CALISTO T1

All-in-One Condition Monitoring System to Prevent Transformer Failures

ASSESS BUSHINGS, PARTIAL DISCHARGE AND I/O FROM ONE UNIT

The Calisto™ T1 encapsulates the functionality of bushings, partial discharge and Input/Output modules in a single configurable package in a cost-effective manner. It provides a clear user interface through a built-in server and manages user access, alert setting, alert management and data visualization — bringing together data from Doble and third-party devices. Standard communication protocols include Modbus and DNP3 with optional IEC 61850, that allow data to be moved between Calisto T1 and other applications such as SCADA.

FEATURES

- The Calisto T1 can be scaled from a single component to a comprehensive transformer monitor covering partial discharge (PD), bushings, operational data that connects to Dissolved Gas Analysis (DGA) and third-party monitors.
  - ◊ PD Guard - Doble PD-Guard™ monitors partial discharge (PD) via the transformer bushings, neutral and inside the main tank; it provides local alarms and will communicate data and notifications across standard interface channels and to networked supervisory systems. Doble PD-Guard analyses PD and EMI signals in the HF, VHF and lower UHF ranges with built-in diagnostic tools.
  - ◊ IDD - Doble IDD™ bushing monitor detects deterioration in bushings, finding abnormalities in the insulation and issuing actionable alerts. It provides leakage current, phase, capacitance, power factor and harmonics analysis for up to six bushings individually. If a voltage reference is available, the Doble IDD will perform both Relative and True Power Factor to detect issues in bushings and voltage reference devices.
  - ◊ iO - Doble iO™ is a data recorder that accepts current, voltage, temperature and relay inputs and integrates and displays data from multiple sensors and sources, including load or operational data, tap position indicators and inputs from other vendor devices.

BENEFITS

- Simplify field configuration of condition monitoring installations
  - ◊ Configurable, multi-functional monitoring in a single, small enclosure
  - ◊ Works within your firewall and meets your cybersecurity regulations
  - ◊ Visualize and overlay data from multiple assets through a single UI
- Comprehensive alert management
  - ◊ Set three levels of alert on each data channel
  - ◊ Alert levels contain default values and are configurable
  - ◊ Built-in audit trail of alert generation and acknowledgement for post-event investigation
- Simplified upgrade path
- Calisto T1 allows for field upgrade of hardware so that you can start small and grow
  - ◊ For example, start with IDD bushing monitoring and add main tank PD later
- Intuitive user interface supports teamwork and investigation of alerts and asset issues

Intuitive user interface showing bushing power factor, capacitance and harmonic distortion.

T1 BASE MODULE

CPU, MEMORY AND BUSES	
Host CPU	ARMv8 1.2GHz
Memory	1 GB RAM, 32GB Flash

STORAGE
32GB eMMC Flash (upgradeable) for application and data storage

PERIPHERALS
USB 2.0
2x Isolated RS485 (Modbus, DNP3)
10/100 BaseT Ethernet (DNP3, Modbus, HTTP)
Alert LED (Status, Info, Warning, Action)
Status Relay, 240VAC 5A (Status, Info, Warning, Action)
LDC Display 4x20 and keypad
GPS 1PPS time sync (Fibre/IRIG) option
IEC 61850 option
Enclosure climate control option

ENVIRONMENTAL	
Humidity	0-95% non-condensing

TEMPERATURE*	
Operating temperature	-20°C to +50°C
Extended temperature	-40°C to +60°C
Storage temperature	-20°C to +70°C

MECHANICAL DATA	
Height	720mm / 28.4 in
Width	550mm / 21.7 in
Depth	363mm / 14.4in
Weight	51kg / 113 lbs
Construction	Coated stainless steel

POWER SUPPLY	
External supply	24 V DC @ 2 A

An optional power adapter can be supplied to suit global mains voltage.

* Temperature is extended when using a climate controlled enclosure.

Doble's condition monitoring has proven effective in identifying problems early and avoiding failures in bushings, transformers, tap changers, generators and more.

Access Calisto T1 from a PC, tablet or smartphone using a standard web browser. No proprietary software is required.

Intuitive user interface showing rising composite gas levels (solid red line) overlaid with alert limits (dotted green, yellow and red lines) and current alert state of the monitor (green, yellow and red backgrounds). The monitor has just reached ACTION (red level alert) so the background is now red.

