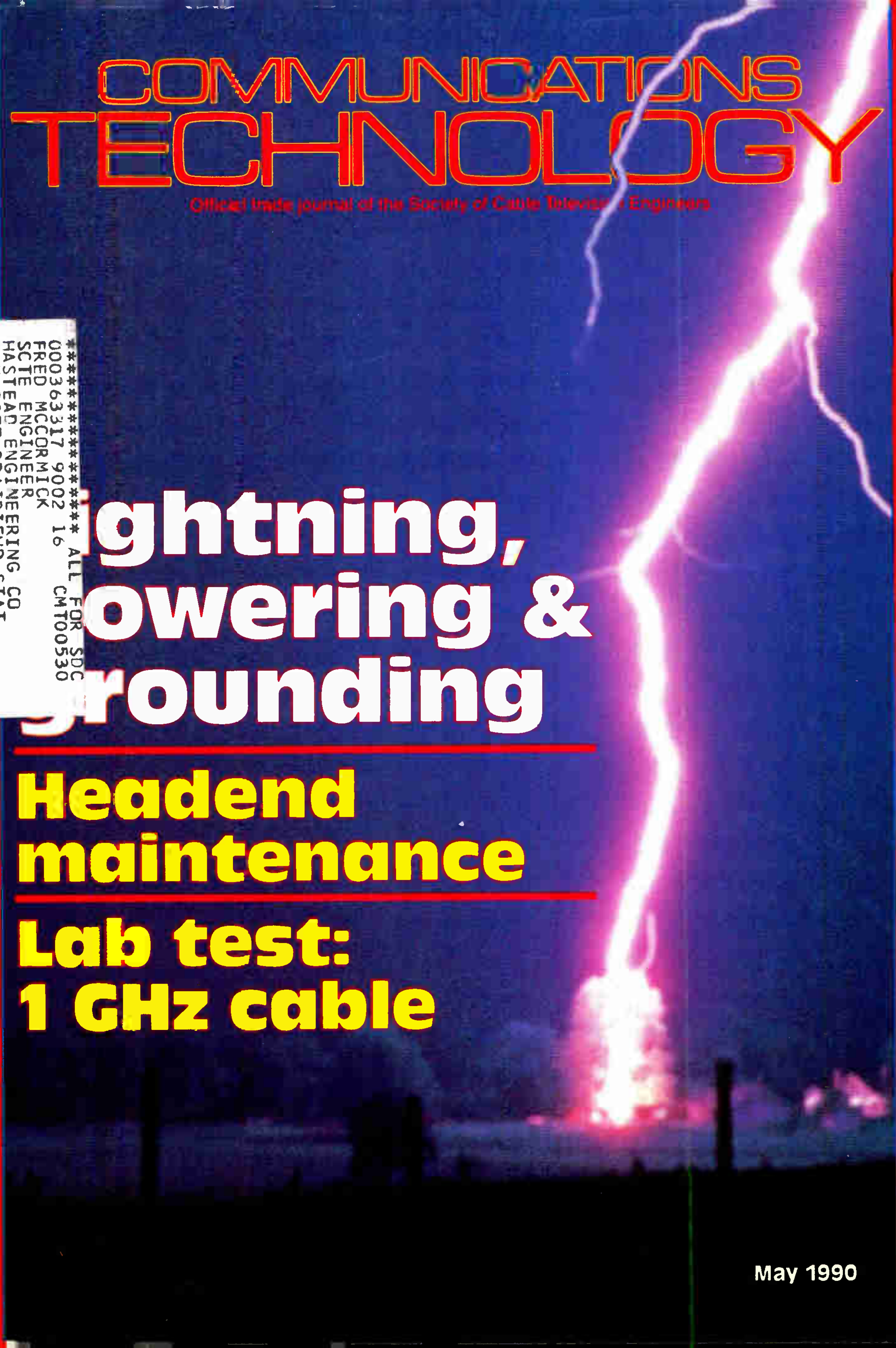
COMMUNICATIONS TECHNOLOGY

Official trade journal of the Society of Cable Television Engineers



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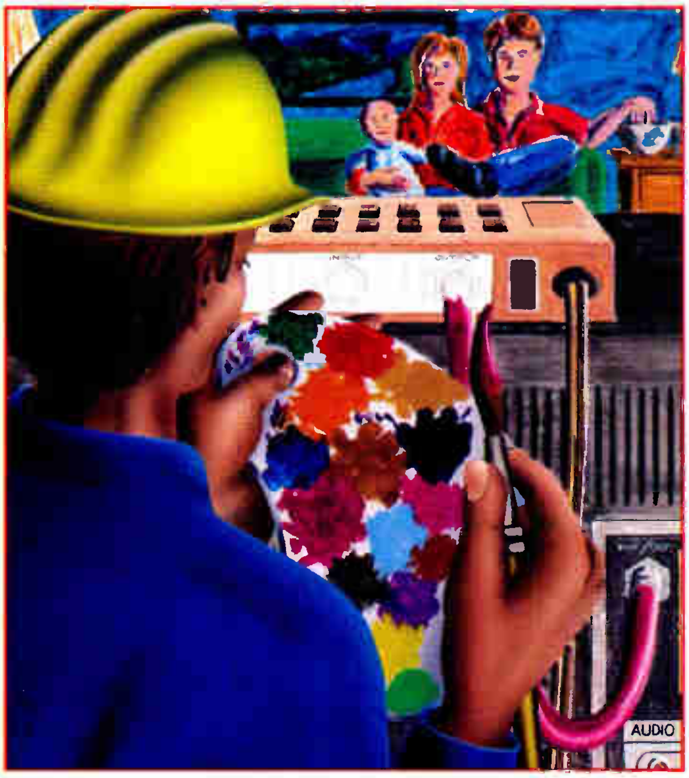
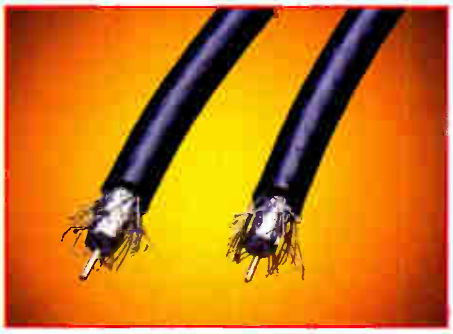
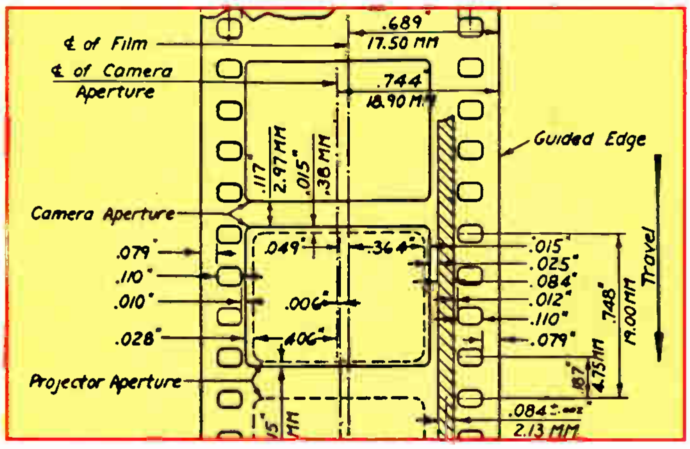


Geri Saye



Courtesy Times Fiber



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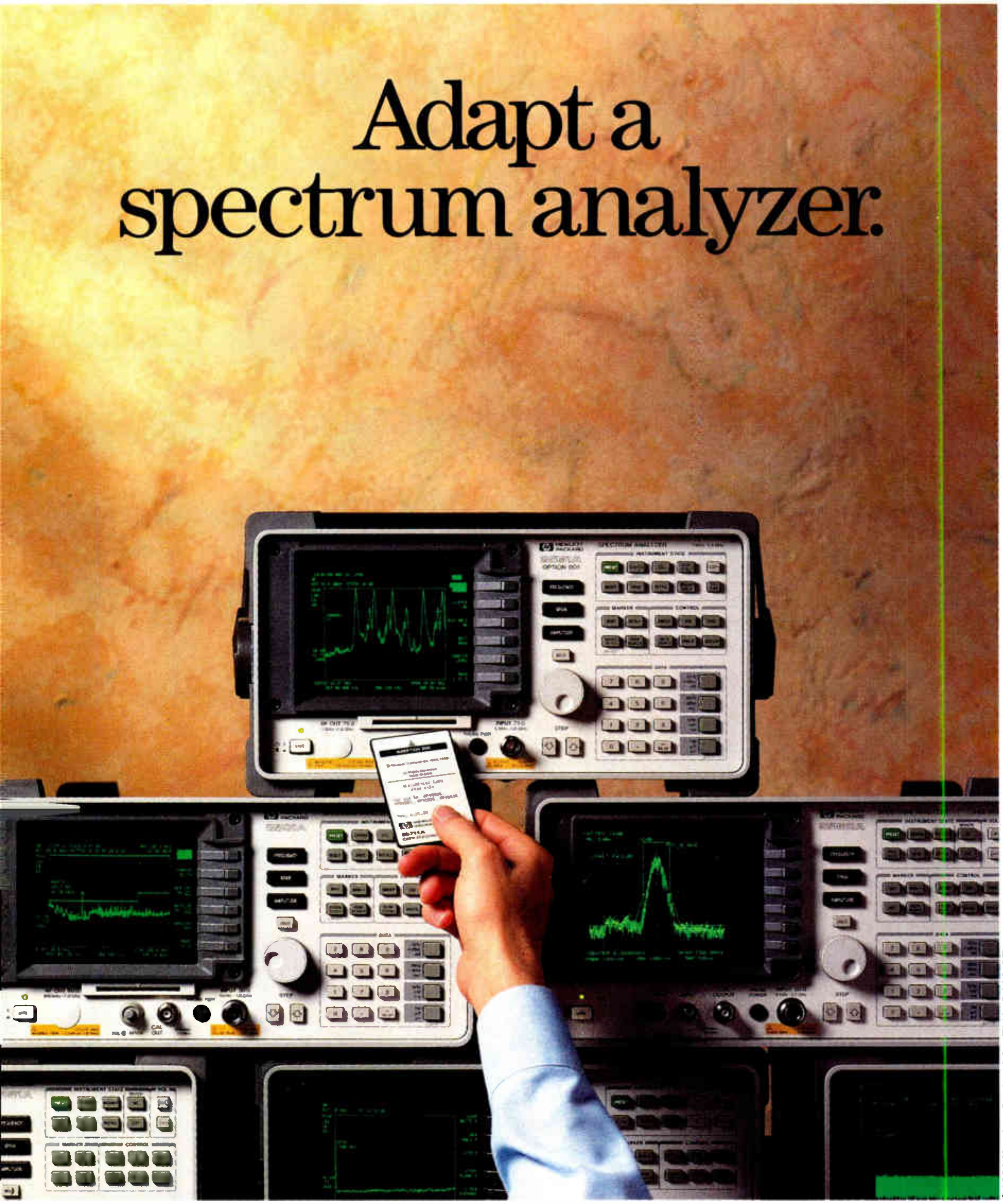

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Reader Service Number 4.

EDITOR'S LETTER

Cast no stones...

I'm not sure I fully comprehend all of the irony behind some of the cable bashing going on in our nation's capital. One of the complaints—and one that is justified in many cases—is that of constant busy signals and being "on hold" for unacceptably long amounts of time. I wonder, though, if some of our detractors shouldn't first look in their own backyards before throwing rocks in ours?

It's no mystery that the cable industry didn't invent poor phone service. I was starkly reminded of that a couple weeks ago when I attempted to call the Government Printing Office in Washington, D.C., to order a copy of the latest *Code of Federal Regulations*. It took me three days to finally place my order.

The first two days I was greeted with busy signals every time I called. When, on the second day, I did get through, I was greeted by a recording telling me that the Government Printing Office was closed. This at 4:30 p.m. East Coast time.

The third day I got through on the first try—well, sort of. After making my way through a maze of recorded messages ("press 'one' if you want more information"), I reached a recording that told me to wait until it transferred my call, "but if you get a busy signal, then all holding queues are full, and you'll have to call back later." For almost 10 more minutes I was on hold, and was able to memorize the every-40-second-message, "We sincerely appreciate your waiting; a technician will be with you soon."

When I finally did reach a real person, she was pleasant and took my order. I got the impression, though, that she was a *very* busy lady.

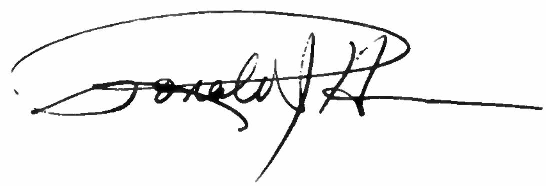
The city of Denver has made a big deal out of similar problems with Mile Hi Cablevision, and it has received a lot of press in the local papers. But I wonder how many of those city officials have tried calling their own city offices ("Cast no stones...").

I'm not trying to make excuses for situations where service problems exist. Certainly our industry has its share of difficulties in that area, and needs to resolve them. *Amateur Television Quarterly*, a ham radio publication I subscribe to, has some stinging comments in one of its columns in a recent issue about the quality of service in a cable system in the Midwest.

"I wonder...if some of our detractors shouldn't first look in their own backyards before throwing rocks in ours?"

The author complains that calls to the new installation number get answered almost immediately, while getting through on the maintenance number takes as long as 20 minutes.

I've said for a long time that our industry is technology-driven. While much of what we do is centered around technology, service is really what drives our business. Our customers aren't concerned with the signal level on their drop, or that the distribution network includes feedforward electronics and fiber optics. They want (and deserve) good service. And yes, we do have service problems that need to be resolved; but we're not the only ones.



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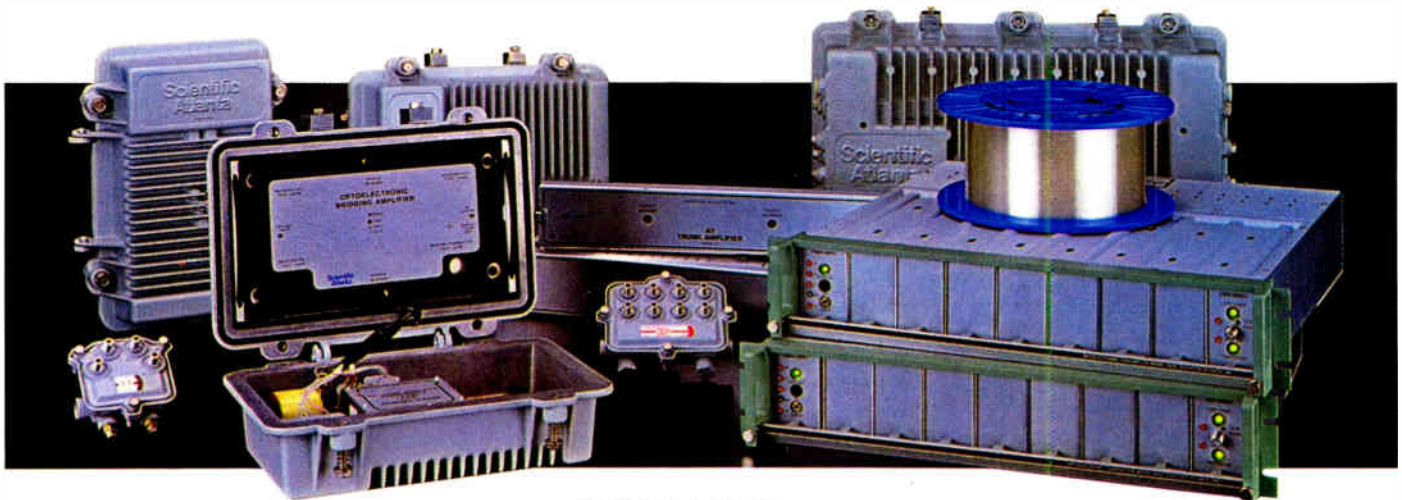

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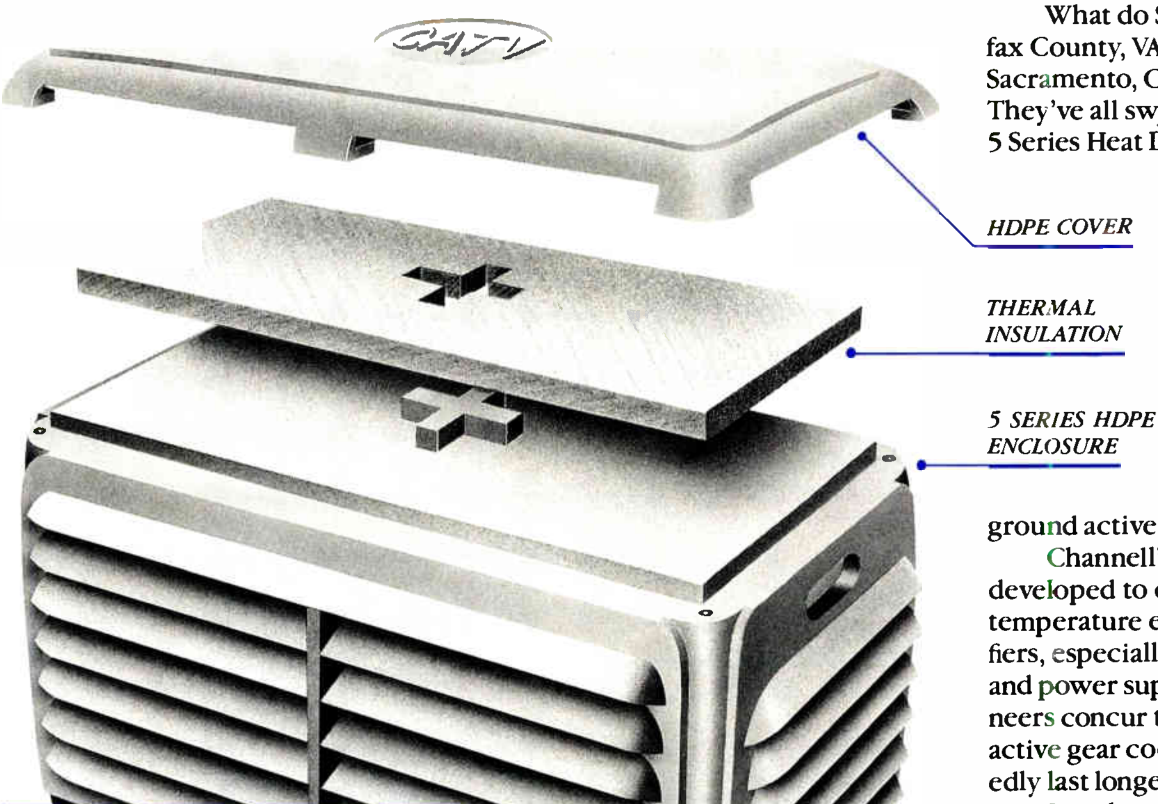

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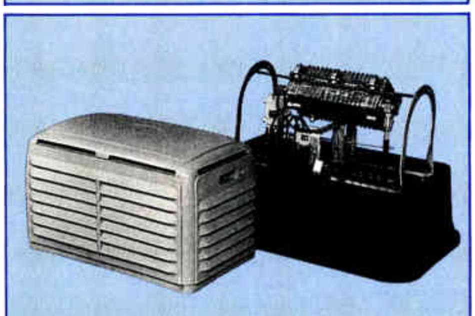

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Ohmmeter useage

I read your troubleshooting technique on trunk outages with the ohmmeter and the double pole double throw switch ("Effective use of the ohmmeter," October and November 1989, *Installer/Technician*). I found it to be very interesting and I would like to find out more information on the Rogers Kitchener system.

William J. Pawlowski
Preventive Maintenance and
Sweep Technician
Palmer Cablevision of Florida

Editor's note: You can contact Glen Shield, author of the two-part series "Effective use of the ohmmeter," at Rogers Cable TV-Vancouver, 1818 Cornwall Ave., Vancouver, British Columbia, Canada V6J1C7.

Pole clearances

Figure 1 in Bruce Liles' article, "Basic aerial construction," appearing in the "Back to Basics" section of your March 1990 issue, illustrates "typical utility pole clearances." Although the dimensions given in this figure may indeed be "typical" in that they represent properly built plant in service today, they do not reflect the requirements of the current (1990) edition of the *National Electrical Safety Code*. Contrary to the implication of the text, clearances and separations are not established arbitrarily by the utility companies. Rather, minimum required values are given in Section 23 of the code.

A clear, concise explanation of and justification for the code changes introduced this year may be found in a recent article by O.C. Amrhyn ("It's Time for a Change," *Telephony*, May 2, 1988).

Appearance of this outdated information in your widely read journal will surely contribute to the continued misunderstanding of present clearance and separation requirements on joint-use pole lines.

Daniel L. Pope
Supervisor, Chester Operations Group
AT&T Bell Laboratories

Tuition assistance

I just wanted to take a minute to express our gratitude to SCTE and the SCTE Tuition Assistance Committee for its excellent service to the industry through the Tuition Assistance Program. Over the last four years we've seen the program make a real and lasting different to the careers of the students involved.

NCTI will continue to support the program through its matching contributions. With the recent generous contributions of Rex Porter and the New York State Commission on Cable Television, the Tuition Assistance Program is positioned to continue providing scholarship assistance for several years to come. NCTI will match, in the form of a half contribution toward tuition in NCTI courses, all contributions to Account #1 that have been received to date. In addition, our intention is to continue this matching policy for future contributions as they are received.

Again, congratulations to the SCTE for providing this important and needed program to the industry. We look forward to continuing our support and contributions.

Tom Brooksher
Executive Vice President
National Cable Television Institute

Editor's note: Anyone interested in applying to the program Brooksher mentioned can use the application form found on pages 99 and 100 in this issue.

Zenith shows HDTV standard

ATLANTA— Zenith demonstrated its high definition TV program production standard at the National Association of Broadcasters convention. According to the company, it is the only proposed HDTV production standard that is perfectly matched to the ideal transmission system for the U.S. market. Zenith's executive director of advanced research and development, Wayne Luplow, said the proposed production standard supports the company's "spectrum compatible" HDTV transmission system and offers several advantages.

According to Luplow these advantages include progressive scan technology, computer-like square picture elements (pixels) and technical compatibility with today's TV system for smooth transition from NTSC to HDTV.

The production standard proposal is based on a 16:9 width-to-height aspect ratio TV picture, but Luplow said the company will continue to seek public and industry consensus on the preferred aspect ratio for HDTV viewing—4:3 or the wider 16:9 format. Zenith's SC-HDTV transmission system (and prototype HDTV receivers under development in cooperation with AT&T Microelectronics) are being built for and will be tested with this new production standard.

SCTE elects national directors

EXTON, Pa.—Society of Cable Television Engineers members sent in over 1,500 ballots during the 1990 national election for eight open seats on its board of directors. Re-elected were Region 3 Director Ted Chesley of CDA Cablevision, Region 4 Director Leslie Read of Sammons Communications, Region 5 Director Wendell Woody of Anixter, Region 7 Director Victor

Bob Rosencrans (left) of Columbia International looks on as the Texas Cable TV Association's Bill Arnold (middle) presents the annual John E. Mankin Sr. Award to Ken Gunter (right), also of Columbia International, at the Texas Show in February. The award is made to someone who has contributed significantly to the industry with time, effort and support over a substantial period of time.

Gates of Metrovision and Region 8 Director Jack Trower of WEHCO Video.

Newly elected to the board are At-Large Director Tom Elliot of CableLabs, Region 10 Director Michael Smith of Adelphia Cable Communications and Region 12 Director Walt Ciciora of ATC. These individuals join the seven existing board members who are currently serving the second year on the board.

In other SCTE news, all the exhibit space for the Society's 1990 Cable-Tec Expo has been reserved. Over 200 companies will display products, services and equipment from June 21-24 at the Convention Center in Nashville, Tenn.

Finally, the SCTE reported that 406 people attended the Society's "Fiber Optics 1990" conference held in March in Monterey, Calif. The event featured the presentation of 20 technical papers on the topic of fiber.

Jerrold relocates repair facility

HATBORO, Pa.—Jerrold announced here it will move all its repair service activities from North Kansas City, Mo., to Matamoros, Mexico, in a move to streamline its subscriber parts services and repair activities.

The move began last year and is expected to be completed in the third quarter of this year. "By locating this organization adjacent to our converter manufacturing facility in Matamoros, we will achieve the flexibility necessary to respond to customer needs," said Ed Ebenbach, the subscriber marketing vice president for the company.

The transition has been moving smoothly according to Ebenbach. Two repair lines are already relocated in Matamoros.

In another Jerrold announcement, Shaw Cablesystems Ltd. was the first Canadian operator to purchase new second generation AM fiber-optics systems developed by Jerrold. Shaw serves approximately 100,000 subscribers in Canada with 12 systems. The MSO will use three AM fiber-optic links to connect its headend to its main office and satellite receive site in Edmonton, Alberta.

S-A announces new contracts

NEW YORK and ATLANTA—International Cablecasting Technologies and Scientific-Atlanta announced they will jointly develop a new product to serve the digital audio market in cable. S-A will complete development of, manufacture, sell and distribute cable headend and subscriber reception equipment for the multichannel digital music package to be programmed and marketed by ICT.

S-A also announced $3.5 million in new contracts for earth station equipment and services and introduced three new satellite products at the National Association of Broadcaster's conference. These were the Model 7530 satellite receiver, the Model 7670 earth station controller (a PC-based monitoring and control system), and the Model 8060 6-meter earth station antenna.

On the international front, S-A announced it has received orders from Masada U.K. and PTUK for three 30-channel PAL I headends. The headends will incorporate the company's satellite receivers, Model 6351 PAL I video modulators and Model 6151 PAL I video processors. They will be installed in the Peterborough, Norwich and Bolton franchises in the United Kingdom. →

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- C-COR Electronics Inc. announced record high financial results for the third quarter ended March 30, 1990, the best quarter ever in the company's history. C-COR reported net income of $1,666,000 on sales of $18,310,000 compared to net income of $1,155,000 on sales of $14,337,000 for the third quarter of the previous year.
- Nebraska cable operator Marty Callahan recently started marketing his Safety Alert Monitor. It is a multipurpose alert system available only via CATV systems that allows the National Weather Service to send a 12-second, 21-tone siren to just those homes within danger of a sighted tornado or other life-endangering weather.
- Optical Cable Corp. announced a new "800" number to provide quotes and answer questions about its fiber-optic cables. The number is (800) 622-7711.
- Fiberoptics Communications Corp. was designated as a certified training facility by Antritsu America, Ametek Controls Division and GTE Fiberoptics Product Division. Students participating in Fiberoptics Communications Corp.'s courses receive certificates of completion and/or competency related to each manufacturer's products.
- Raychem announced as a result of reorganizing its business, it will incur a $75 million to $90 million charge to third quarter earnings and will reduce its 11,400-member worldwide work force by 8 percent or 900 employees. Plans are being implemented over the next several months.
- Jones Cable Group Ltd. was awarded the Leeds cable TV franchise by the Cable Authority of Great Britain. The franchise is the fifth largest in the United Kingdom (based on number of homes), covering approximately 290,000 homes in the eastern side of the West Yorkshire metropolitan area.
- Continental Cablevision filed comments with the National Telecommunications and Information Administration (NTIA) against "rushing headlong to provide additional incentives" to phone companies to deploy integrated broadband fiber-optic networks that would carry voice, video and data services over a single wire to the home. The company said that there are substantial technological and economic uncertainties concerning integrated broadband network architecture. It also said that phone companies do not need to become TV programmers in order to have incentive to make technological improvements in transmission facilities.

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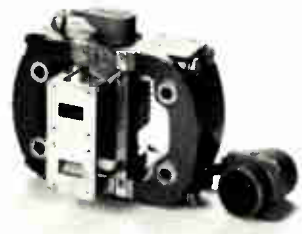

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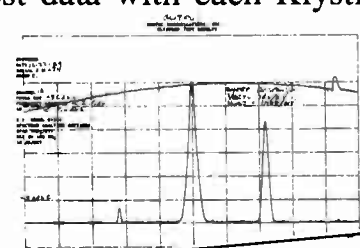

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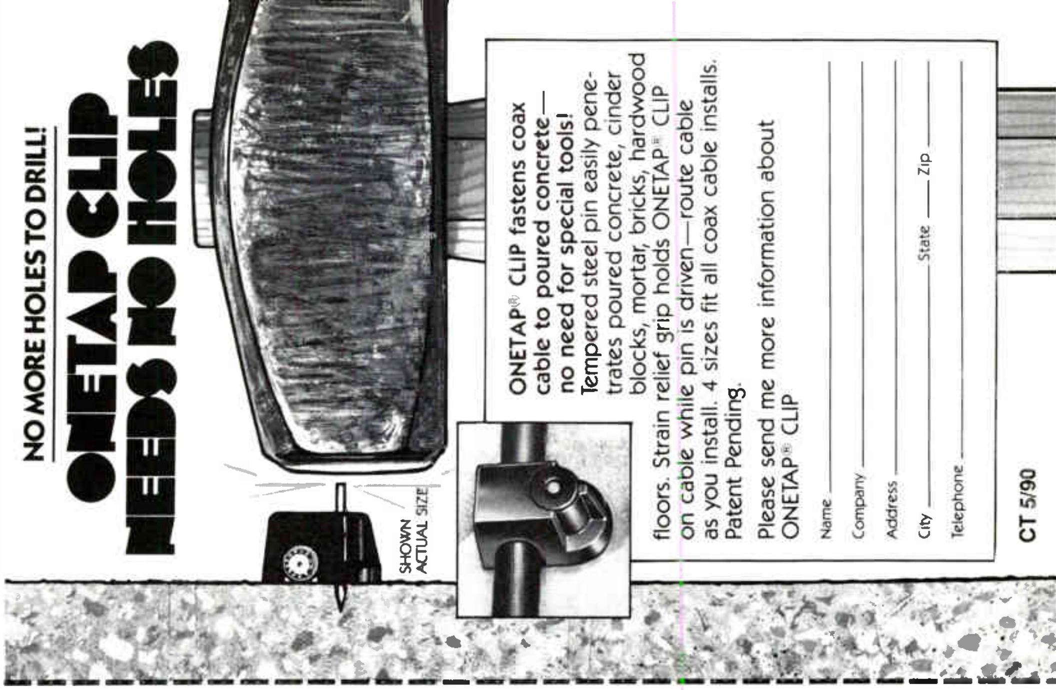

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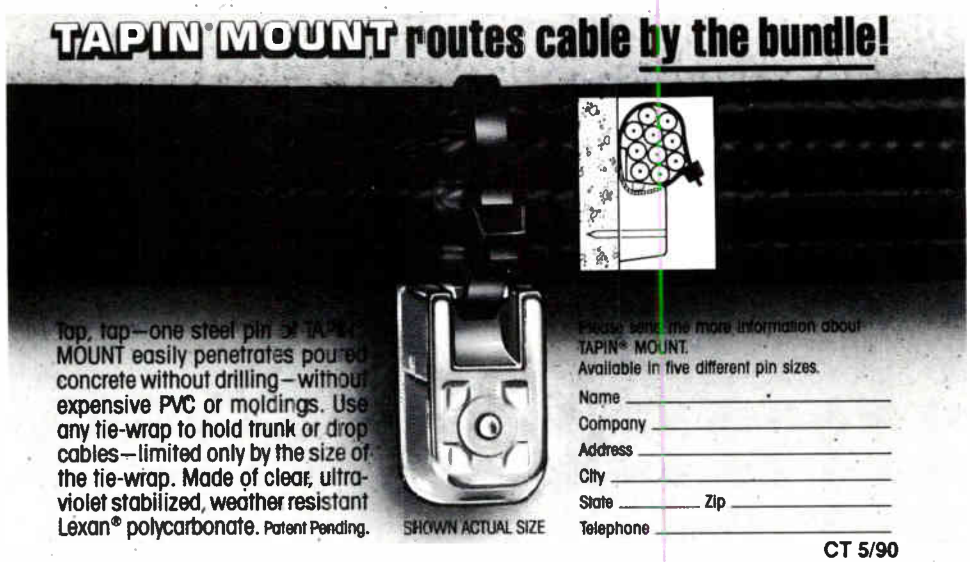

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3. Please check the category that best describes your firm's primary business (please check only one).

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- ☐ 2. Cable TV Contractor
- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
- ☐ 8. Cable TV Component Manufacturer
- ☐ 9. Cable TV Investor
- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
- ☐ 12. Program Producer or Distributor
- ☐ 13. Advertising Agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Other ____________________ *(please specify)*

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1. Are you a member of the SCTE (Society of Cable Television Engineers)?
Yes ☐ No ☐

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

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- ☐ 3. Cable TV Program Network
- ☐ 4. SMATV or DBS Operator
- ☐ 5. MDS, STV or LPTV Operator
- ☐ 6. Microwave or Telephone Company
- ☐ 7. Commercial Television Broadcaster
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- ☐ 10. Financial Institution, Broker, Consultant
- ☐ 11. Law Firm or Government Agency
- ☐ 12. Program Producer or Distributor
- ☐ 13. Advertising Agency
- ☐ 14. Educational TV Station, School or Library
- ☐ 15. Other ____________________ *(please specify)*

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  - ☐ Manager
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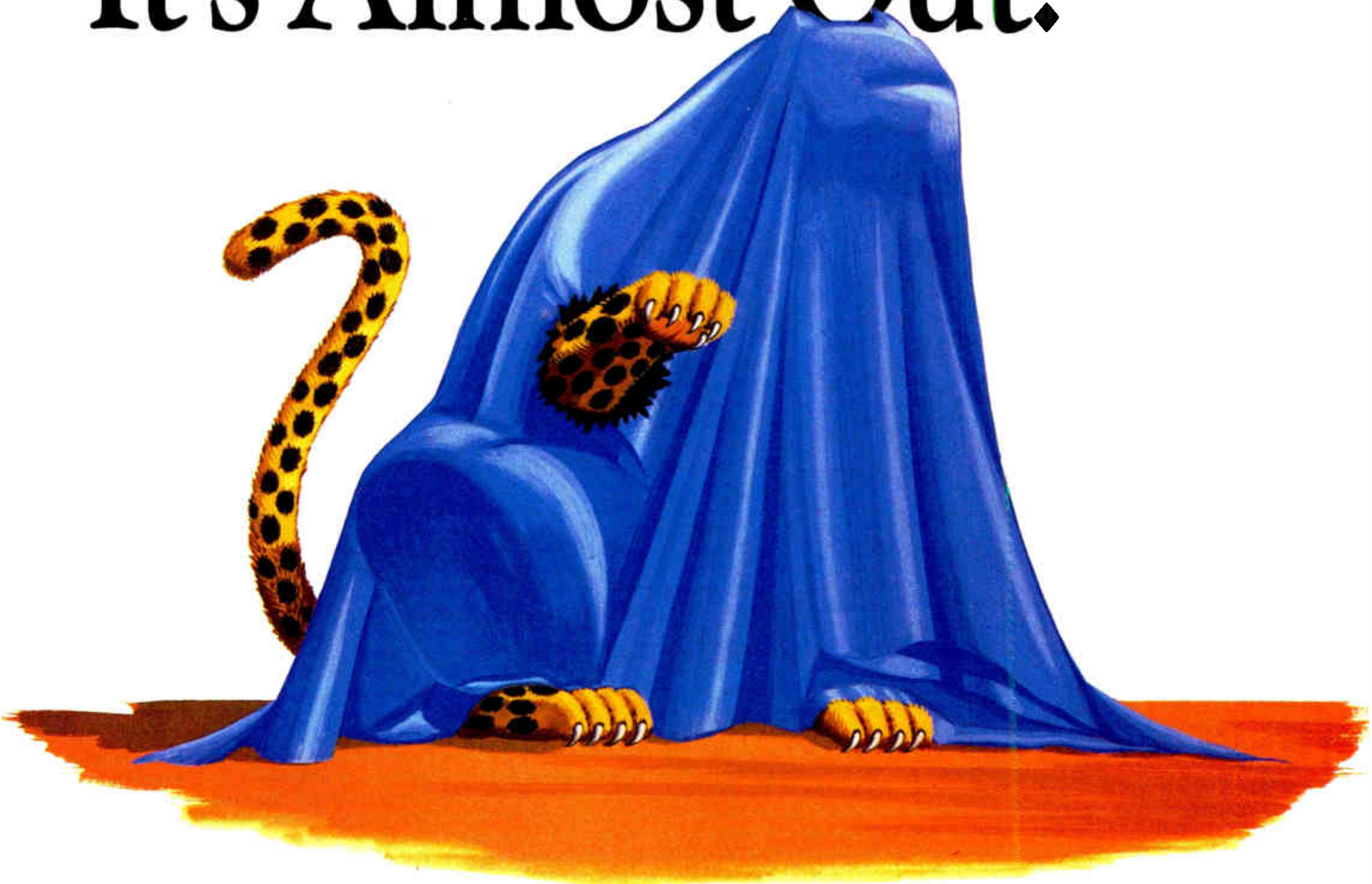

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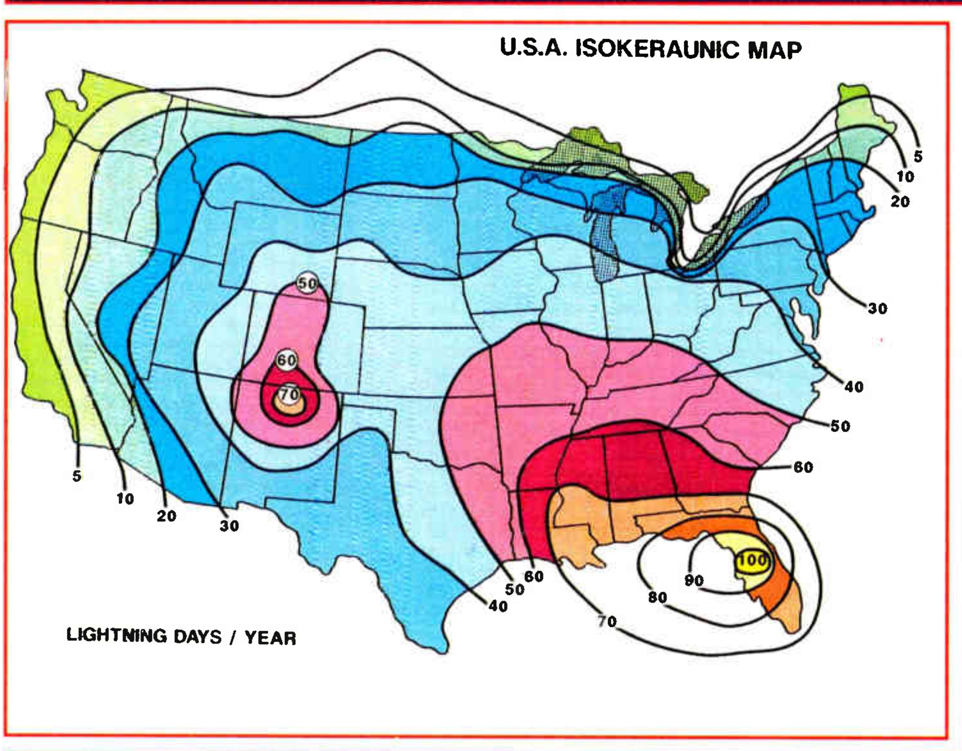
Basic lightning safety

By Laura K. Hamilton



Lightning is drawn to water, metal and the tallest things standing in an open field. So obviously the first rule of lightning safety is to avoid being around water, avoid being around metal objects and avoid being on or actually being the tallest thing standing in an open field.

Thousands of people have been killed by lightning strikes, and you as an installer/technician or someone who has installer/techs working for you should be well aware of lightning safety precautions. After all, someone working on a pole with metal tools and electronic instruments or someone up in a bucket truck is not exactly in the safest position when it comes to lightning.

Common sense first

We all know that towering black clouds, thunder and increasing winds mean an impending thunderstorm, and that thunderstorm could very well emit various forms of visible electrical discharge we call lightning. Now is the time to get down from the pole or down from the bucket truck—before the storm hits. This bit of safety may be common sense, but it often was lack of common sense or lack of basic lightning safety knowledge that has cost people their lives.

The following is a list of tips that is not only helpful on the job, but at any time lightning threatens:

- If you hear (perhaps on your truck's radio) a thunderstorm *watch* has been issued in the area you're in, that means a thunderstorm and lightning are *possible*. Be alert and watch the skies. Remember that lightning can strike miles from the large, main parent cloud and so you should take precautions even though the storm isn't directly overhead.
- If you hear that a thunderstorm *warning* has been issued, this means the storm and the danger of lightning is *imminent*. You may only have a few minutes to seek shelter. Keep in mind though that thunderstorms and thus lightning can occur so fast that you may not even get a warning.
- During a warning, go inside immediately (if possible) or get in an all-metal (not convertible) automobile.
- Except in the case of a severe emergency, do not use the telephone. Lightning can travel through the phone wires.
- If you are caught outside, get away from poles and isolated trees and avoid small isolated buildings like sheds.
- Avoid projecting above the surrounding landscape. That means don't stand on a hilltop—go to a low place like a ravine or valley. It's dangerous to be up in a bucket truck.
- Get away from open water.
- Avoid being near metal equipment or small vehicles like motorcycles, bicycles or golf carts. That includes your tools and metal equipment. Do you have metal tips on the toes of your boots? Like spiked golf shoes, wearing those out in a storm is just asking for trouble.
- Do not stand with a group of people in the open. Keep people several yards apart.
- Stay clear of wire fences, clotheslines, metal pipes and rails.

First aid first

According to the National Weather Service if you are far from a safe shelter in an open field and feel your hair stand on end, lightning may be about to strike you. Drop to your knees and bend foward while putting your hands on your knees and do not lie flat on the ground.

If someone is struck by lightning, he or

Courtesy The Weather Channel

she does not carry an electrical charge and can be handled safely. Note that someone who appears to have been killed by a lightning strike can often be revived. This requires immediate first aid.

If someone is the victim of a lightning strike, the American Red Cross says you should follow these procedures:

1) If the victim stops breathing, you should immediately administer mouth-to-mouth resuscitation, once every 5 seconds for adults and once every 3 seconds to infants and small children. If there is no pulse and no breathing, then a combination of mouth-to-mouth and external cardiac compression is necessary. It is extremely important here to note that only persons with the proper training should administer this. (The Red Cross offers a first aid course that provides instruction on how to help a lightning victim.)

2) If a person is struck by lightning and appears to be only stunned or unhurt, medical attention may still be required. Check for burns, particularly near buckles and jewelry. Do not let the person walk around. Send someone for help and stay with the victim until that help arrives.

Common danger

Thunderstorms are considered one of the most dangerous of all weather storms and even though you probably don't consider them as serious as hurricanes or tornadoes, they can be. If you're a tech, it's likely you'll run into one while working outside this spring or summer because thunderstorms occur everywhere in the country. The accompanying figure shows lightning days per year in different parts of the country.

According to The Weather Channel, lightning may be the most dangerous part of the thunderstorm; every year over 100 people die in the United States because of it. But what exactly is it?

When the air is warm and a lot of moisture in the air, conditions are ripe for thunderstorms and consequently lightning. To get a bit technical, when the wind is still, the air will rise quickly and as it does, the moisture condenses and a cumulonimbus cloud or thunderhead forms. Updrafts hold water in the cloud until eventually there is too much water and the rain breaks through.

As moisture is forced through the air, the water can become positively or negatively charged and those charges build up in the cloud to extremely high levels and are attracted to opposite charges on the ground. Lightning occurs when the attraction becomes too great and there is a rush of electricity to the ground. Note that lightning does not necessarily strike the highest point. Side flashes are common, especially to tall structures. So just because you're not on the highest point in an area doesn't mean you're completely out of danger.

Popular myths like lightning never strikes the same place twice and lightning is not always dangerous just add to its possible dangers. Lightning can strike the same place repeatedly and since a lightning bolt can reach 50,000° F (five times hotter than the sun) there is always a chance of great danger. Obviously being prepared to act quickly and act with common sense is the only way to avoid its dangers.

References

1) Erico Products Inc., "Cadweld News," First quarter 1990.
2) National Oceanic and Atmospheric Administration, National Weather Service, "Thunderstorms and Lightning," 1984.
3) The Weather Channel and The American National Red Cross, "Weather—Bringing it Home," 1989.

Bringing CATV back to earth

By John Thorn III
Applications Engineer, Biddle Instruments

By some estimates, cable TV today reaches close to 50 million households. With CATV's ubiquitous presence and the expected continued growth in outside plant, certain issues—up to this point often ignored—are starting to surface. One of these regards ground resistance testing. This article provides a brief but helpful summary of why and how to test for ground resistance utilizing a ground tester.

Why test grounds on a CATV system? From the headend to the subscriber's TV set, cable companies have a lot of expensive equipment to protect if they're going to provide optimal service. Cable operating companies need to provide their inside/outside plant hardware with a suitable grounding system and for some very good reasons. Let's explore those reasons.

A technician checks grounds using a ground tester.

Equipment protection and subs' safety

With so much cable hanging high off utility poles the chance of damage by a lightning strike is very real. Without a solid, low resistance ground, the energy from such a strike could easily travel down an ungrounded cable (possibly for miles) to seek and destroy valuable electronic equipment. Worse yet, it may reach the subscribers' service. Not a very pretty thought! Even the best surge protection devices that money can buy may not perform when connected to a poorly grounded system.

Unwanted high frequency noise coupled onto an ungrounded cable can be the cause of numerous headaches. The source (if it is transitory in nature) may take hours to locate.

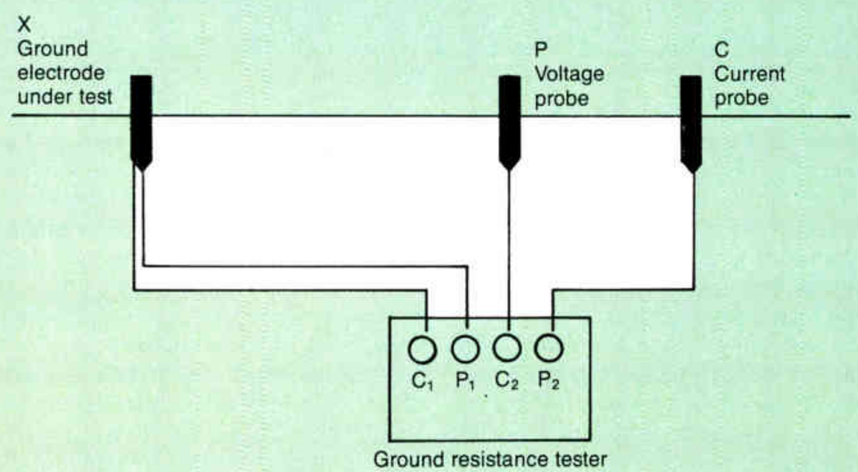
In addition to equipment and sub protection, it's just good practice to provide an adequate path for any type of fault current—whether internally or externally created. What may have been considered a "good" ground may in fact be hundreds or thousands of ohms from ground, thus not providing an adequate low impedance path for unwanted currents. Remember, Mother Nature gives no points for good intentions.

What equipment is needed?

Probably a better question to ask would be, "What equipment *can't* I use?" A standard DC ohmmeter is not capable of measuring ground resistance. This is not only because of excessive ground noise (power and high frequency ground noise) that may "confuse" the meter, but stray DC currents that flow in the earth, which can bias the reading.

There is a line of instruments available that are specially designed to measure the resistance of ground systems. These instruments (such as the one in the accompanying photo) are used to verify the quality of the grounds on utility substations and telephone company ground grids, as well as on simple single-driven

Figure 1: Fall of potential method using a four-terminal instrument



ground rods as found in residential power service entrances and utility poles. This is not to suggest that all such installations are always tested. Thus, it is unwise to trust that a utility pole or residential ground is "good" (or has even been tested).

Testing ground system integrity

The following test and assorted diagrams make reference to Biddle Instruments' ground tester Model 250500CL. This particular instrument is designed to measure ground resistance between .01-1,999 ohms. The instrument also indicates if a high test probe or excessive ground noise condition exists. This article presents a rough overview of the ground testing process. (Some shortcuts have been taken for expediency.) It is important to note that before performing any tests, refer to the operating manual of the particular instrument you are using and be sure to observe the proper safety precautions.

In a perfect world, the resistance of the system ground would be 0 ohms. But even approaching the value is very difficult and very expensive. Some companies follow even more demanding specifications (sometimes looking for values of 5 ohms or less). More than likely, the system designer may have some input regarding the ground resistance values to target.

Methodology

The method that my company recommends for testing involves a procedure known as the fall of potential test. This is not the only test but is very popular and straightforward. To understand the fall of potential test, refer to Figure 1. The instrument produces a 135 Hz, switched DC output current that flows from X, through the earth, and into the current probe (the other side of the current generator). This current is measured by an internal current meter and represents the current passing through the earth. The current flowing through the earth creates a voltage gradient across (and through) the surface of the earth.

The P probe senses the voltage at that frequency of 135 Hz (filtering out all other unwanted signals). The voltage value detected at the P probe is then divided by the current value that is flowing through the earth and from this the resistance of the ground electrode (or system) is measured and indicated directly in ohms on the instrument's LCD.

Equipment setup

The key to this test is in the proper placement of the probes. If the test probes are placed too close to the ground electrode to be tested gross errors will result (see Figure 2). If the probes are placed far enough away from the ground system to be tested (this is said to be out of the *sphere of influence* of the rod to be tested) an accurate test can be made (see Figure 3).

Figure 3: True ground resistance of electrode under test

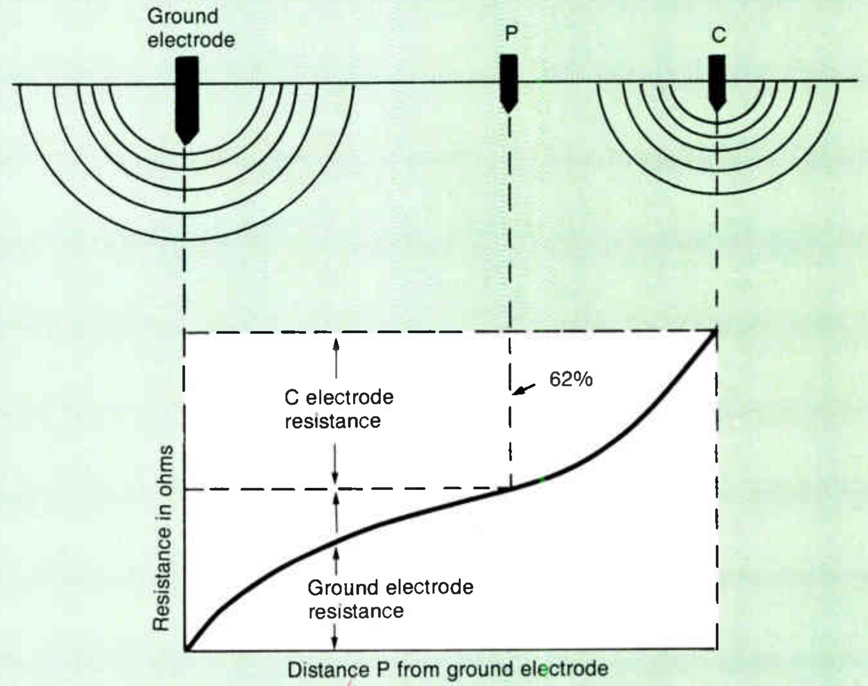
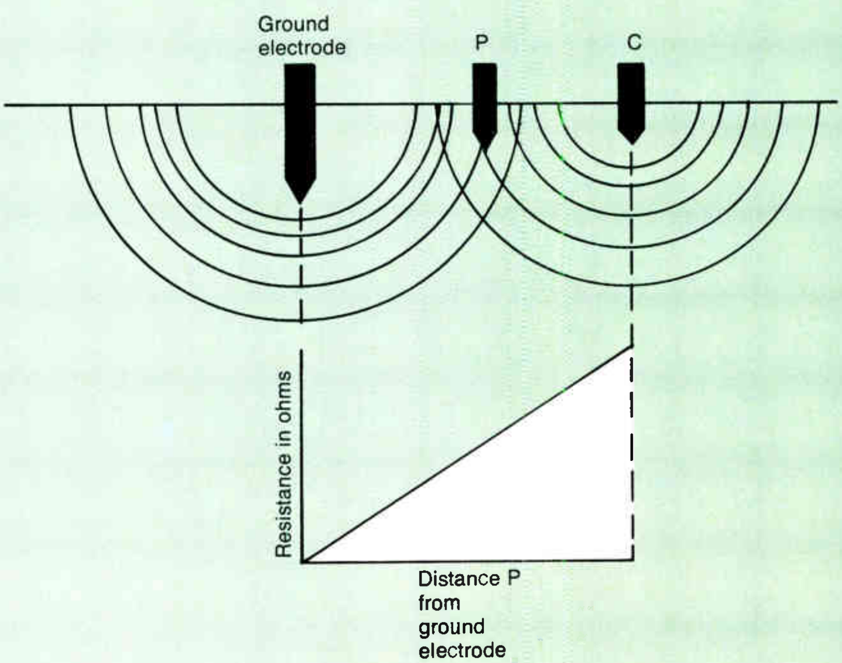


Figure 2: Ground electrode and C test lead too close together



To place the probes, follow these steps (and refer to Figure 4):

1) Determine the depth of the ground electrode to be tested.
2) Place the C probe at least four times the depth of the electrode away from

(Continued on page 88)

Hum modulation in drop passives

By Ron Hepler
Group Engineer, Prime Cable

Worrying about hum modulation in CATV drop passives appears on initial consideration to be a waste of time since power is typically not delivered to any active devices via the drop. But the drop often shares a percentage of the utility neutral current when the installation is bonded in accordance with the National Electrical Code (NEC) Part 820. Of this current on the drop, about 15 percent flows via the center conductor.

This current flow can saturate the ferrite transformer cores in the splitter and hence impress the wave shape of the neutral current on the desired RF carriers as hum modulation. Besides being visible as horizontal bars moving vertically through the picture, hum on an addressable converter data carrier has been known to significantly reduce addressing reliability. Some changes in drop passive design could eliminate hum modulation and reduce tap port, splitter and converter failure during surge conditions.

Figure 1 illustrates a condition where a voltage drop of 3 V across a neutral conductor produces a current flow of 5.53 A on the CATV drop of which 17 percent would be carried by the center conductor. This would certainly produce an unacceptable level of hum modualtion on any RF carriers present on the drop.

Environmental factors

Several factors can influence the amount of current on the drop. First is the numerous connections in the utility neutral conductor between the transformer and the residential power distribution panel. Any increase in the resistance of the neutral conductor due to connector loosening or oxidation will cause a proportional increase in current flow on the parallel CATV drop.

