Transformer Monitoring Systems
and Transformer Health Monitor

Bushing and CCVT Monitoring
On-Line Transformer Impedance
Partial Discharge (PD) Monitoring
DGA Monitoring
Thermal Monitor and Cooling Operation
Ground Induced Current (GIC) Monitoring
Electronic Liquid Level Gauge

*** Operation temperature: (Ambient) -55°C ... +55°C ***
Bushing and CCVT Monitoring with Optional On-Line Impedance

Bushing failures are one of the primary causes of catastrophic transformer failures. Monitoring allows Engineers and Asset Managers to detect incipient deterioration of bushing condensers before damage progresses to a dangerous level where failures can occur.

ZTZ Services offers systems for on-line continuous or local monitoring of bushings and/or CCVT’s. The systems can also be used to monitor EHV CT’s, high voltage oil-filled cables or any other equipment with a condenser and test tap.

Local systems provide the user with low-cost alternatives to continuous monitoring of bushings and CCVT’s, where power factor, capacitance and PD measurements can be taken on-line by test crews using ZTZ Services’ portable Vector test set and can still be taken without the need for a Clearance or outage. Imbalance, Reference and Comparison mode measurements work best with local measurement systems.

Continuous systems supply power factor and capacitance values for each condenser bushing and imbalance current phase and magnitude for each 3-phase set of bushings. Power factor and capacitance can be determined using the adjacent phase, comparison or reference methods, and power factor data is available with or without smoothing algorithms.

Continuous monitoring systems like the 6-Channel ZVCM-1001 and the 12-Channel ZVCM-1200 provide full-time monitoring and communications capabilities to supply bushing and/or CCVT data to the network over a wide variety of connections, protocols and controllers.

- RS-232, RS-485 Interface (RS-485 and USB on ZVCM-1200)
- TCP/IP Protocol
- DNP 3.0 / Modbus Controller

Local and continuous systems can share sensors with ZTZ Services’ TDM-3F PD monitoring system. The 12-channel ZVCM-1200 can also be connected to measure phase impedance on-line using CCVT and auxiliary CT load current inputs. Annunciator alarms can be connected with available Form-C contacts, or when integrated into the Transformer Health Monitor system, alarm alerts can be sent to key people by email.
Partial Discharge Monitoring

PD is caused by highly stressed areas due to insulation defects, movement of energized parts or design errors where low level discharges regularly occur. Some types of PD are not a problem, but other types can develop into surface tracking or insulation failure which can lead to bushing or transformer failure.

- The TDM-3F system utilizes continuous electrical measurement, and shares existing sensors with the bushing monitor
- Detects PD in the bushings and transformer
- HF and UHF frequency measurements eliminate interference from outside noise
- Smart algorithms identify the following PD types and severity:
  - Internal discharge, insulation defects near energized parts, insulation defects near grounded parts, cavities and voids, floating discharge, corona, conductive particles, surface discharge
- We also offer a portable PD monitor for fleet testing and troubleshooting

On-Line Hydrocal DGA Systems

ZTZ Services supplies all models of the MTE Hydrocal on-line DGA monitor.

- Hydrocal 1001 – Composite combustible gas monitor with high sensitivity to acetylene
- Hydrocal 1002 and 1003, Hydrogen and CO detection using membrane diffusion technology, which is preferred for FR3 applications. The 1003 also measures moisture.
- Hydrocal 1005 and 1008. These systems utilize near infrared absorption to accurately measure individual gasses with individual sensors for moisture and hydrogen.
  - The 1005 measures 5 dissolved gasses
    - H₂, CO, C₂H₂, C₂H₄ and H₂O
  - The 1008 measures 8 dissolved gasses
    - H₂, CO, CO₂, C₂H₂, C₂H₄, C₂H₆, CH₄ and H₂O
- All systems use direct mounting with a 1.5” NPT male fitting, with no need for tubing or carrier gas cylinders. The 1005 and 1008 systems employ pumped fluid ejection after testing so they can be mounted up to 2’ from the tank wall or on a drain valve when no other valve is available.
- DGA systems for OLTC monitoring and for banks of 3 single-phase transformers are under development and will be available in late 2014.
Thermal Monitor and Cooling Operation

Insulation can age rapidly and be damaged when overheating occurs. The ZTZ Services THM thermal monitor measures and reports top and bottom oil, ambient and up to 3 winding temperatures. Cooling operation can be set for fail-safe and predictive operation. It can also be set for cooling operation that is only switched on when the transformer is energized (a good feature for shell-form GSU transformers). Overload loss-of-life calculations as well as fan and pump condition monitoring are all included in one simple system.

Electronic Liquid Level Monitor

This new 21st century technology uses pressure and temperature measurements with tank and oil volume data and fluid properties to accurately calculate liquid level in any type of transformer with any type of insulating fluid. The system does not require a float assembly and the display can be mounted anywhere on the transformer for easy viewing and service. High, low and critical low oil levels can all be measured and reported with one system. In addition to normal thermal expansion and contraction, the system can detect rapid liquid loss from events like a gunshot to the radiators and issue smart alarms.

The system can also detect abnormal pressure conditions. If the conservator valve is left closed after maintenance and the transformer is re-energized, the system can issue an alarm in time to respond before the pressure relief device releases oil. It can also detect clogged dessicant breathers when they are in-need of maintenance. This will be available mid-2014.

Ground Induced Current Monitoring

Solar storms and other system disturbances that inject DC in the system can cause transformer damage and failures if not detected and corrected in time. The ZTZ Services GIC Monitor issues an alarm as soon as abnormal levels of DC are detected and provides a second level alarm when DC reaches damaging levels or high levels of harmonics are detected. The system also interfaces with the thermal monitor to detect abnormal heating and with the DGA monitor to detect elevated rates of combustible gas generation.

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