen and the equations help determine the maximum fiber length (about 2.5 km) that may be used before t_S would exceed the specified limit and degrade system performance.

If t_S exceeds the limit indicated, receiver performance will be somewhat less than optimum. This may be acceptable, if the link is operating at a data rate lower than the maximum rate specified for the receiver and the system can benefit by increased sensitivity at the lower data rate.

If improvement in optical signal transition time is needed, consider a faster transmitter. Material dispersion is reduced by moving to the 1,300 nm wavelength or by using an LED with reduced spectral width. In the example, modal dispersion has the smallest effect on transmission time degradation. Selecting a fiber with a higher bandwidth may offer some improvement.

These calculations involve a large number of approximations and empirical estimations. In borderline situations, more exacting measurements are needed. Performance measurements, including power and BER studies, are needed to confirm actual system capability.

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Reader Service Number 53.

Fundamentals of spectrum analysis

As a continuing service to BCT/E candidates, "CT" is reprinting excerpts from various bibliographic sources that may not be readily available. This application note from Tektronix is listed in the Category I bibliography. This is the second installment of a four-part series.

By Bill Benedict
Engineering Operations Manager
Frequency Domain Instruments, Tektronix Inc.

Most RF power meters indicate the total amount of power available at the head of the power meter from all signals present on the cable. Thus, if there are many discrete sinusoidal signals present on the cable, the amplitude of any one signal cannot be determined with the power meter. The spectrum analyzer allows each signal to be viewed separately for both amplitude and frequency. However, the input (attenuator and first mixer) circuitry is like the power meter in that it is exposed to all signals present. Therefore, the rules regarding maximum input level apply to the sum of all signals present on the input, regardless of whether they are all being displayed on the screen or not. As an example, if two signals of +20 dBm and one of −50 dBm are present on a cable, the input circuitry is actually being exposed to over +23 dBm. Remember (from a previous example), if you double the power, you have a signal level 3 dB higher [(+20 dBm) + (+20 dBm) ≥ (+23 dBm)]. With over +23 dBm on the input and a first mixer that works best with −30 dBm, we need 53 dB of attenuation for optimum operation [+23 dBm (input) −53 dB (attenuation) = −30 dBm (first mixer signal level!)]. If the analyzer is tuned to shift the larger signals off screen, the RF attenuation still cannot be removed to shift the −50 dBm signal up on screen for better viewing, because the input circuitry is still being exposed to the two larger signals. However, IF gain may be added to increase the displayed level of the smaller signal.

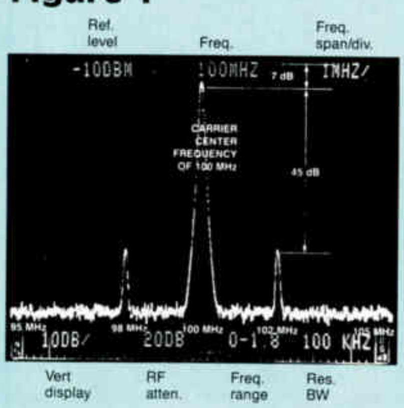

Figure 1

Unlike an oscilloscope, a spectrum analyzer is ordinarily susceptible to damage from DC voltages. This is extremely important to remember. If a DC voltage can be applied to an analyzer, it will usually be indicated on the front panel near the input connector. If DC voltage is a possibility, always use an external blocking capacitor. Suitable blocking capacitors with good VSWR are available from several vendors.

Frequency and span controls

The frequency control identifies the frequency of a particular point on the display. Customarily, this is the center of the screen. In some modes of operation, however, it could be some other point on the screen. On many analyzers, there is a dot or other indication on the display for the point on screen that represents the specified frequency.

With the span or span/div. control, the width of the frequency spectrum being analyzed can be varied. When referred to as span/div., it indicates "X" Hz/division; therefore, a 10-division screen would be sweeping across a frequency spectrum of 10 × "X" Hz. (An analyzer that defines the span control as just "span" will sweep that many Hz across the screen.) As an example, a span of 1 MHz/div. would sweep across a frequency spectrum of 10 MHz. Just exactly which 10 MHz would depend on the frequency control. If the frequency control was set for 100 MHz, then the analyzer would sweep from 95 MHz to 105 MHz (see Figure 1). In Figure 1, note that the large signal is 100 MHz in frequency and has a level of −17 dBm. The smaller signals are 98 MHz and 102 MHz at a level of −62 dBm. Since the smaller signals are symmetrical about the center signal, they could be the modulation of the carrier at 100 MHz. In that case, the previous example would be referred to as a "signal" or "carrier" at 100 MHz with 2 MHz sidebands down 45 dB from the carrier, or −45 dBc. (The term dBc means dB below the carrier.)

The span control has two settings that are not calibrated in Hertz. Turn this control clockwise to eventually reach a position of maximum (max) span. In this position, the analyzer sweeps across its maximum frequency spectrum for the band of frequencies selected. In a band that extends from 0 Hz to 1,800 MHz, the analyzer sweeps the frequency spectrum from 0 Hz to 1,800 MHz to look for signals when in maximum span. Although the analyzer is only specified from 50 kHz to 1,800 MHz, a certain amount of oversweep is common. Turn the span control counterclockwise and the spans get smaller and smaller in frequency until the zero span position is reached. In this position, the analyzer no longer sweeps across a frequency spectrum but behaves like a superheterodyne receiver. The analyzer now basically works like a typical oscilloscope where the display indicates the modulation of any signal at the frequency selected by the frequency control.

Resolution bandwidth

Ideally, the display or graph of amplitude vs. frequency should be vertical lines of minimum width to allow signals of very close frequency spacing to be individually discernible, as shown in Figure 2. Note the pair of sidebands located very close to the carrier. If a wide pen had been used to draw the figure, as in Figure 3, the sidebands might have been overlooked as denoted by the slight width change near the bottom of the carrier. Resolution bandwidth (RBW) performs much the same function as varying the width of the pen when plotting the display on the screen. As the frequency spectrum being displayed on screen varies as a function of the span/div., the width of the "pen" that is calibrated in Hertz also must change. If an extremely narrow pen is used with an extremely wide frequency span, signals will appear very narrow and may be overlooked.

Most modern spectrum analyzers through the use of microprocessors have the capability to select the optimum bandwidth (resolution bandwidth) depending on the span/div. and time/div. selected. There will be times, however, when manual control of this function will be desired.

Resolution bandwidth is a functional control that selects one of several bandpass filters physically located in the instrument's intermediate frequency (IF) chain. It is defined in the term Hertz (Hz) and is a measure of the width of the filter either 3 dB or 6 dB down from its peak, depending on analyzer manufacturer. The shape of the signals being traced out on screen is in reality a combination of the shape of the RBW filter and the signal, not just the shape of the signal being analyzed.

The limitations imposed on an analyzer by the RBW filter are significant. Sweep speed (the rate the analyzer sweep through the frequencies present) must be slow enough to allow the filters to reach peak amplitude or an inaccurate signal

Figure 2

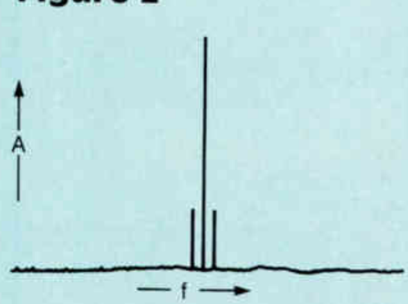

Figure 3

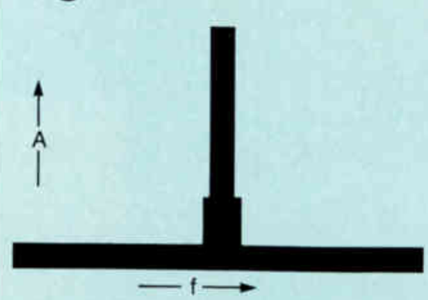

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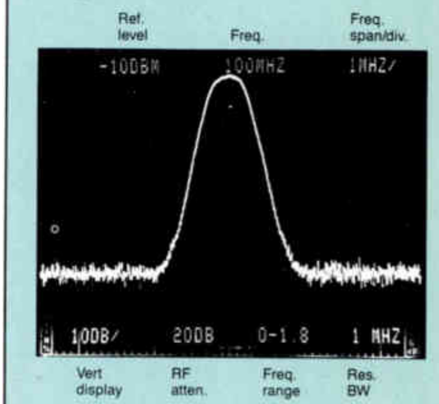
Figure 4



amplitude will result. When analyzing pulse type signals such as radar, RBW is very important or erroneous results will be obtained.

Unless a special requirement dictates a specific RBW, the RBW selected should be somewhat greater than 1/50 times the span/div. Figures 4 and 5 show the two extremes of useful RBW for a particular scan. In each case, the signal being displayed is the same, with only the RBW of the analyzer changing between the two figures. Figure 4 is displayed with an extremely wide RBW for the span/div. selected. Figure 5 has a more optimum RBW selected, and we can now see sidebands on the signal that were not visible in Figure 4. If the bandwidth continues to narrow, the sweep speed of the analyzer would have to slow down to allow the signal to trace the correct amplitude through the filter and the display would be less viewable.

Another characteristic not yet mentioned, which works in our favor, is that as the RBW is decreased, the noise floor of the analyzer goes down. (The term "noise floor" refers to the baseline or lowest horizontal part of the trace. Because of its appearance, this part of the signal is sometimes referred to as the "grass.") For each decade decrease in RBW (e.g., from 100 kHz to 10 kHz), the noise floor of the analyzer decreases by 10 dB. This is extremely important when looking for very small signals. Figure 6 is a composite of two RBWs that show a signal that was initially buried in the noise. The only parameter changed is the RBW, which in effect pushed the noise of the analyzer below the level of the signal's sidebands.

Secondary controls

Sweep time: Like resolution bandwidth, most new analyzers have an auto position in which a microprocessor selects the optimum sweep speed, depending on other parameters. When analyzing a frequency spectrum, this control determines the rate at which the analyzer sweeps through the determined spectrum. If the spectrum is swept too fast, the RBW filters may ring or fail to reach full amplitude. If swept too slow, there are no disadvantages, unless the analyzer does not have digital storage or some form of waveform storage. Without storage, by the time an extremely slow sweep is complete, the operation could have forgotten the content of the original spectrum.

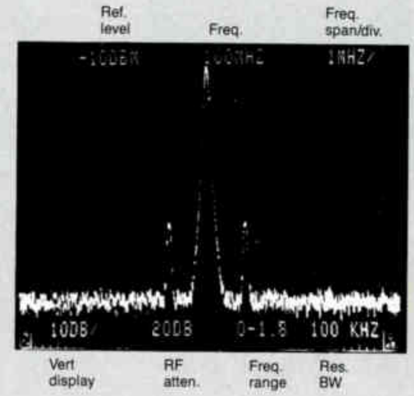
Reader Service Number 56.

When the analyzer span/div. control is set for zero span, the sweep control functions like an oscilloscope's time control. As previously described, the display is a time domain presentation of the modulation at the center frequency selected when in zero span.

