

Preliminary Product Datasheet

OEM Gas Sensing Module LGD Compact Ultra

1 General Description

Axetris offers Laser Gas Detection (LGD) OEM-modules with exceptional advantages and value for the customer. Tunable Diode Laser Spectrometry (TDLS), enhanced by proprietary technology, is used for the measurement of CH₄, CO₂, C₂H₆, C₂H₂, NH₃ and H₂O. The modules are designed for integration by Original Equipment Manufacturers (OEMs), active in the field of gas detection and monitoring in various industries.

The **LGD Compact Ultra** allows the measurement of target gas, based on contactless, near-infrared absorption. The modules come with a flow-through cell set-up for extractive measurements and are self-contained, ready-to-use.

The proprietary lock-in technology as well as the onboard digital signal processing unit runs algorithms compensating drift phenomena and providing reliable and stable measurements over time as well as enhanced detectivity. The OEM modules include an analog and digital data interface as well as digital outputs for state-of-the-art industrial connectivity.

Low maintenance during operation and long life-time provide customers with exceptional low cost-of-ownership and make the LGD Compact Ultra series the ideal solution for your OEM gas sensing applications.

Main applications

- **Leak Detection:** portable instruments, static measurement stations, vehicle-mounted, underwater, refrigeration, toxic gases, ...
- **Environmental & Climate Monitoring:** landfill, greenhouse gases, biogas, livestock, underwater research
- **Medical Applications related to breath analysis:** detection of gastrointestinal, liver and kidney diseases.
- **Additional applications:** gas analysis, control and monitoring in various sectors such as industrial, chemical, automotive, semiconductor, agricultural, ...



Benefits at a Glance:

- Suited for ambient gas measurement applications
- Optical, laser-based and contactless measurement
- High selectivity and long-term stability
- Fast response time
- Ultra-compact design for rapid OEM integration
- Digital and analog data interfaces
- Continuous sensor status monitoring
- Wide power supply range 3.7 - 24 VDC
- Low power consumption for battery-powered applications
- Low cost-of-ownership

2 Execution Specifications

2.1 Gas detection specifications for LGD Compact Ultra CH₄

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 24 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	CH ₄	
Measuring range	ppm	Low Range 0 – 100 (Full Scale)	High Range 0 – 40'000 (Full Scale)
Lowest Detection Limit ¹ 2σ	ppm	≤ 0.4 ≤ 0.1 for version Plus	
Precision ² 2σ	ppm	≤ 0.8 ≤ 0.2 for version Plus	≤ 0.8 or 0.6% of reading whichever is larger
Sampling rate	Hz	2	
T ₉₀ time	s	≤ 1.8 at 2 l/min	
Resolution	ppm	0.01	
Accuracy ³		± 2 ppm or $\pm 2\%$ of reading, whichever is larger	
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Temperature limitation	°C	-10 to +50	

¹ **Lowest Detection Limit (LDL):** The LDL is defined as 2 times the standard deviation σ evaluated over a time period of a 2 min measurement at stable reference conditions with set point 0 ppm. The LDL of the system can be improved by mean of averaging.

² **Precision:** The precision is defined as 2 times the standard deviation σ of a 2 min measurement at stable reference conditions over the full measuring range. The precision of the system can be improved by mean of averaging.

³ **Accuracy:** The accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value at reference conditions. Variations of the operating temperature and pressure can affect the accuracy of the system.

2.2 Gas detection specifications for LGD Compact Ultra CH₄/C₂H₆

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 24 VDC

Parameter	Unit	Value / Range		
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)		
Target gas	-	CH ₄		C ₂ H ₆
Measuring range	ppm	0 – 100 (Full Scale)	0 – 40'000 (Full Scale)	0 – 1'000 (Full Scale)
Lowest Detection Limit ⁴ 2σ	ppm	≤ 0.8 ≤ 0.1 for version Plus		≤ 8 or 5 / % CH ₄ , whichever is larger
Precision ⁵ 2σ	ppm	≤ 1.5 ≤ 0.2 for version Plus	≤ 250	≤ 10 or 5 / % CH ₄ , whichever is larger
Sampling rate dual gas mode	Hz	0.7		
Sampling rate single gas mode	Hz	2		-
T ₉₀ time	s	≤ 1.8 at 2 l/min		≤ 5 at 2 l/min
Resolution	ppm	0.01		
Accuracy ⁶	% of FS	± 3		≤ 2 or 4 / % CH ₄ , whichever is larger
Linearity and repeatability	-	included in the accuracy		
Cross interference	-	Gas matrix and application dependent		
Temperature limitation	°C	0 to 40		

* Examples for C₂H₆ detection in CH₄ gas matrix

C ₂ H ₆	CH ₄	Ratio ⁷	Measurement Result
50 ppm	10'000 ppm	1:200	C ₂ H ₆ detectable
50 ppm	5'000 ppm	1:100	C ₂ H ₆ detectable
50 ppm	20'000 ppm	1:400	C ₂ H ₆ not detectable
1000 ppm	10'000 ppm	1:10	C ₂ H ₆ detectable

⁴ **Lowest Detection Limit (LDL):** The LDL is defined as 2 times the standard deviation σ evaluated over a time period of a 2 min measurement at stable reference conditions with set point 0 ppm. The LDL of the system can be improved by mean of averaging.

