Siemens Bushing Monitoring System

Increased transformer reliability through transparent performance of bushings

Answers for energy.
Online condition monitoring supporting new and effective maintenance approach

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

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

Therefore, maintenance work and repairs can be scheduled accordingly, maintenance downtimes and costs can be minimized, and adequate personnel support can be provided to foster best service results.

The solution: Siemens Bushing Monitoring
The new Siemens Bushing Monitoring System can be used as a standalone system, or in combination with Siemens’ trusted transformer condition monitoring system. Follow the principle that it is always better to prevent multiple measurement results into an overall picture, rather than tracking the analyses on measurements of individual sensors.

For ease of operation, the Siemens Bushing Monitoring System software provides alarm set-values, graphical displays and alert-based alarms that maximize uptime without triggering false alarms. The software can be individually adapted to our engineers to suit any type of installation.

Functional principle
The Siemens Bushing Monitoring System incorporates three measurement modules for standard and two for optional configurations:
• Standard configuration with six current inputs:
  - Sum of three current inputs
  - Phase comparison
  - Option for smoothing with three voltages and three currents
• Optional configuration with six voltage inputs:
  - CT references (plus CT’s)

The software and adaptors are designed for bushings with grounded and ungrounded capacitor bushings to allow measurement of leakage currents of up to 140 mA AC.

The Siemens Bushing Monitoring System: your advantages
• Early detection of a degradation of bushing insulation and internal layer breakdown
• 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 measurement of up to six bushing leakage currents
• Optimized and proactive maintenance strategy reduces outage costs
• Comprehensive online condition monitoring system for transformer and bushings, in combination with a Siemens Transformer Monitoring System description

Most accurate condition analysis
For fast results, the Siemens Bushing Monitoring System offers a combination of analysis methods to provide fast and reliable determination of the actual bushing condition. For identifying changes in the bushing’s condition, bushing power factor and capacitance values are combined with power factor analysis and phase-angle analysis methods. These analysis methods provide stable insulation current and capacitance values, but in some cases the power loss 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 optical variation in the data, or the unmeasurable data can simply be evaluated between other than instantaneous data points. Changes in bushing condition can be easily detected with either approach.

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.

The Siemens Bushing Monitor can also be configured for comparison or reference-node 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.
Technical data

<table>
<thead>
<tr>
<th>Measuring quantity</th>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage current</td>
<td>0 … 140 mA AC</td>
<td>± 1.5 % of reading</td>
</tr>
<tr>
<td>Power factor/Dissipation factor</td>
<td>0 … 100 %</td>
<td>± 0.045 % absolute</td>
</tr>
<tr>
<td>Capacitance</td>
<td>100 … 5000 pF</td>
<td>± 1.0 % of reading</td>
</tr>
<tr>
<td>Phase angle of imbalance current</td>
<td>0 … 360 °</td>
<td>± 1.0 % of reading</td>
</tr>
</tbody>
</table>

General data Siemens Bushing Monitoring System

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>85 … 264 V AC/47 … 63 Hz or 120 … 370 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>max. 24 VA</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W 420 x H 595 x D 153 mm</td>
</tr>
<tr>
<td></td>
<td>W 610 x H 686 x D 229 mm</td>
</tr>
<tr>
<td>Operation temperature</td>
<td>-40 °C … +65 °C</td>
</tr>
<tr>
<td>Output relays</td>
<td>potential-free changeover contacts</td>
</tr>
<tr>
<td>Communication</td>
<td>• RS 232 – screw terminals and RJ45 (proprietary protocol)</td>
</tr>
<tr>
<td></td>
<td>• Optional DNP 3 serial or MODBUS® RTU Controller</td>
</tr>
</tbody>
</table>

Customized bushing sensors, including redundant overvoltage protection, for each kind of bushing-tap available

Scope of supply and services

Bushing Monitoring setup
The Siemens Bushing Monitoring System is available in different versions with 3, 6, 9 or 12 bushing sensors, depending on individual requirements.

Each system comprises:
- 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)

Turnkey installation and communications services
- Highly skilled, experienced service team for installation and commissioning
- Expert analysis of monitoring data and customer support
- On-site training courses for operation and maintenance of our systems
- Design, installation and commissioning of all necessary communications equipment to connect the Siemens Bushing Monitoring System to your network:
  - via MODBUS, DNP 3, Ethernet, RS485, or any other communications protocols
  - or across hard-wire, fiber optic, wireless, cellular modem or any other connections