

Gas transmitters E2618 belong to the PluraSens® family of multifunctional measurement instruments.

The instruments utilise gas sensors of various types with excellent repeatability, stability and long lifetime

The transmitter is supplied either in duct-mount or wall-mount version. For the wall-mount version the range of remote probe options is available.

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

This manual refers to the E2618 series in general, for more detailed information concerning particular devices see Annex 1.

The version of your detector is marked on the package and/or on the sticker inside the device.

Safety requirements

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.

Operating conditions

The device should be used in explosion-safe (non ATEX -rated) indoor areas, without aggressive gases in the atmosphere. Operating conditions depend on the sensor type, see Annex 1 for more information.

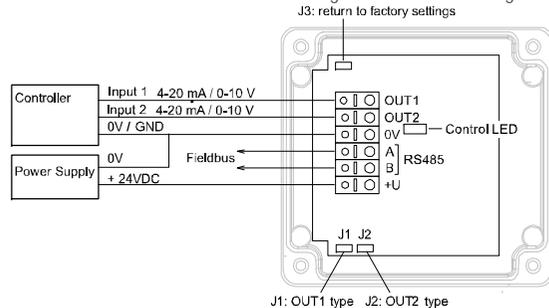
Installation and connection

The device should be mounted in the proximity to potential gas sources and not very close to ventilation openings or strong air currents. Avoid the areas without air circulation (corners, niches) as well. Recommended sensor position is vertical pointing downwards. The location of the device depends on detected gas (see Annex 1 for more detailed information). Make sure that the transmitter is accessible for maintenance and repair.

1. **Duct mount version:** Cut a 36 mm diameter hole 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 three 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 instrument.

Wall mount version: Unscrew four lid screws and detach the lid from the instrument. Fix the transmitter through mounting holes by screws.

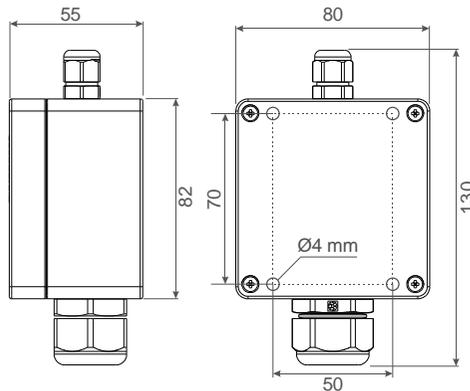
2. Plug the power cable and connect the analog outputs and/or digital interface terminals to the relevant devices according to the connection diagram.



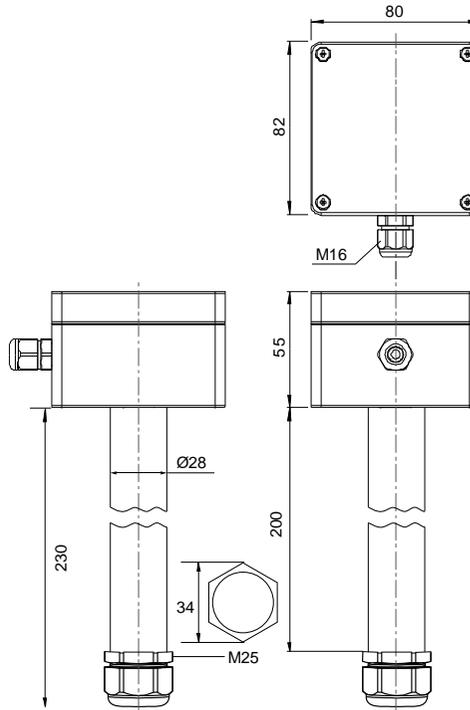
Make certain that the cable gland is properly tightened to ensure the conformity to IP65 protection class.

The screwless quick connect spring terminals on the E2618 series devices are suitable for a wide range of wires with cross-section 0,2...1,5 mm². The recommended wire stripping length is 8...9 mm. Push the spring loaded terminal lever, insert the wire end into terminal hole and release the lever.

Dimensions of the E2618 wall-mount version



Dimensions of the E2618 duct mount version



Use twisted pair cable, e.g. LiYY TP 2×2×0,5 mm² or CAT 5, to connect the device to RS485 network. Use one pair for A and B wires and the second pair for common 0 V and power +U wires. to connect the transmitter to Fieldbus network. Respect polarity. Overall length of all connections via RS485 interface should not exceed 1200 m.

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 closed jumper the output is 0-10 V, with open jumper the output is 4-20 mA.

By default both outputs OUT1 and OUT2 are assigned to gas concentration. The device has built-in temperature sensor which may be connected to any of the outputs.

3. Turn on the power. The sensor heating up may take up to five minutes after switching on. During this period analog outputs and Modbus interface are off. A LED placed on the PCB of the device allows to control the connection process. The LED response to different processes is presented in the table below.

