

## Technical Specifications

Models C501 and C901

Application										
Online monitoring of fault gases, air components and moisture in transformer insulating fluids.										
Technology										
Gas measurements	Proprietary chromatographic method									
Gas extraction	Oil-immersed Teflon® tubing									
Moisture measurements	Oil-immersed relative saturation (RS) sensor									
Communications	Electrical isolation rated for substation environments									
Performance										
	H <sub>2</sub>	CO	CH <sub>4</sub>	C <sub>2</sub> H <sub>2</sub>	C <sub>2</sub> H <sub>4</sub>	C <sub>2</sub> H <sub>6</sub>	CO <sub>2</sub>	O <sub>2</sub>	N <sub>2</sub>	H <sub>2</sub> O
Lower detection limit (LDL)	ppm <sup>1)</sup>									2 ppm, or 2% RS
	0.5	10	0.2	0.2	0.2	0.2	15	500	2,000	
Range <sup>1)</sup>	ppm									Saturation, or 100% RS
	0 - 20,000	0 - 30,000	0 - 100,000	0 - 100,000	0 - 200,000	0 - 200,000	0 - 100,000	0 - 100,000	0 - 150,000	
Accuracy <sup>2)</sup>	(LDL plus X% of reading) ppm									3 ppm, or 3% RS
	X=5	X=5	X=5	X=5	X=5	X=6	X=5	X=15	X=15	
Repeatability	(LDL plus Y% of reading) ppm									2 ppm, or 2% RS
	Y=3	Y=3	Y=3	Y=3	Y=3	Y=4	Y=3	Y=10	Y=10	
Resolution at LDL	ppm									1 ppm, or 1% RS
	0.5	2	0.2	0.2	0.2	0.2	5	100	1,000	
Measurement interval	User configurable: 80, 160 and 240 minutes. Conditional cycle on alarm.									6 seconds
Step response (typical)	In 80 minutes: 95% H <sub>2</sub> ; 90% CO, CH <sub>4</sub> , CO <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> ; 80% C <sub>2</sub> H <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , C <sub>2</sub> H <sub>6</sub>									95% in 20 minutes
Shaded area applies to Calisto 901 only; 1) All ppm in mineral oil; 2) Reference: Morgan Schaffer ISO 17025 accredited laboratory and True North/Atlantis oil standards.										
Reliability										
Gas management	Continuous monitoring of carrier and calibration gas pressure to detect and report gas leak errors and to predict cylinder replacement time									
Enclosure and oil temperature conditioning	Improves measurement accuracy and extends the lifetime of internal components									
Power interruption protection	250 ms advanced power loss system									
Expected operating life (EOL)	> 15 years									
Operation										
Operating temperature range	-50 to +55 °C; cold start -50 °C									
Storage temperature range	-40 to +75 °C									
Operating oil temperature range	-40 to +120 °C									
Operating oil pressure range	Full vacuum to 40 psi									
Operating humidity range	0 - 100% RH									
Storage humidity range	5 - 95%, non-condensing, with caps installed on the carrier gas inlet and outlet of the monitor									
Elevation range	Up to 4,000 m									