Video filter (sometimes referred to as a noise averaging filter): This filter is used primarily as a smoothing filter to remove or smooth out the short duration noise spikes at the bottom of the display. When the analyzer is in auto sweep speed, note that the sweep rate decreases when a video filter is turned on. In most analyzers there are usually several video filters to choose from. Care must be taken, much like selecting the RBW filter. When analyzing a signal such as pulse radar or if the RBW is very narrow for the span (i.e., narrow signals displayed on screen), the video filter should be not be selected, as this will not allow the amplitude of the analyzed signals to reach full amplitude due to its video bandwidth limiting property (i.e., a low-pass filter).

Digital storage: In many older spectrum analyzers, a storage oscilloscope was used as the display. This was necessary because of the slow sweep speeds required to maintain amplitude calibration. With the advances in digital hardware, it is now possible to divide the screen into small horizontal segments and digitize the amplitude as the analyzer sweeps through each segment and store the data in RAM (random access memory). This data can then be accessed, converted to analog signals and sequentially displayed on the screen in the proper horizontal sequence at slightly above flicker rate.

Figure 5



This procedure of digitizing a signal occurs after the signal has been processed by the RBW, logarithmic and video filter circuitries. It usually occurs just prior to being amplified for the CRT.

Once the data is stored in RAM, we usually have an option as to the method of display. If we desire to "save" a particular waveform (e.g., "A" waveform), we can select the "save A" function and the "A memory" within the analyzer will be frozen and not updated. The B waveform in memory will continue to be updated with each sweep of the analyzer; thus we would view separate traces on the screen. If the "saved" trace was not needed for immediate viewing, the "view A" function could be disabled and the "A memory" would not be displayed on the screen; but, its data would still be available for future reference. If the "view B" function is simultaneously disabled, the display portion of digital storage is disengaged and the sweeping signal of the analyzer will be displayed, with the refresh rate determined by the time/div. control.

The "B-save A" control is used to display the difference between two waveforms. As the name implies, it subtracts the saved A waveform from the active B waveform. This function is most useful when the analyzer is used with the tracking generator. The "max hold" function is used to capture the maximum Y deflection (amplitude) for any X axis position (frequency), regardless of how many sweeps must be made to capture these extremes. This is accomplished by the digital storage digitizing new amplitude data for a particular point on screen then checking the amplitude in memory for that specific memory location and saving the larger of the two. The usefulness of "max hold" is in capturing a frequency spectrum where a signal randomly appears, then disappears. Once the signal has been analyzed and stored, the digital storage will continue to display the signal regardless of whether or not it reappears on succeeding sweeps.

A different application might be to monitor a frequency modulating or drifting signal and note the frequency excursions. This can be accomplished by selecting the desired frequency carrier and enabling the "max hold" function. On each succeeding sweep, the analyzer will analyze the carrier at its precise frequency at the moment of analysis and save this value in

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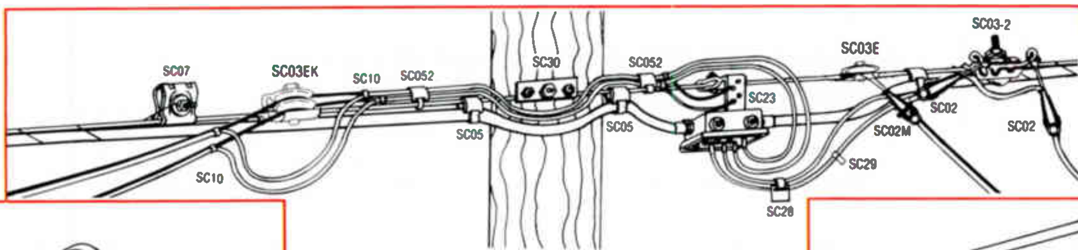

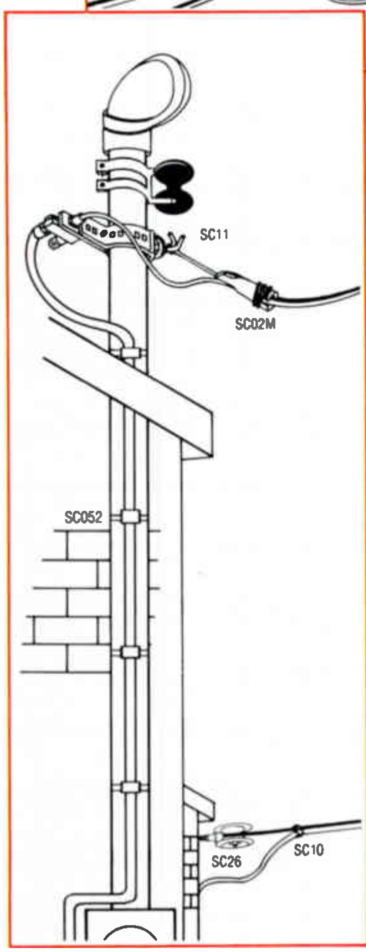

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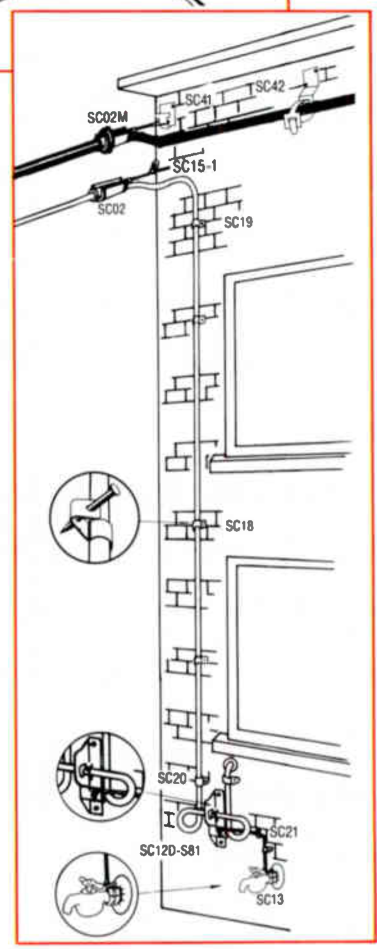

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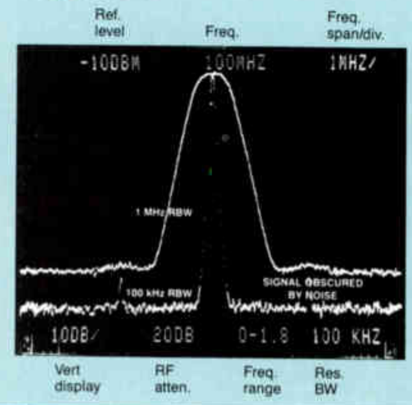
memory. With repetitive sweeps, the maximum excursions will be filled and viewable for analysis. It is important to check the drift specifications of the analyzer to ensure the analyzer is more stable than the signal to be checked.

The peak/average cursor is used to determine data processing prior to loading the digitized information in RAM for a particular horizontal point on the screen. For each horizontal point on the screen (of which there are 1,000) the digitizer may digitize from 2 to 10,000 samples (depending on the sweep speed) to represent the Y value to be stored for a particular horizontal point. If the amplitude of the signal at this horizontal point is above the cursor, the storage will select the maximum value digitized and load this number in memory (thus the term "peak detect"). When the amplitude of the signal at this horizontal point is located below the cursor, the digital storage will take the mathematical average of the digitized numbers and load this number in memory (thus the term "average detect").

The necessity for having a "peak/average" function is to ensure that the maximum value of a narrow pulse can be stored to represent the maximum amplitude of that pulse, and noise or grass can be averaged before storing in RAM to offer the maximum possible signal-to-noise ratio.

Frequency range: This function operates much like a band select switch on a shortwave receiver. Each succeeding selection of either the "up" or "down" control will place the instrument in a higher or lower frequency band of operation.

Figure 6



Phase lock: An analyzer usually has two or more internal oscillators, one or more of which will be swept (or moved) as the analyzer is sweeping through a frequency spectrum. When in wide spans, such as 100 kHz/div. or greater, a slight amount of drift in one of the internal oscillators is usually not noticeable. However, as the span is reduced to several kHz/div. or less, the instability of the internal oscillators becomes apparent. The screen indication is of an apparently drifting signal, when the real problem is a drifting oscillator within the analyzer. Therefore, when an analyzer is operating in the narrower spans, the oscillator causing the drift problem is typically phase locked to a stable reference to prevent the drift. In wider spans/div. this oscillator is typically being swept; therefore, it cannot be locked at all times. When the phase lock circuitry is operating, a front panel indicator will typically inform the operator. This indication requires no action on the user's part and will usually not affect the measurement in an adverse way.

Preselector: A preselector is a filter located just slightly behind the input connector. The function of the filter is to select or allow only a narrow band of frequencies to pass into the analyzer. It is a sweeping filter that tracks the frequency the analyzer is tuned to at any particular point in time. The function it performs is to inhibit harmonic mixing within the first converter. By eliminating the harmonic conversions, unwanted mixing products do not appear as signals in the spectrum. In addition, any large signals (up to +30 dBm) present on the input but out of the frequency range being analyzed are prohibited from reaching the input mixer, thus eliminating the need to use attenuation to protect the input mixer from burnout. The preselector is almost transparent to the user, except that it needs to be "peaked" occasionally. This is usually accomplished with a front panel control. The peaking control allows the user to offset the tracking filter slightly forward or backward with respect to the frequency the analyzer is tuned (i.e., to be centered around the tuned frequency). If the filter is mispeaked and is completely offset from the tuned frequency, the analyzer will indicate a complete lack of signals in the preselected bands.

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TECH TIPS

XPress in the headend

By Elizabeth D. Blick
Product Manager, XPress Information Services

XPress offers cable products (XChange and Executive) for personal computers used by consumers, education and business. Most of the information providers (including Standard & Poor's, Associated Press, Agence France Presse, Tass and other world wire services) transmit their data to our production center in Englewood, Colo., via satellite or leased line. As the various real-time feeds are collected, they are processed and reconfigured into a unified 6.9 kbps asynchronous data stream.

The feed is structured using the ISO/OSI protocol model. It allows us to transmit a variety of electronic information that can be accessed and implemented using various software products. The data stream is made up of four types of packets. Each is composed of various component frames, including unit frames consisting of approximately 6,000 bytes. *Text* packets are created from millions of words of continuously updated, time-sensitive information received daily from over 30 sources. Text stories are transmitted in ACSII format.

Another type of text packet contains *teleconferencing* information. With the current XPress software, these packets are read as "stories"; however, in the future users also will be able to access them with teleconferencing management software.

Equity packets transmit stock and mutual fund prices. A user may program the software to capture up to 128 stock and mutual fund quotations, displayed in a columnar format by the XPress software. In addition, using a software package known as ProQuote, the subscriber can access the XPress feed to receive quotations while simultaneously displaying stock charts and graphs.

File transfer packets make up the fourth component. With file transfer, we are able to transmit, via cable-to-computer feed updates to our software, public domain software, freeware, shareware or other software that enhances the XPress feed. We are also able to send various data bases, graphics, etc., that are accessed and implemented using additional executable software.

Since XPress delivers one unified data stream, it becomes necessary to manage individual packets. This management is accomplished by identifying each packet with a header code and by using a service code to direct the packet to the appropriate software package. For instance, a text packet having a header code of F??POM and a service code of 2 will be directed to the Standard & Poor's Market Movers category of the Executive menu. A text packet with a header code of NI1***** and a service code of 0 indicates an international news item from Agence France Presse, which will be captured by the XChange software.

