222 N. Center St.
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CABLE LOCATION TECHNICAL PRACTICE

A PROTECTION SYSTEM DESIGNED TO FACILITATE CABLE LOCATION WHILE PROTECTING PERSONNEL AND BURIED CABLE

TECHNICAL PRACTICE ISSUE 2, JANUARY 2010

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INTRODUCTION

ACT Communications Inc. is a company dedicated to manufacturing high quality telecom equipment solutions that include both electrical and mechanical designed products.

This Technical Practice is focused on the ACT 44X Cable Location Protection systems, which includes a wide range of cable location surge protector solutions.

SPECIFICATIONS & DESCRIPTIONS

ACT 442 INDOOR PROTECTOR

The ACT 442 Indoor Cable Locating Protection Device is a solid-state hybrid surge protection system installed between the cable sheath and earth ground. Its primary function is to increase the cable locating tone range and efficiency while protecting buried cable from high-energy surges. The ACT 442 is either mounted in a pedestal to allow easy access during testing or inside a fiber closure.

ACT 442 PHYSICAL & ELECTRICAL SPECIFICATIONS

PHYSICAL

The ACT 442 Indoor Cable Locating Protection Device comes standard in a 3x2x1.5 (in.) plastic enclosure. There are two 1/4-20 stainless steel studs mounted on the unit for connection purposes. The designated ground lug is marked with green ink for clarification, even though the protector is not polarity sensitive. Each unit has a 3/16 (in.) mounting hole and weighs 7 ounces.

ELECTRICAL

Voltage Applications (VDC)	150	350
Clamping Voltage (@ 1mA DC) (+/-10% voltage variance)	180	430
Peak Current (8x20µS)	40,000 Amps	
Energy Dissipation (10x1000µS)	1600 joules	
Response Time	1.5 Nanoseconds	
Capacitance @ 5KHz	4004pf	

ACT 444 OUTDOOR PROTECTOR

The ACT 444 Cable Locating Protection Device is an indoor/outdoor solid-state hybrid surge protection system installed between the cable sheath and earth ground. Its primary function is to increase the cable locating tone range and efficiency, while protecting buried cable and personnel from high-energy surges. This unit may be installed either underground or aboveground. Proper installation and location of these devices allows for greater than 75 miles of cable location from one transmitter.

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ACT 444 PHYSICAL & ELECTRICAL SPECIFICATIONS

PHYSICAL

The ACT 444-30X or 40X units have 4x4x2 (in.) waterproof enclosures.

There are two 6 AWG stranded wires feeding through the box that connect green to ground and black to the cable sheath.

ELECTRICAL

Voltage Applications (VDC)	150	350
Clamping Voltage (@ 1mA DC) (+10% voltage variance)	180	430
Peak Current (8x20µS)	40,000 Amps	
Energy Dissipation (10x1000µS)	1600 joules	
Response Time	1.5 Nanoseconds	
Capacitance @ 5KHz	4004pf	

ACT 445X SWITCH BOX

The ACT 445X Cable Locating Protection Device is a remote switching device controlled by a cable location transmitter system. In addition, the ACT 445X unit is built with a high-energy surge protector. The surge protector provides a low impedance path to ground for high-energy transients (lightning, temporary over voltage (TOV), etc.) and a high impedance path for low energy signals (cable locating tones). A heavy-duty relay is installed in this unit allowing the cable sheath to remain grounded while de-energized. When a 48-volt DC signal is applied from the transmitter, it lifts the earth ground off the cable and connects the transmitter to the cable sheath. It also connects the protector from the sheath to ground.

ACT 445X PHYSICAL & ELECTRICAL SPECIFICATIONS

PHYSICAL

The ACT 445X is available for two, four, or sixteen switch cable access in one box.

For dual and quad cable access (labeled 1, 2, 3, and 4) a 12x10x6 (in.) box is used. Both units provide an internal screw terminal block for use with trace wires. Both units are sold with the control cable harness (ACT 445-S12-040) for connection to the tone transmitter.

For sixteen-cable access a 16x14x6 (in.) box is used that can be wall or rack mounted. This unit is sold with control cable harness ACT 445-S18-040.

ELECTRICAL

Voltage Applications	150	350
Clamping Voltage (@ 1mA DC) (+10% voltage variance)	180	430
Peak Current (8x20µS)	40,000 Amps	

Energy Dissipation (10x1000µS)	1600 joules
Response Time	1.5 Nanoseconds
Capacitance @ 5KHz	4004pf
Relay Coil Voltage	-48 Volts DC
Relay Coil Rating	5 Amp continuous
Signal Connector	DB24

ACT 446 DUAL CABLE PROTECTOR

The ACT 446 Dual Cable Locating Protection Device is an indoor/outdoor, dual protection unit designed to protect two wires against high-energy surges while providing isolation between the East and West cable sheath or backbone and spur connection. The ACT 446 has two key purposes: isolating the East and West cable sheath, allowing technicians to be able to test individual cable sections in the field and pin-point problems quickly; and providing an electrical connection between backbone cable and a spur cable connection. During isolation tests, its own hybrid surge arrestor individually protects each direction. This ensures maximum safety for personnel and equipment.

- The ACT 446-150-210 series outdoor protector is a WEATHERPROOF enclosure with a shorting bar between two cable connection posts that provides a technician with a capability to easily isolate the fiber backbone or pull off a spur electrical connection. 6 ft. 6 AWG cable length options are available.
- The ACT 446-150-312 series outdoor protector is a WATERPROOF enclosure with a shorting bar, normally used to bond backbone and spur cables together in a waterproof environment. Waterproof enclosure comes standard with black, red, and green 6 AWG wire.
- The ACT 446-150-410 series protector is designed specifically for pedestal and indoor applications. This protector comes with a shorting bar between two cable connection posts that provides a technician with the capability to easily isolate the fiber backbone or pull off a spur electrical connection.

ACT 446 PHYSICAL & ELECTRICAL SPECIFICATIONS

PHYSICAL

The ACT 446-200 & 300 Series Dual Cable Locating Protection Device comes standard in a 4x4x2 (in.) waterproof enclosure. There are three 6 ft. 6 AWG cables mounted on the unit for connection purposes. The designated ground lug is marked with green cable for clarification, even though the protector is not polarity sensitive.

