COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers

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May 1985

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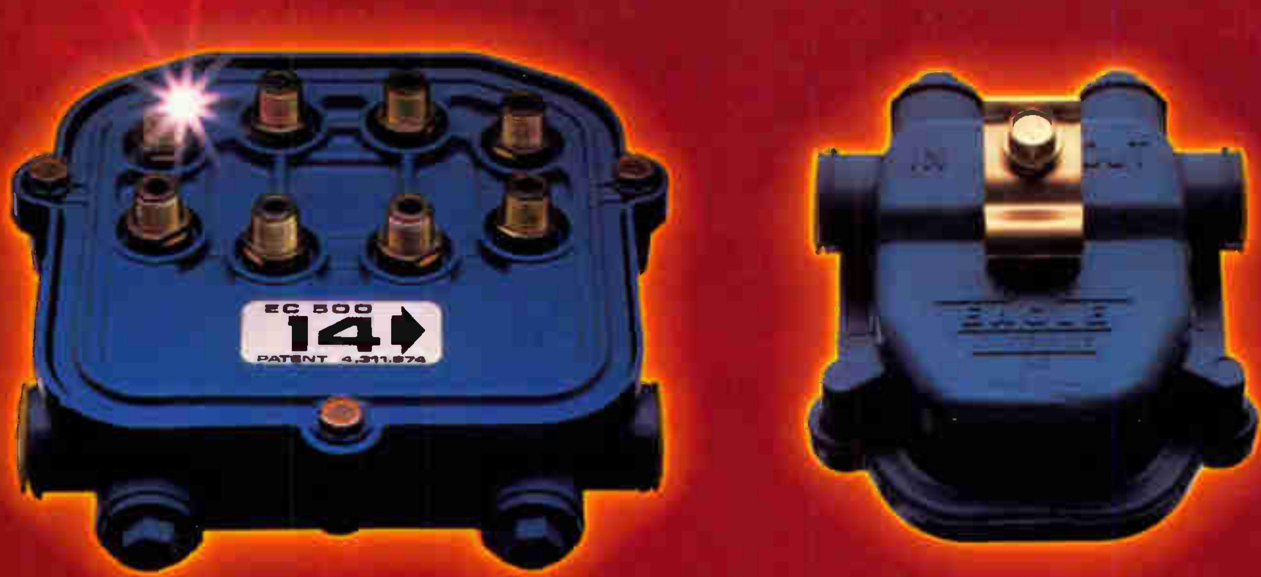

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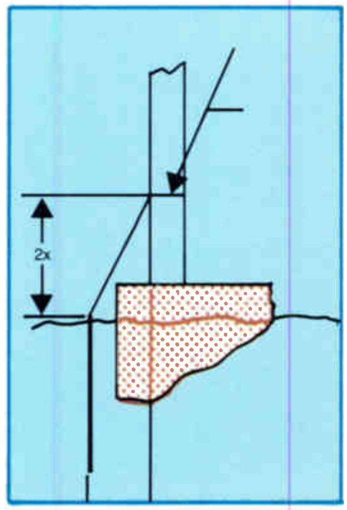

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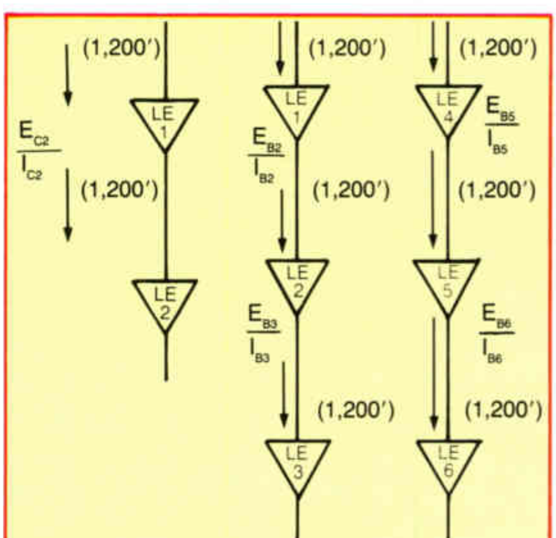

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Lightening photo by Bob Sullivan. Antenna photo courtesy of United Cable.

Communications Technology™ is published monthly by Communications Technology Publications Corp., 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112—or—P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023. May 1985, Volume 2, Number 3.

Remember back in 1951, when TV stations were low in power and antennas not very efficient? Milton Jerrold Shapp, the founder of Jerrold, didn't realize he was helping to create a new industry when he developed an amplifier that Bob Tarlton needed for his Lansford, PA community antenna system.

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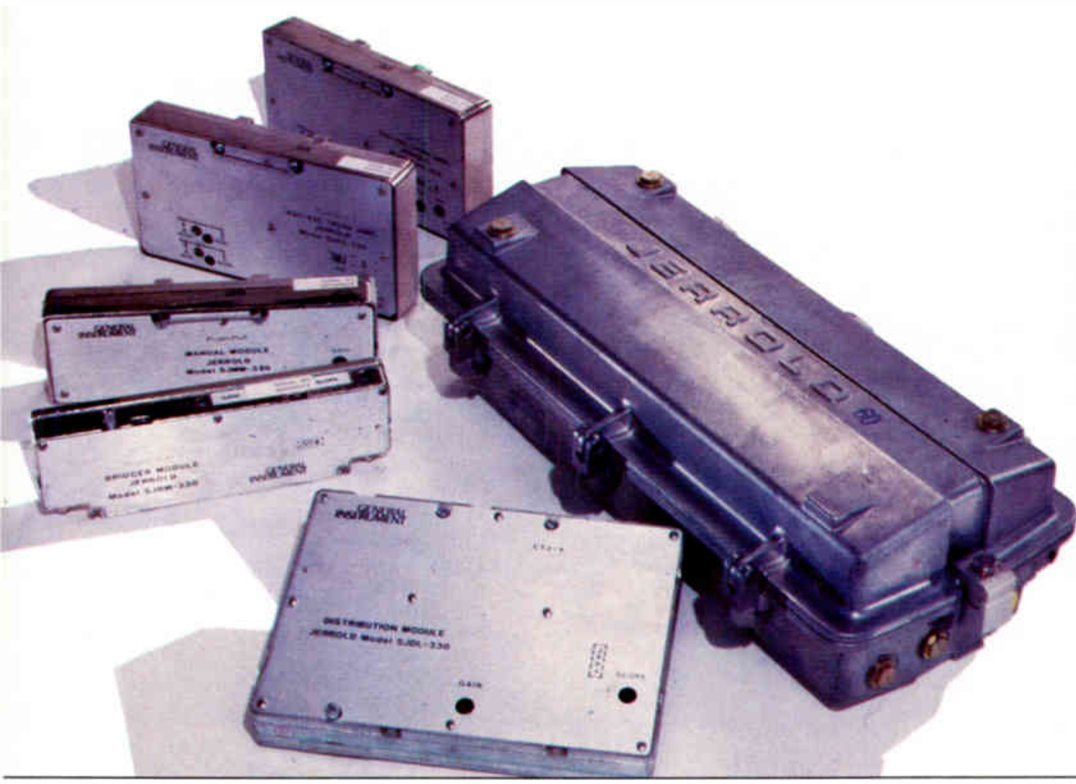


Reader Service Number 3.

GENERAL INSTRUMENT

Elevating the ranks

I recently read an interesting and thought-provoking interview (*Microwave & RF*, February 1985) with Bruno Weinschel, president of Weinschel Engineering and IEEE 1985 president-elect. The IEEE (Institute of Electrical and Electronics Engineers) is the world's largest technical professional organization, boasting more than 250,000 members in 120 countries. Weinschel's thoughts and commentary on engineers should be applied to our industry.

Weinschel was asked why engineering isn't held in higher esteem as a profession. "... I think in order to bring engineering up to the status of other professions ... we must make engineering schools as autonomous as schools of medicine or law ... Secondly, engineering schools need more feedback from practicing engineers."

Weinschel also explained his view on the all-around best utilization of engineers. "... you must consider the way American managers utilize engineers ... I believe engineers should become more involved in the total definition of products ... I rotate them among several departments. Engineers work in the machine shop, drafting, programming, manufacturing, testing and repair. I let them work in marketing ... I give them access to all our in-house services. The result is a much more valuable and better rounded engineer ... I think engineers should be encouraged to move into management."

Personally, I couldn't agree more with Weinschel's comments. While it is true that subscribers generate the revenue to operate cable systems, without competent engineers, there wouldn't be any cable systems to operate.

Same old soapbox

In past issues of *CT*, many of our authors have harped on a problem as old as the cable industry itself—service to the subscriber. In an April issue of *The Denver Post*, the headline read, cable operator "... told to shape up or face fines." The bottom line is that three complaints are the main culprits: extreme difficulty getting through on the phone; inexperienced customer service representatives; and technicians not keeping repair and installation appointments.

No story is ever one-sided, however, after witnessing these problems first-hand while in franchising and as a cable subscriber, I'd have to admit that most cable operators are guilty of at least one of the three previously mentioned problems. I would like to urge cable system operators to read Bob Luff's two-part story (*CT*, November and December 1984) entitled "Busy, busy, busy: Too busy for subscribers." Bob has some excellent ideas on how to control these problems before the problems control your cable system.

On the lighter side

Beginning with this issue, *CT* is extremely proud to announce three additional advisory board members. Cliff Paul, former chief of the Microwave Branch of the Cable Bureau (which was absorbed into the Mass Media Bureau of the FCC), will be providing us with invaluable insight. Cliff has had 40 years of experience in our industry, is a senior member of the SCTE and is currently living in Florida as a consultant to RT/Katek.

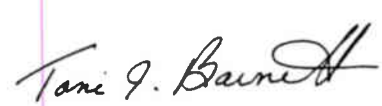
Our second new member is Dave Willis, director of engineering for TCI since 1971. Dave celebrates his 30th year in the industry this summer and is a senior member of the SCTE.

Last, but far from least, we welcome Austin "Shorty" Coryell, director of engineering for ATC. Austin has spent 33 years in the cable industry, also is a senior member of the SCTE and holds a couple of patents on scrambling systems and converters.

We welcome these gentlemen to our advisory board. They will certainly facilitate our knowledge of the issues *currently most critical* to the technical community.

Omission

In an earlier "Publisher's Letter" (*CT*, January 1985), congratulations went out to several cable industry firms for making the "Inc. 500" listing. In that column we inadvertently omitted Brad Cable, which was ranked #377. Congratulations Brad Cable!



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Standard knows that there's more to a good picture than a good (or even a great) receiver. That's why we offer complete TVRO systems with quality in every component.

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Denver: Communications Technology Publications Corp. 12200 E. Briarwood Ave., Suite 250, Englewood, Colo. 80112—or—P.O. Box 3208, Englewood, Colo. 80155, (303) 792-0023. **New York:** 1641 Third Ave., Suite 2K East, New York, N.Y. 10128, (212) 599-0209.

NCTA 'on the move' with annual show

LAS VEGAS, Nev.—Are you ready for the National Cable Television Association's annual convention? With the theme, "Cable '85: On the move," this 34th annual convention, exposition and programming conference promises to deliver useful information for all facets of the industry. NCTA Cable '85 also will emphasize "how to contend with the ever-changing consumer electronics industry."

As for the exposition portion this year, the exhibit hall will be open for a total of 20½ hours. Eleven and one-half hours will be exclusively for viewing exhibits, with no other event or panel sessions scheduled. Exhibit hours are: June 3, 10:30 a.m.-6 p.m.; June 4, 10 a.m.-6 p.m.; and June 5, 10 a.m.-3:30 p.m.

The NCTA has scheduled 11 technical breakout sessions this year. The who, what where and when for these sessions follows.

Technical agenda

Monday, June 3, 1985
10:45 a.m.-12:15 p.m.

• Session No. 1: Slaying the ingress/egress hydra (Room B)

Moderator: John Wong, supervisory engineer, Mass Media Bureau, Federal Communications Commission. *Speakers:* Ted Hartson, director of engineering services, Capital Cities Cable, "Dr. Strangeleak—or—How I quit leaking and learned to love the bomb"; Robert Dickinson, senior vice president, AM/E-COM, "Possible new approaches to leakage monitoring"; John Ward Jr., system engineer, Comcast Cablevision of Montgomery County Inc., "Ingress—Sources and solutions"; William Homiller, manager, headend engineering, Jerrold Division/General Instrument, "The impact of new FCC frequency rules on CATV headend system design and operation"; Ralph Haller, chief, Technical & International Branch, Federal Communications Commission, "CLI made easy." *Standby speaker:* Joe Lemaire, Raychem, "Shielding repair in coaxial distribution cable."

• Session No. 2: Contemporary developments in addressability and pay-per-view (Room D)

Moderator: Graham Stubbs, vice president, Engineering, Oak Communications. *Speakers:* Semir Sirazi, director, CATV Communications Products, "Comparative study of hybrid-IPPV implementations"; Michael Ermolovich, Subscriber Systems Division, Jerrold Division/General Instrument, "The economics of going addressable"; A.E. Hospador, senior applications engineer, Jerrold Division/General Instrument, "Control of remote hubs in addressable CATV systems"; Anthony Wechselberger, vice president, systems engineering, Oak Communications, "The addressable system control channel: Will it become your system's weakest point?" *Standby speaker:* Michael Hightower, manager, advanced development group, Oak Communications, "CATV decoder custom integrated circuit development."

3:30-5 p.m.

• Session No. 3: Off-premises promise—Get out of the house! (Room B)

Moderator: Richard Kearns, vice president, Communications Systems Division, Times Fiber Communications. *Speakers:* Joseph Preschutti, vice president and general manager, AM Cable TV Industries Inc., "Off-premises addressability, system design and operational considerations"; Nancy Kowalski, product planner, subscriber systems, Jerrold Division/General Instrument, "Off-premises addressability: Can it measure up to set-top units?"; James Van Cleave, vice president, engineering, Jerrold Division/General Instrument, "A real-world system cost model for off-premises subscriber equipment"; John Simons (or Charles Wilder), technical services supervisor, Times Fiber Communications, "Star-switched networks in cable television"; Bud Campbell, American Television and Communications, "Powering the off-premises signal control system."

• Session No. 4: Tests, measurements and performance analysis (Room D)

Moderator: Dom Stasi, vice president, general manager, MTV Networks. *Speakers:* Lance Katzfey, manager, product evaluation, Oak Communications Inc. "Automatic testing"; Ed Mitchell, manager of systems evaluation, Jerrold (Century III)/General Instrument, "Composit second order distortion and distribution system performance"; William Gregory Kostka, engineering manager, Gill Cable, "Broadband sweeping: A new approach"; Michael Ellis, Scientific-Atlanta Inc., "Effects of channel loading on composite triple beat and cross-modulation"; Lamar West, Scientific-Atlanta Inc., "Thermal characteristics of modern feedforward CATV amplifiers." *Associated technical paper:* Lamar West, "Standard methods for calculation of carrier-to-noise ratio in modern CATV equipment."

Tuesday, June 4
9-10:30 a.m.

• Session No. 5: Audio advantages—MTS and digital audio delivery in the cable environment (Room B)

Moderator: Joseph Van Loan, vice president, engineering, Viacom Cable. *Speakers:* Thomas Stutz, headend product manager, Jerrold Division/General Instrument, "The impact of multichannel TV sound on cable system headends"; William Thomas, director, communications services, American Television and Communications Corp., "A digital audio system for CATV applications"; Israel Switzer, consulting engineer, I. Switzer Inc., "Audio program distribution in cable television systems"; Arthur Vigil, staff scientist, Oak Industries, "Digital audio applications in cost-effective cable TV systems"; Alex Best, manager, research and new business development, Scientific-Atlanta Inc., "An overview of MTS issues."

• Session No. 6: Fiberoptics—Reports from the field (Room D)

Moderator: Brian Garrett, vice president, engineering, M/A-COM Comm/Scope Inc. *Speakers:* Pieter Kerstens (or Charles Breverman), senior research associate, Philips Laboratories, "A FM/FDM/IM/WDM fiberoptic supertrunk for repeaterless transmission of 10 video channels up to 45 km"; Robert Hoss (or J. Keeley), Warner Amex, "A fiberoptic private network for the *Dallas Morning News*"; Michael Carr, senior vice president, Compucon Inc. "Fiberoptics: CATV's friend or foe"; Jim Chiddix, senior vice president, Oceanic Cablevision, "Optical fiber supertrunking: A comparison of analog and digital approaches"; Lawrence Engdahl, manager, mechanical engineering, Times Fiber Communications, "A discussion of a fiberoptic off-premises two-way addressable converter system installation, the successes and lessons of Alameda."

3:30-5 p.m.

• Session No. 7: Square pegs/round holes?—Meeting the "cable-ready" challenge (Room B)

Moderator: David Large, vice president, engineering, Gill Cable. *Speakers:* Joseph Stern, president, Stern Telecommunications Corp., "Cable-ready home electronics interface devices and the culture and philosophy that surrounds them"; Larry Brown, vice president, new business development, Pioneer Communications, "Accommodation of VCRs and stereo television in the design of subscriber devices"; Geoffrey Gates, senior vice president, engineering and technology, Cox Cable Communications Inc., "Implications of the developing operating environment on CATV terminal equipment"; James Cherry, director, design engineering, Oak Communications Inc., "Multiple set-top terminals—Security issues of a master-slave configuration"; Walt Ciciora, vice president, research and development, American Televison and Communications, "Progress report on the NCTA/EIA 'cable-compatible' committee activities."

• Session No. 8: Aspects of plant design and architecture (Room D)

Moderator: William Riker, executive vice president, Society of Cable Television Engineers. *Speakers:* Robert Blumenkranz, consulting engineer, Jerrold/Century III Electronics, "Superflat feedforward trunk amplifier design"; Richard Thayer, vice president, engineering, Times Fiber Communications, "Reducing attenuation of trunk and feeder cable"; Stanley Moote, vice president, Leitch Video Ltd., "The advantages of baseband video synchronization"; Dave Atman, sales manager, Lindsay Specialty Products Ltd., "Computer aided design in a tapped-trunk environment."

Wednesday, June 5
9-10:30 a.m.

• Session No. 9: Improving customer service (Room B)

Moderator: Larry Janes, senior vice president, engineering, American Television and Communications. *Speakers:* Sharon Thompson, Warner Amex Cable, "Total cable television customer service"; Richard Clevenger, vice president, engineering, Cox Cable Communications, "Using service call measurement to improve operations"; Frederick Baker, Viacom Cablevision, "Doing something about service calls!"; Gregg Nydegger, chief technician, Cardinal Communications, "Maintenance issues"; Jim VanKoughnet, Manitoba Telephone System, "A broadband network status monitoring system using multiple processors." *Standby speaker:* Paul Brooks, project engineer, UACC Midwest Inc., "Mapping and map maintenance, simple methods that work."

• Session No. 10: Signal relay—New demands, new advances (Room D)

Moderator: Scott Tipton, director, RF Systems, Home Box Office. *Speakers:* R.T. Hsu, Hughes Aircraft Co./Microwave Communications Products, "Improved AM microwave performance with predistortion"; Preston White III, electrical engineer/consultant, Scientific-Atlanta Inc., "CAD of TVRO earth stations"; Ned Mountain, director of marketing, Wegener Communications Inc., "Satellite transponder operation with video and multiple subcarriers"; T.M. Straus, chief scientist, Hughes Aircraft Co./Microwave Communications Products, "Tradeoffs in multichannel microwave transmission system design."

10:30-11:30 a.m.

• Session No. 11: The digital domain—Transmission theory, practice and security strategies (Room B)

Moderator: Archer Taylor, senior vice president, Malarkey, Taylor & Associates. *Speakers:* Niraj Jain, manager, technical staff, Philips Laboratories, "Technical considerations of two-way interactive CATV"; Frank Stratton, manager, new business development, Viacom Cablevision, "Packet-switched data communications"; Gregory Baxes, technical staff, communications services, American Television and Communications Corp., "Digital techniques cure line segmentation scrambling problems"; Anthony Wechselberger, vice president, systems engineering, Oak Communications Inc., "Encryption fundamentals: An 'underly' technical overview."

Pioneer's BA-5000 converter.

Pioneer introduces addressable system

COLUMBUS, Ohio—Pioneer Communications of America Inc. unveiled its enhanced one-way addressable system, the BA-5000, at a press conference in New York City on April 17. A number of MSOs have committed systems to the BA-5000 including Warner Amex-Boston, Group W Communications, and Antelope Communications, a Tribune Cable company. Deliveries will begin in June 1985.

According to Pioneer, the converter was designed to solve several problems facing today's cable operator, especially the incompatibility of cable converters and equipment among industry vendors. It integrates Pioneer's coded-key video scrambling with Jerrold's Tri-Mode in one converter. Options include a parental control feature, a time function for VCR compatibility and an IR remote. The BA-5000 also is designed to accept Pioneer additions such as IPPV phone and cable modules, and an MTS adaptor

In keeping with this, Pioneer announced an agreement with Group W Cable to field test its multichannel television stereo (MTS) adaptor this fall in Group W Cable's systems. The BC-S500 MTS adaptor automatically tracks out-of-band stereo audio simulcast signals and sends the signal through a subscriber's existing amplifier and stereo speakers.

TOCOM receives orders for security systems

DALLAS—The TOCOM Division of General Instrument Corp. announced that new orders have been received from Alcoa South Carolina and American Security Services, for TOCOM cable security systems. TOCOM will install a IV-A central data security system and an initial quantity of TOCOM 3000A home security panels on Dataw Island, a private unit residential community owned by Alcoa South Carolina.

Fripp Island Cable is presently constructing a two-way cable system for the community that will provide both entertainment and residential security services to system subscribers. The TOCOM IV-A CDSS will be installed at the cable plant and will provide the alarm monitoring and control of the residents' home security panels.

A second TOCOM IV-A central data security system has been ordered by American Security Services of Middleburg, Va. American has entered into a joint venture with Community Cablevision Inc., a local cable system operator, to provide security service via cable for the first time to Middleburg residents. Installation of the equipment and continuing monitoring services will be provided by American, with the cable communication path being supplied by Community Cablevision.

United Cable now on-line with CableData

DENVER, Colo.—United Cable Television Corp. has contracted with CableData to provide on-line information services for all of United's 43 systems, representing over 800,000 subscribers. "The capabilities of the CableData system will help us reach the corporate objective of decentralization through standardization," stated United President Fred Vierra.

Five data centers, each with a Tandem NonStop TXP, are installed and operational. These centers will be tied into all United Cable sites via dedicated data lines. The network allows United to measure the performance of each system across a wide range of service and financial indicators. The network also is capable of further system integration, such as electronic mail, word processing and engineering design.

Twenty-two systems representing more than 400,000 subscribers are currently on-line

DX Gives You Big System Quality at Small System Prices.

Now you can have top-quality performance for a surprisingly reasonable price. The DSA-643A Satellite Receiver from DX features **dual block downconversion** — unique for receivers in this price range. The DSA-643A uses a discriminator circuit for signal demodulation, a full 30 MHz bandwidth, and a unique threshold extension circuit. These features add up to a low threshold carrier-to-noise ratio, commercial quality reception and low cost installation in any system.

DX also provides the DSA-541 Block Downconverter. It features a highly stable ceramic resonator, with a fixed frequency of 2800 MHz. Stability is maintained at a remarkable ± 1 MHz over the entire −30° to +50° C temperature range. So you can install the downconverter out of doors, at the dish, without concern for frequency drift caused by temperature changes year after year.

The innovative DSA-643A Satellite Receiver and DSA-541 Block Downconverter are brought to you by DX, one of the most respected names in satellite television reception systems in Japan and around the world. DX also provides line amplifiers, power dividers, and other block downconversion-compatible accessories.

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ANTENNA

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with CableData. The remaining 21 sites, most of which are served by CableData's remote batch system, will convert during the next 12 months.

