

# Kelman DGA 900

## Next generation on-line multi-gas DGA

Dissolved Gas Analysis (DGA) and moisture measurement of insulating fluids are recognized as the most important tests for condition assessment of transformers. In previous years, multi-gas DGA was traditionally confined to a laboratory environment, with infrequent off-line manual sampling forming part of time-based maintenance strategies. However, as the global average age of transformers continued to rise, the possibility of rapid ageing, unplanned outages and even catastrophic failure between off-line tests also increased, leading many asset owners to adopt on-line DGA monitoring strategies to increase network reliability.

In the early 2000's, GE's Kelman™ range of analysers brought consumable-free on-line multi-gas DGA to the market and GE is now proud to introduce the Kelman DGA 900, our next generation multi-gas on-line DGA and moisture analyser. At its heart lies an evolved implementation of GE's proven Photo-Acoustic Spectroscopy (PAS) measurement technology, providing laboratory challenging levels of precision and repeatability with no consumables and no need for frequent re-calibration. Benefiting from over 40 years of global DGA vendor experience, the Kelman DGA 900 encapsulates learnings and improvements derived from its predecessors to bring improved performance, innovative new features, enhanced user experience and increased robustness.

### Key Benefits

- Provides remote alert and multi-gas diagnostic of deteriorating transformer condition
- Expedites operational decisions without needing to go to site for manual oil sampling
- Issues can be detected in their infancy, avoiding unexpected failures and facilitating planned outages
- Anchors condition based maintenance and asset replacement strategies on hard data
- No need for consumables or frequent recalibration to operate at optimum performance
- New "Rapid Mode" provides near real-time insight on fast developing faults
- Enhanced computing power and scalable I/Os for a flexible transformer monitoring solution
- Compatible with mineral insulating oils and newer ester based fluids (natural and synthetic)

### Applications

The Kelman DGA 900 is an invaluable foundational tool for implementing Asset Performance Management (APM) across electrical generation, transmission and industry, enabling a condition based asset replacement strategy and delivering improvements in system reliability and availability.

A DS-Agile™ and Grid APM ready device, the DGA 900's wide range of communication methods and protocols enables connection to those platforms and integration with GE's Perception™ transformer fleet management software as well as other software, historian and SCADA systems.



## Proven Technology

- 4th generation of GE's PAS technology delivering improved accuracy with lower detection limits
- From the only vendor with 15 years PAS experience and installed base of >13,000 units
- No carrier or calibration gas consumables
- Laboratory challenging field measurement of nine gases plus moisture
- Complete DGA analysis up to once per hour and new "Rapid Mode" for critical gases in ~30 min

## Reliable and Available

- First Kelman device designed by GE leveraging our quality and continuous improvement ethos
- Enhanced reliability and easier field servicing
- 5-year warranty as standard †
- Factory calibration benchmarked against industry standard laboratory assessment

## Intuitive and Flexible

- Integrated 7" colour LCD screen for simplified local user interaction and visualisation of data
- Lightweight innovative two-enclosure design enables adjacent or separated installation
- Can connect to AC or sub-station DC power

## Scalable and Connected

- Expandable analogue/digital I/Os
- Future proof computing platform ready for feature enhancements
- Designed for cyber security, with a range of comms options and protocols



# Technical Specifications

## MEASUREMENTS

### Technology

Automated head-space gas extraction.  
Photo-acoustic spectroscopy (PAS) gas measurement.  
Thin film capacitive moisture sensor.  
Immersed fiber optic oxygen sensor.

### Frequency

Configurable from once per hour to once every 4 weeks.  
Faster sampling automatically triggered upon alert level reached.  
"Rapid Mode" provides a rapid indication of the evolution of the gasses indicated below in ~30 minutes.

### Range

	LDL	UDL	Accuracy*	Repeatability	Available in Rapid Mode
Hydrogen (H <sub>2</sub> )	5	5,000 ppm	± LDL or ±5%	< 3%	•
Carb. Monox. (CO)	1	50,000 ppm	± LDL or ±3%	< 2%	•
Methane (CH <sub>4</sub> )	2	50,000 ppm	± LDL or ±3%	< 2%	•
Acetylene (C <sub>2</sub> H <sub>2</sub> )	0.5	50,000 ppm	± LDL or ±3%	< 2%	•
Ethylene (C <sub>2</sub> H <sub>4</sub> )	1	50,000 ppm	± LDL or ±3%	< 2%	•
Carb. Diox. (CO <sub>2</sub> )	20	50,000 ppm	± LDL or ±3%	< 3%	•
Ethane (C <sub>2</sub> H <sub>6</sub> )	1	50,000 ppm	± LDL or ±3%	< 2%	•
Oxygen (O <sub>2</sub> )	100	50,000 ppm	± LDL or ±5%	< 2%	•
Nitrogen (N <sub>2</sub> ) **	10,000	100,000 ppm	± LDL or ±15%	< 3%	•
Moisture (H <sub>2</sub> O)	0	100% RS (in ppm)	± 3% ppm	< 3%	•

\*whichever is greater. Accuracy quoted is the accuracy of the detectors during calibration. Gas-in-oil measurement may be affected by oil type and condition. Repeatability as measured from final production test data.

\*\* N<sub>2</sub> value is calculated and available on free-breathing transformers only.

