

CABLEGUARDIAN

TECHNICAL DATA SHEET

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**DETECTS & LOCATES
ELECTRICAL FAULTS
BEFORE THEY BECOME
A PROBLEM**

**CABLE
GUARDIAN®**
A VIPER INNOVATION

THE FIRST PLATFORM TO OFFER PROACTIVE MONITORING, DETECTION AND LOCATION OF BOTH INSULATION AND CONDUCTOR FAULTS ON LIVE LOW VOLTAGE UNGROUNDED POWER DISTRIBUTION SYSTEMS

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:

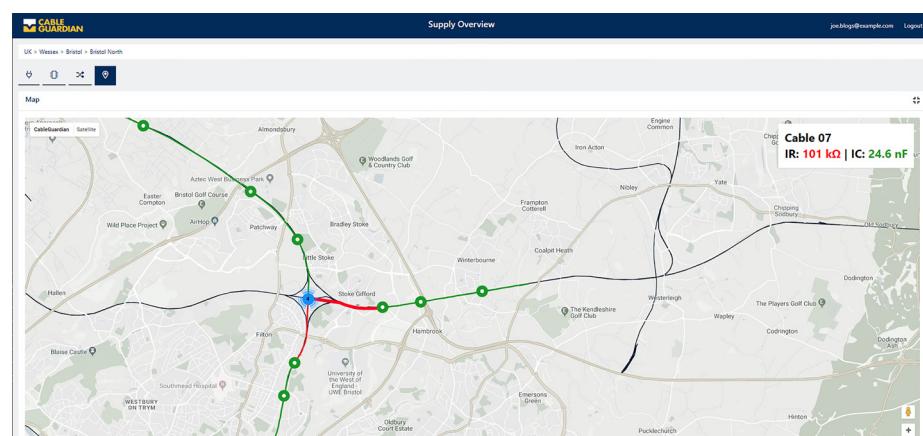
- Insulation Resistance degradation
- Short circuits
- Open circuits

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)

Advantages:

- 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 is a 'slave' to the 'Supervisor and Analytics System'



CableGuardian Web Portal Overview

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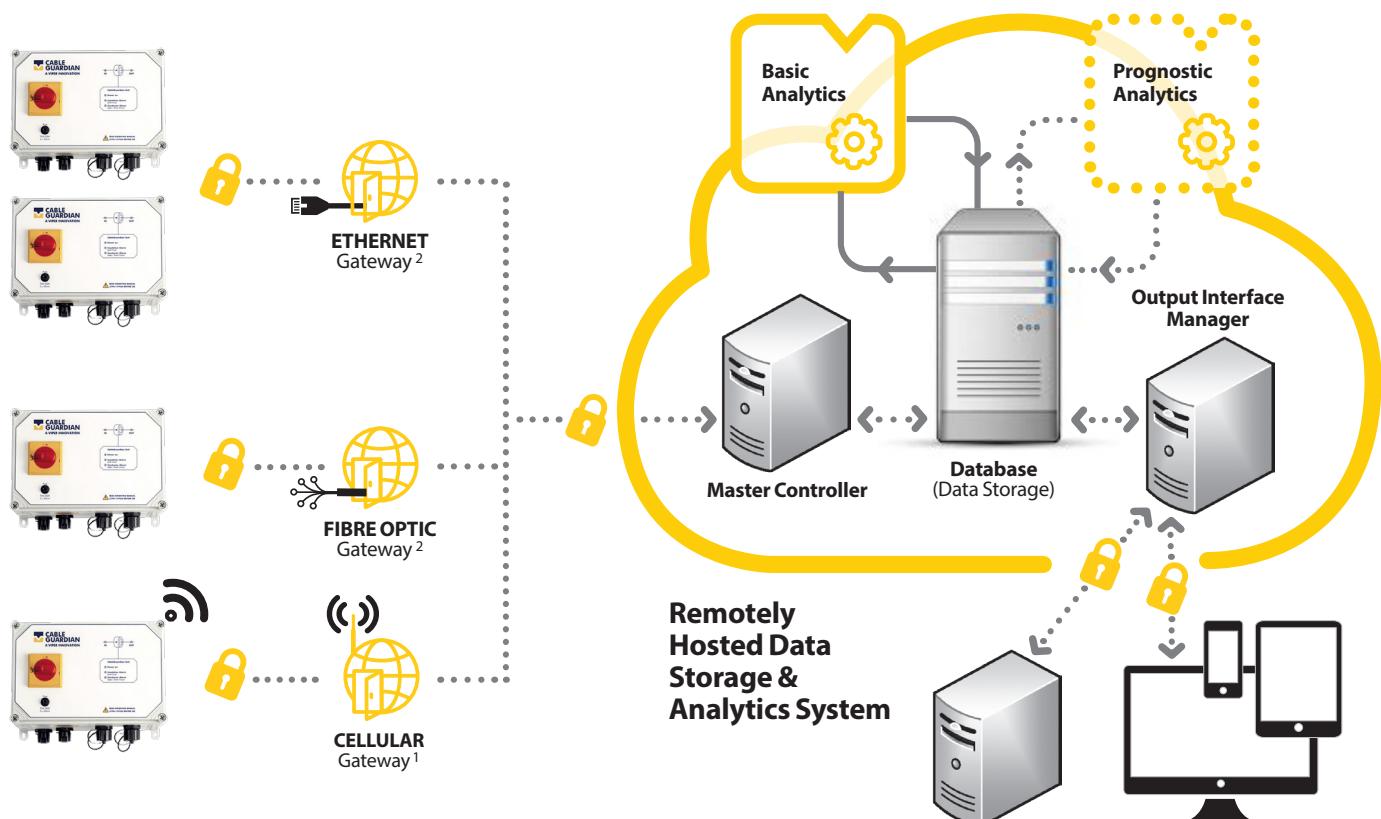
SYSTEM DESCRIPTION