Delivery of the feed to cable systems is accomplished by sending our data stream to Cable News Network in Atlanta. The data is then uplinked along with the digital audio signal of CNN to Galaxy I, transponder 7, using General Instrument's VideoCipher/InfoCipher 1500P, and is inserted on the auxiliary data port.

Cable systems do not have to subscribe to CNN in order to receive the XPress feed; however, they must have access to a "CNN" VideoCipher. The XPress feed arriving at the headend is 48 kbps synchronous. Data is routed out of the VideoCipher via the data auxiliary connection at terminal barrier I, positions 6 (−) and 7 (+). This data feed is an RS422 balanced-voltage signal and is NRZ synchronous. Next, the data is sent to a Wegener 1601 mainframe, housing a

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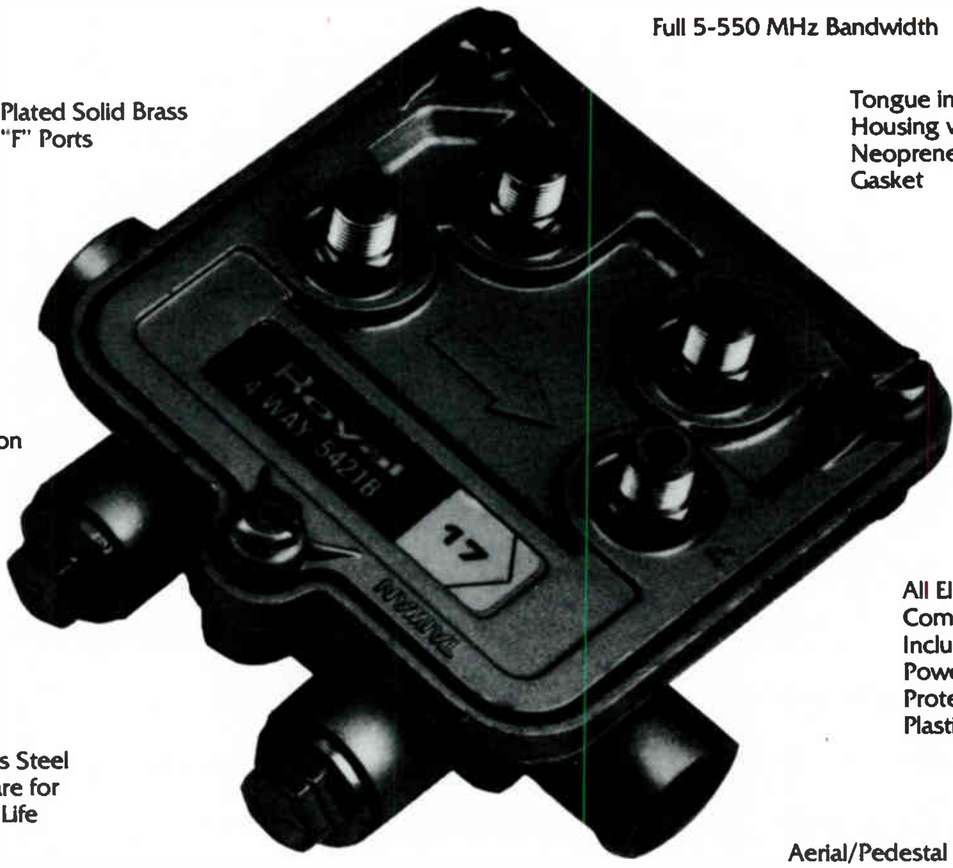

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General Instrument 1500C interface card. This interface card is Wegener-compatible and converts the XPress feed to the required data interchange format of RS232 unbalanced and asynchronous and 9,600 baud (or 9.6 kbps).

The RS232 unbalanced asynchronous format is distributed by routing the RS232 voltage to a Wegener 2060-XX FSK modulator, which also is housed in the 1601 mainframe. One of three frequencies (72.6, 73 or 109.0625 MHz) must be selected. If the frequency used is either 72.6 or 73, the XPress feed will be carried on the guard band between Channels 4 and 5. At a frequency of 109.0625, XPress is carried above the FM band at A-2. The frequency is crystal controlled and referenced by the suffix of the model number: 2060-01, 2060-03 and 2060-02, respectively. The RF signal is then routed to the system combining network and distributed systemwide at a level set approximately 20 dB below the adjacent video channel.

Troubleshooting

Beyond determining sync loss (red error LEDs), troubleshooting the XPress feed is relatively easy. To ascertain that the feed is operating at the headend, you will need a personal computer and an XPress software package. First, determine that the feed has been properly interfaced and that the serial card is seeing the feed. To accomplish this, press Alternate F to access the feed your computer is receiving, while running the software. Text, codes, etc., should be constantly changing from top to bottom, left to right.

Once you have established that the feed is arriving properly, the next step is to determine the quality of the feed. By pressing Alternate Q, you can access a display screen that will indicate the quality of the feed by displaying the number of checksum errors, packets considered, packets received, etc. Compare the number of checksum errors to the number of packets considered. If the quality of the feed is good, the ratio of these should be less than 1 percent.

"Beyond determining sync loss (red error LEDs), troubleshooting the XPress feed is relatively easy."

If the feed is arriving at the headend but its quality is poor, the problem is most likely at the modulator. This can be confirmed by hooking up the PC serial port directly to the 1500C card to test the data before it is modulated unto the system. Connect the PC to the mainframe at connector JX6 (depending on the channel used). Pin 1 is data and Pin 2 is the ground. Again use Alternate F and Alternate Q to determine the quality of the feed.

If everything checks out properly at the headend, but you are still receiving complaints from one or two subscribers, call XPress before you roll a truck. If our customer service department has not received any call regarding feed difficulties, then the problem is most likely occuring at the individual cable subscriber's hookup. To test the feed in the field, you will need a field strength meter. The correct signal for the feed should test between a level of −15 dBmV and −25 dBmV at the appropriate RF carrier frequency.

Reception of the XPress feed by cable subscribers requires a kit, which includes a receiver, RS232 cable, necessary software, documentation and cable connectors. The cable signal is connected to either a Wegener 2010 receiver or an InfoCipher 1000R. A Wegener 2010 receiver is used for XChange exclusively; or upgraded for Executive. These receivers convert the RF signal back to an RS232, 9.6 kbps, asynchronous data stream. The appropriate RS232 cable interfaces the DCE receiver output to the personal computer's DTE communications board (serial) input, delivering data suitable for processing by an Executive or XChange compatible computer.

In the third quarter of 1988, we will be encrypting our signal. Once encryption is implemented, an additional General Instrument 1500M XChange module will be required at the headend. This model will mount on the 1500C. The Executive service will be decrypted at the cable subscriber's receiver by utilizing a 1000M module. This module has been designed to be inserted in the rear of the 1000R receiver. ■

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Ruminations on HDTV transmission

By Lawrence W. Lockwood
President, TeleResources
East Coast Correspondent

What will be the standard in the United States for high-definition television (HDTV) transmission? In August 1987 the Federal Communications Commission issued a Notice of Inquiry (NOI) on HDTV regarding this problem and subsequently created an advisory committee to examine it and help the FCC in its deliberations and future rulemaking. Indeed, will there be just one standard or more than one for different media such as terrestrial broadcast, CATV, DBS, VCRs, etc.? Currently there are "smart sets" available that will decide if the signal is in NTSC, PAL or SECAM and produce the correct picture regardless of the standard of transmission. Even if the same methodology were successfully developed for multiple HDTV transmission standards, the complexity/reliability and the cost of the receivers might very well be unacceptable. Obviously a single HDTV transmission standard is to be devoutly desired.

Improved NTSC

Along the path to HDTV, improvements in NTSC transmission/reception will be made. There are artifacts in NTSC as used today (i.e., cross-color interference, where the luminance signal leaks into the chrominance signal resulting in spurious color patterns in detailed areas; cross-luminance interference, where the chrominance signal spills into the luminance signal causing dot crawl on edges; interlace artifacts such as line flicker, pairing, etc.) that can be either eliminated or greatly reduced by the use of sophisticated signal processing. Work in this area has been done by a number of people in this country (i.e., Yves Faroudja of Faroudja Laboratories has demonstrated applications of his approach[1], which uses multiple combing techniques in both the transmission end and in the receiver, progressive scanning and more).

However, just recently NEC announced an "improved-definition television" (IDTV) system, which produces improved NTSC pictures. IDTV uses complex digital signal processing and many of the techniques that are still in the prototype stage in this country. The kicker is that NEC has already reduced the whole IDTV system to the chip hardware state. This chip set for the TV receiver consists of seven chips of image-field memories (at 1 Mbit each), 11 chips of scan line memories and a handful of data converters. NEC is going to make and sell (in Japan only this year) an expensive 27-inch TV set that will be priced at $2,500. Of course, with the rapid price decreases that accompany expanded production, the prices should soon be in the range of, and therefore competitive with, premium TV receivers.

A single-channel HDTV transmission proposal

The luminance baseband width of 1,125-line HDTV is about 36 MHz (assuming a Kell factor of unity, and a 2:1 interlace). All of the transmission methods currently being considered propose different schemes to reduce the video bandwidth. None claim to be able to produce the full camera resolution at the receiver (a theoretical 1,840 lines horizontally) but the Japanese MUSE system comes the closest. (See Table 1.)

With the limitations imposed by the NTSC standards, i.e., VSB-AM (vestigial sideband amplitude modulation), separate sound carrier, etc., no one claims that a true HDTV signal can be accommodated in a *single NTSC-compatible* channel. Even the RCA/NBC ACTV (advanced-compatible TV) system[2] cautiously and correctly claims only "extended spatial resolution" for their one-channel NTSC-compatible system.

With the exception of the Del Rey Group, all other proposed NTSC-compatible HDTV transmission schemes require additional transmission bandwidth (in most cases about the equivalent of another standard 6 MHz NTSC channel).

Is it time to dump vestigial?

If indeed at least two channels are going to be required to accommodate both current NTSC signals (mandatory since the current base of 140 million sets cannot be ignored) and the proposed HDTV signals, then it seems a good time to consider an approach presented in the FCC NOI—"one approach is to allow for the simultaneous broadcast (simulcast) of programming in both NTSC and ATV (HDTV) formats." This approach would allow for improving channel transmission efficiency by using techniques more efficient than NTSC standards. As said in the NOI, "as important as these requirements may have been over the years, their continuation may no longer be necessary and may be counterproductive in some instances." VSB-AM transmission when established in 1940 by the first NTSC was the most efficient method available at that time. A separate sound carrier in the TV channel was also right at that time.

However, newer techniques are available today that can greatly increase the channel transmission efficiency. In testimony before the House Subcommittee on Telecommunications and Finance in October 1987, William Schreiber presented an interesting proposal[3] for single-channel HDTV transmission. Schreiber is a professor of electrical engineering and director of the Advanced Television Research Program (ATRP) at Massachusetts Institute of Technology. ATRP is an MIT research program funded by the members of the Center for Advanced Television Studies (CATS). The members of CATS are U.S. TV broadcasters and other American companies interested in the TV industry. CATS started in 1983 and has included ABC, NBC, Time Inc. (HBO, ATC), PBS, Ampex, Tektronix, RCA, Harris, 3M, CBS, Zenith and Kodak.

"What will be the standard in the United States for high-definition television (HDTV) transmission?"

