

Substation Monitoring & Diagnostics

Integrated System for Remote Monitoring &
Detailed Condition Assessment of Critical Assets



Advise^{IT} Asset Sentry

Analysis & Data
Management Platform

TstatTM
Transformers

CstatTM
Circuit Breakers

ABB offers an integrated suite of Condition Monitoring products that combines the latest in sensory electronics, communications, web-technology, and advanced data analysis tools to deliver a cost-effective solution for monitoring critical transformers, circuit breakers and their auxiliaries.

Designed for wide-spread use across the entire utility infrastructure, these innovative systems collect and analyze operational and condition monitoring data, and provide personnel with useful information needed to effectively assess equipment health, maximize asset performance, and optimize maintenance.

Comprehensive & Scalable Configuration for Sensor Inputs

- Unrestricted number of addressable sensors provides complete monitoring of equipment AND its auxiliaries, and scalability.
- Open architecture accepts analog or digital inputs from existing sensors & 3rd party devices (i.e. DGA & bushing monitors)

Advanced Algorithms for Expert Data Analysis

- Automated alarming & notification for early warning detection
- Configurable, rule-based algorithm engine provides detailed analysis and recommendations for problem resolution and forecasting maintenance
- Integrated condition summaries reduce time spent reviewing data

Patented Communications for Quick & Simple Installation

- Utilizes existing DC control circuits for transferring data, eliminating the need for running cables and trenching
- Installed and operational in less than a day

Integrated Web-Based System for Data Management

- Secure Internet access to condition data facilitates enterprise-wide collaboration
- Advanced decision support tools for alarming, trending, exception tracking, and condition status reporting
- Integration of online data from TstatTM/ CstatTM with other inspection, PM and PDM information (including CMMS interface capability) provides a total solution for condition monitoring and asset optimization