The second deals with bonding in the CATV distribution plant. Fewer bonds on the distribution plant offer increased potential differences between CATV sheath and utility neutral causing greater current flow on the CATV drop. The worst case scenario would likely be typical underground plant where few bonds exist except at the ferroresonant power supplies and the ground blocks of residential installations. This general lack of bonds

Figure 1: Three volt drop across neutral conductor

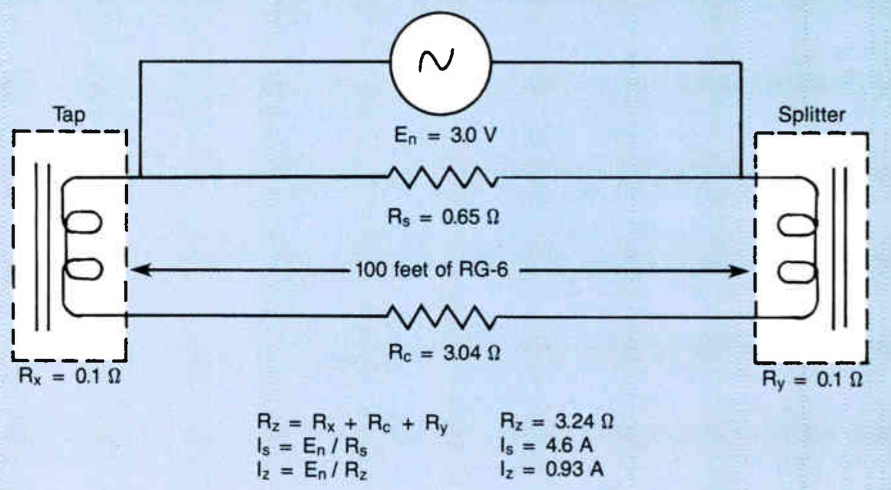


Figure 2: Test interconnect using variac to simulate neutral current source

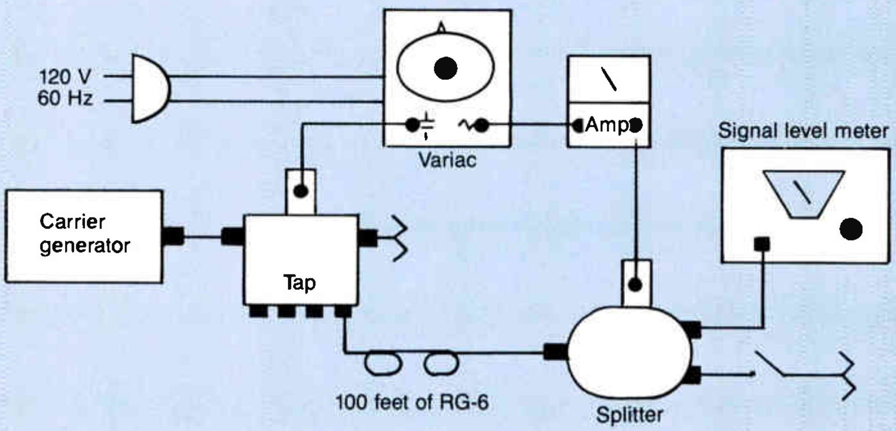


Figure 3: Tap testing using power inserter

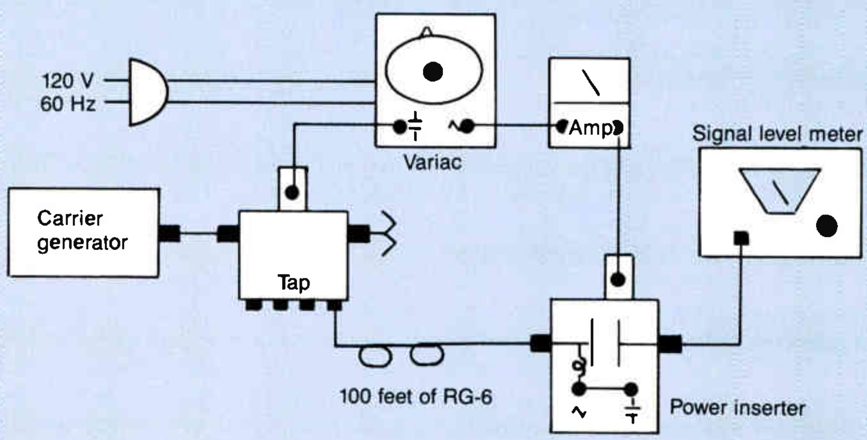
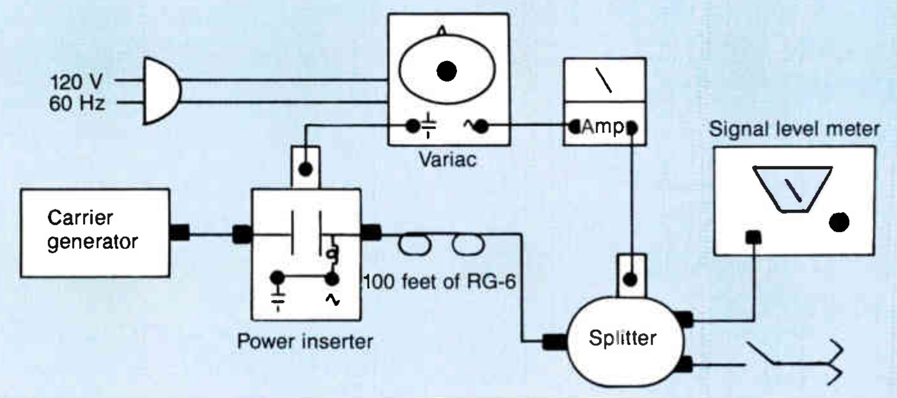


Figure 4: Splitter testing using power inserter



> *"Hum (modulation) on an addressable converter data carrier has been known to significantly reduce addressing reliability."*

Figure 5: Test results of Taps A and B (unused ports open)

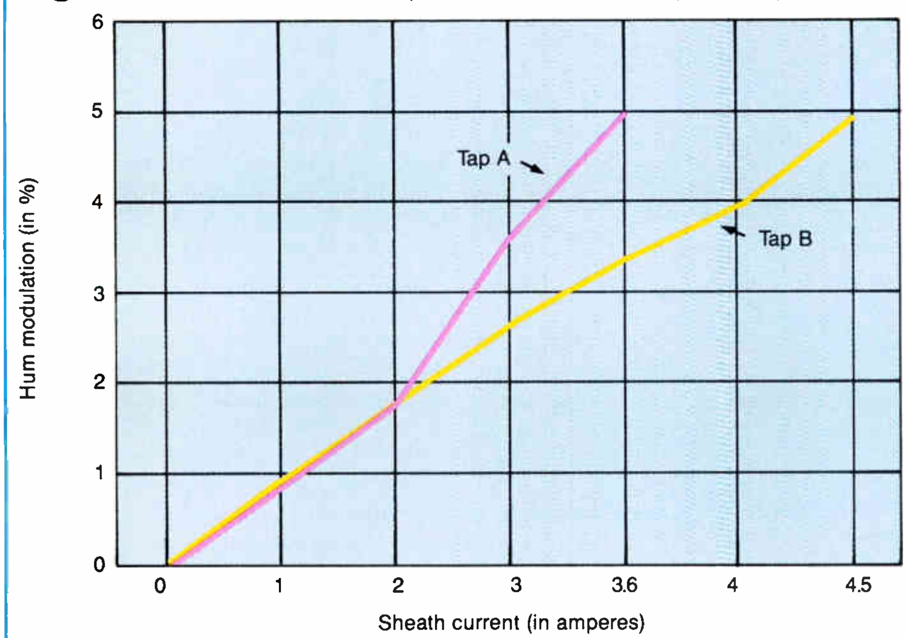
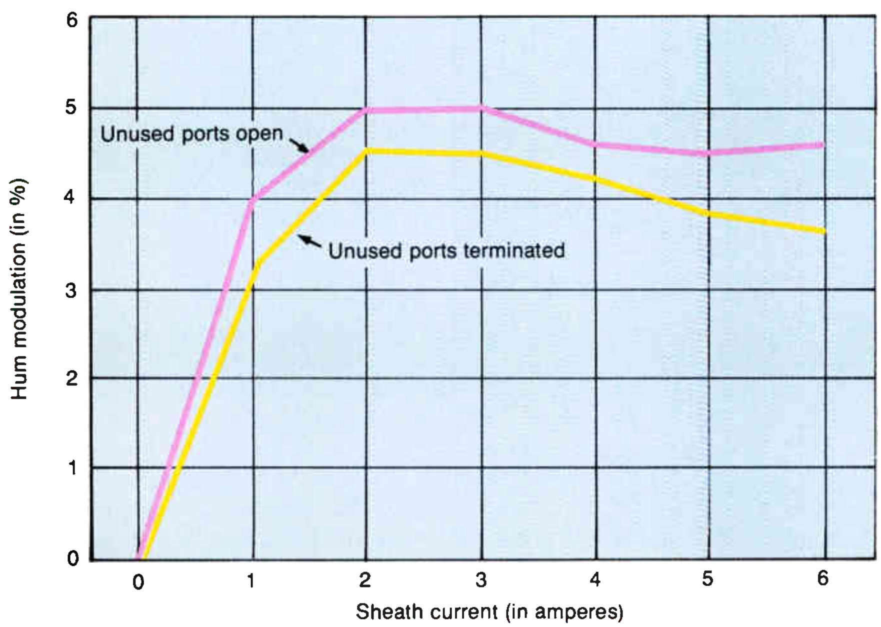


Figure 6: Test results of Splitter A



produces an alternate neutral network capable of carrying primary as well as secondary neutral current since all utility neutrals are common bonded.

Quantifying the effect

Recently measurements were made by the author and Prime Cable's east Houston engineering staff to characterize the relationship between current on the drop and hum modulation of an RF carrier. Two brands of taps and four brands of splitters were tested, both individually and in tandem. Figure 2 shows the test interconnect using a variac to simulate the neutral current source across 100 feet of RG-6 trishield drop cable. Wavetek's SAM I signal level meter was selected to measure hum modulation since it is battery powered. By not requiring AC power, no undesired ground loops are created that might affect the accuracy of the measurements. To test devices individually, a Blonder-Tongue MDX-75F power inserter was used to complete the low frequency path for the center conductor as illustrated in Figures 3 and 4.

The hum modulation vs. sheath current test results are shown in Figures 5-9. These results show that a single device can impress 5 percent hum modulation on a carrier with as little as 2 A of neutral current on the drop. When the tap and splitter were combined, the minimum current to achieve 5 percent hum increased to 2.7 A. But on average, 5 A were required for the combination to produce 5 percent hum. Conversely blocking power in the center conductor circuit eliminated all measurable hum modulation while current continued to flow on the sheath.

The relationship between current and modulation was not always linear as Figures 5-9 show. These illustrate the results of four of the individual tests and two of the eight combination tests. In some cases, after reaching the peak, modulation depth decreased as current flow was further increased. Modulation depth was also affected by the addition of a resistive 75-ohm terminator to any of the open ports on the tap or splitter. The resistive terminator provided an alternate path for current flow within the windings of the device—in some cases reducing modulation while in others increasing it.

"Changes in drop passive design could eliminate hum modulation and reduce tap port, splitter and converter failure during surge conditions."

Surge related failures

Many taps, drop splitters and converters are replaced every year due to the windings of the ferrite transformers being burned open during surge conditions.

Figure 7: Test results of Splitter D

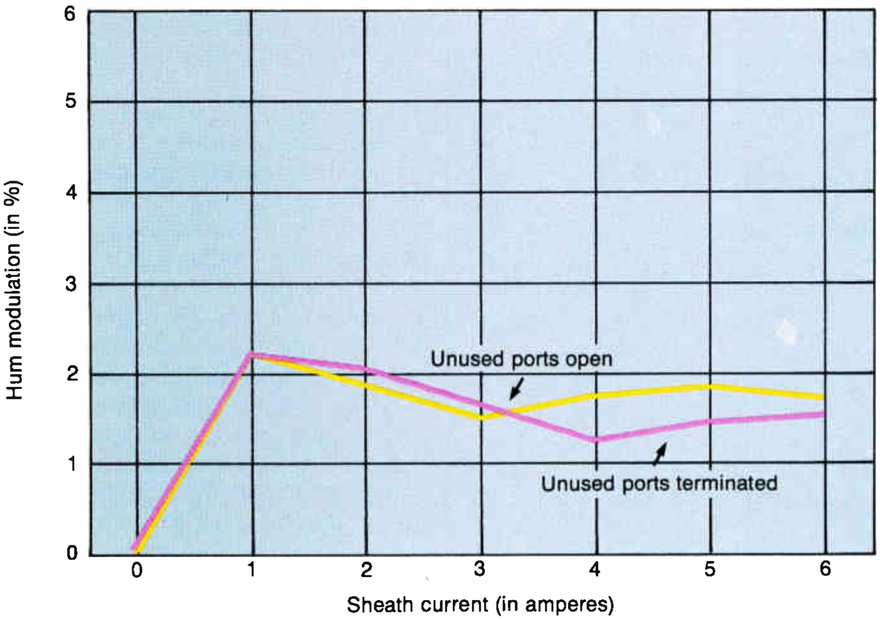
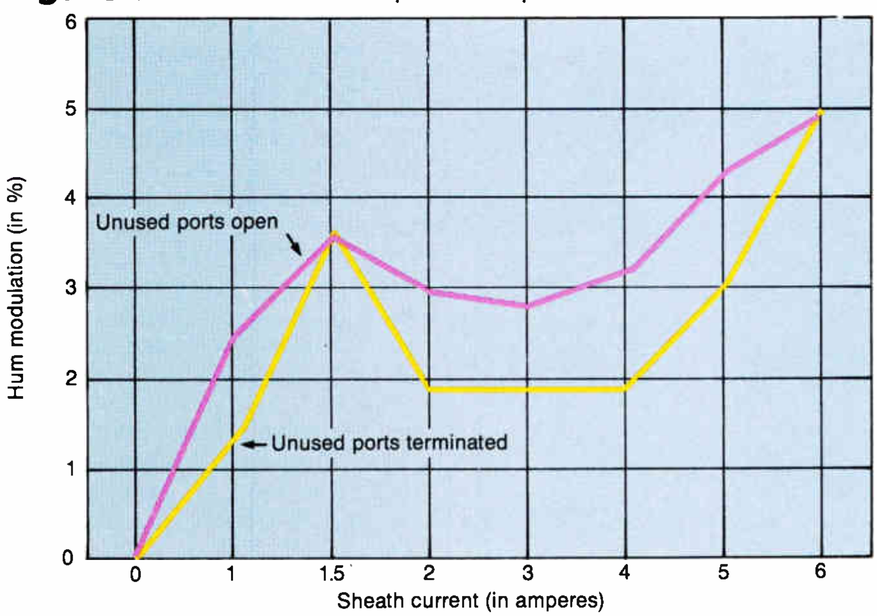


Figure 8: Test results of Tap A and Splitter A



When circuit breakers trip or fuses open on individual phases of the utility distribution, increased neutral current results even if only momentarily. This condition can cause significant currents to flow in nearby CATV drops. Destructive tests indicate that the 28 gallium windings of these ferrite transformers will open at about 6 A. This translates to a total current of about 36 A impressed on a 100-foot RG-6 trishield drop by a potential difference of only 20 V—even less on shorter drops.

Preliminary indications are that 1-2 percent of all service calls are caused by this type of failure during surge conditions. When the calls resulting from drop induced hum are added, a solution would have a noticeable impact on the overall quality of the service we deliver.

Possible solutions

One solution would be to disconnect the bond at the installation ground block, replacing it with a ground rod. While this would likely be effective, it is unacceptable because it would eliminate NEC 820 compliance thereby introducing a safety hazard to the subscriber.

The acceptable alternatives incorporate a power block also known as a DC block on the center conductor. This would effectively eliminate all 60 Hz current flowing on the coaxial center conductor and can be accomplished in several ways.

The first option is to install a high pass filter ground block. By definition these devices employ a DC block. While readily available they would not be usable in full two-way plants due to their designed low frequency cutoff. Additionally, in multiple outlet installations the filters would require two more F connector interfaces increasing the possibility of signal leakage.

Next is the inline DC block. While certainly effective it also adds on F interface and could easily be removed or confused with similar looking inline pads. Moreover, the reactance of the DC blocking capacitor combined with that of the inductor in a splitter produces a resonant tank that can impact frequency response flatness.

It is apparent that the optimal solution involves designing the DC block into the input of the drop splitter. By selecting the proper values of reactive components, frequency response perturbations can be minimized. The capacitor voltage rating need not exceed 500 V due to the low resistance of the parallel sheath. The incremental cost of a DC blocked splitter would likely range from less than 5 cents

(Continued on page 124)

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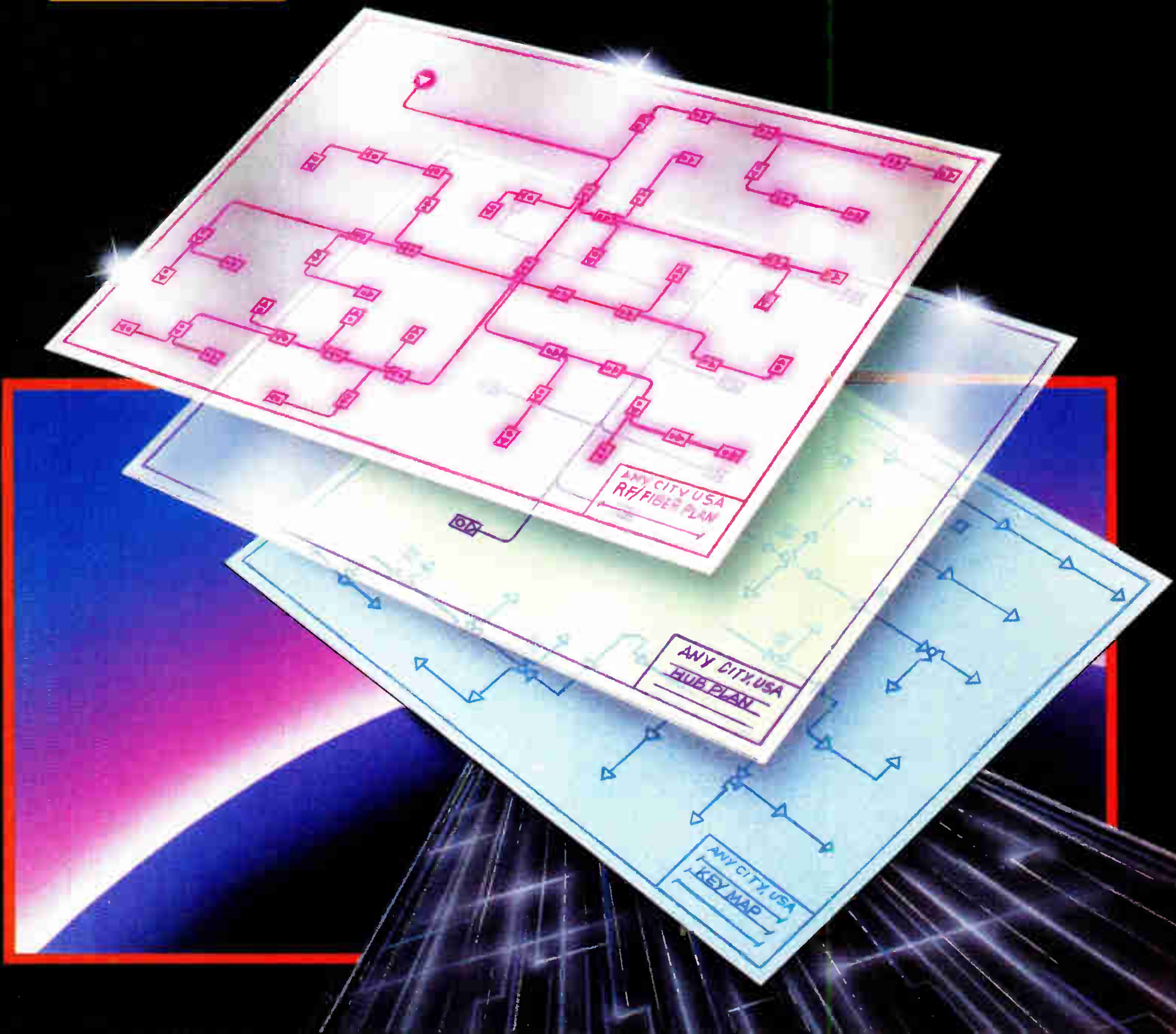


How to improve power supply efficiency

By Tom S. Osterman
Engineering Supervisor, Alpha Technologies Inc.

Power supply efficiency has become very important to all CATV system operators as electrical power rates continue to rise. Efficiency can be improved in several different areas of a plant powering system. Even a 2 to 3 percent increase in efficiency can add up to a surprising cost savings over time.

New developments in CATV technology have brought increased capabilities and transmission quality at the expense of increased power consumption. As cable systems become more "power hungry," system designers have focused more attention on powering efficiency. Efficiency has to be considered carefully in new plant design as well as system rebuilds. This article will suggest some ways to improve the efficiency of the typical CATV powering system.

By far the majority of North American CATV systems use AC power supplies that provide conditioned and regulated 60 VAC power to the active devices in the system. Most of these power supplies are based on the ferroresonant (ferro) power transformer topology. The ferro transformer design has been around for over 40 years and proven to be extremely reliable as well as providing other important advantages.

Ferro transformer facts

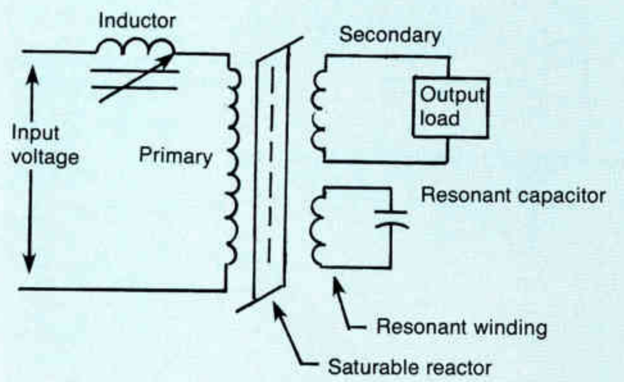
A ferro transformer differs from a regular linear power transformer in many ways. First of all, it is a two-component magnetic regulator. It consists of a specially designed lamination core with separate windows for the primary and secondary coils. Unlike a linear transformer, a ferro core is designed to go into magnetic saturation. The second component is an AC capacitor that with a resonant winding on the transformer secondary forms a resonant tank circuit (see Figure 1).

A ferro transformer can be easily understood as an LC low pass filter with a corner just above the line frequency (60 Hz) followed by a roll off of 40 dB per decade.

In typical operation, voltage present at the primary will excite the main magnetic flux path that in turn excites the secondary winding, which is tuned by the resonant capacitor (usually several microfarads). As the secondary goes into resonance, high circulating currents flow in the resonant tank circuit that drive the main flux path into saturation. Once the core is in saturation, normal voltage fluctuations at the primary will not pass through and increase the secondary voltage. Any decrease in primary voltage will not affect the secondary voltage as long as the core remains in saturation. This tranformer—once it is saturated—will provide line regulation over a wide range of input voltage (usually 80 to 140 VAC).

Load regulation is provided by the use of a shunt magnetic path that has air gaps between it and the main magnetic path that is operating in saturation. The air gaps limit the flux in the shunt path preventing saturation in the shunt portion of the magnetic circuit providing a good linear response.

Figure 1: Ferro transformer simplified equivalent circuit



If the output load current in the secondary is increased, the resonant circuit "Q" drops and the circulating currents will then decrease. The shunt flux also will decrease allowing an increase in the main magnetic flux path, which in turn transfers more energy from primary to secondary thus compensating for the increase in the secondary load current. This provides load regulation.

The transformer regulation can be improved by using a compensation coil, otherwise known as a buck winding. This is a part of the primary winding that is physically wound on the secondary to aid in regulation. This design is not optimal for CATV systems because it compromises the isolation and noise attenuation capabilities of the transformer. Most ferro transformers can withstand a dead short on the secondary for an extended time without damage due to the foldback characteristics of the shunt circuit (see Figure 2).

It is important to note that the output waveform of a ferro transformer is clipped; it is often described as a *quasi-square wave*. This wave shape is caused by the transformer core saturation. It is desirable for CATV systems because of its lower peak voltage that is easier to rectify and filter in the DC power supplies in trunk stations and other active devices.

This output wave shape can be corrected by an additional winding on the transformer appropriately called a correction coil. The output can be corrected with this winding to become a sine wave with low distortion if desired, but is rarely used in CATV plant powering.

Ferro design

The ferro design offers both line and load regulation that pro-

"Even a 2 to 3 percent increase in efficiency can add up to a surprising cost savings over time."

vide protection from voltage surges and sags at the primary. The majority of utility power problems are characterized by dropouts or sags caused by momentary line faults, utility switching operations and heavy equipment such as motors and compressors coming on line in close proximity to the CATV AC power supply. A ferro transformer can provide output power for as long as a one cycle dropout (depending on load). This is known as hold-up time, which is provided by the energy stored in the resonant tank circuit described previously.

The most important advantage of ferro-based power supplies is their outstanding isolation characteristics. The primary and secondary windings are in separate window areas of the core and thus are physically isolated from each other. This minimizes capacitive coupling from primary to secondary and greatly reduces the possibility of voltage spikes and noise being coupled to the secondary and then to the load.

It is common in certain parts of the country to see utility power line transient voltage spikes up to 1,500 V regularly and spikes up to 5,000 V occasionally. The ferro transformer does an excellent job at attenuating these spikes and protecting the output load from damage. Typical noise attenuation is 120 dB for common mode noise referenced to ground and over 60 dB for transverse mode (line to neutral).

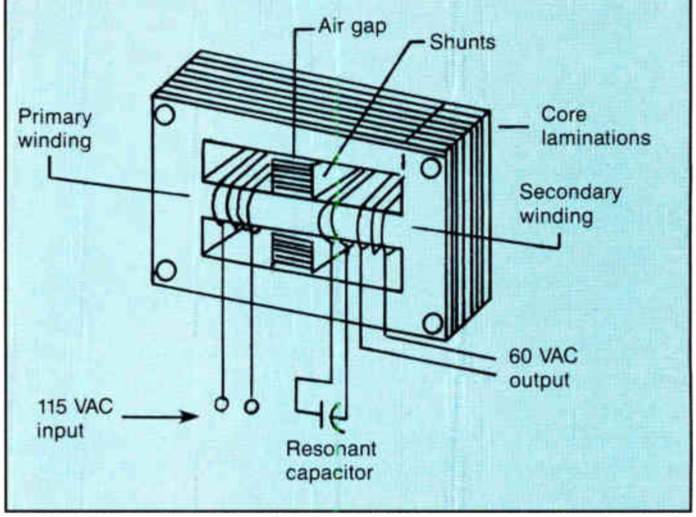
No free lunches

The ferroresonant-based power supply is a natural for the CATV application, but it does have is disadvantages. As the saying goes, "There are no free lunches"; you can't get something for nothing. Ferro transformers are not as efficient as linear power transformers. The textbook maximum efficiency for a ferro is about 94 percent but typical designs run as low as 80 percent.

There are two main causes for inefficiency in a ferro transformer: core loss and I^2R drop (otherwise known as copper losses). The losses can be directly related to temperature—as the operating temperature increases, so will the losses. Copper has a positive temperature coefficient; its resistance will increase about 0.4 percent per degree Celsius. Core losses caused by eddy currents will increase over temperature and make up the majority of the loss in the transformer.

There is another variable that relates to efficiency: the regulation tolerance. A ferro transformer can be designed to meet less than a ±1 percent combined line and load regulation specification, but it will be very inefficient due to the large circulating volt amps (VA) in the resonant tank circuit. The tank circuit will have to be running at a high energy level to maintain the tight regulation over line and load changes.

Figure 2: Typical ferro transformer core



Efficiency will be the best at close to full load and low input line because most of the circulating VA is being delivered to the output load. Efficiency will be worse at nominal or high input line with less than full output load. Again, this is because of the large amount of circulating VA in the tank circuit that is not being used by the load and is subject to core loss and winding resistance losses.

This scenario is common in new installations where system designers often load the power supply to 75 percent capacity worst case. This offers a safety factor and room for future expansion, but it does so at the expense of efficiency (see Figure 3). A ferro transformer will always run more efficient if operated close to its rated full load output current.

DC power supplies

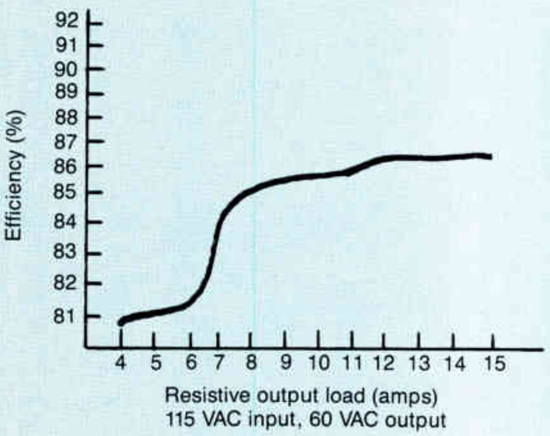
There is a relatively new family of DC power supplies known as *switching power supplies.* There are several topologies including boost, buck, forward and flyback converters whose main job is DC-to-DC conversion, either step up or step down.

Switchers offer much higher efficiency than the older linear series pass regulators. Some switchers can run up to 98 percent efficient compared to 40 to 50 percent for an equivalent linear supply. Switching power supplies are being used in trunk stations and other actives because of the massive gain in efficiency as well as reduction in physical size (watts per square inch) and weight. The switching power supplies in the full-featured trunk stations offered by the major manufacturers have efficiencies close to 90 percent and (more importantly) have an input line regulation tolerance of up to ±30 percent! Their variable duty cycle design offers this wide line regulation range while maintaining very high efficiency.

This takes us back to the ferro AC power supplies. Why maintain ±3 percent output regulation (which is the typical specification) when the active devices to be powered by the AC supply can accept up to ±30 percent variation in input voltage?

It can be argued that I^2R drops in the cable spans between power supplies can eat up some of the power so that a lower

Figure 3: Efficiency vs. output load (±3 percent)



voltage is presented to each active further down the span. But with systems using 450 MHz, the trunk amplifiers are closer together and are linked by larger cable that has lower 60 Hz loop resistance, so that the 60 VAC I^2R drop is lower from the power supplies to the loads.

If the regulation specifications for the AC power supplies were relaxed to a ±5 percent or even a ±7 percent, transformers could be designed with less energy in the tank circuit and thus higher overall operating efficiency (see Figure 4). This could mean an increase in efficiency of up to 7 percent for some power supplies.

Good effects

This wider regulation tolerance would not cause any ill effect to the DC power supplies in the active devices in the system and would provide increased efficiency. If a reduction of 7 percent power consumption was multiplied by the number of power supplies in the system, multiplied by the kilowatt hour (kW hour) rate that is being charged by the local utility company, it will become obvious the magnitude of cost savings that is possible. This can be achieved by using the ferro transformer power supply primarily for its extremely effective protection against transients, utility line noise, dropouts, lightning strikes and as a pre-regulator for the DC power supplies in the active devices in the plant.

The other obvious advantage to the ferro AC power supply is the battery back-up standby mode for protection from complete utility power outages. The ferro transformer uses hold-up time (as mentioned earlier) to cover the brief interruption in power as the power supply transfers in phase from utility power to battery-backed inverter mode. This is so effective that the load sees no interruption in the AC waveform during transfer in either direction.

The transformer will also regulate the change in battery voltage as presented to the AC inverter stage from high battery to low battery while maintaining a steady AC output voltage. With the wider regulation tolerance implemented, the transformer efficiency would be higher and thus the standby time would be longer for the same battery pack.

Load power factor

It is important to note the load power factor can influence the regulation characteristics of a ferro transformer. Switching power supplies look like a partially capacitive load to any AC power supply. This is due to the large DC filter capacitor after the input rectifier in the switcher. There is also a complex relationship with the effect of the DC output filter capacitor as the switching duty cycle changes with fluctuations in AC input voltage and output load variations.

This makes for a complex load to model accurately, as the load power factor in some systems could approach 0.7 P.F. (leading) due to the load capacitance. The effect this has on a ferro power supply is to effectively add the load capacitance in parallel with the resonant tank circuit capacitance, which will de-tune the tank slightly. This will increase the output voltage by a certain amount depending on the actual load power factor. If the transformer was loaded to the other extreme with a 0.7 P.F. inductive load (lagging), the tank circuit would be de-tuned in the other direction producing a drop in output voltage.

Thus it is important to remember that in testing a ferro AC power supply, a purely resistive load or a load using incandescent light bulbs is not necessarily an accurate simulation of the characteristics of the real world loading in the plant. Some power supply manufacturers are aware of this phenomenon and design their transformers accordingly.

Another possible way to improve powering efficiency in a system is to use solid copper center conductor trunk cable instead of the more popular copper clad center conductor cable. It is possible to reduce the cable loop resistance by at least 20 percent, and this would reduce the I^2R loss in the cable between the power supplies and the loads. A plant designer would have to evaluate the estimated power savings over a certain amortization period vs. the initial extra cost of the solid copper center conductor cable.

Utility billing

A related topic to the discussion of efficiency, is the issue of utility billing for CATV plant power usage. The method used varies with each utility and CATV company. Some systems are billed by the nameplate rating of the power supply. It is important to measure the true power in watts that is being used by the input of the power supply as it operates in the field. This will take into account the actual loading of each supply including losses. For example, if XYZ Power Co. reads the nameplate output rating of the power supply as 14 amps and then multiplies that by 115 V supplied to the power supply input, it would charge the cable system operator for 1,610 VA or 1.61 kW hours multiplied by 24 hours for a daily consumption of 38.64 kW hours. Multiply that by the going rate of, let's say 15 cents per kW hour, and that power supply would cost the operator $5.79 a day to operate.

This example mistakenly assumes that the power supply is actually fully loaded to the 14 amp rating (are most power supplies in the system fully loaded?). XYZ Power Co. also made an error in figuring the true power usage of the supply. It should be calculated as 14 amps output load multiplied by the output voltage of 60 VAC, which is 840 VA output load.

Next calculate the power lost due to the inefficiency of the power supply. Assume, for the sake of example, the power supply was only 84 percent efficient. So, 840 VA divided by .84 equals 1,000 VA. This is 1 kW hour.

Next multiply by 24 hours to arrive at 24 kW hours per day. This is the true power usage of the supply per day. To calculate the operating cost, the system operator must multiply the total daily usage by the cost per kilowatt hour charged by the local utility (for example, 15 cents per kilowatt hour). This kW hour cost multiplied by the 24 kW hours per day consumption rate

(Continued on page 126)

How to Cadweld ground connections

By Ron Hranac

Connecting ground wire to ground rods often is done using a simple mechanical clamp. While this may produce a reasonable connection initially, clamps are subject to loosening over time, corrosion and even the craft sensitivity of incorrect installation in the first place. As this mechanical bond deteriorates, the effectiveness of the ground diminishes. At best, mechanical ground connections can be considered only temporary.

Cadwelding defined

Several years ago I was introduced to the Cadweld process while installing microwave and satellite communications equipment. Cadwelding is a method used to make electrical connections (such as ground wire to ground rods) with no outside source of heat or power. Powdered metals (copper oxide and aluminum) are placed in a small mold over the area of the bond and ignited with a flint ignitor. The reduction of the copper oxide by the aluminum is an exothermic reaction that produces molten copper and aluminum oxide slag. The molten copper (about 4000° F) flows over the conductors in the mold and welds them together.

The Cadweld process happens fairly quickly; the mold can be broken off the weld after less than a minute. The ground connection is quite permanent, essentially forming a molecular bond between the ground rod and ground wire. The manufacturer claims these types of connections have a proven field service life of over 50 years. While I can't personally vouch for the 50-year life, buried Cadweld grounding connections I made several years ago are still as good today as when I installed them. I doubt seriously if the same claim could be made for clamped connections buried in the same manner.

The accompanying photos demonstrate Cadwelding #6 solid copper wire to a 5/8-inch ground rod. This particular Cadweld is called a "One Shot" ground rod connection. The manufacturer can provide molds to fit various diameters of ground rods, as well as different sizes and numbers of ground wire. Standard safety procedures should be used when Cadwelding, including the use of safety glasses, leather gloves, etc. The manufacturer includes general safety information with the Cadweld instructions. For more information, contact Erico Products Inc., 34600 Solon Road, Cleveland (Solon), Ohio, 44139.

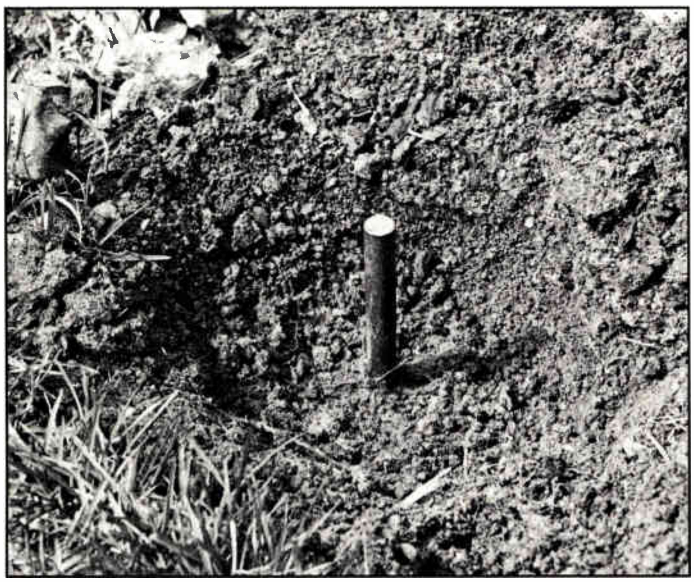


***Photo 1:** Drive the ground rod into the ground using a suitable sleeve or driver so the top of the rod does not mushroom.*

***Photo 2:** Install the mold on the rod being careful not to damage the rubber gasket on the bottom of the mold.*

***Photo 3:** Insert the ground wire through the sleeved hole in the side of the mold until the end of the wire touches the opposite inside surface of the mold. Push down on the mold until the top of the ground rod comes into contact with the bottom of the sleeve and ground wire.*

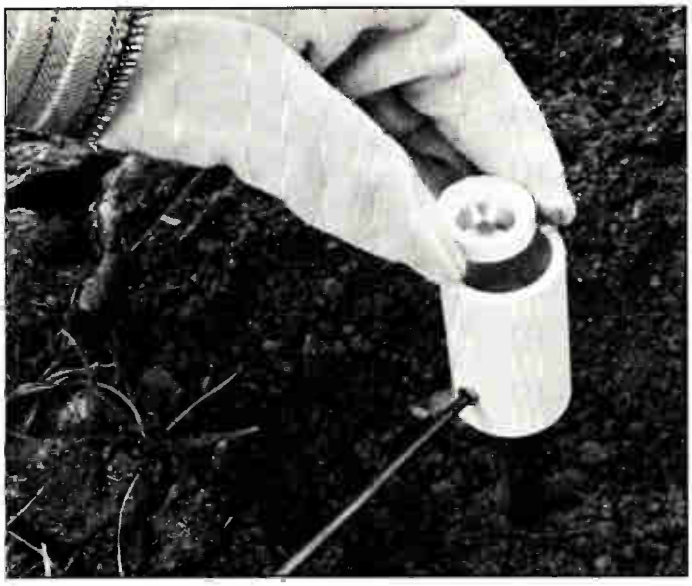


Photo 4: *Insert the disk in the mold.*

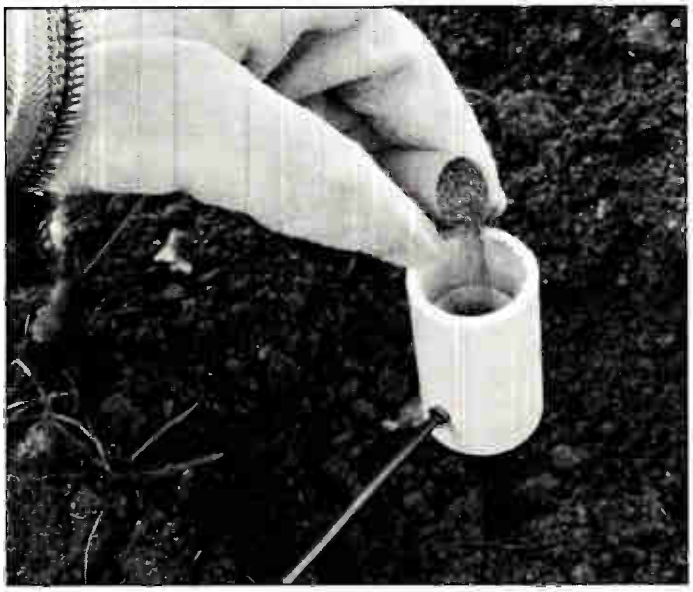


Photo 5: *Pour the weld metal into the mold. Note that a separate starting material will remain in the bottom of the weld metal container.*

Photo 6: *Place the cover on top of the mold.*

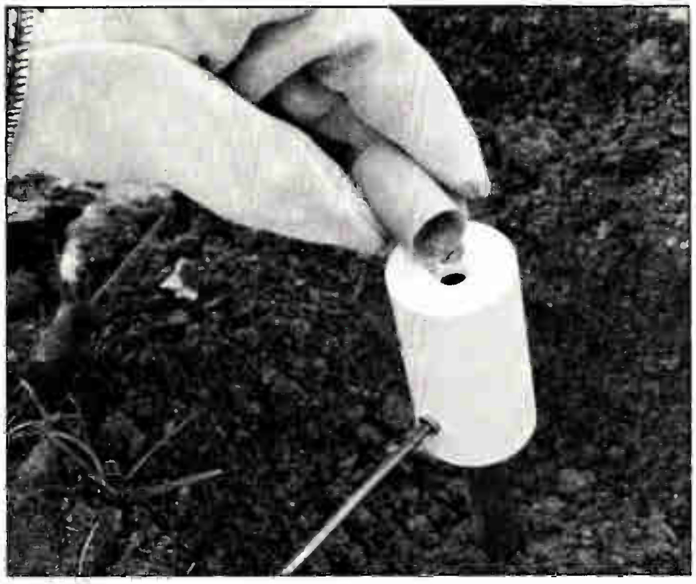


Photo 7: *Tap the starting material out of the weld metal container into the hole in the center of the mold cover.*

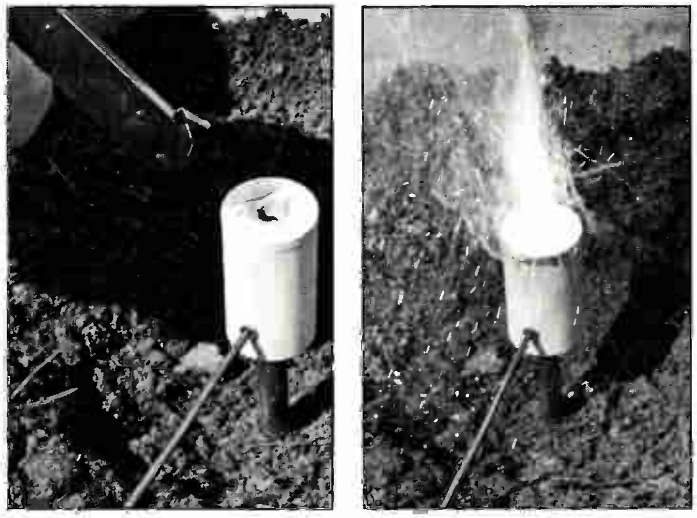


Photo 8: *Ignite the starting material with the flint ignitor, holding it one or two inches from the hole in the mold cover.*

Photo 9: *After 30 seconds to a minute, the mold may be broken off the finished Cadweld.*

Anatomy of a tech-friendly standby inverter

By Jud Williams
Owner, Performance Technologies

The purpose of this article is to give the technician some insight into the design of a standby inverter and what goes on in the designer's head as the power supply evolves. Bear in mind the approach to be described here is one of many and the way it is presented reflects my personal choices based on my philosophy.

The design of a product comes about in several ways. One is an approach wherein one person makes all the decisions. Another is the "team" approach with a group effort. Often, each phase of such a team design must be approved by someone higher up and compromises must be made to satisfy everyone involved. It will be obvious that the approach taken here has been by one individual based upon his best judgment. Thus, this article will be written in the first person.

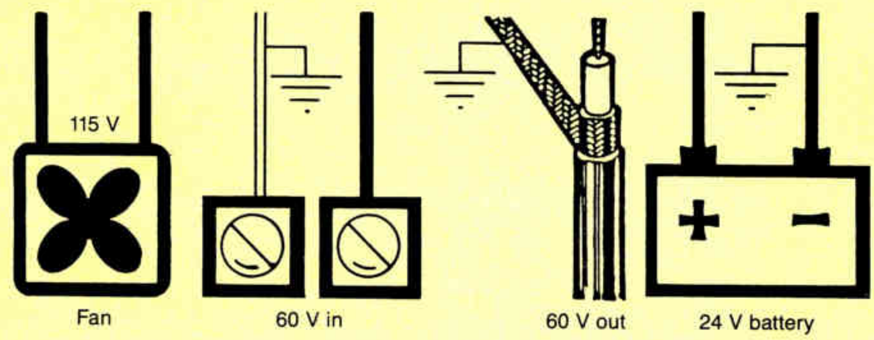
What's an inverter?

An inverter is a form of power supply that inverts direct current into alternating current. To be more specific, an inverter draws current from a bank of batteries (usually lead acid) and by the action of oscillation, transforms that energy into alternating current. By *standby* we mean when there is a utility failure, this power supply that has been *standing by* waiting for the failure to occur, comes on.

After several years of producing a ferroresonant power supply, I decided to develop a companion standby inverter. It is hard to say what prompted me to do this, but it is fair to say that my spending the previous several years specializing in the repair of various popular brands of standby power supplies started me thinking in this direction.

Back when I first started thinking about this inverter and the approach I might take toward a specific format, I was intrigued by the possibility of the retrofit market. I was aware of the many power supply cabinets already in use that could certainly utilize an improved standby unit. Such an approach seemed to be sensible because of its cost-effectiveness since the existing cabinet would be retained along with a perfectly good ferroresonant power supply. All that was necessary was to simply add a new, updated standby for one-third the price of a complete new system.

Figure 1: Terminal pictorials



Design criteria

As a result of the extensive experience I had repairing power supplies, I decided upon several criteria for the design of my power supply. I broke these criteria down into several categories concerning things such as heat dissipation, ruggedness, ease of installation, simplicity, reliability and serviceability.

Regarding the first category (heat dissipation), I considered the obvious: the desert southwest and the scorching heat that a power supply would be subjected to. In some cases I was sure that my product would not always be treated as kindly as I would want, like having a fan to help things out. The best approach I could think of was to have the whole chassis become a massive heatsink, and then have this chassis/heatsink contact the cabinet in such a way that much of the heat would be transferred to it. As a result, an open frame chassis with a heavy duty heatsink mounted to it was chosen. The open frame feature allows cooling air to circulate both above and through the power supply.

As for ruggedness, several things were taken into consideration. First of all, very heavy aluminum is used in the chassis along with a tough bottom cover to protect the circuitry. Point-to-point "hard wiring" is used throughout rather than PC connectors. I felt that connectors lead to intermittents and discontinuities due to the effects of the harsh environment these power supplies are subjected to. All modular circuits are contained in protective enclosures for maximum protection from the elements.

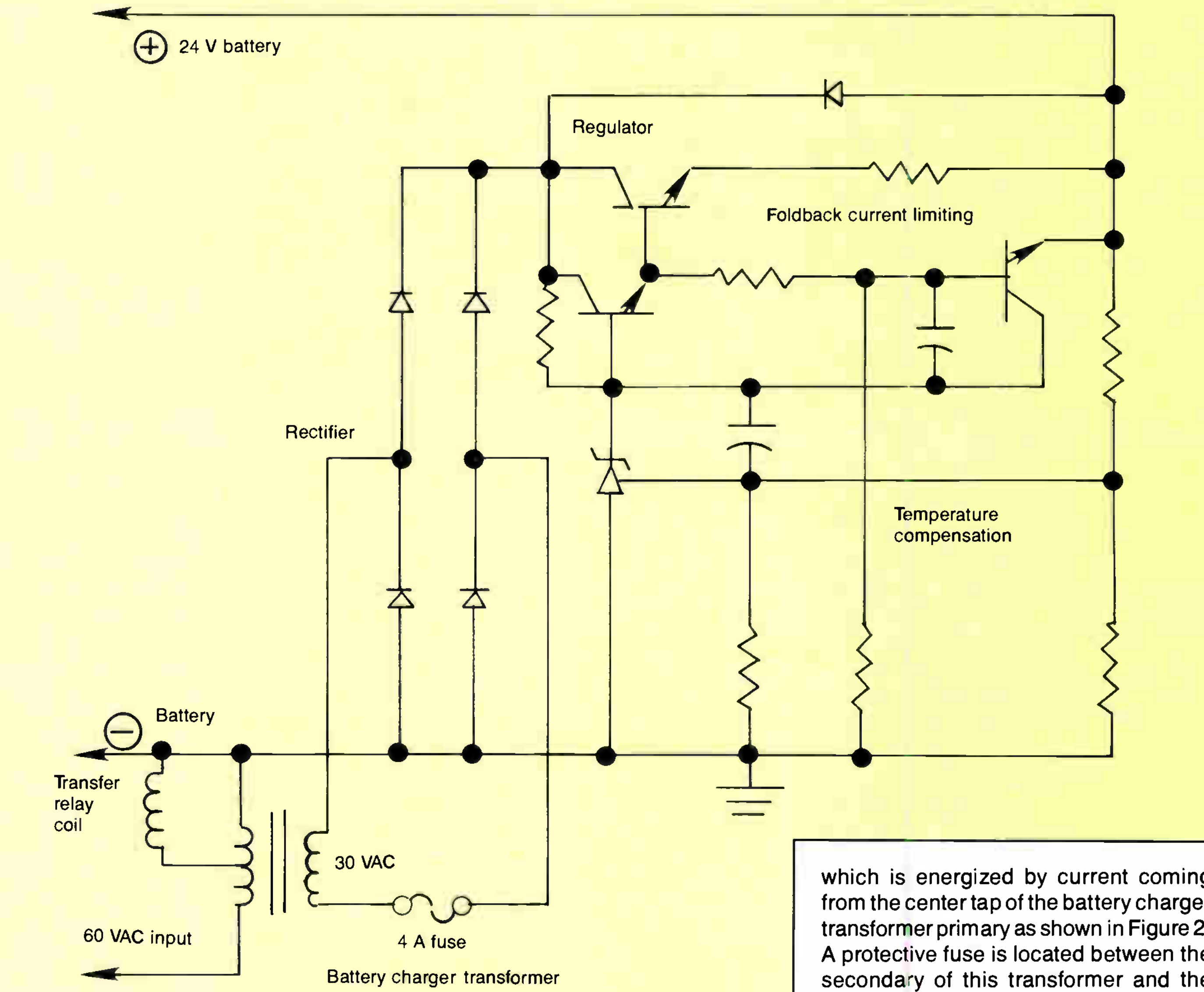
Ease of installation was accomplished by use of a rugged terminal strip for interconnection. In addition to that, the terminals are identified by the use of pictorials (see Figure 1) so it is a simple matter of interpretation to make the correct connections. A technician's literacy is not challenged because of this approach.

Simplicity is a complex subject—particularly in the context of power supply design. By simplicity I mean the power supply does what it is supposed to do and there are no sophisticated frills to accomplish its end. Every effort was made to make this power supply as straightforward as possible. My attitude is the standby power supply has only two functions: to charge the batteries properly while standing by and to come on reliably during a power failure. Any additional features would tend to compromise its reliability.

Any number of factors affect reliability. Component count of course has a direct bearing on dependability. Here we are playing the numbers game. Someone once told me that when buying a car, the simpler the better. He said, "Forget all the fancy options and the many accessories that are available. All the sophisticated additions to the car just mean more things to go wrong and make it more expensive to fix." I firmly believe this to be true for many things we buy. And I certainly hold strongly to this in my design endeavors.

In this world of microprocessors and

Figure 2: Battery charger



digital logic my choice was to leave these things for others since reliability was the one thing that concerned me most of all. I shall discuss various aspects of why I made my design decisions and how they improved the overall reliability of the inverter.

Making it reliable

One of my major decisions was to power the battery charger of the inverter from the 60 V output of the ferroresonant power supply rather than from the 120 VAC line. My purpose here was to isolate the inverter from the harsh, transient-prone utility line. Since the ferroresonant power supply is in reality a line conditioner —wherein it cleans up and regulates the power line, and is truly the most marvelous surge suppressor known—why not use that clean energy to power the inverter? Thus, the input voltage to the inverter battery charger transformer is 60 VAC.

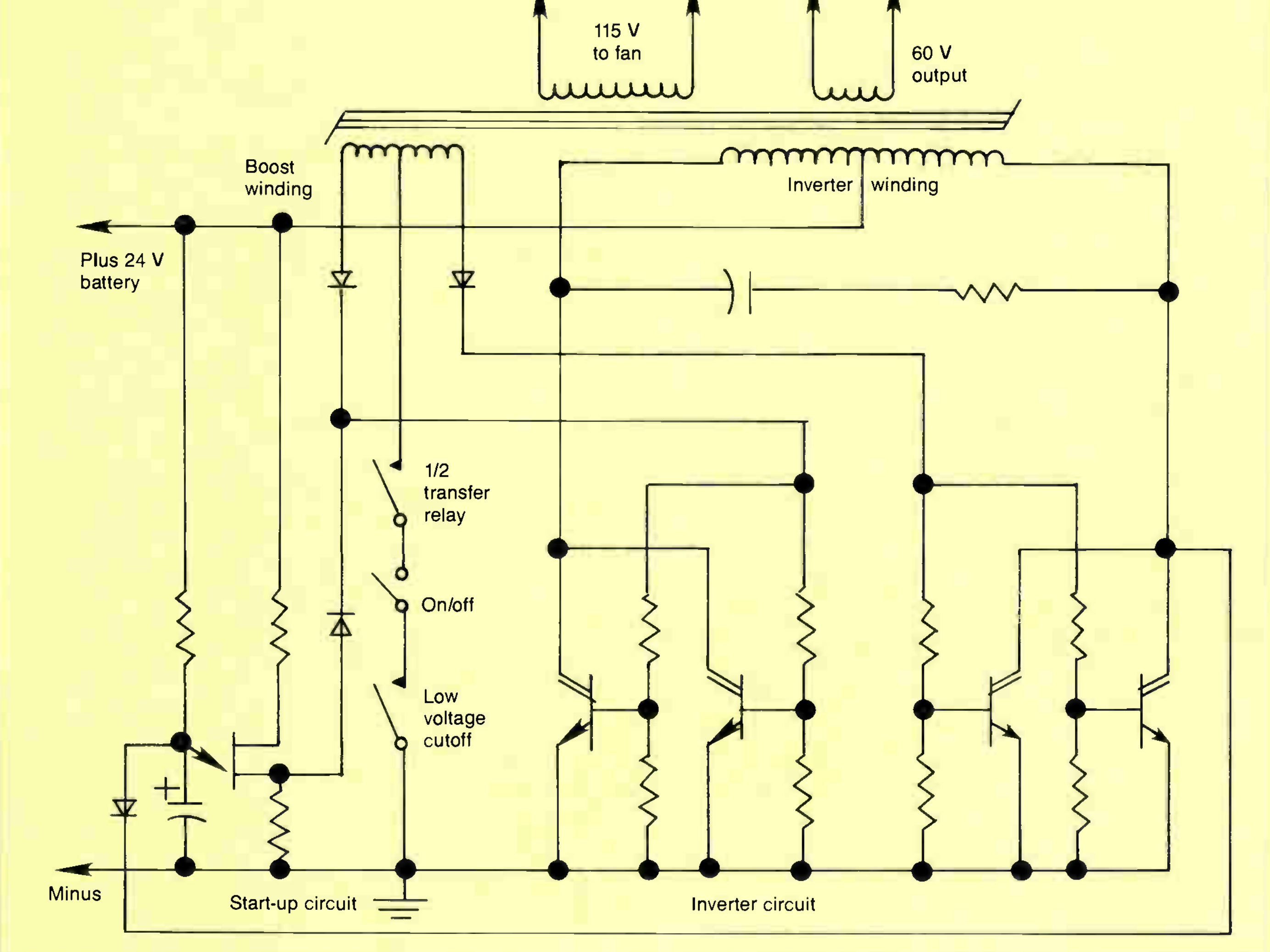
My next consideration concerned the transfer relay. This relay of course transfers the AC voltage going to the cable system from the ferroresonant power supply to the standby inverter whenever there is a utility power failure. The traditional approach is to utilize a relay or contactor operating from the battery charger output. By the way, the battery charger is nothing more than a regulated DC power supply that keeps the standby batteries fully charged. So, most transfer relays are DC relays and are dependent on the reliability of the battery charger. If the battery charger fails, the transfer relay no longer holds in and the whole system fails; this cuts off power to the cable system.

