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Company of the Leister Group

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together.

Laser Gas Detection

OEM Gas Sensing Solutions

Swiss made


Verifikation 03
System BurnIn
Verifikation 03
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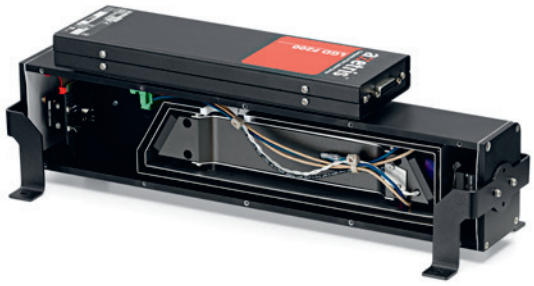
Overview

Laser Gas Detection (LGD), based on Tunable Diode Laser Spectroscopy (TDLS), provides a solution to many gas analysis challenges in emission monitoring and process control. The technology offers unique advantages like precise optical, contactless measurements, excellent target gas selectivity and sub ppm-level detectivity.

Axetris' laser gas detection modules are stand-alone, ready-to-use OEM subsystems for selective detection and monitoring of gases. The sensor is based on a technology called "TDLS" – or Tunable Diode Laser Spectroscopy, which has proven its validity in high-end laboratory and process control applications. It uses a laser to scan the specific absorption lines of a target gas with an extremely high resolution, which enables a precise measurement of the gas concentration with a very high selectivity. Axetris' proprietary approach to TDLS leverages this technology to low-cost, high-volume gas detection & monitoring applications: The use of low-cost telecom-type laser diodes as light source, combined with Axetris' intellectual property of reference channel-free devices, reduces the gas sensor to a set of generic components and enables significant cost synergies across applications.



LGD F200 OEM Module, inside view

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Technology highlights

- Optical, contactless, accurate laser measurement
- High selectivity
- Fast response
- Self-contained, easy to integrate
- Continuous sensor status monitoring
- Low cost-of-ownership
- Hot-gas measurement option up to 220°C

Applications

- **Process control:**

SCR in power generation & engine development, carbonitriding of steel, agriculture

- **Environmental:**

Continuous Emissions Monitoring (CEM), biogas, fugitive emissions, natural gas, leak detection

- **Medical:**

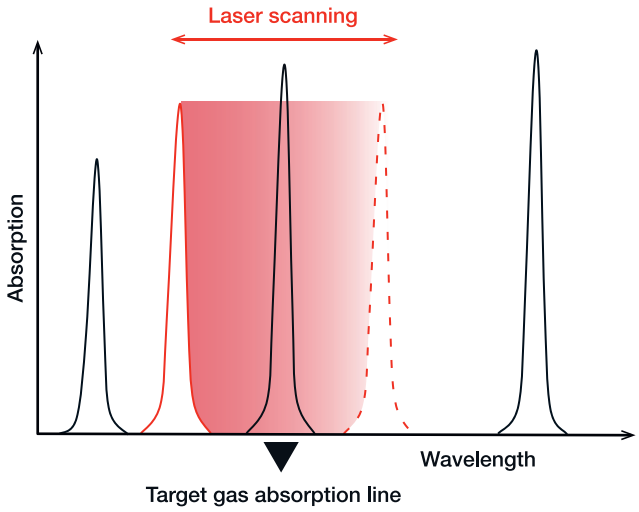
Breath analysis - pulmonary diagnostics (ergospirometry)

- **Research:**

Climate control, environmental studies

Technology Brief

Axetris uses proprietary technology-enhanced TDLS for gas detection, where a 0.05 nm narrow bandwidth diode laser beam scans across an absorption band of the target gas, performing a high-resolution near-infrared absorption measurement. Electronic lock-in technology allows separating the gas absorption information from electro-optical system information, leading to a detection method eliminating the need for a physical reference channel and offering continuous sensor status monitoring. Thus, Axetris' LGDs present a clear alternative to current sub-optimal detection solutions and combine precise, contactless optical measurements with high target gas selectivity, calibration-free operation, low cost-of-ownership and easy OEM integration.



LGD Modules ready for calibration

Your OEM Partner for Gas Sensing Solutions

Axetris AG is a designer and OEM manufacturer of Laser Gas Detection (LGD) solutions based on Tunable Diode Laser Spectroscopy (TDLS). The TDLS technology provides a valid solution to many gas detection challenges. We support our OEM customers with in-depth technology and application expertise from feasibilities until product launch. We collaborate with you in finding the right product design which best suits your needs in terms of performance and costs.