Avtek changes its name

AURORA, Neb.—Marshall Borchert, president of Avtek Inc., announced that the electronic test equipment firm will change its name as of May 2, 1985. The new name, Riser-Bond, will be the only major change within the corporate structure. The company will continue to manufacture a simplified time domain reflectometer; as well, it will develop other similar products.

Peach State Radio chooses Wegener

NORCROSS, Ga.—Peach State Public Radio, a service of Georgia Public Television, has chosen the Wegener Panda® II audio transmission system to deliver its classical programming from the studio to the station transmitters. The Panda® II system is used to deliver audio with 90 dB dynamic range over a statewide microwave and fiberoptic link to the station's 100 kW transmitters. Programming is broadcast to over 3 million listeners in Georgia and Alabama.

The Panda® II system is used to provide the transparent transmission of the full range and transient properties of digital audio source material over satellite, terrestrial microwave and fiberoptic links.

C-COR products slated for Manhattan's traffic control

STATE COLLEGE, Pa.—C-COR Electronics Inc. will supply its new dual cable local area network amplifiers, power supplies, a switching device and other accessories to L.K. Comstock & Co. Inc. of Plainview, N.J., who has been awarded the contract to construct Manhattan's vehicular traffic control system.

The broadband distribution system will control traffic lights and use video screens to monitor traffic flow in New York's borough of Manhattan. C-COR's systems design department will perform some of the design functions for the traffic control system.

State commission sponsors tech seminar

ALBANY, N.Y.—The 11th annual Northeast Cable Television Technical Seminar, sponsored by the New York State Commission on Cable Television, will be held June 16-18 at the Roaring Brook Ranch and Tennis Resort in Lake George, N.Y. No technical sessions will be held the first day of the event; instead it has been reserved for registration, exhibits, a cruise on Lake George, and dinner with speaker William Finneran, chairman of the New York cable commission.

Monday, June 17, 1985
9-10 a.m.—GE Comband system by Ron Polomsky

10:30 a.m.-12:30 p.m.—System upgrade by Thomas Staniec of New Channels and Charles Martin of ATC

1:30-2:30 p.m.—Contractor relations by William Harrison

Converter repair by Robert Price of Brad Cable

2:30-3:30 p.m.—Grounding, bonding and public safety questions and answers with Kenneth Foster and Thomas Conole of the New York cable commission staff

3:30-7:00 p.m.—Exhibits open

Tuesday, June 18
9-10 a.m.—Maintaing 12 GHz AML by Bob Stanton of Hughes

18 and 23 GHz FML by Donald Sicard of M/A-COM

10:30-11:30 a.m.—System Sweeping by Peter Chunka of Wavetek

Time selective spectrum analysis by John Huff

11:30 a.m.-12:30 p.m.—New horizons: Stereo TV via cable by Eric Small of Modulation Sciences

Closed captioning on cable by Peter Ungar of Source

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Broadband's line of quality amplifiers has your system covered from head-end to house-drop. Designed for CATV, SMATV and MATV home-run or branching systems, they meet most requirements for home, apartment, condominium, hotel and motel distribution systems.

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Most Broadband units are available in 330 MHz and 450 MHz bandwidths and offer a range of gains and other options, such as two-way transmission, plug-in pads & equalizers, gain & slope controls, powering options and so forth. Our amps can virtually be customized to your system's special requirements.

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Reader Service Number 9.

Buy American: Is it un-American?

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

The current negative balance of trade exceeds $100 billion, the national deficit will probably reach $200 billion by year end, and we are experiencing some of the bank runs common in the depression years. Yet, the inflation rate is low, employment is high, most of the state and city treasuries are full, and polls find a high level of public confidence in the future.

How long can America travel the deficit path at home and abroad before the inevitable fall? No segment of the population, enjoying some form of subsidy, is willing to sacrifice itself on the altar of economy. Apparently, our entire Congress owes its election to private pork barrels, leaving the president gloriously alone waving the battle flag of the budget with all his troops marching ingloriously to the rear.

Since most economists fail to agree on anything except that we are in a gargantuan fiscal crisis, I have to fall back upon my "Introduction to Economics" freshman course for a layman's analysis.

To simplify the problem, we will postulate that the balance of payment condition is zero, i.e., the U.S. economy is isolated from external pressures. The classical answer to a spending spree and the ensuing deficit is inflation, which erodes the value of currency by the exact sum of the deficit. In other words, we pay the piper with deflated dollars. But why should there be any concern over a deficit and inflation if all it does is to change the value of our own currency?

Virtually every country except the United States has experienced runaway inflation. The damages caused by an eroding currency poison every aspect of the economy. Long-term loans, lines of credit and stock issues disappear as capital sources for business and the overall climate is geared to cash or barter transactions. Inevitably, each citizen finds his standard of living declining even in the hypothetically isolated society. Inefficiency in production and chaos in our personal affairs are the fruits of inflation.

Now let us return to 1985 with the negative $100 billion balance of payment and the $200 billion federal deficit. What happened to the classical theory of currency erosion? Our dollar is the king of all currencies in spite of the deficits. There are, however, two very temporary fingers in the dike:

1) The highest interest rate in the free world. Foreign savers (including Japan) love the safety, low inflation and high interest rates of the U.S. securities, and exchange their savings for our debts. Our per capita debt load is now over $6,000, probably the world's highest.

2) We are selling our capital assets to foreigners—land, buildings, minerals, farms, etc. When the good values are gone and the investment flow is staunched, the turnaround in currency stability will be sharp; there will be a crisis of confidence in the American dollar, and suddenly we will be bereft of our prosperity and confidence in the future.

'The year that was'

Until 1960, electronics manufacturers, including Blonder-Tongue, operated in secure isolation from foreign competition. But that was the year that was! Two of our lines, Hi Fi and closed circuit industrial TV systems, both growing against American competitors, suddenly faced foreign factory products. In both cases the price for the complete item was the same as our bill of materials. It was as if the cost of foreign labor was so low that it represented the least factor in pricing the product.

'The transition from free trade to tradeoff will occur when our national security is threatened by the loss of an industry vital to our defense'

Turned out to be the case! We discontinued both lines that year, losing perhaps 100 jobs in the U.S. economy. As other consumer electronics manufacturers in the state of New Jersey collapsed under the same pressures from overseas manufacturers, another 100,000 jobs were lost. Many other industries tell a similar story.

No nation in the world practices free trade as we do. As a manufacturer, I could tell hundreds of stories of the barriers erected against us when there were similar items produced in their country. But the United States is approaching the end of the free trade era. The transition from free trade to tradeoff will occur when our national security is threatened by the loss of an industry vital to our defense forces. It could be steel, a commodity now underpriced by more than a dozen countries with subsidized and protected facilities.

Thus we may be compelled to make the decision to "buy American" and use the same tactics as are used against us. Unfortunately, the cure is worse than the disease. Instead of buying from the most efficient producer, we will *have* to "buy American" and our standard of living will inevitably erode.

The real cure for this disease is to improve the efficiency of our industrial complex. To match the world leaders, especially from the Far East, our students should study at least 60 hours a week, with no less than 12 hours in hard science; return to the six-day week; reduce law suits and government regulations by 95 percent against business; and eliminate the taxes on business profits and capital gains.

The alternative is to stay as we are and eventually lose our #1 status in every competitive area.

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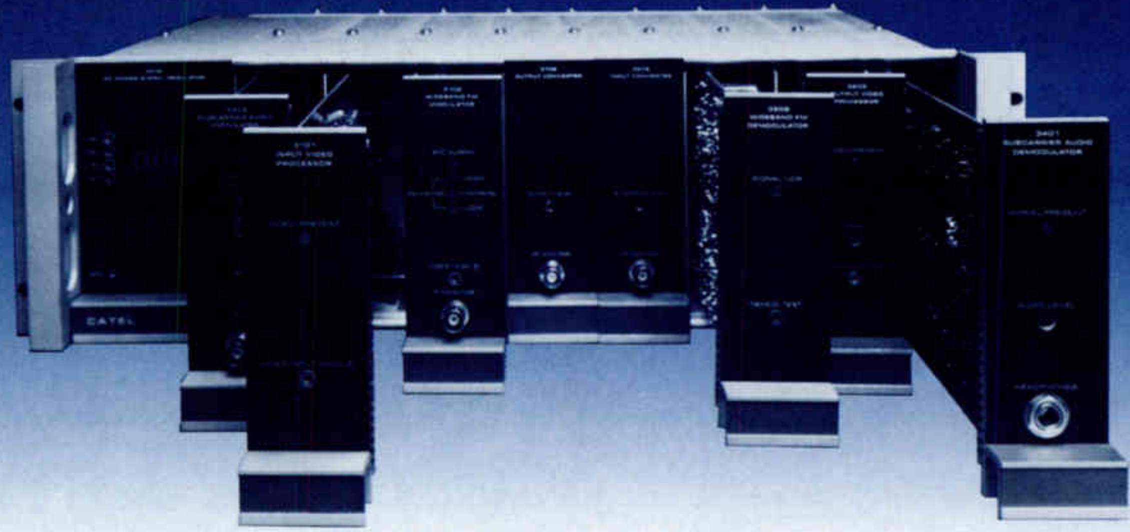

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Reader Service Number 11.

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Pre-empting problems without test equipment

By P.J. Otten
Vice President of Engineering, MAI Communications Inc.

This preventive maintenance (PM) program relates more to how people are trained and how they react to all-around situations in daily CATV plant activities. To implement a successful program, the most important links are the service and maintenance technicians. These people are the backbone of every cable television system. The "chief" can write and direct a program, but without the cooperation of everyone, it won't work.

We must start by an education process to stress maintenance up front. All system operators have, or should have, a construction manual loaded with good ideas, which is the foundation for a well-built plant. When the plant is built to proper specifications, one would have a base of perfection to start the PM program from. All nuts and bolts are corrosion free, all electrical connections are clean and tight, and the elements have not yet started to take their toll. At this point, people come into the picture for a PM program. Now begins an education process. This process must start with proper technique dedicated to the maintenance of this well-built plant. The senses of these people must be directed toward the proper inspection of the plant at all times.

The sense of sight is the one that needs the most training. As a person rides the cable plant daily, this sense needs to be sharpened to a degree where visual problems are spotted, recorded and repair is put into motion before customer-related problems occur. As time progresses, this sense becomes sharper and sharper. One begins to see things that never stood out before. For example, the tree branch rubbing the cable as new growth comes can cause the lashing wire to break or, worse yet, for the branch to wear a hole in the cable and enable water to get in. When a technician opens an amplifier to check levels, a visual inspection of the location should take place at that time. The inspection should cover:

'(The) sense (of sight) needs to be sharpened to a degree where visual problems are spotted, recorded and repair is put into motion before . . . problems occur'

- Strand condition
- Lashing wire
- Heat shrink
- Weather gaskets
- RFI gaskets
- General condition of amplifier modules
- Hold-down bolts (rusty, corroded)

This list can be expanded to cover all problems encountered. The point is to expand beyond looking for level changes when opening amplifiers. Once again the problems seen must be recorded and repair put into motion before problems occur.

Now the aural sense needs to be expanded. This is where we need to be careful that problems spotted in the field do not become words wasted in the wind. Problems need to be documented so corrective action can start to be implemented. As well, the line of communication between people must be opened. The veterans will talk to the rookies, and the rookies will become veterans. As the more experienced relate problems they have seen to the new people, this begins to sharpen their senses.

Classroom sessions provide an excellent environment for aural communications. Whether they are formal and complete with visual aids in a classroom or just held in the lunchroom in a round-table environment, the education of our people should not stop at any time in their career. Literature on new equipment needs to be distributed, discussed and completely understood by all of the people.

The next sense that has to be expanded on is sensibility; this goes hand-in-hand with responsibility. If you look at the definition of these two words, once the sense of sensibility is sharpened, responsibility naturally will take place.

As aural communications take place, visual application happens, sensibility grows and responsibility develops in our people; and a well-planned preventive maintenance program will work. When this program works, the cable television system works, the end user (subscriber) is delivered quality product (pictures) and service calls are kept to a minimum—which means more time can be spent on preventive maintenance.

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Reader Service Number 13.

Power supplies in broadband systems

When CATV was undeveloped and before solid-state technology was prevalent, high voltage power supplies were required because of the vacuum tubes used in the amplifiers. Today's broadband amplifiers are made using solid-state components that require low voltage direct current (DC) power in order to operate. There are ways ranging from feasible to problematical to power the amplifier to operate the solid-state components. Choosing the best power supply for a system requires an understanding of the different powering methods available.

By Kevin J. Hamilton
Applications Engineer, C-COR Electronics Inc.

A low voltage DC power supply such as a battery placed at the amplifier could be used to provide power for the station. However, doing so would be costly because batteries do not have the required continuous operating time of years, or even months on a single charge. Furthermore, because of their very nature, the batteries would require constant attention. Carrying the battery theme one step further, positioning one at a location that could power several amplifiers would reduce the number of batteries; but they still would be limited by time and maintenance requirements.

A more sophisticated powering scheme is to place an alternating current-to-direct current (AC-to-DC) power supply at a common powering location and simulate a battery. In other words, it would receive an AC utility power input, and provide a regulated DC output to several amplifiers. Such a power supply is an emulation of a battery, but doesn't have the hindrances of limited available charge and excessive upkeep.

This configuration was actually used in the early days of CATV, however, practical problems soon became evident. The dissimilar metals used in the cable and connectors, combined with the moisture present between the metals in essence created a small "battery." Additionally, the DC voltage present on the coaxial cable charged this "battery" and caused electrolysis. Electrolysis precipitated corrosion in the cable and decreased its life.

As a result of the problems associated with DC, AC (60 Hz) became the desirable means of powering. AC tends to undo the effects of electrolysis by "discharging the battery" on the negative cycle. Electrolysis can still exist in an AC system, but is greatly reduced.

There are some in the broadband communications industry who have thoughts of abandoning the conventional 60 volt, 60 Hz powering. Rather, they would like to return to DC powering or initiate 400 Hz powering. The reasoning behind these thoughts is rather straightforward: DC and 400 Hz powering would enable smaller power supplies in the trunk station, eliminate some of the heat generated in the station and increase amplifier life expectancy. (Excessive heat is detrimental to amplifier life.)

In a DC system, the amplifier power supply would basically consist of a DC voltage regulator rather than a transformer and associated components. Elimination of the transformer reduces weight and heat in the station and gains the advantages of a cooler operating temperature.

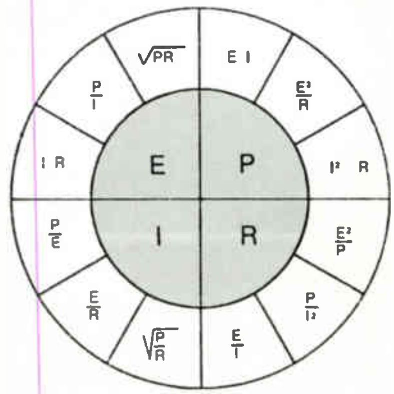
The problem that existed with DC powering was electrolysis. Electrolysis existed because three elements were present: dissimilar metals, moisture between the metals and DC voltage. Today's construction techniques greatly inhibit the variable of moisture. Newer coaxial cable designs use aluminum outer conductors, which are very similar in metal content to the aluminum connectors and amplifier housings. This reduces the variable of dissimilar metals found in the older systems. As long as moisture, which acts as an electrolyte, is not present, and as long as dissimilar metals are not present, electrolysis cannot occur. Therefore, DC powering could be used with little fear of electrolysis.

The merits of 400 Hz powering are demonstrated by the military and the aviation industry usage of it. A formula used in the electromagnetics industry that relates a transformer's secondary voltage to the source frequency and the effective core area is:

$$E = 2NAfB$$

where: E is the secondary voltage
N is the number of turns
A is the effective core area
f is the source frequency
B is the flux density

Two variables that are practical to change are the core area and the source frequency. If the frequency is increased, then the required effective core area could be decreased. Because the weight and size of a power supply are considerations, reducing the core area would be ideal. A reduced core area would mean a size and weight reduction—the very reason 400 Hz is used in aircraft. In fact, a 400 Hz power supply would be about 25-30 pounds lighter than a comparable two-transformer 60 Hz supply as found in standby power supplies. With 400 Hz on the cable, the trunk power supply size, weight and cost could be reduced.



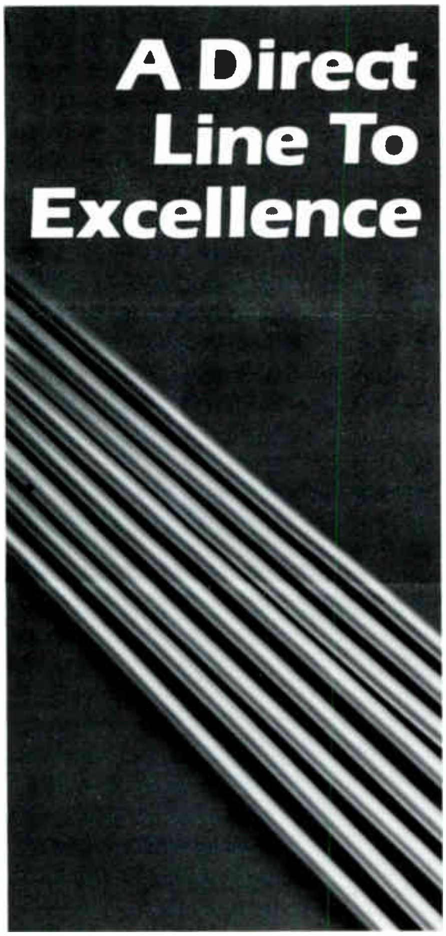
Ohm's Law wheel

Although both 400 Hz and DC powering are advancements in cable powering techniques, few equipment vendors supply amplifiers capable of operating with either form of powering because the vendor would be one of a few in a limited market situation. Buyers would not want to buy a piece of gear that they can get from only a handful of suppliers. An industrywide agreement is necessary for either powering technique to gain widespread popularity.

30 vs. 60 volt powering

When considering how a system will be powered, one must consider what voltage will be carried on the coaxial cable. Local ordinances or industrial safety restrictions may dictate the maximum voltage that may be carried on the cable. If these limitations do not exist, 60 volt powering is more economical than 30 volt powering, for several reasons. One is very similar to the reasoning used in the electric utility industry: higher voltages allow more efficient power transmission. Since power = I^2R, less power is dissipated with lower currents flowing through a resistance. Therefore, increasing the voltage (decreasing the current) for transmission will reduce the power loss in the coaxial cable.

A second reason to use higher voltage involves practical system design. A trunk station power supply module may be capable of using 60 or 30 volt powering. However, the 30 volt powering requires more current, which

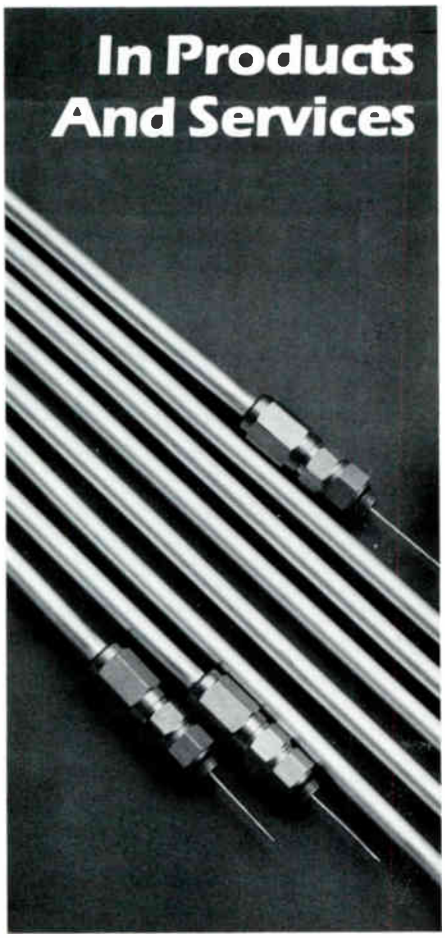


results in more voltage drop across the coaxial cable (I*R), and therefore lower input voltages at the succeeding amplifiers. Starting with a lower voltage (30 rather than 60), plus a greater voltage drop, an input voltage may soon be obtained that will cause improper operation of the amplifier; a voltage-limited situation. Fewer amplifiers can be cascaded in this situation. More current also means that the power supply will reach its current rating sooner due to the increased loading; a current-limited situation. In 30 volt systems, a voltage-limited situation will probably exist before a current-limited one.

A myth about 60 volt powering: "60 volts is twice 30 volts and is therefore twice as dangerous." It is true that 60 volt systems will deliver twice the current across a resistance, but the voltage and current are still low enough that harm is not likely.

Sine vs. square wave powering

Various powering waveforms are available. The most common in broadband systems are sine, square and quasi-square. Each have attributes making them desirable in some situations and undesirable in others. Sine wave powering is easy to produce, but is not a form that is efficiently converted to DC in the amplifier power supply. A square wave would be desirable because it is very close to a DC form in terms of power and voltage in the waveform. Using a square wave allows a lower peak voltage than a sine wave, while still providing the same amount of power. However, a square wave contains undesirable harmonics and is hard to produce. Consequently, a quasi-square wave requires only slightly higher voltages than a pure square wave, does not contain harmonics as does the pure square wave, and its powering is easily produced by driving the power supply ferroresonant transformer into saturation. Using the ferroresonant transformer additionally provides voltage regulation making it desirable over some sine wave systems. Several sine wave power supplies use linear transformers, which are sensitive to input voltage fluctuation. Some sine wave supplies use a ferroresonant transformer to generate a square wave, and then generate a sine wave from the regulated square wave output of the transformer. But this is more costly and does not have any advantages over the quasi-square wave supply.



Standby power supplies

Solid-state components in broadband amplifiers not only reduce power requirements at the station, but also increase the reliability and life expectancy of the station. In fact, most short-term system outages are due to utility power interruptions rather than amplifier outages. Utility power interruptions can disable an entire system and create customer complaints, assuming the customer has power at his television set. There could be a utility interruption that does not affect the subscriber, but only the power feeding the broadband AC power supply. In this situation, the amplifiers will not receive power to operate, but the customer will still have power in the home. Naturally, the cable operator will be blamed for the lack of a picture when in reality it is the fault of the utility company.

In data systems where megabits of information are carried on the cable system and customers are paying premium rates for this service, continuous powering is especially critical. If customer service is desired when the subscriber has power, then a backup power supply that operates on batteries is recommended. Although a standby power supply has a limited operating time because of the batteries, at least there is continued service for a short while during the outage rather than no service at all. Most standby power supplies are capable of powering the cable system for the short amount of time that the utility power is unavailable. Longer outages are usually scheduled and the cable operator can take measures to provide a generator for his system should the standby unit provide insufficient time.

Proper care of a standby power supply is essential, including monitoring the condition and in some cases presence of batteries. The power supply is partially self-maintaining in that it will keep the batteries charged, but the power supply cannot add fluid to the battery cells or replace defective plates. A service representative must visit the power supply site

and perform these maintenance functions.

Battery service and life is determined by proper charging. Three charging schemes are commonly used: float charging, trickle charging and cycle charging. Float charging is a process that maintains a continuous voltage slightly higher than the desired full charge voltage. Trickle charging is a technique that provides a very small continuous current into the battery. With both trickle and float charging techniques, there is the risk of gassing the batteries. When a battery is continuously charged, the battery cannot absorb all the energy from the charging process, especially as it approaches full charge. The excess energy causes the electrolyte to break down into its component gasses, creating a dry battery. A good power supply, which uses either technique, will include a timer that times how long the batteries are charging, and stops charging after a programmed period of time even if the batteries are not fully charged. Cycle charging charges the batteries to a voltage higher than desired and then stops the charging process. This is a safer charging method in terms of battery health but takes longer to accomplish.

