

**PluraSens®**



# **Ammonia Detector-Transmitter**

**E2608-NH3-P**

**User Manual**



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## Ammonia

A colorless gas, highly soluble in water, with a characteristic pungent smell.

Ammonia is a large-scale production of the chemical industry widely used as a raw material for the production of fertilizers and explosives, as a refrigerant, as a cleaning and antimicrobial agent.

Ammonia is also produced naturally from the decomposition of organic matter, including plants and animals.

|  |      |   |
|--|------|---|
| Chemical formula                           |      | NH <sub>3</sub>   |
| Molar weight                               |      | 17  |
| Relative gas density (to air)              |      | 0.59  |
| Conversion                                 |      | 1 ppm = 0.70 mg/m <sup>3</sup>  |
| Boiling point                              |      | -33.3 °C  |
| Low explosive limit (LEL), % vol. in air   |      | 15  |
| Upper explosive limit (UEL), % vol. in air |      | 28  |
| Odor                                       |      | Characteristic pungent smell  |
| Odor detection threshold                   |      | 0.04 ppm ...57 ppm according to different studies   |
| Hazards                                    |      | Ammonia is irritant to the skin, eyes, and respiratory tract. Ammonia inhalation causes breathing difficulties (wheezing). High concentrations may lead to pulmonary edema. |
| Exposure limits<br>(Directive 2000/39/EC)  | TWA  | 14 mg/m <sup>3</sup> / 20 ppm   |
|  | STEL | 36 mg/m <sup>3</sup> / 50 ppm   |

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

## Specifications

|                           |   |
|---------------------------|---|
| Sensor type               | Pellistor (catalytic bead)  |
| Sampling method           | Diffusion   |
| Typical detection ranges  | 0...15%vol. (0...100%LEL NH <sub>3</sub> )  |
| Resolution / digital unit | 0.1%vol. or 1%LEL   |
| Response time T90         | ≤10 s   |
| Sensor lifetime           | > 3 years   |
| Calibration interval      | 6 months  |
| Signal update             | Every 1 second  |
| Power supply              | 12...36 VDC (default),<br>24 VAC or 230 VAC as options  |
| Power consumption         | < 2 VA  |
| Load resistance           | $R_L < (U_s - 2 \text{ V}) / 22 \text{ mA}$ for 4-20 mA<br>$R_L > 250 \text{ k}\Omega$ for 0-10 V mode  |
| Digital interface         | RS485, Modbus RTU protocol;<br>No galvanic isolation  |
| Analog outputs            | 2 × 4-20 mA / 0-10 V, user settable   |
| Outputs assignment        | OUT1: Gas; OUT2: Gas  |
| Output scale width        | > 10 × resolution<br>Recommended: 20-100% of the detection range<br>Analog output scale can be set according to customer's requirement (e.g. 0...4%vol. NH <sub>3</sub> )   |
| Relay outputs             | 2 × SPST, max 5 A, 30 VDC / 250 VAC   |
| Cable connections         | Screwless spring-loaded terminals   |
| Enclosure                 | Grey ABS, wall mount, protection class IP65   |
| Dimensions                | H87 × W82 × D55 mm  |
| CE marking                | According to 2014/30/EU and 2014/35/EU, EN 50491-4-1:2012<br>EN 61000-6-3:2020, EN 61326-1:2013(EMC, emissions)<br>EN 61000-6-1:2019, EN 61000-6-2:2019(EMC, Immunity)<br>EN 60079-29-1:2016, EN 60079-29-2:2015 and EN 60079-29-3:2014 |
| Operating conditions      | -20...+60 °C, 95% RH non-condensing,<br>0,9...1,1 atm   |


|               |  |
|---------------|--|
|               | Explosion safe indoor areas<br>Normal ambient oxygen level<br>Avoid strong mechanical shock, vibrations, or EMI<br>Avoid exposure to corrosive gases or silicone-containing products |
| Other options |  |
| Remote probe  | Protection IP65, default cable length 3.0 m;<br>max height 80 mm, max diameter 65 mm   |

## Product description

E2608 series detectors-transmitters belong to the PluraSens® family of multifunctional measurement instruments. The instruments utilize gas sensors of various types with excellent repeatability, stability, and long lifetime.

