LUMASENSE® TECHNOLOGIES

AWAKENING YOUR 6th SENSE

TRANSMISSION & DISTRIBUTION SOLUTIONS

GIVING OUR CUSTOMERS A COMPETITIVE EDGE BY AWAKENING THEIR 6th SENSE

Providing insight and information to help our customers reduce waste and inefficiency in their most resource-intensive processes

LumaSense Technologies, Inc. was founded in 2005 as the world's first company to focus exclusively on reducing preventable waste and inefficiency across our planet's most resource-intensive global industries. LumaSense delivers advanced sensing technology to detect, reduce, and prevent waste and inefficiency in resource-intensive industries including Global Energy, Industrial Materials, and Advanced Technologies.

LumaSense enables customers worldwide to achieve predictable and sustainable improvements in process efficiency and waste reduction. These customers have processes that include generating and transmitting electricity; oil and gas refining; processing industrial materials; and manufacturing advanced technologies such as semiconductor, wafers, and LEDs. LumaSense gives our customers a competitive edge by awakening their 6th sense.

What is the 6th Sense?

The 6th sense is the power of perception beyond the five senses. Some refer to it as intuition, others say it is the ability to understand the subtle cause and effect relationship behind many events.

LumaSense Technologies provides the sensors and solutions that awaken this 6th sense in customers to allow them to efficiently optimize their processes.

VISION

To give our customers a competitive edge by awakening their 6th sense

MISSION

To provide insight and information to help our customers reduce waste and inefficiency in their most resource-intensive processes

OUR FOCUS MARKETS

Global Energy

LumaSense Global Energy customers include the world's leading power producers and energy transmitters such as electrical utilities as well as oil/gas refineries.

Industrial Materials

LumaSense Industrial Materials customers include the world's leading manufacturers of glass, metals, and plastics.

Advanced Technologies

LumaSense Advanced Technologies customers include the world's leading semiconductor, solar, and LED/MOCVD equipment manufacturers.

CORPORATE HISTORY

1958 — *Impac*™ is founded

1969 — Andros® and Mikron® are founded

1978 — *Luxtron® and Innova™ are founded*

2005 — **LumaSense is founded and acquires *Luxtron®***

2006 — Acquires Innova™

2007 — Acquires Andros®, Impac™ and Mikron®

2010 — Acquires Opsens Energy and ITC

2011 — Acquires Reliability Point for Service Offerings

2012 — LS⁶ Systems at 50,000+ sites, First SmartDGA® for Energy Launched

LUMASENSE TECHNOLOGIES

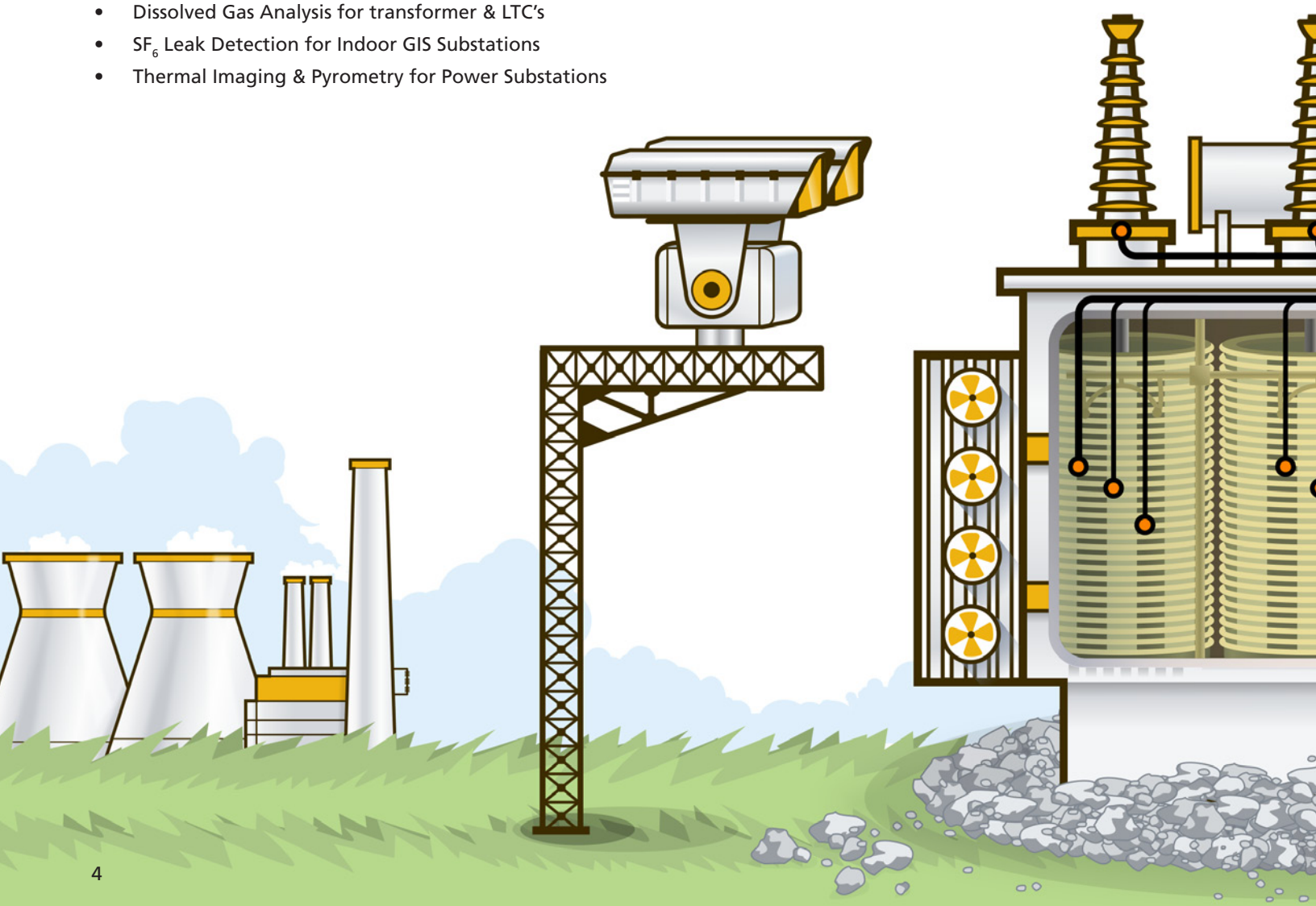
LumaSense Technologies, Inc., delivers innovative temperature and gas sensing instruments for the energy, industrial, and clean technology markets.

