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July 1991

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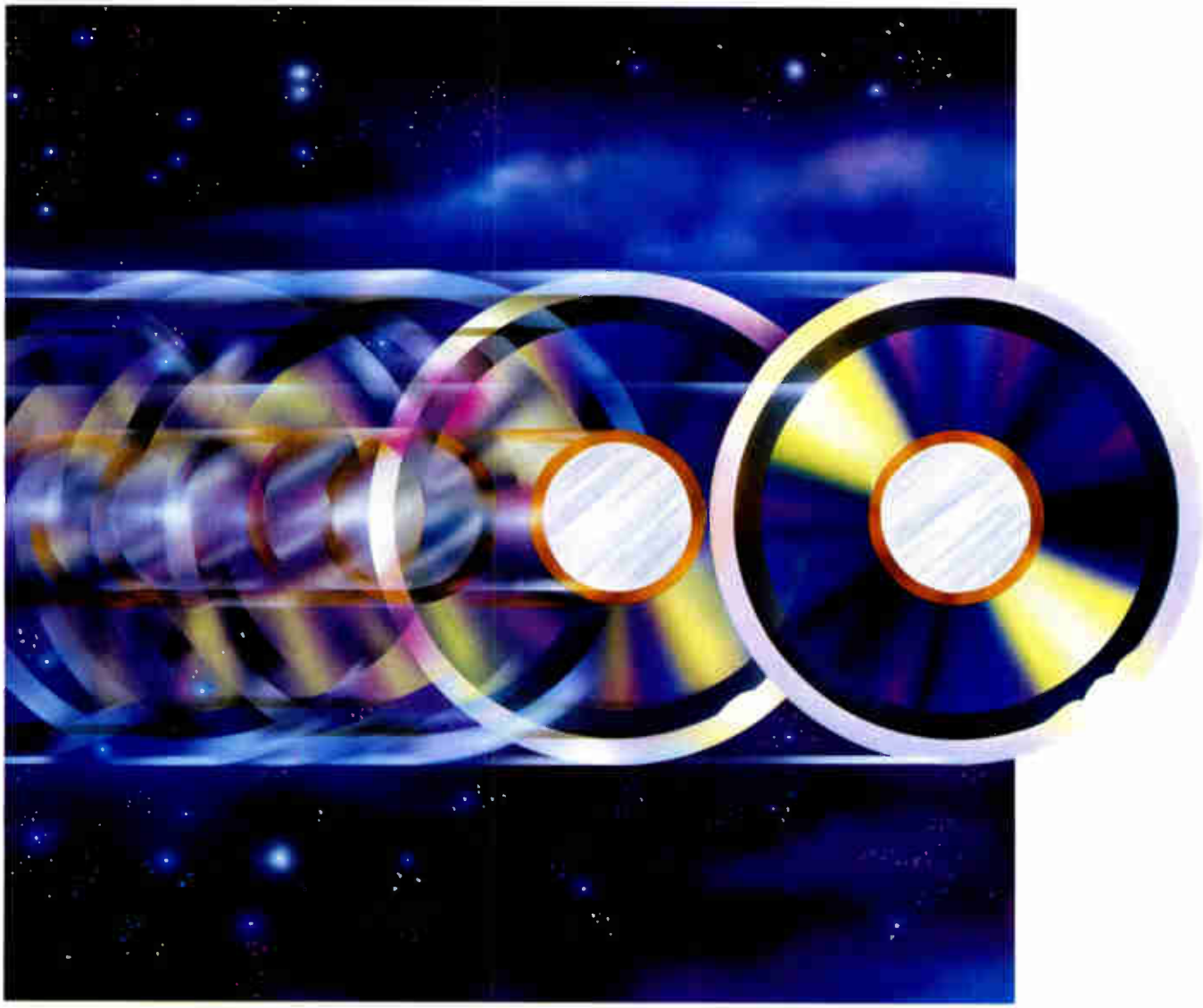

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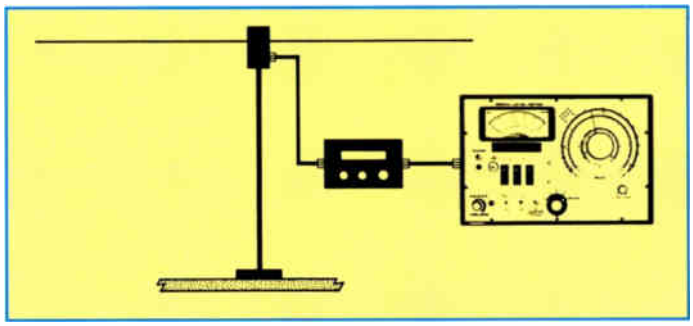

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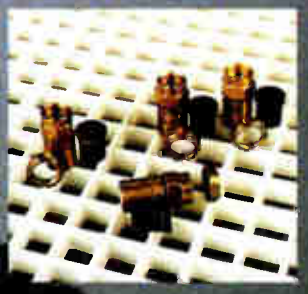

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EDITOR'S LETTER

Getting better but...

Here it is July already — a year has passed since your first CLI and by now you should've sent this year's paperwork in. Hopefully you even avoided the rush and finished well before the deadline. So, how'd you do?

Well, if you're like most operators, your CLI this time was lower than last year's. Your quarterly monitoring program is effective and leakage is for the most part under control. You've checked the headend and frequency offsets are holding right where they're supposed to. When you fire up a new section of plant, you do a mini-CLI before fully activating it. Heck, even your service calls have dropped, and your techs and installers are commenting that picture quality has never been better.

But I wonder if everything is really as good as I've described. After all, over the last several months systems in at least four states have been ordered by the FCC to turn off aeronautical channels because of severe leakage. Yes, those systems' channels were turned back on, but only after the leakage was cleared up.

Even in my continuing unofficial checks of systems I visit when traveling (I use a very sensitive amateur radio to pick up signals in the 130 to 180 MHz range), leakage appears to be getting better. But I still find problems, especially in hotels with cable-compatible TV sets.

But I've heard something that is a little disturbing. And it comes from at least two different sources, both of whom are fairly well-known and respected in the technical community. *Apparently there are some system operators who are falsifying their CLI reports to the FCC.* I won't say who told me or even where those systems might be.

But when management or the engineering staff in those systems encourages throwing out the high leakage numbers, or just plain making up a passing figure, I can only hope that the next visit the FCC makes is to their systems! This problem apparently is not real widespread, but it is not necessarily confined to small or independent operators, either. Some larger MSOs may be surprised to find that it's going on right under their noses. It's this kind of behavior that gives our industry a black eye.

Ham radio invitation

So you've always had an interest in amateur radio, but wanted nothing to do with Morse code? Well, guess what? The FCC earlier this year changed the rules and eliminated Morse code from requirements for the Technician class of license. There are five grades of license in ham radio: Novice, Technician, General, Advanced and Amateur Extra. The Novice class historically has been the entry-level license, requiring passing a 30-question written exam and the ability to copy Morse code at five words per minute. Technician class also required the code at five WPM, as well as a 25-question exam. The other grades had progressively harder exams and tougher code requirements (13 WPM for General and Advanced, and 20 WPM for Extra).

Now you can enjoy this hobby by passing a 55-question written exam (the Novice and Technician tests), but no Morse! The "no-code" privileges include everything above 30 MHz, including the popular 2-meter amateur band. Heck, even Dan Pike got his license (now if only he'd spring for a radio...), fulfilling a commitment he made more than 15 years ago to ATC's Steve Johnson. I understand it was something to the effect: "If they ever get rid of that darned code, I'll get a license." Well, they did, and Dan kept his promise. Congratulations, Dan, and welcome to the hobby.

If you're interested in becoming a ham, contact the American Radio Relay League, 225 Main St., Newington, Conn. 06111; (203) 666-1541.

Ronald J. Hranac
Senior Technical Editor

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Reader Service Number 9

TCI, UAE to merge

DENVER — **Tele-Communications Inc.** and **United Artists Entertainment** signed a merger agreement under which UAE is to become a wholly owned TCI subsidiary. The deal, which should close later this year, was approved by both companies' boards and now must be approved by UAE and TCI stockholders and earn regulatory approvals.

150-channel system announces suppliers

STAMFORD, Conn. — **Time Warner** announced the companies that will develop and manufacture the essential components for its 1 GHz Queens, N.Y., interactive cable system. **Nexus** will produce the headend modulators, **Pioneer** will supply the set-top converters and **Jerrold** will provide laser transmitters and optical receivers. **C-COR** is to manufacture the amplifiers and **Augat** will supply in-home distribution amplifiers for subscribers with multiple TV sets. Finally, **Scientific-Atlanta** will provide the 1 GHz system taps and **Regal** (a division of **Antec**) will supply indoor splitters and couplers.

☛ **Magnavox** donated a 550 MHz cable TV system with an eight-amplifier cascade, line extenders, taps and passives over 1.5 miles of coaxial cable for use in **CableLabs** tests.

☛ **Pioneer** was selected as the addressable converter supplier for the 42,000-sub **Columbia Cable** system in Vancouver, Wash. The order exceeds $1 million.

☛ Management/consulting firm **Frank D'Alesio & Associates** will spearhead **Contec International's** domestic and international sales/marketing efforts.

☛ Fifty **Magnavox** line monitoring systems were ordered by **Simmons Communications**; the company has plans to purchase more in the future.

☛ **Cox Cable** awarded **S-A** a $2 million contract for AM fiber electronics to upgrade the Oklahoma City system. In other S-A news, sales for the quarter ended March were $114.3 million, which is off 29 percent from the same quarter a year ago.

☛ **Riser-Bond** announced a new sales/marketing strategy in which professional sales reps will now handle its products. All marketing through distributors will cease Sept. 1. Reps named are: Communications Supply, Western Systems and Service, Cable Technology Associates, Cable Equipment Corp., John Weeks, Mega Hertz Sales, Dacom, W. Whitaker & Associates, and Glade Communication.

☛ **Fibre Optic Communications Specialists** expansion of its cable assembly production department by 9,000 square feet is now operational.

☛ The **SCTE Rocky Mountain Chapter** now has its own hot line: (303) 721-5762.

☛ **Davis Antenna Wholesalers** is celebrating 17 years in business with the release of its 1991 spring/summer catalog. Contact (301) 843-1166.

☛ **Flow Mole Corp.**, which produces trenchless technology for installation of underground plant, changed its name to **UTILX**.

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Reader Service Number 11

mance — were presented to Jennifer Hays of Metrovision, Rikki Lee of CT Publications, Rob Marshall of the Mid-America Cable TV Association and Mark Wilson of Air Capital Cablevision in Wichita, Kan.

• The second inductee into the SCTE Hall of Fame, Len Ecker, was named. In 1988, SCTE created its Hall of Fame and honored the late Cliff Paul as its first inductee.

• CableLabs was the recipient of the 1990 President's Award in recognition of its support of the Society through the sponsoring of an SCTE technical training videotape (see related story) on Category VII of the Broadband Communications Technician/Engineer (BCT/E) Certification Program, "Engineering Management and Professionalism," as well as a variety of planned cooperative efforts between the two organizations.

• Steve Allen of Jones Intercable was the 1991 recipient of the Society's Member of the Year Award in recognition of his service to the Society. Included among his SCTE activities are serving as co-chairman of the Expo '91 Program Committee and co-founding and coordinating numerous events with the Society's Sierra Chapter.

CableLabs sponsors society training video

Cable Television Laboratories will underwrite the funding of the production of an SCTE training videotape on BCT/E Category VII, "Engineering Management and Professionalism." The agreement between CableLabs and SCTE on the training video marks the biggest step to date in cooperative efforts between the two cable industry technological entities.

CableLabs President Dr. Richard Green had suggested close working relationships between CableLabs, SCTE and the NCTA Engineering Committee in the keynote address he gave at SCTE's Cable-Tec Expo '90 held in Nashville, Tenn. There have been several meetings of representatives of these groups since that conference.

"CableLabs is committed to working with SCTE to build a stronger and more influential engineering community to support the industry," said Green. "The cable industry has three valuable organizations on which to rest the professional growth, training and development of new technology." Green said the training video effort is the first in what will be a series of joint efforts with SCTE to address engineering training.

"We are extremely pleased to announce this first step in what we hope will be a continuing cooperative effort to provide technical training services for the industry," stated SCTE Executive Vice President William Riker. "The video will be of great assistance to the 2,200 technicians and engineers currently seeking full certification in the Society's BCT/E program."

CableLabs is a research and development consortium of cable TV system operators representing more than 85 percent of the cable subscribers in the United States and 20 percent of the subscribers in Canada. CableLabs plans and funds research and development projects that will help cable companies take advantage of future opportunities and meet future challenges in the TV industry. It also transfers relevant technologies to member companies and to the industry. In addition, CableLabs acts as a clearinghouse to provide information on current and prospective technological developments that are of interest to the cable industry.

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Network Systems

CLI: One if by land, two if by air

By Bob Dickinson
President, Dovetail Systems Corp.

I know we are all tired of hearing about cable signal leakage but the phenomenon and its control is with us for the foreseeable future. The Federal Communications Commission requires it and the cable operator has a strong moral obligation to keep the ether clear of leakage from the cable system.

Over the past several years leakage control has become a tightly interwoven part of the cable system operation and maintenance. Supposedly, the first year (ending July 1, 1990) was the hardest and we all learned how to do it before that historic date. Many have got a good handle on leakage control and have improved their system performance and reduced their customer complaints as a direct result.

Unfortunately, some are still either oblivious to the issue or are purposely whitewashing their problems for FCC edification. We trust that these types are few in number and we might wish that they get caught and fined since their poor performance hurts the whole industry. But all of this is not the purpose of this article. Leakage control is still an ongoing problem and there have been numerous developments and refinements of techniques and equipment to address both leakage monitoring and annual qualification.

Techniques

I'm sure you remember how it works under Part 76 of the FCC rules. Essentially, the entire system must be monitored quarterly with leaks located and repaired, while an annual qualification is required either with ground measurements and computations or an aerial survey. The desire of the FCC is that monitoring will be an ongoing procedure, but in order to put some definite bounds on it the quarterly standard has been established.

Many techniques have been developed for monitoring, reporting and repairing leaks. The majority of them require trained personnel, as well as some amount of equipment, plus a system of reporting. Leaks may be monitored by driving down the street noting the response of a receiver tuned to the test signal and recording the approximate location and possibly the amplitude of the leak. Some have chosen to make the reporting process one that is done with a customer service rep taking information over the mobile radio rather than keeping a written log in the vehicle. We have heard of leakage crews who even spray paint on the road for ease of leak relocation for repair. Perhaps the most onerous part of the process is the necessity of assigning skilled people to carry out the monitoring and the repair functions.

Some have envisioned automatic equipment that could relegate the continual monitoring process to unskilled workers who simply pilot the vehicles, allowing technology to locate and record the leakage. A few manufacturers have addressed this need and come up with equipment designed to do essentially this. One interesting unit has been brought out by CaLan, which automatically detects and records the leaks, including the side of the road and the approximate offset. This data is recorded against geographic information generated by a vehicle navigation system that is part of the package. The CaLan Alan equipment is capable of using several available navigation systems, including augmented dead reckoning, GPS and Loran C.

ETAK

The first CaLan units in the field employ a vehicle navigation system called ETAK. This system includes digitized maps of the area and assumes that the vehicle is always on a map segment (street). In this way small errors in direction or distance traveled are periodically and automatically corrected to the street map. For instance, every time a turn is made onto a cross street the navigator realizes it is exactly at the corner and corrects the indicated location if necessary. On a straight road the course may drift to the right or left but the system corrects the track back to the map automatically.

Not only do these maps reference the streets but in most cases they provide house numbers for ends of each block. In this way the equipment can report a leak and interpolate its address from the end of block numbers and provide information to issue a work order referencing the street address. Presently, maps to operate the ETAK navigator are supplied on data tapes but in the very near future laser discs with extraordinary capacity will be employed.

GPS

The use of the global positioning satellite (GPS) navigation system is an alternate means of navigation for CaLan's Alan. The GPS system involves a constellation of ultimately 24 satellites and a very sophisticated method of timing and ranging. It is operated in a receive-only user mode. By receiving signals from three satellites simultaneously a two-dimensional fix (latitude and longitude) may be obtained; with four satellites, altitude above sea level also can be determined. There are many times when more than four satellites are in view, which tends to increase the precision of the computed geographic fix.

GPS in its normal mode is capable of better than 100-meter accuracy more than 95 percent of the time. Real life measurements prove that this is a conservative number and can be expected almost universally with reasonable satellite angles, etc. In some locations GPS service is not available for a full 24 hours a day, but as more satellites are put in orbit this limitation will disappear. In many cases the accuracy of GPS is in the vicinity of ±10 meters, but be cautioned that this is not a figure that can be expected in all situations. GPS also may not work well where there are any tall buildings or hills, excessive tree cover, etc.

As others have demonstrated, maps can actually be drawn from the GPS fixes as the vehicle moves. However, if GPS was the only navigator employed in the Alan, several features of the ETAK system would be lost including the initial presence of the map that forms the basis for navigation and includes all streets whether or not they are cabled.

ETAK, on the other hand, can become confused. On long stretches of road where no turns are made it is pos-

(Continued on page 34)

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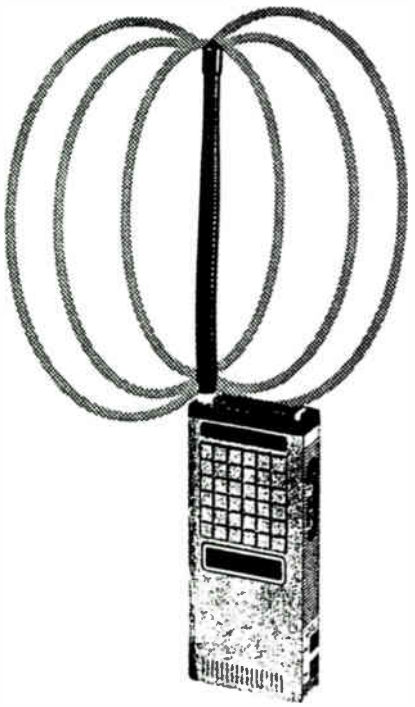
A review on leakage detection and measurement using Wavetek gear — Part 1

By Steve Windle
Product Marketing Engineer
And John Vendely
Senior Design Engineer
Wavetek Corp.

The Federal Communications Commission stimulated a heightened awareness of system leakage performance with new requirements related to the cumulative leakage index (CLI). Now that some time has passed since these requirements have been in effect, it may be helpful to review some of the practical aspects of a conscientious leakage program. Part 76 of the *Code of Federal Regulations (CFR)* describes a requirement for regular monitoring of the cable plant for leakage (76.614), and a requirement for an annual plant leakage test to ensure that the system is operating within specified criteria (76.611). Different equipment and procedures may be used to fulfill each of these requirements.

Figure 1: Rubber duck antenna pattern



Regular monitoring

Part 76.614 states: "Cable TV operators transmitting carriers in the frequency bands 108 MHz to 137 MHz and 225 MHz to 400 MHz shall provide for a program of regular monitoring for signal leakage by substantially covering the plant every three months. The incorporation of this monitoring program into the daily activities of existing service personnel in the discharge of their normal duties will generally cover all portions of the system and will therefore meet this requirement. Monitoring equipment and procedures utilized by a cable operator shall be adequate to detect a leakage source that produces a field strength in these bands of 20 μV/m or greater at a distance of 3 meters. During regular monitoring, any leakage source that produces a field strength of 20 μV/m or greater at a distance of 3 meters in the aeronautical radio frequency bands shall be noted and such leakage sources shall be repaired within a reasonable period of time. The operator shall maintain a log showing the date and location of each leakage source identified, the date on which the leakage was repaired, and the probable cause of the leakage. The log shall be kept on file for a period of two years and shall be made available to authorized representatives of the commission upon request."

