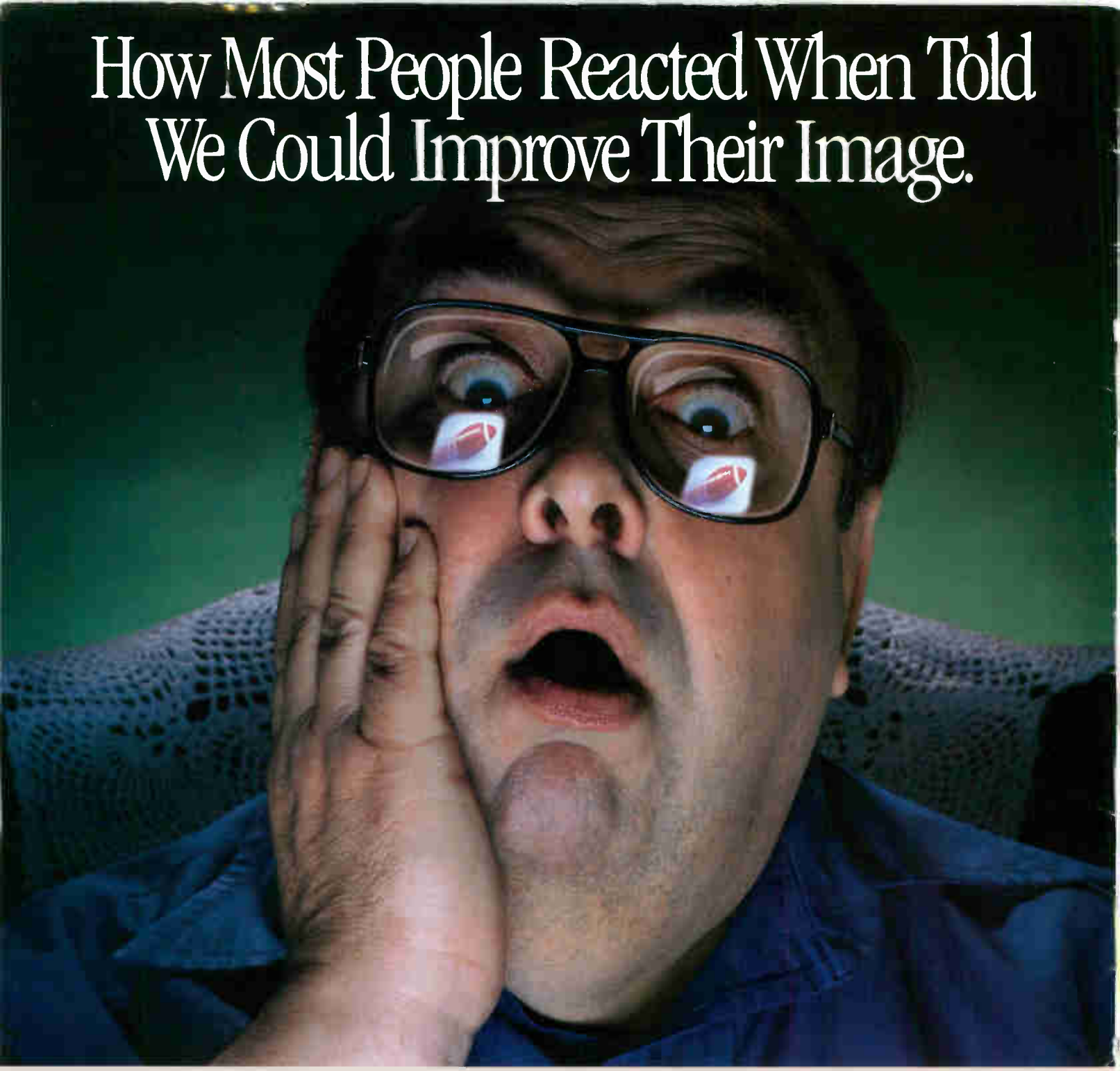
November 1989

Focus on addressability

IT INSTALLER TECHNICIAN

The training and educational magazine for cable television technical personnel.

How Most People Reacted When Told We Could Improve Their Image.



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IT INSTALLER TECHNICIAN

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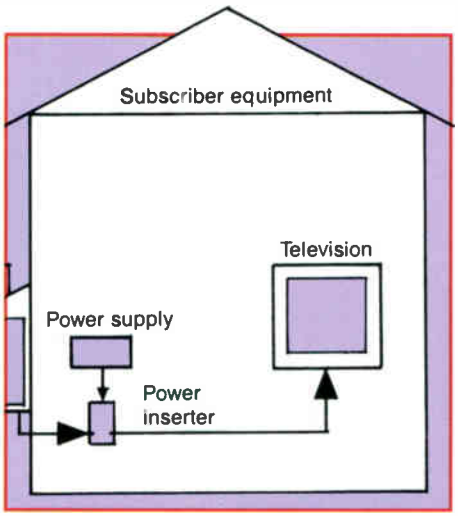

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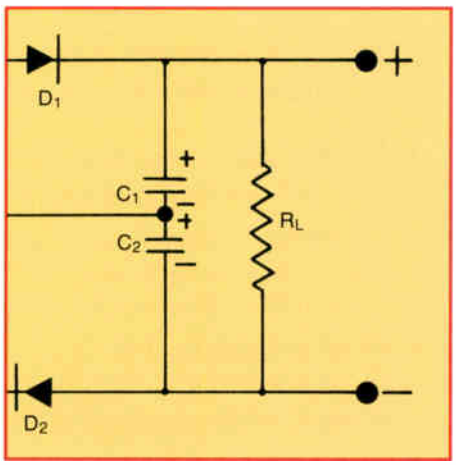

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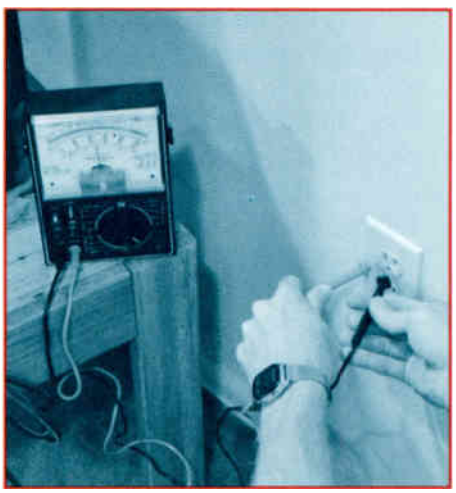

From the NCTI 32

Features

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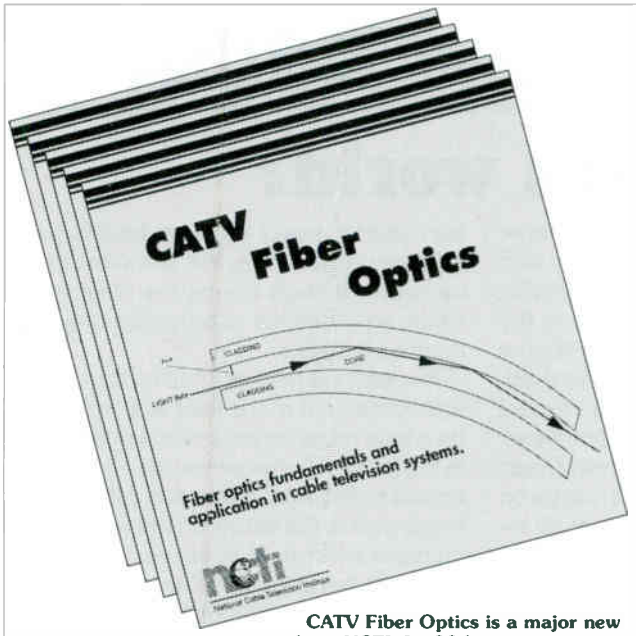

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Introducing NCTI's CATV Fiber Optics

Fiber Optics is undeniably a part of cable television technology. If your system isn't already involved in fiber, chances are it will be in the next three years. And, if you're like most of us, your training and experience is in coaxial cable-based systems, not optics.

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And best of all, it is an NCTI self-study course. That means you decide when and where to learn about fiber optics. You don't have to travel to an expensive seminar. You can learn in the convenience of your office or home.

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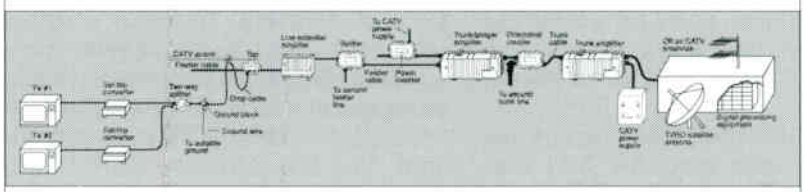
To enroll, use a standard NCTI Enrollment Application and fill in "CATV Fiber Optics" as course title under "NCTI Course Student is Enrolling in?"

NCTI Career Path Courses



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Reader Service Number 3.

From the Editor

It's a man's world?

How would you describe an installer or installer technician? Well, he's a guy who works in the field, right? He installs cable at the customer's house or works on the construction of the cable system. He's the guy who also is sent to find and fix problems in the system and he—wait a minute! He? Aren't we forgetting someone here? What about the installer who doesn't need a shave in the morning (except maybe on the legs) and wears, say, Chanel #5 instead of Old Spice? That's right, I'm talking about the women out there.

Sure, everyone knows there are women working in the cable industry—from customer service reps and personnel directors to vice presidents of programming or sales (or editorial). Heck, they even have an organization for them called Women In Cable. That's great for women in the office but it seems that few folks acknowledge the women in the field.

Case in point: I received a letter from Vicky Gamble, a line tech at Greater Media Cable in Walled Lake, Mich. She writes: "I was at a seminar in Lansing given by the SCTE about CLI when I got my first look at your magazine. I took one home and the first thing I did was fill out the subscription card.

"After reading much of the magazine, I just couldn't get over all the inferences about men. There might not be a lot of women who climb poles for a living but we're out here. For being a relatively new field, there sure are a lot of old stereotypes.

"I enjoy the technical articles and just plain like to read about the job I love. Frankly, I was very upset that there wasn't a single reference made stating there could be a female lineperson. I have worked long and hard to be accepted in the workplace as well as the work field.

"I would appreciate it if you would bring it to the attention of the authors that there are female line techs, service techs and installers. We work out in the field as well as in the office."

Good point. While looking through past issues of *IT*, I noticed these inferences she referred to. When we edit our articles, we do try to eliminate any gender-specific terms, but occasionally we miss them. Also, in defense of our authors (for whose contributions we are eternally grateful) and editors, when sentence structure is such that the use of a gender-specific pronoun is unavoidable, the commonly accepted style says to use the male form when an indefinite antecedent may be male or female.

Anyway, we here at *IT* do realize there are women out in the field and will try to be a little more conscientious of this fact in the future. Maybe all you men out there should be too. And, ladies and gentlemen, I hope you're not too surprised when your plumber is known to some as "Mommy" or your nurse at the hospital is a tall, mustached guy. Old stereotypes die hard. (By the way, you might not be able to tell by my name, but I'm also a woman.)

Giving thanks

It's November and you know what that means. Thanksgiving is just around the corner. I'm sure you all have something to be thankful for, even if it's just that you have a day when you're actually supposed to stuff your face with succulent mounds of turkey, mashed potatoes, stuffing and pumpkin pie.

Another thing installers and techs have to be thankful for is the Society of Cable Television Engineers. In addition to the Society's many local training opportunities via chapters and meeting groups, there is its new Installer Certification Program, designed to test and certify the skills of installers. This new program promises to be a valuable asset for management to ascertain competency, come promotion and raise time. As of October, 34 people joined the SCTE at the installer level. Also, this month the SCTE is presenting "Technology for Technicians II," a followup to its successful training program last year.

So now you have a way to increase your knowledge, your value as an employee and your income—definitely something to be thankful for.

Enjoy that turkey and have a happy Thanksgiving!

Tom J. Barnett

News

TCI orders Jerrold on-premises modules

DENVER—Tele-Communications Inc. recently ordered 250,000 Starport on-premises addressable control modules from General Instrument's Jerrold Division; TCI's Boulder, Colo., system will be the first to implement the units. The Starport module is placed in a box attached to the outside of a subscriber's home. On this initial model, four addressable ports and a disconnect feature control the flow of TV signals into the home. This allows or disallows signals, depending on the preference of individual subscribers. Once the unit's signal passes into the home, a sub can hook up as many cable-compatible sets, VCRs or other devices with no extra charges and no additional converter equipment.

TCI's Executive Vice President and COO J.C. Sparkman suggested that the units would make pay-per-event a more economically viable endeavor for the cable operator.

Society announces new fiber conference

EXTON, Pa.—The Society of Cable Television Engineers recently announced preliminary information on its second fiber-optics seminar. According to the SCTE, the three-day conference will be held March 21-23 in Monterey, Calif; no location has been set. Coordinated by the SCTE's Florida Chapter, the first seminar occurred January 1988 in Orlando, Fla., with 412 people attending. Those interested in presenting technical papers for the second seminar are requested to submit abstracts to Pete Petrovich, Conference Chairman, c/o SCTE, 669 Exton Commons, Exton, Pa. 19341. For more information, contact SCTE national headquarters at (215) 363-6888.

TwixTel, Heritage unveil new service

KEYSTONE, Colo.—In what is being called "the world's first system for interactive cable TV/telephone services," the TwixTel System was launched here Sept. 13 jointly by TwixTel and Heritage Cablevision. The system, developed by the Framingham, Mass.-based telecommunications company TwixTel Technologies, allows pay-per-stay, pay-per-view, hotel-type amenities and direct-billed long distance service for condominium vacationers and time sharers via touch-tone phone. Prior to this, premium cable TV services, telephone service, operator service and room services were often unavailable in condos and time-share units.

