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DATASHEET

OPT100-OPTIMUS

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VAISALA

OPT100 Optimus™ DGA Monitor

For power transformers



Advanced DGA monitoring

- Maintenance-free operation without consumables
- Intuitive user experience
- Smart analysis tools
- Oil sampling with vacuum gas extraction
- Long-term measurement stability through autocalibration and IR reference measurement
- Total gas pressure detects air leaks without oxygen sensors
- Robust mechanics
- Easy installation
- Manufactured in Vaisala's cleanroom
- Optional O_2 and N_2 measurement

Vaisala OPT100 Optimus™ DGA Monitor is the solution for safe-guarding critical transformers in harsh environments. It delivers out-of-the-box performance, eliminates false alarms, and gives you long-term, stable measurements for all fault gases.

Prevent transformer failure

Over 50 percent of serious power transformer faults can be detected and severe failures prevented ahead of time with the right online monitoring tools. Vaisala OPT100 Optimus™ DGA Monitor is robust and intuitive to use with real-time, trouble-free fault gas monitoring. Optimus™ is the culmination of decades of experience, extensive research, and it builds on customer needs. Made with safety and reliability in mind, it is ready for the most demanding operating environments.

Intuitive and smart design

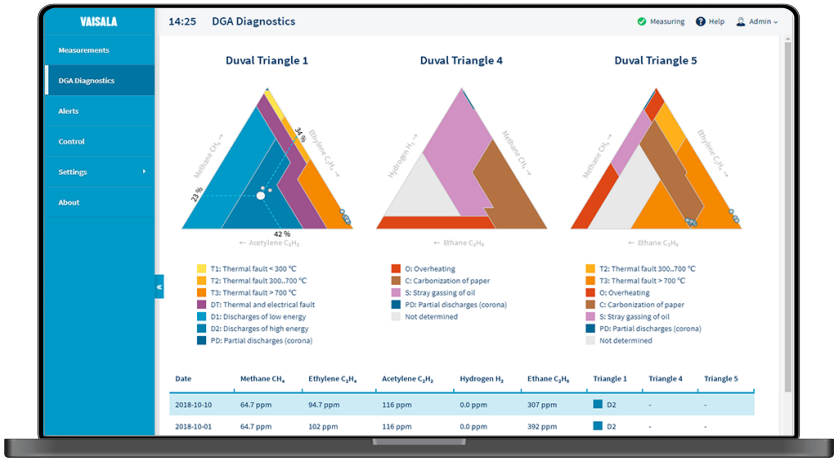
The web-based user interface eliminates the need for additional software. Optimus™ can be connected to an existing control and monitoring system using digital communication and relays, or used as a standalone monitoring device. And in case of a disturbance such as a power outage, self-diagnostics enable automatic self-recovery. Optimus™ can be installed in less than 2 hours: connect oil, power, and data – and you're set.

Reliable data – no false alarms

With autocalibration and IR reference measurement, Optimus™ provides reliable gas trending data at all times. Vacuum gas extraction eliminates fluctuation caused by oil temperature or pressure, and the hermetically sealed and protected optics prevent sensor contamination. Moisture and hydrogen are measured directly in the oil with our capacitive thin-film polymer HUMICAP® sensor and solid-state sensors. The IR sensor is based on Vaisala core measurement technology and components manufactured in our own cleanroom. With the data, you can make critical operational decisions.

Robust construction

Stainless steel pipes, IP66-rated housing, as well as a magnetic drive gear pump and valves bring ensure performance and durability – from the arctic to the tropics. Optimus™ has no consumables to service or replace.