A technician uses a dipole and meter to make a 10-foot measurement under overhead lines.

(Continued on page 38)

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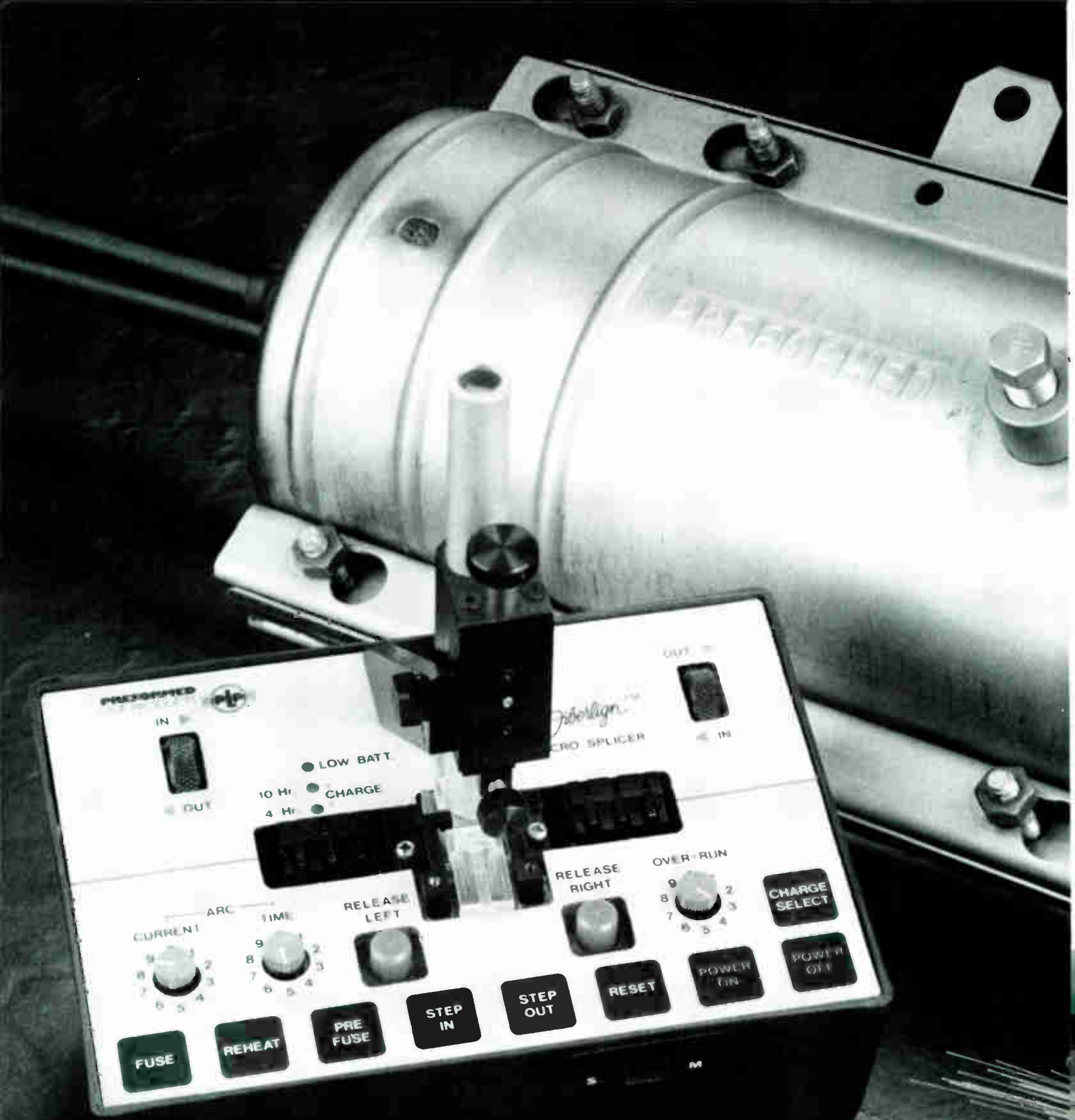
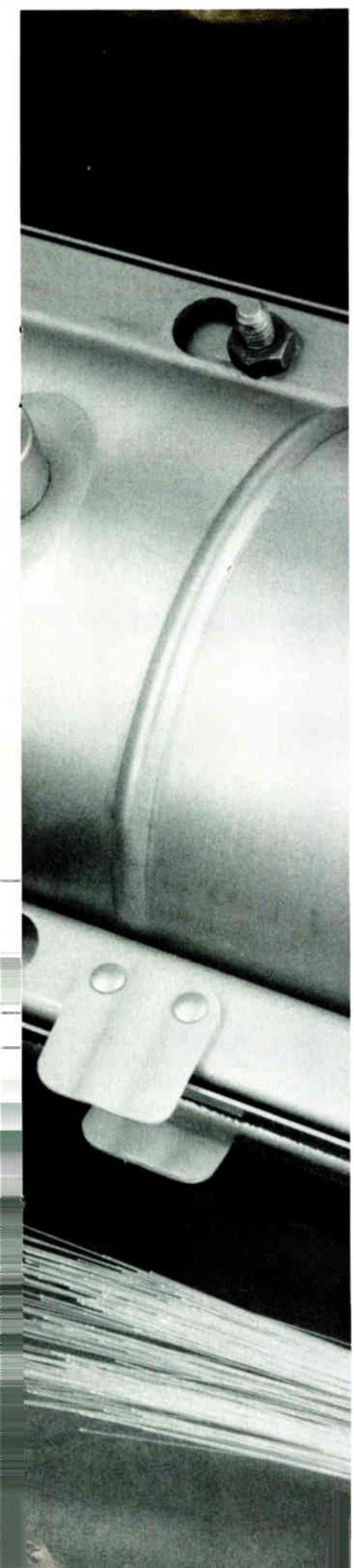


Contest Rules: No purchase is necessary. Entries accepted from authorized representatives throughout the United States faxing their names, title and phone number and the phrase "Please enter us in the Midwest CATV Breeder's Cup contest" on his/her company letterhead to 1 303 643-4797. Contest entry is limited to cable television systems companies only. The prize will be awarded in the company name. The winning company will determine the individual to be given the prize. Midwest CATV, its suppliers, parent companies, subsidiaries and ad agency are not eligible. This contest is void where prohibited by law. Only one entry per company is permitted. The odds of winning will be determined by the number of entries received. Contest entries will not be accepted if received by Midwest CATV after July 31, 1991. Total value of the prize is $2,158. Prize includes airfare from anywhere in the Continental United States to Louisville, Kentucky, hotel accommodations for two nights at the Ramada Hotel and roundtrip transportation from and to the airport. Certain restrictions apply. No cash or prize substitutions. For more information contact Midwest CATV at 1 800 MID-CATV or write: Midwest CATV Sweepstakes, Fairways II at Inverness, 94 Inverness Terrace East, Suite 310, Englewood, CO 80112. The winner's name may be obtained by writing Midwest CATV after August 20, 1991.



Have Some Fun Horsing Around courtesy of Midwest CATV and Preformed.

This month's Midwest CATV Customer Incentive Contest is featuring a trip to the races! The winner gets to try their luck at the Breeder's Cup.

You can enter the contest two ways. First, place your order for Preformed equipment during July, and write the phrase "Please enter me in the Midwest CATV Breeder's Cup Contest" on the bottom of your purchase order, and your company is entered. It's that easy!

Preformed features quality products like the Fiberlign™ MS-1008 Fusion Splicer and the Fiberlign™ Splice Case. The fusion splicer is a patented design which measures only 4" x 6" x 1.75" and weighs just two pounds. It has a battery pack which allows up to 80 splices between charges. A 50X microscope gives clean indication of the cleave quality, and it swivels to allow close inspection and alignment of "V" grooves. The Fiberlign™ Splice Case has easy-to-use lockbar fastening, which reduces installation and reentry time by 50%. It's corrosion resistant and has an airtight and watertight seal that's both lab tested and field proven.

The second way to enter the contest is for you, the company's authorized representative, to send us on company letterhead, via fax machine, your name, title, telephone number, and the phrase "Please enter me in the Midwest CATV Breeder's Cup Contest," and your company is entered.

Only one prize will be awarded. The prize includes roundtrip airfare from anywhere in the U.S., two nights lodging, and roundtrip transfers to and from the race. The winning company will be selected by August 20, 1991. So hurry and enter!

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Reader Service Number 16

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Testing for CLI with an SLM

By Harry Sadel
President, Sadelco Inc.

The following is a procedure for the measurement of field strength in microvolts per meter (μV/m) using most CATV-type signal level meters (SLM) for the purpose of determining compliance with Federal Communications Commission regulations of CATV cumulative leakage index (CLI).

Equipment required

1) A 75-ohm input signal level meter capable of measuring down to -35 dBmV or lower.

2) A 75-ohm wideband, low-noise preamplifier with a gain that is accurately known. It must be capable of extending the SLM measurement level down to -55 dBmV or lower.

3) A half-wave dipole antenna tuned to the desired frequency. A high gain antenna may be used instead of the half-wave dipole, which has a gain only of 1.64. (This is the dipole's numerical gain; its gain in decibels is 2.14 dB above an isotropic source.) However, the gain of the antenna used over that of the half-wave dipole must be taken into account when making leakage measurements.

For equipment setup, see the accompanying figure.

Procedure

The maximum allowed leakage is 20 μV/m at a distance of 3 m. Since the electric field falls off inversely with distance, the maximum allowed leakage signal strength of further distances may be found from the following:

V leakage = (60/D) μV/m

Where:
D is in meters

The maximum allowable SLM reading can be calculated from the following:

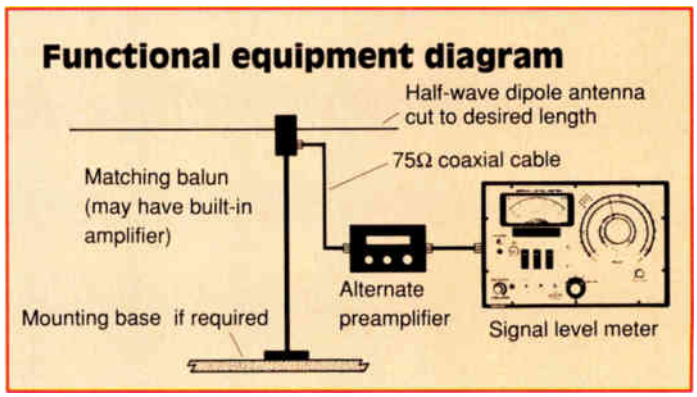
$$\text{SLM reading} = 20 \log_{10} [(60 \times \sqrt{G})/(D \times 0.026893 \times f)] - 60 \text{ dBmV}$$

Where:
G is the numerical gain (not dB) of a resonant half-wave dipole, over an isotropic antenna
D is in meters
f is in MHz

The maximum allowable SLM readings for four typical frequencies that are often used when making leakage measurements are calculated in the accompanying table.

Maximum allowable SLM readings

Field strength	Frequency	SLM reading
20 μV/m	108 MHz	-41.09 dBmV
20 μV/m	137 MHz	-43.16 dBmV
20 μV/m	225 MHz	-47.47 dBmV
20 μV/m	400 MHz	-52.46 dBmV



"A high gain antenna may be used instead of the half-wave dipole ... however, the gain of the antenna used over that of the half-wave dipole must be taken into account."

Let's take an example calculation where G = 1.64, D = 3 m and f = 108 MHz. Therefore:

$$\text{SLM reading} = 20 \log_{10} [(60 \times \sqrt{1.64})/(3 \times 0.026893 \times 108)] - 60 \text{ dBmV}$$
$$= 20 \log_{10} (8.8184) - 60$$
$$= 18.9078 - 60$$
$$= -41.09 \text{ dBmV}$$

If an amplifier has been used between the antenna and the SLM, the maximum allowable reading must be corrected by the amount of the amplifier gain. For instance, if at 400 MHz the amplifier gain was 20 dB, the maximum allowable SLM reading would be -52.34 + 20, or -32.34 dBmV.

It therefore becomes obvious from the previous information that the indication in dBmV of a leakage level on the signal level meter is dependent on the following:

- The loss of test leads, bandpass filters and external attenuators being used.
- The gain of the antenna being used.
- The distance of the antenna from the leakage source.
- The frequency at which the leakage is being measured.
- The sensitivity of the SLM including the gain of a preamplifier (if one is used).

With the information provided herein, it is possible to make leakage measurements with readily available CATV SLMs. Several manufacturers make special antennas for leakage measurement purposes and preamplifiers for these antennas are available.

Suitable low-noise preamplifiers whose gain at the frequencies of measurement is known also are available from many other sources. **CT**

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Reader Service Number 17

WAVETEK

The mathematics of field strength measurements

By Ron Hranac
Senior Technical Editor

I've occasionally been asked where the "0.021" comes from that's used when converting microvolts (μV) to microvolts per meter (μV/m). That number has been part of CATV mathematics longer than I've been in cable. But recently, I've seen some references use different numbers, and with the emphasis being placed on signal leakage and accurate cumulative leakage index (CLI) results, I thought it might be interesting to see how field strength measurements actually are derived.

When we measure signal leakage, we're in effect dealing with a source of RF power (the leak), its propagation from the source to a point of measurement, and determination of the intensity of the RF energy at the point of measurement. The receive antenna is normally a half-wave dipole that is resonant at the frequency of interest. In fact, FCC rules require that CATV leakage measurements be made with a dipole, or at least correlated to a dipole measurement.

Most discussions on RF propagation and measurement refer to an isotropic source or antenna. This is a theoretical (and ideal) signal source that radiates equally in all directions and has unity gain. Even though an isotropic antenna does not actually exist, it's useful as a reference to which comparisons can be made.

Imagine an isotropic antenna in free space, radiating a

(Continued on page 46)

Improve your accuracy

While actual field strength measurements can be a controversial subject, here are a few things to be aware of to at least make what you're doing as accurate as possible:

- When using battery-operated equipment, make sure the batteries in your test equipment have a good charge before you begin.
- Considering that the accuracy specification of a good quality and properly calibrated signal level meter (SLM) seldom is much better than about ±1 dB (it's generally a little worse than this over temperature), you should take extra efforts to ensure that your SLM is well cared for. Send it in annually for factory calibration. Check its calibration in your system at least weekly. Keep it clean and in good operating condition and protect it from abuse and harsh environments.
- If you're using commercial leakage detectors rather than SLMs for leakage measurements, be aware that most of them use RMS detector circuitry rather peak detector circuitry. This isn't a problem when measuring CW (unmodulated) carriers, but a modulated video carrier will result in a lower reading — by as much as 4 or 5 dB — with an RMS detector than the same amplitude CW carrier. If you calibrate your leak detector with a CW carrier, also check its reading when modulation is applied. It likely will be a few dB lower! If you're measuring modulated video carriers for your CLI, remember to add that difference to your modulated carrier reading. Otherwise, your leakage may wind up actually being 4 or 5 dB higher than what you measure!
- Periodically create a "calibrated leak" and check the operation and accuracy of your vehicle-mounted leak detectors. This will be a good opportunity to also check the accuracy of other leakage detection equipment that you use. (Be sure to turn off the leak when you're finished!)
- When performing ground-based leakage measurements in the field, follow the method prescribed by the FCC as closely as possible. But keep in mind that a horizontal dipole may not allow you to find the strongest leak level, since the polarity of a leak will more often than not be random in nature. Also rotate your dipole about a vertical axis (keep it away from overhead conductors) to see if the leak's intensity increases.
- If you're using a preamplifier with your equipment, make sure you *subtract* its gain from your equipment reading. And take into account the loss of your test lead, bandpass filter, etc., which you have to *add* to your reading. Take the trouble to actually measure these things; don't guess or rely on a spec sheet.
- Try to avoid making measurements immediately after windy weather. The wind often will move things around enough to work through small layers of corrosion in loose connections or cracks, providing a temporary improvement in shielding. Of course, severe wind may do enough damage to create new leakage problems.
- CLI software will simplify your calculations and reduce the likelihood of errors. Also check to see what version of software you are using. It's my understanding that early versions of CLIDE and also WIZARD had glitches that gave incorrect CLI results, although in the "right" direction. That is, the software would indicate that your CLI was actually higher than it really was.
- And finally, if your CLI figure comes out to be anywhere close to 64, there's a real good chance that it's actually worse than that. When you take into account the calibration of your test equipment, your measurement techniques and other factors, I seriously doubt whether you can claim even as good as ±3 dB accuracy (one very well-known engineer once told me that we're lucky to be accurate within 6 or 8 dB!) — *RH*

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Reader Service Number 18

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Customer service: Back to the basics

By Gayla Kalp
President, Gayla Associates Inc.

Customer service in the cable industry used to be either non-existent or belonging in the Neanderthal Age. As of three years ago, we have made many attempts (through our national and state cable associations, some individual cable systems and a few MSOs) to become more sophisticated in the customer service area. However, we "overshot the mark" by implementing programs that were too difficult, confusing and time-consuming to get successful results. Therefore, very few systems are even close to achieving the National Cable Television Association Customer Service Standards that must be met by July. We need to throw out all the sophisticated techniques and get back to the basics.

Implement, reinforce and support the following customer service basics and the interpersonal portion of the NCTA standards will be met easily — and even exceeded. An added plus will be a dramatic rise in subscriber retention, staff morale and a bigger "bottom line."

Installer/technicians have a huge responsibility (and customer service potential) in that they are almost invariably the only people customers come in actual face-to-face contact with from your system. If you are an installer/tech, apply the following 18 standards and if you're not, you might want to pass these suggestions on to them:

First impressions count

1) As you drive up to the home to park, make sure you don't park directly in front of the house or block the driveway. You don't want to take up most of the subscriber's parking area.

2) Check your appearance. Take off your sunglasses, comb your hair, tuck in and button up your shirt, check your zipper and spit out your gum (in a tissue not on the porch). If you wear a hat, put the bill in the front and straight out. The cable version of "Vern" should not be greeting the subscriber. If you are dirty because of the work you performed on your last call, excuse yourself and explain your dirty appearance to the sub so he or she won't think that filth is part of your "normal" look.

3) Use deodorant.

4) Knock on the door instead of ringing the bell. A knock can be heard much better. If there is a screen in front of the door, keep your foot braced unobtrusively at the bottom of the screen and don't remove it until you see the subscriber coming to the door without Fido. Otherwise, Fido could greet you first by coming through the screen and mistake you for lunch.

5) As the door opens, step back and smile! The act of stepping back shows that you respect the person's domain and gives the sub space to "size you up" before allowing you into the home. The smile will set a friendly tone.

6) Greet and identify yourself properly. Don't yell, "Cable man!" or "ABC Cable!" Look at the customer and say, "Good morning (or afternoon). I am (name), your service installer/technician from ABC Cable. (By using the pronoun "your," it makes it sound like you are a special service person just for them.) Are you Mr./Ms. (name)? May I come in?"

This introduction sets the entire tone of your visit and lets customers know whether they can trust you in their home. If you come off as an uncouth, ill-mannered slob, the customer will "bug" and follow you throughout your entire visit.

7) Wipe your feet no matter how clean you think they are.

Doing the work right

8) Verify the information on the work order before servicing the home by asking the customer questions about the problem or request. Nothing makes you and the system look more stupid than an incorrect repair or install.

