

PluraSens®



## Dual Gas Transmitter

**E2660-CO-CO2**

User Manual



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## Carbon Monoxide

Carbon Monoxide is a colorless, odorless, and tasteless gas that is highly toxic.

Synonyms: Carbonous oxide, Carbon (II) oxide, Flue gas, Monoxide.

Chemical formula		CO
Molar weight		28
Relative gas density (to air)		0.97
Conversion		1 ppm = 1.15 mg/m <sup>3</sup>
Boiling point		-191.5 °C
Low explosive limit (LEL), % vol. in air		12.5
Upper explosive limit (UEL), % vol. in air		74
Odor		Odorless
Hazards	Highly toxic. Mild poisoning causes lightheadedness, confusion, headache, dizziness, and flu-like effects. Larger exposures can lead to toxicity of the CNS and heart, and death. After acute poisoning, long-term problems may occur. CO also has negative effects on a baby if exposed during pregnancy. Chronic exposure to low levels can lead to depression, confusion, and memory loss.	
Exposure limits (NIOSH)	TWA	40 mg/m <sup>3</sup> /35 ppm
	IDLH	1380 mg/m <sup>3</sup> /1200 ppm

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

## Carbon Dioxide

Carbon dioxide is a colorless, odorless, non-toxic, and non-flammable gas that is present in the Earth's atmosphere at a low concentration.

Chemical formula	CO <sub>2</sub>	
Molar weight	44	
Relative gas density (to air)	1.52	
Conversion	1 ppm = 1.80 mg/m <sup>3</sup>	
Boiling point	Sublimes	
Flammability	Nonflammable	
Odor	Odorless	
Hazards	Dust of various metals (Mg, Zr, Ti, Al, Cr, Mn) is ignitable and explosive when suspended in carbon dioxide. In concentrations up to 1% (10 000 ppm), it will make some people feel drowsy and give the lungs a stuffy feeling. Concentrations of 7% to 10% (70 000 to 100 000 ppm) may cause suffocation, even in the presence of sufficient oxygen, manifesting as dizziness, headache, visual and hearing dysfunction, and unconsciousness within a few minutes to an hour.	
Exposure limits (Directive 2006/15/EC)	TWA	9000 mg/m <sup>3</sup> / 5000 ppm
	STEL	Not specified

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

## Specifications

Sampling method	Diffusion	
Detected gas	CO	CO <sub>2</sub>
Sensor type	Electrochemical cell	Photoacoustic
Typical detection range	0...300 ppm	0...1000 ppm
Resolution / digital unit	1 ppm	
Response time	T90 < 30s	T60 ≤ 60
Sensor lifetime	> 10 years	ca 10 years
Calibration interval	12 months	No field recalibration if ABC algorithm is enabled
Outputs assignment	OUT1: CO	OUT2: CO <sub>2</sub>
Outputs scale width	> 10 × resolution Recommended: 20-100% of the detection range For CO: down to 5-100% of the range is allowed	
Operating temperature, humidity	-20...+50 °C, 15...90 %RH non condensing	-40...+60 °C, 0...100 %RH
Operating conditions	pressure 0,9...1,1 atm non-ATEX-rated areas, non-aggressive atmosphere	
Cross-sensitivity	hydrogen, acetylene	None
Signal update	Every 1 second	Every 5 seconds
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 <sub>L</sub> < (U <sub>s</sub> - 2 V) / 22 mA for 4-20 mA R <sub>L</sub> > 250 kOhm for 0-10 V mode	
Digital interface	RS485, Modbus RTU protocol No galvanic isolation	
Cable connections	Screwless spring-loaded terminals	
Enclosure	Grey ABS, wall mount, protection class IP65	
Dimensions	H90 × W145 × D55 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
<b>Other options</b>	
Remote probe	Protection IP65, default cable length 3.0 m; max height 80 mm, max diameter 65 mm


## Product description

Dual Gas Detector-Transmitter E2660-CO-CO2 belongs to the PluraSens® family of multifunctional measurement instruments. The device is intended for simultaneous detection of carbon monoxide and carbon dioxide. It is a convenient solution for underground parking. The instrument utilizes electrochemical gas sensors with excellent repeatability, stability, and long lifetime.