General Overview / Specifications

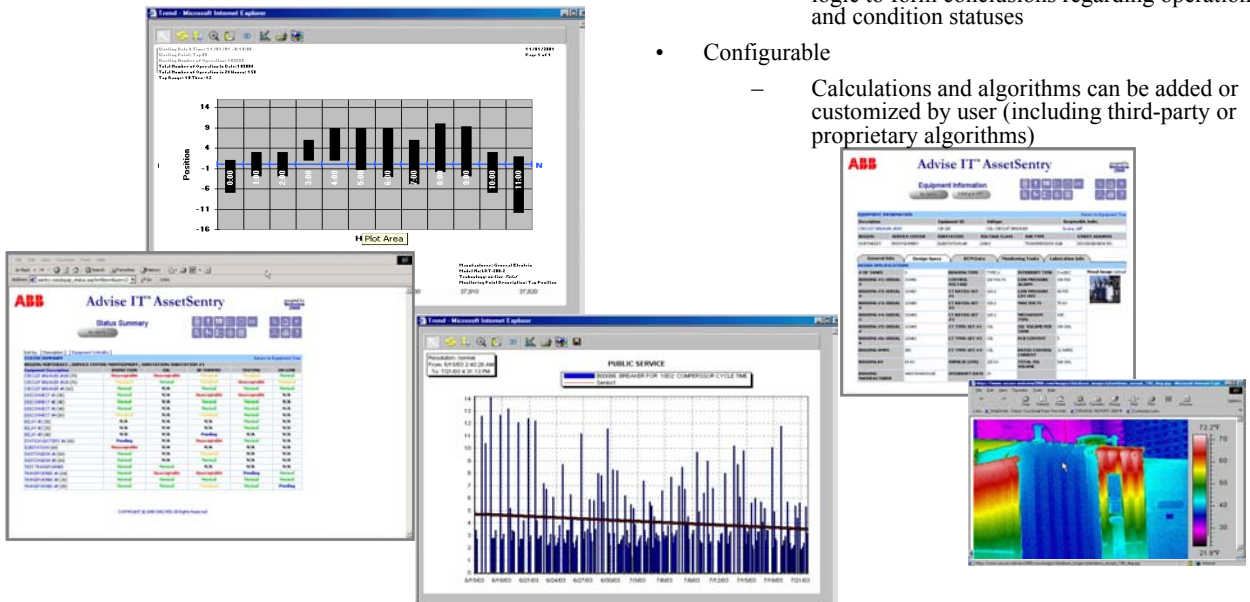


Sensors / Monitoring Points

- Unrestricted number of addressable sensors provides a more comprehensive view of equipment condition
 - Temperatures, pressures, currents, voltages, acoustic activity and position indications
 - Monitors equipment and auxiliary systems down to the component level (individual fans, pumps, compressors etc)
 - Utilizes standard off-the-shelf sensors
- Validation of sensor data with automated and manual substitution for erroneous readings
- Capable of interfacing with third-party monitoring devices, including DGA, bushing and temperature monitors

Analytical Engine

- Threshold alarming and analysis
- Calculations to determine
 - Accumulated values, averages, maximum, minimum, operational counts, data normalization
- Statistical analysis methods
 - Rate of change / performance degradation
 - Comparison to baseline values and/or industry benchmarks
 - Comparison to other components in system
- Rule-based algorithms
 - Incorporates multiple data points and business logic to form conclusions regarding operational and condition statuses
- Configurable
 - Calculations and algorithms can be added or customized by user (including third-party or proprietary algorithms)



Advanced Communications

- Utilizes power-line carrier technology across existing DC circuits to transfer data within the substation (device to substation PC)
- Phone line or Ethernet connection transfers data to the WebView 2000 central data warehouse
- Simple, low-cost installation (no cables or trenching required)
- Operational in less than one day
- Alternative communication options available

Web-Based Data Management

- Secure Internet access provides anytime/anywhere access to condition data
- Assessment of equipment condition and operational status maximizes reliability
- Early warning indication of imminent failures and possible causes reduces failure risks
- Forecasting of required maintenance reduces unnecessary maintenance & extends the time between overhauls/major maintenance
- Management of dynamic loading maximizes equipment life and reduces the risk of failure

Tstat

Transformer Monitor



- 24/7 Condition Monitoring
- Unrestricted number of sensors & points for scalability
- Patented communication provides low-cost installation
- Advanced algorithms for expert data analysis
- Automated alarming and notification provides early warning indication
- Secure Web-access to all transformer data / information
- Capability to interface and move data from 3rd party devices
- Quick and simple installation

Advanced Monitoring for Transformer Management

Tstat is a cost-effective condition monitoring system that provides a comprehensive end-to-end solution for the remote monitoring of critical transformers and their supporting systems / components (LTC's, fans, pumps, selector switches, etc.).

The system collects and analyzes key operating parameters and event data, and provides users with web-based access to real-time data, alarms, trends, condition status summaries, and reports. This coupled with an advanced analysis and algorithm engine, reduces time spent reviewing data, and provides useful recommendations for managing and optimizing transformer performance and maintenance. Primary features include:

Main Tank / Windings

- Temperature profiling & dynamic rating
- Hotspot temperature calculations
- Tracking/forecasting of over-temp conditions from nameplate
- Temperature differentials vs. tap changer

Tap Changer

- Operational profiling (tap changer position, bands of operation, operations through neutral)
- Trouble indications (non-response, hunting / searching)
- Detection of internal arcing (coking)

Cooling System Performance

- Evaluation of system performance & efficiency
- Operational profiling of pumps and fans / run times / loading
- Forecasting of over-temperature occurrences
- Pre-scheduled operation of pumps/fans to verify operational readiness

