Applied Intelligence

INSIGHT S700

Overview

The S700 relay reliably detects high resistance earth faults (in excess of 10 kΩ). It works with all types of neutral treatments and is readily retrofittable to enhance existing protection

At a glance

- Very high earth fault sensitivity (> 10 kΩ)
- Exploits novel and multiple established algorithms operating simultaneously
- Independent of neutral treatment
- 4-stage phase overcurrent and earth fault protection functions
- Auto-reclose with sequence coordination
- Circuit breaker failure detection
- No false indications



- Intuitive, easy to use user interface for configuration and setting
- Sophisticated waveform, phasor and event analysis functionality
- Distance to fault estimation
- Deploy as a standalone unit, or as part of the INSIGHT L700 and M700 systems
- Integration with SCADA, ADMS, OMS

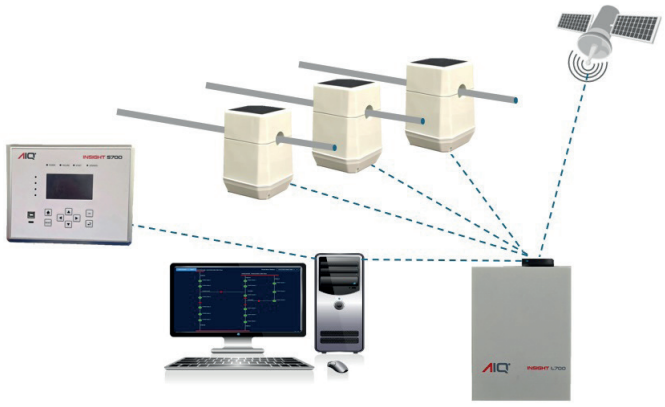


Overall Design

S700™ is housed in a 4U high, half-length case designed to fit within half the standard length of a 19-inch rack or panel. It is modular in construction, with plug-in modules comprising a power supply module, a CPU module, a digital input/output module and an analogue input module. They are connected through a common backplane bus, which in turn is connected to the HMI front panel.

The front panel consists of an OLED display, 4 fixed functional LEDs and 4 user definable LEDs. The OLED display provides measurements, events, fault records and settings to the user. Two USB ports, USB-B and USB-C allow the user to plug in a laptop PC for more detailed data extraction and settings changes.

S700 has two independent Ethernet channels, one to the SCADA system for fault and event reporting, the other to a remote server through MQTT protocol, allowing the S700 to integrate with the INSIGHT L700 system as a substation node. An optional 4G/5G wireless module is available for temporary deployment of the S700, as in the case of the M700 system.



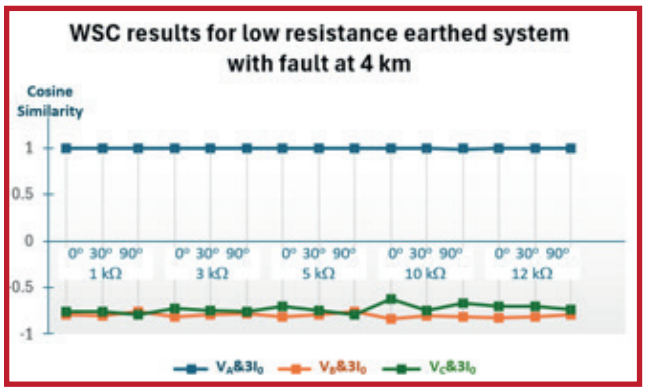
S700 as a part of the INSIGHT L700 system

Analogue Inputs

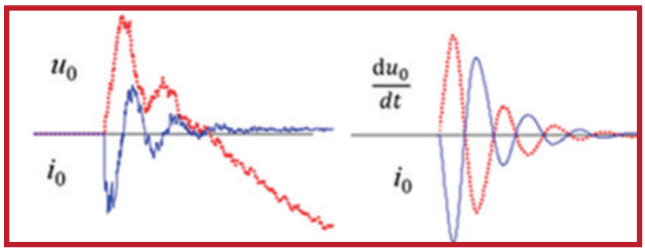
The analogue input module consists of 8 channels for measuring 3-phase and zero-sequence voltages and currents. The sampling rate is at 128 samples per cycle to capture the fault inception transients, required for the novel fault detection techniques. Optional external clip-on CTs are available to facilitate non-intrusive installation. The zero-sequence current input can be connected directly to a core-balanced CT already installed in the substation. Alternatively, a core balanced CT can be provided as an accessory.

Time Synchronisation

Time synchronisation is provided by an IRIG-B input. Optional external GPS module with antenna can be provided. This is applicable to the INSIGHT M700 system, where the installation is temporary. A 1µs time resolution is provided.



Waveform Similarity Coefficient (WSC) Algorithm



Transient Reactive Power (TRP) Algorithm

Fault detection algorithms

Novel and unique to S700

- Transient reactive power (TRP)
- Waveform Similarity Co-efficient (WSC)

Common industry algorithms

3I0> Residual Overcurrent
U0> Zero-sequence Overvoltage Neutral Voltage Displacement)
3IoCosΦ (similar to Wattmetric)
3IoSinΦ (similar to Varmetric)
IPH< and I2/I1 > Open Circuit and Broken Conductor Detection
IPH-DROP< + High Frequency Current Pulses
Δ3I0 - change in zero sequence current
ΔY0 - change in zero- sequence admittance
ΔYPH - change in phase admittance
Restriking and Intermittent Earth Fault Detection
IPH> - Phase overcurrent protection
ΔIPH - change in phase current

PC User Interface

PC user interface software allows easy configuration and setting of the relay. Sophisticated phasor and waveform analysis facilities are provided. Graphical programmable logical configuration allows the fault detection signals to be mapped to LEDs, output relays and onward notifications depending on the user's requirements. A user profile can be created with default settings and logic configuration which are replicated to different installations.

Item	Specification
Installation Process	Non-intrusive installation with clip-on CTs
Rated Frequency	50/60 Hz
Current Rating	1 A or 5 A
Rated Voltage	100 V - 120 V
Voltage Capture & Accuracy	Captures Voltage Phase Angle, Calculates Voltage Amplitude ± 1%
User Interface	LEDs, OLED displays and membrane push buttons
Fault Indication (remote)	Via output relays and/or SCADA communications
Power Supply	110 V - 220 V ac/dc or 24 V - 48 V ac/dc
Ingress Protection Level	IP 51
Operating Temperature	25 °C to 50 °C
Data Recording (Comtrade format)	800 ms magnitude and phase (Cycle by Cycle), 240 ms transient waveforms (128 samples/cycle)
Communications protocol to SCADA	IEC 61850, IEC 60870-5-104, DNP 3.0, Modbus
Communications protocol to Server	Message queuing Telemetry Transport (MQTT)
Weight	3 kg
Dimensions (W x H x D)	210 x 165 x 220 mm

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