CED™

Product Profile: Test Equipment

Communications Engineering Digest/The Magazine of Broadband Technology

October 1981

- Installing Cable Alarm Systems
- TV in Stereo

It's the moment of truth...your turn in the spotlight.

You're about to tell the franchise committee why you should be awarded their franchise. Your program offerings look great, public service commitments are generous and rates reasonable. But your real advantage is your Oak addressable system.

When you specify Oak in your proposal, you offer more subscriber options, more channels and, equally important, proven reliability and delivery records. Recommend Oak TotalControl™, the industry's most successful addressable system, and be able to offer subscriber service packages tailored to the widest possible range of personal preferences.

With pay-per-view, 16 levels of tiering and expansion to two-way capability, Oak TotalControl also provides more opportunities to build and protect your profits.

Our products alone are strong selling tools for your system, but we think Oak should also help you sell your system. To do just that, we've put together a support package. In addition, one of our franchise specialists is available for support advice.

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OAK Communications Inc. | CATV Division

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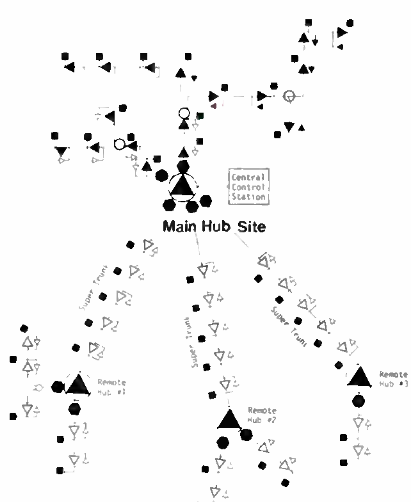

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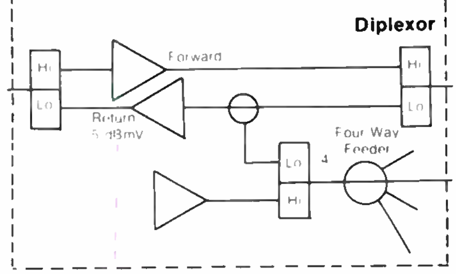
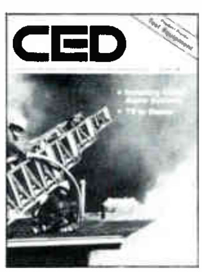
Main Station Amplifier 24





About the Cover
Fire threatens a suburban home but the fire company is on top of the situation thanks to rapid and reliable alarm services. Protection from threats to life and property as well as emergency alert capabilities are possible in a two-way cable plant. Photo courtesy of Cable Marketing Management.

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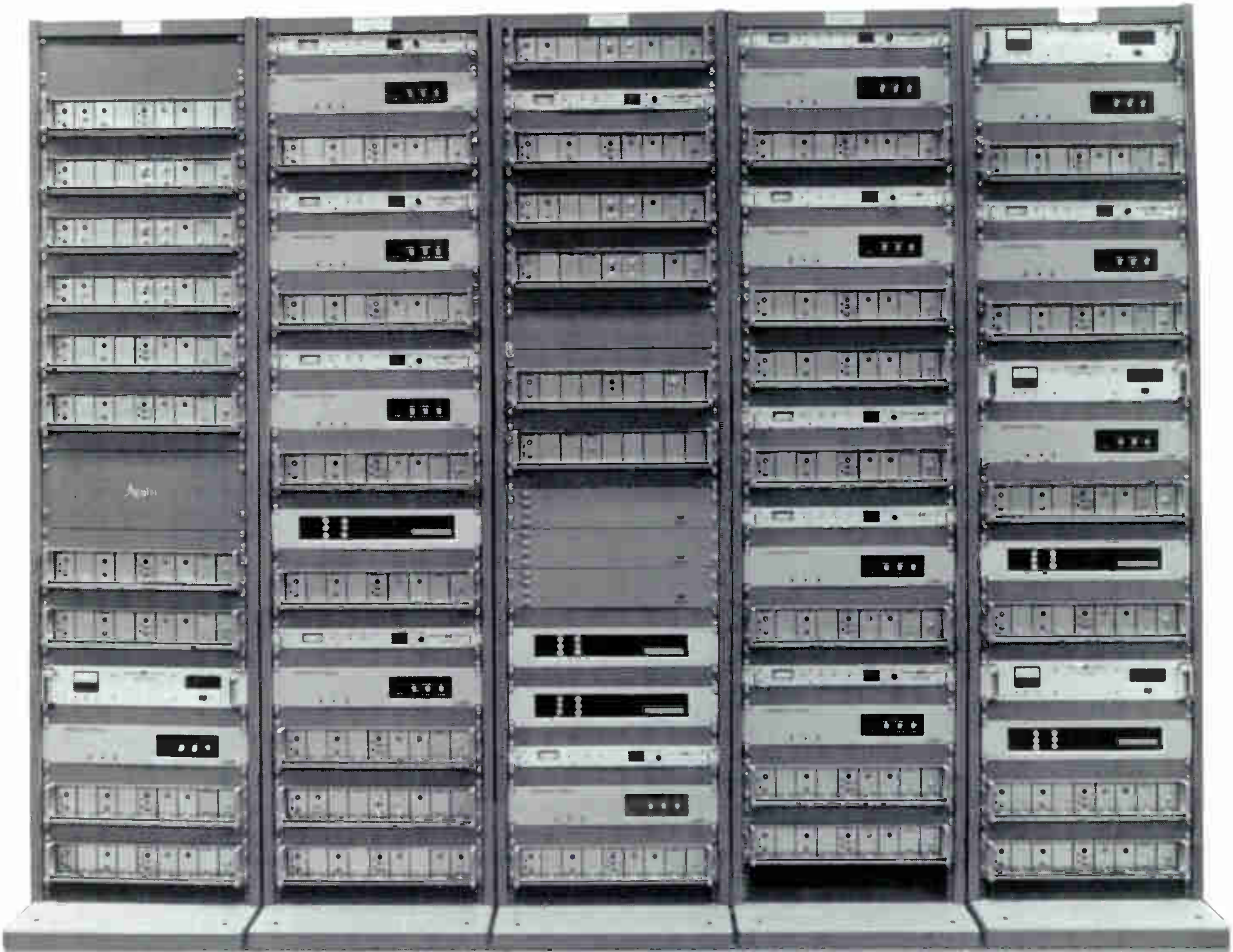

For signals at their very best… where performance really counts.

Call Toner Cable. Single-source responsibility for custom-designed SIGNAL-RECEPTION/SIGNAL-PROCESSING SYSTEMS. Towers and antennas. Earth stations. Prepackaged headends. Total-turnkey installations. With reliable deliveries plus proof-of-performance for dependable turn-on dates.

This prepackaged 35-channel headend is only part of a complete Toner Cable earth-station/signal-processing system supplied to Lorain Cable TV, Lorain, Ohio. This total-turnkey system included ☐ HRC-configuration headend with Scientific Atlanta signal processors and modulators ☐ Microdyne five-meter earth station and receivers ☐ emergency audio override for Civil Defense Alert ☐ Arvin radar/weather-scan ☐ single-frequency CATEL FM equipment ☐ twelve Jerrold encoders ☐ five Compuvid character generators ☐ balancing and proof-of-performance on site . . . *with single-source responsibility for the complete turnkey installation.*

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Toner cable equipment, inc.

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Horsham, PA 19044

Another Shoe Drops

The giant is on the move once more, as a result of a federal district court ruling that allows AT&T to compete in unregulated communications markets. A New Jersey federal judge has given Ma Bell permission to sell and lease customer equipment and also enter competitive data services. According to Judge Vincent P. Biummo, a 1980 Federal Communications Commission ruling that AT&T could compete in such areas does not conflict with a consent decree the company signed in 1956. The court ruling gives AT&T what it was waiting for—the go ahead to reorganize the Bell System in accordance with the FCC requirement that the New York-based AT&T must "create a fully separated subsidiary" by March 1982 if it wants to sell or lease unregulated telephone equipment and terminals. Whether AT&T could compete in unregulated areas was in doubt until the judge's ruling, since the 1980 FCC order seemed to be in contradiction with the 1956 consent decree barring AT&T from entering unregulated markets. As a result of Judge Biummo's decision, the only regulation of AT&T data and equipment prices would be the invisible hand of market competition. While AT&T believes the ruling to be "in the public interest," the Justice Department worried in its opposing brief about "abuses of monopoly power." Meanwhile the Justice Department and AT&T continue to fight over the government's antitrust suit attempting to break up the Bell System. AT&T has filed a motion to dismiss the suit, which seeks to have AT&T divest itself of all local operating companies. A decision is expected shortly.

Wheat from the Chaff

It seems that Comsat's Satellite Television Corporation direct broadcast satellite subsidiary has not taken too kindly to some of the company it is having to keep. STC, which has already invested heavily in the prospects for DBS, is telling the FCC that at least six of the 14 applications for such a service should be thrown out because they are so lacking in specific technical or business information that they don't even amount to applications at all. "A one-page unsigned telex" doesn't cut it, apparently. Meanwhile, attorneys for Home Box Office have asked the commission to act upon STC's application only to the extent it is consistent with a spectrum allocation plan HBO has proposed which is designed to balance the competing needs of fixed satellite service, fixed terrestrial service and DBS.

Atlanta in Reverse

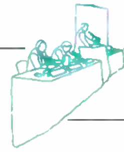
Executives of Scientific-Atlanta will soon be using Jerrold equipment in their homes if they are cable subscribers as a result of a contract reversal. The distribution equipment contract for DeKalb County, Georgia, adjacent to the City of Atlanta, has now been awarded to General Instrument's Jerrold Division. The contract for approximately 1,100 miles of plant was awarded originally to Scientific-Atlanta. In announcing the deal, Jack Forde, Jerrold vice president of sales, stated that the converter contract alone was valued at $1.5 million. The announcement of this contract reversal for DeKalb County follows by only a few months a similar reversal for the City of Atlanta itself. Cable Atlanta awarded the $4 million converter contract to Jerrold after first awarding it to Scientific-Atlanta. Deliveries against the Cable Atlanta contract have already begun. "Since we have been delivering this same type of equipment for over a year, it's time-tested," said Forde. "We anticipate no major difficulties in fulfilling the contract."

What Kind of Blast Off?

RCA may have to wait longer for the launch of Satcom III-R and Satcom IV, which are scheduled for October 15 and December 3, respectively. Both launches will utilize NASA's Star-48 and Delta rockets. The last test of the solid-fueled rockets, however, ended in failure when the engine casing broke up approximately one minute into the test at the Air Force's Arnold Engineering Development Center in Tullahoma, Tennessee. The rocket failure has already delayed launch of one satellite, Satellite Business Systems' SBS-2. Speculation is now raised over the prospects of NASA staying on schedule with other launches involving the Star-48 and Delta rockets. The Delta 3910 rocket being used by NASA to launch SBS and other communications satellites is a two-stage vehicle, in contrast to the three-stage design on earlier Deltas. Instead of the conventional third stage, the SBS-2 mission uses a solid-fueled Payload Assist Module (PAM). It comes in two versions, PAM-A and PAM-D, depending on the weight of the payload. The PAM-D is designed for payloads of up to 2,800 pounds. The SBS-2, with a payload of up to 2,374 pounds, was to use the PAM-D. The PAM-D is powered by the Star-48, solid propellant motor from Thiokol. The motor is four feet in diameter, six feet long and develops 16,000 pounds of peak thrust. The energy required for a particular payload mission is adjusted by varying the propellant loading and rocket nozzle length. In the SBS-2 launch sequence, the PAM/satellite payload is separated from the Delta second stage two seconds after the PAM is activated. Thirty seconds later, the PAM motor, also known as the perigee kick motor, ignites for a burn time of 1 minute 25 seconds. After a coast period of 1 minute 54 seconds, PAM/satellite separation occurs, leaving SBS-2 on its own. This maneuver completes the insertion of the spacecraft into orbit.

Telidon in D.C.

The Canadians have come to Washington, D.C., with the first consumer field trial of the Telidon two-way television system in the United States. Some 50 Canadian-made Telidon terminals are being deployed in selected homes and public locations throughout the nation's capital to test the public acceptability and demand for a variety of information services. Organizations providing information for the trial include the **Washington Post**, the **New York Daily News**, the U.S. Weather Service, the Department of Labor and the District of Columbia Public Library. If the test is successful, according to Canada's Minister of Communications Francis Fox, it will go into its second phase with a considerably larger number of terminals in the fall of 1982. The trial is being sponsored by the Corporation for Public Broadcasting, the National Science Foundation, the U.S. Department of Education and the National Telecommunications and Information Administration.



OCTOBER

4-6: The **National Cable Television Association** and the **Cable Television Administration and Marketing Society** are co-sponsoring the National Software Symposium and Exposition at the New Orleans Hyatt in New Orleans, Louisiana. Contact Char Beales, (202) 775-3629.

4-6: The fall convention of the **Kentucky CATV Association** will be held at the Executive Inn, Owensboro, Kentucky. Contact Patsy Judd, (502) 864-5352.

5-9: Hughes Aircraft Company's microwave communications products division will hold a technical seminar on its AML equipment at the firm's Torrance, California, facility. Contact Seminar Registrar, (213) 517-6100.

5-9: A **Community Antenna Television Association**-sponsored technical training seminar on system distribution, problems, failures, tests and measurements will be held at the Howard Johnsons, Columbus, Ohio. Contact the CATA Engineering Office, (305) 562-7847.

8: The **Iowa Cable Television Association** will hold its annual convention at the Marriott Hotel in Des Moines. Contact Neil Webster, (319) 252-1343.

7-9: Scientific-Atlanta is offering a product training seminar at the Holiday Inn Center Plaza in Dallas, Texas. Contact Earlene Dill, (404) 441-4100.

11-13: The **National Association of MDS Service Companies** convention will be held at the Atlanta Hilton, Atlanta, Georgia. Contact Diane Hinte, (800) 421-2916.

13: The **Southern California Cable Club** is holding a meeting at the Sheraton Hotel in Newport Beach. Contact Bruce Kaufman, (213) 278-5644.

13-15: The annual conference of the **Western Educational Society for Telecommunications** will be held at Harrah's in Reno, Nevada. Contact Dr. Donel Price, (213) 224-3396.

14: A meeting of the **Atlanta Cable Club**, hosted by Metrovision and CNN, will be held at the Atlanta Stadium Club. Contact Cathy Kuhn, (404) 231-5358.

20-22: Scientific-Atlanta is offering a product training seminar at the Hyatt Regency in Columbus, Ohio. Contact Earlene Dill, (404) 441-4100.

20-22: The 12th annual **Video Expo New York**, sponsored by Knowledge Industry Publications, will be held in the Madison Square Garden, New York City. Contact Anne Stockwell, (914) 328-9157.

21-23: The **New Mexico Cable Television Association** annual convention will be held at the Hilton Inn, Albuquerque, New Mexico. Contact Jeff Rosen, (505) 293-3770.

25-27: The annual convention of the **New Jersey Cable Television Association** will be held at the Meadowlands Hilton, Secaucas, New Jersey. Contact Diane Quinton, (609) 392-3223.

NOVEMBER

1-4: Scientific-Atlanta, Inc., will hold its seventh annual satellite communiations symposium at the Hilton Hotel in Atlanta, Georgia. Contact Ray Stuart, (404) 441-4000.

1-4: The **National Association of Educational Broadcasters** will hold its 1981 annual conference at the Hyatt Regency Hotel in New Orleans, Louisiana. Contact the association at (202) 785-1100.

2-6: The **Community Antenna Television Association** is sponsoring a technical training seminar on system distribution, problems, failures, tests and measurements at the Harbor Motor Inn, West Sacramento, California. Contact the CATA Engineering Office, (305) 562-7847.

3-6: The **Pennsylvania Cable Television Association** will hold its annual convention at the Pocono Hershey Resort. Contact the association at (717) 234-2190.

5-6: TeleStrategies, Inc., is holding a seminar on "Telecommunications Technologies, Opportunities and Strategies for Senior Management" at the Twin Bridges Marriott, Washington, D.C. Contact TeleStrategies, (703) 734-7050.

8-10: The Arts/Cable Exchange, sponsored by **University Community Video**, will explore the future of cultural programming on cable in Minneapolis, Minnesota. Contact Pat Brenna, (612) 376-3333.

9-11: The **Subscription Television Association's** annual conference will be held at the Hyatt Hotel at the Los Angeles International Airport. Contact Valerie Backlund, (213) 827-4400.

10-12: The second annual **Visual Communications Congress/West** will be held at the Century Plaza Hotel, Los Angeles, California. Contact Marylou Donoghue, (212) 725-2300.

11-13: The 24th annual **New York International Film and TV Festival** will be held at the Sheraton Centre Hotel in New York City. Contact Meredith Anthony, (212) 249-8572.

12: The **Bay Area Cable Club** is holding a meeting at the San Francisco Press Club, San Francisco, California. Contact Diane DiSalvo or Lou Soucie, (408) 998-7333.

16: A meeting of the **Dallas Cable Club** will be held at the Hilton Inn, Dallas, Texas. Contact Buzz Hassett, (214) 421-1421.

16-17: The **SCTE** 1981 fall conference on "Emerging Technology" will be held at the La Mansion Hotel, San Antonio, Texas. Contact the SCTE at (202) 293-7841.

17-18: The annual convention of the **Tennessee Cable Television Association** will be held at the Opryland Hotel in Nashville. Contact Ruth Sharp, (502) 651-3126.

29-December 3: The **1981 National Telecommunications Conference**, "Innovative Telecommunications—Key to the Future," will be held in New Orleans, Louisiana, at the Marriott Hotel. Contact Kenneth Black, (504) 586-2384.

30-December 1: Communications Technology Management and the **Annenberg School of Communications** are hosting the second annual "Telecommunications for the '80s" conference at the University of Southern California. Contact Regina Schewe, (703) 734-3352.

DECEMBER

2-4: The **California Cable Television Association**'s annual convention, the Western Show, will be held at the Anaheim Convention Center in Anaheim, California. Contact the association, (415) 881-0211.

7-12: A **Community Antenna Television Association**-sponsored technical training seminar on system distribution, problems, failures, tests and measurements will be held at the Hotel Georgian Terrace, Atlanta, Georgia. Contact the CATA Engineering Office, (305) 562-7847.

10-11: "Satellite Communications" is the topic of a seminar sponsored by **TeleStrategies, Inc.**, at the Hyatt Regency O'Hare, Chicago, Illinois. Contact TeleStrategies, (703) 734-7050.

