

Preliminary Technical Specifications

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	Isolation on all ports rated for substation environments

Performance

	H ₂	CO	CH ₄	C ₂ H ₂	C ₂ H ₄	C ₂ H ₆	CO ₂	O ₂	N ₂	H ₂ O
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	
Top of range ²	ppm									Saturation, or 100% RS
	20,000	30,000	100,000	100,000	200,000	200,000	100,000	100,000	150,000	
Accuracy ³	± (LDL plus X% of reading) ppm									± 3 ppm, or ± 3 %RS
	X=5	X=15	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=10	Y=3	Y=3	Y=3	Y=4	Y=3	Y=10	Y=10	
Resolution	ppm									1 ppm, or 1 %RS
	0.5	5	0.2	0.2	0.2	0.2	5	200	1,000	
Measurement interval	User configurable: 3 hours standard mode, 1 hour fast mode, daily measurement of high-range O ₂ and N ₂									6 seconds
Step response (typical)	95% in 3 hours									95% in 20 minutes

Grey color is Calisto 9 only, 1) all ppm in mineral oil, 2) including daily measurements at high range, 3) Reference: Morgan Schaffer ISO 17025 certified laboratory

Reliability

Power interruption protection	250 ms advanced power loss system
Expected operating life (EOL)	> 15 years

Operation

Operating temperature range	-50 to +55 °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% RH, non-condensing
Altitude range	Up to 4,000 m

Construction

Width x Height x Depth	Instrument: 502 x 489 x 337 mm (19.8 x 19 x 13.3 in), Carrier gas manifold: 213 x 292 x 122 mm (8.4 x 11.5 x 4.8 in), plus mounting flanges
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Weight	Instrument: 35 kg / 75 lbs Carrier gas manifold: 5 kg / 11 lbs
Enclosures	Instrument: 304 S.S., gauge 16, lockable Carrier gas manifold: 304 S.S., gauge 14, lockable
Oil circulation	Anti-cavitation reciprocating pump, 10-60 ml/min.
Oil flow monitoring	Proprietary Morgan Schaffer system
Oil lines	3/8" OD stainless steel
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	External quick-connect port plus sampling accessories
Installation	
Calibration	On-board NIST traceable calibration gas, automatic calibration
Carrier gas requirements	99.9999% He
Maintenance	Visual inspection each 12 months Carrier and calibration gas replacement each 24 months
Electrical entry holes (standard)	6 x 22.2 mm / 0.875 in diameter
Commissioning time	5 hours installation, overnight stabilization, 4 hours commissioning
Mounting	Shock mounts. MS Calisto Mounting Stand recommended
Power requirements	100 - 240 VAC, 50-60 Hz, 350 W, 1 ϕ
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 controls	256 x 64 pixel display, vacuum fluorescent, day/night 3 weatherproof, UV resistant buttons
Front panel interface	Menu driven functions for readings, alarms, databank, setup, and maintenance
Communication protocols	MSSP (Morgan Schaffer Systems Protocol), Modbus, DNP3 Level 1, Optional IEC 61850 kit
Local communication port	USB 2.0 (cable provided)
Isolated communication ports (5 kV impulse, 2.6 kVac)	RS-485, RS-232, Ethernet
Isolated analog ports (5 kV impulse, 2.6 kVac)	10 assignable 4-20 mA outputs (5 for Calisto 5) 3 assignable 4-20 mA inputs

Measurement alarms	Programmable dual-level and trend alarms for all readings
Relay outputs (5A, 240V)	10 NO/NC contacts (5 for Calisto 5) assignable for setup, self-test and measurement alarm conditions
Data storage	3 years
Interface Software	
Calisto Manager™	Local and remote configuration, maintenance and data downloads for Calisto 5 and Calisto 9 Tracking of multiple Calisto ⁴ , Calisto 2, Calisto 5, Calisto 9 monitors Database of transformers, Calistos, and tracked data
Platforms	Windows 98 / 2000 / NT / XP / Vista / 7
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 IEC/EN 61850-3 FCC part 15 (US) Class A, ICES-003 (Canada)
Electrical Safety	IEC/EN 61010 IEC/EN 60255-27
Degree of protection	IEC/EN 60529, IP 56
Shipping	
Gross Weight	Instrument: 40 kg / 90 lbs Standard accessories: 10 kg / 22 lbs
Packaging	Instrument: 600 x 584 x 410 mm (24 x 23 x 16 in) Standard accessories: 510 x 510 x 254 mm (20 x 20 x 10 in)
Options	
	Morgan Schaffer Calisto Mounting Stand Calisto Precision Oil Temperature Probe (4-20mA) Dissolved SF ₆ monitoring and alarms (Calisto 9 only) IEC 61850 Ethernet communication kit 900 MHz radio modem over RS-485 2.4 GHz radio modem over RS-485 Ethernet outdoor connectivity kit Quick-connect dust plug Extended warranty up to 3 years Morgan Schaffer on-site maintenance program On-site commissioning assistance
4) Newer version only	

Warranty and Support

1-year factory warranty (standard)
Morgan Schaffer worldwide agent network for sales and support

Note

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

	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 (optional)				√
Moisture	√	√	√	√
Programmable alarming	√	√	√	√
Oil flow monitoring	√	√	√	√
Compatible mounting	√	√	√	√
Sampling rate – every 3 hours	√	√	√	√
Real-time on hydrogen	√	√		
Duval Triangle ready			√	√
Full diagnostic ready				√
DNP3-Modbus	√	√	√	√
IEC 61850 (optional)	√	√	√	√
CE marked-FCC compliant	√	√	√	√
IP 56 enclosure	√	√	√	√
Commissioning time	2 hours	2 hours	4 hours	4 hours

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Morgan Schaffer is ISO/IEC 17025:2005 accredited by the Canadian Standards Council for all its oil testing activities.
Morgan Schaffer is also compliant to ISO 9001 : 2008

