

PAS DGA

Shenzhen Feso Automation Technology Co., Ltd

DGA-900

Laser Photoacoustic Spectroscopy Multi-Gas DGA Monitor

Online Dissolved Gas Analysis (DGA) for Power Transformers

All specifications are subject to the terms of the applicable quotation. Custom measurement ranges and OEM/ODM configurations are available on request.

9 + 1

Gases + Moisture

<0.1 ppm

C₂H₂ Detection

72-Hour

Early Warning

3-Year

Warranty

The DGA-900 is a cutting-edge online Dissolved Gas Analysis (DGA) monitoring system powered by Laser Photoacoustic Spectroscopy (LPAS). It detects and quantifies 9 fault gases plus moisture in transformer oil, delivering laboratory-grade analytical depth with the real-time continuity of an online system. Deployed in China's largest 1000 kV UHV substations and ±800 kV HVDC converter stations, the DGA-900 is the definitive online DGA solution for the world's most critical power transformers.

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Product:	DGA-900 — Laser Photoacoustic Spectroscopy Multi-Gas DGA Monitor
Manufacturer:	Shenzhen Feso Automation Technology Co., Ltd (PAS DGA), Shenzhen, China
Communications:	MODBUS RTU/TCP, IEC 61850, IEC 60870-5-104, DNP3.0, RS-485/232
Warranty:	3 years or 2,000 measurement cycles (whichever first)

1. PRODUCT OVERVIEW

The DGA-900 monitors the condition of oil-filled power transformers by continuously measuring the concentrations of dissolved fault gases and moisture in the insulating oil. At its heart is a semiconductor laser with an ultra-narrow spectral line width of just 15 femtometers (0.000015 nm), precisely aligned to the characteristic absorption line of each target gas. This delivers virtually zero cross-interference — a fundamental advantage over conventional broadband IR photoacoustic systems whose optical filters cannot fully separate overlapping absorption bands. A patented vacuum-assisted membrane extraction module removes dissolved gases from the oil without consuming any oil. The extracted gas enters a miniature photoacoustic cell (1 mL, patented) where the modulated laser excites each gas species at its specific wavelength; the resulting pressure waves are detected by a high-sensitivity microphone, giving a signal directly proportional to concentration. The DGA-900 complies with IEEE C57.104 and IEC 60599. Its embedded diagnostic engine runs Duval Triangle, Rogers Ratio and Doernenburg Method analyses onboard, providing up to 72-hour early warning of incipient faults — enabling planned maintenance before failure.

2. KEY SPECIFICATIONS AT A GLANCE

Parameter	Specification
Technology	Laser Photoacoustic Spectroscopy (LPAS)
Gas Detection	9 gases + moisture
H ₂ LDL	2 ppm
C ₂ H ₂ LDL	≤0.1 ppm
Communication	IEC 61850 (MMS/GOOSE), MODBUS RTU/TCP, IEC 60870-5-104, DNP3.0, RS-485/232
Diagnostics	Duval Triangle, Rogers Ratio, Doernenburg Method
Oil Consumption	Zero (patented vacuum-assisted membrane extraction)
Enclosure	IP55, 630 × 660 × 870 mm
Weight	<150 kg
Warranty	3 years (or 2,000 measurement cycles)

3. GAS DETECTION SPECIFICATIONS

The DGA-900 detects and quantifies all key fault gases identified in IEC 60599 and IEEE C57.104, plus oxygen and nitrogen for complete oil-condition assessment. The table lists each gas's guaranteed lower detection limit (LDL); upper measurement ranges are configured per customer requirement.

