Insulation Monitoring (IEC)

Monitor Insulation Status to Help Improve Safety and Operational Efficiency

EcoStruxure Power Digital Application

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EcoStruxure™ Power

Schneider Electric™

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Overview

Context of Application

Any unexpected downtime or interruptions of critical processes and operations typically result in significant financial losses or danger to human lives. In hospitals, for example, ground faults in medical equipment can be lethal for the patient. Therefore, some of these critical processes require the use of IT (isolated from earth) earthing systems, also called ungrounded earthing systems, to allow for continuity of service of the installation in the event of an insulation fault. Among others, this is typically the case in wet location applications (both MV and LV) such as wastewater treatment, mining, energy and chemicals, marine, hospital operating rooms (OR), or intensive care units (ICU), etc. Facility and operations staff need to be made aware of insulation faults to quickly clear faults and reduce the risk of safety incidents.

Problem to Solve

Medical staff and facility operations and maintenance teams need to:

- Guarantee power availability and continuity of service for critical processes, equipment, or areas.
- Get real-time information, notifications, and alarms for overload, overheating, and insulation status to help ensure that installations are isolated from earth through sufficiently high impedance.
- Comply with insulation monitoring standards such as IEC 60364 and IEC 61557.

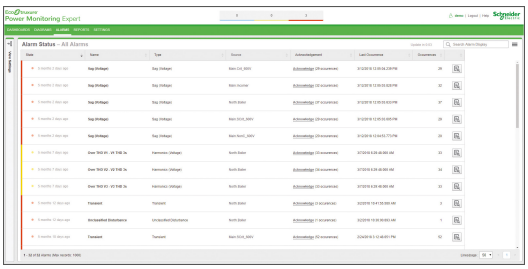
Purpose of the Application

Help prevent disruption of critical processes due to insulation faults, overload, and over-temperature conditions by:

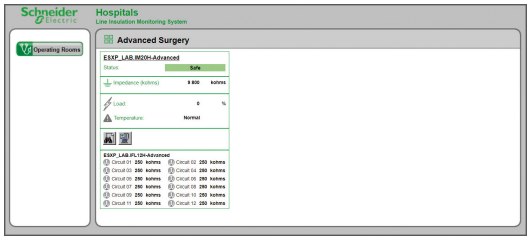
- Continuously monitoring insulation integrity locally and/or remotely
- Displaying the status of the installation
- Triggering and sending alarms in the event of an initial fault, to quickly clear it, since a second fault would cause a circuit breaker to trip

Provide first level troubleshooting support for staff

- For example, in operating rooms and intensive care units



Insulation and Electrical Fault Alarm Viewer



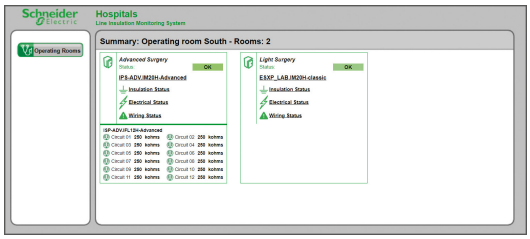
Specific Diagram for Operating Rooms and ICUs

Application Outcomes

The Insulation Monitoring application can provide the following suggested outputs.

Live Data Display

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



Live Data Display

Events and Alarms

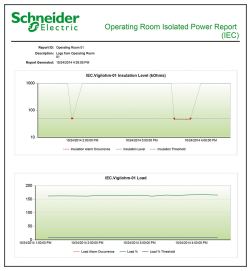
- Insulation fault (visual and acoustic in operating rooms and ICUs)
- Insulation fault location (per feeder / group of sockets)
- Isolation transformer fault (overload/overheating)

