

# **RADIODETECTION – Application Note**

## **POWER CABLE APPLICATIONS FOR BICOTEST TDRs**

Bicotest TDRs are used extensively in the power distribution industry, both on low voltage and high voltage cables. This is possible because the general construction of power cables (with some exceptions) provides at least two conducting paths, the phase and the neutral. In many cases the cable may be three phase, giving three identical phase cores and a concentric wound neutral. Some HV cables have three phases, a concentric neutral and an individual foil earth screen around each phase. Other HV cables have an extruded construction with a concentric neutral, usually of aluminium material. All power cables suffer the problems of age, the environment and inadvertent human intervention.

3 main applications of Bicotest TDRs on power cables are described below:-

### **1 FRONT LINE, EASY FAULT CHECK**

For power cables Bicotest TDRs are applied on two levels. The first is a front line, quick test instrument for low voltage cables – the T810. It is important not to disconnect consumers unless absolutely necessary on the LV network and it is equally important that quick, easily interpreted results are obtained. For quick and easy fault location, looking for shorts, opens and major impedance changes between phase and neutral and phase to phase apply T810. For easy fault location this unit has set automatic gain algorithm to give the same visual image on screen for the same type of fault at all distances. This gives quick and simple fault recognition.

### **2 HIGHER SOPHISTICATION CHECK**

The second level is to apply a more sophisticated TDR for higher accuracy and flexibility to locate a wider range of faults on both LV and HV cable. The T631 and T625 have optional blocking filters available for LV use. With these instruments a greater range of pulse widths and gain settings are built in and comparisons between phases can be made on screen. T631 and T625 are often applied on HV cables for location of faults at some considerable distances, saving time on setting up a full high voltage location van, or for reference prior to implementing full HV fault location kit.



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### **3 LOCATING CORRODED CONCENTRIC NEUTRALS**

Aluminium, along with gold, silver and copper is an effective electrical conductor. It may be true to say that if gold were as economically viable as aluminium or copper it would be the first choice of the cable manufacturers for its conductivity and corrosion resistance. However the realities of economics have meant that copper is normally the first choice with aluminium being adopted at times of high copper market prices.

When it has been adopted, aluminium as proven an effective material, provided that adequate protection against the environment is given, since in fact aluminium will corrode as easily as steel. Aluminium power cables are often constructed with a concentric, stranded neutral and, in some territories, without an external protective sheath. Even with a protective sheath, the usual environmental problems can cause damage to that sheath, exposing the aluminium to the elements.

The process of corrosion may take some time and will slowly eat away the neutral strands one by one over a length of the cable. The consumer will be unaware of the problem until finally the neutral gives up completely, leaving an open circuit. Thankfully the nature of this concentric construction lends itself to TDR test to look for the presence of corrosion before it becomes a catastrophic failure. In doing so, the electricity provider can perform planned repair on the cable, a far more desirable option to emergency repair.

The T631 has two important features to help locate corroded neutrals: narrow pulse widths and the ability to display low noise traces at high gain levels. T631 produces true sine-square shaped pulses with genuine 2nS pulse width. When used to locate corroded neutrals in concentric aluminium cables the unit will display levels of corrosion from 40% to 50% of the circumference. For detail comparison and records for later review, X600 software can be used. This may be especially useful to display before and after views of the same cable after a significant time interval, when traces may be either loaded back into the TDR prior to revisiting the site, or taken from the site and viewed in comparison on the PC.

By testing for corroded neutrals, the appropriate remedial action can be planned and carried out before the fault becomes an emergency repair, thus ensuring maximum efficiency in use of resources.

**Please note that Bicotest offer a full range of other instruments specifically for use in power cable fault location.**

For safety reasons, Bicotest recommends that only qualified personnel work on power distribution cables.