9) After figuring out the problem or install, speak clearly and simply explain what you are going to do in terms that the customer will understand. Words like "addressable," "clean feed," "AO" and "hit the box" are very confusing.

10) If there are children or pets in the home, immediately tell the customer that some of your tools are dangerous and that you will not be able to do your best job if you have to watch that their child or pet doesn't get near them. Then ask if they would keep the child or pet in another area until you are finished. Believe me, the customer will appreciate your concern plus you now can complete your call quickly and without interruption.

11) If the TV set, VCR or stereo is decent, compliment their choice of equipment. They consider you the entertainment expert, therefore a compliment from you will make them feel very good about you and the job you are doing.

12) Carry a clean hand towel. Clean the TV set with it and lay your tools on it. This gesture will not only make the picture look better, but show customers that you are careful and respect their furniture, rug, etc., plus save the system from buying a new coffee table or rug because the customer claimed that you marred them with your tools.

Don't go yet

13) After the service, let customers work the equipment once before you leave. Ask questions. Make sure they understand the use of the equipment. This will stop any unnecessary phone or service call because the customer is still confused.

14) Upgrade. The "entertainment expert" is in their home! They will respect your opinions and suggestions. The upgrade does not take any additional time and is very successful. Just look at what services they have and briefly tell them about an additional pay service, remote control or additional outlet that would complement what they have already.

15) As you enter and leave the house, be sure the door is latched behind you. Nothing is worse than Fido or the child being on the "missing persons list" because of your carelessness.

16) Don't "beat up" your fellow employees or system with insulting remarks like: "Who installed this? What a crummy job." "Don't try to call our customer service line in the morning, they will put you on hold forever." "Special offer? Oh, the system is always running some special. We never know what it is." "The salesman told you what? That figures!"

(Continued on page 80)

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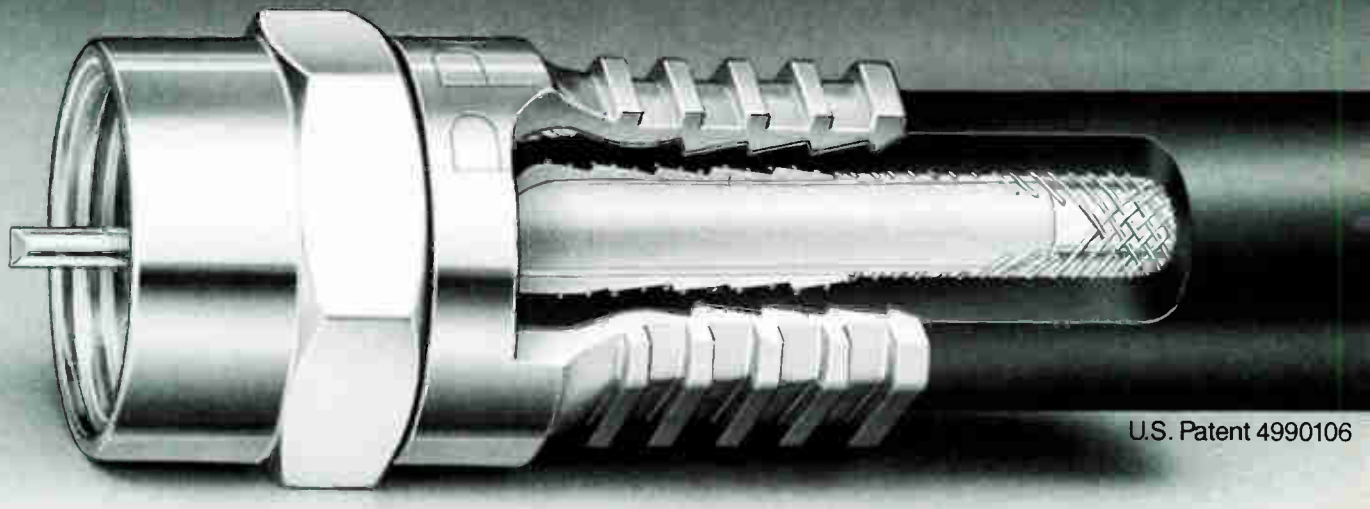

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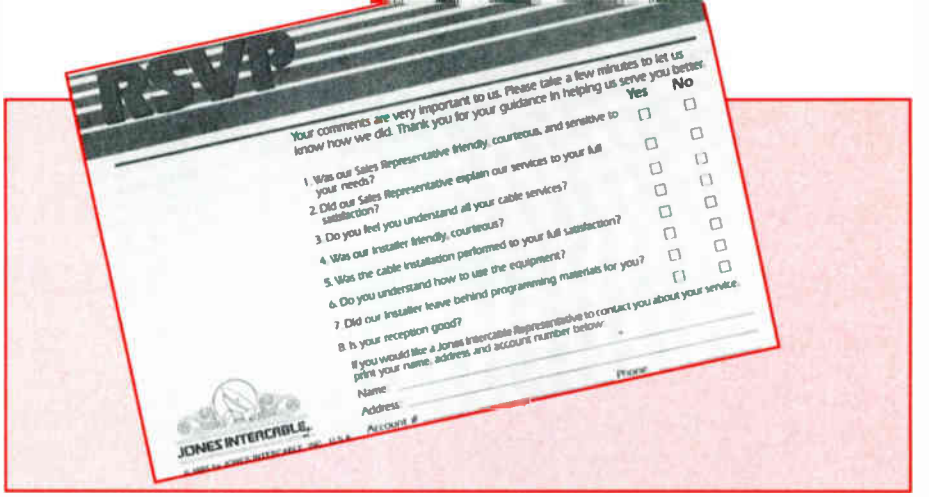
Customer service on the front line



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

Good news has materialized regarding the cable customer's perception of cable TV. Trade journals have provided surveys that indicate cable is no longer the "bad guys." Customer RSVP cards reveal a positive trend. Although we are not yet where we want to be, positive rewards have emerged from our efforts.

Four years ago Jones Intercable embarked on a program that within its first two years was instrumental in reducing companywide service calls by 24 percent. The Jones Qualified Installer Program targeted the front lines of our customer service force — the installers. In addition to concentrating on one uniform drop practice for the company, the program emphasizes the importance of making that *good* first impression.

Proof from the customers

The Jones system in Albuquerque, N.M., keeps track of RSVP cards that are left with customers at the time of installation. Approximately 4 percent of these cards are returned to the office. All customer comments are followed up on (positive and negative). Frank De La Cruz, the telemarketing coordinator, says the overall tendency of the responses has been affirmative, citing that customers are noticing positive trends in the installer's personality, professional appearance and cooperation with them. He attributed improvements to the training done through the Qualified Installer Program, since through this program installers acquire an increased awareness of the importance of providing good customer service. They also know they are subject to inspections of their work — customer service included.

Quality Assurance Supervisor Joe Roney also has noticed a positive trend. Since he has been with the Albuquerque system for 11 years, he can see a difference in how the associates are treated as a whole. He revealed that there was a time when it was risky to wear a company logo in public. Now people see the logo and want to talk about the company and service. He also emphasized the importance of customer service even off the job. For example, customers may form opinions about the company based upon your employees' lunch conversations. You never know who may be listening.

More training

As mentioned previously, although many improvements have been made, we can be better. In addition to the Qualified Installer Program, Jones has (as part of its training library) interactive videos that deal directly with customer service issues, as well as sales, safety and installer training.

The customer service section of the Qualified Installer Program has been reproduced here for your use. Please remember that training and follow-up by the facilitator are necessary to make successful installers.

An introduction

The most essential person in cable TV is the customer. Cable systems serve customers by providing TV entertainment and information through multiple channels, special programming, movie channels, pay-per-view and many other unique services.

Once a customer chooses to buy cable TV services, the CATV signal must be connected to the customer's residence from the existing tap on the feeder cable via a drop cable. To connect this drop cable, the cable company sends a representative to the customer's residence to perform the installation.

As the representative, you the installer are the vital link between the customer and the cable system. In fact, to the new customer, you are the cable company.

Installation is often the customer's first opportunity to deal "face-to-face" with the cable company. That's why your performance, your conversations, your ability to improve the TV set picture, your care of their personal property, your knowledge of programming services, and your appearance are what the customer will remember about the cable company. As an installer, you set the tone of the customer's current and future relationship with the cable company. For this reason, installers need both technical and customer service skills. A positive attitude and enthusiasm are the basic ingredients of customer service. They help to create the professional image your customers will remember and appreciate.

Your appearance

You are allowed only one first impression!

Making a positive first impression means always presenting yourself in a clean and neat manner. Make sure your hair is trimmed, clean and combed. Mustaches and beards should be trimmed and neat in appearance. Keep your face free from dirt or smudges throughout the day, and keep your uniform shirt tucked in your trousers.

Hygiene and cleanliness are important as well. Through proper hygiene, installers can usually perform a normal day's work without developing problem body odors. Carrying a second uniform shirt for afternoon work is a good way to be prepared for an especially busy day. If bad breath is a problem, particularly after a "heavy-on-the-onions" lunch, make sure you have breath mints handy.

You can check your appearance in

the rearview or side mirror on your vehicle before each installation so you feel more confident.

Vehicle operation

Company vehicles are to be driven and parked in a manner that will create a favorable impression to the public, with extra courtesy and consideration for other drivers and pedestrians.

Most vehicle accidents occur when backing up the vehicle after it has been parked. Avoid parking on private property such as driveways where you will have to back up to leave. If you must park on private property, the safest approach is to initially back onto the property, checking carefully for children, toys, pets, etc. Place safety cones immediately after parking. When you're ready to leave, the vehicle will be pointed so that direct entry into traffic is possible. Check again for children, toys, and pets before putting the vehicle in gear.

Vehicles must be maintained in a clean and orderly manner:

- Outside washed frequently
- Parts and equipment placed in inventory bins
- All tools placed in proper bins
- All trash in proper trash container

Vehicle appearance also reflects on the company image.

Meeting the customer

After you have parked your vehicle properly, approach the front door of the customer's residence and ring the doorbell or knock on the door, then stand slightly back from the door.

When the customer appears, greet the customer by name (found on the work order) and with a smile. Give the customer your name, the name of the company, and the purpose of your visit. Provide company identification to the customer. Then ask to enter the home to survey the location of the TV set(s).

If no one answers the door, contact the system office so the customer can be telephoned in case he or she is sleeping or is unable to hear the knocking at the door. Then if no one answers, follow the procedure for a missed appointment (which is detailed later).

Presence of an adult

If you are greeted at the door by a person under the age of 18, ask to speak to a parent or an adult over 18. If no adult is present, do not proceed with the installation. Company policy requires that an adult over age 18 be present throughout installation. Briefly explain to the youngster that the installation will be rescheduled.

Rental units

The installer should follow system policies in regard to permission on doing installs within rentals and residences not owned by the customer.

Inconvenient situations

When you are greeted at the door, determine if the situation is acceptable for you to begin the installation. If there is anyone who is partially dressed, too sleepy or drunk to understand you, if a party is going on, or there is loud angry shouting, tell the customer that you may have come at an inconvenient time. Then ask if you can come back at another time. Leave immediately, excusing yourself again for the inconvenience.

Beginning the installation

When you have determined that you can proceed with the installation, enter the house, making sure your shoes are clean before entering. Let the customer show you the location of the TV set. If the set needs to be moved away from the wall, ask the customer to remove all items that may be on top of the shelf. Then ask the customer to turn on the set. If a problem with the set already exists, this can prevent the customer from accusing you of causing the damage.

Explain that you are required to check the picture quality of the TV set before connecting any cable. If there are any obvious problems, such as no video or audio, call the problem to the customer's attention and note it on the work order. Explain that the TV set will need to be repaired before the cable is connected and operational. Do not attempt to repair the set yourself. The installation may be completed at the customer's request using a test set if the customer's set is not working properly.

If there are no obvious problems with the TV set, explain the installation to the customer. Describe how it will affect the house, how often you will need to enter the house and how long it will take.

New customers may not be informed about the installation process and may have unrealistic expectations.

"The most essential person in cable TV is the customer."

Taking the time to explain to the customer what the installation process involves makes your job easier.

If the customer has questions, listen carefully and try to solve any problems or answer questions quickly. Be patient and courteous at all times to the customer and acknowledge their concerns. Never argue with the customer. If you are unable to resolve a problem with the customer, offer to call your supervisor to arrive at a satisfactory solution.

Additional outlets

If any additional outlets are desired but not originally requested on the work order, make sure customers understands the extra installation and monthly service fee for additional outlets and note it on the work order.

Care of private property

Remember that you are a stranger in the customer's house. One of the most important ways to set the customer at ease and earn the customer's respect is to show extra care and caution with the customer's property, both inside and out. Take a little bit of extra time to do the job right and avoid damaging property.

Customers appreciate courtesy.

Do not smoke inside the customer's house. If you smoke outside, do not leave cigarette butts lying on the ground in the customer's yard.

Always wipe your feet each time you enter the customer's house.

Do not use the customer's bathroom.

Always clean up all debris you have created, inside and out, and dispose of it off the customer's property. (Keeping a small trash container in your vehicle is a preferred disposal method.)

Do not sit on or brush against the customer's furniture. Dirty trousers may leave smudges.

Use your vehicle radio rather than the customer's telephone if you need to contact the office (unless you do not have a radio in the vehicle).

Do not put tools on customer's furniture or TV set because they may scratch or dent the property.

(Continued on page 48)

CLI by land and air

(Continued from page 16)

sible to miscalculate the location, and when the next turn is made a wrong cross street may be selected. If this occurs, the operator has a small traveling map displayed in front of him and can switch back to the right street by the push of a button. The optimum Alan configuration uses GPS continually to correct the ETAK on the area map and thereby includes the best features of both systems. As well, the ETAK system with its detailed map data base can be readily applied to vehicle location and fleet management.

Loran C

Other navigation systems such as Loran C may be employed. Loran C, however, has a number of limitations. As of this date, coverage is not acceptable throughout the whole United States, although this should be improved within the next few years. In addition, Loran C has problems working in downtown areas with large buildings. The accuracy of Loran is inferior to both ETAK and GPS and therefore will probably not see extensive use in this application. As other less expensive or more accurate navigation systems are developed, they may be integrated into the Alan system with comparative ease.

All in all CaLan's approach provides a virtually hands-off monitoring system that delivers its output on a computer disk. The disk is then read by a computer workstation where the data is reduced, house numbers are determined and work orders produced. The workstation provides extensive visual features, including a very complete mapping and leak display facility. The workstation also provides leakage logs and CLI data and computations.

So, these are some of the latest developments in the continuing monitoring that must go on for signal leakage control. But, then there is the annual qualification required by the commission. This of course can be done by one of the following three methods: the CLI_{∞}, CLI_{3000} or a flyover.

Ground-based

Let's first review the ground-based techniques. In this regard a very important point must be reiterated. In order to comply with the FCC Rule 76.609(h), a ground-based qualification must be performed in a specific way. This way includes a distinct and formal measurement of each leak of 50 µV/m or greater at 3 meters. The procedure is as follows:

1) Stop the vehicle.
2) Get out with a horizontal resonant dipole and signal level meter.
3) Position the dipole in the prescribed way relative to the cable.
4) Move the dipole up and down the strand for maximum signal.
5) Rotate the dipole for the greatest signal strength at that location.
6) Record the maximum leakage level.

This requirement obviously precludes driving down the street and making measurements on the fly whether the measurements be made manually, automatically or whatever. Moving measurements simply do not pass muster regarding the FCC requirements. These comments obviously apply to performance of CLI_{∞},or CLI_{3000}.

Flyover

The other possibility for qualification

(Continued on page 36)

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CLI by land and air

(Continued from page 34)

is the use of a flyover, (the aerial measurement of the overall signal leakage integrity of the cable system). There are several specific rules governing the performance of a flyover and in turn there is a good deal of latitude allowed. Basically a flyover is an aerial measurement done at 1,500 feet above the terrain (more or less) where the aircraft is maneuvered in a series of passes that can be demonstrated to have surveyed the entire cable system.

The first thing to note is the purpose of the flyover. A flyover is normally used for qualification and not to find leaks. True, isolated leaks can be spotted from the air and their location approximately determined. However, the instrumentation in the aircraft overflying a system is usually receiving energy from more than one leak so that the indicated result is a summation of leakage energy. Therefore, peaks shown in the data do not necessarily indicate exact locations of specific leaks.

On the other hand, a flyover should be considered as a series of measurements in the same environment that an aircraft encounters while flying over the cable system. It also is a virtual snapshot of the overall leakage conditions since it is performed over a relatively short period of time. The commission realizes, as we do, that leakage conditions can change due to weather, temperature and other effects so that the leakage may not remain the same over a period of days (or perhaps hours or minutes). The best thing that the FCC can hope for is a snapshot of the condition of the cable signal leakage at one point in time and to use that to indicate the measure of compliance of the cable system to the leakage rules.

Flyovers usually are done by contractors who therefore are third parties. That is, they are not the cable operator or the FCC but a disinterested entity. The FCC can feel somewhat more comfortable with this type of survey than one done by the cable operator who has a vested interest in passing the test. The same factor may appeal to cable company management since the flyover represents an independent evaluation of the performance of the company's signal leakage control. In addition, a flyover measures the actual conditions encountered by an aircraft flying above the cable system rather than an estimate produced by ground-based measurements that are subject to a wide range of uncertainties.

Flyovers, particularly on medium and larger systems, are often quite economical as compared with qualification by ground-based methods. The choice is a decision that only the specific cable operator can make and it depends heavily on "how you keep your books." But, all other things being equal, there are less costs involved in a few-hour flyover than there are in doing a proper rideout of the same cable system.

Well then, which is better, a ground rideout or an aerial flyover? Theoretically the flyover is better since it measures the real thing. However, the ground-based rideout is completely acceptable.

It cannot be stressed enough that you have to take the matter of effective leakage control very seriously. It is very important that we never provide any foundation for accusations that our signal leakage is a threat to life or property.

Surely, signal leakage control should have become less painful and more efficient than in the early days. And surely, with the commission's aggressive program of enforcement, the subject is no less important. **CT**

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Reader Service Number 25

Leakage detection

(Continued from page 20)

Now, let's analyze this passage to determine in simple terms what a system must do to fulfill the stated requirements. First, what frequency or frequencies are to be monitored? If you are transmitting carriers in the 108 to 137 MHz and/or the 225 to 400 MHz bands you shall have a quarterly monitoring program. The regulations don't say what particular frequency to monitor, but they do say that any leak greater than 20 µV/m at 3 meters in the aeronautical radio frequency bands shall be dignified with a certain prescribed response. So, the leakage detector should at least be able to monitor a frequency in the aeronautical band. (The ability of a detector to monitor more than one frequency enables the detection of frequency-specific leaks, possibly eliminating these leaks before they become "rat-killers.")

Next, what sensitivity is the detector required to have? The monitoring equipment and procedures should be adequate to detect a 20 µV/m leak at a distance of 3 meters. Probably any detector provided for the purpose of finding cable leakage will meet these requirements, but consideration must be given to how the detector is used, including antenna and antenna orientation. The use of a calibrated leak for daily equipment verification is recommended.

What should be done when a leak with a field strength greater than 20 µV/m is found? The leak must be repaired "within a reasonable period of time" and the following information must be logged: date found, location, date repaired and probable cause. The log must be kept on file for two years. This log may be kept on a computer, with leakage management programs that help with the leakage control function (sorting leaks by intensity, printing out work orders, keeping track of time spent, etc.) The logging process is simplified by using a cable leakage meter with a logging function that enables the operator to log a leak simply by entering the location and a cause code, and dumps logged data to a computer with leakage management software.

