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Intelligent Load Monitoring System of 11KV/440V Multi Distribution Transformers Using SCADA

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Abstract

Transformer gets a vital role in transmission and distribution of electric power. Reducing the failures ensures an increased chance of uninterrupted power to be supplied to consumers. Overload, Voltage fluctuations and heating up of transformers causes severe damages to the

transformers, which takes much time and a lot of expenses. Major portion of the losses in the power system networks is attributed towards the use of distribution transformers (DT). Excess thermal losses in DT become an unsolved major hazard. Only under heavy loads, the winding losses and saturation comes into consideration.

A proper monitoring scheme is designed based on the monitoring of key operating parameters of the distribution transformer. The system is intended on providing essential data regarding the wellbeing of DT. The utility system would make use of the data for optima avocation of available resources, which is DT in this case. The monitoring provides an easier approach to deal with all interruptions, from minor to the most catastrophic failure. In other words, an optimal monitoring setup to maintain the reliability of DT's.

Index Terms— **Load monitoring, on-line monitoring, Distribution transformer (DT), SCADA.**

Introduction

DT, like the other machines, proves to have a reliable operation throughout its lifetime only if operated under prescribed conditions. However overloading of DT results in unanticipated failures, which in turn results in discontinuous power to the consumers. Insufficient or ineffective cooling system provides evidence causing the DT prone to failures.

Supervisory Control And Data Acquisition (SCADA) system is made use for online monitoring of transformers in transmission and distribution networks. The main purpose of SCADA is collection and logging of data. The SCADA can be pulled out towards DT's also, but proving to be costlier.

Typically the consumer side of the single phase transformer is designed to operate at 230V AC. When the consumer side voltage is maintained more than 250V AC for a prolonged duration, subsequently there is a possibility of a risk that the damage to the due to over voltage is excessive. As a defensive measure, the primary is supplied through a relayed contact which disconnects the supply whenever the relay is energized. The data from SCADA system; namely load levels, temperature levels and voltage, are fed through a series of digital communication channels towards a primary controller for prompt action. The scheme, designed taking into account the practical difficulties, biases its objective towards a mobile based embedded system. This embedded system monitors and collects data of key markers such as winding current, oil levels and temperature of the DT. The planned on-line observance system incorporates a Global System for Mobile communications (GSM) Modem, with impartial single-chip microcontroller and set of transducers/ sensor.

Distribution transformers are currently observed manually wherever someone sporadically by visiting the transformer site at the time of maintenance and keeps track of the necessary data. This kind of monitoring cannot endow with information about intermittent overloads and heating-up of transformer oil and windings. All these factors will considerably cut back transformer life.

1. Load Monitoring

Load monitoring is performed by applying instrumentation towards the power system from the main supply to consumer end. This monitoring emphasizes on locating the key equipments and locations for monitoring. The fundamental load data obtained such comprises of voltage, current and frequency. The monitoring equipment varies for single phase system and three phase systems. For example, voltage measurement/power monitoring for single phase system and three phase system has one and three probes respectively, apart from a separate reference or ground probe.

One main difficulty faced is placing these monitoring instruments at required locations. Whenever the data is to be monitored, the instrument is connected, which is mostly kept connected to the system almost permanently. The instruments may not be able to operate at higher voltage levels. Under such circumstances, where direct connection to the facility is complex, the current and voltage values are provided through CT or PT.

The load monitoring is done regularly and the data log is maintained at an interval of 3 to 5 days, depending on the size of the system. The instrumentation is calibrated for accurate measurements over a period of 7 to 30 days depending on the deviations. The harmonics and other values can be monitored if a necessity arises. The load monitoring data with respect to the load levels is continuously mapped.

Once the data has been gathered and put together for a loading profile, a report is generated that includes:

- System Voltage
- Winding current,
- Real power, reactive power
- Harmonics, PQ problems (if required)

1.1 Needs of Electrical load monitoring

Load data is a prerequisite for planning, restructuring and dimensioning of power system at