The system utilizes the existing installed local cable operator's plant and addressable services that are integrated with specialized information gateway technology and controlled by a standard residential telephone. Service will be installed initially in the United States in condos, time-share units and resort hotels; later it will be extended to urban hotels, hospitals, college campuses and short-term rental units in and near military installations.

Transmedia announces move

DENVER—Effective Oct. 9, Transmedia Partners-I, L.P., publishers of *Communications Technology, Installer/Technician, Media Business, Media Business Review, MSO* and *Newspapers and Technology*, has moved to 50 S. Steele St., Suite 700, Denver, Colo. 80209, (303) 355-2101. The new facsimile number is (303) 355-2144.

You and the SCTE

Calendar of events

The following calendar lists a variety of activities of the Society of Cable Television Engineers (SCTE), including Satellite Tele-Seminar Program listings(*), news and upcoming national events and announcements of upcoming local SCTE chapter and meeting group seminars.

Nov. 15: Big Sky Meeting Group—Roundup, Mont. Topic: "Amplifier and headend equipment" with Bob Bird of Scientific-Atlanta. Contact: Harold Mackey Jr., (602) 866-0072, ext. 282.

Nov. 15: Dairyland Meeting Group—Information to be supplied. Contact: Bruce Wasleske, (715) 842-3910.

Nov. 15: New York City Meeting Group—Information to be supplied. Contact: Andrew Skop, (201) 328-0980.

Nov. 16: Upstate New York Chapter—Burgundy Basin Inn, Rochester, N.Y. Topic: "Transportation" with presentations on "Coaxial systems" with Roy Schultz of Magnavox; "Microwave systems" with Dane Walker of Hughes Microwave and "Fiber-optic systems" with John Holobinko of ALS. Contact: Ed Pickett, (716) 325-1111.

Nov. 19-20: Old Dominion Chapter—Information to be supplied. Contact: Margaret Harvey, (703) 248-3400.

***Nov. 28:** Satellite Tele-Seminar Program, "AM fiber-optic transmission (Part one)" featuring J.R. Anderson of Anixter Cable TV and Clive Holborow of AT&T Bell Labs. Recorded at Cable-Tec '89 in Orlando, Fla.

Nov. 29: Piedmont Chapter—Location to be announced. Topic: "Safety and OSHA requirements for CATV," plus vendor showroom and demonstrations. Contact Rick Hollowell, (919) 968-4631.

Nov. 29: Inland Empire Chapter—Information to be supplied. Contact: Randy Melius, (509) 484-4931.

Dec. 6: North Country Chapter—Location to be supplied. Contact: Douglas Ceballos, (612) 522-5200, ext. 705.

Dec. 13: Florida Chapter—South Group, Holiday Inn, Ft. Lauderdale, Fla. BCT/E examinations to be administered in Categories II, III, IV and V. Contact: Denise Turner, (813) 626-7115.

Dec. 14: Florida Chapter—First Coast Group, Holiday Inn Airport, Jax, Fla. Contact: Denise Turner, (813) 626-7115.

Dec. 14: Chesapeake Chapter—Holiday Inn, Columbia, Md. Contact: Doug Worley, (301) 499-2930.

Dec. 15: Miss-Lou Chapter—Baton Rouge, La. BCT/E examinations to be administered in all categories at the technician level. Contact: Dave Matthews, (504) 923-0256.

Dec. 15: Rocky Mountain Chapter—Location to be announced. Topic: "System powering." Contact: Rikki Lee, (303) 355-2101.

***Dec. 26:** Satellite Tele-Seminar Program, "AM fiber-optic transmission (Part two)." Recorded at Cable-Tec '89 in Orlando, Fla. Plus, "The SCTE Music Video" featuring The SCTE Band.

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

Off-premise addressable installation

By Scott Henry
Field Engineer, Midwest CATV

Now that one of the hot topics in the cable television industry is off-premise addressability, let's take a look at the effects of this new technology as it relates to the installer and the service technician in the field.

Until now addressability's effect on field personnel has been converter installation, repair and customer education in the use of the converter and its effect on the operation of the TV set and VCR or videodisc player. At times it entails the re-education of subscribers until they get used to the various operating procedures that we have developed to try to accommodate all of the different interconnect methods for cable-ready TV sets and VCR combinations such as:

- One converter and an A/B switch
- One converter and a two-way splitter
- Two converters, a two-way splitter and an A/B switch

The list and confusion goes on and on.

Getting out of the house

With off-premise addressability the address module is located outside the subscriber's house. All authorized channels go from the control module to the subscriber's television in the clear. This returns the use of all cable-ready television and VCR features to the subscriber.

Off-premise addressable equipment being developed today is either strand/pedestal mount or mounted on the outside of the subscriber's house. Each technology, though similar, will have a different effect on the installer and the service technician.

The strand/pedestal mount device or smart tap would replace the existing directional tap and require inline splicing. Due to the added space required for the electronic equipment in the smart tap, extensive feeder cable resplicing would be required for the installation of the smart tap by the service technician.

Along with the additional splicing required, the strand/pedestal mounted off-premise addressable unit would have to be line powered. This would increase the system power requirements. The effect on the installer would be minimal; since the smart tap is a direct replacement for the passive directional tap, the standard system installation techniques could be followed.

The off-premise addressable unit that the installer mounts on the side of the subscriber's house requires different installation considerations than the strand/pedestal mounted unit. First, an enclosure must be mounted on the side of the subscriber's house to secure the address unit. Typically this is located in the same area of the house as the power meter and telephone equipment. This is normally done so that all of the wires, cables and associated equipment are located together for aesthetic reasons and to provide a common bond for grounding. The cable drop is then routed to the enclosure where the connection, grounding and any splitting for additional outlets takes place. Cable routing to the TV set locations is then accomplished in a normal manner.

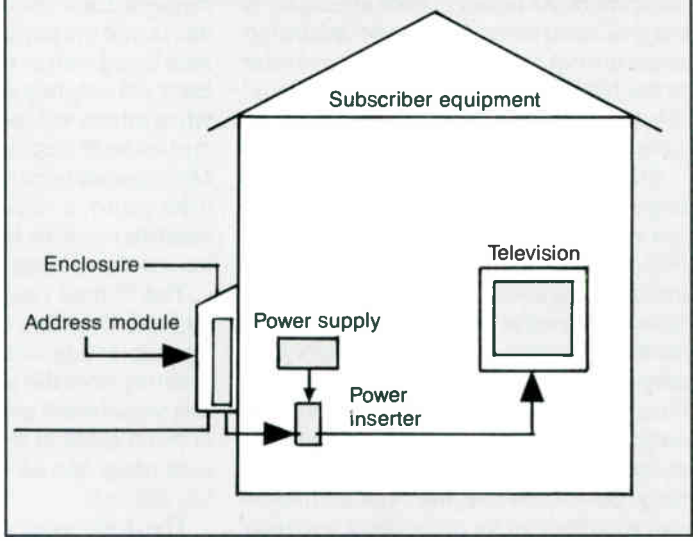
The house-mounted off-premise (on-premise) addressable unit is customer powered. A DC power inserter must be installed on the cable between the address module and the TV set. Power is provided to the inserter from a DC power supply that is plugged into a standard 110 VAC outlet. If more than one outlet is going to be wired from an address unit, a splitter with a power passing leg must be used to allow the DC power to be fed back on the entry cable to the address module. Typically, installing the off-premise equipment will add about 30 minutes to the standard installation time.

Easy access

As far as the service technician is concerned, both off-premise systems put the address units outside the subscriber's home where the technician has access to them. The service technician can do customer service checks on the equipment without requiring the subscriber to be at home. An additional benefit of off-premise addressable systems is that at the time of a subscriber disconnect there is no need to schedule someone to be home to recover system equipment.

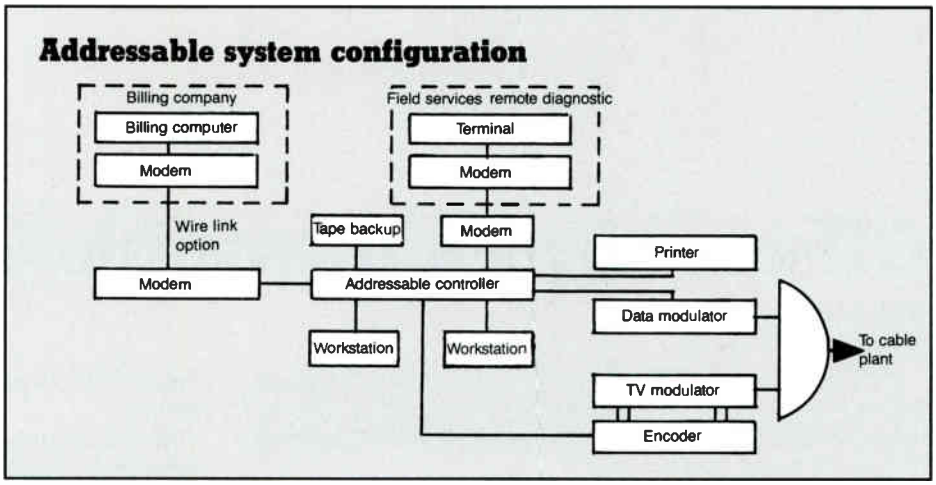
Overall, the effects of off-premise addressable systems on the installer and technician is minimal compared to the benefits of keeping our subscribers happy with the services we can offer, without affecting the operation of the subscriber's home entertainment systems. ■

House-mounted addressable unit installation



An installation guide to addressability

By Glenn E. Sigler
Field Service Manager
Pioneer Communications of America Inc.



Addressable converter computer systems have been available for field installations since 1983. As with other technologies, a sound installation and minimal preventive maintenance will equate to years of reliable service.

The success of an addressable system is related to the overall reliability of all the system components from the billing computer to the addressable converter in the subscriber's home. Thorough planning is the key to a timely and successful addressable system installation.

The accompanying figure is a block diagram of the addressable computer system. The billing company computer acts like a host, while the addressable computer is the slave. The data output from the computer is modulated on an RF (radio frequency) carrier in the data modulator unit. Scramblers are used to secure premium services, with one required per channel. As can be seen the only thing added to the combiner is the data modulator output. In this type of system the data carrier is referred to as an out-of-band type.

Possible difficulties

There are little things that can make life difficult or at least provide challenges for us. To reduce the chance of problems a site survey or some site preparation is essential.

First of all, the power requirements for all equipment should be reviewed. The cable office and headend building should have the proper voltage and current consumption requirements for the planned equipment. All power outlets should be of the grounded variety and power extension strips are not recommended. Please refer to the National Electrical Code and local electrical codes for correct electrical wiring and practices.

Standby powering is becoming more important these days as cable systems are expected to provide more services. Pay-per-view (PPV) services that are controlled by the addressable computer have to be functional at all times. Backup power from an uninterruptible power supply not only will keep your PPV operations functioning 24 hours a day but also provide surge protection. The hostile environment of the headend, at the end of that "lightning rod" in the sky, requires additional surge protection for computers and data communications equipment.

The building environment for the electronics should be maintained generally within 10-40°C and with 10-90 percent humidity. Circuits using RF components tend to be more stable when the temperature is stable.

Cable TV bandwidth is continuing to grow, making rack space as hard to find as spare channels on the cable system. When reviewing all rack-mounting requirements for installation, vertical rack space, as well as depth of rack space, should be considered. When rack-mounting scramblers, always try to mount the scrambler next to the corresponding channel. The headend technician will appreciate it when scrambler alignments are checked. IF (intermediate frequency) loops from the modulator to the scrambler also can be kept to a minimum by placing the scrambler near the modulator.

When scramblers are required for securing pay channels, verify that the modulator and scrambler are compatible. The manufacturer maintains a list of modulators that the company's equipment has interfaced with in the past. Some scramblers will only require a composite IF loop, while others will require a separate video and audio IF loop option on the modulator. Most geostationary satellite scramblers also need a video sample from the satellite receiver before or after connection to the modulator video input.

The IF loop cabling also should allow for ease of access to the scrambler. Some scrambler adjustment must be made by entering from the top of the unit. To make this adjustment an in-service type, leave enough slack in the IF loops so that the scrambler can be moved in the rack for top access.

The field engineer who installs your scrambler equipment will have the proper testing equipment to align your new scramblers. This would be a good time for you to correlate the calibration and scrambler alignment with your system test gear. By the time the field engineer leaves, you should feel confident with the alignment process.

Before the addressable equipment arrives on site, create a diagram showing placement of the new equipment. If drawn to scale, this diagram also can be used to determine cable lengths for peripheral equipment. Computer and terminal placements should be determined before the computer installation and training.

If any telephone lines are needed to complete the installation, schedule these installations far in advance. After the telephone lines are installed, test them in a loop back configuration with the modems or verify their operation with the telephone company.

If your system is purchasing a two-way option, additional planning will be necessary. If an interactive pay-per-view telephone return system is desired, additional phone lines will have to be ordered for the addressable controller. These dial-up lines serve as collection lines for the two-way converters to upload their latest purchases. In an RF return system, diplex filters will have to be installed in the headend to filter the sub-low return carriers to the RF collection modems.

The billing/addressable interface

Most addressable computer systems are controlled via a billing company. The billing interface eliminates a dual key entry system of changing addressable records. The billing vendor should be contacted to verify its capability to interface with your addressable computer.

The addressable vendors all have different protocol communications when interfaced to billing. In some instances a protocol converter may be required for the billing company to communicate with the addressable computer. The billing vendor should be contacted early to assure adequate time to prepare for the addressable interface.

The addressable vendor will contact you with delivery information and shipment method. Upon arrival of the equipment, check for proper count of containers and any shipping damage. If prior authorization was granted, the equipment can be unpacked and set up in its locations to save the field engineer some time.

When handling electronic equipment, take care not to discharge any static electricity that may be stored in your body. If you have any doubt about static, you can discharge yourself by connecting the power cord to the equipment and touching the power supply case on the ground bus. The power cable furnishes ground to the equipment through the AC power cord.