Process	LED mode
Sensor heating period	Blinking 0.5 Hz (50% on, 50% off)
Sensor absence or malfunction	Blinking 0.5 Hz (90% off, 10% on)
Modbus response	The signal is modulated with short on/off pulses, even single Modbus cycle is traceable*
Normal measurement	Continuous light

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

4. Make sure that the detector is properly fixed, the external devices connected, power on and control LED is constantly lit. Place the lid back and fix it with the screws. The device is ready to use.

It is recommended to keep the detector on constantly, except for periods of maintenance and calibration, displacement etc.

The output assignments and scales can be changed by Modbus commands.

Sensor probe handling

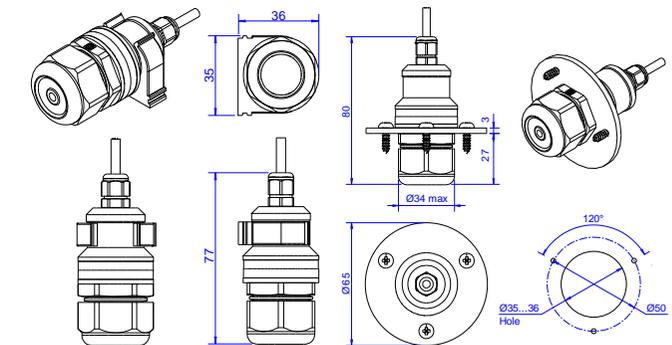
The wall mount version of the transmitter is available with remote probe (see drawing for dimensions).

The remote probe is connected to the main unit with shielded cable. Default cable length is 2.5 m.

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 round filter is snap-fitted and may be replaced if it gets strongly contaminated.

To replace the PTFE filter, unscrew the M25 nut and remove the old filter. Place a new filter into the nut and tighten it again.

NB! Never stab or press the filter near its center where the sensor is located since this may damage the sensor.



The recommended orientation of sensor probe is vertical with the sensor tip pointing downwards. This prevents possible accumulation of condensed water on the sensor protection filter. The horizontal orientation is also suitable. Avoid upward position of the sensor tip.

Return to default settings

To reset the device's Slave ID, baudrate and sbit number to factory settings, proceed as follows:

1. De-energize the device
2. Connect the J3 jumper
3. Turn on the device
4. De-energize the device
5. Disconnect the J3 jumper
6. Turn on the device

Maintenance

Do not perform any maintenance operation with the power on.
Clean the device with soft damp cloth. Do not use any abrasive cleaning agents.
Do not immerse the device into water or any cleaning media.

Calibration

E2618 series transmitters have been calibrated by Manufacturer with standard gas mixtures before delivery. Device lifespan and field recalibration interval depend on the sensor type. See Annex 1 for more information.

Delivery set

- Transmitter E2618 or E2618-DM
- Mounting accessories:
 - 4 screws with plastic dowels for wall mount version
 - rubber flange for duct mount version.
 - fixing clamp for remote probe versions

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 Manufacturer or damaged by customer error or negligence or if there has been an unauthorized modification.

Specifications

Signal update	every 1 second
Power supply options	11...30 VDC or 24 VAC
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 no galvanic isolation, common-mode voltage -7...+12 V,
Cable connections	screwless spring loaded terminals
Enclosure	grey ABS, wall mount, protection class IP65
Dimensions	H82 × W80 × D55 mm
Operating environment	industrial indoor and outdoor locations
CE marking	according to 2014/30/EU and EN61326-1 requirements

RS485 communication interface

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

Parameter	Permitted values	Default
Supported baudrates	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
Data bits	8	8
Parity	none	none
Stop bits	1, 2	1
Protocol	Modbus RTU	
Modbus functions	03 - read multiple registers 06 - write 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)	

The list of Modbus registers is in the Annex 3.



Gas transmitter

E2618
User manual



Gas Detector-Transmitter E2618

User Manual

Annex 1 E2618 series devices: characteristics depending on detected gas

Note: Below are listed the typical characteristics of E2618 series. Please contact us via e-mail (info@evikon.eu) or by phone (+372 7336310) if you need a device with particular properties (detection range, operating conditions etc).

