PluraSens®

Solvent Vapor Detector-Transmitter E2611-VOC

USER MANUAL

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Acetone

A colorless organic solvent with a characteristic pungent odor that is volatile and flammable with the chemical formula $(CH_3)_2CO$.

Synonyms/Trade Names: Dimethyl ketone, Ketone propane, 2-Propanone.

| Chemical formula		$(CH_3)_2CO$
Molar weight		58
Relative gas density (to air)		2.0
Conversion*		1 ppm = 2.38 mg/m^3
Boiling point		56.11 °C
Low explosive limit (LEL), % vol. in air		2.5
Upper explosive limit (LEL), % vol. in air		12.8
Odor		Characteristic pungent smell
Hazards		Highly flammable. Slightly toxic in normal use. Irritant causing mild skin irritation and moderate to severe eye irritation. At high vapor concentrations, it may depress the CNS.
Exposure limits	TWA 8 hours (2000/39/EC)	1900 mg/m3 / 500 ppm
	NIOSH REL TWA	590 mg/m3 /250 ppm
	IDLH (NIOSH)	2500 ppm [10%LEL]

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Benzene

A colorless liquid with an aromatic odor that is highly flammable with the molecular formula C_6H_6.

Synonyms/Trade Names: Benzol, Phenyl hydride.

Chemical formula		C_6H_6
Molar weight		78
Relative gas density (to air)		2.69
Conversion*		1 ppm = 3.19 mg/m3
Boiling point		80 °C
Low explosive limit (LEL), % vol. in air		1.2
Upper explosive limit (LEL), % vol. in air		7.8
Odor		Hyacinth-like odor
Hazards		Highly flammable. Irritant. Carcinogen. May cause dizziness; headache, nausea, staggering gait; anorexia, lassitude. Target organs: eyes, skin, respiratory system, blood, central nervous system, bone marrow.
Exposure limits (NIOSH REL)	Ca TWA	0.319 mg/m3 /0.1 ppm
	STEL 15 minutes	1 ppm
	Ca IDLH	500 ppm

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Ethanol

A clear colorless liquid with a faintly sweet odor and pungent taste.
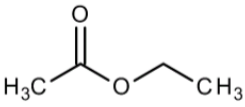
Synonyms/Trade Names: ethyl, alcohol.

Chemical formula	CH_2CH_2OH
Molar weight	46
Relative gas density (to air)	1,59
Conversion*	1 ppm = 1.89 mg/m^3
Boiling point	78.37°C
Low explosive limit (LEL), % vol. in air	3 - 3,3
Upper explosive limit (UEL), % vol. in air	19
Odor	The characteristic smell of alcohol
Hazards	Highly flammable. Gas/air mixtures are explosive. Inhalation of vapors leads to cough, headache, fatigue, and drowsiness. High concentrations may damage the fetus. Repeated high exposure may affect the liver and the nervous system.
Exposure limits according to Commission Directive 2006/15/EC	TWA 8 hours	1210 mg/m^3 / 1000 ppm
	STEL 15 minutes	-

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Ethyl acetate

A colorless organic compound with a sweet pear-like smell that is highly flammable.

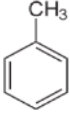Synonyms/Trade Names: ethyl ester, acetic ester, EA, EtOAc.

Chemical formula		$C_4H_8O_2$
Molar weight		88
Conversion*		1 ppm = 3.60 mg/m3
Boiling point		77.1 °C
Low explosive limit (LEL), % vol. in air		2
Upper explosive limit (LEL), % vol. in air		11.5
Odor		Sweat "pear" smell
Hazards		Flammable. Short-term exposure to high levels of ethyl acetate results first in irritation of the eyes, nose, and throat, followed by headache, nausea, vomiting, sleepiness, and unconsciousness.
Exposure limits (NIOSH)	TWA 8 hours	1400 mg/m3 /400 ppm
	IDLH	2000 ppm [10%LEL]

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Toluene

A clear, colorless liquid with a sweet smell that is highly flammable.