My approach is to use an AC relay, which is energized by current coming from the center tap of the battery charger transformer primary as shown in Figure 2. A protective fuse is located between the secondary of this transformer and the rectifier. If anything becomes shorted beyond the fuse, the transformer is completely protected and the transfer relay will remain unaffected. So a possible failure in the inverter will not shut the cable system down; it will continue to be fully operational.

As explained earlier, the battery charger is in fact a DC power supply. Most DC power supplies use large electrolytic capacitors at the input of the regulating circuits to smooth the ripple coming from the rectifier. Electrolytic capacitors are by far the most failure-prone components in use because they literally dry up with age. I chose not to use any since they serve no useful purpose in a battery charger circuit and since the batteries charge very nicely from the pulsating DC. As a matter of fact, when the battery charger is connected to a battery, the pulses are smoothed out.

An additional feature incorporated into the battery charger is fold-back current

Figure 3: Inverter section



limiting. If for instance the output of the battery charger were to be shorted, it would automatically be limited to a very low current. This protects the regulating circuit from damage and prevents the protective fuse from blowing. When the short is removed, the charger begins to function normally.

The most important aspect of the battery charger is the temperature compensation. Since batteries require less current to fully charge them at elevated temperatures, the charger is designed to decrease its output current as the ambient temperature increases. This prevents the batteries from being permanently damaged due to excessive gassing.

Another aspect of the inverter that adds greatly to its reliability is its inherent ability to shut down in case there is a short across the 60 V output. In fact, the inverter cannot start up into a short—a wonderfully protective feature. As for fusing, the power supply contains only one fuse described above and no circuit breakers. The terminal that connects to the positive lead going to the batteries is protected by a *fusable link*. The fusable link disconnects the batteries in case a short circuit develops across them.

One thing contact points do not handle very well is high battery current passing through them. This causes them to gradually deteriorate. Whenever the contacts open, an arc occurs. Since the arc is direct current, there is a gradual transfer of material from one contact to the other resulting in an irregular buildup of material on one contact and the erosion of the other one. The resulting oxidation buildup on the contact surfaces acts as a film of insulation. Soon the insulation develops into what is termed *contact resistance*. Ultimate failure of the equipment then becomes inevitable.

Since this is such a common problem in inverter design, I decided to use a technique that completely eliminates the need to switch the battery current, which by the way may run as high as 30 amperes. In this way, one of the major causes of failure of inverters has been avoided.

The use of a circuit breaker as an on/off switch in an inverter also affects the reliability of the unit. Here again, high DC current is often involved. A circuit breaker was never intended to be a switch. Each time a circuit breaker is used as a switch, it becomes more prone to trip when subjected to currents far below its rating and eventually the equipment becomes plagued by nuisance tripping and shut downs. Needless to say, the use of circuit breakers has been omitted from my design.

The on/off switch in our inverter is located in the booster winding of the inverter circuit (see Figure 3). While in the off position, the batteries may be attached without the inverter trying to come on. The benefit of this of course is that an arc is not drawn while the connection is being made, which would result in the terminal being slightly burned.

One of the circuit modules contains the

(Continued on page 145)

Benefits of a strand-mounted power supply

By Jerry Schultz
President, Power Guard Inc.

In recent months many power companies have become very picky about what (if anything) cable operators can hang on their poles. I have recently encountered one power company that is attempting to keep cable equipment out of the utility easement as well as off their poles. Although it may be impossible for a power company to defend this policy, it is clear that if this trend continues more restrictions will be placed on the use of their poles in the future. These policy changes are being caused, at least in part, by the cluttering up of their poles with all types and forms of miscellaneous equipment. This has created an unsightly and unsafe condition that the power company must contend with. If this trend is to be reversed cable operators will have to clean up their act by providing better looking, safer installations.

Safe, clean looking

Strand-mounted power supplies may be just what are needed to reverse this trend and provide operators with a better way. Strand mounting—in the same manner as an amplifier—allows attachment independent of the pole and in a safe, clean looking familiar manner. The strand mounting of power supplies also has several operational and cost saving advantages over pole or ground mounting. Attachment fees charged by many power companies for each contact with the pole would be reduced by one. Power supplies that are strand-mounted are much less susceptible to damage from accidents or vandalism.

But perhaps the greatest advantage is the elimination of long, fragile cable runs from the supply to the power inserter. Since the limiting factor on most power supplies is the voltage drop caused by the current flowing through the cable, the elimination of this cable run will improve amplifier operation and allow each supply to furnish more power to the system. The fact is in some types of cable, a 50-foot run to the power inserter from a fully loaded 15 A power supply can cause a 2 V drop between the supply and the power inserter. This drop is always unwanted and can become a real problem as your system grows and more power is required.

Figure 1: Unmetered power supply location

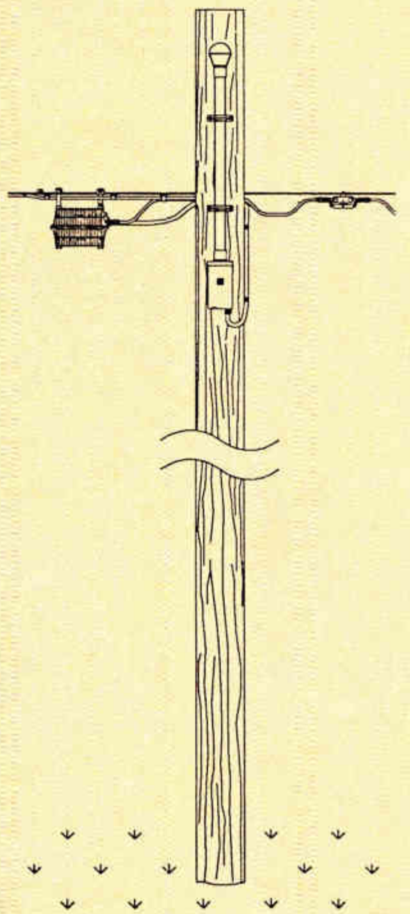
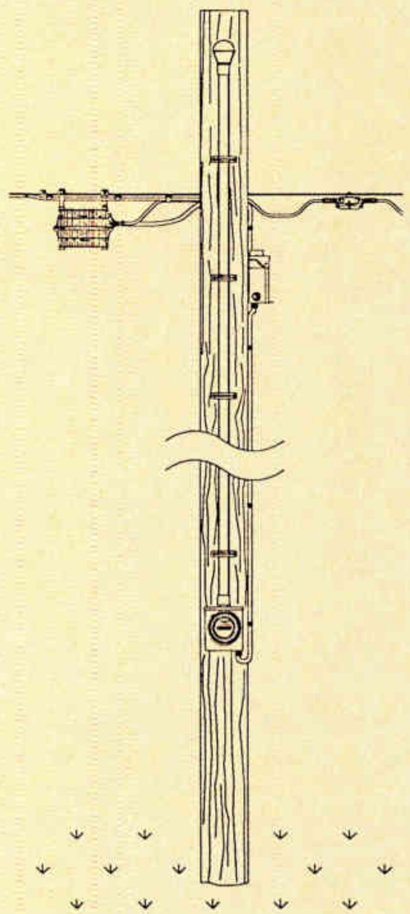


Figure 2: Metered power supply location



Strand mounting preferred

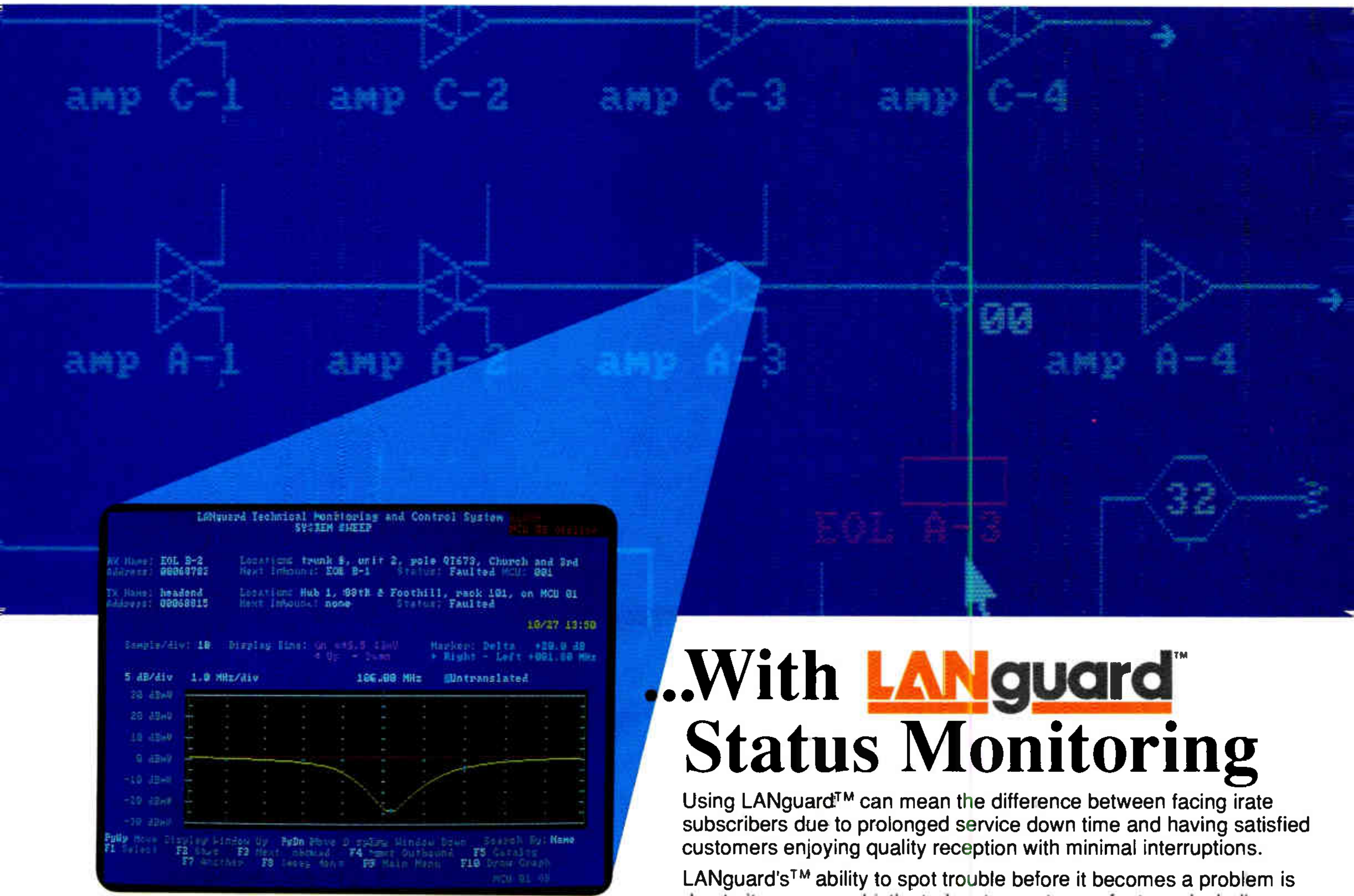
Since the local power company must furnish power and some type of pole space to all power supply locations, their requirements (which will vary greatly in various areas) must be observed in any power supply installation. It is important to remember that disapproval of pole-mounted equipment by power company policy does *not* constitute a disapproval of the strand-mounted power supply. In fact most power companies prefer the strand-mount concept over pole or ground mounting even when they do not allow anything on their poles.

In many areas (such as those served by Alabama Power) metering of power supply locations is not required and a UL approved primary disconnect box can be installed directly on the pole adjacent to the supply. In this scenario (see Figure 1) the 115 V line from the power company's transformer can be connected directly to the disconnect box through a short weather head and then fed to the power supply through a flexible watertight conduit. This provides you with an installation that is totally off the ground with no risers to and from the ground. The pole can be safely climbed, moved or easily replaced if damaged. This super clean, safe and inexpensive installation should make the customer, cable company and power company all very happy.

If your local power company requires metering, the installation will not be as clean as with no metering but still quite acceptable. In this situation (see Figure 2) the weather head must be run from the

(Continued on page 146)

Pinpoint Potential Problems *Before* They Happen...



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NEC® Article 820: CATV system protection and grounding

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C. Protection

820-33. Grounding of outer conductive shield of a coaxial cable. Where coaxial cable is exposed to lightning or to accidental contact with lightning arrester conductors or power conductors operating at a voltage of over 300 V to ground, the outer conductive shield of the coaxial cable shall be grounded at the building premises as close to the point of cable entry as practicable. For purposes of this section, the point at which the exposed cable enters shall be considered to be the point of emergence through an exterior wall, a concrete floor slab or from a rigid or intermediate metal conduit grounded to an electrode in accordance with Section 820-40(b).

Note: Selecting a grounding location to achieve the shortest practicable grounding conductor will help limit potential differences between CATV and other metallic systems.

(a) Shield grounding. Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required.

(b) Shield protection devices. Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

Explanation: This section permits the use of a shield protective device that does not interrupt the grounding system within the premises. This permits protection against overheating for the CATV service-drop cable. Overheating can occur due to neutral fault currents in the power and lighting system. Such a protective device would have to maintain the integrity of the coaxial system to prevent RF leakage. An ordinary fuse, for example, would not be suitable.

D. Grounding methods

820.40. Cable grounding. Where required by Section 820-33, the shield of the coaxial cable shall be grounded as specified in (a) through (d) below.

(a) Grounding conductor.

(1) Insulation. The grounding conductor shall have a rubber or other suitable kind of insulation.

(2) Material. The grounding conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

(3) Size. The grounding conductor shall not be smaller than No. 14; it shall have a current-carrying capacity approximately equal to that of the outer conductor of the coaxial cable.

(4) Run in straight line. The grounding conductor shall be run to the grounding electrode in as straight a line as practicable.

(5) Physical protection. Where necessary, the grounding conductor shall be guarded from physical damage.

(b) Electrode. The grounding conductor shall be connected as follows:

(1) To the nearest accessible location on 1) the building or structure grounding electrode system as covered in Section 250-81, 2) the grounded interior metal water piping system as covered in Section 250-80(a), 3) the power service accessible means external to enclosures as covered in Section 250-71(b), 4) the metallic power service raceway, 5) the service equipment enclosure, 6) the grounding electrode conductor or the grounding electrode conductor metal enclosure, or 7) to the grounding conductor or to the grounding electrode of a building or structure disconnecting means, which is grounded to an electrode as covered in Section 250-24; or

(2) If the building or structure served has no grounding means as described in (b)(1), to any one of the individual electrodes described in Section 250-81; or

(3) If the building or structure served has no grounding means as described in (b)(1) or (b)(2), to: 1) an effectively grounded metal structure, or 2) to any one of the individual electrodes described in Section 250-83.

(c) Electrode connection. Connections to grounding electrodes shall comply with Section 250-115.

(d) Bonding of electrodes. A bonding jumper not smaller than No. 6 copper or equivalent shall be connected between the antenna systems grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

Explanation: This section requires bonding of CATV and power grounding electrodes at the same building or structure. There are no requirements for separate grounding electrodes for CATV.

Notes: See Section 250-86 for use of lightning rods. Bonding together of all separate electrodes will limit potential dif-

(Continued on page 156)

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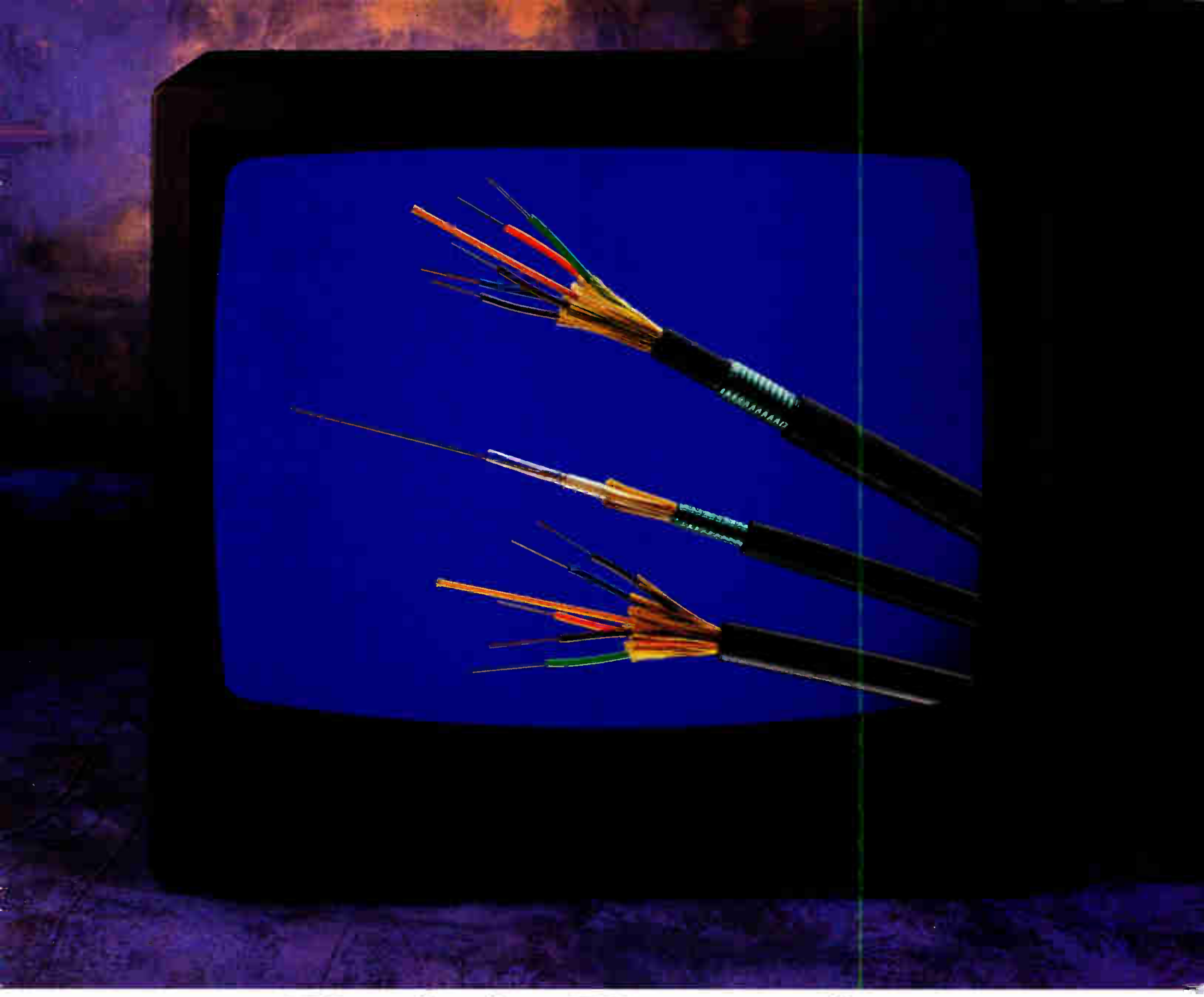


Headend maintenance: Fixing intermittent level problems

By Ron Hranac **Photos by Don Riley**

If you have Scientific-Atlanta 6×50 series headend equipment (6150 processors, 6250 demodulators or 6350 modulators) that is more than two or three years old, the chances are pretty good that you have a channel or two subject to occasional intermittent output level problems. The gremlin generally manifests itself as a 10 to 20 dB drop in output level in the processor or modulator, or a change in video output level in the demod. When one of these problems occurs, the "fix" normally involves pulling one or more of the individual modules out of the chassis and plugging it back in. Presto! Everything is back to normal—for a while.

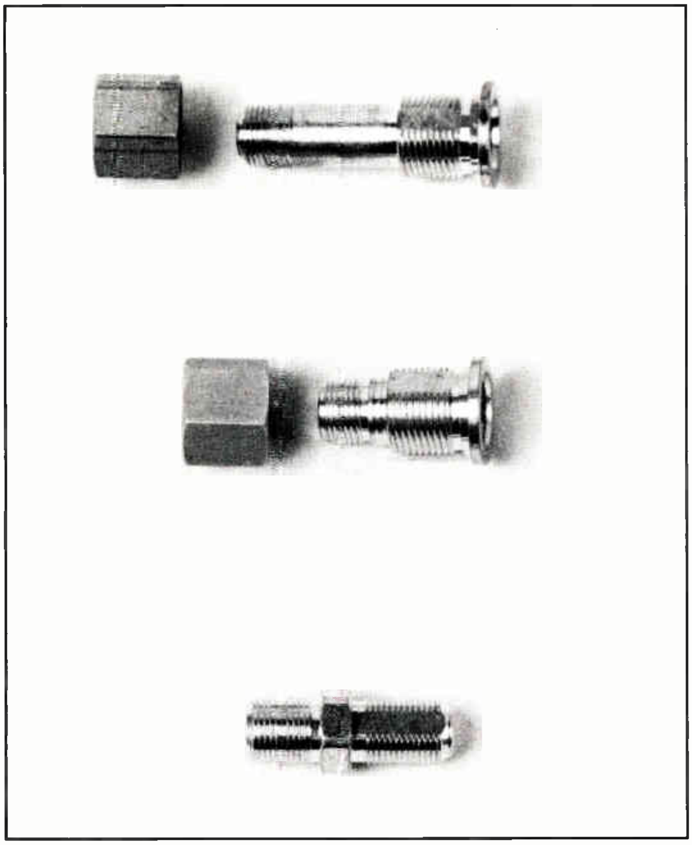
There is a better fix: S-A has issued two technical bulletins that describe causes and solutions to intermittent output level problems in its headend gear. The first one (publication number 33T105Z) identifies the problems and their respective cures. The second bulletin (publication number G1014Z) highlights new chassis and module connectors that have been incorporated in headend equipment manufactured since 1986 and that can be retrofitted to older gear. It also recommends proper cables for use in the chassis rear compartment.

The following table summarizes the most common causes of intermittent output levels and the recommended fixes:

Problem	Solution
Old style chassis connectors with short center pins.	Replace with new style connector that has longer pin.
Main chassis ("cage") rear compartment cables have center conductors too long, too short or not inserted straight in chassis connectors. (Note: RG-59 cables must have center conductor diameter between 0.022 and 0.027 inch, and length must be 0.250 ± 0.020 inch.)	Replace cables.
Right angle connectors, terminators or in-line attenuators in chassis rear compartment have center conductor diameters that exceed 0.027 inch	Replace component(s).
RG-179 cables inside modules have broken center pin (break may not be visible).	Replace complete cable (connector cannot be fixed).
Female F connectors have center conductor pin vises gapped open more than 0.020 inch or damaged by insertion of large diameter male pins (meter test probes, etc.).	Replace defective connectors.
Broken solder connections in the chassis rear compartment at the edge card connector/motherboard interface.	Resolder connections.
"Fretting corrosion" on coax connector center conductors.	Clean male F connector pins using a swab dipped in Dupont #7 white polishing compound, followed by an application of Spray On #2002 T.F. electrical contact and tape head cleaner (or Chemtronics Formula 111 #C2466). Use a swab to remove all residue. Clean female contacts with one of the spray cleaners and allow the residue to evaporate. Caution: Do not use abrasive materials or cleaning tools to clean F connector pins, or cleaning instruments with a diameter or thickness that exceeds 0.020 inch.

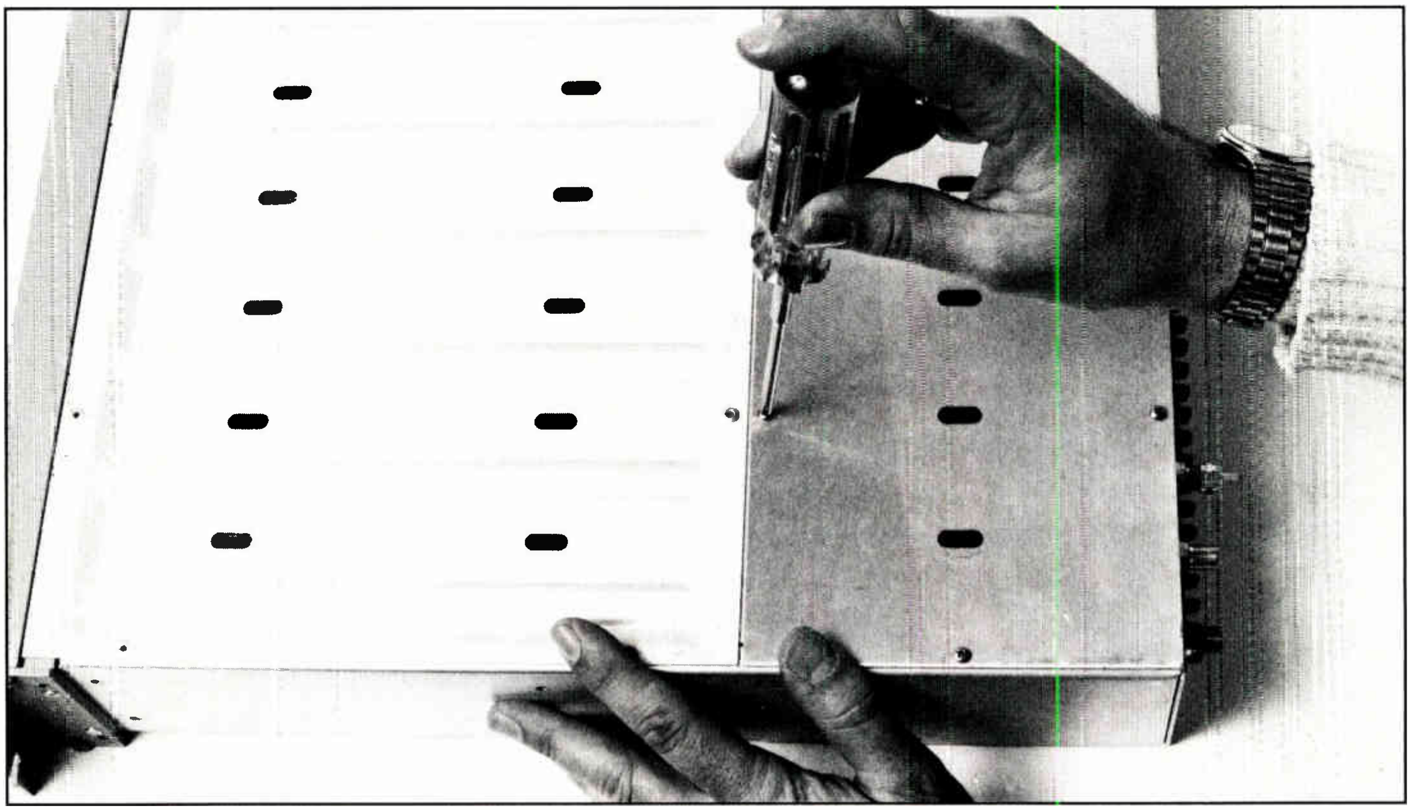
The accompanying series of photos show the step-by-step procedures to replace chassis and module connectors, as well as the connectors used to upgrade the headend equipment. S-A recommends that all old style chassis and module connectors be replaced with the newer versions, in addition to a thorough module and chassis inspection on equipment that exhibits intermittent problems. You also should check the modules' connectors, cables, solder connections and the surfaces of the edge card printed circuit connections.

Inside the chassis



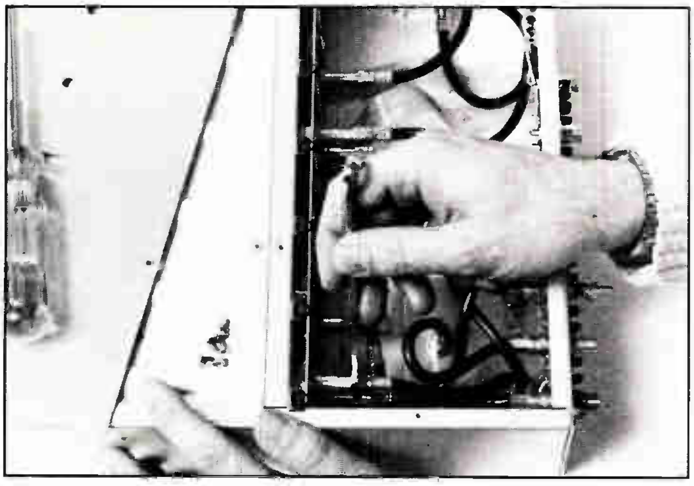
Step 1: If module connectors have to be replaced, the F female to female push-on is part number C082351 (top) and the solder lug to female push-on is part number C275170 (bottom).

Step 2: The top connector and matching nut is the old style internal chassis connector, which should be replaced with the newer version (middle) that has a longer center pin. Its part number is C082370; be sure to specify that you want matching nuts with the connectors when your order them or you will have to ream out the older nuts to fit the new connectors. The bottom connector is the external chassis barrel connector (part number C233819) that only needs to be replaced if the center contacts have spread more than 0.020 inch.

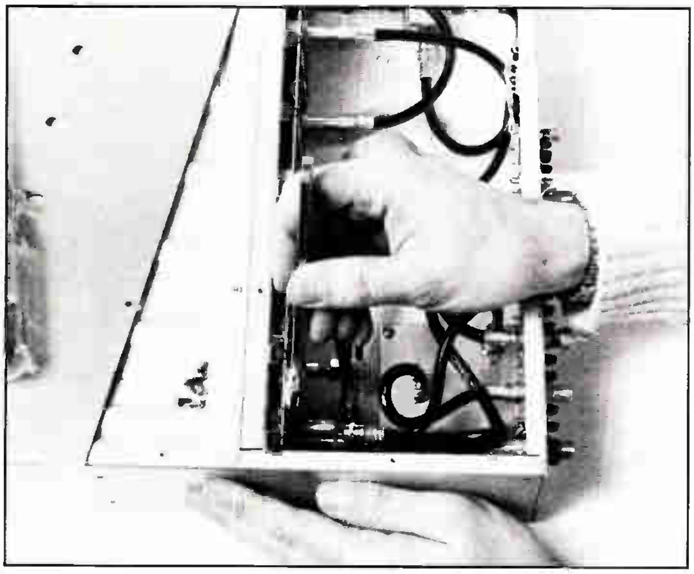


Step 3: To replace chassis connectors, begin by removing the lid that covers the rear compartment. Also remove the modules from the front of the chassis.

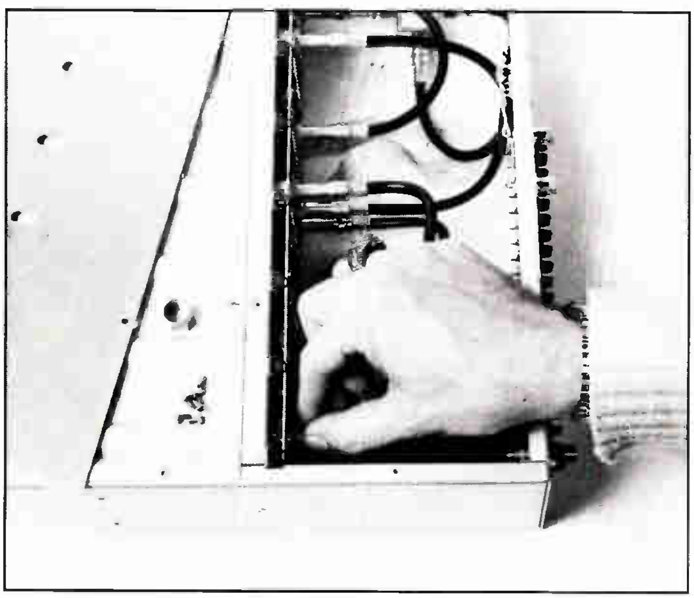
→



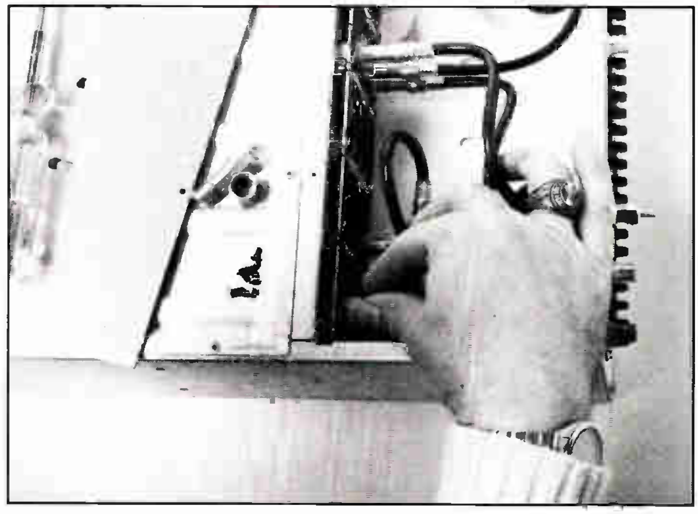
Step 4: Disconnect the RG-59 jumper from the back of the chassis connector. At this time check that the cable's center conductor diameter and length are correct.



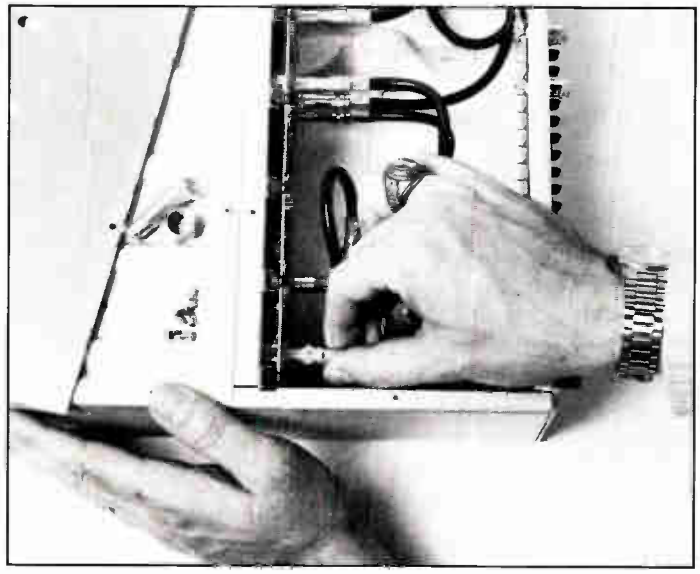
Step 5: Remove the nut from the chassis connector.



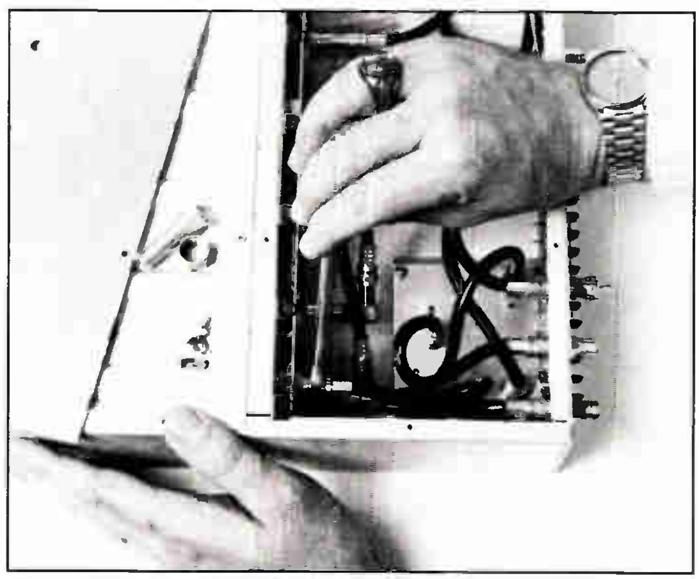
Step 6: Push the chassis connector through the front of the chassis.



Step 7: Install the new connector from the front and replace the nut.



Step 8: Reconnect the RG-59 jumper to the connector making sure the center conductor goes in the connector straight.



Step 9: Wrench tighten the connections then repeat Steps 4 through 9 on the other internal chassis connectors.

(Continued on page 148)

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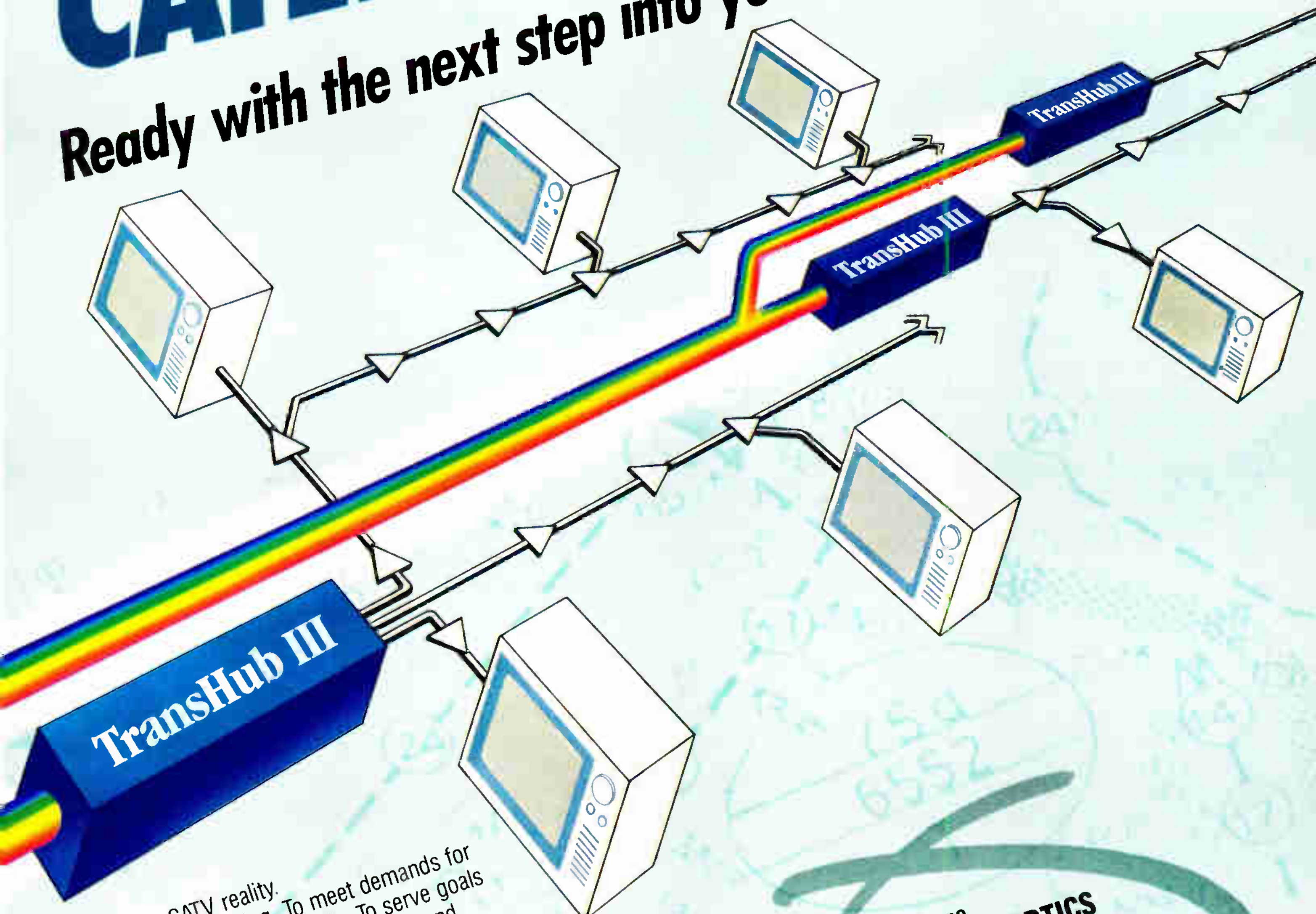

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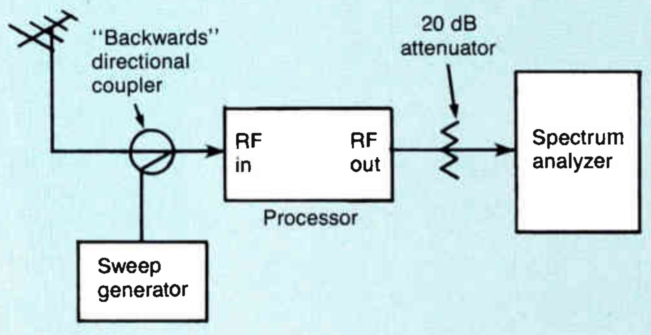
Sweeping modulators and processors

By Ron Hranac

Measuring in-channel frequency response of headend modulators and processors is a straightforward maintenance procedure that can be done using a spectrum analyzer with some kind of display storage, an RF sweep generator (Wavetek 1801 or equivalent) and either a video sweep generator or a video signal generator such as Tektronix's TSG-100 equipped with the sin x/x test signal (see "CT's Lab Report," April 1990, *Communications Technology*).

Headend equipment in-channel flatness should be checked at least annually to ensure compliance with the manufacturer's specifications. I have used the methods described in this article for a number of years and have found them to be repeatable, accurate and easy to do. The procedure for sweeping processors also can be used to check in-channel flatness of AML microwave transmitters.

Figure 1: Setup for processor frequency response testing



Processors

To sweep a headend off-air signal processor, you will need a spectrum analyzer, RF sweep generator, miniature directional coupler (12 dB or 16 dB tap value) and a short RG-59 jumper or male F barrel. Configure the equipment as shown in Figure 1, making sure that you install the coupler backwards. The antenna lead will be connected to the "out" port of the tap, and the "in" port connected to the processor's RF input using the jumper or male F barrel. The signal generator must be connected to the coupler's "tap" port. The most accurate results will be obtained by using the processor's RF output rather than its test point output. Install an in-line 20 dB attenuator between the RF output and the spectrum analyzer's input. Make sure the processor's input and output RF levels are correct.

By configuring the test setup this way, you will be able to use the off-air channel's carriers as markers while sweeping the processor. Furthermore, you can leave the processor's AGC turned on, providing you with an accurate sweep response in that mode. This also avoids interfering with adjacent channels while sweeping the processor.

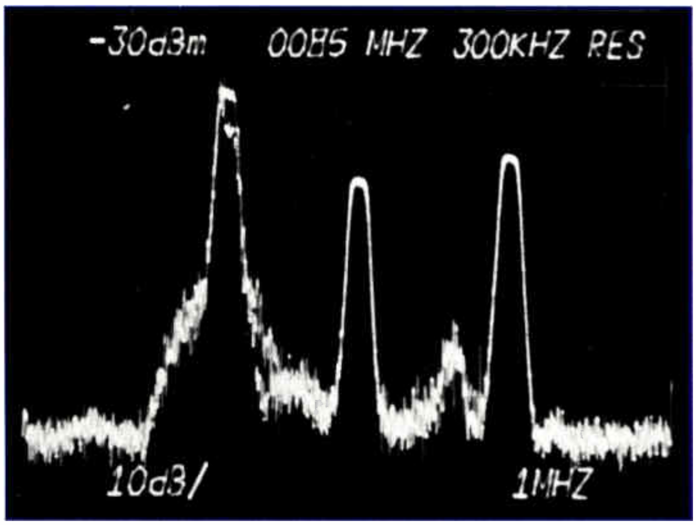


***Photo 1:** While observing the processor's RF output on the spectrum analyzer, tune the sweep generator's CW signal to the center of the channel being measured and adjust the level of the sweep signal 2 or 3 dB below the sound carrier amplitude. This will prevent the sweep generator from interfering with the processor's AGC.*

Set the analyzer's controls as follows, then tune to the channel being measured:

Span per division (horizontal): 1 MHz
dB per division (vertical): 10 dB
Resolution bandwidth: 300 kHz
Sweep rate: 20 ms/div. or auto
Trigger: Line or auto

With the RF sweep generator in CW mode, manually tune it to the center of the channel being measured. Adjust the sweep generator output so its level is 2 or 3 dB lower than the sound carrier amplitude (see Photo 1).

The sweep response shown in Photo 2 was obtained from a

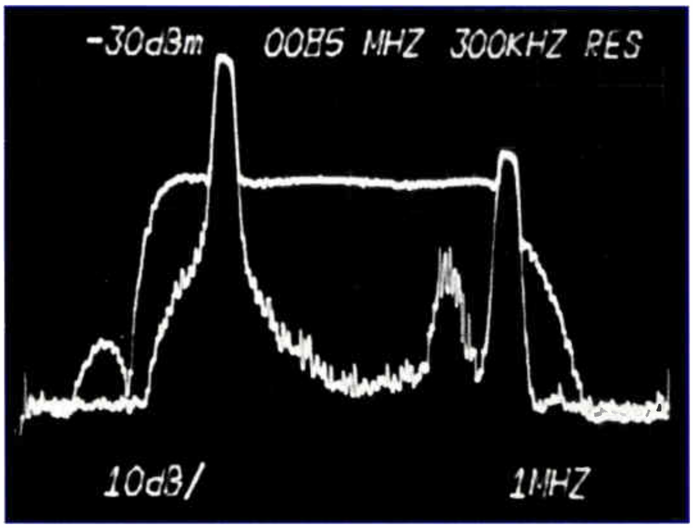


***Photo 2:** Processor frequency response on a digital storage display spectrum analyzer. A similar display can be obtained on analog storage analyzers.*

digital storage analyzer display. If you have a digital display analyzer, temporarily disconnect the sweep generator from the coupler. Then switch the analyzer's A trace to "max hold" to capture the channel by itself; save that display. Reconnect the sweep generator to the coupler while monitoring the analyzer's B trace. Switch the B trace to "max hold," and either manually sweep the signal generator's carrier through the channel bandwidth or set the generator to sweep automatically in a slow sweep. After the response trace is "drawn" on the analyzer screen you can now view the A and B traces simultaneously. For more amplitude resolution, perform this procedure with the analyzer in 1 dB or 2 dB per division (vertical scale).

This method works well with analog storage analyzers too. Instead of using a "max hold" feature, tune the signal generator to the center of the channel and turn on the analyzer's storage mode. Then sweep the carrier through the channel being tested. While the trace is stored on the screen, either photograph the display or note the response in your headend logbook.

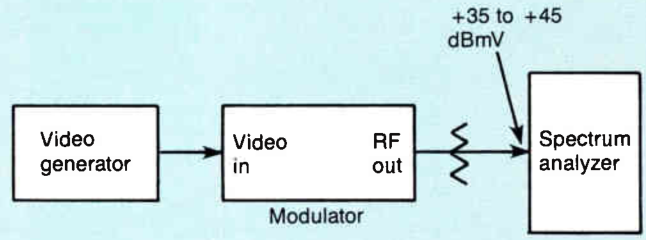
Modulators

Headend modulator in-channel video frequency response measurements cannot be done with a conventional RF sweep generator. Because you must sweep through the modulator's video baseband circuits, the modulation stage then the IF and RF stages, a video sweep generator such as Wavetek's 1201 or Leader's LCG-400 (with the SWEMAR option) must be used. Alternatively, the sin x/x test signal found in Tektronix's 1900 series video generator or its low-cost TSG-100 (option 01) video generator can be used. For accurate results with the sin x/x test signal, a spectrum analyzer with an analog display is necessary.

If you are making this measurement with a video sweep generator, ensure that its output amplitude is 1 volt peak-to-peak, the modulator's depth of modulation has been set to 87.5 percent and RF output levels are correct. Connect the output of the video sweep to the modulator's video input, then measure the response on a storage-type spectrum analyzer (digital or analog) at the modulator's RF output. The procedure will be somewhat similar to sweeping headend processors although the directional coupler is not used on the modulator input, nor do you set the sweep generator to a CW mode during setup.

Figure 2 shows the equipment configuration for this measurement when the sin x/x test signal is used. Again, make sure the generator's output is 1 volt peak-to-peak and that the modulator's depth of modulation and output RF levels are correct. Photo 3 shows the in-channel response of the modulator using the sin x/x signal. Note that an analog display is necessary to resolve the sin x/x response; RF input to the spectrum analyzer should be in the +35 to +40 dBmV range for a noise-free response display. Photo 4 is the same measurement made with the analyzer set to 2 dB per division.

Figure 2: Setup for modulator frequency response testing using sin x/x video test signal



I first ran across the sin x/x test signal a number of years ago when Tektronix introduced its 1900 video signal generator. That test signal has been carried over to the 1910. Both of these generators are relatively expensive, so it was nice to see the sin x/x signal made available in the TSG-100. As a Tektronix engineer once explained to me, the sin x/x is not actually a swept signal, although it produces an analyzer display resembling one. It generates horizontal sidebands out to 4.5 MHz and has an amplitude flatness of ±0.2 dB. (I've confirmed this in the lab.) It's perfect for measuring frequency response, group delay, etc., in video circuits.

These same measurement techniques can be used to perform in-channel frequency response measurements from the headend out into the field. The signal generators are set up in the headend and the spectrum analyzer is used at the system test points. While this will require two people, it will give you an indication of overall system performance. I've performed both the processor and modulator tests on conventional system cascades and through AML microwave links. The sin x/x also can be used to check the performance of FML microwave links. While I've not tried these techniques through fiber links, there is no reason why they shouldn't work there, too.

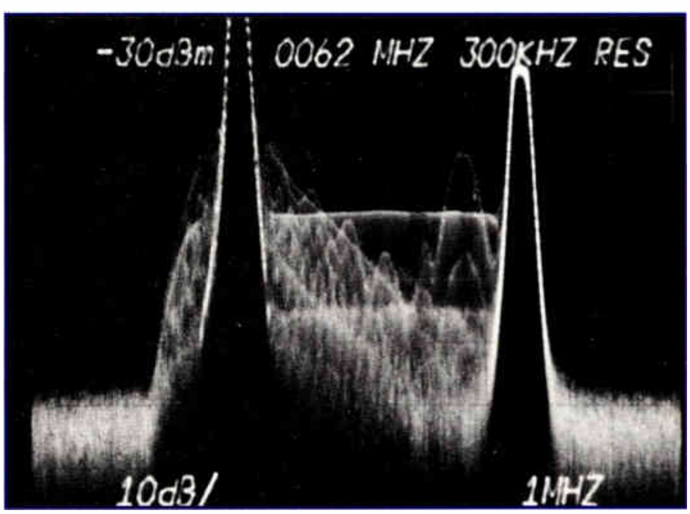


Photo 3: *Modulator frequency response using the sin x/x video test signal.*

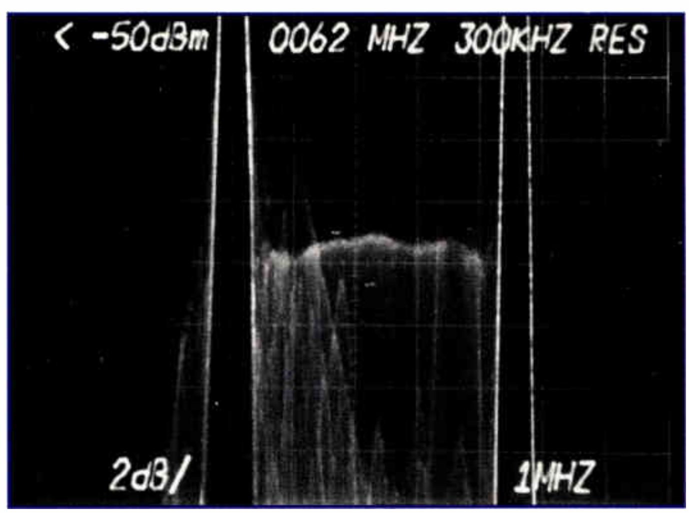


Photo 4: *The same measurement from Photo 3 with the analyzer's vertical scale set to 2 dB per division.*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Curing off-air interference

By Jean Dickinson
Technical Consultant
And Glyn Bostick
President, Microwave Filter Co.

Sources of off-air interference discussed in this article are simplified into just a few categories for the purposes of choosing appropriate cure techniques. We will show how to choose the appropriate technique and identify sources for appropriate filters.

What are the sources of off-air interference? A number of *radio services* can cause interference to CATV reception. Their frequencies range from 20 MHz to about 225 MHz. *In-band* interfering sources are frequencies in the channel being bothered. Examples are co-channel broadcasts (faraways on the same TV channel), wideband sources such as faulty power transformers or leaky transmission line insulators, and RF transmitter harmonics (frequency multiples of an off-band signal that fall within the desired TV channel allocation.) *Off-band* interfering sources are frequencies outside the channel with the interference. Examples are strong, unwanted adjacent TV channel broadcasts, strong FM broadcasters in the lower FM band that interfere with Ch. 6 and paging transmitters in the 74-76 MHz range that often conflict with Chs. 4 and 5.

Figure 1: Co-channel interference forming "venetian blinds"

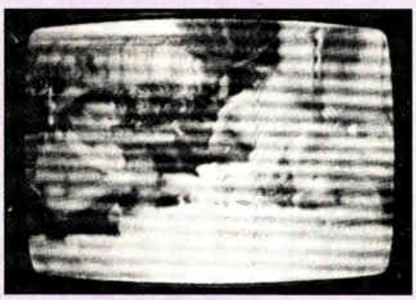
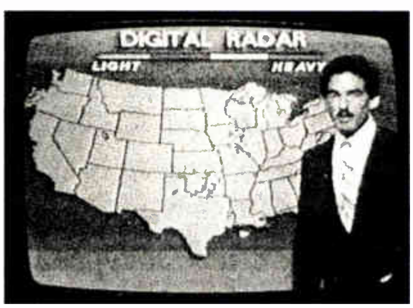


Figure 2: Signal within channel creates "herringbone pattern"

Figure 3: Wideband noise looks like "fuzz balls"



In-band off-air interference

In-band interference happens when we receive a signal within the frequency band of the desired TV channel. Figures 1-3 illustrate typical symptoms of the most common types. In co-channel interference, the CATV antenna receiving the desired channel (Ch. 7 for example) also receives a "far-away" Ch. 7. Both use exactly the same frequency band. Wideband interference, usually caused by high voltage power transmission lines, happens because of a leaky insulator or aging power transformer. Large neon signs or rotating machinery in the vicinity also can be the cause.