OK, now what equipment should be used in performing regular monitoring? The answer to this one is based on economy. If you have every installer equipped with a leak detector, assuming that you have a significant number of installers who will travel throughout the system in the performance of their duties, you'll probably want something simple and inexpensive. When a leak is detected, Wavetek's CLR-4 leak detector activates an alarm that varies in pitch with received field strength. This makes finding the source of the leak like playing the children's game of "hot and cold." The closer the detector gets to the leak the higher in pitch the alarm.

The leak detector may be worn on the installer/technician's belt while performing other work and then hand held when the alarm sounds to pinpoint the leak source. Since the alarm tone varies in pitch with change in received field strength, the operator may move the receiver in such a way as to determine from which direction the leak is emanating. The "rubber duck" antenna has a radial pattern with a null in the direction at which the antenna is pointing (see Figure 1). The receiver may be rotated on an axis that is likely to include the leak source.

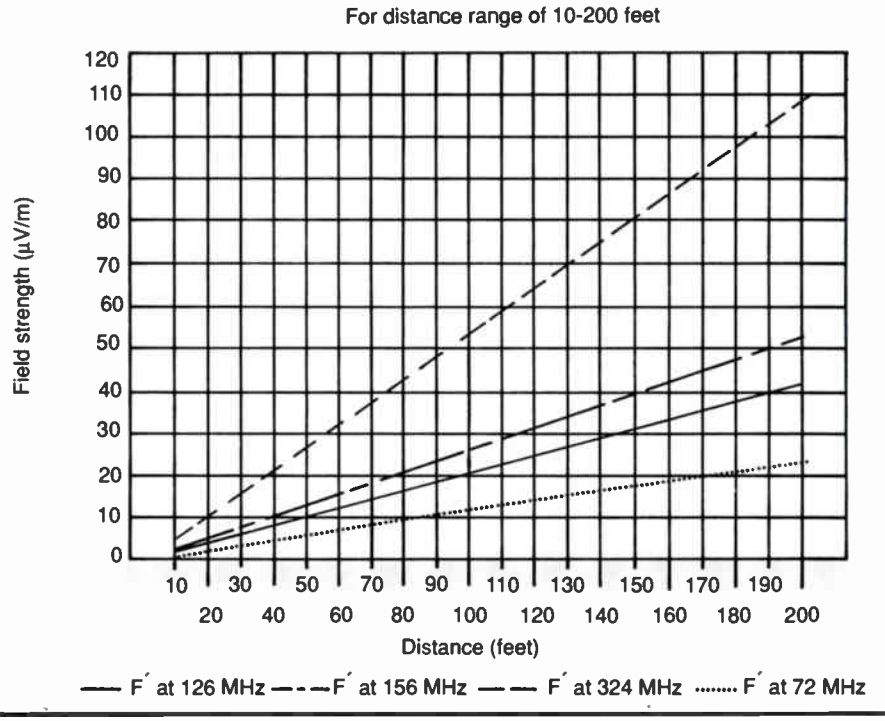
When the alarm tone nulls (goes to its minimum pitch) the antenna is pointing in the direction of the leak. If the receiver is close to a relatively strong leak, making differentiation in alarm pitch may be difficult but in this situation the antenna may be removed entirely. The detector, when moved around the location of the suspected source, will "bark" when it passes the leak source. When not sounding an alarm one detector scans four different video frequencies, enabling the location of frequency-dependent leaks.

If the detector is to be used in a vehicle it should be connected to a vehicle-mounted antenna. It may be desirable to get an idea of the relative strength of the leak when the detector alarm sounds. This may be done using an in-line attenuator in series with the antenna. The leak level may be determined by adding attenuation until the alarm quiets and calculating the level based on the difference (in decibels) from the calibrated reference level.

This last application seems a bit complicated for the average installer/tech, and brings us to: "What equipment should be used by a small system or a system where one person does the whole system maintenance job? Smaller systems (and large sys-

"The ability of a detector to monitor more than one frequency enables the detection of frequency-specific leaks, possibly eliminating these leaks before they become 'rat killers.'"

Figure 2: Cable leakage meter sensitivity related to distance and frequency



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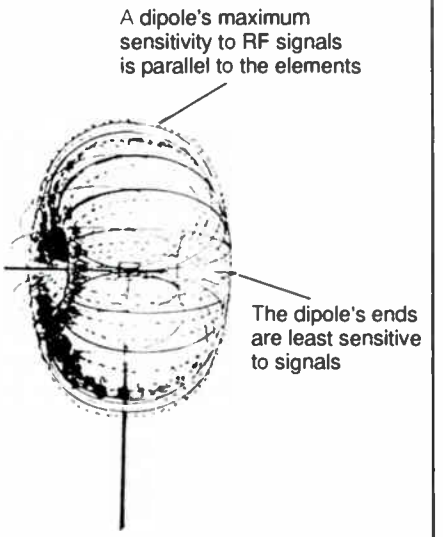
tems that make use of leakage crews) could use a cable leakage meter like Wavetek's CLM 1000 that will perform all of the quarterly monitoring functions as well as those required by the annual plant leakage test (the "CLI ride-out").

Annual ride-out

The annual CLI test requires that at least 75 percent of the system, including the most leaky parts, must be tested with the leaks measuring ≥ 50 µV/m logged for entry in a formula to determine the CLI number. To simplify this procedure systems can use a cable leakage meter and a computer to store and manage the data and to calculate the CLI number.

The cable leakage meter has a variable alarm threshold, which may be set anywhere from 10 µV/m to 999 µV/m. This makes the unit applicable for quarterly monitoring (with a 20 µV/m threshold) and for the annual CLI test (with a 50 µV/m threshold). The variable alarm also enables the operator to patrol the system using a "peel-the-onion" technique. This refers to the method of finding the largest leaks first by setting the alarm at a relatively high level, then gradually decreasing the alarm threshold as the highest amplitude leaks are fixed. Since the cable leakage meter is a measurement device, it is recommended the alarm level be set relatively low and the level read when the alarm sounds to determine the severity of the leak.

Figure 3: Dipole pattern



The cable leakage meter includes a logging function, which was described earlier. This function enables quick logging of leak information for later printout or download to a leakage management program. This function is extremely useful and timesaving both for quarterly monitoring and for the annual CLI test.

The cable leakage meter measures leaks down to 10 µV/m without the need of an external preamplifier and has the critical aircraft bands internally preselected (bandpassed). Leakage signal levels are usually quite low relative to signals broadcast on the air. To measure low-level signals it is necessary to use a very sensitive receiver or to amplify the received signals to the point at which they may be measured. A highly sensitive receiver tends to be subject to intermodulation distortion. This makes it necessary to preselect (use a bandpass filter) on the receiver input to limit the RF input to the specific band of the frequency to be measured. Built-in preselection for the critical aircraft bands eliminates the necessity to carry additional equipment. External preselection may be used (in other non-aeronautical bands) and the cable leakage meter can automatically correct the measurement readout for filter insertion loss.

The cable leakage meter displays the measurement in microvolts per meter, making additional conversion for CLI calculation purposes unnecessary. The meter has a distance feature for situations where it is just not possible to get 10 feet away from the leak. The operator simply enters the distance and the meter reads out the field strength at 10 feet. The distance feature may be used from a vehicle but because of the wide variety of variables that affect the measurement in that circumstance, it is recommended that these measurements only be used to grade the leak's severity, and not be used for CLI drive-out purposes. (The FCC CLI procedure calls for a 10-foot measurement with a tuned dipole). When measuring a leak from a significant distance, it is good to keep in mind that an accurate level measurement requires a nominal signal-to-noise ratio. To ensure that a measurement is accurate, it is recommended that the operator tune off-frequency and verify that the level does drop off to some degree. This makes certain the measurement is not actually noise-induced by a variety of sources that are

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"Only one antenna type is acceptable to the FCC for determining the legality of leaks and providing data for CLI calculations: the half-wave dipole."

not cable leaks. Figure 2 indicates the minimum level that may be measured at x distance assuming that there is no ambient noise affecting the measurement.

For leakage patrolling, the meter is typically connected to a vehicle-mounted monopole or dipole antenna. The calibration of the vehicle-mounted system will be further detailed later.

A directional antenna (Yagi, for example) may be used with the meter (usually outside the vehicle) to help locate the leak source. To locate leakage sources and measure field strengths accurately, consideration should be given to the characteristics of the antenna.

Antenna considerations

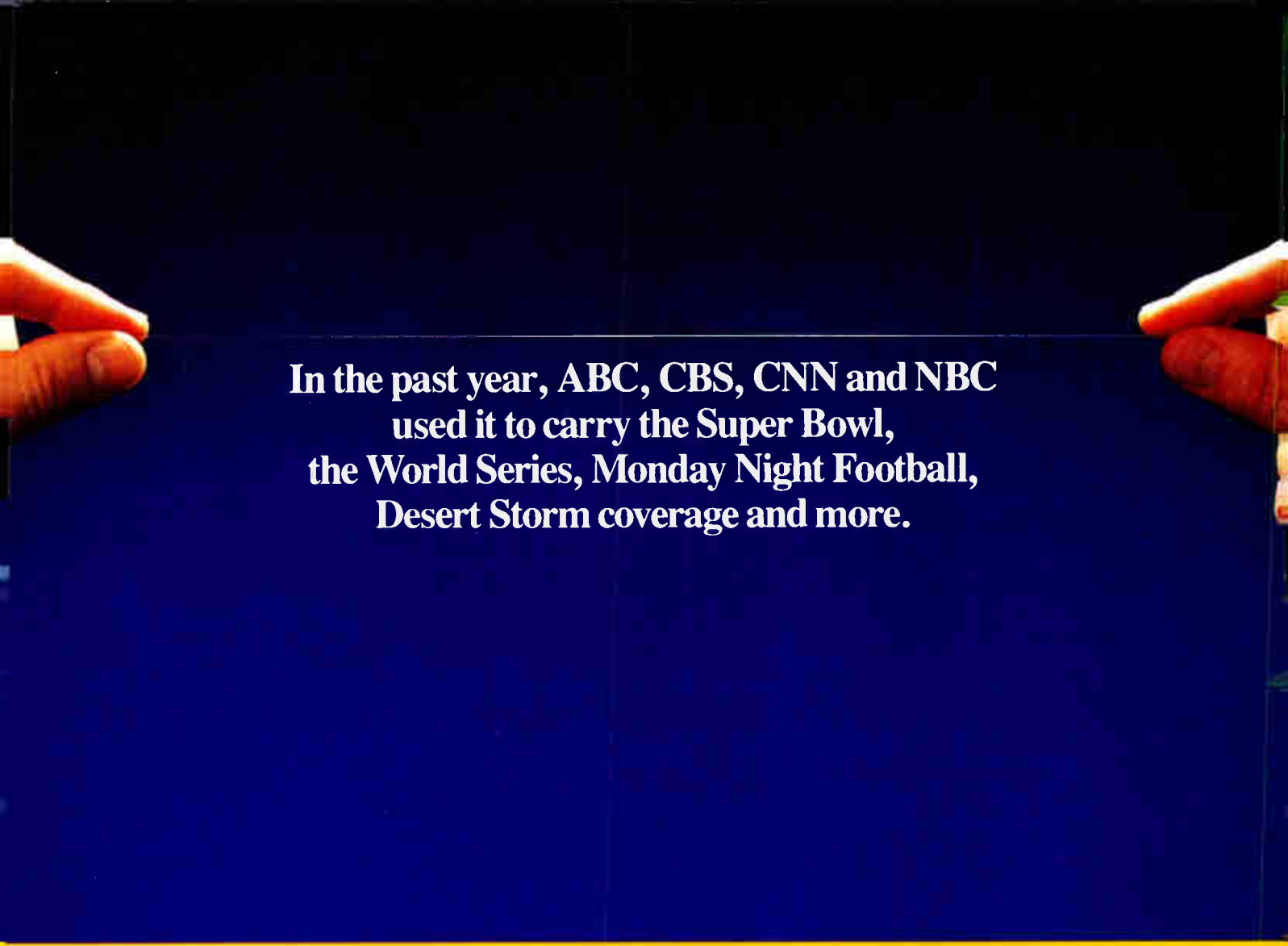
Antenna systems are among the most important and often least understood aspects of leakage field strength measurement. Understanding the characteristics and use of the various types of leakage measurement antennas is essential if accurate measurements are to be made. A variety of antennas can be used for the purposes of locating and pinpointing cable system leaks. However, only one antenna type is acceptable to the FCC for determining the legality of leaks and providing data for CLI calculations: the half-wave dipole. The dipole antenna was chosen because of its well-defined impedance, directivity characteristics and its ease of use. The FCC states that quantitative measurements of cable leaks are to be made with a resonant one-half wavelength dipole held horizontally at a distance of 3 meters (10 feet) above the ground, 3 meters below the cable, and 3 meters from any other conductors (any metallic objects) in the vicinity. In the event that the antenna cannot be held 3 meters above the ground and still be 3 meters below the cable, the antenna may be held 3 meters above ground and moved out 3 meters horizontally from the cable.

After positioning, the antenna is rotated in the horizontal position as necessary to find the maximum field strength. It is this maximum value that is used to determine if the leak is above the legal limit of 20 μV/m and if, in addition, it must be logged and included in CLI calculations (if greater than 50 μV/m).

In some cases, the physical location of the cable together with the orientation of nearby conductive objects can make positioning of the antenna difficult. Nonetheless, the FCC's definition of the positioning requirement provides a standardized method. Since this is the method that will be used by the FCC in checking systems for compliance, it's wise not to depart from it any more than is absolutely necessary.

The cable leakage meter's peak hold function enables the operator to concentrate on proper antenna positioning and rotation, while the meter holds the peak measurement for logging.

While making the measurement, be sure to face the antenna "broadside" to the cable. This is because a dipole receives maximum signal perpendicular to its elements and receives almost



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nothing off the ends of the elements. The horizontal radiation pattern of a dipole is a figure-eight shape as shown in Figure 3.

Be careful to ensure the measurement path between the antenna and the cable is clear and free from obstructions, particularly metallic objects, guy wires, etc. Obstructions may partially block the signal, create reflections or even re-radiate the signal, and therefore produce an inaccurate measurement.

The FCC's requirement that the dipole must be a resonant half-wave means that the length from end to end of the dipole must be one-half wavelength long at the channel or frequency being tested. Therefore, the antenna length must be changed when moving from one channel to another. As a result, a fixed length dipole technically cannot be used at any channel other than the one for which it was made. If you use an adjustable-length dipole it can be set by adjusting its elements to one-quarter wavelength each. The following formula gives the free space length (in inches) of each element of the dipole at any given frequency:

$$L = 2{,}952/F$$

Where:
L = length of each element in inches
F = channel frequency in MHz

In practice, the element lengths will come out slightly less than these ideal values, so it's best to use the lengths supplied by the antenna manufacturer.

The antenna factor

Another essential issue is the antenna factor. This is a number that relates the received signal voltage at the meter input to the radiated field strength. The received signal in microvolts is multiplied by the antenna factor to produce the field strength in microvolts per meter. (If readings are to be made in decibels, the antenna factors are added rather than multiplied.)

Since field strength is related to the amount of energy "captured" by the antenna, the antenna factor changes with frequency. For a dipole antenna, the antenna factors increase with increasing frequency. This means that for a given number of microvolts per meter field strength, the number of microvolts of signal arriving at the meter input will decrease with increasing frequency: In the range of 108-136 MHz, a 20 µV/m field might produce a meter input voltage of 8 to 10 µV, whereas at 300 MHz, the input voltage might be only 2 or 3 µV.

Every antenna type has its own unique set of antenna factors. In fact, even two similar antennas may have slightly different antenna factors due to differences in construction.

The CLM 1000 will eliminate the need for complicated calculations during field strength measurements. A complete set of antenna factors for supplied antennas is stored in the meter's internal memory. The various antennas are keypad-selectable from the front panel. The cable leakage meter performs all field strength calculations automatically, displaying the correct result in microvolts per meter.

In addition, the meter provides a custom antenna factor table for those who wish to supply their own antenna and antenna factors. Custom antenna factors are entered from a personal computer via the meter's front-panel RS232 serial port. **CT**

Part 2 will continue with a discussion on dipoles and monopoles, and then cover equipment calibration and setting up a calibrated leak.

Field strength measurements

(Continued from page 26)

certain amount of RF power (P_t) uniformly in all directions. Now imagine a sphere whose surface is some distance R from the point of radiation, with that point (the isotropic source) at the center of the sphere. You could define the amount of power in a given area on the surface of the sphere — say, in a square meter — as so many watts per unit of area. In fact, that's exactly how RF power density is characterized.

In this example, the power density P_d (in watts per square meter) at the surface of the sphere would simply be the total transmitted power (P_t) divided by the surface area of the sphere ($4\pi R^2$):

$$P_d = P_t/4\pi R^2 \qquad (1)$$

The level of the radiated RF energy also can be expressed in volts per meter (V/m). In fact, if the field strength on our imaginary sphere has an intensity of E (V/m), then the power density will be:

$$P_d = E^2/120\pi \qquad (2)$$

You'll notice that Equation 2 is an expression of one of the Ohm's law equations for power, $P = E^2/R$. In this case, 120π is the "resistance," or impedance of free space (approximately 377 ohms). In order for power density to be useful, though, it has to be converted to received power. To do that, multiply power density (in watts per square meter) by the area (in square meters) of the receiving antenna. In reality, there is little relationship between the actual size of an antenna such as a dipole and its *effective* area. If you know the numerical gain (g) of an antenna you can calculate its effective area (A_e) with the formula:

$$A_e = g\lambda^2/4\pi \qquad (3)$$

For a half-wave dipole, the effective area is:

$$A_e = 1.64\lambda^2/4\pi \qquad (4)$$

Note that in Equation 4, 1.64 is the numerical gain of a half-wave dipole in free space. Its gain in decibels would be 10log(1.64), or 2.14 dB.

As mentioned previously, the power intercepted by a receiving antenna is found by multiplying the antenna's effective area by the power density at the point of measurement:

$$P_r = A_e P_d \qquad (5)$$

Substituting Equations 2 and 4 for P_d and A_e in Equation 5:

$$P_r = 1.64\lambda^2 E^2/480\pi \qquad (6)$$

We now can calculate the received voltage at the terminals of a half-wave dipole antenna using Ohm's Law:

$$E_r = \sqrt{P_r Z} \qquad (7)$$

where P_r is the received power (from Equation 6) and Z is

the impedance of a half-wave dipole in free space (73.2 ohms). Substituting Equation 6 for P_r and 73.2 for Z, Equation 7 becomes:

$$E_r = \sqrt{(1.64\lambda^2E^2/480\pi)73.2} \quad \textbf{(8)}$$

The free space wavelength of an RF signal can be found with the formula:

$$\lambda = c/f_{Hz} \quad \textbf{(9)}$$

where c is the speed of light (299,792,458 meters per second) and f_{Hz} is the frequency in hertz. When dealing with frequencies in megahertz, the formula becomes:

$$\lambda = 299.792458/f_{MHz} \quad \textbf{(10)}$$

Substituting Equation 10 for λ in Equation 8, a little algebra will reduce Equation 8 to a simpler form:

$$E_r = 47.72299333E/f_{MHz} \quad \textbf{(11)}$$

With Equation 11 we can calculate the received voltage (in volts) from a half-wave dipole in free space when we know the field strength in V/m (E) and the frequency in MHz (f_{MHz}). If you want to change units so that the received voltage (E_r) is μV and the field strength (E) is μV/m, the same equation is used. Just make sure you use the same units; *don't* mix units — for example, volts for E_r and μV/m for E.