Two analog outputs and RS485 digital interface with industry-standard Modbus RTU protocol can be used to connect the device to safety or building automation systems.

The following features are available as an option:

- 24 VAC or 230 VAC as options for power supply module,
- Remote probe.

The version of your detector 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 electrical 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, at the pressure 0,9...1,1 atm and relative humidity in the range 15...90%, 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 guidelines

Before proceeding with the installation it is mandatory to read the Safety requirements section and make sure to comply with all listed instructions. Installation standards EN 60079-29-2 and EN 45544-4 are also recommended for further instructions and related information about the installation. During the installation of the transmitter the following points must be considered:

- Application (the instrument is intended for leakage control.)
- Properties of the space under investigation (room geometry, direction, and velocity of airflows, etc.),
- Carbon monoxide has practically the same density as air. CO<sub>2</sub> is heavier than air, it is recommended to locate the sensor not higher than the potential leakage. For air quality control, place the sensor in the breathing zone.
- 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-transmitter 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.

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

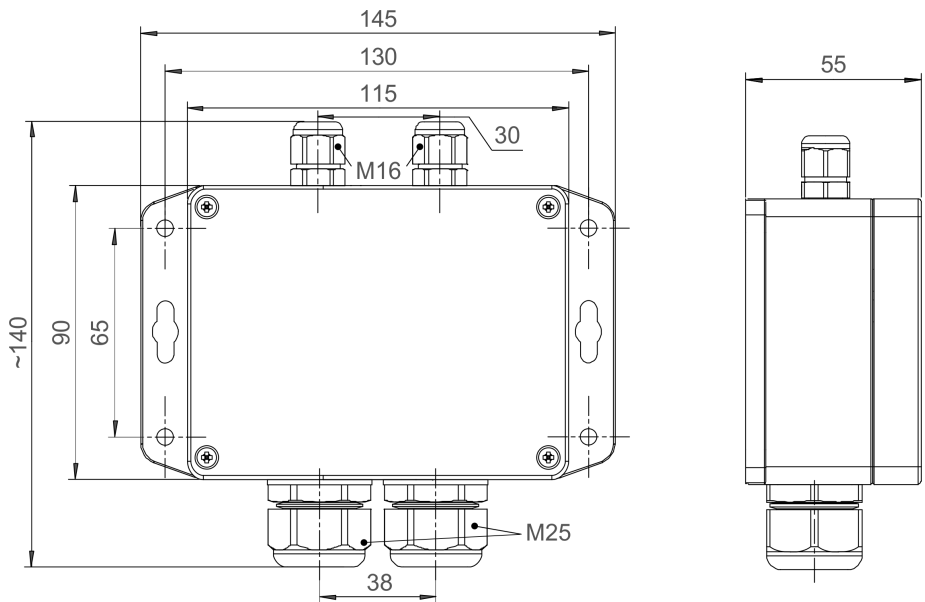
For general area monitoring without definite leakage sources, the detectors should be distributed evenly in the room.

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.

For installing the device, attach the device to the wall using provided screws through the side mounting holes or key slots (see mountains dimensions).

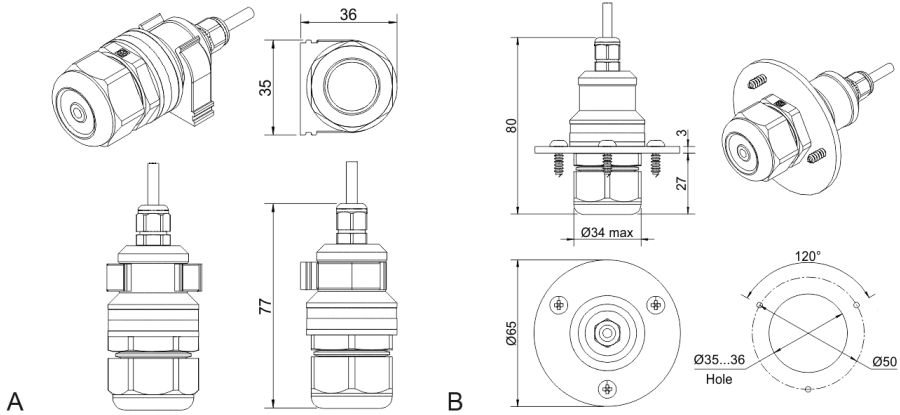


## Mounting dimensions



## Sensor probe handling

The E2660 series devices are available with a remote probe. The remote probe is connected to the main unit with a shielded cable. The default remote probe cable length is 3 m.



