Transformer Monitoring And Control Using SYNC 2100 And SYNC 4900

Application Note

Application Description

Distribution transformers are key equipments, which are placed close to the consumer load points, catering to electrical power multiple feeders. Monitoring failure points or performance in-efficiencies (losses) of these DTs are becoming increasingly important to ensure reliable power supplies to the customers.

Why DT monitoring is required

- Critical end point of DISCOMs
- Reliability of supply
- Longer duration to identification the problems and rectification
- Exposed to severe environmental variations
- Widely varying load conditions
- Low power factors of consumer loads
- In rush currents due to prevailing faults
- Leakage of oils
- Energy auditing/loss estimations requirements

Remote monitoring of DTs and controlling of associated equipments (load break switch/circuit breakers) will enable utilities to monitor the condition and arrive at a proper maintenance plan for the equipments and also critically isolate incoming or outgoing feeders of the DTs during higher demands or operational limits (voltage/currents). The remote monitoring system contains RTUs housed inside the cubicle of DTs on floor mounted stations or installed a separate pole mounted assembly, energy meters, breaker control relay. The centralized application has two main features:

- Operation monitor: continuously monitors the system parameters and facilitates continuous operating status of the equipments, generate reports
- Emergency operation facility: In this mode, transformer OPG operated based on the pre-defined boundary condition configured in the system

Application Solution

The transformer monitoring application reads KWh, KVARh, power factor, Voltage parameters for a customisable period and analyse the transformer behavior by calculating real time efficiency, all day efficiency, copper /constant losses, demands, and voltage profiles for a period. The calculated data will be cross checked with boundary condition defined for the operators. Severity of the failure can be further analyzed to a more granular level, if transformer oil and temperature data is available from the field.

![Solution Architecture](image)

Figure 1: Solution Architecture

Feeder Remote Terminal Units (FRTUs) are required to perform data concentration, executing logic operations, and executing commands for changing tap position of the transformer. The device should have protocol capabilities as well as a wide communication media support like GPRS/ CDMA/ RF to help it to transmit remote data to control center.

SYNC 2101 is one such device that is responsible for fetching the data from multi-function transducer and also
directly from field IOs and converting the data to the IEC60870-5-104/ DNP3.0 format which the control center software can read. SYNC 2101 is also capable of controlling field devices using DO modules. DI, DO and AI cards can be chosen depending upon the application requirement.

An M2M Gateway is also required for manage remote connection of FRTU located in multiple locations in field, supporting secure VPN connections over dynamic IP, and support for GPRS/CDMA as well as 3G technologies.

SYNC 4911 M2M Gateway is used as the communication front end (CFE) for interconnecting the automation system (SCADA/DMS) LAN to public radio networks like GPRS/CDMA/UMTS without compromising on the security of the network. The M2M Gateway creates a trusted network of widely distributed FRTUs. The security is guaranteed by Open-VPN, a virtual private network achieved by creating a tunneling between sites using SSL/TLS. VPN is the term used to refer to any device that is capable of creating a semi-permanent encrypted tunnel over the public network between two private machines.

**Features**

- High end security over VPN and CIP enabled devices
- Remote configuration of the FRTU from control center.
- Transparent channel connectivity to the end devices having propriety protocols

**Products Used**

Products used for this application are:

- SYNC 2101 with GPRS/CDMA/FR modem and IO card
- SYNC 4911 M2M gateway at control center

**Advantages**

- Kalkitech M2M application ensures end to end VPN connection from Nodes to gateway apart from other solutions which offer only VPN security provided by the telecom provider.
- SYNC 4911 M2M Gateway provides virtualization support which helps applications to scale up to 10000-20000 M2M connections.
- Transparent channel concept can also be implemented for downloading the configuration and firmware of the end devices