To convert a received voltage (in μV) to dBmV, use:

$$dBmV = 20\log(E_r/1{,}000) \quad \textbf{(12)}$$

This can be used to modify Equation 11:

$$E_r = 20\log(0.04772299333E/f_{MHz}) \quad \textbf{(13)}$$

Here E_r is the received voltage in μV from the dipole, and E will be the field strength in μV/m. Going the other way, you can determine the field strength in μV/m if you know the frequency in MHz and the dipole's received signal level in dBmV:

$$\mu V/m = 20.9543 \times f_{MHz} \times 10^{(dBmV/20)} \quad \textbf{(14)}$$

Here 20.9543 is the reciprocal of 0.04772299333 from Equation 13. If you divide by 1,000, you'll have the familiar 0.021 (actually 0.0209543) multiplication factor used in the more common conversion from μV to μV/m:

$$\mu V/m = \mu V \times 0.021 \times f_{MHz} \quad \textbf{(15)}$$

dBmV can be converted to microvolts with the formula:

$$\mu V = 10^{(dBmV/20)} \times 1{,}000 \quad \textbf{(16)}$$

Thus, when you know the received signal level in dBmV, the conversion to μV/m becomes a slight variation of Equation 14:

$$\mu V/m = 10^{(dBmV/20)} \times 1{,}000 \times 0.021 \times f_{MHz} \quad \textbf{(17)}$$

CT

Frontline customer service

(Continued from page 33)

Be extremely careful when moving ladders inside the house so as not to mar or mark any walls.

Do not make dirty hand prints or smudges on the walls.

Do not make unnecessary noise.

Do not accept food, beverages or tips from the customer.

Interior wiring

The customer may be particularly concerned about the cable on the inside of the house. Take the time to explain how you propose to run the cable to make sure the customer is satisfied. Explain where the outlets will be so the customer understands that both the cable and outlets are hidden as much as possible.

Inside wiring must be neat. Hide all inside cable along the baseboards or molding wherever possible. Do not leave cable in the direct path of foot traffic and do not cross doorway or window openings. Use the same color cable wall plate as the electrical wall plates in the room.

Picture quality

The customer expects you to provide quality cable service, and may expect the picture to be significantly better than the non-cabled picture, which in most cases will be true. If you are unable to achieve proper picture quality for any reason, contact your supervisor for assistance or schedule a technician to immediately solve the problem. Explain to the customer what you are doing to resolve the problem. Do not leave the installation site without assuring the customer that a technician will fix the problem within a specified period of time.

Do not convey to the customer that there is a problem with the TV set, or that "there has been difficulty elsewhere in the cable system." Statements like "We are having troubles" or "This TV brand is inferior" or "I've never seen this one before" are often interpreted negatively by confused customers.

Explaining the service

When you have finished the installation and have achieved a quality picture, take the time to explain the new service to the customer.

Go through the complete channel lineup explaining the programming on each channel. Explain the operation of the converter. If you have installed a converter with volume control, explain how to set the control in case it is accidently moved or changed, so the customer can reset it without requesting a service call. Show and explain the company-provided channel guides and how to use them. Make sure the customer understands the service; ask if there are any questions or if the customer wants to review anything you have explained.

This is a vital part of the customer service process. If you leave the customer without explaining the service, the new service can be frustrating and disappointing to that customer.

Give the customer all the material including cable guides, pay channel guides, and converter operation booklet that the system provides. If the customer does not yet subscribe to the premium channels (pay channels), the guides will serve as added advertisements.

Problem situations

Certain problem situations may be encountered in your normal day-to-day work activities, some more commonly than others. Here are some techniques you can use when these situations arise:

The missed appointment. If no one answers the door when you arrive, radio or phone the system office so the customer can be contacted in case he or she is sleeping or is unable to hear you knocking at the door. If no one answers even after the system telephones the customer, leave a "Sorry We Missed You" door tag indicating your name, the date and time you were there. Also, mark and initial the work order with the same information.

If you are late for an appointment be honest and apologize for the delay and any inconvenience. Do not make excuses for your lateness or become defensive. Be friendly and smile. Shift the customer's focus by getting right to work. If you know you will be late, contact your dispatcher and ask that the customer be notified, rescheduling the installation if necessary.

Mistaken or undecided home owner. If you are greeted by a home owner who says he or she did not order cable, check the address on the work order and verify you are at the correct house. Apologize for bothering the home owner and leave.

If the home owner tells you he has changed his mind, inquire as to the reasons and note on the work order. Offer to explain the service if there seems to be some confusion about the services originally ordered. If the homeowner still refuses, thank him or her and leave.

The over-friendly customer. At times, a customer may become too friendly and make inappropriate advances. This is a serious situation. Do not hesitate to leave the installation as quickly as possible. Immediately collect all your tools. Politely excuse yourself to the customer, explaining you have to go back to the office. Then leave immediately. Indicate the exact reason for terminating the installation on the work order. Report the situation to your supervisor so other arrangements can be made to complete the installation.

The eagle-eyed customer. Some customers may seem overly interested in what you are doing, particularly to their property. Others may want to know about the technical aspects of CATV and question each part of your installation procedures. These customers tend to watch you at all times, both outside and inside the house. Be patient; quickly answer all the customer's questions while you continue to work. If the customer follows you around, make sure he does not hurt himself on your equipment. Do not let the customer help you, even if he offers.

If a child is following you, be even more cautious and do not hesitate to ask the parent to assist in maintaining the child at a safe distance away from you. Explain that you are concerned for the child's safety.

Dogs. If a dog prevents you from proceeding to the customer's house, request that the customer be called to restrain the dog so that you can proceed with the installation.

Customer service begins with a positive approach. Smiling, speaking with confidence, patience, showing small courtesies, following through and enthusiasm are all keys to successful customer service. **CT**

If you would like information on interactive videos or the Qualified Installer Program, please contact the author at Jones Intercable, 9697 E. Mineral Ave., Englewood, Colo. 80112; (303) 792-3111.

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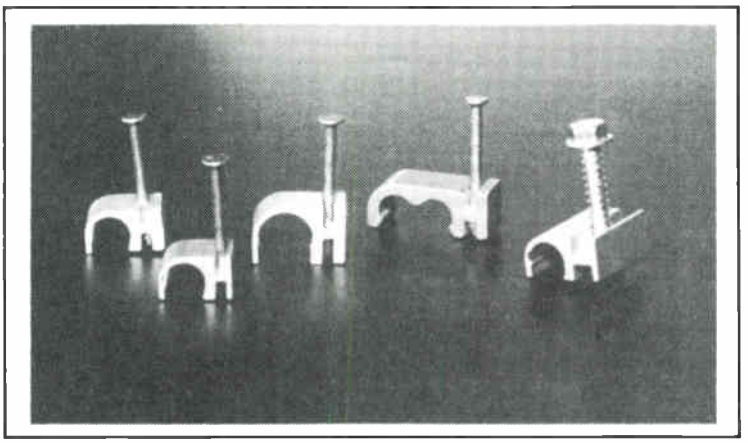

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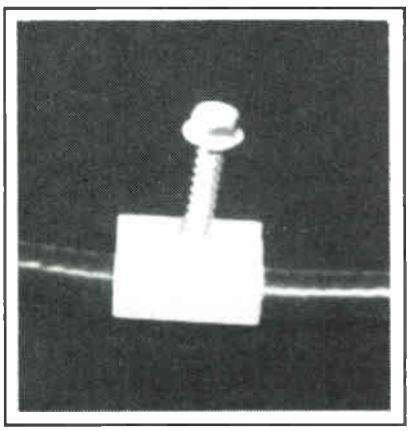

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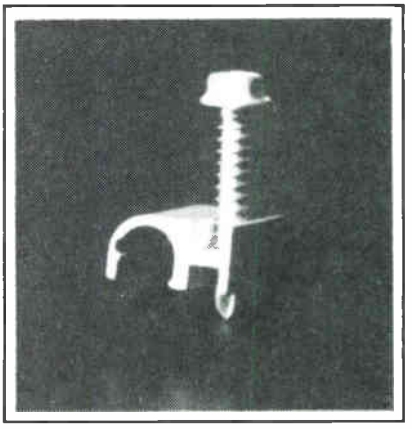

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Reader Service Number 36

Toward a CATV network architecture

Engineers at Cable Television Laboratories Inc. are working to develop a network architecture for cable — a process that may have considerable payoff for cable operators, according to Stephen Dukes, CableLabs' director of advanced network development.

Network architecture, said Dukes, is a set of underlying engineering relationships that are potentially applicable to all cable systems. These relationships, he stresses, are independent of changing technology.

The prime example of this network-architecture perspective is the open systems interconnection (OSI) standard promulgated by the International Organization for Standardization (ISO), which has been the guiding design principle behind communications network architecture for more than 20 years.

CableLabs and a group of collaborating engineers from cable MSOs are in the midst of defining a generalized network architecture for cable — a process that involves three major phases: mathematical modeling, technology assessment and simulation.

Mathematical modeling

The theoretical phase of the advanced network development effort consists of building mathematical models by drawing on the insights of leading theorists at colleges and research institutions around the world.

The smallest component in CableLabs' emerging proposed network architecture is the local distribution area (LDA) — a defined geographical subset of a cable system. Each LDA should function like all other LDAs in terms of a large number of parameters, such as spectrum allocation, C/N, power allocation, etc. Dukes believes that the LDA concept can serve as an analytical tool for smoothing out "design divergences" that result in inconsistent performance in different geographical areas of cable systems.

CableLabs' network architecture model is expected to be completed this year. It incorporates both physical laws and (equally important) economic constraints and will be of immediate use to decision makers facing annual budget decisions.

Today, an operator might be deciding how far to extend fiber into a network. In the future, operators will be confronted with a long list of such decisions like the following:

• *To increase channel capacity by adding bandwidth or by adding switching.* One way to add channels is to increase bandwidth to 1 GHz or more. "In the future," said Dukes, "an alternative will be to add a switch to the topology of the network so that one could switch or route groups of 20 channels to one hub or another hub, thus providing the appearance of a near-video-on-demand type of service."

Since 60 percent of TV viewing is typically directed at only five channels, "there's a happy medium that may involve transmitting the high-viewership channels and switching the special-niche programming," said Dukes.

• *To expand the capacity of fiber with digital compression or with coherent technology.* Digital signal compression is the current industry focus. In the future, other technologies may help expand capacity.

Also part of advanced network development is participation in groups setting standards for future video services. This is important, Dukes said, so that the cable industry's needs are represented on forums that will probably be dominated by telcos. As telcos become more involved in video delivery, Dukes wants to be sure that any new video standards are interoperable with cable's.

CableLabs, which recently joined the American National Standards Committee (ANSI), is now active on ANSI's T1S1.5 broadband architecture and video services working group, whose role is crucial in deciding how cable interfaces with other video networks.

One such interface, said Dukes,

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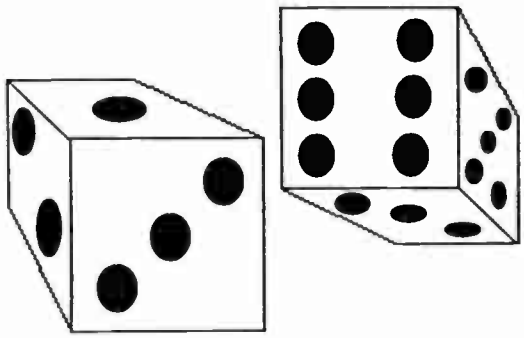

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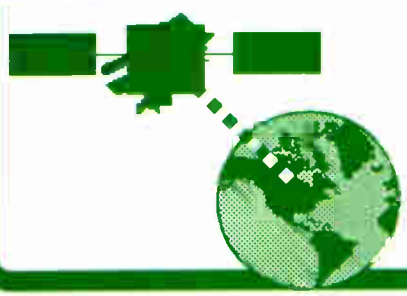

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Reader Service Number 1

will be with the synchronous optical network (SONET) standard, which is not likely to be implemented in cable systems but is being adopted by RBOCs and local exchange carriers.

However, Dukes believes another emerging industry standard, asynchronous transfer mode (ATM), a fast-packet multiplexing protocol, "may be ideal for the switching and routing of video," including that in cable systems.

Role of technology assessment

Dukes' advanced network development effort works closely with the CableLabs program headed by Dr. Aleksander Futro, director of technology assessment. Futro works with hundreds of manufacturers, studying their product development efforts and encouraging them to make products of maximum usefulness to cable operators. For example, optical amplifiers are a mature technology, whereas pump fiber, a technology that uses a separate fiber to "regenerate" a signal instead of amplifying it, is a very new field — one in which CableLabs might want to encourage R & D efforts.

Related to technology assessment is network migration analysis, which assesses the economics, feasibility and time lines for implementing new technologies. It asks whether a given technology will be out of the lab and off the assembly line by the time network designers will be needing it. For example, tunable lasers have been highly sensitive to temperature changes. Will they always be so? Or, how soon will switched terrestrial fiber networks challenge satellites' near-monopoly on bringing distant video signals to cable headends?

One trick of migration analysis is not to embrace a technology too soon when a better technology may be emerging (for example, some telcos bought early SONET equipment and got locked out of second-phase SONET functionality). Quantum leaps of technology must be anticipated — where possible.

Futro's group, said Dukes, "provides me with projections of available technology solutions on the five- or 10-year and sometimes even longer horizon."

Right now, cable operators speak with many voices in directing the product development efforts of manufacturers. If they could agree on some basic parameters of network architecture and suggest them to manufacturers, operators might some day have fewer problems with interoperability of different manufacturers' equipment, Dukes noted. Manufacturers, in turn, could achieve greater economies of scale.

Network simulation

At some point, the development of an advanced network architecture emerges out of the computer models and into laboratories and test bed cable systems. This phase is called network simulation.

Some of the major simulation work under way or planned at CableLabs include the following:

• *Taking precise measurements of the input and output of cable headends to determine the best signal quality one can realistically expect out of a headend.* Without this data as a starting point, it's hard to design the fiber-and-coax architecture that lies beyond the headend.

• *Testing, in conjunction with CableLabs' Advanced Television Group, how relatively low-frequency analog signals and higher-frequency digital signals can coexist on a coaxial cable.* It is believed that a guard band is needed to prevent interference between the two signals — but how large a guard band isn't known.

• *Testing video switching, focusing not on full two-way interactive switching but on one-way switching of blocks of channels among different groups of viewers.*

Conclusion

CableLabs, through the advanced network development process, hopes to provide cable operators with a set of non-binding guidelines with which they can produce "a network design that is robust and flexible enough so that it doesn't box them into a corner and one that can adapt to changes in technology."

In this way, cable operators will retain a clear voice in where their technology is going, Dukes said.

Consider the alternatives, he added.

"Without a network architecture, we are limited to a network-design approach, which is technology-dependent. We'll find ourselves meandering as technology moves ahead.

"With a network architecture, we will be able to adapt to changes in technology more easily — and with less investment. We'll be much more in charge of our destiny." **CT**

Diversified Fastening Systems' Con-Sert concrete fasteners

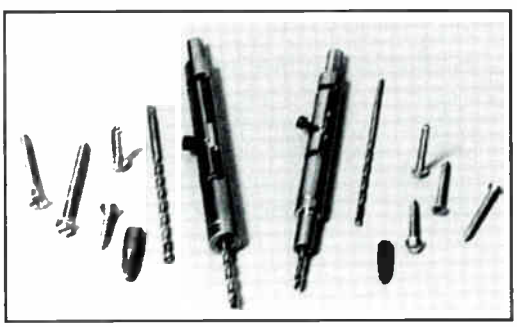
By Ron Hranac
Senior Technical Editor

It's been said if you build a better mousetrap, the world will beat a path to your door. So how do you go about improving upon something as simple as fasteners for attaching things to concrete or similar surfaces?

Most of us at one time or another have used plastic or lead expansion anchors and their associated hardware to fasten to masonry surfaces ground blocks, splitters, apartment boxes, conduit clamps and just about anything else you can imagine. Most of us also have come back some time later only to find that the anchors pulled out of the holes, leaving our original handiwork dangling.

Diversified Fastening Systems of America (DFS/USA) has what just may be the better mousetrap. Its Con-Sert System was designed to replace plastic anchors, plugs and screws and the problems that sometimes accompany them.

CT obtained one of DFS/USA's #8 Con-Sert anchor set tools and a variety of lengths of #8 hex head Con-Sert screws for evaluation.



The product

The Con-Sert System is available in two sizes — 1/4 inch and #8. The term "System" in this product line refers collectively to the corresponding anchor set tool and various masonry screws. We looked at just the #8 size, which is available with 1/2, 3/4, 1, 1-1/4 and 1-1/2 inch long screws (the matching #8 Con-Sert tool works with any of these lengths). All except the 1/2 inch screws are available in either hex or Phillips; the 1/2 inch screws are hex head only.

The manufacturer describes the #8 System as being for moderately light duty attachments such as electrical boxes, conduit straps, CATV hardware, small MDU and SDU boxes, splitters, cable clips and similar applications. Acceptable surfaces include poured concrete, concrete block, brick, wood and light gauge steel. Rather than relying on an expansion anchor being installed in a pre-drilled hole, the Con-Sert System masonry screws actually cut threads in the mounting surface as they're installed.

The installation procedure is quite easy. Put the Con-Sert anchor set tool in a 3/8 inch variable speed drill. A hammer-type drill operating at 400-800 RPM is recommended, and the small battery operated drills also work well. The tool has a replaceable masonry drill bit in a latching spring-loaded mechanism. You simply extend and lock the bit in one of the two notches for proper drilling depth, then drill the hole in the mounting surface. For the #8 screws, a nominal 1/2 inch embedment depth is suggested.

After the hole is drilled, just pull back on the drill and the tool's spring-loaded mechanism will self-retract the bit. If you're using the hex head screws, the anchor set tool has a matching hex socket in the end. If you're using Phillips head screws, the tool also comes with a small Phillips bit that fits in the hex socket. In either case, you can use your drill — with the Con-Sert tool still in it — to install the masonry screws after you've drilled the holes. DFS/USA recommends that hammer-type drills be reset to regular drill operation before installing the screws, though.

The masonry screws are manufactured from carbon steel. The screw heads are formed by a process called cold heading and the threads are rolled. The undersides of the screw heads have serrations (you shouldn't need to use lock washers) and the screws themselves have a gimlet point. After heat treating, the screws are plated with a zinc and yellow dichromate anti-corrosion conversion coating. DFS/USA is just completing testing on a new plating for use in extremely corrosive environments. The new plating should be available as an option by the time you read this.

The anchor set tool main body is made from cold rolled steel, and its removable hex socket as well as the Phillips bit are made of hardened high stress proof alloy steel. The drill bit retracting spring is stainless steel, and the set screw that holds the hand-brazed carbide tip masonry bit in the tool is hardened alloy steel.

The overall length of the tool is 6 inches with the masonry bit retracted. With the #8 tool, the bit can be locked to extend either 13/16 or 1-9/16 inches beyond the end of the tool. The main body diameter is 9/16 inch, the hex socket diameter is 3/8 inch (when the masonry bit retracts, it "disappears" into the end of the socket), and the drill shank is 3/8 inch diameter with flats machined on its surface for an easy fit in a drill chuck. The surface of the tool also is plated for corrosion protection.