These interference "transmitters" emit a continuous spectrum of RF noise that decreases rapidly with increasing frequency, causing the worst interference on the lowest frequency off-air channel. Because the interference spectrum is continuous, some of this interference is the same frequency as the video carrier. We see a lot of dots or "fuzz balls" over the picture.

There is widespread use of RF transmitters for paging, mobile radio, radio control and VHF communications. All such transmitters generate and radiate harmonics (multiples of their assigned frequencies). Even though most of these installations meet their specification for low level second harmonic—usually 60 dB below the field strength of their fundamental, authorized frequency—radiated harmonic strength can still be comparable to the very weak signals being received by CATV systems. If these harmonics land within the assigned TV channel bandwidth, reception will be degraded. If they land within the video portion, the sharpness of the herringbone pattern will be proportional to harmonic signal strength. Color will be distorted or lost if they correspond to the color carrier and if they correspond to the audio carrier, voice communications will often be heard.

It is not feasible to trap out these carriers with notch filters. We will invariably destroy a part of the TV channel bandwidth. In most cases degradation will be worse for trapping; the cure is almost always worse than the original interference. In-band frequencies must be suppressed by *phase cancellation*: This is introducing another sample of the interference into the CATV antenna downlead to cancel the sample being received by it. This removes the undesired carrier frequency without removing TV channel bandwidth.

Figures 4 and 5 illustrate two methods of phase cancellation in current use. In Figure 4 the CATV antenna is replaced by an array of two identical antennas with equal leads to a common antenna terminal. The two antennas are separated by a distance that causes the undesired carrier to arrive at the two antennas in phase opposition. Hence the interference signals received by the two antennas oppose and cancel one another at the common antenna terminal. If the off angle and frequency of the interference is known, then the appropriate antenna separation can be calculated.

Figure 5 illustrates an alternate method, often less costly. The original CATV antenna is not disturbed. A second ("test") antenna is pointed for strongest reception of the interference. Its output is run through a variable phase shifter in series with a variable attenuator (phasor) and then patched into the downlead of the CATV antenna with a directional tap, directing it to the processor. While watching the TV screen, the phase shifter and attenuator are adjusted until the interference is cancelled.

Off-band interference

Strong off-band interference carriers cause overload to "first electronics," which is the antenna pre-amplifier or channel processor. The overloaded preamp or processor becomes less sensitive to the desired signal and "snow" appears in the picture (resembling weak signal

Figure 4: Nulling co-channel interference with a two-antenna array

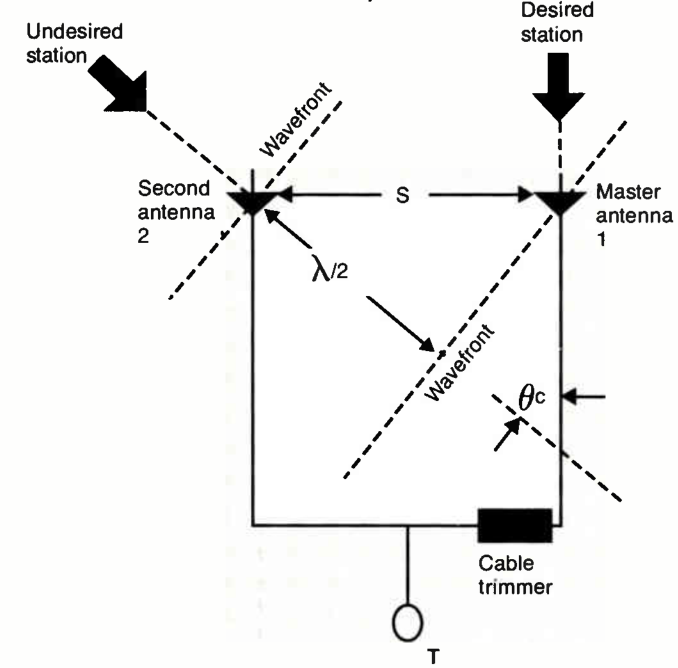
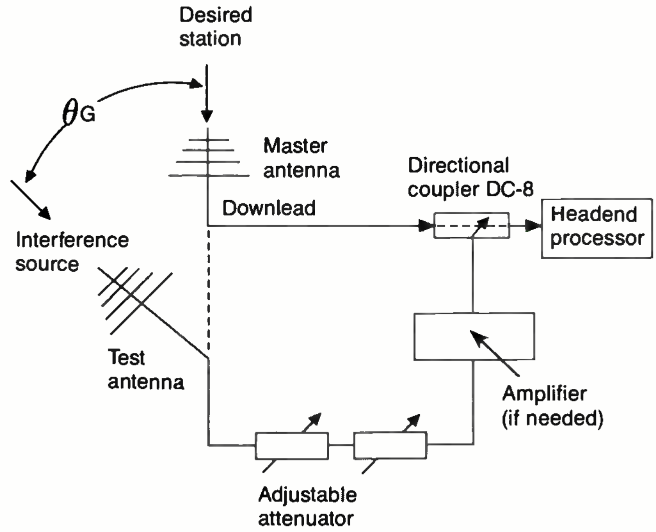


Figure 5: Arrangement for phasing out co-channel interference using a phasor



from a distant station). For very strong off-band carriers, the picture is completely blanked out.

In most cases, the most effective cure is a notch filter tuned to the interference and installed at the antenna before the interference hits first electronics. Otherwise additional interference frequencies, in addition to the original one, may be generated. Quite often, the interference can be suppressed with low cost traps manufactured as standard products by many producers of pay TV traps and tiering filters. The following are some real life examples of how to suppress interference:

- Example 1: Strong, unwanted adjacent TV channels. Install a standard pay TV (negative video) trap, corresponding to the unwanted channel at the off-air antenna terminals.
- Example 2: Strong FM reception overloading Ch. 6 (the nearest channel). Use a standard FM band suppression trap at the antenna.
- Example 3: Strong midband paging frequencies (P-5 152.24 MHz, for example) that get into the system through off-air antennas and degrade internally generated midband Ch. F(19). Install a standard midband suppression trap at the apppropriate off-air antenna. It is sometimes necessary to install midband traps on all off-air antennas before this problem is completely solved.
- Example 4: Interference to low-band channels (particularly Chs. 2 and 3) by strong transmitters for citizen's band radio (27.185 MHz), amateur radio (1.8-30 MHz) or paging (35-44 MHz). Use a standard high pass filter that suppresses all frequencies up to about 45 MHz and has low loss for Ch. 2 and above.

The closer the interference to the channel edge the more attenuation of the channel due to the trap. In general, attenuation will be mild or tolerable for interfering carriers at least 2 MHz off the channel band edge. For interference closer to the channel, it may be necessary to procure a special cut trap or trapping may become impractical for very close spacings. In these cases one should consider one of the phase cancellation methods. This is illustrated by the following two common examples:

- Example 5: Strong FM channel at 88.1 MHz interfering with Ch. 6 whose audio carrier is at 87.75 MHz. If a trap were used, it would have to have its notch at 88.1 MHz and low loss at 87.75 MHz—a difference of only 0.35 MHz. Such a trap would have to be a costly cavity type trap and since the trap would be very sharp, it would have to be specially temperature compensated to stay "on station" during temperature swings. The cost would likely exceed that of one of the phase cancellation methods in Figures 4 and 5.
- Example 6: Desired FM station being "swamped" by a strong, adjacent FM station that is only 0.2 MHz away. An effective trap would be even more complex (and costly) than the trap in Example 5. So clearly the cost-effective solution is one of the phase cancellation schemes of Figures 4 and 5.

For more details

The following is a list of some manufacturers of standard pay TV traps and filters suitable for use in the examples given in this article:
Arcom Labs, (315) 422-2963 (FAX)
Eagle Comtronics, (315) 622-3800 (FAX)
Intercept, (201) 279-4959 (FAX)
Microwave Filter Co., (315) 463-1467 (FAX)
Northeastern Filters, (315) 437-7379 (FAX)
Pico Products, (315) 451-7904 (FAX)
Production Products, (315) 682-2031 (FAX)

The following are some sources of help when using the phase cancellation method:
Biro Engineering, (609) 883-9866 (FAX)
Will design antenna arrays for suppressing co-channel, adjacent FM channel interference and other in-band interference.
Microwave Filter Co., (315) 463-1467 (FAX)
A line of packaged phase cancellers for FM and VHF/UHF TV.

The authors would like to thank Diane Bostick, Michelle Wheeler-Dine, Alesia Galuppo and Jerry Palamer for editing, word processing, graphics and photos, respectively.

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Understanding off-air antennas

This is the first installment of a three-part series. This part will deal with antenna concepts and terminology.

By Ron Hranac

Off-air antennas used at CATV headends are something that we often take for granted. At least we take them for granted until they become the cause of some problem that requires a trip to the headend. But just what are these things we call off-air antennas and how do they work?

By definition, an antenna is a circuit or device that has been designed to intentionally radiate—or transmit—an electromagnetic signal into the space around it. Conversely, an antenna can capture—or receive—an electromagnetic signal that is propagating through the space around it. This reciprocal behavior of antennas is one of the fundamentals of antenna theory: The *reciprocity theorem* states that the properties of a receiving antenna are identical to the properties of the same antenna when used for transmitting. That is, characteristics such as radiation patterns, gain and impedance will be the same whether a given antenna is used for transmitting or receiving.

The most fundamental of all antennas is one that exists only in theory: the *isotropic radiator*. An isotropic radiator is a perfect hypothetical antenna that has unity gain (no loss or gain) and radiates uniformly in all directions. One way to visualize an isotropic radiator is to imagine a very small light bulb that has no wires connected to it, and gives off an equal amount of light in every direction. Isotropic radiators often are used as references to which the characteristics of other antennas can be compared.

The *gain* of an antenna is defined as the ratio of maximum radiation intensity in a given direction to the maximum radiation intensity produced in the same direction by a reference antenna with the same power input. When the reference is an isotropic radiator, the gain is expressed in *dBi*, or gain in decibels relative to an isotropic source.

Also known as a doublet, a *dipole* antenna in its simplest form is a center-fed single wire whose overall length is approximately equal to one-half wavelength of its operating frequency. A dipole is the basis from which many more complex types of antennas are constructed and sometimes is used as a reference against which the gain of other antennas can be compared. (A resonant half-wave dipole in free space has a gain of 2.14 dBi.) If a dipole is used as the reference antenna, the gain is expressed as *dBd*, or gain in decibels relative to a dipole.

When comparing the gain figures of different antennas, it is important to know which reference—dBi or dBd—is used in each manufacturer's specifications. It is not unusual for some manufacturers to express antenna gain only in dB; the stated figure can be either dBi or dBd. Valid comparisons between antennas can be made only when you know what reference is being used.

Polarization is the orientation of the electric field component of an electromagnetic signal as radiated from a transmitting antenna, with respect to Earth. If the electric field is parallel to the Earth, the polarization is said to be horizontal; if the electric field is perpendicular to the Earth, the polarization is vertical. Polarization also can be elliptical or circular. In the case of a half-wave dipole, its polarization is the same as the direction of its axis; thus, a dipole that is parallel to the ground is horizontally polarized.

Directivity is the ratio of maximum radiation intensity to average radiation intensity. If an antenna's efficiency is 100 percent and it has no metallic, dielectric or mismatch losses, then its gain and directivity are identical. Because practical antennas are not 100 percent efficient, the gain will almost always be lower than the directivity.

Beamwidth is an angular measurement (in degrees) of the half power points of an antenna's radiation pattern. You can determine the horizontal beamwidth of a horizontally polarized off-air antenna at your headend by first pointing it at a desired station and noting the received signal strength on a signal level meter. Then rotate the antenna to the left of the desired station until the received signal drops 3 dB; note the angle in degrees from the peak signal point to the −3 dB point. Rotate the antenna back to the peak signal point and continue turning to the right of the desired station until the signal drops 3 dB; note the angle from the peak to the second −3 dB point. The sum of the two angles is the antenna's horizontal beamwidth.

The *front-to-back ratio* is the difference (in dB) between the maximum radiation intensity in the desired direction and the maximum radiation intensity in the opposite direction. An easy way to find out the front-to-back ratio of an antenna is to point it at a desired station and note the received signal level. Then rotate the antenna 180 degrees, so the back of the antenna is pointing at the desired station; measure the signal level again. The difference is the antenna's front-to-back ratio.

(These last two parameters are important because they will determine an antenna's performance in the presence of co-channel or other interference. The methods described here to determine those parameters will provide an approximation of actual performance, since reflections from nearby objects will more than likely introduce some inaccuracies into the measurements.)

The combined effect of a circuit's resistance and reactance on a signal is known as *impedance*. (The nominal impedance of most of the components that make up a CATV system—cable, amplifiers, splitters and couplers—is 75 ohms.) An antenna's impedance is a function of its design and construction, and even its distance from other objects and the ground. Impedance is important with regard to matching the transmission line (or downlead in a receive installation) to the antenna, because maximum power transfer takes place when the two impedances are the same.

When an impedance mismatch exists in a circuit, some of the forward energy is reflected from the mismatch back toward the signal source. This reflected signal interacts with the incident, or forward signal, and produces standing waves. The ratio of the forward-to-reflected voltage on a transmission line in an antenna system is known as voltage standing wave ratio, or *VSWR*. A VSWR of 1:1 exists when there are no impedance mismatches in an antenna system. A high VSWR in an off-air receive antenna system can cause ghosting and other picture impairments, so it is important that the impedances of the antenna, downlead and headend equipment be the same.

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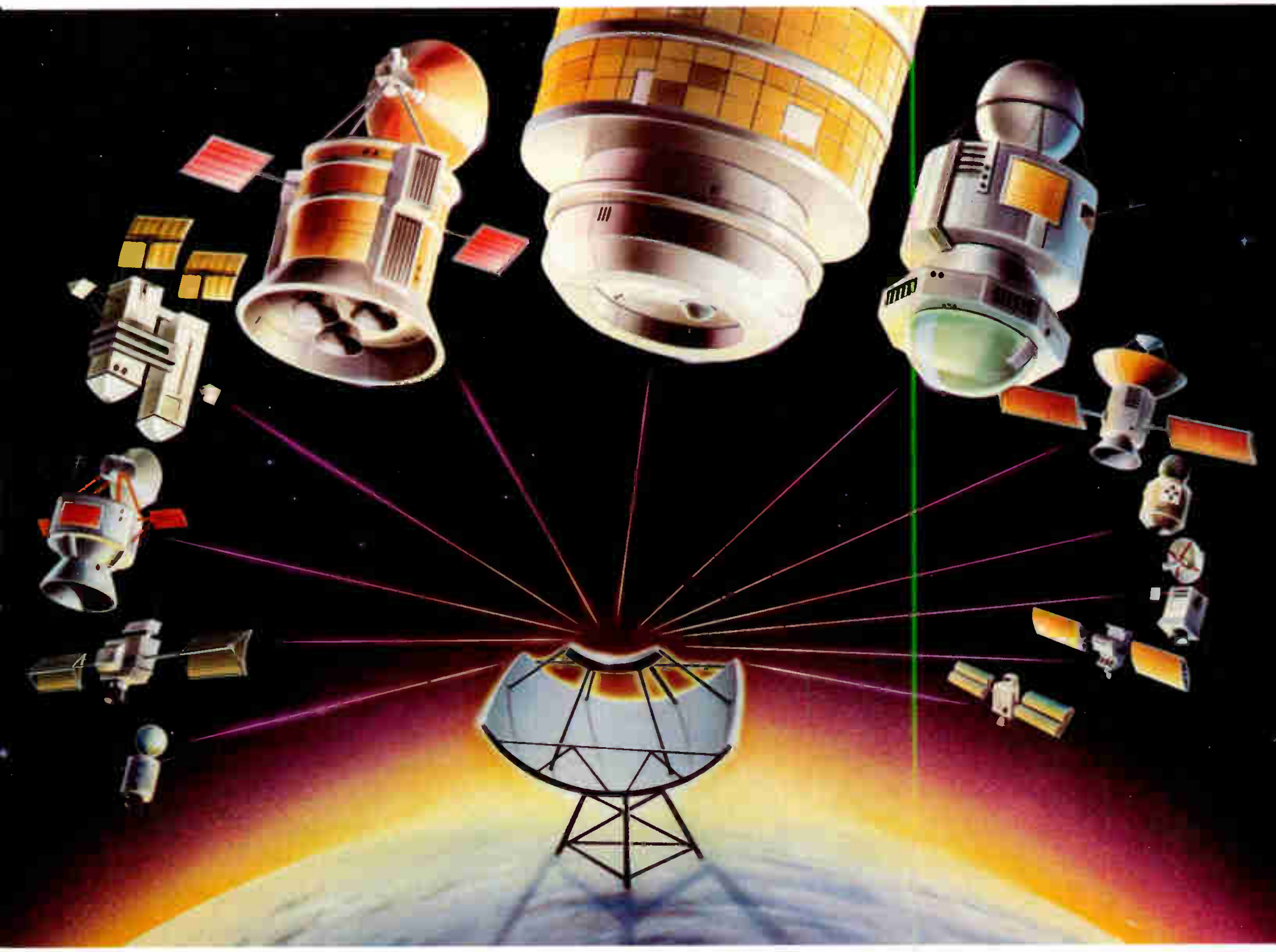

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How's your field crew doing today?

This is the final installment of a two-part series that began last month.

By Barbara J. Wyatt
General Manager, TCI Cablevision of Washington

The value in this DSS comes from the interpretation of the information, not simply from the composite numbers. Consider the example shown in Figure 3. The week began with very poor installation completion on Monday and Tuesday. The returned orders showed a number of reasons for incompletion like no one at home, no money or no adult over the age of 18 to authorize the order. By Tuesday morning, the plant manager (after reviewing the DSS) noticed the significant drop in the percentage of installation orders completed. He discovered the CSR who normally called customers the evening before their scheduled visit was on vacation. The person assigned for that week had not put a priority on that duty. A few duties were immediately reassigned and completion percentages shot up by Wednesday. In this case, the overall system suffered on net growth and uninformed customers. Fortunately, with the plant emphasis on a productive workday it was quickly discovered and addressed.

Also, a spot check on the quality of preventive maintenance can be achieved by observing the repair calls. Many field managers are not involved with the actual numbers of phone calls entering the system yet this can be a great insight into the maintenance of your overall system. With each cable system, there are three main reasons for incoming phone calls: sales, office and plant. (And ideally, they should fall in that order with incoming sales calls being the highest number and field calls the lowest.)

Our system experienced an exceptionally cold February that resulted in a larger number of customers calling in poor reception. (See Figure 4.) Due to the cold snap that hit the area, the plant suffered various distribution lines being sucked out. The average percentage of calls show an immediate improvement (comparing February to March) but a growing increase appears in the percentage of calls per week.

In this example, the technical crew should discuss what may be increasing the number of incoming service calls. The supervisor may find by increasing the

Figure 3: DSS example

Week:						
Customer service Total calls answered						
% calls answered						
Avg. speed answering Office						
Repair						
Plant Number of installs		32	42	46	1	
Number installs outside cont.		43	37	38	39	
Installation comp. %		69%	71%	82%	92%	

Figure 4: Percentage of service calls example

Month:						March	Feb
Customer service Total calls answered							
% calls answered							
Avg. speed answering Office							
Repair							
Avg. number calls/CSR							
% calls service	5%	6%	9%	12%	10%	8%	16%

JULY 1990

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Figure 5: Marketing example

Total number outages							
Number calls/tech							
Absenteeism %							
Sales Total basics sold	103	123	115	142	113	596	424
Total pays sold	62	259	273	436	333	1353	336
Avg. number sales per rep	28	64	55	81	64	58	127
Total basic sold (T)	12	2	18	9	9	50	56
Total pay sold (T)	7	53	136	134	140	470	70
Avg. number sales per telemarketer	6	18	26	24	21	19	42

Figure 6: Call summary sheet

Field personnel __________
Department: Installs
Service

Manager call back questions

Customer name Smith
Phone Number 555-1212

Hello, I am Ted, the plant manager of ABC Cablevision. You recently had a visit from one of our field personnel and I'd like to make sure that everything is fine with your service. How'd we do?

Just fine—he was polite and professional.

Did our installer/service technician answer all your questions and provide professional service to you?

Yes

Did you receive information on:	Yes	No	N/A
Customer handbook	___	___	___
Guide	___	___	___
X*Change	___	___	___
Remote control	___	___	___
Billing assistance	___	___	___
The converter	___	___	___

Did you have any problems calling us or placing the order? Perhaps you have some suggestions for me.

I didn't like having to wait six days to get installed.

number of personnel working in maintenance or simply by closely analyzing which area of distribution these calls are originating from, he can address the problem before it creates an outage or greater customer dissatisfaction.

Another measurement the chief technician can take is to keep track of the marketing decisions with the DSS. (See Figure 5.) A daily/weekly measurement will allow the plant manager to keep abreast of the upcoming needs. A chief technician can observe an increase of incoming orders. Or if additional sales or telemarketing staff are hired, the chief technician can complete his own estimates on how much activity this will create for the plant based on previous history of what a typical telemarketer sells per day. This additional information can assist in crew allocation decisions before the emergency happens.

The value of this simple statistics sheet increases when used daily and redesigned for each system's needs. An added value is the knowledge that the crew understands you want to become more aware of what is happening in the field. It is a simple internal tool to ensure that all the procedures are in place to make their jobs easier and more efficient.

The management role

A field quality check by each of the management staff is crucial. But so often an assistant or foreman does it because the manager is addressing the immediate concerns or emergencies. However, ensuring daily contact with the actual quality of work the field crew is completing is a very simple matter of making a personal commitment to a daily two-minute phone call. (Figure 6 shows a summary sheet for the call.)

A copy of a day's completed route of one installer or technician is given to each manager. Each manager calls one customer. (For example, the general manager completes call #1, the chief tech completes call #2 and the marketing manager call #3.) This two-minute phone call is probably the most effective customer service tool for the desk-bound chief technician. It provides the customer the opportunity to speak with a manager and provide input on what was effective or what should have happened. It provides immediate feedback to the field person for the excellence in his work and/or suggestions on how to ensure his customers fully understand the advantages of cable TV. And, it reminds the chief tech there is only one important factor in his job description: customer service.

May 1990

Spotlight on installation

BACK TO BASICS

The training and educational supplement to Communications Technology magazine.

Formerly Installer/Technician

Table of Contents

Fiber-optic splicing simplified

By Colin Holway
Applications Engineer
And Russell Turner
Manager Fusion Splicing Products
Sumitomo Electric Fiber Optics Corp.

As installation of fiber-optic systems becomes more widespread, splicing has evolved from a kind of black art to a very specific science. Craftspersons and installers once plagued by difficulties and uncertainties now can easily and routinely accomplish even complex installs. The latest products are designed for simplicity, automation and minimal training to enhance ease of use.

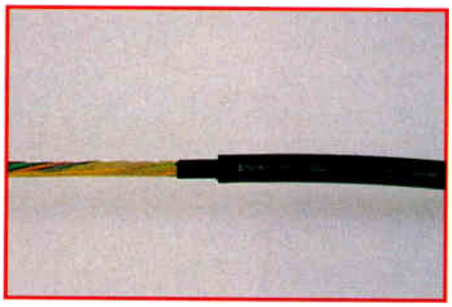
One example of the evolution of installation equipment is the advent of fully automatic fiber-optic fusion splicing machines. Using such equipment, the accompanying photographs illustrate the ease with which fiber-optic links can be installed. The method described is generic due to the vast array of cable designs, closure types and splicing equipment, but can serve as a step-by-step primer when augmented by the specific manufacturer's guidelines and practices. In this example, the cable is of loose-tube construction, the craft tools are common design and the fusion splicer is an automatic single-mode core monitoring system.

The fiber-optic cables usually specified are lightweight plastic cables containing thin glass strands housed in channels designed to reduce stresses and protect the integrity of the fragile fiber. At the point where the ends of two cables must be joined, the individual fibers are spliced and then organized and protected in a sealed housing called a closure. Universal-type closures contain components to anchor the cables, organize the fibers and store the protective splice sleeve. These closures are usually lashed to poles or stored within a vault or pedestal.

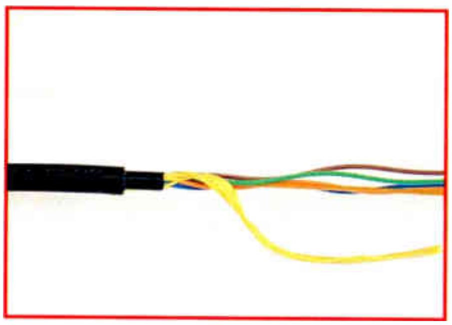
The fusion splicing machine should be set up for splicing in an environmentally stable, relatively clean area such as an air conditioned truck or trailer. Such setups are available complete with electrical generators, lights, test gear and communications equipment. These features are recommended but not essential. Additional tools required include utility knife, diagonal pliers, electricians scissors, coax cutter, fiber stripping tool, precision fiber cleaver and a variety of mechanics tools.

Enhancements across the board in fiber-optic products, installation methods and equipment have allowed installers and users to economically and reliably splice their plant in a variety of environments. Extensive training is not required to master the basics of fiber-optic installations. Careful consideration in the design and planning phases, coupled with the selection of state-of-the-art user-friendly equipment, can minimize problems in installation and operation of fiber-optic systems.

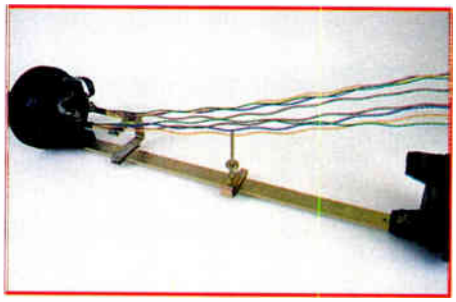
"Extensive training is not required to master the basics of fiber-optic installations."



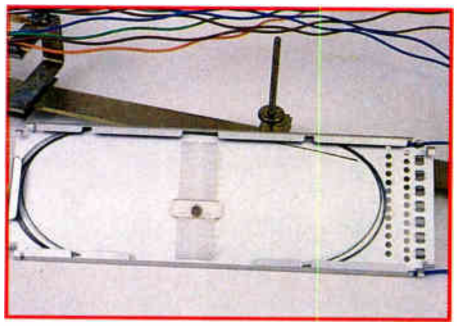
Step 1: *Ring cut the cable sheath 10-12 feet from the end. Separate and remove the sheath from the cable. Fiber-optic splicing requires this extra length to accommodate splicing equipment and to allow for unanticipated remakes of cleaves or broken fibers.*



Step 2: *Remove the wires, spacers, tapes and strength members from the cable, leaving the closure manufacturer's recommended length to secure the cable within the closure. Most fiber-optic cables are filled with a water blocking compound and will require either strain relief or coupling of components to ensure the integrity of the opened cable. Remove the excess filling compound from the cable components with a cable gel solvent.*

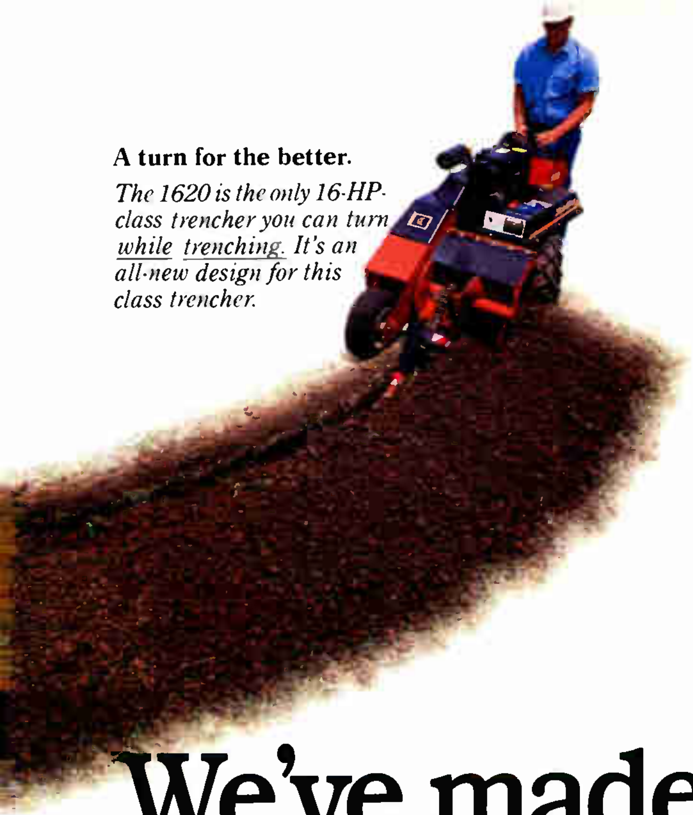


Step 3: *Secure the two cable ends into the closure to provide the required strain relief. Optical cables are designed with components called strength members to give support and carry loading. These are typically steel wires, fiberglass-reinforced plastics and aramid yarns such as Kevlar.*



Step 4: *Remove the tube from the optical fiber strands. Using a dry towel, wipe the excess gel from the fibers then attach the tube to the splice organizer tray. Most closures accomodate between 36-48 inches of excess tube length. The additional 48-60 inches of fiber should be wrapped neatly in the organizer tray.*

Step 5: *Remove about 3 inches of the coating from fiber ends to be joined with an optical fiber stripping tool. Clean the*



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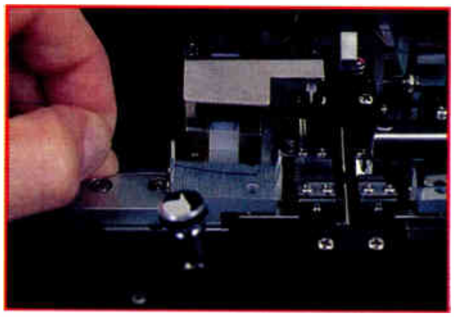
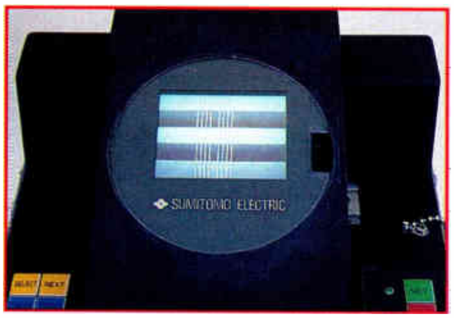
glass with a gauze pad dampened with a solvent, preferably 100 percent isopropyl alcohol or acetone. Wipe the glass carefully two to three times, turning it to assure thorough cleaning. The bare glass must be clean to assure successful cleaving and minimize splice contamination.

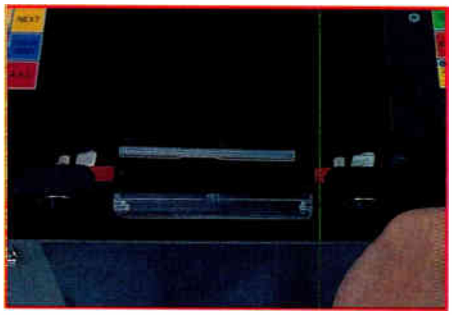
Step 6: *Place the stripped fiber into a cleaving tool to cut the fiber end. Preparation of a perfect end face with a minimum of angularity is the most important step in the splicing process. End face quality directly affects the splice loss and mechanical strength of the joint.*



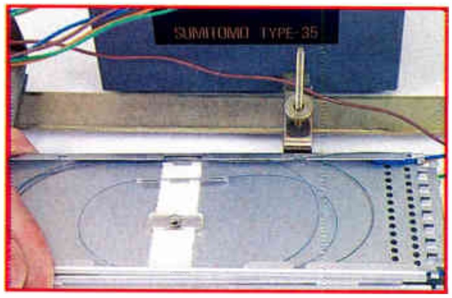
Step 7: *The Type-35 automatic fusion splicer only requires selecting a splicing program from a menu on the self-contained monitor, placing the prepared fiber into the clamps and pressing the start button to initiate the fusion splicing procedure. The microprocessor controls the entire process.*



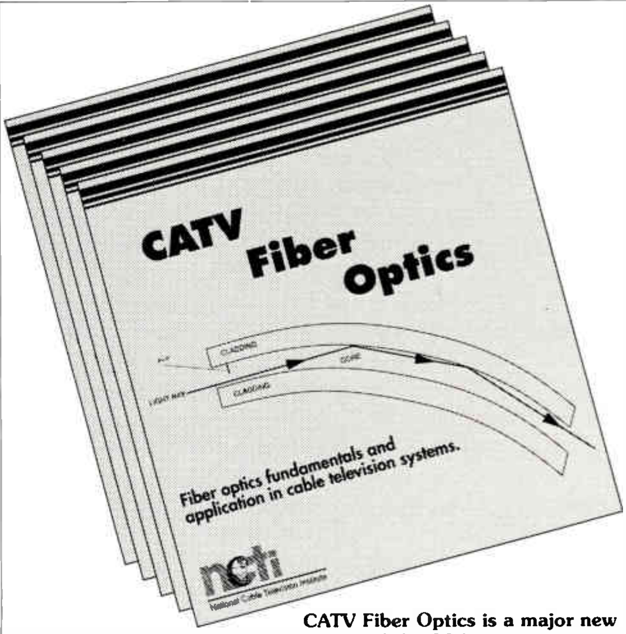
Step 8: *Once the automatic process has been initiated, using a built-in camera and image processor, the machine positions the fibers, inspects the prepared ends, cleans them, and aligns the fiber cores in the vertical and horizontal direction. When the cores are perfectly aligned, an electric arc is turned on to melt the glass while the ends are fed together. Then the resulting splice is inspected and evaluated with the final loss estimate displayed on the screen. The entire automatic process takes less than a minute and produces average splice losses less than 0.5 dB, even for novice splicers.*



Step 9: *The joint must be protected after the splice is completed because uncoated glass fiber is susceptible to fracture and environmental effects. A most effective method is a heat shrinkable, steel reinforced splice protection sleeve. Such a sleeve should be placed over one of the fibers before the fiber end is prepared. After splicing, the sleeve is centered over the joint and placed in the fusion splicer's integral heating oven. It supplies a controlled, even heat to shrink the tube over the splice from the center extending outward toward the ends, evacuating the air and sealing the splice. This protected splice is then secured into the organizer tray for storage.*



Step 10: *Store the completed splice in the organizer tray for permanent installation. The fibers should be wrapped neatly and securely, but without pinching or small bends (called macrobends) that can cause attenuation of the light signal and mechanical failures. The organizer trays are fastened into the closure, which is often temporarily sealed until system testing verifies that all the fibers are continuous and the total splicing losses are within the engineered splicing loss budget. Then the closure can be permanently sealed and stored.* ■



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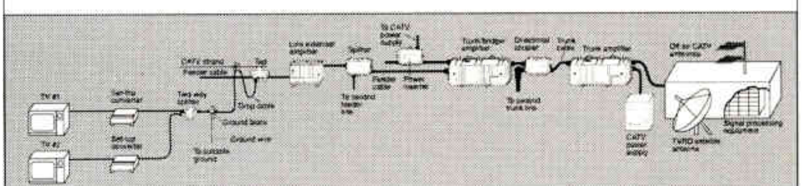

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CT 5/90

The Installer Certification Program: Satisfying a need

By Howard Whitman
Manager, Editorial and Promotion
Society of Cable Television Engineers

When Robert Luff of the SCTE board of directors suggested the development of a certification program for installers at a 1987 board meeting, he articulated a need that has been a concern of the cable TV industry throughout its existence. The installer, the person who makes final provisions for a customer to receive cable service and in many cases the sole person the subscriber comes in contact with, plays an important role in the cable industry and deserves as much attention, preparation and technical training as any cable employee.

Upon Luff's recommendation, an Installer Certification Program Committee was formed, consisting of Richard Covell (chairman), Ron Cotten, Allen Kirby, Dave Pangrac, Roy Tartaglia and Dave Willis. The committee's goals were to establish minimum skill requirements for installers and installer/technicians in the industry. This would be achieved by developing a program for the certification of installers in a process similar to the Society's Broadband Communications Technician/Engineer (BCT/E) Program, which had enjoyed great success since its introduction in 1985. The Installer Certification Program, it was determined, would combine a written examination (modeled after the seven exams utilized in the BCT/E Program) with a series of practical examinations to provide a means for comprehensively measuring an installer's skill and expertise in the performance of job duties.

One important objective of the program was to educate installers in matters besides technical practices. Customer relations is a vital part of an installer or installer/technician's job duties that is commonly overlooked in their initial training. It was decided early in the evolution of the SCTE Installer Certification Program that it would delve into this neglected but significant discipline.

By the book

While there existed a great deal of source material for BCT/E candidates to use as study resources, the Installer Program Committee felt that the more job-specific Installer Certification Program would require a comprehensive manual developed especially for candidates. This manual, it was decided, would offer

"For the first time, installers and installer/techs could be recognized for the skills they had while given the opportunity to develop these skills."

recommended practices for drop cable installation. It would have a consistent viewpoint based on the committee's findings and practical knowledge. Classroom-style and hands-on training would be conducted by the Society's more than 50 local chapters and meeting groups using the manual. Besides functioning as a study guide for the certification program, this manual would offer the industry a complete training guide for this historically neglected job category.

Covell (who also serves as the Society's Western vice president and is an at-large director on its national board) took on the responsibility of assembling the manual. He provided a finished version of the manual, the product of a year of research and discussion, in 1989. Since its publication that year, nearly 1,000 copies have been sold, confirming the industry's endorsement of the program as an acceptable approach to installation. The manual is automatically provided to all participants enrolled in the program but copies of the manual are available to any interested buyer for only $15.

The other product of the committee's efforts, the certification program itself, was officially premiered at Cable-Tec Expo '89 in Orlando, Fla. The program by this point evolved to consist of three parts: a written examination and two practical examinations (cable preparation and fittings; signal level meter reading). Considered in the early stages of the program's development, proposed practical exams on pole climbing and ladder safety were eliminated from the program due to the potential risks of such activities.

As the practical exams would be administered at the local level through the Society's chapters, only the written examination was introduced at Expo '89. Although this was done with little fanfare, it was an important event in the industry's history, as it recognized the need to train people at each of its levels. For the first time, installers and installer/techs could be recognized for the skills they had while given the opportunity to further develop these skills.

Since the program's introduction, candidates for certification have been able to join the Society at the installer member level for a $25 fee that entitles the applicant to one full year's installer membership in the SCTE, as well as covering the cost of the installer manual and the initial certification examination fees.

But wait, there's more

Installer membership in the Society entitles the individual to all of the discounts afforded SCTE members at conferences, meetings and seminars, as well as discounted prices on all products, publications, materials and videotapes sold by the Society. Installer members do not have voting privileges within the Society, cannot hold an office in the Society at the national or local level, and are not eligible for insurance coverage or any other benefits of active membership requiring an expenditure of SCTE funds. A special membership card is issued for installer members.

Presidents of local chapters and meeting groups are authorized to proctor Installer Certification examinations. Other local chapter or meeting group officers also may receive approval to act as proctors through application to the Certification Committee.

Participants in the program will receive a certificate listing the three areas of certification. When each is successfully completed, the candidate will be sent special seals that are to be attached to the certificate. Upon the successful completion of all three exams, the candidate will receive proper recognition through the local chapter. Installer Certification by the Society is valid for a period of three years. The triannual recertification process is currently being developed and will be announced at a later date.

It is the Society's hope to convince state cable associations and system managers that every installer and installer/technician working within their jurisdiction, including in-house installers and contractor personnel, should be certified. SCTE created the Installer Certification Program to satisfy an important need. It is now up to the industry to recognize the need and do something about it. ■

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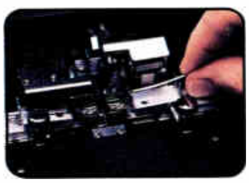
10:01



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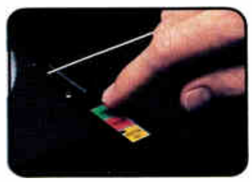

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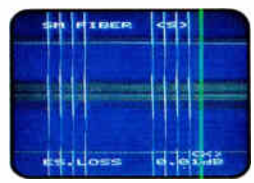

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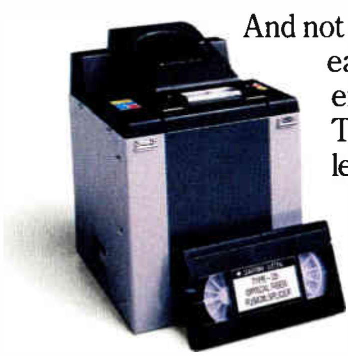

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SUMITOMO ELECTRIC
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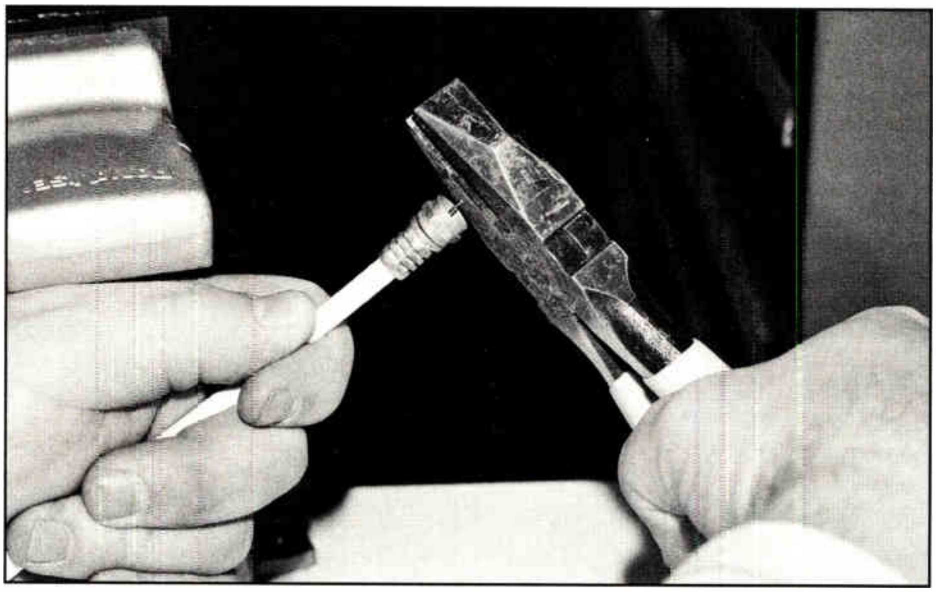
Hands-on through interactive video

By Pam Nobles
Staff Engineer/Technical Training
Jones Intercable Inc.



The video portion in interactive training shows the student how to perform tasks like installing an F connector.

There are three basic steps necessary to ensure competence when teaching technical skills:

1) Instructor tells/instructor does
2) Student tells/instructor does
3) Student tells/student does

The importance of the hands-on practice of a skill cannot be overemphasized. Not only does the student need to hear the skill described and see the skill performed properly, time must be allocated to let the student practice the skill. This also is true in learning the skills necessary to become an installer. Success can be achieved through a balance of classroom and hands-on training.

Interactive video training is one of the fastest-growing training alternatives in cable today. Introduced to the industry just two years ago by the Business Learning Group, interactive training is being used as stand-alone training or to augment existing training programs. The Business Learning Group, in conjunction with Jones Intercable and other major MSOs, is in the process of finalizing the script for an interactive video program for installation training.

Computerized video training

Interactive laser videodisc training is a computerized video training approach. It consists of a television, personal computer and a laser videodisc player. A student watches the video training, which is interspersed with a variety of questions based on the course material. Depending on the student's response, the computer selects feedback that reinforces, rejects or reteaches the subject matter. This automatic "branching" ensures the learner of personalized instruction.

At the end of each lesson, the student receives information as to how he did in that particular segment. These indicators can help the supervisor determine how to coach over the long run with each learner. The video is designed to present simulations that prepare the students for work they are being trained to perform. One of the greatest benefits of interactive systems is the immediate availability of training. Instruction is always consistent. The supervisor's time is demanded less than during classroom training, and this type of learning is fun.

But where, you may wonder, is the hands-on element we all agree is so important? This is perhaps where the most resistance to a program of this type materializes. The answer is in carefully constructed support material for the program, used by both the student and the supervisor.

The interactive installer training revolves around the first days of a new installer, Keith. As Keith interacts with his supervisor, Paul, the installer-in-training at the workstation becomes a part of the process. This is the "instructor tells/instructor (video) does" component. After each learning point, the video stops and the student has the opportunity to work through computer exercises. This is the "student tells/instructor (or computer) does" factor. We assume the student's supervisor has prepared and gathered all appropriate materials necessary for the installer to practice his skills. Thus, the "student tells/student does" ingredient is incorporated into the training. If the installer needs additional help, supervisor assistance can be obtained.

The script

At this point in his training, Keith is about to learn the specifics of installing an F connector. Keep in mind as you are reading the following that it is a script and the dialogue is written the way people may talk. We join Keith and Paul just as they finish their discussion on drop cable.

Begin video segment
Paul picks up the RG-6 and holds it next to the RG-59 to compare sizes.
Paul: See the size difference? RG-6 is obviously larger.
Keith: So one of the first things I'll have

F connector quality checklist

Each F fitting should be inspected to make sure it meets the following quality guidelines:

- all braid folded back over jacket
- center conductor is clean; all dielectric has been removed
- foil is not peeled away from dielectric
- center conductor extends 1/16-inch from the edge of the connector
- end of dielectric is pushed firmly against the post face of the connector
- no braid sticks out from the crimped portion of the connector
- crimped part of connector is not cracked
- pull on the connector to make sure it is firmly attached to the cable

"The video is designed to present simulations that prepare the students for work they are being trained to perform."

to do is figure out which cable to use.
Paul picks up the F connectors on the table.
Paul: Yep. Then you have to match the F connector to the cable.
Paul picks up some other F connectors.
Paul: You might find some other F connectors around too, such as weatherproof fittings. I'm gonna show you how to put on some universal fittings. Then I want you to practice doing a few.

The rest of the video portion of the lesson shows Paul installing an F connector, step by step. Then, the student is instructed to go to the computer for skill practice.

The computer instructions read: "Practice prepping and crimping at least three connectors on both RG-59 and RG-6 cables. Don't worry about how fast you can do it; practice making a good connection. Follow the 'F connector quality checklist' in your workbook to check each connection. Review the steps on the video if desired."

The student is now instructed to go to the workbook. The "F connector quality checklist" can be used as a reference when the student is away from the computer workstation. (See accompanying figure.)

The student is then instructed to press enter on the computer when ready to continue the program, ending that exercise. At the end of this lesson (or at a convenient time set up by the supervisor) the supervisor will review the installer's work. If necessary the student may be instructed to practice under the supervisor's guidance.

The test

Of course, the real test is in the field. Only a carefully planned quality control program to monitor each installer's progress will ensure that skills are mastered. However, beginning with excellent interactive training will ensure quality end results. ■

The author would like to thank The Business Learning Group for use of the script.

Making the F connection

By Ron Hranac

One of the most basic parts of the daily job of an installer or service tech is putting F connectors on the drop cables that serve our subscribers. Unfortunately these usually unobtrusive connectors also cause system operators a lot of grief. Improperly installed F connectors can result in degraded picture quality, signal leakage and increased service calls. Not bad for something that, by itself, costs about 12 cents.

Though the F connector has been blamed for a myriad of problems, more often than not the root of those problems is the way the connector was installed in the first place. Manufacturers have gone to great lengths to design drop connectors that reduce craft sensitivity, and today's products are mechanically and electrically quite good.

This article will address proper procedures for the installation of what I call the conventional F connector. The prep dimensions shown are for one-piece attached crimp ring types. Premium connectors such as Raychem's EZ-F or LRC's Snap-N-Seal, the sealed universal designs (Gilbert's USA, PPC's CFS series), and some new varieties each have their own specific preparation instructions that should be used instead.

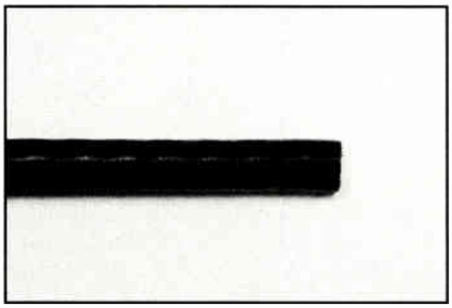
Quality lasts

Lab measurements have shown that a properly installed conventional F connector has electrical performance exceeding 30 dB return loss well past 600 MHz and will last more than 15 years. The key here is *properly installed*. The right connector for the cable being used, correct prep dimensions, correct hex crimp tool (and one that is not worn out), wrench tightening and good weatherproofing (boots and gel) will add up to a foolproof connection.

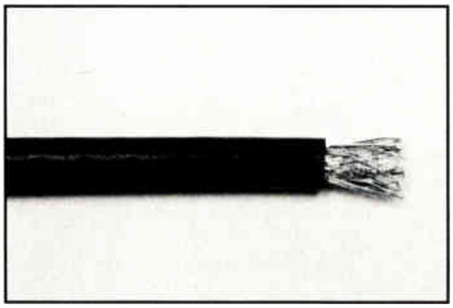
The accompanying photos demonstrate the right way to put on a conventional F connector. It is extremely important that you fold the braid back over the jacket when preparing the cable. If the braid is cut off or shortened to less than 3/8 inch, connector pullout strength will be reduced by as much as 50 percent and RF shielding will be degraded by up to 24 percent.

If you have been using one-step prep tools for the installation of conventional F connectors, you are compromising your system's overall performance. No manufacturer makes a one-step prep tool that will properly prepare drop cable for conventional F connectors. Some of the premium and sealed types have their own one-step prep tools that work well with their respective connectors but those tools should not be used with conventional connectors!

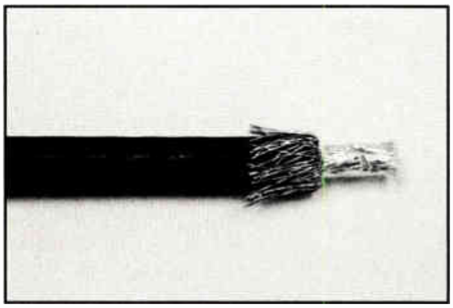
At least one manufacturer (PPC) makes a two-step prep tool that will prepare the



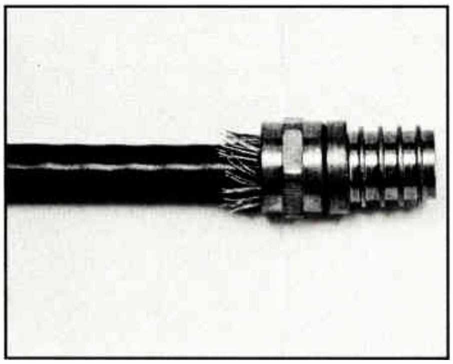
Step 1: *Cut the end of the drop cable square with a sharp pair of cutters.*



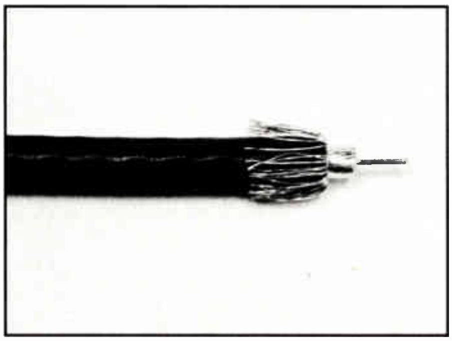
Step 2: *Remove 3/8 inch of jacket, being careful not to cut into the braid.*



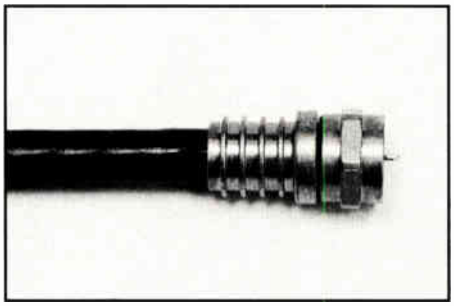
Step 3: *Fold the braid (3/8 inch) back over the jacket.*



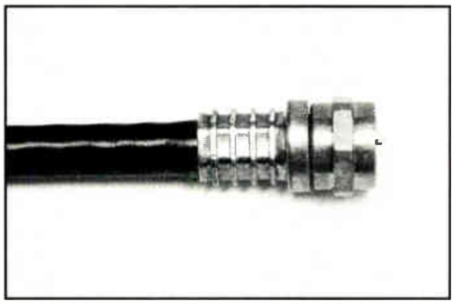
Step 4: *Using the connector you will be installing, shape the dielectric as shown. Push the connector on "backwards" until it bottoms out at the braid.*



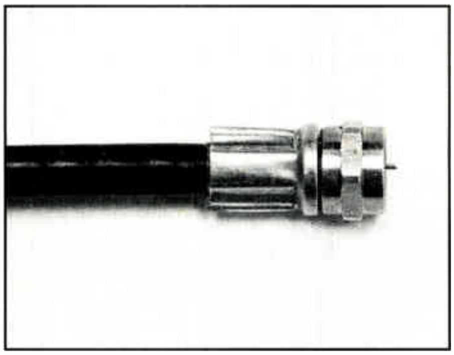
Step 5: *Remove 1/4 inch of dielectric; be sure you don't nick the center conductor. This procedure will leave 1/8 inch of exposed dielectric and 1/4 inch of center conductor.*



Step 6: *Install the connector on the cable, leaving the braid folded back under the connector's crimp ring. When the connector bottoms out, the dielectric should be flush with the inside bottom of the connector.*



Step 7: *Finish the installation with a hex crimp tool. Make sure the tool's hex dimension is the right one for the connector you are using, and don't use a worn-out pair of crimpers.*



If your connector crimps look like this, you have either installed the wrong connector on the cable or used the wrong hex size on the crimping tool.

cable properly for conventional F connectors. The first cut with this tool removes the jacket; you must then fold the braid back before proceeding with the second cut, which removes the dielectric. One-step prep tools usually remove too much or all of the braid.

After the connector is installed on the cable, it is very important that you wrench-tighten it to its mating device. A number of manufacturers are selling drop connector torque wrenches that are preset to 20 inch-pounds; this figure is about ideal for secure drop connections. All connectors installed outside should be weatherproofed as well. Lab testing I have participated in indicates that old fashioned boots and gel are among the most effective ways to accomplish this. Do not use boots without gel, since this can sometimes cause more problems than no weatherproofing at all.

With more than 400 million F connectors installed in this country's CATV systems, and our industry spending something like a half million dollars each day to maintain them, it's reasonable to assume that proper installation of the 12-cent F connector will go a long way toward making each of our jobs a little easier. ■

NEC® Article 820: Cable installation

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Table 820.50: Cable markings

Cable marking	Type	Reference
CATVP	CATV plenum cable	Sections 820-51(a) and 820-53(a)
CATVR	CATV riser cable	Sections 820-51(b) and 820-53(b)
CATV	CATV cable	Sections 820-51(c) and 820-53(c)
CATVX	CATV cable, limited use	Sections 820-51(d) and 820-53(c), Exceptions 1, 2 and 3

Notes: Cable types are listed in descending order of fire-resistance rating. See the referenced sections for listing requirements and permitted uses.