Operating conditions	Installation guidelines
<p>The devices of the E2618 series should be used in explosion-safe (non ATEX rated) indoor areas, at the atmospheric pressure (85...110 kPa) and relative humidity in the range 15...90%.</p> <p>Do not use or store the devices at the temperatures higher than specified in the table below.</p> <p>Do not use the detectors in the rooms where silicone containing materials (silicone rubber/putty, hair grooming materials, adhesives) or other volatile silicon compounds may be present. Adsorbed silicon-containing vapours may coat the sensing material of the sensor or clog the gas diffusion route, irreversibly inhibiting sensitivity.</p> <p>Avoid exposing the devices with electrochemical sensor to high concentrations of basic gases such as ammonia.</p> <p>MOS-type and catalytic bead gas sensors cannot properly operate in a zero or low oxygen content atmosphere. They require the presence of normal ambient oxygen in their operating environment in order to function properly.</p> <p>For best stability the gas detector shall 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 first tens of seconds of few minutes an alarm activation may be possible. After this heating-up period the instrument turns into normal mode.</p>	<p>There's no precise rules or standards to follow when installing the gas detectors. The following points must be taken into account:</p> <ul style="list-style-type: none"> • application (air quality control or leakage detection), • properties of the space under investigation (room geometry, direction and velocity of air flows etc), • detected gas (relative density to air, whether the gas is flammable, or toxic, or oxygen displacing), • safety: strong vibrations, mechanical shock, and the sources of strong electromagnetic interference should be avoided, • the device should be accessible for maintenance and repair. <p>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.</p> <p>For general area monitoring without definite leakage sources, the detectors should be distributed evenly in the room, near the ceiling for light gases and ca. 15 cm above the floor for heavy gases. Coverage area for each detector is 40-80 m². For NO₂ detectors coverage area is up to 700 m² (ca 15 m radius).</p> <p>For personal safety control the detectors are installed in the breathing zone (at the height of the head of people or animals). The location of the sensor is determined by operating conditions. Thus, in underground parkings the NO₂ raises to the ceiling with hot exhaustion gases, so the sensor should be located at 1.2...1.5 m from the floor in order to detect potentially dangerous concentration more quickly.</p> <p>More detailed information concerning density, toxicity and flammability of various gases is summarized in the Annex 2.</p>

Sensor type, operating conditions, maintenance intervals

Device	Sensor type	Operating temperature	Detected gas relative density to air	Sensor lifetime	Maintenance interval	Notes
E2618-C2H2	Metal oxide semiconductor*	-40...70 °C	0.90 Slightly lighter	> 10 years	12 months	
E2618-C2H4	Electrochemical*	-20...50 °C	0.97 Almost equal	≥ 24 months	6 months	
E2618-CH4	Metal oxide semiconductor*	-40...70 °C	0.55 Lighter	> 5 years	12 months	
E2618-CI2	Electrochemical	-20...50 °C	2.44 Considerably heavier	≥ 24 months	6 months	
E2618-CO	Electrochemical	-20...50 °C	0.97 Almost equal	≥ 6 years	6 months	
E2618-CO2-10K	Optical (NDIR)	0...50 °C	1.52 Heavier	> 10 years	5 years	
E2618-CO2-50K	Optical (NDIR)	0...50 °C	1.52 Heavier	> 10 years	5 years	
E2618-ETO	Electrochemical	-20...50 °C	1.52 Heavier	≥ 24 months	6 months	
E2618-H2	Metal oxide semiconductor*	-40...70 °C	0.07 Much lighter	> 10 years	12 months	
E2618-H2S	Electrochemical	-30...50 °C	1.17 Slightly heavier	≥ 24 months	6 months	
E2618-HFC	Metal oxide semiconductor	-40...70 °C	Heavier	> 10 years	12 months	
E2618-LEL	Metal oxide semiconductor*	-40...70 °C	Lighter	> 5 years	12 months	
E2618-LPG	Metal oxide semiconductor*	-40...70 °C	Heavier	> 5 years	12 months	
E2618-NH3-E	Electrochemical	-10...50 °C	0.59 Lighter	≥ 24 months	6 months	Do not use the detector in spaces with constantly high ammonia concentration such as cattle, pig and poultry livestock houses, since it shortens the sensor lifetime.
E2618-NH3-S	Metal oxide semiconductor	-40...50 °C	0.59 Lighter	> 10 years	12 months	
E2618-NO	Electrochemical	-30...50 °C	1.03 Almost equal	≥ 24 months	6 months	
E2618-NO2	Electrochemical	-30...50 °C	1.59 Heavier	≥ 24 months	6 months	
E2618-O2	Electrochemical	-30...50 °C	1.1 Slightly heavier	≥ 24 months	6 months	
E2618-O2-L	Optical (fluorescence-based)	-30...60 °C	1.1 Slightly heavier	> 5 years	Maintenance free	Field recalibration may be necessary, if used under unstable or harsh conditions.
E2618-O3	Electrochemical	-20...45 °C	1.5 Heavier	≥ 24 months	6 months	
E2618-SO2	Electrochemical	-30...50 °C	2.21 Considerably heavier	≥ 24 months	6 months	
E2618-VOC	Metal oxide semiconductor	-40...70 °C	Heavier	> 10 years	12 months	

* For flammable gases, catalytic bead sensors are available on demand. Detection range: 0...100 %LEL; resolution 1% LEL, operating conditions -20...60 °C; 0% to 90% RH; response time T90 <10 s; sensor lifetime 24 months, calibration interval 3...6 months.