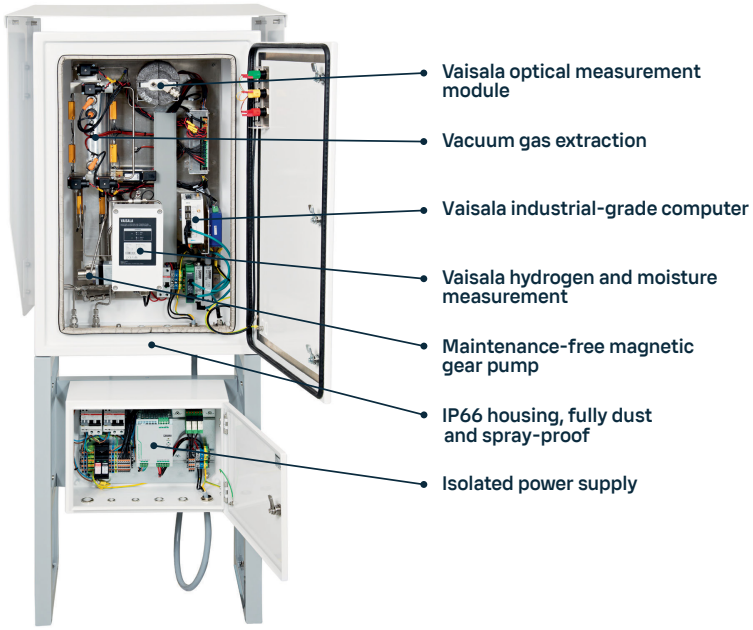


Air leak detection using total gas pressure

Oxygen accelerates the aging of transformers, potentially cutting years from their operational life. Optimus™ DGA Monitor measures the total dissolved gas pressure of the sampled oil volume and detects any air leaks on sealed transformers even without oxygen sensors. In case of an air leak into the transformer's tank, the majority of the dissolved gases are nitrogen and oxygen, and the proportion of fault gases in the pressure value is negligible. The pressure trend of the dissolved gasses gives a reliable indication of a leak, as nitrogen is the dominant component, and it is not formed or consumed in reactions inside the transformer. With the optional oxygen sensor, Optimus™ DGA Monitor can also detect if there is abnormal oxidation active that is consuming oxygen in the transformer.

DGA diagnostics with Duval Triangles

The publicly available and commonly used dissolved gas analysis method for transformer fault diagnostics purposes, Duval Triangles (IEC 60599, Annex B), is available as an optional feature. The user interface displays the progression of data points from the past year overlaid on top of Duval Triangles.



Technical data

Measurement specification

Parameter [1]	Range	Accuracy [2] [3]	Repeatability [3]
Methane (CH_4)	0–10 000 ppm_v	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Ethane (C_2H_6)	0–10 000 ppm_v	±10 ppm or ±5 % of reading	10 ppm or 5 % of reading [4]
Ethylene (C_2H_4)	0–10 000 ppm_v	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Acetylene (C_2H_2)	0–5000 ppm_v	±0.5 ppm or ±5 % of reading	1 ppm or 5 % of reading
Carbon monoxide (CO)	0–10 000 ppm_v	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Carbon dioxide (CO_2)	0–10 000 ppm_v	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Hydrogen (H_2)	0–5000 ppm_v	±15 ppm or ±10 % of reading	15 ppm or 10 % of reading
Moisture [5] (H_2O)	0–100 ppm_w [6]	±2 ppm [7] or ±10 % of reading	Included in accuracy
Oxygen (O_2) [8]	0–50 000 ppm_v	±200 ppm or ±10 % of reading	Included in accuracy
Nitrogen (N_2) [8]	0–150 000 ppm_v	±5000 ppm or ±15 % of reading	Included in accuracy
Total gas pressure	0–2000 hPa	±10 hPa or ±2 % of reading	10 hPa or 5 % of reading

1) *ppm values are defined as µl/l according to IEC 60567 standard conditions.*
2) *Accuracy specified is the accuracy of the sensors during calibration gas measurements.*
3) *Whichever is greater.*
4) *Repeatability of ethane measurement is specified with averaging of five measurements.*
5) *Measured as relative saturation (%RS).*
6) *Upper range limited to saturation.*
7) *Calculated ppm value is based on average solubility of mineral oils.*
8) *Optional parameter.*