Nitrogen / Conservator System

- Indications of leakage
- Forecasting of bottle replacement

Bushings

- Current leakage / acoustic activity



Tstat - Transformer Monitor

Detailed Specifications / Typical Monitoring Points

Note: Actual points varies based on transformer type and configuration

| System/Component | Classification | Monitoring Point | Sampling | Sensor Type |
|-------------------------------|------------------|---|---------------------------------|--|
| Main Transformer (Winding) | Temperature | <ul style="list-style-type: none"> Ambient Air Temperature Average top Oil Temperature Average bottom Oil Temperature Average Overall transformer Oil Temperature | Routine Event Hourly Average | Solid state addressable / digital output temperature devices and is linear for the full range (-40 to +252 °F) |
| | Pressure | <ul style="list-style-type: none"> N₂ Tank Pressure (Transformer) N₂ Bottle Pressure | Routine Event Hourly Average | Pressure Transducer output will be 4-20 ma. |
| | Current | <ul style="list-style-type: none"> Low side A,B,C phase current High side A,B,C phase current Tertiary side A,B,C phase current | Routine Event Hourly Average | (CT) Current Transformer |
| | Bushing Activity | <ul style="list-style-type: none"> Low side A,B,C phase Bushing Leakage current Activity High side A,B,C phase Bushing Leakage current Activity Tertiary side A phase Bushing Leakage current Activity | Routine Event Hourly Counts | Activity is base on number of counts over time. |
| | Oil Level | <ul style="list-style-type: none"> Transformer Oil level Tap changer Oil level Selector tank Oil level | Alarm Event | Existing Micro switch set low level |
| | Miscellaneous | <ul style="list-style-type: none"> Mechanical Relief Valve Limit switch Sudden Pressure | Alarm Event | Existing switch |
| | Calculations | <ul style="list-style-type: none"> Transformer kW Transformer kVA Transformer MVAR Hot spot winding temperature High & Low side | Routine Event Hourly Average | Calculation |
| LTC | Temperature | <ul style="list-style-type: none"> Difference between top and bottom with main tank | Routine Event Hourly Average | Solid state addressable / digital output temperature devices and is linear for the full range (-40 to +252 °F) |
| | Position | <ul style="list-style-type: none"> Tap Changer Number of Operations Tap Changer Position Tap Changer on Position Background Activity | Routine Event | Pulse input from key phase to indicated the tap changers |
| | Motor | <ul style="list-style-type: none"> Tap Changer Average Motor Amps for an Operation Tap Changer Motor Running Time | Routine Event | (CT) Current Transformer |
| | Break | <ul style="list-style-type: none"> Tap Changer Break Amps | Routine Event | (CT) Current Transformer |
| Cooling System | Fans Motor | <ul style="list-style-type: none"> Running Current Number of Operation Highest Running Current Number of Fan Operating | Routine Event | (CT) Current Transformer |
| | Pumps Motor | <ul style="list-style-type: none"> Running Current Number of Operation Highest Running Current Number of Fan Operating Flow Switches | Routine Event | (CT) Current Transformer |
| Spare | 1-5 VDC | <ul style="list-style-type: none"> Number of Spare (100) | Routine Event | Input |
| Spare | State / On-Off | <ul style="list-style-type: none"> Number of Spare (100) | Routine Event | Input |
| Spare | RS-232 | <ul style="list-style-type: none"> Number of RS-232 (1) | Routine Event | Input |

Cstat

Circuit Breaker Monitor

Advanced Monitoring for Circuit Breaker Management



- 24/7 Condition Monitoring
- Full complement of sensors for collection of routine operating data and trip / event data
- Patented communication provides low-cost installation
- Advanced algorithms for expert data analysis
- Automated alarming and notification provides early warning indication
- Secure Web-access to all circuit breaker data / information
- Capability to interface and move data from 3rd party devices
- Quick and simple installation

Cstat is a cost-effective condition monitoring system that provides a comprehensive end-to-end solution for the remote monitoring of critical circuit breakers and their supporting systems / components (operating mechanisms, compressors, hydraulic pumps, bushings, etc.).