Measurement ranges, resolution. Typical factory settings for analog outputs

Device	Measurement range	Max. overload	Response time (T90, if other is not marked)	Resolution	Gas units	OUT1 assignment and scale (gas units)	OUT2 assignment and scale (gas units)	Notes
E2618-C2H2	0...100% LEL (0...2.5 vol%)	not determined	< 5 min	0,1 %LEL (25 ppm)	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
E2618-C2H4	0...10 ppm	20 ppm	T80 < 60 s	0.1 ppm	0.1 ppm	2 gas; 0-100	2 gas; 0-100	
	0...200 ppm	500 ppm		1 ppm	1 ppm	2 gas; 0-200	2 gas; 0-200	
	0...1500 ppm	2000 ppm		5 ppm	1 ppm	2 gas; 0-1500	2 gas; 0-1500	
E2618-CH4	0...100% LEL	not determined	ca. 60s	0,1 %LEL	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
E2618-CI2	0...20 ppm	250 ppm	< 60 s	0.1 ppm	0.1 ppm	2 gas; 0-200	2 gas; 0-200	
E2618-CO	0...1000 ppm	2000 ppm	< 30 s	1 ppm	1 ppm	2 gas; 0-1000	2 gas; 0-1000	
E2618-CO2-10K	0...10 000 ppm	no limit	~2 min	1 ppm	1 ppm	2 gas; 0-10000	2 gas; 0-10000	Accuracy ± (50 ppm + 3% of reading) in the range 300...5000 ppm
E2618-CO2-50K	0...50 000 ppm	no limit	~2 min	100 ppm	100 ppm	2 gas; 0-500	2 gas; 0-500	Accuracy ± (70 ppm + 5% of reading) Up to 100% CO ₂ ranges available on request
E2618-ETO	0...20 ppm	40 ppm	< 140 s	0.1 ppm	0.1 ppm	2 gas; 0-200	2 gas; 0-200	
	0...100 ppm	200 ppm		1 ppm	1 ppm	2 gas; 0-100	2 gas; 0-100	
E2618-H2	0...100% LEL	not determined	< 5 min	0,1 %LEL	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
E2618-H2S	0...100 ppm	not determined	< 30 s	1 ppm	1 ppm	2 gas; 0-100	2 gas; 0-100	
E2618-HFC	0...1000 ppm	not determined	ca. 60s	1 ppm	1 ppm	2 gas; 0-1000	2 gas; 0-1000	
E2618-LEL	0...100% LEL	not determined	< 5 min	0,1 %LEL	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
E2618-LPG	0...100% LEL	not determined	< 5 min	0,1 %LEL	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
E2618-NH3-E	0...100 ppm	200 ppm	< 40 s	1 ppm	1 ppm	2 gas; 0-100	2 gas; 0-100	
	0...300 ppm	500 ppm	< 40 s	2 ppm		2 gas; 0-1000	2 gas; 0-1000	
	0...1000 ppm	1500 ppm	< 60s	5 ppm		2 gas; 0-1000	2 gas; 0-1000	
E2618-NH3-S	0...100 ppm	not determined	< 60 s	1 ppm	1 ppm	2 gas; 0-1000	2 gas; 0-1000	
	0...1000 ppm							
E2618-NO	0...250 ppm	1000 ppm	< 40 s	1 ppm	1 ppm	2 gas; 0-250	2 gas; 0-250	
E2618-NO2	0...20 ppm	100 ppm	< 60 s	0.1 ppm	0.1 ppm	2 gas; 0-200	2 gas; 0-200	
	0...100 ppm	200 ppm	< 40 s	0.5 ppm	0.1 ppm	2 gas; 0-1000	2 gas; 0-1000	
E2618-O2*	0...25% vol	30% vol	<15 s	0.01%vol	0.01%vol	2 gas; 0-2500	2 gas; 0-2500	
E2618-O2-L*	0...25% vol	no limit	< 30s	0.01%vol	0.01%vol	2 gas; 0-2500	2 gas; 0-2500	
E2618-O3	0...5 ppm	50 ppm	T80 < 60 s	0.03 ppm	0.01 ppm	2 gas; 0-500	2 gas; 0-500	
E2618-SO2	0...20 ppm	150 ppm	< 30 s	0.1 ppm	0.1 ppm	2 gas; 0-200	2 gas; 0-200	
E2618-VOC	0...100% LEL	not determined	< 120 s	0,1 %LEL	0,1 %LEL	2 gas; 0-1000	2 gas; 0-1000	
	0...500 ppm			1 ppm	1 ppm	2 gas; 0-500	2 gas; 0-500	

Gas Transmitters E2618

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Annex 2 Properties of gases

Acetylene

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 ³
Boiling point	-84 °C
Low explosive limit (LEL), % vol in air	2.5
Upper explosive limit (UEL), % vol in air	100
Odour	Odourless or with a faint ethereal smell if pure. Commercial grade may have 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 ³ /2500 ppm