Gas	LDL	Accuracy	Repeat.	Fault Indication
H ₂ — Hydrogen	2 ppm	±8%	<3%	Partial discharge, arcing, thermal faults
O ₂ — Oxygen	200 ppm	±3%	<3%	Seal integrity, oil oxidation
CO — Carbon Monoxide	20 ppm	±5%	<3%	Paper/cellulose thermal degradation
CO ₂ — Carbon Dioxide	20 ppm	±5%	<3%	Paper/cellulose thermal degradation
CH ₄ — Methane	0.5 ppm	±8%	<3%	Oil thermal fault (low-temp hot spot)
C ₂ H ₂ — Acetylene	0.1 ppm	±5%	<3%	Arcing (key gas — most critical indicator)
C ₂ H ₄ — Ethylene	0.5 ppm	±8%	<3%	Oil thermal fault (high-temp hot spot)
C ₂ H ₆ — Ethane	0.5 ppm	±8%	<3%	Oil thermal fault (medium-temp)
N ₂ — Nitrogen	1,000 ppm	±3%	<3%	Inert-gas blanket integrity
H ₂ O — Moisture	0 – 100% AW / 0 – 100 ppb	±3%	<3%	Seal integrity, oil quality

4. LPAS TECHNOLOGY — WHY LASER?

The difference between the DGA-900 and conventional photoacoustic systems is the light source. Laser photoacoustic spectroscopy uses a coherent laser tuned to a single gas absorption line, while classic broadband IR-PAS relies on wide-spectrum sources with optical filters whose bandwidths are thousands of times wider than gas absorption lines — causing inherent cross-interference between gases with overlapping spectra.

4.1 L-PAS: 15 fm Line Width

The semiconductor laser has a spectral line width of 15 femtometers — narrower than the absorption lines of individual gas molecules. It can be precisely tuned to the exact absorption wavelength of each target gas without exciting neighbouring species, giving virtually zero cross-interference even for closely spaced bands such as C₂H₄ and C₂H₆.

4.2 Classic Broadband PAS: The Limitation

Broadband IR-PAS sources with optical filters have bandwidths of tens of nanometres — thousands of times wider than gas absorption lines. This causes cross-interference, reduced accuracy, and compensation algorithms that drift over time.

4.3 The LPAS Advantage — 5 Key Benefits

- 1. Zero Cross-Interference**
Laser precisely matches single gas absorption lines. No optical filter drift. No compensation needed.
- 2. Higher Sensitivity**
Concentrated light energy at the target wavelength produces a stronger photoacoustic signal — C₂H₂ detection down to 0.1 ppm.
- 3. Superior Long-Term Stability**
No optical filter degradation. Laser wavelength is inherently stable; factory calibration holds for years.
- 4. Wider Dynamic Range**
From trace (0.1 ppm) to fault-level concentrations — one instrument covers all DGA scenarios.
- 5. No Consumables**
No carrier gas, no columns, no flame ionization detector. Laser source rated for over 10 years of continuous operation.

5. CONFIGURATION MODES

The DGA-900 is available in three configurations tailored to different deployment scenarios — from OEM module supply for system integrators to fully integrated turnkey systems for substations.

5.1 Module Only — OEM Supply

- LPAS degassing module (patented vacuum-assisted)
- Full 9-gas + moisture detection module
- Photoacoustic cell (1 mL, patented)
- Semiconductor laser source (patented)
- Communication module (IEC 61850 / MODBUS / IEC 104 / DNP3.0)
- PC debugging software + control-room client software
- Enclosure drawings + assembly guidelines (free)
- Factory test report for each module
- OEM/ODM branding — no manufacturer logo

5.2 Standard System — Fully Integrated (Most Popular)

- Everything in Module Only, plus:
- IP55 weatherproof enclosure (630 × 660 × 870 mm)
- Integrated air conditioning for the enclosure
- Full installation and commissioning support
- 4-tier hierarchical alarm system
- Advanced data-management software suite
- Multi-format data export (Excel, CSV, PDF)
- Automatic scheduled data logging
- Bidirectional remote communication
- On-site service available

5.3 Premium System — Extended Features

- Everything in Standard System, plus:
- Automatic cloud synchronization option
- Extended warranty (3+ years, up to 2,000 cycles)
- Priority on-site service
- Custom gas-range calibration
- Dual redundant communication paths
- Enhanced cybersecurity package (IEC 62443 aligned)
- Dedicated technical account manager
- Quarterly health-check reports
- Free software updates for life

6. SOFTWARE SUITE & DIAGNOSTICS

6.1 Individual Gas Parameterization

Configure alarm thresholds, measurement ranges and sampling intervals independently for each gas species (H₂, CH₄, C₂H₄, C₂H₂, C₂H₆, CO, CO₂, O₂, N₂, H₂O).

