



## Preliminary Product Datasheet

# OEM Gas Sensing Module LGD Compact-A Series

### 1 General Description

**Axetris** is offering Laser Gas Detection (LGD) modules with exceptional advantages and value for the customer. Tunable Diode Laser Spectrometry (TDLS), enhanced by proprietary technology, is used for the measurement of CO<sub>2</sub>, NH<sub>3</sub>, CH<sub>4</sub>, HCl, (H<sub>2</sub>O). The modules are designed for integration by Original Equipment Manufacturers (OEMs), active in the field of gas detection and monitoring in various industries.

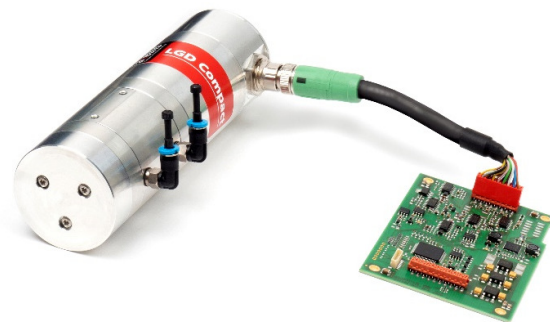
The **LGD Compact** series allows the measurement of target gas, based on contactless, near-infrared absorption. The modules come with a flow-through cell set-up for extractive measurements and are self-contained, ready-to-use.

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 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



#### Key features

- Suited for ambient gas measurement applications
- Optical, laser-based and contactless measurement
- High selectivity and long-term stability
- Fast response
- Compact and self-contained design permitting quick integration by OEMs
- Digital and analog data interfaces, digital outputs
- Continuous sensor status monitoring
- Power supply 3.6 - 5 VDC and 10 – 30 VDC
- Low power consumption for battery-powered applications
- Low cost-of-ownership

- **Medical Applications related to Breath Analysis:** gastrointestinal diseases, lung cancer detection, ...
- **Various Applications:** gas analysis, control and monitoring in various sectors such as industrial, chemical, automotive, semiconductor, agricultural, ...

## 2 Execution Specifications

### 2.1 Gas detection specifications for LGD Compact-A CH4

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 30 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	CH <sub>4</sub>	
Measuring range	ppm	0 – 100 Calibration to full scale (FS)	0 – 40'000 Calibration to full scale (FS)
Lowest Detection Limit <sup>1</sup> 2σ	ppm	≤ 0.4 ≤ 0.15 with 10 s averaging <sup>2</sup>	
Precision <sup>3</sup> 2σ	ppm	≤ 0.8 ≤ 0.25 with 10 s averaging	≤ 250 ≤ 100 with 10 s averaging
Sampling rate	Hz	2	
T <sub>90</sub> time	s	≤ 1.8 at gas flow rate of 2 l/min	
Resolution	ppm	0.01	
Accuracy <sup>4</sup>	% of FS	± 2	
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Calibrating temperature range	°C	-10 ... +50	

<sup>1</sup> **Lowest Detection Limit: (LDL):** The LDL is defined as 2 times the standard deviation  $\sigma$  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.

<sup>2</sup> **Averaging time:** An exponential moving average (EMA) is applied on measured concentration values. The averaging time expresses the period of time of past measurements considered to compute the next averaged value. The averaging time can be set up to 600 s.

<sup>3</sup> **Precision:** The precision is defined as 2 times the standard deviation  $\sigma$  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.

<sup>4</sup> **Accuracy:** For a given (known) reference concentration, the accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value. Variations of the operating temperature and pressure can affect the accuracy of the system.