If possible during the installation, the billing interface should be tested for addressable control of converters in the field. The testing will assure hardware operation as well as provide training for system personnel.

The data output of the addressable computer is fed into the data modulator and is modulated on a carrier, known as the data carrier. The addressable converters listen to the data carrier for their authorizations. The data carrier is injected into the headend combiner and treated as an FM signal. Generally this carrier is set to the system audio carrier level, 15 dB below video carrier.

As an option, redundant or standby data modulators are available to keep addressable converters from timing out if a failure occurs with the main. When the headend is remote from the office a data modulator still may be placed in the headend, while the addressable computer is at the office. The addressable data can be linked to the headend via a dedicated phone line, sublow coax, forward transportation coax, fiber or microwave transmission.

Training, peripheral equipment

Training is a very important task during the addressable installation. A training outline should be written and all employees should attend addressable training. Each employee should have the chance to get familiar with the new converter and, if possible, take one home for use.

The software training on the addressable computer will provide the means to control converters from the office. It's a good idea to have a number of people attend this training. Different people will have different applications for the computer but cross training will protect you if employees leave or are absent on the day you need them.

The addressable computer CRT (cathode ray tube) terminals are generally located within 50 feet of the computer. Remote location of CRTs may be accomplished via phone modems. The computer console CRT should be located near the computer for utility operations like backups and restores.

In the event of a billing outage, addressable computer CRTs can be utilized to continue operations. During the billing downtime all record changes can be logged to paper and applied to billing at a later date.

The printer is ideally in a remote location so it does not interfere with the quiet office environment. Printers are desired to log billing interface transactions and for error and event logging. The printer also may be used as a tool when reconciliation of the billing and addressable data base is required.

The hard disc contains the addressable converter records. This device must be backed up periodically to avoid any loss of data in the event of computer failure. The computer floppy drive is used for backup and restore procedures on the addressable computer.

An addressable computer tape drive option may be desired for larger systems. The backup procedure can become quite long on a large data base using the standard floppy drive. The tape drive process is much quicker, requires less handling and is more reliable than the floppy drive system.

The backup and restore features will keep any addressable computer downtime to a minimum. A data base backup should be done so that if a failure occurs, a restore procedure on the repaired computer will only impact a small number of subscriber changes.

Troubleshooting a failure is not always convenient. During the installation, a flow chart of "what if" situations should be developed as an aid for problem solving. The manufacturer should recommend spares and advice upon a service contract during and after the warranty period.

The addressable system has many applications for marketing and enhanced customer service. Proper installation and maintenance can be of great value to a cable system's bottom line. ■

Taking the mystery out of power supply installation

By Lynn Newsom
Maintenance Manager, Prime Cable
And Jud Williams
Owner, Performance Cable TV Products

The power supply in a cable TV system is the heartbeat of that system just as the RF path is the nervous system. A power supply system will only function as well as it is installed and maintained. We will examine the proper procedures and practices required to assure that the cable system receives adequate powering in the correct way.

Before getting into the power supply installation let us examine what a power supply consists of and what it does. The primary function of a power supply is to convert the utility (power company) electricity from 115 volts AC (VAC) to either 30 VAC or 60 VAC for use in the cable system. Due to the inherent efficiency of 60 VAC it is becoming the virtual standard of the industry.

The section of the power supply system that converts this voltage is called the AC power supply or, more specifically, the ferroresonant power supply (ferro). Not only does the ferro step the voltage down from the utility voltage level, it also tends to clean up the voltage by removing transients and other irregularities. The ferro also regulates the voltage against utility voltage swings and variations.

This portion of the power supply is rather simple in construction and very rugged. The main consideration for extended life of this device is proper cooling, as heat tends to break down the insulation of the windings within the transformer and in time the power supply could fail.

The ferro may function as a stand-alone power supply or it may be combined with a standby power supply to assure continued operation of the cable system during a power outage. The standby power supply is actually called an inverter because it operates from batteries in order to output the 60 volts required by the system. In some power supplies the ferroresonant and standby power supply are combined into one unit while other power supplies are designed so that the ferro and standby are separate units. We will examine both of these units as well as the batteries.

When the power supply arrives at your location it should be unpacked as soon as practical in order to determine if there was any damage done during shipment. If there is damage it has to be reported to both the manufacturer and the shipping company as quickly as possible.

Test run

The next task is to assemble (if needed) and test the unit prior to taking it out to the field. Among the instruments needed to do the testing accurately are a true RMS (root mean square) voltmeter and a clamp-on ammeter. Also, a load of some sort would be useful. Probably the least expensive load would be a series of ordinary light bulbs, preferably 300 watts each. If you are dealing with a 14 ampere (amp) power supply, eight bulbs would come close to putting a full load on the power supply. Six bulbs would present a load of approximately 10 amps. If you are installing only a ferroresonant power supply it is only necessary to attach an AC line cord to the 120 volt terminals, attach the load to the 60 volt terminals and plug it in.

If per chance you do not have a true RMS meter you may find that the meter you are using reads about 3.5 volts high, so you may read something like 65 VAC, which is okay. You will note that the bulbs are not as bright as normal; that is because you are powering the bulbs with only half of the 120 volts the bulbs are rated at.

When dealing with the testing of standby power supplies the task becomes more complex. It is even more important to test the standby power supplies in the shop, particularly if you are dealing with a new model or one that you are not completely familiar with. Testing in the shop becomes sort of a dry run. In addition to the instruments and load listed before, you will now require some fresh, fully charged batteries in order to test the standby power supplies. Bear in mind that the ferro and standby must be interconnected in order to function as a complete system.

While following the manufacturer's installation instructions you will essentially be connecting the power supply system to three things: 1) the 120 volt utility power, 2) the 60 volt load (actually equivalent to the cable system) and 3) the batteries that turn on the standby supply. If your power supply is modular in design so that the ferro and the standby are separate units, the first connection would be between these two units. Basically what you are connecting is the 60 volt output of the ferro to the 60 volt input of the standby. The reason for this is that the 60 volts connects to the transfer relay inside the standby chassis. Next you may connect the 120 VAC utility voltage to the units. Finally, the batteries may be connected.

The wires that are to be used in the interconnecting process are color coded so that "hot" and "neutral" will be connected to their proper places. The wire coming from the utility will consist of three wires. The black wire is hot and has a very dangerous 120 VAC riding on it. The white wire is neutral and should be near ground potential. The green wire is ground and is always attached to the chassis ground lugs. The batteries are attached with black (for negative) and red (for positive). The batteries are in series and should not be interconnected prior to attaching the red and black wires to the power supply.

After all of these wires are attached to their correct terminals and the load is attached, the 120 volt line cord may be plugged in. At this time the load lights should come on and you will hear a singing noise as the power supply begins to operate.

Now is the proper time to interconnect the batteries; by this we mean connection from the open terminal of one of the batteries in series to the open terminal of the next battery in series, making sure that you go between the positive terminal of one battery to the negative terminal of the next battery. The reason that we have chosen to activate the battery after turning the power supply on with the AC is to prevent the inverter from trying to start functioning, with the resulting arc being pulled while connecting the batteries. Some power supplies have a circuit breaker in series with the batteries, which should be in the "open" position when attaching the batteries. Yet other designs have an "on-off" switch to control this function.

Once the power supply is completely connected and operating with AC input, it may be tested to see that the inverter is functioning okay. Merely pull the AC plug and the inverter should kick in. This whole procedure should not take more than five minutes per power supply.

Now that we are satisfied the power supply system is working okay on the

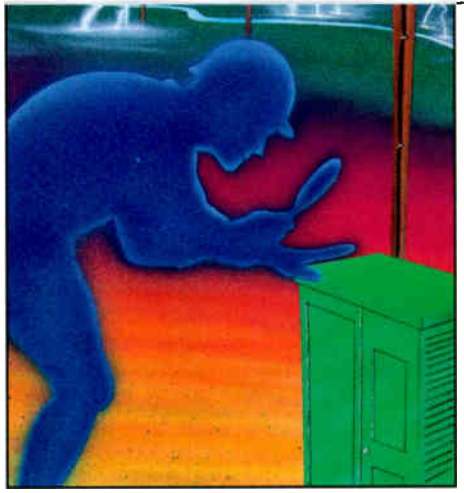
bench, we will go through the process of installing it. If the technician in charge of the power supply installations has not been briefed by the local power company it might be advisable that this be done so that the tech is reasonably familiar with the local codes.

Some installers prefer to completely wire up the power supply system prior to hanging the enclosure on the pole, while others hang the enclosure empty for easier handling (depending on available equipment). The actual process of hanging the power supply to the pole should be adequately described in the manufacturer's manual and is beyond the scope of this article.

What we are concerned with are good practices as far as the actual interconnections are concerned. For instance, if the wrong gauge wire or type of connection is used, terminals may overheat and eventual failure may result. To be more specific, let us examine a practice that is occasionally used on the exposed tips of stranded wire. There is the temptation to "tin" the wire with solder and then tighten a screw terminal down on it. Unfortunately, in time the solder either "cold flows" under compression or simply melts away under extreme temperature, and the connection eventually fails. If you have doubts about using strand wire in certain circumstances it is best to go to solid wire.

Crimping of terminals is another area where good practice is important. Unless it is absolutely necessary, it is best to use non-insulated terminals rather than insulated types. The reason for this is that most crimping tools tend to crush the terminal rather than actually crimping it onto the wire. When using a non-insulated terminal, its barrel must be oriented in the crimping tool properly for the crimp to be good. This means that the seam of the terminal barrel must be facing away from the crimping action of the tool, otherwise the seam will open up and the connection will be loose. In climates where corrosion is a problem, the practice of soldering to seal out moisture might be advisable.

Several things should be considered while following the manufacturer's recommended installation of the cabinet onto the pole. For example, the cabinet should be an adequate distance from the pole so as not to block a climber's access past the cabinet and allow room to reach around the pole. Another point to be aware of is the distance the cabinet should be from the power company's wires. This is usually a minimum of four feet but if in doubt, consult your local code. The placement of an external breaker box should be



below and slightly off to the side of the power supply cabinet so that it may be reached easily when the cabinet door is open.

Connecting to the utility

At this point we will assume that the power supply is on the pole and wired internally as previously described. We will now examine procedures used to connect the power supply system to the utility. Probably the most important connection is to ground. The power company should have an 8-foot grounding rod installed at the base of the pole to which you will attach #6 gauge wire with a ground clamp. This riser then connects to the ground lug of the cabinet, which is in turn connected internally to each of the chassis inside the enclosure. Often, it is advisable to have a double ground so the power supply cabinet is bonded to both the riser going to the ground rod and the breaker box.

So that there is no potential between the various services using the same pole (such as the power company, telephone company, cable company and street lights), it is necessary to confirm that they are all bonded together. If you find that one or more of the services are not properly bonded it is prudent to advise them of the condition.

Since the presence of moisture contributes to corrosion, it is very important to waterproof all entries into the cabinet, otherwise deterioration will occur and your grounds will eventually be compromised. Also be aware that there may be instances where the paint on the cabinet or one of the chassis may act as an insulator to a ground lug. The paint must be scraped away in order to make a good contact.

The service drop (the wires connecting your power supply to the utility) should be approximately 4 to 6 feet long and coiled like a spring so any changes that may be made at one location could be accommodated without having to splice in additional wire. The connection of these wires to the utility wire would normally be done by the utility but if it is to be done by you, certain precautions must be observed.

First of all, remember the potential at the utility is lethal and should be treated with the greatest respect. Working with one hand is the most important practice one can exercise when working around electricity. The use of 20,000 volt gloves should always be considered. Make sure other parts of your body and equipment, such as the gaffs on your leg, do not come into contact with the grounded riser while you are working with live wires. Do not become a part of the circuit.

When working in the rain or a very humid area, the wooden telephone pole can become highly conductive. The tools you use should have plastic handles rather than wood so that they are absolutely non-conductive. When stripping wire from a live conductor make sure you know where your tool is going to end up should it slip.

The breaker to be used in the installation of your power supply should be what is called a "high magnetic" type. Generally speaking, the breaker at the service disconnect should be at a lower ampere rating than the breaker in the power supply. For instance, if the breaker in the power supply is 20 amps, the breaker at the service disconnect should be 15 amps, or a difference of 5 amps. These breakers should not be used repeatedly as an on-off switch as this will shorten the life of the breaker, causing nuisance tripping.

The proper physical placement of the power supply in relation to the plant is the final consideration for this article. Actually, the placement of the power supply should have been determined on the strand map but the verification of its location is the responsibility of the installer.

Two things must be considered here: 1) as a rule of thumb there should never be more than 8 amps of current passing through any one amplifier and 2) you must be sure that none of the outlying amplifiers or line extenders are voltage starved. Some brands of amplifiers will operate okay down to 38 VAC while other brands produce distortion if the AC drops to 43 volts. Another good rule of thumb is to operate your power supply at 80 percent load to allow for additional current consuming devices at a later date.

As an added safety precaution you should install a lightning arrestor such as the GE Movistor at the utility entry point. One last point: Be sure all connections are tightened firmly and that all your grounds are solid. ■

Basic electronics theory

This is Part XVIII of a series about basic electrical and electronic principles, designed for the individual with little or no training in either electricity or electronics.

By Kenneth T. Deschler
Cable Correspondence Courses

This month we will cover some of the more commonly used diode circuits found in CATV equipment as well as the test procedures used to determine the quality of a semiconductor diode.

Diode circuits

Zener voltage regulator: Earlier we found that a zener diode was a device that blocked the flow of current through itself until a specific amount of voltage was applied. This voltage is known as the breakdown, or zener, voltage.