Measurements on each channel can be configured in the user interface up to once every 10 seconds. A sampling interval appropriate to likely failure modes is recommended. Data from multiple channels on one or more assets can be overlaid for visual correlation and analysis.

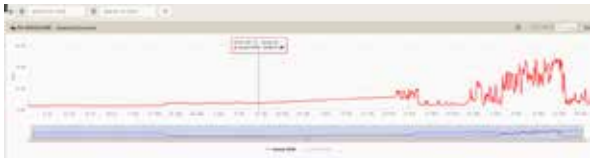
Data from three HV bushings on a 660 MVA GSU shows some rapid changes in current magnitude: up to 7% per hour may be seen and is normal at this location.

PD MONITOR

PARTIAL DISCHARGE DATA ACQUISITION	
Inputs	8 channels, multiplexed 6 built in mini-HFCTs are available for bushing monitoring; CT, UHF, VHF sensors can be connected as required.
Connector	BNC
Input impedance	50 Ω
Maximum Input	+20 dBm for reading
Dynamic range	60 dB
Detection types	Peak, quasi-peak and average detector
Sweep processing	Continuous, average, max hold and differential
RFI TUNER 1	
Bandwidth	50 kHz to 50 MHz
Resolution Bandwidth	9 kHz / 120 kHz
Noise floor	Approximately -90 dBm for peak detect or -100 dBm for average detect (RBW 9 kHz)
RFI TUNER 2	
Bandwidth	50 MHz to 1000 MHz
Accuracy	± 100 kHz
Resolution bandwidth	120 kHz / 1 MHz / 6 MHz
Noise floor	Approximately -80 dBm for peak detect or -90 dBm for average detect (RBW 6 MHz)
EMI MODE	
Bandwidth	50 kHz to 100 MHz
Resolution bandwidth	9 kHz / 120 kHz
AC SYNCHRONISATION	
Wired sync to external AC source	
MEASUREMENT MODES	
RF modes	Spectrum Oscilloscope (Time resolved) Level meter
Results output	IPwr (Integrated Power) PAPR (Peak-Average Power Ratio) PRPD (Phase Resolved PD) QIEC (IEC 60270 compliant) Quadratic rate (QR)

The PD Guard module offers eight individually configurable channels to be used with the bushing sensor, CT or UHF probes for a comprehensive view of transformer PD.

Configurable multi-functional monitoring in a single, compact enclosure.



Configurable QIEC-equivalent calibrated PD levels in a generator before and after a core rewind indicating a rise in PD from background to intermittent high levels.

BUSHING MONITOR

BUSHING DATA ACQUISITION	
Bushing current inputs	6 channels: 2 sets of 3 bushings
Voltage reference	3x instrument transformer input option
Connector	Push-in termination
Measurement method	Leakage current/voltage raw sinusoid waveform, rms current and phase
Tap Current Range	1 - 200 mA
Bushing-Bushing Isolation	>2500 V
Bushing-Host Isolation	>2500 V
Magnitude Accuracy	± 1% of reading
Phase Accuracy	0.01 degrees
Capacitance range	0-1000 pF
Power factor range	0-100%
Resolution	0.1% of input signal peak

Doble has demonstrated that bushings may fail 'gracefully' over several weeks to months, or may fail rapidly, in a few hours, with documented saves published. The Calisto T1 allows for individual alert levels for each bushing, monitoring current magnitude, phase, power factor, capacitance, harmonic distortion, using temperature correction for each bushing where available.

The Calisto T1 utilizes Relative and True Power Factor, capacitance and harmonic anaysis to quickly identify and diagnose deterioration and insulation abnormalities in both bushings and reference voltage devices.

IO CARDS

DATA ACQUISITION	
Connector	Push-in termination: 4 slots available
OPTIONS User selects any mix of 4 of the following:	
8AI - Analog In	8 channel analog input, 4-20 mA or 0-10V. Jumper selectable.
4TI - Temperature In	4 channel input, 2/3-wire PT 100
8DI - Digital In	8 channel digital input, dry or wet contact
8DO - Digital Out	8 channel digital output, sink type only

The iO Multi-Function Data Recorder is a flexible and networkable device that captures, displays and monitors data from any commonly available sensor or module.

The Calisto T1 provides the most cost effective and reliable condition monitoring for transformers. Contact your Doble representative or visit Doble.com for more information and documented bushing and transformer saves.

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