CUBIC

SPECIFICATION

Product Name: TDLAS Methane Sensor

Item No.: Gasboard-2501-05F

Spec No.: Gasboard-2501-05F-3-SPEC-006

Version: A/0

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Revision

No.	Version	Content	Date
1	A/0	Preliminary version	2025.04.29

TDLAS Methane Sensor

Gasboard-2501-05F

Applications

- Underground pipe network
- Underground well (gas well)
- Gas pressure regulating cabinet
- Industrial combustible gas leakage detection

Description

Gasboard-2501 series are methane gas sensors based on Cubic self-developed Tunable Diode Laser Absorption Spectroscopy (TDLAS) technology. Cubic TDLAS gas sensor contains high performance probe and special processing gas chamber with advantages of high accuracy, high sensitivity, wide working temperature range, long lifetime and high stable performance etc. With optimized temperature compensation algorithm, the anti-interference performance is excellent, which makes it can work stably at hazardous conditions and complex gas environments.

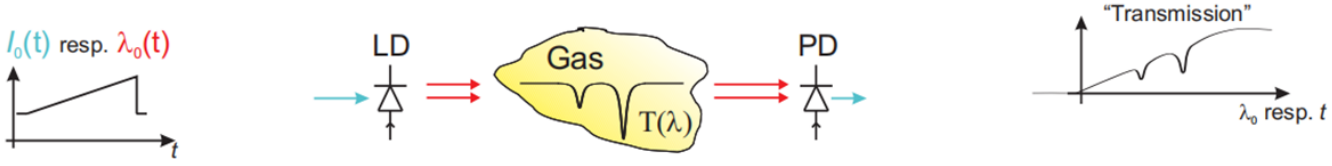
The sensor is easy to install and maintain as it adopts modalized and low power consumption design and can be calibrated through TTL communication interface.

Features

- Measurement range is 0~5%Vol CH4
- Fast response, high accuracy, long life span
- TDLAS technique drive unique methane selectivity, no interference from other gases, water vapor, dust particles
- Low power consumption, compact design, ease of integration

Working Principle

TDLAS sensor mainly consists of a laser light source, an air chamber, and a laser detector, etc. A specified wavelength transmitted by the laser light source will change periodically as the input current being modulated periodically. Scan the wavelength to make the laser output a center wavelength that equals to the absorption peak of the gas to be measured. The gas concentration can be calculated from the spectral intensity signal after absorption.



Specifications

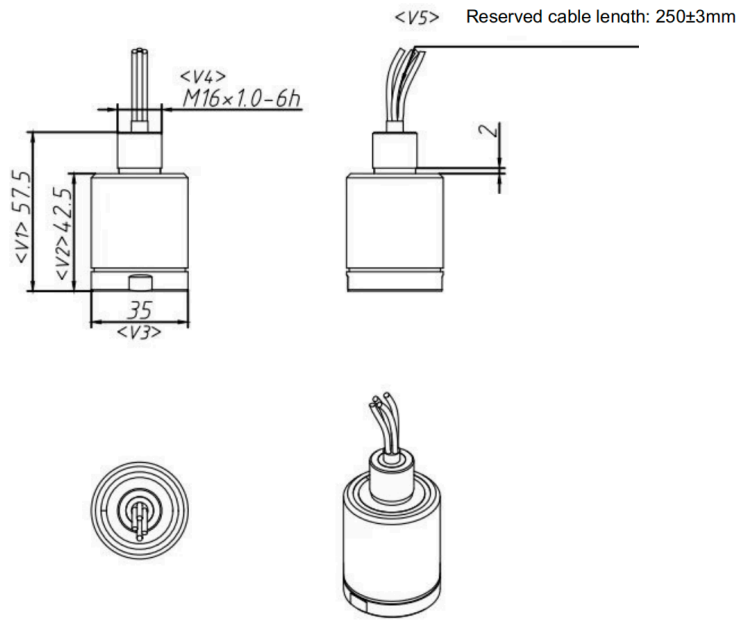
Gasboard-2501-05F Gas Sensor Specification	
Target Gas	Methane (CH4)
Working Principle	Tunable Diode Laser Absorption Spectroscopy (TDLAS)
Measurement Range	0-100%LEL (0-5%Vol)
Accuracy	± 5%LEL
Resolution	0.1%LEL
Response Time (T90)	T90 < 20s
Warm Up Time	<40s
Working Temperature	-25 ~ 55℃
Working Humidity	0~98%RH (non-condensing)
Working Voltage	3.3V~5.5V DC
Working Current [1)]	<30mA (@3.3V)
Output	TTL (3.0V)
Storage Condition	-40 ~ +85℃; 0~98%RH (non-condensing)
Ambient Pressure	900mbar ~ 1100mbar
Dimension	Dia35mm * H57.5mm
Ex-proof Marking	ATEX: II 1 G Ex ia IIC T4 Ga
	IECEx: Ex ia op is IIC T4 Ga