The operation of a regulator circuit can be shown by studying Figure 1. When the input voltage increases, the voltage dropped across the shunt resistor (R_S) and R_1 also increase. To keep the voltage across the load resistor (R_L) constant, R_1 is reduced in value causing the excess voltage to be dropped across R_S. If the input voltage were to decrease, increasing the value of R_1 would cause more voltage to be dropped across it thereby keeping the voltage across the load resistor constant.

By replacing the variable resistor (R_1) with a zener diode, automatic regulation is accomplished. Now when the input voltage increases or decreases, the amount of current through the zener diode causes either less or more voltage to be dropped across R_S thereby regulating the voltage across the load resistor. Figure 2 shows a full wave power supply with zener diode regulation.

A *voltage doubler* is a diode circuit that effectively doubles the value of its input voltage by alternately charging capacitors to the input voltage level and then taking the voltage across both of them in series as an output voltage.

Figure 3 shows a full wave voltage doubler circuit. When the top of the secondary is positive, D_1 will conduct causing C_1 to charge to the peak value of the secondary voltage. When the top of the secondary is negative, D_2 will conduct causing C_2 to also charge to the peak value of the secondary voltage. As can be seen, the circuit's output is taken across both capacitors and effectively doubles the value of the secondary circuit's value.

Voltage multipliers: By adding more rectifiers and capacitors, voltage values that are triple, quadruple or more may be ob-

Figure 1: Regulator circuit

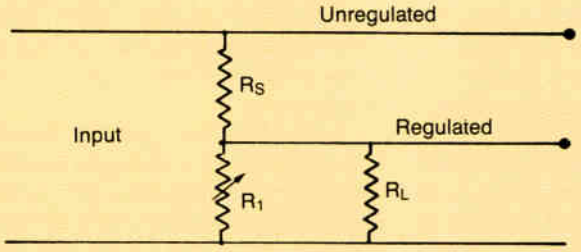


Figure 2: Full wave power supply with zener diode regulation

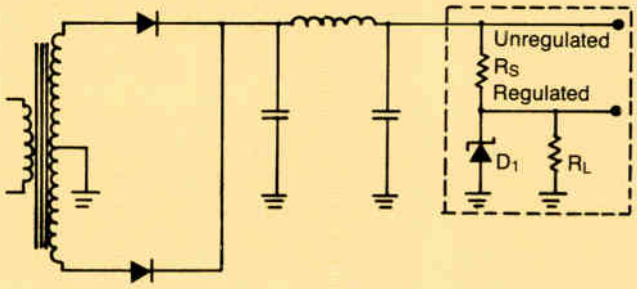


Figure 3: Full wave voltage doubler circuit

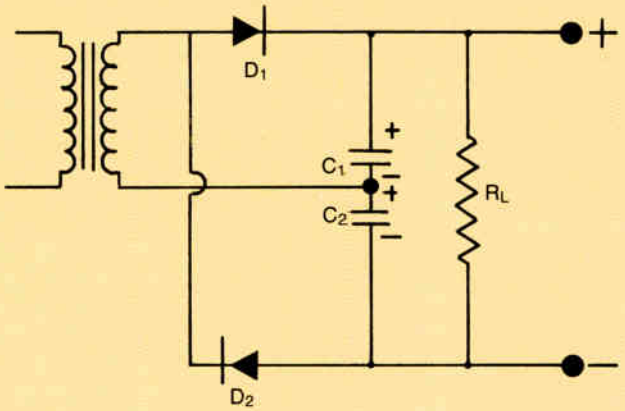


Figure 4: Voltage tripler

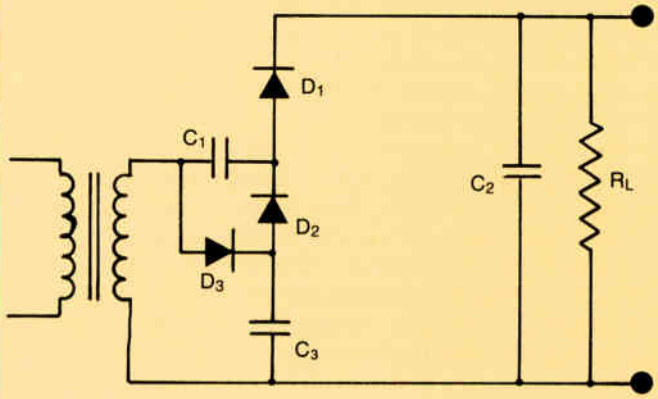


Figure 5: Voltage quadrupler

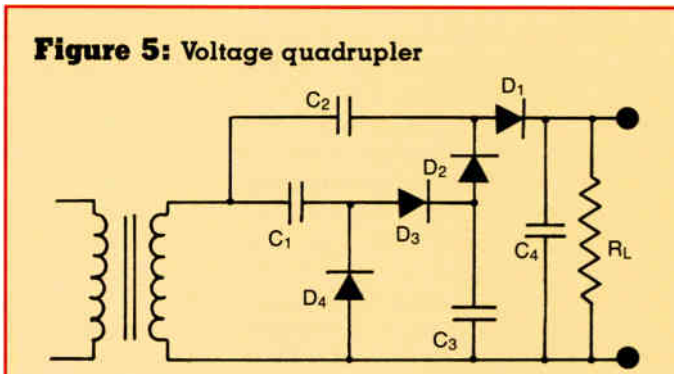
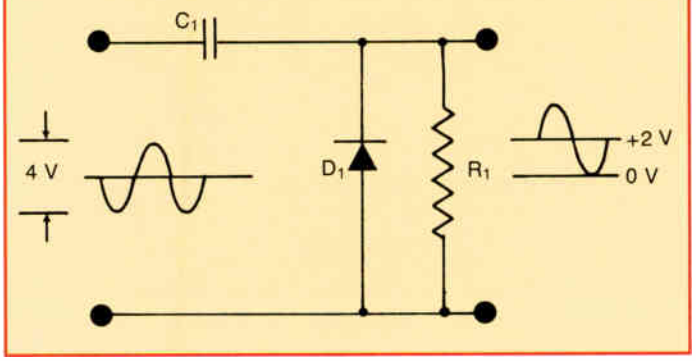


Figure 6: Positive clamper circuit



tained from a voltage source. Figures 4 and 5 show a voltage tripler and quadrupler respectively.

A *clamper* is a diode circuit that is used to place a signal voltage at a DC level. A *signal voltage* is defined as a waveform containing intelligent information. Signal voltages are used to bring both sound and picture information to CATV subscribers. Clampers are used a great deal in communication receivers and computers as well as in CATV signal processing equipment. A signal voltage may be placed either above the zero reference line (positive clamping) or below the zero reference line (negative clamping).

Figure 6 shows a positive clamper circuit containing a coupling capacitor (C_1) in series with a resistor (R_1). Both C_1 and R_1 form an R-C time constant. Across the resistor is a diode (D_1) that conducts on the negative alternation of the input and charges C_1. On the positive alternation the diode is reverse biased and all of the positive alternation appears across the resistor in series with the charge on C_1. This results in the input signal being shifted in value in a positive direction. By reversing the diode, a negative clamper is created. If it is desired to change the level of clamping, all that is necessary is the addition of a voltage, known as bias voltage, in series with the diode and resistor.

For the sake of illustration, Figures 6 through 10 do not take into account the 0.7 volt barrier potential that would normally be found in an actual circuit. Figure 7 shows a positive clamper with the addition of a positive bias of 3 volts. As can be seen, the signal is now at 5 volts above the zero reference line.

Limiter (clipper) circuits are used in communication equipment as well as in signal processing to eliminate some or all of the input waveform. They are used as speech clippers, in wave shaping circuits, to maintain a constant input to another circuit or to square off the peaks of an applied voltage. Figure 8 shows a positive limiter with both input and output waveforms. In operation, the diode is forward biased on the positive alternation resulting in its loss. On the negative alternation diode D_1 is reverse biased and the negative portion of the signal is developed across R_1.

Figure 9 shows a positive limiter using a bias of 3 volts to modify the output waveform. To achieve a negative limiter simply reverse diode D_1. Figure 10 shows an example of double limiting utilizing zener diodes. The amount of limiting is determined by the breakdown voltage of each diode.

Seven segment display units are made up of seven light emitting diodes (LEDs) placed in a figure eight pattern. By selectively applying voltage to individual LEDs, any number between zero and nine may be formed. Figure 11 shows both the schematic of the diodes with their current limiting resistors and how the device displays the number five when inputs A, F, G,

Figure 7: Positive clamper with 3 volt bias

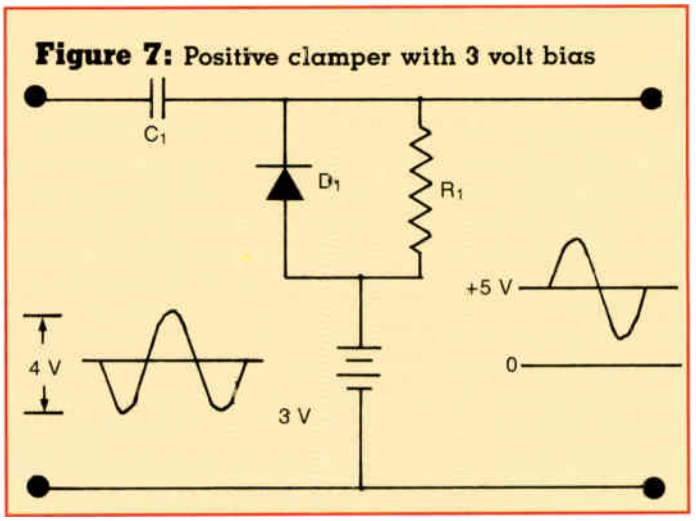


Figure 8: Positive limiter

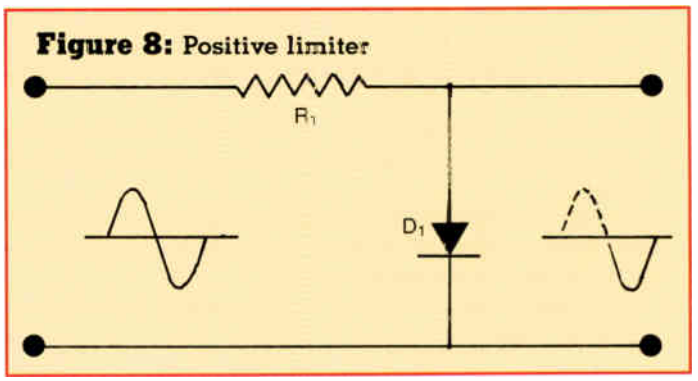


Figure 9: Positive limiter with 3 volt bias

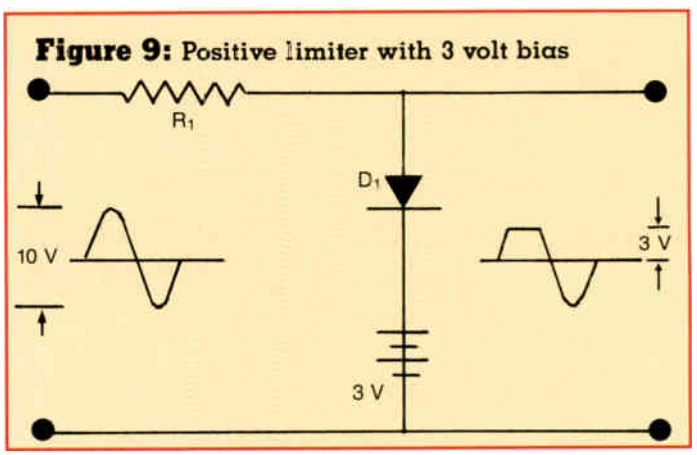
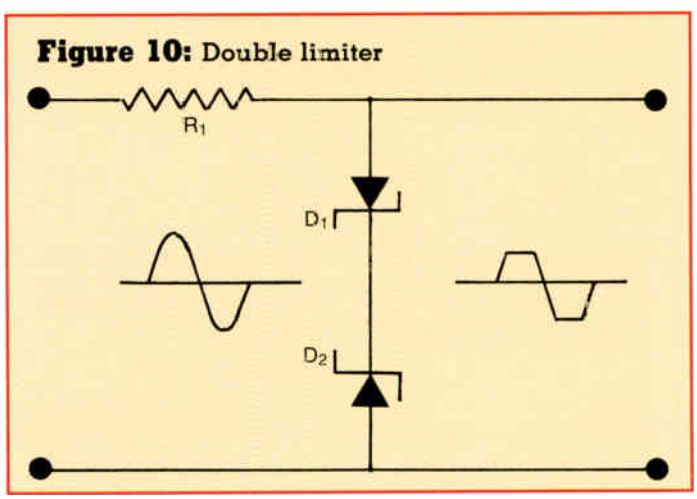


Figure 10: Double limiter



C and D are energized. The most common voltage used to energize a seven segment display is 5 volts.

Semiconductor diode testing

Testing semiconductor diodes may be accomplished by connecting the negative lead of an ohmmeter to the cathode or negative lead of the diode and its positive lead to the anode or positive lead of the diode. A diode connected in this manner will indicate a low resistance of the order of 10 to 100 ohms. By reversing the leads, an extremely high resistance of perhaps 500,000 ohms to infinity will be found. A high resistance in both directions indicates an open diode, and a low resistance in both directions indicates a shorted diode. Both open or shorted diodes should be replaced with good units. Figure 12 shows various ways that silicon diode terminals may be identified.