The ACT 446-400 Series is an indoor or pedestal mounted product in a 3x3x2 (in.) plastic enclosure.

ELECTRICAL

Voltage Applications	150	350
Clamping Voltage (@ 1mA DC) (+10% voltage variance)	180	430

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Peak Current (8x20µS)	40,000 Amps
Energy Dissipation (10x1000µS)	1600 joules
Response Time	1.5 Nanoseconds
Capacitance @ 5KHz	4004pf

ACT 447 OUTDOOR FILTER PROTECTOR

The ACT 447 Band Reject Filtering System is a two-stage protection system installed between the cable sheath and earth ground. The ACT 447 is designed to increase cable locating or cable monitoring range while protecting buried cable from high energy surges and any induced voltage.

The first stage uses ACT 444 cable surge protection technology. The second stage utilizes a band reject filter. The ACT 447 increases cable locating efficiency and allows more than 50 miles of cable to be located with one transmitter.

- Each ACT 447 connected from the fiber cable sheath to ground will attenuate the unwanted induced signal by providing impedance as low as 50 ohms at the frequency rejected.
- Most all cable locating transmitters are designed for transmitting signals above 250Hz at which frequency there is minimal loss. Therefore, the ACT 447 Filter Protector will not interfere with the transmitted cable locating signal.
- The DC resistance characteristic of the ACT 447 Filter Isolator is greater than one megohm; therefore, the ACT 447 does not contribute to cable sheath leakage to ground. For more detailed information, request the ACT 447 engineering specification document.

ACT 447 PHYSICAL & ELECTRICAL SPECIFICATIONS

PHYSICAL

The ACT 447-350-132 filter comes in a 7.5x10.5 (in.) cylinder enclosure. The unit weighs approximately 31 pounds.

ELECTRICAL

Voltage Applications (VDC)	50
Clamping Voltage (@ 1mA DC) (+10% voltage variance)	430
Power Rating	Unlimited
Peak Current (8x20µS)	70,000 Amps
Energy Dissipation (10x1000µS)	1600 joules
Response Time	1.5 Nanoseconds
Capacitance @ 5KHz	4004pf
Operating Temperature	-400C to +600C
Frequency Rejection Level	>60db @ 60Hz
Impedance at 60Hz 3 Amp	<36 ohms typical

CONFIGURATIONS

It is possible to configure the ACT Cable Locating Protection System with any type of fiber optic cable system that has a metallic sheath or trace wire. The system is normally connected to the cable sheath to provide either an isolated or filtered path to ground for unwanted induced energy. If a nonmetallic sheath is used, the ACT Cable Protection System can be connected to any wire that is buried in the trench with the fiber cable or connected to copper wire which is used in a composite cable design. If there is some metallic path for the tone to be sent, the system can be configured.

WIRE/CABLING

All wire connections to the ACT Cable Locating Protection Devices use only UL approved 6 AWG stranded copper wire. All wires are rated for direct burial. Wires are colored for their function:

Green	Indicates Earth Ground
Black	Sheath connection for West Cable Sheath
Blue	Sheath connection for East Cable Sheath
Yellow	Spur Cable Sheath connection
Note: In some configurations a color band may be used on black cable to identify these color codes	

ENVIRONMENTAL CONSIDERATIONS

Since outside plant products are exposed to the harshest environments, care should be taken to specify and install the correct product for the application.

ACT 422 units are constructed of moisture-proof enclosures with stainless steel studs exposed for technician access. These units are designed for aboveground installations such as pedestals or cabinets. The ACT 422 can also be mounted inside most fiber optic closure systems.

ACT 444 units come completely potted with external wire stubs and are designed to be either directly buried or mounted in handholds or vaults. These units can withstand complete submersion in water without degrading their performance.

ACT 446 units are available in a waterproof package (30X versions) which are used for underground/ pedestal applications and indoor units (40X versions).

ACT 447 units are fully potted with cable stubs and are designed to mount underground in handholds or vaults. They are completely waterproof and submersible.

ACT 445 units are designed for mounting in central telephone offices or fiber regeneration huts. These are not waterproof products and should not be exposed to moisture.

VOLTAGE CONSIDERATIONS

When specifying protection voltage for cable locating protection systems, please consider what effect the following factors have: AC voltage induced on sheath and voltage level of transmitted tone.

AC VOLTAGE INDUCED ON SHEATH

Exposure of the fiber cable to high voltage power lines (sharing of right of way) can cause AC voltage to be induced onto the cable sheath. It is possible to measure several hundred volts present on a floating cable sheath. Grounding the cable sheath can minimize the induced voltage. However, this practice also grounds the cable locating transmitter signal and eliminates its use. By utilizing the ACT 447 Filter and Protector Device, induced AC voltage is effectively removed from the cable sheath and signal tones are passed unimpeded down the sheath. This method of treating the cable has proven to be an effective, time saving, and safe plant practice.

ACT Communications, Inc. recommends using no less than 2 ACT 447 units on any fiber run and continuing to add ACT 447 units throughout the fiber line until the induced voltage is decreased to less than 50 volts.

PLANT PRACTICES AND POLICIES

Standard plant practice for copper cable is to limit AC voltage to less than 50V rms present on the cable sheath. When selecting a transmitter for the cable locating system, be aware that the output voltage may be as high as 100 volts AC rms on self-regulating systems during operation.

The ACT cable protector type products will provide excellent protection and at the same time be compatible with the higher voltage transmitters available. Make sure all protector devices used on the system have either 150-volt or 350-volt DC clamp voltage.

350-volt DC clamping is always specified where an ACT 447 Filter Protector is used.

SAFETY OF PERSONNEL

ACT recommends that all plant safety practices for handling fiber cables be followed. Before any personnel physically touch a cable sheath, that sheath must be tested to see if foreign or induced voltages are present. During installation of the protection device, temporary ground should be placed on the cable sheath and only removed once the cable locating protector unit is installed.

