QUALITROL® QTMS

Transformer Monitoring System

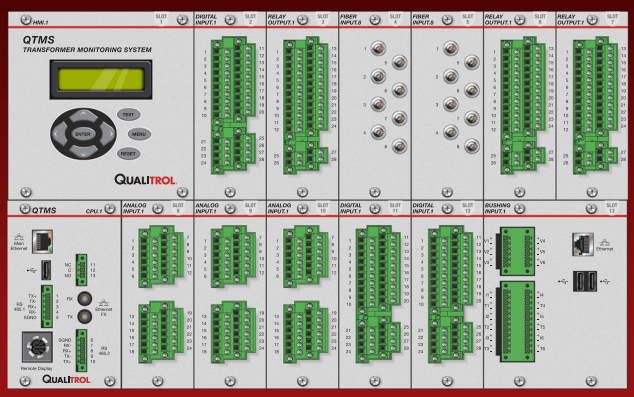
Providing the missing piece in your Condition Based Monitoring platform

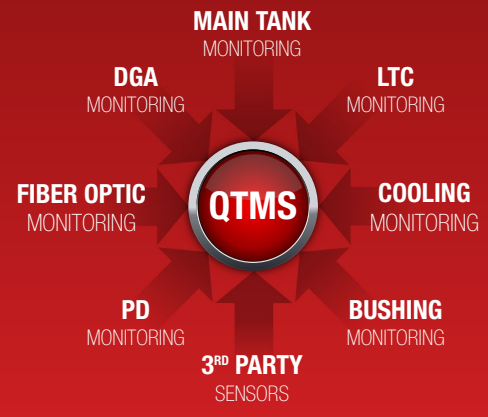
- **Modular design; full customization of monitoring parameters to meet specification**
- **Reduce installation and reconfiguration time; web based software and plug and play modules**
- **Field upgradeable; hot swappable modules with wiring on the front panel of the unit**
- **Multiple chassis sizes and mounting options to suit any application**

Product Summary

Description As industry trends continue to require higher transformer utilization with reduced operations and maintenance budgets, it is becoming vital to reliably monitor asset health in real time. Real time monitoring of important parameters such as traditional transformer main tank / LTC / cooling systems, partial discharge, dissolved gas analysis and bushing health may indicate early warning signs of potential risks to the electrical network and associated assets. Early detection of transformer abnormally may allow for a shorter issue resolution cycle and avoidance of unnecessary maintenance or even potential unplanned outages.

Application Transformer monitor for condition based, continuous online monitoring of asset health (CBM). Interfaces with a variety of Qualitrol and third party smart sensors, as well as traditional gauges to accurately measure transformer parameters vital to asset management. The QTMS utilizes a modular approach allowing for full system customization to specification. Modules are hot swappable and field upgradeable. Web based software is specifically designed for ease of unit commissioning and setup.





Bring ALL sensor data into one monitor

QUALITROL®
Defining Reliability

Asset Health

Reliably monitor asset health in real time

- Individual modules allow for complete QTMS customization
- Certain parameters such as dissolved gas analysis (DGA), partial discharge (PD), and 3rd party sensors can be brought in via communication ports

