EN
ENGLISH

APPLICATION NOTE

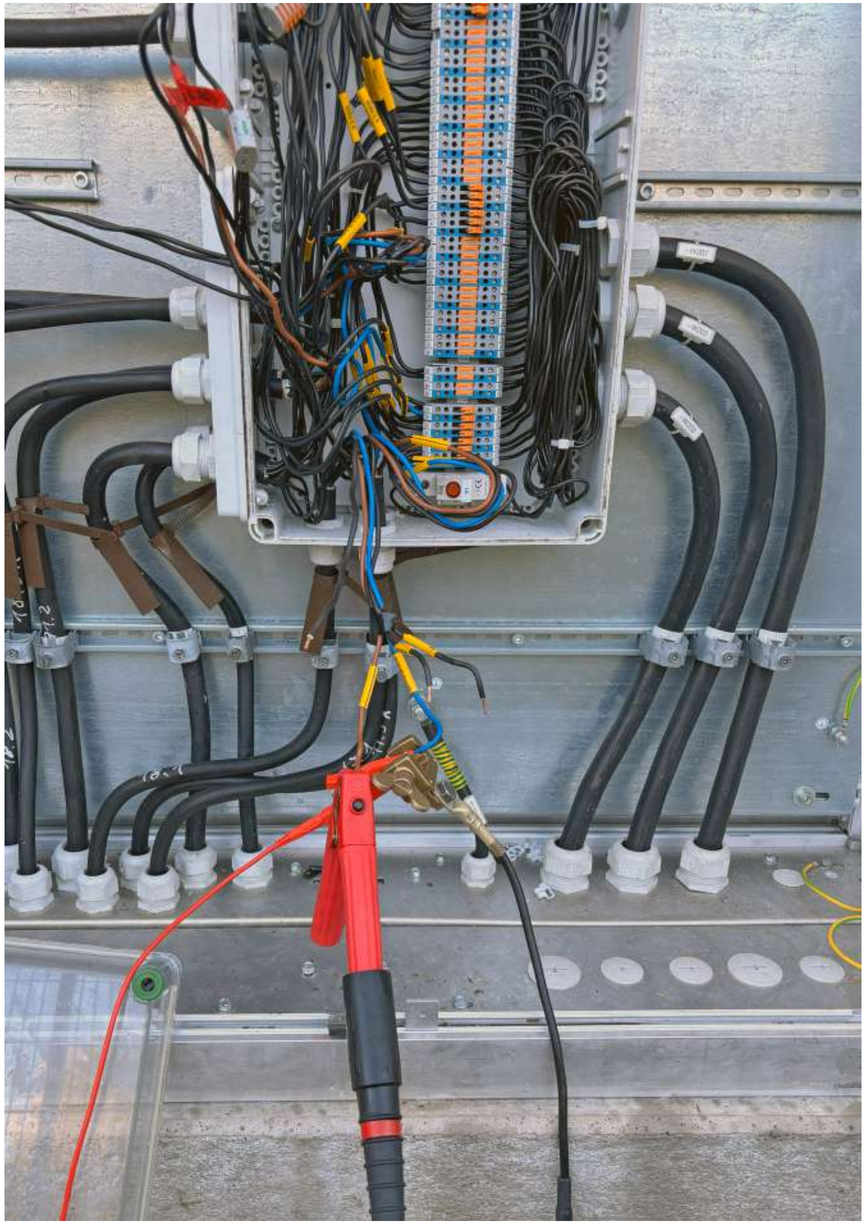
Cable fault location on multi-core signalling cables in railway applications using the STX40

V01 - MARCH 2026

Introduction:

Cable fault location on signalling cables with the STX40

This application note describes cable fault location on multi-core signalling cables using the STX40 in order to ensure reliable operation of signal lights and switch positions, and to guarantee smooth railway operation.