Test your knowledge

1) May a VOM (volt-ohm-milliammeter) be used to test a diode?
2) If a 25 volt zener diode in series with a 5 ohm resistor were used in Figure 2, what would be the value of the regulated voltage?
3) If the input to a voltage tripler is 10 volts at 3 amperes, what voltage and current values would you expect assuming zero losses?
4) If the bias voltage used in the circuit of Figure 7 were changed to 5 volts, at what value would the negative alternation be with respect to the reference line?
5) Which segments of Figure 11 must be energized to form the number three? ■

Figure 11: Seven segment display units

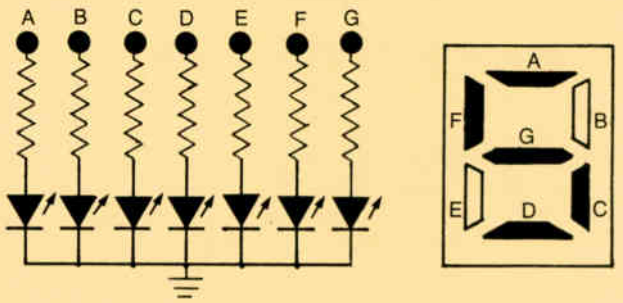
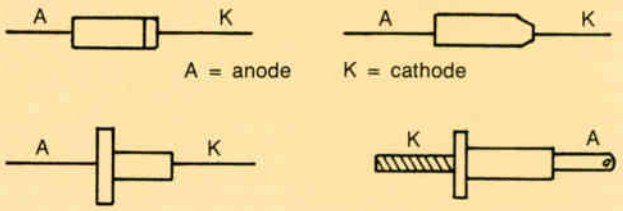


Figure 12: Silicon diode terminals



Answers

1) Yes, on the ohmmeter portion of the instrument.
2) 25 volts.
3) 30 volts at 1 ampere.
4) 5 volts.
5) A, B, C, D and G.

Effective use of the ohmmeter

This is the second of two parts on trouble-shooting using an ohmmeter.

By Glenn Shield
Regional Technical Trainer, Rogers Cable TV-Vancouver

Last month I discussed some of the basic principles of measuring the loop resistance of a drop wire and using this to determine if a drop wire has a partial short or open circuit. This month I'll discuss how to pinpoint a short circuit somewhere in the cable system.

To begin with, this technique I'm about to describe *does not* work with a digital meter. It can only be performed with an analog meter and this meter must have a polarity reversal switch. If you have an analog meter that is not equipped with a polarity reversal switch, Figure 1 shows the circuit diagram that will allow you to modify your meter. I use a Triplett Model 60, but any reputable make will work just fine if equipped with a switch and a reasonably good movement that will deflect easily.

Trunk outages

The outage I am about to describe should in theory never occur. If a system is properly fused there should not be a trunk outage caused by a short circuit in the distribution system. I have been in cable television long enough to realize that all too often the impossible does occur in our industry and in fact occurs with amazing regularity! How many times have you seen the trunk system taken down because of a short circuit in the distribution system?

Figure 2 illustrates a small portion of a typical cable system as represented on most CATV plans. Before I proceed any further, let me illustrate the AC path of a typical trunk bridger amplifier shown with the power director in the power through position (Figure 3).

If the power director is removed, three distinct and separate circuits are created: the input circuit, station circuit and output circuit. With the power director plug removed, these three circuits can be individually tested with an ohmmeter set on the times 1 ohm scale (Figure 4).

If we give some thought for a moment

Figure 1

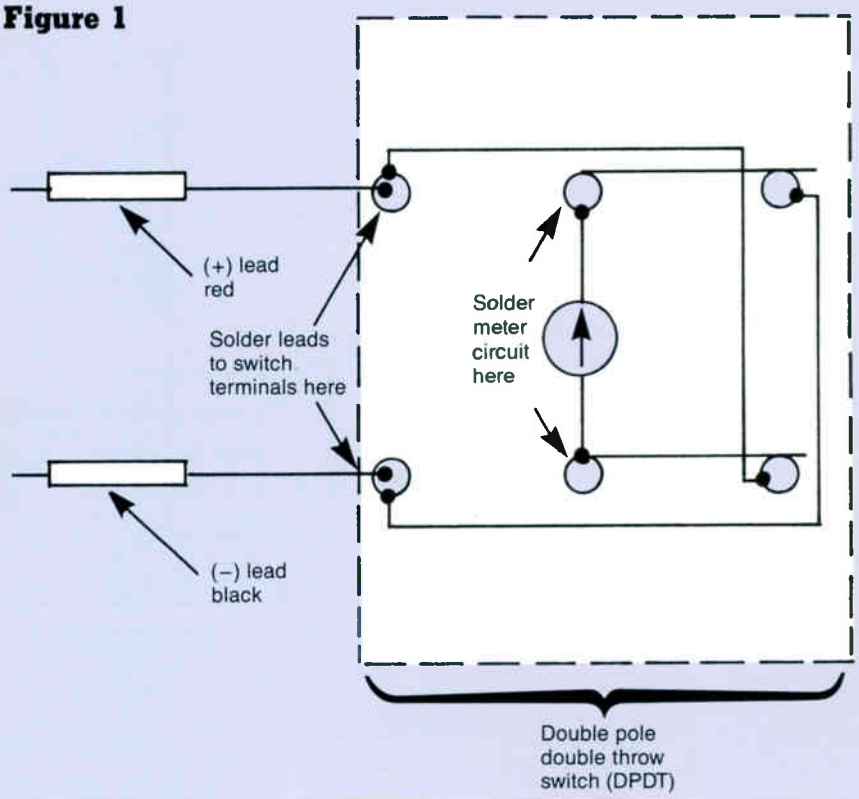


Figure 2

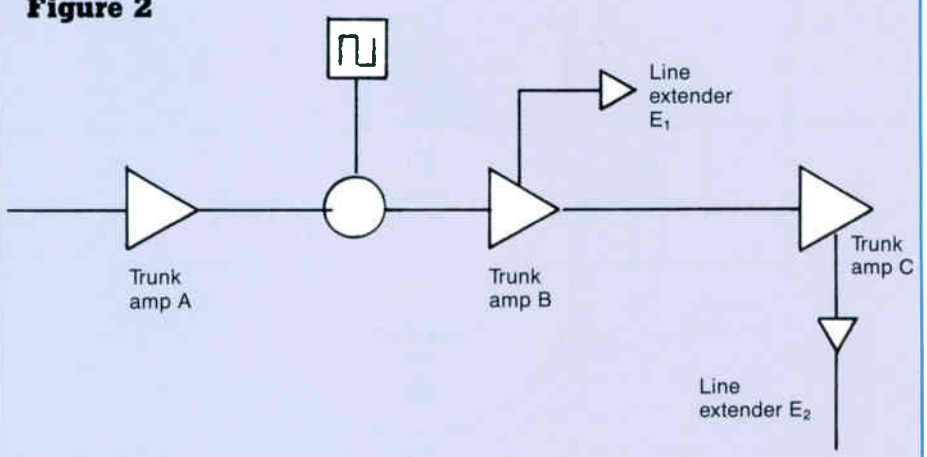
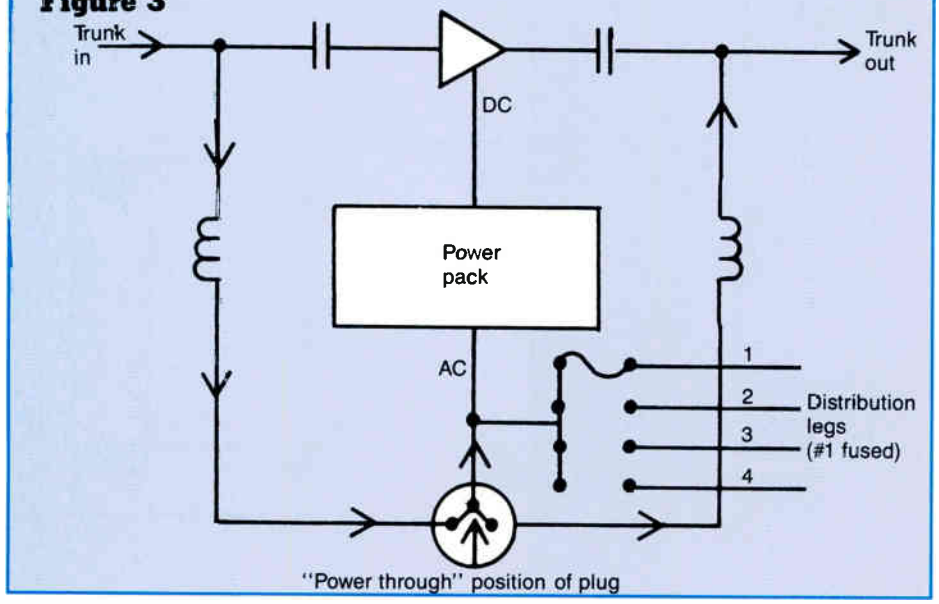


Figure 3



"If the system has a short circuit somewhere...the fuse should blow at the trunk amplifier."

on how amplifiers are powered in a cable system, they can be represented by a number of parallel loads. The three trunk amplifiers shown in Figure 2 can be redrawn as shown in Figure 5. From a DC resistance point of view, when an ohmmeter is placed across the cable as shown the resistance indicated will be very low, typically less than 5 ohms. If the system has a short circuit somewhere, say at line extender E_2, the fuse should blow at the trunk amplifier. If it does not blow here it may well blow at the point of power insertion causing a major trunk outage.

Figure 4

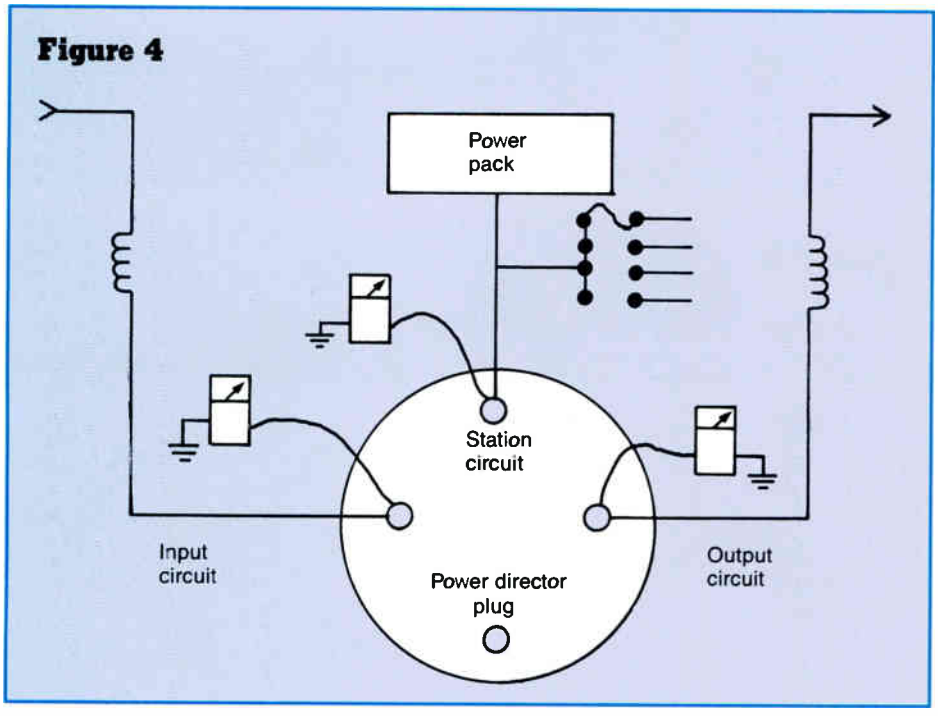
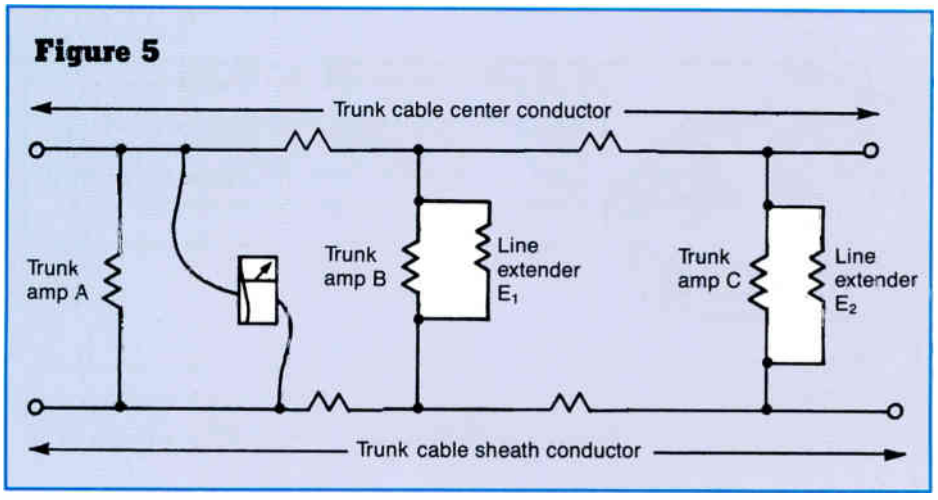


Figure 5



Finding the problem

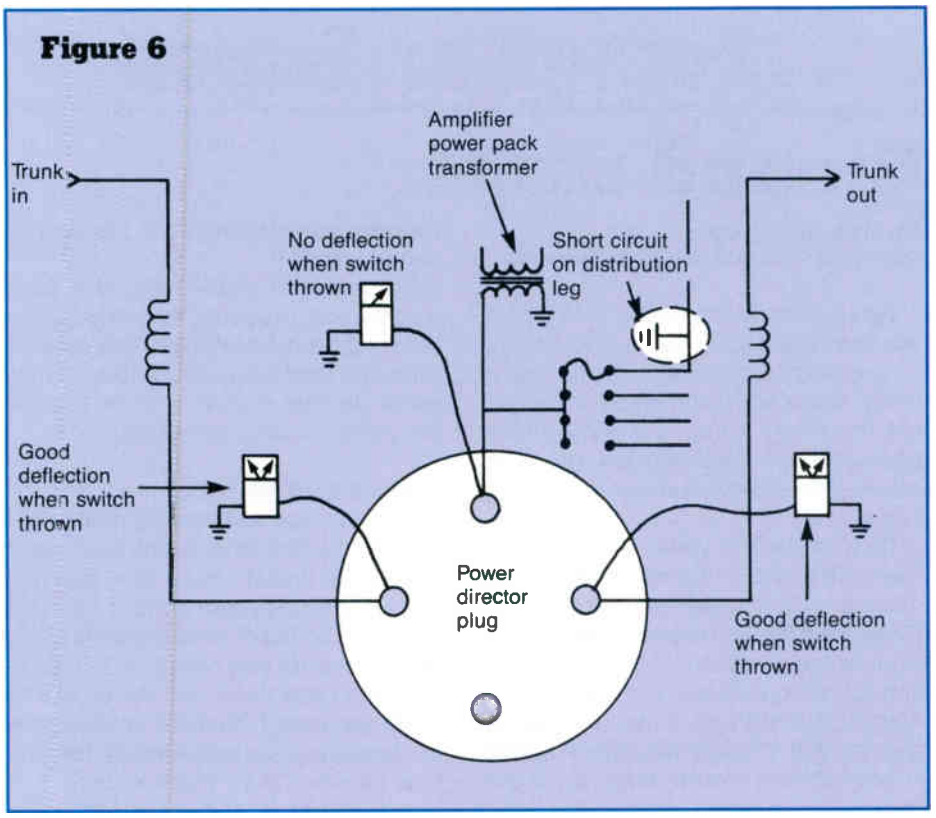
Here's where the technique comes in handy. The resistance looking into the system will not significantly change when there is a short circuit fault. However, there is one more element in the circuit that is the key to the whole exercise. That is the inductance presented by the primary windings of the trunk amplifier's power transformer. This winding is a very large inductor and exhibits those properties usually found in inductors, that is it will resist a change of current. If you connect an ohmmeter across the windings of a transformer you'll read the DC resistance and it will be typically very low, say 2 to 3 ohms.

