

Insulation Monitoring (NEMA)

Monitor Insulation Status to Help Improve Safety and Operational Efficiency

EcoStruxure Power Digital Application

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EcoStruxure™ Power



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Overview

Context of Application

In hospitals, operating rooms and intensive care units require uninterrupted power availability. Ground faults in medical equipment can be lethal for the patient. In addition, many jurisdictions legislate isolated power to help protect patients and staff from leakage currents. To achieve this, IT grounding or grounding systems with insulation supervision provide insulation fault monitoring and alarming without tripping or power interruption. Nurses are typically responsible for taking immediate actions when insulation faults occur and, in many cases, require assistance from electricians or electrical engineers to help with the troubleshooting.

Problem to Solve

The nurses and facility management teams need to:

- Guarantee power availability and continuity of activity in operating rooms (OR) and intensive care units (ICU).
- Get real-time information of insulation status.
- Receive alarms and notifications in case of insulation or overload issues.
- Comply with NFPA 99 and the NEC.

Purpose of the Application

Continuously monitor insulation integrity and display status in real time

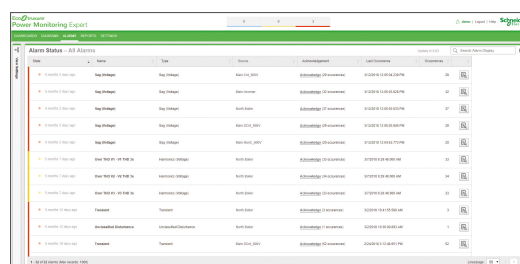
- Remotely monitor from the nurse's station and facility manager's office
- Monitor for overload and over-temperature conditions

Provide alarms in case of insulation faults

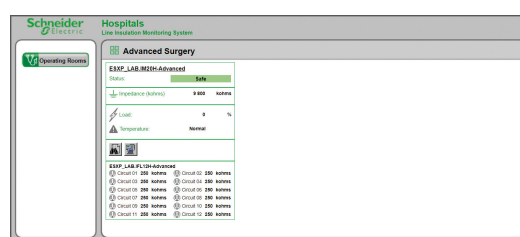
- Receive an alarm in operating rooms and intensive care units

Provide the means to quickly identify the cause of the insulation fault

- Provide first level troubleshooting support for staff in operating rooms and intensive care units



Insulation and Electrical Fault Alarm Viewer



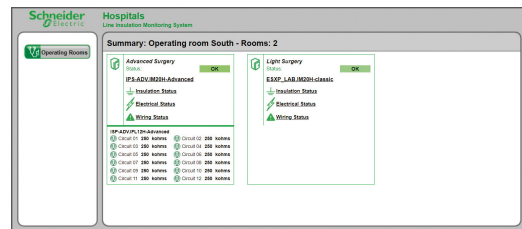
Specific Diagram for Operating Rooms and ICUs

Application Outcomes

The Insulation Monitoring application can provide the following suggested outputs.

Live Data Display

- Insulation monitoring status
- Insulation integrity absolute value (mA)



Live Data Display

Events and Alarms

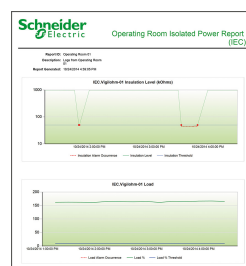
- Insulation fault (visual and acoustic in operating rooms and ICUs)
- Insulation fault location (per feeder / group of sockets)
- Isolation transformer fault (overload/overheating)

Trends

Real-time and historical data can be viewed on a trend viewer.