Trends

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

Reports

Operating Room Isolated Power Report



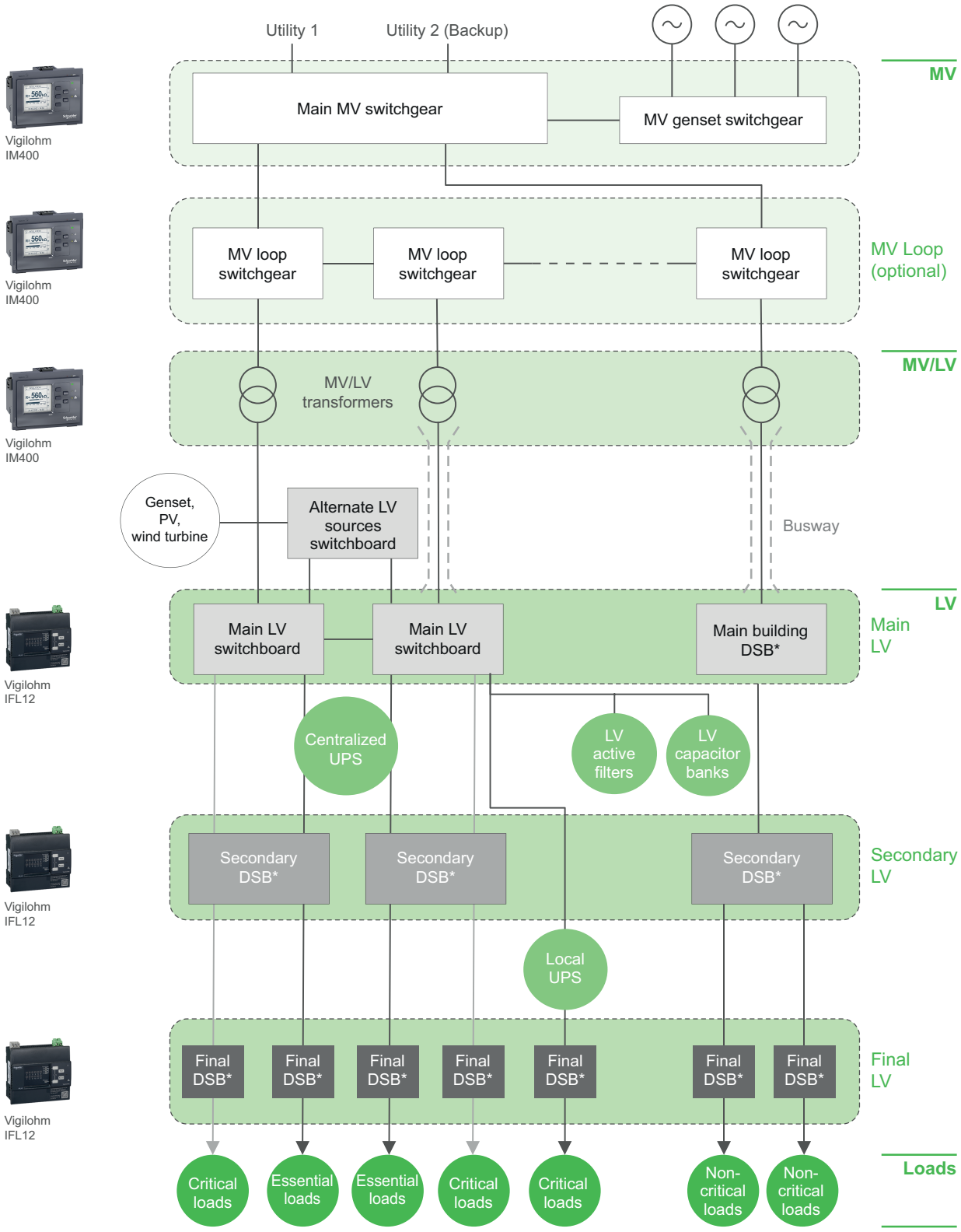
Operating Room Isolated Power Report

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 - Industrial Applications

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