It is not uncommon to find a standby power supply with automotive batteries installed. This is not a recommended practice because automotive batteries, although fine for automotive applications, are not capable of withstanding the stresses that a battery will experience in a standby unit. Rather, deep cycle batteries are recommended for standby applications, as they are constructed with fewer and thicker plates to give the battery greater mechanical strength, and are capable of supplying current for longer periods of time than the automotive battery. Thicker plates allow many times more full discharge cycles than automotive-type batteries, which are designed to supply high starting currents using a larger number of thinner plates.

It is important to use the correct type of battery for your power supply's charger; not because the charger will be damaged, but because the charger is designed with a certain kind of battery in mind. Use of the correct battery type will help ensure longer service from the battery, and consequently longer operation in backup situations.

Components of a standby power supply include: batteries, AC input detector, switch, inverter, regulator and charger. An AC input detector is necessary to detect the presence or absence of utility company power. If the utility power drops out, a signal is sent to the switch, which then connects the batteries to the inverter. The inverter takes the DC from the batteries and converts it to the AC required by the amplifiers.

The most common form of voltage regulation is termed ferroresonant. Although there are disadvantages of ferroresonant regulation such as frequency and temperature sensitivity, the advantages make this type of regulation the best choice. Ferroresonance is highly reliable, has a low cost and simple construction requirements, and an input power factor that makes powering the system less costly.

Status monitoring of standby power

Status monitoring is recognized as a valuable tool. It enables an operator to know at any instant the operating characteristics of his system, such as signal levels and power supply voltages. The operator can then monitor critical parameters, evaluate the condition of the system and, if necessary, take action to correct faulty conditions.

Status monitoring of standby power supplies enables a cable operator to know the condition of the AC power supplies. This feature has as much value as an amplifier status monitoring system. An advanced status monitoring system allows the system operator to "exercise" the batteries by forcing the unit into standby operation. An advanced status monitor also would monitor battery voltage, the unit's operating mode, the operational status of the charger, input/output voltage, output current and charger current. These features help ensure that the operator has "ready" standby power supplies.

Conclusion

Although power supplies are "simple" devices, there are many factors that make each manufacturer's unique. When choosing a power supply, carefully consider your system requirements and whether or not standby power supplies and monitoring are necessary. For most cable systems, status monitoring is desirable for system diagnostics and preventive maintenance.

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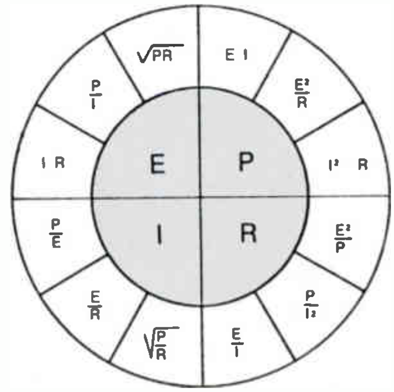
Reader Service Number 17.

Cost-effective powering



The ideas put forth in this article are to highlight areas that can decrease the time frame needed to activate cable system power supplies, as well as minimize the number of power supplies used. These methods have worked well in a number of systems and, when incorporated into existing procedures, may prove helpful in optimizing time and reducing costs.

By Robert E. Sturm
President, Communication Systems Design & Planning Inc.

In today's state-of-the-art cable communication system, the cost of providing power to the system is consuming a greater share of the construction and operations budget than has been associated with new system activation in the past. It is an area often overlooked during the complicated start-up process of a new system or the rebuilding and upgrading of an existing one.

From an operations point of view, it is reasonable to expect the cost of power to increase during the life of the system. With a minimal amount of advanced planning for power supplies during the start-up phase of building a cable communication network, a manager can have a higher degree of certainty that power will be available to energize his newly built plant in a timely fashion, possibly increase his subscriber revenues and help minimize operating costs over the life of the system.

From a system powering stand point, it is important that the total project be completely designed with power supply locations calculated prior to the start of the construction or rebuild effort. A cable system can be most efficiently powered when the total plant layout is known. This should include any provisions for future development and plant expansion.

The most efficient method for calculating power supply locations is to start the process at the system extremities (the last line extender being fed from the last trunk amplifier in the longest cascade of the system) and calculating optimum power supply locations in a backward fashion toward the hub or headend. In this manner, power supplies can be strategically placed and loaded to their optimum rating. This method also will eliminate the possibility of placing any unnecessary power supplies.

Starting the system powering calculations at the headend or hub and working the calculations outward toward the system extremities increases the probability of placing a partially loaded power supply at terminations of the trunk system. This "powering out" method is commonly used when the system design is not completed prior to the start of construction. As a result, a system powered in this fashion may require as many as 15 percent more power locations than normally would be needed. If the system is a dual cable system, the number of actual power supplies could be increased by 30 percent.

The completed system design should include all of the home subscriber networks, institutional networks and any special interconnect networks that may be required. Not only will having the completed system design allow an operator to identify all of the required power supply locations, it also will allow for the plant to be scheduled for construction in a more cost-effective manner. The home subscriber network trunks that pass the greatest number of homes can be assigned priority numbers and scheduled for makeready, construction, activation and marketing in sequence.

There are many fine cable construction contractors with excellent reputations for getting plant built on time. Any of these contractors can build plant at any rate per month a construction budget will allow for. But if the new plant cannot be energized shortly following the construction phase, installations are delayed and subscriber revenues are lost. These lost revenues cannot be recaptured.

With all power supplies located, the installation and activation of the supplies can be scheduled with the local public power company in a much more controlled and cost-efficient manner. Table 1 illustrates key data concerning the activation sequence for power supplies within a system. Priority numbers can be assigned to each supply and those numbers coordinated with the local public power company for activation. The activation sequence can be scheduled to allow for "float time." That is, activation can be planned well in advance of the cable plant construction to ensure that the supply will be active at the appropriate time for installs to commence. By assigning and tracking priority numbers, a manager can always be abreast of the status at all the various stages of power supply activation and manage the sequence to coincide with new plant construction. Potential sub-

Table 1: Power supply priority list

Power supply number	Hub	Map #	Pole #	Street name	Activation sequence #	Date installed	City insp. date	Power co. installed	Cable plant activated
HSN 1	1	5050	12/345T	1023 Main	1	3-5-84	4-15-84	5-5-84	5-10-84
HSN 2	1	5050	12/889TC	2045 Main	2	3-5-84	4-15-84	5-5-84	5-10-84
HSN 3	1	5050	13/879TR	1515 Elm	3	3-6-84	4-15-84	5-5-84	5-10-84
HSN 4	1	5150	14/657DC	234 E. Spring	4	3-6-84	4-15-84	5-5-84	5-10-84
HSN 5	1	5150	14/692DA	1212 Swinton Dr.	5	3-7-84	4-15-84	5-8-84	5-13-84
HSN 6	1	5150	14/234DD	6725 Baron Rd.	6	3-8-84	4-15-84	5-8-84	5-13-84
HSN 7	1	5051	15/12454	1508 Twisting Tree	7	3-8-84	4-15-84	5-8-84	5-13-84
HSN 8	1	5051	15/234/D	3510 Twisting Tree	8	3-9-84	4-15-84	5-8-84	5-13-84
HSN 9	1	5051	15/879BB	310 Maple Dr.	9	3-9-84	4-15-84	5-9-84	5-14-84
HSN 10	1	5151	19/349FF	1600 Penn. Ave.	10	3-9-84	4-15-84	5-9-84	5-14-84
HSN 11	1	5151	19/768K	8201 E. Briarwood	11	3-11-84	4-15-84	5-9-84	5-14-84
HSN 12	1	5151	19/290GO	6900 E. Briarwood	12	3-11-84	4-15-84	5-9-84	5-14-84
HSN 13	1	5151	19/1789C	5004 Swinton Dr.	13	3-11-84	4-15-84	5-10-84	5-15-84
HSN 14	1	5151	19/132/U	310 Magnolia	14	3-11-84	4-15-84	5-10-84	5-15-84
HSN 15	1	5251	20/2245/	2105 Fulton Ave.	15	3-12-84	4-15-84	5-10-84	5-15-84
HSN 16	1	5251	20/512TF	1108 Railroad St.	16	3-12-84	4-15-84	5-10-84	5-15-84
HSN 17	1	5251	20/7834D	1100 Bird Creek St.	17	3-12-84	4-15-84	5-10-84	5-15-84
HSN 18	1	5252	21/902-A	1290 Chobe Rd.	18	3-12-84	4-15-84	5-11-84	5-16-84
HSN 19	1	5252	21/432-B	6290 Penn. Rd.	19	3-13-84	4-15-84	5-11-84	5-16-84

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Table 2: Power supply operational costs

Power supply (PS) rated output wattage	900
Total system power supplies	250

Commercial power costs	
Kilowatt-hour cost	.06316/kwhr
Fuel charge	.01703/kwhr
Cost/kwhr	.08019/kwhr
Meter charge	$7.50/month

Ave. watts drawn/PS	Total kwhr drawn/month for system	Ave. cost per PS per month	Ave. cost per year per PS	Ave. cost for 15 years per PS	15-year power cost for all system PSs
900	167400	$61.20	$734.34	$11015.14	$2,753,785.08
800	148800	55.23	662.75	9941.24	2,485,308.96
700	130200	49.26	591.16	8867.33	2,216,832.84
600	111600	43.30	519.56	7793.43	1,948,356.72
500	93000	37.33	447.97	6719.52	1,679,880.60
400	74400	31.36	376.37	5645.62	1,411,404.48
300	55800	25.40	304.78	4571.71	1,142,928.36

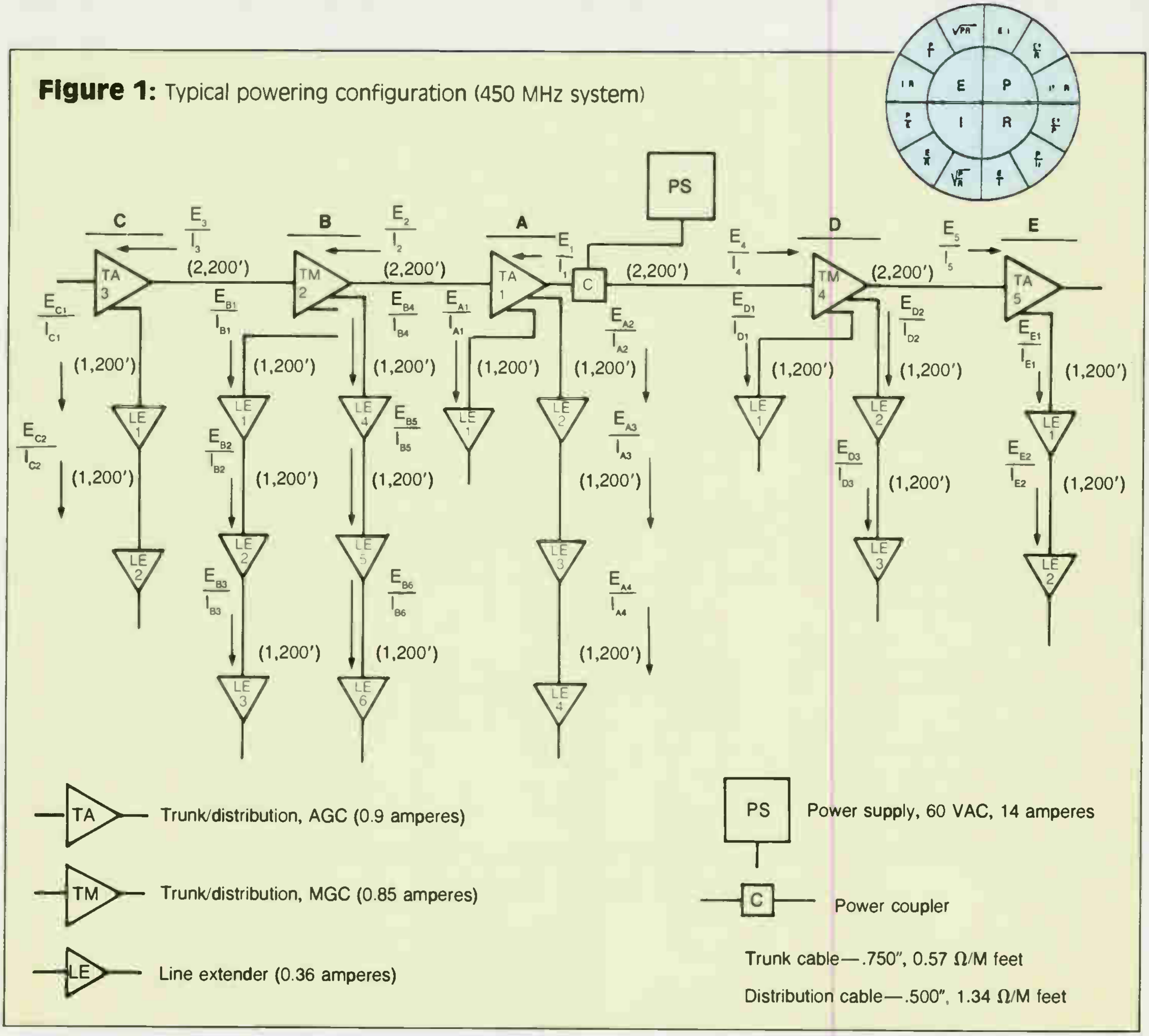
scribers can be marketed and added to the system revenue base at a much more controlled pace.

There are many excellent power supplies available to the system operator today. How those power supplies are applied to a new system has a direct impact upon the operational costs of that system as illustrated in Table 2. The utility cost per kilowatt hour and meter charge, used in this model, are fairly typical of rates charged by public power companies. Rates, of course, will vary from area to area across the country. Table 2 assumes that all supplies are metered.

If our model could be powered by 10 percent fewer power supplies, this would result in a substantial savings. One could expect to achieve this reduction with a reasonable amount of advanced planning. A 10 percent reduction would result in an operational cost savings, over the life of the system, of approximately $33,750 in meter charges alone. Double that amount if the plant is dual cable.

The items mentioned are a few that the operator should consider during the advanced planning stages for providing power to his system. A little time spent reviewing the powering can directly affect the timely addition of subscribers to the system and add to the profitability of the system.

Figure 1: Typical powering configuration (450 MHz system)



A step-by-step method of solving your power requirements

Ronald B. Adamson
Sales Applications Engineer, Texscan Instruments

Powering requirements vary widely from system to system depending, mainly, upon amplifier configurations utilized and the cable used to interconnect them. Every amplifier has a specific power requirement and different cable types/sizes have specific resistances per unit length. All of these parameters are specified by the respective manufacturers.

The purpose of this article is to present a step-by-step solution to a typical system powering problem. In general, the approach presented here can be applied to any system.

Figure 1 represents a portion of a typical trunk/distribution system. The powering problem is: 1) What is the total power used, and what must be provided by the power supply? 2) Will there by sufficient power available for all of the amplifiers in the layout?

Step 1: Determine total power requirements. (Since current will be used in subsequent steps, this step will be solved in terms of total current. Amplifier manufacturers generally specify unit power needs in terms of watts and amperes. The amplifier power requirements specified here are based upon linear regulator power supplies. Switching regulator power supplies have lower power requirements.)

- 3 trunk/distribution amplifiers w/ACG (0.9 A) $3 \times 0.9 = 2.7$ amperes
- 2 trunk/distribution amplifiers w/MGC (0.85 A) $2 \times 0.85 = 1.7$ amperes
- 17 line extender amplifiers (0.36 A) $17 \times 0.36 = 6.12$ amperes

System total = 10.52 amperes

Solution 1: The power supply has sufficient load current capacity (14 amperes, 60 VAC) to power the Figure 1 layout.

Step 2: Determine the equivalent resistance (R_{EQ}) of each cable length used (manu-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facturers specify DC resistance characteristic per 1,000 feet at 68°F).

$$R_{EQ} = \frac{\text{Actual cable length}}{\text{Specified resistance length}} \times \text{Specified resistance}$$

Trunk cable (0.57 Ω/1,000 feet), 2,200′/section:

$$R_{EQ} = \frac{2{,}200 \times 0.57}{1{,}000} = 1.25\ \Omega$$

Therefore, trunk cable sections between amplifiers 3, 2, 1, 4 and 5 have a characteristic DC resistance of 1.25 Ω/section.

Distribution cable (1.23 Ω/1,000 feet), 1,200′/section:

$$R_{EQ} = \frac{1{,}200 \times 1.34}{1{,}000} = 1.6\ \Omega$$

Therefore, distribution cable sections between trunk amplifiers and line extenders, and between line extenders have a characteristic DC resistance of 1.6 Ω/section.

Step 3: Determine current flowing in trunk and distribution branches of the system (this is a most important step toward accomplishing a correct solution.) To review, I = current in amperes.

I_{TA} = 0.9 amperes
I_{TM} = 0.85 amperes
I_{LE} = 0.36 amperes

Trunk section currents will be termed I_1, I_2, etc. Distribution branch currents will be termed I_{A1}, I_{A2}, etc. For the trunk section/distribution branch:

$I_1 = I_{TA} + I_{TM} + I_{TA} + (12 \times I_{LE})$
$= 0.9 + 0.85 + 0.9 + (12 \times 0.36)$
$= 6.97$ A

(A branch) $I_A = I_{TA} + (4 \times I_{LE})$
$= 0.9 + (4 \times 0.36)$
$= 2.34$ A

(B branch) $I_B = I_{TM} + (6 \times I_{LE})$
$= 0.85 + (6 \times 0.36)$
$= 3.01$ A

(C branch) $I_C = I_{TA} + (2 \times I_{LE})$
$= 0.9 + (2 \times 0.36)$
$= 1.62$ A

$I_4 = I_{TM} + I_{TA} + (5 \times I_{LE})$
$= 0.85 + 0.9 + (5 \times 0.36)$
$= 3.55$ A

(D branch) $I_D = I_{TM} + (3 \times I_{LE})$
$= 0.85 + (3 \times 0.36)$
$= 1.93$ A

(E branch) $I_E = I_{TA} + (2 \times I_{LE})$
$= 0.9 + (2 \times 0.36)$
$= 1.62$ A

$I_2 = I_B + I_C$
$= 3.01 + 1.62$
$= 4.63$ A

$I_3 = I_C$
$= 1.62$ A

$I_5 = I_E$
$= 1.62$ A

Branch current distribution

A) $I_{A1} = I_{LE}$
$= 0.36$ A

$I_{A2} = 3 \times I_{LE}$
$= 3 \times 0.36$
$= 1.08$ A

$I_{A3} = 2 \times I_{LE}$
$= 2 \times 0.36$
$= 0.72$ A

$I_{A4} = I_{LE}$
$= 0.36$ A

B) $I_{B1} = 3 \times I_{LE}$
$= 3 \times 0.36$
$= 1.08$ A

$I_{B2} = 2 \times I_{LE}$
$= 2 \times 0.36$
$= 0.72$ A

$I_{B3} = I_{LE}$
$= 0.36$ A

Since the second part of the B branch is the same, then:

$I_{B4} = I_{B1}$
$= 1.08$ A

$I_{B5} = I_{B2}$
$= 0.72$ A

$I_{B6} = I_{B3}$
$= 0.36$ A

C) $I_{C1} = 2 \times I_{LE}$
$= 2 \times 0.36$
$= 0.72$ A

$I_{C2} = I_{LE}$
$= 0.36$ A

D) $I_{D1} = I_{LE}$
$= 0.36$ A

$I_{D2} = 2 \times I_{LE}$
$= 2 \times 0.36$
$= 0.72$ A

$I_{D3} = I_{LE}$
$= 0.36$ A

E) This branch is the same as the second part of D, then:

$I_{E1} = I_{D2}$
$= 0.72$ A

$I_{E2} = I_{D3}$
$= 0.36$ A

Step 4. Determine voltage drops across trunk and distribution cable sections. In step 2 the equivalent resistance of each cable type/length was determined. Determination of trunk and distribution currents was accomplished in step 3. The application of Ohm's law for voltage and the use of the resistance/current data will provide a complete analysis of operating voltages throughout the system.

To review, E(volts) = I(amperes) x R(ohms)

Note: There are no voltage drops across amplifiers that are thru-powered. Sixty volts (E_1) is present at the coupler and the "A" branch trunk amplifier, TA_1.

Voltage drops:
Trunk (R = 1.25 Ω for 2,200′)

$E_2 = I_2 \times R$
$= 4.63 \times 1.25$
$= 5.79$ V

$E_3 = I_3 \times R$
$= 1.62 \times 1.25$
$= 2.03$ V

$E_4 = I_4 \times R$
$= 3.55 \times 1.25$
$= 4.44$ V

$E_5 = I_5 \times R$
$= 1.62 \times 1.25$
$= 2.03$ V

Voltage at $TM_2 = E_1 - E_2$
$= 60 - 5.79$
$E_{TM2} = 54.21$ V

Voltage at $TA_3 + (E_1 - E_2) - E_3$
$+ (60 - 5.79) - 2.03$
$E_{TA3} + 52.18$ V

Voltage at $TM_4 = E_1 - E_4$
$= 60 - 4.44$
$E_{TM4} = 55.56$ V

Voltage at $TA_5 = (E_1 - E_4) - E_5$
$= (60 - 4.44) - 2.03$
$E_{TA5} = 53.53$ V

Voltage drops:
Distribution (R = 1.6 Ω for 1,200′)

A) $E_{A1} = I_{A1} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

$E_{A2} = I_{A2} \times R$
$= 1.08 \times 1.6$
$= 1.73$ V

$E_{A3} = I_{A3} \times R$
$= 0.72 \times 1.6$
$= 1.15$ V

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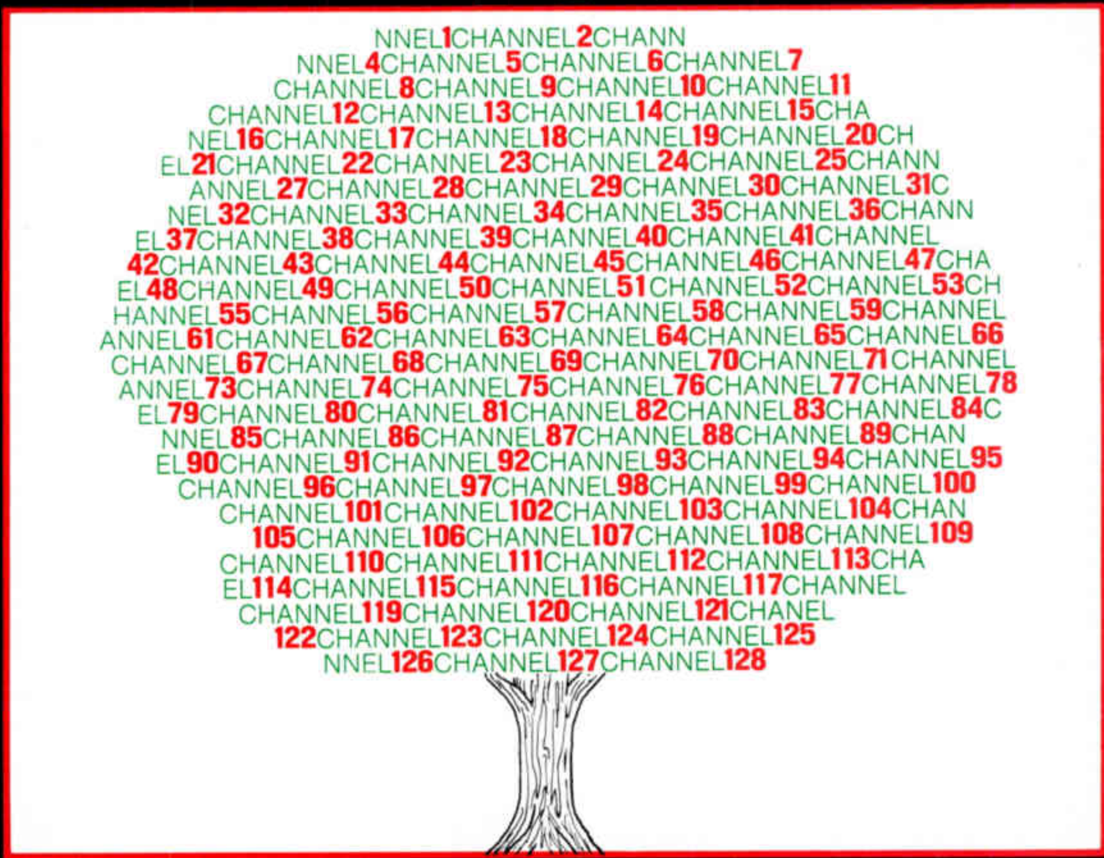

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$E_{A4} = I_{A4} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

Voltage $LE_1 = E_{.} - E_{A1}$
$= 60 - 0.58$
$= 59.42$ V

Voltage $LE_2 = E_{.} - E_{A2}$
$= 60 - 1.73$
$= 58.27$ V

Voltage $LE_3 = (E_{,} - E_{A2}) - E_{A3}$
$= 60 - 1.73 - 1.15$
$= 57.12$ V

Voltage $LE_4 = (E_{.} - E_{A2} - E_{AE}) - E_{A4}$
$= (60 - 1.73 - 1.15) - 0.58$
$= 56.54$ V

B) $E_{B1} = I_{B1} \times R$
$= 1.08 \times 1.6$
$= 1.73$ V

$E_{B2} = I_{B2} \times R$
$= 0.72 \times 1.6$
$= 1.15$ V

$E_{B3} = I_{B3} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

Voltage $LE_{.} = E_{TM2} - E_{B\cdot}$
$= 54.21 - 1.73$
$= 52.48$ V

Voltage $LE_2 = (E_{TM2} - E_{B\cdot}) - E_{B2}$
$= (54.21 - 1.73) - 1.15$
$= 51.33$ V

Voltage $LE_3 = (E_{TM2} - E_{B\cdot} - E_{B2}) - E_{B3}$
$= (54.21 - 1.73 - 1.15) - 0.58$
$= 50.75$ V

*Since the second branch of B is identical, cable voltage drops and line extender voltages will be the same as the first branch.

