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Customer Services for Transformers

Siemens Bushing Monitoring System



Monitoring & Diagnostics

Introduction

Among the reasons for transformer outages, bushing failures rank considerably high. One reason could be that these bushings are usually tested offline to measure capacitance, dissipation factor and power factor.

With its new online Bushing Monitoring System, Siemens enables asset managers to check the condition of critical equipment such as power transformers and reactors without having to shut down facilities first. The asset condition data allows a thorough analysis and can reveal developing equipment issues before they become a problem.

Features

The new Siemens Bushing Monitoring System can be used as a standalone system, or in combination with Siemens' trusted transformer condition monitoring system. This follows the principle that it is always better to integrate multiple measurement results into an overall picture, rather than founding the analysis on measurements of individual sensors.

For ease of operation, the Siemens Bushing Monitoring System software provides alarm set-points, graphical displays and algorithm-based alarms that maximize response without triggering false alarms.

The software can be individually adapted by our engineers to suit any type of installation.

Siemens Bushing Monitoring System allows:

- Monitoring power factor/dissipation factor and capacitance at nominal voltage
- Universal applicability for each condenser bushing type and other OEMs
- High accuracy measurement by using parallel measurements of up to six bushing leakage currents
- Comprehensive online condition monitoring system for transformer and bushings
- Different versions with 3, 6, 9 or 12 bushing sensors

Benefits

- Improved scheduling of maintenance work and downtimes, repairs, adequate personnel support
- Maintenance downtimes and outage costs can be minimized
- Early detection of a degradation of bushing insulation and internal layer breakdown

Scope of work / deliverable

- Bushing sensors with connection cable
- Siemens Bushing Monitor System including mounting plate, power supply, circuit breaker, terminals and wiring
- Optional cabinet IP 55 (higher specifications available)
- On-site training courses for operation and maintenance of the systems
- Design, installation and commissioning of all necessary communications equipment to connect the bushing monitoring system to your network.



Technical details

The Siemens Bushing Monitoring System is designed to be permanently installed, monitoring the condition of condenser bushings, CVTs (capacitor voltage transformers) and free standing CTs (current transformers) as well as potential transformers. To this end, up to six leakage currents are being measured online, the power factor and capacitance values are tested, and the entire system is being monitored. The Siemens Bushing Monitoring System incorporates three measurement modes for standard and two for optional configurations:

Standard configuration with six current inputs:

- Sum of three current tests
- Adjacent phase reference test
- Phase comparison
- Optional configuration with inputs of three voltages and three currents; reference test (three bushings and three CVTs)
- Optional configuration with six voltage inputs, CVT reference test (six CVTs)

Should the sensor become disconnected from the bushing monitoring system, the adapter design prevents a harmful overvoltage developing on the bushing.

By establishing communications between the Siemens Bushing Monitoring System and Siemens Transformer Monitoring, a comprehensive transformer and bushing monitoring system is available as a package solution.

The Siemens Bushing Monitoring System has two programmable output relays with alarm changeover contacts. Its built-in programmable scheme logic, allows operators to:

- Measure AC leakage currents of fundamental harmonic (ΔC)
- Measure phase angle ($\Delta\%PF$) between two currents
- Measure phase angle ($\Delta\%PF$) between currents of adjacent phases (three-phase mode)

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Subject to change without prior notice. The information in this document contains general descriptions of the technical options available, which may not apply in all cases.

Measurements		
Measuring quantity	Range	Accuracy
Leakage current	0 ... 140 mA AC	± 1.5 % of reading
Power factor/Dissipation factor	0 ... 100 %	± 0.045 % absolute
Capacitance	100 ... 5000 pF	± 1.0 % of reading
Phase angle of imbalance current	0 ... 360°	± 1.0 % of reading
General data Siemens Bushing Monitoring System		
Supply Voltage	85 ... 264 V AC / 47 ... 63 Hz or 120 ... 370 V DC	
Power consumption	Max. 24 VA	
Dimensions	1 Data Acquisition Units (up to 6 channels) W 420 x H 595 x D 153 mm W 610 x H 686 x D 229 mm 2 Data Acquisition Units (up to 12 channels)	
Operation temperature	-40°C ... +65°C	
Output relays	Potential-free changeover contacts	
Communication	- RS-232 – screw terminals and RJ45 (proprietary protocol) - Optional DNP 3 serial or MODBUS® RTU Controller	

- Measure magnitude and phase angle of imbalance current of three Y-connected bushings
- Generate Alarm in case the measured values exceed the threshold

These analysis methods provide stable imbalance current and capacitance values, but in some cases the power factor data can be affected by temperature and power system voltage fluctuations, particularly on lower voltage bushings.

If these conditions exist, the Siemens Bushing Monitor can be supplied with smoothing algorithms to eliminate any cyclical variation in the data, or the unsmoothed data can simply be evaluated for trends rather than instantaneous data points.

Changes in bushing condition can be easily detected with either approach.

The Siemens Bushing Monitor can also be configured for comparison or reference mode analysis in addition to the full leakage current magnitude and phase angle data. These analysis modes provide the highest available power factor and capacitance accuracy without the need for data smoothing algorithms.

Using proprietary algorithms, the Siemens Bushing Monitoring System software evaluates all available analysis modes to eliminate false alarms and ensure that bushing deterioration is detected early on.

Siemens AG
Energy Management
Humboldtstr. 59
90459 Nuremberg, Germany

Customer Support Center
Phone: +49 (911) 433 78 78
Fax: +49 (180) 524 2471*
E-mail: support.energy@siemens.com

*(Charges depending on provider)

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