How Axetris enables its OEM customers to master gas measurement challenges?
Axetris provides easy-to-integrate sensor modules with Swiss Made quality and precision allowing you to reach new applications or simply to make your instruments better.

Understanding customer needs very well from the outset is essential to the development of an appropriate OEM product. This is where our core competencies come in: our customers trust in our TDLS technology expertise, practical application knowledge, and experience in the OEM business. On the basis of the jointly defined product requirements, we develop a solution and verify its feasibility at an early stage through initial laboratory tests as well as field tests. The test results help us optimize the product design which is then industrialized in order to reach market readiness. In doing so, we not only establish the performance expected of the future product; we also deal with the matter of cost in order to make it possible for our customers to get the OEM solution that best suits al their requirements.

As an OEM partner, we assist our customers with the integration at their side as well as with technical trainings. We have a competent Application Engineering Team for consulting in the fields of product integration and after-sales support. Our Repair & Service Center performs repairs, maintenance, and recalibration.

Our customers can count on Axetris even after the industrialization/market introduction. We maintain our OEM solutions with software updates and, on request, assist our customers with the further development or modernization of existing OEM product solutions.

TDLS compared to other Gas Sensing Technologies

	TDLS	NDIR	FTIR	E-Chem
Performance & Reliability				
High selectivity	+	=	+	-
High stability and reliability in the field	+	=	+	-
Cost				
Low initial investment	=	=	-	+
Low cost of ownership	+	=	=	=
Flexibility				
Hot gas measurement	+	=	+	-
Multigas Sensing	=	+	+	+

LGD OEM compact module

LGD point detector

Application Examples

NH_3 slip control in de-NO_x processes based on Selective Catalytic Reduction (SCR)

Gases like NO_x can cause significant long-term environmental affects. Considering an over 100-year period, it has 310 times more impact 'per unit weight' (global warming potential) than carbon dioxide according to the United States Environmental Protection Agency (EPA). Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR) technologies for NO_x (Oxides of Nitrogen, NO +NO_2) controls have become the most popular means of NO_x reduction worldwide.

This process is extensively used in power plants and has found its way into emission control of large marine and fixed installed diesel engines.

The LGD Module is a perfect tool for OEM integrators because it offers a contactless low ppm-level measurement of NH_3 in a heated sample gas cell (220°C). Its extractive set-up allows for simple zero and span-gas calibrations.

NH_3 / HCl Continuous Emissions Monitoring (CEM)

Regulators worldwide dictate strict emissions limits for many atmospheric pollutants, including HCl (Hydrochloric Acid) and NH_3 (Ammonia). These emission limits require the emitting industries to monitor and report the level of the gas present in stack emissions and to ensure that steps are taken to guarantee that emissions fall below the specified limits. This may require the emitting industry to either refine their process, use cleaner fuels, or to add abatement apparatus downstream of the industrial process to reduce the emitted HCl or NH_3.

The Axetris LGD F200 integrated into an extractive set-up allows for simple zero and span-gas testing in compliance with legal regulations, e.g. in continuous monitoring of HCl in waste incinerators, cement & lime kilns, in steel production, etc. Typical applications for NH_3 monitoring are in stacks of power plants or chemical plants, as well as in fertilizer production prilling towers.

CH_4 leak detection from gas extraction over land or subsea transportation pipelines up to city-gas distribution leak search

Methane and other hydrocarbon emissions from extraction sites, gas treatment plants, from leakages in pipelines and city-gas networks are not only a safety hazard but also present a serious challenge in reducing overall greenhouse gas (GHG) emissions.

Fast reaction times due to minimized cell volume and rugged layout make the LGD Module an excellent instrument for CH_4-specific measurements. These characteristics are required for portable and vehicle mounted monitoring equipment used by utilities or their service providers in leak-search applications, or for shale-gas & oil extraction site surveillance.

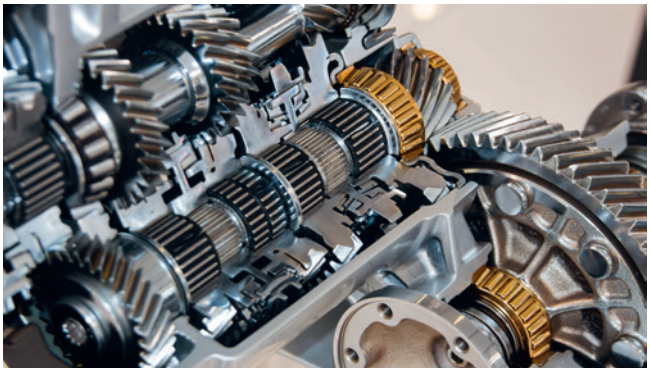
Environmental studies of greenhouse & landfill gas

Methane (CH_4) is a potent greenhouse gas, about 25 times more effective than CO_2 at trapping heat in the atmosphere, which outgases from reservoirs, landfills and permafrost soils. Axetris Laser Gas Detection technology can reliably & selectively measure methane down to low ppm concentrations without the need for frequent recalibrations. Our sensors are suited for under-water or remote-site applications, e.g. in environmental research or for applications related to the commerce of CO_2 certificates.