C) $E_{C1} = I_{C1} \times R$
$= 0.72 \times 1.6$
$= 1.15$ V

$E_{C2} = I_{C2} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

Voltage $LE_1 = E_{TA3} - E_{C1}$
$= 52.18 - 1.15$
$= 51.03$ V

Voltage $LE_2 = (E_{TA3} - E_{C1}) - E_{C2}$
$= (52.18 - 1.15) - 0.58$
$= 50.45$ V

D) $E_{D1} = I_{D1} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

$E_{D2} = I_{D2} \times R$
$= 0.72 \times 1.6$
$= 1.15$ V

$E_{D3} = I_{D3} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

Voltage $LE_1 = E_{TM4} - E_{D1}$
$= 55.56 - 0.58$
$= 54.98$ V

Voltage $LE_2 = E_{TM4} - E_{D2}$
$= 55.56 - 1.15$
$= 54.41$ V

Voltage $LE_3 = (E_{TM4} - E_{D2}) - E_{D3}$
$= (55.56 - 1.15) - 0.58$
$= 53.83$ V

E) $E_{E1} = I_{E1} \times R$
$= 0.72 \times 1.6$
$= 1.15$ V

$E_{E2} = I_{E2} \times R$
$= 0.36 \times 1.6$
$= 0.58$ V

Voltage $LE_1 = E_{TA5} - E_{E1}$
$= 53.55 - 1.15$
$= 52.4$ V

Voltage $LE_2 = (E_{TA5} - E_{E1}) - E_{E2}$
$= (53.55 - 1.15) - 0.58$
$= 51.82$ V

Solution 2: Linear regulator power supplies require a minimum of 36 to 40 volts input to operate (transformer low tap). The analysis of this powering example determined all amplifier voltages are above minimum requirements.

The mathematics of system powering analysis are basic. Correct results will be achieved when a methodical approach is used. The step-by-step method presented here assures all information is available for each subsequent step, thus making each step uncomplicated and producing the correct results.

In summary

1) Assign identifying terms to the parameters to be determined (E, I, etc.)

2) Obtain manufacturer data regarding amplifier power requirements, cable resistance/length.

3) Remember that a portion of the total current in the trunk splits off into each distribution branch, so voltage drops vary along the trunk, as well as in the branches. This is due to the changing currents through cable resistances.

4) A calculator makes the math quick and easy.

5) Determine the necessary information for each step before proceeding to the next.

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FCC microwave rules: Their impact on cable

By Norman Weinhouse
Norman Weinhouse Associates

New FCC rules on microwave were released Aug. 17, 1984. This is good news and bad news for the cable industry. In my opinion the good news outweighs the bad. However, the complete story is not yet written. The Memorandum Opinion and Order (FCC 84-389) opens the 18 GHz frequency band to cable; it was previously off limits for use by cable. That's the good news. The bad news is that virtually everyone else can use the same frequencies.

Background

The aforementioned FCC action has its roots in two separate dockets, neither of which is directly associated with the cable industry. The first root goes back to a 1979 docket (79-188) relating to the use of 18 GHz for digital termination service (DTS) and digital electronic message service (DEMS) as well as other uses. The second root was a 1980 docket (80-603) relating to establishment of direct broadcast satellite (DBS) service at 12.2 to 12.7 GHz. The first docket (79-188) lay fallow for many years, while the 1980 docket was closed out in 1982 by a Report and Order (FCC 82-285) that authorized DBS service.

This Report and Order (82-285) directed the FCC staff to arrange for spectrum to accommodate those private operational fixed (POF) licensees who were to be displaced from the 12.2-12.7 GHz band since the DBS service cannot share spectrum with terrestrial microwave. In addition, the Report and Order directed the staff to look to frequencies below 18 GHz to accommodate the displaced licensees. Specifically identified for relocation was the 6 GHz POF band and the 12.7-13.25 CARS and broadcast auxiliary band. The concept of sharing (among all private entities) available bandwidth, regardless of the user, was introduced. The FCC had this concept in mind for some time and has granted licenses on a waiver basis to some users outside their traditional frequency bands.

The FCC opened Docket 82-334 with a Notice of Inquiry (NOI) on July 9, 1982. Comments and reply comments were received by the FCC from 18 entities. The next step in Docket 82-334 was a Notice of Proposed Rule Making (NPRM) released Jan. 18, 1983. This proposal was extremely wide in scope affecting all commercial users (including common carrier) of microwave. It proposed a new part (Part 200) dealing with technical standards for the frequency bands: 1.99-2.11 GHz, 6.525-7.125 GHz, 12.7-13.25 GHz, 17.7-19.7 GHz and 31.0-31.2 GHz. In addition to the sharing concept, these new rules imposed technical standards and coordination procedures that are virtually identical to common carrier practice. Stations currently licensed and not meeting these standards would be grandfathered for 10 years.

Response to this NPRM was massive, as 244 entities made comments or reply comments or both. In many cases the comments were from multiple entities. For example, in the cable industry, joint comments were made by: Cablevision Industries, Cox Cable and Sammons; Gill Cable and Western Communications; and Daniels, Rogers/UA and United. But I don't want to detail all aspects of this proceeding. Instead I will concentrate on the recent action of the FCC and its impact on cable.

Commission actions

On Sept. 30, 1983, the commission released its First Report and Order in Docket 82-334. With this action, FCC 83-393, the broad issues of technical standards, coordination, etc., could not be resolved at that time. The Report and Order dealt with reaccommodation issues (procedures) and 18 GHz allocations. The primary band for accommodation of the displaced licensees is 18 GHz, however, they can be reaccommodated in the 6 GHz and 13 GHz bands. These displaced licensees also are granted certain priorities and waivers of some of the rules. One important rule change, associated with reaccommodation, is a new requirement for a formal coordination procedure for the 13 GHz band. It is my opinion that these procedures are a positive factor. Common carrier coordination procedures are to be employed in the 18 GHz band.

The First Report and Order was challenged by many parties by petition for reconsideration or partial reconsideration. This resulted in a Memorandum Opinion and Order (FCC 84-389) released Aug. 17, 1984. From a cable standpoint, several positive changes were made here in the 18 GHz allocation plan. Figure 1 shows the allocation plan as it currently exists. It is now the law of the land and it is available for use by the cable industry.

A wide variety of bandwidths are available for CARS (see Table 1). Either analog or digital modulation can be used consistent with the available bandwidth.

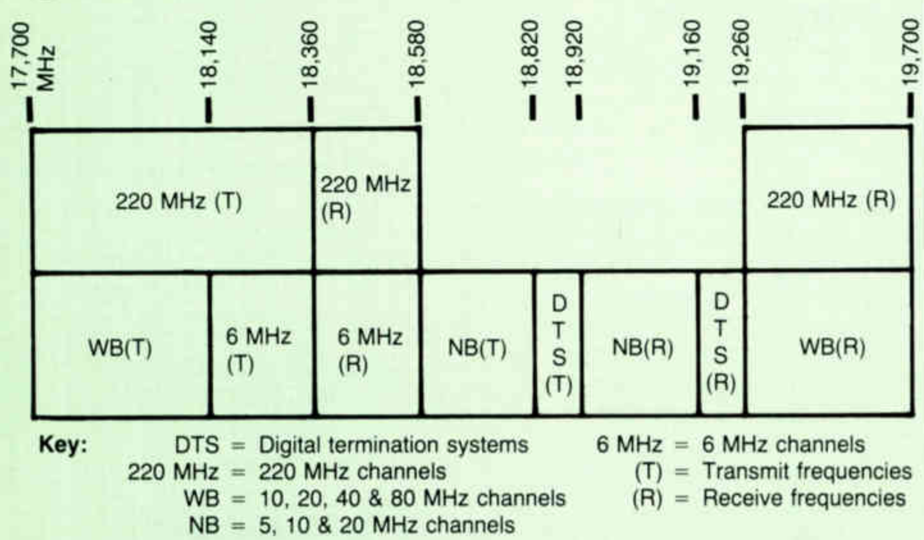
Other technical standards

1) Frequency coordination (good news).
   a) Formal procedure (new para. 78.36) for coordination of 12.7-13.25 GHz band.
   b) Para. 21.100 for coordination of 17.7-19.7 GHz band.
2) Power limitations—18 GHz (good news). Peak effective isotropic radiated power (EIRP) can be +55 dBW for all channels except 18.6-18.8 GHz. (This is a relatively high EIRP and can overcome the rain attenuation at 18 GHz by providing high margins during clear weather. Alternatively, longer paths can be engineered in low rain rate regions.)
3) Emission and bandwidth—18 GHz (good news). Consistent rules for all users of the

Table 1: Part 78, 18 GHz frequency allocation for CARS

Maximum bandwidth	Number of channels
2 MHz	1, one-way
6 MHz	73 one-way (contiguous) or 36 pairs (216 MHz separation between pairs) or any combination
10 MHz	44 pairs (1560 MHz separation)
20 MHz	22 pairs (1560 MHz separation)
40 MHz	11 pairs (1560 MHz separation)
80 MHz	5 pairs (1560 MHz separation)

Figure 1: FCC 18 GHz allocation plan



band will facilitate frequency coordination.

4) Antenna Systems (good news).
   a) No change in antenna requirements for 12.7-13.2 GHz.
   b) Standards for 18 GHz consistent for all users with minimum gain requirement, facilitates frequency coordination.

5) Frequency tolerance—18 GHz (good news). Consistent rules for all users.

Good/bad news

Table 2 summarizes the recent FCC actions on microwave and their impact on cable. Note that I have placed the coordination procedures in the good news column. It may seem that a formal procedure with its attendant cost may be a burden if you are planning a new system at 13 GHz. But these formalized procedures at 13 GHz are designed to protect existing facilities. The days when you can call your cable neighbors to find out if your planned route is clear are fast disappearing. The 13 GHz band is getting crowded, especially in the big cities. Furthermore, we should expect that the shared concept for all commercial users will probably prevail. An objective analysis says that it is a more effective means of spectrum management.

Recommendations

1) Start planning 18 GHz facilities. Here are a few uses for 18 GHz radios.

a) Wideband local area networks, which use cable technology, are booming. Corporations are installing such systems to tie their computers and terminals into an integrated network. The local cable company is a natural source to operate such systems. Compare costs with radio for this application. Radio will probably be cost effective in many cases.

b) Parallel 13 GHz paths for dual cable systems.

c) New dual cable systems (73 one-way channel capacity at 18 GHz).

d) Short haul clearance of natural barriers where cable is prohibitive and 13 GHz not available.

e) Plant expansion that might be blocked by 13 GHz congestion.

I am sure that innovative operators can think of many more applications. While the 18 GHz spectrum is not used extensively at this time, it will become popular very soon. Manufacturers are gearing up and have designs available to fit virtually every application. They are anticipating a great demand from common carriers and private users.

The NCTA and others have put up a valiant battle on your behalf for 18 GHz especially for a sizable contiguous chunk of spectrum for 6 MHz channels. You probably can use them effectively.

2) Protect your 13 GHz systems from the displaced private 12 GHz users.

If you haven't already registered your systems with a coordination firm for protection services you better do so. You could establish your own protection services, but it may not be cost effective.

Table 2: FCC microwave actions

Good news

- Lots of spectrum available to cable operators in the 17.7-18.7 GHz range.
- Formal frequency coordination required in 12.7-13.2 and 17.7-19.7 GHz bands.
- Standard technical requirements at 18 GHz apply to all users of the band. This will facilitate frequency coordination.

Bad news

- All other commercial users (common carrier, broadcast, private, local government) have equal rights to 17.7-19.7 GHz band.
- Private users, vacated from 12.2-12.7 GHz band, can be licensed in the 12.7-13.2 GHz band with priority in case of mutual exclusivity.

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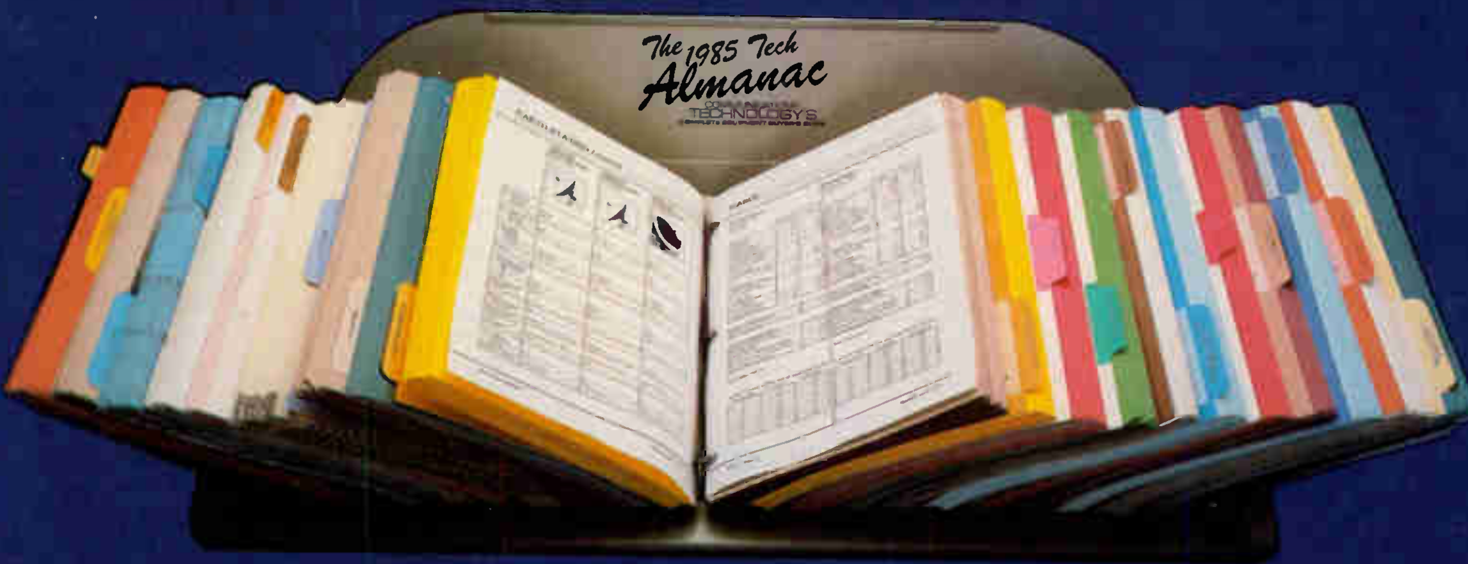

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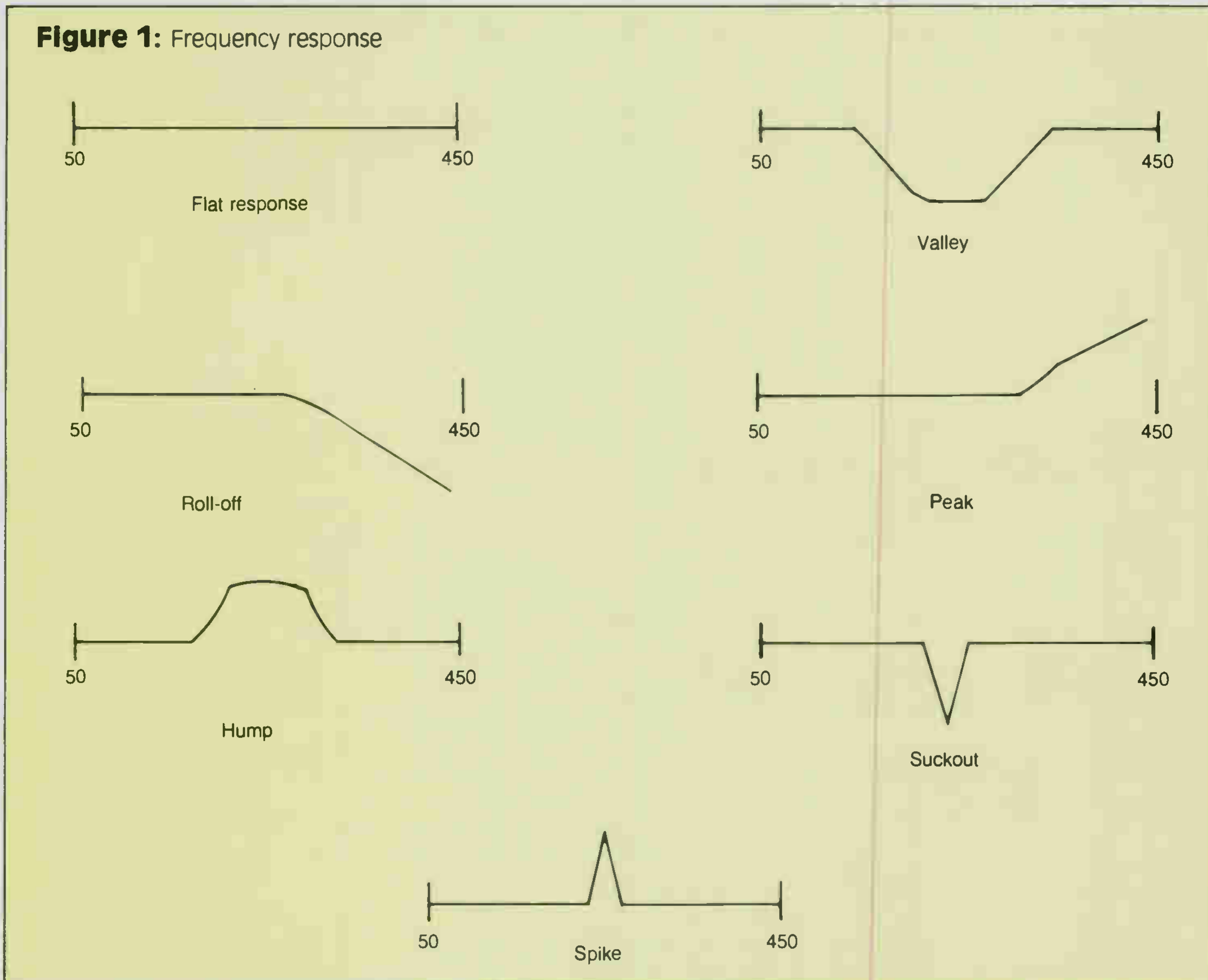

Sweeping your cable system

This article gives some insight on sweeping cable systems and defines what a sweep system is, how it operates, and what to expect when you go out to the field to perform this procedure.

By Herb Longware
Product Manager, Amplifier Systems, Magnavox CATV Systems Inc

A sweep system is a set of test equipment used to observe the entire bandwidth of the forward or return direction. The system allows us to perceive the entire range of frequencies concurrently rather than of each channel individually. Although it is possible to look at all the channels on the system with a spectrum analyzer to obtain an impression of the response, this method does not allow observation between channels or in channels not utilized at present. At best, use of the spectrum analyzer gives only a partial indication of the signals' capability to travel through the system.

The benefits gained by sweeping are immense, both in terms of system performance and of time utilization. When sweeping is done on a regular basis, the system is being monitored for possible failures. Many times a potential outage can be detected and the problem repaired under favorable working conditions (during daylight hours, when spare parts are easily accessed, etc.) as opposed to reparation when the outage occurs.

Another benefit is the improved performance of the system from the subscriber standpoint. A flat response (within specification) will result in the channels being delivered to the subscriber's house as the system was designed. As a rule, design specifications do not take into account the peak-to-valley of the system. The levels and distortions are based on a flat response. Large variations from this flat response will result in snowy pictures or cross-modulation/triple beat. Maintaining a flat response will allow descrambler information to reach the subscriber's converter. This information may be carried on the television audio carrier or in the broadcast band. Both of these sources are transmitted by FM, which will allow lower signal levels. A low signal would never be noticed by listening to the audio on a television or stereo. However, descrambled information is frequently amplitude modulated on the TV audio carrier, and it is susceptible to valleys or suckouts that would reduce the level going to the converter/descrambler.

When the system is swept to its design frequency, the system remains in a ready state to add channels without extensive repair work to get them through to the subscribers. This is particularly true when the pilots used do not represent the bandwidth that the system is capable of. Pilots of 3 and 12 should not be used on a system that operates to 300 MHz. In this lopsided selection, the automatic gain control (AGC) circuits do not see what is happening in the super-band. Pilots should be


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placed so that they represent the entire bandwidth of the system design. Even with improper pilots, regular sweeping will keep the entire system flat.

Controlling bandwidth

Each year, increasing numbers of cable companies are sweeping their systems. As 300 MHz equipment gained prevalence, the need for sweeping became apparent. The bandwidth has since increased to 450 MHz and above, which necessitates control of the large bandwidth. One question often asked of the larger frequency system has been: "Is a 450 MHz system more difficult to sweep than a 300 MHz system?" The answer is no. Although the actual time spent on the 450 MHz system is more, this occurs because there is more band to control. The degree of difficulty in sweeping a 450 MHz system is no more than a lower frequency system. In both cases, a logical process should be developed and followed to efficiently sweep the system.

You may wonder when you should sweep your system. The system should have been swept right after the rough balance. Doing this allows you to build a history of your system for future sweeping operations. It also will ensure that the system was constructed to high standards and that a long life is possible.

By using sweep equipment, we will evaluate the response of the system. Criteria are used to judge how flat the system is. The term peak-to-valley is used as a general term to describe the overall flatness and is a measurement from the highest amplitude frequency to the lowest amplitude frequency and is referenced in dB units. The specifications for a single amplifier usually are specified ± .25 dB. The formula for a cascade of amplifiers is dependent on the bandwidth being carried. When a system is operating at 330 MHz or less, an accepted peak-to-valley = n/10, where n equals the number of amplifiers in cascade. Thus, at a 20 amplifier cascade, an acceptable peak-to-valley would be 2 dB. In systems above 330 MHz, the formula changes to compensate for the increased bandwidth. The formula for expanded bandwidth systems = n/10 + 1, where n = number of amps in cascade. These two formulas work well beyond the 10th amp in cascade but are a little deceptive on the first amps in cascade. When working on the first 10 amps, strive to maintain the best possible peak-to-valley as this initial response will follow throughout the rest of the system.