Precisely detecting faults and damage

To transmit signals from light installations, switch positions, switch heating systems, etc., multi-core cables with cross-sections of e.g. 4-6 mm^2 are often used. These cables are usually laid in duct, trays, or buried directly in the ground and can be several kilometres long. Faults can often occur with typical causes being poor quality joint sleeves and damage to the concrete ducts

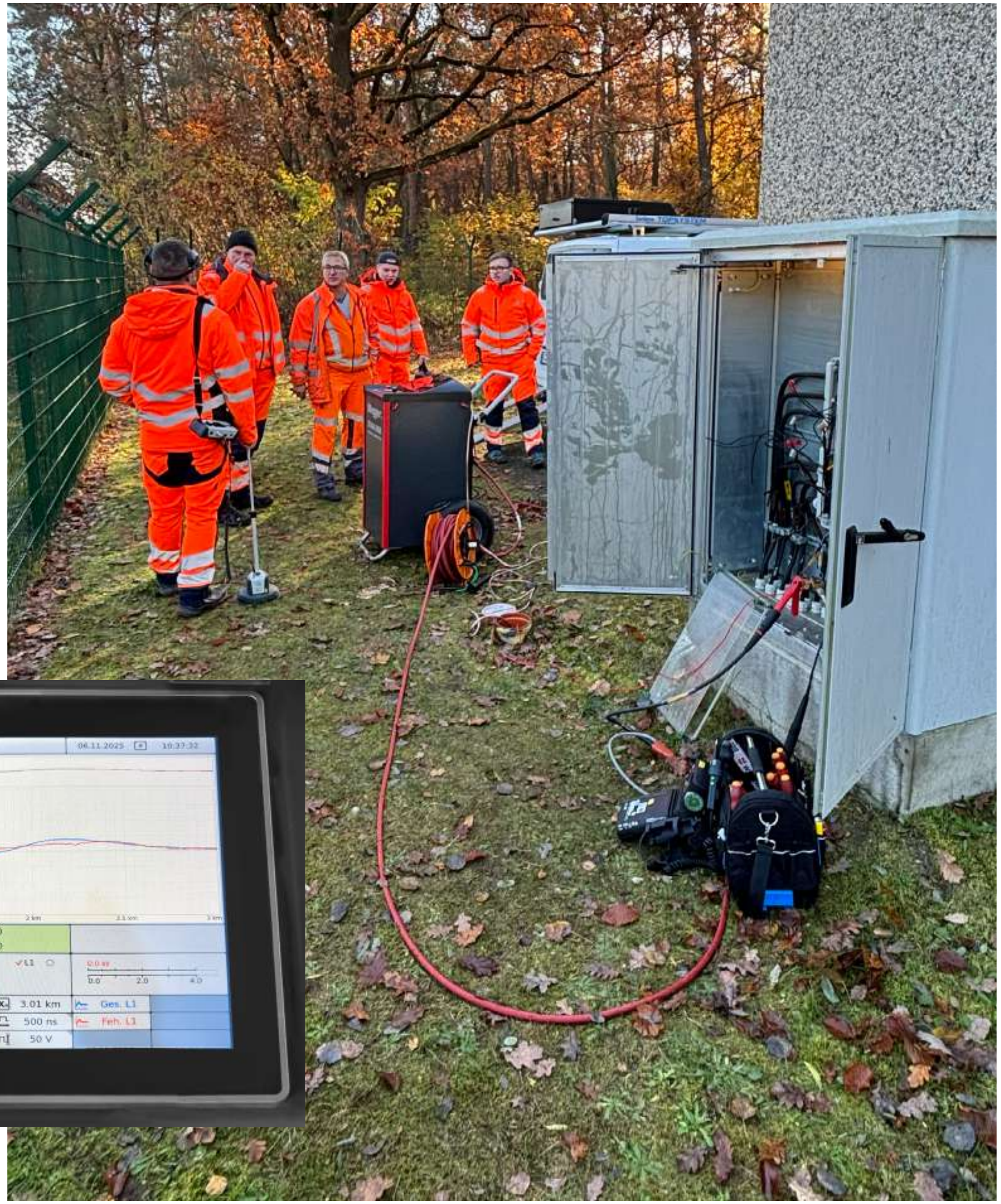
Fault resistance changes can be due to instances such as moisture ingress in a damaged cable sheath, resulting in a low resistance warning on the signal box and therefore meaning the cable can no longer be used for stable operation.

In order to pinpoint the fault location and repair the cable, cable fault location systems such as the STX40 are required. It is suitable not only for medium-voltage cables, but also for smaller cross-sections and voltage levels.

Fault identification

As a first step, an insulation resistance measurement was carried out between the cores and against earth. Resistance values of 10 kΩ were measured between two cores, and approximately 20 - 100 kΩ against earth on several cores.