Measurement operation

Measurement cycle duration	1–1.5 h (typical)
Response time for fault gases (T63)	One measurement cycle [1]
Warm-up time until first measurement data available	Two measurement cycles
Initialization time to full accuracy	Two days
Data storage	At least 10 years [2]
Expected operating life	> 15 years

1) *Three cycles for ethane and hydrogen.*
2) *Data storage may run out of space after 20 years of measurements. To keep the old data, it is recommended to download it every 10 years.*

Field performance

Parameter	Typical variance to laboratory DGA [1] [2]
Acetylene (C_2H_2)	±1 ppm or ±10 % of reading
Hydrogen (H_2)	±15 ppm or ±15 % of reading
Other gases (CH_4, C_2H_6, C_2H_4, CO, CO_2)	±10 ppm or ±10 % of reading
Moisture (H_2O)	±2 ppm or ±10 % of reading

1) *Compared with gas chromatography result from an oil sample considering also laboratory uncertainty. Performance of the gas-in-oil measurement may also be affected by oil properties and other chemical compounds dissolved in oil.*
2) *ppm values are defined as µl/l according to IEC 60567 standard conditions.*

Calculated parameters

Total dissolved combustible gases (TDCG)	Combined total of H_2, CO, CH_4, C_2H_6, C_2H_4, and C_2H_2
24 h average	Available for single gases, moisture, TDCG, and total gas pressure
Rate of change (ROC)	Available for single gases and TDCG for 24 h, 7 d, and 30 d periods
Gas ratios [1]	Available ratios: • CH_4/H_2 • C_2H_2/C_2H_4 • C_2H_2/CH_4 • C_2H_6/C_2H_2 • C_2H_4/C_2H_6 • CO_2/CO • O_2/N_2

1) *Calculated from 24 h average values. See standard IEC 60599.*

Power supply

Operating voltage	OPTPSU1: 100–240 V AC, 50–60 Hz, ±10 % OPTPSU2: 110–220 V DC, ±10 %
Overvoltage category	III
Maximum power consumption	500 W
Typical power consumption at +25 °C (+77 °F)	100 W

Outputs

RS-485 interface	
Supported protocols	Modbus RTU, DNP3 (optional feature)
Galvanic isolation	2 kV RMS, 1 min
Ethernet interface	
Supported protocols	Modbus TCP, HTTP, HTTPS, DNP3 (optional feature), IEC 61850 (optional feature)
Galvanic isolation	4 kV AC (50 Hz, 1 min)
Relay outputs	
Number of relays	3 pcs, normally open (NO) or normally closed (NC), user- selectable
Trigger type	Gas alert with user-selectable limits
Max. switching current	6 A (at 250 V AC) 2 A (at 24 V DC) 0.2 A (at 250 V DC)
Auxiliary device interface	
Maximum power	48 W
Voltage output	24 V DC
User interface	
Interface type	Web-based user interface, can be operated with standard web browsers

Mechanical specifications

Oil fitting	Stainless steel Swagelok® fitting for 10 mm (0.39 in) outer diameter tubing.
Max. length of oil pipe to transformer for mineral oil	Max. 10 m (33 ft) with 7 mm (0.28 in) inner diameter tubing [1] Max. 5 m (16 ft) with 4 mm (0.15 in) inner diameter tubing
Max. length of pipe to transformer for ester liquid	Max. 10 m (33 ft) with 8 mm (0.31 in) inner diameter tubing
Housing material	Marine aluminum (EN AW-5754) (DGA Monitor), stainless steel AISI 316 (OPTPSU)
Installation options	Ground Mounting Set, Wall Mounting Set, Antivibration Wall Mounting Set