FAILSAFE PROTECTION

Each protector isolator or filter device manufactured by ACT provides failsafe protection. If the device fails, it will provide a hard ground to the cable sheath and thereby be easily located with the test and analytical capability inherent to the modern transmitter maintenance systems. This failsafe protection provides added safety to the personnel working on the cable.

INSTALLATION CONSIDERATIONS & PROCEDURES

TOOLS AND MATERIALS REQUIRED

Flat blade screwdriver (medium)
Phillips head screwdriver (medium)
CAD welding machine
Screw hex nut wrench 1/2 in. socket
Utility knife
Heavy-duty pliers
Heavy-duty wire cutters

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Crimp Tool
Die set

TEST EQUIPMENT

Volt-ohmmeter (Multimeter)
Megger

CABLE PREPARATION & SHEATH CONNECTION

The ACT Cable Locating Protection products are designed to be connected by approved plant practices directly to the fiber cable sheath. Access to the sheath is normally provided: (a) within the fiber closures (b) by external terminal connection on the fiber closures (c) inside a cable vault or (d) within the fiber regeneration hut where the fiber cable is broken out to the distribution panel.

ACT recommends that a 3M type bullet sheath connection bond clamp be used when connecting either the blue or black 6 AWG stranded wire to the cable sheath.

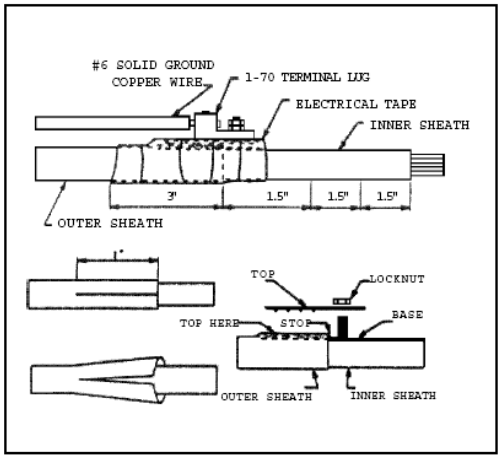

Figure 2.2
Recommended I-70 GND & Bonding Connection

EXTERNAL GROUND CONNECTION

It is recommended that a ground rod be driven in or adjacent to the handhold, or vault, when field installing the ACT Cable Locating Protection unit. Field cable grounds should be installed and meet local practices. 25 ohm or less ground is preferred. Although the system will operate with higher resistance, the higher resistance grounds will raise the DC clamping voltage and may cause unsafe conditions to exist. An exothermic welded bond of the wire to the ground rod is the preferred method of connection since it will insure against resistance build up at the connection or subsequent corrosion and ultimate high resistance ground which is always a possibility with clamp or grip type connectors.

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PRE-INSTALLATION TESTS

It is imperative that a fiber cable sheath has continuity to properly ensure operation of the cable locating tone transmission. If the cable is installed and spliced through and cable locating protectors or filters are to be added, the following tests are recommended.

AC INDUCTION VOLTAGE TEST

With an AC voltmeter, either digital or analog type, measure between cable sheath and ground at each central office and fiber regeneration location. Be sure direct ground is removed from the sheath for this test. There should be no AC voltage present. If the tests show above 50-volt AC rms present, an ACT 447 Filter Protector should be located at strategic points where AC voltage is induced onto the cable.

GROUND MEGGER TEST

This test should be performed where grounds are known to be difficult to obtain 25 ohm or less resistance. Where high resistance grounds exist, the installer should try driving multiple ground rods and connecting them in a circle. The ground rods should be spaced no more than twice the length of the ground rod. All ground rod connections should be exothermally bonded or use a UL approved compression connector.

VOLTAGE BREAKDOWN TEST

The individual protector units can be tested for proper voltage breakdown by using the Joslyn breakdown tester. This test set generates a 1000Vdc low current impulse, which will activate the ACT protector and verify the DC clamping characteristics of the device. A good module will breakdown 150-200Vdc (150V rating) or 350-450 volts (350-volt rating).

HANDHOLDS

Handholds are a commonly used housing in the telecommunications industry, which can protect buried outside plant terminations and splices yet give ready access to installers and maintenance personnel. Install all handholds according to the manufacturer's recommendation. When the protector isolator needs to be submersible, without shorting to ground, an ACT 444 type protector isolator is used which has a submersible rating. ACT Cable Locating Protector units should be mounted towards the upper portion of the sidewall.

Mount the respective ACT 444, ACT 446, or ACT 447 unit with two 1/4x1 1/2 (in.) hex screws.

Connect the 6 AWG stranded cable sheath wire to the fiber cable sheath either at the fiber closure external ground terminal lug or to the inside ground terminal.

Note: It is important that all sheath connections remain waterproof to prevent accidental shorting of the cable sheaths.

Maintain East-West sheath separation when using the ACT Cable Locating Protection System. Blue banded wire is connected to the East cable sheath, black wire is connected to the West cable sheath. This configuration is usually installed as a special system or ACT 446 unit.

CABLE VAULT

At central office locations, the fiber cable normally enters the building through an underground cable vault. When the cable is being treated to filter AC voltage off the sheath, the ACT 447 should be mounted in the cable vault. A ground bus is normally available in the vault, which the green wire will connect to. The cable sheath would be connected to the black wire via the use of a bullet bond clamp and screw lug. (See fig. 2.2)

PEDESTAL

Certain ACT 442 products are designed to mount above ground or in pedestal applications.

Standard telephone company pedestals can be used to house the ACT Cable Locating Protector. The protectors are either single hole or dual hole mounted.

When using the pedestal mount, the 6 AWG wire is routed underground to a handhold or directly buried with the closure. When connecting to the cable sheath, the connecting point should be enclosed within the closure.

If the ground connector on the fiber closure is external to the closure, once the connection is made, the complete terminal and all exposed copper should be completely coated with silicon lubricant or other similar non-corrosive material. A weatherproof connection is required.

Pedestal mounting of the ACT cable locating protector or cable locating switch device provides above ground access to the installer or craft technician for connecting field tone transmitters or separating East-West cable sheath.

Long distance carriers quite often place a pedestal at the mid-point of a particular cable run for their personnel to access when making cable location tests.