With a 50-year history of creating efficiencies through light-based measurement, LumaSense Technologies, Inc., delivers innovative temperature and gas sensing instruments for the Global Energy, Industrial Materials , and Advanced Technologies markets. Our unrivalled passion for excellence is why we have become the one of the world's most trusted sensing solution providers. Beyond providing precision engineered instruments, our customers turn to us knowing our commitment to their success comes first. With expert application understanding and a growing portfolio of products, LumaSense can combine several technologies together into novel solutions even for the most complex environments.

At LumaSense, our mission to give our customers a competitive edge by awakening their 6th sense. We do this by helping our customers improve resource efficiency with sensing solutions for their difficult-to-measure processes. Our gas portfolio not only helps our customers achieve energy and process efficiency, but monitors the world's most harmful and dangerous gases. Because our gas sensing solutions offer superior sensitivity over other gas detection techniques, our gas modules and instruments are particularly beneficial when the environment and human safety are involved.

Our Solutions include

- Fiber Optics Temperature measurements
- Dissolved Gas Analysis for transformer & LTC's
- SF_6 Leak Detection for Indoor GIS Substations
- Thermal Imaging & Pyrometry for Power Substations







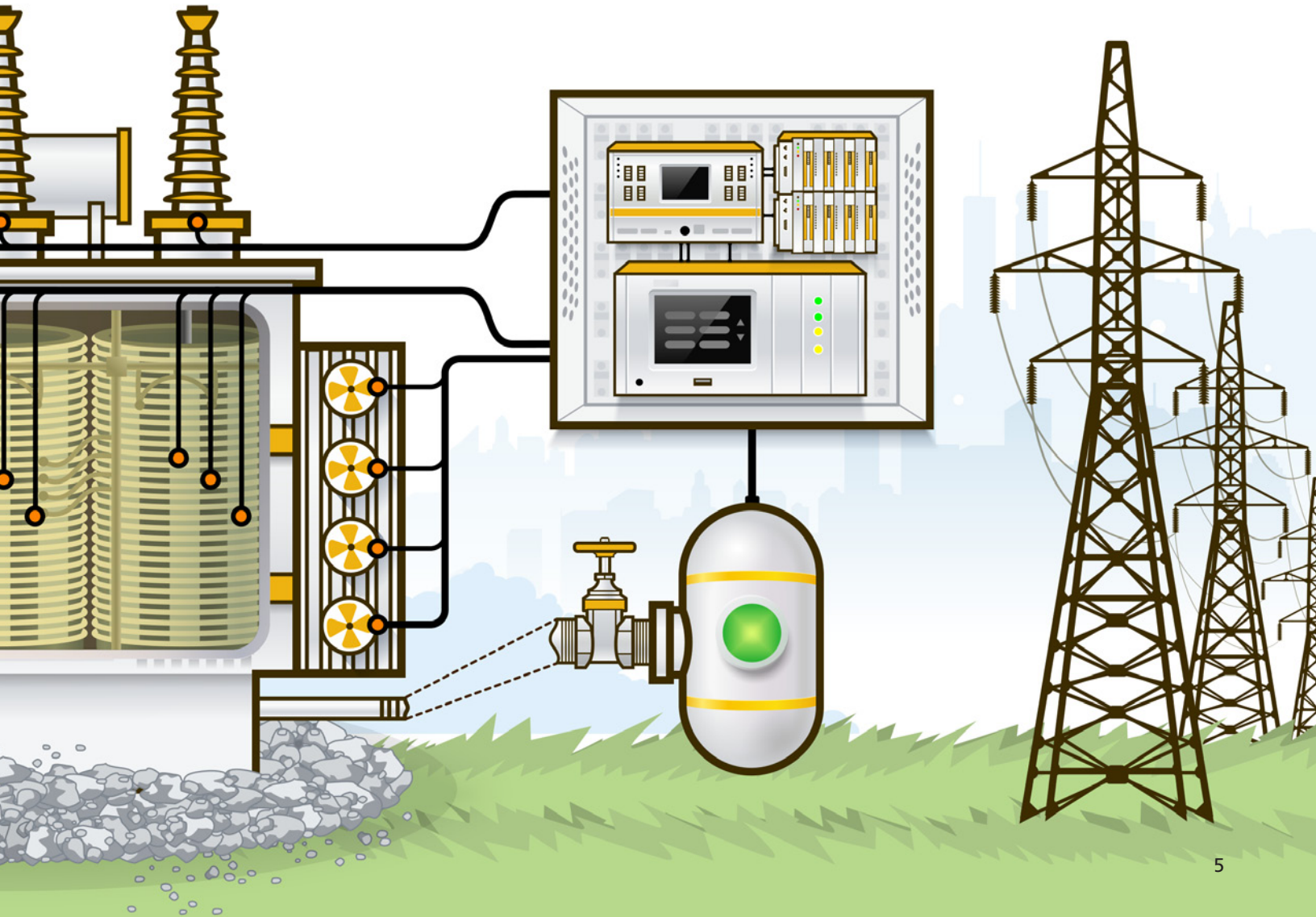
LumaSense Technologies is well established in fiber optic temperature measurement through our LUXTRON Fiber Optic Hot Spot sensing solutions, with over 5,000 transformers monitored globally over the last 30 years.