Ammonia

Colourless gas, highly soluble in water

Chemical formula	NH ₃
Molar weight	17
Relative gas density (to air)	0,59
Conversion	1 ppm = 0.70 mg/m ³
Boiling point	-33.34 °C
Low explosive limit (LEL), % vol in air	15
Upper explosive limit (UEL), % vol in air	28
Odour	Characteristic pungent smell
Odour detection threshold	0.04 ppm ...57 ppm according to different studies
Hazards	Ammonia is an irritant to skin, eyes and respiratory tract. Ammonia inhalation causes breathing difficulties (wheezing). At high concentrations may lead to pulmonary edema.
Exposure limits (Directive 2000/39/EC)	TWA 14 mg/m ³ /20 ppm STEL 36 mg/m ³ /50 ppm

Butane

(the term is used for any one of two isomers, or a combination thereof)

Chemical formula	n-butane CH ₃ CH ₂ CH ₂ CH ₃	iso-butane CH ₃ CH(CH ₃)CH ₃
Molar weight	58	
Relative gas density (to air)	2.0	
Conversion	1 ppm = 2.38 mg/m ³	
Boiling point	-0.56 °C	-11.7 °C
Low explosive limit (LEL), % vol in air	1.6	1.8
Upper explosive limit (UEL), % vol in air	8.4	9.6
Odour	gasoline-like odour	
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 pressurised container, and can result in death from asphyxiation and ventricular fibrillation.	
Exposure limits (NIOSH)	TWA 1900 mg/m ³ /800 ppm	not established

Carbon dioxide

Synonyms: Carbonic acid gas, Carbonic anhydride, Carbon (IV) oxide; Dry ice (in solid state)

Chemical formula	CO ₂
Molar weight	44
Relative gas density (to air)	1.52
Conversion	1 ppm = 1.80 mg/m ³
Boiling point	Sublimes
Flammability	Nonflammable
Odour	Odourless
Hazards	Dusts of various metals (Mg, Zr, Ti, Al, Cr, Mn) are 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.[97] 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 ³ /5000 ppm STEL Not specified

Carbon monoxide

Colourless, odourless, and tasteless gas. 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 ³
Boiling point	-191.5 °C
Low explosive limit (LEL), % vol in air	12.5
Upper explosive limit (UEL), % vol in air	74
Odour	Odourless
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 have 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 ³ /35 ppm IDLH 1380 mg/m ³ /1200 ppm

Chlorine

Heavy greenish-yellow gas with a pungent, irritating odour.

Chemical formula	Cl ₂
Molar weight	70.9
Relative gas density (to air)	2.44
Conversion	1 ppm = 2.90 mg/m ³
Boiling point	-34.04 °C
Odour	Pungent, irritating smell
Odour detection threshold	Some individuals will not notice the odour until it is more than three times the exposure limit.
Hazards	Nonflammable, but a strong oxidizer, may react explosively with many common chemicals. Potent irritant of the eyes, mucous membrane, skin and respiratory system. Death can occur within minutes after exposure of 400 to 1000 ppm. Chronic exposure of 1 ppm can cause a moderate, but permanent, reduction in pulmonary function.
Exposure limits (Directive 2006/15/EC)	TWA not specified STEL 1.5 mg/m ³ /0.5 ppm
IDLH (NIOSH)	10 ppm

Chlorofluorocarbon refrigerants

Name	Components	Components weight %	Boiling point
R-12	CCl ₂ F ₂	100	-29.8°C
R-123	CHCl ₂ CF ₃	100	27.9°C
R-125	CHF ₂ CF ₃	100	-48.5°C
R-134a	CF ₃ CH ₂ F	100	-26.2°C
R-143	CHF ₂ CH ₂ F	100	
R-143a	CF ₃ CH ₃	100	-47.5 °C
R-22	Chlorodifluoromethane CHClF ₂	100	-40.8 °C
R-404a	C ₂ HF ₅ (HFC-125), CF ₃ CH ₃ (HFC-143a), CF ₃ CH ₂ F (HFC-134a)	44:52:4	-47.8 °C
R-407c	CH ₂ F ₂ (HFC-32), C ₂ HF ₅ (HFC-125), CF ₃ CH ₂ F (HFC-134a)	23:25:52	-43 °C
R-410a	CH ₂ F ₂ (R-32), CHF ₂ CF ₃ (R-125)	50:50	-48.5 °C

Halocarbon refrigerants are highly volatile nonflammable liquids, with vapours heavier than air.

Overexposure may cause dizziness and loss of concentration. At higher concentrations, CNS depression and cardiac arrhythmia may result from exposure. Vapours displace air and can cause asphyxiation in confined spaces. At higher temperatures (>250°C) decomposition products may include hydrofluoric acid (HF) and carbonyl halides.