WALL MOUNT (HUT)

The ACT 4454 & ACT 4456 system units are designed with external tabs for wall mounting. The units should be affixed to a plywood board using 1/4 in. screws or mounted to masonry with proper masonry screws. The weight of these units requires that they be firmly attached to the wall.

The ACT 445X system is connected to the tone transmitter via a control cable supplied by ACT. The cable sheath and ground wires use 6 AWG stranded wire.

Always connect ground (green) wire first to the office or regeneration hut local earth ground bus. Next, connect black 6 AWG wire to the West cable sheath and blue 6 AWG wire to the East cable sheath. The final connection is the tone transmitter which is connected by the appropriate cable supplied by ACT. The

cables use male & female DB24 connectors. The ACT 445X unit always requires the male end and the transmitter the female end.

RELAY RACK MOUNT (C.O. OR HUT)

Where the fiber cable is cabled directly to the relay rack the ACT 445X can be mounted using the mounting brackets provided. Cabling will be identical to the hut mounted instruction.

FILTER & PROTECTOR

The ACT 447 series provides both AC filtering and surge protection in one unit. The ACT 447 can be either wall mounted at regeneration or central office, or vault in the field.

A 1/4x1 1/2 in. hex screw is recommended for mounting this unit.

Connect the 6 AWG Earth Ground (green) wire to ground rod. Use an exothermic CAD weld or UL approved compression connector.

Connect the 6 AWG East/West cable wire to cable sheath via the isolated ground connection on the fiber closure.

At regeneration huts or central office locations, the ACT 447 can be connected to the fiber cable sheath with a 3M bullet bond connector where the sheath terminates in the building.

PROTECTOR ISOLATOR

The basic protector isolator used in all the ACT family is a hybrid protective device which uses a maximum duty 3 element gas tube in parallel with heavy duty MOV's. The MOV's provide fast clamping (1.5 nanoseconds) protection and limit the surge voltage to the rated voltage unless an exceedingly high voltage surge is experienced. When this happens, the gas tube ionizes, and shorts the cable sheath to ground. Thus, the protector provides faster clamping and heavier surge rating, 1600 joules, as compared to normal telecommunications protectors.

GROUND ROD CONNECTIONS

A ground rod is only a part of the total grounding and protection system. To be effective, the grounding system must do the following:

a) Provide a low impedance path to ground.
b) Withstand and dissipate repeated fault and surge currents.
c) Provide corrosion resistance to various soil chemistry for the life of the equipment being protected.
d) Provide rugged mechanical properties for easy driving with minimum effort and rod damage.

Depending upon soil conditions, the ground rod should be driven at least 3 feet from the bottom of the ditch or handhold. Preferably the rod should be driven to a point where the soil remains moist year around.

Where ground rods must be driven below 8 feet, a sectional ground rod should be used.

In corrosive soils, it is recommended that copper bonded ground rods be used. These rods have a 99.9% pure copper sheath metallically bonded to a cold drawn carbon steel core. The uniform layer of permanently bonded copper assures an extended life in even corrosive soils.

An exothermic weld is recommended for connecting the ground wire from the protection isolator to the ground rod.

If user plant practices permit, a compression connector can also be used.

ALL DIELECTRIC CABLE & USE OF TONE WIRE

Where plant practices dictate the use of all dielectric fiber cables, a common practice is to bury a trace wire in the trench with the fiber cable. This wire must be for direct burial and adequately gauged to transmit a tone signal, which is not attenuated, to a point that it cannot be detected with the location receiver.

The tone wire is terminated to the protector isolator in the same way a fiber sheath would be connected.

SPUR CABLE (SIDE LEG)

Whenever a smaller fiber cable is branched off the main backbone cable, the cable locating tone must be balanced. If untreated, the short route will bleed most of the energy because of its low impedance path to ground. At these locations, a spur termination unit is used which provides impedance to the signal allowing most energy to remain on the backbone sheath and extends a weaker signal to the spur cable. This is adequate to allow detection up to 5 miles.

Whenever a spur cable length is similar to the backbone, it is recommended that the far end of both backbone and spur cables be grounded.

If more than 3 spur cables are to be connected to the backbone, please contact us so we can have one of our representatives contact you for direct support.

LOCATION OF PROTECTORS

Ideally, protector isolators should be placed at every fiber closure location. The only grounding a fiber cable will get is provided by the protector isolator; therefore, a protector isolator should be located at every personnel access point. This will then provide maximum safety and convenience for personnel handling the fiber cable or closure systems.

Frequent spacing of protector isolators will reduce the possibility of multiple surges being transmitted along the cable and entering buildings.

Any deviation from this practice should be done only after all safety considerations are made and preventative measures have been taken to reduce the risk to personnel handling cables at intermediate untreated locations.

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ACT PROTECTION PART NUMBERING MATRIX

ACT 442 PEDESTAL/INDOOR PROTECTOR

ACT 442–XXX-2YZ		
XXX = Protection Voltage (VDC)	150	350
2	3x2x1 (in.) enclosure with flanges	
Y	0 = No shorting bar	1 = Shorting bar
Z	0 = 1/4-20 studs only	1 = 6 AWG crimp lugs on studs
Example: ACT 442-150-200		

ACT 444 BURIED PROTECTOR (SINGLE SHEATH CONNECTION)

ACT 444–XXX-YYY		
XXX = Protection Voltage (VDC)	150	350
YYY = Mounting Type	Description	Equipped with
302	Waterproof For Long Haul and Metro in-line grounds	Two 6 ft. 6 AWG color-coded stubs
352	Waterproof For Long Haul spur	Two 6 ft. 6 AWG color-coded stubs
402	Waterproof For Metro End of Line grounds only	Two 6 ft. 6 AWG color coded stubs
Example: ACT 444-150-302		

ACT 445X ELECTRONIC SWITCH BOX SYSTEM

System	Description	Voltage application
ACT 4454-150	Dual direction switch box with 40 ft. cable	150
ACT 4456-150	Quad direction switch box with 40 ft. cable	150
ACT 4457-350	16 directions switch box with 40 ft. cable	350

ACT 446 DUAL DIRECTION PROTECTOR

ACT 446–XXX–#YZ			
XXX = Protection Voltage (VDC)	150	350	
# = Enclosure type	2 = 4x4x 2 (in.) weather resistant enclosure	3 = 4x4x2 (in.) waterproof enclosure	4 = 3x3x2 (in.) indoor enclosure

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Y	0 = No shorting bar	1 = With shorting bar
Z	0 = Connection studs, No cable	Two 6 ft. 6 AWG stranded cables (black and green)
Example: ACT 446-150-410		

ACT 447 FILTER ISOLATOR

ACT 447–XXX–YYY		
XXX = Protection Voltage (VDC)	350	
YYY = Series	132	60 Hz 3 Amp Waterproof with 6 ft. 6 AWG stranded cables (black and green)
Example: ACT 447-350-132		

SAFETY

INSTALLATION

All outside plant practices for safety must be followed while installing the cable locating protection system. Of particular importance is electrical hazard safety.