16: A meeting of the **Atlanta Cable Club** will be held at the Atlanta Stadium Club in Atlanta. Contact Cathy Kuhn, (404) 231-5358.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You'll get an extra mile of homes passed in every 20 amplifier cascade by using Times' 7/8" Series 4875 trunk cable in your 400 MHz system.

TIMES HELPS STRETCH YOUR 400 MHz SYSTEM EXTRA MILES.

The lower attenuation of 7/8" versus 3/4" coax allows you to increase amplifier spacing by 14%. You get significant savings in purchase cost, operating maintenance, and power consumption.

You'll also reduce trunk cable scrap by restoring amplifier spacing to the normal distance for 300 MHz systems.

And if you're rebuilding an existing system for 400 MHz operation, or upgrading an existing design, you'll find that using 7/8" trunk instead of 3/4" will permit you to keep your present amplifier spacing with virtually no loss in performance.

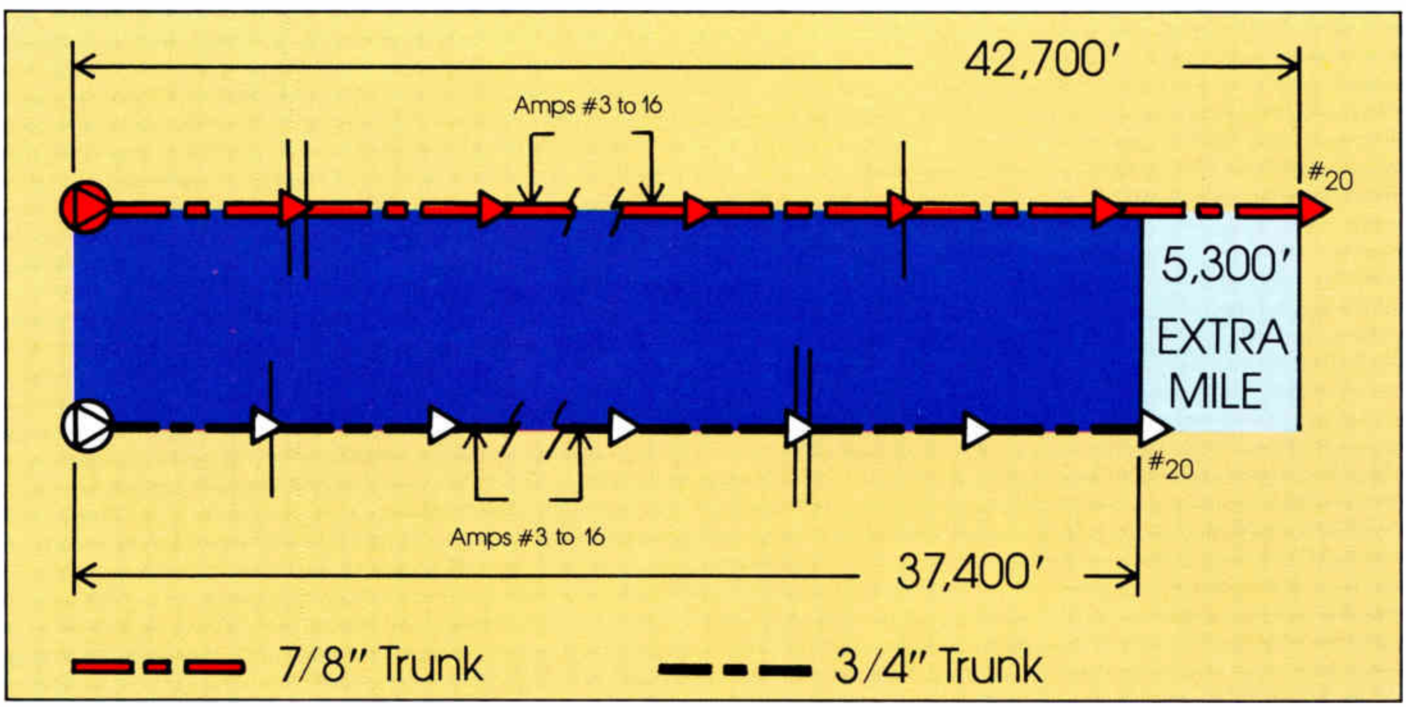
40% greater subscriber coverage

If your system is a major city build with a large homes-passed count, you'll also want to use Times' 5/8" Series 4625 feeder cable for a total of 40% increase in subscriber coverage.

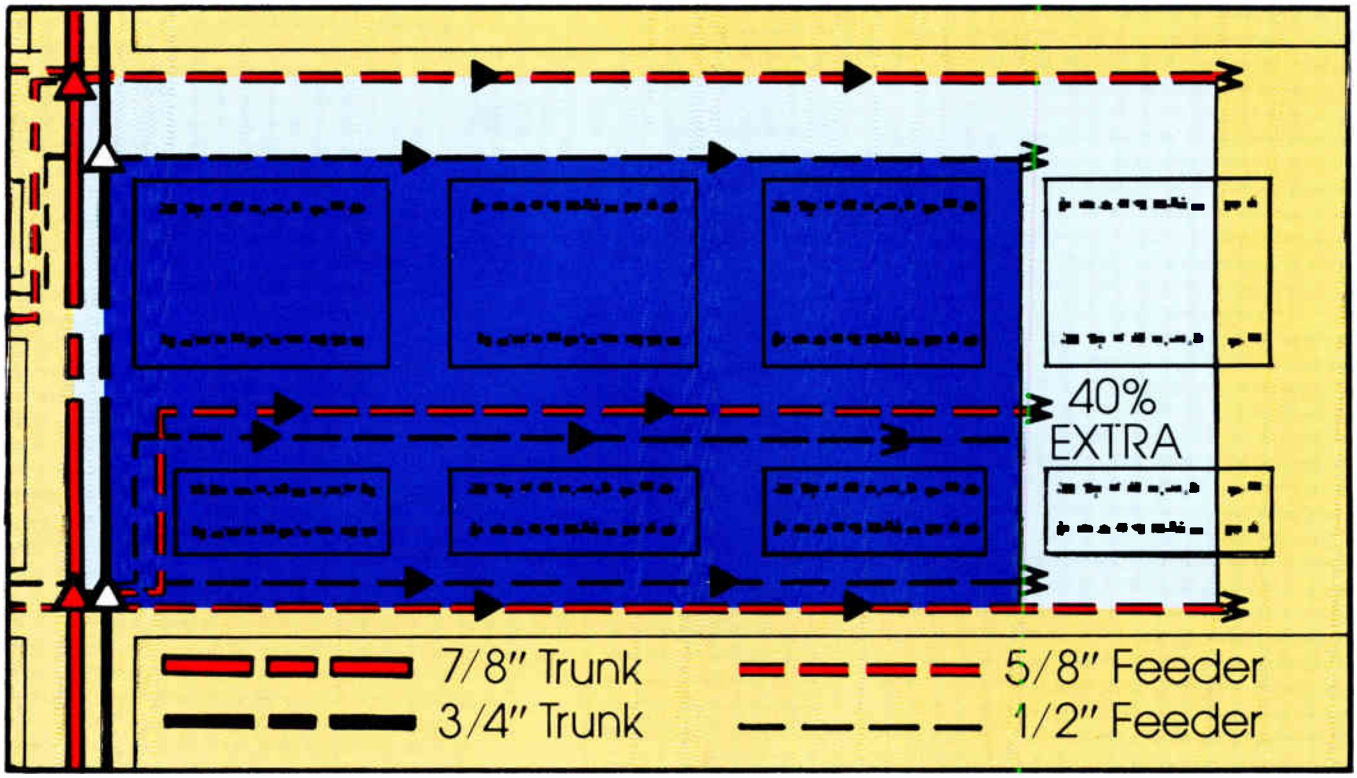
The lower attenuation of 5/8" versus 1/2" cable also allows improved levels of bridger and line extender operation. You get better signal quality, lower cross-modulation, and less triple-beat distortion throughout your entire system.

You also gain extended area coverage

20 AMPLIFIER TRUNK CASCADE



SUBSCRIBER DISTRIBUTION AREA



for low density "horizontal cities," where you need long feeder runs to reach remote subscriber locations.

But the final test is in the field. Times' Series 4875 trunk and 4625 feeder cables have proven top performers with major MSOs from coast-to-coast.

These new larger sizes are in full production, available in a complete range of aerial and underground configurations: production-tested to 500 MHz for an extra margin of performance.

For more information, speak to your Man From Times. Or contact us at 358 Hall Avenue, Wallingford, CT. 06492, telephone (800) 243-6904

TFC

TIMES FIBER COMMUNICATIONS, INC.

Times Wire & Cable Div.

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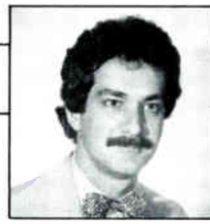
Dawn of a new era in community-wide cable communications.
A new generation of sophisticated cable tv systems is emerging throughout the country. Technological advances have brought a new dimension to cable tv. Systems under construction today would have staggered the imagination just a few years ago.
One of these super systems is now a commercial reality. Cable America, Inc.'s new 400 MHz service will pass 350,000 homes in Atlanta and its metropolitan area. Broad-based programming and state-of-the-art technology will provide up to 54 channels, with added side-band potential and dozens more channels reserved for institutional use.
Cable America's Atlanta area affiliates have trained hometown people to build and maintain their systems. Over 50% of Cable Atlanta's employees are minorities.
On the hardware side of the awesome 3200-mile system, suppliers were required to provide the cable and equipment necessary to meet a construction pace of over 150 miles per month.
The coaxial cable selected also had to meet or exceed demanding mechanical and electrical specifications. Comm/Scope PIII ⅝" and ⅞" low-loss coaxial cable was picked for trunk and distribution lines. And Comm/Scope's new Super Shield drop cable was selected to overcome Atlanta's high RF noise environment.
The cable industry can be proud of the pioneering efforts of progressive MSO's like Cable America and its Cable Atlanta system. All of us at Comm/Scope are proud of our contribution.
Comm/Scope
A M/A-COM COMPANY

Editorial



If You Know Where You Are Going . . .

As CTAM '81's keynote speaker Professor Daniel Bell, Harvard don and longtime analyst of the post-industrial society, pointed out, "If you don't know where you're going, any road will take you there."

You don't need a road atlas in front of you to agree with Dr. Bell's aphorism. His intention, echoed by all the speakers that followed him to the podium, was to show that effective strategies for cable product marketing may require as a starting point clear self-definition.

But it is clear whatever your product—entertainment, information, communications—what binds it all together as an industry is a broad and seamless web of technology that provides the means of transmission of your product. Without this conduit you are like a traveller with many suitcases packed but no road to take you where you're going.

A "road atlas" of cable technology will show that there are many roads you can take, if you know where you're going. If two-way interactive is the super highway you want on for future upgrading, one access ramp you can take now may be emergency alarm services.

Security services seem to be a natural for cable. Cable has inherent advantages over traditional alarm methods. The existing alarm industry has never seriously considered its market as total households across the country. Rather, it has sought a moderate size base of high paying customers. Installation costs are designed for immediate payback on investment. This pricing structure sets the market out of reach of average households. As a result, traditional alarm services are considered affordable for businesses but a luxury for the more affluent households. Therefore, penetration is low and the alarm industry shows no inclination to move into new areas beyond their established market.

Due to high cost and problems with dedicated line availability, traditional consumer alarm installations do not constantly interrogate a dwelling. They simply report alarms on an event basis. Cable, on the other hand, has both dedicated line and polling capability to constantly report on the status at each location by computer. Cable can provide this improved protection at a 50 percent to 60 percent reduction in installation prices over those offered by traditional alarm companies. Also, cable operators can offer generally lower monthly fees. A more diverse population with mixed demographics can be reached.

Alarm systems are considered to be a separate business which the cable company can treat as a profit-making venture or as a loss leader for tax purposes. Many MSOs are doing both. They have one or two tiers of service involving push-buttons and smoke detectors that are loss leaders plus a third tier involving perimeter security that is a money maker.

Is there a demand for security services? Crime seems to be on everyone's list of social concerns. Improved statistics gathering and reporting by police and fire officials have made us all aware that threats to life and property are all around us. This awareness was reflected in comprehensive national research conducted last year by Cable Marketing Management, a Columbus, Ohio-based marketing and research firm. When interest in "future services" was measured, security received top ranking. The nine cable market study surveyed 1,900 people. A recent update revealed two-thirds of those surveyed expressed support and willingness to pay for a full range of security services including burglar and fire protection, medical alert and an emergency push-button. According to industry figures, in its first year of providing security alarm service, the cable industry signed up 12,335 customers in 15 systems, all but four of which had start-up dates in the second half of 1980.

Cable security services is expected to be a $500 million business by 1985. And if you know where you're going, many roads can take you there, especially if where you want to get to is profitability.

George Sell

CED

Volume 7, No. 10

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You just found a whole van load of instruments. Because SAM II is the most complete signal level meter ever built.

It's a programmable signal level meter, calibrator, hum meter, AC/DC voltmeter, even a spectrum analyzer.

Frequency coverage is 4 to 300 MHz or 400 MHz, with UHF (470-890 MHz) optional. Up to 32 frequencies can be programmed for push button tuning. Amplitude is shown at ±.5 dB accuracy from -40 dBmV to +60 dBmV. The built-in calibrator backs up those specs by letting you calibrate at operating temperature with your test jumper.

SAM II reads hum (0-5%) at the flip of a switch. Add a scope and SAM II becomes a spectrum analyzer that you can sweep manually, or at an adjustable 2 to 40 Hz rate.

But don't get the idea that SAM II was built to stay on a bench. It's a SAM after all. That means the case is drawn aluminum with a rubber gasket and back printed lexan clad cover.

In other words, if you're looking for a signal level meter that's ready for anything, you just put your finger on it. SAM II.

For details, contact Wavetek Indiana, Inc., 5808 Churchman, P.O. Box 190, Beech Grove, IN 46107. Phone Toll Free 800-428-4424. In Indiana (317) 787-3332. TWX: 810-341-3226.

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If anything's wrong with your signal, SAM II will put your finger on it.

SCTE News

SCTE Establishes Certification Program

WASHINGTON, D.C.—By establishing a voluntary designation program for the qualification of engineers and technicians as a Professional Cable Television Engineer or PCTE, the Society of Cable Television Engineers has taken a new step toward the professionalization of the field.

"The PCTE designation is designed to acknowledge the extra effort, the extra experience and expertise a professional engineer or technician in the cable television industry brings to the job," said SCTE President Tom Polis. "Receiving the designation will be a measure of personal growth and success in the field."

The peer recognition of accomplishment is one of the intangible rewards of engineering, a role that the professional society can offer to members. "The benefits include self-esteem and respect in the cable television industry and a better ability to compete in the job market. It will initiate the advancement of industry standards and upgrade the education, skills and experience of the engineering and technical person in the field," Polis said.

Qualification will be based on a Personal Data Form and an examination to be given several times and places throughout the year. A seven-member SCTE Professional Designation Board will evaluate and judge the qualifications of applicants for PCTE status on the basis of points earned on the Personal Data Form and on the examination. A total maximum number of points possible will be 2,390 points, 1,195 on the Personal Data Score (PDS) and 1,195 on the examination.

High performance scores on the examination portion will be crucial when the PDS is low. The Professional Designation Board will encourage applicants if the PDS is 700 or higher. There is little chance for attaining PCTE if the PDS totals 400 or less and chances are diminished if the PDS is below 500 points, according to SCTE sources. The Board will require documentation to substantiate the information on the Personal Data Form.

The Personal Data Form will be divided into three parts: Division I, Education; Division II, Achievements in Society Leadership; and Division III, Experience and Activities in Cable Television Engineering and Community Leadership.

Points will be accumulated according to a predetermined points schedule. For example, in Division I, attendance at SCTE nationally sponsored educational programs will accumulate one point per hour of attendance or three points for one-half day, to a maximum of six points per day of attendance. Similarly, but with differing point totals, attendance at other SCTE, IEEE, NCTA, CATA or CCTA programs, conferences or conventions will accrue points for an applicant. Higher education courses, both degree and non-degree, will mean points as will completed technical correspondence courses. The maximum allowable points for Division I will be 400 points total.

Division II provides points for professional society national, regional and local activity including special points for committee work and officer status. Other participation in technical, business, professional or management organizations as well as government advising, scheduled speaking, publishing, technical education instructing, program chairing and participating will give a total maximum points accumulation for Division II of 435 points.

Applicants can accumulate a maximum of 360 points in Division III. Criteria for points include CATV technical employment, management experience, leadership activity in the community, social service or political organization activity, honors received, patents awarded, technical contributions and other technical activities. The SCTE advises it is essential that candidates devote considerable time and effort to completing the Personal Data Form since judgment by the Professional Designation Board can be based only on the information provided.

The examination questions will be based on concepts, experiences and technical requirements basic to sound cable television engineering practices, management, published texts and training materials, and supplementary readings, according to SCTE sources. Some choice in subject matter areas will be permitted but some questions will be required to be answered. A variety of types of questions will be presented. Confidential and objective grading will be accomplished by the Professional Designation Board or their designee and the Board Secretary.

Examinations will be a full day affair at various locations at least three times a year. Also tests will be given on a day preceding annual meetings of cable television industry organizations. **CED** has learned that the first examination will be held in conjunction with the SCTE Spring Engineering Conference and Annual Membership Meeting in 1982.

Costs involved will be $50 for processing of the application, $25 at the time of the examination and $50 due upon granting of the PCTE designation.

The designation is not intended to restrict the industry's hiring practices or prevent non-designated personnel from engaging in engineering. According to SCTE Executive Director Judy Baer, "If a person is not designated as a PCTE, it does not indicate the person is unqualified to practice cable television engineering, it means only that such a person has not fulfilled the requirements for PCTE or applied for the recognition."

Applications and information on the PCTE program will be available for the SCTE by year's end.

News

FCC Issues Reminder On Retransmission

WASHINGTON, D.C.—The General Counsel's office of the Federal Communications Commission has reminded all FCC broadcast licensees and cable television operators that the Communications Act prohibits the interception of point-to-point radio transmissions and divulgence without permission. Stephen Sharp, general counsel to the commission, said that "a sufficient number of complaints" to the various bureaus prompted the reminder. He added that since "many people have been calling and questioning about what can and cannot be transmitted," the reminder was a means to eliminate confusion. According to FCC regulations, for a private nonbroadcast station to retransmit information from a commercial aircraft, for instance, it must receive permission from the aircraft communicator as well as the commission. FCC authorization may be requested by telephone, but a written request must follow, along with written permission from the originating station. To retransmit information from a federal government agency, FCC authorization is not required, but written notification must be sent to the commission within one week.