Moreover, an escape of refrigerant through a leak may damage the refrigerating facilities.

Ethanol (vapours)

Chemical formula	CH ₃ CH ₂ OH	
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	
Odour	Characteristic smell of alcohol	
Hazards	Highly flammable. Gas/air mixtures are explosive. Inhalation of vapours 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	1900 mg/m ³ / 1000 ppm
	STEL 15 minutes	-

Ethyl acetate

Chemical formula		
Molar weight	88	
Conversion	1 ppm = 3.60 mg/m ³	
Boiling point	77.1 °C	
Low explosive limit (LEL), % vol in air	2	
Upper explosive limit (UEL), % vol in air	11.5	
Odour	Sweet "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/m ³ / 400 ppm
	IDLH	2000 ppm [10%LEL]

Ethylene

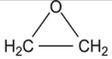
Extremely flammable colourless gas. Widely used as a raw material in polymer industry and as a fruit ripener.

Chemical formula	H ₂ C=CH ₂	
Molar weight	28	
Relative gas density (to air)	0,97	
Conversion	1 ppm= 1.15 mg/m ³	
Boiling point	-103.7 °C	
Low explosive limit (LEL), % vol in air	2.7	
Upper explosive limit (UEL), % vol in air	36.0	
Odour	Faint sweet odour when pure	
Odour threshold	270...600 ppm, so odour is not an adequate warning property to prevent excessive exposure to ethylene	
Hazards	Extremely flammable. Gas/air mixtures are explosive. Excessive exposure by inhalation may cause headache, dizziness, anaesthesia, drowsiness, unconsciousness, or other central nervous system effects.	
Exposure limits (ACGIH)	TWA	200 ppm
	STEL	not established

Ethylene oxide

Other names: epoxyethane, ethylene oxide, dimethylene oxide, oxacyclopropane, 1,2-Epoxy ethane. Proper IUPAC name: oxirane.

Highly reactive, toxic and flammable colourless gas.

Chemical formula	C ₂ H ₄ O	
Molar weight	44	
Relative gas density (to air)	1.52	
Conversion	1 ppm = 1.80 mg/m ³	
Boiling point	10.7 °C	
Low explosive limit (LEL), % vol in air	3	
Upper explosive limit (UEL), % vol in air	100	
Odour	Pungent, ether-like	
Odour threshold	430 ppm	
Hazards	Flammable. Gas/air mixtures are explosive. Ethylene oxide is a slow poison with carcinogenic, mutagenic, irritating, and anaesthetic effect. Exposure routes are inhalation, ingestion, (liquid), skin and/or eye contact.	
Exposure limits (OSHA)	TWA	1 ppm
	STEL	5 ppm

Hydrogen

Colourless flammable gas

Chemical formula	H ₂
Molar weight	2
Relative gas density (to air)	0.07
Conversion	1 ppm = 0.0818 mg/m ³
Boiling point	-252.88 °C
Low explosive limit (LEL), % vol in air	4
Upper explosive limit (UEL), % vol in air	75
Odour	Odourless
Hazards	Flammable, forms explosive mixtures with air. Asphyxiant.
Exposure limits	not established

Hydrogen sulfide

Synonyms: Hydrosulfuric acid, Sewer gas, Sulfuretted hydrogen

Chemical formula	H ₂ S	
Molar weight	34	
Conversion	1 ppm = 1.40 mg/m ³	
Relative gas density (to air)	1.17	
Boiling point	-60 °C	
Low explosive limit (LEL), % vol in air	4.0	
Upper explosive limit (UEL), % vol in air	44.0	
Odour	Characteristic smell of rotten eggs. Above 30 ppm, odour described as sweet or sickeningly sweet.	
Odour threshold	0.01-1.5 ppm Note: Sense of smell becomes rapidly fatigued & can NOT be relied upon to warn of the continuous presence of H ₂ S.	
Hazards	Highly flammable, explosive gas. Broad-spectrum poison, mostly affecting nervous system. At low concentrations causes eye irritation, a sore throat and cough, nausea, shortness of breath, and pulmonary edema. Long-term, low-level exposure results in fatigue, loss of appetite, headache, poor memory, irritability, and dizziness. Exposure to high levels can induce immediate collapse, with loss of breathing and a high probability of death.	
Exposure limits according to Commission Directive 2009/161/EU	TWA	7 mg/mm ³ / 5 ppm
	STEL	14 mg/mm ³ / 10 ppm
	IDLH (NIOSH)	140 mg/mm ³ / 100 ppm

Methane

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

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

Nitric oxide

Colourless gas, relatively insoluble in water.