DO NOT TOUCH the cable sheath or wire terminals connected to the sheath with your bare hands.

Use dielectric insulated gloves when handling any cable sheath and grounding system.

Use only tools that have dielectric insulated handles.

TESTING

Pretest cable sheaths at each location to determine if AC voltage exists. Install the ACT 447 Filter Isolators at any location where induced AC voltage exceeds 50 volts.

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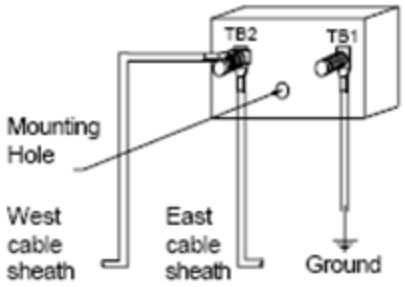
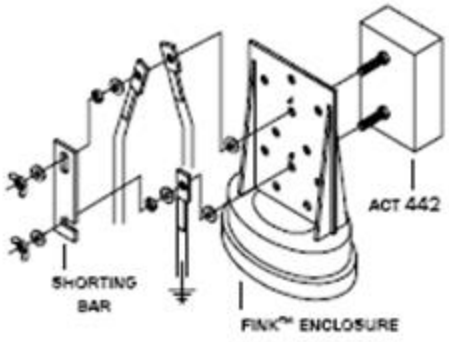
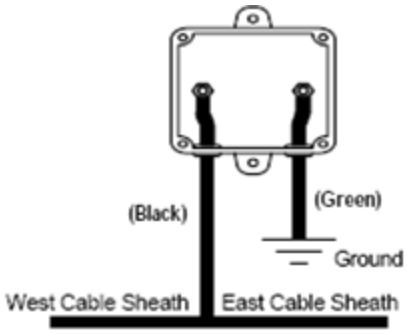
APPLICATION DRAWINGS



