CableGuardian

Detects & Locates Electrical Faults Before They Become a Problem

INTELLIGENCE INSTALLED

The first platform to offer proactive monitoring, detection and location of both insulation and conductor faults on live low voltage ungrounded power distribution systems.

CableGuardian

The CableGuardian system is comprised of a network of nodes which monitor the insulation resistance, capacitance and electrical parameters of live cables and system components, using Viper Innovation's proven line insulation monitoring technology. Additionally, the live conductors are continuously monitored for short circuits, open circuits and intermittent faults using ground-breaking Spread Spectrum Time Domain Reflectometry (SSTDR). This information is then displayed clearly and accurately, in real-time, on a user-friendly web portal.

Key Features

Input power supply options:
- Directly from Line being monitored
- From convenient 'domestic supply'

Multiple measurement parameters:
- Network Insulation Resistance (IR)
- Network Insulation Capacitance (IC)
- Directional IR and IC
- Line Voltage, Current, and Frequency

Identification & location of:
- Insulation Resistance degradation
- Short circuits
- Open circuits

Communications interfaces provided:
- 2G/3G/4G cellular - recommended and preferred
- Ethernet - provisioned but connection to external infrastructure would require development
- Fibre Optic - provisioned but connection to external infrastructure would require development
- RS485 - Datalogger interface (if required)

Benefits

- Enables compliance with the requirements of the Network Rail standard for Insulation Monitoring NR/L2/SIGELP/27725
- Multiple nodes on a feed allows for an in depth granular view of the electrical system integrity
- CableGuardian web portal minimises personnel's exposure to track-side risks
- Analysis of data trends facilitate proactive maintenance
- Fast and accurate fault location informs asset stakeholders minimising service outage
- Fault tolerance built in - No master node required; each CableGuardian node operates independently under the Supervisor and Analytics System
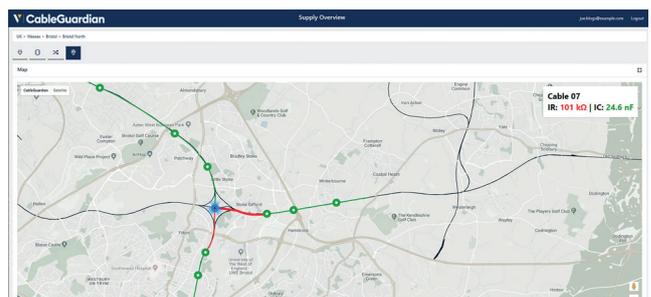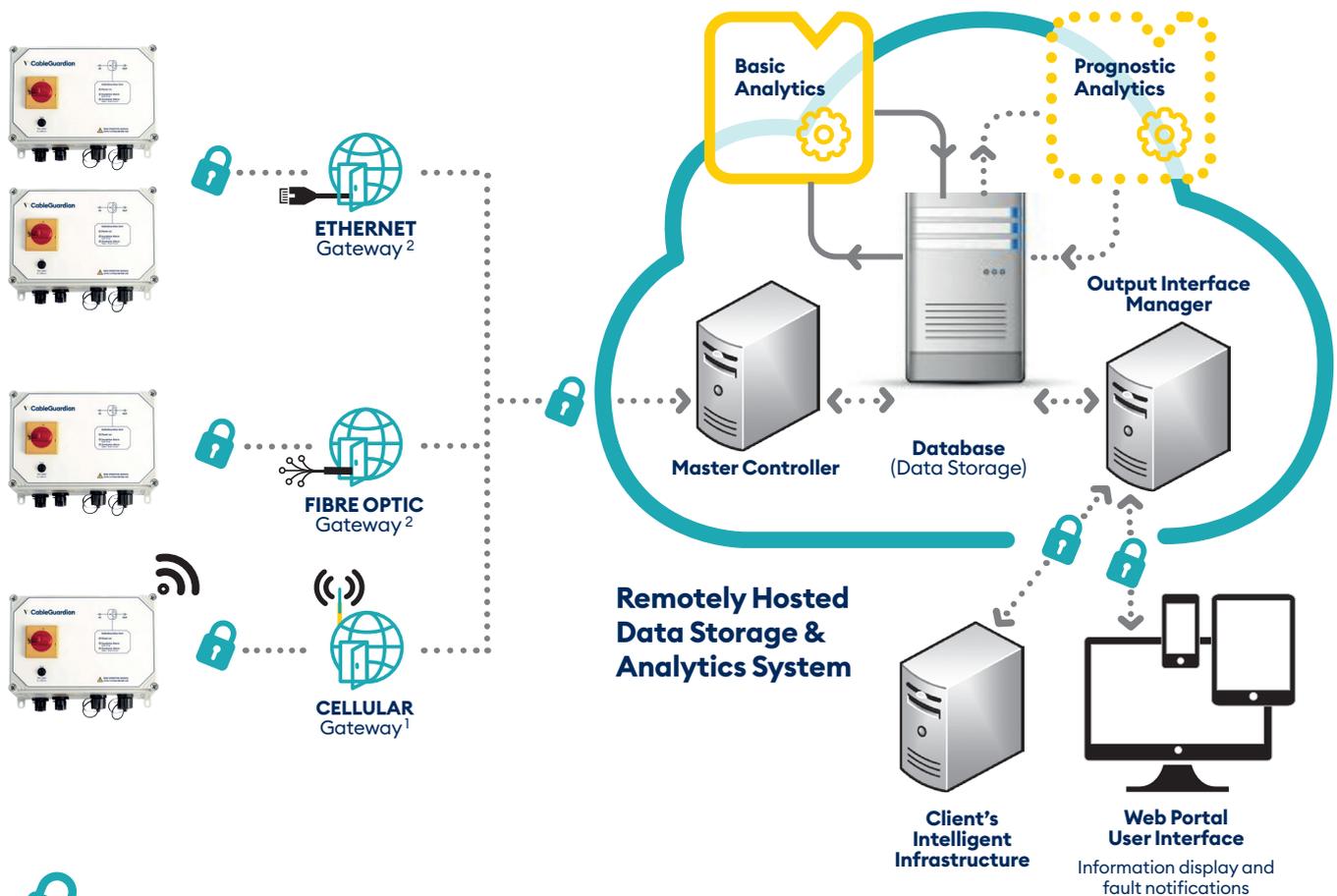

