

The background image shows two workers in safety gear (hard hats and high-visibility vests) standing on a metal structure, looking out over a landscape with a wind turbine under a bright, hazy sunset sky. The scene is bathed in warm, golden light.

Analysis

Smart Transformer:

Fault Detection and Communication

prolec



Introduction

By Fernando Saldívar / Carlos Gaytán.

One of the main issues with the electrical distribution system is its response time to restore the system in the event of a failure. This time is critical, as the longer it takes to stabilize it, the more complaints there will be from end users.

Unavoidable natural events, such as, hurricanes or thunderstorms, can affect the electricity supply system and produce power outages.

These situations put energy companies under extreme pressure of speeding up their response time, identifying the specific cause of failure (since the integrity of the transformer could end up affected), and reducing the power outage time as much as possible.

In situations like this, the most common problem energy companies have is that, since they do not know the specific source of the failure, they must rework and this increases their response time to restore power. Currently, there are systems that let you know if the failure is an internal fault in the transformer, and it needs to be replaced; however, these devices do not communicate the event remotely, as they only show a local visual signal, and they only work in the event of sudden failures.

Proudly, at Prolec GE, we have developed a Smart Transformer that has (proven and developing) fault detection and communication capabilities, which helps keep operating costs low for companies.



The solution involves 3 elements:

1. Internal Fault Detection Electronic Board
2. Electronic Communication Card.
3. Management Software

Internal Fault Detection Electronic Board

The main board in this solution uses Rogowski coil current sensors as input peripherals; not having an iron core, these sensors have a high linearity from mA to kA, and rely on the differential protection principle to report if the fault was inside or outside the transformer. Our solution is designed to use

sensors inside the transformer, or the retrofit version, which can be used for transformers already installed in the field. The board is self-powered from the secondary side of the transformer and has backup power to be able to communicate the information once the fault occurs. The system can effectively distinguish an Inrush. This solution detects evolving faults, identifies transformers with permanent damage in the windings, reduces power outages that are the result of transformer failure, and prevents false-alarm mobilizations, which results in a more efficient use of the resources.



Electronic Communication Board

This board uses wireless mesh network radio-frequency technology between transformers, which guarantees communication of the data as it makes use of different ways to communicate the information. All these data are sent to a gateway, which then proceeds to send them to the management system through a GSM (Global System for Mobile) cellular network.

Management System

At Prolec GE we have developed our own system, which can manage the transformers used by our clients, users, etc. The data this system shows is both high and low voltage current, transformer secondary voltage and transformer status:

- Normal Operating status
- High voltage winding fault
- Fault between windings

- Low / High Voltage
- Energization / De-energization

This system also offers geolocation, which is a very helpful tool since it helps identify where the transformer is physically located.

The system is programmed with the optimal programming languages for the Internet of Things (IoT) application. The default system is in the cloud, but it can be installed on the clients' servers.



Conclusions

- This system detects internal electrical faults in the transformer and communicates them to a management system in the Cloud. With this data the user will know exactly when a transformer needs to be replaced or when changing the fuses would solve the issue.
- The technology it uses for communication ensures that the data is properly sent to the management system.

- The system's operating principle is based on differential protection.
- By making use of this solution, Energy companies will be able to prevent false alarm mobilizations and schedule services, while making resources more cost-effective.

Prolec GE: Transforming Together



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