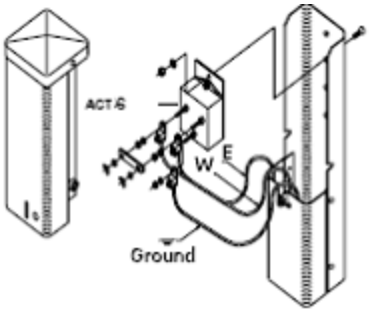
ACT 442 Pedestal Protector



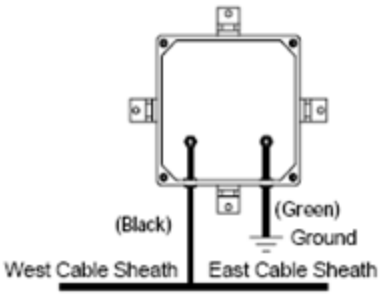
ACT 442 in Fink type Pedestal



ACT 444 Waterproof Protector



ACT 446-150-410 Pedestal Mount



ACT 447 Filter Waterproof Protector

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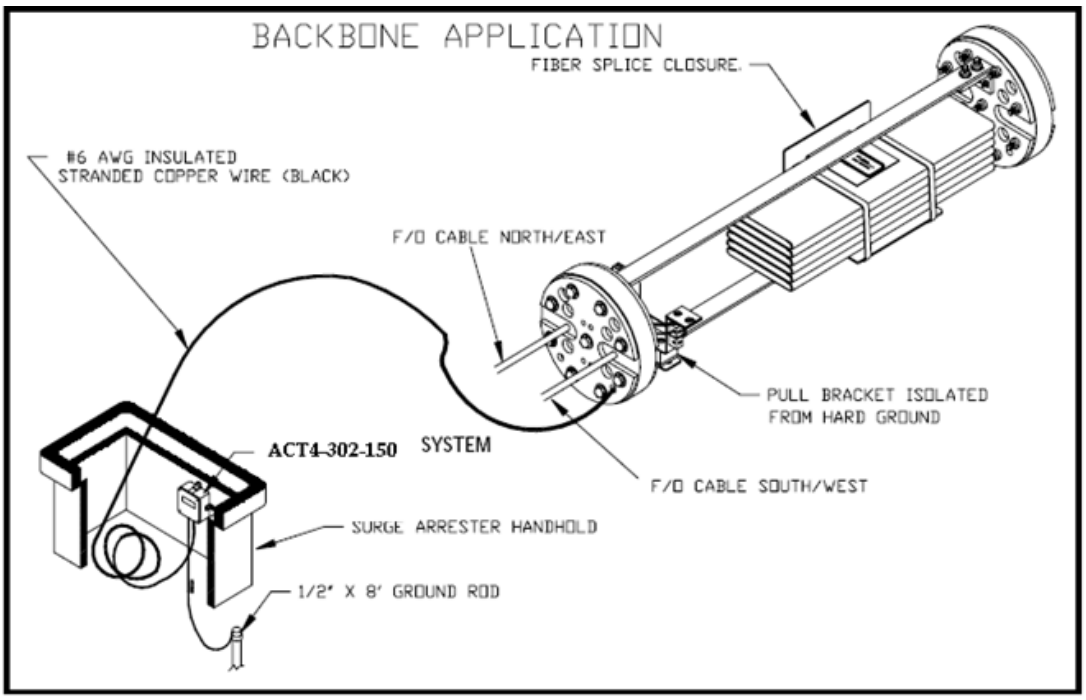
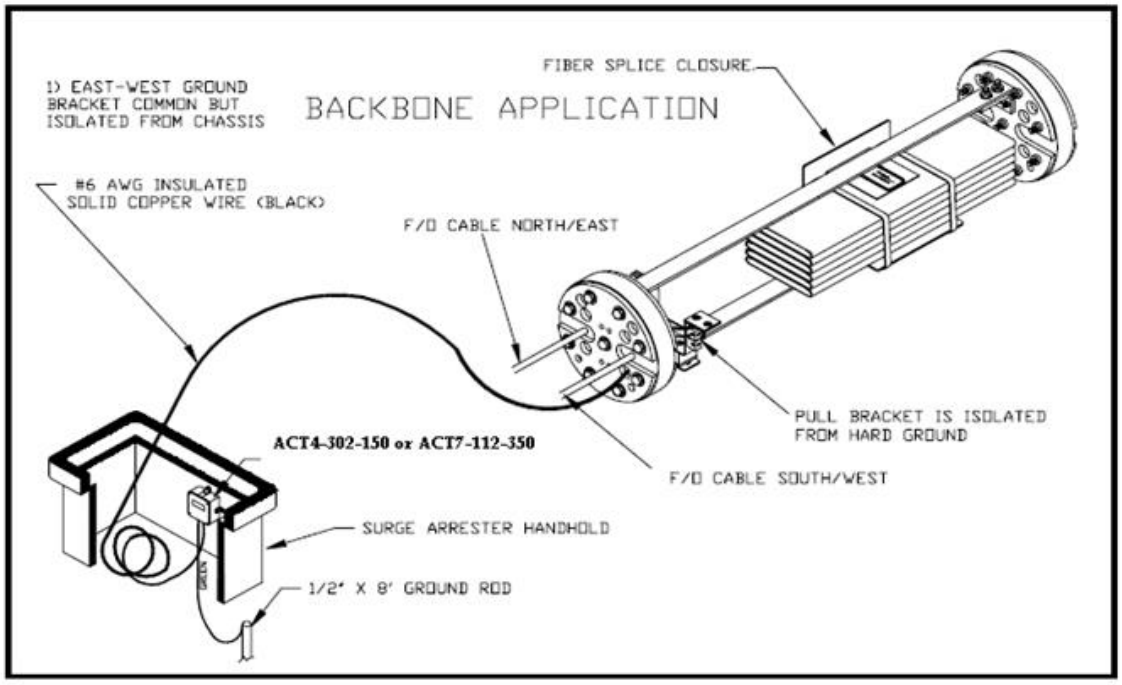


ACT 444-150-302 Application



ACT 444-150-302 or ACT 444-150-352 Spur Application

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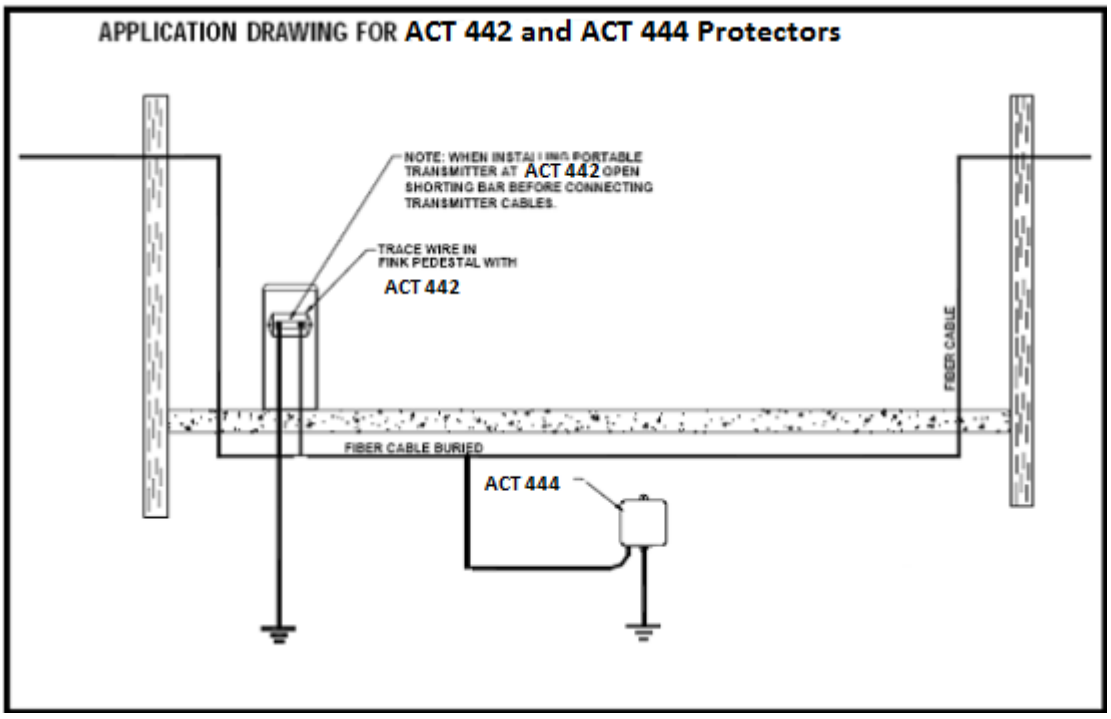
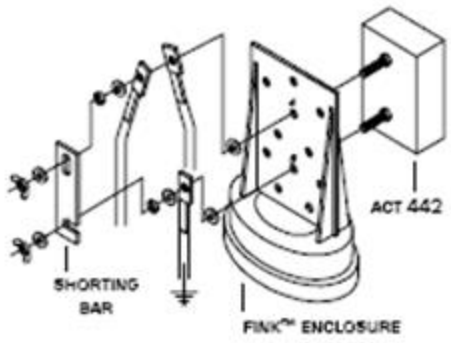
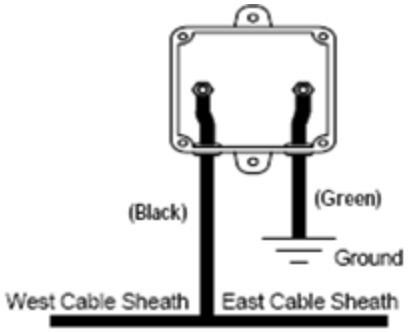