Synonyms/Trade Names: methylbenzene, phenylmethane.

Chemical formula	$C_6H_5CH_3$
Molar weight	92
Conversion*	1 ppm = 3.77 mg/m3
Boiling point	110.7 °C
Low explosive limit (LEL), % vol. in air	1.1 - 1.27
Upper explosive limit (UEL), % vol. in air	6.75−7.1
Odor	Characteristic "chemical" smell
Hazards	Highly flammable. Gas/air mixtures are explosive. Inhalation possible effects: irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paraesthesia; dermatitis; liver, kidney damage.

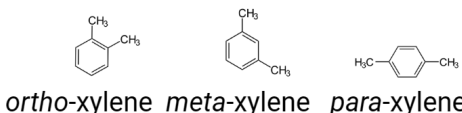| Exposure limits according to Commission Directive 2006/15/EC	TWA	192 mg/mm3 / 50 ppm
	STEL	384 mg/mm3 / 100 ppm

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Xylene

A colorless, flammable liquid with a chemical smell. Xylenes are produced by the methylation of toluene and benzene.

The term is used for any of three isomers of dimethylbenzene, or a combination thereof.

Synonyms/Trade Names: xylol, dimethylbenzene.

Chemical formula		$C_6H_4(CH_3)_2$	
Isomers		*ortho*-xylene *meta*-xylene *para*-xylene	
Molar weight		106	
Conversion*		1 ppm = 4.34 mg/m3	
Boiling point	144.4 °C	139 °C	138.35 °C
Low explosive limit (LEL), % vol. in air		0.9 - 1.1	
Upper explosive limit (UEL), % vol. in air		6.0−7.0	
Odor		Characteristic "chemical" smell	
Hazards		Flammable. Inhaling can cause dizziness, headache, drowsiness, and nausea.	
Exposure limits according to Commission Directive 2000/39/EC	TWA 8 hours	221 mg/mm3 / 50 ppm	
	STEL 15 minutes	442 mg/mm3 / 100 ppm	

*Conversion of ppm to mg/m3 is calculated for 25°C and 1 atm.

Specifications

Detected vapors	Acetone, Benzene, Ethanol, Ethyl Acetate, Toluene, Xylenes and other solvents	
Default calibration	Toluene	
Sensor type	Long-life metal-oxide gas sensor	
Sampling method	Diffusion	
Detection ranges	0...100% LEL	0...100 to 0...1000 ppm
Resolution	0.1% LEL	1 ppm
Default alarm setpoints (set/release)	LOW: set 20 , release 16 %LEL HIGH: set 50, release 40 %LEL	LOW: set 100 , release 80 ppm HIGH: set 300, release 240 ppm (for the range 0...500 ppm)
Response time T90	< 120 s	
Sensor lifetime	> 5 years	
Calibration interval	12 months	
Warm-up time	≤ 1 min	
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	For 4-20 mA output mode: RL < (Us - 2V) / 22 mA for 0-10 V output mode: RL > 250 kOhm	
Digital interface	RS485, Modbus RTU protocol	
Relay outputs	2 × SPST relays (closing contact), 250 VAC / 30 VDC, 5 A max	
Alarms	Buzzer 85 dB	
Enclosure	ABS plastic with ventilation slots, wall mount, protection class IP20	
Dimensions	H85 × W85 × D37 mm	
Operating conditions	-30...+70 °C; <95 %RH, non-condensing; 0.9...1,1 atm Explosion-safe areas	

	Normal ambient oxygen level Avoid strong mechanical shock, vibrations or EMI Avoid exposure to corrosive gases or silicone containing products
Electromagnetic compatibility	According to 2014/30/EU, 2014/35/EU and EN61321-1 standard requirements

Product description

E2611-VOC detector-transmitter belongs to the PluraSens® family of multifunctional measurement instruments. The instrument is based on a fully calibrated and temperature compensated semiconductor metal-oxide (MOS) gas sensor with high repeatability, stability and long lifetime.

