

Technical Specifications

Application

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.

Performance

Dissolved gases (H₂ and CO) in oil

Measurement technology	Proprietary Morgan Schaffer cell
Gas extraction technology	Oil-immersed PTFE tubing
Detection range	H ₂ : 2 - 50,000 ppm CO: 25 - 100,000 ppm
Accuracy (ref: Morgan Schaffer ISO/IEC 17025 accredited laboratory and True North oil standards)	H ₂ : Greater of ±5 ppm or ±5% CO: Greater of ±25 ppm or ±15%
Repeatability	H ₂ : Greater of ±3 ppm or ±3% CO: Greater of ±25 ppm or ±10%
Resolution	H ₂ : 1 ppm CO: 5 ppm
Step response (typical conditions)	H ₂ : 50% in 60 minutes CO: 90% in 6 hours
Interference	H ₂ : < 0.3% of other gases CO: < 5% from C ₂ H ₂ , C ₂ H ₄ ; < 3% from H ₂ , CH ₄ , C ₂ H ₆

Moisture (H₂O) 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 Atlantis 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

Operation	
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 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.
Construction	
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
Installation	
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% ¹⁾ , 50 - 60Hz, 1Ø 100 - 220 VDC +10% ¹⁾ 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

Communication and Data	
Front panel interface	112 x 16 pixel display, vacuum fluorescent, day/night, 3 weather-proof UV-resistant buttons
Local	USB 2.0 port (cable provided)
Permanent connection	RS-485 port (1,500 V isolation) RS-232 port (1,500 V isolation) 2 Ethernet ports (1,500 V isolation) 3 independent H ₂ , CO and H ₂ 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 ₂ , CO and H ₂ O
Alarm relays	5 NO/NC contacts, configurable for set-up, self-test and measurement alarm conditions (250VAC, 5A; 48VDC, 1.5A)
Data update	8 readings/day, validated H ₂ and CO 1 reading/minute, continuous H ₂ 1 reading/5 seconds, continuous H ₂ O
Data storage	3,000 (1 year)
Interface Software	
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	Inside View software integrates DGA data from monitors and portable analyzers with laboratory oil quality data. Diagnostic tools for fleetwide transformer health management (sold separately).
Regulatory	
CE marking	Low Voltage Directive 2006/95/EC EMC Directive 2004/108/EC WEEE Directive 2002/96/EC, amended 2003/108/EC RoHS Directive 2002/95/EU
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)
Shipping	
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

Brass shipping kit
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)
50 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

IEC 61850 Ethernet Communication Kit
Insulation Kit (for -50 to 55 °C operation)
Ethernet Outdoor Connectivity Kit
Fiber Optic Ethernet

Accessories

Stainless Steel fittings and hoses
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 flex lines
Quick-connect dust plug
900 MHz radio modem (RS-485)
2.4 GHz radio modem (RS-485)

Warranty

Morgan Schaffer's Calisto and Calisto 2 monitors are backed by a 30-month standard warranty.

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.

Accreditation

Morgan Schaffer is ISO/IEC 17025:2005 accredited by the Standards Council of Canada for the tests listed on the scope of accreditation. Morgan Schaffer USA accreditation is forthcoming.
Morgan Schaffer is certified ISO 9001:2008

www.morganschaffer.com

 **MORGAN®
SCHAFER** | Accuracy is
Everything.

Comparison Table

	Calisto	Calisto 2	Calisto 5	Calisto 9
Hydrogen (H ₂)	✓	✓	✓	✓
Carbon monoxide (CO)		✓	✓	✓
Methane (CH ₄)			✓	✓
Acetylene (C ₂ H ₂)			✓	✓
Ethylene (C ₂ H ₄)			✓	✓
Ethane (C ₂ H ₆)				✓
Carbon dioxide (CO ₂)				✓
Oxygen (O ₂)				✓
Nitrogen (N ₂)				✓
SF ₆ gas (Model C900S)				✓
Moisture	✓	✓	✓	✓
Programmable alarming	✓	✓	✓	✓
Oil flow monitoring	✓	✓	✓	✓
Compatible mounting	✓	✓	✓	✓
3-hour sampling	✓	✓	✓	✓
1-hour sampling			✓	✓
Real-time on hydrogen	✓	✓		
All Duval Triangle* gases			✓	✓
All DGA Diagnostic* gases				✓
DNP3 & Modbus	✓	✓	✓	✓
IEC 61850 protocol (optional)	✓	✓	✓	✓
CE marked-FCC compliant	✓	✓	✓	✓
IP 56 enclosure	✓	✓	✓	✓

*Additional software required, such as Morgan Schaffer's Inside View.

Accreditation

Morgan Schaffer is ISO/IEC 17025:2005 accredited by the Standards Council of Canada for the tests listed on the scope of accreditation. Morgan Schaffer USA accreditation is forthcoming. Morgan Schaffer is certified ISO 9001:2008

www.morganschaffer.com

**MS MORGAN®
SCHAFFER** | Accuracy is
Everything.