Future Technologies Will Highlight Conference

NEW ORLEANS, LOUISIANA—"Innovative Telecommunications—Key to the Future" is the theme of the 1981 National Telecommunications Conference to be held here November 29-December 3.

Sponsored by the Institute of Electrical and Electronics Engineers (IEEE), the Communications Society Conference Board and the New Orleans' IEEE, the conference will be held at the New Orleans Marriott. Maurice Bernard, director of the Centre National d'Etudes des Telecommunications (C.N.E.T.) in France, will address the plenary session, officially opening the conference.

FCC Grants Broadcaster Permission To Try Teletext

LOS ANGELES, CALIFORNIA—KNBC, the NBC affiliate here, has received permission from the Federal Communications Commission to conduct broadcast teletext experiments. Under the grant, the station will be allowed to use lines ten-18 of the vertical blanking interval for teletext purposes. KNBC Project Manager Teddy Zee said that the station will proceed with plans to offer teletext programming (using the Antiope format) in conjunction with two similar projects launched this spring by CBS affiliate KNXT and PBS station KCET. All three efforts will be offered to a group of 100 Los Angeles households next month, through an independent research study metering audience response to teletext services.

Business Notes

★ **Comsearch, Inc.**, announced ground breaking for its new office and laboratory facilities in Reston, Virginia, a suburb of Washington, D.C. The 10,000 square-foot facility will have a shielded enclosure for radiation susceptability measurements. Construction of the two-story structure is expected to be completed in early 1982.

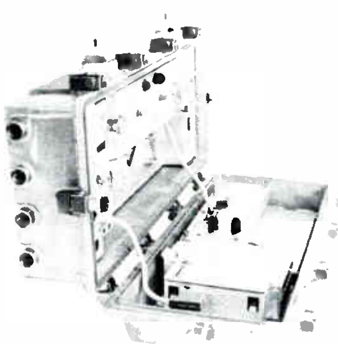
★ **Magnavox CATV Systems, Inc.**, has joined with Sammons Communications of Dallas, Texas, in the recent purchase announcement of Magnavox CATV's Magna 440 MHz equipment for the newly-awarded Sammons Fort Worth franchise. C. Richard Mullen, vice president of marketing and sales for Magnavox CATV, noted that the agreement with Magnavox CATV is for a three-year planned construction using 440 MHz distribution electronic products.

★ **C-COR Electronics, Inc.**, has signed a $6 million agreement with Warner Amex Cable Communications, Inc., to provide cable television distribution electronics for the balance of 1981 and 1982. The general supply contracts will provide equipment for Dallas; greater St. Louis; Mesquite, a Dallas suburb; Pittsburgh; Cincinnati, greater Cincinnati and other locations.

★ **Texscan Corporation** has received a contract from Viacom Communications for 235 miles of new system and 430 miles of rebuild in the San Francisco area. The present system serves 58,400 subs with 35 channels of programming. The rebuild will provide 54 channels with two-way capability, home security and several tiers of pay. The new system will use Texscan/Theta-Com's T-400 two-way amplifiers. Viacom expects completion by the end of 1988.

★ **General Instrument Corporation** has been awarded an $8.4 million contract to supply Rogers Cablesystems, Inc., of Canada with Jerrold 400 digital converters for remote cable TV channel selection. To be delivered over the next year, Rogers Cablesystems will utilize the new subscriber terminals in its market area in the provinces of Alberta, British Columbia and Ontario, Canada. The new Jerrold converters will provide channel capacity for the foreseeable future. General Instrument will manufacture the converters in Toronto, where the company's Jerrold Canada Division is headquartered.

What's the best way to deliver 50-plus channels at 400 MHz over thousands of miles of cable?



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Structuring a System For Cable-Based Security

By Pat Birney, systems engineering manager, Pioneer Communications of America.

The potential for a variety of revenue producing services exists within any two-way plant. Most of that potential is untapped by cable operators. Although today's advanced engineering designs allow for greatly expanded applications, cable continues to be perceived primarily as an entertainment medium. But the picture is rapidly changing.

The requirements for alarm services dovetail with the cable industry's available resources. The combination creates an opportunity for a new profit center within individual cable companies and the industry at large.

Providing cable based security is a viable move for cable companies contemplating new sources of revenue. An unserved market exists and systems are available which require minimum plant modification.

The engineering design of one two-way interactive security system on the market today is detailed below.

Pioneer Communications of America provides a two-way interactive security system package with provision for burglar, fire, police and emergency alerts, and plant and terminal status monitoring services.

The system is designed to provide central station monitoring of all system functions. Communication between the security terminals and the central station utilizes a bi-directional CATV cable transmission network. In addition, redundant backup communication between the security terminals and the central station will occur via the telephone system network in the event of a cable system network failure.

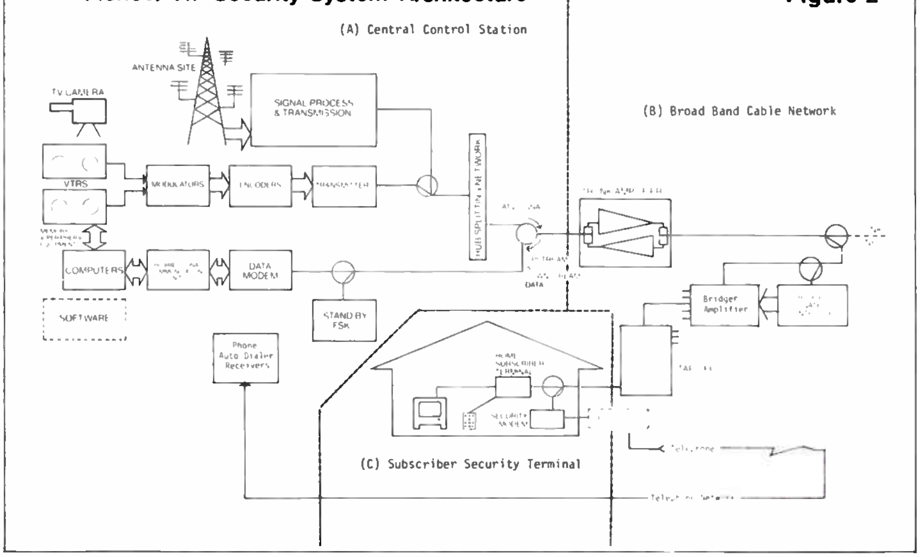
The Pioneer Security System uses follow-up polling, parity check and phone autodial redundancy to ensure maximum communication path reliability. The system computer is continually monitoring the security terminals and sensors seeking a response for not only an alarm, but also a "normal" condition. Within the software a follow-up poll is requested whenever an abnormal condition occurs, thereby decreasing the number of potential false alarms being reported. In addition, if the cable system network is unable to report an alarm, the autodialer, built into each security terminal, is activated and completes the alarm notification sequence via non-dedicated phone line.

Depending on the type of service selected, sensors are located in the home as shown in Figure 1.

The security terminals are continually interrogated by the central computer determining alarm status and system status and reporting a normal alarm or malfunction state. If a sensor is tripped, the security terminal sends an appropriate response. The computer receives the response and immediately repolls the security terminal for additional verification. Upon receipt of the verification from the security terminal the computer processes the data and retrieves the customer database information for that terminal's address. The alarm processing procedure could call for notification of the proper authorities and/or calling the resident.

The central station computer software provides all the necessary support for the central station security operator to monitor the receipt of security alarms and maintain the integrity of the security terminal network. The computer system also provides several functions to assist the security operator to maintain control and status information for all security customers.

Pioneer VIP Security System Architecture **Figure 2**



Architecture

Figure 2 shows the total system architecture. The central control station functions include alarm monitoring and detection, alarm processing, alarm notification and system plant monitoring.

The bi-directional CATV cable network provides the two-way communications path between the security terminal and the central control center.

Each security terminal is connected to the two-way CATV cable distribution system. The security terminal performs two main functions: first, to monitor and determine the status of each security sensor connected to the terminal; and second, to allow the Central Control Station to monitor the terminals' status via the CATV cable or telephone system networks.

The central control station's system elements include the computer system, the broadband cable network, and the subscriber security terminal.

The computer system main functions are:

- Controlling the subscriber security terminals. The most critical aspect of this function is the proper enabling of network transmission paths.
- Monitoring the subscriber terminal status. The most critical aspects of this function are detecting the alarm conditions of each terminal and detecting malfunctions in the system network. This function also includes logging and printing when necessary.
- System diagnostic surveys.
- Analysis and reporting on operating conditions and status data acquired by the system; and
- On-line subscriber identification (provides the subscriber's name, address, and telephone number, and related notification information for the terminal address).

The bi-directional communications unit (BCU) is a special purpose I/O controller which performs four principal functions:

- Converts parallel-bit message words from the processor into serial form for transmission downstream, and reconverts serial upstream data into parallel form for presentation to the processor.
- Establishes timing (clock pulses) for the downstream and upstream data transmission (256 KB).
- Applies synchronization and parity bits to downstream message words and checks the parity of all incoming upstream message words.
- Provides upstream level monitoring capabilities.

The data modem is an interface between the analog distribution system and the digital computer system. The communications modem consists of a transmitter and receiver. The data modem design is based upon long term stability and high reliability; thus, taking into account the possible deviations of the numerous terminals' receivers/transmitters within the system as well as possible effects from vast system noise or ingress.

Sample CATV Network

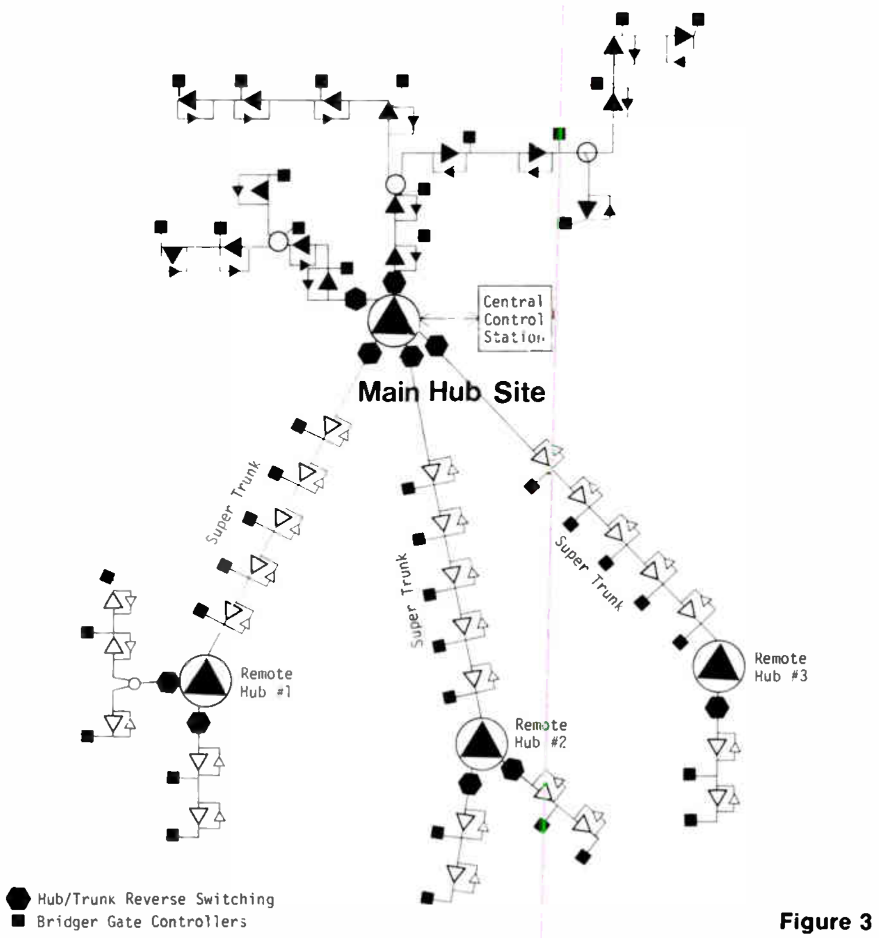


Figure 3

Burglar/Intrusion	Fire	Medical/Police
Magnetic Contact	Heat Detectors	Push-Button (Police Only)
Infrared Beams	Smoke Detectors	Push-Button Remote
Ultrasonic motion		
Pressure Pads		

Home Alarm Sensors

Figure 1

Broadband Cable Network

Figure 3 shows a block diagram of a CATV broadband cable network. In a sub-split two-way cable system, the cable plant is designed to carry downstream signals in the 50-400 MHz frequency spectrum and simultaneously carry upstream signals in the 5.0-30 MHz frequency spectrum.

Use of the 5.0-30 MHz spectrum for reversed system signal carriage has some characteristics that make it desirable not to have the entire reverse system operational at every instant. Among these are:

- Ingress. The external off air 5.0-30 MHz spectrum contains thousands of high-power sources (c.b. radio, short-wave radio transmitters, ham radio) which are "picked-up" by the coaxial cable system. This ingress is a fact-of-life that each cable operator must contend with in a coaxial network.
- Reverse amplifier noise. Since all reverse amplifier output signals eventually converge (i.e. come together) at the headend, so does all of the noise generated by them. Thus, in the reverse system, signals are subject to noise degradation by the noise build-up of possibly hundreds of reverse amplifiers, while in the forward system, there are seldom more than 30 amplifiers contributing to the noise present at any location.
- Possible "runaway" subscriber terminals. If, for any reason, a subscriber terminal should fail to stop responding when told to, it would generate a signal which would interfere with the reception of responses from all other system terminals until the "runaway terminal" was located.

The solution to these problems lies in the placement of a remotely-addressable electronic switch at each trunk-bridger station in the system. This switch allows the headend computer to interrupt reverse signal paths on each feeder line in the system. This switch does not affect the reverse trunk system in any way. In addition (see Figure 3), reverse trunk switches may be used to minimize the number of reverse amplifiers converging at the headend.

Since the upstream path of the bi-directional CATV cable network collects and accumulates noise and ingress from all points in the system, these levels at the headend upstream output may be high enough to cause significant error degradation of terminal response messages. To minimize this effect, each trunk/bridger amplifier (TBA) in the cable network is provided with a gating switch, the bridger gate controller (BGC) in the return (upstream) signal path. The switch will be normally open in all trunk/bridgers, thus disconnecting all feeders and leaving only the trunk line as an upstream noise source. Upon command from the control center, the switch in a particular trunk/bridger station will be closed ("gate-on") to permit upstream response from the terminals connected to the distribution lines of that TBA station. When polling of the terminals is completed, the gate switch will be commanded to open ("gate-off") and disconnect the trunk from any upstream signals or noise/ingress originating on the feeder lines.

The BGC units are mounted on the trunk cable adjacent to each trunk/bridger station (see Figure 4). The BGC unit is similar in function to a subscriber terminal, containing a data receiver, a unique address, logic and a data transmitter. Connection for downstream and upstream data signals is made directly to the trunk line to permit upstream message return even if the associated bridger gate switch is open and to obtain operating power from the trunk. Another connection is made to the trunk/bridger station housing to carry the gate switch TTL logic level "1" for gate switch closed, and logic "O" for the gate switch open (disconnect) condition.

Pioneer BGC and Trunk/Bridger Connection

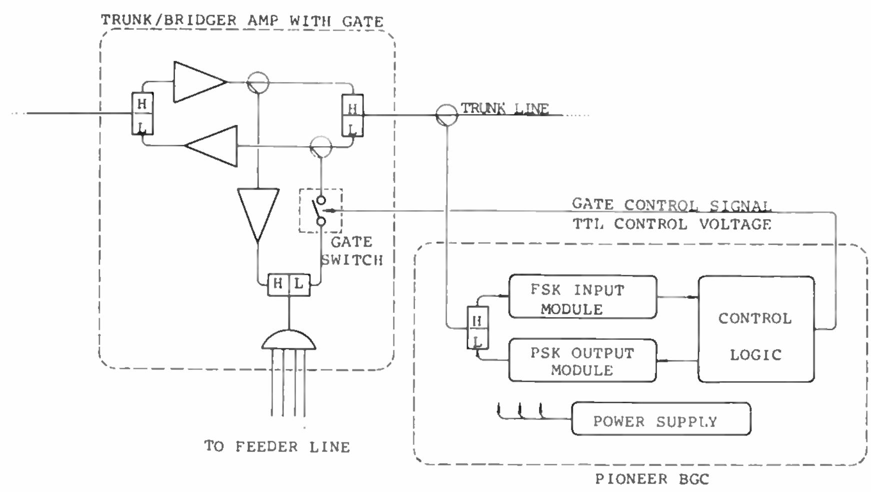


Figure 4

Subscriber Terminals

The security terminal consists of two units—a main panel and remote keypad. It is connected to the cable system and is used to perform message analysis, command action, and data reporting functions.

The message analysis function is designed to receive all downstream messages sent from the control station and compare message address against the assigned address pre-set into a specific security terminal. It activates appropriate functions in the terminal from the command portions of a message when a correct (group)/(private) address match is obtained.

Command actions include echoing the alarm condition upon command from the central station and activating a diagnostic response message upon command from the central station. Fire supervisory circuits and auto-dialer tests can be performed utilizing the above mentioned diagnostic commands. Command action will terminate the alarm condition and reset the terminal upon command from the central station, as well as inhibit operation of the reply message transmitter in case of a defect resulting in continuous PSK carrier output from a terminal upon command from the central station.

Cable based security—the market exists and the technical tools are in hand. The cable operator is in a position to provide high quality, professional alarm service to people who could not previously afford it. He must act quickly to take advantage of the opportunity as it exists today and he must accomplish his entry into the security field in a manner which will fulfill its potential.

Before joining Pioneer last year, Patrick J. Birney served as a consultant and operations manager for Cable Link Engineering.

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Turning On Your First Cable Alarm System

By Clifford Schrock, executive vice president and director of engineering, CableBus.

This article will attempt to familiarize the cable television technician with some of the problems and solutions encountered when adding two-way services, particularly residential alarms to CATV.

CableBus has turned on over 25 systems and has visited many systems utilizing both CableBus' and competitors' equipment. The successful turn-on of new services can vary from a nightmare to a routine chore, depending upon the preparation of the plant and a technical understanding of the data signals and formats. A systematic approach to turning on the new service is required.

The Signals and System

Two-way cable alarm services can utilize a variety of RF carriers and modulation formats depending upon the design and subscriber capacity. The CableBus system uses two radio frequency carriers, the downstream being an FSK modulated carrier, commonly located in the 72 MHz to 76 MHz frequency band and also available in a variety of other frequencies from 50 to 172 MHz. The carrier occupies 250 kHz of bandwidth, similar to an FM signal on the cable. The FSK carrier is continuously on and can be accurately detected and measured with a standard signal level meter. By using the audio speaker in the SLM, the data can be heard and will have a distinctive bursty sound with each interrogation. All of the data rates used in the industry produce distinctive audible clicks or bursts and can be recognized easily, once the technician is familiar with them.