## 2.2 Gas detection specifications for LGD Compact-A CH4/C2H6

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 30 VDC

Parameter	Unit	Value / Range		
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)		
Target gas	-	CH <sub>4</sub>		C <sub>2</sub> H <sub>6</sub>
Measuring range	ppm	0 – 100 Calibration to full scale (FS)	0 – 40'000 Calibration to FS	0 – 1'000 Calibration to FS
Lowest Detection Limit <sup>5</sup> 2σ	ppm	≤ 0.8 ≤ 0.3 with 10 s averaging <sup>6</sup>		≤ 20 ≤ 10 with 10 s averaging
Precision <sup>7</sup> 2σ	ppm	≤ 1.5 ≤ 0.5 with 10 s averaging	≤ 500 ≤ 150 with 10 s averaging	≤ 40 ≤ 15 with 10 s averaging
Sampling rate dual gas mode	Hz	0.7		
Sampling rate single gas mode	Hz	2	-	
T <sub>90</sub> time	s	≤ 1.8 at gas flow rate of 2 l/min		
Resolution	ppm	0.01		
Accuracy <sup>8</sup>	% of FS	± 2		Depending on CH <sub>4</sub> concentration
Linearity and repeatability	-	included in the accuracy		
Cross interference	-	Gas matrix and application dependent		
Calibrating temperature range	°C	-10 ... +50		

<sup>5</sup> **Lowest Detection Limit: (LDL):** The LDL is defined as 2 times the standard deviation  $\sigma$  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.

<sup>6</sup> **Averaging time:** An exponential moving average (EMA) is applied on measured concentration values. The averaging time expresses the period of time of past measurements considered to compute the next averaged value. The averaging time can be set up to 600 s.

<sup>7</sup> **Precision:** The precision is defined as 2 times the standard deviation  $\sigma$  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.

<sup>8</sup> **Accuracy:** For a given (known) reference concentration, the accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value. Variations of the operating temperature and pressure can affect the accuracy of the system.

## 2.4 Gas detection specifications for LGD Compact-A CH<sub>4</sub>/CO<sub>2</sub>

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 30 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	CH <sub>4</sub>	CO <sub>2</sub>
Measuring range	ppm	0 – 250 Calibration to 100ppm	0 – 100'000 Calibration to FS
Lowest Detection Limit <sup>9</sup> 2σ	ppm	≤ 0.4 ≤ 0.15 with 10 s averaging <sup>10</sup>	≤ 2'000 ≤ 600 with 10 s averaging
Precision <sup>11</sup> 2σ	ppm	≤ 0.8 ≤ 0.25 with 10 s averaging	≤ 2000 ≤ 600 with 10 s averaging
Sampling rate	Hz	0.7	
T <sub>90</sub> time	s	≤ 30 s at 0.3 l/min	
Resolution	ppm	0.01	
Accuracy <sup>12</sup>	% of FS	± 2	
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Calibrating temperature range	°C	-10 ... +40	

<sup>9</sup> **Lowest Detection Limit: (LDL):** The LDL is defined as 2 times the standard deviation  $\sigma$  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.

<sup>10</sup> **Averaging time:** An exponential moving average (EMA) is applied on measured concentration values. The averaging time expresses the period of time of past measurements considered to compute the next averaged value. The averaging time can be set up to 600 s.

<sup>11</sup> **Precision:** The precision is defined as 2 times the standard deviation  $\sigma$  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.

<sup>12</sup> **Accuracy:** For a given (known) reference concentration, the accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value. Variations of the operating temperature and pressure can affect the accuracy of the system

## 2.5 Gas detection specifications for LGD Compact-A NH3/H2O

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 30 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	NH <sub>3</sub>	H <sub>2</sub> O
Measuring range	ppm	0 – 100 Calibration to full scale (FS)	0 – 200'000 <sup>13</sup> Calibration to FS
Lowest Detection Limit <sup>14</sup> 2σ	ppm	≤ 0.4 ≤ 0.15 with 10 s averaging <sup>15</sup>	≤ 2'000 ≤ 600 with 10 s averaging
Precision <sup>16</sup> 2σ	ppm	≤ 0.8 ≤ 0.25 with 10 s averaging	≤ 2'000 ≤ 600 with 10 s averaging
Sampling rate	Hz	1	
T <sub>90</sub> time	s	≤ 1.8 at gas flow rate of 2 l/min	
Resolution	ppm	0.01	
Accuracy <sup>17</sup>	% of FS	± 2	
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Calibrating temperature range	°C	-10 ... +65	

<sup>13</sup> **H<sub>2</sub>O Range:** depending on operating temperature, non condensing conditions required. Max. allowed H<sub>2</sub>O at 65°C is 200'000 ppm.