E. Cables within buildings

820-50. Listing and marking of CATV cables. Coaxial cables installed as wiring within buildings shall be listed as being suitable for the purpose, listed as being resistant to the spread of fire in accordance with the requirements of Section 820-51, installed in accordance with Section 820-52, and marked in accordance with Table 820.50. The cable voltage rating shall not be marked on the cable.

Note: Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light and power applications.

Exception 1: Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

Exception 2: Where the length of cable within the building does not exceed 50 feet (15.2 meters) and the cable enters the building from the outside and is terminated at a ground block.

820.51. Additional listing requirements. Cables shall be listed in accordance with (a) through (d) below.

(a) Type CATVP. Types CATVP community antenna TV plenum cable shall be listed as being suitable for use in ducts, plenums and other space used for environmental air and shall also be listed as having adequate fire-resistant and low smoke-producing characteristics.

Note: One method of defining low smoke-producing cables is by establishing an acceptable value of the smoke produced when tested in accordance with the Test for Fire and Smoke Characteristics of Wires and Cables, NFPA 262-1985 to a maximum peak optical density of 0.5 and a maximum average optical density of 0.15. Similarly, one method of defining fire-resistant cables is by establishing maximum allowable flame travel distance of 5 feet (1.52 meters) when tested in accordance with the same test.

(b) Type CATVR. Types CATVR community antenna TV riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of the Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts, ANSI/UL 1666-1986.

(c) Type CATV. Type CATV community antenna TV cable shall be listed as being suitable for general purpose CATV use, with the exception of risers and plenums, and shall also be listed as being resistant to the spread of fire.

Note: One method of defining resistance to the spread of fire is that the cables do not spread fire to the top of the tray in the Vertical-Tray Flame Test in the Reference Standard for Electrical Wires, Cables and Flexible Cords, ANSI/UL 1581-1985. Another method of defining resistance to the spread of fire is for the damage (char length) not to exceed 4 feet 11 inches (1.5 meters) when performing the Vertical Flame Test—Cables in Cable Trays, as described in Test Methods for Electrical Wires and Cables, CSA C22.2 No. 0.3-M-1985.

(d) Type CATVX. Type CATVX limited use community antenna TV cable shall be listed as being suitable for use in dwellings and for use in raceway and shall also be listed as being flame-retardant.

Note: One method of determining that cable is flame-retardant is by testing the cable to the VW-1 (Vertical-Wire) Flame Test in the Reference Standard for Electrical Wires, Cables and Flexible Cords, ANSI/UL 1581-1985.

820-52. Installation of cables and equipment. Beyond the point of grounding, as defined in Section 820-33 (see page 46 in this issue of *CT*), the cable installation shall comply with (a) through (d) below.

(a) Separation from other conductors.

(1) Open conductors. Coaxial cable shall be separated at least 2 inches (50.8 millimeters) from conductors of any electric light or power circuits or Class 1 circuits.

Exception 1: Where the electric light or power or Class 1 or coaxial cable circuit conductors are in a raceway, or in metal-sheathed, metal-clad, non-metallic-sheathed or Type UF cables.

Exception 2: Where the conductors are permanently separated from the conductors of the other circuits by a continuous and firmly fixed non-conductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.

(2) In enclosures and raceways.

a. Other power-limited circuits. Coaxial cables shall be permitted in the same raceway or enclosure with jacketed cables of any of the following:

1. Class 2 and Class 3 remote-control, signaling and power-limited circuits in compliance with Article 725.
2. Power-limited fire protective signaling systems in compliance with Article 760.
3. Communications circuits in compliance with Article 800.
4. Optical-fiber cables in compliance with Article 770.

b. Electric light or power circuits. Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conduc-

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tors of electric light or power or Class 1 circuits.

Exception 1: Where the conductors of the different systems are separated by a permanent barrier.

Exception 2: Conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment or for power connection to remote-control equipment.

(3) In shafts. Coaxial cables run in the same shaft with conductors of electric light or power shall be separated from electric light or power conductors by not less than 2 inches (50.8 millimeters).

Exception 1: Where the conductors of either system are encased in metal raceway.

Exception 2: Where the electric light or power conductors are in raceway, or in metal-sheathed, metal-clad, non-metallic-sheathed or Type UF cables.

(b) Spread of fire or products of combustion. Installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be so made that the possible spread of fire or products of combustion will not be substantially increased. Openings around penetrations through fire-resistance-rated walls, partitions, floors or ceilings shall be firestopped using approved methods.

(c) Equipment in other space used for enviromental air. Section 300-22(c) shall apply.

(d) Hybrid power and coaxial cabling. The provisions of Section 780-6 shall apply for listed hybrid power and coaxial cabling in closed-loop and programmed power distribution.

Table 820-53: Cable substitutions

Cable type	Permitted substitutions
CATVP	None
CATVR	CATVP
CATV	CATVP, CATVR
CATVX	CATVP, CATVR, CATV

820-53. Application of listed CATV cables. CATV cables shall comply with (a) through (d) below.

(a) Plenum. Cables installed in ducts, plenums and other spaces used for environmental air shall be Type CATVP.

Exception: Types CATVR, CATV and CATVX cables installed in compliance with Section 300-22.

(b) Riser. Cables installed in vertical runs and penetrating more than one floor, or cables installed in vertical runs in a shaft shall be Type CATVR. Floor penetrations requiring Type CATVR shall contain only cables suitable for riser or plenum use.

Exception 1: Where the cables are encased in metal raceway or are located in a fireproof shaft having firestops at each floor.

Exception 2: Types CATV and CATVX cables in one- and two-family dwellings.

(c) Other wiring within buildings. Cables installed in building locations other than the locations covered in (a) and (b) above shall be Type CATV.

Exception 1: Where the coaxial cables are enclosed in raceway.

Exception 2: Type CATVX cable in non-concealed spaces where the exposed length of cable does not exceed 10 feet (3.05 meters).

Exception 3: Type CATVX cables that are less than .375 inch (9.52 millimeters) in diameter and installed in one- or two-family or multifamily dwellings.

(d) Cable substitutions. The substitutions for community antenna TV cables listed in Table 820-53 shall be permitted.

Cable basics

This is Part II of a series on the basic elements of cable TV measurements.

By Richard G. Covell
Applications Engineer, General Instrument/Jerrold

At any temperature, other than absolute zero, a resistor will produce a voltage due to random electron activity caused by heating. In a 4 MHz bandwidth and at 68° F, a 75-ohm resistor will produce 2.2 microvolts (μV). When measured with a meter with a 75-ohm internal impedance (matching that of the resistor), it will measure 1.1 μV, which is equivalent to −59.2 decibel-millivolts (dBmV).

When measured between the center conductor and sheath, an infinitely long piece of coaxial cable with a 75-ohm characteristic impedance (or a shorter one terminated at the opposite end in 75 ohms) also will produce 1.1 μV at 68° F if measured with a microvolt meter with a 75-ohm internal impedance (Figure 1). If such a piece of 75-ohm cable is connected to the 75-ohm input of a 20 dB gain amplifier at 68° F, we will have an input noise of 1.1 μV or −59.2 dBmV.

Connecting a 75-ohm carrier generator to the other end of this cable and adjusting its output to provide a carrier level of +10 dBmV at the input to the amplifier, we will have an input carrier-to-noise ratio (C/N) of 69 dB, the difference between the carrier level (+10 dBmV) and the noise level (−59.2 dBmV). The input C/N is in fact nothing more than the difference between the input carrier level and the input noise level, expressed in dB.

The output of the 20 dB gain amplifier will have a +30 dBmV carrier level, the sum of the input level of 10 dBmV and the 20 dB gain of the amplifier. If while still monitoring the output of the amplifier the carrier generator is turned off, only the −59.2 dBmV of noise produced by random electron activity in the cable is the amplifier's input.

One might expect the noise output of the amplifier to be −39.2 dBmV (20 dB higher than the input noise of −59.2 dBmV), but when measured, the meter indicates −29 dBmV. The extra noise is produced by the active amplifier. If a 75-ohm resistor sitting by itself on a bench can produce a noise level of −59.2 dBmV, imagine what noise an amplifier can generate when the power supply causes electrons to flow through it.

The difference in noise level between what would have been measured at the amplifier's output had it contributed no noise (−39.2 dBmV) and what was measured (−29.2 dBmV) is called the amplifier's noise figure (NF). In this case it's 10 dB. That is, the amplifier contributed 10 dB more noise than its input noise plus what its gain would have provided, and therefore has a 10 dB NF.

The output carrier level of the amplifier is 30 dBmV and the output noise level is −29.2 dBmV, so the output C/N is 59.2 dB (the difference between the carrier level and the noise level). This is 10 dB worse than the input C/N, an amount numerically equal to its noise figure.

All this information is represented in Figure 2 and can be summarized in the following rules:

1) If the input level in dBmV numerically equals an amplifier's NF, the output C/N will always be 59.2 dB.

2) For each dB the input level is raised *above* the amplifier's NF, the amplifier's output C/N improves by an equal amount above 59.2 dB.

3) C/N at the output of a single amplifier is always worse than that at the input by an amount numerically equal to the amplifier's NF.

C/N formulae

C/N of one station equals the input level to the amplifier module, minus its NF, plus 59.2. Here is the equation:

$$C/N = L_1 - NF + 59.2$$

Where:
L_1 = input level in dBmV
NF = noise figure in dB
59.2 = noise floor in a 4 MHz bandwidth at 68° F (with its sign changed) in dBmV.

For example, to find the C/N at the output of a single amplifier module with a NF of 7 dB and an input level of 10 dBmV, make the following calculations:

$$C/N = L_1 - NF + 59.2 = 10 - 7 + 59.2 = 62.2 \text{ dB}$$

C/N is a 10log function; each time the number of like amplifiers with like input levels is doubled, the combined C/N gets 3.01 dB worse. For most calculations, 3 (rather than 3.01) dB is close enough. (See Table 1.)

To find the C/N at any point in a cascade of like amplifiers with like input levels, subtract 10 times the log of the number of amplifiers in cascade from the C/N of one of the amplifiers. Here's the formula:

$$C/N_t = C/N_1 - 10\log(N)$$

Where:
C/N_t = C/N at end of cascade
C/N_1 = C/N of one amplifier
N = number of like amplifiers in cascade

For example, each trunk amplifier in a 20-amplifier cascade produces a C/N of 62.2 dB. To find the C/N of the trunk as measured at the 20th amplifier, make the following calculations:

Figure 1

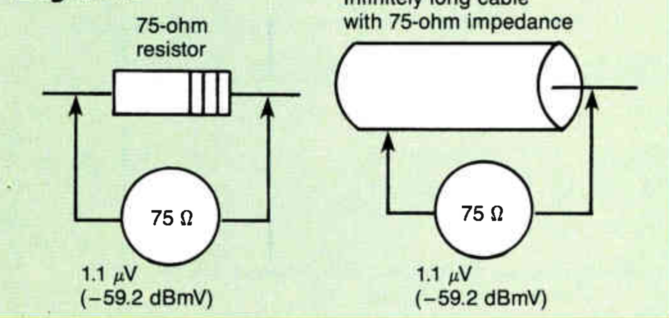

Table 1

Cascade length	Carrier-to-noise ratio
01	62.20 dB
02	59.19 dB
04	56.18 dB
08	53.17 dB
16	50.16 dB
32	47.15 dB

TOP SHELF PERFORMANCE AT ROCK BOTTOM PRICES

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S1450R-VCII C/Ku Switchable Satellite Receiver

- ***Integrated VideoCipher® II Descrambling Module***
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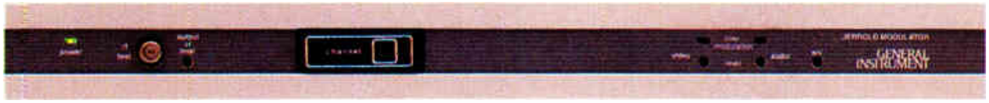
- ***Automatically Switched SAW Filter from 29 MHz (C Band) to 22 MHz (Ku Band)***

S450M Frequency Agile Modulator



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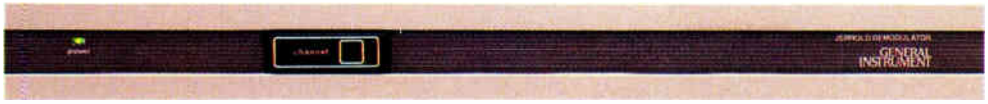
- ***Front Panel Controls***
- ***60 dBmV Output***
- ***BTSC Stereo Compatible***

S890D Frequency Agile Demodulator



- ***Accepts VHF, UHF and all Cable Channels to 470 MHz for Standard, HRC and IRC Frequency Formats***
- ***Sub-Band Option Available***
- ***MPX Output for BTSC Stereo Encoded Signals***

S450P Frequency Agile Heterodyne Processor

- ***Accepts VHF, UHF and Cable Channels to 450 MHz***
- ***Front Panel Controls***
- ***60 dBmV Output***

JERROLD COMMUNICATIONS

GENERAL INSTRUMENT

Reader Service Number 42.

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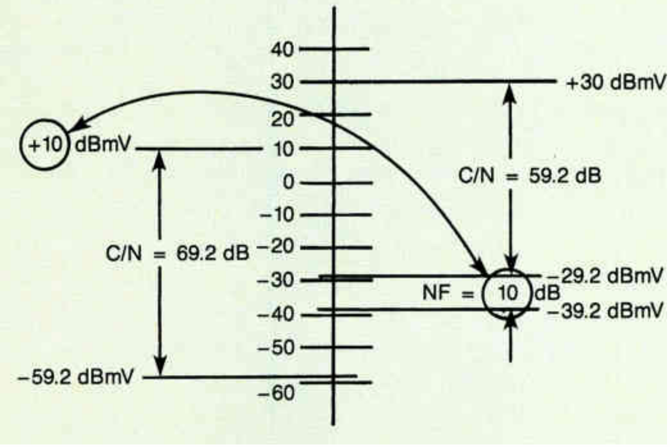
Figure 2



$$
\begin{aligned}
C/N_t &= C/N_1 - 10\log(N)\\
&= 62.2 - 10\log(20)\\
&= 62.2 - 10(1.3010)\\
&= 62.2 - 13.01\\
&= 49.19 \text{ dB}
\end{aligned}
$$

When two like C/Ns are combined, the results are 3.01 dB worse. A 46 dB C/N summed with another 46 dB C/N will yield a 43 (42.98) dB C/N.

One formula that may be used to combine any two C/Ns uses the difference between them as part of the equation. It states that the combined C/N is equal to the worst case C/N, minus 10 times the log of the quantity 1 divided by 10 to a power (which is the lesser C/N subtracted from the better C/N) plus 1. It is easier to comprehend when seen in its algebraic form:

$$C/N_c = C/N_l - 10\log_{10}(1 \div 10^{(C/N_h - C/N_l) \div 10} + 1)$$

Where:
C/N_c = combined C/N (in dB)
C/N_h = higher C/N (in dB)
C/N_l = lower C/N (in dB)

For example, to find the end-of-line C/N of a system whose trunk contribution is 48 dB with the feeder portion providing a 55 dB C/N, make the following calculations:

$$
\begin{aligned}
C/N_c &= 48 - 10\log(1 \div 10^{(55-48) \div 10} + 1)\\
&= 48 - 10\log(1 \div 10^{0.7} + 1)\\
&= 48 - 10\log(1 \div 5.0119 + 1)\\
&= 48 - 10\log(0.1995 + 1)\\
&= 48 - 10\log(1.1995)\\
&= 48 - 10(0.0790)\\
&= 48 - 0.7901\\
&= 47.2 \text{ dB}
\end{aligned}
$$

The next formula may be used to add any number of C/Ns together, including finding the end-of-line (EOL) C/N in the previous example. To add two or more unlike C/Ns, change their sign, divide by 10 and make the result an exponent of 10. Sum each of these new values, take the log of the sum, then multiply by 10. Here's the formula:

$$C/N_t = -10\log(10^{-C/N_1 \div 10} + 10^{-C/N_2 \div 10} + 10^{-C/N_n \div 10})$$

For example, the trunk portion of a system delivers a C/N 48 dB. The bridger's C/N is 62 and the two line extender cascade contributes a 53 dB C/N. To find the EOL C/N performance, make the following calculations:

$$
\begin{aligned}
C/N_t &= -10\log(10^{-48 \div 10} + 10^{-62 \div 10} + 10^{-53 \div 10})\\
&= -10\log(10^{-4.8} + 10^{-6.2} + 10^{-5.3})\\
&= -10\log(1.5849^{-5} + 6.3096^{-7} + 5.0119^{-6})\\
&= -10\log(2.1492^{-5})\\
&= -10(-4.6677)\\
&= 46.68 \text{ dB}
\end{aligned}
$$

Table 2

Keystrokes	Display	Keystrokes	Display
01) 48	48	13) 53	53
02) [CHS]	−48	14) [CHS]	−53
03) [ENT]	−48.0000	15) [ENT]	−53.0000
04) 10	10	16) 10	10
05) [÷]	−4.8000	17) [÷]	−5.3000
06) [10^x]	1.5849^{-05}	18) [10^x]	5.0119
07) [62]	62	19) [+]	5.6428^{-06}
08) [CHS]	−62	20) [+]	2.1492^{-06}
09) [ENT]	−62.0000	21) [LOG]	−4.6677
10) 10	10	22) [10]	10
11) [÷]	−6.2000	23) [CHS]	−10
12) [10^x]	6.3096^{-07}	24) [X]	46.6772

To solve the same equation using a Hewlett-Packard calculator with Reverse Polish Notation, use the procedure in Table 2. The calculator has been set to display four decimals.

The lowest C/N at which snow or grain is not visible on a typical TV receiver is 42 dB. On the newer high resolution monitors, a C/N of 48 dB may be required!

When using a typical TV set to compare an excellent off-air picture to that carried on the cable system, a 46 dB or better system C/N is required for no noise-related differences to be observed between the two pictures.

Noise voltage

To calculate the noise voltage (thermal noise) for any resistance, temperature or bandwdith, the formula is:

$$E = \sqrt{4KTBR}$$

Where:
E = noise voltage in volts (with no load)
K = Boltzmann's constant (1.38×10^{-23})
T = absolute temperature in ° Kelvin
B = bandwidth in hertz (Hz)
R = resistance or impedance in ohms

A Kelvin degree is equal to a Celsius degree, but with the freezing point of water at 273.16° K. To find the Kelvin temperature equivalent for 68° F, convert the temperature in Fahrenheit to Celsius (68° F = 20° C) and add it to 273.16. The result here would be 293.16° K (68° F = 293.16° K).

For example, to find the noise produced by a 75-ohm resistance (cable) at 68° F in the video portion of a TV channel (4 MHz), make the following calculations:

$$
\begin{aligned}
E &= \sqrt{4KTBR}\\
&= \sqrt{4(1.38 \times 10^{-23})(293.16)(4 \times 10^6)(75)}\\
&= \sqrt{4.8547 \times 10^{-12}}\\
&= 2.2 \times 10^{-6}\\
&= 2.2\ \mu\text{V}
\end{aligned}
$$

(Continued on page 83)

Converting dBmV to μV/m

By Ron Hranac

Channel 47 or KK (361.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	7.59	−36	120.24	−10	2399.07	16	47867.66
−59	8.51	−35	134.91	− 9	2691.80	17	53708.40
−58	9.55	−34	151.37	− 8	3020.25	18	60261.81
−57	10.72	−33	169.84	− 7	3388.77	19	67614.86
−56	12.02	−32	190.56	− 6	3802.26	20	75865.13
−55	13.49	−31	213.82	− 5	4266.21	21	85122.07
−54.08	**15**	−30	239.91	− 4	4786.77	22	95508.53
−54	15.14	−29	269.18	− 3	5370.84	23	107162.34
−53	16.98	−28	302.02	− 2	6026.18	24	120238.12
−52	19.06	−27	338.88	− 1	6761.49	25	134909.39
−51	21.38	−26	380.23	0	7586.51	26	151370.83
−50	23.99	−25	426.62	1	8512.21	27	169840.86
−49	26.92	−24	478.68	2	9550.85	28	190564.58
−48	30.92	−23	537.08	3	10716.23	29	213816.97
−47	33.89	−22	602.62	4	12023.81	30	239906.59
−46	38.02	−21	676.15	5	13490.94	31	269179.62
−45	42.66	−20	758.65	6	15137.08	32	302024.50
−44	47.87	−19	851.22	7	16984.09	33	338877.07
−43.62	**50**	−18	955.09	8	19056.46	34	380226.32
−43	53.71	−17	1071.62	9	21381.70	35	426620.95
−42	60.26	−16	1202.38	10	23990.66	36	478676.58
−41	67.61	−15	1349.09	11	26917.96	37	537083.95
−40	75.87	−14	1513.71	12	30202.45	38	602618.11
−39	85.12	−13	1698.41	13	33887.71	39	676148.64
−38	95.51	−12	1905.65	14	38022.63	40	758651.25
−37	107.16	−11	2138.17	15	42662.09		

Channel 48 or LL (367.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	7.71	−36	122.24	−10	2438.91	16	43662.66
−59	8.65	−35	137.15	− 9	2736.50	17	54600.41
−58	9.71	−34	153.88	− 8	3070.41	18	61262.66
−57	10.89	−33	172.66	− 7	3445.05	19	68737.84
−56	12.22	−32	193.73	− 6	3865.41	20	77125.13
−55	13.72	−31	217.37	− 5	4337.06	21	86535.81
−54.50	**15**	−30	243.89	− 4	4866.27	22	97094.78
−54	15.89	−29	273.65	− 3	5460.04	23	108942.13
−53	17.27	−28	307.04	− 2	6126.27	24	122235.09
−52	19.37	−27	344.51	− 1	6873.78	25	137150.02
−51	21.74	−26	386.54	0	7712.51	26	153884.86
−50	24.39	−25	433.71	1	8653.58	27	172661.65
−49	27.37	−24	486.63	2	9709.48	28	193729.56
−48	30.70	−23	546.00	3	10894.21	29	217368.14
−47	34.45	−22	612.63	4	12223.51	30	243891.06
−46	38.65	−21	687.38	5	13715.00	31	273650.27
−45	43.37	−20	771.25	6	15388.49	32	307040.65
−44	48.66	−19	865.36	7	17266.16	33	344505.28
−43.76	**50**	−18	970.95	8	19372.96	34	386541.28
−43	54.60	−17	1089.42	9	21736.81	35	433706.45
−42	61.26	−16	1222.35	10	24389.11	36	486626.64
−41	68.74	−15	1371.50	11	27365.03	37	546004.07
−40	77.13	−14	1538.85	12	30704.07	38	612626.64
−39	86.54	−13	1726.62	13	34450.53	39	687378.40
−38	97.09	−12	1937.30	14	38654.13	40	771251.25
−37	108.94	−11	2173.68	15	43370.65		

Channel 49 or MM (373.2625 MHz)

dBmV	µV/m	dBmV	µV/m	dBmV	µV/m	dBmV	µV/m
−60	7.84	−36	124.23	−10	2478.76	16	49457.67
−59	8.79	−35	139.39	− 9	2781.21	17	55492.42
−58	9.87	−34	156.40	− 8	3120.57	18	62263.52
−57	11.07	−33	175.48	− 7	3501.33	19	69860.82
−56	12.42	−32	196.89	− 6	3928.56	20	78385.13
−55	13.94	−31	220.92	− 5	4407.92	21	87949.56
−54.36	**15**	−30	247.88	− 4	4945.77	22	98681.03
−54	15.64	−29	278.12	− 3	5549.24	23	110721.93
−53	17.55	−28	312.06	− 2	6226.35	24	124232.05
−52	19.69	−27	350.13	− 1	6986.08	25	139390.65
−51	22.09	−26	392.86	0	7838.51	26	156398.89
−50	24.79	−25	440.79	1	8794.96	27	175482.44
−49	27.81	−24	494.58	2	9868.10	28	196894.53
−48	31.21	−23	554.92	3	11072.19	29	220919.30
−47	35.01	−22	622.64	4	12423.21	30	247875.53
−46	39.29	−21	698.61	5	13939.07	31	278120.92
−45	44.08	−20	783.85	6	15639.89	32	312056.80
−44	49.46	−19	879.50	7	17548.24	33	350133.49
−43.91	**50**	−18	986.81	8	19689.45	34	392856.24
−43	55.49	−17	1107.22	9	22091.93	35	440791.95
−42	62.26	−16	1242.32	10	24787.55	36	494576.70
−41	69.86	−15	1393.91	11	27812.09	37	554924.19
−40	78.39	−14	1563.99	12	31205.68	38	622635.18
−39	87.95	−13	1754.82	13	35013.35	39	698608.16
−38	98.86	−12	1968.95	14	39285.62	40	783851.25
−37	110.72	−11	2209.19	15	44079.20		

Channel 50 or NN (379.2625 MHz)

dBmV	µV/m	dBmV	µV/m	dBmV	µV/m	dBmV	µV/m
−60	7.96	−36	126.23	−10	2518.60	16	50252.68
−59	8.94	−35	141.63	− 9	2825.92	17	56384.43
−58	10.03	−34	158.91	− 8	3170.73	18	63264.37
−57	11.25	−33	178.30	− 7	3557.62	19	70983.79
−56	12.62	−32	200.06	− 6	3991.71	20	79645.13
−55	14.16	−31	224.47	− 5	4478.77	21	89363.30
−54.22	**15**	−30	251.86	− 4	5025.27	22	100267.27
−54	15.39	−29	282.59	− 3	5638.44	23	112501.73
−53	17.83	−28	317.07	− 2	6326.44	24	126229.02
−52	20.01	−27	355.76	− 1	7098.38	25	141631.29
−51	22.45	−26	399.17	0	7964.51	26	158912.92
−50	25.19	−25	447.88	1	8936.33	27	178303.23
−49	28.26	−24	502.53	2	10026.73	28	200059.51
−48	31.71	−23	563.84	3	11250.17	29	224470.46
−47	35.58	−22	632.64	4	12622.90	30	251860.00
−46	39.92	−21	709.84	5	14163.13	31	282591.57
−45	44.79	−20	796.45	6	15891.29	32	317072.95
−44.04	**50**	−19	893.63	7	17830.32	33	355761.71
−44	50.25	−18	1002.67	8	20005.95	34	399171.20
−43	56.38	−17	1125.02	9	22447.05	35	447877.45
−42	63.26	−16	1262.29	10	25186.00	36	502526.77
−41	70.98	−15	1416.31	11	28259.16	37	563844.30
−40	79.65	−14	1589.13	12	31707.30	38	632643.72
−39	89.36	−13	1783.03	13	35576.17	39	709837.92
−38	100.27	−12	2000.60	14	39917.12	40	796451.25
−37	112.50	−11	2244.70	15	44787.75		

(For the formula used to derive the conversion data in these charts, see May 1989 *Installer/Technician*'s "Installer's Tech Book.")

IDing MDU drops

A cheap alternative for a "beeper box" for identifying drops in apartment complexes is to take an AM-FM radio (Radio Shack #12-721, for example) and an F to mini-plug adapter (Radio Shack #287-257).

First tune the radio to a strong station, then screw the adapter onto the coax behind the customer's set. Insert the adapter into the earphone jack of the radio. Now go to the apartment box; taking the earphone (that usually comes with the radio), touch the tip of the earphone jack to the center conductor of the F fitting and let the rear of the jack touch the metal part of the fitting itself. Repeat this with all the drops until you hear the radio station in the earphone. Remember, this will only work on the part of the drop that is run to the apartment box; it won't pass through a splitter or apartment tap.

Also, if your system is equipped with a "Cuckoo" in the FM radio band for leakage detection, the radio can be used to check the installation for egress after you have finished.

— Bill J. Naivar Jr.
Chief Technician
Douglas County Cable TV
Douglasville, Ga.

An eye on temp

Proper regulation of temperature in a headend will ensure that electronic equipment operates within specifications and has maximum longevity. Scientific-Atlanta recommends that the headend temperature should be comfortable—around 68° F.

Analysis of the BTU capacity needed for your headend should be determined with the assistance of a licensed air conditioning expert. Some of the factors, in addition to the heat generated by headend electronic equipment, that affect capacity requirements are: type of construction material used in the headend building, R rating factor of insulation used, lighting, traffic flow, local weather, etc.

A simple formula can be used to determine BTUs generated by your headend equipment. The watts consumed by each piece of equipment, multiplied by 3.4144, will give the BTUs generated. The total BTUs generated by the headend can then be given to an air conditioning expert who will add this number to his calculations for total air conditioning requirements.

The total BTU number you have calculated should be compared to the BTU capacity of the present air conditioning system. Present air conditioner capacity should be higher than the number calculated. The amount it is higher will be determined by factors previously mentioned. If the number you have calculated is close to or lower than your present air conditioner's capacity, an air conditioning expert should be contacted immediately.

—Rick Penley
Scientific-Atlanta
Atlanta, Ga.

Cable basics

(Continued from page 80)

When the output of the noise source is connected to a matched (same impedance) load, the voltage is halved. In this case it would be 1.1 μV, which is approximately -59.2 dBmV.

As discussed before, noise is a 10log or power function. To find the dB change in noise from one bandwidth to another, the formula is:

$$N_d = 10\log(BW_1 \div BW_2)$$

Where:

N_d = change in noise in dB
BW_1 = first bandwidth in Hz
BW_2 = second bandwidth in Hz

For example, to find the noise difference between a 1 MHz and 4 MHz bandwidth, make the following calculations:

$$N_d = 10\log(1 \times 10^6 \div 4 \times 10^6)$$
$$= 10\log(0.25)$$
$$= 10(-0.6021)$$
$$= -6.02 \text{ dB}$$

A cable system able to provide pictures that are noise free to the eye of a subscriber using a high definition television receiver or (hopefully in the near future) HDTV, should be geared to deliver an EOL C/N performance of 48 dB or better. ■

Hands On

Troubleshooting tips: S-A line extenders

By Jud Williams
Owner, Performance Technologies

One of the purposes of this column is to bring servicing tips to the bench technician who repairs the distribution equipment used in his system. This month we are going to explore Scientific-Atlanta line extenders. We will touch on procedures for troubleshooting, repairing and testing the amplifier modules. Special emphasis will be on what to look for and improvements that may be made to enhance reliability.

DC power supply

There have been several changes made in the DC power supply section of the various S-A line extenders. These have mostly to do with the voltage regulating circuits. Early versions of the power supplies used a series regulating transistor combined with a zener diode and signal transistor functioning as a reference amplifier. This was preceded by a bridge rectifier and a large axial lead electrolytic capacitor.

The first thing to look for when troubleshooting this type of power supply is a loose electrolytic capacitor because it has a tendency to break away from its solder connection on the PC board. This is the usual problem when the repair tag comes in with the words "hum bar."

Since electrolytic capacitors deteriorate over time, it is always good to replace them when a unit is in for repair. When replacing the series regulating transistor in this version, the transistor tab may be connected directly to the heat sink since its collector may be grounded. Also, be aware that the small reference transistor is a PNP rather than the more commonly used NPN.

The next generation of power supplies use an integrated circuit (IC) regulator. The series regulating transistor used with it requires that its tab be insulated from the heat sink. This generation of line extenders have what is called a "crowbar circuit" located between the fuse and the regulator. If a surge appears at the fuse, an SCR (silicon controlled rectifier) fires and grounds the fuse, causing it to blow.

"Since electrolytic capacitors deteriorate over time, it is always good to replace them when a unit is in for repair."

Actually, the fuse is located in the wrong place to protect what it should be protecting. Fuses should be placed in such a way that they will guard the power transformer since a replacement is expensive and sometimes difficult to obtain. By placing the fuse between the secondary of the transformer and the failure-prone rectifier filter section of the power supply, maximum protection would result.

As far as the crowbar circuit is concerned, its existence is of dubious value. For instance, if the wrong fuse is used the crowbar can cause a series of failures resulting in the burnout of the power transformer, rectifier and 3-ohm power resistor. As a precaution against this extensive damage, it is probably best to clip out the SCR to eliminate this circuit. Current models of the S-A line extenders have, in fact, done away with the crowbar circuit.

The most recent line extenders are now using a dedicated 24 volt regulator, the uA7824, greatly simplifying repair of the modules' power supply section. The tab of this device may be connected to chassis ground so it does not need insulation.

There is a zener diode on the regulator's output side that may be the culprit causing the frequent failure of some uA7824s. It may be advisable to eliminate this zener when replacing the regulator since it always seems to be shorted whenever the uA7824 fails.

One of the easiest ways to check the condition of a power supply is to attach a 30 volt DC (VDC) bench supply to the regulating circuit's input, which happens to be at the fuse clip. If all is OK, 24 VDC will be measured at the hybrid. If 60 volts AC (VAC) power is applied to the amplifier in an attempt to turn it on and if the fuse is either open or missing, it is then necessary to discharge the electrolytic prior to inserting a new fuse. This may be done by touching the tip of a screwdriver to the fuse clip and then grounding the shaft to the chassis. Don't be surprised when you hear a loud snap as the capacitor discharges. If you install an electrolytic the wrong way, it will explode like a firecracker so be sure to observe its polarity.

The surge suppressors located at the input and output terminals are often a reason for amplifiers to fail. After flashing repeatedly, the devices tend to short out, sometimes causing the foil of the PC board to burn, resulting in an open electrical path. If the foil survives, then the RF signal will be greatly attenuated at the low end due to the short. There is some question as to the usefulness of these components and some feel they are not worth replacing. Some systems routinely remove them from all their line extenders before installation and have experienced greater reliability without them.

Since most systems are now operating on 60 VAC it may be a good idea to take away the shorting bar that enables the unit to operate on 30 V. This removes the temptation to change to 30 V in the field areas where the 60 VAC is a little on the low side.

When troubleshooting the power supply section of most devices, often the quickest way to find a problem is visually. A faulty electrolytic frequently has a puffed appearance or is leaking. A bridge rectifier will sometimes have a blister on its side, or the solder on the PC board will appear gray and lusterless due to overheating. This also may be the case with a bad power transistor. An ohmmeter check will confirm the existence of a short. Power transformers usually are dark with an acrid odor when burned out.

RF section

Since the S-A line extender's RF section is modular, servicing is quite simple because the plug-in hybrids are easily removed and replaced. Occasionally, the RF choke immediately adjacent to the hybrid will burn out if the hybrid has a short in it. Other than that, testing the hybrid on a sweep generator is the quickest way to determine its condition. Remember that when the scope's response trace slopes downward abruptly, the hybrid is bad. Also, be wary of a hybrid that draws excessive current.

When inserting the hybrid into the amplifier, make sure the hybrid's pins sit properly in their holes. Hybrids have a tendency to come loose when the amplifier is being carried around, and if they are not properly aligned when installed, the pins may become bent.

Other things to look for in the RF section are equalizer pin sockets that have come loose from the PC board. This will result in an intermittent signal. Also, check the test points to see they are securely soldered.

The line extenders should always be installed in a housing when tested on the bench. Once the captive screws are tightened down, it is necessary to go around the edge of the PC board and tighten each of the chassis screws. Be careful not to use too much force as there is a tendency for them to strip because they are self-tapping. The transformer screws should be tightened as should the nut holding the RF connectors to the PC board. All of these things will help flatten the response.

Once the amplifier is ready for sweeping, insert a zero attenuator and 4.5 dB equalizer into their sockets along with appropriate jumpers. The typical response curve of S-A line extenders will be slightly hump-shaped rather than perfectly flat. This is normal.

In addition to checking the swept response of the output of the amplifier, the test points should be checked making sure that when making this test, that the amplifier's output is properly terminated with 75 ohms. The DC power supply should be checked to see that it is close to 24 V. One other vital test is to verify that the AC path has continuity.

If the response reveals glitches, suckouts or oscillations, some things to look for are: 1) excessive thermal compound on the hybrid, 2) chassis screws that are not tight, 3) burned or loose RF connectors, 4) very wide-band hybrids in models designed for narrow-band use, 5) captive screws that were not tightened enough, 6) loose RF strap under the hybrid needing resoldering to the PC board and 7) hybrid pins not properly seated in their holes. ■

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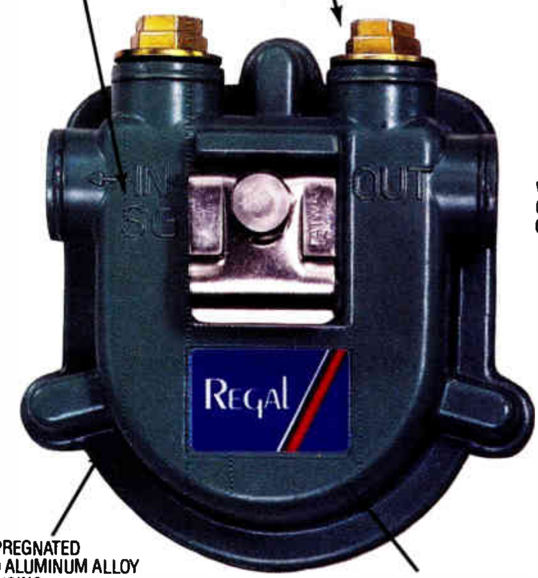

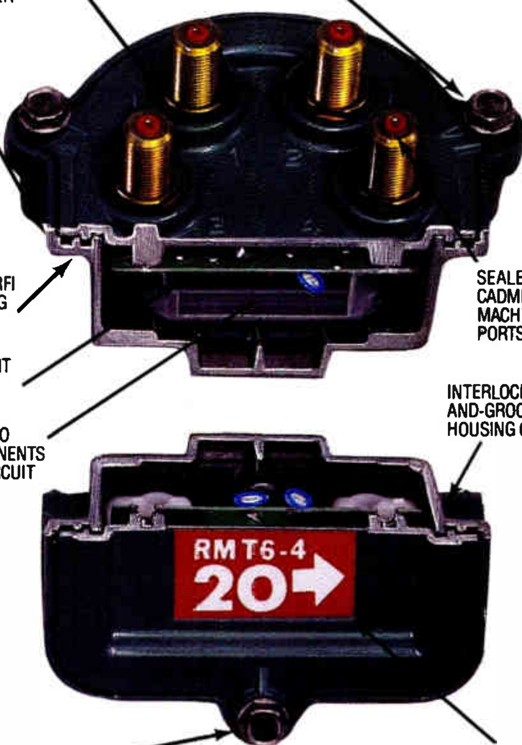

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How to become reader-friendly

By Rikki T. Lee
Editorial Consultant

Someone from the corporate office requested that you write a report in favor of implementing fiber optics in a future upgrade. After spending a few hours in research and tying up your entire weekend at the word processor, you completed the report. You even constructed some awesome graphs comparing fiber and coax specs—carrier-to-noise, composite triple beat, etc. In short, you wrote a technical masterpiece. A few weeks later, it came back to you with a note attached: "Nice graphics, but I don't understand a word of it. Please simplify."

What happened? You either forgot or didn't bother to inquire who your reader was. In this case, if you had taken into account the fact that your audience had an MBA and no technical background, you could have tailored your writing for that person's comprehension.

With report in hand, you're just about to complain to your boss about having to write for someone "beneath your technical level." Maybe you didn't know that translating technical information into nontechnical language is much more difficult than writing for your technical peers. But knowing how to identify and target your reader is an important step on the way to becoming "reader-friendly."

Who is your reader?

So before you actually start your next writing project (memo, report, article—whatever), ask yourself, "Who's my reader?" Keeping your audience in mind dictates the depth of technical information you should include. Remember, writing is a means to communicate and preserve your ideas, not to confuse people or show off your knowledge.

But wait a second: What if your readers run the gamut of technical levels, from installer to senior vice president of engineering? In that case, begin with the basics and then gradually layer it with more complex information.

OK, let's use fiber optics again as our example. It's no easy task, but the paper has to reach your entire audience. It must teach the installers something new, provide background information to the technicians and even stimulate interest of the engineers. Your outline—and don't try writing anything longer than a memo without an outline—for such a technical paper on fiber might contain these major subheads:

I. Fundamentals of single-mode transmission
II. Performance comparison of fiber vs. coax
III. Components of a basic AM fiber design
IV. Common applications and architectures
V. Cost considerations

Looking at this general outline, you might expect that some engineers might merely browse sections I, II and III and concentrate on IV and V. Also, some installers or techs might read sections I and II but only glance at III, IV and V. However, if you gradually raise the level of knowledge throughout, most of your readers will learn something new as they read from start to finish.

Six writing techniques

Sorry, but identifying for whom you are writing is only one part of becoming reader-friendly. Your writing technique (also known as "style") is equally important. Let's say you've targeted your audience perfectly. But if your ideas have gotten tangled in run-on sentences, needless repetition or vagueness, you're not friendly. And if you don't use enough examples, if your facts are inaccurate or if you criticize your colleagues, you're not friendly either. So when you begin your next project, try to follow these six techniques of better writing:

1) Be *accurate*. It goes without saying that you must have your facts correct. If you write, "There are no differences in noise performance between Fabry-Perot and distributed feedback lasers in any AM application," you're being inaccurate. Research has shown that there are differences in noise performance between F-P and DFB lasers.

In addition, choosing an inaccurate word, technically or otherwise, can be confusing and/or wrong. Example: "As always —whether burying fiber or coax—before beginning the dig, the cable installer should contact an underground cable locating service." Although perhaps understandable by context, it might be more accurate to change "installer" to something like "contractor," since "installer" means "a person who hooks up the cable at the subscriber's home."

2) Be *clear*. Keep the writing simple and avoid being vague. Make sure the construction of the sentence doesn't lead to questions. Also, choose words that cannot be construed to mean two different things. Example: "Before beginning construction, a supervisor should discuss how to dig trenches with employees." This is clearer: "Before beginning construction, a supervisor should discuss with employees how to dig trenches."

3) Be *concise*. Reduce your sentences to their simplest form; get rid of redundancies. Eliminate words that do nothing but make your paper take longer to read. Example: "Basically, it's bad if a mistake is made in your design, so you must do your best to rectify the situation and correct it as soon as possible." This is more concise: "If a mistake is made in your design, correct it as soon as possible."

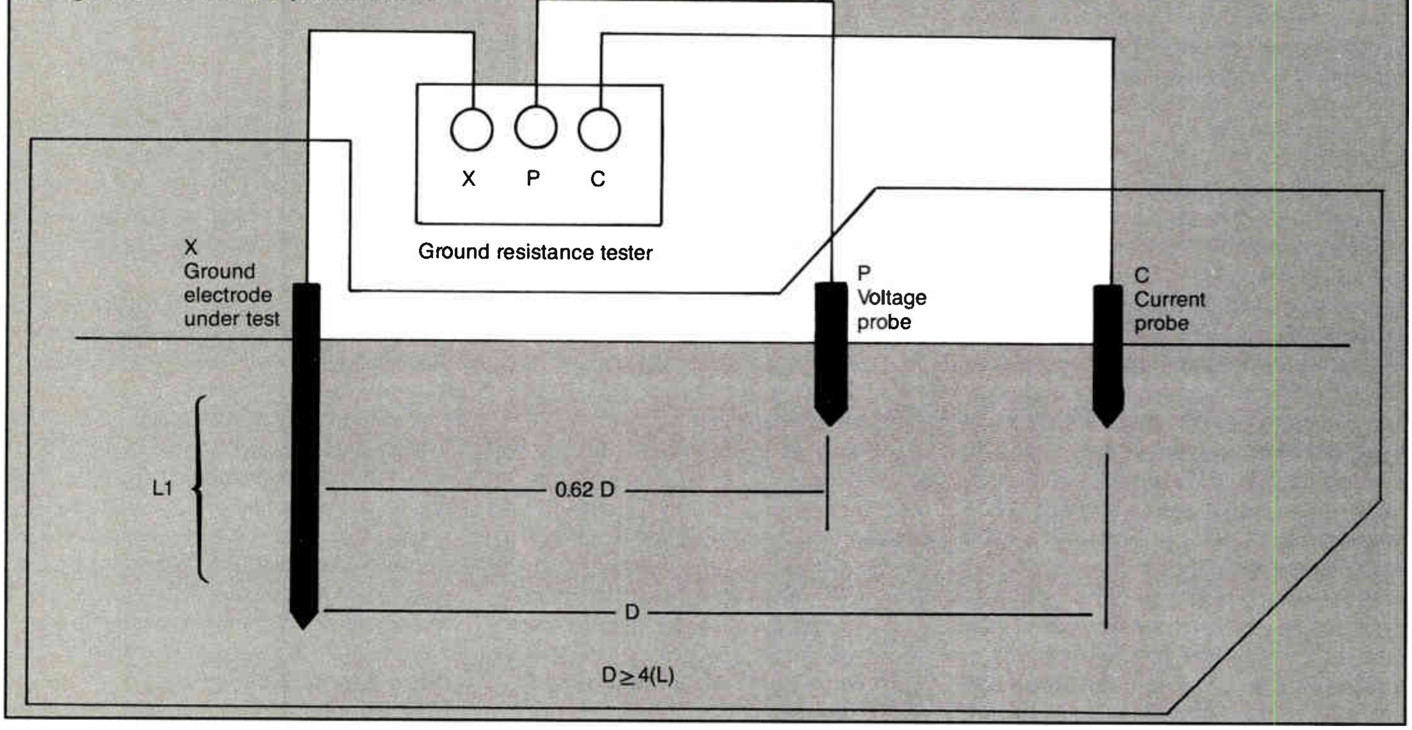
4) Be *fluid*. Vary your size of sentences and paragraphs but don't make them too long. Also, use transition words (such as "also," "however," "therefore," "on the other hand," "as previously mentioned," "in other words") to connect one sentence or paragraph to the next. In other words, let your thoughts flow smoothly throughout the paper.

5) Be *concrete*. Choose words that bring forth images; don't just let abstract terms do the work. Also, put more analogies and examples in your writing. Example: "When performing maintenance on fiber, bring along the instrument that fits your needs." This is more concrete: "When performing maintenance on fiber, bring the instrument (such as an optical power meter, OTDR, etc.) that fits your needs."

6) Be *objective and ethical*. Avoid personal and professional biases. Be on your best behavior and don't belittle your competition, colleagues or co-workers. Example: "It has come to my attention that certain techs in this company (especially in our Pittsfield system) still need some pointers in producing a low-loss mechanical splice." More ethical: "This paper will suggest an approach to improve the technique of producing a low-loss mechanical splice."

If you get into the habit and start writing reader-friendly, certain good things could happen to you. You'll be asked to write more and you might even get published. After a while, based on your improved written communication skills, you might be in line for a raise and/or promotion.

Figure 4: Probe placement



Back to earth

(Continued from page 27)

the rod to be tested. (This may require fairly long test leads.)

3) Place the P probe at 62 percent of the distance from X to *C*.
4) Take and record the measurements.

Biddle publishes an applications booklet titled *Getting Down to Earth* that elaborates on the test procedures highlighted herein. If you'd like a free copy, please call (800) 366-5593 and mention this article.

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Times Fiber Communications' 1 GHz cable

The increasing use of fiber optics in the CATV industry and the continuing trend of ever-expanding system operating bandwidths means that we all will benefit from the advances in technology that accompany these changes. It's one thing to "bench race" expanded bandwidth operation but actually implementing it is quite another.

A number of manufacturers have been introducing products that give us RF bandwidth far beyond what anyone would have imagined possible just a few short years ago. The new benchmark now is 1 GHz (1,000 MHz); while we don't yet have distribution electronics capable of broadband performance to this lofty frequency, the component side of the business is preparing our networks for this milestone. Connectors, some passives, amplifier housings/motherboards and now coax are there.

This month we report on a lab evaluation of Times Fiber's new 1 GHz cable. Introduced at 1989's Western Show in Anaheim, Calif., it is the first complete line of cable for our industry that provides performance we've taken for granted at much lower frequencies. Not only is this a product that is available today, but to the relief of those who have been wondering, it really is 1 GHz cable!

The product

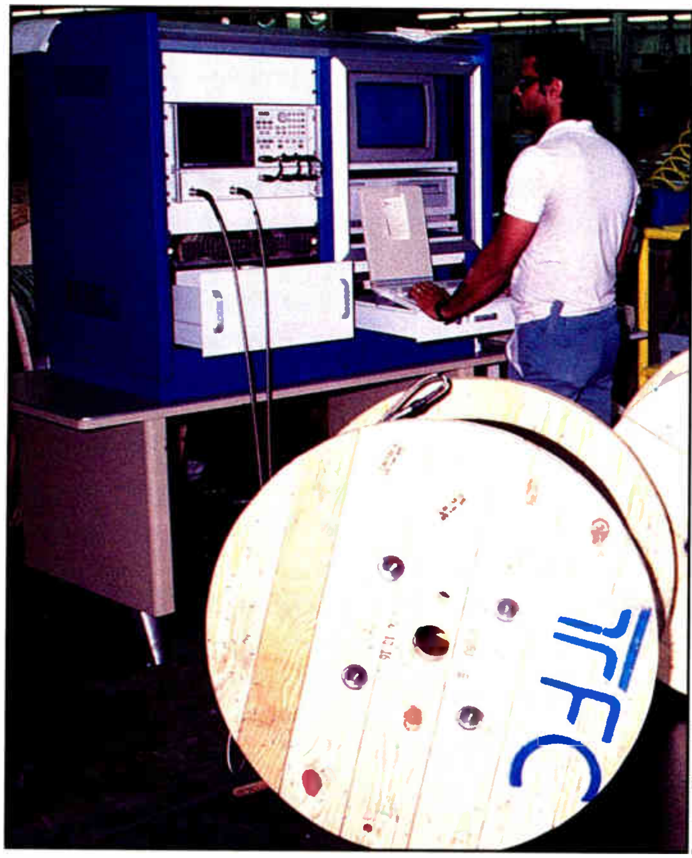
The new cable is available in the same standard configurations at Times' 600 MHz products: T6 and TX. This means that 1 GHz capability can be had as unjacketed, jacketed, messengered, jacketed burial (flooded) or armored cable. *T10* is available in .500-, .625-, .750-, .875- and 1.000-inch sizes, and *TX10* is available in .565-, .840- and 1.160-inch. One GHz drop cable also is available in RG-59 and RG-6 configurations.

Physically these cables are identical to their lower frequency counterparts. The same connectors can be used, handling characteristics are the same and in all other respects (except electrical performance) you would be hard-pressed to tell one from the other. T10 and TX10 command about a 5 percent cost premium over their 600 MHz equivalents.

Just what is 1 GHz cable? We know that cable available to us for some time has been capable of being used at 1 GHz. The issue is *how well* it actually works up to that frequency. For trunk and feeder applications, a defacto industry standard has been a minimum 30 dB structural return loss (SRL) up the the "maximum" frequency, which, with Times Fiber's product line, has been 600 MHz. (Theoretical upper limits for the coax we use is well into the microwave region: 13.4 GHz for .500 and 7.7 GHz for .750.) Other important factors are attenuation, impedance and velocity of propagation.

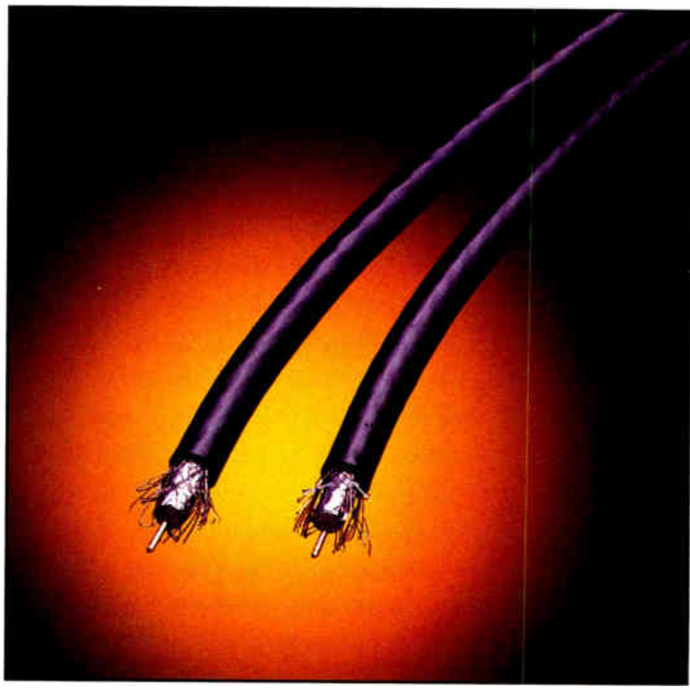
Lab measurements

For this evaluation, I randomly selected a reel each of .500 and .750 T10 cable to be tested. The .500 was 2,410 feet of T10500JB (jacketed and flooded) and the .750 cable was 2,465 feet of T10750 (bare aluminum). Both reels of cable were allowed



Courtesy Times Fiber

Production testing of 1 GHz cable requires upgraded test equipment and measurement techniques.



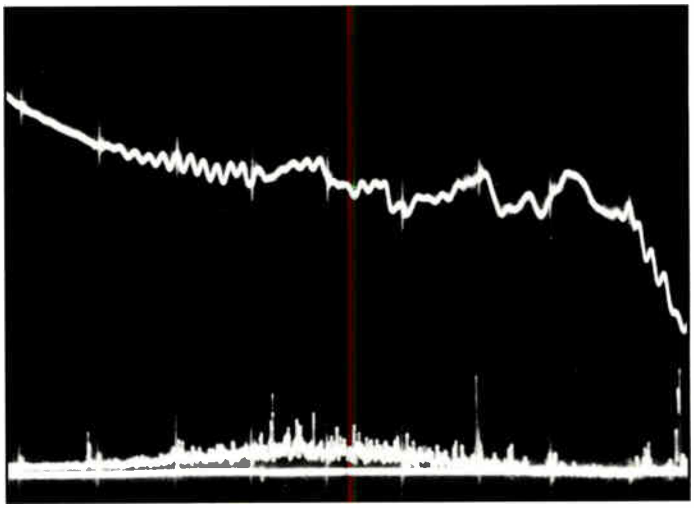
Courtesy Times Fiber

Times' new 1 GHz cables are physically identical to their lower frequency counterparts. In all respects (except electrical performance) you would be hard-pressed to tell one from the other.

to temperature stabilize for 24 hours at 68°F before testing began.

Measurements performed included SRL from 5 to 1,000 MHz from both ends of each reel, attenuation from 50 to 1,000 MHz, nominal impedance, velocity of propagation and DC loop resistance (center conductor resistance only on the .750). The accompanying tables summarize measured performance compared to the manufacturer's specifications.

One of the accompanying photos shows the SRL of the reel of .750, measured from the inside out. The worst case return loss spike is at 968 MHz (31.3 dB), visible at the far right of the photo. (Note: for the actual measurements, the swept bandwidth and RF sweep rate were reduced to eliminate detector error.)



Structural return loss of reel of .750 1 GHz cable.

Comments

Achieving this kind of cable performance on a consistent and repeatable basis requires rethinking the cable manufacturing process just a bit. While some of the things Times Fiber did are proprietary processes, the outcome was an overall improvement in the uniformity of the cable.

Cable attenuation is a function of metallic and dielectric losses; since the center conductor and shield remained essentially unchanged, better attenuation performance came from improvements in the dielectric, which reduced dielectric losses. Good SRL is dependent upon minimizing periodic reflections (or repetitive impedance variations) along the cable's length. Improvements here were realized by keeping physical dimensions of the center conductor diameter and shield inner diameter more consistent, as well as maintaining better consistency in the dielectric throughout the cable's length.

