TMDS™ Smart Monitor
Solutions for transformer life-cycle management

Answers for energy.
Selecting a transformer monitoring solution is a critical step in achieving your company’s Smart Grid asset management strategy. Siemens TMDS™ Smart Monitor is a self-contained, expert system combining multiple IEEE/ANSI-accepted engineering models with advanced rule-based logic, far exceeding existing monitoring concepts. TMDS™ Smart Monitor turns transformer monitoring data into actionable information by translating combustible dissolved gas, bushing capacitance deviation, moisture and other sensor measured data into diagnostic and prognostic messaging.

The TMDS™ Smart Monitor provides alarming using models that work with rule-based logic, derived from accepted IEEE/ANSI guidelines. Alarm messaging includes maintenance support and suggested loading recommendations should TMDS™ classify the observed deviation as severe enough that it may result in the damage or potential failure of the transformer.

Additionally the TMDS™ can perform cooling system control functions by initiating staged cooling to optimize transformer operating temperatures.

The Siemens TMDS™ Smart Monitor advantages include the following:

- Best-in-class transformer monitoring and diagnostic system
- Advanced detection of abnormal conditions
- Supports customer preferences in transformer sensing technologies
- Automatically detects bad sensor data to avoid false diagnosis
- Configurable for legacy transformers
- Can be integrated with Siemens TMDS™ to support a centralized asset management strategy.
Comprehensive data requires powerful analytical tools.

Select from a suite of analysis applications. The following Siemens specialist models are provided with TMDS™:

- **Bushing relative capacitance deviation**
  Evaluation of bushing insulation condition

- **Insulation moisture**
  Evaluation of oil moisture condition and estimated moisture in paper

- **Thermal**
  Hot spot evaluation by ANSI, IEC and Siemens proprietary methods

- **Ageing and life expectancy**
  Evaluation of relative loss of life and relative ageing by ANSI, IEC or ABNT methods

- **Cooling system monitoring**
  Evaluation of proper cooling system operation by monitoring the load current of the fan groups and oil or water flow (depending on the cooling system)

- **Conservator oil volume**
  Provides advanced notification of conservator oil volume before reaching lowest acceptable level

- **Cooling system control**
  Controls the cooling system by calculating the future hot spot as a function of the current loading, executing periodical cooling groups exercise

- **Dissolved gas-in-oil**
  Evaluation of limit values of gas generation in oil (depending on sensors installed, may include methane, ethylene, acetylene, ethane, carbon dioxide, hydrogen, oxygen and carbon monoxide). Analysis and indication of incipient faults using the Duval triangle method

- **LTC monitoring**
  Evaluation of position indication, contact wear calculation and torque for comparison with learned values.

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Duval’s analysis was performed. In case gas formation shows stability, no further action is recommended. TMDS will re-assess Duval’s analysis within 24 hours. Region of Duval’s Triangle = T2 - Thermal Fault, 200(degrees) C < T < 700 (degrees) C. Reduce load by 25 percent and re-assess transformer behavior. In case it persists, must undertake immediate internal inspection to establish cause of fault.

TMDS™ delivers decision support to the right personnel in the context of actionable information.
Siemens’ answers for transformer monitoring

Siemens provides a comprehensive suite of transformer life-cycle management solutions specifically designed to meet your needs.

**TMDS™ Smart Monitor**

TMDS™ Smart Monitor supports a distributed diagnostic strategy where responsibility for responding to alarms and providing diagnostic expertise is regionally distributed. Field teams are self-sufficient in assessing asset condition, performing tests and arriving at corrective actions to be taken.

**TMDS™**

TMDS™ supports a central diagnostic strategy where responsibility for fleet-wide asset analysis and budget preparation is centralized. Field teams are typically dispatched by central maintenance or asset management groups.

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### Differences in functionality and architecture between TMDS™ and TMDS™ Smart Monitor

<table>
<thead>
<tr>
<th>Feature</th>
<th>TMDS™</th>
<th>TMDS™ Smart Monitor</th>
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<tbody>
<tr>
<td>Provides monitoring and diagnostics for transformers in one or across multiple substations</td>
<td>X</td>
<td>Stand alone monitor for single transformer</td>
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<tr>
<td>Provides advanced detection of abnormal conditions</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Supports customer preference in sensing technologies</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Automatically detects bad sensor data to avoid false diagnosis</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Provides maintenance support and loading recommendations to address abnormal operation</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Provides overview of possible consequences (prognostics) if current trend or parameter deviation continues</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Location of historical data and diagnostic information</td>
<td>Central TMDS™ engineering server</td>
<td>Smart Monitor flash memory</td>
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<tr>
<td>Access to data and diagnostic information</td>
<td>Active monitoring remotely via customer intranet</td>
<td>Active monitoring via Smart Monitor touch screen or remotely via Smart Monitor Web server</td>
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<td>Cooling system control</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Creates and monitors statistical definition for multiple parameters</td>
<td>X</td>
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<tr>
<td>Performs correlation between multiple parameters and across multiple transformers</td>
<td>X</td>
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The TMDS™ Smart Monitor can easily be installed on new or legacy transformers from any manufacturer utilizing existing sensors

**Actionable information**
- Delivers statistically relevant abnormal operating data and alarm conditions
- Provides maintenance support to address abnormal operation
- Suggests loading recommendations through the adaptation of models using actual field condition assessment data.

**Sensing technology agnostic**
Due to the large availability of sensors in the market, TMDS™ is designed to support data acquisition from different manufacturers’ sensors.

- Supports customer preference in transformer sensing technologies
- Allows customer to incorporate appropriate sensing technology based upon transformer importance.

**Self diagnostic**
TMS™ automatically detects bad sensor data to avoid false diagnosis.

**Configurable for legacy transformers**
Legacy transformers are unique in that they each have a specific operational history. Siemens TDMS™ allows condition assessment data to be incorporated into the configuration of alarms and recommended loading to take into account the operational history of the transformer.

**Features include:**
- Active monitoring via TMDS™ Smart Monitor’s local 12” touch screen or laptop connection and passive monitoring remotely via built-in Web server
- Historical and diagnostic information that can be downloaded directly from the TMDS™ Smart Monitor and is also buffered up to 12 months
- DNP 3.0/Modbus communication options are available for SCADA-type communications.

### Variables monitored, depending on sensors installed, include:

1. Winding temperature
2. Top and bottom oil temperatures
3. Ambient temperature
4. Load current
5. Fan motor current
6. Oil flow (pump motor)
7. Moisture in oil
   - Aquaoil
   - Vaisala
8. Dissolved gas in oil
   - Multi-gas
   - Serveron TM8
   - Siemens GAS-Guard 8
   - Kelman MULTITRANS
   - Single-gas
   - Calisto
   - Hydran
9. Bushing condition
   - Doble IDD
   - HSP
10. LTC monitoring
11. Oil level

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