Our ANDROS brand for NDIR gas analysis has been a pioneer for special applications such as auto emissions, patient monitoring, and dissolved gas analysis. We have shipped over 400,000 instruments with NDIR technology over the past 45 years.

The SF_6 Leak Detector 3434i from LumaSense Technologies offers unmatched performance and convenience. Based on Photoacoustic Spectroscopy (PAS) technology, the system offers highly accurate, reliable and stable quantitative gas detection. The growing environmental requirements regarding the use of SF_6 make LumaSense's system a coveted tool designed for everyday use.

The LumaSpection™ TS724DV Remote Thermal Monitoring System represents another milestone in innovative infrared thermometry. With its multiple camera system functionality, it is the first system to allow remote monitoring of temperatures in real time via image data obtained from one or more cameras and sent to a single central controller.

Our unrivalled passion for excellence is why we have become one of the world's most trusted sensing solution providers.



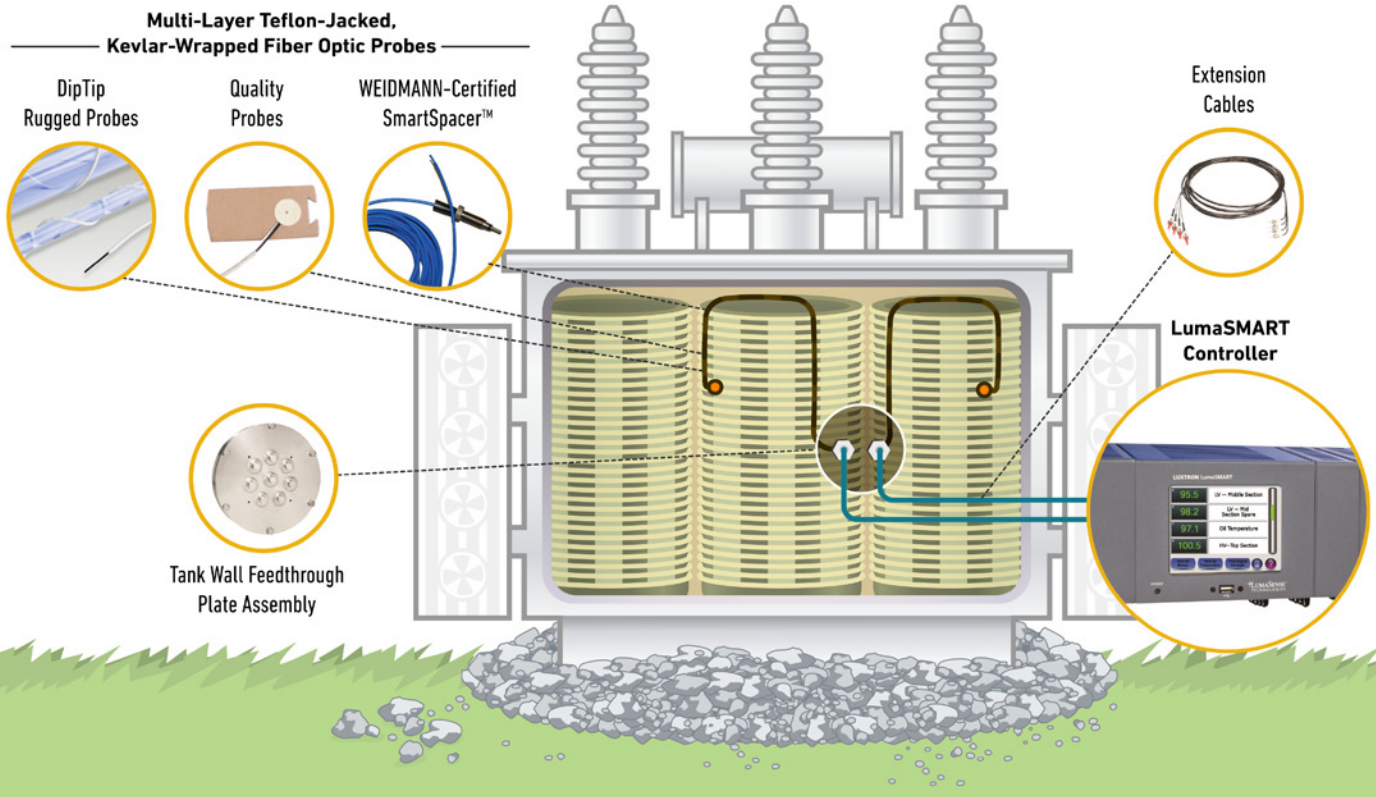
LumaSMART® Fluoroptic Thermometry Fiber Optic Temperature Sensing System