Reports

Operating Room Isolated Power Report



Operating Room Isolated Power Report

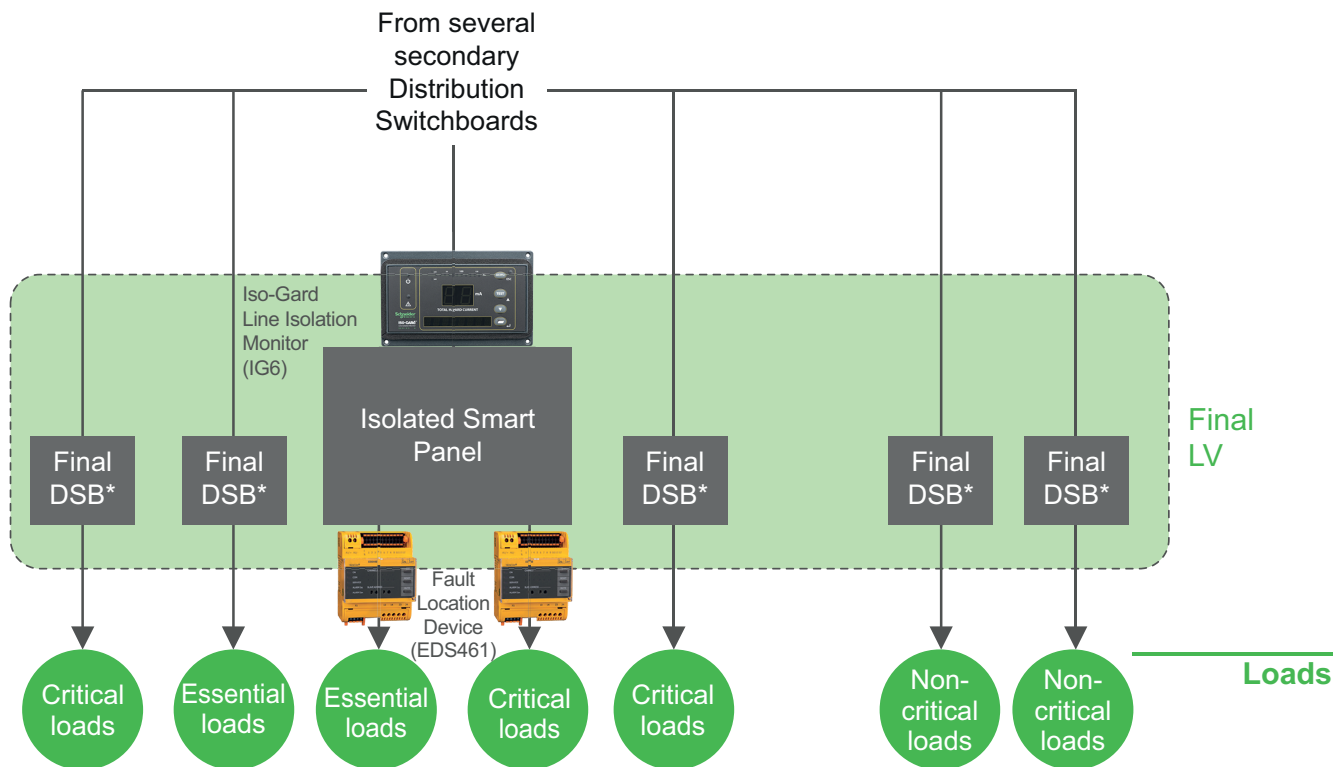
Notifications

- SMS and/or email notifications can be sent for fast analysis and action.
- Additional email notifications are available to send reports and other noncritical information.

Electrical Architecture

An Iso-Gard Line Isolation Monitor (LIM) serves as the central insulation monitoring device to monitor the network insulation. Fault Location Devices can be installed as an option on each feeder to identify the problem circuit.

The following diagram details the areas of the architecture where the connected products should be installed in order to implement the Insulation Monitoring application.