The return carriers from the home are more difficult to detect and measure. Industry practice is to use the higher T-band frequency of T-9 and T-10 or roughly from 18 to 30 MHz. CableBus offers equipment operating in the 30 to 32 MHz guard bands which have the added advantage of leaving four T-band channels for video services. Return carriers vary from wideband FSK to the CableBus

narrowband keyed carrier approach. Either system, and particularly the CableBus approach, key on the carrier for only a short duration, hence the signal cannot be accurately measured by a SLM, particularly those with a mechanical meter. The duration of the transmission is so short that the needle cannot begin to respond. Accurate level measurement of the return carrier requires a spectrum analyzer. However, by using special techniques and tricks, the technician should not have to carry an expensive spectrum analyzer in the field to service the cable alarm system.

The levels that the alarm data is carried on the system vary from manufacturer to manufacturer; however, CableBus recommends that the levels be set 10 to 15 dB below picture carrier levels in both the forward and return paths. It is important to establish an optimum level for your particular cable system and accurately set each terminal the first time it is installed, otherwise system maintenance will become a vicious circle of setting home terminal levels over and over again to compensate for system changes and/or poor performance.

Preparing the System

In my estimation, a minimum of 30 days of plant preparation will be required prior to connecting the first customer. Many technicians feel that all you have to do is plug in the return amplifiers on a two-way capable plant and everything will work fine. Experience tell us different!

A two-way plant, even if it is new construction, must be aligned or swept after it is turned on. After a settling in or burn-in period, the system should be rechecked.

Particularly in older systems, a cable alarm system turn-on should be planned in stages by geographic area, perhaps starting in an area of newest cable construction or in a good demographic area of town for alarm sales. Then, as the area is saturated and more experience is gained, other areas can be activated.

Once the cable plant or section of plant has been activated, aligned and burned-in, a system audit should be

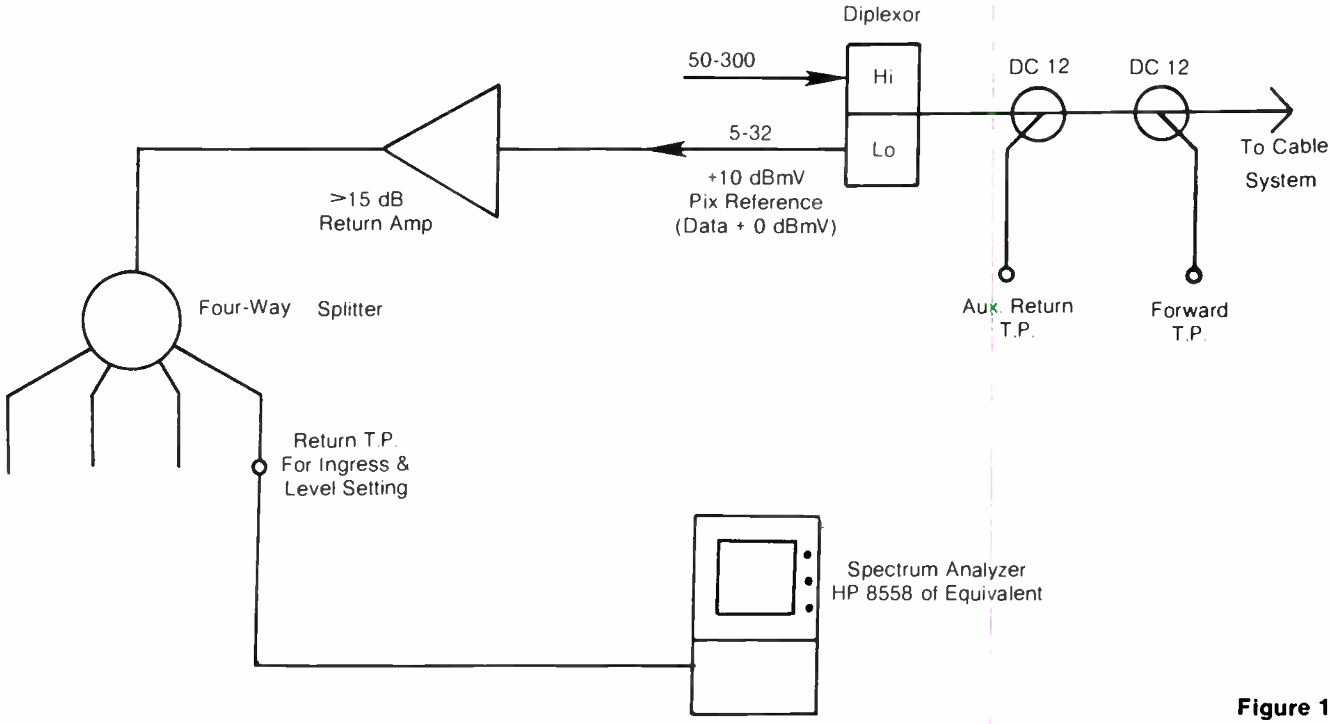

Figure 1

performed to verify the performance and determine the optimum frequencies and levels to be used in the system. To perform the audit, two people will be required—one to operate a spectrum analyzer at the headend and a field tech to operate a signal source at home drops.

The forward plant is rarely a problem unless the picture level delivered to the home is marginal. Since a fixed ratio is established at the headend between the picture and data carriers, the levels should carry through the home drop.

The return path is where the problems develop. The first test to be performed should be an ingress audit done at the headend. The spectrum analyzer should be set up at the return signal output. As a rule, standard return level test probes should not be used since the return data levels are often around 0 dBmV, and an extra 30 dB loss in a test probe does not give enough margin for an adequate ingress analysis. The analyzer should be connected directly to the return output. If the return video reference level is below +10 dBmV at the headend, a booster amplifier should be used. An ideal setup with levels noted is shown in Figure 1.

Once an appropriate test point is established, the return level picture carrier reference level should be noted. This can be obtained by putting a modulator or CW generator on the cable system and setting the level until the system reference level is obtained at the output of the return amplifier closest to the headend. This level will typically be about +30 to +33 dBmV. Observe the reference signal on the spectrum analyzer and note the level for future use. The data carrier will typically be carried 10 dB below the picture reference level.

With the reference level established, the spectrum analyzer should be used to watch the frequency-band where the alarm signals are proposed to be carried. Using a 300 kHz resolution bandwidth, the frequencies should be observed for other carriers that may be entering the system, as well as noise problems.

The goal of these tests is to find a frequency slot that is clean 40 dB below the data carrier level. Tests should be conducted at various times during the day and night to verify that operation will be possible. Local two-way radio, CB ignition noise and other signals can all cause serious operational problems. Sometimes a simple frequency shift as a result of an audit will save the technician years of grief in chasing bad connectors and cables. As a final point, many frequencies in the 5.0 to 32 MHz bands that appear quiet during the day will become very busy at night due to skip conditions, since the off-air frequencies are used for shortwave broadcasts. The night portion of the audit is extremely important.

After completing the frequency audit, the system return path audit should be conducted from home drops to the headend.

It is important for the cable technician to understand the factors that contribute to the return cable loss. The first point of understanding is that the highest loss encountered in the return path will be through the first tap (typically a 30 or 33 dB tap) out of an amplifier, whereas in the forward direction, the most distant tap is most troublesome.

As shown in Figure 2 on page 26, the return path loss between the home terminal output and the return amplifier input would vary from a low of 28 dB through a low value tap to a high of 46 dB through a high value tap. Factors contributing to the loss include the splitter in the home (3.0 dB), the home drop (although it is not significant) at 30 MHz, the tap loss and the cable and passives back to the return amplifier input. The tap flat loss is the most significant factor in the return path loss.

The return amplifiers of a system are commonly set up to carry video at the output at +30 dBmV maximum and accept an input of +10 dBmV. The data carrier should enter the amplifier, depending upon the manufacturer's specifications at -10 to + 10 dBmV. The CableBus system, because of its narrow bandwidth and associated noise immunity, can enter at -10 dBmV and carry effectively through the system. Using Figure 2 again as a reference, it would require a signal of +36 dBmV in the home to obtain -10 dBmV at the return amplifier. Most manufacturers' home terminals deliver +50 dBmV output to overcome the losses and operate effectively. The CableBus system output level is limited to +41 dBmV maximum in the home, the lower level being adequate for reliable alarm performance, however, more importantly, the limited output level of the home terminal being necessary to comply with the FCC 76:613 radiation specifications. CableBus believes that limiting the terminal output to +41 dBmV is the only effective way to guarantee that the home drop cable, connectors and equipment will remain in compliance with current FCC radiation regulations.

Once the losses of the return system are understood and the return reference

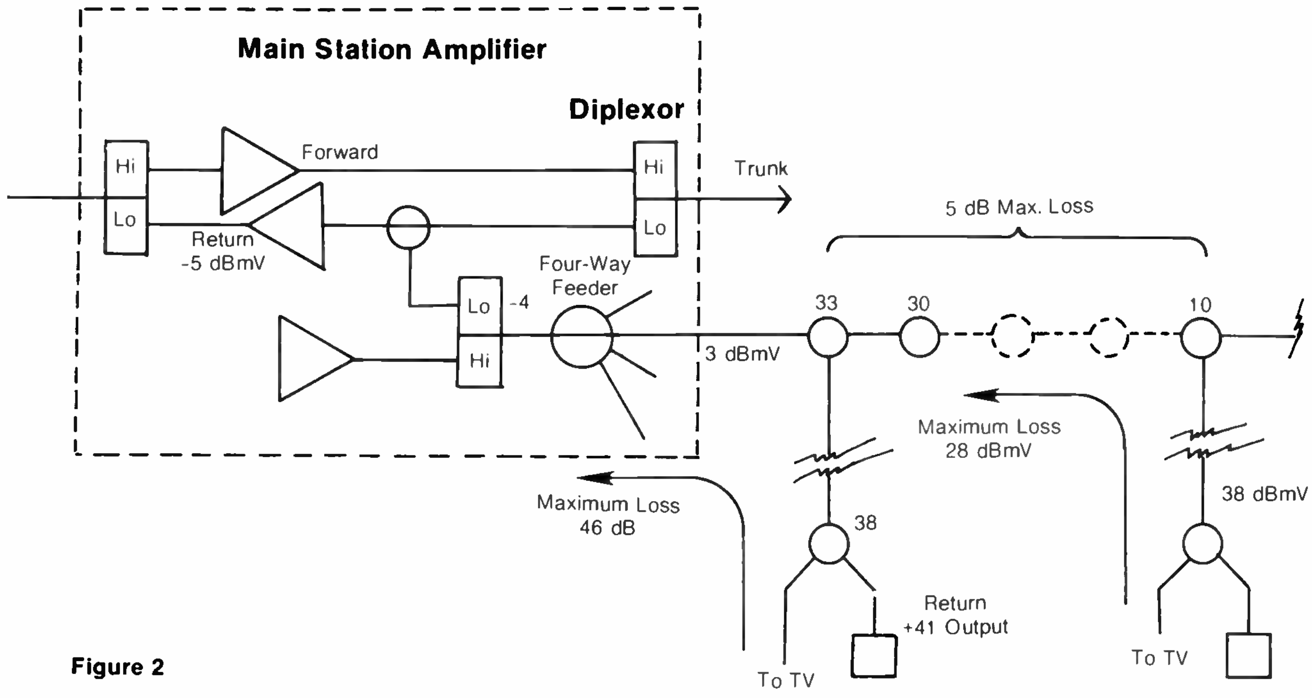

Figure 2

level at the headend is known, it is a simple matter to perform a system audit. Using the spectrum analyzer to monitor the return signals at the headend, a signal generator is put on the system on a home drop. A maximum level in the home of +41 dBmV (for the CableBus System) should produce a signal of at least -10 dBmV at the headend return output measuring point. The audit should be continued by testing a number of sample drops in homes to verify that the return path is operating correctly. Problems commonly encountered are defective amplifiers, excessive padding on amplifier inputs, bad or mistuned diplex filters and missing jumpers, pads, equalizers and return amps.

In summary, the frequency audit and return path audit are two of the most important tests a technician must complete before attempting to turn on a two-way cable service.

System Maintenance

Once the two-way service is operating, the day to day approach to operations and maintenance becomes of paramount importance. Continued routine maintenance will prevent those middle of the night emergencies and a variety of other frustrations.

One of the positive aspects of operating a two-way service on cable is that it has, in effect, a built-in status monitoring system. If terminals in one sector of the cable plant start to act up or quit responding, it can be a simple matter to locate the point in the system where the problem is starting. One of the simplest techniques is to take the city cable map, at 300 feet/inch or 1,000 feet/inch, and overlay a transparent plastic sheet. Each alarm account number should then be entered on the overlay in the installed location on the system. Then, as problems occur, locations can be quickly located using the logging information from the alarm system.

Routine system maintenance procedures should be established on a weekly basis. Good records and logs should be kept by the technicians working on the system.

Emergency procedures during outages should also be documented. It is assumed that any operator carrying alarm signals would have standby power supplies on the cable plant and backup power on critical parts of the headend. Many technicians think that standby power will solve all evils. Unfortunately, they soon learn that the standby supply will kick into standby and: 1) go dead because the batteries are not maintained; 2) go dead in four hours because there was no indication that the power was off; 3) go dead because someone stole the batteries. Obviously, good weekly and monthly maintenance is necessary, and procedures after a power failure should go beyond the initial to include backing up supplies with portable gasoline generators.

Lectro Power Supply Company offers a status monitoring option for their supplies using a CableBus modem that would remotely indicate a change to standby or tampering with the battery compartment. In addition, the supply can be exercised and measurements of most voltage and current parameters are possible from a small central computer.

Another area of emergency outage procedures is the technician's approach and attitude during a plant failure. Rapid response time is a must. Immediately assess the problem. Particularly with alarms, if the outage is a malicious or deliberate act, such as a cut cable or amplifier tampering, it is imperative that the police be put on notice in the affected area.

Service should be restored as soon as possible, even if it is temporary while a more permanent repair is effected. For instance, if a section of cable were broken or knocked down, the section could be by-passed temporarily with a smaller diameter cable laid on the ground and booster amplifier to compensate for the additional loss.

Whatever procedures are established, a two-way service such as cable alarms will not tolerate a casual approach to system outages. Restoration of service must be immediate and effective.

Adding a two-way service to cable is a challenge to the technical abilities of any cable technician. However, a systematic approach to the problem and a basic understanding of the nature of the data signal can yield a successful, minimum hassel turn-on of the new service. Good maintenance practice will keep the system operating smoothly for years.

Clifford Schrock left his position as CATV program manager at Tektronix, Inc., in 1978 to form CableBus. He holds a BSEE from the University of California, Long Beach, and is a member of the NCTA, SCTE and CATA. He also served as editor of **CED** *and technical editor of* **Cable-Vision** *in 1975.*

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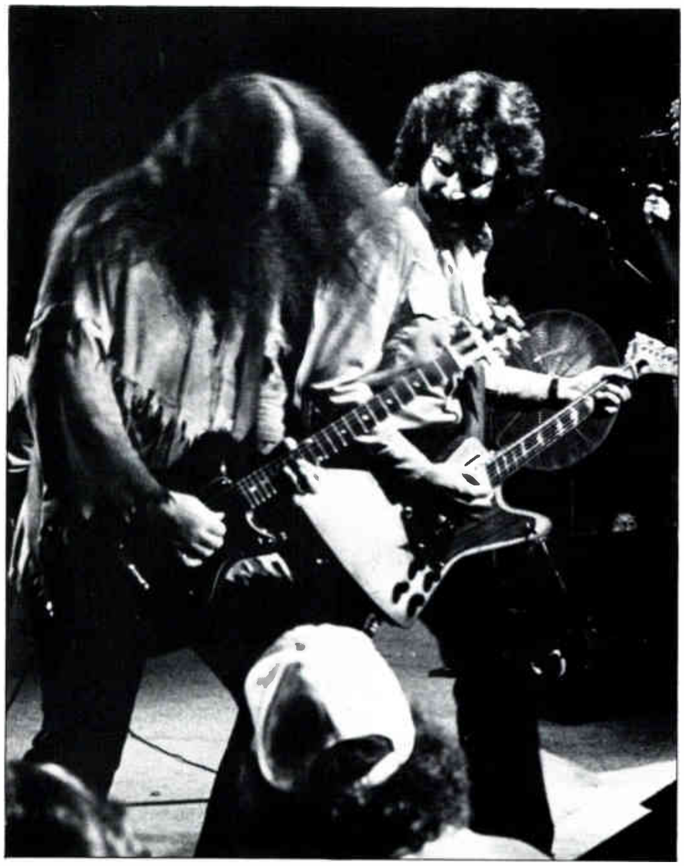
TV in Stereo: A Compatible System Via Satellite



By Dom Stasi, director of engineering, Warner Amex Satellite Entertainment Company

In the domestic satellite medium video service generally enjoys the allocation of full transponder bandwidth. Such allocation can provide abundant spectrum space for in-band, ancillary services. Thoughtful use of the available spectrum and efficient modulation loading can yield dynamically increased information transfer with little more than statistical impairment to extant signals.

One such application provides for the enhancement of satellite delivered program audio into compatible nonredundant stereo. The technique addressed is an adaptation of the sum and differences scheme introduced by Zenith—G.E. in 1961 and applied here to the conventions of satellite transmission into CATV systems.

Multiplex Scheme

To distribute FM signals efficiently without loss of fidelity or monophonic compatibility, the multiplex scheme of L+R, L-R double sideband suppressed carrier was put into use in the United States.

To the credit of its developers, it has enjoyed widespread acceptance since its inception despite what, from a strictly parametric appraisal, was a compromise of virtually all major modulation parameters in the interest of compatibility. The FM broadcast band, developed to accommodate a monaural baseband (1 channel audio not exceeding 15 kHz) set a peak deviation limit of 75 kHz. As Figure 1 indicates, to incorporate stereo, a second baseband channel must be multiplexed above the first, extending the baseband excursions to 53 kHz. This reduction in FM improvement ratio, coupled with the anomalies of de-matrixing the sum and difference signals, results in a S/N reduction in stereophonic reception of some -20 dB from monophonic reception of the same signal. It is beyond the scope of this article to discuss further, however, since stereo transmission constitutes the vast majority of all current FM broadcast allocations. Its nearly universal acceptance, despite the inherent degradations, bears testimony to the dynamic subjective appeal of stereophonic sound in the transmission of music.