Best-in-Class Fluoroptic®-Based Solutions for Winding Hot Spots

LumaSense Technologies' LumaSMART winding hot spot temperature system is the most advanced and reliable real-time monitoring solution available today. LumaSense is the leader in Fluoroptic (FOT) Technology, with decades of proven expertise. The LumaSMART FOT hot spot monitoring systems provide accurate, real-time temperature readings for protection and control of your critical power transformer assets.

LumaSense Technologies' LUXTRON brand is the world leader in fiber optic temperature measurement in transformers. With more than 30 years of fiber optic experience, LumaSense continues to lead the way in innovation of new, robust technology.

Measuring Hot Spot Winding Temperature
Transformers often take the brunt of an overload condition. Monitoring the transformer winding hot spot is critical to safeguard your transformer from damage and extend its usage. The highest temperature on the windings is the Winding Hot Spot, where the insulating paper will deteriorate first. Conventional methods simulate or calculate this temperature, but do not accurately measure it. Our reliable, accurate Fiber Optic monitors quickly detect and respond to hot spot conditions, triggering alarms and relays to protect your most valuable assets.



LumaSMART Controller

LumaSense Technologies' LumaSMART controller is the newest innovation from the leader in FOT technology. The LumaSmart Controller provides all of the capabilities of its predecessor, while adding smart grid capabilities, an innovative touch screen, and extended channel and relay capabilities.

Fluoroptic Probes

The measurement performance of LUXTRON probes exceeds common temperature sensors in environments with high voltage, radio frequency interference (RFI), electromagnetic interference (EMI) or corrosive and above boiling point liquids.

WEIDMANN-Certified SmartSpacers™

Our sensor tips can be supplied with WEIDMANN-certified SmartSpacers. All WEIDMANN-certified components, including adhesives and assemblies, meet strict manufacturing process controls.

Tank Wall Plate Assembly

LumaSense provides welded tank wall feedthrough plate assemblies. Each tank wall plate features our proprietary welded feedthroughs on a stainless steel plate, with a carbon steel backing ring and Viton O-ring for maximum protection against leaks.

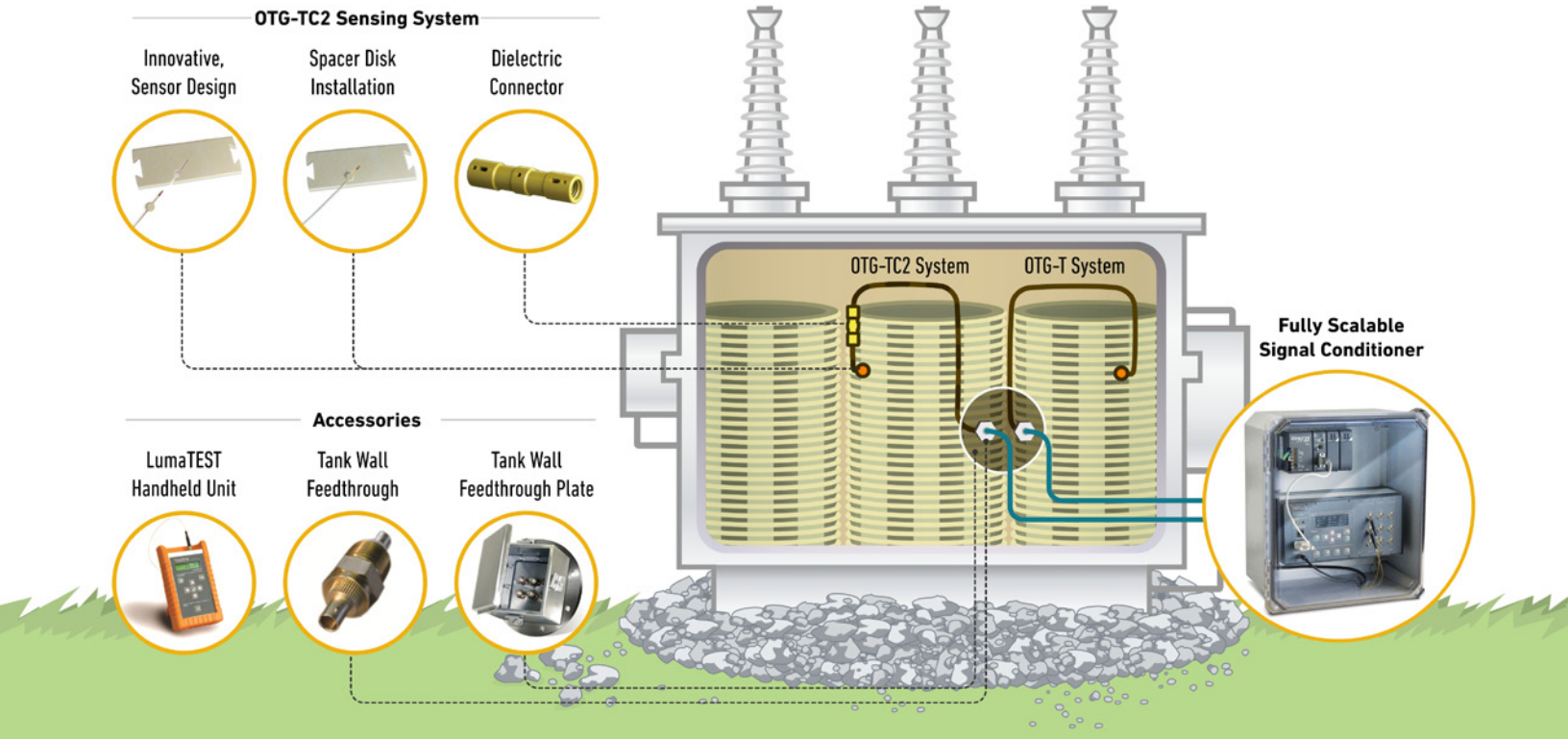
LumaSHIELD® GaAs-Based Fiber Optic Temperature