This was followed by a TDR measurement to confirm the actual cable length. The 1,500 m specified in the plan matched the measurement; however, the propagation velocity v/2 had to be adjusted unusually low to 60 m/µs, which could indicate moisture in the cable.



Fault prelocation

For prelocation of the fault, the ARM method was initially used with a surge voltage of 2 kV. A clear negative reflection was observed at 1,079 m.

Application description:

Pinpointing

The operating mode was then switched to “thumping” in order to locate the fault more precisely using the digiPHONE+2 and ESG NT2. Thumping was also carried out at a voltage of 2 kV at five-second intervals.

The cable route was known and was confirmed by receiving the magnetic impulses generated by the surge current and shown on the display unit of the digiPHONE+2. In the vicinity of the fault, an acoustic signal was also detected by the device, so that the evaluation also displayed a numerical value.

This numerical value became smaller as the operator approached the fault. At the fault location, the value was lowest and when moving past the fault location it increased again.

The bang was now audible even without a microphone, so the cable duct in which the cable was supposed to run was opened. The damaged section of the faulty cable was identified and cut. It turned out that a defective joint, caused by insufficient shrinking and the use of uninsulated connectors, had led to the fault.

After cutting out the faulty section, insulation testing was carried out in both directions. The resistance values were now in the MΩ range.

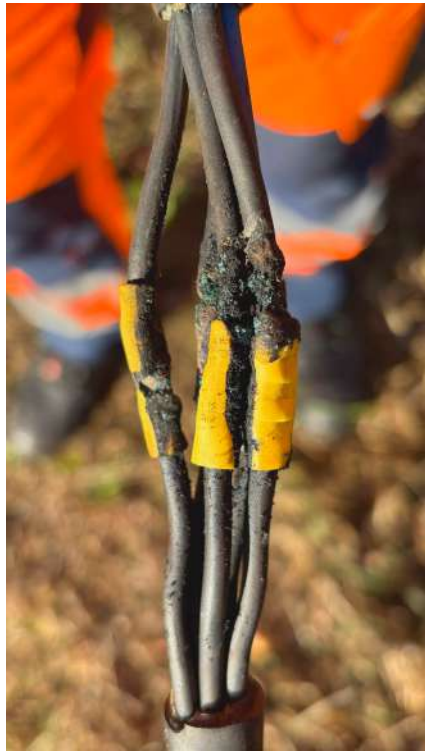
Summary and conclusion:

High flexibility and reliable fault location with the STX40

The investigations carried out show that the STX40 is also suitable for cables with smaller cross-sections. Continuous voltage adjustment allows a material-friendly test procedure. Especially in low voltage applications like this, the optional 4 kV stage with a surge energy of up to 1,100 J enables significantly improved measurement results and facilitates pinpointing in particular.

If limitations occur during acoustic pinpointing due to high ambient noise, for example from passing trains, the fault can alternatively be successfully located using the step-voltage method. Because of the resistance values in the kΩ range with respect to earth, sheath fault pinpointing would also be useful and effective in this case.

Overall, the use of several measurement and location methods underlines the high flexibility of the system, which enables reliable fault prelocation and pinpointing for different fault types and operating conditions.



The solution:

STX40

The STX40 is the most advanced portable fault location system on the market. It combines outstanding performance with state-of-the-art technology. It is fully centrally controlled via a single software application with a clear graphical user interface on an industrial multi-touch control unit with a high-resolution display that is easy to read even in sunlight.

An important aspect is maximum automation: motorised high-voltage switches and operation via a single rotary control raise the user experience to the level of a cable test van.

Datasheet

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Benefits at a glance

- Ideal for many cable types: suitable for low- and medium-voltage cables with XLPE or EPR insulation. Thanks to its 40 kV DC source and high-frequency burner, it is also suitable for PILC cables
- Field-ready, durable outdoor design (IP43) with excellent handling and mobility
- Safety interlocks for monitoring station earth and touch potentials (F-U) as well as earth connections (F-Ohm)
- All modes can be operated fully automatically via motorised switching
- Software-based user interface with simple "turn-and-click" operation via a rotary control
- DC testing up to 40 kV, surge testing up to 32 kV and HF burning up to 40 kV
- Energy up to 2,000 J in several voltage ranges
- Integrated bipolar TDR (Teleflex® RDR)
- Integrated HV prelocation methods: Inductive ARM BestPicture® Multishot, ICE, Decay

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