The tool, with a masonry drill bit installed, the 1 inch long Phillips bit and a small instruction sheet are enclosed in a reusable protective threaded clear plastic cylinder, and at the time of the evaluation had a list price of $48. The masonry screws are packaged 100 to a box, and include a new masonry bit in each box (according to the manufacturer, each masonry drill bit should be good for drilling about 100 holes, depending on the material being drilled). The #8 screws range in price from $16/100 for the 1/2 inch length to $19/100 for the 1-1/2 inch ones.

Lab test

The Con-Sert System was evaluated by Twin Cities Testing of St. Paul, Minn. That firm is an independent lab that has the capability to test expansion anchors in concrete, using nationally accepted standards.

For the Con-Sert System components, Twin Cities Testing followed guidelines that were in accordance with ASTM (American Society for Testing and Materials) E-488.88, which includes C-31-69 and C-33-81. The accompanying

BOOKSHELF

The following is a listing of videotapes available by mail through the Society of Cable Television Engineers. The prices listed are for SCTE members only. Non-members must add 20 percent when ordering.

☛ *Video Waveform Measurements* — Using actual equipment setups, various measurements are discussed. Topics include baseband video, demodulators, envelope-type detection, synchronous detection, depth of modulation on radio frequency (RF) signals and zero choppers. Full-field video waveform testing includes multiburst, depth of modulation, sine pulse, 2T window, field rate square wave and tilt. Includes information on use of vectorscope, average picture levels and video signal-to-noise. (30 min.) Order #T-1008, $35. **B-II**

☛ *High Frequency RF Sweep Generator Basics* — Using test setups, graphics and blackboard discussion, this tape details major measurements by comparison, attenuators as precision instruments, measuring gain and flatness, peak-to-valley, loss, return loss/voltage, standing wave ratios on passives and cable and delay scan loss. (30 min.) Order #T-1009, $35.

☛ *RF Sweep Generator Applications* — System sweeping shown with graphics and discussion on low-level vs. high-level sweeping. Measuring at the headend and at the cable is shown. Equalizers, trunk measurements, mismatch in cable and swept response are covered. (30 min.) Order #T-1010, $35.

☛ *CATV Converter Repair Procedures* — Basic block diagrams explain multichannel varacter converters, RF modules, power supply and control box functions. Electrical and mechanical features, tuning voltages, disassembly and testing, meter leads, lifting loads on power supply and troubleshooting are addressed. Test points are identified. Overall converter repair procedures are presented. (30 min.) Order #T-1011, $35.

Note: The appearance of a **B-** indicates a tape relating to the BCT/E Certification Program; the Roman numeral designates which category. All videotapes listed were produced in 1981, are in color and available in 1/2″ VHS format only.

Shipping: Tapes are shipped approximately three weeks after receipt of order via UPS (no PO boxes). SCTE pays surface charges within the continental U.S. Orders to Canada or Mexico add $5 (U.S.) for each tape. Orders to Europe, Africa, Asia or South America: SCTE will invoice the recipient for additional air or surface charges (please specify). "Rush" orders: a $15 surcharge will be added in addition to air shipping cost.

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table summarizes the performance of the #8 Con-Sert screws.

And how do they work out of the lab? I tried several poured concrete surfaces and found that: 1) a hammer-type drill works far better than a standard variable speed drill for drilling the hole; 2) the hole that you drill *must* be deeper than the screw embedment depth, or the screw may strip the threads it has cut in the concrete if it prematurely bottoms out; 3) there may be a problem with retention in old, soft crumbly concrete; and 4) in some situations — particularly with the 1/2 inch screw — you may want to install the masonry screw with a hand tool rather than the drill-operated Con-Sert tool's hex socket.

Comments

The Con-Sert System works quite well. I think you'll find it to be a good alternative to the limitations of plastic and lead anchors or screw plugs. Because it's somewhat different than the traditional methods of attachment, I suggest that you experiment with a variety of mounting surfaces and different lengths of masonry screws before putting it to use in the field. The manufacturer recommends a hammer-type drill for concrete work, and based on our field trials I agree with that recommendation.

While we didn't test the company's other concrete attachment products, DFS/USA has heavier-duty Con-Sert System components (1/4 inch diameter in a variety of lengths) as well as several different kinds of expansion, wedge and T-type anchors.

For more information, contact Diversified Fastening Systems of America, 501 Richings St., Charles City, Iowa 50616; (800) 833-6417 or (515) 228-1162. **CT**

Performance of #8 Con-Sert screws

						Ultimate load (lbs.)		Safe working load per fastener (lbs.)		Safe working load per foot (lb./ft.)	
Size	Diameter (d)	Embedment (E)	E/d	S	Actual spacing (inches)	Tension	Shear	F_T Tension	F_S Shear	F_T Tension	F_S Shear
#8	Same	1/2	3.0	3.5E	2	280	670	40	170	240	1,000
#8	Same	3/4	4.6	3.5E	3	540	750	70	200	280	800

Notes: Recommended spacing (S) is from ASTM E 488-88, Table 2. Actual spacing was rounded to the next highest inch. The ultimate load is the load at which the joint fails; the safe working load (SWL) is a design load that is obtained by dividing the ultimate load by a factor of safety. The SWL per foot is found with the formula (12/spacing) x (SWL per fastener). For these tests 3,500 PSI concrete was used.

The joys of outlining

By Rikki T. Lee
Consultant

Would anyone cheat at poker in order to lose? Probably not. But if you write a tech report and afterward outline its contents for an accompanying memo, you cheat at writing and lose. "Post-outlining" comes from the morbid fear that outlining is painful and a necessary evil. Quite the opposite: It's easy and the best thing you can do for your project, just as long as you outline first — not last.

Properly constructed, an outline has a wealth of benefits:

- It helps a beginning writer produce excellent work. Without an outline, your writing rarely rises above mediocre.
- It can get almost anybody over a bad case of writer's block and thus speed up the actual writing.
- It clears up incoherent and disorganized thinking; you ensure major points receive the emphasis they deserve.
- In many cases, you can tell by the outline whether it's time to stop researching and start writing.

And now, the down side. To do it properly, any outline takes some time. Also, after a few successful writing projects, preparing an outline becomes addictive; you'll refuse to work without one.

Do the laundry first

At various intervals during your brainstorming and/or note-taking for a writing project, stop and do the laundry. That is, make a "laundry list": a collection of ideas or topics in any order that you might need to cover in your paper. Don't be timid about what you write; no one's going to look at your list.

Avoid putting topics into priorities just yet (unless you're sure about what the paper must emphasize). Use as many words you need for each topic in order to understand it during your next outlining. Don't bother with Roman numerals, ABCs or other means of organizing topics. Let's say your report explains the OTDR. You might come up these topics on the first laundry list:

- Features of FiberLook 398
- Taking safety precautions with fiber
- What's an OTDR?
- Calculating losses in an optical fiber
- Step-by-step instructions for its use
- Compare to the CoaxLook 124
- Uses in a fiber new-build

And so on. As you continue to research or think about the paper, keep breaking now and then for another outlining session. Don't start from scratch; revise your previous outline. Look at the last one in the light of new data. If you've discovered new topics or new facts that fit a topic, add them. To branch off into subtopics, draw a line from one topic to a secondary list.

After a few revisions, your laundry list expands in both number of topics and number of words attached to each topic. Now begin establishing priorities. Which is most important or provides foundation for everything else? Which follows from the previous topic? Any conclusions or recommendations?

No one's insisting you follow the style of your school days, unless you must present the final outline to a supervisor or co-worker. It helps when others advise and make suggestions before you write the paper. And if you organize the topics into a standard structure, you provide the basis for a table of contents and an abstract. Your final outline might look like this:

I. What is an optical time domain reflectometer?

A. General and applications-based definitions.

1. The OTDR is a piece of optical test equipment measuring the location of Fresnel reflections and backscattered light waves that have been caused by a break or other discontinuity in the fiber.

2. It also provides a working "map" of the plant's splices, connectors and other devices for later maintenance.

II. What does the OTDR test?

A. Reflections and backscattering, as applied to CATV.

B. Circumstances that cause discontinuities.

1. Breaks in the fiber are often created by poor construction practices or utility contractors who dig without first contacting "Call Before You Dig."

2. Splices and connectors must be applied properly to the fiber or they can cause reflections and add to the amount of optical return loss.

And so on. Notice that some elements are sentences while others are words or phrases. Using a similar approach can keep your outline understandable to yourself and others. But try not to get locked in by structure; remove mental obstacles that might make outlining seem painful. For example, you don't have to go as far down as sub-sub-subtopics. Whatever works for you will work in your paper's favor. You can just as easily make every topic (or subtopic) a word, phrase or sentence. Or make each main topic a summary of each paragraph.

Outline and grow rich

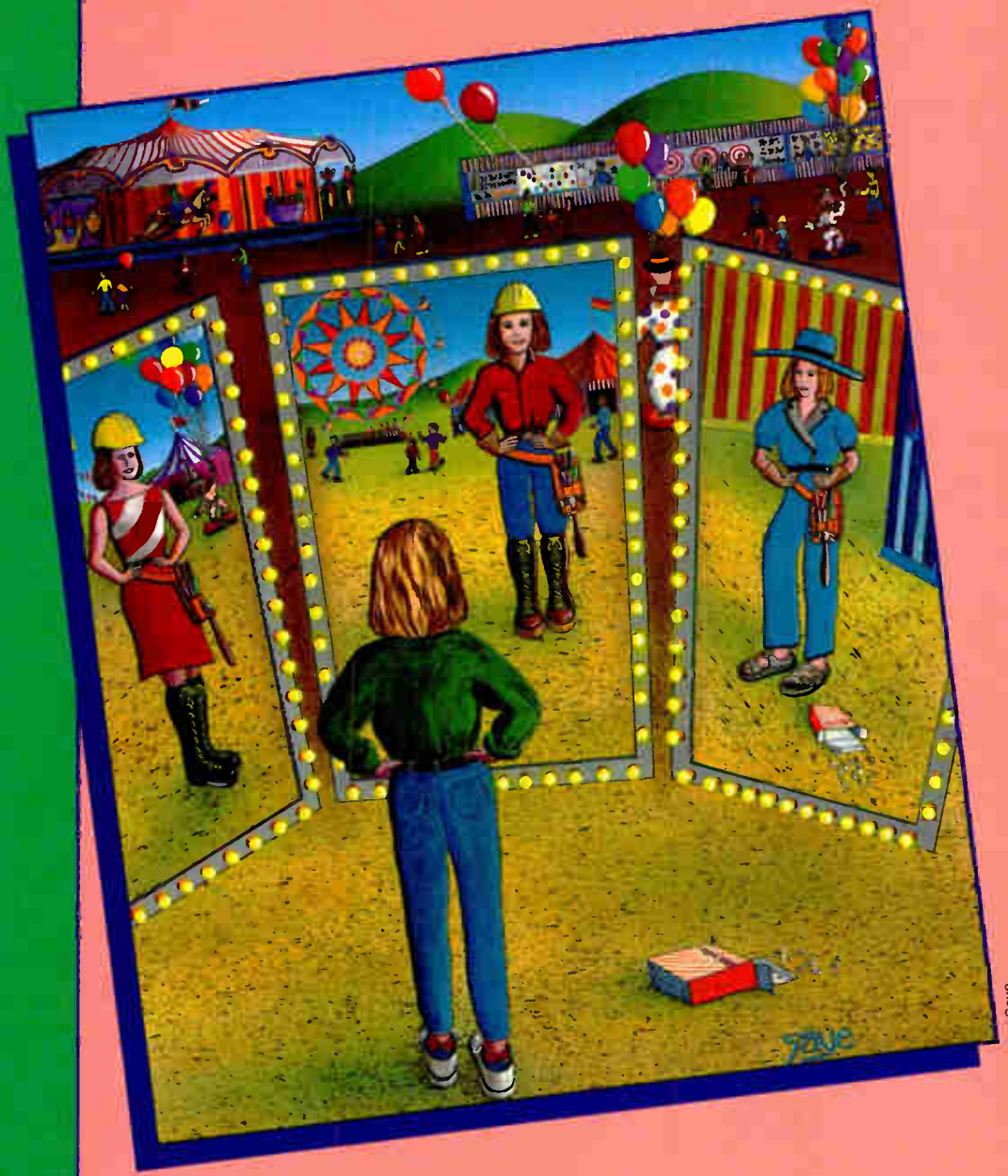
You can outline more than tech reports, journal articles or other writing projects. It also works for seminars, presentations, meetings and so on. You can even outline your day's work every morning. Practice outlining while you read; it soon becomes automatic and your communication skills grow rich. **CT**

July 1991

Proper equipment use

BACK TO BASICS

The training and educational supplement to Communications Technology magazine.



Geri Saye

Table of Contents

Formerly Installer/Technician

Comprehensive safety techniques and tips

By Jim Bishop
Line/Service Manager, United Artists Cable

United Artists Cable Denver suburbs implemented a comprehensive safety program in August 1990 that includes monthly safety checks of vehicles, tools and equipment, and sessions dedicated to specific job-related subjects. These safety meetings last from one to two hours and all field personnel attend.

The first week of every month the area supervisors are required to inspect company vehicles in accordance with the *United Artists Safety Manual*. The supervisor, along with the employee, completes a vehicle inspection report identifying any faulty condition that may exist. This report is then copied and forwarded to the fleet administrator for resolution of any vehicle problems.

The third week of every month is dedicated to the inspection of employees' personal protective equipment and tools. As with vehicle inspections, tool

"Inspection of poles, maintenance of equipment, testing of gaffs, proper protective clothing and climbing techniques are all critical areas in mastering the art of pole climbing and none should be taken for granted."

Figure 1: Climbing equipment

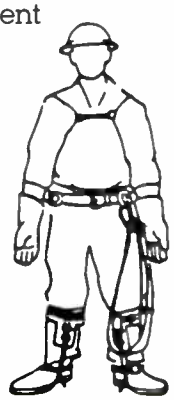


Figure 2: Body belt

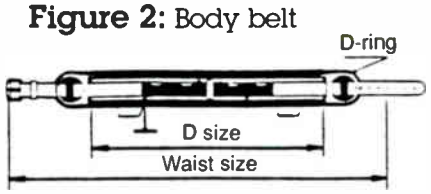


Figure 3: Measuring the individual

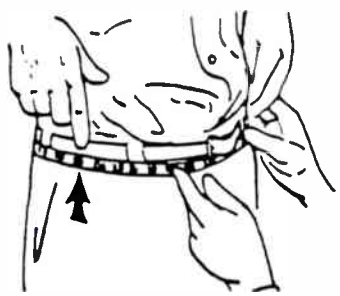


Figure 4: Measuring individual for waist size

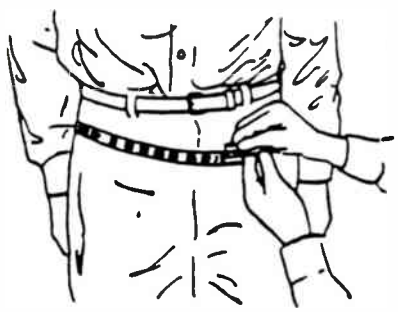


Figure 5: Position of belt and strap when climbing

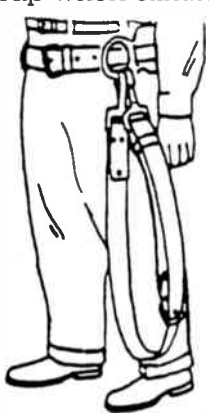


Figure 6: Climbers

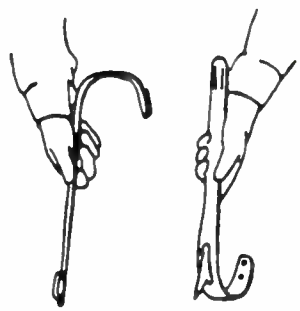


Figure 7: Climbers properly worn

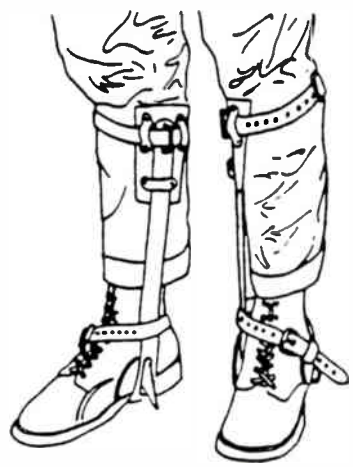
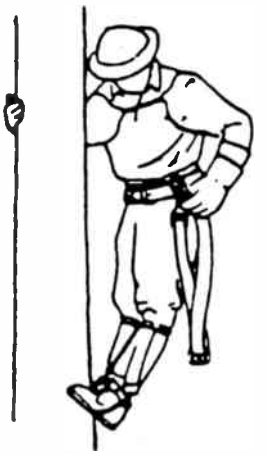


Figure 8: Adjusting pants leg

Figure 9: Position while climbing

Figure 12: Releasing safety strap



and equipment inspections are documented and any tool or piece of equipment found to be unsafe is replaced.

The second and fourth weeks of each month are used for specific job-related safety topics. Every safety meeting is documented by completing a weekly safety meeting report, which includes the names of all attendees. A copy is forwarded to the company trainer's office.

The following are some safety techniques and tips that are covered in the program.

Figure 10: Ascending the pole

Figure 13: Passing strap to right hand

Figure 11: Descending the pole

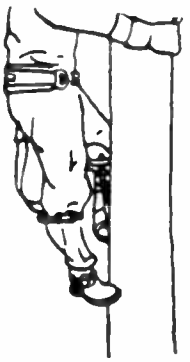
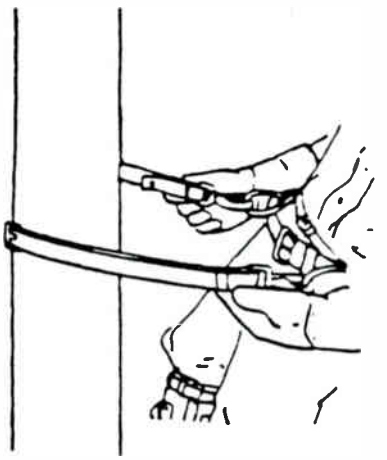


Figure 14: Position of strap in use



Pole climbing

Pole climbing is a large part of the technician's job and if not performed properly, could result in a serious accident. Proper pole climbing equipment consists of a body belt, safety strap and a pair of climbers as depicted in Figure 1. This equipment allows a workman to climb, stand or change positions on a pole when no other suitable means of support is available. It also allows the free use of both hands while in any position on the pole.

The belt consists of a cushion section, a belt section with tongue and "D-rings," which are attached solidly to the cushion or on shifting D-ring belts that are attached solidly to a D-ring saddle. The body belt usually has provisions for a tool pouch used for carrying one or more tools. The belt, as a general rule, is marked in "D" sizes. The D size is the distance between the heels of the D-rings when the belt is laid flat (see Figure 2). The waist size measurement of the belt is found by measuring from the roller on the buckle to the center hole on the tongue end as shown in Figure 3.