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System Description

A CableGuardian system may consist of a single node or multiple nodes, depending on the system monitoring requirements and the level of fault location granularity desired.

Each CableGuardian node transmits data, via a secure internet connection, to the remotely hosted CableGuardian "Data Storage and Analytics System". This system analyses the data to monitor cable degradation in real time and determines the location of any cable or conductor faults on the live power network. The results are displayed clearly at a glance on an interactive web portal.

Users with correct privileges have full control to set the CableGuardian alarm thresholds for cable Insulation Resistance (IR), which send alerts direct to key personnel via the interactive web portal. It is possible to set alarm and pre-alarm IR values for each Sub-Network Section (this could be an entire feeder, part of a feeder, right down to an individual cable), which will also be visible within the portal. By setting these Sub-Network Alarm Thresholds above the Network values, it is possible to create an advanced warning of potential faults or long term degradation long before they become an emergency.

Future developments of CableGuardian include a "Prognostic Analytics" package which utilises Machine Learning (Artificial Intelligence) algorithms to provide an enhanced level of predictive fault monitoring, detection and location, to support condition based maintenance, stock control and manpower planning.

Basic Analytics

Prognostic Analytics

Output Interface Manager

Master Controller

Database (Data Storage)

Remotely Hosted Data Storage & Analytics System

ETHERNET Gateway [2]

FIBRE OPTIC Gateway [2]

CELLULAR Gateway [1]

Client's Intelligent Infrastructure

Web Portal User Interface
Information display and fault notifications

Secure Connection

1. The Cellular interface is the recommended and preferred communications method (SIM embedded in CableGuardian unit)
2. Interface is provisional but connection to external infrastructure would require development

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Electrical

Input Power Supply (wiring options):

- 110 V AC 47/63 Hz 'domestic' supply
- 230 V AC 47/63 Hz 'domestic' supply
- Direct from Line Supply being monitored

Line Supply Conditions:

Voltage: 350 V to 690 V AC

Frequency: 47 Hz to 63 Hz

Power Consumption:

25 W typical

30 W maximum

Earth Connections:

Functional Earth via connector

No Protective Earth required

V-LIM Insulation Resistance Accuracy (IR < 1MΩ)

V-LIM Insulation Resistance Accuracy (IR > 1MΩ)

Measurement accuracies are specified in the form ±YY%±1kΩ, where YY is the tolerance expressed as a percentage of measured value from the graph above on the Y axis.