1) *Bigger pipe volume will increase response time.*

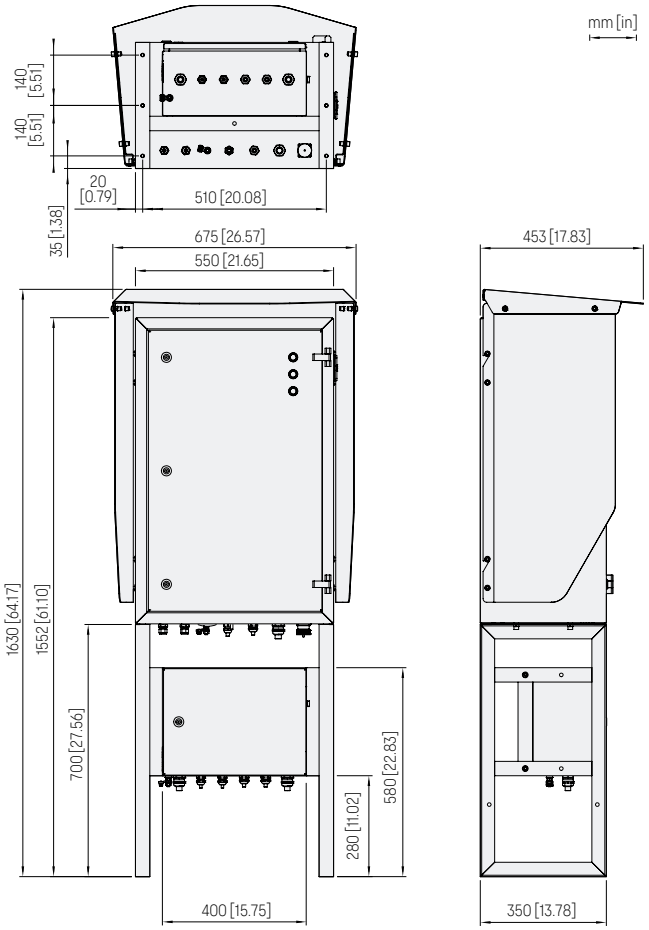
Operating environment

Transformer liquid type [1]	Mineral oil or ester liquids
Required minimum fire point of insulation liquid [2]	+125 °C (+257 °F)
Transformer oil pressure at oil inlet	Max. 2 bar (absolute) continuous Burst pressure 20 bar (absolute)
Transformer insulation liquid temperature at oil inlet	Max. +100 °C (+212 °F) Min. +0 °C (+32 °F) for ester liquids Min. temperature for mineral oil depends on the pour point of the mineral oil.
Ambient humidity range	0–100 %RH, condensing
Ambient temperature range in operation	−40 ... +55 °C (−40 ... +131 °F)
Storage temperature range	−40 ... +60 °C (−40 ... +140 °F)
IP rating	IP66

1) Selected when ordering the device.
2) "The fire point [of transformer oil] is normally approximately 10 °C [18 °F] higher than the closed flash point." Heathcote, Martin J. The J & P Transformer Book. 13th ed. Elsevier, 2007.

Compliance

EU directives and regulations	EMC Directive (2014/30/EU) Low Voltage Directive (2014/35/EU)
	OPT100 is specifically designed to be installed as part of another type of equipment that is excluded from the RoHS directive (2011/65/EU) scope.
EMC immunity	EN 61326-1, industrial environment IEC 61000-6-5, class 4
EMC emissions	FCC 47 CFR 15, section 15.107, class A ISED ICES-003, section 5(a)(i), class A
Safety	IEC/EN/UL/CSA-C22.2 61010-1
Environmental	IEC 60068-2-1 IEC 60068-2-2 ISO 6270-1:2017, constant humidity condensation atmosphere, C5 ISO 9227:2017, salt fog, C5 IEC 61010-1:2010/AMD1:2016, pollution degree 4 (outdoor), 3 (industrial area), 2 (device internal)
Compliance marks	CE, China RoHS, EAC, RCM



Dimensions with Ground Mounting Set

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www.vaisala.com

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