A) Wall mount remote probe with fixing clamp (default version),

B) Remote probe with rubber flange and three self-tapping screws (on request)

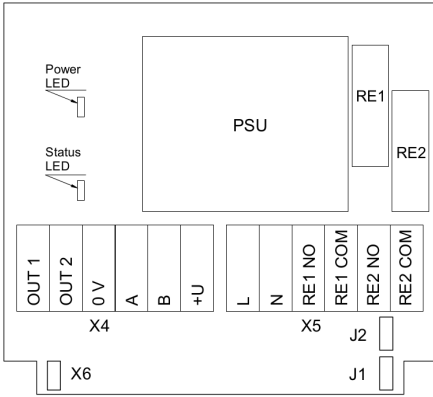
The sensor probes of all types are equipped with a hydrophobic microporous PTFE filter to protect the sensor from dust, dirt, and water drops. The filter should be replaced if it gets strongly contaminated. To replace the PTFE filter, unscrew the sensor head cap and remove the old filter. Place a new filter into the cap and tighten it again.

**NOTE!** Never stab or press the filter near its center where the sensor is located since this may damage the sensor. Do not remove the filter as it may cause the device to show incorrect values and/or break the sensor.

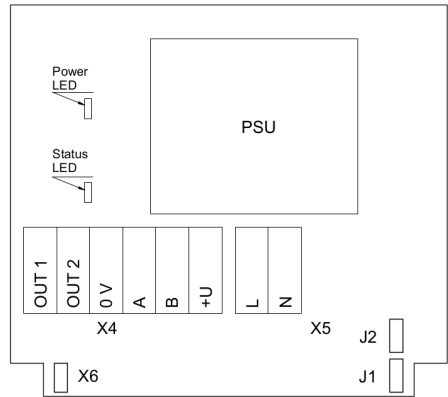
The recommended orientation of the sensor probe is vertical with the sensor tip pointing downwards. This prevents the possible accumulation of condensed water on the sensor protection filter.

## Electrical connections

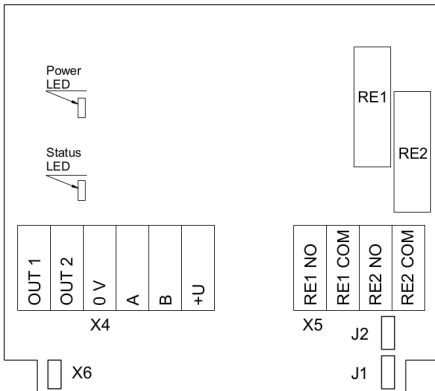
Unscrew four lid screws and detach the lid from the device. Use the M16 cable gland to let in cables of the power supply and of the external devices. Attach the power cable to the device without turning it on. Using the connection diagram below, connect the analog outputs and digital interface terminals to the relevant devices according to your tasks.



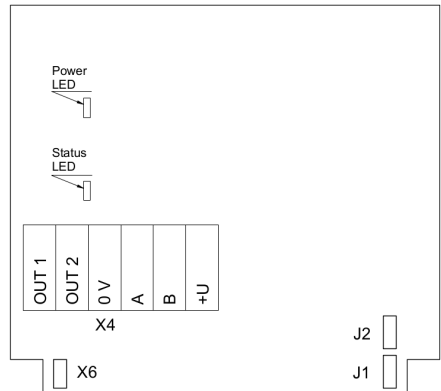
Version with PSU and relays



Version with PSU and without relays



Version without PSU and with relays



Version without PSU and relays

<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

The screwless quick connect spring terminals on the E2660 series devices are suitable for a wide range of wires with a cross-section of 0.2...1.5 mm<sup>2</sup>. We recommend stripping the wire end by 8...9 mm and using wire end sleeves.