<sup>14</sup> **Lowest Detection Limit: (LDL):** The LDL is defined as 2 times the standard deviation σ 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.

<sup>15</sup> **Averaging time:** An exponential moving average (EMA) is applied on measured concentration values. The averaging time expresses the period of time of past measurements considered to compute the next averaged value. The averaging time can be set up to 600 s.

<sup>16</sup> **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.

<sup>17</sup> **Accuracy:** For a given (known) reference concentration, the accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value. Variations of the operating temperature and pressure can affect the accuracy of the system

## 2.6 Gas detection specifications for LGD Compact-A C2H2/H2O

Reference conditions (if not otherwise specified): operating temperature 20°C, pressure 1013 hPa and humidity 45% r.H., power supply 10 - 30 VDC

Parameter	Unit	Value / Range	
Principle of measurement	-	Tunable Diode Laser Spectroscopy (TDLS)	
Target gas	-	C <sub>2</sub> H <sub>2</sub>	H <sub>2</sub> O
Measuring range	ppm	0 – 100 Calibration to full scale (FS)	0 – 200'000 <sup>18</sup> Calibration to full scale FS
Lowest Detection Limit <sup>19</sup> 2σ	ppm	≤ 1 ≤ 0.4 with 10 s averaging <sup>20</sup>	≤ 2'000 ≤ 1'000 with 10 s averaging
Precision <sup>21</sup> 2σ	ppm	≤ 1 ≤ 0.4 with 10 s averaging	≤ 2'000 ≤ 1'000 with 10 s averaging
Sampling rate	Hz	1	
T <sub>90</sub> time	s	≤ 1.8 at gas flow rate of 2 l/min	
Resolution	ppm	0.01	
Accuracy <sup>22</sup>	% of FS	± 2	
Linearity and repeatability	-	included in the accuracy	
Cross interference	-	Gas matrix and application dependent	
Calibrating temperature range	°C	+15 ... +55	

<sup>18</sup> **H<sub>2</sub>O Range:** depending on operating temperature, non condensing conditions required. Max. allowed H<sub>2</sub>O at 65°C is 200'000 ppm.

<sup>19</sup> **Lowest Detection Limit: (LDL):** The LDL is defined as 2 times the standard deviation σ 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.

<sup>20</sup> **Averaging time:** An exponential moving average (EMA) is applied on measured concentration values. The averaging time expresses the period of time of past measurements considered to compute the next averaged value. The averaging time can be set up to 600 s.

<sup>21</sup> **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.

<sup>22</sup> **Accuracy:** For a given (known) reference concentration, the accuracy is defined as the difference between the mean response during a 2 min time interval and the reference value. 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
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 module	mm	163 (length) 50 (diameter w/o fittings and electrical connector)
Dimensions of electronic unit with housing	mm	257 x 83 x 26 (L x W x H)
Dimensions of electronic unit without housing (optional)	mm	105 x 70 x 10 (L x W x H, main board) 84 x 70 x 10 (L x W x H, interface board)
Approx. weight sensor module	g	≤ 600
Inlet / outlet gas fittings	-	Festo QSML-M5-4, angled Festo QSM-M5-4, straight Festo QSMLLV-M5-4-1, stainless steel angled

### 3.3 Electrical characteristics

Parameter	Unit	Value / Range
Voltage supply min. - max.	VDC	3.6 – 5 and 10 - 30 (max. ripple $\pm$ 100mV, max. current 1A, no inrush current limitation) Note: if the module is powered at a voltage between 3.6 and 5 VDC, only product executions without the interface board are available. Limitations related to data interface to be considered, refer to section 3.4.
Power consumption	W	$\leq$ 1 at T <sub>amb</sub> 20°C
Start-up time	s	$\leq$ 30