In a nutshell, all of this has been accomplished by better process control during manufacturing. To this end, new chemical and polymer mixtures were developed for improved dielectric uniformity. Mechanical improvements in the production line included upgrading temperature and pressure control systems, and the extruder design was modified. Because much of the performance of cable is related to even simple things in manufacturing like rollers, pulleys and sheaves on the production lines,

T10750 cable

Parameter	Measured	Manufacturer's specification
Impedance	74.7 ohms	75 ± 2 ohms
Velocity of propagation	86.7 percent	87 percent (nominal)
Center conductor resistance	0.58 ohms/1,000 ft.	0.59 ohms/1,000 ft.
SRL	31.3 dB (968 MHz)	30 dB

Attenuation (dB/100 feet)

Frequency (MHz)	Measured	Manufacturer's specification	
		Nominal	Maximum
50	0.33	0.34	0.35
108	0.49	0.50	0.52
216	0.72	0.72	0.75
300	0.84	0.86	0.89
400	0.97	1.01	1.05
500	1.10	1.14	1.18
600	1.21	1.26	1.31
700	1.35	1.38	1.43
800	1.45	1.48	1.54
900	1.57	1.59	1.64
1,000	1.72	1.68	1.74

T10500JB cable

Parameter	Measured	Manufacturer's specification
Impedance	75.6 ohms	75 ± 2 ohms
Velocity of propagation	87.2 percent	87 percent (nominal)
DC loop resistance	1.73 ohms/1,000 ft.	1.7 ohms/1,000 ft.
SRL	30.7 dB (936 MHz)	30 dB

Attenuation (dB/100 feet)

Frequency (MHz)	Measured	Manufacturer's specification	
		Nominal	Maximum
50	0.49	0.50	0.52
108	0.73	0.75	0.77
216	1.05	1.07	1.10
300	1.24	1.28	1.31
400	1.44	1.49	1.53
500	1.63	1.68	1.73
600	1.78	1.86	1.91
700	1.96	2.02	2.08
800	2.10	2.18	2.24
900	2.27	2.32	2.39
1,000	2.44	2.46	2.53

these also were modified. Even something as simple as cable packaging had to be reviewed.

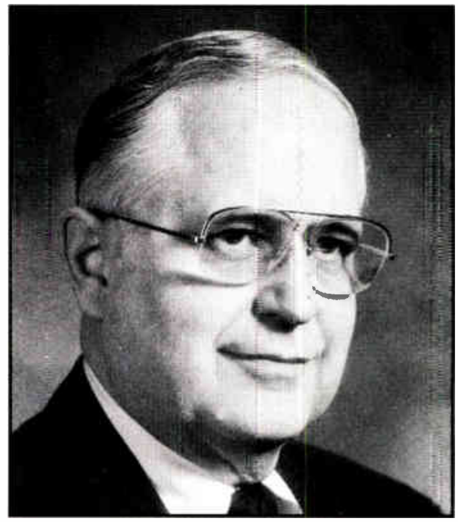
One of the toughest things to address, though, was 1 GHz testing. Standard bench sweeps will not provide the necessary accuracy in a production environment without some modifications. Variable return loss bridges and terminators must be upgraded as well. Standard push-on lab connectors for repetitive cable testing also don't work; new designs are needed. This is also where more exotic test equipment such as network analyzers come into play. All of this is within reach and has now been done.

According to Times' personnel, getting up to speed for consistent production of 1 GHz cable took nearly two years of R&D. Having seen the process before and after, I can see why.

For more information, contact Times Fiber Communications, 358 Hall Ave., Wallingford, Conn. 06492.

About HDTV scanning line rates

By Lawrence W. Lockwood
President, TeleResources
East Coast Correspondent



Before examining the subject of scanning line rates it would be best to address first the broader question: "What is HDTV?" A generally accepted definition is that HDTV is television with about twice both the horizontal and vertical resolution of current NTSC or PAL/SECAM TV. However, 2 × NTSC (525) is 1,050 and 2 × PAL/SECAM (625) is 1,250 so where did the Japanese get 1,125? When the Japanese started work on HDTV they wanted to relate it to the largest possible world market and 1,125 is a number about halfway between 1,050 and 1,250 that has relations to 525 and 625. Conversion of 1,125 to 525 and 625 use factors with whole numbers—15/7 for 1,125 to 525 and 9/5 for 1,125 to 625.

A listing of the proposed major HDTV system scanning line standards does not lack for variety. They include: Japan—1,125 interlaced; Europe—1,250 progressive; Philips—1,050 progressive and interlaced; Faroudja—1,050 progressive and interlaced; Sarnoff, ACTVI—525 interlaced, ACTVII—1,050 interlaced; Zenith—787.5 progressive; MIT, Receiver Compatible—787.5 interlaced, Channel Compatible—787.5 progressive.

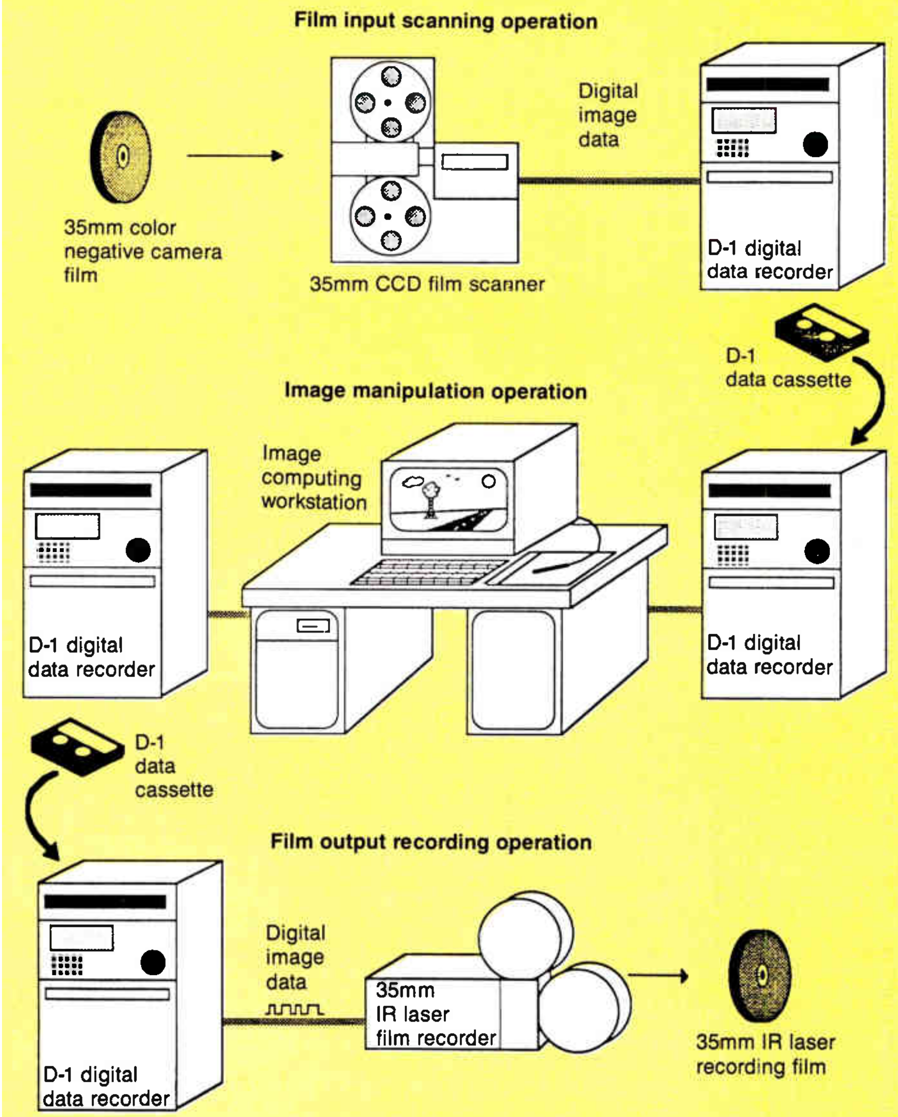
240M

The first scanning line rate standard was of course the one proposed by the Japanese—1,125/60 interlaced. With heavy proselytizing on the part of the Japanese (and some Americans such as Joe Flaherty of CBS) the Advanced Television Systems Committee (ATSC) proposed it as a production standard; subsequently a U.S. State Department delegation in May 1986 proposed it at a meeting of the International Telecommunications Unions Consultive Committee on International Radio (ITU/CCIR). "Production standard" means that this is the standard that will be used in producing the original program material. Transmission might or might not use this standard. The 1,126/60 standard was accepted by the Society of Motion Picture and Television Engineers (SMPTE) and issued as SMPTE 240M and the National Standards Institute (ANSI) accepted the SMPTE standard.

However, in the '86 ITU/CCIR meeting the Europeans refused to accept it and thus it did not become an international standard. They said that since the frame rate was 60 and their frame rate is 50 (tied to their electrical power cycle rate of 50 Hz as ours was, before color, tied to our power of 60 Hz) that it was unacceptable.

➔

Figure 1: High resolution electronic intermediate system



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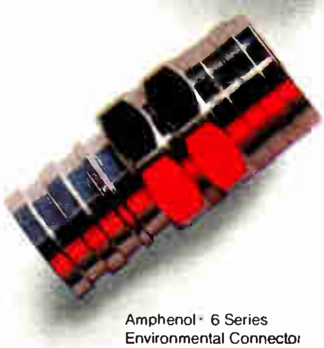


Amphenol® 6 Series Environmental Connector

It is widely felt that a powerful additional motive was that they had no intention of accepting a Japanese standard, which would allow an invasion of Japanese TV products.

Time to dump 1,125?

An interesting observation on the state of "this quarter's bottom line" oriented American business approach is the story of Eureka. In 1986 after rejection of the 1,125/60 standard a number of major European electronics/TV manufacturers, such as Philips (Dutch) and Thompson (French), banded together under the banner of "Eureka EU95" to develop a European HDTV standard. In four years with $400 million in funding (from both government and industry) the project developed a European standard called HD-MAC using 1,250-line 50-fields-per-second interlaced. (For a brief overview of MAC see *CT*, June '87, page 36, "Video Signal Security," Lawrence W. Lockwood.) At the International Broadcasting Convention in Brighton in September 1988, a 1,250 line, 50 Hz progressive scan color camera was demonstrated and a full HD-MAC transmission chain was in operation over a satellite. Also, HD-MAC home VCRs were demonstrated. Work is proceeding to provide European coverage of the '92 Olympic games in Barcelona, Spain, with the new European standard.

Such a firm commitment to a non-1,125 standard by the European community in addition to objections from some in this country has thwarted the effort by the Japanese to establish 1,125/60 as an international HDTV transmission standard. In April 1989 ANSI, for the first time in its history, cancelled its approval of an

Common image format specifications

Parameters	1,920 × 1,080		1,920 × 1,160	
	1,125/60/2:1	1,250/50/2:1	1,221/59.94/2:1	1,250/50/2:1
Aspect ratio	16:9	16:9	16:9	16:9
Active pixels/line	1,920	1,920	1,920	1,920
Active lines/frame	1,080	1,080	1,160	1,160
Sampling structure	Orthogonal	Orthogonal	Orthogonal	Orthogonal
Interlace	2:1	2:1	2:1	2:1
Vert. Res. (KF = 0.65)	702 TVL/PH	702 TVL/PH	754 TVL/PH	754 TVL/PH
Line rate	33.750 kHz	31.250 kHz	36.5933 kHz	31.250 kHz
Line period	29.6296 μs	32 μs	27.324 μs	32 μs
Active line period	25.8585 μs	26.6666 μs	23.7037 μs	26.6666 μs
Hor. blank. period	3.7710 μs	5.333 μs	4.2643 μs	5.333 μs
Luminance sampling rate	(33) 74.25 MHz	(33) 72 MHz	83.25 MHz	72 MHz
Total samples/line	2,200	2,304	2,275	2,304
Active samples/line	1,920	1,920	1,920	1,920
Total lines/frame	1,125	1,250	1,221	1,250
Total data rate	1.188 Gb/s	1.152 Gb/s	1.332 Gb/s	1.152 Gb/s
Effective luminance BW	31.625 MHz	30.666 MHz	35.45 MHz	30.666 MHz
Horizontal resolution	920 TVL/PH	920 TVL/PH	945 TVL/PH	920 TVL/PH
Vertical blanking	45	170	61	98

Common data rate specifications

Parameters	1.188 Gb/sec		1.152 Gb/sec	
	1,125/60/2:1	1,250/50/2:1	1,050/59.94/2:1	1,250/50/2:1
Aspect ratio	16:9	16:9	16:9	16:9
Active pixels/line	1,920	1,920	1,920	1,920
Active lines/frame	1,035	1,152	966	1,152
Sampling structure	Orthogonal	Orthogonal	Orthogonal	Orthogonal
Interlace	2:1	2:1	2:1	2:1
Vert. Res. (KF = 0.65)	673 TVL/PH	749 TVL/PH	628 TVL/PH	749 TVL/PH
Line rate	33.750 kHz	31.250 kHz	31.4685 kHz	31.25 kHz
Line period	29.6296 μs	32 μs	31.7778 μs	32 μs
Active line period	25.8585 μs	25.8585 μs	26.6666 μs	26.6666 μs
Hor. blank. period	3.771 μs	6.1414 μs	5.1111 μs	5.3334 μs
Luminance sampling rate	74.25 MHz	74.25 MHz	72 MHz	72 MHz
Total samples/line	2,200	2,376	2,288	2,304
Active samples/line	1,920	1,920	1,920	1,920
Total lines/frame	1,125	1,250	1,059	1,250
Total data rate	1.188 Gb/s	1.188 Gb/s	1.152 Gb/s	1.152 Gb/s
Effective luminance BW	31.625 MHz	31.625 MHz	30.66 MHz	30.666 MHz
Horizontal resolution	920 TVL/PH	920 TVL/PH	945 TVL/PH	920 TVL/PH
Vertical blanking	90	98	94	98

SCTE TECHNICAL TUITION ASSISTANCE APPLICATION

SCTE
669 Exton Commons
Exton, PA 19341
(215) 363-6888

Name: Mr. / Mrs. / Ms. ______________________ (Last) (First) (Middle)

Telephone Numbers:

Mailing Address: ______________________

Home: (   ) ______

Work: (   ) ______

Date of Birth: ___/___/___ (mo. day yr.)

Social Security No. ___-___-___

SCTE STATUS:

Chapter or Meeting Group Member? ______ Yes ______ No

Nat'l Member? ______ Yes ______ No

Chapter or Meeting Group Name: ______

Member Number: ______

CURRENT EMPLOYMENT INFORMATION: Total No. of Years in the Cable Industry: ______

Company Name: ______

Telephone Number: (   ) ______

Address: ______

Present Supervisor: ______

Title/Position: ______

Duties: ______

Employment period: from ______ to ______

EMPLOYMENT HISTORY:

Employer: ______
Address: ______
Phone Number: (   ) ______
Title/Position: ______
Duties: ______
Immediate Supervisor: ______
Employed from: ______ to ______

Employer: ______
Address: ______
Phone Number: (   ) ______
Title/Position: ______
Duties: ______
Immediate Supervisor: ______
Employed from: ______ to ______

Professional Activities & Memberships:

Activity or membership: ______
Your most significant contribution: ______

Activity or membership: ______
Your most significant contribution: ______

Activity or membership: ______
Your most significant contribution: ______

Current SCTE BCT/E Certifications: ______

EDUCATIONAL HISTORY: (Attach all appropriate transcripts)

High School Level Completed: ☐ 9 ☐ 10 ☐ 11 ☐ 12

Names & Locations of Schools: (Attach additional page if necessary.)

______________________	______________________
Diploma Granted: ____ Yes ____ No ________ Date	Diploma Granted: ____ Yes ____ No ________ Date
Course of Study: ______________	Course of Study: ______________
GPA ______ Dates of Attendance: __________	GPA ______ Dates of Attendance: __________

College Level Completed: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

Names & Locations of Schools: (Attach additional page if necessary.)

______________________	______________________
Degree Granted: __________ Date: __________	Degree Granted: __________ Date: __________
Major: ______________ GPA: __________	Major: ______________ GPA: __________
Dates of Attendance: __________ to __________	Dates of Attendance: __________ to __________

Vocational/Military School:

Name & Location of School:	Course of Study: ______________
______________________	Dates of Attendance: __________ to __________
Graduated: ____ Yes ____ No ________ Date	Grade Point Average (4.0 scale): __________

Correspondence Courses:

Name and Location of Institution:	Course of Study: ______________
______________________	Dates of Attendance: __________ to __________
Diploma Granted: ____ Yes ____ No ________ Date	Grade Point Average (4.0 scale): __________

PERSONAL REFERENCES: (Industry-Related)

Name: ______________	Name: ______________
Title/Position: ______________	Title/Position: ______________
Company: ______________	Company: ______________
Address: ______________	Address: ______________
______________	______________
Telephone Number: ( ) __________	Telephone Number: ( ) __________

CONFIDENTIAL FINANCIAL DATA:

Gross Annual Income:* $__________

Net Taxable Income:* $__________

Number of Dependents: __________

*As reported to the IRS in last tax year; for married couples filing separately, include both incomes.

Explain why you should receive an SCTE Technical Tuition Assistance Grant and how it will benefit you (use additional page if necessary):

____

____

____

____

____

____

____

____

____

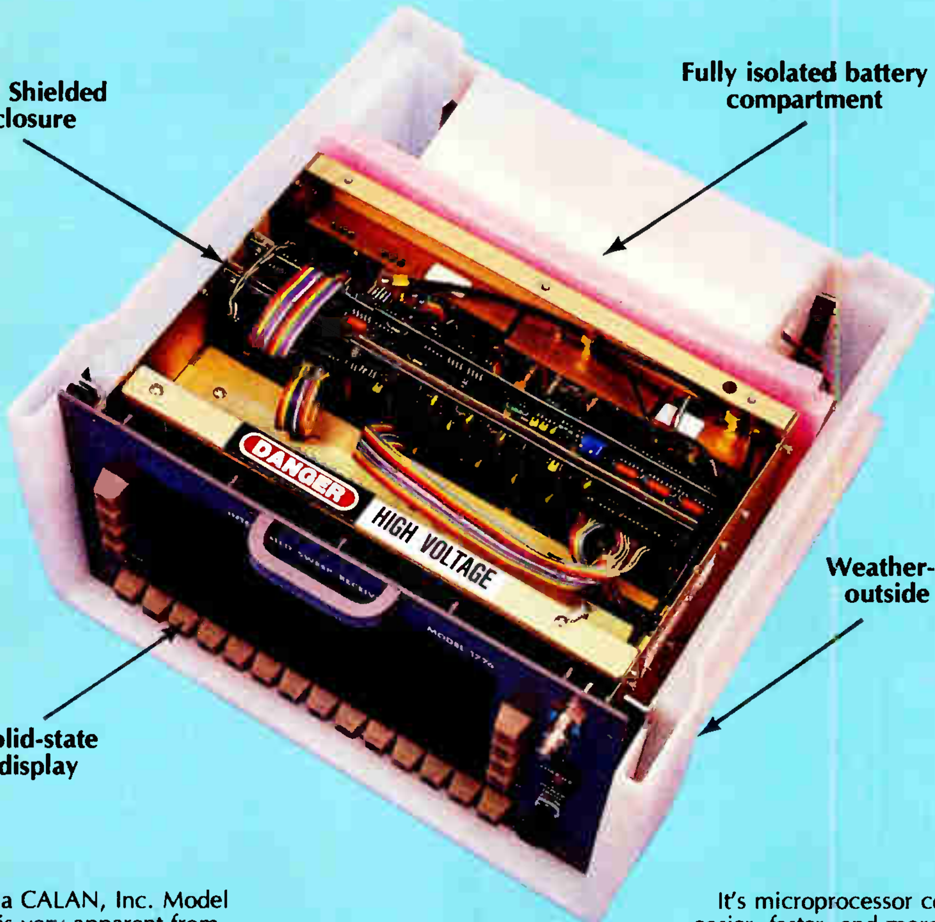
Signature: ______________________

Date: ______________________

Please return
completed form to:
Society of Cable Television Engineers
669 Exton Commons
Exton, PA 19341

CT 5/90

The Inside Story on Reliability



Reliability built into a CALAN, Inc. Model 1776 Sweep Receiver is very apparent from the outside: the totally weather-sealed case; the ruggedized overall construction; the moisture-sealed key covers on the front panel.

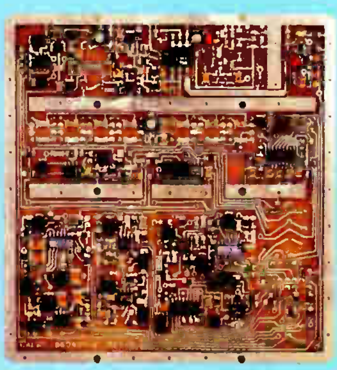
But what really makes this unique equipment reliable is on the ***inside***.

It's high-reliability components throughout the design, allowing incredible stability over temperature and humidity extremes.

It's complete RF shielding, allowing extended dynamic range for precise tests like Composite Triple Beat.

It's a solid-state Electro-Luminescent display, replacing the outdated CRTs.

It's new Surface-Mount RF Technology, making critical RF boards more reliable and more accurate than ever possible before. And a battery compartment that is totally isolated from the electronics, for absolute protection of the unit.



CALAN Surface-Mount RF Technology

It's microprocessor control, making testing easier, faster, and more accurate.

But all of these careful design criteria would be useless without the 75 years of CALAN engineering experience that went into the unit, making it the most reliable test equipment available today.

But if you ask a CALAN user, he'll most likely tell you that he hasn't seen the inside of his unit...just the outside, improving his system performance with no interference, and allowing more with his limited maintenance budget.

Maybe that's the **real** inside story.

CALAN

CABLE AND LOCAL AREA NETWORKS

CALAN, Inc., R.R. 1, Box 86T, Dingmans Ferry, PA 18328 • (717) 828-2356

Reader Service Number 54. *See us at the NCTA Show, Booth 115.*

Figure 2: MTF curves—Eastman Kodak EXR 5345

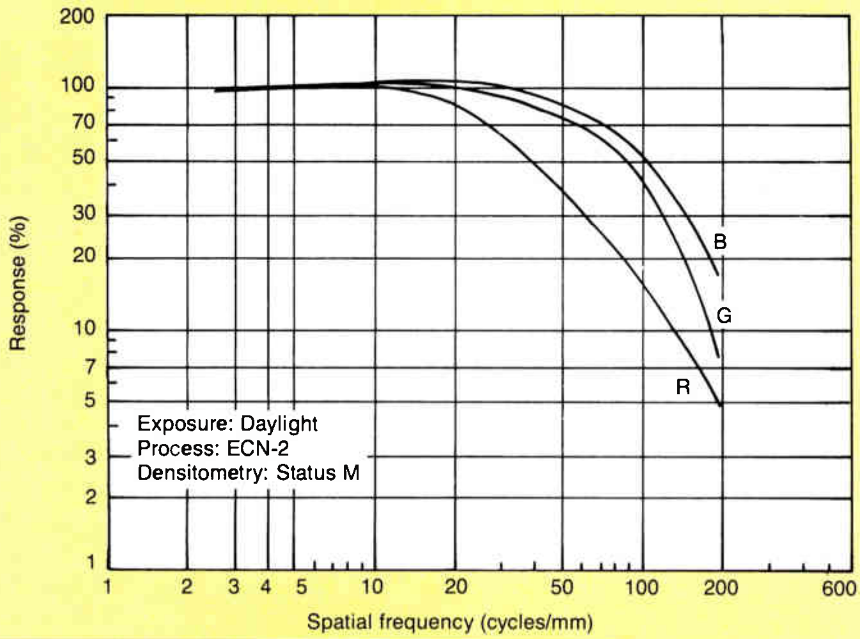
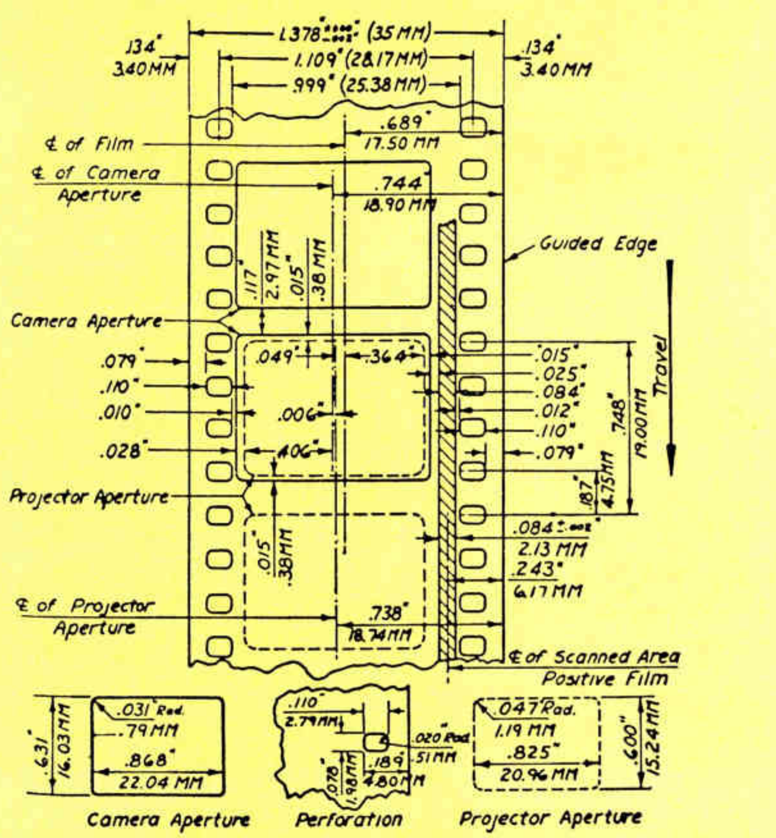


Figure 3: Standard 35mm sound film (camera aperture, projector aperture and scanned area)

These dimensions and locations are shown relative to unshrunk raw stock. Positive—emulsion side up. Negative—emulsion side down.



- In the camera the emulsion side of the film faces the objective. Viewed from the objective the sound track is to the left.
- In the projector the emulsion side of the film faces the light source. Viewed from the light source the sound track is to the right.

"A firm commitment to a non-1,125 standard by the European community in addition to objections from some in this country has thwarted the effort by the Japanese."

SMPTE standard. This leaves only SMPTE trying to figure out what to do with 240M.

Production standards

However, there is still a substantial effort by many to maintain 1,125/60 as a production standard—the goal being a worldwide production standard. An example is the organization that has been formed in this country headed by exCBSer William Connolly called the 1,125/60 Group (heavily funded by the Japanese—Sony). Their goal is to establish 1,125/60 as the production standard at least for program exchange.

There also has been considerable international activity in establishing exchange standards. The CCIR's most recent efforts have been behind a common image format (CIF) and a common data rate (CDR). CIF would include as common elements: aspect ratio, number of active lines, number of picture elements (pixels) per active line, and colorimetry and modulation transfer characteristics; it could serve systems having frame rates and different scanning methods. CDR would provide a maximum commonality in parameters such as line frequency and sampling frequency. (At this point rumor has CIF somewhat favored.) See accompanying tables.

There is currently a significant amount of program material (commercials, music videos, etc.) being generated in this country by about a half dozen production houses. This output is in both tape and film. One reason for doing this in 1,125/60 is the practical consideration that if anyone wants to shoot anything in HDTV the only equipment available is Japanese 1,125/60. It may be worthwhile to pause and consider that shortly that will not be the case even if we drop the ball completely in America—the Europeans will soon be producing HD-MAC equipment.

As to the viability of 1,125/60 in pro-

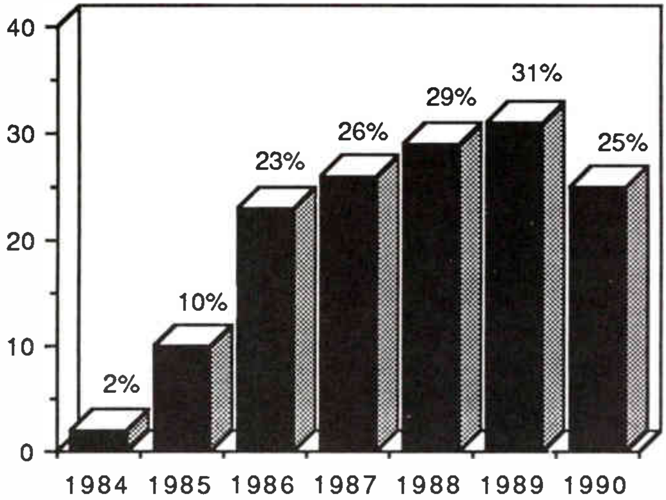
(Continued on page 120)

the SCTE INTERVAL

May 1990

PARTICIPATION IN ANNUAL ELECTION

(percentage of active members)



Members Elect National Directors; Membership Meeting set for Expo `90

Over 1,500 ballots were received from members of the Society of Cable Television Engineers during its 1990 national election for eight open seats on its board of directors. Re-elected to their current positions on the board are Region 3 Director Ted Chesley, CDA Cablevision Inc., serving Alaska, Idaho, Montana, Oregon and Washington; Region 4 Director Leslie Read, Sammons Communications, serving Oklahoma and Texas; Region 5 Director Wendell Woody, Anixter, serving Illinois, Iowa, Kansas, Missouri and Nebraska; Region 7 Director Victor Gates, Metrovision, serving Indiana, Michigan and Ohio; Region 8 Director Jack Trower, WEHCO Video Inc., serving Alabama, Arkansas, Louisiana, Mississippi and Tennessee.

Newly elected to the board are At-Large Director Tom Elliot, Cable-Labs; Region 10 Director Michael Smith, Adelphia Cable Communications, serving Kentucky, North Carolina, Virginia and West Virginia; and Region 12 Director Walt Ciciora, ATC, serving Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.

These individuals join the seven existing board members who are currently serving their second year on the board, including At-Large Directors Richard Covell, Jerrold Communications, and Robert Luff, Jones Intercable; Region 1 Director Pete Petrovich, Petrovich and Associates, serving California, Hawaii and Nevada; Region 2 Director Ron Hranac, CT Publications, serving Arizona, Colorado, New Mexico, Utah and Wyoming; and Region 6 Director Bill Kohrt, Kohrt Communications, serving Minnesota, North Dakota, South Dakota and Wisconsin; Region 9 Director Jim Farmer, Scientific-Atlanta, serving Florida, Georgia and South Carolina; and Region 11 Director Pete Luscombe, TKR Cable Co., serving Delaware, Maryland, New Jersey and Pennsylvania.

Completing their terms on the SCTE board of directors on May 1, 1990, are Region 10 Director Wendell Bailey, NCTA; Region 12 Director Robert Price, BradPTS; and At-Large Director David Willis, TCI.

The first meeting of the new 1990 SCTE board of directors will be held May 20 in conjunction with the NCTA Show in Atlanta. The board will elect the Society's officers for the coming year at its second meeting, to be held at Cable-Tec Expo `90 in Nashville, Tenn.

While the number of members that voted in the 1990 election is the same as the number that participated in the 1989 election, the percentage of voting members out of the entire membership has decreased from 31 percent in 1989 to 25 percent this year.

"I'm definitely disappointed that we didn't show an increase over last year's election," stated SCTE President Jack Trower, adding that an increase "would show that the membership's input was continuing on an upward spiral.

"I hope people aren't becoming complacent," Trower said. In the interest of avoiding complacency on the part of the members and increasing their input in the national organization, the Society will conduct an open membership meeting June 21 at Expo `90.

Previously conducted during the annual awards luncheon at past expos, the membership meeting has been reorganized to allow members an open forum to voice their comments directly to the board of directors and fellow members.

"I expect members to ask questions of the board and staff," Trower said. "We want to hear what they have to say. We hope to make the Society better for the membership."

Cable-Tec Expo `90 Update; Floor Sold Out, Contest Announced

All exhibit space has been reserved for the 1990 Cable-Tec Expo, to be held June 21-24 at the Nashville Convention Center, it was recently announced.

Sponsored by SCTE, Cable-Tec Expo is a fully technical conference and trade show offering an instructional exhibit floor featuring all types of cable industry hardware, as well as a wide variety of educational programs, hands-on training sessions and technical workshops.

Over 200 exhibiting companies, displaying all types of products, services and equipment used in the operation of cable TV systems have rented space on the exhibit floor for

Cable-Tec Expo '90. The exhibit hall has been carefully coordinated to provide industry suppliers with the opportunity to present live technical demonstrations of their products in a relaxed atmosphere. An added feature on the floor will be the Technical Training Center offering additional equipment demonstrations.

1990 marks the fourth year in a row that the exhibit hall has sold out. Cable-Tec Expo '89 showed a significant increase in attendance over the previous year, and SCTE is confident that Expo '90 will be another record-breaking event.

One early indicator that Cable-Tec Expo `90 will be the most successful expo yet is the news that the Stouffer Nashville Hotel, the event's headquarters hotel, has already sold out of sleeping rooms on the dates of the show.

People planning to attend the expo are advised to seek lodging at one of the alternate hotels, as listed in the Expo Registration Packet that was mailed to all SCTE members earlier this year. If you wish to receive a registration packet, contact SCTE at (215) 363-6888.

Companies wishing to exhibit at Cable-Tec Expo '90 can also contact SCTE national headquarters to be placed on a waiting list and contacted in the event of an exhibitor's cancellation.

Cable-Tec Expo `90 will offer attendees countless educational opportunities, as well as an exciting and entertaining stay in "Music City USA," Nashville.

Besides numerous training opportunities, Expo `90 will offer a variety of activities and special events planned to make this the most special expo yet.

One event of note is the "Classic Cable Equipment Competition." Co-sponsored by the National Cable Television Center and Museum (NCTCM) and SCTE, expo attendees can participate in this contest by bringing with them what they consider to be a classic piece of cable TV equipment.

These pieces will be judged on the basis of historical value and uniqueness by a panel of experts. The first place winner will receive a camcorder (valued at more than $1,000) donated by Zenith. The equipment will be considered for possible acceptance into the NCTCM collection for display in the SCTE room at the NCTCM center.

For further information on Cable-Tec Expo `90 and the "Classic Cable Equipment Competition," contact SCTE national headquarters at (215) 363-6888.

"Fiber Optics 1990" Draws 406 Attendees

Four-hundred and six people were in atttendance when SCTE held "Fiber Optics 1990" March 21-23, 1990, at the Doubletree Hotel and Monterey Conference Center in the beautiful setting of Monterey, Calif.

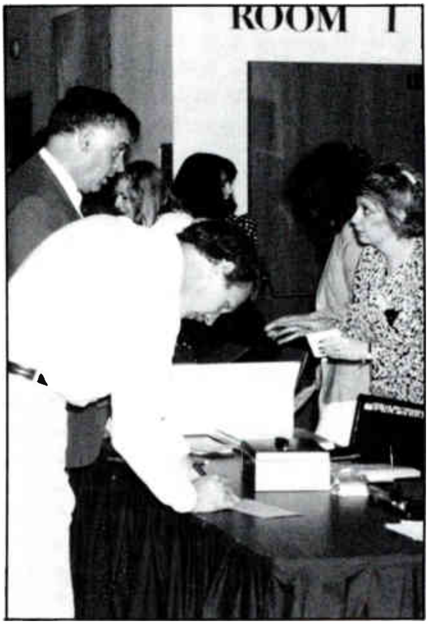
This event, which featured the presentation of 20 technical papers on the vitally important topic of fiber optics by some of the cable TV industry's engineering leaders, was the first national conference SCTE has held since its 1988 fiber optics seminar from Jan. 18-20 in Orlando, Fla. That seminar attracted 412 attendees. While "Fiber Optics 1990" hosted six less attendees, it should be noted that the anticipated attendance at the recent event was 150 attendees, a figure that was exceeded by over 250 people.

Industry leaders in attendance offered praise of the event. "I really did enjoy the seminar," said Dave Willis of Tele-Communications Inc. "Most of the speakers were extremely knowledgeable and imparted excellent, very important information. I didn't miss a single presentation. Overall, I thought it was excellent."

Everyone who attended the event received a copy of the *Fiber Optics 1990 Proceedings Manual*, a 200-page collection of each of the 20 papers presented at the conference. This manual, which presents a comprehensive look at the utilization of fiber optics in today's cable TV industry, is currently available through SCTE for only $35. In addition, the Society recorded all 20 presentations given at the event, and these audio transcripts are available for only $75 per set. The combination of audio transcripts and a proceedings manual is available for $110 per set.

For further information on ordering the *Fiber Optics 1990 Proceedings Manual* and/or audio transcripts, please see the ad in this month's issue of *Communications Technology* or contact SCTE at (215) 363-6888.

At "Fiber Optics 1990"



Pete Petrovich

Over 400 attendees signed in at the registration booth for "Fiber Optics 1990" held March 21-23 in Monterey, Calif. Attending the booth are SCTE staffers Anna Riker and Ralph Haimowitz.

Pete Petrovich

Louis Williamson of ATC presents his paper titled "Laboratory vs. Field Measurement of AM Optical Links - Reconciling the Differences" on March 21.

Pete Petrovich

"Broadband AM Lightwave Transmissions Systems: A Technology and Applications Review" is presented by Carl McGrath of AT&T Bell Laboratories on March 23.

Pete Petrovich

Dave Large of Raynet poses a question to a conference speaker in the style of a TV talk show at "Fiber Optics 1990."

SCTE Calendar

The "**SCTE Calendar**" is an *Interval* feature incorporating Satellite Tele-Seminar Program listings(*), news of upcoming national events and announcements of upcoming local SCTE chapter and meeting group seminars.

Dates for 1990

May 1 New York City Meeting Group--Staten Island Cable, Staten Island, N.Y. Topic: "Sweep Maintenance - Tips and Procedures" presented by Scientific-Atlanta, Jerrold Communications, C-COR, CaLan and Wavetek. Contact: Andy Skop, (201) 722-1935.

May 2 North Country Chapter--Sheraton Midway, St. Paul, Minn. Topic: "BCT/E Category II - Video and Audio Signals and Systems." Contact: Rich Henkeymeyer, (612) 522-5200.

May 5 Rocky Mountain Chapter--Location to be announced. Topic: "RF and Video Testing." Contact: Steve Johnson, (303) 799-1200.

May 6-7 Old Dominion Chapter--Holiday Inn, Richmond, Va. Topic to be announced. Contact: Margaret Davison-Harvey, (703) 248-3400.

May 8 Central Illinois Chapter--Sheraton Normal Hotel, Normal, Ill. Topic: "Preventive Maintenance." Contact: Ralph Duff, (217) 424-8478.

May 8 Chattahoochee Chapter--Perimeter North Inn and Conference Center, Atlanta. Topic to be announced. Contact: Richard Amell, (404) 394-8837.

May 9 Mount Rainier Chapter--Location to be supplied. Topic: "Outage Control." Contact: Sally Kinsman, (206) 821-7233.

May 9 Dairyland Meeting Group--Amora Villa Motor Lodge, Appleton, Wis. Speaker: Saconna Blair of Jones Intercable. Contact: John Boltik, (715) 834-3151.

May 10 Big Country Meeting Group--San Angelo, Texas. Information to be supplied. Contact: Albert Scarborough, (915) 698-3585.

May 10 Big Sky Meeting Group,--Colonial Inn Best Western, Helena, Mont. Topic: "Distribution" with Mike McCracken of Scientific-Atlanta. Contact: Marla DeShaw, (406) 632-4300.

May 10 Sierra Meeting Group--Oxford Suites Hotel, Roseville, Calif. Topic: "Introduction to Data and Local Area Networks" presented by Hewlett-Packard. Contact: Steve Allen, (916) 786-2469.

May 12 Great Plains Meeting Group--Holiday Inn, Omaha, Neb. Topics: "Basic Electricity" with Steve Frye of Gateway Electronics School and "Basic Test Equipment Use" with various manufacturers. Contact: Jennifer Hays, (402) 333-6484.

May 12 Sierra Meeting Group--Jones Intercable, Roseville, Calif. Topic: "BCT/E Review Day." Contact: Steve Allen, (916) 786-2469.

May 13-14 Old Dominion Chapter--Information to be supplied. Contact: Margaret Harvey, (703) 248-3400.

May 15-16 Ohio Valley Chapter--May 15: Cleveland. May 16: Cincinatti. Topic: "Transportation." Contact: Jon Ludi, (513) 435-2092.

May 16 New England Chapter--Sheraton Hotel, Boxborough, Mass. BCT/E exams to be administered in categories IV and VI. Contact Jeff Piotter, (508) 685-0258.

May 16 North Country Chapter--Edina Community Center, Edina, Minn. BCT/E testing to be administered in Categories II, III, V and VI. Contact: Rich Henkemeyer, (612) 522-5200.

May 16 Razorback Chapter--Howard Johnson's, Little Rock, Ark. Topic to be supplied. Contact: Jim Dickerson, (501) 777-4684.

May 16 Great Plains Meeting Group--Omaha, Neb. Topic: "Plant Maintenance." Contact: Jennifer Hays, (402) 333-6484.

May 16 Palmetto Meeting Group--Information to be supplied. Contact: Rick Barnett, (803) 747-1403.

May 17 Southeast Texas Meeting Group--Warner Cable, Houston. Topic to be announced. Contact: Tom Rowan, (713) 580-7360.

May 19 Chaparral Chapter--Amfac Hotel, Albuquerque, N.M. Topic: "BCT/E Category VI - Terminal Devices." Contact: Brian Throop, (505) 761-6200.

May 12 Sierra Meeting Group--Roseville City Hall, Roseville, Calif. BCT/E exams to be administered in categories I, IV, V and VII (tentative). Contact: Steve Allen, (916) 786-2469.

May 23 Dixie Chapter--Birmingham, Ala. Information to be supplied. Contact: Rickey Luke, (205) 277-4455.

May 23 Greater Chicago Chapter--Location to be supplied. Topics: "BCT/E Category IV - Distribution Systems" plus "CLI Filing Information." Contact: John Grothendick, (312) 438-4200.

May 23 Piedmont Chapter--Location to be supplied. Topic: "BCT/E Category I Review - Signal Processing Centers." Contact: Rick Hollowell, (919) 968-4631.

May 23 Dairyland Meeting Group--Howard Johnson Motor Lodge, Eau Claire, Wis. Speaker: Steve Palchik, ATC Cablevision of Wisconsin. Contact: John Boltik, (608) 372-2999.

May 27 Old Dominion Chapter--Continental Cablevision Training Center, Richmond, Va. BCT/E testing to be administered (tentative). Contact: Margaret Davison-Harvey, (703) 248-3400.

***May 29** Satellite Tele-Seminar Program, *"High Definition Television (Part One)"* with Walt Ciciora, Ph.D., of ATC, Wayne Luplow of Zenith Electronics Corp. and Norman Hurst of the David Sarnoff Research Center. Videotaped at Cable-Tec Expo '89 in Orlando, Fla.

June 6 Florida Chapter: Central Florida Group--Information to be supplied. Contact: Rick Scheller, (305) 753-0100.

June 11 Greater Chicago Chapter--Location to be supplied. BCT/E testing to be administered in categories II, IV, V and VII (tentative). Contact: John Grothendick, (312) 438-4200.

June 13 Great Plains Meeting Group--United Artists Cable, Bellevue, Neb. BCT/E testing to be administered (tentative). Contact: Jennifer Hays, (402) 333-6484.

June 14 Chesapeake Chapter--Holiday Inn, Columbia, Md. Topic: "New Technologies, HDTV, Fiber, Multiport and DCR." Contact: Keith Hennek, (301) 731-5560.

June 20 Delaware Valley Chapter--Information to be supplied. Contact: Diana Riley, (717) 263-8258.

June 20 Great Plains Meeting Group--United Artists Cable, Bellevue, Neb. BCT/E examinations to be administered in Categories II, IV, V and VII. Contact: Jennifer Hays, (402) 333-6484.

June 21-24 SCTE Cable-Tec Expo '90--Nashville Convention Center, Nashville, Tenn. The best investment in technical education you can make! Contact: SCTE national headquarters, (215) 363-6888.

June 22 Miss-Lou Chapter--Biloxi, Miss. Information to be supplied. Contact: Dave Matthews, (504) 923-0256.

***June 26** Satellite Tele-Seminar Program, *"High Definition Television (Part Two)."* Plus *"Digital Video: A Future Alternative (Part One)"* with Steffen Rasmussen of ABL Engineering. Videotaped at Cable-Tec Expo '89 in Orlando, Fla.

June 27 Palmetto Meeting Group--Information to be supplied. Contact: Rick Barnett, (803) 747-1403.

*Tele-Seminar Programs may be downlinked by any cable system and recorded for immediate and future employee training purposes. All Tele-Seminar Programs will air from 12-1 p.m. ET on Transponder 2 of Galaxy III.

Member Profile: Jim Miller

"Member Profile" is an *Interval* feature that puts the spotlight on *you*, the Society's members. Each month, an SCTE member will be profiled in this feature: his career, his experience, his involvement with the Society.

Members featured will be chosen from all levels within the industry; from engineer to installer, from manager to technician.

Jim Miller serves as an example of someone who has worked his way up from modest beginnings to the upper levels of the cable TVindustry through dedication, hard work and commitment to training.

Jim is the president of dB Communications in Englishtown, N.J., a company that serves the industry in the areas of manufacturer representation, distribution and repairs.

"When I started with the company 10 years ago," Jim recalls, "my philosophy was to treat all customers as friends. Today, all of my friends just happen to be customers."

A native of Brooklyn, N.Y., Jim entered the industry in 1972 as a "grunt" for United Artists in Brookhaven, N.Y. He did installations and service work in that position until 1976, when he joined the Vision Cable Corp. in New York as director of purchasing.

"We were real spoiled," he recalls of his four years with the company. "It was a small office - five men and five women, including the president and the CEO. We started with 65,000 subscribers, but those were boom years."

It was while with Vision Cable that Jim became an SCTE member. "I got really involved in the last three to four years," he explains, telling of his increased participation in the activities of the New Jersey Chapter, for which he currently serves as secretary.

Of the chapter's goals, Jim says, "We try to determine what the industry and our members want. Everyone wants to do a good job. They need someone to tell them how to do it, and I think SCTE is the way. Our work with the New Jersey Chapter is a sincere effort on our part to make the industry more efficient and professional. I think we're making it mature."

Jim recalls that while doing service calls for United Artists, "All of the trucks would gather for lunch. We would talk about what we would do if we owned the system. We all had our own ideas. It is ironic that 10 years later I owned a system."

When asked if he ran it in accordance with his lunchtime discussions from his service days, he says "I did it totally differently - in a much more businesslike manner. I never knew how much I didn't know about a cable system until I owned one."

In his spare time, Jim enjoys downhill skiing, sporting events, photography and travelling with his wife, Mary, an aerobics instructor.

"I enjoy conducting training seminars," says Jim, who tells of how, while recently conducting a seminar on LRC equipment, "an installer wanted to know if I remembered when I had to get up and change channels. Boy, did that make me feel old."

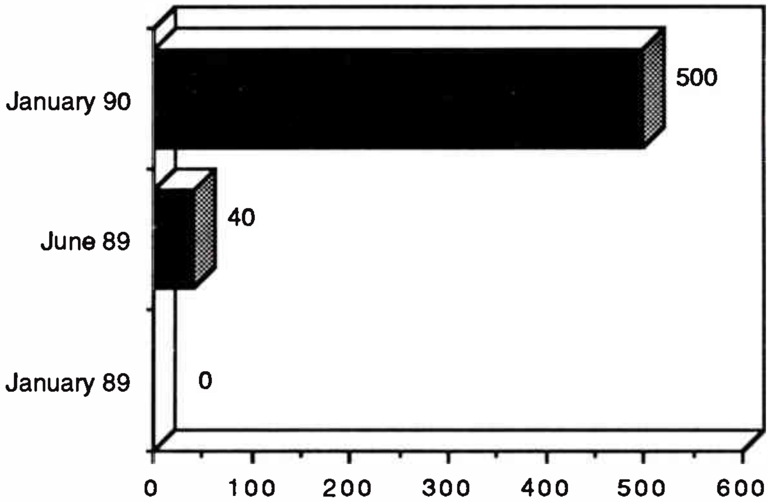
But Jim is proud of the years he has spent in cable TV, thanking the industry "...for being my home for the past 18 years."

Society Now Boasts Over 500 Installer Members

More than 500 people are currently members of SCTE at the installer level. This figure represents an increase of more than 90 percent over the year-end figure of installer members for 1989.

The SCTE Installer Certification Program officially premiered at Cable-Tec Expo '89 in Orlando, Fla. It was developed to establish minimum skill requirements for installers and installer/technicians in the cable TV industry. Once they have mastered the elements of the program and successfully completed the required examinations given by SCTE, the Society awards them a certificate indicating their competence in this area.

SCTE INSTALLER MEMBERS



Local SCTE chapters and meeting groups, under the guidance and direction of SCTE national headquarters, are conducting training and examination of candidates.

The Society has published a training manual for the program, developed by the Installer Program Committee to serve as a comprehensive study guide for candidates for certification, as well as an invaluable resource for anyone involved in cable TV installation. This manual is a vital part of the training process for this program.

Upon completion of training, a 50-question written examination provided by SCTE national headquarters is administered to candidates.

In addition to the written examination, two practical examinations will be conducted. The areas covered under the practical examinations are:

1) Proper drop cable fitting preparation and installation

2) Signal level meter reading

Installers and installer/technicians applying for certification are charged a $25 registration fee. This fee entitles the applicant to one full year's Installer Membership in the SCTE, as well as covering the cost of the *Installer Manual* and the initial certification examination fees. Annual dues for renewing the installer level of SCTE membership are $20.

Installer membership in the Society entitles the individual to all of the discounts afforded SCTE members at conferences, meetings and seminars, as well as discounted prices on all SCTE products, publications, materials and videotapes sold by the Society.

Installer membership does not include voting privileges, holding an SCTE office at national or local chapter and meeting group levels, insurance coverage or any other active membership benefits that require an expenditure of Society funds. Installer Certification by the Society is valid for a period of three years.

A list of installer members of the Society follows.

Vincent Adragna
Milton Alexander
Richard Alexander Jr.
Patrick Amelio
Timothy Ames
Frank Antonovich
Edgar Ardon
Carlos Astudillo
Michael Avery
Joe Ballard
Keith Bamonte
Jon Barrows
Mark Baumgardner
Don Beatty Jr.
Victor Ray Beckner
Charlie Bell
Mike Berklund
Jack Betty
Mark Boltz
James Bornemann
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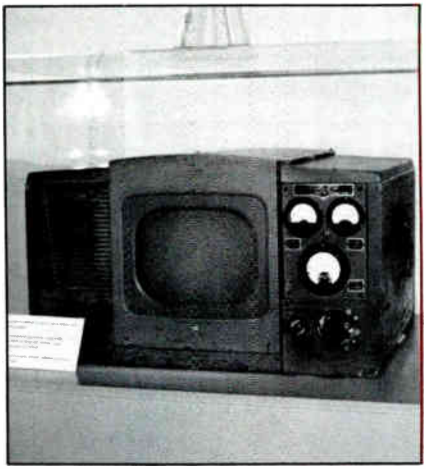
A Visit to the Cable Museum

The National Cable Television Center and Museum (NCTCM) SCTE Room is devoted to memerobilia, photographs and documents showing the evolution of broadband technology. The room will soon be remodeled in accordance with the Society's designs and will feature a wall-size mural depicting a typical cable TV system.

Bill Riker


Bill Riker

Currently on display at the NCTCM, the first portable field strength meter was modified from an RCA TV set to create a device for testing cable systems. It was made portable thanks to its handles. This piece will be on display at Cable-Tec Expo '90 in Nashville, Tenn.

Obituaries

This month, we sadly report the passing of four SCTE members: Andy Andrews, Ed Foust, Robert Levy and John Nichols.

C.C. "Andy" Andrews passed away March 5. The first vice president of the Old Dominion Chapter, he was regional director of converter repairs for the Mid-Atlantic region of Warner Cable Communications in Hampton, Va. He had worked with Warner Cable Communications for 18 years following his retirement from military service.

Ed Foust of Comm/Scope Inc. passed away March 25 after a lengthy illness. He had been with Comm/Scope for 10 years, most recently as an account executive for the company's market development Group. For nine years, he was a regional sales manager for the Denver area. His career in the cable TV industry spanned 30 years with various companies including the Ron Merit Co., Tele-Vue Systems, Theta-Com, Showtime and Anixter.

He is survived by his wife Donna, children Kim, Kirk, Stephen and Stephanie and five grandchildren.

Memorial donations may be made to any Shriner's Hospital in care of the Nile Temple, 500 Northeast 205th, Edmonds, Wash. 98020.

Robert Levy, the former deputy director of the New York State Commission on Cable Television's Telecommunications Division, passed away April 4 after a long illness. A native of Troy , N.Y., he worked as chief engineer for WHRL-FM in North Greenbush, N.Y., a broadcast engineer for WFLY-FM and a reporter for the Troy *Record* prior to joining the state commission in 1975.

He was an active member of several civic organizations and a senior member of SCTE. He was active in SCTE training and recruitment efforts. He was involved in the production of TV programs for the deaf.

He is survived by his wife Jeanine, his son Denis, his daughter Rachelle, his mother Marjorie and his sister Susan.

A scholarship fund in his name will be established at Rensselaer Polytechnic Institute in Troy, N.Y. The fund will offer grants to deserving students or applicants in the institute's School of Electrical Engineering.

For information concerning donations to the fund, contact: Harry Perlow, 3145 Lake Valencia Lane East, Palm Harbor, Fla. 34684, (813) 786-6382 or Kenneth Foster, New York State Commission on Cable TV, 21st Floor, Tower Office Bldg., Empire State Plaza, Albany, N.Y. 12223, (518) 474-1324.

John Nichols passed away March 15. As vice president of engineering for Cablevision Industries in Liberty, N.Y., he oversaw a staff of regional engineers and technicians who designed, constructed and maintain over 27,000 miles of cable plant.

He had worked on the construction and reconstruction of cable TV systems in a variety of markets. He began working in electronics while serving in the U.S. Navy. His expertise, creativity and knowledge were respected throughout the industry.

Memorial contributions may be made to the following:

Liberty Fire Dept., Hose #1, Liberty, N.Y. 12754.

First Presbyterian Church, South Main St., Liberty, N.Y. 12754

Sullivan County Hospice, P.O. Box 1316, Monticello, N.Y. 12701

Town of Liberty Volunteer Ambulance Corp., Mill St., Liberty, N.Y. 12754

(Thanks to Bill Day of Warner Cable, Steve Coffey and Patty Greenhill of Comm/Scope Inc., Al Richards of the New York State Commission on Cable Television and Myra Morse of Cablevision Industries for their help in the preparation of this article.)

Chapter and Meeting Group Exchange

This section of the *Interval* has been created to aid in the exchange of ideas and procedures between SCTE chapters and meeting groups. We hope the information reprinted here will assist other chapters and meeting groups in organizing their own operations and give officers ideas in planning their own upcoming seminars.