Schreiber states: "I believe that it is possible to achieve true HDTV within a single independent channel. Such a system could be used by cable companies, such as Home Box Office."

The key elements of his proposal are:

- *"Better analog channel utilization.* Eliminate the separate sound carrier, the retrace intervals and vestigial sideband transmission. Instead use two 3 MHz baseband signals, quadrature modulated onto a single carrier in

Table 1: Comparison of NTSC and HDTV transmission methods

	Compatible?	Number of channels required	Bandwidth (MHz)	Resolution pixels/frame Vert.*	Horiz.**	Number of scan lines/frame	Aspect ratio	Interlace***	Approx. Kell factor
NTSC	N/A	1	6	483	440	525	4:3	2:1	0.7
MUSE	No	2	8.1	1,035	1,496	1,125	16:9	2:1	0.8
North American Philips	Yes	2	9.5	483	853	525	16:9	Transmit 2:1 Display 1:1	1.0
Del Rey Group	Yes	1	6	828	1,320	Transmit 525 Display 894	14:9	2:1	1.0
ACTV	Yes	1	6	483	747	Transmit 525 Display 1,050	16:9	2:1	0.87

*To get vertical resolution in TV lines, multiply by the Kell factor (its value varies with system claims from 0.7 to 1.0). The resultant is usually referred to as the resolution of the TV system.
**In this direction, pixel values are equivalent to TV lines.
***There has been considerable speculation that all HDTV displays will be produced with an interlace of 1:1. This will be possible, since each HDTV receiver will require a frame store.

the middle of the band. Use time multiplexing of the various components, reserving about one-twelfth of the time for audio and data. This gives an improvement of as much as 70 percent in efficiency (pels/sec per unit bandwidth).

- *"Separation of camera and display standards from those of the channel.* This involves a frame store and high-rate progressively scanned display. This method effectively increases the resolution at least 40 percent.
- *"Increased spatial resolution/reduced frame rate.* I would guess that 18 frames and 36 fields per second would be entirely satisfactory with a carefully designed non-adaptive interpolator. This should give much better motion than film and would result in another two-thirds improvement in resolution.
- *"Relatively lower frame rate for high spatial frequencies.* This technique is used in MUSE and by Glenn, as well as in the Philips and Sarnoff/NBC systems. The savings depend on just how the band is divided, but come to at least 25 percent.

"If all these improvements in efficiency multiply, then we have about a six-fold increase in the area spatial resolution compared to NTSC, even with non-adaptive interpolation. This would give a quality at least equal to MUSE, *with the possibility of eventually getting much better."*

In the paper Schreiber outlines several possible improvements that might be added in the future that would be perfectly compatible with the base system as described.

A TV receiver for this system presents an ideal case for the application of the "smart set." The smart set would determine whether the signal is NTSC, or the proposed single-channel HDTV, and then produce the picture in the proper format. Since the items of largest cost in a TV receiver are the kinescope, the cabinet and the power supply, the addition of chips to process the signal in the NTSC format should add very little cost to the HDTV receiver.

Conclusions

The progression to better TV pictures, which means the reduction or elimination of NTSC artifacts and ultimately higher resolution pictures, is inevitable. The higher resolution will be required because of the increasing demand for larger pictures, which will undoubtedly be viewed at the same distance in the home as the current smaller, lower resolution picture NTSC sets.[4] Additionally the drive for higher resolution in the better pictures will be fueled by consumer acceptance of the significantly better resolution and reduction of artifacts produced by the new S-VHS and EDTV VCRs and the continual improvements in NTSC.

Before HDTV becomes widely available in the consumer market we will have increasingly improved NTSC pictures. Although there has been some work in this country to that end the Japanese have stolen a march on us again through the development to the finished chip hardware stage of the IDTV system by NEC. Of course, it is easier to steal a march on your competition if your competition (American TV businesses) helps you with their religious devotion to the bottom line, which results in reducing or eliminating R&D, giving away or selling laboratories and other activities aimed at ignoring the future for a slightly better return this quarter.

The MUSE transmission of HDTV was designed for DBS. The Japanese never intended to transmit HDTV by terrestrial broadcast. It is a fine DBS system producing high-quality HDTV pictures, but MUSE presents problems when adapted to NTSC channels for which it was not designed.

Schreiber of MIT has proposed an interesting single-channel non-NTSC system for HDTV transmission that has a number of advantages over other proposed systems and shows great promise for future compatible improvements.

However, there is potential disaster for *any* of the proposed American systems regardless of possible approval by the FCC or industry standardization. The problem is that there is, in truth, probably a short time (viewed by many as about three years) before the Japanese MUSE system becomes a de facto standard. The MUSE TV receivers, MUSE VCRs, MUSE laser discs, etc., will be introduced in this country, probably within a year, and if there is no American competition nor any American system fully demonstrated, tested and firmly established as a standard then MUSE may very well become the de facto standard. Ironically, American aid in establishing the Japanese 1,125-line system as a standard in this country has already occurred. The SMPTE has just made the 1,125 system a standard for production. *Tempus fugit.*

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[1]"Improving NTSC To Achieve Near-RGB Performance," Y. Faroudja and J. Roizen, *SMPTE Journal,* August 1987.
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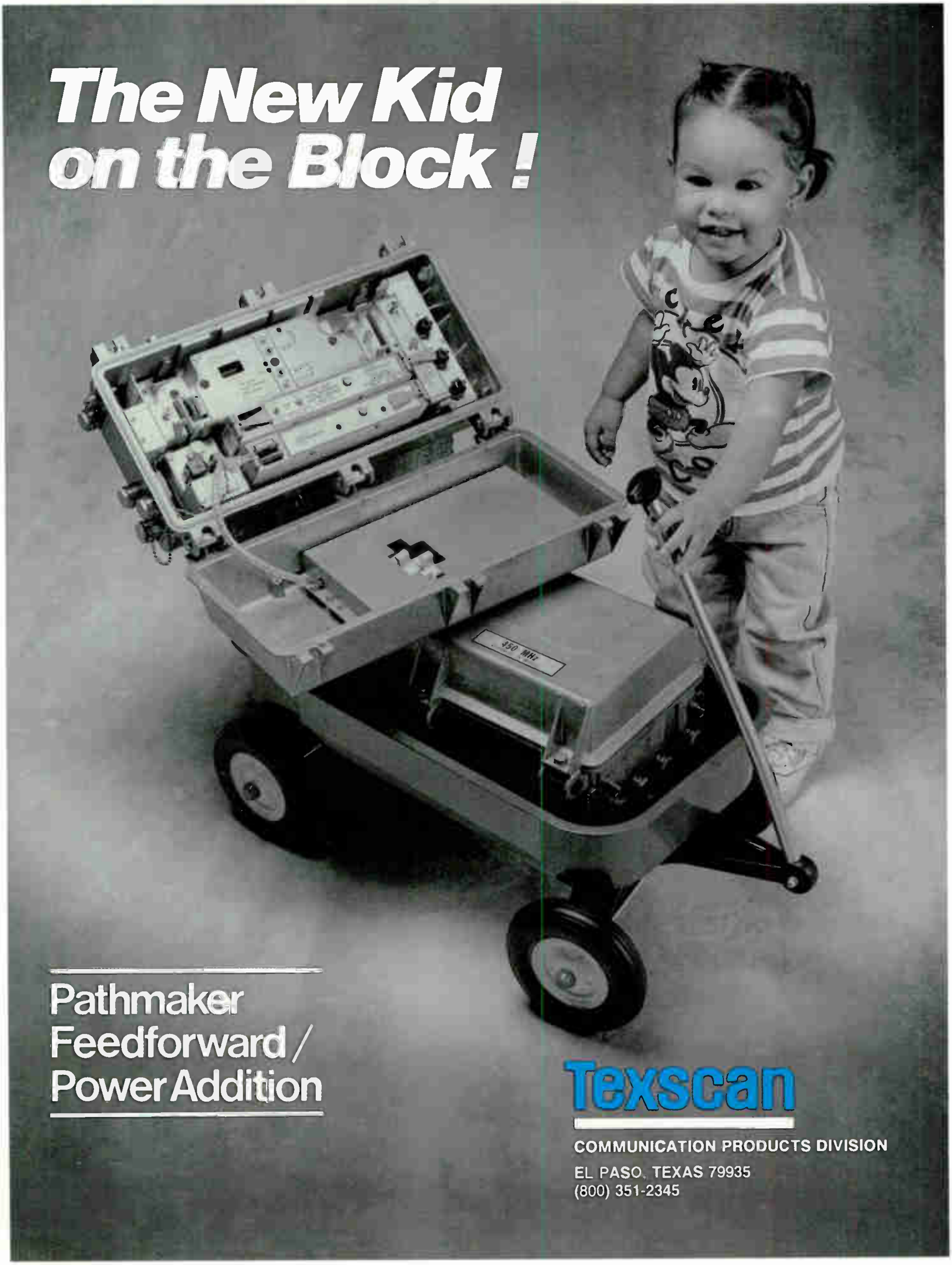
[3]"6 MHz Single-Channel HDTV Systems," W. Schreiber, *HDTV Symposium,* Ottawa, October 1987.
[4]"HDTV Viewing Distance," Lawrence W. Lockwood, *Communications Technology,* November 1987.



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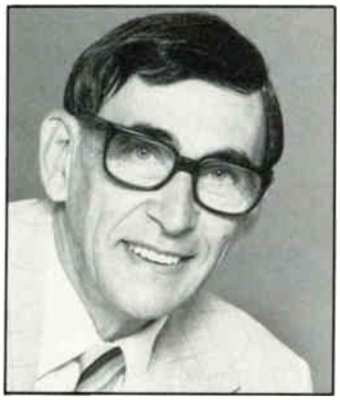
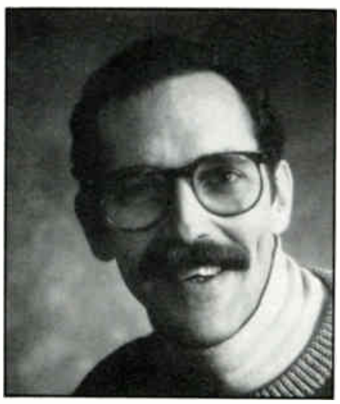


Ehman

Jones Intercable appointed **Roy Ehman** as director of engineering at its Englewood, Colo., corporate office. Formerly, he was engineering vice president for Storer Communication's Kentucky/Virginia CATV operation. Contact: 9697 E. Mineral Ave., Englewood, Colo. 80112, (303) 792-3111.

Pyramid Industries recently announced several appointments. **Steve Youtsey** was named vice president of marketing. **Rex Porter** was appointed director of CATV sales. Also named were **Bob Abrahams** as national sales, **David Butchko** as sales engineer and **Debi Stanton** as customer service representative. Contact: 3700 N. 36th Ave., P.O. Box 23169, Phoenix, Ariz. 85063, (602) 269-6431.



Jones

Robert Jones was selected as technical supervisor for **Adams-Russell**'s Bangor, Maine, cable system. Previously, he was proof-of-performance supervisor for Galaxy Cablevision in Sikeston, Mo. Contact: 278 Florida Ave., P.O. Box 1405, Bangor, Maine 04401, (207) 942-4661.

Broadband Networks announced the appointment of **Stanford Cook** as vice president of operations. Before this, he was vice president of manufacturing for AM Communications. Contact: P.O. Box 8071, State College, Pa. 16803, (814) 237-4073.