Industrial process control for surface treatment (steel surface hardening by gas nitriding)

Gas nitriding is a thermochemical process that diffuses nitrogen into the surface of a metal to create a case-hardened surface used to increase wear resistance, surface hardness and fatigue life.

In gas nitriding the donor is a nitrogen rich gas, usually ammonia (NH_3). When ammonia comes into contact with the heated work piece, it dissociates into nitrogen and hydrogen. The nitrogen then diffuses onto the surface of the material creating a nitride layer. Recent developments have led to a process that can be accurately controlled. The thickness and phase constitution of the resulting nitriding layers can be selected and the process optimized for the particular material properties required.
The Axetris OEM sensor LGD F200 with its large linear measuring range from 0 – 5000 ppm represents a reliable measuring solution for this application achieving a good control of the layer properties and thickness.



CH_4 / CO_2 detection for breath analysis in medical applications

Breath tests represent an effective way to investigate functional bloating, diarrhea, constipation, and suspected malabsorption, such as lactose and fructose. They are considered as a valid alternative to more invasive procedures. Approximately half the biomarkers identified in human breath air can be detected by laser spectroscopic techniques. TDLS is a robust and reliable technology able to sense many of these biomarkers such as methane (CH_4) and carbon dioxide (CO_2). The spectroscopic analysis of breath air can shorten the period needed to conduct tests from hours down to seconds and subsequently reduce mortality, prevent unnecessary hospitalization and greatly reduce medical expenses. Breath analysis is also seen as an effective diagnosis instrument helping in defining the appropriate antibiotic therapy at an early stage.
Elevated methane levels can suggest indigestion and are a possible indicator of fructosemia or lactose intolerance. Axetris Laser Gas Detection technology is capable of measuring methane with unprecedented precision at trace levels. Methane provides important insights into the performance of the carbohydrate metabolism.
Carbon dioxide is a quality indicator, signaling whether the subject is taking sufficiently long and deep breaths. Low levels of carbon dioxide suggest shortness of breath. It has also been identified as an indicator of certain infections as well as liver malfunction and excessive bacteria growth. It is also often used as a reference to determine the amount of exhaled air that has been detected by the sensor to help determine the percentage concentrations of constituents.

Typical Specifications

Target gas*		Lower detection limit **	Typical measuring ranges
NH_3, (H_2O)	Ammonia *** (Hot-wet measurement)	0.2 ppm	0 – 15, 50, 100, (500) ppm
HCl, (H_2O)	Hydrogen chloride *** (Hot-wet measurement)	0.1 ppm	0 – 10, 100, (500) ppm
CH_4	Methane	0.4 ppm	0 – 100 (40'000) ppm
CO_2	Carbon dioxide	4.0 ppm	0 – 1000 (300'000) ppm

* Other gases on request.
** Detection limits at constant system temperature, 20°C, 1013 hPa and 50 ± 1.5% r.H. Detection limits may change where system temperature changes occur significantly faster than concentration changes, and/or where a difficult gas matrix is present.
*** Detection limits degrade at higher temperatures due to spectroscopic reasons; e.g. NH_3 at 220°C.

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About Axetris AG

Axetris serves OEM customers with micro-optical components, micro technology-based (MEMS) infrared light sources, mass flow meters and controllers, and laser gas detection modules used in industrial, telecom, environmental, medical, analytical and automotive applications.

Our multi-disciplinary and highly skilled engineering and manufacturing teams combine broad experience in design, manufacturing and metrology from MEMS components to advanced optical and electronic sensor modules. Axetris supports its customers with in-depth application know-how. Customers benefit from excellent product value, consistent high product quality and outstanding customer support. OEMs rely on Axetris worldwide as a competent partner for customer-specific solutions from concept to volume production. Axetris is ISO 9001:2015 certified and operates its own 6-inch to 8-inch wafer MEMS foundry for its own products and contract manufacturing for external customers. A wafer back end, a sensor assembly and calibration facility under clean room conditions completes the manufacturing infrastructure of Axetris.

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