ACT 442 and ACT 444 Cable Protector Application



ACT 442 in Fink type Pedestal



ACT 444 Waterproof Protector

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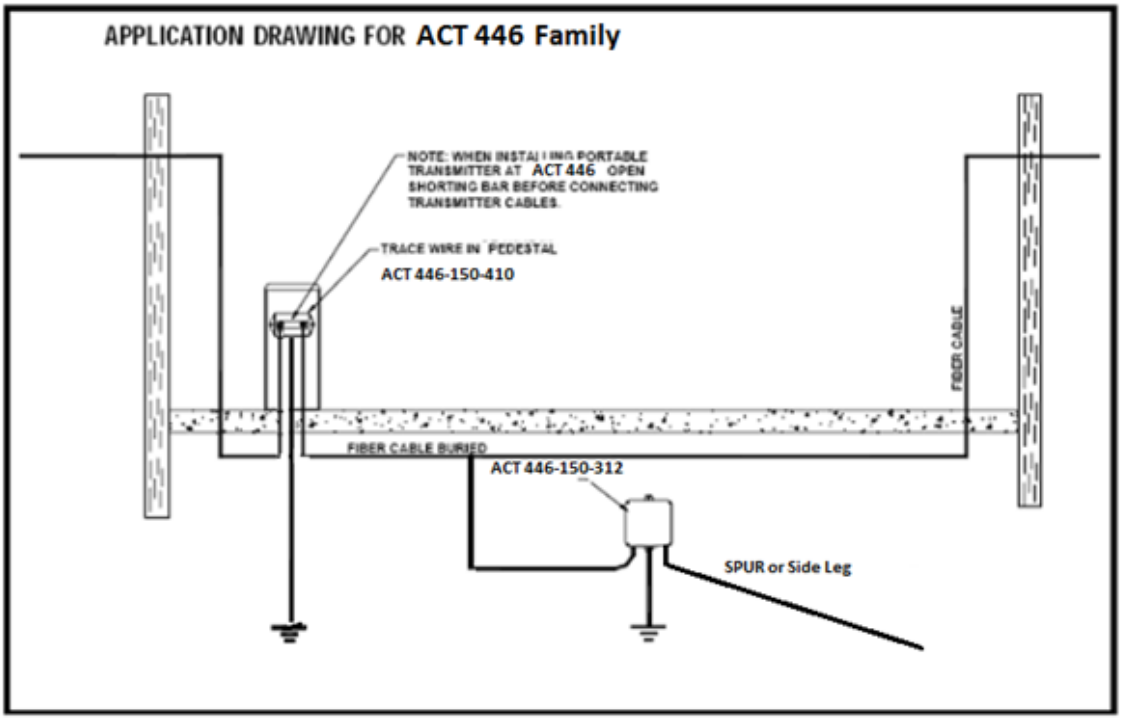