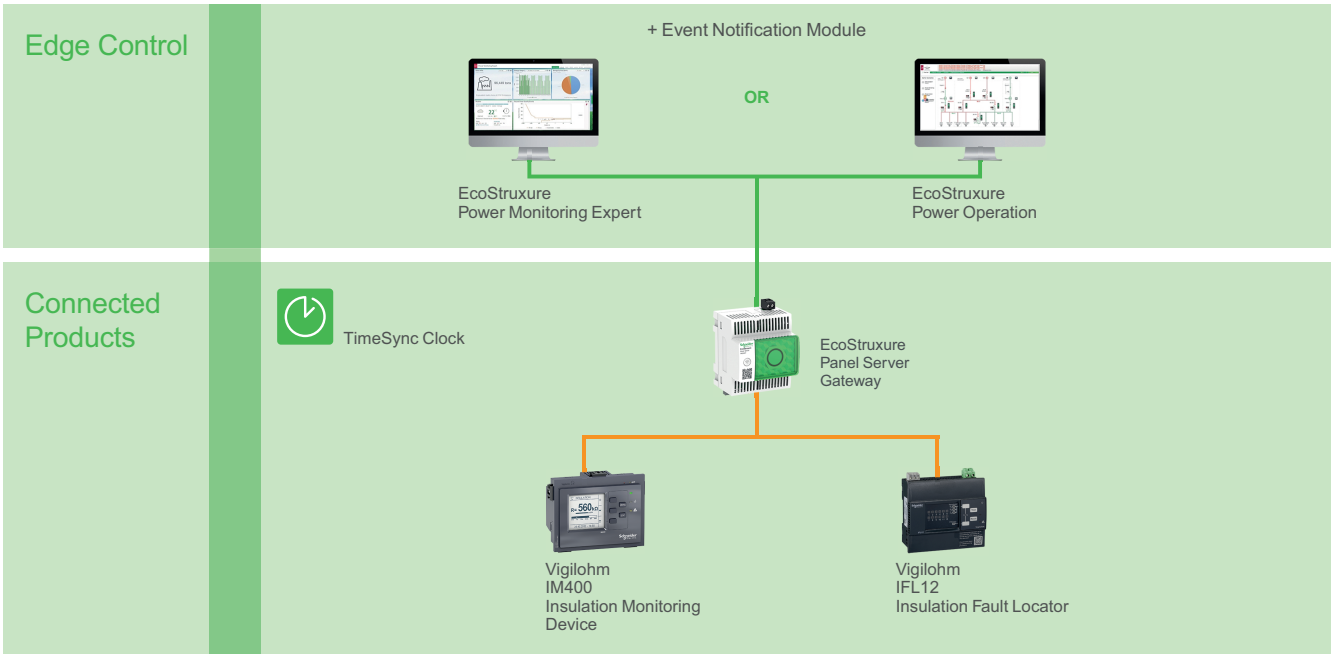


* DSB = Distribution Switchboard

Digital Architecture - Industrial Applications

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

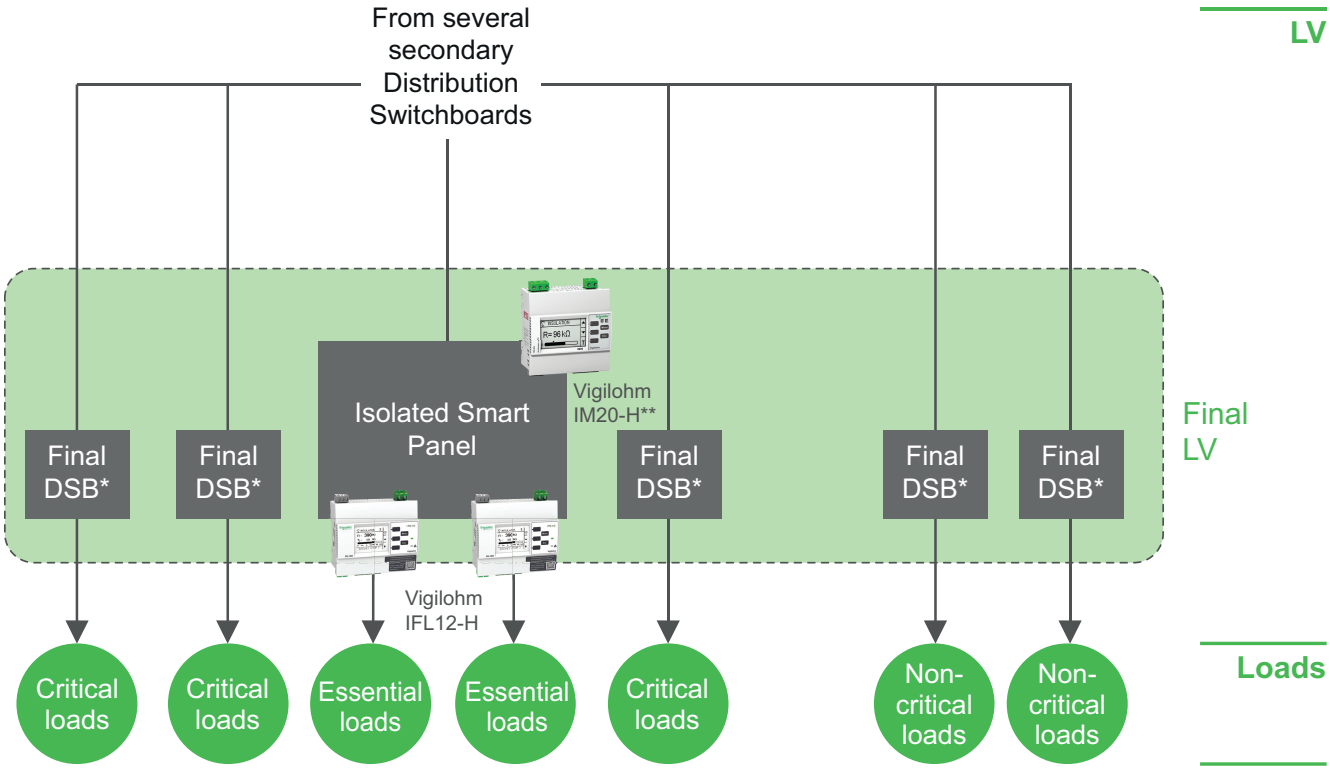
The recommended digital architecture for the application is shown below:



Electrical Architecture - Healthcare Applications

The Vigilohm IM20-H serves as the central insulation monitoring device to monitor the network insulation. Fault Location Devices (Vigilohm IFL12-H) 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.



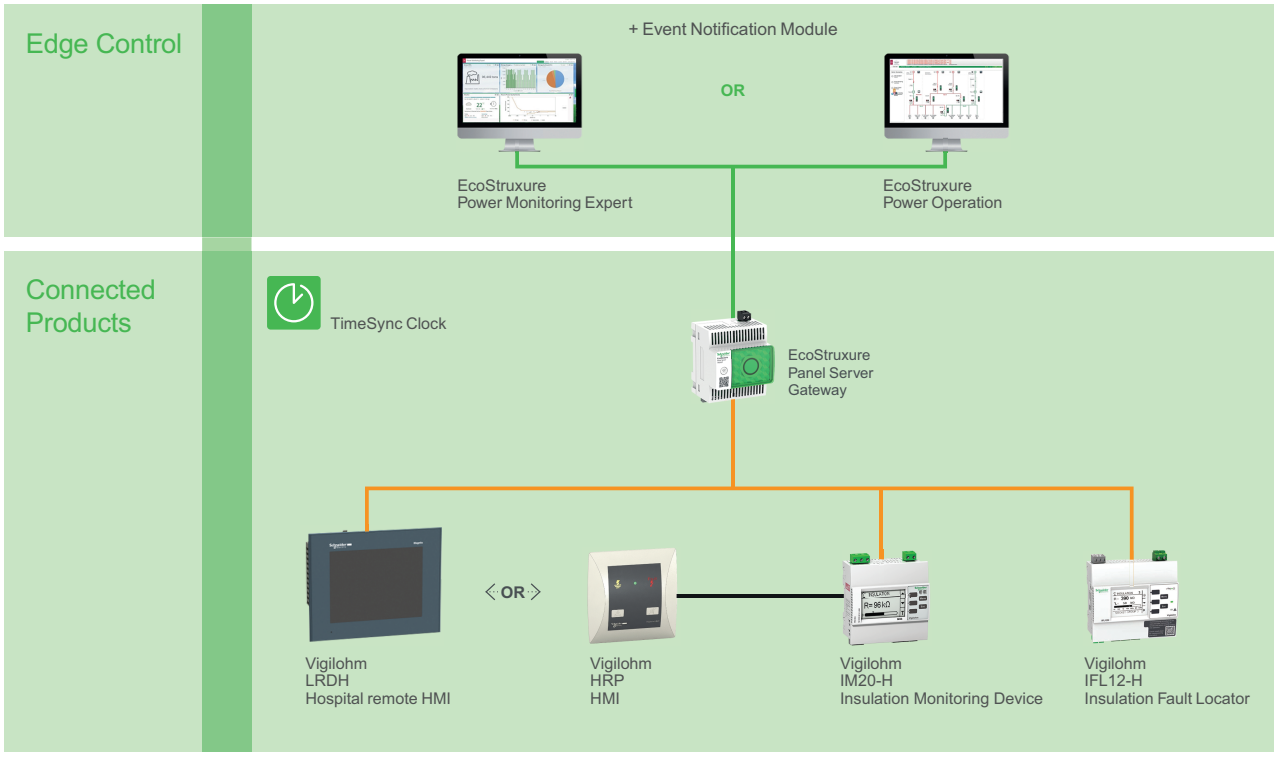
* DSB = Distribution Switchboard

** In non-healthcare applications, the IM400 can be used (e.g., Marine, Industrial)

Digital Architecture - Healthcare Applications

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.