### 3.4 Data interface

#### Module powered at 10 - 30 VDC (with interface board)

Parameter	Unit	Value / Range
RS 232 EIA	-	RS232 protocol
RS 232 TTL	-	TTL signal amplitude 0 - 3.3 VDC
Analog Current Output	mA	4 - 20, 12-bit resolution (on 0 - 25 mA)
Analog Voltage Output	V	0 - 5, 12-bit resolution
Digital Alarm Outputs (relay)	-	Relay power supply: 10 V < Vcc Relay < 30 V; max. 0.75 A Various alarm outputs available, for more details refer to the User Manual.

#### Module powered at 3.6 – 5 VDC (without interface board)

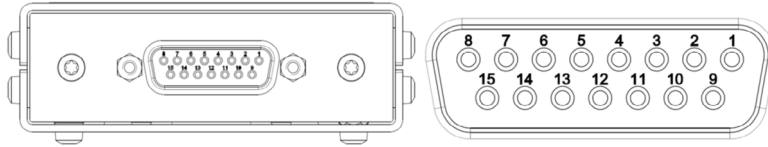
Parameter	Unit	Value / Range
RS 232 TTL	-	TTL signal amplitude 0 - 3.3 VDC
Analog Voltage Output	V	Analog out 0 - 2.5 VDC
Digital Alarm Outputs (relay)	-	Relay power supply: 10 V < Vcc Relay < 30 V; max. 0.75 A Various alarm outputs available, for more details refer to the User Manual.



## 4 Connector Assignments

### 4.1 Product execution with electronics housing

**Figure 1:** 15pol D-Sub connector (J1)



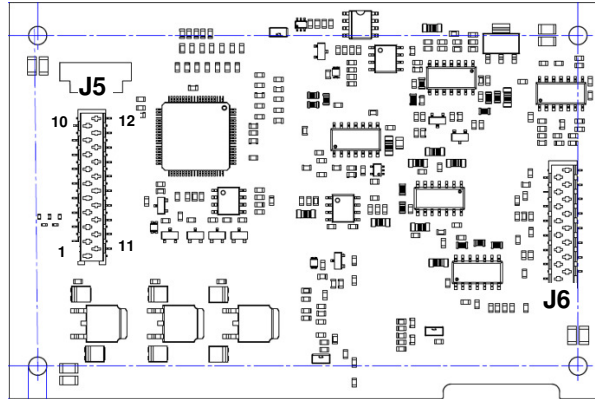
#### Connector assignment J1

	Pin	Name	Description
Power Supply	1	POWER IN	Power supply 3.6 ... 30V
	2	GND IN*	Power supply ground
	3	SHIELD	DB 15 Connector - Housing
Digital Interface	6	GND*	Ground serial communication
	7	RS232 TX	UART serial communication
	8	RS232 RX	UART serial communication
	14	N/A	Not used
	15	N/A	Not used
Digital Alarms (relay)	4	ALARM 1	On/Off signal at defined conditions for relay control, hardware watchdog, etc.
	5	ALARM 2	On/Off signal at defined conditions for relay control, hardware watchdog, etc.
	11	ALARM 3	HW watchdog, firmware error and warnings
	12	VCC RELAY	Relay power supply: 10 V < Vcc Relay < 30 V; max. 0.75 A
	13	GND*	Ground, relay alarms
Analog Interface	9	ANALOG GND*	Analog ground
	10	ALANALOG OUT	Analog output Factory setting: current output (4-20mA); voltage output (0-5V) configurable

