RADIODETECTION

Locating a core-to-core short fault in LV power distribution networks

Application note

SPX

BACKGROUND

Underground 3-phase LV cables are generally used to distribute power across towns and cities. They are usually laid beneath pavements in the area served, with link boxes where the network can be interconnected.

A common fault for these cables is a short circuit between two or more phases–known as a phase-to-phase or core-to-core short faults.

THE PROBLEM

Locating a core-to-core short fault is not a simple task. Typically, utility companies will dig and cut at set distances along the cable to isolate the section where the fault is present – a long and laborious task.

Due to the number of joints and varying cable types within transmission networks, conventional TDR (Time Domain Reflectometer) measurements can be unreliable, while standard Electromagnetic locating techniques are generally unable to provide reliable fault pinpointing.

RADIODETECTION SOLUTION

Radiodetection's Tx-121™ Isolation transformer is designed to be used alongside a suitable Radiodetection Precision Locator* and Tx-10™ transmitter to detect core-to-core shorts using the cable lay effect and a low-frequency signal.

With CAT IV rated isolation, the Tx-121 allows authorised and qualified personnel to apply a locate-able signal across two shorted faulty cores of an energised LV cable** if required, where regulations permit, avoiding the need to isolate the cable.

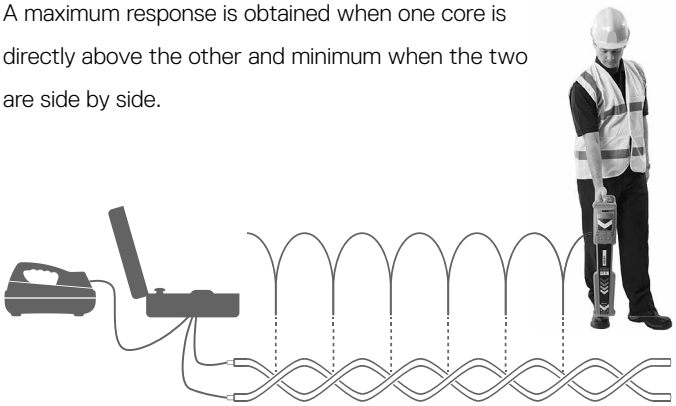
*Compatible precision locators are RD8200™/RD7200™, RD8100™/RD7100™ & RD8000™/RD7000™

**Rated for connection to CAT IV mains circuits up to 230V phase-to-neutral. Maximum phase to phase voltage differential: 3Vrms at 50/60Hz

CABLE LAY EFFECT

A commonly found type of LV cable (particularly familiar across Europe), comprises twisted conductors, usually arranged in pairs, triples or quads.

When a transmitter signal is applied across two cores of a multi core cable, the size of detectable response above ground is dependent on the relative position of the two cores concerned. Cores within such a cable twist in a regular pattern, exchanging positions every one or two meters, which result in a regular, fluctuating, response on the locator as the operator traces the cable from above. This response is called the cable lay effect. A maximum response is obtained when one core is directly above the other and minimum when the two are side by side.



Two core cables

The rise and fall of the response should be regular and with a pronounced null between each peak (although the sharpness of the null will become less distinct as the signal is traced further along the cable due to stray signal pick-up on the other cores or the sheath).

Note that the cable lay effect is only locatable close to the cable; as distance from the cable increases, the locator tends not to respond to the cancelling fields radiated by the adjacent twists. Generally the depth of the cable needs to be less than the distance between two crossovers to obtain a reasonable response. Therefore it's important to determine the route of the cable underground before attempting to pinpoint the fault.

Co-axial cable

There is no cable lay effect on co-axial cables and this effect cannot be used to detect faults on this type of cable.

TECHNIQUE FOR LOCATING A CORE-TO-CORE SHORT FAULT ON A TWISTED STYLE LV CABLE

1 **Trace the cable route:**

Trace and mark the cable route – for example using a signal clamp connected to the Tx-10 transmitter with a suitable Radiodetection locator.

2 **Connect the Tx-121 across the faulty cores:**

Use the C.A.T4™ fused crocodile clips to connect to the 2 faulty cores at the feeder pillar or link box.

3 **Set the Tx-10:**

Select a frequency between 512Hz / 640Hz and 1kHz and set the desired output power. Generally an indicated locate frequency current of over 100mA will be required to ensure a clear cable lay effect.

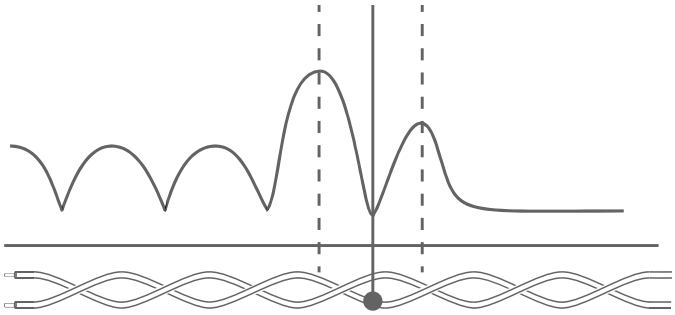
The Tx-121 is also compatible with the obsolete T10 transmitter.

4 **Trace the cable lay signal:**

Use the locator (peak or single mode/ same frequency) to trace the cable lay effect across the pre-marked route keeping the locator's blade (aerial) inline with the cable, contrary to the normal receiver locate orientation.

5 **Locate the fault**

If the fault is suitably low resistance, the signal received, will drop at the point of the fault.

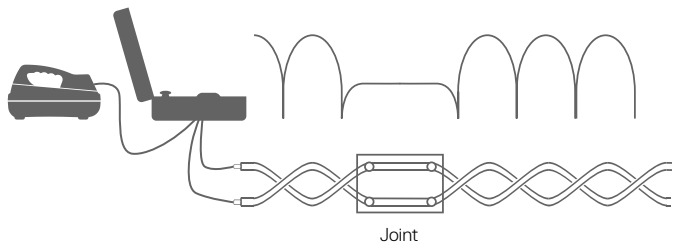


Just prior to the fault, the signal will rise dramatically and then fall to a null followed by a slightly smaller peak. The fault will lie at the null point between the peaks. The 'lay effect' should be virtually zero past the fault.

If the fault resistance is higher than ideal (few ohms), some lay effect may remain on the cable past the fault point.

Note:

Care should be taken when identifying the position of a fault as features of a cable run, such as cable splices, changes of cable type or 'T' joints, which can give similar effects to those experienced from locating a fault. In these instances the 'lay effect' will resume past the suspected fault location.



⚠ **WARNING!** Fault location on power cables must only be undertaken by appropriately authorised and qualified personnel.

DISCLAIMER

This Application Note is provided free of charge, and is only intended to provide a brief overview on the use of a Radiodetection Tx-121 Isolation Transformer alongside a suitable Radiodetection cable locator system. For a full explanation of the Radiodetection Tx-121 isolation transformer please consult the User Label for this product, which should be read in its entirety before operating this equipment.

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