

**PluraSens®**



# **Combustible Gas Detector-Transmitter**

**E2611-LEL**

**User Manual**



# Table of contents

Acetylene	4
Butane	5
Hydrogen	6
Methane	7
Propane	8
Specifications	9
Product description	10
Safety requirements	10
Operating conditions	11
Installation guidelines	11
Installation and connections	12
Correct and incorrect cabling for 24 VAC	15
Operation	16
Maintenance	16
Calibration	16
Delivery set	16
Order code for E2611-LEL options	17
Configuring	17
Return to default settings	17
RS485 communication interface	18
Modbus registers (0-based, decimal format)	18
Factory settings	19
Warranty	20
Manufacturer contacts	20

## Acetylene

A colorless flammable gas, lighter than air. Mixtures with air are explosive. It results from the interaction of calcium carbide with water. In industrial production, acetylene is mainly manufactured by the pyrolysis of light hydrocarbons.

Acetylene is widely used for welding and cutting of metals. The usage of acetylene as a feedstock in the chemical industry declines due to cost and environmental considerations.

Synonyms/Trade Names: Ethine, Ethyne.

Chemical formula	HC≡CH	
Molar weight	26	
Relative gas density (to air)	0.90	
Conversion	1 ppm = 1.06 mg/m <sup>3</sup>	
Boiling point	-84 °C	
Low explosive limit (LEL), % vol. in air	2.3* (2.5**)	
Upper explosive limit (UEL), % vol. in air	100	
Odor	Odorless or with a faint ethereal smell if pure. The commercial-grade may have a garlic-like smell due to impurities.	
Hazards	Highly flammable. Gas/air mixtures are explosive. Forms explosive acetylide compounds with copper, mercury, silver & brasses (containing more than 66% copper). Asphyxiant. Non-toxic, but, when generated from calcium carbide, it can contain toxic impurities such as traces of phosphine and arsine.	
Exposure limits (NIOSH)	REL C	2662 mg/m <sup>3</sup> /2500 ppm

## Butane

A colorless flammable gas that is heavier than air. The term "butane" is used for any of two structural isomers (n-butane or iso-butane, with unbranched and branched-chain respectively) or for their mixture. Occurs in light petroleum fractions.

Butane is used mainly as a fuel and as a feedstock in organic synthesis. It is applied also as a propellant in aerosol sprays and may be used as an ozone-friendly refrigerant.

Mixtures of butane with propane and other hydrocarbons are referred to as LPG (liquefied petroleum gas).

Chemical formula	n-butane $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$	iso-butane $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_3$
Molar weight	58	
Relative gas density (to air)	2.0	
Conversion	1 ppm = 2.38 mg/m <sup>3</sup>	
Boiling point	-0.56 °C	-11.7 °C
Low explosive limit (LEL), % vol. in air	1.4* (1.6**)	1.5* (1.8**)
Upper explosive limit (UEL), % vol. in air	8.4	9.6
Odor	Gasoline-like odor	
Hazards	Highly flammable. Inhalation of butane can cause euphoria, drowsiness, narcosis, asphyxia, cardiac arrhythmia, fluctuations in blood pressure, and temporary memory loss, when abused directly from a highly pressurized container, and can result in death from asphyxiation and ventricular fibrillation.	
Exposure limits (NIOSH)	TWA 1900 mg/m <sup>3</sup> /800 ppm	Not established

## Hydrogen

A colorless, odorless, flammable gas, that is much lighter than air. Mixtures with air are explosive. Results from the interaction of acids, bases, and water with active metals and from the electrolysis of aqueous solutions. In industrial production, the main source of hydrogen is hydrocarbons.

Chemical formula	H <sub>2</sub>
Molar weight	2
Relative gas density (to air)	0.07
Conversion	1 ppm = 0.0818 mg/m <sup>3</sup>
Boiling point	-252.88 °C
Low explosive limit (LEL), % vol. in air	4.0
Upper explosive limit (UEL), % vol. in air	75
Odor	Odorless
Hazards	Flammable forms explosive mixtures with air. Asphyxiant.
Exposure limits	not established

## Methane

A colorless flammable gas, the main component of natural gas, marsh gases. Methane results from bacterial decomposition of plant and animal matter (landfill gas).