The National Speakers' Bureau

By Ralph Haimowitz
Director of Chapter
Development and Training, SCTE

SCTE had a great idea when it established its National Speakers' Bureau to provide a listing of qualified speakers and their various topics (including BCT/E tutorials) for local chapters and meeting groups to draw from.

Many of SCTE's 55 groups have used the National Speakers' Bureau in the planning of local training events, but some have yet to take advantage of this service. We will therefore take this opportunity to bring them up to date on some new training opportunities available through the bureau.

Recently, SCTE received a letter from two vendors who have offered to make technical presentations to the Society's local groups. Representatives from Lindsay Specialty Products will discuss "1990 Antenna Technology" in an in-depth seminar covering all facets of antennas for cable and MATV systems. Contact A. Gordon Zimmerman at (705) 324-2196 to make arrangements.

CaLan Inc. has also offered to do seminars on system sweeping, spectrum analysis and distortions. Contact Ron Boyer at (800) 544-3392 for scheduling.

Although several vendors are already offering to conduct this type of program, many have not yet submitted information on available programs to SCTE for inclusion on the Speakers' Bureau listing. Therefore, I am asking anyone who would like to be a part of this listing to contact SCTE national headquarters and request an application.

Printouts of SCTE's National Speakers' Bureau listing also may be requested through the national office.

I would remind companies wishing to be listed that seminars must remain generic and cannot be specifically geared to a manufacturer's equipment or services. The use of a certain company's product in "hands-on" demonstrations, however, is acceptable and encouraged.

A reminder to chapters and meeting groups: give your speakers the proper respect and consideration. For example, provide at least six weeks notice for a speaking engagement, help arrange for hotel accommodations and assist the speaker in getting to and from the airport.

If you or your chapter or meeting group has any ideas, information or things that you are doing that might be of interest or help to your fellow groups, please submit this material to:

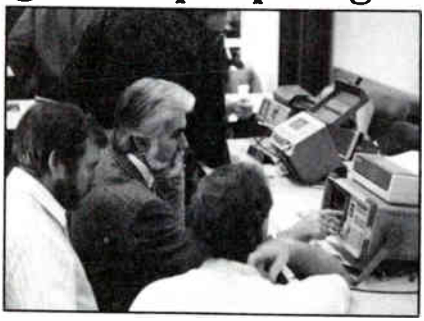
SCTE Meeting Exchange
c/o Ralph Haimowitz
669 Exton Commons
Exton, PA 19341

Chapter and Meeting Group Spotlight

"Chapter and Meeting Group Spotlight" is a new *Interval* section that will focus on recent SCTE chapter or meeting group events noteworthy for their topic, attendance numbers or innovative approaches to technical training.

The Chicago Chapter held its first annual safety seminar March 22 at the Embassy Suites Hotel in Schaumburg, Ill. The topic was "The Right Way, The Safe Way."

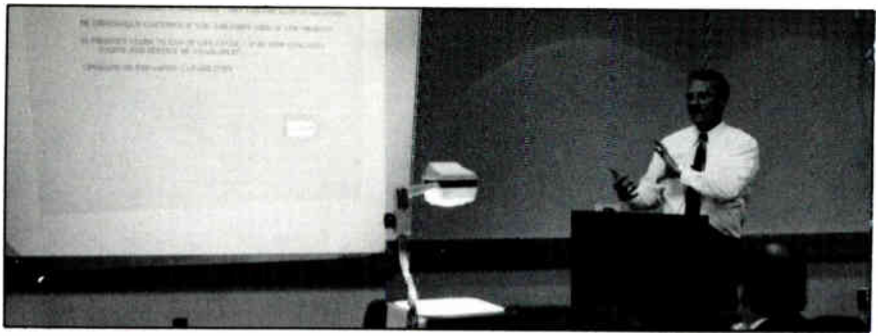
Among the 150 people in attendance were safety coordinators, cable contractors, cable technicians and managers. Representatives from local utilities, OSHA, the Illinois Safety Council and the Greater Chicago Safety Council were on hand to speak on various safety issues. In addition, there was a panel discussion on company safety programs as well as a lecture on alcohol and drug awareness on the job, which was presented by a representative of an employee assistance program.



Steve Allen

John Cecil of Hewlett-Packard demonstrates a sweep analyzer to attendees of the Sierra Meeting Group's March 15 meeting.

Chapter President John Grothendick reported that based on the phenomenal reception that this event received, the chapter plans to hold



Preventive maintenance is discussed by Viacom's Del Heller at the March 15 meeting of the Sierra Meeting Group.

annual safety seminars in years to come.

The Mount Rainier Chapter devoted an entire day to "BCT/E Category IV - Distribution Systems," at its March 14 meeting, held at the Martha Lake Community Center in Martha Lake, Wash.. Secretary Sally Kinsman reports, "We had two very thorough instructors, Marty Mattingly from Scientific-Atlanta and Ken Dawson from Tektronix. The 62 attendees should be well-prepared for our next BCT/E testing session."

The chapter held a drawing for three items: an Anixter nut driver set (won by Paul Kellog of Viacom) and two SCTE national memberships (won by Mike Sturgeon of Northland Communications and Rod Fadden of the City of Sumas).

The North Country Chapter hosted 115 attendees at its Feb. 28 seminar held at the Sheraton Midway in St. Paul, Minn. Rick Cole of Anixter gave presentations on "Fiber Optics" and "BCT/E Category VII - Engineering Management and Professionalism." Don White and Mike Whitcraft of AT&T also spoke on "Fiber Optics."

The chapter also reported that beginning this month, it will offer members dual technical sessions- one for the BCT/E Program and the other for the Installer Program.

The Sierra Meeting Group achieved a new group record when 92 people attended its March 15 meeting, which covered trunk sweeping, standby power and preventive maintenance.

Speakers included Syd Fluck of CaLan, representatives from Alpha Technologies and Del Heller of Viacom Cablevision. The event also offered "hands-on" demonstrations conducted by Wavetek, CaLan, Tektronix and Hewlett-Packard. "This was especially useful," notes President Steve Allen, "because it allowed sweep technicians to compare notes and share experiences regarding those hard-to-correct response problems."

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Reader Service Number 55.

(Continued from page 102)
ducing quality 35mm film Eastman Kodak revealed recent developments in this area at the October '89 Los Angeles annual conference of the SMPTE and they took exception to claims of the 1,125/60 Group that their standards produce quality 35mm film output. Jeorg Agin, vice president of Kodak's Motion Picture and Audiovisual Products Division, noted that "80 percent of prime-time evening network programming and most TV commercials and music videos as well as feature films are produced on film." C. Bradley Hunt, director of advanced technologies planning for Kodak's Motion Picture and Audiovisual Products Division, added, "In a world with multiple proposed HDTV standards film will continue to be the common denominator for the international exchange of TV programming. We have consistently said that the proposed high definition image standards aren't good enough for use in producing theatrical film."

At this juncture it is well to note that a "library" of films represents a huge asset base—via Ted Turner and MGM, Sony and Columbia. There will be those who say, "But what about the tremendous amount of TV programming that is not film, i.e., news, sports, soaps, etc.?" Kodak is not attempting to encompass these areas. It is saying that those extremely valuable entertainment libraries and a "future proof" exchange medium will largely consist of film.

J. Philips Samper, Kodak vice chairman and CEO, said in his keynote address to the SMPTE, "Kodak has plans to develop a high resolution electronic intermediate system for motion picture film. This system (see Figure 1) would be used to convert 35mm film to digital data for subsequent manipulation at an image computing station—and allow for the conversion of digital images to 35mm film for theatrical release." Hunt said, "The motion picture industry is interested in utilizing digital image manipulation as a tool for reducing time and costs associated with creating sophisticated visual effects. None of the proposed HDTV systems are adequate for this purpose."

Kodak's Agin added, "We conducted modulation-transfer function (MTF) analyses using Eastman EXR color negative film 5244. (See Figure 2.) We determined that in order to produce a duplicate negative with a MTF characteristic similar to the original camera negative film, an image manipulation system with at least 2,000 to 3,000 scanning lines per picture height for an Academy aperture 35mm frame would be needed. (See Figure 3.) No HDTV system has that capability. That's why we are proposing the development of a high-resolution electronic intermediate system, which is based on twice the resolution of any proposed HDTV standard." The optical term MTF is analogous to the electronic frequency response of a system (by comparison it is an optical response). Simplistically it is a curve showing the amplitude of the output resolution of a system vs. its input; similar to a multiburst test.

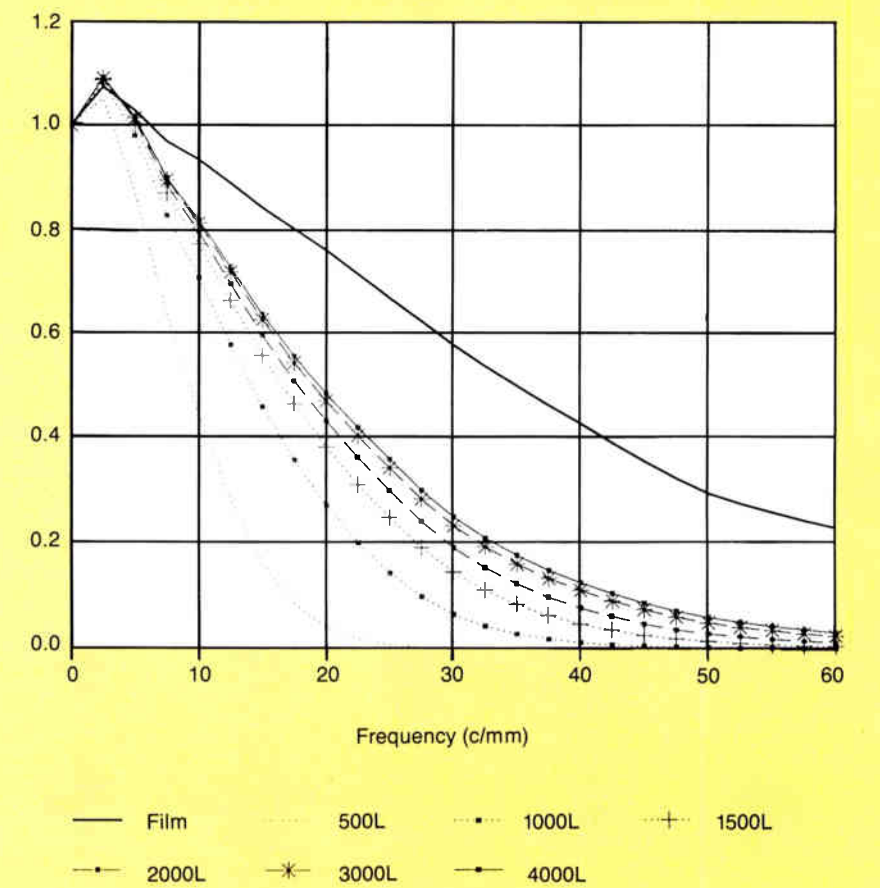
"Four years ago we were all at the same starting gate—now the Europeans have an HDTV standard... Europe and Japan will have HDTV...years before we do."

Researchers at Kodak were kind enough to send a copy (from a paper yet to be published in the *SMPTE Journal*[1]) of the MTF comparisons referred to by Agin indicating the necessity for 2,000 to 3,000 scanning line requirements. See Figure 4.

To repeat, this proposal is for further development of a production standard only *not* a transmission standard. Currently, Kodak is proposing a 2,160 scan line frame with manipulation and processing at about one frame per second. However, they note when such a system is used in film production not only will the quality truly be adequate for the value represented by the film library but a digital record of the program will remain. With proper system design this digital record can then be transposed into whatever HDTV standards evolve nationally and internationally—it will be a true universal exchange standard. Agin added an interesting comment, "It is possible for us to improve the imaging characteristics of film—such as speed and grain—by a factor of 10 during the next decade. We

Figure 4: MTF curves (film vs. scan rates)

Comparing the MTF of film and the MTFs of the results of various TV scanning rates of the film (from Eastman Kodak)



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anticipate that some advances will be made in 1990."

Conclusion

There certainly is no lack of scanning line rates to choose from. In the beginning there was but one—1,125/60—in which the Japanese invested heroic efforts to get accepted internationally as *both* a production and transmission standard. Bob Cohen of the Economic Policy Institute has reported that the "total HDTV funding in Japan: 1964-1984 was 386.9 billion to 486.9 billion yen or $2.6 billion to $3.2 billion. Either as a result of heavy lobbying or due to a lack of American development, or both, 1,125/60 was accepted by the ATSC and then as an SMPTE standard (240M), rubber stamped by ANSI and presented to the international standards body ITU/CCIR by the U.S. State Department. Then the steamroller met its first major obstacle—the European Community.

The Eureka EU95 project in producing the European HDTV standard HD-MAC in just four years provides a shining example of what America used to do best in the world—cooperative industrial research producing a new system. We did it with television itself and later with color TV.

But with American industry largely run by financial experts guided by lawyers limiting American industry's vision (read investments) no further out than the short-term bottom line, we have lost the capability for the required long-term investment commitments—that others in the world are happily making. The Eureka project required not only industrial cooperation but various governments were involved—and the partners didn't even speak the same language! The recent consortium of RCA/NBC and Philips is a step in the right direction and certainly the new directions reported by Kodak are encouraging but it really looks like "a day late and a dollar short."

Four years ago we were all at the same starting gate—now the Europeans have an HDTV standard and it is a certainty that Europe and Japan will have HDTV broadcasting/cable/satellite years before we do. It is available now in Japan and will be in Europe before we even set a standard.

After the same four years we are still attending meetings and generating reports. Sic transit gloria mundi.

Reference

1 Current title "High Resolution Electronic Intermediate System For Motion Picture Film," DeMarsh, Hunt, Kennely and Kristy—to be published in the *SMPTE Journal*.

Figure 9: Test results of Tab B and Splitter D

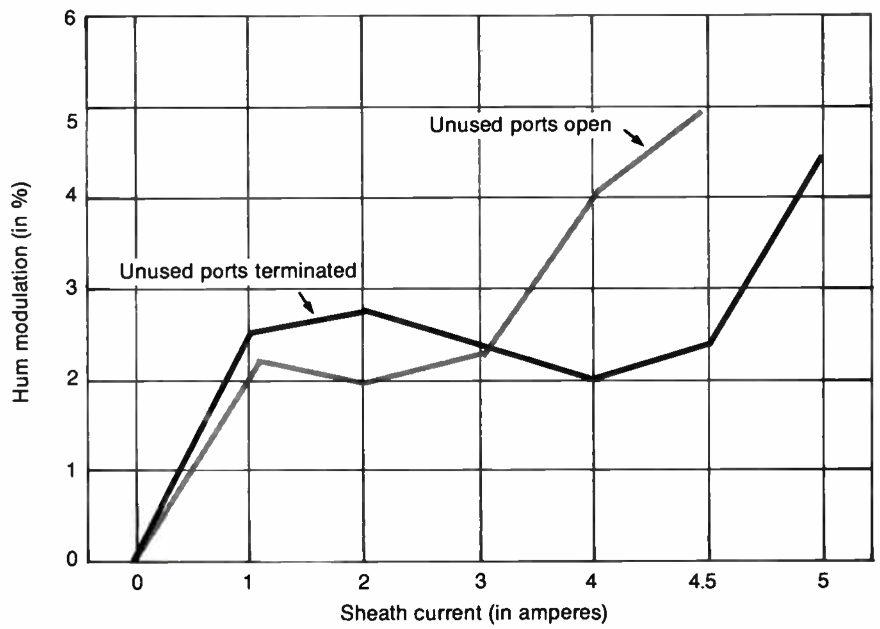
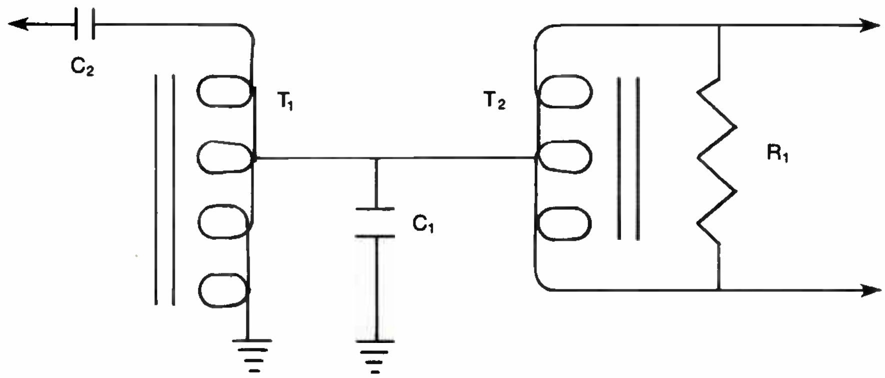


Figure 10: Splitter with DC blocked input



Hum modulation

(Continued from page 30)

to about 50 cents depending on production quantity. Figure 10 illustrates a classic splitter schematic with Capacitor C_2 added to the input to provide the DC block. A DC blocked ground block also would be needed for single outlet installations since not all converter models employ DC blocking on the RF input.

Several manufacturers are considering new designs that include a DC block but are unconvinced of acceptance in a market where a price differential of only 2 cents per unit can swing a purchase. One manufacturer will build them to order with attendant lead times and price adjustments. If you agree that there is a market for DC blocked drop passives you should let your manufacturer's representative know.

The author would like to thank Stan Conn and Mike Sprague for their help with testing and data acquisition and also Dan Pike for his assistance in the assembly of this article.

References

1) National Fire Protection Association, *The National Electrical Code*, 1990, pages 741-742.
2) Michael Holland, *Workshop Guide—SCTE Engineering Conference*, "Design, testing and applications of RF splitters in the CATV market," page 12.

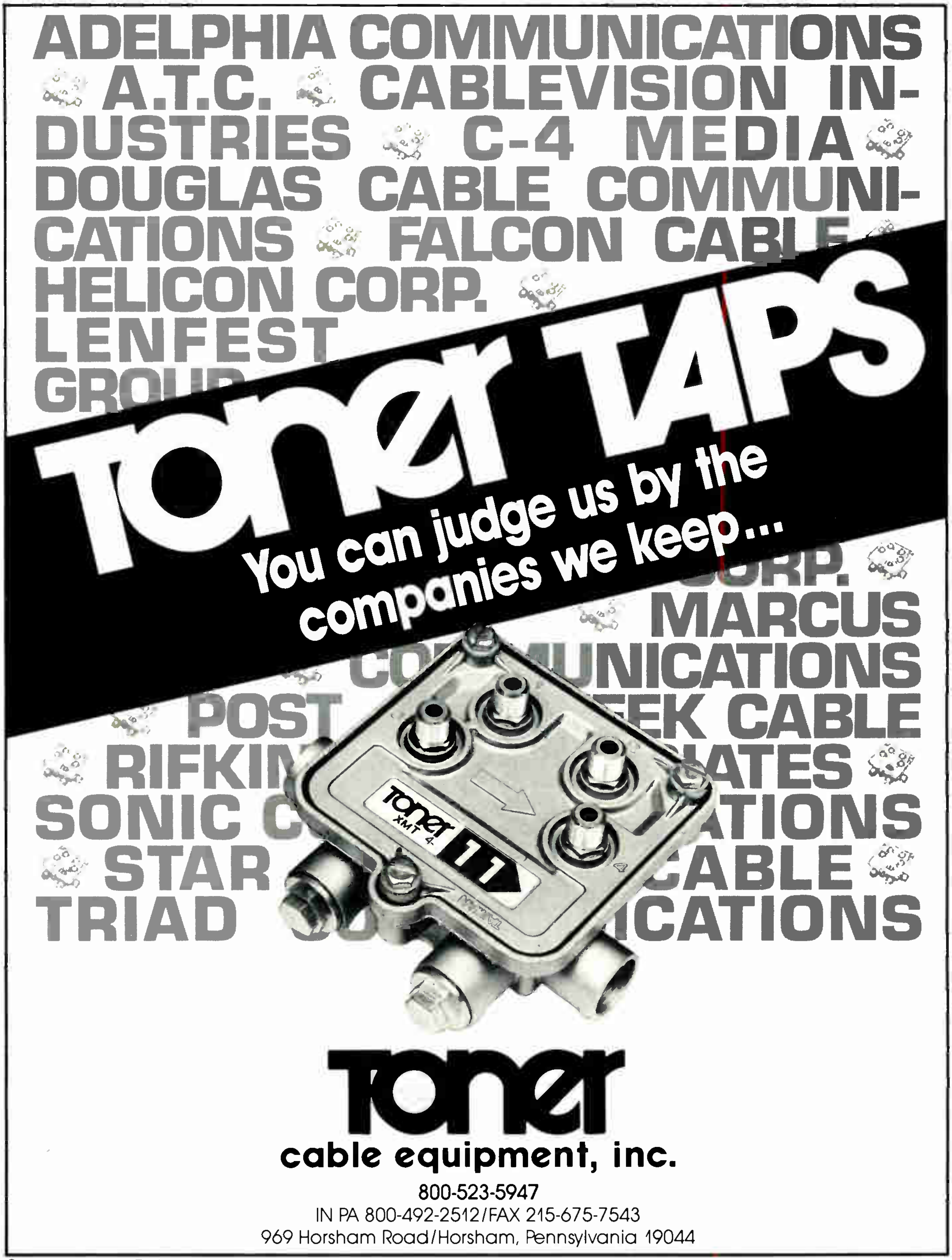


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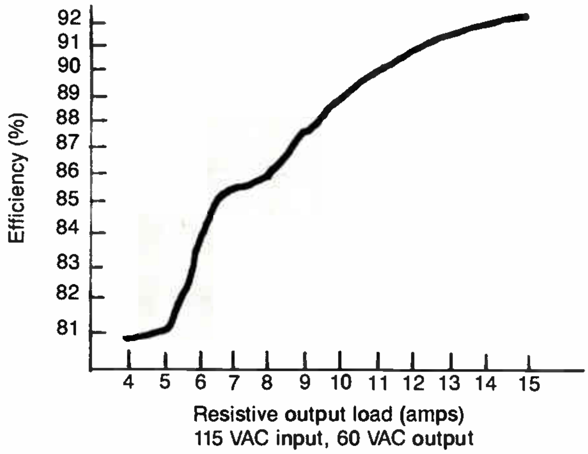
Figure 4: Efficiency vs. output load (±5 percent)



Power supply

(Continued from page 34)

equals the true power supply operating cost of $3.60 per day!

Why measure?

I suggest the use of a clamp-on true RMS (root mean square) wattmeter to measure the input power of each power supply in the system to get an accurate indication of the real power consumption of the system instead of the power supply nameplate ratings. Then compare the measured consumption with what you are being billed for by the utility company.

Some systems get billed at a very low commercial rate, in which case measuring each power supply might not be worth the effort. If the system is measured and there is a substantial overbilling by the utility company, a system operator might want to consider installing metering at each power supply to ensure fair billing representing the true power usage of the system. The potential cost savings could pay for the cost of installing the meter hardware in a few months, after which there would be a noticeable reduction in operating costs.

Efficiency is important to system operators because of the direct relationship to operating costs. Even small improvements made in the system to gain power efficiency can amount to a substantial savings over time, depending on the total system power consumption and the cost of electricity. A relaxation of ferro power supply regulation specifications, solid copper center conductor cable, switching power supplies in active devices and accurate power consumption measurement by the utility company are all possible ways to reduce operating costs.

The author gratefully acknowledges the following people for their contribution to this article: Jeff Geer, Alpha Technologies Inc.; Howard Bobry, P.E., independent consultant; Merv Eaton, Albar Inc.

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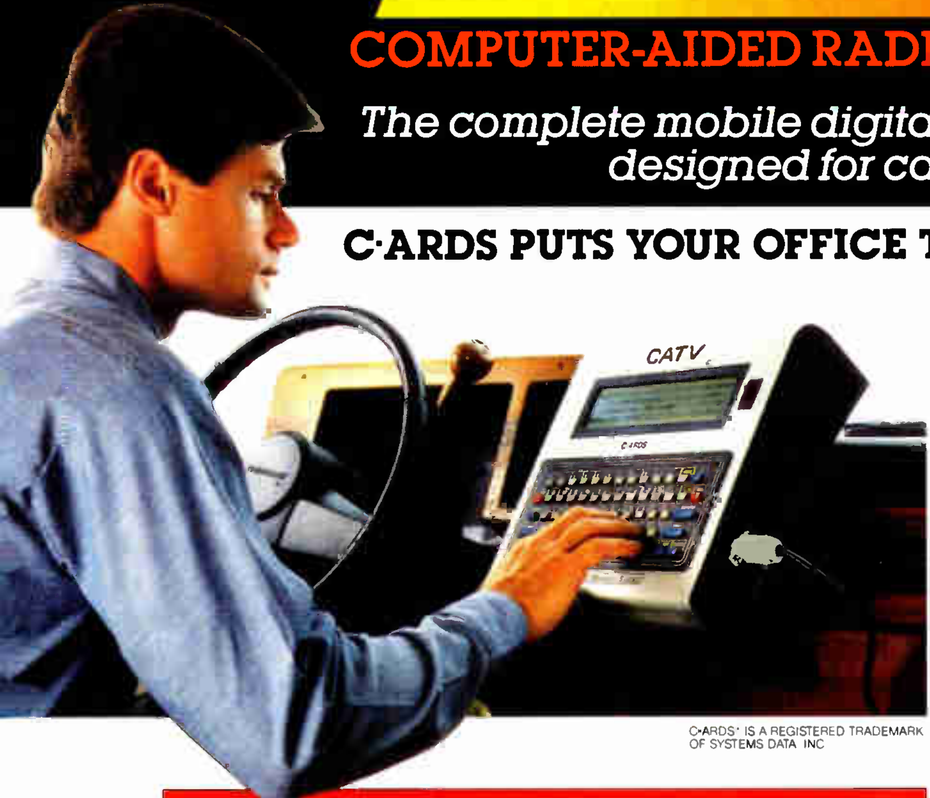

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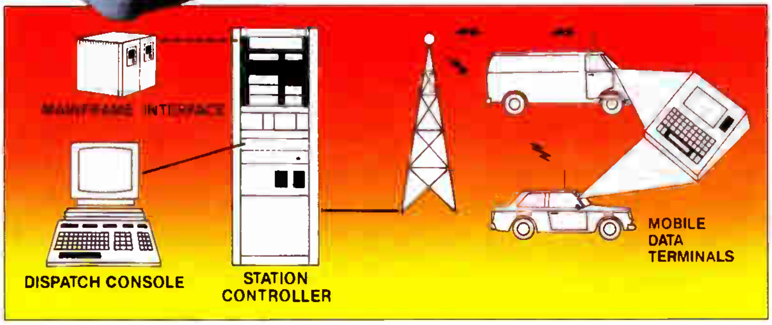

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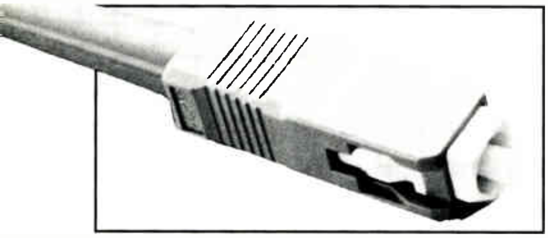
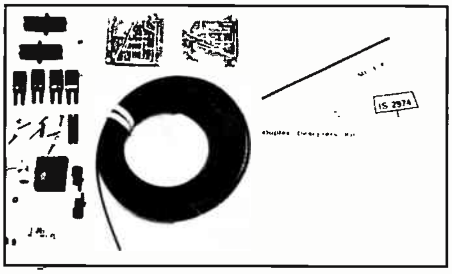


FO connectors

Alcoa Fujikura introduced its new family of SC type fiber-optic connectors. The connectors feature a square design that according to the company assures the highest packing density and eliminates damaging rotational torque on the fiber endface. They are available in single or duplex configuration.

The push-pull operation of the SC coupling is said to speed optical fiber connections in long and short transmission lines, subscriber loops, LANs and other applications involving single-mode and multimode fibers. According to the company, the pull-proof floating ceramic ferrule may be specified in standard PC or precision factory-polished super PC style for highest optical performance with minimal reflections. The molded plastic housing is designed to resist mechanical shock and vibration.

Reader service # 140



FO design kits

Sintec introduced its fiber-optic designer's kits, which are available in either the simplex or duplex version for single or bi-directional data communications. Said to require no training or previous experience to use, all the components are included to construct a 10-meter data link extendable to 60 meters with extension kits.

The kits contain emitter(s), detector(s), printed wiring board(s), all the necessary electronics and 10 meters of simplex or duplex cable. Connections for interfacing to emitter, detector, two bulkheads and a fiber-optic splice are included. Instructions are enclosed.

Reader service # 112

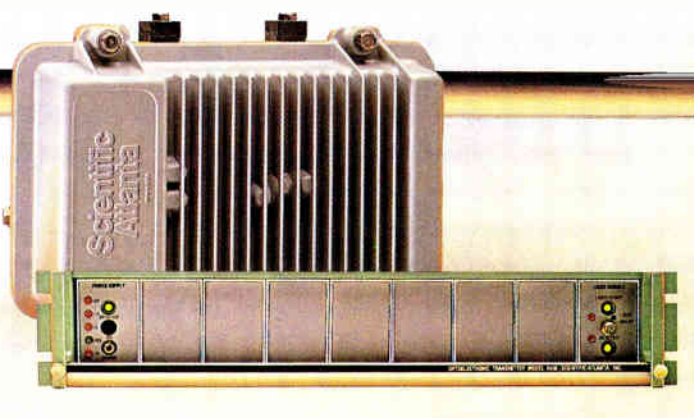
Assemblies

Viewsonics made available its cable assemblies with locking F connectors for security against tampering with headend connections and converter theft. They are available in 3-, 6- and 12-foot lengths. Special lengths are available upon request.

Reader service # 122

FO video link

Laser Diode announced the development of its Model LDAL 1210 video fiber-optic link that provides 55 dB carrier to noise performance for a 6 MHz channel over 25 dB of optical loss. The unit accepts a single 75 ohm video input at 1 V peak-to-peak and its transmitter utilizes a 1,300



nm laser diode coupled to single-mode fiber. Its receiver incorporates a high sensitivity pinfet front end and provides a 1 V peak-to-peak output. According to the company, typical differential gain is 5 percent and differential phase is two degrees.

The unit is available as a 3- × 5-inch DC powered module or optionally as an AC powered rack unit. Video input and output is via a BNC connector. The link can be configured to simultaneously transmit video, audio and data over a single fiber. Also available are links that accept wideband video (125 MHz) for high definition applications.

Reader service # 114

Power supply

Performance Cable TV Products' Model FR840A ferroresonant power supply uses an MOV and a 20 A circuit breaker on its input for surge protection and is said to retrofit most existing power supplies with base dimensions of 10¾ inches by 6 inches. It is 7 inches tall and weighs 3 pounds. It delivers 60 V square wave with 14 A of current (840 VA).

According to the company, its rugged chassis resists physical abuse in the field and its handle makes for easy removal from the cabinet. It has a large transformer that is said to allow for an extended life expectancy.

Reader service # 141

Angle indicator

Moagon AG's new generation Moangle angle indicator is an inclinometer that can be used for installing satellite antennas. It has adjustable locking, a large vernier dial with high ratio and is said to be convenient to hold at different angles because of its rounded handle.

According to the company, it has an easy to read screen setting and high sensitivity. The system is made up of a measuring handle, base bar and magnetic bar.

Reader service # 118

Amp housing

C-COR introduced its FH series 8-port finned lid housing that incorporates 242 square inches of additional heat-sinking area to increase heat dissipation capabilities that is said to be required with today's high performance amplifiers. A 10°C reduction in the ambient temperature is achieved with an overall size increase of .75 inches in the housing height and no increase in the housing length.

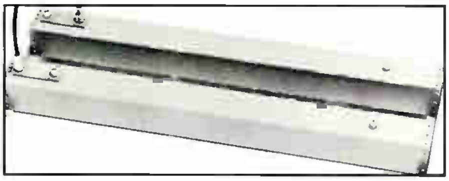
The housing uses the company's 3 A power supply that is said to run cooler and has increased current capacity. It is compatible with the company's current 500 series RF modules and ancillary products. All of the company's CATV trunk amplifiers began being shipped with the FH housing as of March.

Reader service # 138

AML repeater

Hughes Aircraft Co. introduced its Model IBBR-124 AML broadband repeater that is designed to permit cable operators to extend existing signal paths farther than was previously possible and to implement paths where direct line-of-sight transmission is obstructed. According to the company the product has the highest linear power output of any amplifier at its frequency range.

The unit is a solid state, on-frequency active repeater that amplifies signals received from the primary microwave transmitter and retransmits them to new or secondary cable hub sites. It incorporates a transmit monitor that provides VHF test point for output signal monitoring and a built-in microwave test tone can be activated during routine maintenance testing. A built-in microwave local drop port serves as a low-noise front end for an optional local receiver.
Reader service # 116

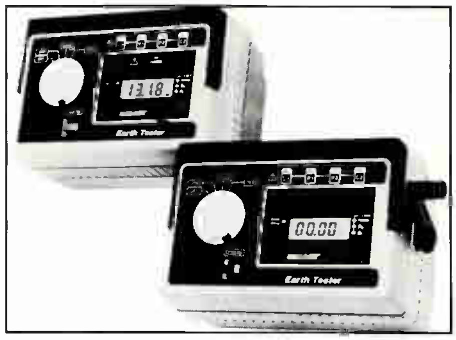


FM filter

Microwave Filter's Model 7142 FM filter eliminates signal spurs created by coupling between two transmit antennas located on the same tower. Frequency separation between the pass and stop bands is 1.8 MHz minimum and passband loss is 0.5 dB maximum and 0.25 typical. Passband return loss is 20 dB minimum and the 25 dB reject bandwidth is 200 kHz minimum. Notch peak is 50 dB minimum, ambient temperature is 0 to 45°C and transmit power is 200 watts. Units may be specially tuned to any frequency 88 to 108 MHz or for different frequency separations.
Reader service # 111

Surge network modules

Two new plug-in modules, Models S3B and S7 surge networks for the Model 587-PLUS surge generator were announced by KeyTek. They are said to increase the machine's peak current capabilities to 5,000 and 10,000 amperes respectively for surge testing to the extended requirements of ANSI/IEEE C62.41 (formerly IEEE Std. 587) and to various other national and international standards.
Reader service # 109



Ground testers

Biddle's Models DET/3 and DET/5 ground testers provide resolution in three resistance ranges from 0.01-1,999 ohms for applications ranging from single-driven rod systems to complex grids and measurements are displayed on a 3½ digit LCD. According to the company, the products provide accuracies of ± 2 percent of reading, ± 1 digit at −23°C (−9.4°F). They provide a warning of excessive input noise or high current probe resistance that could interfere with the measurement. By pressing a button, the user can check for potential probe resistance.

The Model DET/3 features a hand-cranked power source with a warning indicator that can alert the operator when

the cranking speed is too low. The Model DET/5 is powered by internal rechargeable batteries and has a built-in charger that can be used with either a 120 or 240 VAC line. As four-terminal instruments, they can be used to make soil resistivity measurements that aid in the design of grounding systems. The terminals are recessed for operator safety and are packaged in an OSHA "safety yellow" case that is designed for field use.
Reader service # 137

Drill bits

Klein Tools offers 16 different step-drill bit models including six metric styles. According to the company, the line has been changed to include lasered hole-size markings that offer positive identification for each hole-size step and thus help minimize user errors.

Each bit is said to do the work of several size bits without changing tools and ten of the models have self-starting, non-skid tips for fast starts without need for center punching or pilot holes. The bits drill multiple-size round holes in metal, wood, plastic and other materials up to 1/8 of an inch thick. Depending on the bit selected, hole sizes range from 1/8 of an inch to 1-3/8 inches in diameter. Holes are deburred automatically by the next succeeding size step. The bits are marketed under the Klein-Unibit name.
Reader service # 130

Calorimeter brochure

Anritsu made available a 12-page brochure describing its ML9010A optical calorimeter. Included are the product's specifications and functions. Complete descriptions of on-screen displays and diagrams of the automatic measurement system and optical power meter calibration system are included. A list of accessories to the ML9010A is also contained in the brochure.
Reader service # 110

Editing systems

The Comp/Editor series of automated videotape editing systems is being offered by Channelmatic. The systems can be purchased as individual components or completely racked, wired and installed in your studio.

The low-end product is the ECU-300 that is a full-featured three-VCR A/B roll system. At the mid-range is the ECU-400. This is a full-featured four-VCR-control editor with continuous roll capability. The ECU-600 is the high-end product, which is capable of controlling six VCRs and has continuous roll, fit and fill variable speed calculations, "slo motion" learn/replay reported to EDL and E-MEM effects for switcher, upload/download. Software and hardware modules can be added to provide CATV spot-reel compiling capability and tape location marker encoding.
Reader service # 139

Handbook

Fiber Optics Handbook and Buyers Guide has been made available by *Fiber Optics Magazine*. It contains a manufacturers directory, reference material on fiber applications, market trends, technology, terminology, references and other information. It is said to be useful to both the fiber-optics professional and those new to the field.
Reader service # 126

Video radio

Microwave Networks expanded the features of its MicroNet 18 video radio that incorporates the same features as the MicroNet 23 video radio. The MicroNet 18 is a microwave radio terminal for point-to-point video transmission used for longer paths. A turbo-plus option incorporates a 1 W GaAs-FET power amplifier to accommodate extended ranges. It can be simplex or duplex and is available in a non-protected configuration, monitored hot-standby configuration for 1:1 protection or a dual-channel configuration that is said to double the system's capacity.

Other features include extensive built-in diagnostics, same interface unit for 15, 18 and 23 GHz, up to three 15 kHz audio subcarrier channels, T1 over video subcarrier option and transient surge protection.

Reader service # 127

LNB

The Slimline Ku-band (Model KU117 HMT-SL) LNB was announced by California Amplifier. It incorporates high electron mobility transistor (HEMT) technology and special surface mounting techniques to produce this 11.7-12.2 GHz LNB.

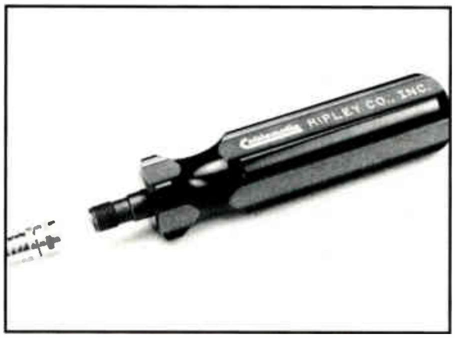
It is broadcast-quality and can be used for commercial, VSAT networks and consumer downlinks. The company's Power Alert LED, which indicates power is being passed from the receiver, is a standard feature. It measures around 5 by 2 by 1½ inches and weighs 10.6 ounces. It is available in HEMT noise figures ranging from 1.4 dB to 1 dB with a gain specification of 55 dB typical.

Reader service # 125

Color monitor

Leader introduced its Model 5130 NTSC color monitor at the 1990 NAB conference. It features underscan, a 6-inch screen and AC/DC operation. It has dual video inputs and external sync drive. It is half-rack sized so, according to the company, it complements Leader's combination waveform monitor/vectorscopes, Model 5870 and Model 5872.

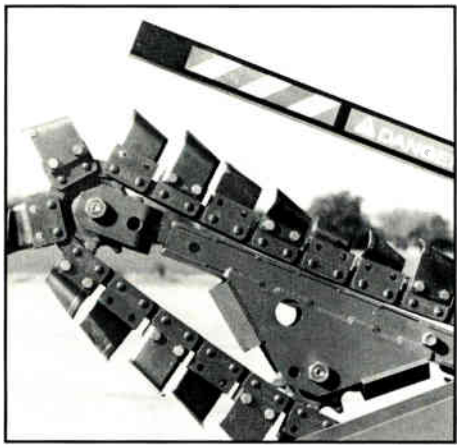
Reader service # 123



Insertion tool

Ripley introduced its IT-F59, 6, 11 insertion tool that is designed to facilitate inserting F connectors into drop cable. According to the company, after threading the F male connector onto the end of the insertion tool it becomes an easy job to then insert the post end of the connector into the drop cable. The tool is said to create a mechanical advantage to make the job fast especially in cold weather and it is made of rugged plastic and heat-treated hardened steel. It is currently available through Ripley Cablematic distributors.

Reader service # 134

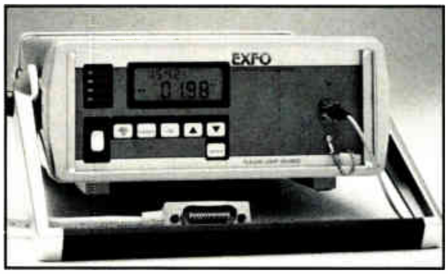


Trencher tooth

The Charles Machine Works introduced its new Ditch Witch Tough Tooth 90 digging assembly. It is a trencher tooth and chain digging assembly that can dig up to twice as much trench, and is said to be as much as 30 percent faster than the original Ditch Witch Tough Tooth.

It is available in two sizes to fit 30-HP class to 75-HP class trenchers. The digging assembly consists of the Tough Tooth 90 teeth and a special raised-rivet chain. The tooth is said to be more efficient than ordinary teeth in normal soil conditions due to its shape and profile. (The company does not recommend the product for digging in rocky soils.)

Reader service # 131



Light source

The Model FLS-220 laser light source was introduced by Electro-Optical Engineering. It is said to have high power, stable output and a calibration test source with its optional pigtail that can verify accuracy of optical powermeters made by any manufacturer.

It is available in three models. The "A" model is a non-modular unit that is available for single wavelength (850, 1,300 or 1,550 nm) or dual wavelength transmission (850/1,300 or 1,300/1,550 nm). It can come with one, two, four, eight or 16 output connectors to be used to launch into cables containing many fibers. The "B" model uses plug-in source modules that are compatible with the company's model FOT-150B power meter for flexibility. The "C" model provides a voice communication capability compatible with the company's high-end talk set Model VCS-20 and Model FOT-150C power meter/talk-set.

According to the company, the product offers stability better than .01 dB over one hour, fast stabilization time, high output power (1-2 dBm at 1,300 and 1,550 nm) and an optional RS-232 and IEEE-488 computer interface.

Reader service # 129

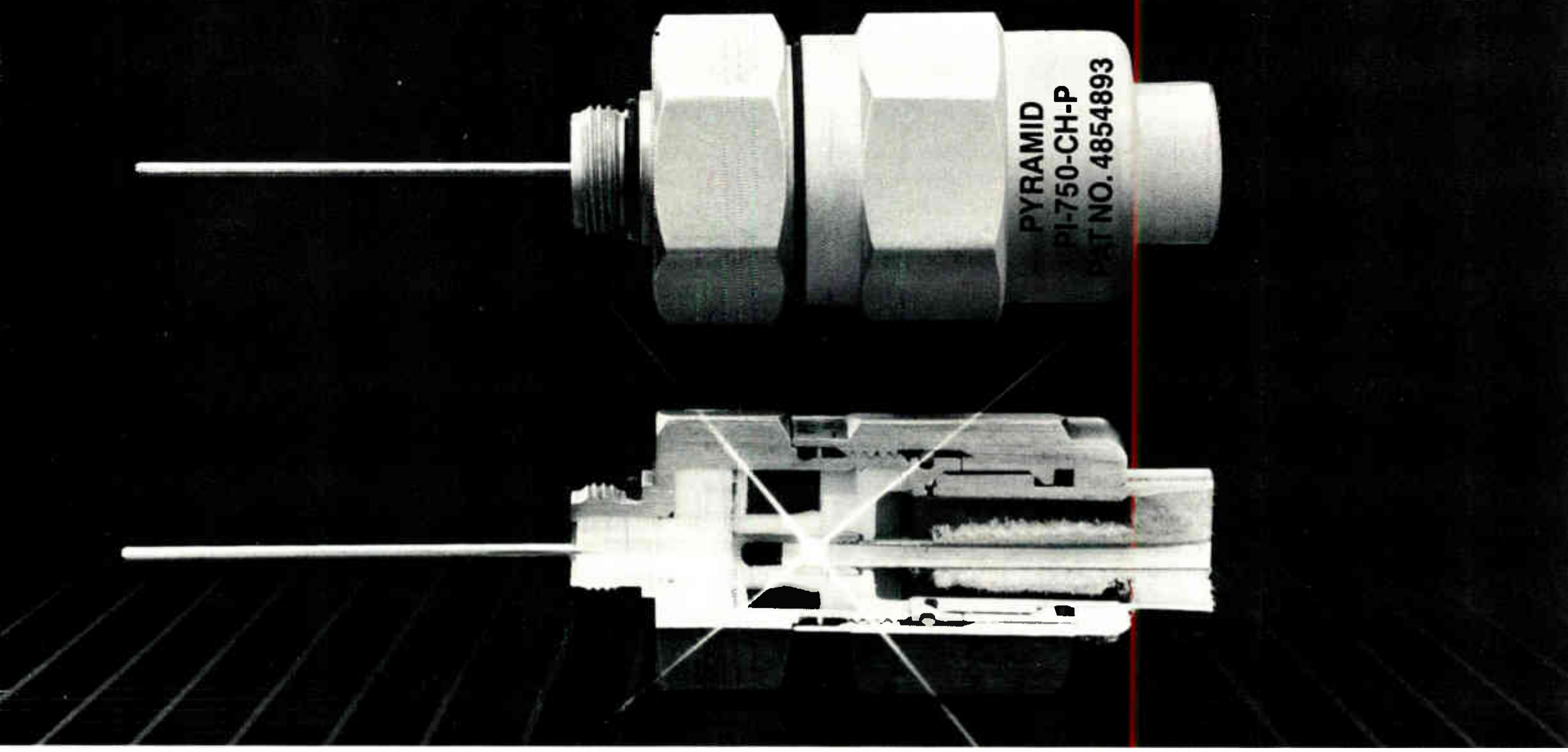
Marker printer

Brady's Bradymarker XC Plus Printer for marking cable and wire, labeling components and for general identification projects is portable and operates on a 120 VAC power source or an internal rechargeable battery. It can print up to 500 wire markers on a single charge and it comes in a carrying case to ease transport in the field.

It prints on Brady's wire marking materials in a variety of sizes and on the company's Bradysleeve heat-shrink markers. The printer has 8K of memory for storage of wire marker lists, allowing for entry of new lists for teardowns and changeovers.

Reader service # 128

PI SERIES* CONNECTORS



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Reader Service Number 69.

See us at the NCTA Show, Booths 1174, 1175.

Satellite book

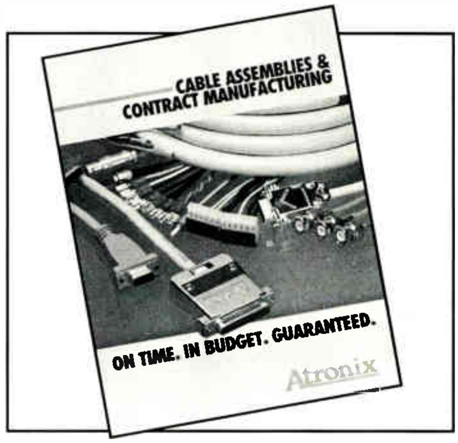
The proceedings of the European Satellite Broadcasting conference held in London in June 1989 have been published by Blenheim Online Publications. The book examines the issues of business services, market penetration of hardware and the acceptance of new satellite and TV channels in Europe and the major program suppliers (including Eutelsat, Intelsat, Sky TV and British Satellite Broadcasting). It also considers the impact on Europe of the U.K. government's White Paper.

Reader service # 117

European report

Logica Consultancy Ltd. made available its *Satellite Television Receivers—The European Market*. This report includes information on the supply of and demand for satellite TV reception equipment for direct-to-the-home (DTH) and satellite master antenna TV (SMATV) reception in western Europe.

Chapters cover satellite TV systems and services (Eutelsat, Intelsat, Astra, TDF-1 and British Satellite Broadcasting), equipment components, sourcing of components, multiservice reception, distribution routes, installation, consumer demand issues, product development and pricing and new and future technology. The report also details the major manufacturers of satellite TV receivers and their components.



Manufacturing brochure

Atronix made available an 8-page color brochure that describes its full range of equipment and capabilities for manufacturing cable assemblies. It describes the company's automated and semi-automatic equipment for manufacturing cable and electromechanical assemblies. Products routinely produced by the firm include ribbon, coax, harnesses and molded cables and complete assemblies to the next higher level in prototype to production quantities.

Reader service # 115

CAD software

ComNet introduced an AutoCAD application drawing software package to its BSE-Pro CATV design software called BSE-Pro CAD. It translates the design file created by BSE-Pro into user defined drawing symbols that can be overlaid onto a strand map or building drawing.

The symbol table is user defined for any system design including amplifier title blocks that display visible attributes about the amplifier. According to the company, the product simplifies the inserting of symbols over a strand map and can minimize the chances of omitting schematic symbols. It requires AutoCAD Rel. 10.

Reader service # 133

Microwave handbook

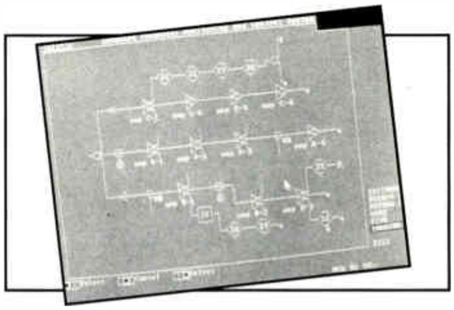
RSGB Microwave Handbook Volume 1, edited by M.W. Dixon (G3PFR) was made available by the American Radio Relay League. It is the first of three volumes of the *RSGB Microwave Handbook*. This volume covers operating techniques, system analysis and propagation, microwave antennas, transmission and components and microwave semiconductors and valves.

It has 224 pages and it contains largely non-mathematical presentation of microwave theory and practice. It contains a collection of practical designs that have evolved from RSGB's *Radio Communication* and *Microwave Newsletter.*
Reader service #136

FO splicer

Siecor introduced its CamSplice for single-mode and multimode fibers. According to the company, no adhesives are required to complete low-loss mechanical splices with the product. The universal, single splice part accommodates fibers for 250/250 μm, 250/900 μm and 900/900 μm applications. Average splice loss is said to be specified at 0.2 dB with return loss greater than −50 dB. Splices can be tuned and remated as needed and blind (non-tuned) splices still offer consistent loss measurements under 0.5 dB, according to the company.

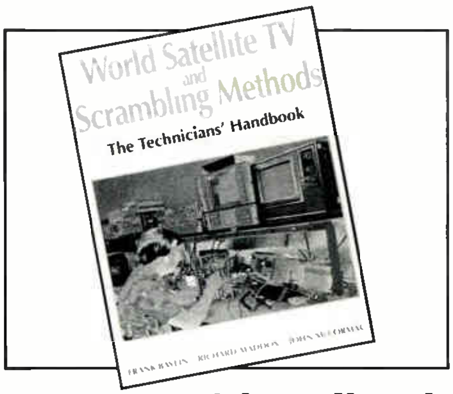
The "cam" locking mechanism requires no adhesives or epoxies. Glass rods comprise the alignment mechanism so there are no metallic components to affect long-term splice quality. Long inner lead-in eliminates torsion of 900 μm fibers and a recommended assembly fixture is said to optimize splice quality.
Reader service # 107



Monitoring software

AM Communications announced the release of its Topologer Level III software for LANguard status monitoring systems. According to the company, it is the first status monitoring software that lets the user see a schematic of the whole cable plant and graphically pinpoint system problems.

It is mouse-driven and based on EGA color graphics and windows. It is linked to the basic LANguard system to let the operator point and zoom in on system problems. Alarms appear as uniquely color-coded industry standard symbols on a familiar network schematic diagram.
Reader service # 120



Home TVRO handbook

World Satellite TV and Scrambling Methods—The Technician's Handbook was released by Baylin Publications. The authors explore all components of home satellite systems from the perspective of a technician who wants to understand their design, operation and repair. It is said to complement the newly released third

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Reader Service Number 73. *See us at the NCTA Show, Booth 200.*

edition of *Ku-Band Satellite TV—Theory, Installation and Repair* and *The Home Satellite TV Installation and Troubleshooting Manual*, both also published by Baylin.

Nearly a third of the handbook is devoted to an in-depth study of broadcast formats including NTSC, PAL, SECAM and MAC, digital audio and techniques as well as basic scrambling and encryption methods. American and European current satellite TV technologies including the VideoCipher II, Oak Orion, RITC IRDETO, FilmNet, Sky Channel EuroCypher, B-MAC, D2-MAC, VideoCrypt and Teleclub Payview II systems are explored. Chapters on troubleshooting and setting up a test bench follow.

Reader service # 108

Enclosure

The D Series double box CATV enclosure for apartments, townhouses and other MDU applications was announced by White Tool. It has open sides to allow a full 180° access while reinforced corners and a double-thick top and bottom help maintain security capabilities.

The enclosure is made of 16 gauge mill galvanized steel for maximum protection and can handle a variety of locking mechanisms. It is available with as many as nine triple knockouts so special boxes with extra knockouts are not necessary. The D Series are furnished with two vertical hex mounting rods for fast installation of taps. Plywood and metal mounting plates are available and a grounding lance is standard for convenience in wiring.

Models come with a choice of full back or an open back design. Keyhole-style mounting holes are furnished on both versions. They are available in various colors and a range of sizes from 10 inches by 10 inches by 6 inches to 18 inches by 24 inches by 8 inches.

Reader service # 135

T&M catalog

Wavetek's test and measurement instrumentation catalog has 217 pages of descriptions, technical specifications, illustrations and pricing and ordering information for the company's line of signal sources and measurement equipment plus related special equipment and components.

It covers equipment categories including the company's VXI instruments, WaveTest development software, modular instruments, function and arbitrary waveform generators, frequency synthesizers, microwave signal and sweep generators, microwave scalar analyzers and microwave CW and peak point power meters. It also covers the company's precision digital multimeter, calibrators and calibration equipment, datalogger systems, signal processing filters, signal switching systems, CATV signal level meters, CATV system analyzers and system sweep and RF components.

Reader service # 124

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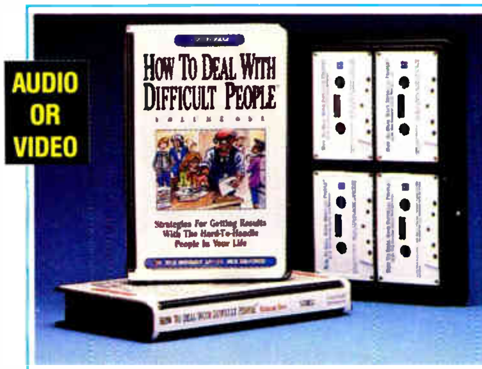

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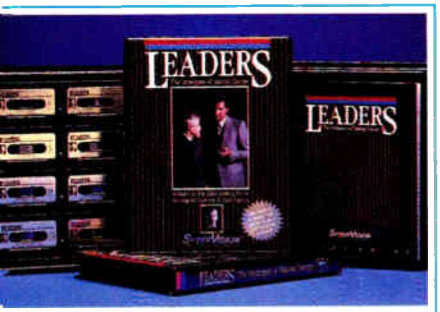

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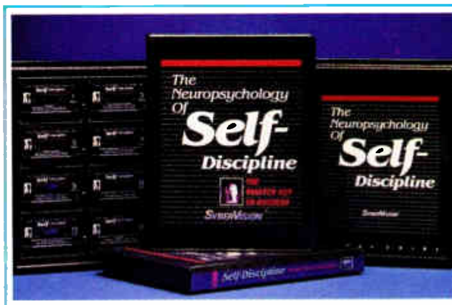

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Reader Service Number 77.