Kashian

Greg Kashian joined **Reliable Electric/Utility Products**, a division of Reliable Comm/Tec, as area sales manager for Illinois and Wisconsin. He was most recently with CTC in sales. Contact: 11333 Addison St., Franklin Park, Ill. 60131, (312) 451-5521.

Richard Kay was named chief financial officer of **Oak Industries**. Before joining Oak, he was senior vice president of finance for Energy Factors in San Diego.

John Edl was appointed executive vice president of operations. He was previously with Elkay Manufacturing Co. as vice president of marketing. Contact: 16935 W. Bernardo Dr., Rancho Bernardo, Calif. 92127, (619) 485-9300.

James Wonn was appointed **C-COR Electronics'** vice president of sales and marketing. He was formerly vice president of engineering for the company. Contact: 60 Decibel Rd., State College, Pa. 16801, (814) 238-2461.

Thomas Ledbetter was named plant manager of **Pirelli Cable Corp.**'s optical cable manufacturing facility. He previously held positions in manufacturing and customer service at Siecor Corp.

Michael Ricciardi was promoted to product line manager of fiber-optic cables and cable assemblies. He was formerly customer service manager of fiber-optic cable telephone applications.

Wayne Harris was promoted to customer service manager of fiber-optic cable products. Prior to this, he was a marketing specialist. Contact: 800 Rahway Ave., Union, N.J. 07083, (201) 687-0250.

Charles Fitzer rejoined **Blonder-Tongue Laboratories** as national accounts manager of CATV products. He has more than 20 years experience in the TV industry. Contact: 1 Jake Brown Rd., Old Bridge, N.J. 08857, (201) 679-4000.

Robert Busch was named corporate senior vice president of administration and services at **Avantek**.

The company also promoted five others to corporate officer status. Elected as corporate vice presidents were **Steven Allan**, vice president and corporate controller; **Richard Clark**, vice president, telecommunications division; **Robert Malbon**, vice president, gallium arsenide technology development; **Peter Manno**, vice president, microwave product sales; and **David Norbury**, vice president, subassemblies division. Contact: 4401 Great America Pkwy., Santa Clara, Calif. 95054, (408) 970-3028.

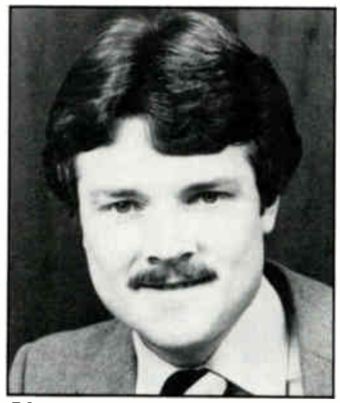
Kaiser

Bruce Kaiser was named president of **Lightning Master Corp.** He was formerly director of marketing for Avian Corp. Contact: P.O. Box 446, Brooksville, Fla. 34605-0446, (904) 799-6800.

Penn Central Telecommunications Co. promoted **Eugene Tonkovich** to president of its General Cable Guardian Products Division. He was most recently vice president and general manager of the division. Contact: 50 Tice Blvd., CN 12, Woodcliff Lake, N.J. 07675, (201) 573-8200.

T.E. Connor joined **MicroSat Cable Services** as vice president of operations. He was formerly with Storer Communications for 18 years. Contact: 1519 Johnson Ferry Rd., Suite 250, Marietta, Ga. 30062, (404) 971-1021.

Cable Link announced two promotions in its sales department. **Mark Romero** was named senior account executive at the San Antonio, Texas, branch office. **Pete Tippett** was appointed senior account executive in charge of converter part sales at the main office. Contact: 280 Cozzins St., Columbus, Ohio 43215, (614) 221-3131.

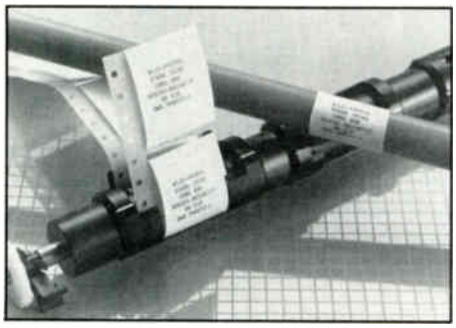


Pfundt

William Pfundt was named director of marketing for **General Machine Products Co.** Prior to this, he was regional sales manager in the Caribbean and Latin America for Northern Telecom CALA. Contact: 3111 Old Lincoln Hwy., Trevose, Pa. 19047, (215) 357-5500.

Scientific-Atlanta appointed **Brian Koenig** as vice president of human resources. He was previously vice president of corporate personnel at RJR Nabisco. Contact: 1 Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000.

Chyron promoted **Steve Sloane** to vice president of international sales for its telesystems and video products lines. Most recently, he was based in the company's London office. Contact: 265 Spagnoli Rd., Melville, N.Y. 11747, (516) 845-2000.



Marking system

Raychem recently introduced its new Thermolift Marking System. The heat-shrinkable sleeves are made of polyolefin to insulate and protect against chemical and mechanical abuse and abrasion. The range of sleeve sizes now includes ¾-inch and 1½-inch diameters. Each sleeve accommodates up to 18 characters per line, with the 1½-inch sleeve holding up to 10 lines of type.

The System 90 platen allows for printing of the sleeves on an IBM Wheelwriter or Wheelprinter. Its sprocket design, combined with the bandolier format of the sleeves, makes it easy to pin-feed the sleeves into the typewriter or computer-driven printer.

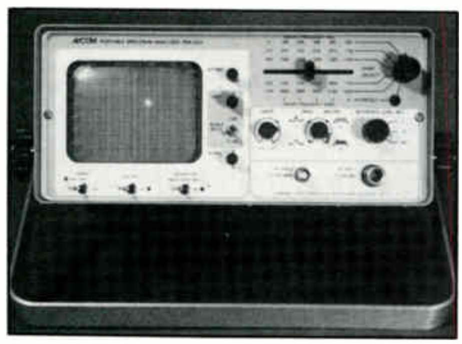
For further details, contact Raychem Corp., 300 Constitution Dr., Menlo Park, Calif. 94025, (415) 361-3333; or circle #136 on the reader service card.

Trap/filter system

Superior Satellite Engineers developed an automated terrestrial interference trap/filter system (ATIFS) for applications where satellite signal reception is a requirement but is not advisable due to varying levels of terrestrial interference.

ATIFS is a combination of four product services. First, Superior will perform a physical survey of appropriate sites. Second, a combination of 950-1450 MHz tuneable traps and 60 and 80 MHz filters is used to notch and trap undesirable carriers, then appropriate RF and IF switching configurations are determined and a custom unit built. Third, a computer software package is developed to allow activation of the filter/trap by computer. Finally, Superior provides for licensing of the site with the FCC to prevent other carriers from overlaying the site.

For more details, contact Superior Satellite Engineers, 2320 Sierra Meadows, Rocklin, Calif. 95677, (916) 624-8214; or circle #120 on the reader service card.



Spectrum analyzer

Avcom's Model PSA-35A Portable Spectrum Analyzer 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, faulty connectors, LNAs, feedhorn isolation and cable loss at all commonly used satellite communication frequencies, including 12 GHz downconverters.

It features a built-in DC block with +18 VDC for powering LNAs and BDCs with the flip of a switch, calibrated signal amplitude display, and rechargeable internal battery with built-in charger.

For more information, contact Avcom of Virginia Inc., 500 Southlake Blvd., Richmond, Va. 23236, (804) 794-2500; or circle #114 on the reader service card.

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2) Please check the category that best describes your firm's primary business (check only one).
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- ☐ MSO (two or more cable TV systems)
- ☐ Independent Contractor
- ☐ Microwave or Telephone Company
- ☐ SMATV or DBS Operator
- ☐ MDS, STV or LPTV Operator
- ☐ Government Agency
- ☐ Educational TV Station, School or Library
- ☐ Other __________ (please describe)

3) In the performance of my job I authorize, specify or recommend products and/or services for purchase.
☐ Yes ☐ No

4) Primarily my responsibilities involve:
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SCTE is a 501(c) (6) non-profit professional membership organization. *Your dues may be tax deductible.* Consult your local IRS office or tax advisor.

Make check payable to SCTE. Mail to: **SCTE, 669 Exton Commons, Exton, PA 19341.**

*/** Applications without payment will be returned. Applications from outside U.S./Canada/Mexico, enclose additional $40 (U.S.) to cover mailing expenses. Sustaining Membership is non-voting and not corporate or group-type category.

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Yes ☐ No ☐

2. In the performance of my job, I authorize, specify or purchase products and/or services.
Yes ☐ No ☐

3. Please check the category that best describes your firm's primary business (please check only one).
1. Cable TV Systems Operations
- ☐ a. Independent Cable TV Systems
- ☐ b. MSO (two or more Cable TV Systems)
- ☐ 2. Cable TV Contractor
- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
- ☐ 8. Cable TV Component Manufacturer
- ☐ 9. Cable TV Investor
- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
- ☐ 12. Program Producer or Distributor
- ☐ 13. Advertising Agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Other __________ (please describe)

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Rack mount cabinets

Winsted Corp. is offering rack mount cabinets said to provide increased rack space with great flexibility of arrangements. They feature a 30° sloping profile with 21 inches of rack space and are suited for low silhouette and security consoles. The sloping module can be combined with Winsted's existing System/85 modules. Corner unit consoles can be arranged with flat or sloping work shelves.

For additional details, contact Winsted Corp., 10901 Hampshire Ave. South, Minneapolis, Minn. 55438, (612) 944-8556; or circle #122 on the reader service card.

Time/frequency sync

Kode, a division of Odetics Inc., announced the addition of two new options for its SatSync satellite synchronized precision time and frequency system. SatSync uses the time information available from global positioning system (GPS) satellite signals to provide a continuous time and frequency reference.

The first new option is a disciplined rubidium oscillator, permitting SatSync to offer stratum one performance as a frequency reference and continuous submicrosecond timing accuracy. The second option is a time tagging feature, which allows SatSync to tag the time of randomly occuring events with submicrosecond resolution. It also has the capability to generate a trigger pulse at a preset time of year.

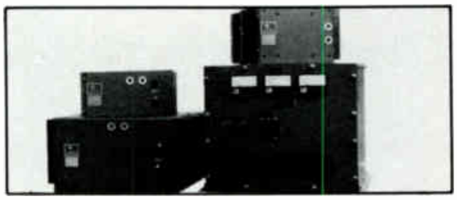
For further information, contact Kode, Odetics Inc., 1515 S. Manchester Ave., Anaheim, Calif. 92802-2907, (714) 758-0400; or circle #108 on the reader service card.

LNB converter

Panasonic Industrial Co. introduced a data grade LNB to its line of compact Ku-Band low-noise block downconverters. The product is designed specifically to amplify RF signals without introducing phase noise into the signal. This is important for transmission of high data rate digital information.

It has an input frequency range of 11.7 to 12.2 GHz and an output frequency range of 950 to 1,450 MHz. It provides a worst-case performance noise figure of 2.3 dB for Ku-band reception and is housed in a die-cast aluminum case with integral waveguide flange and waterproof construction.

For more information, contact Panasonic, 1 Panasonic Way, Secaucus, N.J. 07094, (201) 348-7183; or circle #115 on the reader service card.