Best-in-Class GaAs-Based Solutions for Winding Hot Spots

LumaSense Technologies' LumaSHIELD fiber optic temperature measurement system is a high value, cost-effective alternative to LumaSense's rugged Fluoroptic® monitoring systems. Based on field-proven Gallium Arsenide (GaAs) crystal technology used in transformers since the 1990s, the LumaSHIELD's direct, real-time temperature measurement addresses the critical issues encountered by transformer and electric utility managers: ease of installation, long-term reliability, and easy integration into existing infrastructures.

GaAs-based Fiber Optic temperature sensing technology is ideal for smaller, lower voltage transformers found in the distribution side of the smart grid.

Measuring Hot Spot Winding Temperature
Transformers often take the brunt of an overload condition. Monitoring the transformer winding hot spot is critical to safeguard your transformer from damage and extend its usage. The highest temperature on the windings is the Winding Hot Spot, where the insulating paper will deteriorate first. Conventional methods simulate or calculate this temperature, but do not accurately measure it. Our reliable, accurate Fiber Optic monitors quickly detect and respond to hot spot conditions, triggering alarms and relays to protect your most valuable assets.



LumaSHIELD Monitor

The LumaSHIELD is a reliable multi-channel signal conditioner built for smooth and easy field deployment. It distinguishes itself through innovation, simplicity, and enhanced integration flexibility. This fully scalable signal conditioner, provides reliable real-time temperature measurements and offers both direct on-screen and on-PC display of real-time winding temperature. Using its internal data logging capability, it can collect and store temperature data in memory over a selected period of time.

GaAs-Based Probes

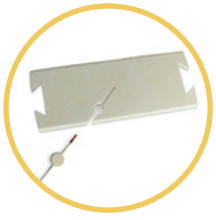
LumaSense's GaAs-based probes feature proven technology and innovative installation solutions. The perforated PTFE tubing and spiral wrap protective sheathing allow easy cable handling and guarantees sensor and cable integrity. The probe tip is encapsulated in uniform size protective tubing, ensuring full protection against mechanical stress and transformer oil damage.

OTG-TC2 Sensing System

Our innovative two-step fiber optic sensor winding installation process eliminates the need for handling long fiber optic cable during transformer assembly.

Spacer Disk

Our sensor tips can be supplied with a factory fitted Nomex™ spacer disk. The spacer allows easy, adhesive-free mounting in the spacer key, facilitating optimal probe position.