LOAD TAP CHANGER

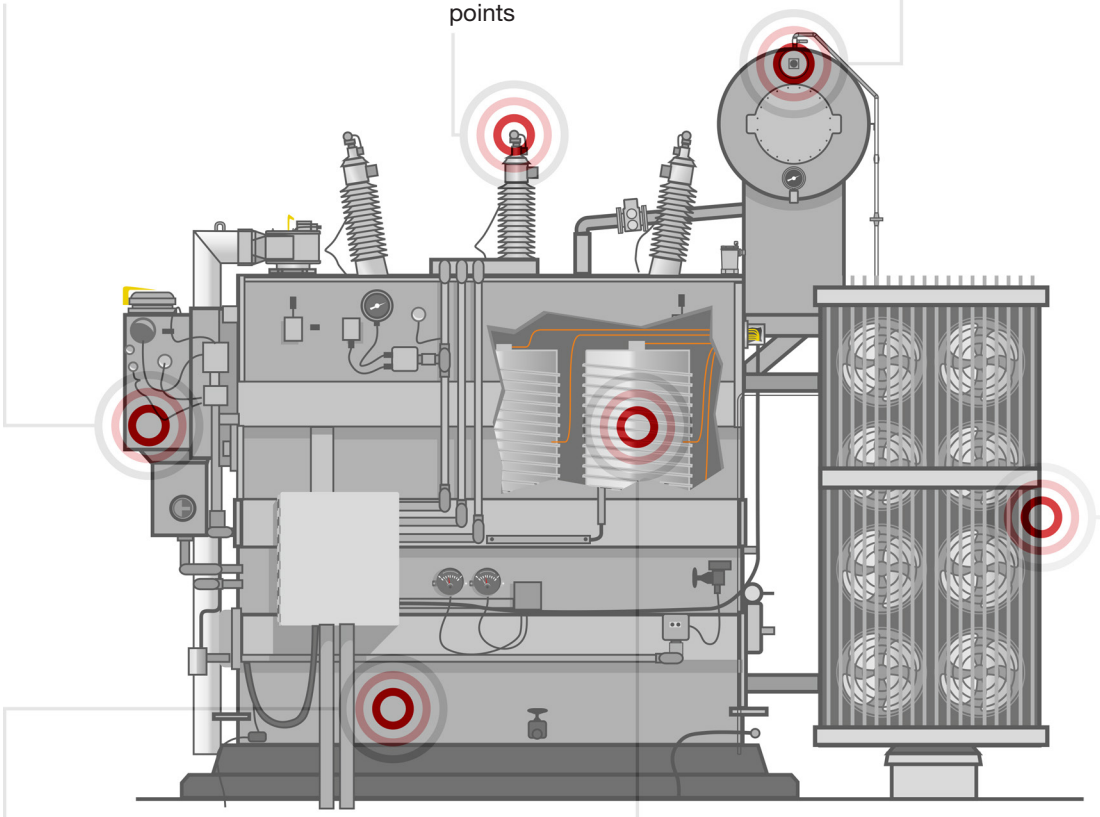
- Contact wear status
- Current position and range
- Tap run time and count
- Motor current power
- Motor actuation counter
- Alarm set points
- LTC temperature and differentials

BUSHINGS

- Capacitance current value
- Capacitance alarm set points
- Tan delta value
- Tan delta alarm set points
- Temperature value
- Temperature alarm set point
- Leakage current value and set points

CONSERVATOR TANK

- Liquid level
- Buccholz relay
- Bladder rupture alarm



MAIN TANK

- Temperature
- Pressure relief
- Rapid pressure rise relay
- Liquid level
- Smart breather
- 3rd party smart sensors

WINDINGS

- Fiber optic winding temperature
- Simulated winding temperature
- Partial Discharge (PD)
- Dissolved Gas Analysis (DGA)
- Geomagnetically Induced Current (GIC)

COOLING MONITORING

- Motor current power and motor run time
- Alarm set points
- Cooling bank temperature and differentials
- Flow indicator status
- Efficiency status

Modular Platform

Field upgradeable, hot swappable modules

- All modules are isolated from one another. Each is engineered to be hot swappable and fully field upgradeable to aid in configuration changes
- The web based interface software will automatically recognize hardware changes to reduce installation and commissioning time

DISPLAY

- Optional push button display screen
- Large backlit LCD screen
- Integrated overlay buttons

