

## Technical Specifications

Application	
<p>Early detection of transformer faults using continuous monitoring of dissolved hydrogen in insulating fluids. Monitoring dissolved carbon monoxide as a key indicator of cellulose degradation (Calisto 2 only). Continuous moisture monitoring.</p>	
Performance	
Dissolved gases (H <sub>2</sub> and CO) in oil	
Measurement technology	Proprietary Morgan Schaffer cell
Gas extraction technology	Oil-immersed PTFE tubing
Lower detection limit (LDL) <sup>(1)</sup>	H <sub>2</sub> : 2 ppm CO: 25 ppm
Range	H <sub>2</sub> : 0 - 50,000 ppm CO: 0 - 100,000 ppm
Accuracy in service <sup>(2)</sup>	H <sub>2</sub> : Greater of ±2 ppm or ±5% CO: Greater of ±25 ppm or ±15%
Repeatability	H <sub>2</sub> : Greater of ±2 ppm or ±3% CO: Greater of ±25 ppm or ±10%
Resolution	H <sub>2</sub> : 1 ppm CO: 5 ppm
Step response (typical conditions)	H <sub>2</sub> : 50% in 60 minutes CO: 90% in 6 hours
Interference	H <sub>2</sub> : < 0.3% of other gases CO: < 5% from C <sub>2</sub> H <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> ; < 3% from H <sub>2</sub> , CH <sub>4</sub> , C <sub>2</sub> H <sub>6</sub>
<p>(1) All ppm in mineral oil. (2) Accuracy in service throughout product lifetime (see Interference). Reference: Morgan Schaffer ISO 17025 accredited laboratory and True North/Atlantis oil standards.</p>	
Moisture (H <sub>2</sub> O) in oil	
Measurement technology	Oil-immersed RS sensor
Detection range	2 ppm - saturation, 2 - 100% RS
Accuracy (ref: Morgan Schaffer ISO/IEC 17025 accredited laboratory and <b>Atlantis</b> oil standards)	±3 ppm or ±3% RS
Repeatability	±2 ppm or ±2% RS
Resolution	1 ppm, 1% RS
Step response (typical conditions)	95% in 20 minutes
Reliability	
Power interruption protection	250 ms advanced power loss
Expected operating life (EOL)	> 15 years

<b>Operation</b>	
Operating temperature range	-40 to 55 °C standard -50 to 55 °C with Insulation Kit. Cold Start -50 °C
Storage temperature range	-40 to 75 °C
Operating oil temperature range	-40 to 120 °C
Oil temperature and enclosure conditioning temperature	35 °C +/- 0.1 °C
Oil pressure operation range	Full vacuum to 40 psi
Operating humidity range	0 - 100% RH
Storage humidity range	5 - 95% RH, non-condensing
Elevation range	Up to 4,000 m. Atmospheric pressure compensation.
<b>Construction</b>	
Width x height x depth	381 x 483 x 325 mm (15 x 19 x 12.8 in.)
Weight	22.7 kg / 50 lbs
Enclosure	Stainless steel 304 gauge 16, lockable
Oil circulation	Anti-cavitation reciprocating pump, 10 - 60 ml/min.
Oil flow monitoring	Proprietary Morgan Schaffer system
Oil lines (standard)	3/8 in. OD copper with brass compression fittings
Air bubble elimination	Proprietary Morgan Schaffer system: Intelligent Bubble Trap
Enclosure temperature conditioning	Thermoelectric feedback
Oil temperature conditioning	Passive heat exchanger / thermoelectric feedback
Cooling	Forced air convection
Safety protection	Thermal cut-off fuse, rated at 77 °C over-current protection fuse
Oil sampling	External quick-connect port with sampling accessories
<b>Installation</b>	
Calibration	No calibration required
Maintenance	Annual visual inspection
Electrical entry holes (standard)	4 x 22.2 mm / 0.875 in. diameter
Commissioning time	2 hours
Mounting	Shock mounts. MS Calisto Mounting Stand recommended
Power requirements	100 - 240 VAC +10% <sup>1)</sup> , 50 - 60Hz, 1Ø 100 - 220 VDC +10% <sup>1)</sup> 320W, Client disconnect breaker 10A minimum
Power conductor size	Max. 2.05 mm /AWG 12
Oil supply line length	1.5 - 10.5 m /5 - 35 ft
Oil return line length	1.5 - 10.5 m /5 - 35 ft