E2608 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. Remote probe, duct mount version and 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 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 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 detector-transmitter the following points must be considered:

- Application (air quality control or leakage detection)
- Properties of the space under investigation (room geometry, direction, and velocity of airflows, etc.),
- Ammonia is lighter than air, so the sensor should be placed higher than the potential leakage or formation 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-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.

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

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

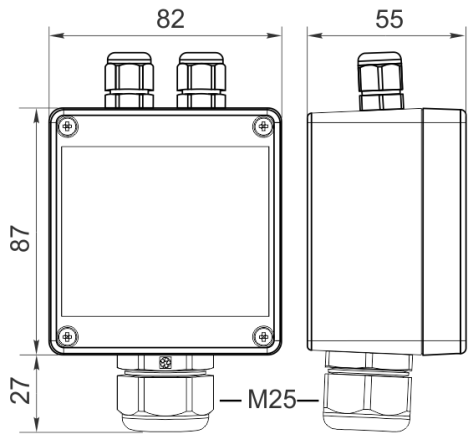
### Wall mount version

Attach the mounting lugs to the back of the detector-transmitter using the provided screws. Screw the device to the wall through the mounting lug holes (for dimensions see the drawing in the next section).

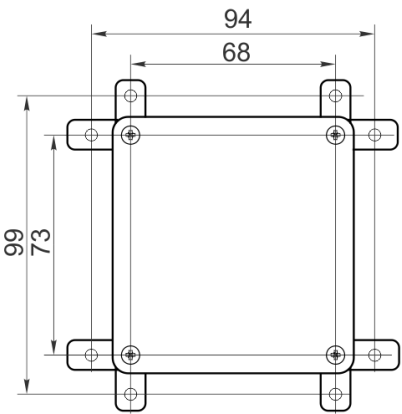
### Duct mount version

Cut a hole with a diameter of 36...45 mm in the air duct at the chosen mounting place. Place the rubber flange aligning the holes in the flange and the air-duct and fix the flange with four self-tapping screws. Pass the sensor probe through the flange and adjust it to the appropriate depth. Unscrew four lid screws and detach the lid from the detector-transmitter.

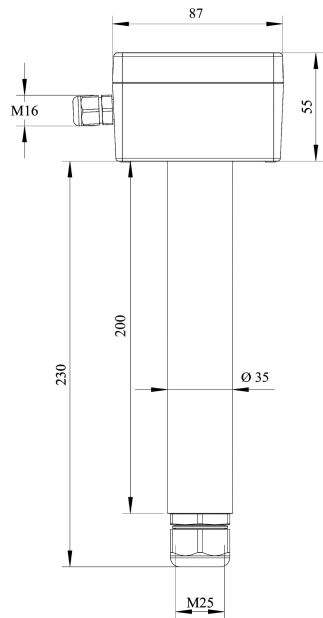
Mounting dimensions



Wall mount version



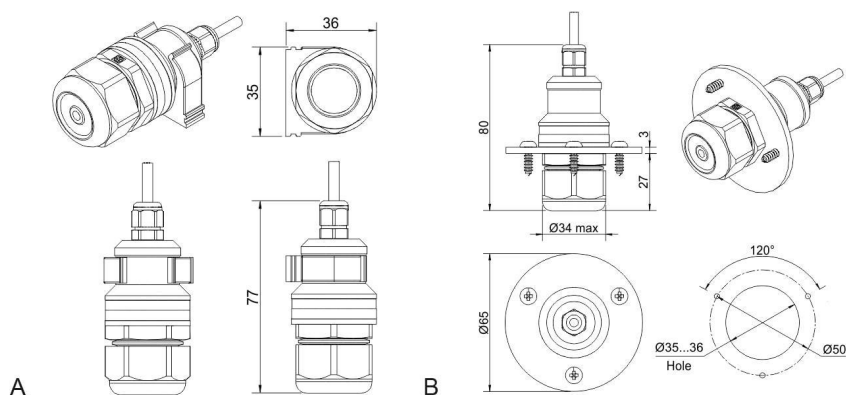
with mounting lugs



Duct mount version

## Sensor probe handling

The wall-mount version of the detector-transmitter is available with a remote probe (see drawing below for dimensions). 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.