DIGITAL INPUTS

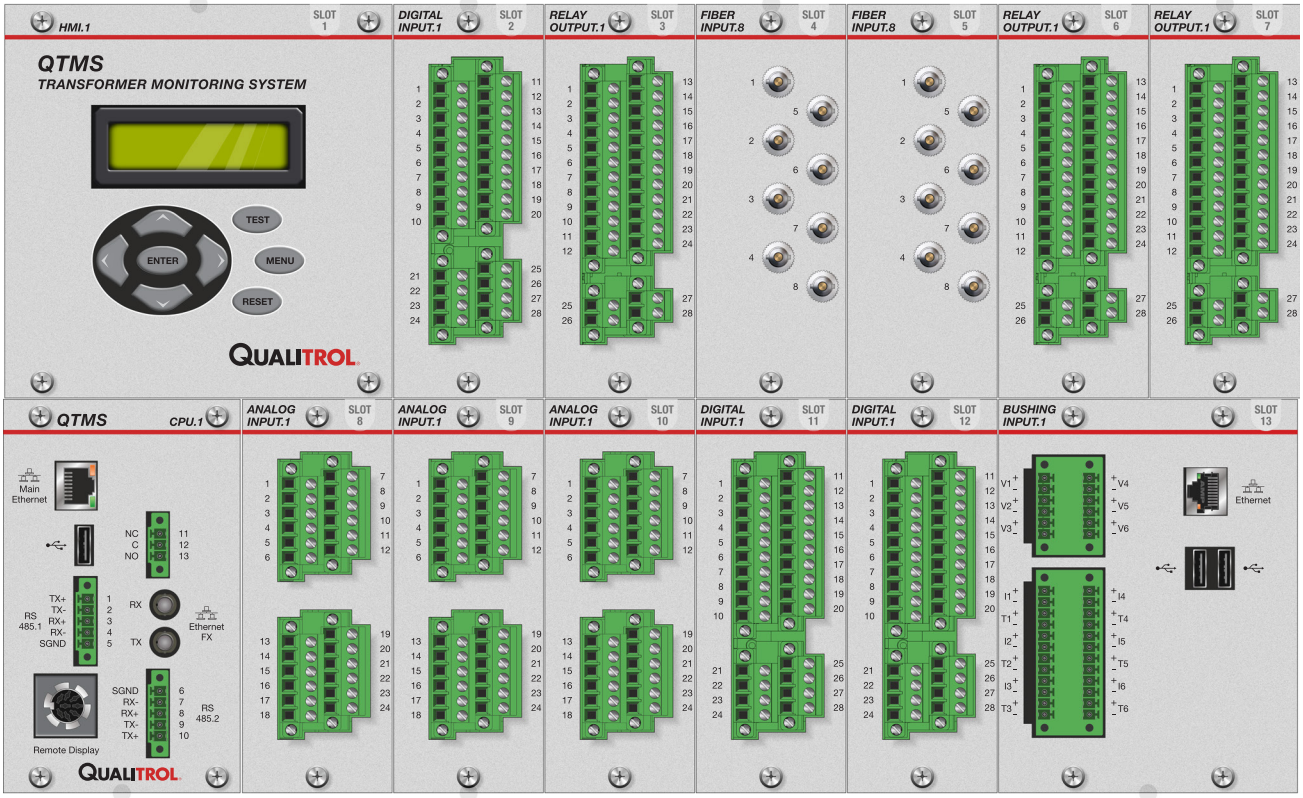
- Completely configurable per specification
- 14 digital inputs per module
- Up to 196 digital inputs per system

FIBER OPTICS

- Accurate direct winding temperature
- Accurately characterize asset aging
- Available in 4, 6, or 8 inputs

RELAYS

- Cooling system activation, alarms and customized signals
- 8 relays per module
- Up to 112 relays available per system



CPU

- USB and serial ports; IEC 61850, DNP 3.0, Modbus, IEC 60870 protocols
- Web based interface
- Universal power supply

ANALOG INPUTS

- Flexible configuration of multiple analog types
- 8 analog inputs per module
- Up to 112 analog inputs per system

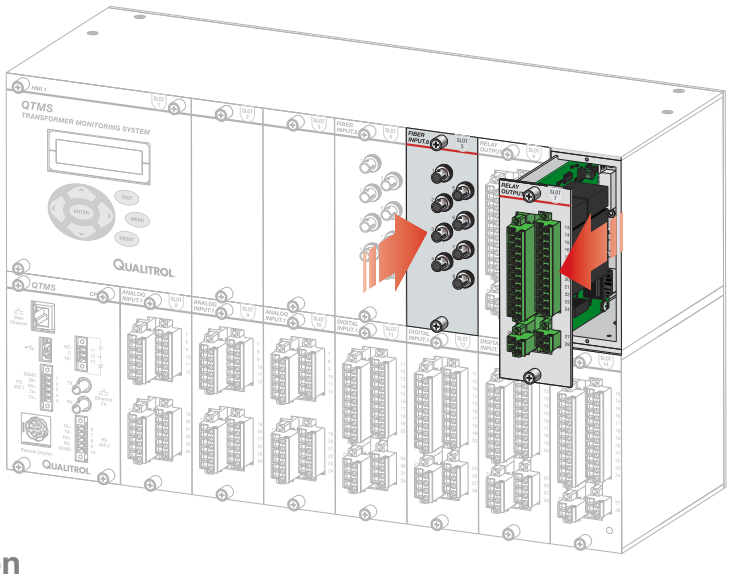
BUSHING MONITOR

- Real time monitoring of up to 6 bushing taps per module
- Detect changes in Tan Delta
- Detect changes in capacitance