However, if you can reverse the polarity quickly by changing a polarity reversal switch the meter movement will momentarily deflect in an attempt to read infinity ohms. Why? Because the collapsing field around the inductor will prevent current flowing in the new direction, hence the deflection of the movement will occur. This will only happen if there is no other path to allow the current to travel. A short circuit in a cable system is that other path.

So now we have available a test to determine if there is a short circuit in the cable system. If a good healthy deflection is noted, the system is okay. If not, suspect a short circuit somewhere.

By removing the power director at one of the trunk amplifiers in the outage and checking between here and ground for deflection on the times 1 ohms scale, we can quickly identify if the problem is on

Figure 6



the input, the output or at that particular station itself (Figure 6).

If that particular station has a short circuit on one of its distribution legs and the fuse has not blown, this will be identified by no deflection of movement. Simply remove each fuse in turn and perform the test. When you see a deflection you know you have identified the leg with the short circuit.

I have identified a deliberately placed short circuit three trunk amps deep. This test has been taught and performed for many years in the Rogers Kitchener system and without doubt has saved many hundreds of hours of troubleshooting and needless outages. ■

"If a good healthy deflection is noted, the system is okay. If not, suspect a short circuit somewhere."

I would like to thank Warren Fischer of Rogers Kitchener for his invaluable assistance in developing this troubleshooting technique.

Ad Index

Ground clutter

By Mike Mayberry
Construction Coordinator, Continental Cablevision

Ground clutter is the term I use for talk you hear when you're up a pole and the conversation isn't. Some of the talk is funny, some scary and some crazy (you get the idea). I call it ground clutter because it's jumbled; you don't get all the conversation firsthand and sometimes it's just as well!

Over the last 10 years, though, it has been interesting. I found out about the space shuttle disaster while up on a pole. It reminded me how unsafe things can be, especially when taken for granted. I heard about fiber optics while at the top of a 45-foot, Class 3 pole. I thought it was a new cereal! I heard two Illinois power linemen talking about putting up a cluster mount on the pole just down the line. I won't even tell you what I thought that was.

The customer speaks

Up a pole, you hear mostly what affects people's lives and interests, day in and day out. Back in 1980 I did hear how excited people were about cable in my area. Of course, by 1982 I heard how dissatisfied people were with cable. By 1983 we weren't moving fast enough. In 1984 I finally understood why people didn't like me to chew tobacco while working up a pole, especially nurses, in windy weather!

In 1985 I heard people say they wished they lived in our franchise area instead of the area served by their cable company. In January 1988 I heard people complaining about the latest price increase in cable. Then the conversation turned to what new movies were going to be on or what sports channel would get additional baseball coverage. And over the years what I heard about cable from people on the ground was a continuous interest and appreciation.

Ground clutter, whether it's from customers or your own co-workers is that half truth, half "I think so" conversation you hear while your mind is on your work. In 1983 I heard we were going places. Our system manager sent us to put up 9,000 feet of strand and cable on 56 poles. In 1984, while on a Class 1 heavy, I heard two Illinois power linemen discussing their desire to put a phone lineman in a machine that cut up tree limbs! The phone lineman was working a bit too slow for them I imagine.

Through the years I heard a lot of laughter and, of course, those lies that are known to every lineman as "war stories." I shouldn't say lies because they do have some element of truth in them, but over the years they become better.

Things that go bump

In 1981 I saw and heard a man burn a pole for the first time. Same man, same pole, three times! I knew then that man was in the wrong line of work. In 1983 I first heard the sound of an automobile hitting a pole. I heard it very clearly on 17th Street because I was there—on the pole! That year I also heard the spine-tingling noise of a pole snapping below me. At the same time I learned to fly (from a pole).

In 1988 I heard Billy laugh when I fell off the bucket truck twice in one year. In 1983 I heard Denny yell a warning to Frank and I about lightning striking around the poles we were on. A year before, I heard Frank tell me to hold on while he climbed a 45-foot pole to get me down safely after I was injured.

I think what I heard most were people who enjoyed working together. The sound of cooperation is like a welcome mat on the front porch. In 1985, 1986 and most of 1987 I heard pride. It's an unmistakeable sound of people working hard. It's the noise of their profession, their job at hand and their company. It's the cleanest, finest sound I can remember. I'd like to hear a lot more of it.

Over the years I heard several people say goodbye. They went on to better things. Of course, I heard a lot of people say goodbye whom I wished had never said hello. But I guess time has a tendency to erase the bad memories so all that's left are the good times and good people. Maybe you just hear what you want or maybe the wind up there cuts out the bad and leaves the good.

Overall I heard the same things from people involved in the cable industry. For those of us who will never get a chance to hear from those in power, take heart! You hear a lot up a pole. In fact, I believe those in charge on the ground should take some time to talk to those installer/technicians who climb poles. They might be surprised what they hear. ■

Products

Connectors

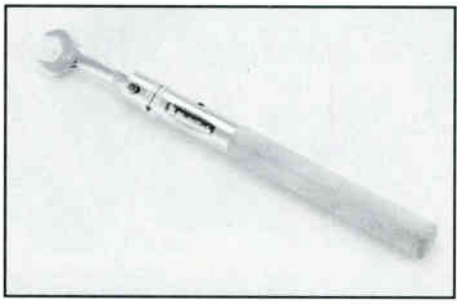
Pyramid announced the development of its hard line PI Series connectors. According to the company, the design meets or exceeds all current electrical, mechanical and CLI specifications. The connectors are equipped with EP O-rings, stainless steel radiation sleeve, metal to metal positive stop and visual alignment of center conductor. Electrical specifications include passband to 700 MHz with 30 dB return loss and RF shielding of less than 115 dB.

For more details, contact Pyramid Industries, P.O. Box 23169, Phoenix, Ariz., (602) 269-6431; or circle #124 on the reader service card.

Spectrum analyzer

Hameg Instruments introduced Model 8028 spectrum analyzer and tracking generator for testing headend equipment, amplifiers, passives and measuring signal leakage. The unit connects with an oscilloscope to read signals as low as −40 dBmV with a 70 dB dynamic range at 12.5 kHz resolution.

For further information, contact Holland Electronics, 5308 Derry Ave., Suite W, Agoura Hills, Calif. 91301, (818) 597-0015; or circle #118 on the reader service card.



Torque wrench

Multilink introduced its torque wrench for CLI maintenance. According to the company, use of this tool helps ensure proper connectorization and signal contact with the F connector.

For more details, contact Multilink, 196 Morgan Ave., P.O. Box 955, Elyria, Ohio 44035, (216) 324-4941; or circle #113 on the reader service card.

F connectors

According to Times Fiber, its one-piece weatherproof F connectors for CATV applications can be installed with just one crimp. Features include two weathertight seals inside, and a third seal that is formed when installed with Times Fiber's round crimp tool. A built-in stripping guide is also included. The connectors (when coupled with the company's drop cable with lifeTime corrosion protectant) are said to help minimize CLI.

For more information, contact Times Fiber Communications, 358 Hall Ave., Wallingford, Conn. 08492-0384, (203) 265-8500; or circle #123 on the reader service card.

Signal analysis meter

Wavetek introduced FiberSAM, a cable signal analysis meter with a built-in fiber optic power meter. This instrument measures optical power at 1330 and 1550 nm, RF signal level, carrier-to-noise ratio, hum, tilt and video to audio carrier level ratio.

Special tuning functions enable the operator to configure the FiberSAM to suit specific system requirements. The channel plan may be selected (standard, HRC, IRC and Jerrold formats) by keyboard control. A high/low carrier key allows quick rough balancing, along with the tilt measurement mode. The high and low carriers, as well as eight favorite channels may be user configured to enable quick tuning to these frequencies, according to the company.

For more information, contact Wavetek, 5808 Churchman Bypass, Indianapolis, Ind. 46203-6109, (317) 788-5965; or circle #116 on the reader service card.

MDU security

Augat's modular Multi-Port Channel Controller (MPCC) serves up to 10 subscribers with basic on/off service, seven premium channel selection and pay-per-view compatibility. A patented blocking technique eliminates all audio and video information from unscrambled or unimpaired CATV channels. According to the company, the MPCC is undefeatable and inherently temperature stable.

For more information, contact Augat Communications Group Inc., 2414 S.W. Andover St., P.O. Box 1110, Seattle, Wash. 98111, (206) 932-8428; or circle #128 on the reader service card.

Pliers

The Model D203-6CR long-nosed pliers from Klein Tools can wrap, loop and cut wire and apply solderless connectors. The product is 6 inches long and has knurled jaws for gripping and contoured plastic-dipped handles.

For more information contact Klein Tools Inc., 7200 McCormick Blvd., Chicago, Ill. 60645; or circle #126 on the reader service card.

From the NCTI

(Continued from page 34)

causing the hot chassis condition. When no AC voltage is measured between the CATV wall outlet and the coaxial cable's F connector body, as shown in Figures 5-8, the device that is currently disconnected from the AC wall outlet is causing the hot chassis condition and needs to be repaired prior to using it. The presence of AC voltage between the converter input cable F connector nut and CATV wall plate F-81 barrel connector threads indicates hot chassis condition at either the television or converter (Figure 5). No AC voltage between the converter input cable F connector nut and F-81 barrel connector threads at the CATV wall plate indicates a hot chassis condition at the television (Figure 6). Presence of AC voltage between the CATV wall plate F-81 barrel connector threads and converter input cable F connector nut indicates hot chassis condition at the converter (Figure 7). AC voltage present between the F connector nut and center conductor of the converter input cable indicates AC voltage on the drop cable (Figure 8). ■

Installer's Tech Book

Converting dBmV to μV/m

By Ron Hranac
Senior Staff Engineer, Jones Intercable Inc.

Channel 23 or J (217.25 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
-60	4.56	-36	72.31	-10	1442.71	16	28785.85
-59	5.12	-35	81.13	-9	1618.75	17	32298.26
-58	5.74	-34	91.03	-8	1816.26	18	36239.24
-57	6.44	-33	102.14	-7	2037.88	19	40661.10
-56	7.23	-32	114.60	-6	2286.54	20	45622.50
-55	8.11	-31	128.58	-5	2565.54	21	51189.29
-54	9.10	-30	144.27	-4	2878.59	22	57435.32
-53	10.21	-29	161.87	-3	3229.83	23	64443.49
-52	11.46	-28	181.63	-2	3623.92	24	72306.79
-51	12.86	-27	203.79	-1	4066.11	25	81129.55
-50	14.43	-26	228.65	0	4562.25	26	91028.85
-49.66	**15**	-25	256.55	1	5118.93	27	102136.06
-49	16.19	-24	287.86	2	5743.53	28	114598.54
-48	18.16	-23	322.98	3	6444.3C	29	128581.68
-47	20.38	-22	362.39	4	7230.68	30	144271.01
-46	22.87	-21	406.61	5	8112.96	31	161874.74
-45	25.66	-20	456.23	6	9102.89	32	181626.44
-44	28.79	-19	511.89	7	10213.61	33	203788.22
-43	32.30	-18	574.35	8	11459.85	34	228654.15
-42	36.24	-17	644.43	9	12858.17	35	256554.17
-41	40.66	-16	723.07	10	14427.10	36	287858.51
-40	45.62	-15	811.30	11	16187.47	37	322982.57
-39.20	**50**	-14	910.29	12	18162.64	38	362392.40
-39	51.19	-13	1021.36	13	20378.82	39	406610.96
-38	57.44	-12	1145.99	14	22865.41	40	456225.00
-37	64.44	-11	1285.82	15	25655.42		