Sine wave inverter

Nova Electric introduced a new series of sine wave inverters designed for communications applications. According to Nova, these inverters can provide up to 50 percent overload for short periods and survive a short circuit for an indefinite time. The systems recover to full output power and voltage within three cycles after removal of output overload or short circuit. They accept input voltages of 12, 24 and 48 VDC and are available in output voltages of 120 and 220 VAC at 6 Hz and output power ratings of 125, 250, 500 and 1,000 VA.

For more details, contact Nova Electric, 263 Hillside Ave., Nutley, N.J. 07110, (201) 661-3434; or circle #132 on the reader service card.

Power system

RTE Deltec's 8000 Series on-line uninterruptible power system is more than 50 percent smaller than most inverter biased systems and operates at less than 57 dB. It uses a bidirectional utility interactive, on-line converter that acts as a charger and inverter, adjusting the pulse widths and phase angles. It also allows for early detection of any inverter failure, and operates at a 95 percent AC-to-AC efficiency. Its manual bypass switch makes it possible to perform maintenance on the system without interruption or phase shift, according to the company.

For further information, contact RTE Deltec Corp., 2727 Kurtz St., San Diego, Calif. 92110, (619) 291-4211; or circle #139 on the reader service card.

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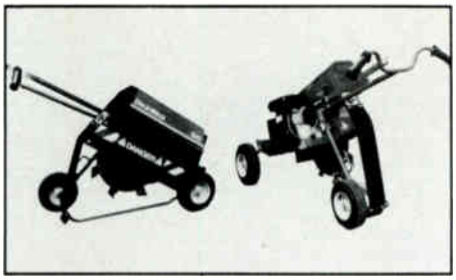
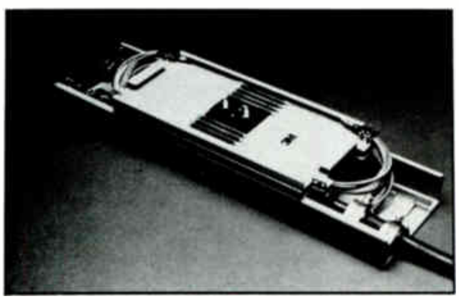


Disk trencher

Ditch Witch introduced its Model 510, a lightweight, compact disk trencher for applications requiring a shallow, narrow trench. It can dig to depths of 10 inches at 2-inch widths, and its eight digging teeth bolt on and off the 22-inch steel wheel. An integral slip clutch protects the engine against shocks and an operator-presence control system requires that one hand remain in contact with a handlebar control during operation. Its 31¼-inch width allows for access in hard-to-reach work areas.

For additional details, contact Ditch Witch, The Charles Machine Works, P.O. Box 66, Perry, Okla. 73077-0066, (405) 336-4402; or circle #134 on the reader service card.



FO splice protection

Available from 3M's TelComm Products Division, the 2119 fiber-optic splice organizer and 2120 splicing tray provide mechanical protection for AT&T single and multimode rotary spliced fibers. The tray stores all common splice configurations including butt, in-line and branch (with up to four branch cables). Its 4-inch width ensures that the fiber is stored in a relaxed position, minimizing microbend losses and signal attenuation. Strain relief hardware and ties are included in the tray kit. The organizer is completely re-enterable and holds up to four trays. As many as three additional trays can be added to increase fiber splice storage capacity.

For additional information, contact 3M, Dept. 427, P.O. Box 2963, Austin, Texas 78769-2963, (512) 834-3897; or circle #131 on the reader service card.

AML upconverter

Hughes Microwave's Model AML-AUPC-135 is a frequency agile upconverter designed for use with its MTX-132 transmitter. The unit can be used as a backup for any one of the 80 TV channels of the transmitter or as a ninth channel in a bay able to carry a non-premium channel, then switch to carry a premium channel if necessary.

According to Hughes, switching over to the upconverter during maintenance or retuning from an existing channel module can be accomplished quickly. The unit has a bandwidth of 550 MHz, requires no tuning and operates in the CARS band.

For further details, contact Hughes Aircraft Co., Microwave Communications Products, P.O. Box 2940, Torrance, Calif. 90509-2940, (213) 517-6233; or circle #130 on the reader service card.

Scientific software

MicroMath Scientific Software announced the 2.3 version of the MINSQ package for non-linear curve fitting and model development that comes with an expanded and rewritten manual; the software includes several new features. Graphic output capability now includes PostScript plot descriptions that may be sent either to a file for later plotting or directly to a PostScript output device.

New features include algebraic identification of linear parameters, a fine tuning option for adjustment of step sizes and convergence criteria for difficult problems and an interactive graphics section for zooming in on small regions.

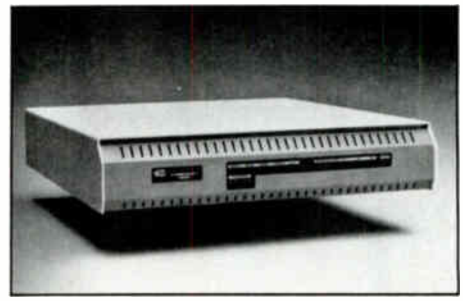
For additional information, contact MicroMath Scientific Software, 2034 E. Fort Union Blvd., Salt Lake City, Utah 84121-3144, (801) 943-0290; or circle #121 on the reader service card.

Lubricant

Available from General Machine Products is a new cable pulling lubricant with Teflon to wet both cable and duct to minimize cable/conduit friction. According to the company, this clear, slow-drying liquid leaves a tack-free film that won't dry out or gum up.

It can be used with all common cable sheathing and duct materials and can be pumped or poured where needed using normal lubrication techniques at temperatures above 25°F. The non-toxic, non-flammable, biodegradable liquid also has a normal pH balance and is said to be environmentally safe to use.

For additional details, contact General Machine Products Co., 3111 Old Lincoln Hwy., Trevose, Pa. 19047-4996, (215) 357-5500; or circle #140 on the reader service card.



LAN bridge

The Ethermodem III bridge, based on Chipcom's broadband transceiver technology and Digital Equipment Corp.'s LAN Bridge 100 architecture, allows interconnection of any Ethernet IEEE 802.3 10 Mbps subnetwork (baseband, broadband, fiber or twisted pair) directly to a broadband Ethernet backbone LAN. This product complies fully with IEEE 802.3 10BROAD36 standards of 10 Mbps throughout with 100 percent CSMA/CD, and has 24,200 packets/second filtering rate and 13,404 packets per second forwarding rate. It is available in 12 and 18 MHz versions and features packet filtering and a distributed spanning tree algorithm for loop detection.

For more details, contact Chipcom Corp., 195 Bear Hill Rd., Waltham, Mass. 02154, (617) 890-6844; or circle #126 on the reader service card.

Fiber driver

The Black Box fiber driver allows existing devices transmitting via the RS232 interface to take advantage of fiber-optic communications techniques. These drivers will guard equipment from electrical damage or electrical interference up to 2.5 miles at 76.8 kbps.

For additional information, contact Black Box Corp., P.O. Box 12800, Pittsburgh, Pa. 15241, (412) 746-5500; or circle #137 on the reader service card.

Distribution analyzer

Sencore introduced its FS74 Channelizer Sr., an RF distribution analyzer that automatically indicates the problem when a system fails. Tests performed by the system include: all-channel testing from 5 MHz to 890 MHz, audio-to-video ratio, on-channel signal-to-noise ratio, hum level on any in-use channel and automatic frequency offset. It also measures AC or DC through the RF input for both trunk line RF and power supply voltages and tests ohms. Its 4 MHz monitor allows the user to see picture quality problems before the customer sees them, according to the company.

For more information, contact Sencore, 3200 Sencore Dr., Sioux Falls, S.D. 57107, (605) 339-0100; or circle #141 on the reader service card.

O-scope software

Programs for remote control of LeCroy's Model 9400/9400A digital oscilloscope are included in two brochures. *Linking the LeCroy 9400 to an IBM PC-AT via GPIB* presents a sample program in the C language for controlling up to 16 9400 Series oscilloscopes over GPIB using IBM PC-AT or compatible PC as bus controller. *Linking LeCroy 9400 to an HP9000 Model 216 Controller* gives examples of interactive remote control of the 9400 over HPIB and shows how to store and retrieve waveform data from disk via a program using Model 216 Controller and the HP Basic 3.0 language.

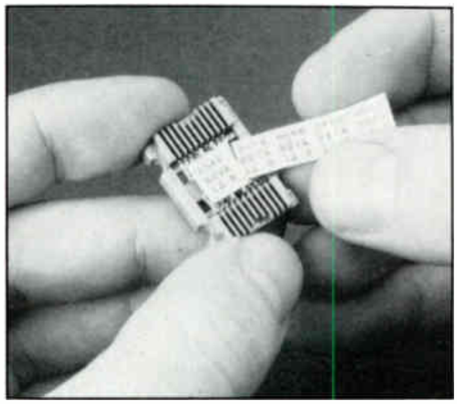
For additional details, contact LeCroy, 700 Chestnut Ridge Rd., Chestnut Ridge, N.Y. 10977-6499, (914) 578-6084; or circle #128 on the reader service card.

Lubricant/penetrant

Available from Klein Tools, Cinch Yellow-Plus has a low surface tension, allowing it to penetrate and lubricate quickly to free rusted nuts, bolts and other "frozen" parts, leaving a transparent, corrosion-resistant barrier. It also lifts moisture with its active water-displacing properties.

This product is available in 6- and 12-ounce aerosol cans, featuring a 360-degree spray system that permits the user to spray at any angle. It also comes in 1-, 5- and 55-gallon containers.

For further information, contact Klein Tools, 7200 McCormick Blvd., Chicago, Ill. 60645-2791, (312) 677-9500; or circle #127 on the reader service card.



Identification labels

According to the Industrial Products Division of W.H. Brady Co., its Datab B-658 label removes cleanly, leaving no residue. The labels are flame retardant and can withstand temperatures up to 700°F, making it useful for EPROM and SMT applications. Made of polyimide Karlon, they are available in three sizes: 0.65″ × 0.20″, 0.90″ × 0.25″ and 1″ × 0.50″.

For additional information, contact W.H. Brady Co., Industrial Products Division, P.O. Box 2131, Milwaukee, Wis. 53201, (414) 351-6630; or circle #125 on the reader service card.

Vectorscope

Leader Instruments announced the addition of its Model 5854 vectorscope to its line of EFP/ENG test instruments. Weighing less than 3-pounds, this battery powered hand-held unit features dual loop-through input for video source phase matching, adjustable gain control for differential gain and phase measurements, viewing and triggering from either one of its two loop-through inputs and internally etched graticule for parallax readings.

For further information, contact Leader Instruments Corp., 380 Oser Ave., Hauppauge, N.Y. 11788, (516) 231-6900; or circle #133 on the reader service card.

Channel combiner

Model 6434 from Microwave Filter Co. combines channels F1 and G1 in the instructional television fixed services (ITFS) band (2,500-2,686 MHz). The unit enables two channels to use one transmission line, eliminating the need for a second line. Combiners for other ITFS channels are also available. Insertion loss for both channels is 1 dB maximum, return loss is 18 dB minimum and isolation at ±42 MHz is greater than 50 dB. Connectors are type N, impedance is 50 ohms and power is 100 watts per channel.