Module Customization

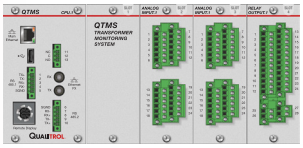
Simple Installation of Additional Monitoring Technologies

- Qualitrol offers a wide variety of modules to populate the various sizes of QTMS chassis
- Any module configuration may be chosen, and module changes are auto-recognized by the QTMS software



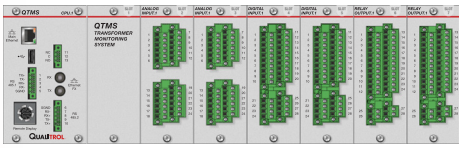
Modules easily slide in and out of the chassis to create custom configurations

Chassis Customization



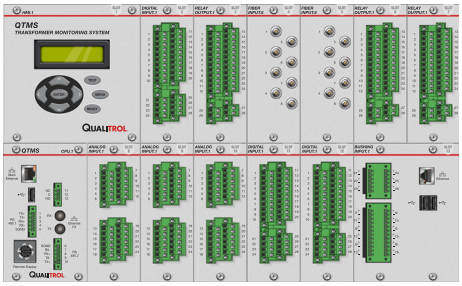
STX Chassis

- Optional remote display
- Houses up to 4 modules
- Generally used for traditional transformer monitoring or specialty applications



MTX Chassis

- Optional remote or internal display
- Houses up to 7 modules
- Generally used for traditional monitoring plus some advanced functionality such as Fiber Optics, DGA or Bushing Monitoring



LTX Chassis

- Optional remote or internal display
- Houses up to 14 modules
- Generally used for advanced CBM transformer monitoring:
  - Traditional monitoring / LTC / Cooling
  - Bushing Monitoring
  - Dissolved Gas Analysis (DGA)
  - Partial Discharge (PD)
  - Fiber Optic Temperature

Mounting options

- A variety of mounting options are available with the QTMS. Including panel mount, rack mount, and various enclosures

Product Advantages

Customization and Configuration

- Modular approach customizable to any CBM platform; traditional monitoring plus DGA, PD, Bushing Monitoring
- Choose a unique combination of monitoring parameters and health algorithms for various sized transformers
- All modules are backward compatible and can be added or subtracted at any time with simple configuration
- Fully field configurable by the end user with web based software that can be accessed on or offline
- No need for constant manufacturer technician support on installation or configuration changes!

Installation and Reliability

- Universal power supply with wiring on the front of the unit for easy assess
- Multiple mounting options and chassis sizes allow for a tailored application for any CBM platform
- Hot swappable modules and simple configuration of 3rd party sensors through multiple communication options
- Made in USA, with robust materials that are fully tested according to current electrical and security protocols