The E2611 series provides two independent analog outputs OUT1 and OUT2, user-selectable to 4-20 mA or 0-10 V. RS485 Modbus RTU digital communication interface allows easy instrument configuration and integration into various automation systems.

Two relays RE1 and RE2 with closing dry contacts can be used to switch alarm sirens, ventilation fans, shut-off valves, or other actuators. 24 VAC or 230 VAC power supply options are available.

The version of your detector-transmitter is marked on the package. If the symbol ⚠ is marked on the equipment, consult the documentation for further information.

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 both in a non-hazardous area and in a basic electromagnetic environment, where the latter is defined in EN 61326-1. Avoid strong mechanical shock and vibrations. Avoid corrosive atmosphere 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 and connections

The gas detector should be mounted on a wall at a place located as close as possible to a possible gas leakage source and not very close to ventilation openings, with the sensor pointing downwards. Avoid the areas without air circulation (corners, niches) as well. Solvent vapors are heavier than air and tend to sink. Consider, if the vapours are heated or not, if the detector is used for fire safety (LEL range) or air quality control (ppm range) etc. Take into consideration the geometry of the room and the speed and direction of air currents. The device should be available for maintenance and repair.

To install and connect the device, proceed as follows:

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 dimensional drawing below).
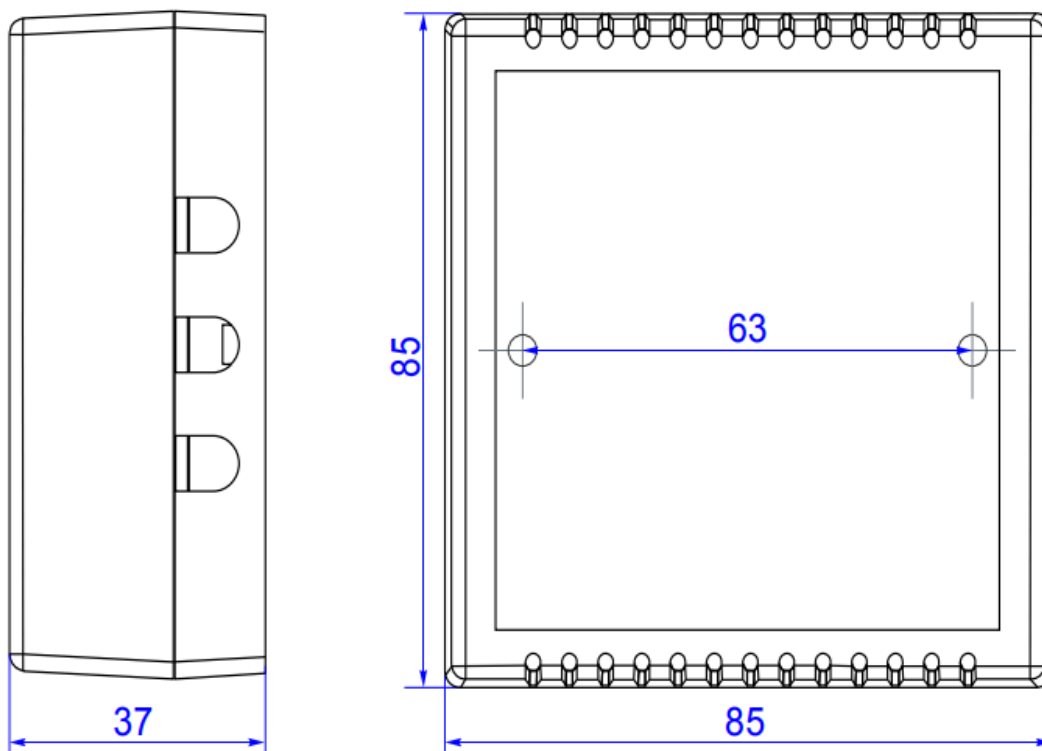
3. Connect the power supply and external devices to the terminal blocks on the PCB according to the connection diagram below.
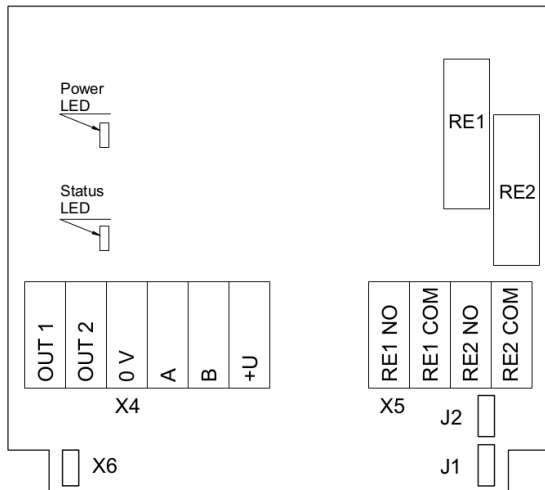
Version without PSU
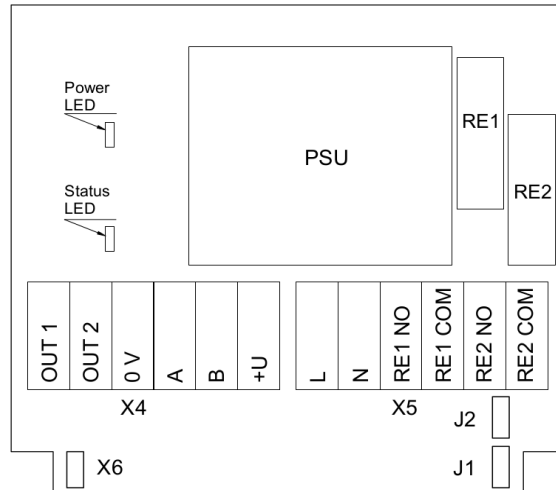
Version with PSU