\* same potential

## 4.2 Product executions without electronics housing

**Figure 2:** Top view main board with connector J5 and J6



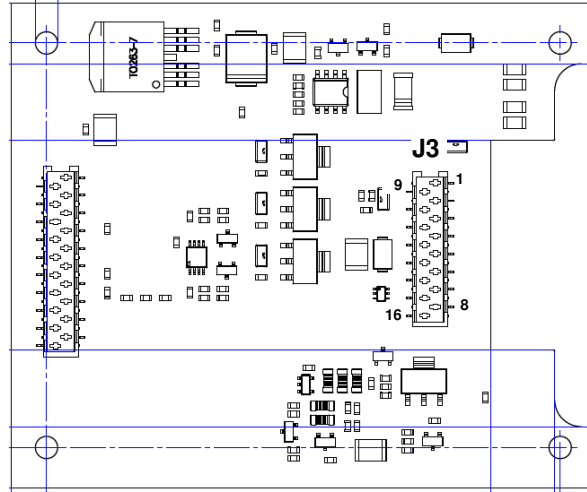
### Connector assignment J5

	Pin	Name	Description
Power Supply	1	5V*	Power supply input for mainboard
	2	5V*	Power supply input for mainboard
	3	3.3V	Power supply output 3.3V from mainboard to drive digital hardware on interface board; not used in case of removing the interface board
Digital Interfaces	4	TXD TTL	UART serial communication TTL-Level
	5	RXD TTL	UART serial communication TTL-Level
Digital Alarms	13	ALARM 1	Signal for alarm 1 from Microcontroller, contact Axetris if needed
	15	ALARM 2	Signal for alarm 2 from Microcontroller, contact Axetris if needed
	14	ALARM 3	Signal for alarm 3 from Microcontroller, contact Axetris if needed
	20	ALARM 4	Signal for alarm 4 from Microcontroller, contact Axetris if needed
Analog Interface	10	DAC ANALOGOUT	Analog output signal (0...2.5V) from Microcontroller, contact Axetris if needed
	16	HW INTERFACE PCB	Input for identification of interface board, connect to GND in case of removing the interface board
	11	GND**	Ground
	12	GND**	Ground
Not used	6...9	n/a	n/a
	17...19	n/a	n/a