Describing responses

While the peak-to-valley number gives an overall idea of what is happening to the entire bandwidth, it does not tell the whole story. *We are trying to avoid sharp changes in the amplitude over a narrow frequency range*. Frequently applied terms used to describe how the response looks within the prescribed bandwidth include (see Figure 1):

Flat Response—This term is used even though the response is not perfectly flat, but is well within the peak-to-valley flatness spec and does not exhibit sharp excursions or any of the following terms.

Roll-off—The high or low channels are attenuated more than they should be. Those channels "in the roll-off" are lower in amplitude than the other channels. Possible causes include:

a) The system is being operated at a frequency higher than the one for which it was designed.

b) A replacement cable with a higher loss than the original.

c) The cable is defective due to aging, poor construction or water ingress.

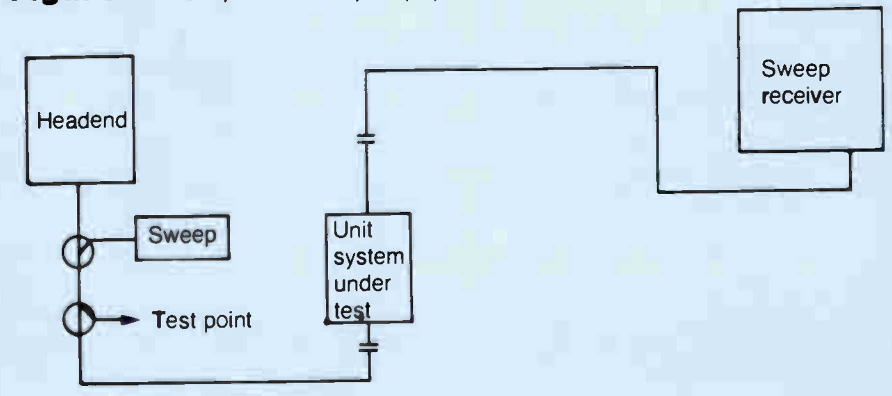
d) Defective amplifier or equalizer.

Hump—This is when the amplitude of some frequencies rise above the rest of the response. The increase occurs over a broad bandwidth and is a gradual one. One possible cause of a hump is under-equalization. If the equalizer does not properly compensate for the cable, the gain and slope controls will be adjusted so that the pilots, at least, are at the proper amplitude (this would occur during a rough balance). Another cause may be cable that does not follow the normal loss curve.

Valley—When the amplitude for some frequencies are lower than the other frequencies, a valley is present in the response. This results in a gradual change in amplitude over a wide bandwidth. Over-equalization can cause this type of response to occur.

Peak—An increase in the amplitude of signals over a small bandwidth that can occur

Figure 2: Setup for sweep equipment



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anywhere in the band; but this term is often reserved for the extremities of the bandwidth. In this case, the controls may be miss-set at the amplifier, and the equalizers are not tracking cable loss. Some equalizers compensate for the additional roll-off that might occur in the diplex filter. Used in a housing without diplex filters, they may over-compensate and increase the amplitude at the band edges.

Suckout—A large change in amplitude in the negative direction over a small bandwidth. The loss of grounding along the RF path is chiefly responsible for this happening. Proper grounding can be interrupted by loose screws on trunk modules, diplex filters, or on the motherboard. Connectors in and outside the housing that have loosened can cause loss of grounding. Cable that has been kinked also may cause this problem.

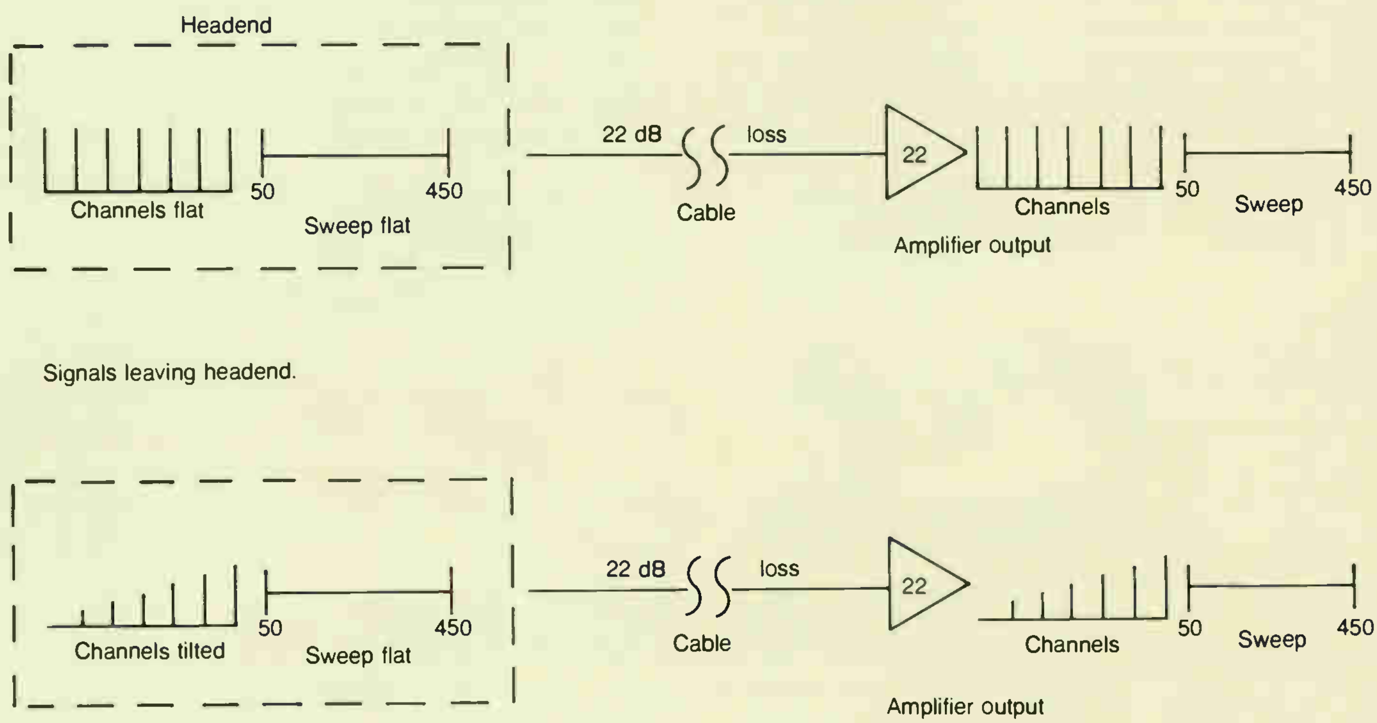
Spike—When the signals increase sharply over a narrow frequency range. Loose connectors, screws and other sources of reduced grounding can cause this problem.

Evaluating components

With the types of response that have been explained and shown, it is important that the different components of the system be evaluated on their own merits. Some problems such as suckouts and spikes could happen in any of the three major components: amplifiers, connectors or passives.

Don't overlook the possibility that equipment was installed improperly. Trunk amplifiers that are not secured with screws or clips will have excessive heat build-up and can cause re-

Figure 3: Sweeping tilt vs. flat



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sponse problems. Coring depths or center conductor lengths that have not been prepared to the manufacturers specifications are likely to give an inferior electrical and mechanical bond. Cable that has been stepped on or is nicked is no longer a continuous 75 ohm conduit. The difference in impedance reduces the amount of power that is transferred through the cable. Energy that does not make it to the next amplifier will be reflected back and forth along the cable. The reflections of unintentional mismatches could theoretically be cancelled by a calibrated kink in the cable. Although the process of being "dent tuned" is sometimes applied to the waveguide, any attempt to do this on coaxial cable would be extremely difficult. This is not considered a solution to reflections caused by damaged cable!

Sweep equipment

The equipment consists of two parts, the transmitter and the receiver. The transmitter remains in the headend or the beginning of the system. It generates the entire bandwidth of frequencies that the system is designed for, in the forward direction. The sweep of frequencies occurs at regular intervals. This injected signal is known as amplitude, and this amplitude becomes the standard for the output of each trunk amplifier.

The receiver is typically a portable unit that can be operated and is taken from one amplifier to another. The response is evaluated on the screen of the receiver. Any changes in the response that have occurred as a result of the signal passing through the cable passives or amplifiers is observed and corrective action is taken.

In theory, all sweep systems work the same. When it comes to application on a cable system that contains television, FM and data signals, the two major types of sweeps are classified as high level and low level. The high level sweep derives its name from the fact that the transmitter's output is above the TV channels being carried by 15 to 20 dB. The sweep receiver receives both sweep signal and TV channels and subtracts the TV channels from the incoming signal and displays only the sweep response. An example of a high level sweep device is the Wavetek 1855/1865. In a low level sweep, the transmitter generates a signal below the TV channels. The receiver displays the sweep signal and the TV channels being carried. The Avantek 2000 is an example of a low level sweep unit. There are advantages and disadvantages to both systems. Resolution (clarity of sweep), versatility and ease of use in the field have to be weighed when making the selection between units.

With either sweep system, you need to become familiar with the unit's operation. Someone who has worked with the equipment before can be informative. Extra features, however, are often overlooked when getting the information through a second source. Some necessary information should be obtained from the instruction manual.

Before the sweep equipment can be installed in the field, a back-to-back measurement should be made to determine how good the response of the test equipment is. The response of the system is rarely better than the response of the test equipment alone. The back-to-back test should be done with the same cable that may be used in the hookup of the receiver and transmitter to the system. A picture should be taken as record of the test equipment flatness. The sweep transmitter is connected into the headend lash-up with a directional coupler placed as close to the input to the trunk system as possible (Figure 2). An 8 or 12 dB directional coupler is often used providing the trade-off between insertion loss and tap loss. A second directional coupler often is installed after the sweep insertion directional coupler to monitor sweep response level and the level of the channels coming from the headend.

Tilted sweep?

"What will the response look like if the channels being carried are operating at a tilt from the headend? Will the sweep be tilted as well at the output of each amp?" The answer is no, provided that the tilt on the channels is added at the headend, not at the first amplifier (Figure 3). In order to satisfy the unity gain concept, each trunk amplifier should have the same output as the headend. If the levels are tilted leaving the headend and the sweep is flat, each successive amplifier will have tilted outputs in respect to channels and a flat output in respect to the sweep.

A trunk system that is tilted will sweep no differently than one that is operated with a flat output. Standard test points can be used, or with some amplifiers the input to the AGC or bridger can be accessed to give a more reliable test point. This second method is not as subject to the effects of mismatches beyond the amplifier that is being observed. Adding in for the value of the test points, the level of the sweep measured should be the same as where the sweep transmitter is inserted into the system.

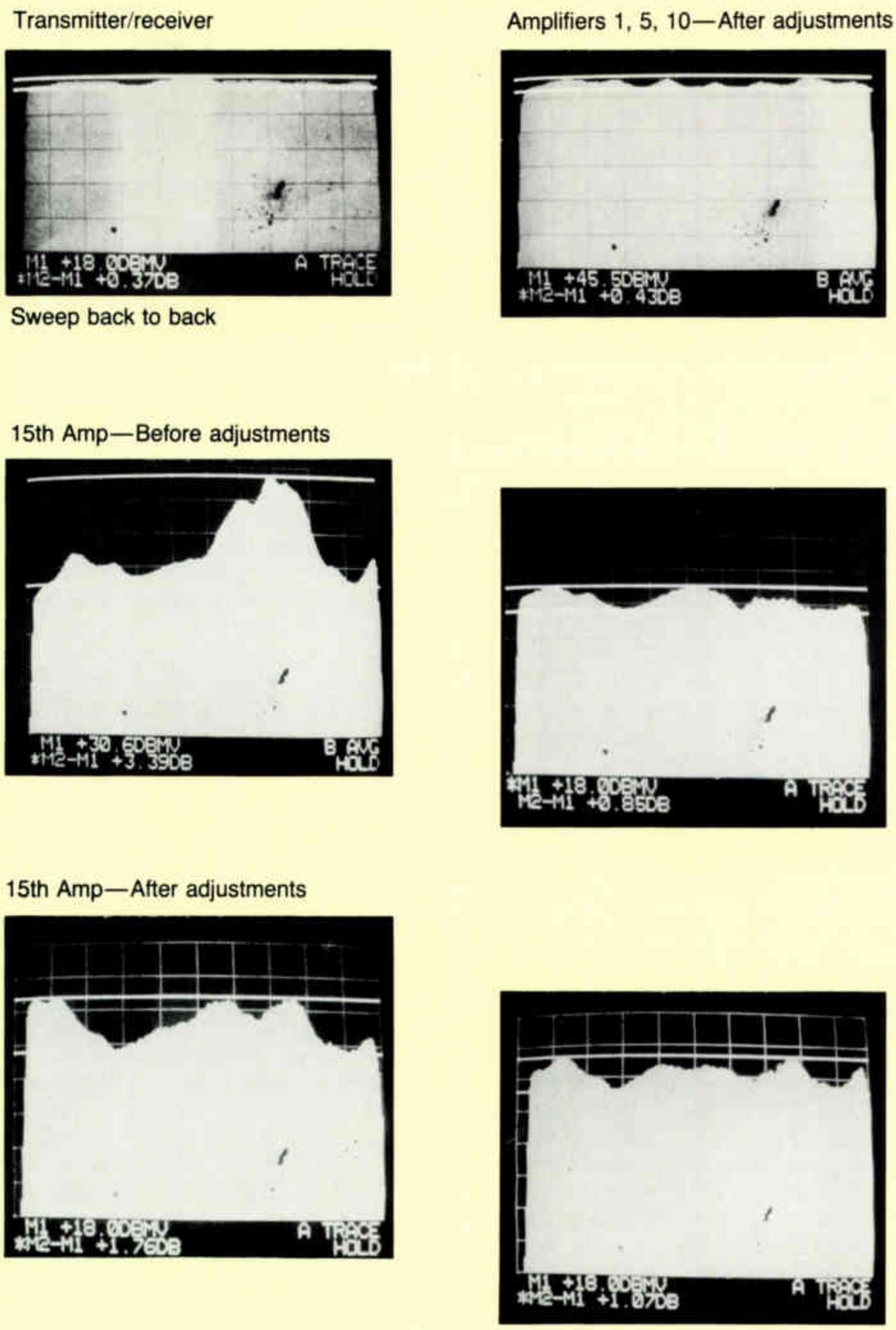
Necessary adjustments

In addition to the response, gain and slope range should be checked to ensure that there is adequate up and down range. The actual requirements differ with amplifier manufacturers, but amplifiers should operate in the middle of their gain and slope range. This should yield the best flatness and allow the automatic gain control and automatic slope control circuits to compensate over a wide temperature range. The AGC/ASC circuits may be working fine, but if there is no range left in the amplifier, levels will not be compensated for.

Controls for adjusting the response may be located on the equalizer, in the trunk housing or in the motherboard. These are considered standard controls to flatten the amplifiers and should be used to their full potential. The controls are interactive with each other so some time adjusting different controls will be required. It is a good idea to adjust only one control at a time. If the adjustment yields an improvement in the response, leave the control in that position (see Figure 4). If there is no apparent improvement or a degradation, return the control to its original position and proceed to the next control. It will take some time to get to know an amplifier's different controls. Working with the amplifier on the bench with sweep equipment can be very beneficial to determining what adjustments are available.

Some amplifier models have additional plug-in response equalizers or debumpers that are available to take care of special response problems. A word of caution about these devices. They can have a high insertion loss that may limit AGC/ASC action. They also may cover up a severe problem such as a suck-out due to a loose connector. The suck-out could change its frequency or the connector could separate, causing a total outage. Use care when these devices are used. While in most cases you will try to get the best possible peak-to-valley, there is a trade-off that may be exercised to improve a roll-off or other response problem that has been building up through the cascade. If you find yourself saying "If I could only get rid of this ______, the peak-to-valley would be fine," controls may be adjusted to give improved response in the area of the problem at the expense of an overall degradation in the peak-to-valley. These are judgment calls that you will be making as you sweep through the cascade.

Figure 4: Sweep pictures—before and after adjustments



The process

It is easier to sweep a previously swept cascade for two reasons. Even if the cascade was swept some time ago, no doubt many of the original problems have been cleared up. There is also a picture history of how the cascade looked at one time, proving that the flatness can be achieved. The history will be added to by each successive sweep of the system.

If you are the first to sweep the system or the first to document this event, you should go through the cascade after the rough balance and take pictures of the sweep response without flattening. This will give you an idea of what kind of problems you are having at the end of the cascade. Film is cheap compared to the time spent trying to reverify what could have become part of a permanent record.

When you are sweeping, strive to get the best possible peak-to-valley in the first 10 amps. This will take extra time, but it's worth it. The response that you develop in the first amplifiers will follow out to the end of the cascade. Try to sweep when the temperatures are moderate. This will reduce changes in peak-to-valley due to severe temperature changes caused by different gain and slope levels. Previous sweep work always should be checked from the day before.

The forward sweeping operation should be from the headend out; backtracking consumes a lot of time. The sweep transmitter should be turned off when not in use. Interference to subscribers may occur when the transmitter is operating in the system. This can be reduced to a minimum by using low sweep levels and turning off the transmitter during the prime-time hours.

Sweeping the distribution system is not done to the same extent as trunk. If the trunk can be swept flat, the distribution with its short distance should remain relatively flat. There are many physical connections and passive devices on the distribution line. Most line extenders do not have provisions for adjusting the response. Aside from solving problems relating to poor installation of the equipment, the response that occurs is not adjustable by the line extenders gain and slope controls.

We have covered a number of points on how to properly maintain your system. When you are sweeping, take time to learn the controls on the test equipment and the amplifiers. Develop a logical process for trouble shooting passive/cable/amplifier problems, and document your work to build up a history file on the system. Regular sweeping will reward you with a well-performing system, less maintenance and a readiness for additional channels as they are required.

Equipment reliability prediction

By James R. Van Cleave
Vice President of Engineering
Jerrold Division, General Instrument

I would be preaching to the choir to say that the only plant reliability number that really matters is the quantity of service calls per plant mile per year. But how could a manufacturer specify equipment in that way? And how could an operator verify the reliability if stated in any other terms? These basic questions lead to other questions, such as: "What are hard vs. soft failures?"; "Can we predict reliability?"; "Can we test reliability?"; "Are power doubling and feedforward more prone or less prone to failure?" Unfortunately, there are many opinions offering plenty of confusion to the above issue. This article will attempt to investigate the above questions in light of what the U.S. Department of Defense (DOD) has accomplished toward establishing the science of reliability engineering.

Air Force reliability

About 20 years ago, the DOD had a problem not unlike that of many system operators today. There were no standards for reliability prediction or testing, but lots of promises from potential equipment suppliers, which were masked by much confusion and accented with several classic examples of users being "burnt" by poor field reliability.

'The need to keep the parts cool cannot be overemphasized in regard to reliability'

Amidst all this, engineers from the Rome Air Development Center at Griffis Air Force Base in Rome, N.Y., kept claiming that they knew what ought to be done to organize the reliability issues. They convinced the Air Force, and since they volunteered to fix the problem, they got the assignment. They did such a good job that the Army and Navy adapted their work and use it to this day.

Murphy had it easy compared to the engineers at RADC whose task was to figure out how to predict an equipment's reliability prior to field implementation and, in fact, prior to design. The idea is that if the prediction falls

Table 1: Environmental symbols and descriptions

Environment	π_F symbol	Description
Ground, benign	G_B	Nonmobile, laboratory environment readily accessible to maintenance; includes laboratory instruments and test equipment, medical electronic equipment, business and scientific computer complexes.
Ground, fixed	G_F	Conditions less than ideal such as installation in permanent racks with adequate cooling air and possible installation in unheated buildings; includes permanent installation of air traffic control, radar and communications facilities, and missile silo ground support equipment.
Ground, mobile	G_M	Equipment installed on wheeled or tracked vehicles includes tactical missile ground support equipment, mobile communication equipment, tactical fire direction systems.
Space, flight	S_F	Earth orbital. Approaches benign ground conditions. Vehicle neither under powered flight nor in atmospheric reentry; includes satellites and shuttles.
Manpack	M_P	Portable electronic equipment being manually transported while in operation; includes portable field communications equipment and laser designations and rangefinders.
Naval, sheltered	N_S	Sheltered or below deck conditions, protected from weather; includes surface ships communication, computer, and sonar equipment.
Naval, unsheltered	N_U	Nonprotected surface shipborne equipment exposed to weather conditions; includes most mounted equipment and missile/projectile fire control equipment.
Naval, undersea, unsheltered	N_{UU}	Equipment immersed in salt water; includes sonar sensors and special purpose anti-submarine warfare equipment.
Naval, submarine	N_{SB}	Equipment installed in submarines; includes navigation and launch control systems.
Naval, hydrofoil	N_H	Equipment installed in a hydrofoil vessel.
Airborne, inhabited, transport	A_{IT}	Typical conditions in transport or bomber compartments occupied by aircrew without environmental extremes of pressure, temperature, shock and vibration, and installed on long mission aircraft such as transports or bombers.
Airborne, inhabited, fighter	A_{IF}	Same as A_{IT} but installed on high performance aircraft such as fighters and intercepters.
Airborne, uninhabited, transport	A_{UT}	Bomb bay, equipment bay, tail, or where extreme pressure, vibration, and temperature cycling may be aggravated by contamination from oil, hydraulic fluid and engine exhaust. Installed on long mission aircraft such as transports and bombers.
Airborne, uninhabited, fighter	A_{UF}	Same as A_{UT} but installed on high performance aircraft such as fighters and intercepters.

Table 2: Diode failure rate vs. environmental factor

Environment	π_E
G_B	1
S_F	1
G_F	6.4
N_{SB}	8
N_S	11
A_{IT}	25
M_P	35
G_M	31
N_H	54
N_{UU}	58
A_{UT}	40
N_U	33
A_{IF}	50
A_{UF}	80

Note: The outdoor failure rate is between 11 (N_S) and 33 (N_U) times worse than indoor (G_B).