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

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RE1 COM	Relay 1, common terminal
RE2 NO	Relay 2, normally open terminal
RE2 COM	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.

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.

Correct and incorrect cabling for 24 VAC
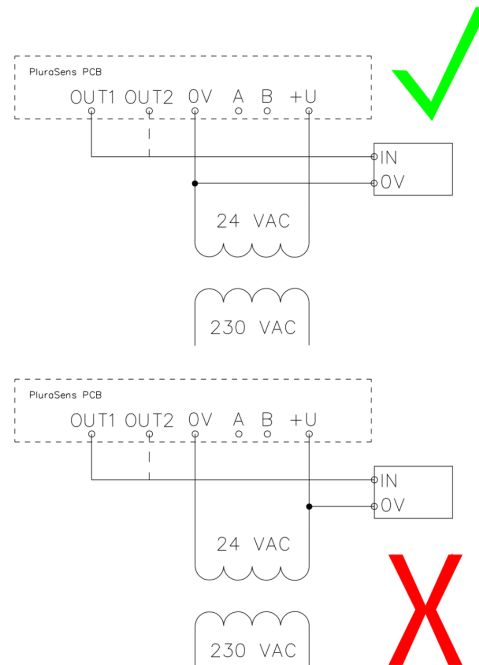
4. Turn on the power. The instrument warm-up time takes about 5 minutes after switching on and the final sensor stabilization time to maximum accuracy takes about 60 minutes. The operating status is indicated by the LED on the PCB of the device. The control LED (red) response to different processes is presented in the following table:

Process	LED mode
During calibration mode or sensor heating period (if activated) 0.5 Hz (50% on, 50% off)	During calibration mode or sensor heating period (if activated) 0.5 Hz (50% on, 50% off)
Sensor absence or malfunction	Blinking 0.5Hz (90% off, 10% on
Relay 1 turned on	Blinking 1 Hz (50% on, 50% off)
Relay 2 turned on	Blinking 2 Hz (50% on, 50% off)
Modbus response	Short on-off pulses*
Normal measurement	Continuous light

NOTE! Pulse corresponding to Modbus response is visible only when the LED is on.

5. Push enclosure to the base.

Operation

For best stability the gas detector should be powered permanently. If the instrument is left for a long time in 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

2611-VOC has been calibrated by the Manufacturer with standard gas mixtures before delivery. The metal-oxide 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.

