LUMASENSE® TECHNOLOGIES

SmartDGA® Monitoring Solutions

Cost-effective and accurate gas detection solutions based on Non-Dispersive Infrared (NDIR) sensor technology to measure fault gases in transformers or load tap changers (LTCs)

- Identify potential faults prior to failures and reduce unplanned outages and associated cost
- Reduce the number and frequency of LTC maintenance cycles, thereby increasing uptime and maximum efficiency of the LTC
- Proactively investigate premature aging or the cause of faults of a transformer

Protect critical assets through comprehensive analysis of transformer fault conditions with online SmartDGA® monitors

SmartDGA® Instruments

The SmartDGA® family of instruments is the industry's most cost effective Dissolved Gas Analysis (DGA) solution, designed to be the most flexible and to provide the best user experience available.

Each model has been designed using state-of-the-art Non-Dispersive Infrared (NDIR) technology. The continuous online DGA values reported by the SmartDGA® instrument quickly identify potential fault conditions through monitoring of key gas levels, rates, and ratios.

Each SmartDGA® package includes the instrument, mounting hardware, connection cable, the SmartDGA EZHub™ unit, and SmartDGA Viewer Software.

- **SmartDGA Gauge™** is the industry's first dedicated online Load Tap Changer (LTC) condition monitor. The Gauge measures and records Methane, Acetylene, and Ethylene plus moisture to assess LTC health.
- **SmartDGA Guard™** provides a cost effective early warning monitoring system of potential transformer failures. The Guard measures and records Hydrogen, Acetylene, Carbon Dioxide, and Carbon Monoxide plus moisture to provide an early diagnostics tool.
- **SmartDGA Guide™** provides comprehensive online DGA results that enable diagnostic techniques. The Guide measures and reports nine (9) DGA gases plus moisture in an instrument that vastly reduces total cost of ownership of an on-line monitoring system.

Key Functional Features

- Versatile mounting configurations – including single and dual valve mount. Inline mounting is available for LTC filter system or non-valve mounting for a transformer.
- Extremely cost effective – total cost of ownership is a fraction of the cost of other instruments and installation can be accomplished in just hours.
- No consumables, carrier gases, or scheduled calibration required.
- Sunlight visible indicators for Caution, Warning, and Alarm conditions. Status Relay notification and corrective action triggering to ensure optimal system operations.
- Communications supported via all major protocols common in the electric power industry such as Modbus RTU, DNP 3.0, and IEC 61850 with the optional *i*Core.

40+ Years of Experience with NDIR

With over 40 years of experience, LumaSense is the industry leader in the use of Non-Dispersive Infrared (NDIR) technologies and has deployed thousands of systems in the field. Our ANDROS® brand pioneered NDIR gas analysis for automotive emissions and patient monitoring. This NDIR technology is the heart of our suite of SmartDGA® products.

Industry leading installation options including on-transformer installation of a full nine gas monitor using a single valve.

Mount the instrument anywhere using the compact off-transformer mounting kit when space at the transformer is limited or policy prohibits direct mounting to the transformer.

Separate supporting electronics can be mounted up to 30 meters away in a separate enclosure. This allows for a compact sensor that can be conveniently mounted anywhere.

SmartDGA EZHub™

The SmartDGA EZHub™ unit is the central intelligence for the SmartDGA® system. A fully configured unit is capable of handling the power and communication needs for the SmartDGA® system. The EZHub can support a Gauge instrument for the LTC and a Guard or Guide instrument for the transformer. All interface functions and interconnects are provided in the EZHub device as well as internal memory, and four (4) relays with bright LED indicators to indicate Caution, Warning, and Alarm gas level, rate, and ratio conditions. The fourth relay provides status information on the SmartDGA system itself.

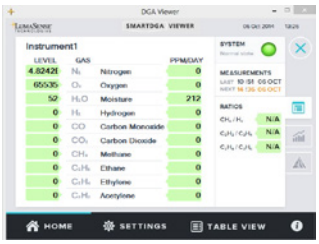
LumaSMART *i*Core™ (Optional)

The LumaSmart *i*Core™ controller provides a local interactive touch screen display of DGA data collected from the SmartDGA EZHub™ using the DGA Viewer™ software. The DGA Viewer™ software allows for on-site viewing of DGA data collected from the SmartDGA® instruments. The software provides a local means to set and create operational levels for caution, warning and alarm conditions. Additionally, the LumaSmart *i*Core™ device provides communications to external systems using RS485 or Ethernet. Each LumaSmart *i*Core™ device enables connectivity to multiple EZHub™ units (up to a maximum of 4 using either the Ethernet or RS485 connection).

DGA Viewer™ software

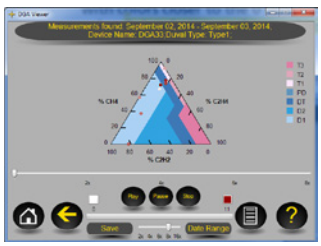
The DGA Viewer™ software allows users to configure systems using various set-up tools and view data being captured by the SmartDGA® instrument.

DGA Dashboard
The DGA Viewer™ software displays all connected instruments with status as well as the last and next sampling times.

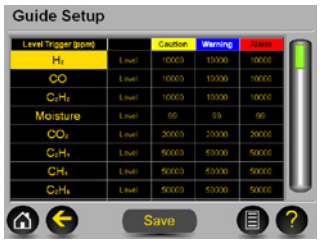


Details Screen
Review Gas levels and PPM/day as well as Ratios in a single screen. The last and next measurement date and times are also visible.