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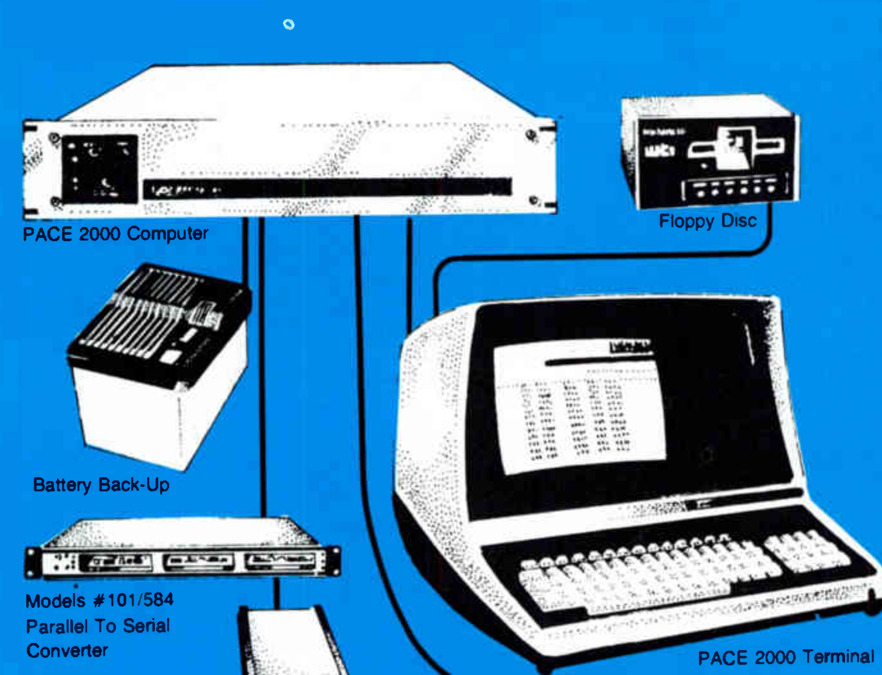

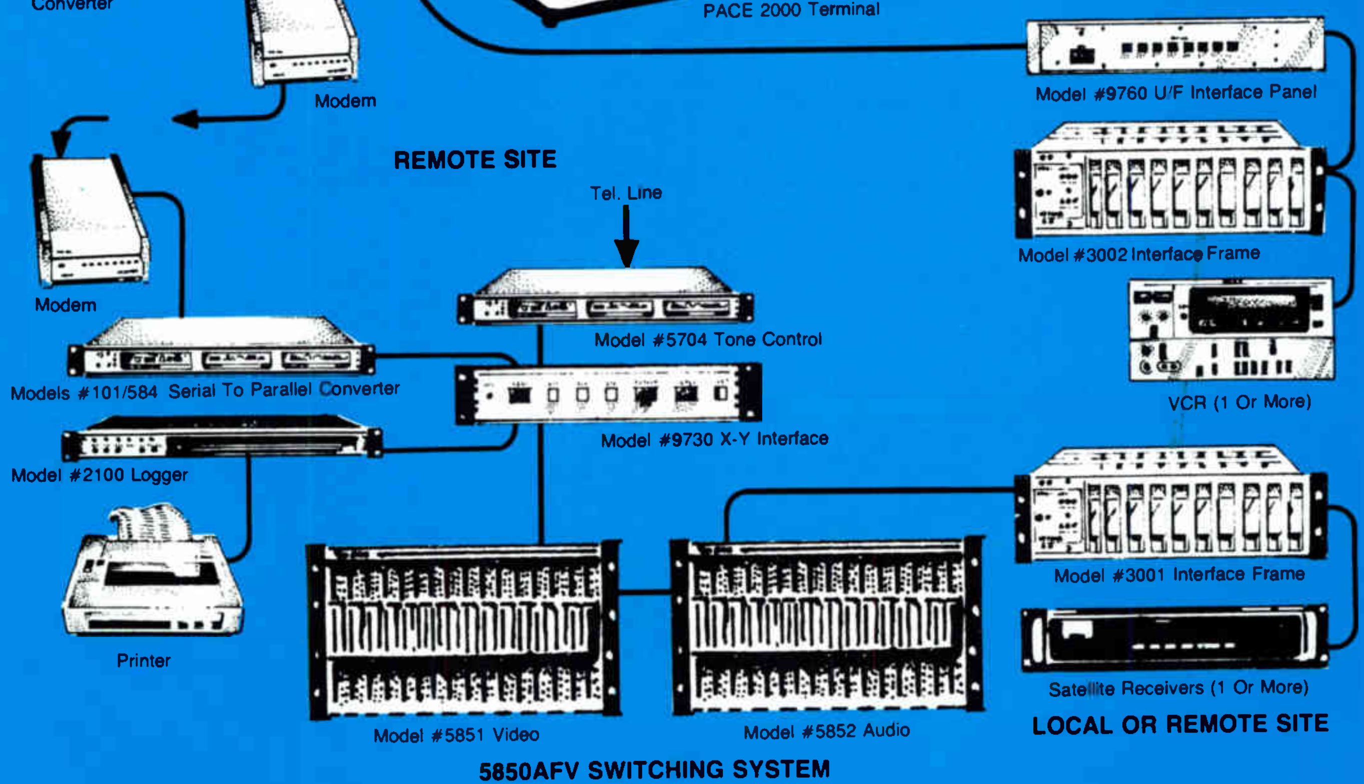

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short of the goal, then the design can be changed before it is cast in concrete. In order to do this, it was necessary to analyze just why things sometimes go wrong, that is, the failure mechanisms of each and every component and connection within an equipment. They also had to analyze the failure rates of each part, had to find how to specify the part to assure that the acceptable failure rate would not be exceeded, and even had to determine how to reduce the failure rate by increasing the part quality. This action caused the inclusion of maximum allowable failure rates within virtually every component MIL-SPEC, a seemingly overwhelming task involving hundreds of specifications and thousands of vendors and vendor parts. They wrote a handbook on prediction, and call it MIL-HDBK-217, now on revision E.

Failure rate factors, quality levels

Fundamentally, part reliability has to do with the following failure rate factors (FRFs):

1. The intrinsic failure rate of the best possible manifestation of that part, operating under controlled conditions and operating at a tiny fraction of its ratings. This is termed λ_b, or base lambda.
2. Degradation (of the intrinsic rate) due to various lower quality levels, termed π_Q.
3. Degradation due to environment, termed π_E.
4. Degradation due to operation at higher fraction of part rating, termed π_R.

As a coarse generality, the more complex a part is, and the more interconnections it contains within, then the more prone to failure it is. Accordingly, the contributors to failure are, in (very rough) order: microprocessors, memories, digital ICs, linear ICs, transistors, diodes, capacitors, resistors, inductors, connectors, and even printed wiring boards, solder joints and jumper wires.

The intrinsic failure rate is that which prevails after any "infant mortality" failures have occurred. MIL-HDBK-217 can't predict infant mortalities.

There are several quality levels, ranging from space qualified through various MIL-SPEC levels. Unfortunately, commercial parts typically fall into a lower category, and since DOD is vehemently negative toward anything non-MIL-SPEC, they assign the worst possible degradation toward commercial parts. Off-shore parts, such as those from Japan, are essentially forbidden in military equipment. This is not because they aren't reliable, but because no non-U.S. vendor can be properly controlled by the DOD specification and procurement rules, notwithstanding the fact that our entire consumer electronics industry uses parts and manufacturing from Far East sources. Our DOD simply can't enforce the MIL-SPECs in Japan. Of course, this must not be misconstrued to say that off-shore parts are bad, or even necessarily poorer than MIL-SPEC; it simply means that an equipment supplier must rely on his own means to determine intrinsic part reliability, by specification and/or independent testing. General Instrument, as an example, established programs years ago for specifications, procurement offices and testing for off-shore component reliability and quality assurance. It nevertheless is true that many off-shore parts are totally unacceptable for use in cable

Table 3: Aluminum electrolytic capacitor failure rate vs. environmental factor

Environment	π_E
G_B	1
S_F	1
G_F	2.4
N_{SB}	5.8
N_S	6.7
A_{IT}	8.5
M_P	12
G_M	12
N_H	19
N_{UU}	20
A_{UT}	21
N_U	13
A_{IF}	17
A_{UF}	42

Note: Outdoor applications are between 6.7 and 13 times more prone to fail than indoor.

Table 4: Connector failure rate vs. environmental factor

Environment	π_E
G_B	1.5
S_F	1.5
G_F	4.7
N_{SB}	8.1
N_S	11
A_{IT}	15
M_P	17
G_M	25
N_H	26
N_{UU}	28
A_{UT}	15
N_U	27
A_{IF}	30
A_{UF}	30

Note: Outdoor applications are 7.3 to 18 times higher than indoor failure rates.

Table 5: Failure rate vs. junction temperature for transistors

T_J(°C)	π_T	T_J(°C)	π_T	T_J(°C)	π_T	T_J(°C)	π_T
25	0.10	51	1.7	77	18.	103	142.
27	0.13	53	2.0	79	22.	105	165.
29	0.16	55	2.5	81	25.	110	236.
31	0.20	57	3.0	83	30.	115	335.
33	0.25	59	3.6	85	35.	120	472.
35	0.31	61	4.4	87	42.	125	659.
37	0.39	63	5.2	89	49.	135	1,252.
39	0.48	65	6.3	91	57.	145	2,308.
41	0.60	67	7.5	93	67.	150	3,099.
43	0.73	69	9.0	95	78.	155	4,134.
45	0.90	71	11.	97	91.	165	7,210.
47	1.1	73	13.	99	106.	175	12,272.
49	1.4	75	15.	101	123.		

Note: The failure rate (π_T) approximately doubles for every 9°C increase in IC junction temperature.

plant equipment because they will likely fail prematurely, due to environment.

The environmental factor

Suppose one were to take the electronics from a set-top converter, add temperature compensation such that the converter performs from the -40°C to +70°C range associated with outdoor plant, repackage it into an outdoor off-premise converter (OPC), and put it into the field. We would expect (and some unfortunate users are experiencing) an increase in failure rate of between 10 and 15 times worse. That is, if the set-top failure rate was 2 percent per year, the OPC failure rate is typically 25 percent per year. Even worse for the operator, a set-top failure is a subscriber carry-in, but an OPC failure is a truck roll. This unfortunate fact is being proven in at least one U.S. city right now, and the embarrassing part is that it is predictable using MIL-HDBK-217!

Taken from MIL-HDBK-217, Table 1 lists the environmental categories. A set-top converter is certainly ground benign (G_B), not having to undergo much temperature cycling and vibration. Plant equipment, however, is somewhere between Naval unsheltered (N_u) and Naval sheltered (N_s), depending on location. Southern California is a lot kinder to electronics than is Butte, Mont., but the plant equipment has to be designed for both. While there is considerable vibration conducted through the strand and cable from street traffic, the big stress is from day-night temperature cycling. Even in Southern California, the day-night temperature change can be 30-40°F, due to sun loading. In Rocky Mountain areas, the temperature can vary by as much as 90°F within hours.

The prediction degradation due to environment is consistent with fatigue due to mechanical flexing of the innards of the component; that is, wires, bonds and substrates will weaken and break after so many flexings. It's literally wear and tear on a microscopic scale. Tables 2, 3 and 4 show typical component failure rates versus environmental factors. And the environmental factor tells another thing: The failure rate exhibited in a constant temperature life test setup always should be much better than that of the real world outside.

Ratings and heat

The closer a part operates to its maximum ratings, the more prone to failure it is. Of particular importance are applied voltage breakdown, maximum current and highest temperature. Excess voltage can rupture dielectrics or semiconductor junctions. Current ratings usually are associated with microscopic heating. Designing well within the maximum ratings of current and voltage, such that the associated reliability degradation is small, is usually a straightforward design exercise. Minimizing operating temperature, however, isn't so easy, and heat becomes a chief contributing factor, especially for the new trunk, bridger and line extender amplifier approaches of power doubling, feedforward and dual feedforward. Power doubling doubles the heat over that of a single push-pull cascode IC. A feedforward stage generates about 3.5 times that of a push-pull cascode IC.

Also from the MIL-HDBK-217, Table 5 says that transistor failure rate essentially doubles for every 9°C increase in die temperature. This means that power doubling technology, which promises reliability improvement due to redundancy, does generate more heat which, if not reckoned with, could negate the reliability goals. A power doubling IC that simply parallels each of the four transistors with four more, produces twice the heat for the same size IC substrate. If the four transistor die operated at 30°F above the housing temperature, the eight power doubled die could operate at 60°F above, if all else remained unchanged. In this case, going to a power doubled IC would increase the failure rate by almost four over that of a push-pull cascode IC. And of course, failure of any of the eight transistors, usually in a shorting mode, would cause catastrophic failure in IC gain. For this reason, Jerrold has chosen to use two push-pull cascode ICs coupled by "Magic-T" hybrids for isolation, providing cool operation and only a moderate gain loss in the event of an IC failure.

The need to keep the parts cool cannot be overemphasized in regard to reliability. To do this, mechanical packaging is very important, with emphasis on large heat sink areas and high cross-sectional area of heat conducting paths; in short, this means bulky aluminum casting modules, lots of fins on the outside, and thermal grease on all heat-conducting interfaces. This also extends to the power supplies, where it is important to minimize heat generation by high conversion efficiency and sinking of any heat generated to the outside rather than conducting it to other electronics.

Failure rate formula

In consideration of the aforementioned failure rate factors, the failure rate for every part within an equipment can be predicted using MIL-HDBK-217. The symbol λ (lambda) is used to denote the failure rate, and is usually expressed in failures per million hours (FMH). A typical formula is:

$$\lambda = \lambda_b \times \pi_E \times \pi_Q \times \pi_R$$

All of the factors thereby directly degrade reliability.

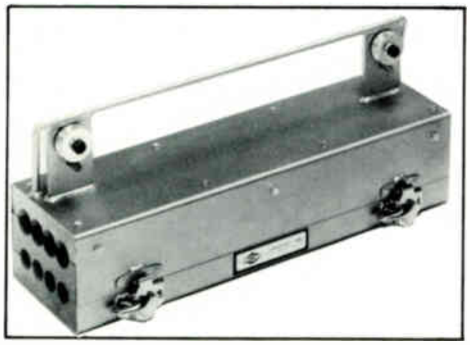
MIL-HDBK-217 also provides a generic (parts count) failure rate prediction procedure that is less accurate but much easier since it does not require stress analysis and rating evaluations.

The point here is not that all cable plant equipment should undergo MIL-HDBK-217 analysis. Rather it is that the science of reliability engineering is well established in the government electronics sector, and that we will do well to consider what others have found. The philosophy within MIL-HDBK-217 is totally consistent with the philosophy of highly reliable cable equipment.

Addressable cradle

Pioneer Communications of America Inc. introduced an addressable cradle that gives operators a vehicle to move into addressability by upgrading a standard converter to an addressable converter. The addressable cradle utilizes an out-of-band data carrier for its enabling map instructions and an in-band tag for authorization of the cradle descrambler. The unit is compatible with Pioneer's coded-key video scrambling and Jerrold's Tri-mode scrambling. The crade will be available in July.

For more details, contact Pioneer Communications of America, 2200 Dividend Dr., Columbus, Ohio 43228, (614) 876-0771.



Cable straightener

Used ahead of the lasher, the Lemco cable straighteners eliminate wee-wahs, organize cable and provide uniform lashing tension, according to the firm. These tools feature 1-inch holes for trunk cable and ¾-inch holes for the feeder. The overall length of 19 inches ensures straight cable. Hardened rollers work on either ¼-inch or 5/16-inch strand. Available in two-hole, five-hole and eight-hole models.

For additional information, contact Lemco Tool Corp., R.D. #2 Box 330A, Cogan Station, Pa. 17728, (800) 233-8713 or (717) 494-0620.

Security box

The Comptroller is designed to virtually eliminate theft of service, cut down on time used for auditing, and decrease time used for installation and disconnection of service, according to Brink Security Boxes Inc., manufacturer of the product.

The cover is 14-gauge steel. It has solid welded seams at the corners and a full lip at the bottom. The cover is locked into place with carbon steel barrel locks. These locks seat flush with the cover to protect them from being sawed or chiseled off. Under the outer cover is the inner panel. This panel acts as a second locking barrier against a would-be cable thief. It also serves as a mounting bracket for incoming jumpers from the taps and outgoing postwires (or prewires). The Comptroller comes in two sizes, an eight-outlet and a sixteen-outlet. Both boxes are designed to accommodate one additional outlet per apartment unit.

For more details, contact Brink Security Boxes, P.O. Box 1154, Port Neches, Texas 77651, (409) 721-5101.

Hex crimp tools

Ben Hughes Communication Products Co. Inc. added four new hex crimp tools to its Cable-Prep product line. The HCT-325, HCT-340 and HCT-775 expand the RF connector application series of crimp tools. The HCT-669 is for CATV, MATV and STV applications.

The HCT-325 crimps UHF connectors on RG-8 and RG-58; it combines four hexes on a larger jaw. The HCT-340 crimps BNC connectors on RG-174, RG-179, RG-187 and RG-188. The HCT-775 will crimp Gilbert N connectors for RG-58, RG-59 and RG-6.

The fourth crimp tool, the HT-669, is a combination tool, on the new larger jaw, of Hughes' HCT-659 and HCT-660.

For more information, contact Ben Hughes Communication Products Co., 304 Boston Post Rd., Old Saybrook, Conn., 06475, (203) 388-3559.

Satellite antenna

Miralite announced a new 5-meter Clear Aperture antenna designed for receive and transmit at both C- and Ku-bands. The Clear Aperture design features outstanding sidelobe performance and excellent gain, according to the firm. There are no feed or support structures interfering with the main beam.

The antenna designs have a first sidelobe level of −30 dB/peak and provide equal beamwidth and sidelobe superiority in all planes. The projected Clear Aperture is a perfect circle.

The design also assures outstanding performance in normal installations, and is ideally suited to 4 GHz severe interference applications where traditional symmetrical focal point-fed reflectors are frequently incapable of delivering clean downlink. The standard feed has an aperture diameter of 2.4 lambda and edge taper of −16 dB, providing less than 4 percent spillover with smooth taper and constant beamwidth.

The Clear Aperture also is for multibeam service. The high focal length-to-diameter ratio enables 4 degree arc coverage at 12 GHz and 15 degree at 4 GHz, for −1 dB gain reduction. Polar mount is standard and several drive options are available.

For more details, contact Miralite, 4050 Chandler, Santa Ana, Calif. 92704, (714) 641-7000.

Block downconverters

The Panasonic Industrial Co. introduced two C-band low-noise block downconverters that provide satellite video reception on smaller antenna sizes. The converters operate in the C-band, 3.7 to 4.2 GHz. Model CI-LNB-100 has a low-noise specification of 100°K max., while model CI-LNB-85 has a low-noise specification of 85°K max. Both converters utilize premium quality GaAs FETs in a three-stage RF amplifier configuration. The IF output frequency is 950 to 1450 MHz.

Panasonic converters utilize a stable ce-

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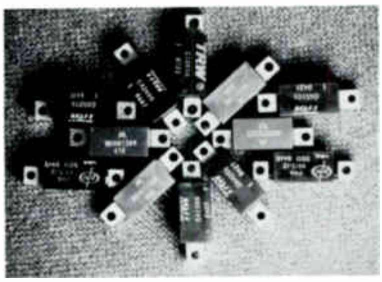

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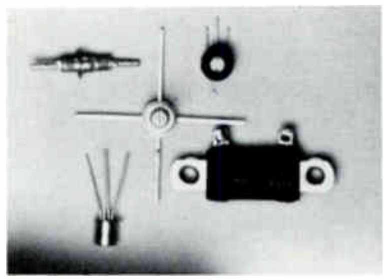

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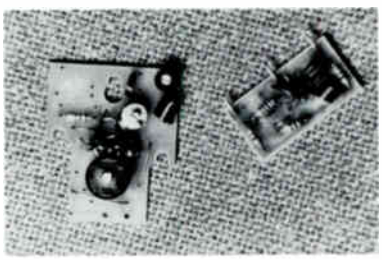

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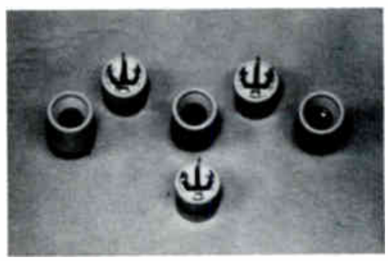

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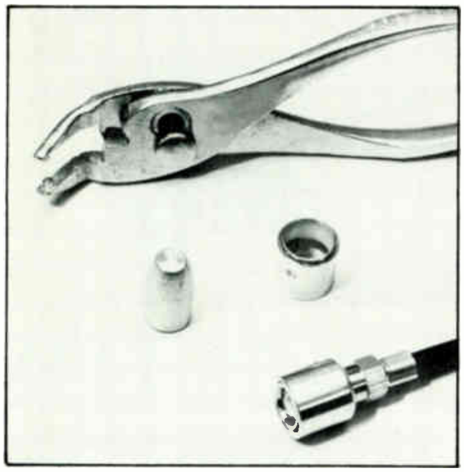
ramic resonator local oscillator to assure service with minimum drift for temperature variations. They feature low input and output VSWR and tightly controlled gain variation. The units are powered by a low DC voltage that is applied to the converter through the IF output connector, and incorporate an internal IC voltage regulator. The converters are packaged in a cast aluminum case with an integral waveguide flange and offer waterproof construction.

For more information, contact Panasonic, One Panasonic Way, Secaucus, N.J. 07094, (201) 392-4109.



BNC components, grounding block

LRC Electronics introduced new crimp-on BNC connectors. This one-piece connector has no loose parts and attaches directly to the coax by crimping. Standard hex crimping tools are required as used on the most common "F" style connectors. For use in headends, with test equipment, in LANs or anywhere BNC connectors are used. Available for most RG59, RG6 and RG62 cables.

LRC also introduced a BNC security shield that may be used on all manufacturers' male BNC connectors. It eliminates tampering and unauthorized changing of connectors anywhere BNCs are used; and once installed it remains on the connector permanently, resulting in a one-time investment. Installation and removal tools allow removal of the BNC from the mating connector; however, the shield stays on the BNC male.

Finally, the firm introduced a new aluminum grounding block available with or without a pipe clamp attachment. This block is raised away from mounting surface to allow installation of "F" fittings. The pipe clamp permits attachment directly to any water pipe. The grounding block is made of a die cast aluminum block with a machined brass cadmium-plated "F" connector. To order the ground block, specify part number GB-81. To order the pipe clamp version, specify part number GB-81PC. Proper mounting hardware is included with each version and the pipe clamp also is available in a dual style block manufactured from zinc die cast. Specify part numbers DGB-81 and DGB-81PC.

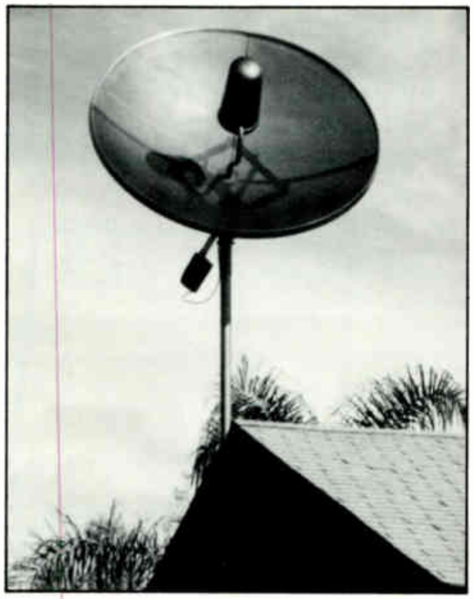
For more information, contact LRC Electronics, 901 South Ave., Horseheads, N.Y. 14845, (607) 739-3844.

Oscilloscope, roll base

A compact dual-trace LCD digital storage oscilloscope is now available from CWY Electronics. The Model 1000 oscilloscope fits into a briefcase for transportation and on-site analysis. It is ideal for field service, design engineering and plant maintenance, according to the firm. Its battery-operated memory allows remote data analysis.

CWY also introduced the Model RR/RB roll base for relocating headend racks. The role base, designed to accommodate the CWY Model RR72 rack, is shipped assembled and comes with locking casters and outrigger-style supports, and is support weight rated at 500 pounds. The RR72 rack bolts tightly to the roll base. Dimensions of the roll base are: 2½" high, exterior 26¼" by 27", interior 20" by 20¾" and shipping weight is 12 pounds.

For more information, contact CWY Electronics, P.O. Box 4519, Lafayette, Ind. 47903, (800) 428-7596; in Indiana, (800) 382-7526.



Satellite dish

Winegard introduced a new six-foot perforated aluminum rooftop antenna. Because of the antenna's small size, Winegard offers two mounts for flat, sloping or peaked roof installations. A third mount secures a pipe alongside a house for above-roof-height installation. All mounts permit coverage of the orbital arc, require no special orientation, and include stainless steel hardware. The Mini-Ceptor™ incorporates the same "deep-dish" design that provides interference rejection and side lobe suppression in Winegard's eight- and 10-foot perforated aluminum antennas. The reflector's 35.4 dB gain and 60 percent efficiency rating is achieved through a design that allows the dish to be die-stamped to a precision-formed petal with just a 32/thousandths-of-an-inch tolerance. The stretched-formed outer ring provides additional stability while maintaining the parabolic integrity of the reflector.

Shipped in four quarters, the antenna weighs 22 pounds and can be assembled by one installer. A smoked chrome finish guards against the elements, and the antenna has a wind survival rating of 125 mph. A scaled-down version of Winegard's back-up structure and mini-mount is included with each dish.

For more information, contact Winegard Co., 3000 Kirkwood St., Burlington, Iowa 52601, (319) 753-0121.

Silicone sealants, dielectric compounds

A utilization guide for silicone rubber adhesive-sealants and silicone dielectric compounds in cable TV and general electrical applications is now available from General Electric's Silicone Products Division. These durable silicones, according to the manufacturer, can help simplify the installation of cable TV components while providing long term protection.