To connect the wire, insert the wire end into the terminal hole. To disconnect, push the spring-loaded terminal lever, pull the wire out, and release the lever.

Use a twisted-pair cable, e.g. LiYY TP 2×2×0.5 mm<sup>2</sup> or CAT 5, to connect the device to the RS485 network. A and B on the device represent DATA+ and DATA- respectively, polarity must be respected when connecting to an external RS485 network. The overall length of all connections via the RS485 interface should not exceed 1200 m.

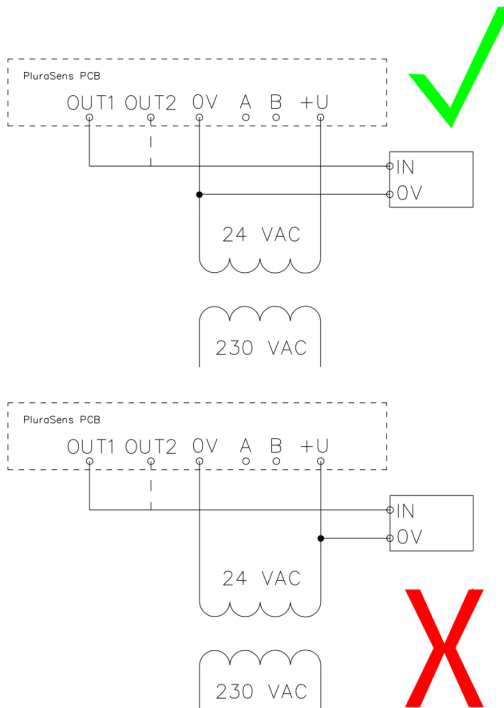
Both analog outputs can be independently changed between 4-20 mA and 0-10 V type using jumpers J1 (OUT1) and J2 (OUT2). By closing pins on a specific jumper the related output is 0-10 V, with an open jumper the output is 4-20 mA. Power restart is required after changing the position of the jumpers.

The relays RE1 and RE2 are assigned to CO and CO<sub>2</sub> concentration, respectively.

**NOTE!** The outputs are not galvanically isolated from the external power supply and share a common 0V. Allowed load resistance limits are stated in the Specifications table. To power the instrument from an external power source, connect terminals 0V and +U to the source. If the integrated mains power supply module is used, connect terminals L and N to the mains.

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

### Correct and incorrect cabling for 24 VAC



## Operation

Turn on the power. The instrument warm-up time takes about 1 minute after switching on and the final sensor stabilization time to maximum accuracy takes 30 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:

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

Make sure that the transmitter is properly mounted, the external devices connected, the power LED (green) on, and the control LED (red) is constantly lit. Make certain that the cable glands are properly tightened to ensure the conformity to IP65 protection class. Place the lid back and fix it with the screws. The device is ready to use. It is recommended to keep the device powered constantly, except for periods of maintenance and calibration, replacement, etc.

## 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

E2660-CO-CO2 detector-transmitter devices have been calibrated by the Manufacturer with standard gas mixtures before delivery. Provided that the device is used under moderate conditions, electrochemical gas sensor require field recalibration every 12 months. The photoacoustic sensor does not require recalibration if the ABC algorithm is enabled. Please contact your dealer for more information.

## Delivery set

- Detector-transmitter E2660-CO-CO2
- Mounting accessories:
  - 4 screws with plastic dowels
  - Fixing clamp for remote probe versions



### Order code for E2660-CO-CO2 options

E2660 options	Order code
Remote probe, 3 m cable	E2660-CO-CO2-RP33-3
Remote probe, 10 m cable	E2660-CO-CO2-RP33-10*
Integrated 90...265 V mains power supply module	E2660-CO-CO2-230
Integrated 24 VAC power supply module	E2660-CO-CO2-24VAC
Two SPST relays	E2660-CO-CO2-R

\* maximum cable length for CO2 is 5 meters

## 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.

Detectors- transmitters E2660 share all functionalities of the PluraSens® multifunctional 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
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### 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, Addr in hexadecimal, Reg in decimal format.