Accessories

Transformer Wall Optical Interface

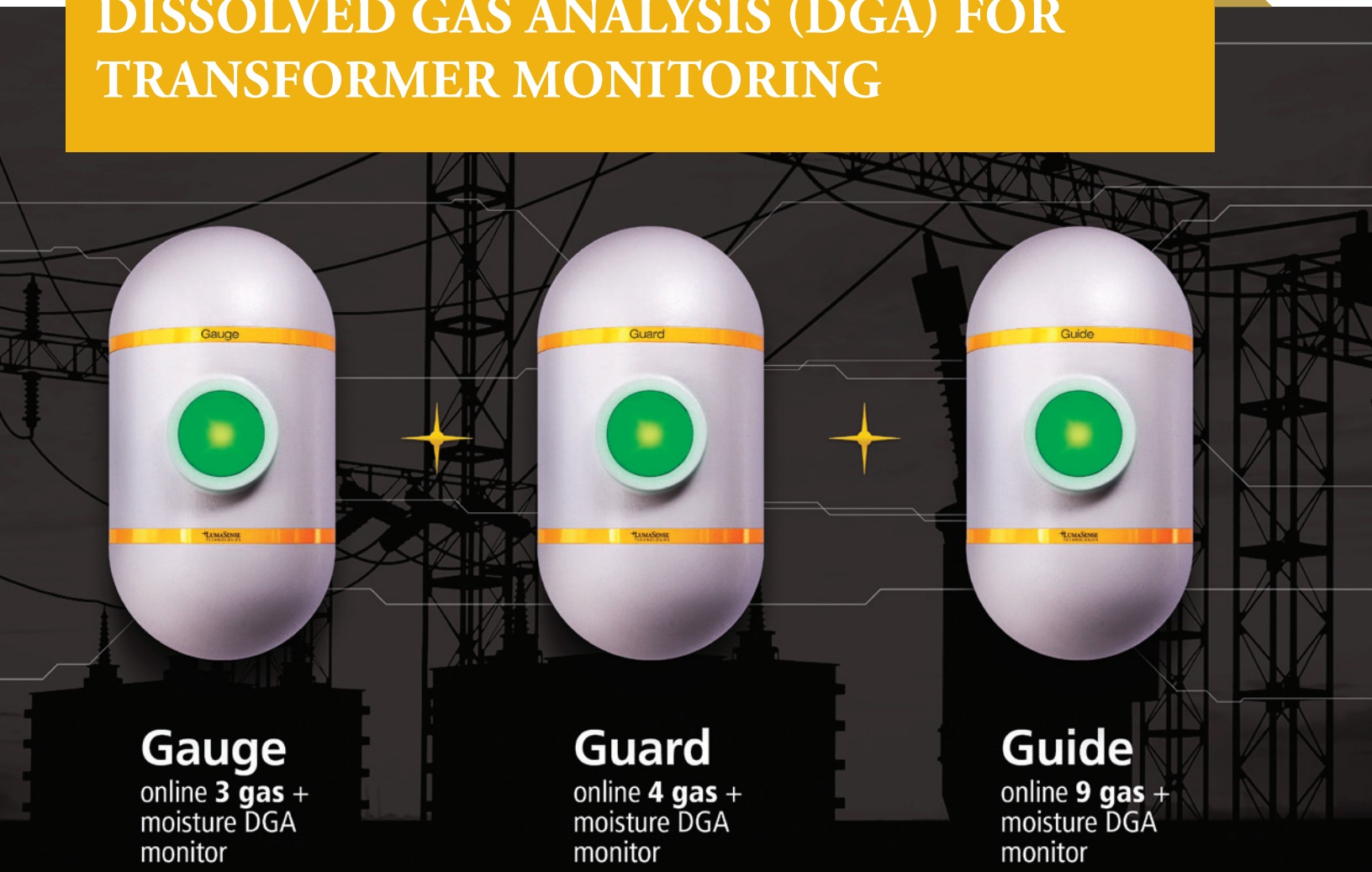
Installing the OFT-N38 feedthroughs on the bolted stainless steel tank wall plate ensures a transformer optical interface withstands up to 20 BAR / 290 PSI of oil pressure.

A stainless steel protective cover can be attached to gaurd the assembly.

LumaTEST

The LumaTEST is a rugged, handheld system designed for field test applications. The LumaTEST allows for quick, easy validation of the sensor.

DISSOLVED GAS ANALYSIS (DGA) FOR TRANSFORMER MONITORING



SmartDGA®

It's Easy

In 2012, LumaSense Technologies released SmartDGA® – a new category of DGA monitors designed for easy installation, high performance, large scale deployments, and to help utilities achieve fleet-wide usage of transformer and load tap changer (LTC) DGA monitoring. Using our field proven Non-Dispersive Infrared (NDIR) sensing platform, innovative gas separation technology, and innovative design, SmartDGA is designed to be Easy... easy to buy, install, and maintain.

SmartDGA addresses three major challenges:

Cost of ownership: most DGA monitors are too expensive to support wide-scale deployment, thus limiting the ability to realize a Smart Grid and true condition-based maintenance. SmartDGA brings a total cost of ownership up to 80% less than what is seen in the market today.

Flexibility: online DGA systems lack flexibility and the ability to accurately identify and mitigate faults. SmartDGA has flexible mounting and configuration, which can easily be expanded upon.

Ease-of-Use: most monitoring technologies are cumbersome to install, maintain and service, leading to a poor overall user experience. SmartDGA is simple to install, simple to use, and simple to upkeep.

THE SMARTDGA® SYSTEM

LumaSense has developed a cost-effective online monitoring solution based on proven, state-of-the-art non-dispersive infrared (NDIR) technology. This new suite of products is designed to allow customers to continuously monitor and control the condition of LTCs and transformers.

The **SmartDGA Gauge**™ is the industry's first dedicated online load tap changer (LTC) condition monitor. With the ability to monitor ethylene (C_2H_4), acetylene (C_2H_2), Methane (CH_4), and moisture without maintenance and routine calibration, it offers the best value to assess LTC health.