Figure 4 illustrates that proper measurement for the D-ring size is the distance around the body at the point where the belt will be worn between the prominent points of the hip bones, plus 1 inch. The proper waist size of the body belt is determined by measuring the distance around the body at the

Figure 15: Moving safety strap position

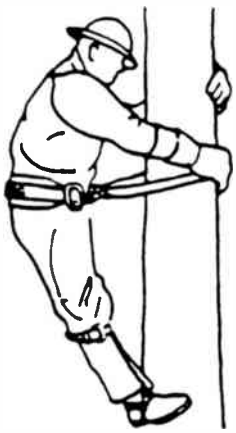


Figure 16: Practice position

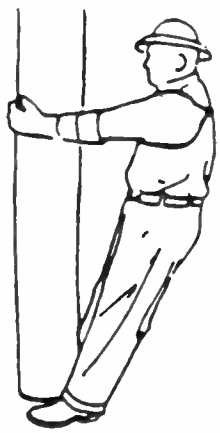


Figure 17: Practice climbing

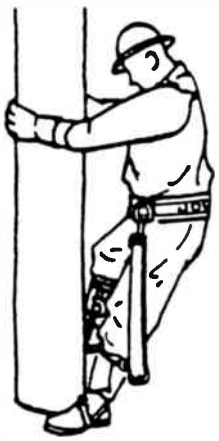
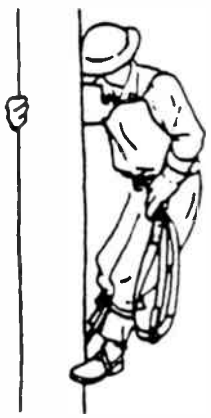


Figure 18: Ready to place strap



point where the belt will be worn. The measurement should be made outside any clothing normally worn while working.

The body belt should be worn snugly but not too tightly. The end of the strap always should be passed through the keeper and kept clear of the D-ring when the belt is being worn as in Figure 5. The safety strap is used for support while working on poles, towers or platforms. Snap hooks on each end are provided for attachment to the D-ring on the body belt.

When climbing poles (under normal conditions) both snaps should be engaged in the same D-ring for safety. The snap on the double end should have the keeper facing outward and the other snap should face inward. Never depend on sound or feel when "belting off." Always look to see the snap is secured to the D-ring.

Climbers (as shown in Figures 6 and 7) are used for ascending, descending and maintaining the working position on poles. The condition, length and shape of the gaffs of the climbers are critical. Defective gaffs are dangerous and could cause inadvertent falls from poles. Proper fit of climbers requires the leg iron to reach approximately 1/2 inch below the inside prominence of the knee joint (see Figure 8). Figure 9 shows proper climbing position.

While it is important to inspect all equipment before climbing, it is equally important to be wearing proper protective clothing. Lineman's boots, hard hats, long-sleeved shirts with buttoned cuffs, and leather gloves with a minimum 3-inch gauntlet are a must in protective climbing clothing.

After protective clothing and climbing equipment are in place and before attempting to ascend a pole (Figure 10), we must first carefully inspect the pole for unsafe conditions. These could include rotted places, nails, tacks, cracks, knots, foreign attachments and any other similar hazardous objects. When descending the pole (Figure 11), keep the arms and body relaxed with the hips, shoulders and knees a comfortable distance away from the pole, taking short steps using hands and arms for balance only. Figures 12-18 illustrate other important pole climbing techniques.

Inspection of poles, maintenance of equipment, testing of gaffs, proper protective clothing and climbing techniques are all critical areas in mastering the art of pole climbing and none should be taken for granted.

Bucket truck

Another means of working in aerial plant is with the vehicle-mounted aerial lift, which is usually operated in accessible areas like streets or alleyways. It is extremely important to be conscious of power lines and avoid contact at all times. Only trained employees should be allowed to operate aerial lifts and then only after a comprehensive training program and inspection of the lift and proposed work area, which will identify any potential hazards or unsafe conditions.

As in climbing a pole, a hard hat should be worn at all times when in the air. Vehicle brakes should be set and locked and wheel chocks should be used when necessary. The vehicle must not be moved by anyone when the boom is extended and vehicle safety equipment (such as a revolving beacon or strobe lights) should be operating at all times when the lift is in operation. It is also important to ensure that proper signs, traffic cones, flags and in some cases a flagman are in place before operating the lift. State and local laws vary from place to place on specific requirements and should be identified in your area prior to performing work.

Employees should remain standing on the floor of the basket. They should never sit or stand on the edge or use planks, ladders or other devices for a work position while the bucket is in operation. A body belt should be used when operating the aerial lift and techs should always face the direction they are moving while staying alert.

Ladders

A third method for aerial work is the

(Continued on page 64)

The bucket truck: A versatile tool (Part 3)

This is the third in a series of articles on bucket trucks and will cover equipment and accessories. Part 1 (February 1991) explored their uses and benefits, while Part 2 (March 1991) discussed maintenance and routine servicing.

By Pat Bartol
Technical Representative, Mobile Lifts Inc.

Perhaps one of the happiest times an engineer or technician can experience in his cable TV working career is the day he selects accessories for his shiny new bucket truck. He is sure to arrive at the mobile lift shop bright and early and will be certain to know exactly what he wants in that truck. Well, he has been waiting a long time patiently hasn't he? But is what he wants really what he is going to need?

It is possible that our "Smilin' Jack" does know what he wants and does know exactly what his needs are for his particular job. This is usually the guy who already has had a lift truck or two for his own use and has already learned a lot from experience. But even the experienced technician often can get better ideas after talking to a truck technician or reviewing the vast catalog of items in stock.

Trucks for the long haul

The way the truck is outfitted is usually how it will be used for at least the next five to 10 years. Therefore, it makes sense to put some thought into which accessories the truck is going to carry. This is best done by personally considering what will be needed and by discussing these needs with someone who is very familiar with the various accessories available and their applicability to the requirements.

Not all trucks are laid out the same way, nor should they be. A truck used for construction will have totally different requirements for bins, shelving and storage boxes than a truck assigned for technical use such as summation sweeping or maintenance. Is it important? You bet it is. Try stacking 14-inch pole bolts into a 12-foot bin sometime. You might as well dump them on the floor because that's where they will end up anyway.

The first thing to consider is the type of vehicle body your truck has. Is it a van, pickup or flatbed? Next, what will be the primary assigned use for the vehicle most of the time: construction, maintenance, technical, quality control, or what? Third, you need to consider required safety equipment. Finally, explore equipment options that just make the job easier and quicker — which may be appreciated during a system outage.

Let's review some of the possibilities — and I emphasize *some!* Because of the great quantity of items available, I could write a book and not cover all of the possible good layouts and arrangements.

Lights

Basically you are required to have a strobe light or rotating beacon on your vehicle for safety of the operator and as a hazard warning to other motorists. This light should be bright and have a clear unobstructed view from the truck. This is your first decision: strobe light or rotating beacon?

How much candle power, flashes per minute, color and current consumption do you need? You will find that the strobe light is brighter and has lower current consumption than the rotating beacon that may have more flashes per minute. The color amber is fairly standard for utility vehicles; red and blue are generally used on police, fire and other emergency vehicles.

"Your truck inventory of technical items can easily exceed $10,000 and you are sure to be sorry if you put them into some 'Mickey Mouse' compartment boxes."

How will you mount it — directly to the roof or on a light bar or pedestal? Again we must be careful to mount it in a good, visible location. A poorly mounted light may not be visible in all directions because the light is blocked by the lift pedestal or tool boxes, etc. It also is necessary to mount it in a place where it won't be knocked about and damaged by horizontal movement of the boom or perhaps when a hand ladder is being replaced on the vehicle. A lot of techs are asking for (and getting) two of them for safety's sake.

Running lights and reflectors also are a very good idea if it is anticipated there will be a lot of night work. The idea is to make sure the truck is as visible as is practicable so that the tech can feel relatively safe up in the bucket on a dark night.

Aside from beacons, strobes and running lights, spotlights operated from the truck cab and/or boom spotlights to illuminate the work at the bucket are invaluable. (Try holding a five-cell flashlight between your teeth for 10 minutes while adjusting an amplifier or repairing a splice.)

Finally, extra accessory lights to illuminate the inside of a van or inside the main tool boxes also improve efficiency a bit and make it easier and quicker to find the proper tools and parts.

Back-up alarm

There are two types of back-up alarms: electrical and mechanical. These alarms alert anyone behind the vehicle that it is, in fact, in reverse and backing up. The electrical alarms are connected to the back-up light switch off the reverse shifting lever and the alarm is usually the "oogaooga" type klaxon. The mechanical alarm has wheel-mounted hammers that strike a bell-type sounding device, which of course makes a bell-type sound. Sound output level for both devices are in the required 97-112 dbA range.

The main thing to consider here is

that the electrical klaxon type must have the vehicle gear shift lever in reverse to work and is dependent on a switch and electrical circuit. If the truck is in neutral and drifting backward there is no alarm. The mechanical alarm is relatively simple and therefore more dependable and sounds off even when the truck is in neutral and drifting backwards. Nevertheless, it is not quite as loud as a klaxon.

Wheel chocks and brake lock

There are a variety of wheel chocks to choose from and it usually depends on vehicle weight and tire size as to which are selected. Common wooden blocks cut from a railroad tie have appeared to work well at times depending on use and terrain. Aluminum non-skid, non-spark, purposely designed blocks were developed and tested in all kinds of terrain and skid conditions to stay put where you insert them.

The trouble with wheel chocks is you can't tell how good your blocks are until you really need them. If you ask me, that's a heck of a time to find out. You are apt to end up spouting one of those famous last sayings.

A mico-lock electrically locks up the brakes on your vehicle. This is in addition to the emergency brake and (with automatic transmission) putting the vehicle in "Park. " Installing one regardless of whether the vehicle is an automatic or stick shift is a good idea. It's the kind of device that just plain makes sense to have on board.

Ladder racks

Whether a ladder rack is included as part of the vehicle accessories is really a function of the primary use of the truck. The times when it is needed over the life of the vehicle may vary from a few to regular use.

However, even in the case of only a few uses, when the cost to bring in another person and vehicle plus the inefficiency of operating in such a manner are considered, the cost of a ladder rack and ladder are cheap indeed. This is especially true when you consider the possibilities of extended downtime during an outage because a ladder was not at hand when needed.

Bucket accessories

This is one area where you can do much to improve the efficiency of engineers or technicians and their ability to do their jobs. Instrument trays, glove boxes and tool organizers will help keep things in place until needed and protect against needless lost tools and small parts. The instrument trays can be purposefully selected in dimensions to hold any type of test equipment you might need to take up the pole.

A lip protector will give added protection to the bucket liner and a scuff pad on the floor of the bucket provides surer non-skid footing in bad weather while prolonging the life of the bucket. A bucket lid either of solid polyethylene or a soft cover made of vinyl-coated polyester will keep the weather out and the bucket and tools fairly dry in sleeting and snowy conditions.

Auxiliary power

Auxiliary power for energizing things like instruments, test equipment, TV receivers and electric tools can be generated in several ways such as inverters, engine-driven generators or alternators and battery-driven motor generators.

Inverters are solid-state devices with no moving parts that convert 12 VDC to 117 V, 60 cycle, single phase AC. Power outputs available are from 100 to 4,000 watts.

Auto generators and alternators are vehicle engine-mounted and energized by the vehicle engine through another pulley wheel and vee belt. Their output voltage is normally 115 V, single phase, sine wave AC at power ratings from 2,000 to 6,000 watts.

A transistorized voltage regulator and a magnetic clutch are very sensible options to consider with the auto generator. The regulator of course provides protection against excessive voltage at high engine speeds, while the magnetic clutch engages the generator only when you want it by flipping a switch. This reduces needless wear on the bearings, belts and brushes as well as additional load on the vehicle engine.

A Redi-Line motor generator is an interesting device in itself. Power is taken from a battery to drive a 12 VDC motor that in turn drives a 120 VAC, 60 cycle, single phase generator in a fairly good sine wave. Power from the source is extracted only when there is a demand such as when the trigger of a drill is pressed. This is an important feature to conserve battery power for longer use. They are easily mounted in almost any out of the way place and various power outputs from 500 to 1,600 watts are available. These generators also can be ordered with 120 VDC outputs for use with equipment that has universal brush-type motors.

Motor generators require a nominal current draw to get them started and some appliances simply do not draw enough current either because they are low wattage solid-state or are a double insulated tool and hence the generator does not function. This problem and voltage regulation also is readily solved by an optional remote start or remote start and regulation module that can be installed anywhere in the vehicle.

All of these power generators should be suspected of generating high voltage spikes and/or RFI at times. Therefore, if you intend to use them with instruments, an AC line filter should be installed. This unit will ensure clean and proper AC output voltage.

Storage bins and shelving

I once worked at a place where there was a guy called the "Pilot." This wasn't because he could fly an airplane or anything like that but because of the way he kept his truck. If he had anything to put in it he would just "pile-it." This guy hardly ever found anything when he needed it and trying to get around his truck was taking your life into your own hands. (I swear there were things with eyes living under that mess and they used to watch me all the time if I dared to look for a tool or something.) Now I believe that perhaps if the Pilot had better storage facilities on the vehicle he would have put more or at least some things away and we probably would have had to call him "Red" or something like that. Storage bins and tool boxes are an important component of the truck and care should be exercised in their selection.

Obviously, pickup trucks and flatbeds will require weatherproof boxes designed to function in the elements. This may be a full-scale utility body installed on a flatbed chassis or a customized set of tool boxes strategically mounted on a pickup truck. Their primary purpose, however, is the same — storage of parts, tools and instruments that are probably quite expensive.

Ordinarily, construction materials need not be fretted over except to be sure they are secure enough not to be lost, stolen or bounced around in the truck. Technical materials on the other hand such as amplifier modules, signal level meters and TV and sweep receivers need protection from the ele-

ments, excessive vibration and banging around. Your truck inventory of technical items can easily exceed $10,000 and you are sure to be sorry if you put them into some "Mickey Mouse" compartment boxes.

A point you should consider is whether you want steel or aluminum materials used to make the boxes. Weather-stripping, door locks and latches, concealed hinges, divider trays as well as capacity of the boxes and the ability to rearrange them internally also need consideration. Sliding drawer boxes and bed-mounted sliding drawers often utilize space that would otherwise be wasted. They also are easier to stock up and speed finding parts and tools.

Because storage bins for a van bucket are inside, you can be more flexible since you will not have the weather problem to contend with. However, you must still carefully plan out what size bins and shelves you will need. Measure the most common items (such as modules, housings and connectors) to select the proper drawer sizes or at least be able to adjust the dividers to accommodate the equipment. One way to plan your shelving is to draw out the inside dimensions of your truck on quadrille paper with 1/4-inch squares. Make your drawing fill the full sheet and use a scale of 1/4 inch = 6 inches or even 3 inches. From catalogs that list the dimensions of various pieces of shelving, you can now draw up different shelving schemes to suit your needs. Don't forget you can use some of your doors for door trays and shelves.

I have found one of the most useful cabinets is the between-the-seats file cabinet. It allows for the storage of maps and manuals all in one place. The top makes a great desk for writing up amplifier logs or customer worksheets and with a clear Lucite cover over the top, you can insert important data underneath face up. This could include notes concerning amplifier levels, equalizer losses, cable losses, etc.

Other bolt-on accessories that get a lot of use are hard hat racks and extension cord brackets. Window screens or protectors, bulkhead dividers and cab protectors can help prevent damage to the truck from loose, rolling, sliding or dropped items.

The finishing touch to the truck are some of the necessary safety items such as the first-aid kit and fire extinguisher. Whether it is a van or utility body, rubber non-skid floor mats also should be made a necessary item. These mats cannot really be appreciated until you have walked with snowy or muddy wet boots on that smooth enamel finish of the truck floor or bed. A few bucks more for the rubber mats is almost guaranteed to save you many more in "lost-time-due-to-injury" hours.

The speed and efficiency with which any particular task is resolved in the field is a function of person/truck/tools/equipment and parts and the organization of such. Having the proper vehicle and tools, the right parts and being able to find them quickly and easily in undamaged condition is half the job, which the mobile lift technicians can help you with. The other half of the formula (a top notch technician or engineer) you will have to provide yourself. **CT**

Safety tips

(Continued from page 60)

ladder. While you may initially think that ladders are foolproof and the safest way to work aerial plant, if not used properly they too could be potentially hazardous.

Inspect ladders prior to every use. Never climb a damaged, bent or broken ladder. Defective ladders should be tagged and returned to the warehouse. Keeping ladders clean and free from mud or snow when in use and placing them on a firm level surface helps to ensure injury-free performance.

When climbing or descending a ladder, be sure to face the ladder at all times using both hands. Avoid "side" loading of a ladder, keeping the work area close to the ladder within reach of the employee. Only one employee should occupy a ladder at a time and no ladder should be used to gain access to a roof unless the top of the ladder can extend at least 3 feet above the point of support (at the eaves, gutter or roofline).

There are different types of ladders — extension, straight and step, to name three. They have one thing in common: If not used properly, they could cause injury from an accident.

Obviously, safety consciousness is extremely important at all times on the job. But this is especially true when working aloft. It is then that serious accidents may be the result of a fall or contact with electrical lines. Remember, accidents affect family members and friends as well as your company Make safety a prority. **CT**

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Reader Service Number 39

AD INDEX

It's so simple! To obtain additional information from any of the display advertisers appearing in this issue of ***Communications Technology,*** please use one of the **Reader Service Cards** on the facing page (pass the others along). The ad index below has been expanded to include not only the page number of each advertiser, but also each corresponding reader service number to be circled on the Reader Service Card.

The importance of testing batteries, Part 1

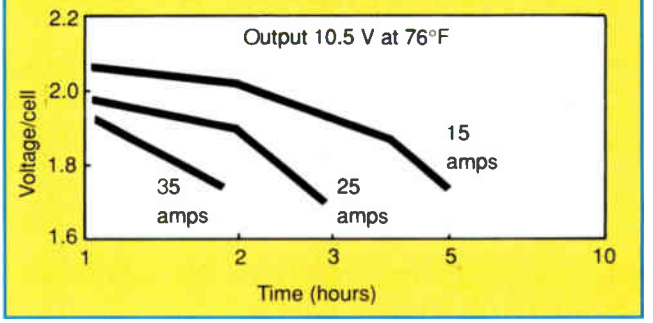
There are two places where batteries are generally tested, one is in the field and the other, the shop. This article will explore the proper method of testing batteries on the bench, while next month's installment will discuss field testing. This will be somewhat of an equipment construction article as well as an explanation as to the proper way to determine the reserve capacity of a battery.

By Jud Williams
Owner, Performance Technological Products

Not all batteries coming in from the field have lost their ability to hold a charge and, bearing this in mind, it may be prudent to subject some to further testing before disposing of them. They are, after all, a big investment, each ranging from $60 to $90.

A device called a reserve capacity tester is used to determine how much life remains in a battery. This relates to the AH (ampere-hour) rating the battery has when new. A battery specification sheet may have a set of curves (see Figure 1) showing the time period a battery is able to provide current, prior to reaching a cutoff voltage of 10.5 volts. One accepted test draws 25 amperes from the battery under test. Other tests subject the batteries to loads drawing greater or lesser amounts of current. These tests are generally made in the temperature range of 75-80°F. We will use 25 amps as our standard since many standby power supplies draw a similar magnitude of current.