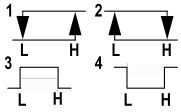
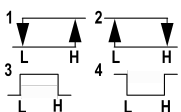
Modbus holding register numbers MHR are shown in the decimal 1-based format and may be addressed either from 00001 or 40001 base.

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x0001	1 / 40002	R	Hardware version		-
0x0002	2 / 40003	R	Software version		-
0x0003	3 / 40004	R	Product serial number	1...65535	-
0x0004	4 / 40005	RW	Slave ID (net address) *	1...247 **	1
0x0005	5 / 40006	RW	Baud rate *	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600

0x0006	6 / 40007	RW	Response delay, ms	10...255	10
0x0007	7 / 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 <b>NOTE:</b> 3 and 4 are available starting from the Software version 0x204 (dec. 516)	1
0x0008	8 /40009	R	Last error code	1...255	-
0x0011	17 / 40018	RW	Technological: age of last data in seconds (read) / restart (write)	0...65535 s (read), writing 42330 restarts the instrument	-

0x00A5	165 / 40166	RW	Zero adjustments 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	The change rate limit for gas units/s	1...32000, 0 - no limit	0
0x00A8	168 / 40169	RW	Integrating filter time constant, s	1...32000 (seconds), 0 - no filter	0
<b>Addr</b>	<b>Reg / MHR</b>	<b>RW</b>	<b>Description</b>	<b>Supported values (dec)</b>	<b>Default</b>
0x00C9	201 / 40202	RW	Parameter tied to analog output 1	0 – None 2 – 1st Gas concentration 3 – 2nd 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 – 1st Gas concentration 3 – 2nd Gas concentration 9 – Forced Modbus control, value set in MHR / 40205	3
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	0 –none	2

			RE1	2 – 1st Gas concentration 3 – 2nd Gas concentration 9 – control by Modbus control, state set in MHR / 40214	
0x00D4	212 / 40213	RW	Parameter tied to relay RE2	0 – none 2 – 1st Gas concentration 3 – 2nd Gas concentration 9 – control by Modbus control, state set in MHR / 40215	3
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

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x00DB	219 / 40220	RW	Control logic for relay RE1	 <p>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</p>	0
0x00DC	220 / 40221	RW	Control logic for relay RE2	 <p>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</p>	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
0x00E0	224 / 40225	RW	HIGH setpoint for relay RE2	0...65535 (gas units)	see Specifications

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x00FF	255 / 40256	RW	Sensor, analog outputs, LED and buzzer status	bit[0]=0/1 – sensor present/absent, read-only! 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, read-only! bit[7]=0/1 – current/voltage output detected on output2, read-only! bit[8]=0/1 – LED deactivated/activated, bit[9]=0/1 – buzzer deactivated/activated bit[10]=0/1 – LED is on/off in	user defined

				normal condition	
0x0101	257 / 40258	R	Raw 1st gas sensor data	0...4095, ADC units	
0x0103	259 / 40260	R	1st gas concentration	signed integer, -32000...+32000 (gas units)	
0x0105	261 / 40262	RW	0% value for analog output 1	-32000...+32000, gas units	0
0x0106	262 / 40263	RW	100% value for analog output 1	-32000...+32000, gas units	1000
0x0107	263 / 40264	RW	0% value for analog output 2	-32000...+32000, gas units	0
0x0108	264 / 40265	RW	100% value for analog output 2	-32000...+32000, gas units	1000
0x016D	365 / 40366		Zero adjustments for 2nd gas data, ADC	-32000...+32000 ADC units	0
0x016E	366 / 40367		Slope adjustment for 2nd gas data	1...65535	512
0x016F	367 / 40368		The change rate limit for 2nd gas data, gas unit / s	1...32000, 0 - no limit	0
0x0170	368 / 40369		2nd Integrating filter time constant, s	1...32000 (seconds), 0 - no filter	0
0x01C9	457 / 40458		Raw 2nd gas sensor data	ADC data 0...4095	
0x01CB	459 / 40460		2nd gas concentration	signed integer, -32000...+32000 (gas units)	

\* – 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 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

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