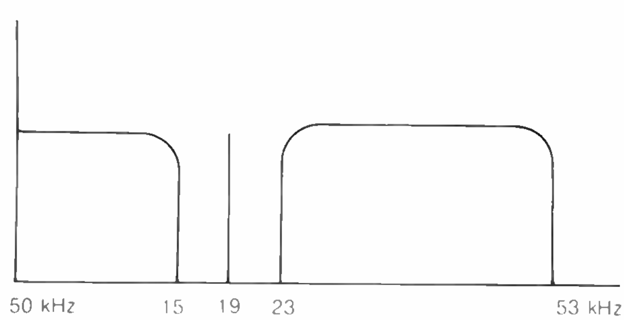


Figure 1

Satellite Applications

The application of the sum and difference technique to satellite video transmission, however, may exploit the scheme to much greater advantage in the absence of the stringent deviation constraints imposed by broadcast regulations.

Two techniques will be discussed:

1. Strict adherence to National Cable Television Association recommendations for main aural subcarrier modulation, the advantage being compatibility in an existing universe.

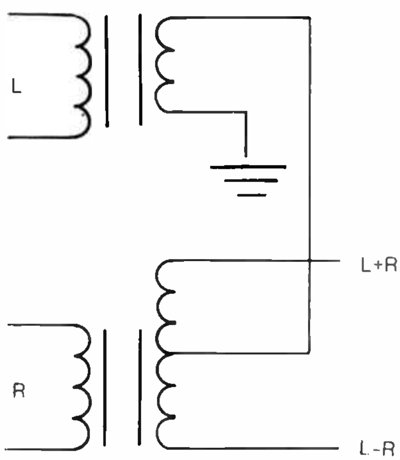


Figure 2

2. An optimum modulation loading and signal processing technique, emphasizing audio as the prominant signal component.

In both cases, the proposal utilizes generic or public domain techniques. The affiliated participant is not limited to proprietary equipment designs in an as yet undefined equipment universe.

A simple technique for obtaining sum and difference signals is indicated in Figure 2.

In the (L+R) output, left and right channel baseband inputs are added to form the monaural signal for use in conventional reception.

In the stereo receiver, the (L-R) signal is combined with the (L+R) signal to regain the original left and right channel stereo relationship, as shown in Figure 3.

$$(L+R) + (L-R) = 2\,L$$
$$(L+R) - (L-R) = 2\,R$$

Figure 3

To provide the stereo receiver with proper information to perform the above summation, it is necessary to transmit the stereo (L-R) information on separate multiplex subcarrier.

Applied to a CableNet I transponder, video associated audio may be transmitted in stereo with no redundant signals. Matrixing at the uplink transmitter, the sum (L+R) channel is modulated upon the 6.8 MHz subcarrier. A conventional video receiver will detect this as a monaural signal and provide a baseband output. The difference (L-R) channel is modulated upon a separate subcarrier. For discussion, let's choose 5.8 MHz, as shown in Figure 4.

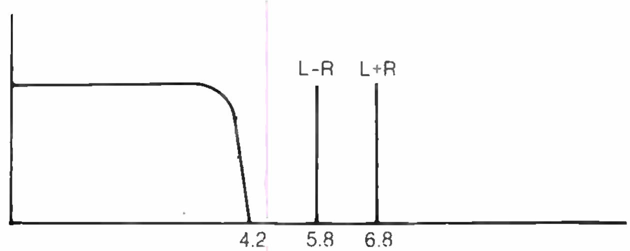


Figure 4

As per NCTA recommended practices, additional subcarriers may be multiplexed above video on full transponder (36 MHz) services. For the limited subcarrier case, a root sum squared rule applies in determining peak composite deviation and thus occupied bandwidth, as shown in Figure 5 on page 30. For the single subcarrier case, assuming conventional subcarrier modulation indices of 1:0.29* and deviation standards (as per NCTA document #T.B.D.) of 100 kHz peak deviation, composite deviation, composite deviation is equal to 10.98 MHz, as shown in Figure 6 on page 30.

$$F_{comp} = \left[\Delta F_v 2 + \Delta F_e 2 + \sum_{i=1}^{n} \left(\frac{\chi}{F_{S1}} \; F_{Si} \right)^2 \right]^{1/2}$$

where:

ΔF_v = deviation of main carrier by video = 10.75 MHz

ΔF_e = deviation of main carrier by energy dispersal waveform = 1.0 MHz

χ = deviation of main carrier by existing subcarrier = 2.0 MHz

F_{s1} = frequency of existing subcarrier = (6.8 MHz)

F_{si-n} = frequency of additional subcarrier(s)

Figure 5

In Figure 7 Carson's rule is applied to determine occupied bandwidth.

The figure attained, 35.76 MHz, may be rounded to bandwidth = 36 MHz. Thus it may be assumed that in order to add information, in the form of additional subcarrier(s), some reduction in peak deviation of existing service(s) must be accomplished: (1) to avoid overdeviating. Decreasing video deviation to accommodate our difference (L-R) channel subcarrier imposes a minimal penalty, manifest as an imperceptable reduction in video S/N.

$$\left[\left(10.75^2 + 1^2 \right) + \left(\frac{2}{6.8} \times 6.8 \right)^2 \right]^{1/2} = 10.98 \text{ MHz}$$

Figure 6

$$BW = 2(\Delta F + FM)$$

where:

ΔF = peak composite deviation

FM = max instantaneous modulating frequency

then:

(6.8 + .100)

BW = 2(10.98 + 6.9) = 35.76 MHz

Figure 7

Consider the second subcarrier of 100 kHz peak deviation, 1:0.29 modulation index at 5.8 MHz. Scaling according to modulation index, yields subcarrier deviations of main carrier, as shown in Figure 8.

Statistically, according to Carson's BW rule, this would cause a slight overdeviation. Some parameter (ΔF_v) must be reduced.

S/N Performance

Video deviation, and subsequent video signal-to-noise ratio penalty attributed to the additional subcarrier, is then 10.74 MHz, as shown in Figure 9, or approximately a -.01 dB reduction in video S/N. A minimal tradeoff to accommodate stereo audio.

$$F_{comp} = \left[\Delta F_v + \Delta F_e + (.29 \times 6.8)^2 + (.29 \times 5.8)^2 \right]^{1/2} = 11.1 \text{ MHz}$$

Figure 8

Audio signal-to-noise ratio is identical to one channel operation when modulation indices are maintained. Or S/N is identical to the calculation in Figure 10.

$$\Delta F_v = \left[(123.21 - 1^2 - 2^2 - 1.68^2) \right]^{1/2} = 10.74 \text{ MHz}$$

Figure 9

The figure 63 dB represents a quite acceptable audio S/N ratio and should yield excellent quality at the TVRO with no apparent effect upon video or monaural audio subcarrier.

Consider, however, as mentioned earlier, that prior to carriage over a cable system the conversion to broadcast FM format must be undergone, replete with its -20 dB signal-to-noise penalty. This, coupled with average cablesystem noise figures, will yield signal typically 40 dB above the noise floor. Several methods are available to improve this figure. The most apparent is, of course, increased subcarrier deviations.

Optimized Transmission

In delivering services where audio enjoys a unique prominence, such as Warner Amex's MTV, The Music Channel, deviation and processing may be employed which reflects that prominence. For example, extending deviation peaks to 237 kHz (75 kHz + 10 dB headroom) will yield S/N ratios on the order of 70 dB (C/N=12 dB). Again, it is achieved at minimal penalty to existing services. The MTV optimized system may utilize subcarriers of 6.6 MHz, in the interest of improved threshold performance.

In Figure 11 on page 33, the techniques just discussed are applied. The S/N of 71.8 dB attained is a striking improvement. But it can be improved further.

$$S/N_a = C/N + BW + P + 10 \; \tfrac{3}{4} \left[\frac{\chi^2 \;\; \Delta F_s^2}{F_a^3 \;\; F_s^2} \right]$$

where:

BW = bandwidth in decibels = 75 dB

P = Preemphasis improvement (75u) = 13.2

χ = deviation of main carrier by subcarrier (1.68 MHz)

F_a = top modulating frequency (15 kHz)

F_s = subcarrier frequency (5.8 MHz)

ΔF_s = subcarrier peak deviation (± 100 kHz)

Then assuming a C/N of 12 dB:

$$S/N = 12 + 75 + 13.2 + 10 \log \tfrac{3}{4} \left[\frac{(1.68 \times 10^6)^2 (100 \times 10^2)}{(15 \times 10^3)^3 \;\; (5.8 \times 10^6)^2} \right] = 63 \text{ dB}$$

Figure 10

Noise Reduction

An additional technique, which exploits the freedom of the CATV industry is the addition of a world renowned noise reduction system, B type Dolby encoding. The Dolby B system boosts high frequencies by 10 dB. In decode an equal and opposite cut is applied, restoring the signal to its original characteristics. In the process, all low level noise introduced between encoder (uplink) and decoder (TVRO) is attenuated, as per Figure 12 on page 33.

MTV, The Movie Channel, and Nickelodeon transmissions incorporate B type Dolby encoding.

Extensive tests worldwide have shown the B system to be compatible. The compatible nature of the system permits the CATV operator to allow the encoded signal to pass directly to his subscribers. This accords the noise reduction advantages (Figure 12) of the compander to those equipped with Dolby receivers at no perceptible detriment to non-Dolby or TV receivers.

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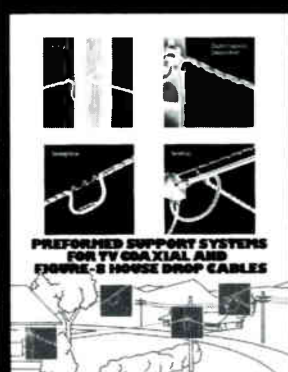

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Reception

Reception of stereo subcarriers may be accomplished by the simple addition of appropriate subcarrier demodulator cards to the satellite video receiver. Serious caveats apply and this technique, while enticingly simple, is not recommended at this time.

Consider the following. For good stereo reception it is necessary that the L and R channels remain well separated (that is, audio in one channel shall not appear in the output of the other channel). The FCC requires 29.7 dB separation (which was about the best achievable when the rules were adopted). Exciters soon became available which were capable of better than 35 dB separation.

In order to maintain good separation, it is necessary that the amplitude and phase of the L+R and L-R paths be nearly identical. The channel separation as a function of these three factors is given in the equation in Figure 13.

$$\Delta F_v = \left[\frac{BW^2}{4} - (BW \bullet F_{max}) + F_{max}^2 - F_e^2 - F_1^2 - F_2^2\right]^{1/2}$$

$$= \left[\frac{36^2}{4} - 246.132 + 6.84^2 - 1^2 - 1.98^2 - 1.68^2\right]^{1/2}$$

ΔF_v = 10.8 MHz (no video S/N penalty to the 36 MHz BW receiver)

Audio S/N =

$$S/N_a = C/N + BW + P + 10 \log \left[\frac{(X)^2}{(F_a)^3} \frac{(\Delta F_s)^2}{(F_s)^2}\right]$$

$$12 + 75 + 13.2 + 10 \log \left[\frac{(1.98)^2 \times (.237)^2}{(.015)^3 \quad (5.8)^2}\right]$$

S/N_a = 71.8 dB

Figure 11

These chart recordings show the noise reduction effect of Dolby FM. The top curve is the noise spectrum of conventional 75 microsecond FM. The botton curve shows the reduced noise level of Dolby FM.

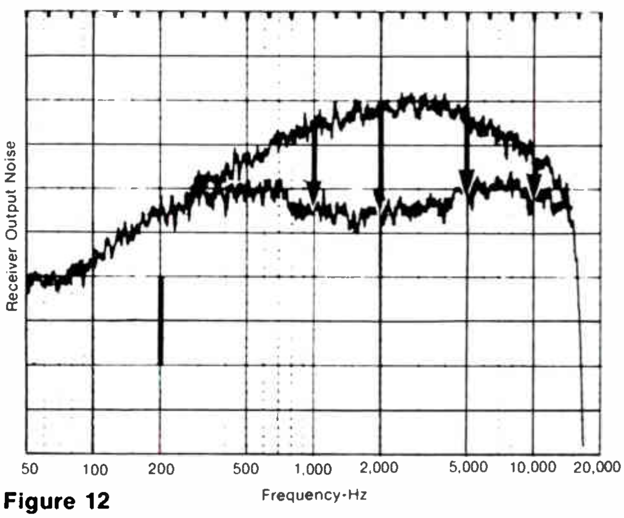

Figure 12

$$20 \log \left[\frac{(\cos\theta + \frac{S}{M}\cos\phi)^2 + (\sin\theta)^2}{(\cos\theta - \frac{S}{M}\cos\phi)^2 + (\sin\theta)^2}\right]^{1/2}$$

where:

M is the gain of the main L+R path
S is the gain of the stereo L-R path
ϕ is phase error of reinserted 38 kHz subcarrier
θ is difference in phase between L+R and L-R paths

Figure 13

The effect of each alone upon the separation is shown in Figure 14. In practice, loss of separation is due to some of each. Therefore, to achieve 35 dB separation, the amplitudes must match to about 1 percent and the phase to about 1° over the entire audio range from 50 Hz to 15 kHz. These are very stringent requirements. For this reason, designers keep the amount of circuitry in the separate L+R and L-R paths to a minimum.

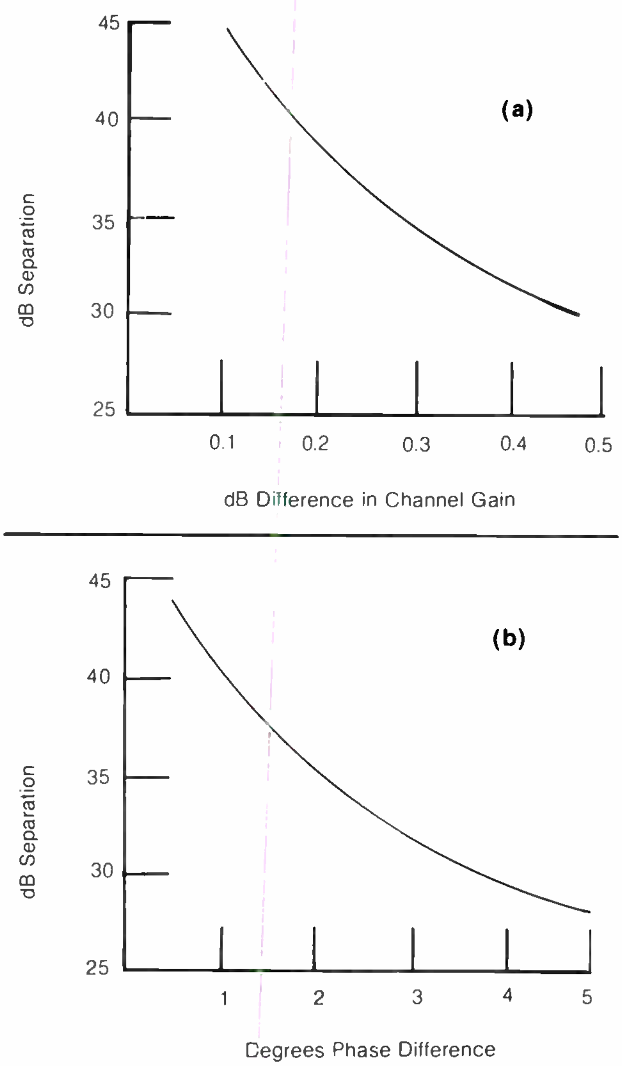

Figure 14

Propagation delay deltas, long term component degradations and manufacturing differences make independent subcarrier demodulator cards impractical as stereo receivers, at this time.

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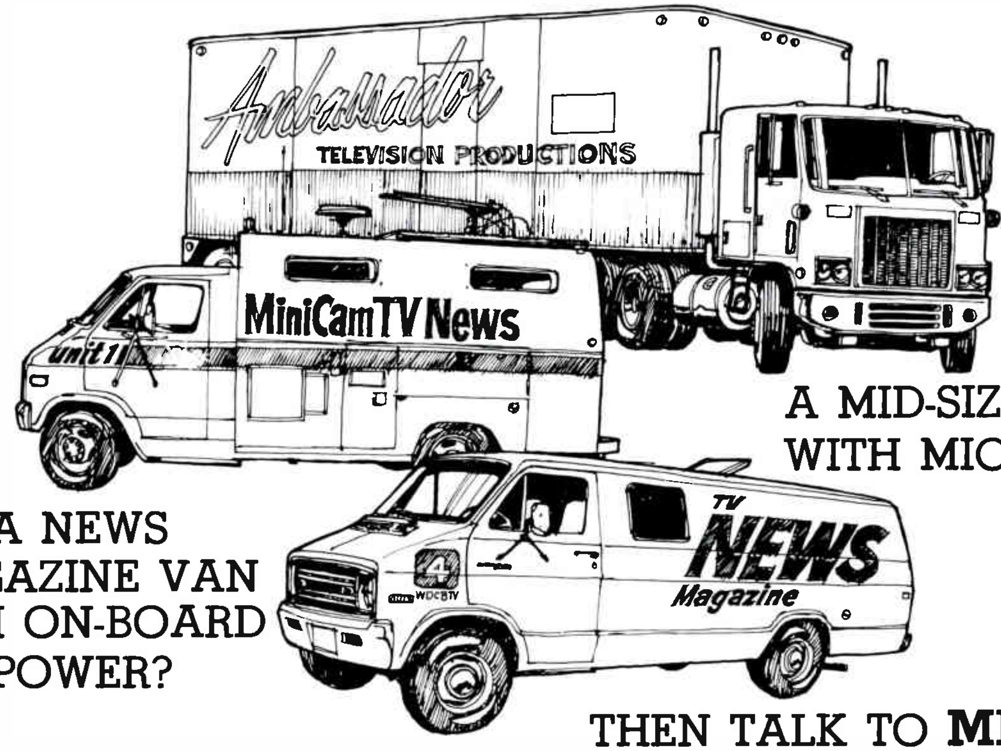

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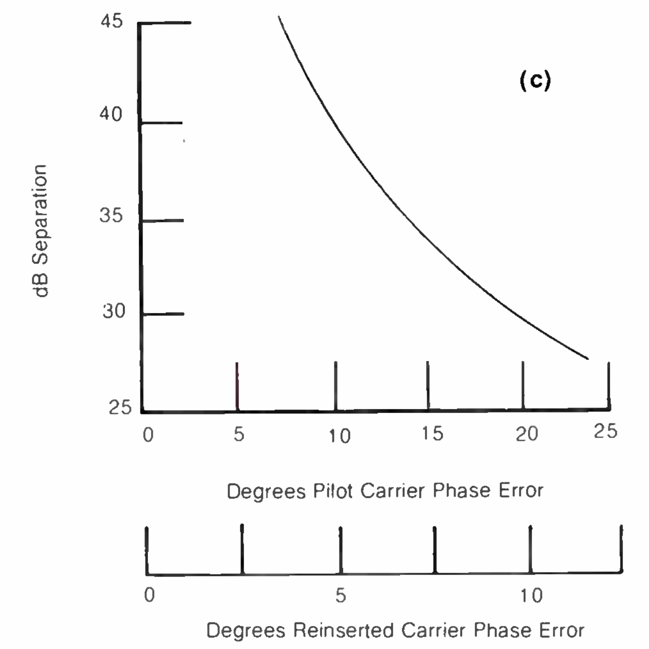


Figure 14

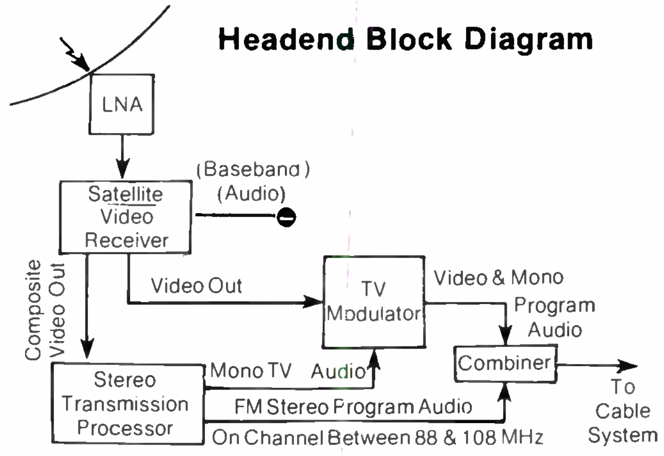


Figure 15

A number of efficiencies are inherent in a reception scheme like that of Figure 15, not the least of which is the preservation of stereo separation in the long term.