\* connected on mainboard

\*\* same potential

**Figure 3:** Top view interface board with connector J3.

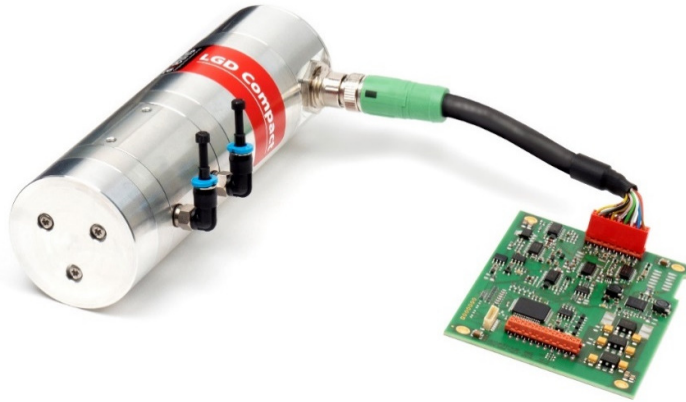


**Connector assignment J3**

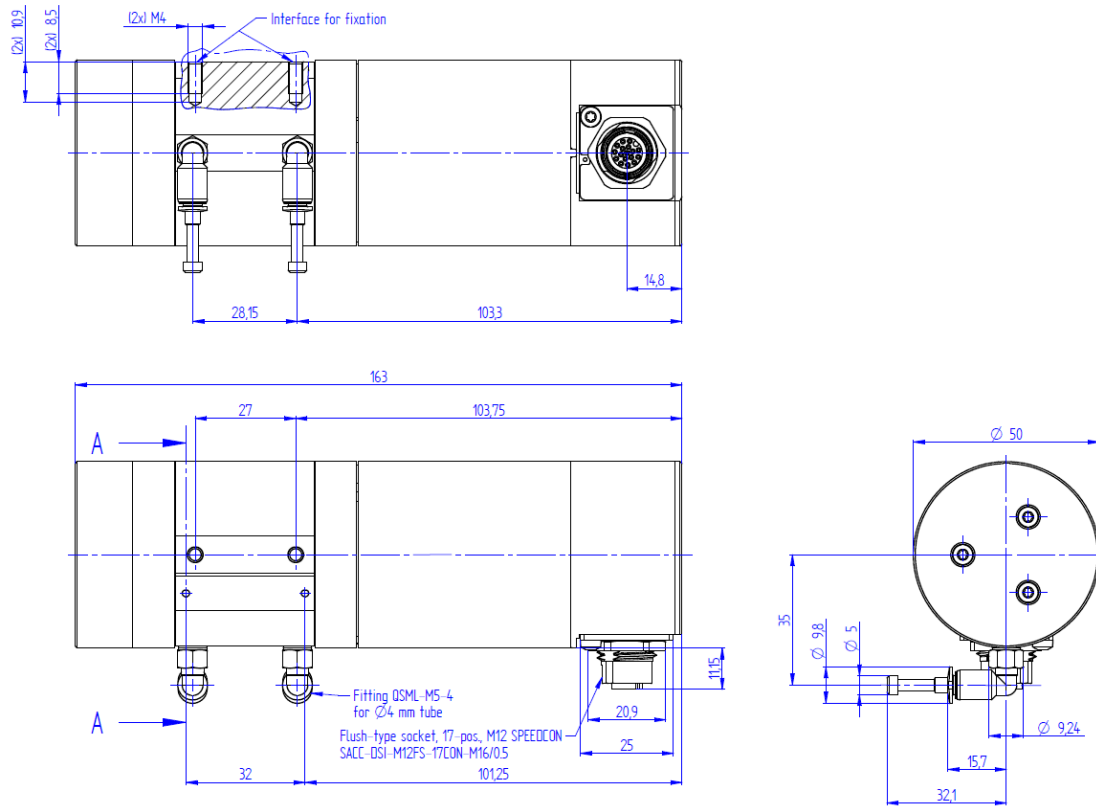
The connector assignment of J3 is identical to J1 (refer to section 4.1) except the additional pin 16 which is not used.