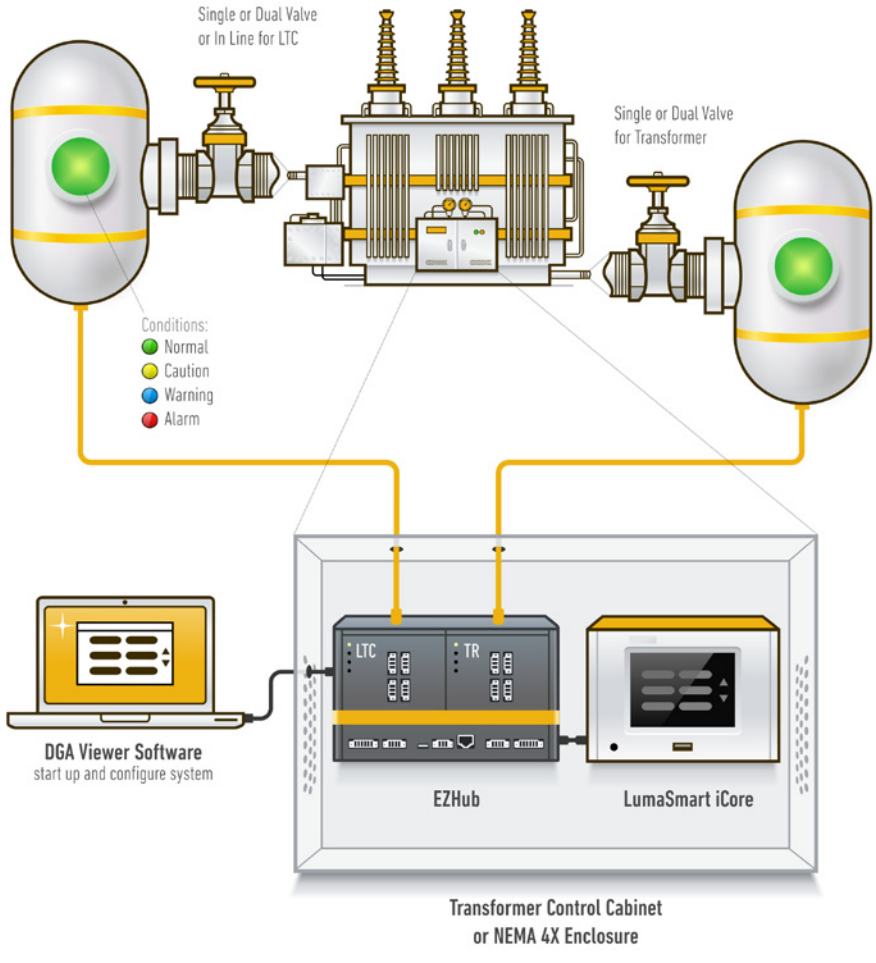
The **SmartDGA Guard**™ provides reliable early warning diagnostics to prevent transformer failures. It measures and reports Hydrogen (H_2), Carbon monoxide (CO), Carbon Dioxide (CO_2), acetylene (C_2H_2), and moisture for incipient fault detection without routine maintenance, calibration, or need for carrier gas.

The **SmartDGA Guide**™ provides comprehensive online Dissolved Gas Analysis (DGA) monitoring and diagnostics to prevent transformer failures. It measures and reports all DGA gases at half the cost of other 9 gas DGA monitors. Furthermore, the Guide vastly reduces total cost of ownership due to its differentiated design and installation scheme.

The **SmartDGA EZHub**™ unit is designed for easy connectivity. It provides power and communications (RS485 and ethernet) for the SmartDGA system. It has on-board memory storage and allows for easy upload and download of data and updates via RS485, Ethernet or a USB connection.

The **LumaSMART *i*Core**™ controller provides Smart grid ready advanced communications like IEC 61850, DNP3, MODBUS. It also provides high-powered computerized display for viewing, trending, and diagnostics; as well as long-term memory storage.

The **DGA Viewer**™ software allows users to configure systems using various set-up tools and view data being captured by the SmartDGA® instrument. The software also enables easy commissioning and local display of online DGA results.

