



# 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

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

### Prevent transformer failure

**There is nothing worse than an unplanned outage. Lost revenue, damage to your reputation and brand – all of it avoidable. 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 – there are no false alarms, no maintenance and no consumables required. Optimus™ is the culmination of decades of experience, extensive research, and it builds on customer needs. Made with the ultimate safety and reliability in mind, ready for the most demanding operating environments.**

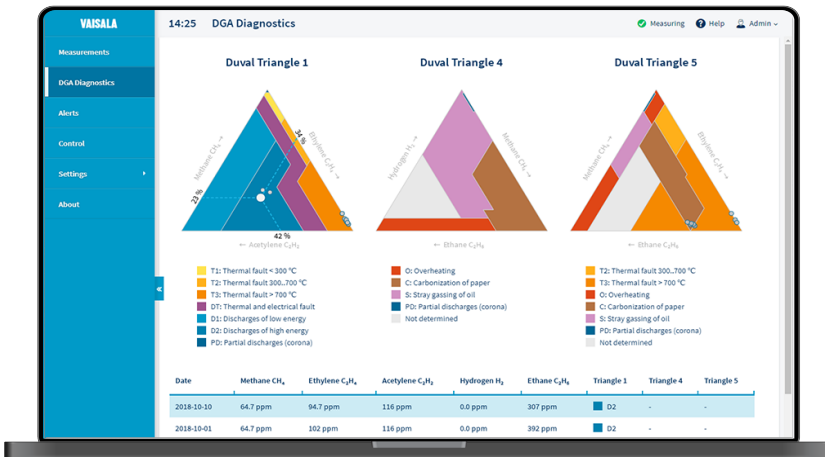
### Intuitive and smart design

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

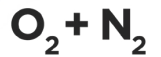
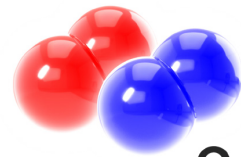
Thanks to autocalibration and IR reference measurement, Optimus™ provides reliable gas trending data at all times. Vacuum gas extraction eliminates fluctuation caused by oil temperature or

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. The result is data you can rely on to make critical operational decisions.



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.

### Total gas pressure



### Robust construction

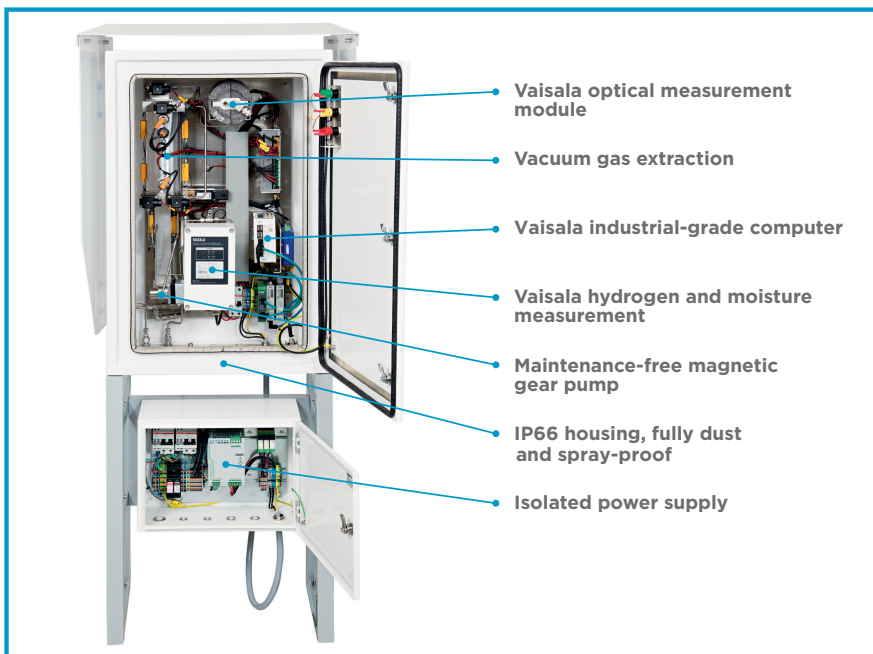
Stainless steel pipes, IP66-rated and temperature-controlled housing, as well as a magnetic drive gear pump and valves bring superb performance and durability – from the arctic to the tropics. What's more, there are no consumables to service or replace.