Additionally, wide deviations may be implemented in the absence of receiver imposed roofing limitations, thus yielding the benefits of optimized transmission.

Conclusion

We have striven to develop a system suited to the needs of the CATV industry. Also, the CATV operator is well aware of the significant advantages the term "Dolby" conveys to subscribers.

Dominick Stasi joined Warner Amex Satellite Entertainment Company a year ago as director of engineering. He is a member of SMPTE, IEEE, and NCTA and serves on the Satellite Subcommittee and the Signal Security Subcommittee of the NCTA.

Product Profile

The Sadelco model FS 3D-VS signal level meter.

The SAM II signal level meter from Wavetek/Mid State.

In this month's Product Profile we present information on three types of test equipment commonly used by CATV engineers to measure and analyze critical parameters of an operating system's performance. They are Signal Level Meters, Spectrum Analyzers, and Sweep Transmitter/Receiver Systems. Other types of "garden variety" as well as the more "exotic" types of test equipment will be featured in future issues of **CED** along with the full range of equipment hardware that make up the constituent elements of operating CATV systems.

Signal level meters and spectrum analyzers are essentially sophisticated voltmeters or power meters. Power meters can measure total signal power within a given frequency range but cannot measure specific frequency or power differences between discrete signals. If the signal at the input of a power meter is limited to a narrow bandwidth somewhere in the circuit, specific signal voltages can be measured. Such an instrument is called a tuned voltmeter. "Tuned" means the amplitude measurement is frequency sensitive. Signal level meters are tuned voltmeters.

Unlike voltmeters or power meters, signal level meters can measure frequency as well as individual carrier and sideband power. Other names for these instruments are frequency selection meters, field strength meters, or wave meters.

Spectrum analyzers are automatic tuned voltmeters, usually employing a cathode ray tube (CRT), and can display more information faster. For measurement simplicity the frequency of the tuned voltmeter can be automatically swept so that a continuous readout can be displayed on an amplitude versus frequency plot. This "swept-tuned voltmeter" is called a spectrum analyzer or spectrum viewer.

The displays that spectrum analyzers provide are ideal for CATV applictions because they show more about the signal than any other technique. Signal level, noise, sidebands, and many forms of interference can all be measured and analyzed. The

Test Equipment

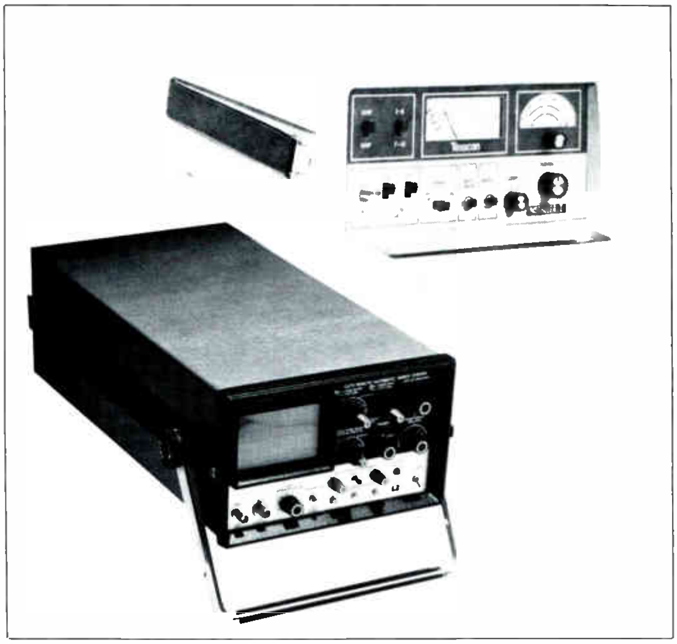
spectral display renders instant insight into the operation of the system and its components.

When comparing relative prices of spectrum analyzers care must be taken to consider standard features offered with each model but most especially the buyer should take note as to whether the unit is of a piece with an integral mainframe (oscilloscope) or whether the spectrum analyzer is a plug-in component of a separate mainframe. If it is a modular or plug-in component, the mainframe will be an additional cost over the plug-in instrument. Many plug-in type spectrum analyzers are usable with various mainframes and other plug-in components that are optional with the spectrum analyzer but are usually only compatible with a single manufacturer's line of mainframes and components. When requesting product information from manufacturers (in this as in all buy situations), ask for information and spec sheets on all related equipment and compatible components as well as individual prices on all equipment elements.

Unique to cable television is our third type of test equipment, sweep transmitter/receiver systems. Sweep systems offer many advantages to system operators. Consisting of a rack mounted (at the headend) sweep transmitter and a portable sweep receiver for in-field system measurements at any point in the plant, sweep systems provide daily trouble-shooting and preventative maintenance indications, 24-hour test as well as the annual proof-of-performance test as required by the FCC rule §76:605. The "signature" of the swept response as displayed on the CRT will indicate system problems or faults such as moisture in the cable, bad grounds on amplifier modules, corroded or loose RF cable fittings, mismatches from kinked or squeezed cable, low gain amplifiers, or suck-outs within the frequency response well before they develop into major repair problems or cause a total system shut-down.

In the following chart, general information is provided on signal level meters, spectrum analyzers and sweep systems. The reader should note that the categories or criteria for each of the three types of equipment will vary from type to type but within a type grouping effort has been made to provide comparable data. However, readers contemplating purchasing test equipment should obtain detailed product information from several manufacturers.

Next month's Product Profile will feature CATV system passive devices.



The Installer 1 signal level meter from Texscan Corporation, and the CR-2000 sweep receiver system from Avantek.

Product Profile

Signal Level Meters

Model	Range	Amplitude Measurement	Calibrated Accuracy	Operating Power	Special Features	Availability	Single Unit Cost
Avantek, Inc., Santa Clara, California							
SL-300A	4.5 MHz to 300 MHz	-40 to +60 dBmV	±1.0 dB NBS traceable	Internal rechargeable batteries; 12 V external, AC	Built-in speaker, built-in hum test, single band, tuner, LED digital and meter analog readout, optional modules including voltmeter, spectrum analyzer, stability monitor, UHF converter, charger/power supply weight 18 lbs., portable	Immediate	$1,495
SL-400	4.5 MHz to 400 MHz	-40 to +60 dBmV	±1.0 dB NBS traceable	Internal rechargeable batteries, 12 V external, AC	Built-in speaker; built-in hum test, single band frequency coverage, LED digital and meter analog readout, optional modules including voltmeter, spectrum analyzer, stability monitor, UHF converter charger/power supply, weight 18 lbs., portable	Immediate	$1,695
Sadelco, Inc., Englewood, New Jersey							
719C	54 MHz to 216 MHz & 470 MHz to 812 MHz	-32 to +62 dBmV	±2.0 dB lower range ±3.0 dB higher range NBS traceable	various battery combinations, AC	Charger/adaptor, built-in speaker, weight 8 lbs., portable	Immediate	$475
733 B	54 MHz to 216 MHz	-32 to +62 dBmV	±2.0 dB, NBS traceable	Four 9V batteries	Built-in speaker, weight 5 lbs., portable	Immediate	$425
733C	54 MHz to 402 MHz	-32 to +62 dBmV	±1.5 dB, NBS traceable	Various battery options	Built-in speaker, two bands with individual tuners, weight 6 lbs., portable	Immediate	$545
FS 3D-VS	54 MHz to 402 MHz	-32 to +62 dBmV	± 1.0 dB, NBS traceable	Various battery or AC options	Built-in speaker, two bands with individual tuners, optional 4.5-45 MHz adaptor, preset auto-shut-off, weight 8 lbs., portable	Immediate	$695
FS 3D-VU	54 MHz to 216 MHz & 470 MHz to 812 MHz	-32 to +62 dBmV	±1.0 dB VHF & ±2.0 dB UHF, NBS traceable	Various battery or AC options	Built-in speaker, two bands with individual tuners, optional 4.5-45 MHz adaptor, preset auto-shut-off, weight 8 lbs., portable	Immediate	$695
DL-200-VS	54 MHz to 450 MHz	-30 to +60 dBmV	±1.0 dB, NBS traceable	Internal rechargeable batteries AC	Built-in speaker, LED digital and meter analog readout, auto-ranging attenuation, dual-mode variable detector, two bands with individual tuners, preset auto-shut-off, weight 6 lbs., portable	Early 1982	$1,200
DL-200-VU	54 MHz to 216 MHz, 470 MHz to 812 MHz	-30 to +60 dBmV	±1.0 dB lower range ±2 dB higher range NBS traceable	Internal rechargeable batteries, AC	Built-in speaker, LED digital and meter analog readout, auto ranging attenuation, dual-mode variable detector, two bands with individual tuners, preset auto-shut-off, weight 6 lbs., oortable	Early 1982	$1,200
Texscan Corporation, Indianapolis, Indiana							
Installer VHF	54-88 MHz, 174-216 MHz	-20 to +50 dBmV	±2.0 dB	Internal rechargeable battery, AC	Built-in charger, built-in speaker, three-band tuner, weight 2 lbs., portable	Three weeks	$295
Installer I	54 MHz to 890 MHz	-20 to +30 dBmV	±1.5 dB	Internal rechargeable battery, AC	Built-in charger, built-in speaker, three-band tuner, weight 5 lbs., portable	Four weeks	$395
Installer II (European)	47-290 MHz, 470-890 MHz	-20 to +30 dBmV	±1.5 dB	Internal rechargeable battery, AC	Built-in charger, built-in speaker, three-band tuner, weight 5 lbs., portable	Four weeks	$395
Installer III	5 MHz to 450 MHz	-20 to +30 dBmV	±0.75 dB	Internal rechargeable battery, AC	Built-in charger, built-in speaker, four-band tuner, weight 5 lbs., portable	Six weeks	$695
7272	5 MHz to 405 MHz	-35 to +70 dBmV	±1.0 dB	Internal battery, 12V external, AC	Built-in speaker, built-in voltmeter-ohmmeter, six-band tuner, rotary attenuator, optional UHF converter, weight 15 lbs., portable	Two weeks	$1,095
Digitech I	4 MHz to 450 MHz	-40 to +60 dBmV	±0.5 dB	Internal rechargeable battery, AC	Keyboard operation, digital display of frequency, amplitude and synthesized channel, direct measurement of hum and noise, ohmmeter, temperature indicator, optional UHF converter, weight 12 lbs., portable	Ten weeks	$1,700
Wavetek/Mid State, Beech Grove, Indiana							
SAM Jr.	10 MHz to 300 MHz	-35 to +60 dBmV	±0.75 dB	Rechargeable batteries	Built-in speaker, optional UHF range, weight 6 lbs., portable	Two to three weeks	$695
SAM I	4.0 MHz to 300 MHz	-40 to +60 dBmV	±1.0 dB	Internal batteries, AC	Built-in speaker, hum modulation testing, five-band tuner, built-in calibration optional features including spectrum analyzer function, UHF range, extention to 400 MHz, automatic signal-to-noise switch, weight 11 lbs., portable	Four weeks	$1,095
SAM II	4.0 MHz to 300 MHz	-40 to +60 dBmV	±1.0 dB	Internal batteries, AC	Manual and push-button tuning, spectrum analyzer function when used with oscilloscope, built-in calibration, hum modulation testing, automatic signal-to-noise switch, built-in voltmeter, weight 11 lbs., portable	Four weeks	$1,595

Sweep Transmitter/Receiver Systems

Model	Range	Sweep Level	Sweep Speed	Pilot Carrier	Special Features	Availability	Single Unit Cost
Avantek, Inc., Santa Clara, California							
CT-2000/ CR-2000	5.0 MHz to 300 MHz	-30 to -35 dB below video	25 ms continuous repeat	49-52 MHz	Bench sweep test mode, built-in calibration, spectrum analyzer mode wave function analyzer, non-interfering pilot adjustments in real time	Immediate	$3,650 transmitter, $8,650 receiver
CT-4000 /CR-4000	5.0 MHz to 440 MHz	-30 to -35 dB below video	25 ms continuous repeat	49-51 MHz	Bench sweep test mode, built-in calibration, spectrum analyzer mode, wave function analyzer, non-interfering pilot, adjustments in real time	Eight weeks	$3,950 transmitter $9,150 receiver
Texscan Corporation, Indianapolis, Indiana							
9551T-9551R	4.0 MHz to 450 MHz	+10 to +15 dB above video	4 0 ms, 2s repeat and remote triggering	N/A	Digital storage, adjustable tilt output, bench sweep test mode, optional pilot carrier notch	Two-to-four weeks	$1 395 transmitter $2 395 receiver
Wavetek/Mid State, Beech Grove, Indiana							
1855B/1865B	5.0 MHz to 350 MHz	+15 dB above video	1 0 ms or less	50 MHz	Dual-cursor measurement with on-screen readout, digital microprocessor storage, keyboard operation, bench sweep test mode optional features including pilot carriers, notch filters, camera, card read writer	Two-to-three weeks	$3 240 transmitter $5 275 receiver

Spectrum Analyzers

Model	Range	Amplitude Measurement	Resolution	Flatness	Special Features	Availability	Single Unit Cost
Comsonics, Inc., Harrisonburg, Virginia							
SA 440	0.5 MHz to 440 MHz	-60 to +20 dBmV	1.0 MHz to 0.1 MHz, Four positions	±1.0 dB	Storage mainframe; phase lock, built-in calibrator; 72 dB dynamic range	Immediate	$4,500
Hewlett-Packard Company, Palo Alto, California							
8557A option 002	0.01 MHz to 350 MHz	-63 to +70 dBmV	3.0 MHz to 1.0 kMz, Eight Positions	±0.75 dB	Automatic coupling of front panel controls, LED digital frequency display, 70 dB dynamic range, optional features including amplifiers camera, active probe, 180 series mainframes, storage normalizer	Eight weeks	$5,750 (with option 002, without mainframe
8558B option 002	0.1 MHz to 1500 MHz	-63 to +80 dBmV	3.0 MHz to 1 0 kHz, Eight positions	±1 0 dB	LED digital frequency display, 70 dB dynamic range, optional features including amplifiers, camera, active probe, 180 series mainframes, storage normalizer, tracking generator	Ten weeks	$7,100 (with option 002, without mainframe
Tektronix, Inc., Beaverton, Oregon							
7L12	100 kHz to 1800 MHz	-68 to +78 dBmV	3.0 MHz to 300 Hz, Five positions	±1 5 dB	Automatic phase lock, 4 1 resolution shape filter, 70 dB dynamic range, optional features including 7000 series mainframes with CRT readout of major parameters, preamplifier, dual-trace amplifier, time base, internal graticule, TV sideband analyzer, camera	Thirteen weeks	$8,500 (without mainframe)
7L14	10 kHz to 1800 MHz	-78 to +78 dBmV	3.0 MHz to 30 Hz, Six positions	±1 5 dB	Built-in limiter; built-in calibration, digital storage with two independent memories, 4 1 resolution shape filter, 70 dB dynamic range, optional features including 7000 series mainframes with CRT readout of major parameters, tracking generator, amplifiers, time bases, logic analyzers, counters A/D converters, readout units, TV sideband analyzer, camera	Eighteen weeks	$16,000 (without mainframe)
496	1 kHz to 1800 MHz	-78 to +78 dBmV	1.0 MHz to 30 Hz, Six positions	±1.5 dB	CRT readout of seven parameters, most-used functions automated, digital storage with two independent memories, 80 dB dynamic range, phase lock, optional features including full programmability of all signal-affecting controls and stored displays, rack versions, higher frequencies, TV sideband analyzer, trigger synchronizer, camera, ruggedized	Six weeks	$22,950 (without mainframe)
Texscan Corporation, Indianapolis, Indiana							
VSM-1A	4.0 MHz to 450 MHz	-40 dBmV to +62 dBmV	150 kHz fixed	±1 5 dB	Programmed preset bands, 20 dB or 40 dB dynamic range selectable	Two-to-four weeks	$2,295 (integral mainframe)
VSM-2A	4.0 MHz to 1000 MHz	-50 dBmV to +52 dBmV	200 kHz to 500 Hz, Three positions	±2 0 dB	Built-in calibrator; programmed preset bands, phase lock; 60 dB dynamic range; optional digital display storage, audio recovery	Two-to-four weeks	$5,845 (integral mainframe)
VSM-5B	4.0 MHz to 450 MHz	-50 dBmV to +72 dBmV	200 kHz to 500 Hz, Three positions	±1 25 dB	Built-in calibrator, phase lock, programmed preset bands, 60 dB dynamic range, optional digital display storage, audio recovery	Two-to-four weeks	$5,545 (integral mainframe)

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We are seeking two professionals to join our young, rapidly growing CATV interactive communications company in Beaverton, Oregon. We are now marketing residential security systems combining cable technology and alarm systems, and need the following:

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CED

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Names and locations will not be published without written authorization. Send your questions, and possible solutions, to: "Out of Sync," **Communications Engineering Digest**, *P.O. Box 5400-TA, Denver, Colorado 80217.*

Q. We are planning to expand our system bandwidth to include some of the midband channels. None of us has ever worked with converters and we don't really understand their operation. Do you know of any books or other sources we can get to help us learn converter theory and maintenance?