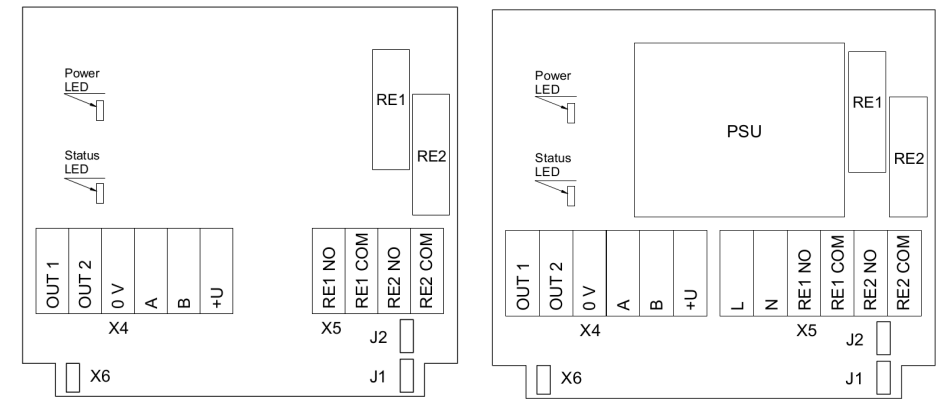
The recommended orientation of the sensor probe is vertical with the sensor tip pointing downwards. This prevents the possible accumulation of condensed water on the sensor protection filter.

## Gas sensor replacement procedures

1. Remove the sensor head cap from the device (or the remote probe),
2. Remove the PTFE filter (if it is not removed within the cap),
3. Remove the O-ring rubber,
4. Detach the pellistor (catalytic) sensor from the device,
5. Insert the new pellistor (catalytic) sensor inside,
6. Put back the O-ring rubber, PTFE filter, and the head cap, respectively.

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 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)          |

| <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 E2608 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 to strip the wire end by 8...9 mm and use 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.

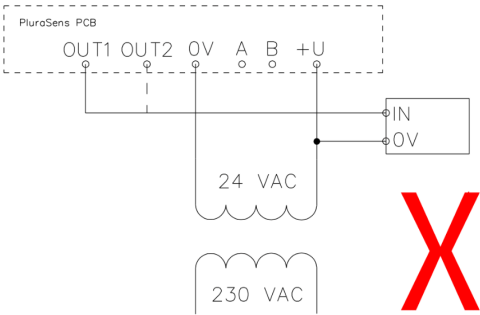
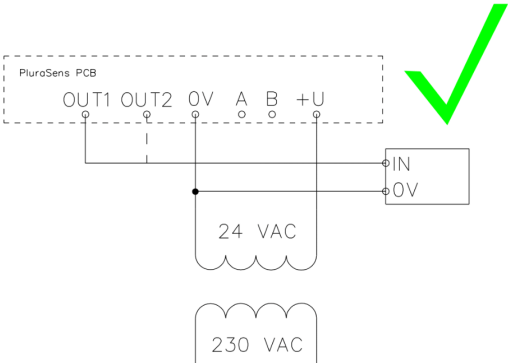
Use a twisted-pair cable, e.g. LiYY TP 2×2×0.5 mm<sup>2</sup> or CAT 5, to connect the device to the RS485 network. A and B on the device represent DATA+ and DATA- respectively, polarity must be respected when connecting to an external RS485 network.

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.