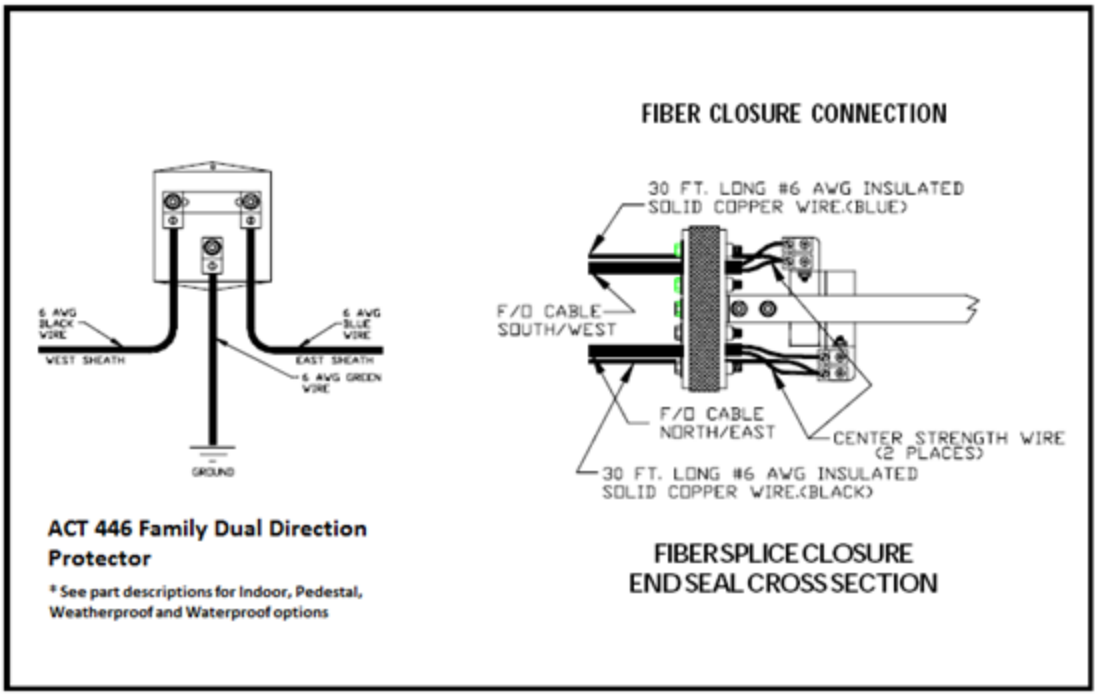

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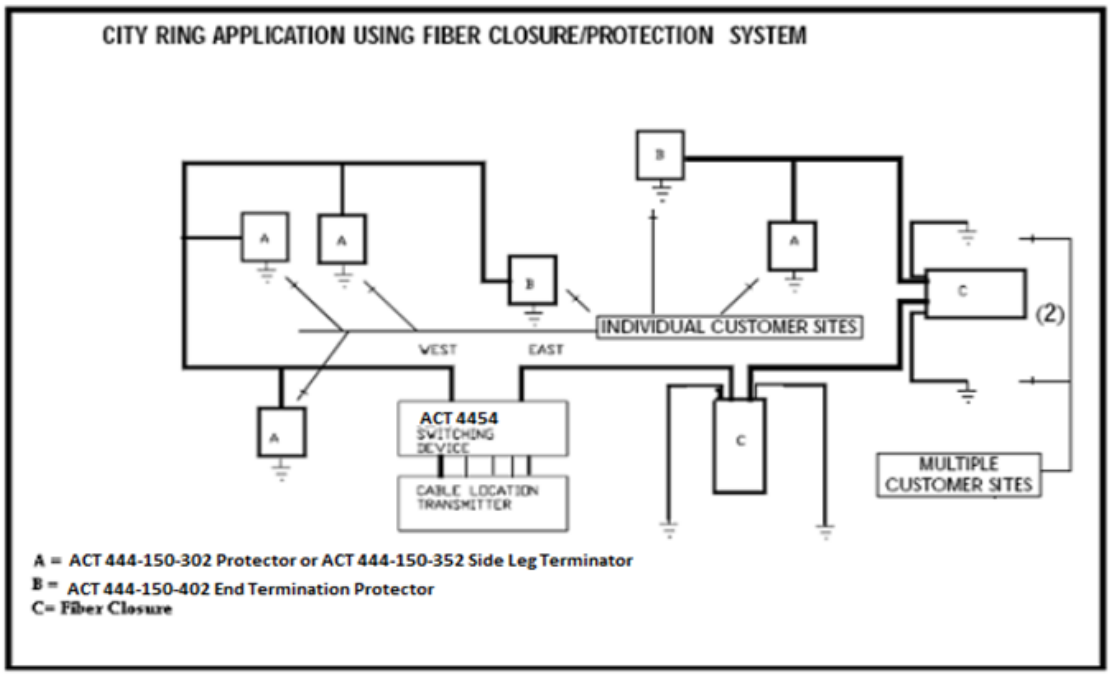

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CONTROL HARNESSES

WIRE LIST		
P1 PIN #	CONDUCT COLOR	P3 (ACT)
13	WHT/BLU	13
1	BLU/WHT	1
14	WHT/ORN	14
2	ORN/WHT	2
15	WHT/GRN	15
3	GRN/WHT	3
16	WHT/BRN	16
4	BRN/WHT	4
17	WHT/SLT	17
5	SLT/WHT	5
18	RED/BLU	18
6	BLU/RED	6
19	RED/ORN	19
7	ORN/RED	7
20	RED/GRN	20
8	GRN/RED	8
21	RED/BRN	21
9	BRN/RED	9
	RED/SLT	
	SLT/RED	
	BLK/BLU	
	BLU/BLK	
	BLK/ORG	
	ORG/BLK	

(40 ft. long)

(40 ft. long)

ACT5-S12-040 DB24 connectorized cable, 40 feet in length, connects ACT54 & ACT56 units to Logline Maintenance Systems tone transmitters.

ACT5-S18-040 DB36 connectorized cable, 40 feet in length, connects ACT57 units to Longline Maintenance Systems tone transmitters. All switch box systems are sold as system numbers when combined with cable harness.

WIRE LIST		
P1, LLTS	CONDUCT COLOR	P3 (ACT)
SIGNAL OUT(BLUE)	BLUE/WHITE	1
2	ORANGE/WHITE	2
3	GREEN/WHITE	3
4	BROWN/WHITE	4
5	SLATE/WHITE	5
6	BLUE/RED	6
7	ORANGE/RED	7
8	GREEN/RED	8
9	BROWN/RED	9
10	SLATE/RED	10
11	BLUE/BLACK	11
12	ORANGE/BLACK	12
13	GREEN/BLACK	13
14	BROWN/BLACK	14
15	SLATE/BLACK	15
16	BLUE/YELLOW	16
17	ORANGE/YELLOW	17
18	GREEN/YELLOW	18
SIGNAL OUT(BLUE)	WHITE/BLUE	19
20	WHITE/ORANGE	20
21	WHITE/GREEN	21
22	WHITE/BROWN	22
23	WHITE/SLATE	23
24	RED/BLUE	24
25	RED/ORANGE	25
26	RED/GREEN	26
27	RED/BROWN	27
28	RED/SLATE	28
29	BLACK/BLUE	29
30	BLACK/ORANGE	30
31	BLACK/GREEN	31
32	BLACK/BROWN	32
33	BLACK/SLATE	33
34	YELLOW/BLUE	34
35	YELLOW/ORANGE	35
SIGNAL RETURN(WHITE)	YELLOW/GREEN	36

*USED ON 32 DIRECTION UNITS ONLY

COMMON APPLICATIONS

ALL LONG LINE MANAGEMENT SYSTEMS

ACT 4454-150	2 direction switch box and protector, with control harness to LMS
ACT 4456-150	4 direction switch box and protectors, with control harness to LMS
ACT 4457-150	16 direction switch box and protectors, with control harness to LMS

POINT TO POINT PROTECTION SYSTEMS

ACT 442-150-200	Pedestal mount only, terminal post. Access to shield.
ACT 444-150-302	Underground or buried protector, waterproof box. No access to shield
ACT 446-150-212	Pedestal or marker post, weatherproof, E/W isolation. Access to shield.
ACT 446-150-410	Pedestal mount only, terminal post. Dual Directional. Access to shield.
ACT 447-350 -132	Underground or buried protector and 60Hz filter, waterproof box. No Access to shield.

SIDE LEG (SPUR) PROTECTION SYSTEMS

ACT 444-150-302	Underground or buried protector, waterproof box. No access to shield.

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ACT 444-150-352	Protector & Impedance Spur Point to Ground, waterproof box. No access to shield.
ACT 446-150-312	Dual Protector for Spur and Backbone connection, waterproof box. No access to shield.
ACT 447-350-132	Underground or buried protector and 60Hz filter, waterproof box. No access to shield

CITY RING PROTECTION SYSTEMS	
ACT 444-150-302	Underground or buried protector, waterproof box. No access to shield.
ACT 444-150-352	Protector & Impedance Spur Point to Ground, waterproof box. No access to shield.
ACT 444-150-402	Protector & Impedance End Point to Ground, waterproof box. No access to shield.
ACT 447-350-132	Underground or buried protector and 60Hz filter, waterproof box. No access to shield.