The calibration should be performed by a trained specialist. Please contact your dealer for more information.

Delivery set

- Solvent Vapor Detector-Transmitter E2611-VOC
- Mounting accessories:
  - 2 screws and 2 plastic dowel plugs

Order code for E2610-VOC options

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

Configuring

A standard configuration kit includes a USB-RS485 converter, fixed flow regulator, gas tubing with applicators, and a software pack. Please contact your Seller for more information.

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

- Digital output change rate-limiting filter
- Digital integrating (averaging) filter
- Free assignment of each analog output to the 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 the chosen parameter
- Several relay control logic modes
- Switch delays and minimum on/off state durations for each relay

The output scales can be changed by Modbus commands by using the configuration software and the standard configuration kit (see Modbus RTU Communication).

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.

Modbus RTU Communication

RS485 communication interface

Databits: 8 Parity: none / odd /even Stop bits: 1 or 2 Protocol: Modbus RTU	Supported Modbus functions: 03 - read multiple registers 06 - write a single register

Communication parameters

Parameter	Permitted values	Default
Supported baud rates	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
Data bits	8	8
Parity	none / odd /even	none
Stop bits	1,2	1
Protocol	Modbus RTU	
Modbus functions	03 - read multiple registers 06 - write a single register	
Error codes	01 – Illegal function 02 – Illegal data address 03 – Illegal data value 04 – Slave device failure (details of last error 04 can be read from register 0x0008)	

Modbus holding registers

Register addresses are shown 0-based, Address in hexadecimal, Reg in decimal format. Modbus holding register numbers MHR are shown in the decimal 1-based format and may be addressed either from 00001 or 40001 base.

Address	Reg / MHR	RW	Description	Supported values (dec)	Default
0x0001	1 / 40002	R	Hardware version		-

0x0002	1 / 40003	R	Software version		-
0x0003	1 / 40004	R	Product serial number	1…65535	-
0x0004	1 / 40005	RW	Slave ID (net address) *	1….247 **	1
0x0005	1 / 40006	RW	Baud rate *	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
0x0006	1 / 40007	RW	Response delay, ms	1…255	10
0x0007	1 / 40008	RW	Stop bits, parity bit *	1 – No parity bit, 1 stop bit (default after factory reset) 2 – No parity bit, 2 stop bits 3 – Odd parity, 1 stop bit 4 – Even parity, 1 stop bit **NOTE:** 3 and 4 are available starting from the Software version 0x218 (dec. 536)	1
0x0008	1 / 40009	R	Last error code	1…255	-
0x0011	1 / 40018	RW	Technological: age of last data in seconds (read) / restart (write)	0…65535 s (read), writing 42330 restarts the instrument	-

Address	Reg / MHR	RW	Description	Supported values	Default
0x00A5	165 / 40166	RW	Zero adjustment for gas data, ADC	-32000…+32000 ADC units	0
0x00A6	166 / 40167	RW	Slope adjustment for gas data	1…65535	512
0x00A7	167 / 40168	RW	Change rate limit for gas data, units / s	1…32000, 0 - no limit	0
0x00A8	168 / 40169	RW	Integrating filter time constant, s	1…32000 (seconds), 0 - no filter	0

0x00C9	201 / 40202	RW	Parameter tied to analog output 1	0 − None 2 − Gas concentration 9 − Forced Modbus control, value set in MHR / 40204	2
0x00CA	202 / 40203	RW	Parameter tied to analog output 2	0 − None 2 − Gas concentration 9 − Forced Modbus control, value set in MHR / 40205	2
0x00CB	203 / 40204	RW	Forced value for analog output 1***	0...1000 (0.0%...100.0% of output scale)	0
0x00CC	204 / 40205	RW	Forced value for analog output 2***	0...1000 (0.0%...100.0% of output scale)	0
0x00D3	211 / 40212	RW	Parameter tied to relay RE1	0 − none 2 − gas concentration 9 − control by Modbus control, state set in MHR / 40214	2
0x00D4	212 / 40213	RW	Parameter tied to relay RE2	0 − none 2 − gas concentration 9- − control by Modbus control, state set in MHR / 40215	2
0x00D5	213 / 40214	RW	Forced state for relay RE1***	0 −off, 1 − on	0
0x00D6	214 / 40215	RW	Forced state for relay RE2***	0 −off, 1 − on	0
0x00D7	215 / 40216	RW	Switching delay for relay RE1	0...1000 (s)	0