**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 about 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 detector-transmitter is properly mounted, the external devices connected, power LED (green) on, and the control LED (red) is constantly lit. Place the lid back and fix it with the screws. The device is ready to use.

## Maintenance

Do not perform any maintenance operation with the power on.

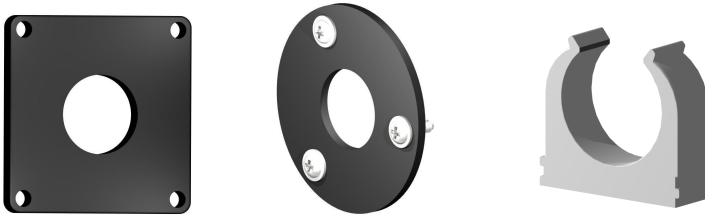
Clean the device with a soft damp cloth. Do not use any abrasive cleaning agents. Do not immerse the device in water or any cleaning media.

## Calibration

E2608-NH3-P detector-transmitters have been calibrated by the Manufacturer with standard gas mixtures before delivery. Provided that the sensor is used under moderate conditions, field recalibration is recommended every 6 months Please contact your dealer for more information.

## Delivery set

- Detector-transmitter E2608 (wall mount or duct mount version)
- Mounting accessories:
  - 4 cross-shaped mounting lug with screws and 4 screws with plastic dowels for wall mount version
  - Square Rubber flange for Duct mount option
  - Round rubber flange for Remote probe option
  - Fixing clamp for Remote probe option



## Order code for E2608-NH3-P options

| E2608 options  | Order code          |
|--|---------------------|
| Remote probe, 3 m cable  | E2608-NH3-P-RP33-3  |
| Remote probe, 10 m cable   | E2608-NH3-P-RP33-10 |
| Duct mount option, stem Ø35×L230 mm  | E2608-NH3-P-DM      |
| Integrated 90...265 V mains power supply module                            | E2608-NH3-P-230     |
| Integrated 24 VAC power supply module                                      | E2608-NH3-P-24VAC   |
| Remote LCD single value display, wall mount box 115 × 65 × 40mm, 3 m cable | E2608-NH3-P-RLCD3   |

## 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 E2608 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

# Modbus RTU Communication

## RS485 communication interface

|   |   |
|---|---|
| Databits: 8<br>Parity: none / odd / even<br>Stop bits: 1 or 2<br>Protocol: Modbus RTU | Supported Modbus functions:<br>03 – Read multiple registers<br>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<br>06 - Write a single register  |         |
| Error codes          | 01 – Illegal function<br>02 – Illegal data address<br>03 – Illegal data value<br>04 – Slave device failure<br>(details of last error 04 can be read from register 0x0008) |         |

## Modbus holding registers

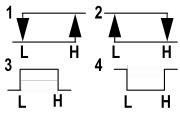
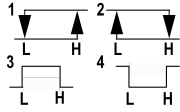
Register addresses are shown 0-based, Address in hexadecimal, Reg in decimal format. Modbus holding register numbers MHR are shown in the decimal 1-based format and may be addressed either from 00001 or 40001 base.

| Address | Reg / MHR | RW | Description              | Supported values (dec) | Default |
|---------|-----------|----|--------------------------|------------------------|---------|
| 0x0001  | 1 / 40002 | R  | Hardware version         |                        | -       |
| 0x0002  | 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   | 1...255  | 10   |
| 0x0007 | 7 / 40008  | RW | Stop bits, parity bit *  | 1 – No parity bit, 1 stop bit (default after factory reset)<br>2 – No parity bit, 2 stop bits<br>3 – Odd parity, 1 stop bit<br>4 – Even parity, 1 stop bit<br><b>NOTE:</b> 3 and 4 are available starting from the Software version 0x218 (dec. 536) | 1    |
| 0x0008 | 8 / 40009  | R  | Last error code  | 1...255  | -    |
|        |            |    |  |  |      |
| 0x0011 | 17 / 40018 | RW | Technological:<br>age of last data in seconds (read) / restart (write) | 0...65535 s (read),<br>writing 42330 restarts the instrument   | -    |