<b>Construction</b>	
<b>Width x height x depth</b>	Instrument: 610 x 489 x 337 mm (24 x 19 x 13.3 in.)
<b>Weight</b>	Instrument: 45 kg / 99 lbs
<b>Enclosures</b>	Instrument: 304 S.S., gauge 16, lockable Carrier gas manifold: 304 S.S., gauge 14, lockable option
<b>Oil circulation</b>	Anti-cavitation reciprocating pump, 10 - 60 ml/min.
<b>Oil flow monitoring</b>	Proprietary Morgan Schaffer system with low flow error
<b>Oil lines</b>	3/8 in. OD stainless steel
<b>Air bubble elimination</b>	Proprietary Morgan Schaffer system: Intelligent Bubble Trap
<b>Enclosure temperature conditioning</b>	Thermoelectric feedback
<b>Oil temperature conditioning</b>	Passive heat exchanger plus thermoelectric feedback
<b>Cooling</b>	Forced air
<b>Equipment protection</b>	Thermal cut-off fuse (77 °C), over-current mains fuse
<b>Oil sampling installation</b>	External quick-connect port plus sampling accessories
<b>Installation</b>	
<b>Calibration</b>	On-board NIST traceable calibration gas, automatic calibration, aluminum cylinder. Note: Not compatible with earlier models C500, C500B, C900 & C900B
<b>Carrier gas requirements</b>	99.9999% He, 3600 psi maximum
<b>Maintenance</b>	Visual inspection every 12 months Carrier gas replacement every 48 months Calibration gas replacement every 48 months
<b>Electrical entry holes (standard)</b>	5 x 22.2 mm / 0.875 in. diameter
<b>Commissioning time</b>	5 hours installation, plus 4 - 12 hours before first readings
<b>Mounting</b>	Shock mounts. MS Calisto Mounting Stand recommended
<b>Power requirements (no selection required)</b>	100 - 240 VAC ±10% <sup>4)</sup> , 50 - 60Hz, 1Ø, 350W 100 - 220 VDC ±10% <sup>4)</sup> , 350W / 10 A minimum client disconnect breaker
<b>Power conductor size</b>	Max. 2.05 mm / AWG 12
<b>Oil supply line length</b>	1.5 - 10.5 m / 5 - 35 ft
<b>Oil return line length</b>	1.5 - 10.5 m / 5 - 35 ft
<b>Communication and Data</b>	
<b>Front panel interface</b>	English and French  256 x 64 pixel display, vacuum fluorescent, day/night, screen-saver Three weatherproof, UV resistant buttons  Menu functions for readings, alarms, databank, set-up and maintenance
<b>Communication</b>	SCADA: Modbus, DNP3 Level 2, Optional IEC 61850 kit Time Synchronization: SNTP HTTP: Calisto Web Server Integrator: MSSP (Morgan Schaffer System Protocol)
<b>Local communication port</b>	USB 2.0 (cable provided)
<b>Isolated communication ports (5 kV impulse, 2.6 kVAC)</b>	RS-485, RS-232, 2 x copper Ethernet, *See options
<b>Isolated analog ports (5 kV impulse, 2.6 kVAC)</b>	1 assignable 4-20 mA input, *See options
<b>Measurement alarms</b>	Programmable dual-level and trend alarms for all readings
<b>Relay outputs (250VAC, 5A; 48VDC, 1.5A)</b>	5 NO/NC contacts assignable for set-up, self-test and measurement alarm conditions, *See options
<b>Data storage</b>	8 years
<b>Self diagnostics</b>	192 error codes with intuitive descriptions and recommended client actions