GE's RTV108 adhesive-sealant has been used as a cure-in-place seal for cable splices, providing protection against water and direct contamination, according to the company. It also can be used to seal connectors, adaptors, feed-throughs and house hooks. In such applications, the room temperature vulcanizing rubber sealant can be applied directly from the cartridge and the cured seal will remain resilient and resistant to temperature extremes.

GE's G635 dielectric compound is a companion product for providing protection in cable TV installation. In CATV applications, it can be used as an environmental seal and lubricant for F fittings, taps, traps and ground blocks. The compound is a medium-to-soft consistency grease with waterproofing capabilities. Because it is silicone, it will not melt or run off, even at temperatures to 450 F, or harden at temperatures as low as −100 F.

To obtain a copy of the publication, contact General Electric Silicone Products Division, Waterford, N.Y. 12188, (518) 237-3330.

Like-new equipment

A 36-page illustrated catalog offering thousands of like-new, state-of-the-art electronic instruments for sale has been published by Genstar REI Sales Co. The catalog describes nearly 50 categories of sophisticated electronic devices—manufactured by more than 75 companies. Products listed for sale have been removed from the rental inventory of parent company Genstar Rental Electronics Inc. and are offered with full warranties.

Instrumentation for sale includes: amplifiers, analyzers, attenuators, calibrators, counters, couplers, desktop computers, filters, generators, meters, PROM programmers, oscillators, oscilloscopes, printers, DC power supplies, recorders, sources, synthesizers, terminals, test bridges, chambers, and sets.

Catalog copies may be obtained from Genstar REI Sales Co., 6307 De Soto Ave., Suite J, Woodland Hills, Calif. 91367, (800) 227-8409 or (818) 887-4000.

Test equipment

Leader Instruments Corp. announced the availability of its new 1985 test and measurement catalog. This 80-page catalog details complete features, specifications and applications on more than 100 products, including 19 new products.

Leader's new 35 MHz two-channel digital storage oscilloscope and the 100 MHz three-channel dual time base oscilloscope are among the most notable of the new products presented in the catalog. Leader also is introducing a new line of signal and sweep generators including a 520 MHz synthesized signal generator and a 1.5 GHz sweep/marker generator. The new Technicart™ series of instrument carts also is highlighted.

For further details or a free copy of the catalog, contact Leader Instruments Corp., 380 Oser Ave., Hauppauge, N.Y. 11788, (516) 231-6900.

Combiners, filters

Microwave Filter Co. has published a catalog containing a new and expanded line of broadcast filters for ITFS, MDS and UHF. It also mentions several products still under development for which customers have expressed interest. The BTV/85 features instructional television fixed service (ITFS) products such as channel combiners and bandpass filters for combining or separating several individual channels or groups of channels. Introduced is the ITFS/MDS coupler, which combines the MDS band to existing ITFS systems, along with filters for a variety of MDS and UHF applications.

Television relay bandpass filters for electronic news gathering and diplexers for combining or separating two frequency bands are summarized. And mention also is made of other MFC products for suppressing terrestrial interference at satellite earth station antennas, and filters and traps for cable television. In-line coaxial relays for remotely switching two to nine antennas with a single coaxial cable to the radio also are described.

For a free copy of the catalog, contact Microwave Filter Co. Inc., 6743 Kinne St., East Syracuse, N.Y. 13057, (800) 448-1666.

Proper tower grounding

By Arthur F. Schoenfuss
Director of Engineering, Heritage Communications

Spring is here. Summer will follow soon, and with it, more lightning will come! A typical ground connection, like the one in Figure 1, has a low DC resistance and satisfies safety codes, but is not good enough when lightning hits. In a major lightning stroke, the instantaneous current may go from zero to 10 or 20 thousand amperes in a fraction of a millisecond. Most of the destructive energy is transferred at an equivalent frequency of several megahertz. If a ground connection has right angles, those angles have inductance, and at such frequencies, the inductance causes high series impedance.

That is why "lightning does not like to go around corners." It is more apt to follow a straighter capacitive path, because at RF frequencies, the capacitance becomes low impedance. Thus the lightning will jump through coax cable and radio equipment with that portion of the lightning bolt that involves the most energy in the least time and therefore does the most damage.

The answer is to provide ground paths that do not have any right angles or bend more than 30 degrees. An example of this principle is shown in Figure 2. It will be well worth the time and trouble to correct the grounding on all your towers, because it will greatly reduce the chances of damage to equipment when lightning strikes.

Figure 1

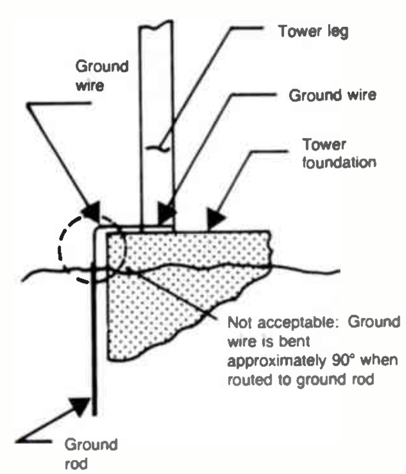
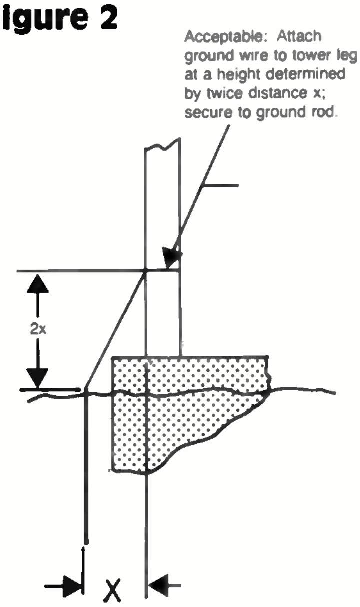


Figure 2



The art of pulling cable

By Anthony J. DeNigris
President, Nationwide CATV Services Inc

Sounds like a simple subject to discuss; pulling cable. Well, quite often the lineman's job mistakenly is thought of as a relatively simple function by those who don't really understand the skills one must possess in order to perform a quality job. You don't just have to be a rough and tumble type person and learn how to stick a gaff in a pole to call yourself a lineman, as many apprentices might think. All the rest, and there is an awful lot of it, doesn't come easily or quickly. Besides the necessary skill and time it takes to gain experience, a continuing awareness of safety practices and an understanding of the inherent hazards of the job must always be present.

Dilemas and decisions

The actual task of getting cable in the air, that is, placing strand along a tentative pole line, and then lashing cable to it gets quite involved. A line crew may face situation after situation, each requiring a decision as to its handling. What type of circumstances could develop in order to present a dilema that a line crew would have to overcome in order to do the job properly and safely?

Before I explore the preceeding question, I would like to pick at a couple of words in it, namely *properly* and *safely*. I can recall times when I have viewed linemen working for the sake of speed alone; and workmanship and safety did suffer. Too many linemen have been categorized as "good" because they happened to be fast.

Sensible operation?

Starting with the stranding operation, a crew would set up a trailer, and in this case lets say that the set up was done properly. But, the street that the pull is taking place on is laden with parked cars and driveways. Now, what the crew doesn't do is to take precautions in anticipation of possible problems due to this obvious fact. They start framing poles and stringing the strand through the clamps but they are not thinking properly. The clamps are set very loose because they know that the pull becomes increasingly more difficult and slower if they set them with the right amount of tightness necessary to not allow the weight of the strand between poles to sag itself down as it commonly does. And when it does it usually will droop down over the parked cars or driveways, and even onto sidewalks.

There are many reasons for strand sagging way down during the pulling operation, and one of them is not the lack of use of so called "clamp attached strand brakes." These little items are placed at the strand clamp at various intervals along a run while the strand is being pulled out. They allow for one-way slippage of the strand through the device, and were primarily designed as a protection against the possibility of the pulling grip letting go and the strand sliding back through a series of clamps. These clamps should be placed and used properly, or should I say strategically; but they are not the trick of the trade when it comes to preventing the weight of the strand from sagging forward (in the direction of the pull) and down into trouble. The real culprit in these cases is man; or man's preoccupation with speed.

How about lack of experience and training in the proper methods? How about haphazardly performing the task of pulling? What does that mean? That means flooring the gas peddle when the lineman on the pole gives the signal and seeing how fast you can make it to the next pole. When this takes place, the strand reel back at the trailer starts spinning fast and builds up a sort of momentum, as it has been jerked by the forward force applied too fast by the driver. When the driver gets to the next position, usually somewhere past the next pole he stops; but the reel back there somewhere doesn't. Nobody's there to slam the brakes on. And not only will this extra spillage from the reel try to spread itself out along the run, the extra at the reel just might get caught on the trailer somewhere, and the next time Mario floors it, he might flip the trailer.

Dangerous accidents

What if at this time the reel comes off the trailer and goes rolling somewhere. Oh I forgot, every good line crew locks the reel carrier bar in every time. How many times do you see strand crews using reel brakes on the reels at the trailer? They are supposed to be used with all pulling operations.

Since I'm getting heavy here, try this one on for size: Mario the speedster has managed to jerk a lot of excess strand off the reel and it has sagged pretty low, or almost to the ground in many places. Now the pulling operation is approaching a long span and the pulling is getting a little harder, just due to the normal build up of tension as the pull gets longer. The lineman on the preceding pole finishes getting the strand into the clamp and signals the driver to go, and he does in his usual way. But, as the driver floors it again, some spans of strand back there somewhere flip up extremely high because of all the slack, and one span gets hung up on a branch causing the CATV strand to touch a primary voltage line. Up front somewhere, the lineman on the pole may just now have touched the CATV strand as he touched the telephone strand as he was going to get into position to climb down the pole. Perhaps, in this instance, he'll get down quicker.

Common sense

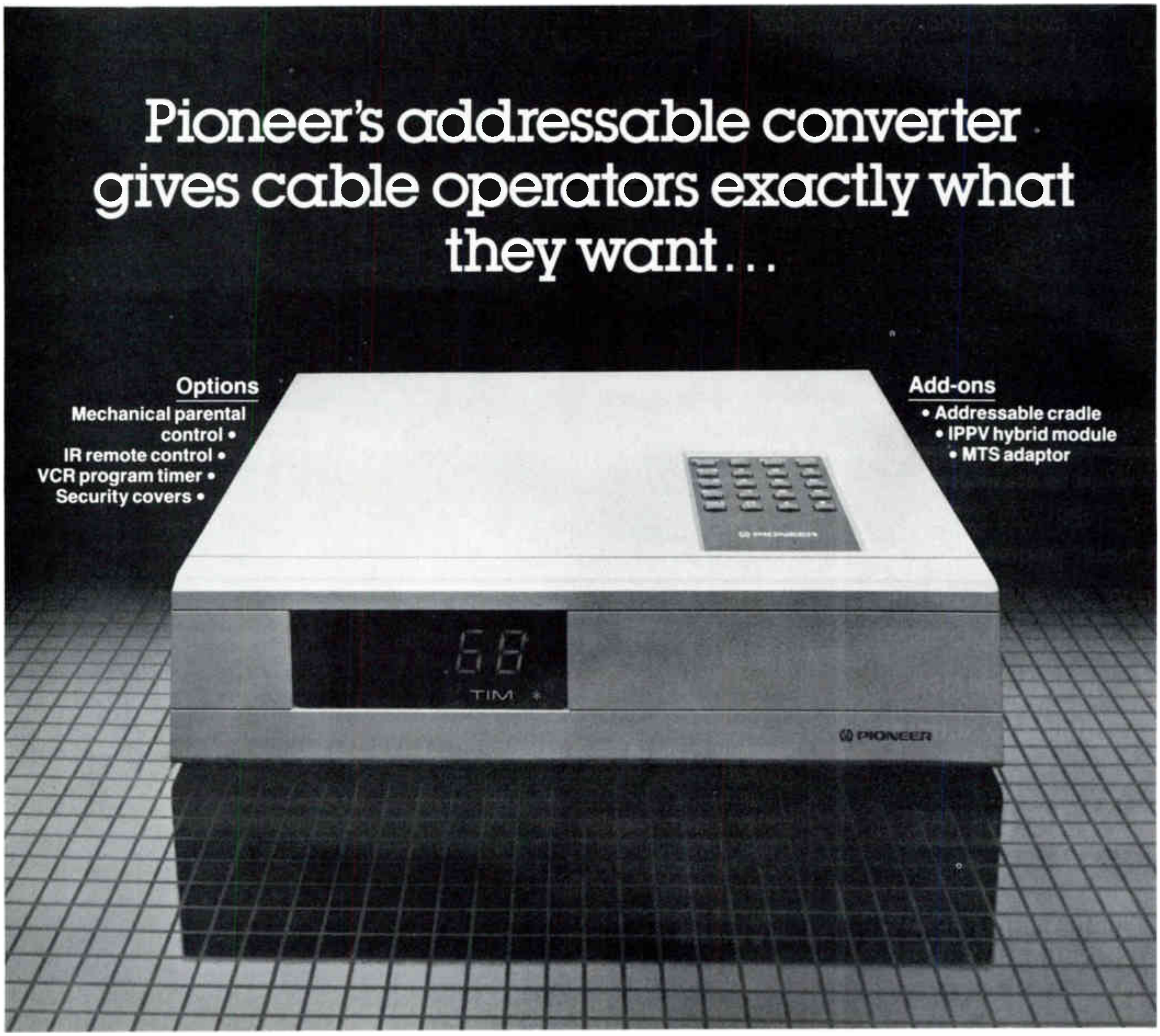
Common sense is the single most valuable asset a tradesman can have. Of course, ability and capability are necessary attributes that form the basis, in addition to common sense, for the successful performance of ones duties. And this goes right back to those two words: properly and safely.

Extremely secure and workable reel brakes should be used at the trailer site on the strand reel, and fashioned in such a way that the pulling commences under a slight tension. The strand clamps should be adjusted to a degree of tightness that is adequate. (Here is where the skill and experience comes in. There is no formula for this judgment which must include an assessement of the conditions of the pull including length, how many bends in the run and where is the pole line located in relation to personal property of others or pedestrians.) The strand should be pulled with slow and even force from pole to pole. Clamp attached strand brakes should be used with care being sure to place one at the forward side of all intersection or road crossings as well as at sporadic locations along the run.

Two pulling grips should be used; one as the primary grip that is under the tension of the pull and a second grip attached a few feet back from the primary grip with a slack line between it and the item doing the pulling. Getting back to the trailer, it should be set at an angle that allows for a shallow radius into the first clamp, which means to set it back far enough to eliminate the possiblity of the strand getting a kink in it from a binding at the first clamp. The strand should be pulled off of the bottom of the reel always because it has a lessor tendency to unravel than if it was pulled off of the top. Precautions should be taken so that the trailer can't be jerked from its position and either flip or be swung to the side into traffic or a passer-by or observer (we call them sidewalk engineers). When jacking in the strand to give it proper tension (not too much and not too little), something very few line workers like to do is to ride out the run prior to the tensioning operation, to check for possible obstructions (mail box hang-ups), but it should be done.

Along the run as strand is being woven through possible trees, or over and around phone drops or other aerial lines that are in the way (so to speak), care should be exercised not to wrap the CATV strand under and back up or around any telephone or other existing lines. This blunder, sometimes called belly wrapping, causes havoc for the unfortunate cable crew that attempts to pull and lash cable on that strand. When tossing a throw rope through trees, make sure that you haven't crossed over power lines. This is a common and well known blunder, and seriously dangerous besides; it has caused numerous cases of death from electrocution in the past.

(Part 2, next month: Lashing cable)



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— Bruce M Brown Associates

Management Consulting
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Reader Service Number 40.

Getting the most out of your bench sweep

By Ron Hranac
Corporate Engineer, Jones Intercable Inc.

Bench sweep equipment is considered a luxury in some cable systems; and many that do have the equipment don't use it to its potential. The large investment required for an adequate bench sweep system, however, can be offset by effective use of that equipment.

By testing samples of all passive devices used in the system, you can detect potential problems before those passives are installed. The subscriber and system passives always should be checked *before* being released for use in the system. A good amount to test is 5 percent to 10 percent. Case in point: Sample testing could pinpoint a batch of passives that missed the soldering machine. And service calls to correct problems like this after the devices have been installed can be very costly.

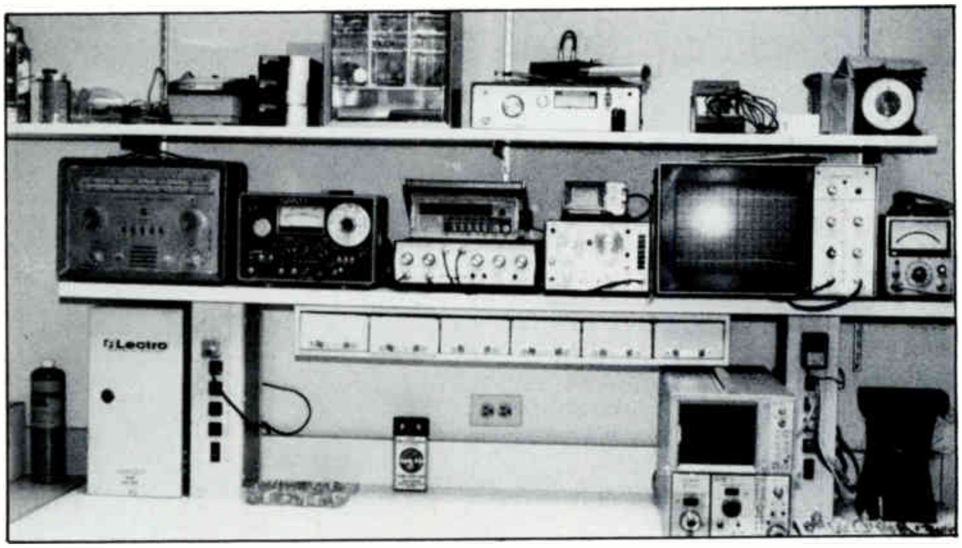
Are you paying a premium for extended bandwidth splitters and couplers? If you test some of the budget brands, you may be surprised to find that many of them meet or exceed extended bandwidth requirements even though the manufacturer does not specify them as such. The cost savings, over time, could pay for your bench sweep system and the technician to operate it.

What to test

Bench sweep testing should not be limited to checking passive devices. All of your trunk and feeder cable, most of which is 100 percent sweep tested by the manufacturers, should be tested again when you receive it. Hidden damage can and does occur during shipment; you need to verify that the 30 dB return loss you specified on the order is in fact 30 dB or better.

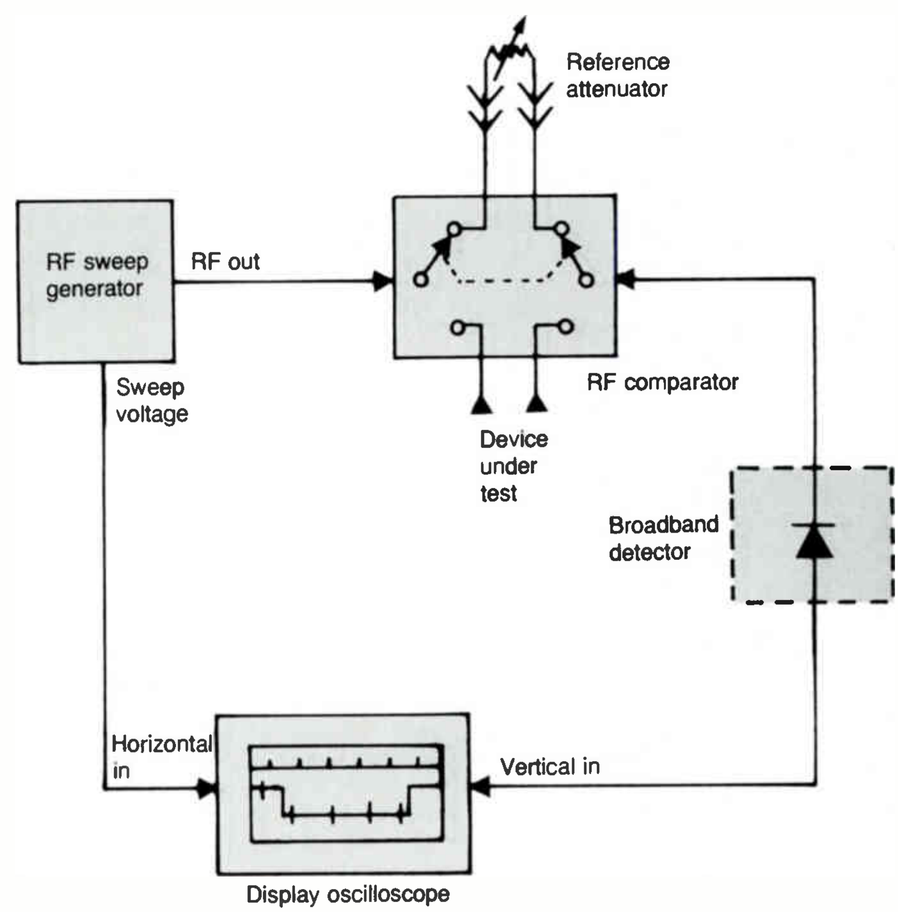
Because of the quantity of drop wire used in systems these days, a representative sample, say 10 to 20 percent, is usually satisfactory to test. Bench sweep testing provides the best opportunity to verify return loss, attenuation

'Bench sweep testing provides the best opportunity to verify return loss, attenuation and other electrical characteristics of the cable used in your system'



An example setup for bench sweep equipment.

Figure 1: Equipment configuration for loss measurement



and other electrical characteristics of the cable used in your system.

All amplifiers, bandpass filters, converters, traps and headend equipment should be tested on the bench. You cannot rely solely on factory alignment because equipment can miss a QC inspection; a factory technician might have had a bad day; or the equipment may be damaged in transit to your system. Check it today, and avoid problems tomorrow!

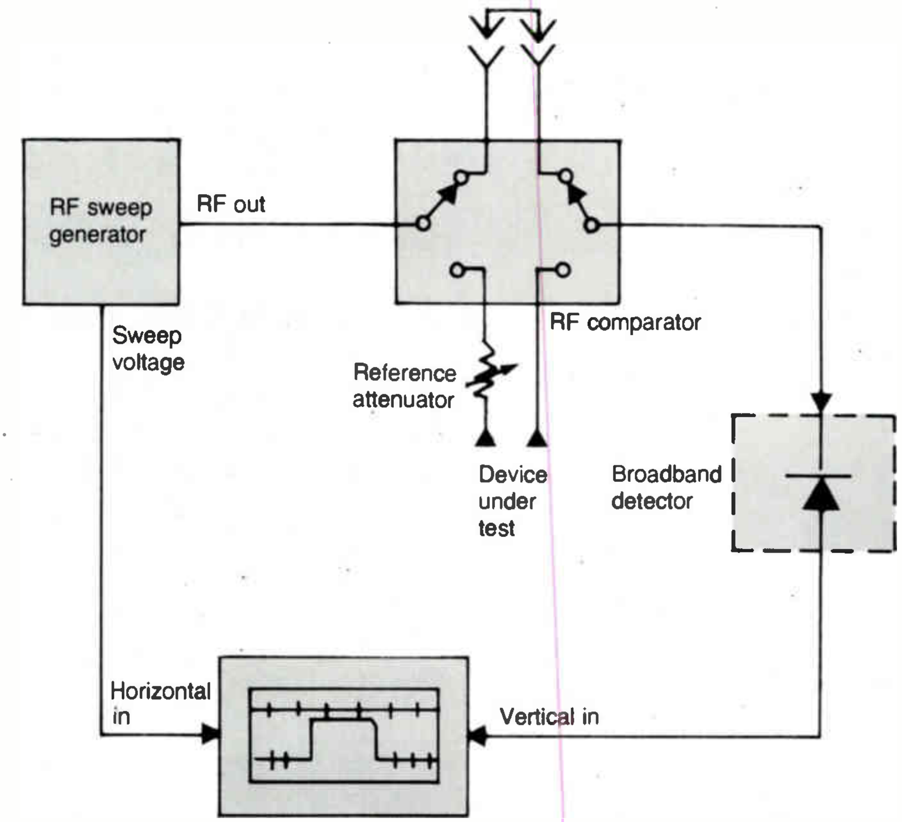
Bench sweep system components

The typical bench sweep system consists of several components *fundamental* to its intended use (see Figures 1 and 2). These include an RF sweep generator, RF comparator, reference attenuator(s), broadband detector and a display oscilloscope. Other accessories might include variable and fixed return loss bridges, precision mismatches and terminations, lab-type connectors and adapters, and a post amplifier. Depending on how this equipment is configured, it can be used to measure bandwidth, flatness, bandpass, gain, loss, isolation and return loss.