### 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.

### Air leak detection using total gas pressure

Oxygen accelerates the aging of transformers, potentially cutting years from their operational life. With a groundbreaking method, Optimus™ DGA Monitor measures the total dissolved gas pressure of the sampled oil volume and detects any air leaks on sealed transformers without oxygen sensors. In case of an air leak into the transformer's



# Technical data

## Measurement specification

Parameter <sup>1)</sup>	Range	Accuracy <sup>2) 3)</sup>	Repeatability <sup>3)</sup>
Methane (CH <sub>4</sub> )	0 ... 10 000 ppm <sub>v</sub>	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Ethane (C <sub>2</sub> H <sub>6</sub> )	0 ... 10 000 ppm <sub>v</sub>	±10 ppm or ±5 % of reading	10 ppm or 5 % of reading <sup>4)</sup>
Ethylene (C <sub>2</sub> H <sub>4</sub> )	0 ... 10 000 ppm <sub>v</sub>	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Acetylene (C <sub>2</sub> H <sub>2</sub> )	0 ... 5000 ppm <sub>v</sub>	±0.5 ppm or ±5 % of reading	1 ppm or 5 % of reading
Carbon monoxide (CO)	0 ... 10 000 ppm <sub>v</sub>	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Carbon dioxide (CO <sub>2</sub> )	0 ... 10 000 ppm <sub>v</sub>	±4 ppm or ±5 % of reading	10 ppm or 5 % of reading
Hydrogen (H <sub>2</sub> )	0 ... 5000 ppm <sub>v</sub>	±15 ppm or ±10 % of reading	15 ppm or 10 % of reading
Moisture <sup>5)</sup> (H <sub>2</sub> O)	0 ... 100 ppm <sub>w</sub> <sup>6)</sup>	±2 ppm <sup>7)</sup> or ±10 % 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.

## Measurement operation

Measurement cycle duration	1 ... 1.5 h (typical)
Response time (T63)	One measurement cycle <sup>1)</sup>
Warm-up time until first measurement data available	Two measurement cycles
Initialization time to full accuracy	Two days
Data storage	At least 10 years
Expected operating life	> 15 years

- 1) Three cycles for ethane and hydrogen.

## Field performance

Parameter	Typical variance to laboratory DGA <sup>1) 2)</sup>
Acetylene (C <sub>2</sub> H <sub>2</sub> )	±1 ppm or ±10 % of reading
Hydrogen (H <sub>2</sub> )	±15 ppm or ±15 % of reading
Other measured gases	±10 ppm or ±10 % of reading
Moisture (H <sub>2</sub> O)	±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 <sub>2</sub> , CO, CH <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , C <sub>2</sub> H <sub>4</sub> , and C <sub>2</sub> H <sub>2</sub>
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 <sup>1)</sup>	Available ratios: <ul style="list-style-type: none"> <li>• CH<sub>4</sub>/H<sub>2</sub></li> <li>• C<sub>2</sub>H<sub>2</sub>/C<sub>2</sub>H<sub>4</sub></li> <li>• C<sub>2</sub>H<sub>2</sub>/CH<sub>4</sub></li> <li>• C<sub>2</sub>H<sub>6</sub>/C<sub>2</sub>H<sub>2</sub></li> <li>• C<sub>2</sub>H<sub>4</sub>/C<sub>2</sub>H<sub>6</sub></li> <li>• CO<sub>2</sub>/CO</li> </ul>

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

## Power supply

Operating voltage	OPTSU1: 100 ... 240 V AC, 50 ... 60 Hz, ±10 % OPTSU2: 110 ... 220 V DC, ±10 %
Overvoltage category	III
Maximum power consumption	500 W
Typical power consumption at +25 °C (+77 °F)	100 W