4) As per IEC/EN 61010

<b>Interface Software</b>	
<b>Calisto Manager™</b>	<p>English, French, Simplified and Traditional Chinese</p> <p>Local and remote Calisto configuration, maintenance, data downloads and diagnostic downloads</p> <p>Tracking network of Calisto, Calisto 2, Calisto 5, and/or Calisto 9 monitors</p> <p>Database of Calistos, transformers and measurements.</p>
<b>Platforms</b>	Windows XP / Vista / Windows 7 / Windows 8 / Windows 10
<b>DGA data management and diagnostics</b>	<p><b>Inside View</b> software integrates DGA data from monitors and portable analyzers with laboratory oil quality data.</p> <p>Diagnostic tools for fleetwide transformer health management (sold separately).</p>
<b>Regulatory</b>	
<b>CE marking</b>	<p>Low Voltage Directive 2006 / 95 / EC</p> <p>EMC Directive 2004 / 108 / EC</p> <p>WEEE Directive 2012 / 19 / EC</p> <p>RoHS Directive 2011 / 65 / EC</p>
<b>EMC (Electromagnetic Compatibility)</b>	<p>IEC/EN 61326</p> <p>IEC/EN 61000-6-5</p> <p>IEC/EN 61850-3</p> <p>FCC part 15 (US)</p> <p>Class A, ICES-003 (Canada)</p>
<b>Electrical safety</b>	<p>IEC/EN 61010</p> <p>IEC/EN 60255-27</p>
<b>Ingress protection</b>	IEC/EN 60529, IP 56
<b>Shipping</b>	
<b>Gross weight</b>	<p>Instrument: 56 kg / 124 lbs</p> <p>Standard accessories: 9 kg / 20 lbs</p>
<b>Packaging dimensions</b>	<p>Instrument: 775 x 700 x 521 mm (30.5 x 27.5 x 20.5 in.)</p> <p>Standard accessories: 560 x 510 x 270 mm (22 x 20 x 10.5 in.)</p>
<b>Options (may be purchased as factory installed)</b>	
	<p>IEC 61850 Ethernet communication kit</p> <p>Ethernet outdoor connectivity kit (copper)</p> <p>Optional client communication cards (choose 2 maximum per Calisto);</p> <ul style="list-style-type: none"> <li>• Optical Ethernet card: Multimode, SC connector, 100BASE-FX, 1300 nm</li> <li>• 4-20mA card: 10 outputs plus 2 inputs (5 kV impulse, 2.6 kVAC)</li> <li>• Relay card: 5 NO/NC outputs (250 VAC, 5A; 48 VDC, 1.5A)</li> </ul>
<b>Accessories</b>	
	<p>Morgan Schaffer Calisto Mounting Stand</p> <p>Calisto precision oil temperature probe (4-20mA)</p> <p>All metal stainless steel flexible oil lines</p> <p>Low-temperature insulated oil lines</p> <p>Calisto isolation valves</p> <p>Radio modem (RS-485)</p> <p>Cellular modem (Ethernet)</p> <p>Sun shield to reduce thermal load in extreme hot environments</p> <p>Breather drain kit for humid environments</p>
<b>Warranty</b>	
<p>Morgan Schaffer's Calisto 5 and Calisto 9 monitors are backed by a 30-month standard warranty. 1,2 and 3 year extended warranty available.</p>	
<b>Service and Support</b>	
<p>On-site commissioning service and on-site maintenance program available upon request.</p>	
<b>Note</b>	
<p>Continuous research and product improvements may result in specification or appearance changes at any time.</p>	

## Comparison Table

	Calisto	Calisto 2	Calisto 501	Calisto 901
Hydrogen (H <sub>2</sub> )	✓	✓	✓	✓
Carbon monoxide (CO)		✓	✓	✓
Methane (CH <sub>4</sub> )			✓	✓
Acetylene (C <sub>2</sub> H <sub>2</sub> )			✓	✓
Ethylene (C <sub>2</sub> H <sub>4</sub> )			✓	✓
Ethane (C <sub>2</sub> H <sub>6</sub> )				✓
Carbon dioxide (CO <sub>2</sub> )				✓
Oxygen (O <sub>2</sub> )				✓
Nitrogen (N <sub>2</sub> )				✓
Moisture	✓	✓	✓	✓
Programmable alarming	✓	✓	✓	✓
Oil flow monitoring	✓	✓	✓	✓
Compatible mounting	✓	✓	✓	✓
180 minute measurement interval	✓	✓		
80, 160, 240 minutes measurement intervals			✓	✓
Real-time 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.

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### Accreditation

Morgan Schaffer is certified ISO 9001:2008.

Morgan Schaffer laboratory is ISO/IEC 17025:2005 accredited by the ANSI-ASQ National Accreditation Board for the tests listed on its scope of accreditation. Morgan Schaffer is also ISO Guide 34:2009 accredited by the ANSI-ASQ National Accreditation Board for the production of reference materials listed on its scope of accreditation.

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