	<b>Pin</b>	<b>Name</b>	<b>Description</b>
Not used	16	n/a	n/a

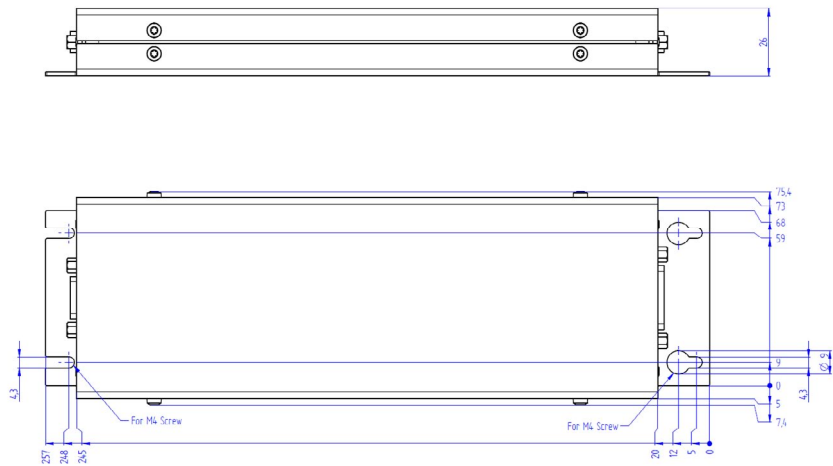
## 5 Product Dimensions



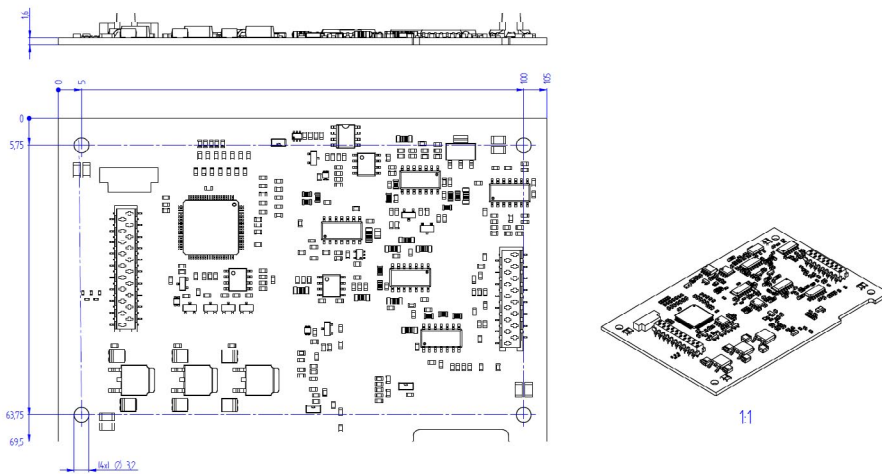
**Figure 4:** General view of the LGD Compact-A module (execution without electronics housing)



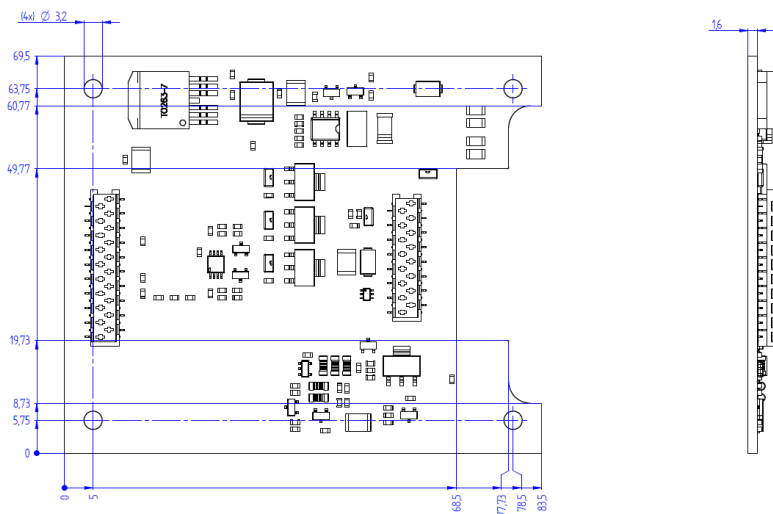
**Figure 5:** Side and front view, with gas connectors. Dimensions in mm



**Figure 6:** View of the electronics housing. Dimensions in mm



**Figure 7:** Main printed circuit board. Dimensions in mm



**Figure 8:** View of the interface printed circuit board. Dimensions in mm

## 6 Norms and Regulations

Type	Standard / Regulation	Limits
European Conformity: Low voltage EMC compatibility	CE 2006/95/EG 2004/108/EG	
Safety of laboratory products	EN/IEC 61010	EMC conformity according to EN 61326-1:2013
Safety of laser products	EN/IEC 60825-1	
EMC	EN/IEC 61326-1	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 <sup>2</sup> , 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 cycle)
Electronics conformity	RoHS 2 / WEEE	

## 7 Caution

### 7.1 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 sensor outside of its specifications
- The sensor 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 sensor. Gas loaded with particles or other substances can eventually contaminate the 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.

### 7.2 Danger of life

- The sensor 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.

## 8 Important Notice / Disclaimer

The information furnished by Axetris is believed to be correct and accurate. However, Axetris shall not be held liable to recipient or any third party of any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interrupt of business or indirect, special incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of technical data herein. No obligation or liability to recipient or any third party shall arise or flow out of Axetris rendering of technical or other services.

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

## 9 Axetris Certifications

Axetris is an ISO 9001:2015 certified company. The LGD Compact module is CE and RoHS 2 compliant.



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**Swiss Made Quality.** Axetris is an ISO 9001 certified enterprise. Specifications are subject to change without prior notice

## Document History

Version	Date	Sign	Change
Rev. A	26.06.2019	SBO	DS Rev. A released
Rev. B	06.11.2019	RPD	Preliminary added, performances updated, accuracy definition changed and some corrections