A. Your best bet is to write or call the company whose converters you plan to use. If you will be buying from a sales representative rather than a manufacturer, contact your salesman or sales manager. They can usually supply you with at least some maintenance and service information. In the meantime, perhaps the following basic converter theory might be of some benefit.

The type of converters used to serve subscribers in cable television systems are RF to RF frequency transposing devices. They are capable of converting the information contained within one or several bands of frequencies to a different band or bands of frequencies. For example, a simple single channel converter might have the ability to change the input TV signals on Channel C (132 to 138 MHz) to an output frequency of Channel 3 (60-66 MHz). The block diagram in Figure 1 illustrates this conversion.

To better understand the conversion process, let's follow a single visual signal through the diagram in Figure 1. We will assume that there are a number of channels at the input to the converter, but only one (Channel C) needs to be converted for reception on the TV set.

Signals arrive at the converter input (1). The bypass switch (2) is in the "on" position, allowing signals to reach the bandpass filter (3). The filter rejects all frequencies except those between 132 and 138 MHz, which are passed with minimal attenuation. The signal at 133.25 MHz is passed and then routed to one input of the mixer (4).

The other input of the mixer is fed from a device called an oscillator or local oscillator (5). This device produces a fairly stable, unmodulated signal at some carefully chosen frequency. In this example, we are using an oscillator frequency of 72 MHz for simplicity. In actual practice, this frequency may not be used.

In the mixer (4) the 133.25 MHz signal and the 72 MHz signal are combined or mixed to produce at least four other frequencies at the mixer output. Those frequencies are:

F1 — input signal frequency of 133.25 MHz
F2 — oscillator signal frequency of 72.0 MHz
F1 minus F2 — combined signal frequency of 61.25 MHz
F1 plus F2 — combined signal frequency of 205.25 MHz

The output signals from the mixer are routed to another bandpass filter (6) which has been adjusted to reject all signals except those between 60 and 66 MHz. The 61.25 signal derived from the mixer as F1 minus F2 passes easily and is the standard frequency assignment of the visual carrier for Channel 3. Channel C visual signals have now been converted to Channel 3 visual signals. The aural and other carriers within a TV channel are converted in exactly the same way.

Many problems can be encountered with single conversion units unless much care is used in their design. Many of the more expensive converters use dual conversion techniques as shown in Figure 2. Hope this has helped you to understand converters a little better.

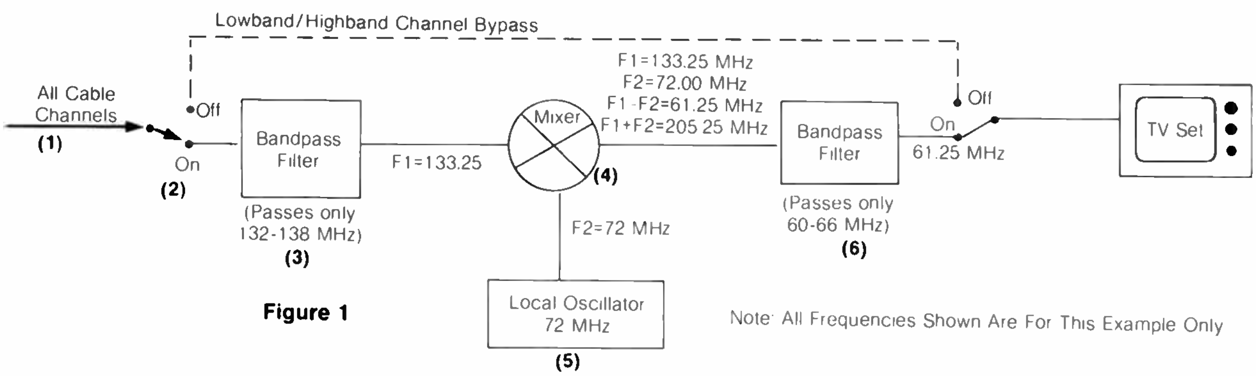


Figure 1

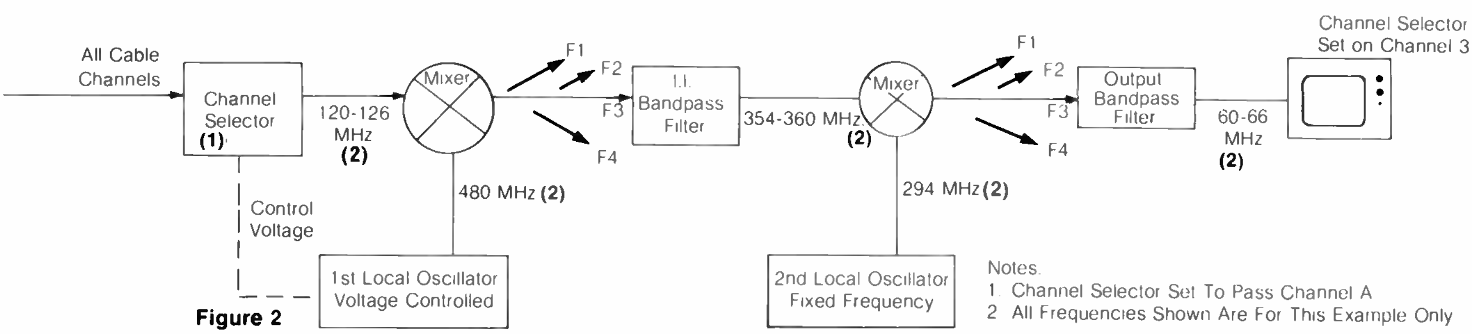
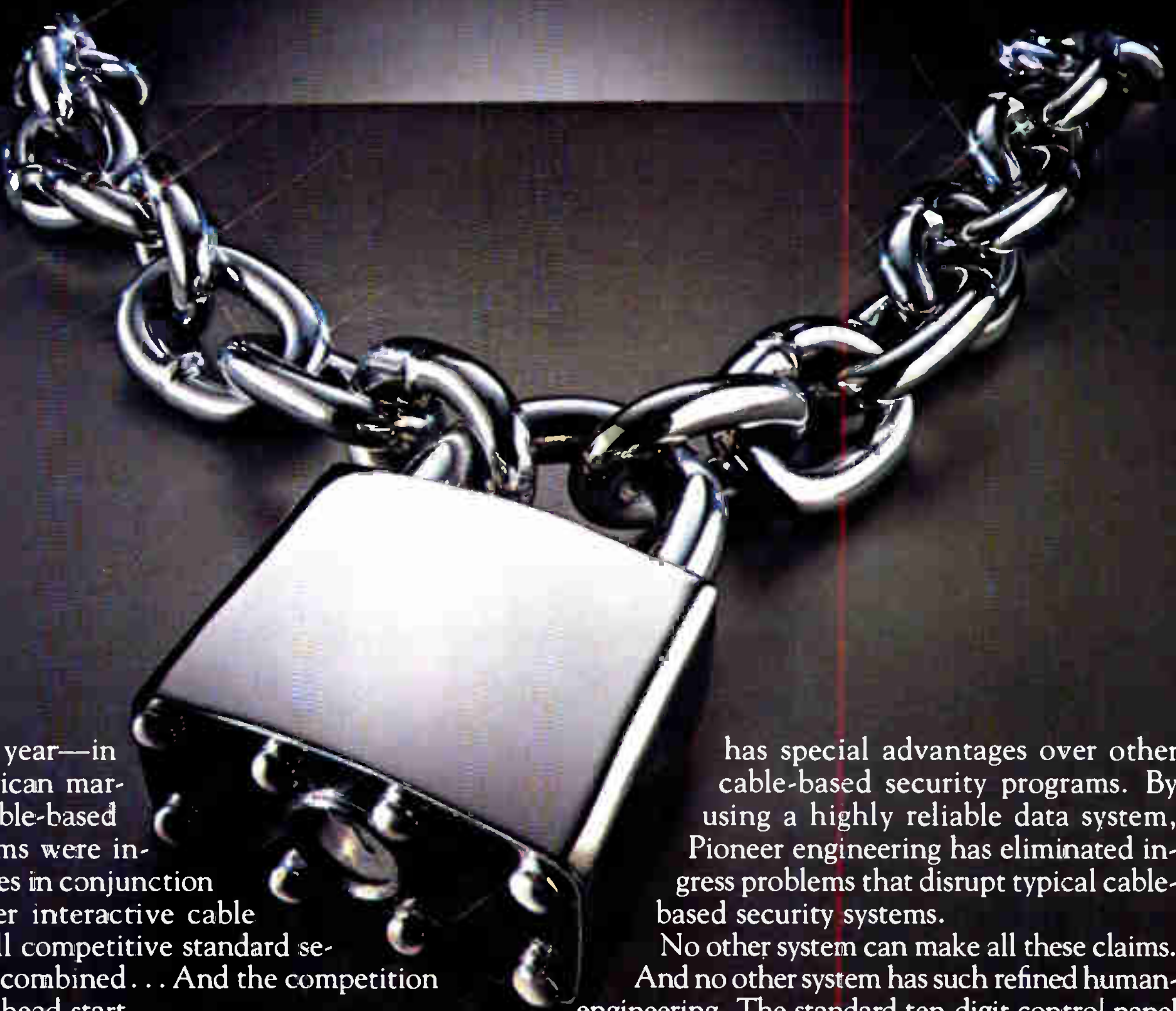


Figure 2

MAXIMIZE SYSTEM PENETRATION AND POTENTIAL—WHEN YOU INSTALL INTERACTIVE SECURITY



In a single year—in a major American market—more cable-based security systems were installed in homes in conjunction with a Pioneer interactive cable system than all competitive standard security systems combined... And the competition had a 60 year head start.

Of course, Pioneer's VIP Security System has more than its fair share of advantages over standard security systems. Unlike the VIP System, standard systems are not monitored constantly by high speed computers. And by using two-way, interactive cable, Pioneer provides a unique, proven built-in transmission redundancy with a telephone auto-dialer back up.

Pioneer's VIP Security System has special advantages over other cable-based security programs. By using a highly reliable data system, Pioneer engineering has eliminated ingress problems that disrupt typical cable-based security systems.

No other system can make all these claims. And no other system has such refined human-engineering. The standard ten-digit control panel is programmable for flexible entry times ... for temporary codes for babysitters and guests... and manual system checks.

Pioneer's reliable two-way, interactive cable security system gives your subscriber the best possible protection at the most affordable price ... and no other system has Pioneer's proven market penetration to give your cable company the profit edge.

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Intermod

Computer Users' Group For Cable?

With the increase in numbers of small home or business computers now finding a home in cable television systems, it seems strange that computer software specifically written for cable television engineering is so rarely advertised. There are a number of software companies that can and will provide almost every other type of program required, but we have seen few software suppliers whose products are specifically aimed at cable system engineering. Of course, there are any number of electronics engineering programs and all types of mathematics programs available which can be modified to suit some of our needs. Also, I am sure many cable engineers have written their own computer engineering programs which they may not have offered for sale or trade to others in the industry.

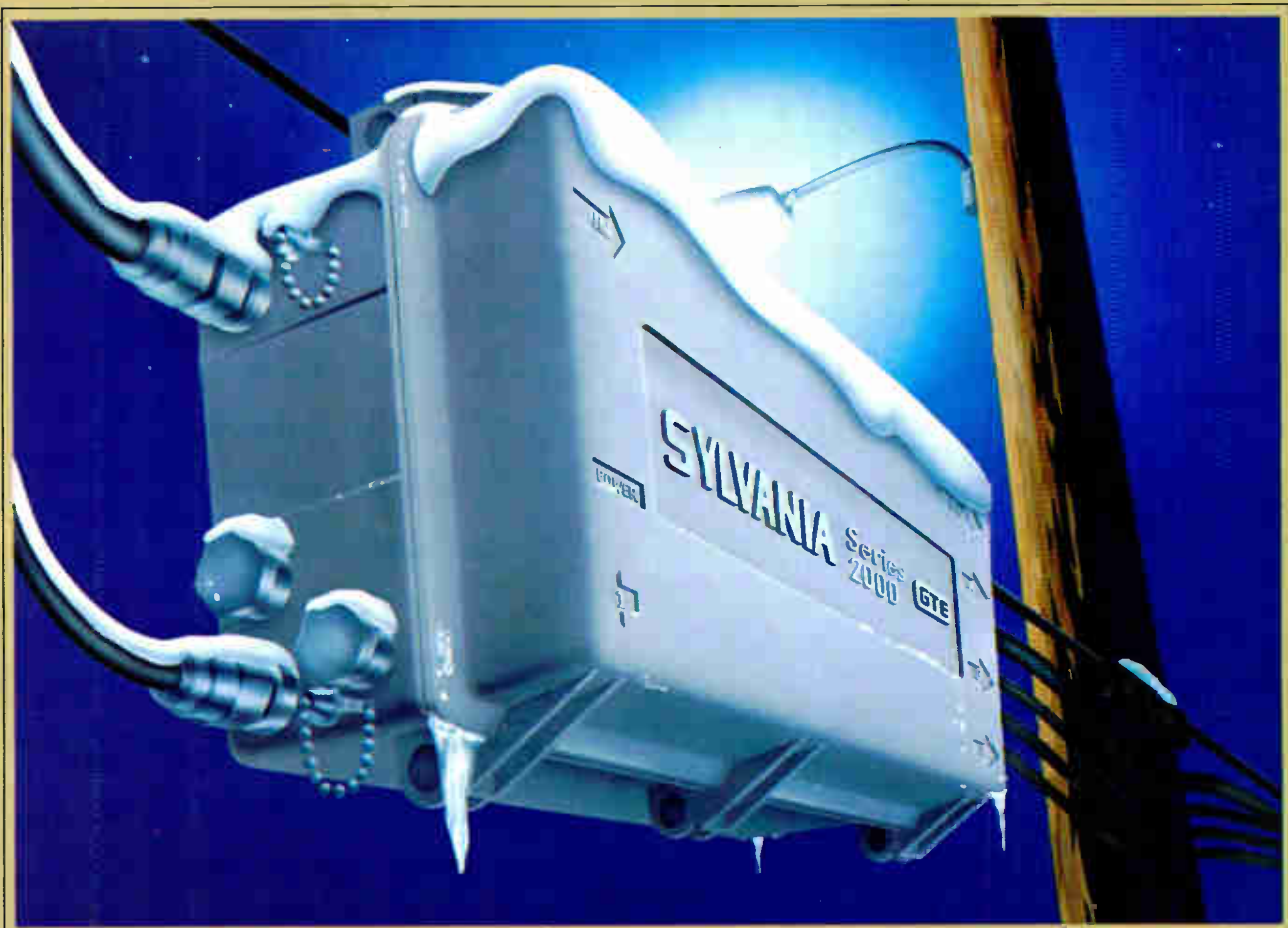
One reason for this apparent shortage of advertised software may be the wide variety of hardware which is in use by various cable systems. I have recenty seen Motorola, Heath, Radio Shack, Apple and Ohio Scientific computers all used for engineering calculations within the same company. A program which has been specifically written for one make of computer generally requires at least some modification before it will perform properly on another make of computer even though the program is written in a basic language.

Wouldn't it be nice that when the need arises we could contact one or more software sources and get well designed, affordable software for such basic system engineering requirements as trunk and feeder design, system distortion analysis, system towering, warehousing and inventory controls and similar programs which have been written and/or adapted to our own make and model of computer?

What might be even better and possibly more affordable for everyone would be if a cable engineering users' group for each of the popular type computers could be formed within the industry. Then if each users' group could communicate with and share programs with all of the other users' groups, all the members would benefit. If a number of good cable engineering programs were to become available at reasonable cost, this probably would help induce system owners and operators to purchase or lease more computers which would in turn help to pay for more engineering programs to be developed or adapted.

If you know of any cable television computer users' groups already operating or companies which specialize in cable engineering software, drop me a line at **CED**. I would be glad to learn about it and even buy or exchange some programs myself.

The Sylvania 400 MHz line. The signal must go through.



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For complete details, contact your local Sylvania CATV Transmission Systems sales office. Or phone toll free 800-351-2345 within the continental U.S., except Texas. From Alaska, Hawaii and Texas, call (915) 591-3555 collect.

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Canadians Sponsor Two Telidon Projects

OTTAWA, CANADA—The Canadian government, currently urging the Federal Communications Commission to adopt a North American standard for broadcast teletext in light of AT&T's expressed interest in standards for American use, has embarked on two new projects to market Telidon, its videotex system, in Canada.

The two-way information technology, developed three years ago, "has been fully demonstrated and proven to work," a Canadian government spokesman said. "Now we must develop our approach to marketing this system."

To promote Telidon, Canada is offering federal assistance to businesses, non-profit groups and educational institutions that start Telidon services.

Under the Telidon Industry Investment Stimulation Program, the government will arrange to have 6,000 terminals built by Canadian firms and will make them available for use in new Telidon systems operated by the private sector. To qualify for the aid, applicants must agree to provide at least an equal number of terminals.

The government will spend $10.5 million on this program in 1981 and 1982. In return, Communications Minister Francis Fox said, "it is anticipated that this investment will generate more than $100 million worth of investment in Telidon equipment and services by the private sector."

Fox noted that large and small organizations representing a cross-section of Canadian society would be eligible for the aid.

The government hopes that the program will produce some 20 new Telidon systems across Canada. At least 12,000 new terminals will be built under the program, strengthening the nation's Telidon equipment manufacturing industry and accelerating the decline in cost of the equipment, according to officials.

It will also help the private sector develop the skills and resources to operate and market commercially viable videotex services, officials say. A major goal of the program is to stimulate the growth of Telidon data bases and the development of pages of information of sufficient quality and quantity to make the purchase of Telidon terminals attractive to both home and office users.

The government's second Telidon project is a nationwide test of the broadcast version of Telidon. A joint effort of the Communications Department and the Canadian Broadcasting Corporation (CBC), the test will be conducted over a three-year period beginning in 1982, according to officials.

Approximately half of the $6 million allocated to this project will be spent on content development. Tentative plans include a television guide highlighting Canadian television programs, a news headline service, captioning for the hearing impaired, English and French subtitles for programs, and audience research surveys. The CBC will be responsible for the development of the information which will be constantly updated.