Chemical formula	NO	
Molar weight	30	
Relative gas density (to air)	1.03	
Conversion	1 ppm = 1.23 mg/m ³	
Boiling point	-152 °C	
Flammability	Nonflammable, but accelerates the burning of combustible materials.	
Odour	Pure NO is odourless, but in the air it oxidizes to NO ₂ which has a pungent odour	
Hazards	Irritates respiratory tract and eyes, at high concentrations may cause lung edema and death.	
Exposure limits (Directive 91/322/EEC)	TWA	30 mg/m ³ /25 ppm
	IDLH (NIOSH)	123 mg/m ³ /100 ppm

Nitrogen dioxide

Reddish-brown gas above 21 °C with a pungent, acrid odour, becomes a yellowish-brown liquid below 21 °C, and converts to the colourless dinitrogen tetroxide (N₂O₄) below -9 °C.

Chemical formula	NO ₂	
Molar weight	46	
Relative gas density (to air)	1.59	
Conversion	1 ppm = 1.88 mg/m ³	
Boiling point	21.2 °C	
Flammability	Powerful oxidizer, can cause many organic substances (wood, paper, oil etc) to ignite.	
Odour	Characteristic pungent odour	
Odour threshold	0.1 to 0.4 ppm	
Hazards	Irritates the skin, eyes and respiratory tract. Exposure to levels above 100 ppm can cause death due to asphyxiation from fluid in the lungs. There are often no symptoms at the time of exposure other than transient cough, fatigue or nausea, but over hours inflammation in the lungs causes edema.	
Exposure limits (NIOSH)	ST REL	1.88 mg/m ³ / 1 ppm
	IDLH	37.6 mg/m ³ /20 ppm

Oxygen

Colourless, odourless, and tasteless gas, one of the main components of the air.

Chemical formula	O ₂
Molar weight	32
Relative gas density (to air)	1.1
Conversion	1 ppm =1.31 mg/m ³
Boiling point	-183°C
Odour	Odourless
Hazards	Strong oxidant. May reacts with combustible and reducing materials (oils, solvents etc), causing fire and explosion hazard. Oxygen enriched atmospheres (>22% O ₂) present a significant fire and explosion risk. Oxygen deficiency in air may lead to loss of concentration, reduced coordination, fatigue. At very reduced levels fainting and death may occur. Breathing of oxygen at increased concentrations may lead to hyperoxia (seizures, respiratory problems, disorientation).
Normal atmosphere concentration	20.8...21%
Deficiency threshold (OSHA)	19.5%
Immediately life-treatening concentration	<10%
Exposure limits	not established

Ozone

Toxic Colourless gas with characteristic pungent smell

Chemical formula	O ₃	
Molar weight	48	
Conversion	1 ppm = 1.96 mg/m ³	
Relative gas density (to air)	1.50	
Boiling point	-112 °C	
Odour	Characteristic pungent irritant odour	
Odour threshold	100 ppb	
Hazards	Powerful oxidizer, can cause flammable substances to ignite. Ozone can harm lung function and irritate the respiratory system. Exposure to ozone (and the pollutants that produce it) is linked to premature death, asthma, bronchitis, heart attack, and other cardiopulmonary problems.	
Exposure limits (NIOSH)	TWA	0.2 mg/mm ³ / 0.1 ppm
	IDLH (NIOSH)	9.8 mg/mm ³ / 5 ppm

Propane

Chemical formula	CH ₃ CH ₂ CH ₃	
Molar weight	44	
Relative gas density (to air)	1.55	
Conversion	1 ppm = 1.80 mg/m ³	
Boiling point	-42 °C	
Low explosive limit (LEL), % vol in air	2.1	
Upper explosive limit (UEL), % vol in air	9.5	
Odour	Odourless 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 ³ / 1000 ppm
	IDLH	2100 ppm [10%LEL]

Sulfur dioxide

Synonyms: Sulfurous anhydride, Sulfur(IV) oxide
Colourless water-soluble gas.

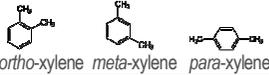
Chemical formula	SO ₂	
Molar weight	64	
Conversion	1 ppm = 2.62 mg/m ³	
Relative gas density (to air)	2.21	
Boiling point	-10 °C	
Flammability	Nonflammable	
Odour	Characteristic pungent irritant odour similar to a just-struck match	
Odour threshold	From 0.266 mg/m ³ (0.1 ppm) to 12.5 mg/m ³ (4.7 ppm) according to different studies	
Hazards	Inhaling sulfur dioxide is associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death.	
Exposure limits (NIOSH)	TWA	5 mg/mm ³ / 2 ppm
	STEL	13 mg/mm ³ / 5 ppm
	IDLH (NIOSH)	262 mg/mm ³ / 100 ppm

Toluene

Chemical formula	C ₆ H ₅ CH ₃ 	
Molar weight	92	
Conversion	1 ppm = 3.77 mg/m ³	
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	
Odour	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/mm ³ / 50 ppm
	STEL	384 mg/mm ³ / 100 ppm