Trends
The Trends screen displays all detected gases via a trend graph over a user-selectable period of time. Each gas can be individually displayed or all 9 gases can be displayed at once.



Duval Triangle
Visual diagnostic tool divided into fault zones based on the types of electrical and thermal faults as defined in Duval triangle type 1 and 2 for transformers and LTCs respectively.



Device Configuration
Customized gas detection levels of Caution, Warning, and Alarm values. Included are user-configurable settings for each gas Rate of Change detection levels. Ratio setpoint activation is also available.

SmartDGA™ System Technical Data

Instrument Specifications

NDIR Gas Phase Sensor Accuracy	± 5% or ± LDL, whichever is greater
Reporting Rate	Every 24 hours - default, user selectable from approximately 3 hours to 7 days.
Measurement Range	Minimum value is the lower detectable limit, maximum value is the upper limit of accurate response
Moisture Accuracy	± 3 ppm or ± 2% RS
Oil Pressure	up to 45 psig (3 bar)
Enclosure Rating	IP 55
Sunlight visible indicators for condition codes **Note:** Indicators normally flash on for 5 seconds, off for 15 seconds	• Green - Normal • Yellow - Caution • Blue - Warning • Red - Alarm • Red/Blue - System Status Error • Green/Yellow - Loss of Communication

Environmental

	SmartDGA® Instrument	SmartDGA EZHub™	LumaSMART *i*Core™
Operating Temperature*	-50 to 55 °C	-50 to 55 °C	-40 to 70 °C
Storage Temperature	-50 to 70 °C	-50 to 70 °C	-40 to 75 °C
Storage Humidity (non-condensing)	1 – 99% RH	1 – 99% RH	1 – 99% RH
Dimensions (L x H x D)	20.9" x 8.6" dia.	10.3" x 5.7" x 6"	8.7" x 7.4" x 6.6"
Weight	~18.74 lbs	6.61 lbs	11.02 lbs

Standards Compliance

The SmartDGA system underwent thorough testing and complies with the following standards.

Emissions / Immunity	EN 61000-6-5 (2001) EN 61000-6-4 (2007) +A1 EN 61000-3-2 (2006) +A1 EN 61000-3-3 (2008)
Environmental / Vibration	ETSI EN 300 019-2-4
Surge Protection	4000V (IEEE C37.90.1-2002)

SmartDGA® Instrument Gas Measurements (Min-Max)

Gas	Gauge	Guard	Guide
Acetylene (C_2H_2)	0.5–50,000 ppm	0.5–10,000 ppm	0.5–10,000 ppm
Ethylene (C_2H_4)	2–50,000 ppm		2–50,000 ppm
Carbon Monoxide (CO)		10–10,000 ppm	10–10,000 ppm
Moisture (RS)	1–99%	1–99%	1–99 %
Hydrogen (H_2)		5–10,000 ppm	5–10,000 ppm
Carbon Dioxide (CO_2)		10–20,000 ppm	10–20,000 ppm
Methane (CH_4)	2–50,000 ppm		2–50,000 ppm
Ethane (C_2H_6)			2–20,000 ppm
Oxygen (O_2)			500–50,000 ppm
Nitrogen (N_2)			5,000–100,000 ppm

EZHub™ & LumaSMART *i*Core™ Specifications

Power Supplied to EZHub & *i*Core	90 ~ 264 VAC, 127 ~ 370 VDC, 47 ~ 63 Hz, 6.5 A max
Power Supplied to Instrument	48 VDC ~ 4.16 A max
Memory	Up to 40+ years worth of data storage available with optional *i*Core
Data Export *(Available with EZHub and iCore/PC)*	Export of results to date in a single file onto a USB memory stick. When using *i*Core/PC, user can select date range; when using EZHub port, all data is exported
Available Communications *(Available with EZHub)*	Proprietary communications via RS485 and Ethernet connections to DGA Viewer software
Optional Communications *(ModBus available with PC, others available with iCore)*	IEC61850 Edition 2, DNP3 IEEE Std 1815-2012, ModBus RTU V1.02, ModBus TCP/IP 1.0b protocols
EZHub Alarm Contacts	(3) programmable relay outputs (Type C, NO/NC) for caution, warning, & alarm (1) alarm relay output for system status (Type C, NO/NC)
Relay Contact Ratings	Single phase alarm relays (8 A, 250 VAC; 5 A, 30 VDC)

Standard Accessories (included in system order)

- Mounting Hardware - includes single valve, dual valve or off transformer installation kit
- Connection Cable - 10 m standard (additional lengths and cold weather options available)
- DGA Viewer™ software

Optional Accessories

- LumaSMART *i*Core™ controller
- NEMA4x Enclosure (for SmartDGA EZHub™ and/or *i*Core)

*For operating temperatures less than -20 °C, the cold weather cable is required. Additional heating of oil transfer lines may be required for operation in cold locations. The unit will generate a system fault if the mineral oil temperature is outside of standard fluid limits of -20 and 120 °C. For operating in environments where the temperature routinely exceeds 40 °C, the high temperature accessory is recommended to prevent premature aging and reduction of component lifetime. Temperatures are based upon air temperatures for unit installation in shaded location.

LumaSense Technologies — **Awakening Your 6th Sense**

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