1) As per IEC/EN 61010

<b>Communication and Data</b>	
Front panel interface	112 x 16 pixel display, vacuum fluorescent, day/night, screen-saver, 3 weather-proof UV-resistant buttons
Local temporary connection	USB 2.0 (cable provided), RS-232
Permanent connection	RS-485 (1,500 V isolation) 2 Ethernet (1,500 V isolation) 3 independent H <sub>2</sub> , CO and H <sub>2</sub> O analog outputs, 4-20 mA (1,500 V isolation) Oil temperature analog input, 4-20 mA (1,500 V isolation)
Communication	SCADA: Modbus, DNP3 Level 2, Optional IEC 61850 kit integrator: MSSP (Morgan Schaffer System Protocol)
Measurement alarms	Programmable dual-level and trend alarms for H <sub>2</sub> , CO and H <sub>2</sub> O
Alarm relays	5 NO/NC contacts, configurable for set-up, self-test and measurement alarm conditions (250VAC, 5A; 48VDC, 1.5A)
Measurement interval	8 readings/day, validated H <sub>2</sub> and CO 1 reading/minute, continuous H <sub>2</sub> 1 reading/5 seconds, continuous H <sub>2</sub> O
Data storage	3,000 (1 year)
<b>Interface Software</b>	
Calisto Manager™	English, French, Simplified and Traditional Chinese  Local and remote Calisto configuration, maintenance, data downloads and diagnostic downloads  Tracking network of Calisto, Calisto 2, Calisto 5, and/or Calisto 9 monitors  Database of Calistos, transformers and measurements.
Platforms	Windows XP / Vista / Windows 7 / Windows 8 / Windows 10
DGA data management and diagnostics	<b>Inside View</b> software integrates DGA data from monitors and portable analyzers with laboratory oil quality data. Diagnostic tools for fleetwide transformer health management (sold separately).
<b>Regulatory</b>	
CE marking	Low Voltage Directive 2006/95/EC EMC Directive 2004/108/EC WEEE Directive 2012/19/EC RoHS Directive 2011/65/EC
EMC (Electromagnetic Compatibility)	IEC/EN 61326 IEC/EN 61000-6-5 FCC part 15 (US) IEC/EN 61850-3 Class A, ICES-003 (Canada)
Electrical safety	IEC/EN 61010 IEC/EN 60255-27
Ingress protection	IEC/EN 60529, IP56
Mechanical	IEC 60255-21-1, Class 1 (Vibration) IEC 60068-2-27 (Shock) IEC 60255-21-3 (Seismic)
<b>Shipping</b>	
Gross weight	30.8 kg / 67.8 lbs
Packaging (H x W x D)	508 x 584 x 470 mm (20 x 23 x 18.5 in.)

## Standard Package

Calisto DGA Monitor with brass oil fittings.  
1 x Calisto Manager interface software CD  
1 x Calisto Manager User Guide  
1 x Calisto/Calisto 2 Installation and Operation Manual  
1 x Quick-Connect Oil Sampling Tube  
4 x Stainless Steel Shock Mount Assembly (85 Shore A)  
2 x Copper Tubing -  $\frac{3}{8}$  in. OD x 25 ft (7.6 m)  
2 x Brass Elbow One-Lok® Tube Fitting,  $\frac{3}{8}$  in. x  $\frac{1}{2}$  in. NPT (Male)  
4 x Ferrules One-Lok® Brass,  $\frac{3}{8}$  in. tube  
1 x Thermal Fuse: 77 °C  
1 x USB Cable A-B Full Rated 6 ft (1.8 m) long

## Options (may be purchased as factory installed)

IEC 61850 Ethernet communication kit  
Insulation kit (for -50 to 55 °C operation)  
Ethernet outdoor connectivity Kit  
USB outdoor connectivity kit  
Optical Ethernet card  
Stainless steel oil fittings

## Accessories

Morgan Schaffer Calisto Mounting Stand  
Interchangeability kit (to facilitate future exchange with Calisto 5 or Calisto 9)  
Calisto precision oil temperature probe (4-20 mA)  
Stainless steel braided flexible oil lines  
Low-temperature insulated oil lines  
Quick-connect dust plug  
Cellular modem (Ethernet)  
Sun shield to reduce thermal load in extreme hot environments  
Breather drain kit for humid environments  
Enclosure locking block

## Warranty

Morgan Schaffer's Calisto and Calisto 2 monitors are backed by a 30-month standard warranty. 1,2 and 3 year extended warranty available.

## Service and Support

On-site commissioning service and on-site maintenance program available upon request.

## Note

Continuous research and improvements may result in specification or appearance changes at any time.

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### Accreditation

Morgan Schaffer is ISO 9001:2015 certified.

Morgan Schaffer laboratory is ISO/IEC 17025:2017 accredited by the ANSI-ASQ National Accreditation Board for the tests listed on its scope of accreditation. Morgan Schaffer is also ISO 17034:2016 accredited by the ANSI-ASQ National Accreditation Board for the production of reference materials listed on its scope of accreditation.

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