⁵ **Precision:** The precision is defined as 2 times the standard deviation σ of a 2 min measurement at stable reference conditions over the full measuring range. The precision of the system can be improved by mean of averaging.

⁶ **Accuracy:** The accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value at reference conditions. Variations of the operating temperature and pressure can affect the accuracy of the system.

⁷ **C₂H₆/CH₄ Ratio:** C₂H₆ is just detectable in a CH₄ gas matrix in the ratios from 1:200 up to 1:10 at reference conditions. Variations of operating temperature and pressure can affect the C₂H₆ detectivity.

2.3 Gas detection specifications for LGD Compact Ultra CH₄/CO₂

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 24 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	CH ₄	CO ₂
Measuring range	ppm	0 – 100 (Full Scale) linear up to 250 ppm	0 – 100'000 (Full Scale)
Lowest Detection Limit ⁸ 2σ	ppm	≤ 0.4	≤ 2'000
		≤ 0.1 for version Plus	≤ 500 for version Plus
Precision ⁹ 2σ	ppm	≤ 0.8	≤ 2'000
		≤ 0.2 for version Plus	≤ 500 for version Plus
Sampling rate	Hz	0.7	
T ₉₀ time	s	≤ 3 at 2 l/min	
Resolution	ppm	0.01	
Accuracy ¹⁰	% of FS	± 2	± 3
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Temperature limitation	°C	10 to 40	

⁸ **Lowest Detection Limit (LDL):** The LDL is defined as 2 times the standard deviation σ evaluated over a time period of a 2 min measurement at stable reference conditions with set point 0 ppm. The LDL of the system can be improved by mean of averaging.

⁹ **Precision:** The precision is defined as 2 times the standard deviation σ of a 2 min measurement at stable reference conditions over the full measuring range. The precision of the system can be improved by mean of averaging.

¹⁰ **Accuracy:** The accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value at reference conditions. Variations of the operating temperature and pressure can affect the accuracy of the system.

2.4 Gas detection specifications for LGD Compact Ultra NH₃/H₂O

Reference conditions (if not otherwise specified): operating temperature 45°C, pressure 1013 hPa and humidity 20% r.H., power supply 10 - 24 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	NH ₃	H ₂ O
Measuring range	ppm	0 – 100 (Full Scale)	0 – 50'000 ¹¹ (Full Scale)
Lowest Detection Limit ¹² 2σ	ppm	≤ 0.4	≤ 1'500
		≤ 0.1 for version Plus	≤ 500 for version Plus
Precision ¹³ 2σ	ppm	≤ 0.8	≤ 2'000
		≤ 0.2 for version Plus	≤ 1'000 for version Plus
Sampling rate	Hz	0.7	
T ₉₀ time	s	≤ 3 at 2 l/min	
Resolution	ppm	0.01	
Accuracy ¹⁴	ppm	± 2	± 4'000
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Temperature limitation	°C	0 to +55	

¹¹ **H₂O Range:** depending on operating temperature, non-condensing conditions required in any case.

¹² **Lowest Detection Limit (LDL):** The LDL is defined as 2 times the standard deviation σ evaluated over a time period of a 2 min measurement at stable reference conditions with set point 0 ppm. The LDL of the system can be improved by mean of averaging.

¹³ **Precision:** The precision is defined as 2 times the standard deviation σ of a 2 min measurement at stable reference conditions over the full measuring range. The precision of the system can be improved by mean of averaging.

¹⁴ **Accuracy:** The accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value at reference conditions. Variations of the operating temperature and pressure can affect the accuracy of the system.

2.5 Gas detection specifications for LGD Compact Ultra C₂H₂/H₂O

Reference conditions (if not otherwise specified): operating temperature 45°C, pressure 1013 hPa and humidity 20% r.H., power supply 10 - 24 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	C ₂ H ₂	H ₂ O
Measuring range	ppm	0 – 100 (Full Scale) linear up to 500 ppm	0 – 100'000 ¹⁵ (Full Scale)
Lowest Detection Limit ¹⁶ 2σ	ppm	≤ 0.6	≤ 1'000
		≤ 0.1 for version Plus	≤ 500 for version Plus
Precision ¹⁷ 2σ	ppm	≤ 0.8	≤ 1'000
		≤ 0.15 for version Plus	≤ 500 for version Plus
Sampling rate	Hz	0.7	
T ₉₀ time	s	≤ 60 at 0.6 l/min	
Resolution	ppm	0.01	
Accuracy ¹⁸	% of FS	± 2	± 1.5
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Temperature limitation	°C	15 to 55	

¹⁵ **H₂O Range:** depending on operating temperature, non-condensing conditions required in any case.