The system collects and analyzes key operating parameters and trip / event data, and provides users with web-based access to real-time data, alarms, trends, condition status summaries, and reports. This coupled with an advanced analysis and algorithm engine, reduces time spent reviewing data, and provides useful recommendations for managing and optimizing circuit breaker performance and maintenance. Primary features include:

Main Tank / Contacts

- Overall trip / close times on each phase
- Current on each phase at time of trip / close event
- Phase time differentials during trip / close
- Running current on each phase & trip / close coil voltages
- Duty life calculation

Operating Mechanism

- Air compressor pressures, currents, and charge times
- Hydraulic pump operations, pressures, and currents
- Duty cycle calculations for detecting leakage
- Loss of speed indications
- Loss of safety factor calculations

Gas Compressors

- Gas compressor pressures, currents, and charge times
- Duty cycle calculations for detecting leakage
- Indication of internal wear (rings, cylinder walls, pilot valves)
- Indication of external wear on filters and belts

Bushings

- Current leakage / acoustic activity

Off-Line Testing Capability

- Internal excitation and motion analyzer provides travel speed & displacement measurements during off-line testing



Cstat - Circuit Breaker Monitor

Detailed Specifications / Typical Monitoring Points

Note: Actual points varies based on circuit breaker type and configuration

| System/Component | Classification | Monitoring Point | Sampling/Event | Sensor Type |
|----------------------|----------------|---|--|--|
| Main Tank / Contacts | Current | <ul style="list-style-type: none"> A,B,C phase current (Amps) A,B,C phase current (Cumulative Amps) | Routine Event Hourly Average Trip Event Close Event | (CT) Current Transformer Contact Inputs |
| | Voltage Input | <ul style="list-style-type: none"> Trip Coil (Voltage) | Trip Event Close Event | DC Voltage Input |
| | Contacts | <ul style="list-style-type: none"> Auxiliary 52 A Finger Auxiliary 52 B Finger | | Contact Inputs |
| | | <ul style="list-style-type: none"> Trip Speed | | Calculation |
| | | <ul style="list-style-type: none"> Close Speed | | Calculation |
| | | <ul style="list-style-type: none"> Duty Life | | Calculation |
| Operating Mechanism | Temperature | <ul style="list-style-type: none"> Ambient Air Temperature Housing Air Temperature Gas Temperature | Routine Event Hourly Average | Solid state linear output IC (-40 to +252 °F) |
| | Pressure | <ul style="list-style-type: none"> Compressor or Pump Receiver Pressure (Starting Pressure/Stopping Pressure) | Routine Event Hourly Average | Pressure Transducer output will be 4-20 ma. |
| | Current | <ul style="list-style-type: none"> Compressor or Pump Motor Current (Start /Stop) | Drive Event | (CT) Current Transformer, Calculation |
| | Calculation | <ul style="list-style-type: none"> Compressor Charge Time Compressor or Pump Duty Cycle | Trip Event Close Event | Calculation |
| Gas Compressor | Temperature | <ul style="list-style-type: none"> Ambient Air Temperature Housing Air Temperature Gas Temperature | Routine Event Hourly Average | Solid state linear output IC (-40 to +252 °F) |
| | Pressure | <ul style="list-style-type: none"> Compressor Discharge Pressure | | Pressure Transducer output will be 4-20 ma. |
| | Pressure | <ul style="list-style-type: none"> Compressor Suction Pressure | | Pressure Transducer output will be 4-20 ma. |
| | Pressure | <ul style="list-style-type: none"> Starting Pressure/Stopping Pressure | Compressor Event | Pressure Transducer output will be 4-20 ma. |
| | Current | <ul style="list-style-type: none"> Compressor Motor Current (Start /Stop) | | (CT) Current Transformer, Calculation |
| | Calculation | <ul style="list-style-type: none"> Compressor Charge Time Compressor Duty Cycle | | Calculation |