Analysis

Smart Transformer:

Measurement and remote disconnection

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For the Energy Industry, the effective control and management of power supply is an underlying challenge that keeps growing as time goes by, since non-technical losses represent significant expenses for the organization, and must be addressed as a priority.

Introduction

By Luis Fernando Sánchez Gómez.

At Prolec GE, we provide our clients with comprehensive solutions for their monitoring and control of power supply, always making every effort to optimize both connection/disconnection, and consumption monitoring processes. To do this, we have developed a smart transformer with remote measuring and disconnection capabilities to detect anomalies and improve operating costs for energy companies.

The solution involves adding a control cabinet to a single-phase pole-type transformer, which houses a maximum of 24 meters connected to the transformer phases, meeting the performance requirements described in the CFE Specifications G0100-05 [1] and NMX-J -116-ANCE-2017 [2]. In addition to covering the required number of meters, it also has the capacity to housing data processing, power and security devices.

Figure 1: Distribution of inner elements in the cabinet: meters and data management devices.

The solution adapts to the Advanced Metering Infrastructure System, through solid communication patterns. Inside the cabinet, the elements of measurement and data analysis communicate by using PLC (Power Line Carrier) technology, which simplifies the internal distribution of these elements.

Within the implementation area, the transformers are arranged in a master-slave control scheme, where communication between these units is carried out through a mesh-type network that works on a carrier frequency of 2.4 GHz. Lastly, the information collected by each monitoring system reaches the master, which then proceeds to transmit it to the control center over a 900 MHz radio frequency band, reaching distances of up to 10 km.

Our solution guarantees:

Reduction of Operating Costs
• Improving operating costs through the efficient use of service crews
• Eliminating the open secondary network (Low Voltage).

Capital Investment Reduction
• Replacement of conventional meters.

Profit Increase
• Reduction of non-technical losses

Higher User-Service Quality
• Shorter power restoration time in the event of a power outage.

Measuring System

Set of devices that perform voltage and current measurement, power calculation, data conversion and analysis, and finally sends these to the transformer network and the display module.

Home Display

Display of usage information to the user through a digital screen with unidirectional communication from the meter to the module via PLC, through the power line.

Short Range Communication

2.4 GHz radio frequency communication through a wireless mesh network of transformers, transmitting the data provided by each measuring system.

Long Range Communication

Communication via radio frequency at 900 MHz, transmitting data from the entire transformer mesh network to the substation (management center).

Display in the Management Center's Software

Display of data in the Management Center software for interpretation, based on an AMI-type data system. This generates the necessary actions for each event.

Conclusions

• Unlike typical AMI (Advanced Metering Infrastructure) systems, this system has the ability to centralize the transformer LV (Low Voltage) measuring, eliminating the open secondary network.

• This solution, since it is already part of the transformer, reduces installation times.

• With this system, data is available on the transformer electrical parameters. This can be used to compare the sum of measurements made by the user against the transformer's own measurements, identifying and alerting of possible energy theft.

• This system supports the goals of reducing non-technical losses of electrical energy in general distribution networks.

Prolec GE: Transforming Together

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