¹⁶ **Lowest Detection Limit (LDL):** The LDL is defined as 2 times the standard deviation σ evaluated over a time period of a 2 min measurement at stable reference conditions with set point 0 ppm. The LDL of the system can be improved by mean of averaging.

¹⁷ **Precision:** The precision is defined as 2 times the standard deviation σ of a 2 min measurement at stable reference conditions over the full measuring range. The precision of the system can be improved by mean of averaging.

¹⁸ **Accuracy:** The accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value at reference conditions. Variations of the operating temperature and pressure can affect the accuracy of the system.

3 General Specifications

3.1 Environmental conditions

Parameter	Unit	Value / Range
Usage	-	Interior use
Operating temperature range	°C	-10 ... +65 ¹⁹
Operating humidity	% r.H.	0 ... 99, non-condensing
Operating pressure	mbar	800 ... 1100
Storage temperature	°C	-40 ... +80
Storage humidity	% r.H.	0 ... 99, non-condensing

3.2 Mechanical characteristics

Parameter	Unit	Value / Range
Measurement cell	-	Flow-through set-up
Cell volume	ml	19
Gas flow (min - max)	ml / min	100 - 3'000
Dimensions of sensor module	mm	148 (length)
Approx. weight sensor module	g	≤ 530

3.3 Electrical characteristics

Parameter	Unit	Value / Range
Voltage supply; min. - max.	VDC	3.7 - 24 (max. ripple ± 100mV, max. current 1A, inrush current limitation)
Power consumption	W	≤ 1 at T _{amb} 20°C
Start-up time	s	≤ 30

¹⁹ For application specific temperature ranges please see the specifications in chapter 2

3.4 Data interface

Parameter	Unit	Value / Range
RS 232 EIA	-	RS232 protocol
RS 232 TTL	-	RS232 protocol, TTL signal amplitude 0 - 3.3 VDC
Analog Current Output	mA	4 - 20, 12-bit resolution
Analog Voltage Output	V	0 - 5, 12-bit resolution
Resistive loads		
for voltage output	kΩ	> 2
for current output	kΩ	< 0.47
Capacitive loads		
For voltage output	pF	< 200
For current output	pF	< 200
Protection		ESD protected

4 Configuration Options

4.1 Standard

	Silver cover - standard version
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4.2 Version *Plus*

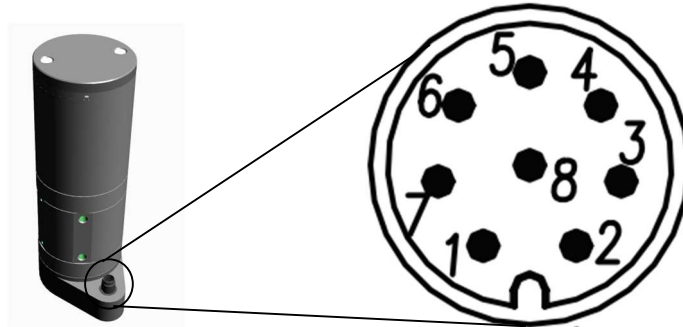
	Golden cover - version Plus with enhanced performances.
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4.3 Gas fitting connectors

Gas Fittings	
	
Festo (QSM-M5-4, straight)	Festo (QSML-M5-4, angled)

5 Connector Assignments

Figure 1: Pin numbering according to M8 male A-coded standard.



Connector assignment

	Pin	Name	Description
Power Supply	1	GND IN	Power supply ground
	2	POWER IN	Power supply 3.7 ... 24 VDC
	3	GND*	Common Ground
Analog Interface (1)	4	ANALOG OUT	Analog output (voltage or current, configurable)
Digital Communication (2)	5	RXD TTL	UART serial interface, TTL level
	6	TXD TTL	UART serial interface, TTL level
	7	RXD RS232	UART serial interface, RS232 (EIA standard)
	8	TXD RS232	UART serial interface, RS232 (EIA standard)

(1): The analog output functionality depends on the applied supply voltage.

- For voltage output operation (0–5 V), a minimum supply voltage of 5 V is required.
 - For current output operation (4–20 mA), a minimum supply voltage of 8 V is required.
- Operation below these limits may result in degraded or invalid output signals.

(2): The TTL and RS232 interfaces use different electrical signal levels and are not compatible.

Only one interface shall be used at a time. Simultaneous connection or use of both interfaces is not permitted.