Methane is widely used as a fuel and chemical feedstock.

Synonyms: Marsh Gas, Natural Gas, Carbon tetrahydride, Hydrogen carbide.

Chemical formula	CH <sub>4</sub>
Molar weight	16
Relative gas density (to air)	0.55
Conversion	1 ppm = 0.65 mg/m <sup>3</sup>
Boiling point	-161.49 °C
Low explosive limit (LEL), % vol. in air	4.4* (5.0**)
Upper explosive limit (UEL), % vol. in air	15
Odor	Odorless when pure. Methane used in the kitchens contains an odorant
Hazards	Highly flammable, mixtures with air are explosive. Asphyxiant.
Exposure limits	not established

## Propane

A colorless flammable gas that is heavier than air. It occurs in light petroleum fractions.

Propane is used mainly as a fuel and as a feedstock in organic synthesis. It is applied also as a propellant in aerosol sprays and may be used as an ozone-friendly refrigerant.

Mixtures of propane with butane and other hydrocarbons are referred to as LPG (liquefied petroleum gas).

Chemical formula	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>	
Molar weight	44	
Relative gas density (to air)	1.55	
Conversion	1 ppm = 1.80 mg/m <sup>3</sup>	
Boiling point	-42 °C	
Low explosive limit (LEL), % vol. in air	1.7* (2.1**)	
Upper explosive limit (UEL), % vol. in air	9.5	
Odor	Odorless when pure. Commercially available propane for fuel purposes may contain odorant ("gas smell").	
Hazards	Highly flammable, mixtures with air are explosive. Asphyxiant. May cause dizziness, confusion, excitation when inhaled.	
Exposure limits (NIOSH)	TWA	1800 mg/m <sup>3</sup> / 1000 ppm
	IDLH	2100 ppm [10%LEL]

Conversion of ppm to mg/m<sup>3</sup> is calculated for 25°C and 1 atm.

\* according to new EU standards ('stirred' concentration of gas)

\*\* according to US standard ('still gas' method)

## Specifications

Detected gas	Acetylene, Butane, Hydrogen, Methane, Propane
Default calibration	Methane CH <sub>4</sub>
Sampling method	Diffusion
Sensor type	Metal Oxide Semiconductor
Detection range	Up to 100% LEL
Resolution	0,1% LEL
Response time	~ 60 seconds
Sensor lifetime	> 5 years
Calibration interval	12 months
Operating temperature	-40...+70 °C
Power supply	12...36 VDC (default), 24 VAC or 230 VAC as options
Power consumption	< 2 VA
Analog outputs	2 × 4-20 mA / 0-10 V, user settable
Load resistance	$R_L < (U_s - 2 V) / 22 \text{ mA}$ for 4-20 mA $R_L > 250 \text{ k}\Omega$ for 0-10 V mode
Digital interface	RS485, Modbus RTU protocol
Cable connections	Screwless spring-loaded terminals
Relay outputs	2 × SPST, max 5 A, 30 VDC / 250 VAC
Default alarm set-points	LOW set 20, release 16% LEL HIGH set 50, release 40%LEL
Alarm	Buzzer 85 dB
Enclosure	ABS plastic with ventilation slots, wall-mount, IP20
Dimensions	85 × 85 × 37 mm
CE marking	According to 2014/30/EU and 2014/35/EU, EN 50491-4-1:2012 EN 61000-6-3:2020, EN 61326-1:2013(EMC, emissions) EN 61000-6-1:2019, EN 61000-6-2:2019(EMC, Immunity) EN 60079-29-1:2016, EN 60079-29-2:2015 and EN 60079-29-3:2014
Operating conditions	(operating temperature is mentioned above.) <95 %RH, without condensation, non-ATEX Normal ambient oxygen level Avoid strong mechanical shock, vibrations or EMI Avoid exposure to corrosive gases or silicone-containing products.

## Product description

Combustible Gases Detector-Transmitter E2611-LEL is intended for early detection of leakages or accumulation of light hydrocarbon gases (acetylene, methane, propane, butane) and hydrogen. The instrument is based on a fully calibrated and temperature compensated semiconductor metal-oxide (MOS) gas sensor with high repeatability, stability, and long lifetime.