In the project's first phase, two parallel systems will be set up in French and English. Tests will be conducted in 150 homes in Montreal and 150 homes in Toronto in the first year, with a limited number of terminals located in public places in all ten provinces. In the second year, research will be conducted with a larger population sample: 250 homes in Montreal, 150 homes in Toronto and 150 in Calgary, as well as those in public places. Terminals will also be supplied to CBC regional offices.

Venezuela Turns On Videotex System

CARACAS, VENEZUELA—With the recent start-up of its $750,000 videotex system, Venezuela has become the first nation, outside of Canada, to use the Canadian Telidon system.

The system began operating in Caracas this summer with 30 user terminals and six information provider terminals manned by operators 24 hours daily. Twelve of the terminals have been placed in store front information centers, post offices, libraries, as well as in other locations in the city. This configuration was established, an official spokesman said, to provide easy access to people seeking free government information on health programs, educational statistics and other government services.

The Presidential Central Office of Statistics and Information, project coordinator, has indicated that if the present system works well it will be increased to 70 Telidon terminals by the end of the year. More than 2,400 pages of information have been created by Canadian-trained technicians.

Construction Equipment

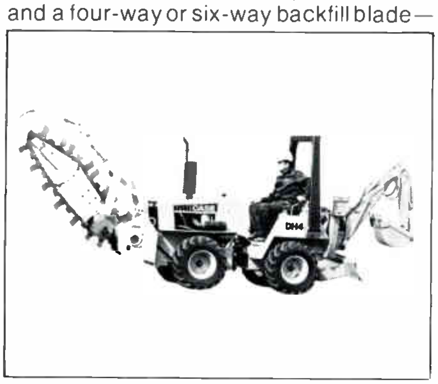
J I Case Announces Bi-Directional Trencher

The **J I Case** DH4 trencher features a hydrostatic drive trenching attachment that permits forward/reverse and infinitely variable digging chain speeds and has a 43HP liquid-cooled diesel engine.

Two hydrostatic systems power the unit. One system powers the ground drive, the other system powers the attachments. A two-speed transmission increases transport speed. Other features include four-wheel hydrostatic ground drive, limited-slip differentials, 70° total articulation and 18°total oscillation.

The DH4 trenches up to 16 inches wide and up to 72 inches deep. Offset trenching depths are 8.0 inches wide/48 inches deep or 10.0 inches wide/36 inches deep.

Three major attachments—trencher, D100 or D100-XR (extended reach) backhoes with outrigger-type stabilizers, and a four-way or six-way backfill blade—



The DH4 trencher from J I Case.

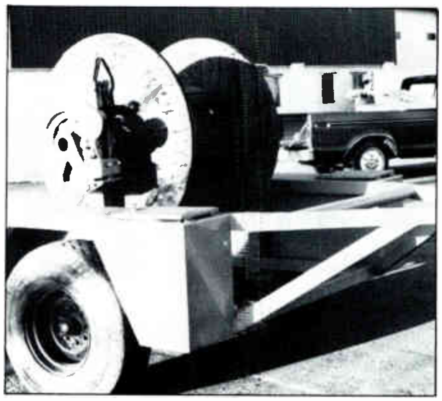
can be outfitted on either end of the DH4 for total versatility. Equipped with P60 vibratory plow, the DH4 direct-buries lines or cable up to 24 inches deep.

For information, contact J I Case, Light Equipment Division, P.O. Box 9228, Wichita, Kansas 67277.

Sauber Manufacturing Markets Take-Up/Retriever-Versatile Unit

Sauber Manufacturing Company demonstrated its Take-Up/Retriever-Versatile unit at the International Construction and Utility Equipment Exposition in Olathe, Kansas.

The system can be used to rewind old or salvageable overhead and ground cable or tension wire by using a hydraulic motor, bringing wire up to sag. The unit runs from hydraulic power supplied from truck tool lines or its optional, self-contained power source. It mounts easily on any Sauber Disc Brake, and the chain drive assures no slippage when stringing/retrieving.



The Take-Up/Retriever-Versatile unit from Sauber Manufacturing Company.

For information, contact Sauber Manufacturing Company, 10 North Sauber Road, Virgil, Illinois 60182.

Earth Stations

Scientific-Atlanta Modifies Three-Meter Earth Station

Scientific-Atlanta, Inc., has introduced the model 8012 3.65-meter satellite earth station antenna. The 3.65-meter earth station provides additional signal quality over a three-meter earth station for use in areas of reduced signal strength. A simple modification to the three-meter feed provides efficient illumination of the larger reflector, thus maximizing performance.

The 3.65-meter earth station utilizes the single-axis mount of the three-meter earth station. The single axis mount provides structural rigidity and simple pointing adjustment.

The antenna can be pointed with a single adjustment to any two satellites in the 91° to 136° arc with zero pointing error. Similar pointing adjustments can be made in the 70° to 90° arc by a single strut change. A pier foundation mounting kit which minimizes installation costs is available from Scientific-Atlanta. The reflector is made up of 12 aluminum panels bolted to a Scientific-Atlanta model 8006 three-meter earth station.

For information, contact Scientific-Atlanta, Inc., One Technology Parkway, Box 105600, Atlanta, Georgia 30348; (404) 441-4000.

Antennas

Conifer Modifies Paraceptor Antenna

Conifer Corporation has introduced the next generation of its Paraceptor MDS receiving antenna series. The Paraceptor series includes two models: PT-1000 (18 dBi min. gain) and the PT-1800 (21dBi min. gain).

The Paraceptor design has been modified to reduce overall wind drag by over 25 percent and reduce the total weight by 20 percent without affecting gain characteristics, front-to-back ratio and VSWR.

Special features include slotted ribbed-reinforced reflectors to capture maximum signal; versatile mounting bracket for easy horizontal or verticle polarization; and factory-attached pigtail RG-8 jumper. All aluminum components are anodized and the mounting brackets are zinc plated steel with a dichromate finish to ensure long survival from rugged environmental conditions.

For information, contact Conifer Corporation, 1000 North Roosevelt, Burlington, Iowa 52601; (319) 752-3607.

The PT-1800 Paraceptor from Conifer.

Miscellaneous

North Supply Markets Cable Tracers

North Supply is marketing two cable tracers from Fisher Research Laboratory, Inc.

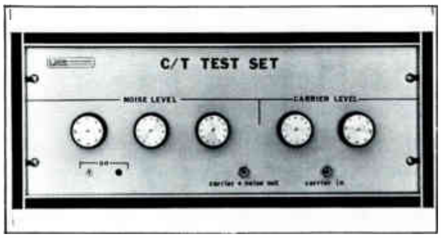
The M-Scope model PF-15 cable tracer and fault locator is a versatile tool for locating power cable faults, tracing the path of underground or submerged power cable, and determining underground cable depth. It is an AC tone fault locator and has a 45-watt output. This unit consists of a portable transmitter and receiver; inductive and conductive probes ; ground rod; appropriate cables and clamps; and carrying case. Features include CW or pulsed tone; seven-step impedance-match control; 1000-cycle interference filter; and internal or external (car or truck) battery operation.

The model TW-5 pipe and cable locator has three operating modes: inductive location, inductive tracing and conductive tracing. It locates, traces, pinpoints and determines depth of buried pipe and cable. Depth mesurement is attained by a 45° bull's-eye level built into the control housing. Even greater accuracy is possible by using the tracer probe. Its discriminator circuit eliminates outside interference such as 60 Hz signals. Model TW-5's improved design includes four new features: a coupling clamp; an 80-inch depth finder probe; a 37-inch tracer probe; and a five-inch mini-probe.

For information, contact North Supply Company, 10951 Lakeview Avenue, Lenexa, Kansas 66219; (913) 888-9800.

LNR Announces Model C/T-70 Test Set

LNR Communications, Inc., has introduced its model C/T-70 test set for testing transmission quality in message, digital and video transmit/receive loops. By injection of controlled levels of calibrated 70 MHz noise, the C/T-70 makes possible accurate measurement of FM/FDM message receiver quieting curves,



The C/T test set from LNR Communications.

bit error rate vs. EB/NO measurement of digital service, or continuous-random-noise vs. C/T measurements for video links, according to the company.

Specifications of the C/T test set include noise bandwidth: 50 to 90 MHz; noise density variation: 0.025 dB/Hz; noise power density: -73 dBm/Hz, min.; carrier input: 70 MHz/BNC female/75 ohms; carrier plus noise output: 70 MHz/BNC female/75 ohms; carrier level adjust: 80 dB in 1.0 dB steps; noise level adjust; 80 dB in 0.1 dB steps; and input power: 115 or 230 VAC, 50/60 Hz.

For information, contact LNR Communications, Inc., 180 Marcus Blvd., Hauppauge, New York 11788; (516) 273-7111.

3M TelComm Markets Cable Splicing Kit

A new splicing kit designed for CATV distribution cable installation and maintanance is available from **3M's TelComm Products Division.** The CX-3840 kit consists of a round plastic cylinder within a round plastic cylinder and end caps. Each cylinder has an elongated slot. Slots are lined up over the splice and 3M's 4407 hard polyurethane encapsulant is poured through them. This fills the inner cylinder void. The outer cylinder then is rotated a half-turn to provide a permanent, weatherproof seal. The 4407 compound comes in a patented, two-part unipak bag which permits mixing and pouring without tools or a container. For information, contact 3M, TelComm Products Division, Department TL81-35, P.O. Box 33600, St. Paul, Minnesota 55133.

The CX-3840 splicing kit from TelComm Products Division.

People News

★ **Cox Cable Communications** has announced that **Dennis L. Marmon** has been named general manager of the company's newest franchised market in Vancouver, Washington.

Marmon has been Cox Cable San Diego's vice president for operations since March of last year and prior to that was assistant general manager of Cox Cable Tidewater. Joining Cox Cable in 1966, Marmon has compiled an extensive background of experience in all facets of cable telecommunications operations.

Through the years Marmon has been instrumental in various system development and rebuild construction projects for Cox Cable in Bakersfield, San Diego and Tidewater, Virginia.

Marmon will be responsible for directing the development aspects associated with constructing the single cable, 400 MHz, 725-mile system, as well as the 122-mile 400 MHz institutional network. The area has 58,000 homes.

★ **William P. Johnson** has been named assistant chief engineer of **Microwave Filter Company** in East Syracuse, New York, and will head the company's new research and development department. An honors graduate of Syracuse University's School of Engineering, Johnson, 27, also has a bachelor's degree from King's College in Briarcliff Manor, New York, and engineering experience with WMHR-FM radio, Syracuse Electronics Corporation and Bridgeboat Sales Ltd.

William P. Johnson

★ **John F. Hodges** has been named testing and quality control engineer for **Siecor Optical Cable**, a service of Siecor Corporation. Hodges will be responsible for testing and quality control of optical cables at the new cabling facility being built in Hickory, North Carolina, by Siecor Corporation. Hodges joined Superior Cable in 1979 as a product design engineer. Prior to joining Superior Cable, Hodges was a captain in the U.S. Air Force. He graduated from The Citadel in Charleston, South Carolina, with a BSEE degree.

John F. Hodges

★ **Eric S. Kronen** has been named assistant to the general manager of **Viacom Cablevision of Long Island**. Kronen comes to Viacom Cablevision with ten years of business experience. His last position was that of assistant to the president at Instructional/Communications Technology, Inc.

★ **Christopher Ben Evridge** has been promoted to manager of Riverlands Cablevision in La Place, Louisiana, as announced by Thurber M. Foreman, vice president and general manager of developing systems for **MetroVision**.

Evridge served in the U.S. Navy for four years. He then received a B.S. in telecommunications from American Technological University in Killeen, Texas. Prior to joining MetroVision, he was employed as a cameraman and on-air director at KCEN in Waco, Texas. Evridge joined Waco Cablevision in 1977 where he served as movie operator, program director and manager trainee.

Effective August 1, 1981, he was named manager of Riverlands where his new responsibilities will include the overall day-to-day operation of the Louisiana system.

★ **Times Fiber Communications** has named two senior design engineers, **Januz B. Sosnowski** and **Charles F. Goclowski**.

Sosnowski will work in the areas of amplifier design and high frequency fiber optic receiver design. He comes to Times Fiber from the ITT Corporation, where he

Janusz B. Sosnowski

served as senior project engineer in the Aerospace/Optical Division. Sosnowski, who holds a master of science degree in electrical engineering from the Technical University of Warsaw, Poland, has worked as an electronics engineer for RCA, Nortron, Aydin Energy Systems, Singer Instrumentation and Ampex Corporation.

Goclowski is working as senior design engineer in the advanced systems development group. He has extensive past experience in analog electronic design engineering. Goclowski comes to Times from the Timex Clock Company where he was a senior project engineer. He has worked as a project engineer for W-P Instruments, Inc., Electrostatic Equipment Corporation, and the Unholtz-Dickie Corporation. Goclowski has a BE in

Charles F. Goclowski

electrical engineering from Yale University and an MS in electrical science from Rensselaer Polytechnic Institute.

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In Orbit

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
ARTS		9:00 p.m./12:00 a.m.		F1,#1
ACSN	Weekdays Weekends	6:00 a.m./4:00 p.m. 6:00 a.m./1:00 p.m.	192°/#	F1,#16
AETN	Mon.-Sat. Sunday	4:00 p.m./7:00 p.m. 4:00 p.m./6:00 p.m.		F1,#16
BET		11:00 p.m./2:00 a.m.	018°/#	F1,#9
Bravo		8:00 p.m./6:00 a.m.		Comstar D-2,#3H
Cabletext		24 hrs.	None	F1,#6 Vertical Blanking
CBN		24 hrs.	None	F1,#8
Cinemax		24 hrs.	None	F1,#20/23
CNN		24 hrs.	None	F1,#14
C-SPAN	Weekdays Sundays	9:30 a.m./6:00 p.m. Precedes USA Network, three to four hours	195°/#	F1,#9
ESPN		24 hrs.	None	F1,#7
Escapade		8:00 p.m./6:00 a.m.		Comstar D-2,#4V
Eternal Word Television Network		7:00 p.m./11:00 p.m.		Westar III,#12
GalaVision	Weekdays Saturdays Sundays	8:00 p.m./3:00 a.m. 3:00 p.m./3:30 a.m. 1:30 p.m./3:00 a.m.		F1,#18

HBO	Day	Start	Stop		
	Oct. 1	5:00 p.m.	2:00 a.m.	Program	F1,#24
	Oct. 2	5:30 p.m.		729°/#	F1,#22
	Oct. 3			Scramble	F1,#23
	Oct. 4		3:00 a.m.	835°/#	F1 #20
	Oct. 5	6:00 p.m.	2:50 a.m.	Duplication	
	Oct. 6	5:30 p.m.	2:40 a.m.	940°/#	
	Oct. 7	5:30 p.m.	3:15 a.m.	Take-2 E	
	Oct. 8	5:00 p.m.	3:10 a.m.	592°/#	
	Oct. 9	5:30 p.m.		Take 2 W	
	Oct. 10			681°/#	
	Oct. 11		2:45 a.m.		
	Oct. 12	5:00 p.m.	2:10 a.m.		
	Oct. 13	5:30 p.m.	1:40 a.m.		
	Oct. 14	6:00 p.m.	2:45 a.m.		
	Oct. 15	5:00 p.m.	2:05 a.m.		
	Oct. 16	5:00 p.m.			
	Oct. 17				
	Oct. 18		2:30 a.m.		
	Oct. 19	5:30 p.m.	2:40 a.m.		
	Oct. 20	5:30 p.m.	2:55 a.m.		
	Oct. 21	5:30 p.m.	2:50 a.m.		
	Oct. 22	6:00 p.m.	2:45 a.m.		
	Oct. 23	5:00 p.m.			
	Oct. 24				
	Oct. 25		3:05 a.m.		
	Oct. 26	6:00 p.m.	2:05 a.m.		
	Oct. 27	5:00 p.m.	3:05 a.m.		
	Oct. 28	5:00 p.m.	2:05 a.m.		
	Oct. 29	5:00 p.m.	3:10 a.m.		
	Oct. 30	5:00 p.m.			

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
HTN		8:00 p.m./2:00 p.m.	517°/#	F1,#21 (P)

E=eastern M=mountain
C=central P=pacific

Signal	Day	Start/Stop	Alert Tones	Satellite/ Transponders
Lifestyle		24 hrs.	None	F1,#3
The Movie Channel		24 hrs.	None	F1,#5
Modern Satellite Network	Weekdays Weekends	noon/5:00 p.m. 8:00 a.m./1:00 p.m.	243°/#	F1,#22
MTV: Music Television		24 hrs.	None	F1,#11
National Christian Network		6:00 a.m./8:00 p.m.	073°/#	Comstar D-2,#4V
National Jewish Network	Sunday	noon/4:00 p.m.		F1,#16
Nickelodeon		8:00 a.m./9:00 p.m.	311°/# (E,C,M) 519°/# (P)	F1,#1
PTL		24 hrs.	None	F1,#2
Private Screenings	Fri.-Sat.	12:00 a.m./3:00 a.m.		Westar III,#7
Reuters	Weekdays	4:00 a.m./7:00 p.m.	None	F1,#18
SIN		24 hrs.	None	Westar III, #8
SPN		24 hrs.	None	Westar III, #9
Showtime		24 hrs.	None	F1,#12 (E,C) F1,#10 (M,P)
Trinity (KTBN)		24 hrs.	None	Comstar D-2, #9V
USA Network	Off-times are listed below. For on-times, see notes below.			F1,#9
	Starts 24 hr programming October 1			
	Calliope. Weekdays, 6:00 p.m. to 7:00 p.m., except October 20, when it will not be shown Saturday 8:30 a.m. to 11:30 a.m.			
	The English Channel Tuesdays 11:30 p.m. to 1:30 a.m., except October 6, 1:00 a.m. to 3:00 a.m. Saturdays 12:30 p.m. to 3:30 a.m.; Sundays 10:30 p.m. to 12:30 a.m.			
WGN		24 hrs.	None	F1,#3
WOR		24 hrs.	None	F1,#17
WTBS		24 hrs.	None	F1,#6
Women's Channel		24 hrs.	None	F1,#6 Subcarrier

All program times are listed for the eastern time zone, unless otherwise noted.

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Model #	Rejection Depth	Lower Video	Lower Adj. Sound	Upper Adj. Video
5-NF 2-6, low band	-75db	.5db	-4db	-.5db
5-NF A-F, mid band	-75db	1.0db	-5db	-1db
5-NF G-I, mid band	-75db	1.5db	-6db	-1db
5-NF 7-13, high band	-75db	2.0db	-10db	-2db
5-NF J-W, super band	-70db	3.0db	-15db	-3db

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