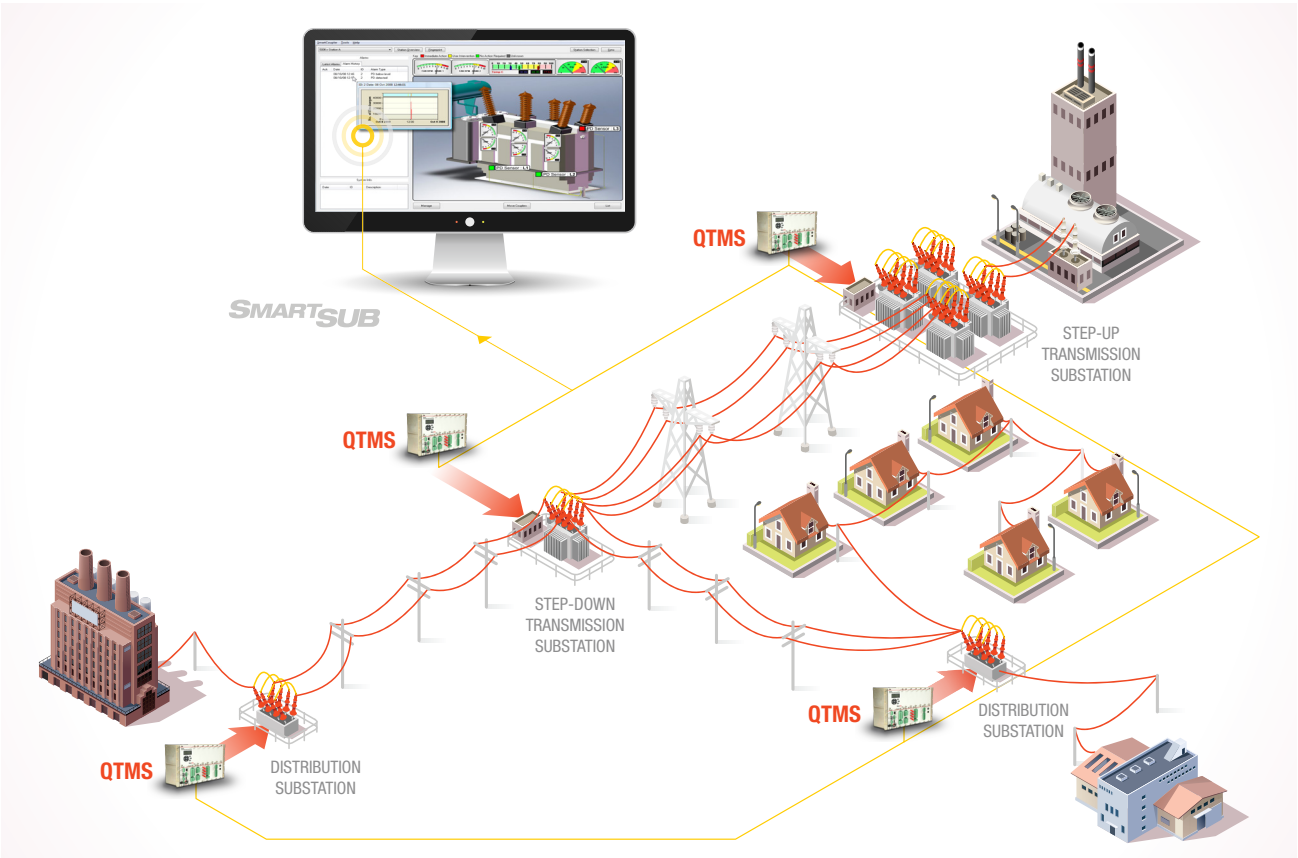
Software and Algorithms

- Web based software can be accessed locally or remotely depending on the application
- Configuration of sensors, alarms, and modules are simple and intuitive with just a few mouse clicks
- Incorporation of state of the art health assessment algorithms
- Algorithms are based on IEC and IEEE standards that are well accepted in the industry

Transformer Fleet Monitoring

SmartSUB Enterprise Software

- Bring data from multiple QTMS units into a centralized location with Qualitrol's SmartSUB enterprise software
- Show data on an individual asset level, regional view, or consolidated fleet wide look



TECHNICAL SPECIFICATIONS

Power supply	Universal	120 - 240 V AC, ±20%; 50/60 Hz; 125 - 250 V DC, ±15%; <50 W Fuse: 5.0 A / 250 V
Processor module	CPU	TX6-DL dual-core processor 10/100 Ethernet TX, RJ45 port USB-A port RS-485, 4-wire communications port, Display port for optional remote display
Comms module (integral to the CPU)	Option 1	Ethernet FX, ST connector RS-485, 4-wire communications port System status relay
User interface	Platform	Web based
Data comms	Protocols - serial	DNP 3.0 (Level3), Modbus IEC 60870-104-5
	Protocols - Ethernet	IEC 61850, IEC 60870-104-5 DNP 3.0 (Level 3), Modbus
Memory	Data logging	100 variables; store rates 1 minute to 24 hours 32 parameters at 15 second capture rate for 90 days without overwriting, with 4 GB memory space
Display	Local (optional) Remote for swing panel (optional)	Backlit LCD, 2 x 16 characters
	Controls (switches)	8 pushbutton (Navigation, Test and Reset)
Analog input module	Inputs	Measures up to 8 parameters
	Accuracy	±0.5% full scale input range
	Temperature	100 ohm platinum (Pt100) RTD; simulated winding Liquid / ambient temperature range: -40 - 120°C Winding temperature range: -40 - 200°C
	Current	Clamp-on CT, 0 - 5A, - 10A, - 20A, -100A and others available
	DC current loops	0 - 1 and 4 - 20 mA DC
	DC voltage	0 - 100 mV DC and 0 - 10 VDC
	AC voltage	0 - 140 VAC and 0 - 320 VAC; 50/60 Hz
	Potentiometer	1500 - 15,000 ohms
	Switch contact (dry)	Open / closed
	Switch contact (powered)	>80 V or >130 V open, jumper selectable; optically isolated
	Taps	0 - 1 mA DC or 4 - 20 mA DC
	Tap position	0 - 1, 0 - 5, 0 - 10, -5 - +5, -10 - +10, 0 - 125 VDC or non-powered; resistor bridges of 40 - 2500 ohm (1% acc, 100 ppm); or 0 - 1 mA DC or 4 - 20 mA DC
Digital input module	Inputs	Measures up to 14 optically isolated inputs
	Maximum voltage	250 V DC
	Threshold voltage	>75 V DC