E2611 series devices provide two independent analog outputs OUT1 and OUT2, user-selectable to 4-20 mA or 0-10 V, proportional to the gas concentration. RS485 Modbus RTU digital communication interface allows easy instrument configuration and integration into various automation systems. Two relays RE1 and RE2 with closing contacts can be used to switch 24 V or 230 V powered alarm sirens, ventilation fans, shut-off valves, or other actuators. The device is equipped with an acoustic alarm.

## Safety requirements

Misuse will impair the protection of the product. Always adhere to the safety provisions applicable in the country of use.

Do not perform any maintenance operation with the power on. Do not let water or foreign objects inside the device.

Removal of the PCB from the enclosure voids the warranty. Do not touch the electronic components directly, as they are sensitive to static electricity.

Connection diagrams can be found in the installation and connections section. The device might not perform correctly or be damaged if the wrong power supply is connected.

External circuits connected to the equipment should have sufficient insulation rating according to the environmental conditions and equipment power.

A disconnecting device that is marked as such and easily accessible should be included in the installation of this product.

## Operating conditions

The device should be used in a non-hazardous (non-ATEX -rated) indoor area at the atmospheric pressure  $\pm 10\%$ ,  $< 95\%$  RH, without condensation, and in a basic electromagnetic environment, where the latter is defined in EN 61326-1. Metal-oxide sensors cannot properly operate in a zero or low oxygen content atmosphere. Normal ambient oxygen concentration is recommended. Avoid strong mechanical shock and vibrations. Avoid corrosive atmosphere ( $H_2S$ ,  $SO_2$ ,  $HCl$ ,  $Cl_2$ , etc) and areas highly contaminated with dust, oil mist, etc. Keep the instrument away from direct sunlight. A sudden temperature or humidity change might affect the sensitivity of the sensor.

## Installation guidelines

There are no precise rules or standards to follow when installing gas detectors. The following points must be taken into account:

- Application (the instrument is intended for leakage control.)
- Properties of the space under investigation (room geometry, direction, and velocity of airflows, etc.),
- For gases lighter than air install the sensor higher than the potential leakage/generation source or near the ceiling. Combustible gases lighter than air are hydrogen, methane, and acetylene. Propane and butane are heavier than air and tend to sink. It is recommended to place the sensor lower than potential leakage or generation source.
- The device should be accessible for maintenance and repair.

The aforementioned conditions above will affect the coverage area of the device. however, the coverage area for a detector is usually between 2.5 to 5 meters radius.

For early leakage detection install the sensor as close as possible to the potential leakage sources (flanges, valves, pressure reducers, pumps, etc.), taking into consideration other points listed above.

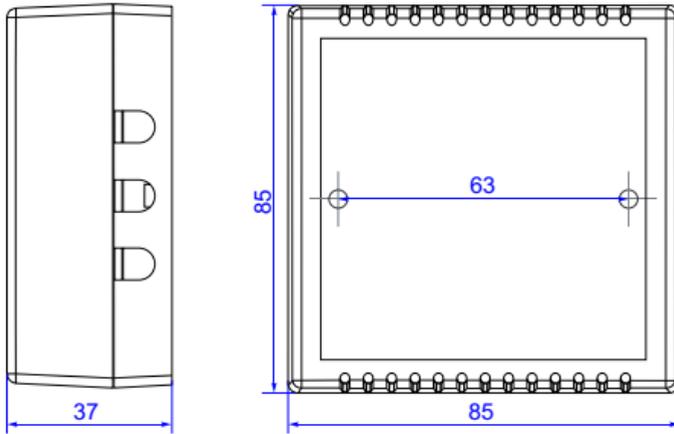
For general area monitoring without definite leakage sources, the detector should be distributed evenly in the room.

Do not locate the detector close to ventilation openings and strong air currents. Avoid the areas without air circulation (corners, niches) as well.