## Outputs

<b>RS-485 interface</b>	
Supported protocols	Modbus RTU, DNP3 (optional feature)
Galvanic isolation	2 kV RMS, 1 min
<b>Ethernet interface</b>	
Supported protocols	Modbus TCP, HTTP, HTTPS, DNP3 (optional feature), IEC 61850 (optional feature)
Galvanic isolation	4 kV AC (50 Hz, 1 min)
<b>Relay outputs</b>	
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)
<b>Auxiliary device interface</b>	
Maximum power	48 W
Voltage output	24 V DC
<b>User interface</b>	
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. See list of available accessories for adapters.
Max. length of oil pipe to transformer for mineral oil	Max. 10 m (33 ft) with 7 mm (0.28 in) inner diameter tubing <sup>1)</sup> Max. 5 m (16 ft) with 4 mm (0.15 in) inner diameter tubing
Max. length of pipe to transformer for synthetic 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)

- 1) Bigger pipe volume will increase response time

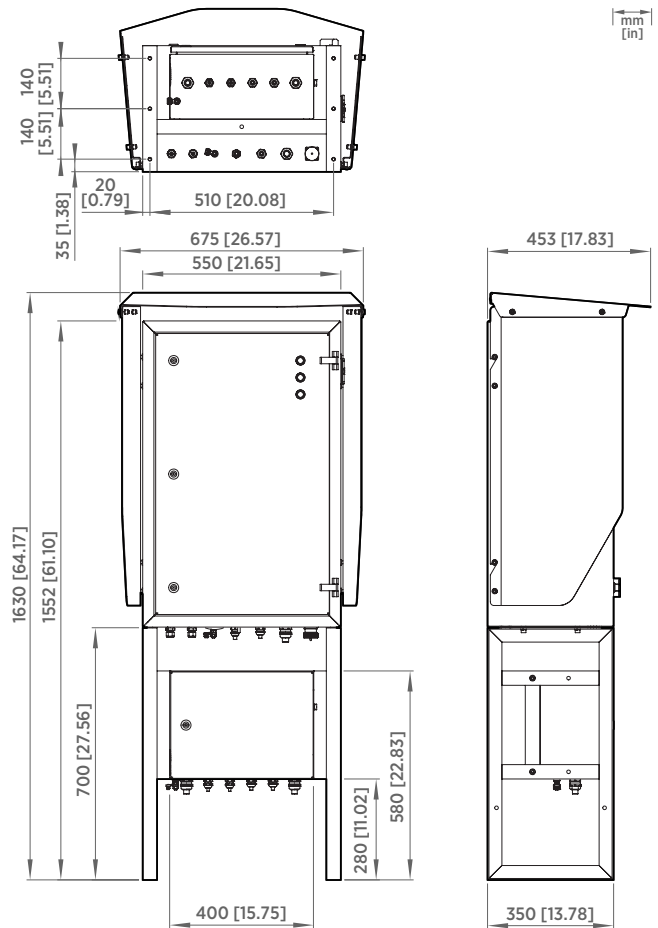
## Operating environment

Transformer liquid type <sup>1)</sup>	Mineral oil or synthetic ester liquid
Required minimum fire point <sup>2)</sup> of insulation liquid	+125 °C (+257 °F)
Transformer oil pressure at oil inlet	Max. 2 bar <sub>abs</sub> continuous Burst pressure 20 bar <sub>abs</sub>
Transformer insulation liquid temperature at oil inlet	Max. +100 °C (+212 °F) Min. +0 °C (+32 °F) (synthetic ester liquids) <sup>3)</sup>
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. See, for example, Heathcote, Martin J. The J & P Transformer Book. 13th ed. Elsevier, 2007.  
 3) Mineral oil minimum temperature depends on the pour point of the mineral oil.

## 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 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

## You can count on Vaisala

Vaisala has created measurement devices for 80 years. Our instruments and systems are used in over 150 countries in industries where failure is not an option, including airports, pharmaceuticals, and power generation. Over 10,000 companies in safety and quality-critical sectors rely on Vaisala.

Vaisala sensors are used in the harshest places on Earth – Arctic, maritime, and tropical environments – and even on Mars.

## Power transformer monitoring that works

Vaisala Optimus™ DGA Monitor delivers out-of-the-box performance, eliminates false alarms, and gives you the best long-term stable measurements for the key fault gases used in transformer diagnostics.

**VAISALA**

www.vaisala.com

Published by Vaisala | B211583EN-M © Vaisala 2023

All rights reserved. Any logos and/or product names are trademarks of Vaisala or its individual partners. Any reproduction, transfer, distribution or storage of information contained in this document is strictly prohibited. All specifications – technical included – are subject to change without notice.