For more information, contact Microwave Filter Co., 6743 Kinne St., East Syracuse, N.Y. 13057, (315) 437-3953; or circle #129 on the reader service card.

May

May 5: SCTE Chesapeake Meeting Group technical seminar. Contact Thomas Gorman, (301) 252-1012.
May 7: SCTE Golden Gate Chapter BCT/E testing. Contact Walt Reames, (408) 998-7333; or Terry Cotton, (415) 588-9646.
May 9-10: Telecom Publishing Group's seminar "Fiber optics: The last mile," Key Bridge Marriott Hotel, Arlington, Va. Contact (703) 683-4100.
May 10: SCTE Cascade Range Meeting Group technical seminar. Contact Randy Love, (503) 370-2770.
May 10: SCTE Chattahoochee Chapter technical seminar and BCT/E testing. Contact Guy Lee, (404) 451-4788.
May 10-11: ElectroniCast Corp. conference on fiber optics, Monterey Plaza Hotel, Monterey, Calif. Contact Eloise Beckett, (415) 572-1800.
May 10-12: Magnavox CATV training seminar, Bellingham, Wash. Contact Amy Costello, (800) 448-5171.
May 11: SCTE Greater Chicago Chapter BCT/E testing. Contact William Gutknecht, (312) 690-3500.
May 11: SCTE Gateway Meeting Group technical seminar. Contact Darrell Diel, (314) 576-4446.
May 12: SCTE Central California Meeting Group technical seminar on design technology. Contact Andrew Valles, (209) 453-7791; or Dick Jackson, (209) 384-2626.
May 16-18: Siecor Corp. seminar on fiber optics for management and supervisory personnel in LANs, building and campus applications, Hickory, N.C. Contact (704) 327-5539.
May 17-19: Magnavox CATV training seminar, Great Falls, Mont. Contact Amy Costello, (800) 448-5171.
May 19: SCTE Central Indiana Chapter technical seminar on AML microwave. Contact Steve Murray, (317) 788-5968.
May 23-26: Siecor Corp. technical seminar on fiber-optic installation and splicing for LANs, building and campus applications, Hickory, N.C. Contact (704) 327-5539.
May 23-27: Trellis Communications workshop on designing and installing fiber-optic networks, Trellis Training Center, Salem, N.H. Contact (603) 898-3434.
May 24-26: C-COR Electronics technical seminar, Harrisburg, Pa. Contact Shelley Parker, (800) 233-2267.
May 25: SCTE Appalachian Mid-Atlantic Chapter technical seminar. Contact Ron Mountain, (717) 684-2878.
May 25-27: Magnavox CATV training seminar, St. Paul, Minn. Contact Amy Costello, (800) 448-5171.
May 30-June 1: Canadian Cable Television Association annual convention and expo, World Trade and Convention Center, Halifax, Nova Scotia, Canada. Contact (613) 232-2631.

June

June 1-3: Magnavox CATV training seminar, Casper, Wyo. Contact Amy Costello, (800) 448-5171.
June 6-9: Siecor Corp. technical seminar on fiber-optic installation and splicing for utility applications, Hickory, N.C. Contact (704) 327-5539.
June 7-9: Magnavox CATV training seminar, San Francisco. Contact Amy Costello, (800) 448-5171.
June 9: SCTE Greater Chicago Chapter technical seminar on construction and cable handling. Contact William Gutknecht, (312) 690-3500.
June 13-14: Siecor Corp. technical seminar on network cabling design and bidding, Hickory, N.C. Contact (704) 327-5539.
June 13-15: Hughes Microwave technical training seminar on broadband AML equipment, Torrance, Calif. Contact (213) 517-6244.
June 13-15: New York State Cable Commission on Cable Television's Northeast Cable Television technical seminar on fiber optics, Roaring Brook Ranch, Lake George, N.Y. Contact Bob Levy, (518) 474-1324.
June 13-16: Trellis Communications workshop on designing and installing fiber-optic networks, Trellis Training Center, Salem, N.H. Contact (603) 898-3434.
June 16-19: SCTE Cable-Tec Expo, Hilton Hotel, San Francisco. Contact (215) 363-6888.
June 20-23: Siecor Corp. technical seminar on fiber-optic installation and splicing for LANs, building and campus applications, Hickory, N.C. Contact (704) 327-5539.
June 21-23: C-COR Electronics technical seminar, Minneapolis. Contact Shelley Parker, (800) 233-2267.
June 21-23: Online International's International ISDN Conference, Wembley Conference Centre, London. Contact 01-868-4466.
June 27-July 1: Information Gatekeepers' European Fiber-Optic Communications and Local Area Networks Exposition (EFOC/LAN 88), Amsterdam, Netherlands. Contact (617) 232-3111.
June 28-July 1: Colorado Cable Television Association summer convention, Beaver Run Resort, Breckenridge, Colo. Contact Steve Durham, (303) 863-0084.
June 29: SCTE Delaware Valley Chapter technical seminar on CLI, leakage and FCC rule update, Williamson Restaurant, Horsham, Pa. Contact Diana Riley, (717) 764-1436.
June 29: SCTE Rocky Mountain Chapter technical seminar on CLI, fiber optics, microwave and coax, Beaver Run Resort, Breckenridge, Colo. Contact Steve Johnson, (303) 799-1200.

July

July 11-14: New England Show, Tara Hyannis, Cape Cod, Mass. Contact William Durand, (617) 843-3418.

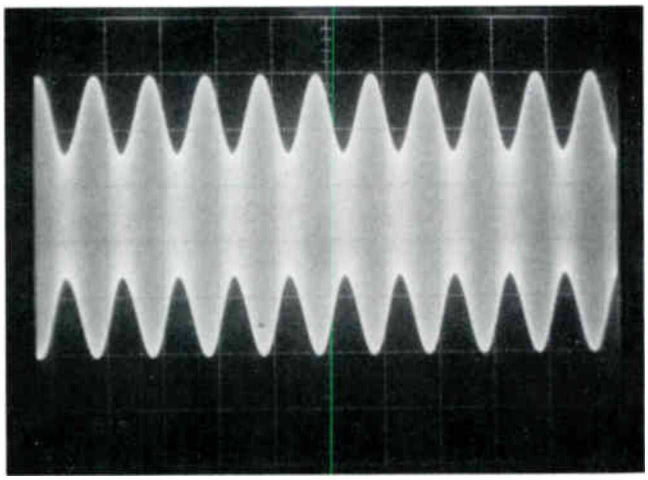
Planning ahead

June 16-19: SCTE Cable-Tec Expo, Hilton Hotel, San Francisco.
July 11-14: New England Show, Tara Hyannis, Cape Cod, Mass.
Sept. 7-9: Eastern Show, Atlanta Merchandise Mart, Atlanta.
Sept. 27-29: Great Lakes Expo, Cobo Hall, Detroit.
Oct. 4-6: Atlantic Show, Convention Center, Atlantic City, N.J.
Oct. 18-20: Mid-America Show, Hyatt Regency, Kansas City, Mo.
Dec. 7-9: Western Show, Convention Center, Anaheim, Calif.

Amplitude modulation on an oscilloscope

By Ron Hranac
Jones Intercable Inc.

An amplitude modulated signal, when viewed in the time domain on an oscilloscope, might appear as shown below. In a conventional double-sideband AM signal, the percentage of modulation can be determined by the relationship of the modulated signal envelope's maximum to minimum peak-to-peak voltage. It also is related to the ratio of the peak-to-peak voltage of the modulating signal to the peak-to-peak voltage of the unmodulated RF envelope.



A 20 MHz carrier amplitude modulated 40 percent by a 20 kHz signal.

The following formulas express these relationships:

$$M = \left(\frac{E_{max} - E_{min}}{E_{max} + E_{min}}\right) \times 100$$

where:
M = percentage of modulation
E_{max} = maximum peak-to-peak voltage of modulated RF carrier envelope
E_{min} = minimum peak-to-peak voltage of modulated RF carrier envelope

---

$$M = \left(\frac{S_{p-p}}{RF_{p-p}}\right) \times 100$$

where:
M = percentage of modulation
S_{p-p} = peak-to-peak voltage of modulating signal
RF_{p-p} = peak-to-peak voltage of unmodulated RF carrier envelope

Examples

Problem: You are measuring an AM signal on your oscilloscope and note that the modulated RF carrier envelope's maximum peak-to-peak voltage is 3 volts and its minimum peak-to-peak voltage is 1 volt. What is the percentage of modulation? (Refer to Figure 1.)

Solution: Use the formula

$$M = \left(\frac{E_{max} - E_{min}}{E_{max} + E_{min}}\right) \times 100$$

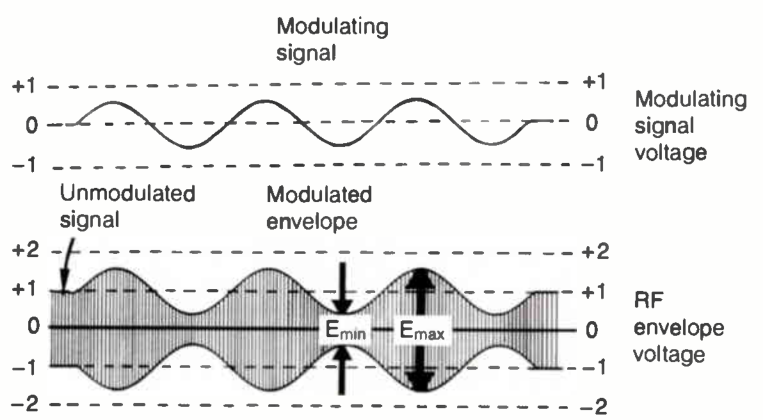
$$= \left(\frac{3 - 1}{3 + 1}\right) \times 100$$

$$= \left(\frac{2}{4}\right) \times 100$$

$$= (0.5) \times 100$$

$$= 50\%$$

Figure 1



Problem: The peak-to-peak voltage of an unmodulated RF carrier's envelope measured on an oscilloscope is 2 volts. If that carrier is amplitude modulated by a 1 volt peak-to-peak signal, what is the percentage of modulation? (Refer to Figure 1.)