Channel 24 or K (223.25 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
-60	4.69	-36	74.30	-10	1482.55	16	29580.86
-59	5.26	-35	83.37	-9	1663.45	17	33190.27
-58	5.90	-34	93.54	-8	1866.43	18	37240.09
-57	6.62	-33	104.96	-7	2094.16	19	41784.07
-56	7.43	-32	117.76	-6	2349.69	20	46882.50
-55	8.34	-31	132.13	-5	2636.40	21	52603.03
-54	9.35	-30	148.26	-4	2958.09	22	59021.57
-53	10.50	-29	166.35	-3	3319.03	23	66223.29
-52	11.78	-28	186.64	-2	3724.01	24	74303.76
-51	13.21	-27	209.42	-1	4178.41	25	83370.18
-50	14.83	-26	234.97	0	4688.25	26	93542.89
-49.90	**15**	-25	263.64	1	5260.30	27	104956.84
-49	16.63	-24	295.81	2	5902.16	28	117763.52
-48	18.66	-23	331.90	3	6622.33	29	132132.84
-47	20.94	-22	372.40	4	7430.38	30	148255.48
-46	23.50	-21	417.84	5	8337.02	31	166345.39
-45	26.36	-20	468.83	6	9354.29	32	186642.59
-44	29.58	-19	526.03	7	10495.68	33	209416.44
-43	33.19	-18	590.22	8	11776.35	34	234969.10
-42	37.24	-17	662.23	9	13213.28	35	263639.67
-41	41.78	-16	743.04	10	14825.55	36	295808.58
-40	46.88	-15	833.70	11	16634.54	37	331902.68
-39.44	**50**	-14	935.43	12	18664.26	38	372400.93
-39	52.60	-13	1049.57	13	20941.64	39	417840.72
-38	59.02	-12	1177.64	14	23496.91	40	468825.00
-37	66.22	-11	1321.33	15	26363.97		

Channel 25 or L (229.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	4.81	−36	76.30	−10	1522.48	16	30377.52
−59	5.40	−35	85.62	− 9	1708.25	17	34084.14
−58	6.06	−34	96.06	− 8	1916.69	18	38243.03
−57	6.80	−33	107.78	− 7	2150.56	19	42909.39
−56	7.63	−32	120.94	− 6	2412.97	20	48145.13
−55	8.56	−31	135.69	− 5	2707.40	21	54019.72
−54	9.61	−30	152.25	− 4	3037.75	22	60611.12
−53	10.78	−29	170.83	− 3	3408.41	23	68006.80
−52	12.09	−28	191.67	− 2	3824.30	24	76304.88
−51	13.57	−27	215.06	− 1	4290.94	25	85615.48
−50.13	**15**	−26	241.30	0	4814.51	26	96062.15
−50	15.22	−25	270.74	1	5401.97	27	107783.51
−49	17.08	−24	303.78	2	6061.11	28	120935.09
−48	19.17	−23	340.84	3	6800.68	29	135691.40
−47	21.51	−22	382.43	4	7630.49	30	152248.25
−46	24.13	−21	429.09	5	8561.55	31	170825.35
−45	27.07	−20	481.45	6	9606.22	32	191669.19
−44	30.38	−19	540.20	7	10778.35	33	215056.37
−43	34.08	−18	606.11	8	12093.51	34	241297.22
−42	38.24	−17	680.07	9	13569.14	35	270739.93
−41	42.91	−16	763.05	10	15224.83	36	303775.20
−40	48.15	−15	856.15	11	17082.53	37	340841.38
−39.67	**50**	−14	960.62	12	19166.92	38	382430.32
−39	54.02	−13	1077.84	13	21505.64	39	429093.88
−38	60.61	−12	1209.35	14	24129.72	40	481451.25
−37	68.01	−11	1356.91	15	27073.99		

Channel 26 or M (235.2625 MHz)

dBmV	μV/m	dBmV	μV/m	dBmV	μV/m	dBmV	μV/m
−60	4.94	−36	78.30	−10	1562.33	16	31172.53
−59	5.54	−35	87.86	− 9	1752.96	17	34976.15
−58	6.22	−34	98.58	− 8	1966.85	18	39243.89
−57	6.98	−33	110.60	− 7	2206.85	19	44032.36
−56	7.83	−32	124.10	− 6	2476.12	20	49405.13
−55	8.79	−31	139.24	− 5	2778.25	21	55433.46
−54	9.86	−30	156.23	− 4	3117.25	22	62197.37
−53	11.06	−29	175.30	− 3	3497.61	23	69786.59
−52	12.41	−28	196.69	− 2	3924.39	24	78301.85
−51	13.92	−27	220.68	− 1	4403.24	25	87856.12
−50.35	**15**	−26	247.61	0	4940.51	26	98576.18
−50	15.62	−25	277.83	1	5543.35	27	110604.30
−49	17.53	−24	311.73	2	6219.74	28	124100.06
−48	19.67	−23	349.76	3	6978.66	29	139242.56
−47	22.07	−22	392.44	4	7830.18	30	156232.72
−46	24.76	−21	440.32	5	8785.61	31	175296.00
−45	27.78	−20	494.05	6	9857.62	32	196685.35
−44	31.17	−19	554.33	7	11060.43	33	220684.59
−43	34.98	−18	621.97	8	12410.01	34	247612.18
−42	39.24	−17	697.87	9	13924.26	35	277825.43
−41	44.03	−16	783.02	10	15623.27	36	311725.26
−40	49.41	−15	878.56	11	17529.60	37	349761.50
−39.90	**50**	−14	985.76	12	19668.53	38	392438.86
−39	55.43	−13	1106.04	13	22068.46	39	440323.64
−38	62.20	−12	1241.00	14	24761.22	40	494051.25
−37	69.79	−11	1392.43	15	27782.54		

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

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Professional Services

Hot chassis condition

The National Cable Television Institute recently introduced Troubleshooting TV Problems to its Installer Technician course. That lesson contains a section on troubleshooting hot chassis conditions caused by improper AC receptacle wiring, altered AC power cords and defective electronic devices. The procedures contained in the following lesson excerpt require the use of a volt-ohmmeter and AC outlet tester to test 115 VAC wall outlets. Only authorized personnel trained to properly operate this test equipment and safely measure AC voltage should perform those procedures. Always comply with your local CATV system policy and observe all safety precautions for working with AC voltage. Fault current will be discussed in a future installment.

By Ray Rendoff
Technical Training Director
National Cable Television Institute

Figure 1: Checking polarity with a VOM (A) and AC outlet tester (B)

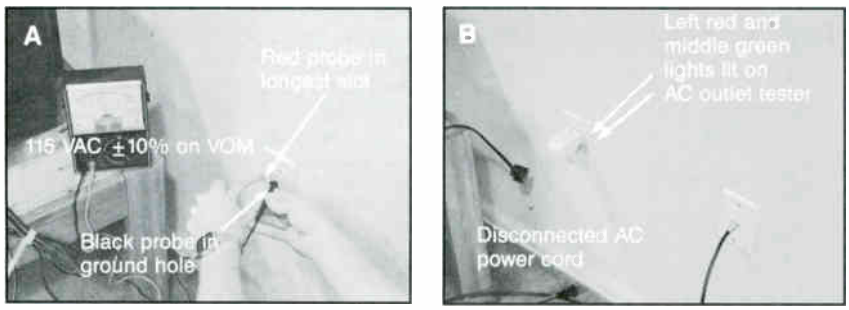
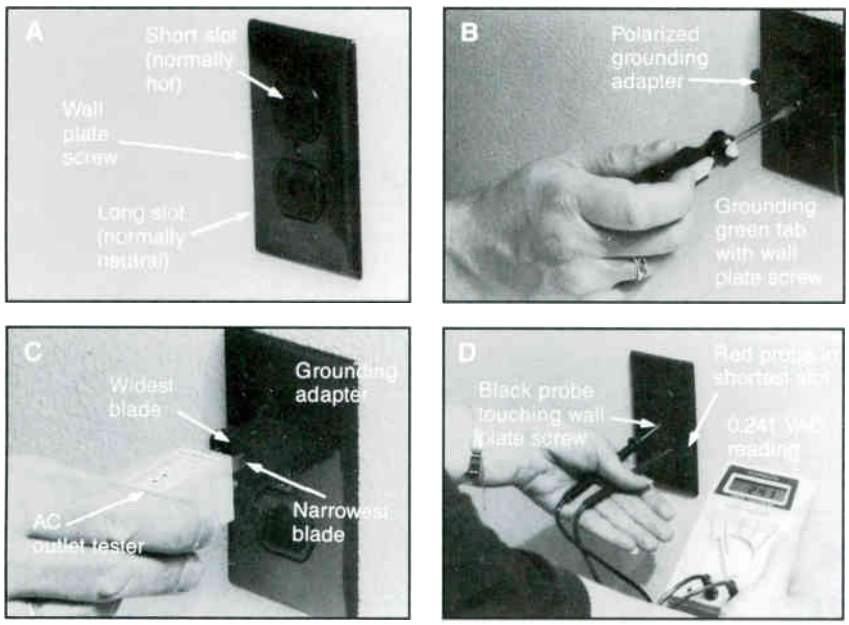


Figure 2: Installing a grounding adapter and outlet tester (A, B, C) and measuring AC voltage (D) at a grounded polarized two-slot receptacle

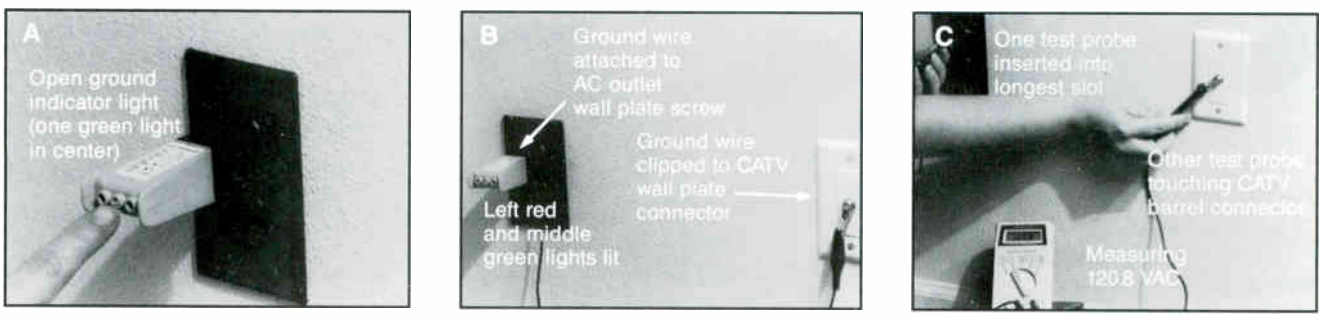


By a Ray Rendoff

It is good installation practice to test an AC receptacle prior to connecting the drop cable to the television and plugging in the converter AC power cord. As a further precaution, avoid contacting metal with both hands while installing an F connector onto a barrel connector, especially when the drop cable is common-bonded to power ground. Placing the left hand on the converter's metal chassis while using the right hand to install an F connector at the converter's input or output port could create a current path from the right hand through the chest and to the left hand if there is current on the cable sheath.

Older TV sets, inadequate TV repairs, faulty receptacle wiring, power ground fault currents and component failure in televisions, VCRs, and set-top converters may present a potential safety hazard to

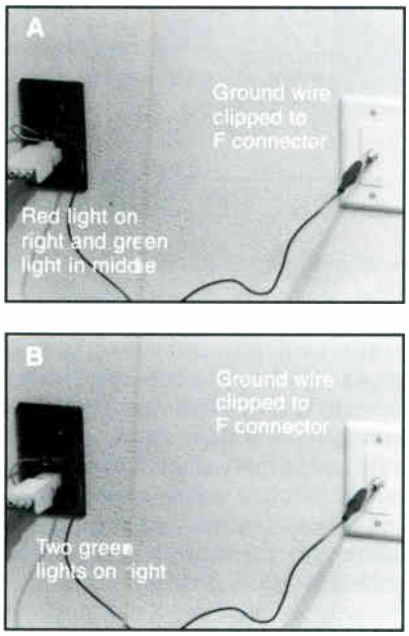
Figure 3: Using an outlet tester (A, B) and multimeter (C) to check non-grounded polarized two-slot receptacle wiring



AC outlet polarity tester chart

Indicator lights	Wiring fault
○ ● ○	Ground contact not connected
● ○ ●	Hot and ground contacts interchanged
● ● ○	Hot and neutral contacts interchanged
○ ● ●	Receptacle is wired correctly

Figure 4: Grounding adapter improperly (A) and properly (B) installed on non-grounded non-polarized two-slot receptacle



installers and installation technicians. Therefore, it is important to be aware of the very rare possibility of receiving an electrical shock (severity varies) or seeing a spark while connecting or removing coaxial cables at a television, VCR, or set-top converter. Although a power ground fault may cause this condition when the CATV drop cable is common-bonded to the power ground, this lesson presents how to troubleshoot hot chassis conditions caused either by improper wiring of a polarized receptacle; by cutting the wide blade on the TV, VCR or converter power cord plug and incorrectly plugging it into a polarized or non-polarized AC wall outlet; by plugging an adapter incorrectly into a non-polarized receptacle; or by an internal problem in the television, VCR or set-top converter. A hot chassis condition exists when inadvertently applying AC voltage to the chassis ground. In addition to safety concerns, a hot chassis condition can damage electronic devices (i.e., televisions, VCRs and set-top converters).