Xylene

(the term is used for any one of three isomers of dimethylbenzene, or a combination thereof)

Chemical formula	C ₆ H ₄ (CH ₃) ₂		
Isomers			
Molar weight	106		
Conversion	1 ppm = 4.34 mg/m ³		
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		
Odour	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/mm ³ / 50 ppm	
	STEL 15 minutes	442 mg/mm ³ / 100 ppm	

Terms and abbreviations

TWA: time-weighted average concentration for up to a 8-hour workday during a 40-hour workweek

STEL: 15-minute TWA exposure that should not be exceeded at any time during a workday

IDLH (immediately dangerous to life or health): likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment

PEL: permissible exposure limits

REL recommended exposure limits.

A ceiling REL is designated by "C" preceding the value; unless noted otherwise, the ceiling value should not be exceeded at any time.

ACGIH: American Conference Of Governmental Industrial Hygienists

NIOSH (National Institute for Occupational Safety and Health): the United States federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness.

OSHA (Occupational Safety and Health Administration): an agency of the United States Department of Labor.

NIOSH, OSHA and ACGIH data are quoted in this manual where EU regulations are not accessible.

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

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E2618_UM_EN Annex 3. Modbus RTU Communication Reference

Modbus holding registers

Register addresses are shown 0-based, Addr in hexadecimal, Reg in decimal format.

Modbus holding register numbers MHR are shown in 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	R	Hardware version		-
0x0002	2	R	Software version		-
0x0003	3	R	Product serial number	1...65535	-
0x0004	4	RW	Slave ID (net address) *	1...247 **	1
0x0005	5	RW	Baudrate *	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
0x0006	6	RW	Response delay, ms	1...255	10
0x0007	7	RW	Stop bits *	1, 2	1
0x0008	8	R	Last error code	1...255	-
0x0011	17	RW	Restarts counter	write '42330' to restart device (no response will follow)	-
0x0091	145	RW	Heater voltage pulse duration, ms	0...1000 ms	0
0x0092	146	RW	Sensor voltage pulse delay, ms	0...995 ms (values 0...4 reserved to set sensor type)	0
0x0093	147	RW	Sensor type specific parameter	0...65535	100
0x0094	148	RW	Sensor type specific parameter	0...65535	100
0x0095	149	RW	Sensor type specific parameter	-32767...+32767	32000
0x0096	150	RW	Sensor type specific parameter	-32767...+32767	100
0x0097	151	R	Sensor type code	0...65535	0
0x0098	152	R	Output units code	0 - ppm, 1 - ‰, 2 - ‰	0

* - The new value is applied after restart.

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

*** - This value is dynamic and not kept in EEPROM after restart

RS485 communication interface

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

Parameter	Permitted values	Default
Supported baudrates	1200, 2400, 4800, 9600, 19200, 38400, 57600	9600
Data bits	8	8
Parity	none	none
Stop bits	1, 2	1
Protocol	Modbus RTU	
Modbus functions	03 - read multiple registers 06 - write 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)	

E2618_UM_EN Annex 3. E2618 series Modbus holding registers (part 2)

Register addresses are shown 0-based, Addr in hexadecimal, Reg in decimal format.

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

Addr	Reg / MHR	RW	Description	Supported values (dec)	Default
0x00A2	162 / 40163	RW	Zero adjustment for temperature data, °C × 100	-32000...+32000 (-320,00...+320,00 °C)	0
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, ppm (% _o for O ₂) / 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 1- temperature 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 1- temperature 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
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 (always 0 for E2618), bit[9]=0/1 - buzzer deactivated/activated (always 0 for E2618)	
0x0100	256 / 40257	R	Raw temperature data, °C×100	signed integer, -4000...+8500 (-40,00...+85,00 °C)	
0x0101	257 / 40258	R	Raw gas sensor data	ADC data 0...4095	
0x0102	258 / 40259	R	Measured temperature, °C×100	signed integer, -4000...+12500 (-40,00...+125,00 °C)	
0x0103	259 / 40260	R	Gas concentration, ppm / % _o	signed integer, -32000...+32000 (ppm / % _o)	
0x0105	261 / 40262	RW	0% value for analog output 1	signed integer, -32000...+32000 (ppm / % _o)	0
0x0106	262 / 40263	RW	100% value for analog output 1	signed integer, -32000...+32000 (ppm / % _o)	1000
0x0107	263 / 40264	RW	0% value for analog output 2	signed integer, -32000...+32000 (ppm / % _o)	0
0x0108	264 / 40265	RW	100% value for analog output 2	signed integer, -32000...+32000 (ppm / % _o)	1000

* - The new value is applied after restart.

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

*** - This value is dynamic and not kept in EEPROM after restart