6.2 Embedded Fault Analysis Engines

Duval Triangle 1 (IEC 60599), Rogers Ratio 3D visualization, and Doernenburg Method run onboard. Dynamic gas-ratio trend plotting with configurable time windows.

6.3 Enterprise Data Management

Unlimited historical data storage with automatic cloud sync option. Export to Microsoft Excel (formatted templates), CSV for SCADA, clipboard copy/paste, and printer-ready PDF reports.

6.4 4-Tier Alarm System

Attention (50% threshold) → Warning (80%) → Critical (100%) → Emergency (120%). Each tier is configurable per gas with independent notification actions — email, SMS, relay, or SCADA alarm.

6.5 Bidirectional Communication

Local and remote operation via IEC 61850 MMS/GOOSE, MODBUS RTU/TCP, IEC 60870-5-104 (IEC 104), DNP3.0, and RS-485 (up to 1 Mbps, 32-node daisy chain).

6.6 Automated Scheduled Logging

Configure automated measurement schedules — from continuous sub-minute sampling during fault conditions to hourly logging during steady-state operation. All data is timestamped and stored.

7. FULL TECHNICAL SPECIFICATIONS

7.1 Measurement System

Parameter	Specification
Technology	Laser Photoacoustic Spectroscopy (LPAS)
Laser Line Width	15 fm (0.000015 nm)
Degassing	Patented vacuum-assisted membrane (zero oil consumption)
Photoacoustic Cell	1 mL volume (patented)
Gases Detected	H ₂ , O ₂ , CO, CO ₂ , CH ₄ , C ₂ H ₂ , C ₂ H ₄ , C ₂ H ₆ , N ₂ , H ₂ O
Measurement Accuracy	Min detection limit or ±20% (whichever is greater)
Sampling Interval	Configurable, 1 minute minimum
Oil Temperature Range	10 to 100 °C

7.2 System & Environmental

Parameter	Specification
Power Supply	AC 210–240 V, 50/60 Hz, 2 kW
Ambient Temperature	–40 to +55 °C (–10 to +55 °C when starting)
Humidity	10–95% RH, non-condensing
Enclosure Rating	IP55
Dimensions	630 (W) × 660 (D) × 870 (H) mm
Weight	<150 kg
Communication	IEC 61850, MODBUS RTU/TCP, IEC 104, DNP3.0, RS-485/232
Warranty	3 years or 2,000 cycles (whichever first)

8. PROVEN AT THE HIGHEST LEVELS

The DGA-900 is deployed across China’s most critical power infrastructure — from 1000 kV UHV AC substations to ±800 kV HVDC converter stations, nuclear power plants and major hydropower facilities.

Nuclear Power Dalian Hongyanhe Nuclear Power Plant — continuous DGA for critical GSU and station-service transformers.
1000 kV UHV AC Jiangxi Ganjiang, Shanxi Beiyue, Shandong Gaoxiang, Shanxi Changzhi, Jingmen — China’s UHV backbone.
±800 kV HVDC Wuhan Converter Station, Ningxia Lingzhou, Gansu Qilian, Gusu, Hubei Daye — converter-transformer monitoring.
Hydropower Plants Jiangxi Wan’an, Hunan Dongjiang — GSU transformer monitoring at major hydroelectric stations.
750 kV Substations Gansu Jiuquan Shazhou, Gansu Dingxi Lanlin, Gansu Hexi — Northwest China grid backbone.
500 kV Regional Grid Huizhou Goose City, Hubei Mulan, Liaoning Dandong — regional transmission-hub substations.

9. STANDARDS & CERTIFICATIONS

- Measurement basis consistent with IEC 60599:2022, IEC 60567:2023 and IEEE C57.104-2019
- A1-level evaluation by China Electric Power Research Institute (CEPRI); SGS & TUV audited
- Cybersecurity design aligned with the IEC 62443 framework

10. CONTACT

For pricing, availability, technical specifications, or OEM/distributor partnership enquiries:

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Response within 1 business day. Full datasheets, dimensional drawings and site-survey checklists are provided with every quotation.