Note:

1) The working current refers to the average working current at room temperature of 25 ℃, excluding the peak current when the sensor is powered on.
2) When the product is used in hazardous Zone 0 areas, measures should be taken to avoid sparks caused by impact or friction.
3) For on-site installation, the wires should be properly mechanically protected and terminated inside the user equipment casing

Product Dimensions and Pin Definition

1. Dimensions (Unit: mm)



2. Pin Definition

Pin	Color	Description
Vi	Red	Power Input(DC 3.3V~5.5V)
G	Black	Power Ground
R	Green	RX (3.0V)
T	Blue	TX (3.0V)

Precautions

1. During transportation, the sensor is not allowed to be subjected to severe mechanical shock and exposure to the sun and rain, and is strictly prevented from falling, rolling, and heavy pressure.
2. Please read the manual before use to understand the performance and usage to avoid accident or damage to the instrument caused by mis-operation. Avoid large shocks and vibrations, so as not to affect the service life of the sensor.
3. In order to ensure good detection accuracy, the power supply of the sensor must be within the range of technical parameters and use the correct power supply.
4. If you encounter any problems that cannot be solved, please contact the manufacturer directly. The sensor is sealed internally, and disassembling the sensor by oneself may result in irreparable damage.
5. After installation on the complete machine, it is necessary to consider the peak current during startup in extreme environments

Communication Protocol

1. Protocol Overview

The sensor communicates with other devices via serial port with settings as below:

Configuration	Parameter	Remark
Baud rate	9600	3V/DC
Data bit	8	
Stop bit	1	
Parity	None	
Flow control	None	

Note:

1. The sensor data output has two modes: active reporting and passive query, which are specified by the customer before leaving the factory. When the sensor is in active reporting mode, it will automatically upload measurement data at a fixed frequency after power on. For details, please refer to the concentration data format section. When the sensor is in passive query mode, the host needs to send command to read data, please refer to the section on communication data format for details.

2. There are two selectable baud rates, 9600 and 115200, which are specified by the customer before leaving the factory.

2. Communication Data Format

Host Send Data Format

Start Character	Command	Data		Check Digit	Ending Character	
Start	Tcmd	Data1	Data2	Check	0x0D	0x0A

Sensor Response Data Format

Start Character	Command	Data	Check Digit	Ending Character	
Start	Rcmd	Data1	Check	0x0D	0x0A

Protocol Format Description:

Start: Start character, fixed to 0x3a

Tcmd: The command sent by host

Rcmd: The command responded by sensor

Data1, Data2: For host transmit frame, they're the data that need to be written into the sensor, and Data 1 is the high 8 bits and Data 2 is the low 8 bits. For sensor response frame, when Data1=0x31, it indicates successful command writing, and when Data1=0x30, it indicates command writing failure

Check: Sum check, only retaining the lower 8 bits. For host transmit frame, Check = Tcmd + Data1 + Data2. For sensor response frame, Check = Rcmd + Data1

0x0D, 0x0A: Ending character, Carriage return and line feed

Command Table

No.	Function	Tcmd	Rcmd	Note
1	Read Measurement Results	0x30	Refer to 3	
2	Set Zero Point Threshold	0x31	0x32	
3	Span Calibration	0x33	0x34	
4	Reset to Factory Settings	0x35	0x36	
5	Zero Calibration	0x37	0x38	

3. Sensor's Output Data Format

The sensor will send length variable string data actively when it is in working mode. The data format as below:

Format	**[Concentration] [Space] [Temperature] [Space] [Pressure] [Space] [Status Code] [Space] [Checksum]<CR><LF>**												
Description	Conc.	Space	Temp.	Temp. Sign	Space	Baro. Press.	Baro. Sign	Space	Status Byte	Space	Check Sum	Carriage Return	Line Feed
Example	0.0	<SP>	9.0	℃	<SP>	1012.01	mbar	<SP>	21	<SP>	9c	<CR>	<LF>
ASCII(Hex)	30 2E 30	20	39 2E 30	A1 E6	20	31 30 31 32 2E 30 31	6D 62 61 72	20	32 31	20	39 63	0D	0A

Note:

1. Displayed concentration range is from 0 to 1.2*F.S. Resolution and unit are the same as sensor's specifications.
2. Temperature range: -40.0~85.0
3. Barometric pressure range: 200.00~1200.00
4. Hex 20 corresponds to spaces in ASCII code. It is recommended to use space characters for segmented parsing

Checksum Calculation:

Checksum = 0x100 – (sum of the bytes from start of the frame to the byte before last space) %100, The formula contains hexadecimal operations. The checksum calculation for the example above is shown as below:

Checksum = 100 - (30+2E+30+30+20+39+2E+30+A1+E6+20+31+30+31+32+2E+30+31+6D+62+61+72+20 +32+31) %100 = 9C, ASCII "9**C**" = Hex (**39 63**).

Status Byte Table:

Bit	8	7	6	5	4	3	2	1
Description	Reserved	TEC Temperature Abnormal	Calibration Data Abnormal	Temperature Over Range	Warming Up	Baro. Pressure Abnormal	Temperature Abnormal	Optical Path Malfunction

Description: The status code is 8-bit hexadecimal data, with each 1 bit representing 1 alarm type, 0 indicating invalid and 1 indicating valid. Multiple states may exist simultaneously,

Example: 'A' corresponds to binary 00001010, indicating that preheating is in progress and the temperature is abnormal; 0 corresponds to binary 000000, indicating normal operation.

4. Protocol Detailed Description

4.1 Read Measurement Results

Send: 3a 30 00 00 30 0d 0a

Response: Please refer to '3. Sensor's Output Data Format'

Function: Real sensor output data of concentration, temperature, etc.

4.2 Set Zero Point Threshold

Send: 3a 31 [DF1] [DF2] [CS] 0d 0a

Response: 3a 32 31 63 0d 0a

Function: Set zero-point threshold to a specific value.

Example: The sensor has a range of 100% LEL and a resolution of 0.1%. Its scaling factor is 10. Send the following command to set the zero-point threshold to 10.0% LEL:

3a 31 00 64 95 0d 0a

Hex 00 64 represents Dec 100, and after scaling conversion, it corresponds to a concentration value of 10.0%LEL.
Check is 31+00+64=95

4.3 Zero Calibration

Send: 3a 37 [DF1] [DF2] [CS] 0d 0a

Response: 3a 38 31 69 0d 0a

Function: Calibrate sensor's zero point to a specific concentration.

Example: The sensor has a range of 100% LEL and a resolution of 0.1%. Its scaling factor is 10. Send the following command to set sensor's zero point to 0.0%LEL:

3a 37 00 00 37 0d 0a

Hex 00 00 represents Dec 0, and after scaling conversion, it corresponds to a concentration of 0.0%LEL.
Check is 37+00+00=37

4.4 Span Calibration

Send: 3a 33 [DF1] [DF2] [CS] 0d 0a

Response: 3a 34 31 65 0d 0a

Function: Calibrate sensor's span point to a specific concentration.

Example: The sensor has a range of 100% LEL and a resolution of 0.1%. Its scaling factor is 10. Send the following command to set sensor's span point to 100.0%LEL:

3a 33 03 E8 1E 0d 0a

Hex 03 E8 represents Dec 1000, and after scaling conversion, it corresponds to a concentration of 100.0%LEL. Check is 33+03+E8=011E, only retaining the lower 8 bits, so, [CS] is 1E

4.5 Reset to Factory Settings

Send: 3a 35 00 00 35 0d 0a

Response: 3a 36 31 67 0d 0a

Function: Restore the sensor's concentration linearity back to factory settings.

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