6 Product Dimensions

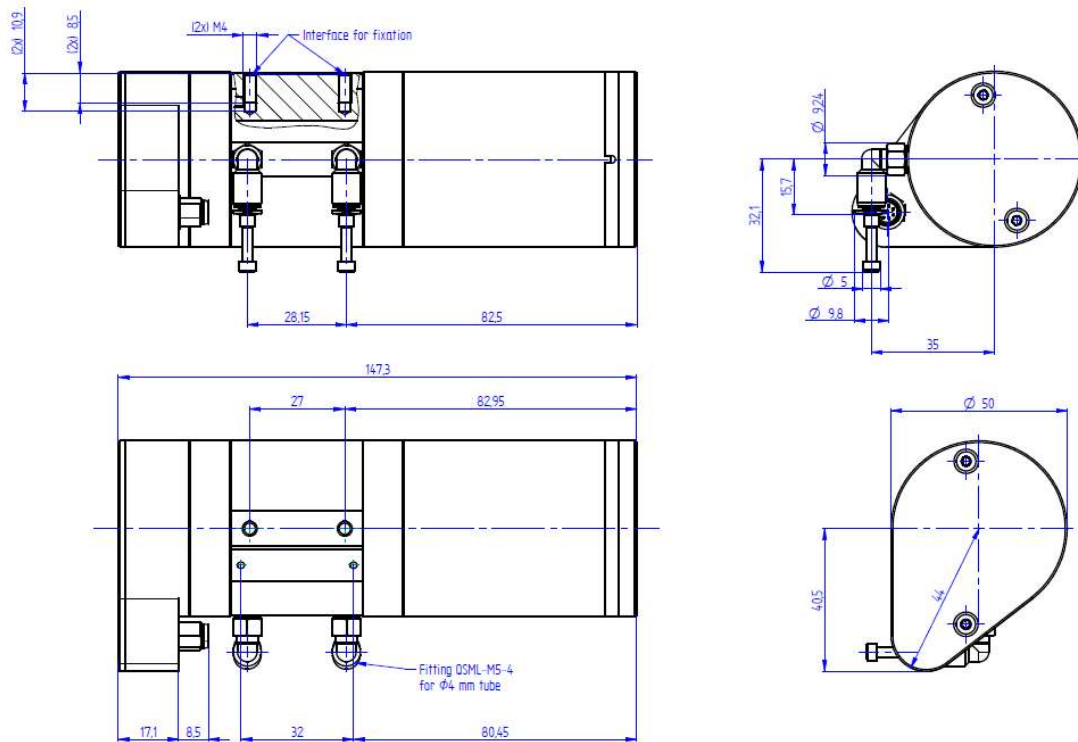


Figure 2: Side and front view, with gas connectors. Dimensions in mm

7 Norms and Regulations

Type	Standard / Directive	Limits / description
LGD Compact Platform conformity	REACH, CE	
Electronics conformity	RoHS, WEEE	
EMC	EN/IEC 61326-1 EN/IEC 61000-6-2 EN/IEC 61000-6-3	Conformity granted only for product executions delivered with electronics housing. For product executions without electronics housing, the EMC conformity has to be fulfilled by the integrating Original Equipment Manufacturer itself.
Shock	EN60068-2-27	max acceleration 150 m/s ² , 11 ms, half sinus, 18 cycles
Vibration	EN60068-2-6	5 - 55 Hz, amplitude 0.35 mm, 1 octave/min, 2h 20 min per orientation (20 frequency cycles)
Drop Test	EN 22248	Free fall with packaging

8 Caution

8.1 Product damage

- Read all instructions carefully before using the device.
- The LGD Compact laser gas detection modules are calibrated for a particular gas and concentration range. Do not use the device outside of its specifications.
- The device is not suited for measuring gases with a dust load. The incoming measurement gas must be conditioned in order to avoid dust and condensation of liquid in the measurement cell. Gas loaded with particles or other substances can eventually contaminate the measurement cell and make it necessary to service the instrument.
- The appliance must not be used in damp or wet surroundings.
- Use only accessories that are indicated in the instructions for use or are recommended by the manufacturer.
- Failure to comply with these instructions could result in product damage.

8.2 Danger of life

- The device must not be used with flammable or explosive gases or mixtures.
- Unprofessional gas handling can cause injury or death. The use of gas detection modules should only be performed by qualified personnel

- Do not use this product as safety or emergency stop device or in any other application where failure of the product could result in personal injury or death.

9 Important Notice / Disclaimer

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While due caution has been exercised in the production of this document, possible errors or omissions are unintentional.

10 Axetris Certifications

Axetris is an ISO 9001:2015 certified company. The LGD Compact Ultra module is CE and RoHS compliant.



CLASS 1 LASER PRODUCT
(classified according to
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