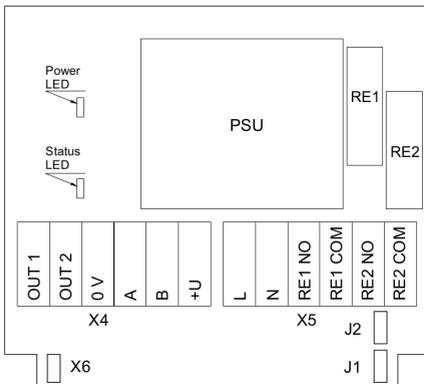
For personal safety control, the detectors are installed in the breathing zone (at the height of the head of people or animals). The recommended sensor position is vertical, pointing downwards.

## Installation and connections

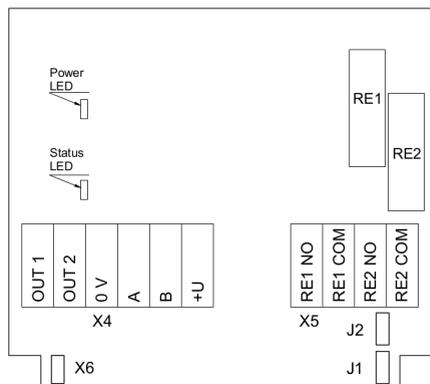
1. Detach the base of the enclosure by gently pulling along four guiding pins.
2. Attach the base to the wall with two screws (see drawings below).



3. Connect the power supply and external devices to the terminal blocks on the PCB according to the connection diagram below.



Version with PSU



Version without PSU

<b>Jumpers</b>	
<b>J1</b>	OUT1 type (open: 4-20 mA; closed 0-10 V)
<b>J2</b>	OUT2 type (open: 4-20 mA; closed 0-10 V)
<b>X6</b>	Reset Modbus network parameters to default
<b>X4 terminals</b>	
<b>OUT1</b>	4-20 mA / 0-10 V output
<b>OUT2</b>	4-20 mA / 0-10 V output
<b>0V</b>	0 V / 24 VAC Neutral (optional)
<b>A</b>	RS485 A / Data +
<b>B</b>	RS485 B / Data -
<b>+U</b>	+24 VDC / 24 VAC Phase (optional)
<b>X5 terminals (optional)</b>	
<b>L</b>	90...265 VAC Phase
<b>N</b>	90...265 VAC Neutral
<b>RE1 NO</b>	Relay 1, normally open terminal
<b>RE1 COM</b>	Relay 1, common terminal
<b>RE2 NO</b>	Relay 2, normally open terminal
<b>RE2 COM</b>	Relay 2, common terminal

To power the instrument from an external 24 V power source, connect terminals 0 V and +U to the source. If an integrated mains power supply module is used, connect terminals L and N to the mains.

**NOTE!** If the instrument is powered from mains, connect to 0 V and +U terminals only light external loads, which consume less than 30 mA in total, as the integrated mains supply module capacity is limited.

To use analog outputs, connect the terminals OUT1 and/or OUT2 and 0 V to the input of the secondary instrument (indicator or controller).

**NOTE!** The outputs are not galvanically isolated from the 24 V power supply and share a common 0 V. Allowed load resistance limits are stated in the Specifications table.

The type of each analog output can be independently changed between 4-20 mA and 0-10 V with jumpers J1 (OUT1) and J2 (OUT2). With a closed jumper, the output is 0-10 V, with an open jumper the output is 4-20 mA. By default, both outputs OUT1 and OUT2 are assigned to the gas concentration. The output assignments and scales can be changed by Modbus commands.

To use relay outputs, connect the chosen actuators to the relay terminals RE1 and/or RE2.

**NOTE!** Actuator short-circuits shall be avoided, to protect the instrument relays using external fuses or safety switches.