Standby inverter

(Continued from page 42)

start-up circuit and the *low voltage cutoff*. The start-up circuit kicks the inverter into oscillation when it is to function in the standby mode. It is a very simple pulse generating circuit that is in continuous operation and always stands ready to turn the inverter on. Again, refer to Figure 3.

The low voltage cutoff circuit functions as a protection for the batteries by preventing them from being excessively discharged. There may be times when the power outage exceeds the ampere hour rating of the batteries used to power the inverter. Before the voltage level of the batteries reaches a dangerously low level (approximately 21.5 V for a two-battery system) the boost winding of the inverter circuit is interrupted causing the power supply to shut down. This of course saves the batteries and allows them to receive a full charge again.

Speaking of batteries, my selection of a two-battery system was for two reasons. First, it seems that three-battery systems are plagued by middle battery failure. Since this has become such a significant problem, I felt it wise to avoid the situation all together. The difference in standby time for the two-battery system is not significantly reduced. This is due to the inherent efficiency of the inverter. Second, the cost of batteries is one-third less when only two batteries are used.

A control box is located inside our pole-mounted cabinet and has three functions. One use is to illuminate an alarm lamp to indicate if the inverter has failed to come on when there has been a utility power interruption. Rather than using semiconductor logic for this, I have chosen relays due to their inherent reliability. I felt that semiconductor logic would be too vulnerable considering the harsh environment cable TV systems are subjected to. Relays used within their design limitations are practically indestructible and offer a virtually fail-safe system.

A useful bypass switch is also incorporated into the control box enabling the technician to bypass either the ferro or inverter should either require a change out. This way, there is never any interruption of power going to the system. The final function of the control box is to switch the operation of the fan from the ferro to standby to assure continuous cooling.

Simple and serviceable

The various functions of the power supply are arranged in such a manner that they are separate from each other. There is little or no interaction or interdependence between the various circuits so this of course simplifies troubleshooting any problems that may occur and promotes serviceability. As an example, if there is a problem in the battery charger section, there is no need to consider any possible problems in the inverter circuit. The three active circuits—the battery charger, the low voltage cutoff circuit and the start-up circuit—are contained in easily detachable modules and are connected into the chassis by color-coded wires. Change out time is typically five to 15 mintues depending on the level of a technician's skill. The circuitry of the power supply utilizes universally available components, most obtainable from broad line electronic distributors. Thus, obsolescence due to discontinued components is minimal.

As the rest of the industry becomes more complex and sophisticated, I have taken the attitude of the simpler the better. A design can certainly be an engineer's dream, but once in the field it becomes a technician's nightmare. All efforts have been made to make this product "technician friendly." ◻

Strand-mounted power supply

(Continued from page 44)

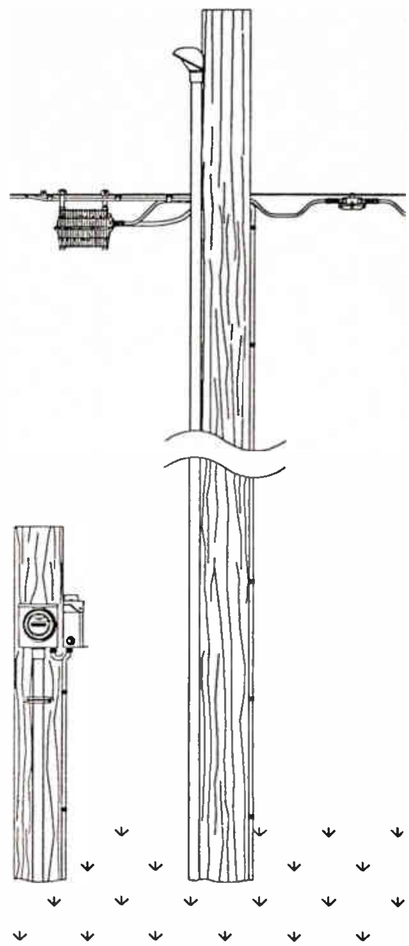
top of the pole down to the meter that will usually be mounted at about eye level. Another conduit must run up from the meter socket to the disconnect box and then on to the supply. This will still keep everything off the ground and make it relatively easy to climb or replace the pole.

By far the least desirable situation occurs in areas that require metering and will not allow anything to be attached to their poles. This will force the cable operator to install a stub pole (see Figure 3) somewhere close to the main pole and mount the disconnect and/or meter base on it.

Some electric suppliers have post-mounted service equipment that has everything you need including the pole in one unit, which will greatly simplify the installation. Two risers must be used in this scenario, one must be run from the power company transformer through the weather head, down the pole and underground to the meter socket on the stub pole. The other riser must run underground from the disconnect box, up the pole and to the power supply on the strand. Any type of mounting in this situation will be more complex and cluttered. However, the advantages of the strand-mounted power supplies as previously stated will still apply.

It is my belief that as more and more strand-mount power supplies appear throughout the country, power company policy will begin to change allowing reasonable use of their poles and making it much easier for all concerned.

Figure 3: Disconnect and meter on stub pole



"Strand-mounting—in the same manner as an amplifier—allows attachment independent of the pole."

Best is yet to come

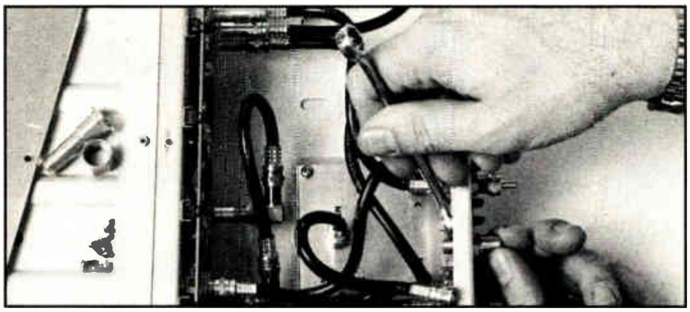
As good as the strand-mount power supply is in conventional cable systems, the best may be yet to come. As fiber optics takes over our industry, the demand for 60 V standby power supplies will most likely decline. At the same time the demand for smaller non-standby supplies (5 A or so) will skyrocket. Since the trunk and most main runs will be line-powered, only local and line extender equipment will be powered by 60 V supplies. The local distribution of the signals will require numerous power supplies to handle the many short runs, each of which will have only a few line extender amplifiers. Since any power failure in these small areas will affect the customer as well as the cable, no standby power will be necessary. The value of a small strand-mounted power supply in these locations is clear. With several fiber systems already committed to strand-mounted power supplies it seems certain that this is a product whose time has come.

The author wishes to thank Dave Cushman for providing the line drawings for this article.

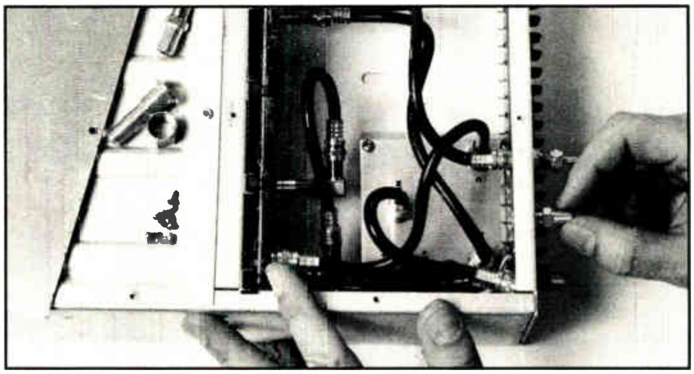
Intermittents

(Continued from page 50)

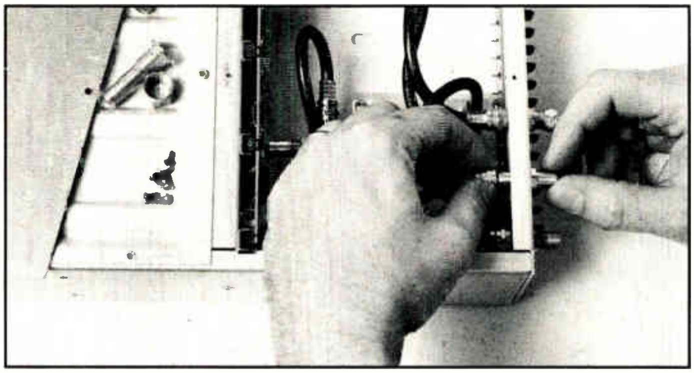
Step 10: To replace an external chassis connector disconnect the RG-59 jumper from the connector. Check the cable's center conductor diameter and length.



Step 11: Remove the nut that holds the barrel connector in the chassis and pull the connector out the back. Note that the barrel has flats on the threaded surface to prevent the connector from spinning in the chassis.

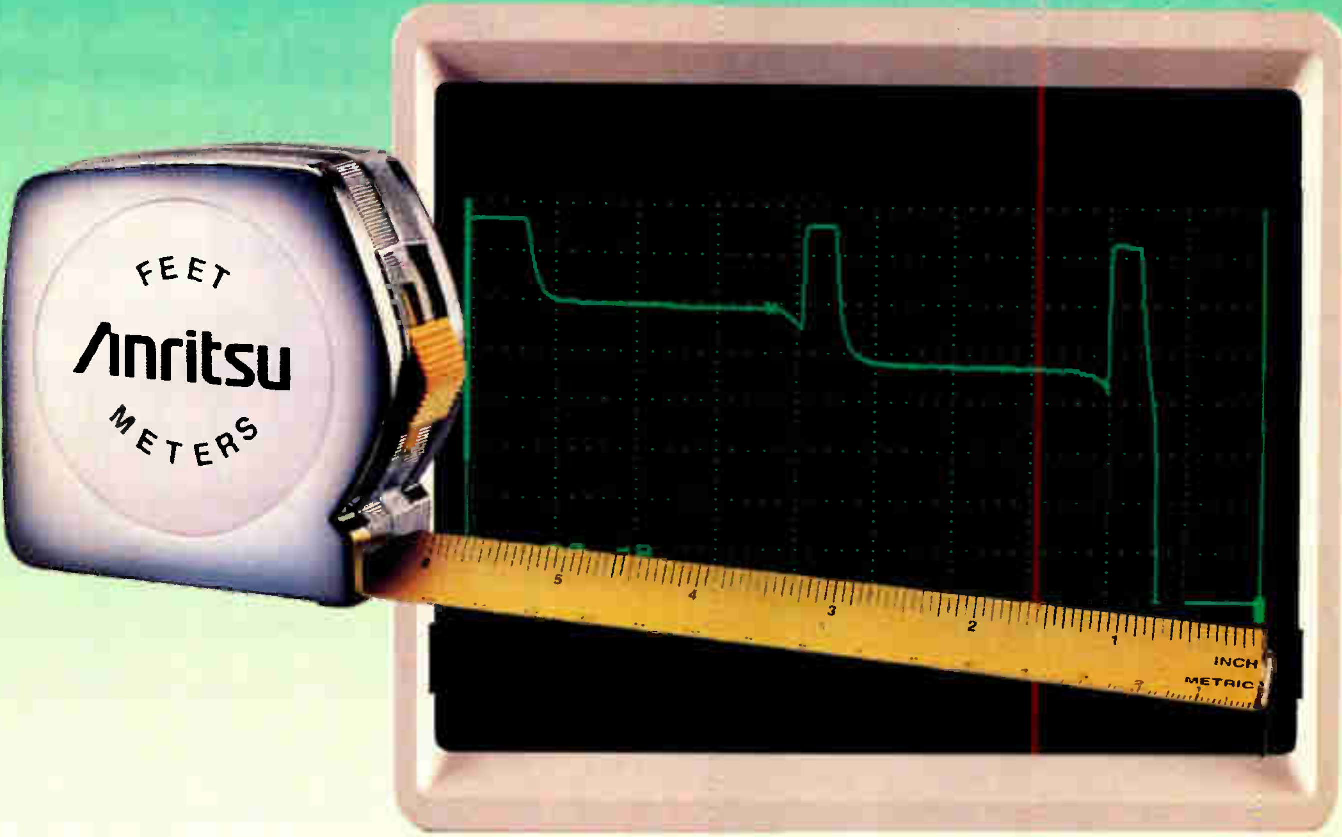


Step 12: Install the new connector from the outside; the retaining nut should be installed from inside the chassis rear compartment and wrench tightened.



Step 13: Reconnect the RG-59 jumper to the connector making sure the center conductor goes in straight. →

FROM START...TO END



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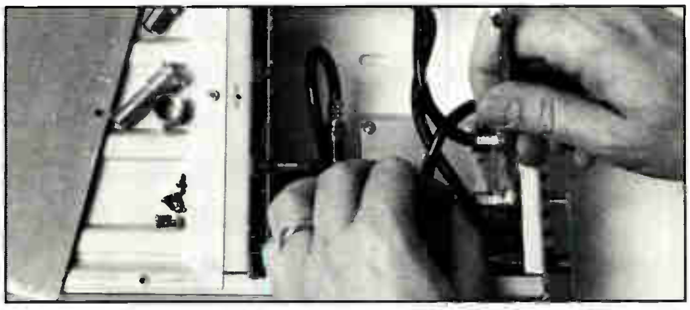
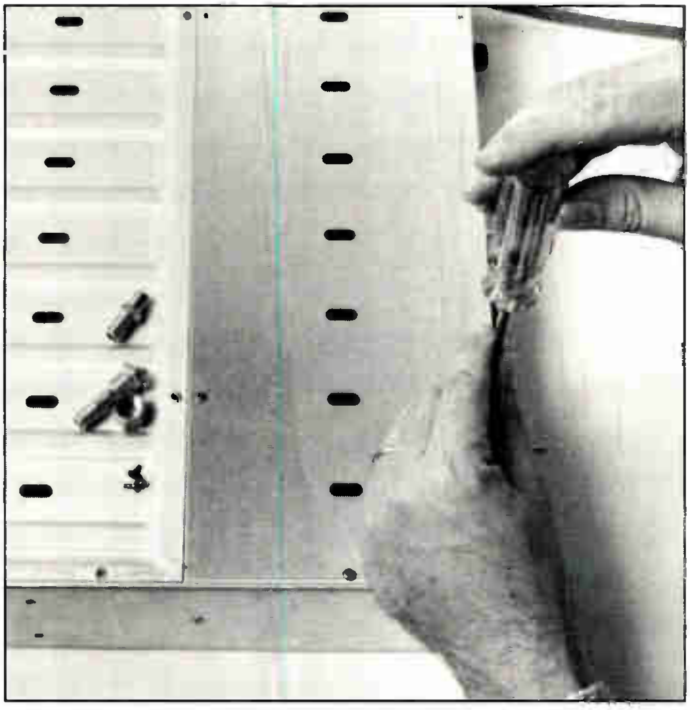


Step 14: Wrench tighten the cable's F connector.

Step 15: After new connectors, jumpers and other components have been replaced, install the rear compartment cover.



Step 16: Make sure all the screws are replaced and tightened.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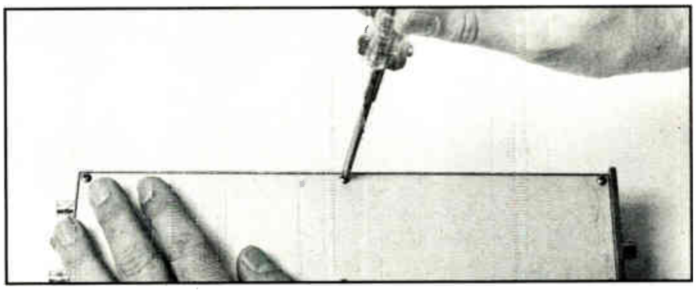
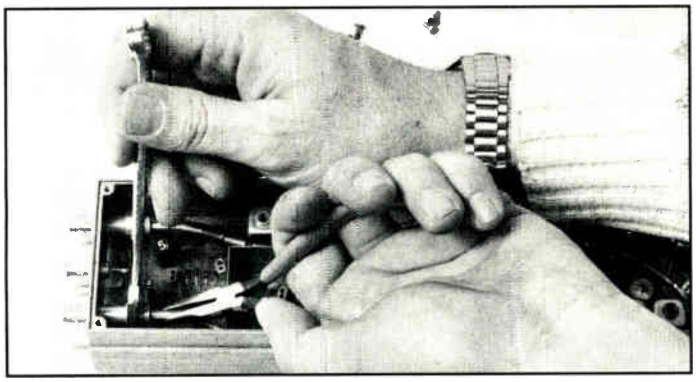
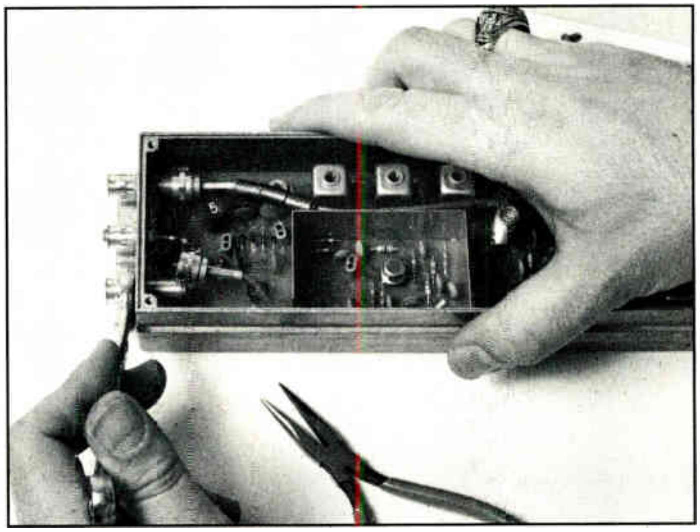
Inside the module



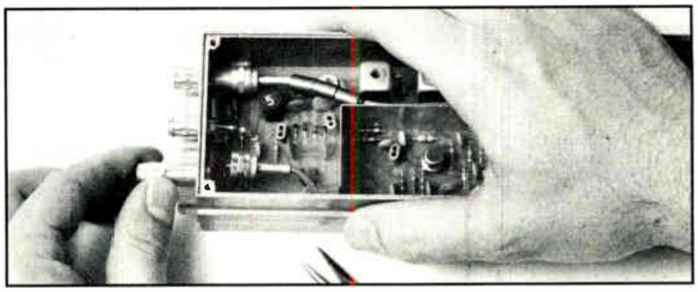
Step 1: Remove the six screws that hold each module cover in place.



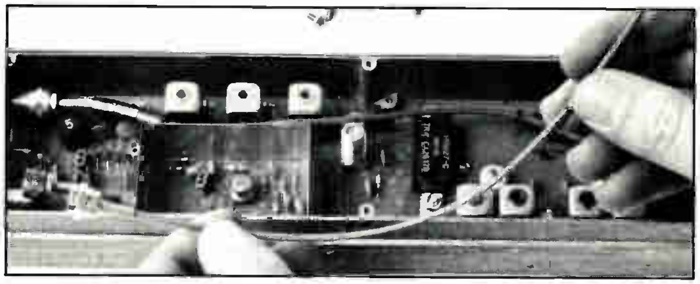
Step 2: To prevent twisting off the center pin of the RG-179 cable inside the module, grip the flat surfaces of the crimped retainer sleeve on the cable's F connector with needle nose pliers when disconnecting the cable from the module connector.



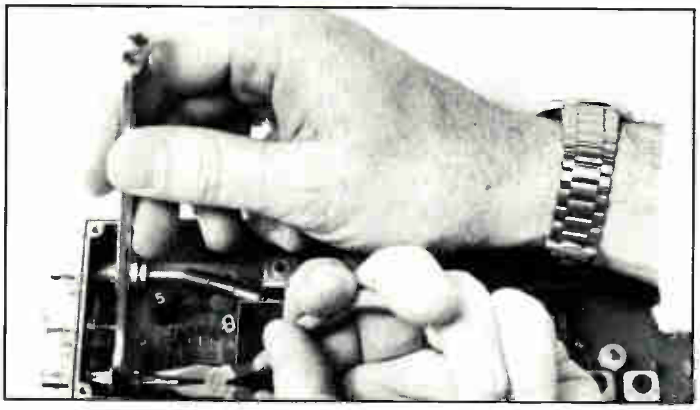
Step 3: Remove the module connector from the module.



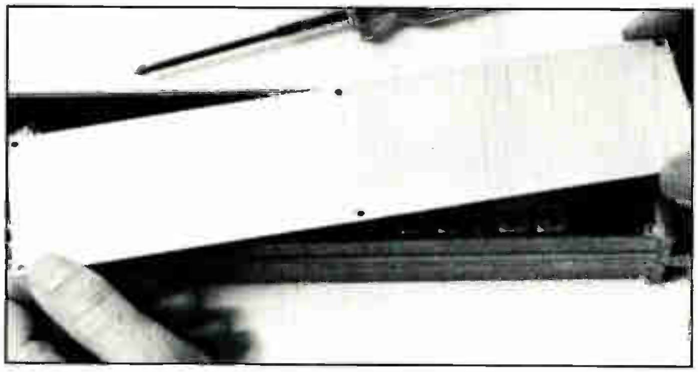
Step 4: Install the new connector and wrench tighten it. →



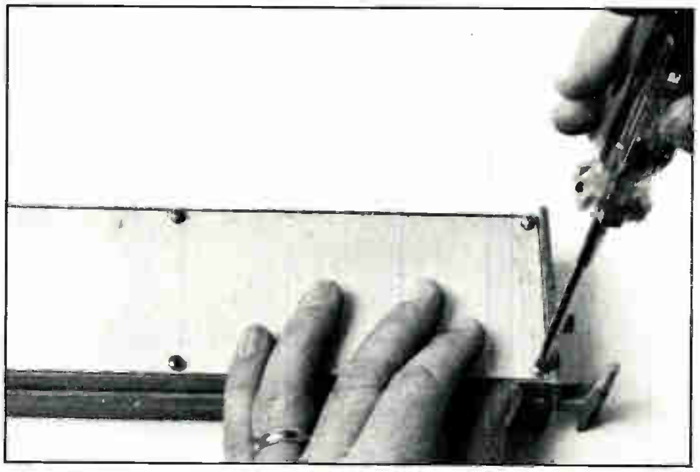
Step 5: If the RG-179 cable's center pin has been twisted off (or is broken internally), you will have to replace the entire cable assembly. The part number of the cable will vary depending upon the application.



Step 6: Carefully reconnect the RG-179 cable to the module connector, holding the retainer sleeve with needle nose pliers while tightening the F connector.

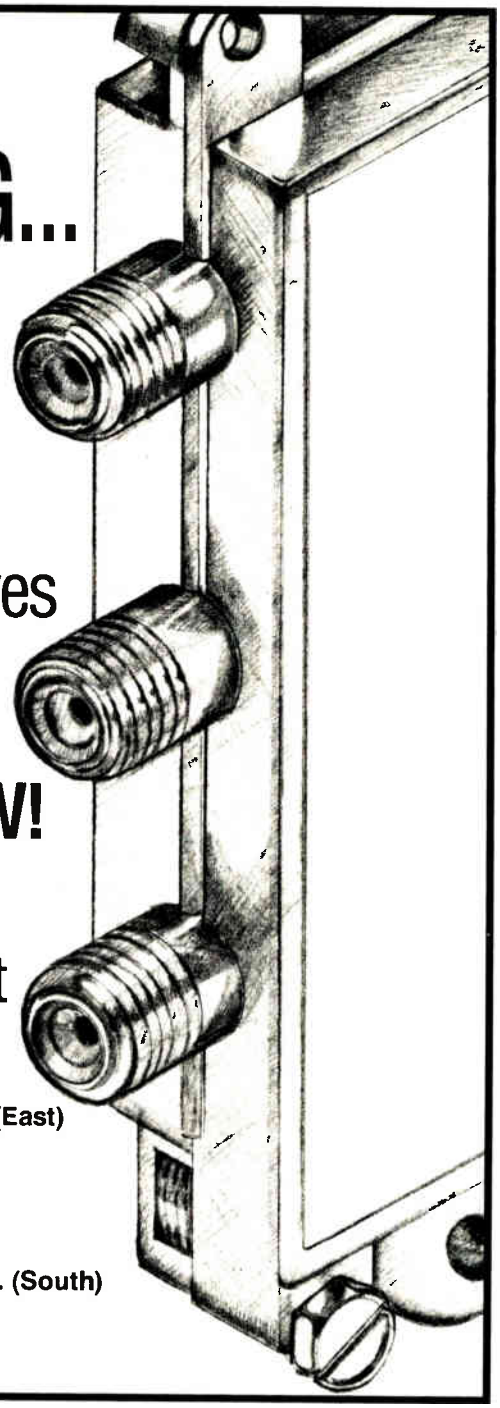


Step 7: Install the cover making sure the holes line up.



Step 8: Replace and tighten all the screws.

AD INDEX



Electrical code

(Continued from page 46)

ferences between them and between their associated wiring systems.

Explanation: The most common error made in grounding CATV systems is to connect the coaxial cable sheath to a ground rod driven by the CATV installer at a convenient location near the point of cable entry to the building. This is permitted by the code only if the building or structure has none of the ground means described in Sections 820-40(b)(1) or 820-40(b)(2), which is extremely unlikely. The code does not require that these grounding means be readily available; if they exist, they are required to be used.

Proper bonding of the CATV system coaxial cable sheath to the electrical power ground is needed to prevent potential fire and shock hazards. The earth cannot be used as an equipment grounding conductor or bonding conductor as it does not have the low-impedance path required. See Section 250-91(c).

Both CATV systems and power systems are subject to current surges as a result, for example, of induced voltages from lightning in the vicinity of the usually extensive outside distribution systems. Surges also result from switching operations on power systems. If the grounded conductors and parts of the two systems are not bonded by a low-impedance path, such line surges can raise the potential difference between the two systems to many thousands of volts. This can result in arcing between the two systems; for example, wherever the coaxial cable jacket contacts a grounded part, such as a metal water pipe or metal structural member, inside the building.

If an individual is the interface between the two systems and the bonding has not been done in accordance with the code, the high-voltage surge could result in electric shock. More common, however, is burnout of the TV tuner, as this part is almost always an interface between the two systems. The tuner is connected to the power system ground through the grounded neutral of the power supply, even if the TV set itself is not provided with an equipment grounding connector.

Also see commentary following Sections 250-71(b)(3) and 820-33(b) in the handbook for more details.

820-41. Equipment grounding. Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

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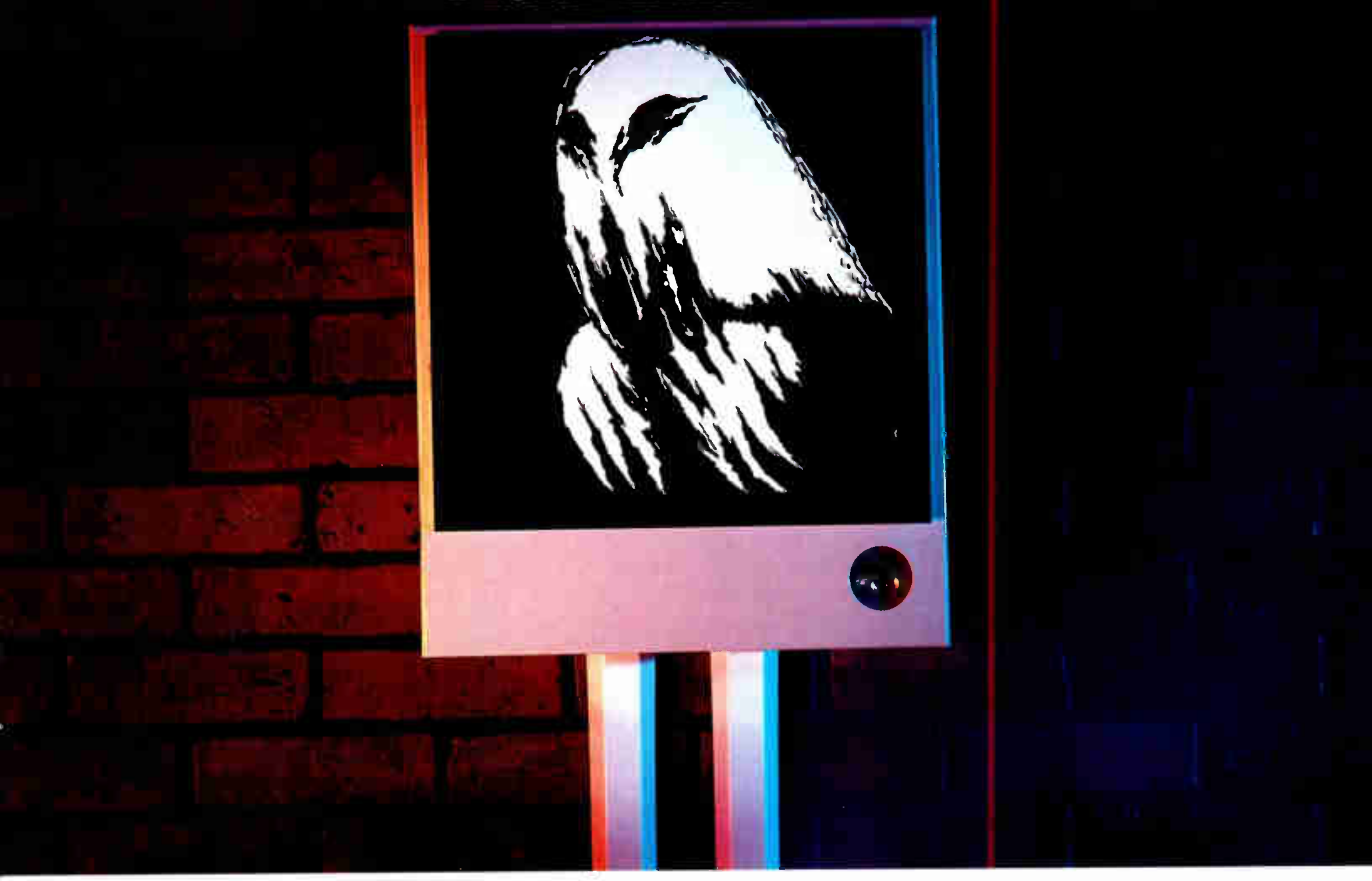

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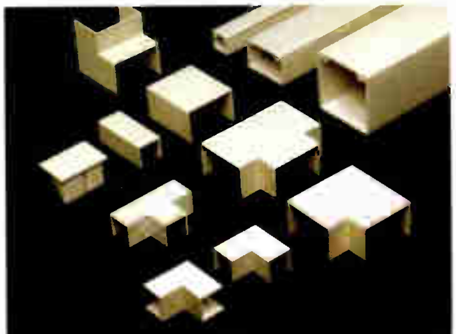

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May

May 1: SCTE New York City Meeting Group technical seminar on sweep maintenance, Staten Island Cable, Staten Island, N.Y. Contact Andy Skop, (201) 722-1935.

May 1-3: Magnavox mobile training center seminar, San Antonio, Texas. Contact Amy Costello Haube, (800) 448-5171.

May 1-4: Siecor Corp. technical seminar on fiber-optic installation and splicing for LAN, building and campus applications, Hickory, N.C. Contact (800) 634-9064.

May 2: SCTE North Country Chapter technical seminar on BCT/E Category II—Video and Audio Signals and Systems, Sheraton Midway, St. Paul, Minn. Contact Rich Henkeymeyer, (612) 522-5200.

May 2-4: AT&T fiber-optic seminar on splicing and testing, AT&T Regional Training Center, Atlanta. Contact (800) TRAINER.

May 5: SCTE Rocky Mountain Chapter technical seminar on RF and video testing, ATC National Training Center. Contact Steve Johnson, (303) 799-1200.

May 6-7: SCTE Old Dominion Chapter technical seminar, Holiday Inn, Richmond, Va. Contact Margaret Davinson-Harvey, (703) 248-3400.

May 7: TV Active '90 conference on interactive TV, Four Seasons Hotel, Beverly Hills, Calif. Contact Sally Chin, (212) 382-3929.

May 7-8: AT&T fiber-optic training on testing fiber, AT&T National Product Training Center, Dublin, Ohio, and AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.

May 8: SCTE Central Illinois Chapter technical seminar on preventive maintenance, Sheraton Normal Hotel, Normal, Ill. Contact Ralph Duff (217) 424-8478.

May 8: SCTE Chattahoochee Chapter technical seminar, Perimeter North Inn and Conference Center, Atlanta. Contact Richard Amell, (404) 394-8837.

May 8-10: Magnavox mobile training center seminar, Orlando, Fla. Contact Amy Costello Haube, (800) 448-5171.

May 9: SCTE Mount Rainier Chapter technical seminar on outage control. Contact Sally Kinsman, (206) 821-7233.

May 9: SCTE Dairyland Meeting Group technical seminar, Amora Villa Motor Lodge, Appleton, Wisc. Contact John Boltik, (715) 834-3151.

May 9-11: AT&T fiber-optic seminar on communications, AT&T National Product Testing Center, Dublin, Ohio. Contact (800) TRAINER.

May 10: SCTE Big Country Meeting Group technical seminar, San Angelo, Texas. Contact Albert Scarborough, (915) 698-3585.

May 10: SCTE Big Sky Meeting Group technical seminar on distribution, Colonial Inn Best Western, Helena, Mont. Contact Marla DeShaw, (406) 632-4300.

May 10: SCTE Sierra Meeting Group technical seminar on introduction to data and LAN, Oxford Suites Hotel, Roseville, Calif. Contact Steve Allen, (916) 786-2469.

May 10-11: Siecor Corp. technical seminar on FDDI network design and implementation, Hickory, N.C. Contact (800) 634-9064.

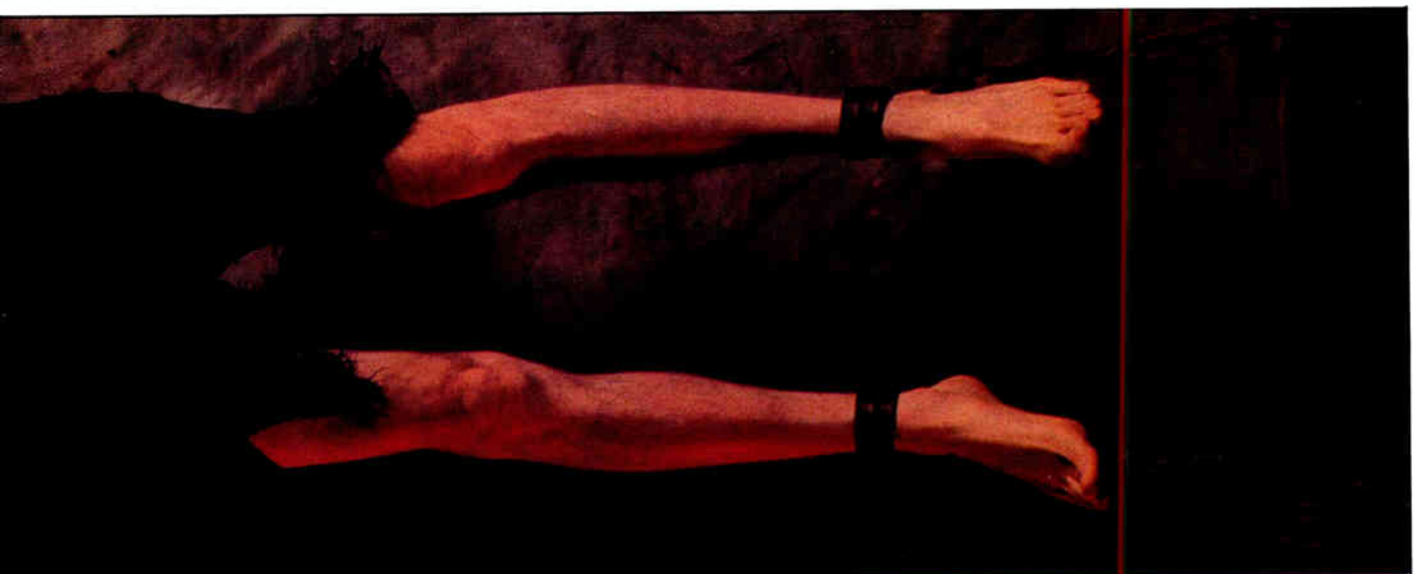
May 12: SCTE Sierra Meeting Group BCT/E review day for exams, Jones Intercable, Roseville, Calif. Contact Steve Allen, (916) 786-8597.

May 14-16: AT&T fiber-optic

training on underground lightguide, AT&T Bell Laboratories, Chester, N.J. Contact (800) TRAINER.
May 14-16: AT&T fiber-optic training on fiber to the customer, AT&T Regional Training Center, Atlanta. Contact (800) TRAINER.
May 14-17: Business Systems Inc. annual users' conference, Hilton Head Island, S.C. Contact (803) 297-9290.
May 14-18: AT&T fiber-optic training on installation and splicing, AT&T National Product Training Center, Dublin, Ohio, and AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.
May 15: SCTE Ohio Valley Chapter technical seminar, Cleveland. Contact John Wise, (513) 223-4077.
May 15-18: Siecor Corp. technical seminar on fiber-optic installation and splicing for LAN, building and campus applications, Hickory, N.C. Contact (800) 634-9064.
May 16: SCTE Ohio Valley Chapter technical seminar, Cincinnati. Contact John Wise, (513) 223-4077.
May 16-18: AT&T fiber-optic training on aerial lightguide, AT&T Bell Laboratories, Chester, N.J. Contact (800) TRAINER.
May 19: BCT/E Categories I, IV, V, and VII examinations, Roseville City Hall, Roseville, Calif. Contact Steve Allen, (916) 786-8597.
May 19: BCT/E Categories II, III, V, and VI examinations, Viacom headquarters, Pleasanton, Calif. Contact Wayne Sheldon, (408) 436-2930 or 436-2912.
May 20-23: National Cable Television Association Convention and Exposition, Georgia World Congress Center, Atlanta. Contact Kelly McGowan, (202) 775-3690.
May 21-24: FOCS fiber-optic workshop, Worchester, Mass. Contact (508) 757-0611.
May 21-22: AT&T fiber-optic training on testing fiber, AT&T Regional Product Training Center, Atlanta. Contact (800) TRAINER.
May 21-24: AT&T fiber-optic training on splicing fiber, AT&T Regional Product Testing Center, Atlanta. Contact (800) TRAINER.
May 21-25: Fiberoptic Communications Corp. fiber-optic workshop, Sturbridge, Mass. Contact (508) 347-7133.
May 22-24: C-COR technical seminar on basic theory, installation and maintenance of cable TV systems, Allentown, Pa. Contact Teresa Harshbarger, (800) 233-2267.
May 23: SCTE Piedmont Chapter technical seminar on signal processing center. Contact Rick Hollowell, (919) 968-9661.
May 24-25: AT&T fiber-optic training on assembling connectors, AT&T National Training Center, Dublin, Ohio. Contact (800) TRAINER.
May 29: SCTE Satellite Tele-Seminar Program on HDTV (Part 1). To air from 12-1 p.m. (ET) on Transponder 2 of Galaxy III. Contact (215) 363-6888.

Planning ahead

June 21-24: SCTE Cable-Tec Expo, Nashville, Tenn.
Sept. 16-18: Eastern Show, Washington, D.C.
Sept. 18-20: Great Lakes Expo, Indianapolis.
Oct. 2-4: Atlantic Cable Show, Atlantic City, N.J.
Oct. 9-11: Mid America Show, Kansas City, Mo.
Nov. 28-30: Western Show, Anaheim, Calif.



Century Cable TV appointed **David Randolph** to the newly created position of regional director of engineering. Previously he was vice president of engineering in the southwest division of Paragon/American Television and Communications.

John Pitts was named director, technical operations for the Philadelphia cable operations by **Greater Philadelphia Cablevision**. Most recently he was director of technical operations for American Cablesystems of California.

Channelmatic announced a reorganization of its management team. **David Castellini** officially accepted the position of president and COO. He was acting president in the last year.

Richard Rager was appointed executive vice president by the company. Formerly he was vice president of corporate engineering at Xscribe.

Don Kritzer was named controller for the company. He previously held financial executive positions with high technology companies, including Xentek.

Jerrold appointed **Patricia Harkins** the product manager in the product marketing group. Prior to this, she was the senior financial analyst in the company's distribution systems division finance department.

Tom Dennis joined **Shaffer Communications Group** as a director of engineering. Most recently he was a consultant.

Kevin Drew joined **Lightning Master** as vice president of operations. Most recently he was a representative for Lafayette Tower Service.

Callahan

Anixter named **Ed Callahan** vice president of technology. Prior to this he was a consultant.

K-Prime Partners announced two new vice presidents. **David Beddow**, previously corporate vice president and chief strategic officer for Comsat Corp., was named vice president and general manager for KPP.

Thaddeus Mazurczyck was appointed vice president of engineering. Before this he was manager, new products and services for GE American Communications.

Comcast Corp. elected five senior vice presidents. **John Alchin** was named senior vice president and treasurer. Formerly he was managing director of merchant banking services at Toronto Dominion Bank. **Thomas Baxter** was appointed senior vice president and president of Comcast Cable Communications. Previously he was regional vice president of the Midwest region and senior vice president of operations for the company's cable division. **Robert Clasen** was named senior vice president and president of Comcast International Holdings. Prior to this he was president of Comcast Cable Communications. **Lawrence Smith** was named senior vice president, accounting and administration. He joined Comcast in 1988 with responsibility for financial administration and corporate accounting. Finally, **Stanley Wang**, who has served as general counsel to Comcast since 1981 and secretary since 1989, was also named a senior vice president.

North American Philips Corp. appointed **Dennis Horowitz** president of the Philips Components discrete products division. Previously he was president of Magnavox CATV Systems.

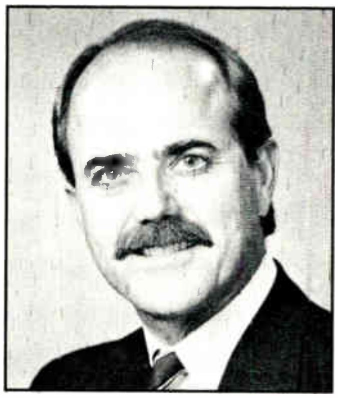
Arthur Sando was named vice president, marketing and communications by **Comsat Video Enterprises**. Previously he held a similar position at Turner Broadcasting System.

Brauer

Magnavox CATV Systems appointed **Dieter Brauer** president and chief executive officer. Previously he was vice president of engineering for the company.

Jones Spacelink made two new appointments. **Thomas Autry** was named general manager for the company's Lodi, Ohio, system. Previously he was chief technician there.

Joel Hudson was appointed general manager for the company's Lake Almanor, Calif., and Winnemucca, Nev., systems. Before this he worked as general manager for the Rosenburg, Texas, system.



Watson

Michael Watson was appointed the new Southeastern regional sales manager by **Channelmatic**. Before this he was an advertising sales representitive for Austin CableVision.

Jones Intercable named **James Honiotes** as general manager of its Colorado systems and **Ann Montague** as manager for the company's Broomfield, Colo., system. Honiotes was previously the director of programming for the company. Montague formerly was the office manager for the Broomfield system.

Van Valkenburg

David Van Valkenburg was named president and COO of **MultiVision Cable TV Corp.** Most recently he was the president and COO of Cablevision Industries Inc.

Gee whiz!

By Archer S. Taylor
Senior Vice President of Engineering
Malarkey-Taylor Associates

Telecommunications is in a ferment. New techniques and concepts boil up out of the laboratories in such bewildering profusion we can only gasp and say: "Gee whiz!"

Technology tells us what can be done. If technology were to explain with mathematical and scholarly precision what cannot be done, engineers and even hobbyists would probably do it anyway, without realizing it couldn't be done. No longer inescapable, the natural laws of physics are being exploited to achieve the seemingly impossible, like "flying to the moon." The success of those incredibly adventurous, gravity defying space flights is the direct result of learning how to take advantage of the interaction between the laws of gravity and the laws of motion. Likewise, the technological success of high definition television (HDTV) will necessarily derive from exploiting to the fullest the natural laws of information transfer and the physiology of human vision. Perhaps it is not too arrogant to suggest that, given enough time, money and motivation, engineers can do anything. Well, almost anything.

If the price is right

But what technology says can be done often does not happen. Why not? There are many reasons. In our business we are interested in potential revenue producing opportunities—especially among residential households. Technology that enables consumers to do normal things in easier, faster, better, cheaper or more efficient ways tends to be readily accepted—if it works as advertised, is easily understood and the price is right. For example, have you seen the high tech plastic egg that changes color in a pot of boiling water to indicate whether the real eggs are runny, soft-boiled, firm or hard-boiled? It does work. The cooks love it because it takes away the guesswork.

On the other hand, technology that enables consumers to do something new that they have not yet even thought about doing is hard to sell, especially if they have to learn how and it costs too much. Consumers first have to be persuaded that the thing is worth doing.

Creating an awareness of needs not previously recognized is a task for advertising, not technology. Thomas Edison and Alexander Graham Bell were unusually perceptive in anticipating the future consumer interest in recorded music and voice communication by wire. Today's scientists and engineers are far more adept at discerning what technology can do than in creating consumer demand.

"Now the RBOCs plus GTE and Contel are replicating our old lists as well as our old optimism about what the public will buy."

Even Edison and Bell had to wait for many years for such strange and unfamiliar ideas as the phonograph and telephone to become household words. Infinitely patient capital is often required to bring extraordinary new technology successfully through a long, dry period while people get used to the idea. Patient capital is a rare commodity in the current investment environment where the overriding criterion is the short-term payoff. Even the intensive "Talk Back to Your TV" promotional campaign failed to make Warner's QUBE a significant part of everday life. Short-term results were simply too inauspicious to justify the additional capital expense that may have been needed to upgrade the technology and survive the long gestation period preceding the emergence of viable consumer demand.

Social reality

Technically sound and feasible developments that conflict with social reality on personal characteristics may also fail to generate significant consumer interest. The personal computer, for example, was once touted as an easy way to balance the checkbook and prepare tax returns. But for consumers who lack the discipline to enter each check accurately and promptly or to keep complete income and expense records (like most of us), even a supercomputer is not much help. Fortunately, there were more persuasive reasons for consumers to buy personal computers.

A few years ago, the magazine for amateur fliers, *AOPA Pilot*, published an article titled "Roads Not Taken—And a Good Thing, Too!" The only thing missing in 1947 from the flying motorcycle that Piper called the Skycycle was the kickstand; but it failed to sell. Piper had fallen for the recurring myth that Americans wanted single-seat, light airplanes. The idea of "flying cars" continues to surface from time to time. "Developed by one inventor after another for a thankless public," says the *AOPA Pilot*, "these vehicles were designed with the intention of leaping over massive traffic jams in a single bound. They have appeared on television and in a James Bond movie, but they have yet to play any kind of role in real life."

HDTV—a flying car?

Will HDTV and its intrinsic partner, the large flat panel video display, be the "flying cars" of the 1990s: technically feasible, definitely desirable, almost certainly too expensive and potentially incompatible with traditional living arrangements? Or will the TV manufacturer's and retailer's need for new products to stimulate expanded sales lead to sufficient price reductions and marketing efforts to create a genuine demand for the "new TV"?

Only time will tell. But I would guess that most of us will be watching the celebrations on New Years' Day in the year 2000 on 24- to 35-inch conventional TV sets with improved NTSC picture quality, while a few million of us (maybe 2 or 3 percent) watch on 40- to 50-inch rear-projection LCD screens or perhaps on 3×5-foot flat panel HDTV screens that cost between $5,000-$10,000 (equivalent 1990 dollars).

By 2010, all bets are off. By then line scanned, analog TV and terrestrial broadcasting may have joined the dodo and vacuum tube. On the other hand, that was expected 40 years ago to be the fate of sound radio. Instead, the number of AM stations doubled between 1949 and 1989 and there are more FM stations in operation today than AM. On second thought, NTSC TV may still be with us when my grandsons retire.

For at least 30 years, cable TV people have talked eloquently about various technically feasible ancillary non-video services that might be provided on the coaxial network for additional revenue. Now the Regional Bell Operating Companies (RBOCs) plus GTE and Contel are replicating our old lists as well as our old optimism about what the public will buy. They have the deep pockets and they may even be the patient investors. They may in fact be able to develop the residential market for information services that has so far evaded others. But, will their price be right or will they have to concentrate on the upscale 10 percent market, leaving the rest to less sophisticated, less expensive competitors?

Meanwhile, they tell us they can enable the working mother to shop at home, bank at home and monitor the kids. They can read gas, electric and water meters, shed peak loads and control the "Smart House." They can eliminate traffic congestion by making it possible to work at home with computers. They can provide plane, train and bus schedules, encyclopedias and sell theatre tickets.

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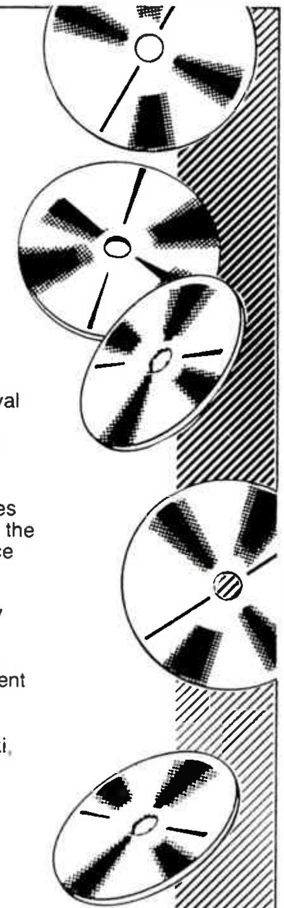

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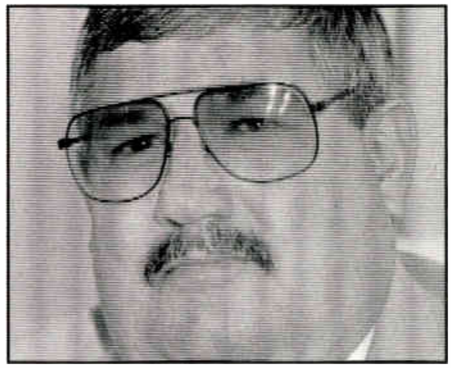
Answering the call

By Jack L. Trower
President, Society of Cable Television Engineers

If everything has gone as planned you should be reading this while the National Show is going on in Atlanta. The Society of Cable Television Engineers board of directors will have met and our newest members of the board will have gotten their feet wet, their heads full of knowledge and as many assignments as I could get them to accept.

We have three new members on the board and I would like to tell you who they are. The new at-large director we elected this time is Thomas Elliot of TCI. Elliot is presently serving as vice president of CableLabs and is the chairman of the SCTE Interface Practices Committee. The new Region 10 director is Mike Smith of Adelphia Cable, who is the MSO's regional engineer in Virginia. He has been very active in the SCTE especially at the chapter level and we expect he'll continue his hard working ways. The new Region 12 director is Walt Ciciora, vice president of technology at ATC. He has credits too numerous to mention here, but he is the chairman of the newly created SCTE Fellow Member Committee. In Regions 3, 5, 7 and 8 the incumbents were re-elected so we have a mixture of old and new for the next year.

There were seven positions on the board up for election this time and we had 24 candidates running for those positions. I can't remember ever having that many people interested in being on the board. I guess its a sign that the Society is healthy and on the right track. It also means that there were 17 individuals who were deserving but did not get elected. I hope this does not mean they will quit trying to achieve a goal they set for themselves. Good dedicated people are what the Society needs and this attitude of wanting to serve the SCTE in a demanding job is what we need to continue our success.



"With these new (additions)...the Society will be in a position to provide some of the needed solutions to...the industry today."

Thank you

Another product of electing three new members to the board is that three old members are no longer with us on the board. Two of these members declined to stand for re-election and the third lost a very close race. These three members who we will all miss are Dave Willis of TCI, Robert Price of Brad/PTS and Wendell Bailey of the NCTA. Having had the pleasure of serving on the board the past two years with these gentlemen and having had their support during my term as president of the Society, I can tell you that they are hard working individuals who are dedicated to the goals of the Society and the good of the entire cable industry. I want to say to them "thank you" from myself and the entire Society.

Bill Riker, our Society's executive vice president, tells me that we are well over 6,400 active national members and over 500 installer members. What a pleasure it is to see our growth especially at the installer level, which is usually those newer individuals in the industry. New members with new ideas are what keep any organization growing.

I would say that with these new board members, these new national members, these new installer members and all their new ideas, that the Society will be in a position to provide some of the needed solutions to all the opportunities facing the industry today. I know a technically better product goes a long way toward keeping customers happy and complaints to elected officials to a minimum.

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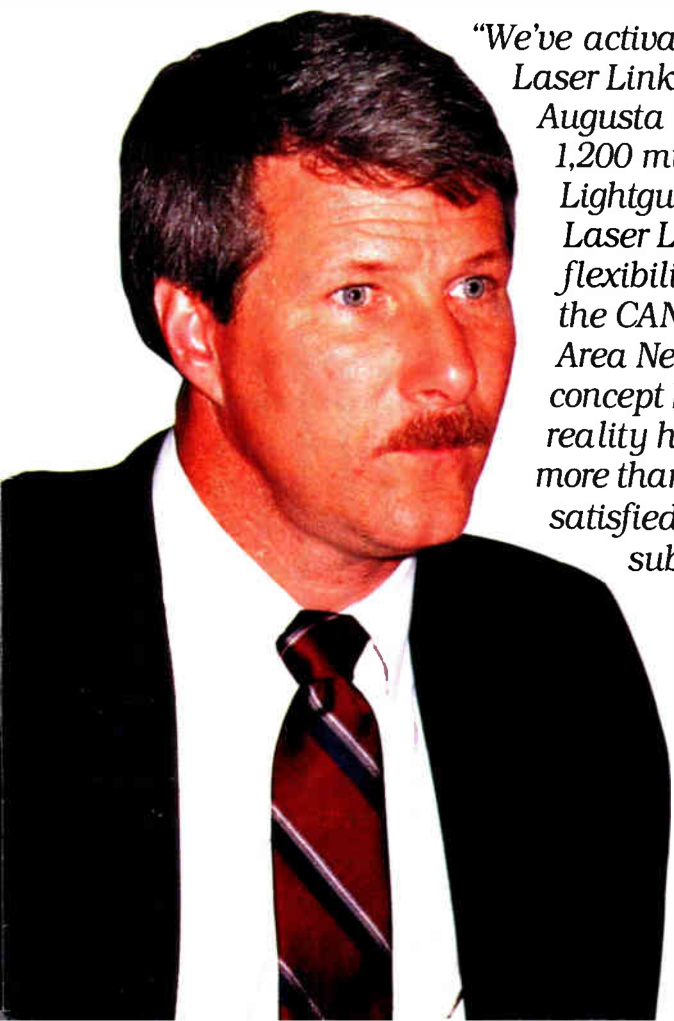

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