

NETWORK SYSTEMS CABLE FAULT LOCATING

15 kV - 35 kV cable: PILC, XLPE, EPR



This is a summary of the equipment HVI would recommend for cable fault locating on Network Systems and feeders rated up to 35 kV and of mixed insulation types. HVI has a great deal of experience in this area and already supplies many utilities with this equipment. Some utilities also use our VLF products for cable testing, and in some cases, for cable fault burning. Tan Delta testing is also popular and available from HVI.

The option of which fault locator is really down to one, the model that offers the greatest joule output (yet low voltage outputs to minimize cable damage) in order to provide the greatest noise to hear the fault and the greatest current/electro-magnetic surge to make the best use of above ground detection devices, like the X35. Although TDR/radar fault pre-location has some limitations in Network fault finding, it can still be a very useful tool and should not be overlooked. In many cases, arc reflection can work very well in network systems as well as Current Impulse.

Fault Locator

The CDS-3632UF from HVI offers the Voltage, Burn Current, and High Joules needed to get the job done. Its three full energy output voltage taps permit low voltage thumping yet at high energy and the 280 mA of burn current make it possible to reduce the fault arc over voltage to a level to make use of the lower voltage outputs. The discharge rate is variable from 6 – 10 seconds: the optimum range of time. Any shorter or longer is not ideal. Internal to the thumper is a TDR filter designed to supply both arc reflection and current impulse types of fault detection and can accept any TDR/radar.

There is no better thumper. Some similar, but none better and several inferior.



0 – 9/18/36kV @ 3200 Joules
280 mA Burn. TDR/radar ready

TDR/Radar



TDR- 1669CI
Arc Reflection
Current Impulse

Contrary to the common misperception that a TDR is not useful for pre-locating faults on network systems, HVI offers the 1669CI from Radar Engineers. If there is a different TDR that one chooses to use, fine, for nearly any TDR produced will interface to the HVI thumpers. For long feeder runs the use of a TDR is perfect. For more complicated network systems it can also be useful, although not as ideal. The thumper is already set up: why not spend 10 seconds to take a radar shot to see if your fault is 200' or 2000' away or down leg one or two. It is also useful for tracing cable circuits, identifying splices, verifying the cable under test is continuous, neutral continuity, verifying accuracy of maps, etc.

Electro-Magnetic Listening Device



The best magnetic detection device to use for network systems is the X35 produced by TEC Power: www.tecpower.com. This device is designed specifically for networks systems where there is a ground at each man hole or transformer location. It can also work on non grounded feeder runs. It is an electro-magnetic impulse detector. It is not an acoustical detector. Acoustical detectors are not that suitable for this environment where the cable is in conduit and usually in noisy environments. The X35 will follow the thumper pulse and indicate when the user has passed the fault. It can also detect which leg the fault is down. The Operators Manual is very complete in its instruction.

Cable Reels & Accessories

The CRR-100T is a dual cable reel contain 100' of high voltage output cable, with return, and 100' of #2 ground cable with exposed ground locations every 10'. More than 100' of cable can be offered if needed. The hub of the HV cable reel contains a female MC connector to mate with the male MC connector at the end of the thumper output cable. The MC connector at the end of the reel's HV cable can mate with various attachments that may be used: vice grip, hot line clamp, elbow, etc. Tell us what you want. (Elbow supplied by customer. HVI will mount MC.)



Complete Package for Van or Truck Mounting

HVI can package all of the components quoted into a pre-engineered and assembled package ready to be dropped into a truck or van. All components will be mounted to a common skid facilitating instant and easy loading and unloading into any vehicle or to minimize the time and effort needed to mount the various pieces. Here's an example of a package containing fault locating and a VLF hipot:



Other Fault Locating Methods

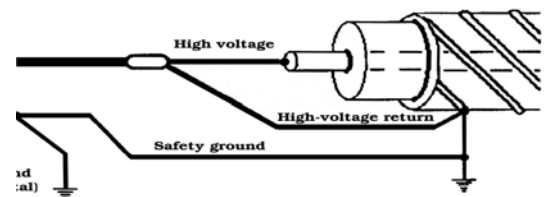
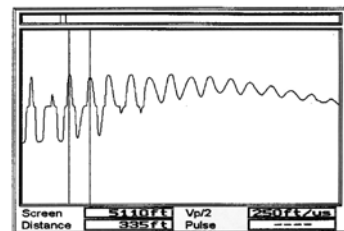
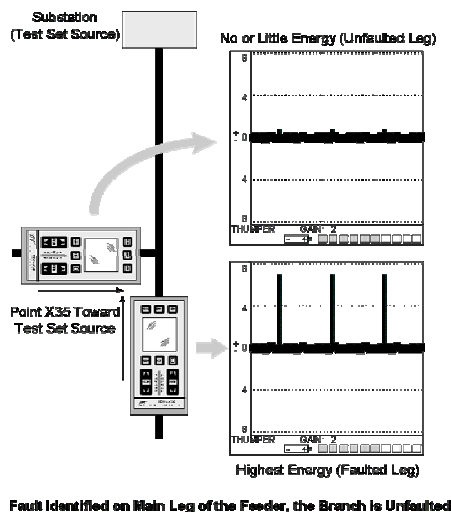
There are other methods of fault location. However, arc reflection and thumping with 3200 joules along with the X35 are the most conventional and easiest understood and mastered by the average worker and will be effective for perhaps 95% of the faults. Other more complicated and esoteric methods exist and can be explored. These include using TDR methods called loop-on loop-off and current impulse, as well as a resistance bridge method (murray loop), requiring additional equipment. HVI personnel are familiar with these methods and they can be taught if desired. The Current Impulse method should possibly be taught and can be performed with the existing HVI thumper and TDR delivered. This method may be needed to find perhaps 5% of faults; where arc reflection and thumping with the X35 device can find the rest.

Not shown here is the SDAD acoustical/electro-magnetic detection pick-up, or listening device from Aquatronics, Inc. www.aquatronics.com. This device works very well in URD situations where its acoustical and magnetic pick-ups can be used effectively. Its magnetic detection feature can work on network systems, however, the X35 is more specifically designed for network systems and offers a better alternative. Acoustical detection is not that effective on networks. If money were no object, then the X35 and SDAD should be on the truck. If only one, then the X35.

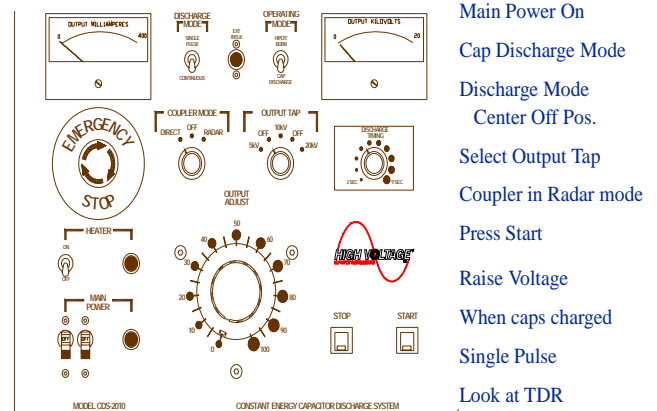
Fault Locating Training – Network Systems

A large part of the success of a cable fault locating program is the workers' knowledge of the equipment, the procedures, and the science. Some vendors attempt to fully automate fault locating by reducing it to a one button process. That's fine perhaps 30% of the time when it works but what about the rest of the faults? Fault locating cannot be reduced to a five point cheat sheet as many would like and wrongly believe possible. Training is extremely important. Not just learning how to perform steps 1, 2, & 3 but understating the basic approach and the physics behind fault locating so a worker can think their way through a problem. This includes how the thumper, TDR, and listening device all operate separately and function together. Toward this end, HVI will offer along with its hardware a package of software containing various training materials, including written instructions, procedures, and guides to efficient fault locating, PowerPoint's for training on all products, and operational videos of many of the products delivered. This multi-media package of training materials will be comprehensive and will permit a utility to efficiently and thoroughly train its own personnel in the future.

Various representative training pictures and slides of the X35, TDR & Thumper



ARC REFLECTION TO SEE FAULT



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