Note: 1 - Based on IEC61557-8 reference conditions

Interfaces

Communications Options:

- 2G/3G/4G Cellular (SIM embedded)

Datalogger Interface:

RS485

Front Panel Indicators:

- Power on
- Insulation Alarm (Core to Earth)
- Conductor Alarm (Core to Core)

Cellular Aerial:

External mounted (IP67)

Measurements

Network Insulation Resistance (IR):

1 kΩ to 1 GΩ @ see graphs

Directional Insulation Resistance:
(via External Coil)

1 kΩ to 10 MΩ @ Network IC dependent

Response Value (Alarms)[1]:

1 kΩ to 10 MΩ

Network Insulation Capacitance (IC):

0.1 µF to 150 µF @ ± 25% ± 0.05 µF

Directional Insulation Capacitance:
(via External Coil)

0.1 µF to 80 µF @ Network IR dependent

Line Voltage (True RMS):

Up to 690 VAC @ ± 3% ± 50 mV

Line Current (True RMS):
(via External Coil)

Up to 100 A ± 5% ± 50 mA

Line Frequency:

47 Hz to 63 Hz @ ± 1% ± 0.5 Hz

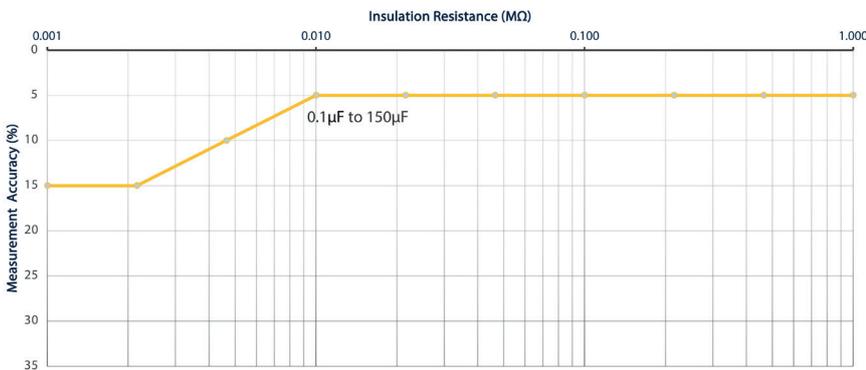## Conductor Short/Open Circuit:

Located to 98% accuracy by distance

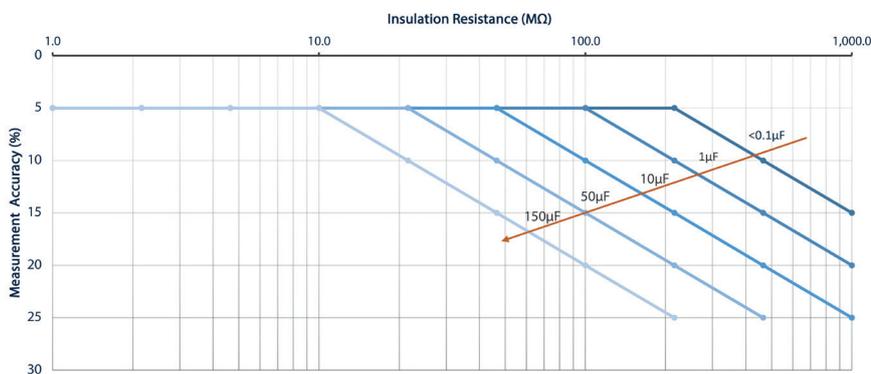## Intermittent Conductor Faults:

Duration >100 ms

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Environment

Operating Temperature Range:
-25°C to +70°C (-13°F to 158°F)

Storage Temperature Range:
-40°C to +85°C (-40°F to 185°F)