Figure 1: Current discharge rate



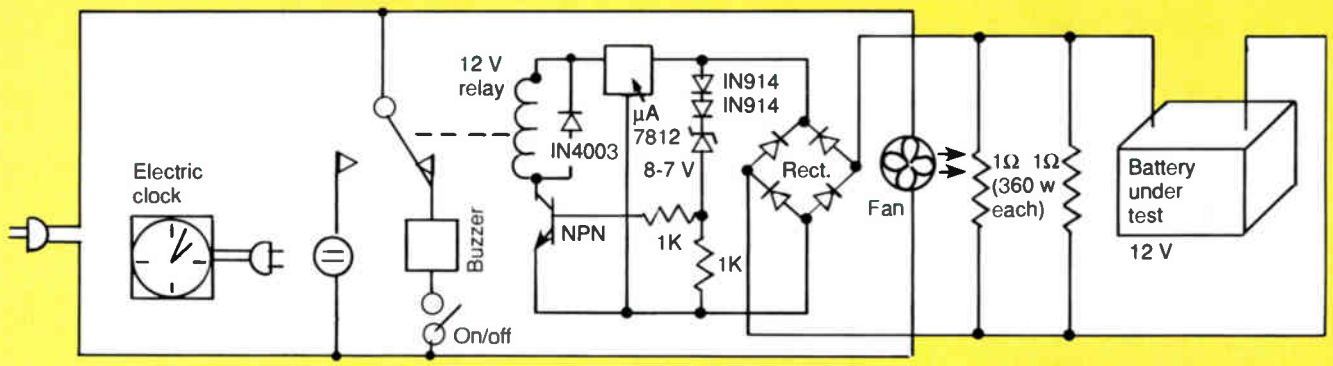
The test unit described here is quite simple in concept and very easy to construct. Figure 2 shows the complete circuit. The basic section of the device is a pair of resistors cooled by a muffin fan. Since Ohm's law tells us that a 12 V battery requires a load of 0.5 ohms (actually 0.48 ohms) in order to draw approximately 25 amps, two paralleled 1 ohm resistors are used. The 1 ohm value was chosen because it is readily available and easily mounted and cooled as shown in the accompanying photograph.

The second section of the tester is the low voltage cutoff circuit. It requires the selection of a specific value of zener in series with several signal diodes for precisely 10.5 V. You might expect that a 10.5 V zener would do the trick very nicely. Not so, because of the use of a bridge rectifier. This allows connections to the battery without regard to polarity. The rectifier also adds approximately 0.6 V to the zener.

When selecting a zener, a trial-and-error procedure is followed in order to achieve the desired 10.5 V. And mind you, zeners have very wide tolerances. One way to ease into the proper voltage is to select a 5 percent zener with a nominal voltage of, lets say, 8.7 V (a standard value) with two general purpose signal diodes pointing in the direction shown in the schematic. These diodes will build up the zener voltage by approximately 0.6 V each. Remember, we also have 0.6 V because of the bridge rectifier. Add these and see how the 10.5 V threshold is reached (8.7 + 0.6 + 0.6 + 0.6).

Be sure to construct the cutoff circuit first before going through the zener selection process so that you have a means of testing. The circuit is made up of a single pole, double throw 12 V

Figure 2: Battery reserve capacity tester schematic



Battery reserve capacity tester.

relay, a 7812-type of 12 V regulator, a general purpose audio-type NPN transistor and two 1,000 ohm resistors. Use a variable DC bench supply and digital voltmeter to determine the 10.5 V level. Note that it is the relay drop-out voltage we are concerned with, not the pull-in point.

The final section is the timer circuit. An ordinary electric clock works fine for the timer. The relay contacts are arranged so that 120 VAC comes into the contact arm. The AC receptacle for the clock attaches to the normally open contact. The AC buzzer is connected to the normally closed contact. The on/off switch silences the buzzer when the tester is initially plugged into the AC outlet. Once the connection is made to the battery, the switch may be turned on. The buzzer announces when the cutoff of 10.5 V has been reached, so that the load resistors may be disconnected from the battery to prevent any further drain on it.

When setting the clock, plug it into an outlet momentarily until the second hand is at 12:00 and then set the hour and minute hands to the same position. When ready, plug the clock into the tester and when the battery is connected, the clock automatically will begin to time the battery. When the buzzer goes on, the clock will stop and show the reserve capacity of the battery in hours and minutes. Add up the total minutes and multiply by 25 amps. This will give you the total "ampere-minutes." Divide that number by 60 to arrive at ampere-hours, which is the standard used to determine the reserve capacity of batteries. A battery in very good condition should last between 2-1/2 and 3 hours. One last note, make sure you have fully charged the battery to at least 13.5 V prior to performing the test. **CT**

Readers with questions or wishing to discuss the contents of this article are invited to call the author at (404) 475-3192 or write to P.O. Box 947, Roswell, Ga. 30077.

PRODUCT NEWS

Power meter

Anritsu introduced its Model ML9050A standard optical power meter that measures optical power from both beam and optical fiber with an accuracy of ±2 percent from -10 to +10 dBm at wavelengths of 0.4 to 1.8 mm. It has a DC calibration function that compensates for variations in instrument sensitivity, which come from minor variations in ambient temperature.

A built-in heater allows the sensitivity of the optical power sensor to be calibrated as required. It uses a Ni-P black body absorber for a moisture-proof and vibration-free structure and features amorphous Ge for a rapid thermo-electric response time of approximately 1.8 seconds. Measurement power range is -20 to +10 dBm and response time is approximately 2 seconds in the 0 to 10 dBm range.

Reader service #141

Case catalog

Jensen Tools published its full-color, 32-page catalog of cases and shipping containers of interest to field operations. Lightweight and heavy-duty cases, hard and soft-sided attache-style models, lockable and vacuum sealed cases, static shielding products, carts, hand trucks and other items for electronic transport and storage are featured. The book also describes Jensen's custom case and tool kit design services.

Reader service #147

Cable clip

M&B Manufacturing Co. announced a new drill and screw drop cable clip, which attaches to all sizes of RG-6 cable and drills. It screws the clip into numerous types of surfaces including hard and soft wood, corrugated steel up to 12-gauge, hard board and asbestos cement tile shingles.

First the clip drills a hole of the proper size and then screws the clip firmly into the surface, which is said to prevent the fastener from splitting asbestos cement even when near to the edge. The screw attaches to the shingle itself and does not require attaching to a subsurface.

Reader service #148

Catalog

Tektronix highlights more than 3,000 products, including over 70 new ones, in its 1991 customer catalog. Hardbound and 388 pages, the book lists the company's complete line of products in electronic test and measurement instruments, professional broadcast equipment and computer peripherals.

Included is information on new oscilloscopes, digital signal analyzers, signal source generators and more. Among other new products covered are fiber testers, audio signal generators, HDTV sync generators and an HDTV oscilloscope.

Reader service #152

Lubricating literature

The Front End Pack cable lubricating system offered by American Polywater Corp. is described in a new brochure. The system contains polywater lubricants and is designed to lubricate conduits ahead of the cable during a pull. It eliminates the need for hand application of lubricant in many pulls. The brochure discusses sizes, quantities, general and optional use methods, and information for longer pulls.

Reader service #149

Expansion plugs

Watertight expansion plugs for any CATV duct and cable installation are available from Jackmoon USA. According to the company, the plugs can reduce the cost of cable placement and removal, eliminate signal attenuation caused by freezing water crushing cable and keep underground structures and carrier houses cleaner and drier.

They are said to be easily installed and removed and are reusable. Split plugs are designed for optical fiber and coax install around preconnected or continuous cable and inner duct runs.

Reader service #136

HDTV report

The Big Picture: HDTV & High Resolution Systems is a 108-page report released by the Office of Technology

Assessment. It examines the scope of high definition TV and how the United States might benefit. The report includes information on the potential influence of HDTV and related high resolution systems (HRS) on the consumer entertainment industry and how they may affect communications, national security, research and education.

Also focused on is how HDTV and HRS are causing the United States to re-examine current national policies dealing with manufacturing, educational and training standardization, communications, military command, structural economic problems and the relationship between government and business. The report discusses HDTV's role for the United States in rebuilding its leadership in the global and domestic electronic technology markets.

Reader service #134

Attenuator

Wavetek made available its P3010 programmable attenuator for 300 kHz to 3 GHz. This 60 dB attenuator is designed for OEM instrumentation applications. It has insertion loss of 2.4 dB maximum and VSWR of 1.4 to 1.

It has a small package size, no degradation across temperature and integral DC block. Other features include isolated ground and a TTL interference option.

Reader service #154

Descrambler

Wegener Communications introduced its Model 2900 compact VideoCipher II Plus TV descrambler. It is a low-profile (1.75 inches high) standalone commercial descrambler for CATV and SMATV systems.

The product has the VideoCipher II Plus commercial descrambler making the transition to "Plus" technology automatically. It is equipped with the same interface features as existing full-size descramblers and includes front panel gain controls and indicators for easy routing adjustments and a gain equalized monaural bypass audio input.

Reader service #133

Termination kit

OFTI made available a termination kit for its D4 fiber-optic connector. The kit provides a complete set of tools and consumable materials to terminate 50-100 single- or multimode connectors.

The product is especially designed for field use and included is a rugged tool carrying case that protects the contents from rough handling. Two kits are available. One has a low-cost

(Continued on page 80)

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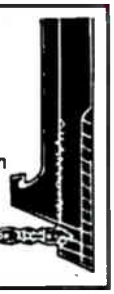

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A+

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Product News

(Continued from page 72)

inspection microscope and the other has a high precision inspection microscope.

Reader service #150

Pedestal support

The PS (Pedestal Support) systems by Alpha Technologies provide a one-step method for ground-mount supply enclosure installations. They are made of high-density polyethylene and are equipped with custom enclosure footprints to eliminate the need for concrete form construction, pouring and curing.

Underground designs allow "handhole" working space, allowing for cable bends, wire loops and grounding connections. The above-ground support pad features a molded "tread" surface that eliminates enclosure distortion often experienced with uneven concrete pad installations. The PS support systems are for use with the company's UPE, UPE/M, PWV/PED, PED/M and PMD/PED ground-mount enclosures.

Reader service #135

Service, tech style

(Continued from page 28)

sporting events, and other types of shows. Go to a movie? No contest. Attend a professional sports event? Get real.

Every person in our industry should be proud that cable TV was built nationwide with no federal subsidy, no tax breaks and no guaranteed return. Cable is wholly and specifically responsible for the many and diverse channels available via satellite today.

Why should you be upbeat when you go out to meet a sub? Because you are part of an industry that has brought fantastic entertainment to millions at very low cost. You are part of an industry that affects the lives of most Americans on a daily basis. You are the "on-scene" representative of an industry that has made masses of information available to schoolchildren and adults throughout the nation. You have every right to be proud — proud of your industry, your company and yourself! **CT**

Service basics

(Continued from page 30)

17) Never use the bathroom or eat/drink anything in their home. If they insist you try "Aunt Martha's cake" ask them if you can take it with you to eat later. Nothing is worse than you spilling a drink (giving the impression that if you can't handle a glass, what are you going to do to the repair/install) or not eating all of their fabulous food (that tastes like fertilizer) you have accepted. You are there to install or repair the cable, not to become their buddy.

18) Say goodbye to the customer by complimenting the TV set or choice of services again, asking more questions to make sure the customer understands all you did, and thanking them for being a subscriber.

Perform the above basics and your job will be more fun, easier and rewarding. The system will gain a happy customer who will support and defend you, the NCTA standards will be one step closer to being within reach, and you will see a much bigger bottom line. **CT**

If you would like more information on the author's employee training and productivity firm, contact her at 1955 Tamarack St., Westlake Village, Calif. 91361; (805) 495-4600.

CALENDAR

July

July 17: SCTE Golden Gate Chapter seminar on BCT/E Category VI, "Terminal Devices." Contact Mark Harrigan, (415) 785-6077.

July 17: SCTE Razorback Chapter seminar. Contact Jim Dickerson, (501) 777-4684.

July 17: SCTE Penn-Ohio Meeting Group seminar on new business technologies in CATV and PCNs, Cranberry Motor Lodge, Warrendale, Pa. Contact Bernie Czarnecki, (814) 838-1466.

July 17: SCTE Razorback Chapter seminar, Howard Johnson, Little Rock, Ark. Contact Jim Dickerson, (501) 777-4684.

July 17-19: Colorado Cable TV Association convention, Marriott's Mark Resort, Vail, Colo. Contact (303) 863-0084.

July 18: SCTE Rocky Mountain Chapter seminars on outage control, digital compression, fiber optics and design of broadband networks with active taps, held at Colorado Cable TV Association convention, Vail, Colo. Contact (303) 721-5762.

July 18: SCTE Cable-Tec Games held at Colorado Cable TV Association convention, Vail, Colo. Contact Ron Wolfe, (303) 753-9711.

July 19: SCTE Greater Chicago Chapter, "A Day at the Races," to be held in conjunction with Women In Cable, Arlington Heights, Ill. Contact: Bill Whicher, (708) 438-4423.

July 20-21: SCTE Big Sky Chapter, "SCTE Family Fun" camp out, Campground, Kalispell, Mont. Contact Marla DeShaw, (406) 632-4300.

July 20: SCTE Cactus Chapter seminar on customer equipment. Contact Harold Mackey Jr., (602) 352-5860, ext. 135.

July 20: SCTE Southeast Texas Chapter seminar, Warner Cable, Houston. Contact Tom Rowan, (713) 580-7360.

July 21: SCTE Old Dominion Chapter annual "You're Appreciated" party, King's Dominion, Ashland, Va. Contact Margaret Davison-Harvey, (703) 248-3400.

July 23-25: C-COR seminar, State College, Pa. Contact Kelly Jo Kerstetter, (800) 233-2267.

July 23: SCTE Magnolia Meeting Group, BCT/E (all categories) and Installer exams. .Contact Steven Christopher, (601) 992-0445.

July 24: SCTE Great Lakes Chapter seminar on fiber optics. Contact Rob Austin, (313) 827-7330.

July 25: SCTE Lake Michigan Meeting Group seminar on BCT/E Categories IV and VI, plus exams. Contact Grant Pearce, (616) 247-0575.

Planning ahead

Aug. 25-27: Eastern Show, Inforum Exhibit Hall, Atlanta. Contact Nancy Horne, (404) 255-1608.

Sept. 24-26: Great Lakes Cable Expo, Cobolt Hall, Detroit. Contact (517) 484-4954.

Oct. 1-3: Atlantic Cable Show, Convention Center, Atlantic City, N.J. Contact (609) 848-1000, ext. 304.

Oct. 8-10: Mid-America Show, Hilton Plaza Inn, Kansas City, Mo. Contact (913) 841-9241.

Training breeds training

By Wendell Woody
President, Society of Cable Television Engineers

The goal of SCTE is to increase the technical knowledge and skill of all members for their own benefit in personal career growth as well as for the benefit of the company that employs them. Our 65 local chapters and meeting groups generate a great deal of technical training, as do our national seminars and workshops. However, our Society does not have the ability to provide *all* the training necessary for every member to reach a level for certification testing. Therefore, our industry and Society depend greatly on our professional training institutions and schools, such as the National Cable Television Institute (NCTI), ATC National Training Center, National Satellite Technology Institute (NSTI) and others.

In addition to the above organized type of training, many members benefit greatly from textbooks, training manuals, trade journals, SCTE publications and tapes. Sometimes the best stimuli for technical training is to get involved in a technical or high technology hobby such as amateur radio or computer electronic bulletin boards. Our Society doesn't care where its members get their training, or what motivates them to continue learning — just be proud of your educational achievements, which we hope will include SCTE's BCT/E and Installer Certification Programs too!

Bulletin board

SCTE national member Gary Heimstead, who is with the MASADA Corp. in Birmingham, Ala., has established a bulletin board that is being used primarily by SCTE members and SCTE chapters. However, he notes TECH-NET is an electronic bulletin board system (BBS) designed to serve as a vehicle for information exchange among members of the RF engineering and technical community. Although the primary focus is on the CATV industry, there are additional "conferences" serving the interests of broadcast engineering, A/V production, etc.

Access is obtained via modem at (205) 853-8134. Currently, the system supports baud rates of 1,200/2,400 MNP5 (8-N-I). Implementation of 9,611 baud access lines is being configured for use sometime in August. Subscriptions to the service are automated on the first "log-on" to the system. There is no charge for access to the message base and users are allotted 30 minutes daily.

A feature of TECH-NET is "Qmail." This allows you to download messages for reading and replying off-line using an off-line mail handler. Other features are: "Business Cards" data base of subscriber business cards; "Conference," which currently has 14 public conference areas; "Files" public domain and shareware files; and "Bulletins," in which technical bulletins covering various topics are posted, covering SCTE news, SCTE meeting schedules, FCC rules and regulations, as well as vendor-supplied information.

SCTE technicians using modern technology for training and personal communications is my reason for sharing this TECH-NET information with all our SCTE membership. TECH-NET is menu-driven and on-line help is available along with a user's guide. It operates 24 hours a day from Birmingham. To contact Gary directly, you may telephone (205) 871-3470 or FAX him at (205) 871-3574.

Ham radio operators

For the past three years, the agenda for the SCTE Cable-Tec Expo has included a Ham Radio Operators' Reception. All amateur ham radio operators and those interested in amateur radio are invited to the reception. The Expo Planning Committee also generally assigns an official ham frequency for communications at each expo. Each year the reception grows in size and is a most popular event — because where else but at this "Ham Fest" could you win $1,000 worth of radio gear, along with free wine and cheese?

Technical training is initiated, implemented, supported and advanced by the hobby of amateur radio. This is one reason why manufacturers like Scientific-Atlanta have a company ham radio club. The same is true with cable TV operators like American Television and Communications. ATC has a radio club at its Denver office as well as individual local clubs at operating locations.

"Technical training is initiated, implemented, supported and advanced by the hobby of amateur radio."

Not long ago most ham operators built their own equipment (gear). They would trade and "scrounge" parts, modify surplus equipment and wind the proper number of "henrys" on each coil. The ultimate challenge was to build a "gallon rig" and spend only pocket change. That type of electronic, technical hands-on training is not nearly as common today. Still, the technical theory and knowledge for the amateur radio licensee is the same and provides a good basis to support technical training in various fields — including CATV engineering technology.

Acknowledging the mutual benefit of ham radio training, SCTE encourages participation in amateur radio. Steve Johnson, an SCTE national member, maintains a list of all known CATV personnel who hold ham radio licenses and are identifiable by their individual "handles" (call letters). The latest list appeared in last month's issue of *Communications Technology* in "News." Are you on the list? If not, or if in question, FAX your name, address, call letters, etc., to Steve at ATC in Denver. His FAX number is (303) 799-5651. — *73's, WO-0DY* **CT**

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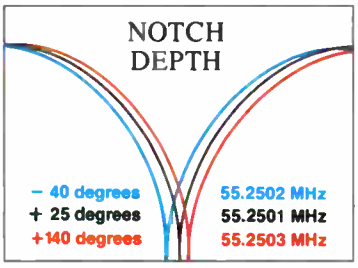
Engineered to eliminate notch drift over temperature

We designed thermally compensated components to meet our specifications for temperature stability and then used state-of-the-art robotic manufacturing techniques to ensure a perfectly repeatable product, trap after trap. But advanced circuitry is not enough.



We also designed a new dual sleeve housing which eliminates the need for O-rings and provides greater than 125dB EMI isolation at a full 600 MHz bandwidth. Closed cell foam encapsulation, compressed rubber grommets at both ports and a special UV-cured epoxy stop moisture ingress and provide an environmental barrier that is virtually impenetrable.

For maximum stability and design flexibility, use Regal – the new standard in trap technology.

REGAL® Technologies Ltd.

1-800-36-REGAL

CORPORATE HEADQUARTERS: CHICAGO: (708) 675-2266, (800) 367-3425; **SALES OFFICES: ATLANTA:** (404) 449-0133, (800) 752-9810; **DALLAS:** (214) 466-0227, (800) 448-0881; **SAN DIEGO:** (619) 584-4617; **ENGINEERING GROUP:** (303) 740-6262, (800) 222-0508.

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