Calisto 5
5 fault gases - moisture

Calisto 9
complete DGA - moisture

ACCURACY BY DESIGN

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_2	CO	CH_4	C_2H_2	C_2H_4	C_2H_6	CO_2	O_2	N_2	H_2O
Lower detection limit (LDL)	ppm[1]									2 ppm, or 2% RS
	0.5	10	0.2	0.2	0.2	0.2	15	500	2,000	
Range[1]	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[2]	(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	200	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_2; 90% CO, CH_4, CO_2, O_2, N_2; 80% C_2H_2, C_2H_4, C_2H_6									95% in 20 minutes

Shaded area applies to Calisto 9 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 ºC; cold start -50 ºC
Storage temperature range	-40 to +75 ºC
Operating oil temperature range	-40 to +120 ºC
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

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Construction

Width x height x depth	Instrument: 610 x 489 x 337 mm (24 x 19 x 13.3 in.)
Weight	Instrument: 45 kg / 99 lbs
Enclosures	Instrument: 304 S.S., gauge 16, lockable Carrier gas manifold: 304 S.S., gauge 14, lockable option
Oil circulation	Anti-cavitation reciprocating pump, 10 - 60 ml/min.
Oil flow monitoring	Proprietary Morgan Schaffer system with low flow error
Oil lines	⅜ in. OD stainless steel
Air bubble elimination	Proprietary Morgan Schaffer system: Intelligent Bubble Trap
Enclosure temperature conditioning	Thermoelectric feedback
Oil temperature conditioning	Passive heat exchanger plus thermoelectric feedback
Cooling	Forced air
Equipment protection	Thermal cut-off fuse (77 °C), over-current mains fuse
Oil sampling installation	External quick-connect port plus sampling accessories

Installation

Calibration	On-board NIST traceable calibration gas, automatic calibration, aluminum cylinder. Note: Not compatible with earlier models C500, C500B, C900 & C900B
Carrier gas requirements	99.9999% He, 3600 psi maximum
Maintenance	Visual inspection every 12 months Carrier gas replacement every 48 months Calibration gas replacement every 48 months
Electrical entry holes (standard)	5 x 22.2 mm / 0.875 in. diameter
Commissioning time	5 hours installation, plus 4 - 12 hours before first readings
Mounting	Shock mounts. MS Calisto Mounting Stand recommended
Power requirements (no selection required)	100 - 240 VAC ±10% [4] , 50 - 60Hz, 1Ø, 350W 100 - 220 VDC ±10% [4] , 350W / 10 A minimum client disconnect breaker
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

Communication and Data

Front panel interface	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
Communication	SCADA: Modbus, DNP3 Level 2, Optional IEC 61850 kit Time Synchronization: SNTP HTTP: Calisto Web Server Integrator: MSSP (Morgan Schaffer System Protocol)
Local communication port	USB 2.0 (cable provided)
Isolated communication ports (5 kV impulse, 2.6 kVAC)	RS-485, RS-232, 2 x copper Ethernet, *See options
Isolated analog ports (5 kV impulse, 2.6 kVAC)	1 assignable 4-20 mA input, *See options
Measurement alarms	Programmable dual-level and trend alarms for all readings
Relay outputs (250VAC, 5A; 48VDC, 1.5A)	5 NO/NC contacts assignable for set-up, self-test and measurement alarm conditions, *See options
Data storage	8 years
Self diagnostics	192 error codes with intuitive descriptions and recommended client actions

4) As per IEC/EN 61010

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 2012 / 19 / EC RoHS Directive 2011 / 65 / EC
EMC (Electromagnetic Compatibility)	IEC/EN 61326 IEC/EN 61000-6-5 IEC/EN 61850-3 FCC part 15 (US) Class A, ICES-003 (Canada)
Electrical safety	IEC/EN 61010 IEC/EN 60255-27
Ingress protection	IEC/EN 60529, IP 56

Shipping

Gross weight	Instrument: 56 kg / 124 lbs Standard accessories: 9 kg / 20 lbs
Packaging dimensions	Instrument: 775 x 700 x 521 mm (30.5 x 27.5 x 20.5 in.) Standard accessories: 560 x 510 x 270 mm (22 x 20 x 10.5 in.)

Options (may be purchased as factory installed)

	IEC 61850 Ethernet communication kit Ethernet outdoor connectivity kit (copper) Optional client communication cards (choose 2 maximum per Calisto); • Optical Ethernet card • 4-20mA card: 10 outputs plus 2 inputs (5 kV impulse, 2.6 kVAC) • Relay card: 5 NO/NC outputs (250 VAC, 5A; 48 VDC, 1.5A)

Accessories

	Morgan Schaffer Calisto Mounting Stand Calisto precision oil temperature probe (4-20mA) All metal stainless steel flexible oil lines Low-temperature insulated oil lines Calisto isolation valves Radio modem (RS-485) Cellular modem (Ethernet) Sun shield to reduce thermal load in extreme hot environments Breather drain kit for humid environments

Warranty

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.

Service and Support

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

Note

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

Comparison Table

	Calisto	Calisto 2	Calisto 5	Calisto 9
Hydrogen (H_2)	✓	✓	✓	✓
Carbon monoxide (CO)		✓	✓	✓
Methane (CH_4)			✓	✓
Acetylene (C_2H_2)			✓	✓
Ethylene (C_2H_4)			✓	✓
Ethane (C_2H_6)				✓
Carbon dioxide (CO_2)				✓
Oxygen (O_2)				✓
Nitrogen (N_2)				✓
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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