Relative Humidity:
Up to 100%

Design Life:
Minimum 15 years operation

Climatic Conditions:
'Category T1 environment' as defined in BS EN 50125-3

Solar Radiation:
1120 W/m² as defined in BS EN 50125-3

Shock and Vibration:
'Outside the track' as defined in BS EN 50125-3

Mechanical

Dimensions:
See diagram below (in millimetres [inches])

Weight:
<10 kg

Mounting:
See diagram below (M6 fixings)

Construction and Assembly:
In accordance with BS EN 61439-2 and BS 7671

Ingress Protection:
IP65 as defined in BS EN 60529

Fire Protection:
Category F1 as defined in BS EN 50125-2

Product Standards

Safety:
IEC 61140:
- Protection Class II

BS EN 61010-1:
- Overvoltage Category III (110/230V Mains & 690V Line)
- Pollution degree 2

BS EN 61010-2-030:
- Measurement Category III

Electro-Magnetic Compatibility:
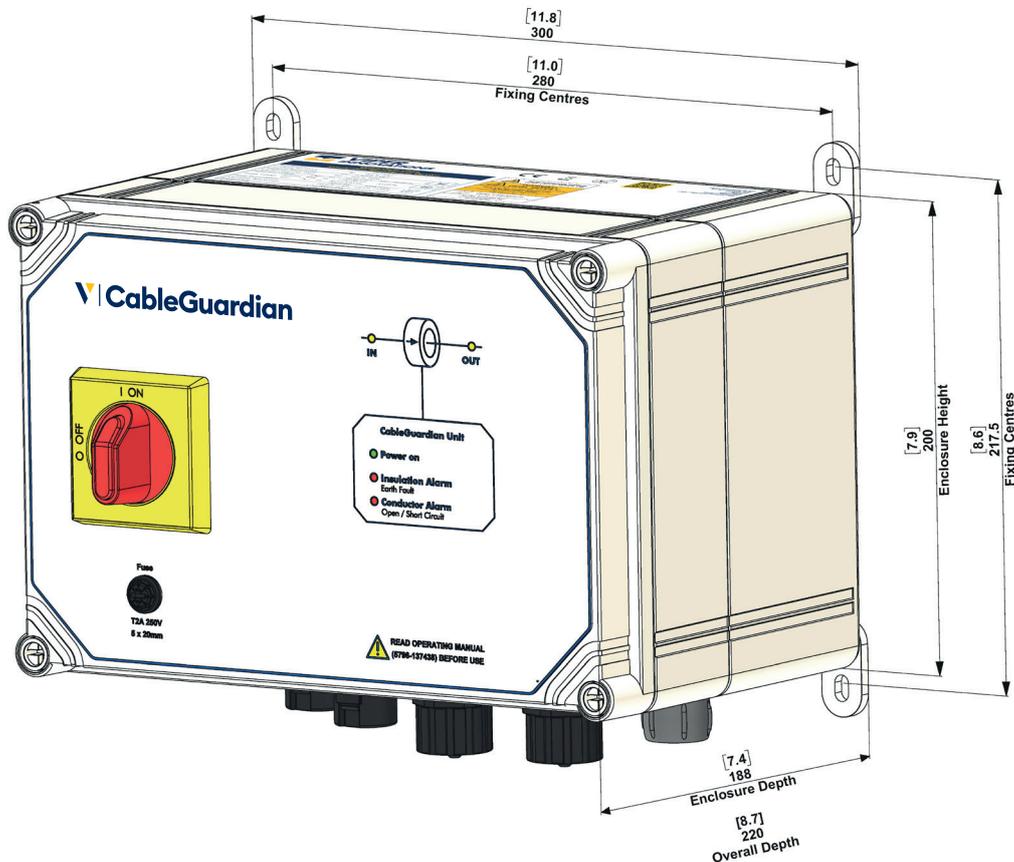In accordance with BS EN 50121-5, BS EN 61326-1 & BS EN 61326-2-4

Insulation Monitoring Device:
IEC 61557-1
IEC 61557-8

Network Rail:
NR/L2/SIGELP/27725

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Get in touch with one of our experts today and learn what CableGuardian can do for you.

✉ **enquiries@viperinnovations.com**

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