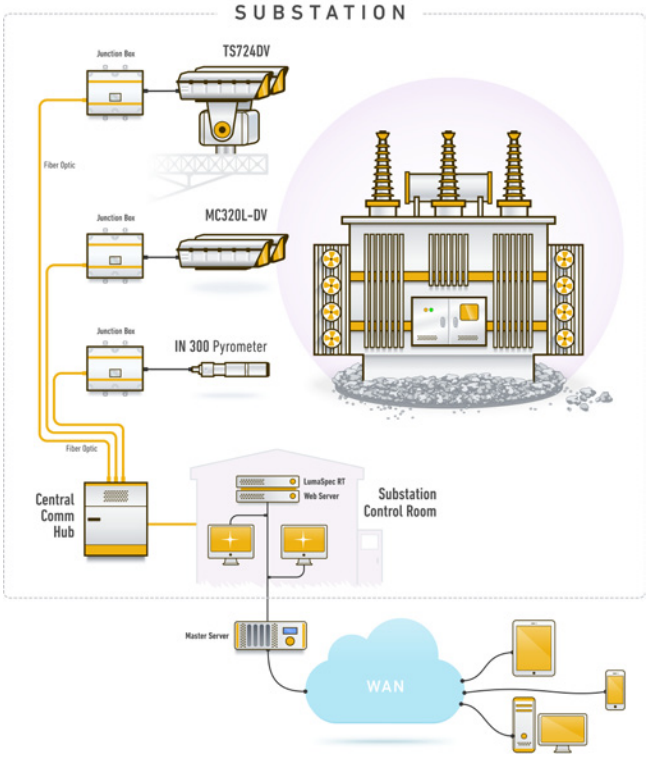


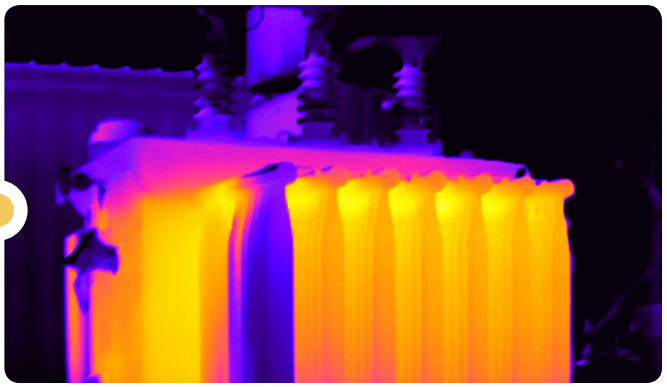
LUMASPECTION™ FOR SUBSTATIONS: TS724DV

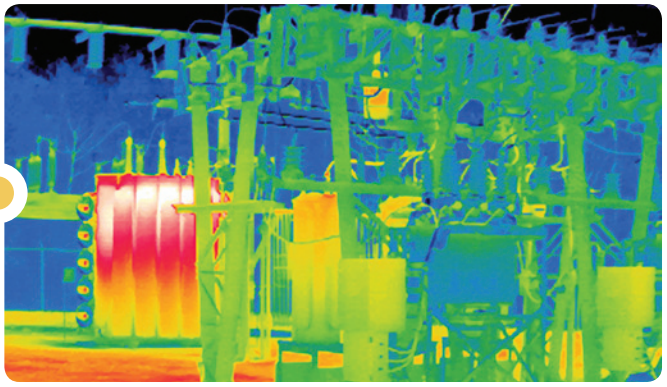
Automated, continuous thermal and visual imaging to identify thermal abnormalities within electrical substations and other process control systems

The LumaSpection™ TS724DV Remote Thermal Monitoring System represents another milestone in innovative infrared thermometry. With its multiple camera system functionality, it is the first system to allow remote monitoring of temperatures in real time via image data obtained from one or more cameras and sent to a single central controller.

Designed with advanced maintenance-free electronics and industrial protective packaging, the LumaSpection TS724DV system offers a high degree of accuracy for demanding industrial and electric utility settings, while quickly measuring temperature without contact in even the most adverse environments.







LumaSpection™ for Substations: TS724DV

- Real-Time, Remote Monitoring/Control with Full Range Pan-and-Tilt Capability
- High Resolution Readings of 0.08 °C at up to 60 measurements per second
- Temperature Measurement Between -40 °C and 500 °C
- Alarm Communication via OPC/Modbus or Standard Alarm Feedback (Relay, 4-20mA, 0-10V, etc.)
- Multi-Spot Temperature Measurement with Independent Emissivity Settings at Each "Tour" Location

MIKRON Infrared Temperature Sensors: MC320

High Performance Infrared Camera for Demanding Real-Time Imaging Applications

- High performance, cost-effective complete monitoring solution
- Advanced maintenance-free electronics and industrial protective packaging
- Serves the industry's broadest range of process monitoring applications
- Superior images and temperature measurement for long- and mid-wave applications

Compact pyrometer for non-metallic surfaces: IN 300

Small, stationary infrared thermometer for non-contact temperature measurement of non-metallic surfaces between -20 °C and 500 °C

- Very small housing dimensions for easy installation, suitable for use in confined spaces
- Stainless steel housing
- Easy electrical and mechanical installation
- Ambient temperature up to 70 °C without cooling

SF_6 LEAK MEASUREMENT SOLUTION

SF_6 Filled Equipment Testing

Sulfur Hexafluoride (SF_6) is one of the most potent greenhouse gases, with a Global Warming Potential of more than 22,000 times than that of CO_2. Over the past decades, manufacturers have replaced oil high-voltage switch gears with SF_6-insulated units. Today, the power utility industry uses roughly 80% of all SF_6 produced worldwide.

The system measures the total concentration of the SF_6 gas in an enclosed area of a GIS Substation to determine the leak rate. By accurately measuring leak rate, utilities can improve quality while decreasing costs and emissions.

SF_6 Leak Detector 3434i

- Highly stable, with no consumables or radioactive sources
- Exceptional accuracy with auto-compensation for temperature and pressure fluctuations, as well as water vapor compensation and measurement
- Expandable to an area monitoring system in up to 24 locations with 1309 Multipoint Sampler(s)
- Remote control capability via LAN using the LumaSoft Multi Point 7860 software

INNOVA 1309

- Full remote-control from a PC via the gas monitor over the IEEE 488/ RS-232 serial interface
- Twelve (12) sample-input channels
- Six temperature transducer inputs
- Self-test function
- Pneumatic system constructed of AISI-316 Stainless Steel and PTFE tubing to minimize gas absorption

LumaSoft Gas Multi Point 7860

- Synchronizes the sampling functions of the sampler units to the measurement cycle of the Photoacoustic Gas-Monitors
- Displays measurement data in either a table or a graphical window; data can be displayed in a Channel or Gas view mode
- Easy exchange of displayed data for different measurement locations
- Measurement data stored in SQL Server 2005 database
- Online access to the measurement data via built in OPC Server
- Login-secured access to measurement data
- Alarm reporting for each gas at each measurement location

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