Improper receptacle wiring

Polarized three-hole receptacle. Before assuming that the television, VCR or converter is the cause of the hot chassis condition, use a multimeter (VOM), as in Figure 1A, or an AC outlet tester, as in Figure 1B, to verify that the polarized three-hole receptacle has proper polarization. A reading of 115 volts AC (VAC) ±10 percent between the longest slot and the ground hole indicates improper polarization (Figure 1A). A red light on the left and a green light in the middle of the AC outlet tester indicates that the hot and neutral wires are reversed (see accompanying table and Figure 1B). No AC voltage between adjacent receptacle slots indicates no AC input voltage. No AC voltage between a short slot and the ground hole in-

Figure 5: Hot chassis condition at television or converter

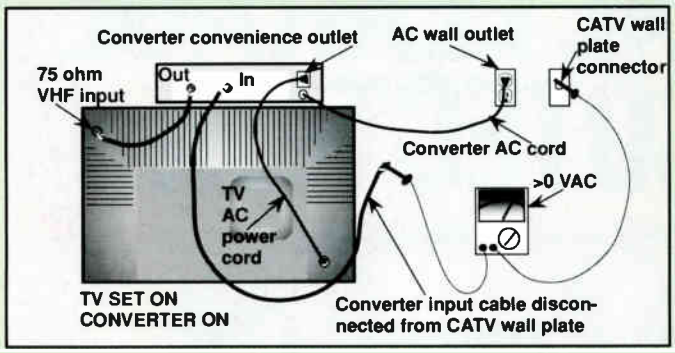


Figure 6: Hot chassis condition at television

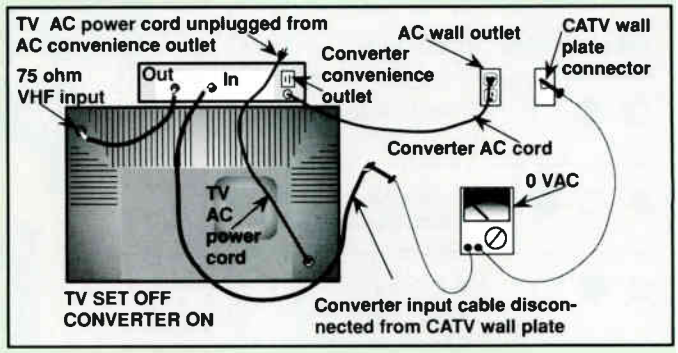


Figure 7: Hot chassis condition at converter

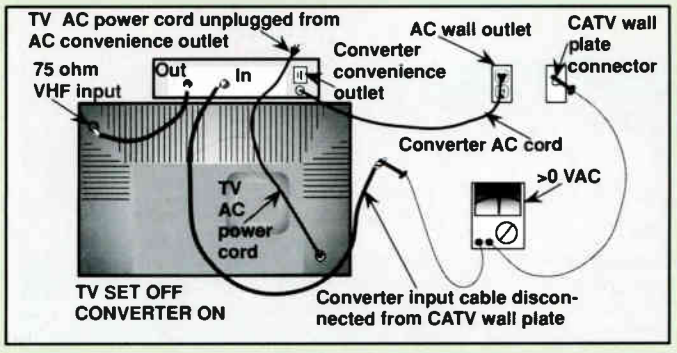
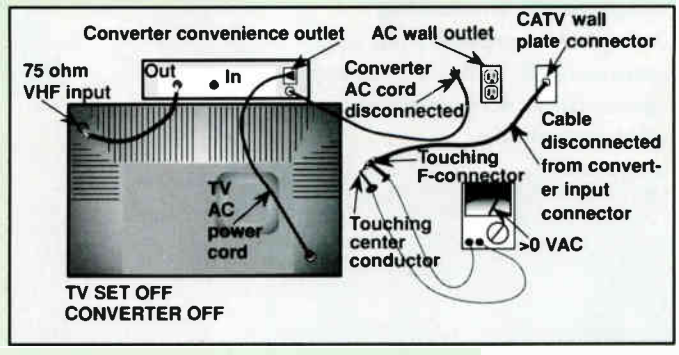


Figure 8: AC voltage on drop cable



dicates either no ground or improper wiring. Do *not* connect any AC power cords to a faulty AC wall outlet.

Polarized two-slot receptacle. To check the wiring on a grounded receptacle with slots of unequal length and no ground hole (Figure 2A), use a polarized grounding adapter and an AC outlet tester (Figure 2C) or a VOM set up to measure AC voltage (Figure 2D). Remove the AC outlet wall plate screw prior to installing a grounding adapter. Plug the adapter's male polarized prongs into the polarized two-slot receptacle by inserting the widest blade of the adapter into one long slot and the narrowest blade into its adjacent short slot. Fasten the adapter's green ground tab to the receptacle with the AC wall plate screw (Figure 2B). Insert the AC outlet tester prongs into the grounding adapter (Figure 2C) and determine wiring condition by noting which indicator lights are lit (see table). Set a VOM to measure 115 VAC and then touch its black test probe to the wall plate screw and insert its red test probe into one short slot (Figure 2D). An AC voltage reading of 0 VAC or near 0 VAC indicates either improper wiring and polarity or no ground.

An open ground indicator, shown on the outlet tester as one green light in the center (table and Figure 3A), means that the receptacle is not grounded and must be grounded before determining the condition of the AC outlet wiring with an outlet tester. To ground the receptacle, connect an insulated ground wire between the CATV wall plate barrel connector and the AC outlet wall plate screw (Figure 3B). A red light on the left and a green light in the middle of the AC outlet tester indicates that the hot and neutral wires are reversed (table and Figure 3B). Measuring 115 VAC ±10 percent between the longest receptacle slot and the CATV wall plate connector (Figure 3C) indicates that the hot and neutral wires are reversed. Do *not* plug any AC power cords into an improperly wired AC wall outlet.

Non-polarized two-slot receptacle. The wide blade of the AC power cord plug on the subscriber's television, VCR or set-top converter may have been cut and plugged into a non-polarized two-slot receptacle in a way that caused either a hot chassis condition, blew a fuse or burned up the subscriber's equipment. Inspect all AC power cord plugs to ensure that the wide blades have not been cut. Ask the subscriber to have all altered plugs repaired prior to plugging them back into an AC outlet.

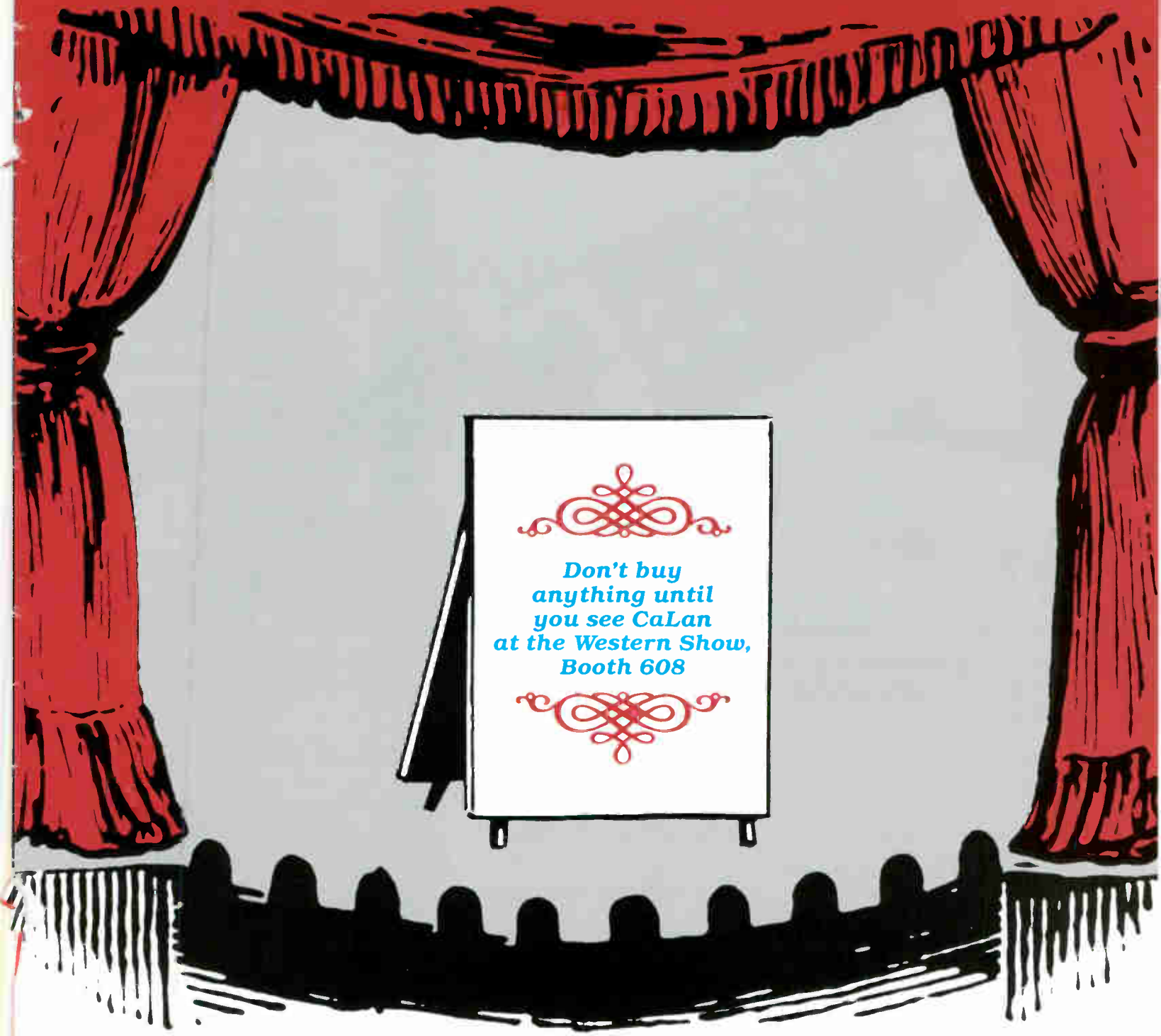
It also is possible to find a grounding adapter with non-polarized prongs plugged into a non-polarized two-slot receptacle in a way that caused either a hot chassis condition, blew a fuse or burned up the television, VCR or set-top converter. Please follow your system's policy concerning the use of grounding adapters and non-polarized receptacles. To determine if the grounding adapter is incorrectly plugged into a non-polarized two-slot receptacle, unplug its AC power cord, install a ground wire between the AC outlet wall plate screw and cable ground, and plug an AC outlet tester into the adapter. Observe the indicator lights on the tester. If a fault is indicated (Figure 4A), unplug the adapter, rotate the prongs 180°, plug the adapter into the receptacle and confirm tester lights indicate proper installation (Figure 4B).

Defective electronic device

If the receptacle polarity is correct, disconnect AC power from one electronic device at a time to determine which is

(Continued on page 26)

Coming Attraction



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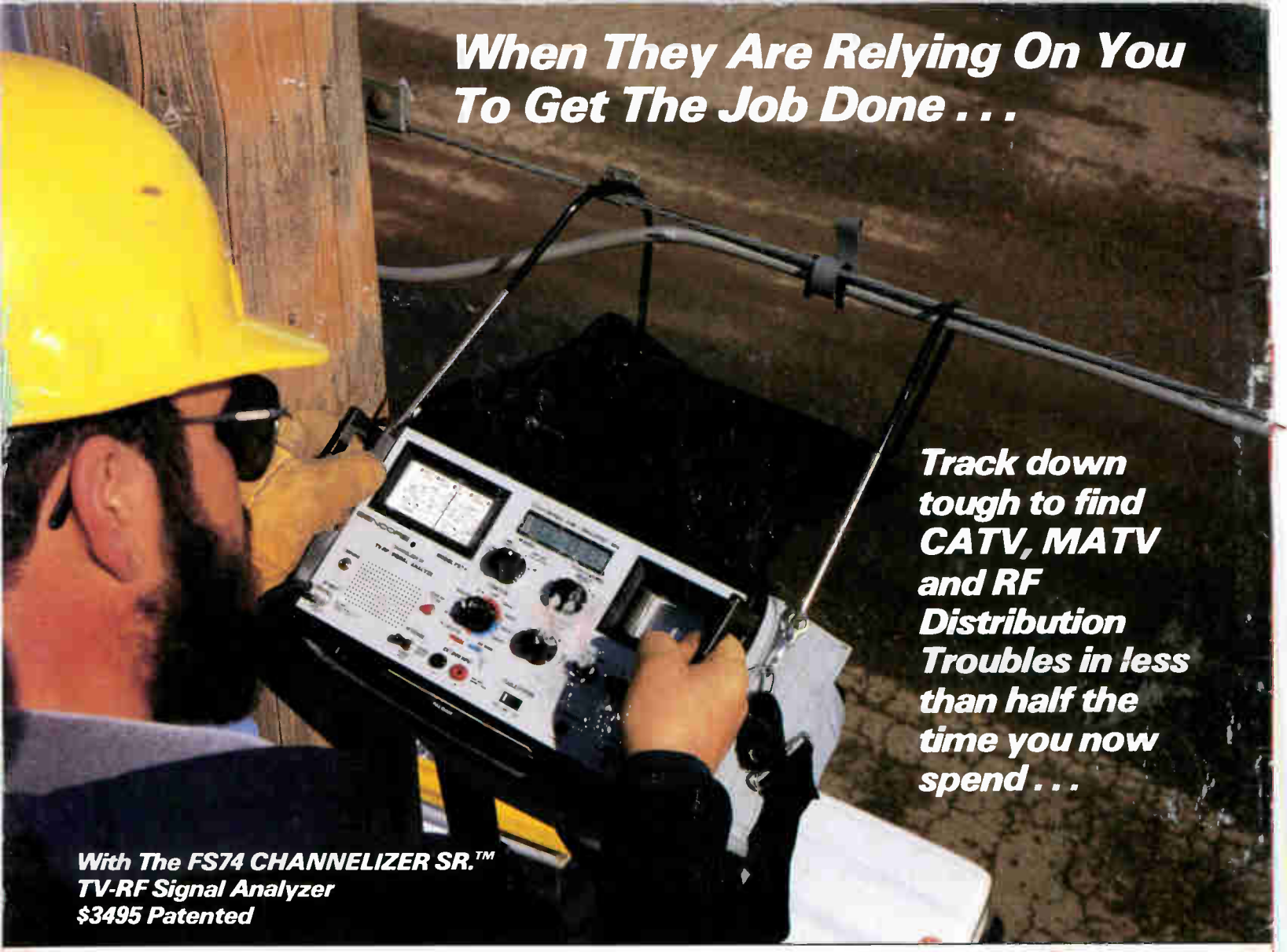

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