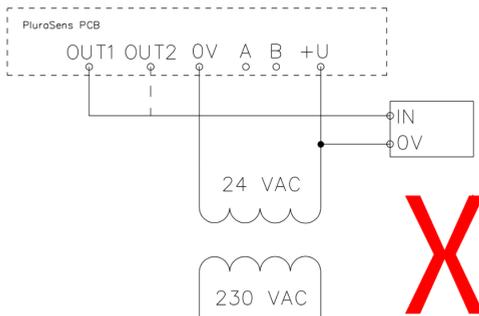
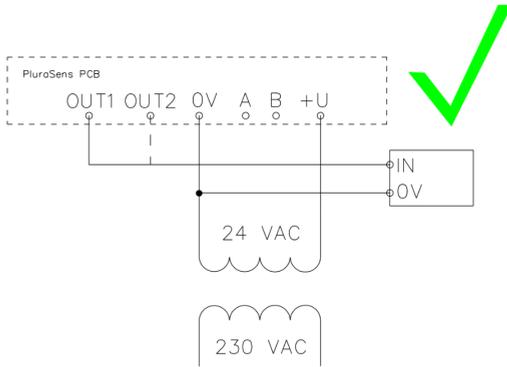
4. Turn on the power. It may take up to five minutes after switching on for the sensor to stabilize. During this period relays, analog outputs, and Modbus interface are off. A LED placed on the PCB of the device allows controlling the connection process. The LED response to different processes is presented in the table below:

Mode	LED mode
During calibration mode or sensor heating period (if activated)	0.5 Hz (50% on, 50% off)
Relay 1 turned on	Blinking 1 Hz (50% on, 50% off)
Relay 2 turned on	Blinking 2 Hz (50% on, 50% off)
During the Modbus communication cycle	Short on-off pulses
Normal operating/measurement	Continuously on or off

**NOTE!** Pulse corresponding to Modbus response is visible only when diode light is on.

5. Push the enclosure to the base.

### Correct and incorrect cabling for 24 VAC



## Operation

For best stability, the gas detector should be powered permanently. If the instrument is left for a long time in an unpowered state, then after initial power-on the metal-oxide gas sensor needs some time to heat up and burn adsorbed contaminants. So for the first tens of seconds of a few minutes, an alarm activation may be possible. After this heating-up period, the instrument turns into normal mode. When the concentration of the detected gas reaches the LOW alarm level, the control LED starts blinking and the buzzer starts beeping with 1 Hz frequency. When the HI alarm level is reached, the frequency of blinking/beeping is 2 Hz. The alarm signal turns off automatically if gas concentration decreases to 80% of the alarm setpoint.

## Maintenance

Do not perform any maintenance operation with the power on.

Clean the device with a soft damp cloth. Do not use any abrasive cleaning agents. Do not immerse the device in water or any cleaning media.

## Calibration

E2611-LEL has been calibrated by the Manufacturer with standard gas mixtures before delivery. The semiconductor gas sensor exhibits high stability and > 5 years' lifetime. However, as the gas sensor is directly exposed to the environment, the instrument requires at least annual field recalibration with a portable calibration kit.

## Delivery set

- Combustible Gas Detector E2611-LEL
- Mounting accessories:
  - 2 screws and 2 plastic dowel plugs

## Order code for E2611-LEL options

E2611 options	Order code
Integrated 90...265 V mains power supply module	E2611-LEL-230
Integrated 24 VAC power supply module	E2611-LEL-24VAC

## Configuring

Gas detector E2611 shares all functionalities of the PluraSens® multifunctional transmitter platform. The features and options include:

- Digital output change rate limiting filter
- Digital integrating (averaging) filter
- Free assignment of each analog output to chosen parameter
- Flexible setting of analog output scales for each output
- Output zero and slope adjustment for calibration
- Free assignment of each of two relays to chosen parameter
- Several relay control logic modes (HI or LO with hysteresis, U or П)
- Switch delays and minimum on/off state durations for each relay
- Modbus controlled forced state options for analog outputs and relays.

E2611 can be configured through its RS485 interface by Modbus RTU commands. A standard configuration kit includes a USB-RS485 converter and Configurator software. Please contact your Seller or the Manufacturer for more information.

## Return to default settings

To reset the device's Slave ID, baud rate, and stop bit numbers to factory settings, proceed as follows:

1. De-energize the device
2. Connect the X6 jumper
3. Turn on the device
4. De-energize the device
5. Disconnect the X6 jumper
6. Turn on the device

**NOTE!** Cables should be connected / disconnected from PCB when the power supply is unplugged. Connecting or Disconnecting Live wires can result in Corrupt Firmware.