Time Response (typical): 1 measurement cycle; >95%: C<sub>2</sub>H<sub>2</sub>, CO, C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>4</sub>, CH<sub>4</sub>, CO<sub>2</sub>; >90%: H<sub>2</sub>

## FEATURES

### Display

4 x sunlight visible LED arrays  
Integrated backlit 7" inch color resistive touch screen (800 x 480)  
Embedded secure webserver (https)

### Analogue Inputs

1 x CT input standard  
5 x optional analogue inputs slots (Add up to 5 additional load CT's or PT100 inputs or 4-20mA sensor cards)

### Digital Output

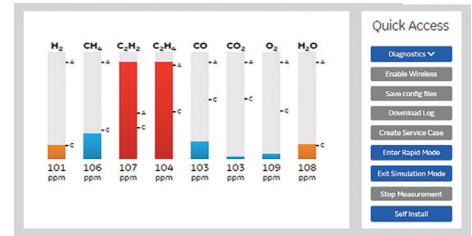
6 x standard customer programmable dry contact relays (type C, SPDT), NO/NC, 10A@ 250Vac resistive load, 10A@ 30Vdc resistive load  
1 x standard service alarm relay  
1 x standard watchdog relay

### Digital Communications / Protocols

1 x Modbus® over RS485 / TCP/IP as standard  
1 x Standard 1Gb Ethernet (RJ45)  
Option: DNP3.0 over RS485 or TCP/IP  
Option: IEC 61850 Edition 2  
Option: ST/SC Multi-mode fiber converters  
Option: GSM/GPRS/UMTS/HSPA+ modem  
Option: Wi-Fi (802.11b/g/n)

### Alarms

Multiple Alarm setting/scenarios, all assignable to relays or SMS  
Gas: absolute gas level, Rate of Change (ROC), moisture level, Total Dissolved Combustible Gas (TDCG) and 7 x user defined gas ratios alarms  
Analog inputs: absolute Level, and Rate of Change (ROC)  
Digital inputs: status transition



DGA 900 gas levels displayed on the local LCD screen

## ENVIRONMENT

### Conditions

Operating ambient temperature -40°C to +55°C (-40°F to +131°F)  
Operating ambient humidity 0-95% RH, non-condensing  
Oil temperature at valve\*\*\* -20°C to +120°C (-4°F to +248°F)

\*\*\*Based on testing carried out using VOLTESSO™ 35 mineral oil, over a ¼" pipe run of 10 metres or less from oil supply or return valve to monitor connection point and on transformer oil supply valve volumes of 200ml or less. For oil temperatures colder than -20°C GE recommends the use of heat trace cabling on piping

### Enclosure

IP56 certified  
Standard: Powder coated marine grade aluminium (RAL9002)  
Option: Unpainted 316 Stainless Steel

### Power Requirements

AC Nominal 100-240 Vac, Range 85-264 Vac, 4A  
DC Nominal 100-250 Vdc, Range 90-300 Vdc

### Mechanical

	Analysis Unit	Hub Unit
Dimensions	600 x 484 x 330 mm 23.6 x 19.1 x 13.0 in	600 x 380 x 330 mm 23.6 x 15.0 x 13.0 in
Weight	33.4Kg 73.6 lb	18.5Kg 40.8 lb

### OPTIONS

Mounting stand  
Sun canopy  
Longer umbilical cable between units  
Analogue output of gas values

† Terms and conditions apply

Configuration Code											Part No.	Description			
	E0	P0	M0	U0	S0	C0	CO	CO	X0	X0	X0	X0	X0	Kelman DGA 900	DGA 900 - Base Unit
<b>Enclosure Options</b>															The 316SS enclosure is still an option, however it should be noted that the DGA900 standard painted aluminum enclosure provides our highest possible rated ingress and corrosion protection levels at IP56 and C5M.
<b>Protocol Options</b>		P1 P2 P4												COMM90022 COMM90012 COMM90014	DNP3 over RS485 DNP3 over Ethernet IEC 61850 Edition 2 over Ethernet
<b>Mounting Stand</b>			M1 M2 M3											87-0036-01 87-0035-01 87-0038-01	Mounting Stand Pair, 1 stand for Analyzer, 1 stand for HUB 316SS Mounting Stand Pair, 1 stand for Analyzer, 1 stand for HUB Mounting Stand Converter (Transfix Stand for DGA900)
<b>Umbilical Cable</b>				U0 U1 U2										CABL01054 CABL01055	Standard: 2 Meter Cable 5 Meter Cable 10 Meter Cable
<b>Sun Canopy</b>					S1 S2									87-0031-01 87-0033-01	Sun Canopy Pair, 1 x Canopy for Analyzer, 1 x Canopy for HUB 316SS Sun Canopy Pair, 1 x Canopy for Analyzer, 1 x Canopy for HUB
<b>Communication Options</b>						C1 C2 C3 C4 C5 C6 C7 C11								COMM90016 COMM90017 COMM90018 COMM90019 COMM90020 COMM90021 COMM90005 COMM90023	DGA 900 Ethernet switch, 1x 100BaseF - ST Multi-mode Fiber + 4x RJ45 10/100 MB copper DGA 900 Ethernet switch, 1x 100BaseF - SC Multi-mode Fiber + 4x RJ45 10/100 MB copper Ethernet Converter - RJ45 to 10/100Mbps Multimode Fibre LC Connector DGA 900 Ethernet switch, 2x 100BaseF - ST Multi-mode Fiber + 6x RJ45 10/100 MB copper DGA 900 Ethernet switch, 2x 100BaseF - SC Multi-mode Fiber + 6x RJ45 10/100 MB copper DGA 900 Ethernet switch, 2x 100BaseF - SC Single-mode Fiber + 6x RJ45 10/100 MB copper GSM / GPRS Modem RS485 to 16 channel Analogue Outputs, 4-20mA
<b>Analogue I/O Card (5 slots available)</b>								X1 X2	X1 X2	X1 X2	X1 X2	X1 X2		13-0396-01 13-0399-01	Analogue Input Card, 4-20mA Analogue Input Card, for PT100 Temp Sensor

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Grid-GA-L3-DGA\_900-1599-2019\_09-EN\_R002