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.



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

Client's Intelligent Infrastructure

Information display and fault notifications

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Electrical

Input Power Supply (wiring options):

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

Line Supply Conditions:

Voltage: 350V to 690V AC
 Frequency: 47Hz to 63Hz

Power Consumption:

25W typical
 30W maximum

Earth Connections:

Functional Earth via connector
 No Protective Earth required

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)

1kΩ to 1GΩ @ see graphs

Directional Insulation Resistance:

(via External Coil)

1kΩ to 10MΩ @ Network IC dependent

Response Value (Alarms)¹:

1kΩ to 10MΩ

Network Insulation Capacitance (IC):

0.1μF to 150μF @±25% ±0.05μF

Directional Insulation Capacitance:

(via External Coil)

0.1μF to 80μF @ Network IR dependent

Line Voltage (True RMS):

Up to 690VAC @±3% ±50mV

Line Current (True RMS):

(via External Coil)

Up to 100A ± 5% ±50mA

Line Frequency:

47Hz to 63Hz @±1% ±0.5Hz

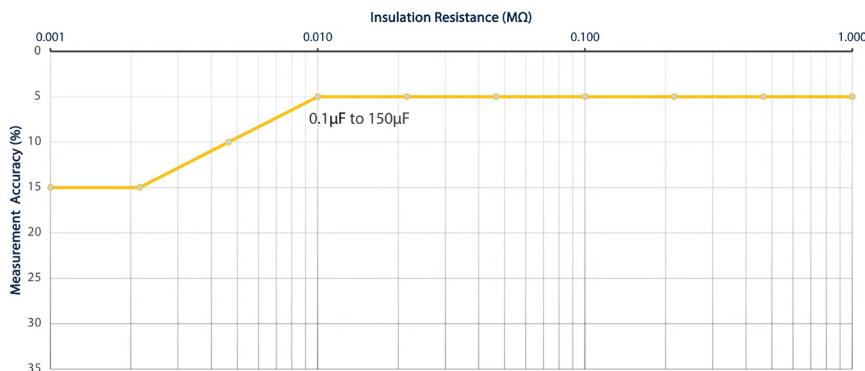
Conductor Short/Open Circuit:

Located to 98% accuracy by distance

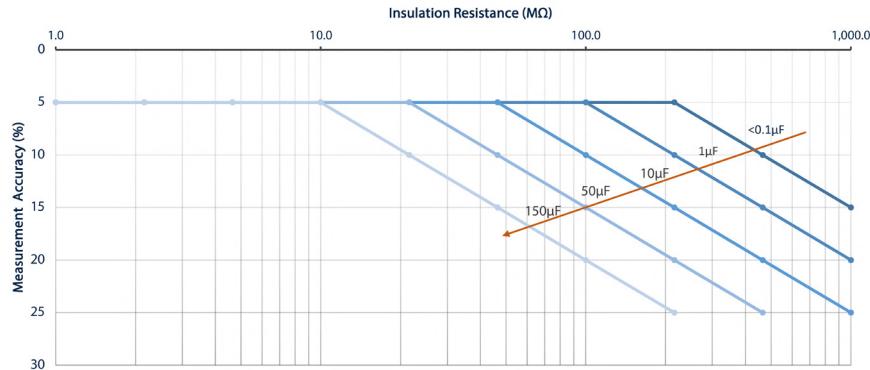
Intermittent Conductor Faults:

Duration >100ms

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



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



Measurement accuracies are specified in the form $\pm YY\% \pm 1k\Omega$, 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

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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:
<10kg

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:

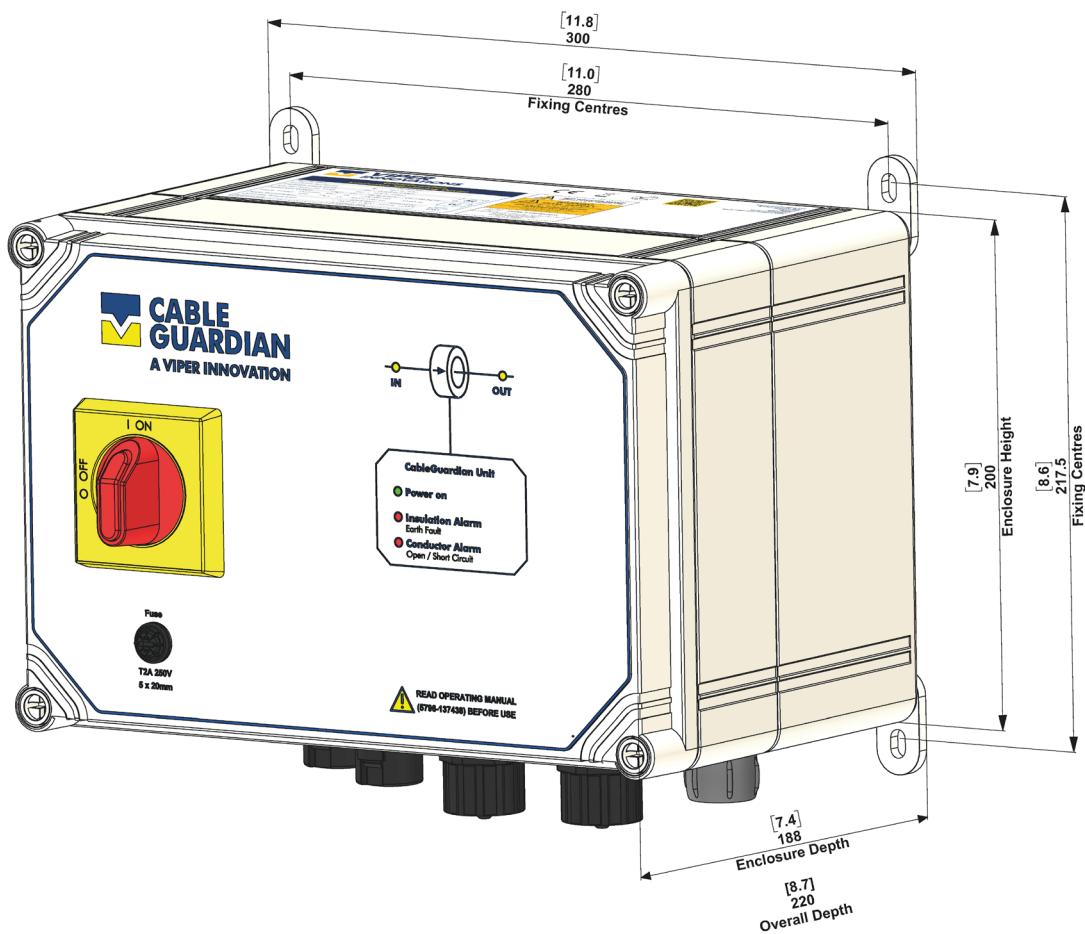
In accordance with BS EN 50121-5,
BS EN 61326-1 & BS EN 61326-2-4

Insulation Monitoring Device:

IEC 61557-1
IEC 61557-8

Network Rail:

NR/L2/SIGELP/27725



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