## RS485 communication interface

Databits: 8 Parity: none Stop bits: 1 or 2 Protocol: Modbus RTU	Supported Modbus functions: 03 – Read multiple registers 06 – Write a single register
--	---

### Modbus registers (0-based, decimal format)

Reg	Description	Supported values
1	Hardware version	Read-only
2	Software version	Read-only
3	Product serial number	Read-only
4	Slave ID (network address)*	1...247, default 1
5	Baud Rate*	1200...57600 baud, default 9600
6	Response delay, ms	1...255 ms, default 10
7	Stop bits*	1 / 2, default 1
17	Restart	Write '42330' for soft restart
162	Temperature shift adjustment	-32000...+32000 T units (0,01 °C)
165	Gas channel shift adjustment	-32000...+32000 gas units, default 0
166	Gas channel slope adjustment	1...65535, default 512
167	Output change rate limit	1...32000 gas units/s, 0=no limit
168	Integrating filter time constant	1...32000 s, 0=no, integrating filter
201	Parameter assigned to OUT1	0=none, 1=T, 2=gas, 9=forced by 203
202	Parameter assigned to OUT2	0=none, 1=T, 2=gas, 9=forced by 204
203	Forced value for OUT1	0...1000 (0.0...100.0% of full scale)
204	Forced value for OUT2	0...1000 (0.0...100.0% of full scale)
211	Parameter assigned to RE1	0=none, 1=T, 2=gas, 9=forced by 213
212	Parameter assigned to RE2	0=none, 1=T, 2=gas, 9=forced by 214
213	Forced state for RE1	0=off, 1=on (relay control by Modbus)
214	Forced state for RE2	0=off, 1=on (relay control by Modbus)

215	Switch delay for RE1	0...1000 s, default 0
216	Switch delay for RE2	0...1000 s, default 0
217	Min on/off time for RE1	0...1000 s, default 0
218	Min on/off time for RE2	0...1000 s, default 0
219	Control logic for relay RE1	0:_, 1:↓↑•P, 2:•P↑↓_, 3:↑•P↓_, 4:•P↓↑•P
220	Control logic for relay RE2	0:_, 1:↓↑•P, 2:•P↑↓_, 3:↑•P↓_, 4:•P↓↑•P
221	LOW setpoint for relay RE1	-32000...+32000, gas or T units
222	HIGH setpoint for relay RE1	-32000...+32000, gas or T units
223	LOW setpoint for relay RE2	-32000...+32000, gas or T units
224	HIGH setpoint for relay RE2	-32000...+32000, gas or T units
258	Measured temperature	-4000...+12500 T units (0,01 °C)
259	Gas concentration	0...65535 gas units
261	0% value of OUT1	-32000...+32000 gas units/integer °C
262	100% value of OUT1	-32000...+32000 gas units/integer °C
263	0% value of OUT2	-32000...+32000 gas units/integer °C
264	100% value of OUT2	-32000...+32000 gas units/integer °C

\* - the new value is applied after restart

Broadcast ID=0 may be used to assign a new ID to a device with an unknown ID

## Factory settings

Gas unit	0,1 % LEL
OUT1 assignment and scale	gas, 0 - 100% LEL
OUT2 assignment and scale	gas, 0 - 100% LEL
RE1 assignment and logic	gas, on at high values
RE1 HIGH setpoint (set)	20% LEL
RE1 LOW setpoint (release)	16% LEL
RE2 assignment and logic	gas, on at high values
RE2 HIGH setpoint (set)	50% LEL
RE2 LOW setpoint (release)	40% LEL

## Warranty

This product is warranted to be free from defects in material and workmanship for a period of one year from the date of the original sale. During this warranty period, the Manufacturer will, at its option, either repair or replace a product that proves to be defective. This warranty is void if the product has been operated in conditions outside ranges specified by the Manufacturer or damaged by customer error or negligence or if there has been an unauthorized modification.

## Manufacturer contacts

Evikon MCI OÜ

Teaduspargi 9, Tartu

50411 Estonia

info@evikon.eu

www.evikon.eu