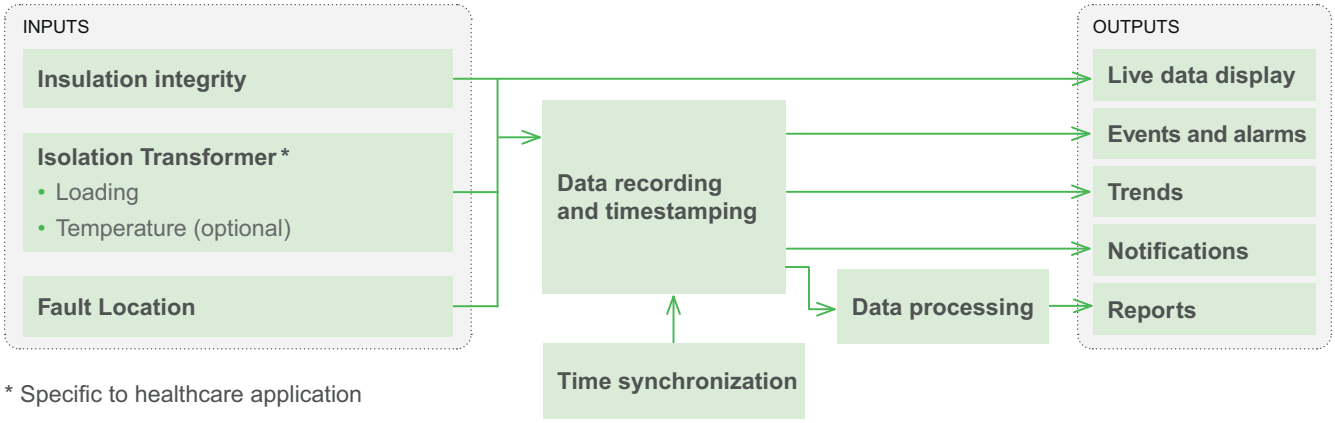
The recommended digital architecture for the application is shown below:



System Description

Data Flow

The Insulation Monitoring application can be broken down as follows:



* Specific to healthcare application

Inputs

The following data is required for the Insulation Monitoring application and is acquired from the Insulation Monitoring Device Vigilohm (IM400 or IM20-H[1]) .

Vigilohm IM400

Vigilohm IM20-H

Insulation Integrity

- Permanent measurement of insulation resistance to ground in IT systems

Isolation Transformer[1]

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

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

1. Specific to healthcare application

Fault Location

In case of an insulation fault, the location of the fault is indicated by the fault location device (Vigilohm IFL12).

Vigilohm IFL12

Vigilohm IFL12-H

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

Timestamping is done by the Vigilohm IM400 or IM20-H for the general insulation fault and independently by Vigilohm IFL12 series fault locators (MC and H) for the specific fault location.

Vigilohm IM400

Vigilohm IM20-H

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 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 kΩ and/or µF), transformer loading[2], and temperature[2] are 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

Outputs are displayed remotely via EcoStruxure Power Monitoring Expert or Power Operation.

EcoStruxure
Power Monitoring Expert

EcoStruxure
Power Operation

For healthcare, additional data is available with the optional healthcare Insulation Monitoring Module of EcoStruxure Power Monitoring Expert or Power Operation. In addition, the live data events and alarms can be displayed locally by Vigilohm HRP or LRDH (Operating Theater Display) for instant access by staff.

Vigilohm
LRDH

Vigilohm
HRP

2. Specific to healthcare application

Live Data Display

The following data is available natively:

- Insulation monitoring status
- Insulation integrity absolute value (kΩ) and/or leakage capacitance value (µF)

Events and Alarms

The following alarms can be raised:

- Insulation fault pre-alarm
- Insulation fault alarm through communications and dry contact relay, plus visual and acoustic in operating rooms[3]
- Insulation fault location (per feeder / group of sockets)
- Transformer fault[3]

Trends

Any Insulation Monitoring parameter such as insulation integrity (kΩ/µF) 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.

3. Specific to healthcare application

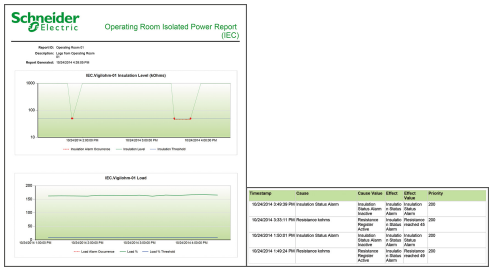
Reports[4,5]

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

Isolated power report

For each Vigilohm IM20-H 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 dropped below the threshold.
- Transformer load graph: displays a comparison of transformer load measurements to the load threshold. The threshold is a blue line and actual measurements are shown with a green line. A red line shows the time when the load rose above 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

4. Specific to healthcare application
5. The Insulation Monitoring module of EcoStruxure Power Monitoring Expert and Power Operation must be deployed to benefit from these features.

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