• RF sweep generator—This instrument provides a swept RF signal over the frequency range of interest. The amplitude of the RF signal, its frequency coverage and sweep rate are usually adjustable. Frequency markers are useful for determining observed frequency on the display oscilloscope.

• RF comparator—In order for the displayed sweep to be meaningful, a comparator automatically switches the RF sweep signal alternately through a reference circuit and the device under test. This allows comparison of the response of the device under test to a known reference.

Figure 2: Equipment configuration for gain measurement



• Reference attenuator(s)—Usually adjustable in steps of 0.1 dB, 1 dB and/or 10 dB, these highly accurate attenuators are used in the reference circuit of the comparator when measuring loss, and in series with the device under test when measuring gain. They provide a convenient way to accurately measure level changes and reference comparison differences.

• Broadband detector—In its simplest form, the broadband detector is a diode circuit that changes the RF signal from the output of the comparator into a DC voltage that corresponds to the relative amplitude of the RF signal. This DC voltage is fed to the vertical input of the display oscilloscope, where it changes the height of the displayed trace as the level of the RF signal changes.

• Display oscilloscope—The CRT of the oscilloscope displays an electronic representation of the response characteristics of the device under test. The display oscilloscope is driven horizontally by a sample of the RF sweep generator's sweep voltage. Thus, as the signal generator sweeps higher in frequency, the sweep voltage causes the display oscilloscope to "paint" a trace from left to right on the CRT. As the amplitude of the swept RF signal changes through the device under test and the reference circuit, the broadband detector DC voltage output coincides with those changes and causes the trace on the display oscilloscope CRT to "paint" the relative changes vertically. The final result is the response of the device under test.

• Other accessories—Variable return loss bridges are used when measuring coaxial cable structural return loss, and fixed bridges when measuring return loss of other devices under test. Precision mismatches usually are used in conjunction with return loss bridges for calibration purposes; precision terminations are used to terminate unused ports on devices under test or the end of a reel of cable when measuring structural return loss. Lab-type connectors and adapters provide an interface between the bench sweep system and the cable or device under test. Post amplifiers are used when it is necessary to increase signal level to the detector input.

Intelligent investment

A good bench sweep testing program can help you reduce long-term operating expenses by preventing costly problems from reaching your cable system. It's also possible to save on material costs by identifying lower cost passive devices that do the same job as the more expensive ones. An effective bench sweep testing program can even be integrated into your preventive maintenance program. Next month we'll look at some common bench sweep measurement techniques and measurement errors that can affect the accuracy of your bench sweep testing.

Leader Instruments Corp. announced the appointment of **Shigehiko Hirota** to the office of president. Also announced was the promotion of **Bruce Storch** to the position of vice president of sales and **Robert Sparks** to the position of director of marketing.

The three men bring over 60 years of engineering, sales, marketing and management experience to their new positions. Contact: 380 Oser Ave., Hauppauge, N.Y. 11788, (516) 231-6900.

Avantek Inc. announced the appointment of **Alan King** to the newly established position of vice president and general manager of microwave semiconductor businesses. King joins Avantek from a position as president and CEO of Crystalvision, a manufacturer of flat panel displays. Prior to moving to Crystalvision, he was with Signetics Corp. for 18 years. Contact: 3175 Bowers Ave., Santa Clara, Calif. 95054-3292, (408) 727-0700.


Grant

Susan Grant has been appointed vice-president of sales for **Magnicom Systems.** Grant comes to Magnicom from Turner Broadcasting System Inc. where she most recently held the post of director of regional sales and marketing. Contact: 1177 High Ridge Rd., Stamford, Conn. 06905, (203) 968-0088.

Broadband Engineering Inc. announced the appointment of **Sherwood Hawley** as national sales manager. A design engineer with Broadband since August 1981, Hawley has been directly involved in the design and development of the firm's line of CATV amplifiers. Prior to this association, he served eight years as a technical leader in the design lab at General Electric's Mobile Radio Division in Lynchburg, Va. This followed five years as an applications engineer in the semiconductor industry. Contact 1311 Commerce Lane, Jupiter, Fla. 33458-5636, (305) 747-5000.


Seth-Smith


Hyers


Rhea

Scientific-Atlanta Inc. announced the election of **Robert Hyers, Randall Rhea** and **Nigel Seth-Smith** to the rank of principal engineer, the company's highest technical position.

Hyers, currently assigned to the Atlanta Instrumentation Division, has been with Scientific-Atlanta since 1967. He has made major contributions in the development of new instruments in the Instrumentation Group and specializes in the application of microprocessors and in both digital and analog circuit design.

Rhea, an S-A employee for 11 years, is assigned to the Satellite Communications Division, where he is involved in the business development of customer premises satellite terminals for business data.

Seth-Smith, the chief engineer for the Digital Video Systems Division in the Broadband Communications Group, is a former member of the Video R&D Group in the Independent Broadcasting Authority in the United Kingdom. Seth-Smith has led the design team in the development of B-MAC, a new satellite transmission system for video, audio and data and the associated integrated circuits for a low-cost implementation. Contact: 1 Technology Pkwy., Box 105600, Atlanta, Ga. 30348, (404) 441-4000.


Senken

Magnavox CATV Systems Inc. announced the appointment of **Michael Senken** to the position of controller. Senken began his career as a staff auditor for North American Philips Corp. In 1983, he moved to Magnavox, where he has held the position of manager of financial reporting for the last two years. Contact: 100 Fairgrounds Dr., Manlius, N.Y. 13104, (315) 682-9105.


Nelson

Gill Management Services announced the appointment of **Jerry Nelson** to regional sales manager for the firm. Nelson formerly served in a similar regional position for CableData. Prior to that he spent 17 years in sales management and promotion for NCR Corp. Contact: 2050 Bering Dr., San Jose, Calif. 95131, (408) 998-8078.

Craig Kemper, has been appointed manager-direct sales for **Blonder-Tongue Laboratories Inc.** In his new position, he will supervise sales of the company's pay TV system products. Kemper was previously manager of Northeast Regional Sales for the company's general line of products. Contact: One Jake Brown Rd., Old Bridge, N.J. 08857, (201) 679-4000.

Sony Corporation of America has appointed **Gary Hall** digital sales engineer in the Professional Audio Division. Prior to joining the firm, Hall operated his own audio electronics service and consulting business in Boston. He also held design engineering and marketing positions at Lexicon Inc. Hall will be based in Sony's Paramus, N.J., regional offices. Contact: Sony Drive, Park Ridge, N.J. 07656, (201) 930-6432.

Microdyne announced the appointment of **Stephen Benoit** as sales engineer, satellite communications. Benoit will be responsible for the sales of satellite

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equipment for TV and radio broadcasting, fixed and portable uplinks and teleconferencing. Before coming to Microdyne, Benoit was with Florida Video Systems of Jacksonville, Fla. for three years. Contact: P.O. Box 7213, Ocala, Fla. 32672, (904) 687-4633.

North Hills Electronics Inc. recently announced some executive changes. **Leo Staschover,** formerly president, has been elected chairman of the board and chief executive officer. **Howard Anders,** formerly vice president and treasurer, has been elected to the office of president and chief operating officer. Anders also will retain the title of treasurer. Contact: 1 Alexander Place, Glen Cove, N.Y. 11542, (516) 671-5700.

Anixter Bros. Inc. announced the appointment of **Michael Long** as executive vice president of Anixter-Canada Inc. Long has served as managing director of Anixter's British subsidiary, Anixter U.K. Ltd., since 1979. He has been with Anixter since 1976. Prior to joining the company he was with City Electrical Factors in London, England.

Anixter also announced the appointment of **David East** to deputy managing director of the company's British subsidiary, Anixter U.K. Ltd. East has served as general manager of Anixter U.K.'s communications group since 1983. Prior to joining the company he was a sales executive with Ward and Goldstone. Contact: 4711 Golf Rd., One Concourse Plaza, Skokie, Ill. 60076, (312) 677-2600.

The board of directors of **Avantek Inc.** named **James Sterrett** to the position of vice president and Fellow of Avantek. The title of Avantek Fellow has been instituted by the board of directors to recognize an individual for significant technical contributions over an extended period of time. Sterrett is the first recipient of this award.

A founder of Avantek, Sterrett was instrumental in developing the technology and initial products that launched the company. Contact: 3175 Bowers Ave., Santa Clara, Calif. 95051, (408) 727-0700.

First Data Resources has announced the promotion of **D. Rusty Rau** to director of operations for the Cable Services Division. Prior to this appointment, Rau was the product development manager for the Cable Division. In his new position, he will be responsible for the day-to-day delivery of the Cable Control System. He has been with FDR for eight years, serving in various management capacities.

FDR also announced the promotion of **Jay Oxton** to director of national accounts for the cable services division. Prior to this appointment, Oxton was a national account manager for the cable division. In his new position, Oxton will be responsible for sales and customer support. Contact: 7301 Pacific St., Omaha, Neb. 68114-5497, (402) 399-7000.

RMS Electronics Inc. announced the promotion of Michael Soloman to the position of divisional sales director. Soloman has been in Cable TV for almost 19 years, serving in various capacities, such as general manager for Liberty Communications, as well as owner and operator of cable systems in both California and Oregon. Most recently, Soloman served as general manager-Western operations for RMS. Contact: 50 Antin Place, Bronx, N.Y. 10462, (212) 892-1000.

Covell

Richard Covell has been named account executive for **Burnup and Sims Cable Products Group.** He will be handling Capscan and Lectro products in the Rocky Mountain region. Most recently Covell worked as a sales engineer for C-COR Electronics. Contact: 511 Burland Dr., Bailey, Colo. 80421, (303) 838-6584.

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CALENDAR

May

May 1: SCTE New England Meeting Group seminar on preventive maintenance. Contact Gene Bartlett, (617 337-4100.

May 1-3: Magnavox CATV training seminar, St. Paul, Minn. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

May 6-8: Magnavox CATV training seminar, St. Paul, Minn. Contact Laurie Mancini, (800) 448-5171.

May 6-8: Louisiana Cable Television Association spring convention, Hilton, Lafayette, La. Contact Lisa Black, (504) 928-5604.

May 12-15: *Channel Guide's* and *Satellite Broadcasting's* Sat Expo, Sheraton Denver Tech Center, Denver. Contact (303) 779-7930.

May 14-15: The Yankee Group seminar on data communications, New York. Contact (617) 542-0100.

May 15: SCTE South Lake Meeting Group seminar, "FCC update on proofs and leakage," Holiday Star Hotel, Merrillville, Ind. Contact Scott Weber, (219) 464-2288.

May 15: SCTE Golden Gate Chapter seminar on underground construction techniques, Italian Gardens, San Jose, Calif. Contact Pete Petrovich, (415) 463-0870.

May 21-23: C-COR Electronics technical seminar, Dallas. Contact Debra Cree, (814) 238-2461 or (800) 233-2267.

May 29: SCTE North Jersey Meeting Group seminar on theft of service, Victor's Holiday Inn, Wayne, N.J. Contact Bill Westerman, (201) 289-1234.

June

June 2-5: National Cable Television Association annual convention, Las Vegas (Nev.) Convention Center. Contact (202) 775-3629 or (202) 775-3606.

June 4-7: Continuing Education Institute course on satellite communications, Amfac Hotel, Los Angeles. Contact (213) 824-9545.

June 11-13: Security Equipment Industry Association and **National Burglar & Fire Alarm Association** "ISC Expo 85," O'Hare Exposition Center, Chicago. Contact Ann Feltes or Bill Campeau, (818) 965-7454.

June 16-18: New York State Cable Commission annual "Northeast Cable Television Technical Seminar," Lake George, N.Y. Contact Bob Levy, (518) 474-1324. SCTE endorsed.

June 17-19: Community Antenna Television Association annual convention, CCOS '85, The Opryland Hotel, Nashville, Tenn. Contact Ruth Williams, (703) 823-6522.

June 19: SCTE Delaware Valley Chapter meeting on basic system preventive maintenance, Fiesta Motor Inn, Willow Grove, Pa. Contact Bev Zane, (215) 674-4800.

June 24-26: Online Conferences' Videotex '85 conference and exhibition, New York Hilton. Contact Online, (212) 279-8890.

June 26: SCTE Golden Gate Chapter meeting on microwave licensing, San Jose, Calif. Contact Pete Petrovich, (415) 463-0870.

July

July 9-11: Online Conferences Inc. satellite and cable TV conference, "The Cable '85 Exhibition," the Brighton Metropole, U.K. Contact (212) 279-8890.

July 10-12: Magnavox CATV training seminar, Detroit. Contact Laurie Mancini, (800) 448-5171; in New York, (800) 522-7464.

July 15-18: American Federation of Information Processing Societies' National Computer Conference, "Technology's Expanding Horizons," McCormick Place, Chicago. Contact Helen Mugnier, (703) 620-8926 or (800) NCC-1985.

July 23-25: C-COR Electronics technical seminar, Boston. Contact Deb Cree, (814) 238-2461 or (800) 233-2267.

August

Aug. 14-16: Rocky Mountain CATV Association's annual convention, Jackson Hole Racquet Club, Jackson, Wyo. Contact John Harrison, (307) 245-3392; or Oscar Davis, (505) 538-3701.

Aug. 20-22: C-COR Electronics technical seminar, Minneapolis. Contact Deb Cree, (814) 238-2461, or (800) 233-2267.

Aug. 21: SCTE Delaware Valley Chapter meeting on FCC rules update and field testing procedures, Fiesta Motor Inn, Willow Grove, Pa. Contact Bev Zane, (215) 674-4800.

Aug. 25-27: Eastern Cable Show, Congress World Center, Atlanta. Contact (404) 252-2454.

Aug. 27-29: Security Equipment Industry Association and **National Burglar & Fire Alarm Association** "ISC Expo 85," New York Coliseum, New York. Contact Ann Feltes, (818) 965-7454.

Planning ahead

June 2-5: National Cable Television Association annual convention, Las Vegas (Nev.) Convention Center.

June 17-19: Community Antenna Television Association, CCOS '85, The Opryland Hotel, Nashville, Tenn.

Aug. 25-27: Annual convention of the Southern Cable Television Association, the Eastern Show, Congress World Center, Atlanta.

Sept. 18-20: Atlantic Show, Atlantic City, N.J.

AD INDEX

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Reader Service Number 45.

Dress-ability

By Robert A. Luff
Senior Vice President, Engineering
United Artists Cablesystems Corp

While attending the SCTE Spring Conference and Tec Expo, I was reminded of the importance of proper dress and grooming for a successful technical career. Frankly, I was appalled by the number of CATV technical personnel wearing dress shoes, slacks, and coats and ties! Don't they know what they looked like?

Dress for success

Where were their hush-puppies, baggy and too short plaid trousers, clashing pastel or polk-a-dot pattern shirts with the bulging pockets of assorted screw drivers, diddle-sticks, pens, pencils—complete with plastic pocket liner bearing some electronic company logo? And, their hair—it looked (gulp) like they paid more than $1.75 for their haircut.

At a time in the industry when every CATV company is taking a hard look at reducing its personnel overhead, including technical personnel overhead, do these neatly dressed and groomed brethren of ours really know what they are doing? Do they have any idea how different they look from the time-honored stereotype CATV tech of yesterday that so many have worked so hard to create and preserve all these years?

But, what if the industry is going through a "leaning" process; why would they be dressing like someone hoping for more responsibility? And, their managers weren't even attending the SCTE Expo to impress. Certainly it wasn't because they were concerned with projecting a more professional image at work and wear a sport coat and tie every day, was it?

Identity crisis

There are serious practical consequences to consider if the CATV technical community loses its long-recognized and expected traditional dress code. For one thing, you use to be able to sit near the convention hotel front desk and pick our group out of all other guests. It didn't matter whether it was during breakfast, luncheons, in the hallways, cocktail lounge, or at the most expensive restaurants, no badges were necessary; CATV techs could always recognize other CATV techs just by how they looked.

Not so anymore! The attendance of the SCTE convention has steadily increased to nearly 1,000 of the best and it is becoming harder to keep the fast trackers identified. At the SCTE Washington Expo, what a mess of things the growing number of CATV tech renegades made. Without their badges you couldn't tell whether they were part of our convention or not. Even with their badges, people were letting them on the elevator first and waitresses found themselves waiting on their tables faster. On one occasion, a recognizable traditional CATV tech asked for site-seeing information from a responsible, prosperous-looking Washingtonian, only to find out that person was one of us! Don't they know how important the first impression is?

Other consequences are the observed change in convention behavior seemingly caused by the new images. Science doesn't know why, but such a change in clothing style seems to result in better attentiveness and triggers the desire to ask more questions during the Q & A periods of a session—the session would be over and everyone out in the bar if it weren't for them. Speaking of the bar, that's another side effect observed. After one or two, they've had enough and call it a night at a reasonable hour. Only to get up early, walk alertly around the convention floor (not to collect meaningless trinkets in a stupor) and engage in meaningful discussions and demonstrations of the latest equipment. Don't they know what conventions are for?

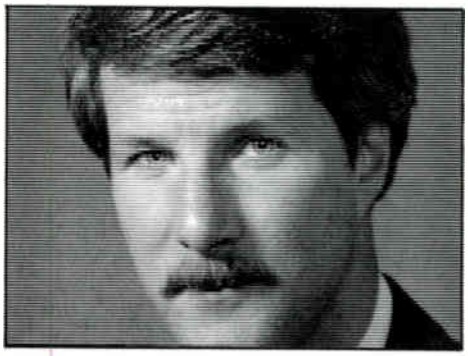
We still have no answer why more and more cable techs are laying to rest their hush-puppies, leisure suits and bulging shirt pockets. However, throwing out our time-honored past CATV technical community dress and grooming norms has serious implications far beyond the few days at the SCTE convention. This same sort of person is likely to show extra pride in their day-to-day work back at the system.

They are probably going to keep their company field vehicle neat and clean and well-maintained at all times because they care about the image of the company, like they care about their own image. They like their bosses to inspect their work because they are proud of it. And, they are likely to suggest or develop a quality assurance program to help keep cable performance and its life at its best. Are these guys for real?

For the same reasons these progressive techs come to the SCTE conventions, they are likely to take correspondence or night courses during the year, not only to keep up with cable technology, but to sharpen and develop their budget and management skills. These folks are likely to be a *real* help at system budget time and all through the year, in addition to expertly managing themselves and those under them year round. And for all these light-duty tasks, they think they will be promoted?

A barometer

Is there a metamorphosis taking place in the image and capabilities of the CATV technical community? Is there any relationship between more and more stereotypical 12-channel systems upgrading their images and capabilities to modern 64-channel, fully two-way addressable systems with stand-alone local billing



computer systems and data traffic and status monitoring; and more and more conventional CATV engineers upgrading their images and capabilities to run these high investment and technology communications complexes? Hog wash! Everyone knows that clothes do not a man make. Certainly there is no relationship between an industry upgrade from 12-channel systems that practically ran themselves to very sophisticated complex engineered systems and a change in the perception of how the CATV technical community is beginning to view itself.

When office duplicating technology changed from ink and alcohol of the mimeograph machine to the high-tech method of xerograhy, IBM field service went to white shirts and conservative ties. And where IBM went, all others followed. Soon it was evident that a new era was upon us—even if you didn't know what was going on inside the machine or inside the industry. Like a barometer, the changing dress code of the industry foretold of an important, yet nearly invisible change afoot. Certainly, our few over-dressed misfits aren't all that prophetic?

Even though it was only 10 years ago and just a year or two before the big decade-long CATV boom period, a group convention photo of CATV managers (the guys always wearing the coats and ties today) looked like they were single-handedly supporting the hush-puppy and light green leisure suit industries, except for a few of their own "barometer needles" forecasting a change just over the horizon. Can there really be anything to such quackery? Do any of those image-conscious folks in the picture wearing a suit even have a job today?

A metamorphosis

The evolution of 12-channel basic systems to high-dollar and high-tech communications complexes is changing system, corporate and industry images. Clothes and grooming are just as important to our "state-of-the-art" image to others and ourselves as a modern system and the latest test equipment. A CATV technician or chief's attire is like any other equipment—knowing when to replace it can make all the difference.

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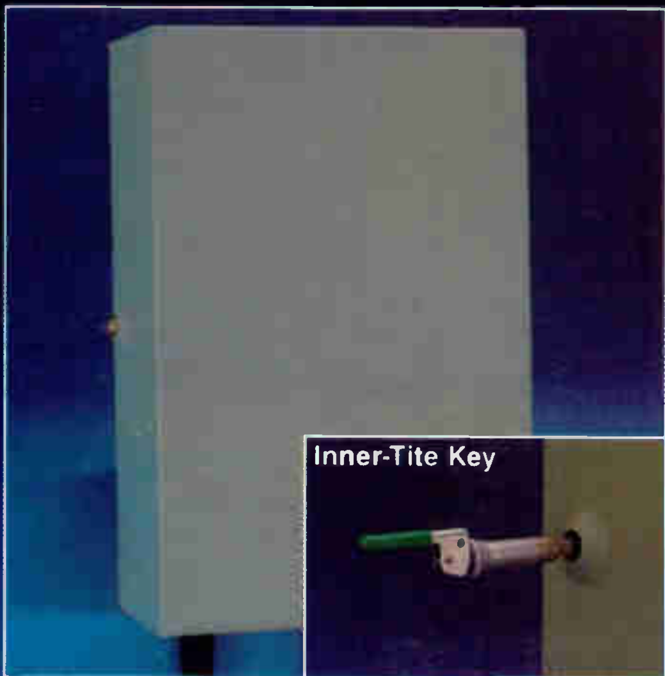

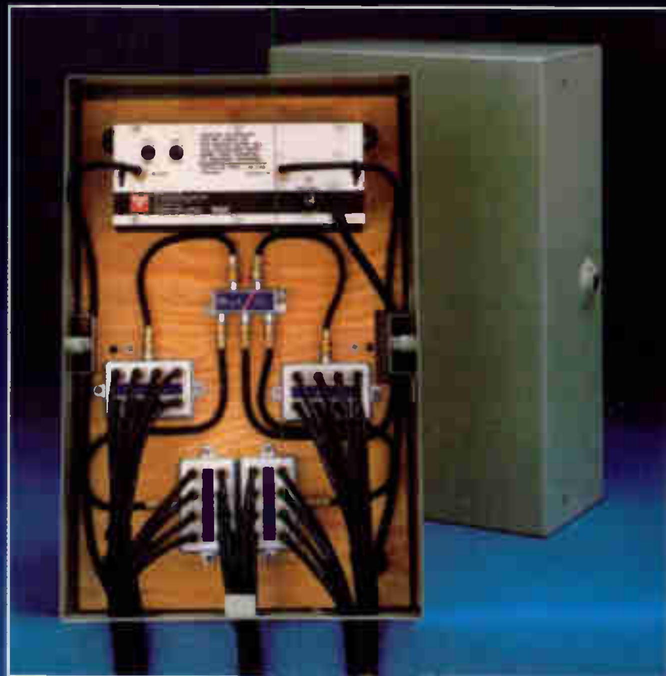

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