0x00D8	216 / 40217	RW	Switching delay for relay RE2	0...1000 (s)	0
0x00D9	217 / 40218	RW	Minimal on/off time for relay RE1	0...1000 (s)	0
0x00DA	218 / 40219	RW	Minimal on/off time for relay RE2	0...1000 (s)	0

Address	Reg / MHR	RW	Description	Supported values (dec)	Default
0x00DB	219 / 40220	RW	Control logic for relay RE1	 0 − none 1 − relay on at high values 2 − relay on at low values 3 − relay on at values within the range 4 − relay on for the values out of the range	0
0x00DC	220 / 40221	RW	Control logic for relay RE2	 0 − none 1 − relay on at high values 2 − relay on at low values 3 − relay on at values within the range 4 − relay on for the values out of the range	0
0x00DD	221 / 40222	RW	LOW setpoint for relay RE1	0...65535 (gas units)	see Specifications
0x00DE	222 / 40223	RW	HIGH setpoint for relay RE1	0...65535 (gas units)	see Specifications

0x00DF	223 / 40224	RW	LOW setpoint for relay RE2	0...65535 (gas units)	see Specifications
0x00ED	224 / 40225	RW	HIGH setpoint for relay RE2	0...65535 (gas units)	see Specifications
0x00FF	255 / 40256	RW	Sensor, analog outputs, LED and buzzer status	bit[0]=0/1 − sensor present/absent, **RO** bit[1]=0/1 − analog outputs deactivated/activated bit[2]=0/1 − in case the sensor is absent, turn signaling off/on analog output1 bit[3]=0/1 − in case the sensor is absent, turn on signaling with low current/high current on analog output1; if bit[2]=0 this bit will be ignored bit[4]=0/1 − in case of sensor absent, turn signaling off/on analog output2 bit[5]=0/1 − in case of sensor absent, turn on signaling with low current/high current on analog output2; if bit[4]==0 this bit will be ignored bit[6]=0/1 − current/voltage output detected on output1, **RO** bit[7]=0/1 − current/voltage output detected on output2, **RO** bit[8]=0/1 − LED deactivated/activated bit[9]=0/1 − buzzer deactivated/activated bit[10]=0/1 - LED is	User defined

				on/off in normal condition bit[11]=0/1 - 1 Hz (50% on, 50% off) LED signal off/on if relay1 turned on bit[12]=0/1 - 2 Hz (50% on, 50% off) LED signal off/on if relay2 turned on	
0x0101	257 / 40258	R	Raw gas sensor data	0...4095, ADC units	
0x0103	259 / 40260	R	Gas concentration, gas units	0...65535, gas units	
0x0105	261 / 40262	RW	0% value for analog output 1	-32000...+32000, gas units	User defined
0x0106	262 / 40263	RW	100% value for analog output 1	-32000...+32000, gas units	User defined
0x0107	263 / 40264	RW	0% value for analog output 2	-32000...+32000, gas units	User defined
0x0108	264 / 40265	RW	100% value for analog output 2	-32000...+32000, gas units	User defined

* – The new value is applied after restart.

** – Broadcast slave ID 0 can be used to assign a new ID to the instrument with an unknown ID. When addressing by ID 0 the device shall be the only Modbus instrument in the network. The device will not respond to the Master command when addressed by ID 0.

*** – This value is dynamic and not kept in EEPROM after a restart.

Warranty

This product is warranted to be free from defects in material and workmanship for a period of one year from the date of original sale. During this warranty period Manufacturer will, at its option, either repair or replace 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