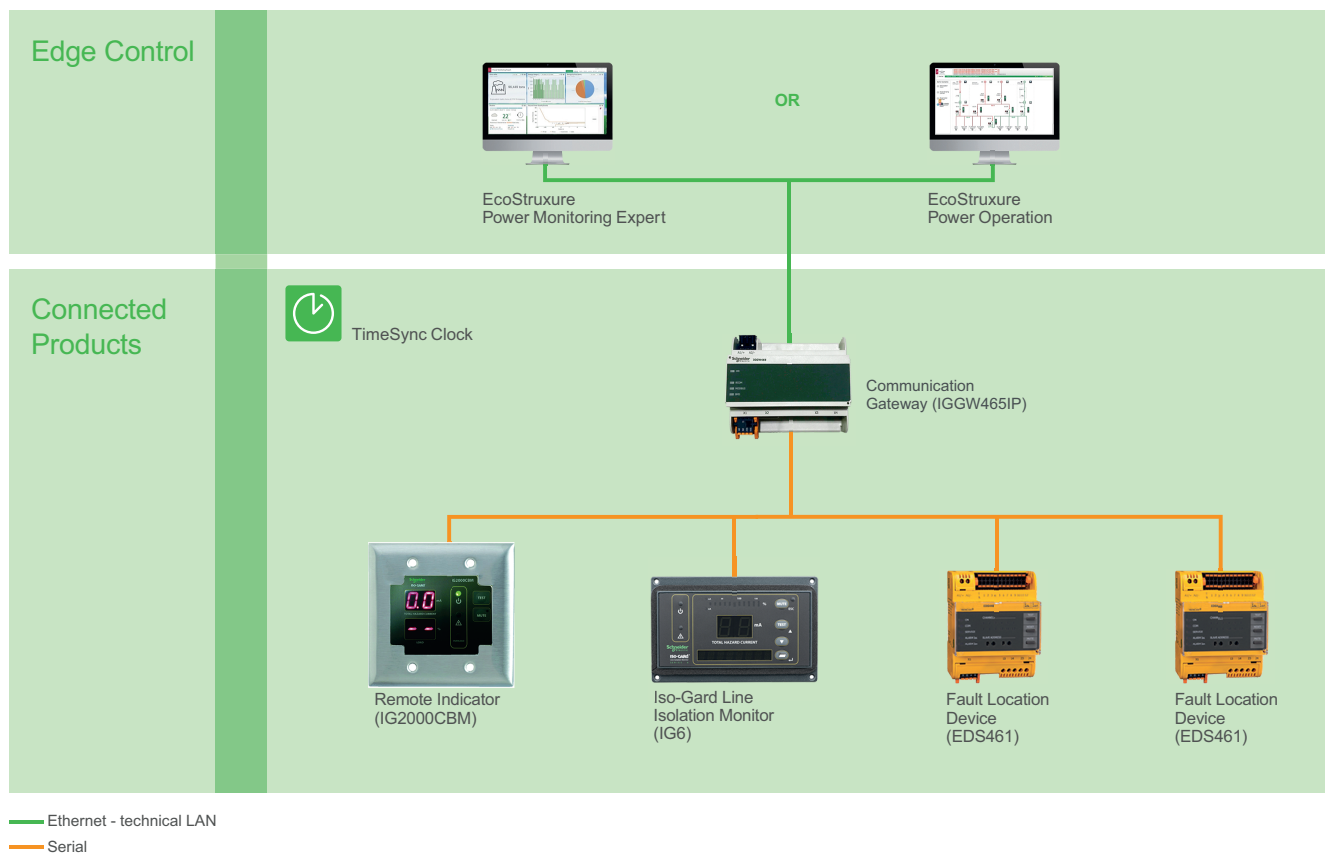


* DSB = Distribution Switchboard

Digital Architecture

Insulation Monitoring data is transferred to the Edge Control software (EcoStruxure Power Monitoring Expert and Power Operation) via a gateway for on-premise visualization, analysis, and reporting.

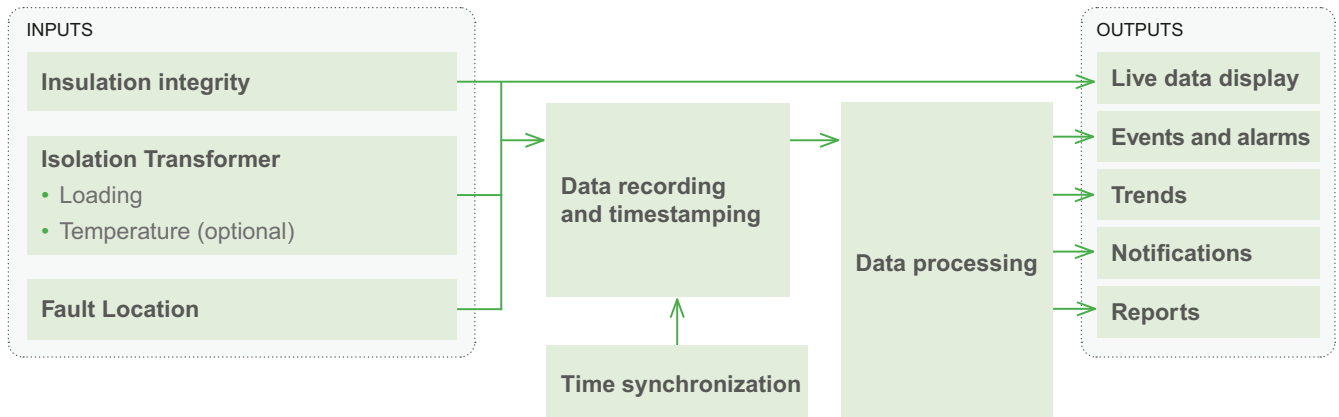
The recommended digital architecture for the application is shown below:



System Description

Data Flow

The Insulation Monitoring application can be broken down as follows:



Inputs

The following data is required for the Insulation Monitoring application and is acquired from the Iso-Gard Line Isolation Monitor (LIM).