TECHNICAL SPECIFICATIONS

Direct winding temperature	Inputs	Up to 8 fiber optic input probes
Fiber optic	Accuracy	±1°C
Output relay module	Output relays	8 Form C relays; 10 A @ 120 / 240 V AC; 10 A @ 30 V DC
	Accuracy	2 Loops; 0 - 1 mA (max resistive load 10,000 ohms) / 4 - 20mA (max resistance 500 ohms); other options available
Bushing input module	Input signals from bushing sensors	Up to 6 bushings (minimum 3 signals required) 6 x bushing current (equivalent voltage) signal 6 x temperature signal 6 x reference voltage signal Ethernet port to connect 1 OCU for partial discharge monitoring
	Measuring principal	Calculates the phase difference between leakage current and reference voltage
	General	Tan Delta / Power Factor: Accuracy better than ±0.0001 (0.1mrad in phase shift) Capacitance: Accuracy better than 0.2% Leakage current: Accuracy better than ±0.1% Reference Voltage: Accuracy better than ±0.1% Temperature compensated Tan Delta / Power Factor Integration into SmartSUB: Accuracy better than ±0.1%
Immunity	Dielectric strength	IEC 60255-5:2000; IEEE C37.90-2005
	Impulse	IEC 60255-5:2000
	Electrostatic discharge	C37.90.3 (IEEE); IEC 61000-4-2:2009
	Radiated RF	61000-6-5; IEC 61000-4-3:2010
	Fast transient, burst	IEC 60255-22-4:2008; IEC 61000-4-4:2011
	Surge	61000-6-5; IEC 61000-4-5:2005
	Capability damped oscillatory	61000-4-12
	Conducted RF	IEC 61000-4-6:2006; IEC 61000-4-6:2006
	Conducted emissions	EN 55011 Class A
	Radiated emissions	EN 55011 Class A
	Tolerance to power frequency	61000-4-8; IEC 60529:2001
Environmental	Enclosure IP rating	IP20. (Higher IP enclosure ratings available on request)
	Sinusoidal vibration	IEC 60255-21-1:1988, Class 1
	Shock and bump	IEC 60255-21-2:1988, Class 1
	Cold	IEC 60068-2-1:2007
	Damp heat, cyclic	IEC 60068-2-56
	Dry heat	IEC 60068-2-2:2007
	Operating temperature	-40°C to +72°C
	Operating temperature (Bushing module)	-20°C to +72°C
	Storage temperature	-60°C to +85°C
	Operating humidity	5 - 95% non-condensing

QUALITROL® Field Services

QUALITROL® provides on-site commissioning/start-up and comprehensive maintenance contracts to all customers worldwide. To further improve reliability, an extended warranty is available on selected products commissioned by QUALITROL®.

About QUALITROL®

Established in 1945, with continual improvement at the core of our business, QUALITROL® provides smart utility asset condition monitoring across the globe. We are the largest and most trusted global leader for partial discharge monitoring, asset protection equipment and information products across generation, transmission and distribution. At QUALITROL® we are redefining condition monitoring technology for Electric utilities assets.

QUALITROL®
Defining Reliability

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