| Address | Reg / MHR   | RW | Description                               | Supported values (dec)   | 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),<br>0 - no filter  | 0       |
|         |             |    |   |  |         |
| 0x00C9  | 201 / 40202 | RW | Parameter tied to analog output 1         | 0 – None<br>2 – Gas concentration<br>9 – Forced Modbus control, value set in MHR / 40204 | 2       |
| 0x00CA  | 202 / 40203 | RW | Parameter tied to analog output 2         | 0 – None<br>2 – Gas concentration<br>9 – Forced Modbus control, value set in MHR / 40205 | 2       |
| 0x00CB  | 203 / 40204 | RW | Forced value for analog output 1***       | 0...1000<br>(0.0%...100.0% of output scale)  | 0       |
| 0x00CC  | 204 / 40205 | RW | Forced value for analog output 2***       | 0...1000<br>(0.0%...100.0% of output scale)  | 0       |

|        |             |    |                                   |  |   |
|--------|-------------|----|-----------------------------------|--|---|
| 0x00D3 | 211 / 40212 | RW | Parameter tied to relay RE1       | 0 – none<br>2 – gas concentration<br>9 – control by Modbus control, state set in MHR / 40214 | 2 |
| 0x00D4 | 212 / 40213 | RW | Parameter tied to relay RE2       | 0 – none<br>2 – gas concentration<br>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 |  <p>0 – none<br/>1 – relay on at high values<br/>2 – relay on at low values<br/>3 – relay on at values within the range<br/>4 – relay on for the values out of the range</p>   | 0       |
| 0x00DC  | 220 / 40221 | RW | Control logic for relay RE2 |  <p>0 – none<br/>1 – relay on at high values<br/>2 – relay on at low values<br/>3 – relay on at values within the range<br/>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 |
|        |             |    |   |  |                    |
| 0x00FF | 255 / 40256 | RW | Sensor, analog outputs, LED and buzzer status | bit[0]=0/1 – sensor present/absent, <b>RO</b><br>bit[1]=0/1 – analog outputs deactivated/activated<br>bit[2]=0/1 – in case the sensor is absent, turn signaling off/on analog output1<br>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<br>bit[4]=0/1 – in case of sensor absent, turn signaling off/on analog output2<br>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<br>bit[6]=0/1 – current/voltage output detected on output1, <b>RO</b><br>bit[7]=0/1 – current/voltage output detected on output2, <b>RO</b><br>bit[8]=0/1 – LED deactivated/activated<br>bit[9]=0/1 – buzzer deactivated/activated<br>bit[10]=0/1 - LED is on/off in normal condition<br>bit[11]=0/1 - 1 Hz (50% on, 50% off) LED signal off/on if relay1 turned on<br>bit[12]=0/1 - 2 Hz (50% on, 50% off) LED signal off/on if relay2 turned on | user defined       |

|        |                |    |                                   |                            |                 |
|--------|----------------|----|-----------------------------------|----------------------------|-----------------|
| 0x0101 | 257 /<br>40258 | R  | Raw gas sensor data               | 0...4095, ADC units        |                 |
| 0x0103 | 259 /<br>40260 | R  | Gas concentration,<br>gas units   | 0...65535, gas units       |                 |
| 0x0105 | 261 /<br>40262 | RW | 0% value<br>for analog output 1   | -32000...+32000, gas units | User<br>defined |
| 0x0106 | 262 /<br>40263 | RW | 100% value<br>for analog output 1 | -32000...+32000, gas units | User<br>defined |
| 0x0107 | 263 /<br>40264 | RW | 0% value<br>for analog output 2   | -32000...+32000, gas units | User<br>defined |
| 0x0108 | 264 /<br>40265 | RW | 100% value<br>for analog output 2 | -32000...+32000, gas units | User<br>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 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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