Iso-Gard
Line Isolation
Monitor (LIM)

Insulation Integrity

- Permanent measurement of insulation resistance to ground in IT systems

Isolation Transformer

- Isolation transformer loading (A)
- Isolation transformer temperature (optional)

The transformer loading calculation requires the transformer name plate rating and impedance threshold.

Fault Location

In case of an insulation fault, the location of the fault is indicated by the fault location device (EDS461).



EDS461

Data Recording and Timestamping

Real-time impedance, loading, temperature, as well as the generated event and alarm data, are recorded as historical values in the Edge Control software (EcoStruxure Power Monitoring Expert or Power Operation).



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

The Iso-Gard Line Isolation Monitor (LIM) sends all insulation fault and fault location data to EcoStruxure Power Monitoring Expert or Power Operation, where this data is timestamped.



Iso-Gard
Line Isolation
Monitor (LIM)

Timestamping of digital data, while not critical for Insulation Monitoring performance, should be accurate to ± 1 s for consistency and data integrity.

For a comprehensive overview of device recording and timestamping capabilities, refer to Data Recording and Time Synchronization Capabilities of EcoStruxure Power Connected Products.

Time Synchronization

For consistent timestamping of all the power and energy data, the date and time should be accurately distributed to connected products and data loggers.

Time synchronization can be performed through various technologies (PTP, NTP, SNTP, etc.). An external master clock may be required and can be connected to a GPS antenna to reach the expected time precision.



TimeSync Clock

Data Processing

The insulation integrity (in mA) is sent to EcoStruxure Power Monitoring Expert and/or Power Operation for data processing. Here, the data is analyzed and converted into events and alarms.



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

Outputs

The output display is performed locally by an Iso-Gard Line Isolation Monitor (LIM) or Iso-Gard Remote Indicator IG2000CBM for instant access by staff. Remote display and additional features are available with the Edge Control software EcoStruxure Power Monitoring Expert or Power Operation.



Iso-Gard
Line Isolation
Monitor (LIM)



Iso-Gard
Remote
Indicator
IG2000CBM



EcoStruxure
Power Monitoring Expert



EcoStruxure
Power Operation

Live Data Display

The following data is available natively:

- Insulation monitoring status (color code according to NFPA 99)
- Insulation integrity absolute value (mA)

Default Isolated Panel diagrams are available with the Insulation Monitoring Module.

Events and Alarms

The following alarms can be raised by the Iso-Gard Line Isolation Monitor (LIM) and EDS461:

- Insulation fault alarm (visual and acoustic in operating rooms)
- Insulation fault alarm through communications and dry contact relay, plus visual and acoustic in operating rooms
- Insulation fault location (per feeder / group of sockets)
- Transformer fault

Alarms can be raised by the various HMIs (Iso-Gard Line Isolation Monitor (LIM) or Iso-Gard Remote Indicator IG2000CBM) and remotely by the Edge Control software.

Trends

Any Insulation Monitoring parameter such as insulation integrity (mA) can be displayed as a trend in the Edge Control software.

Notifications

- SMS and/or email notifications can be sent for fast analysis and action.
- Additional email notifications are available to send reports and other non-critical information.

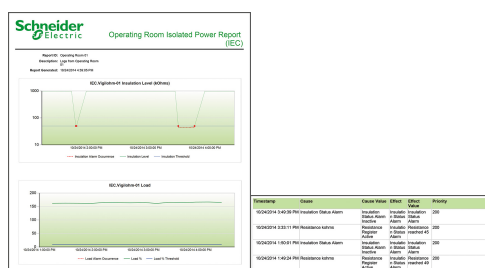
Reports¹

The following report can be displayed or automatically sent via email with the optional Insulation Monitoring module:

Isolated power report

For each Iso-Gard Line Isolation Monitor (LIM) in the room, the report shows:

- Impedance graph: displays a comparison of impedance measurements to the impedance threshold. The impedance threshold is a blue line and actual measurements are shown as a green line. A red line shows the time when the impedance exceeded the threshold.
- Events table: shows information for each event that occurred in the date range.
- Data log table (optional): contains measurements for impedance, load, and temperature in the selected date range. Red values indicate measurements over the limit.



Isolated Power Report

1. The Insulation Monitoring module of EcoStruxure Power Monitoring Expert and Power Operation must be deployed to benefit from these features.

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