Solution: Use the formula

$$M = \left(\frac{S_{p-p}}{RF_{p-p}}\right) \times 100$$

$$= \left(\frac{1 \text{ volt}}{2 \text{ volts}}\right) \times 100$$

$$= (0.5) \times 100$$

$$= 50\%$$

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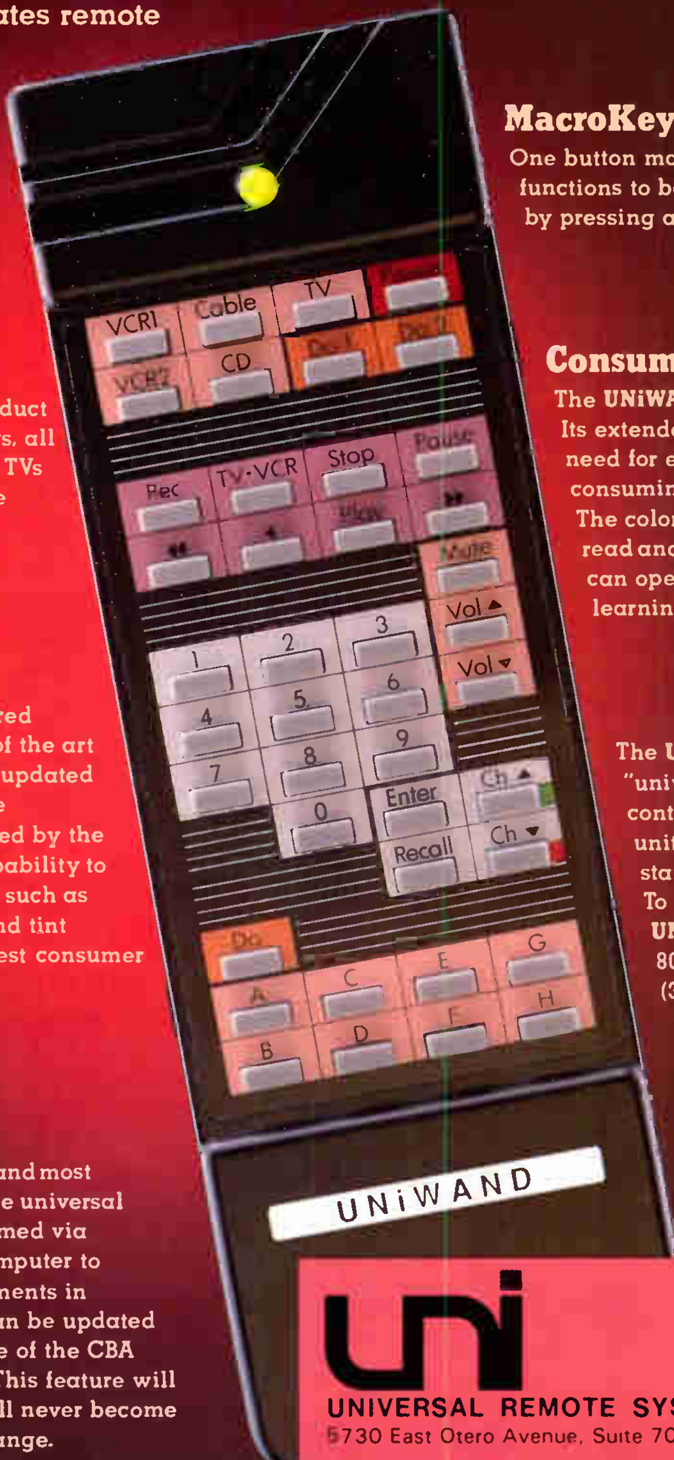

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A trail guide to the FCC HDTV committees

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

In the March column, I laid out a road map of high-definition television (HDTV) committees. This month I'll pick up the unfinished business of describing the FCC committees. While it is common to use the term HDTV, advanced television or ATV is the preferred generic term. HDTV is a subset of ATV.

The committees

1) Advisory Committee on Advanced Television Service (ACATS): The objective of this committee is to advise the FCC on the facts and circumstances regarding ATV systems for commission consideration. In the event that the commission decides that adoption of some form of advanced broadcast television is in the public interest, the committee also would recommend policies, standards and regulations that would facilitate the orderly and timely introduction of ATV in the United States. The scope of activity includes all steps necessary to assemble and analyze information, deliberate upon appropriate policies and actions and develop recommendations regarding the introduction of terrestrial ATV. Included are technical, economic, legal and regulatory issues.

2) Planning Subcommittee: The objective of the Planning Subcommittee is to plan the attributes of ATV in the United States. The scope of activity includes all steps necessary to provide advice on desired features of terrestrial ATV. The subcommittee will define the desirable characteristics of ATV including picture quality; population served; costs to broadcasters, consumers and manufacturers; relationship to existing broadcast service; and relationships to non-broadcast services. It also will review the technical planning factors for the existing TV service and recommend planning factors for ATV, including coverage area, quality of service, frequency reuse criteria, receiver quality and spectrum allocations.

The Planning Subcommittee has six working parties and two advisory groups. The advisory groups cover "creative issues" and "consumer/trade issues." The creative issues group intends to ensure that the producers of programming and movies find the ATV system well suited to providing satisfying programming to audiences. The consumer/trade issues group has been wrestling with questions of international balance of trade, U.S. industrial position and jobs.

Working Party 1, "ATS technology attributes and assessment," is defining the parameters that are important for comparing and judging ATV systems. Working Party 2, "ATS testing and evaluation specifications," is defining the tests to be performed in evaluating systems that exist in hardware. Working Party 3, "ATS spectrum utilization and alternatives," is addressing one of the key questions in this debate: For various approaches to ATV, what scenarios are possible for *terrestrial* carriage in representative TV markets in the United States? Working Party 4, "alternative media technology and broadcast interface," is a key group for cable interests. Among the alternate media under consideration is, of course, cable. This is the only formal consideration of cable's role in the entire proceedings. Ed Horowitz of HBO chairs this important working party. Informal consideration exists elsewhere only if cable representatives participate actively and keep raising the issue. Working Party 5 considers the economic factors and likely market penetration. Working Party 6, "AT systems subjective assessment," is attempting to determine what the viewer's reaction will be.

3) Systems Subcommittee: The objective of this subcommittee is to specify the transmission and reception facilities appropriate for providing ATV in the United States. The scope of activity includes all steps necessary to advise on system parameters for terrestrial ATV. The Systems Subcommittee will evaluate ATV now under development for the purpose of determining feasibility for implementation in the United States. It will recommend ATV systems now under development as candidates for implementation or specify the design of an appropriate system. This subcommittee will advise on the appropriate transmission and reception technical standards and spectrum requirements for the recommended system(s).

The Systems Subcommittee has four working parties. Working Party 1, "ATS technology analysis," is to perform non-judgmental analysis of all proposals based on the Planning Subcommittee's Working Party 1 definitions. This is the point of entry for proponents into the committee process. Working Party 2, "ATS evaluation and testing," takes its direction from the corresponding working party of the Planning Subcommittee. Cable involvement here is important to ensure cable aspects of the proposals receive adequate testing. Working Party 3, "economic assessment," also carries on the work of its corresponding Planning Subcommittee group to compare the economic impact of the proposals. All the information gathered then is fed to Working Party 4, "ATS standard," which makes the system(s) choice recommendation to the FCC. Working Party 4 is a critically important "last chance" group for ensuring cable's interests are well represented.

4) Implementation Subcommittee: The objective of this subcommittee is to establish a transition scheme for implementation of ATV in the United States. The scope of activity includes all steps necessary to advise on policies, regulations and standards for implementation of terrestrial ATV. It also will recommend appropriate FCC policies and regulations to oversee implementation of ATV and develop guidelines for industry activities.

The Implementation Subcommittee has only two working parties. Working Party 1, "policy and regulation," recommends FCC rules while Working Party 2, "transition scenarios," outlines ways in which ATV could happen in the United States.

Cable impact

The FCC defined these objectives and scope of activities for ACATS and its subcommittees. Two points should be carefully noted. First, the FCC makes the decisions; ACATS only recommends and advises. Second, the FCC's mandate only mentioned "terrestrial advanced television service." As far as the FCC is concerned for the purposes of this proceeding, the role of cable, VCRs, DBS, etc., is considered only in the way they impact broadcast. The reason for this is because one of the highest priority issues before the FCC at the present time is the question of spectrum allocation. The land mobile entities are requesting reallocation of UHF spectrum for radio communications. Broadcasters naturally are opposed to this. Their argument is that this spectrum, and perhaps more, is needed so that ATV can be carried over the air. If over-the-air broadcast is precluded from ATV, they claim it will wither and pass away.

For cable, two inferences can be drawn. The FCC is not proposing to set ATV standards for cable at this time. Cable's primary interest in these proceedings is to ensure that the ATV choices made for terrestrial ATV work well on cable. Since the broadcasters also are interested in this, the work boils down to ensuring that the cable ramifications of each proposal are well-understood and communicated to all parties involved.

Some elements in these proceedings are trying to use them to obtain a single universal ATV standard. This, of course, would not apply to recorded media. As discussed in last month's column, cable needs to be able to compete with 20 MHz VCR video displayed on 50-inch and larger TV receivers. Cable needs to participate to ensure no attempt to limit our technical ability succeeds. Cable also needs to participate so that ATV broadcast signals will provide adequate results when they are passed through cable systems.

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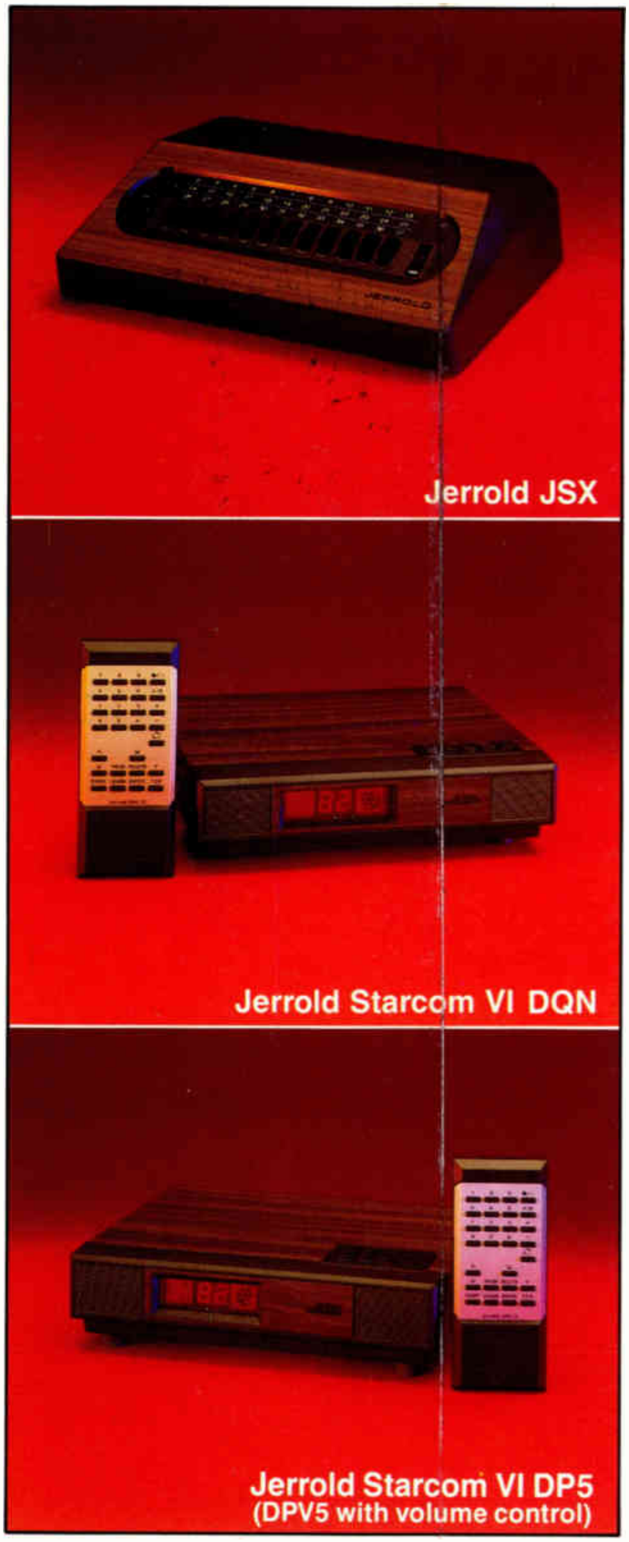

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