

INSIGHT M710

Overview

The M710 reliably locates high resistance earth faults out along the network between reclosers or fixed fault indicator positions. A binary search technique is used but no network switching is required. It works with all types of neutral treatments, whether the earth fault is sustained or tripped.

At a glance

- Locates the precise fault location without any need for network sectionalising
- Works with the earth fault energised or with the circuit tripped
- Independent of neutral treatment
- Exploits three detection techniques
- Very high earth fault sensitivity
 - 1 A in current mode
 - 0.5 A in delta mode
 - > 5 k Ω in injection mode
- No false indications
- Intuitive application, easy to use
- Deploy as a standalone unit, or as part of the INSIGHT L700 and M700 system
- Suitable for Overhead Networks only
- Usable at chest height from the ground
- Distinguishes between phase currents (including unbalance (i.e., positive and negative sequence)) and earth fault currents (zero sequence)



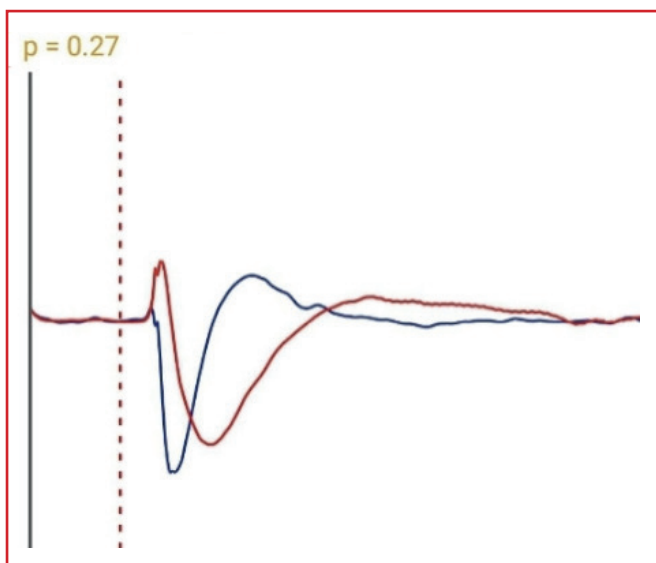
- Adjustable sensitivity
- Additional sensitivity dependent upon change detection (such as switching of a damping resistor, injection capacitor or removal of faulted phase earthing)
- Stores each measurement in device memory, for both on-site and off-site analyses
- Captures the waveforms in memory for each test, with time and date and GPS location if GPS is available, (e.g., from operator's smart phone or tablet).
- OLED display of output (currents and earth fault indication)
- Potential connectivity via an APP over Bluetooth to operator's smartphone

Operation

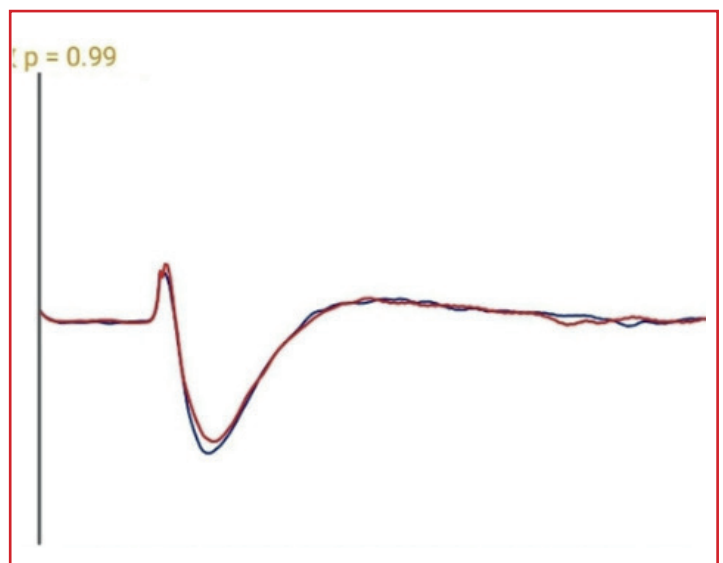
Protection relays in substations, reclosers and similar devices out along the network, fixed fault passage indicators and fault location systems will indicate the faulted section of network. This leaves the hard part – locating the precise fault location of the earth fault, be it a faulty surge arrestor, failed MV/LV transformer, downed conductor, or whatever. On non-effectively earthed systems (such as isolated, compensated or high resistance earthing) the energy release is very small as are the earth fault currents.

Further localisation can be achieved by successive sectionalising, and re-energisation where tripping is implemented. This typically utilises a binary search technique where the known faulted network section is split in half and the faulted half identified. This procedure must be repeated until the fault is located. At the latter parts of the localisation process, cutting breaking jumpers may prove necessary to refine the search. Such repeated sectionalising is very time consuming, may take a long time (hours) which is expensive for utilities and frustrating for customers. In addition, on effectively earthed systems, this approach inflicts multiple applications of potentially high earth fault currents onto the system which can be hugely damaging to network plant in the fault path.

The M710 provides a superior solution. It is a mobile fault localisation device (hand held or drone mounted) which reliably identifies the fault point without the need for expensive and time consuming network sectionalising. For non-effectively earthed systems where the fault is sustained, the device uses the presence of the fault to track it. The same binary searching approach is adopted but without the need to repeatedly sectionalise. At each check point, the device confirms if the fault is forward or behind that point. For all instances where the earth fault is tripped upon detection, the device uses a different mode to detect the fault location by injecting a signature that the locating M710 identifies. At each check point, the device confirms if the fault is forward or behind that point without the need to sectionalise or re-energise the line. Fast, efficient, reliable fault location results which save utilities money and minimises outage time and nuisance to customers.



Fault Reverse



Fault Forwards





M710 handheld device

Overall Design

M710 is a small handheld device, which may also be drone mounted. There is an OLED display which indicates if the fault is behind or in front of the operator. The current at the measuring point is presented when in current only mode. Control buttons allow the user to select the optimum sensitivity setting, to hold a current measurement and to reset recorded values. A USB-C port allows the user to plug in a laptop PC for more detailed data extraction and recording. The M710 can integrate with the INSIGHT L700/M700 systems for central recording of results.

Fault detection techniques

1. Measurement of the electromagnetic field associated with the earth fault current overhead.
2. Detection of the change in electromagnetic field associated with the change in earth fault current overhead when a change to the system is initiated by the control centre. Such a change could be removing a damping resistor, inserting a tuning capacitor, changing tuning level (all for compensated systems) or temporarily switching off faulted phase earthing on compensated or isolated neutral systems.
3. Injection of a high voltage pulse onto a tripped line for detection by the device.

Item	Specification
Installation Process	Non-intrusive installation with clip-on CTs
Rated Frequency	50/60 Hz
Current Sensitivity	0.5 A or better
Fault Indication (local)	OLED display
Fault Indication (remote)	Via Bluetooth to smartphone or laptop
Ingress Protection Level	IP 6 or better
Operating Temperature	-40 °C to 55 °C
Battery	Easily accessible and replaceable
Communications	Bluetooth
Weight	< 300 g
Dimensions (W x H x D)	150 x 80 x 50 mm

If you have a question on any aspect of network protection, control or monitoring, please visit the 'Ask the Expert' section on our website, where our network engineers will provide you with an experts view of your particular issue. Each problem will be answered in the form of a video posted to the site without disclosing the source of the question if so requested.

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