GVZ components

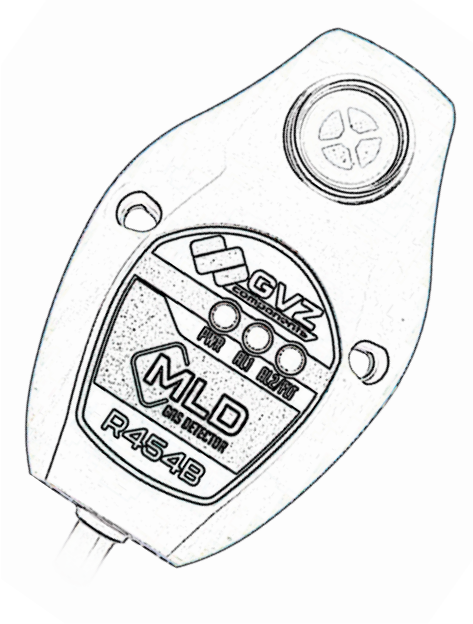
Your Sensing Solutions

MLD (Molecular Leakage Detector)
for gas concentration monitoring

Valid for MLD-MN & MLD-S4 Series
with NevadaNano MPS Sensor inside

MLD GAS DETECTOR

USER MANUAL



Rev: UM001-06

GVZ Components Srl - Via Magenta 77/16A - 20017 Rho (MI)
Tel. +39 02 3340 0846 - Email: info@gvzcomp.it
https://gvzcomp.it

Notice and General Warning

This publication is protected by copyright and all rights are reserved. No part of it may be reproduced or transmitted by any means or in any form, without prior consent in writing from GVZ Components.

This Symbol warns the user about the presence of important operating and maintenance instructions found in the documentation attached to the device.

The information in this document has been carefully checked and is believed to be accurate. However, changes are made periodically. These changes are incorporated in the newer publication editions.
GVZ Components may improve and/or change products described in this publication at any time. Due to continuing system improvements, GVZ Components is not responsible for inaccurate information which may appear in this manual.

For the latest product updates, consult GVZ Components web site **https://gvzcomp.it**.

In no event will GVZ Components be liable for direct, indirect, special exemplary, incidental, or consequential damages resulting from any defect or omission in this document, even if advised of the possibility of such damages.

In the interest of continued product development, GVZ Components reserves the right to make improvements in this document and the products it describes at any time, without notices or obligation.

The customer shall bear full responsibility and risk for product configuration in order to achieve the results pertaining to installation and/or final equipment/system.

Warnings: Disconnect all the electric connections and pass a damp cloth on the detector case before performing any maintenance on it: electrostatic charges could build up on the enclosure.

The device must not be opened. If opened, the warranty expires immediately!
The device must never be hand-held while being used.

- ✓ Do not drop or apply strong impact to the detector.
- ✓ Do not apply any sharp-pointed items to the membrane filter. Broken filter will damage the water protection feature and accuracy in detection.
- ✓ Do not cover the membrane filter.
- ✓ Do not apply any air or liquid flow with high pressure.
- ✓ Do not install the detector on curved surfaces unless the detector remains surely fixed and not bended.
- ✓ Do not place the detector in temperature above 120°C, the plastic housing may become deformed.
- ✓ Do not spray any agents on the detector.
- ✓ Do not clean the device with corrosive chemical products, solvents or aggressive detergents.
- ✓ Clean the enclosure only with a damp cloth. Electrostatic spark risk.
- ✓ Do not touch the membrane with hands, this could compromise the sensor performance and IP rating.

Please Recycle
Shipping materials are recyclable. Please save them for later use, or dispose of them appropriately.

With reference to Directive 2002/96/EC of the European Parliament and of the Council of 27th January 2003 and to the relative national legislation, please note that there lies the obligation not to dispose of electrical and electronic waste as municipal waste but to separate the waste.

- Public or private collection points must be used for disposal, in accordance with local laws.
- This equipment may contain hazardous substances. Improper use or incorrect disposal can have adverse effects on human health and the environment.
- Should the product be disposed of incorrectly, sanctions may be applied as stipulated in applicable local regulations regarding waste disposal.

TABLE OF CONTENTS

1. NOTES AND GENERAL INFORMATION

1.1. Applicability

MLD-MN and MLD-S4 devices are unique smart refrigerant or flammable gas detectors, based on NevadaNano MPS sensors, that detect and accurately quantify A1 – A2L – A3 refrigerants used in HVAC-R applications as well as flammable gas leakages. MLD Series is robust, extremely poison-resistant, factory-calibrated, with more than 15 years of lifetime expected without any recalibration process needed.

1.2. Intended Use

MLD fixed gas detectors are designed to monitor and detect refrigerant/flammable gas leakages and are suitable for use in HVAC-R, in Stationary fuel-cells, electrolysers, H2-ICE, transportation, drilling, piping and production of oil & gas and chemical products within the environmental conditions specified in the technical data. Verify the limits of application before using the device.

1.3. For your safety

These instructions must be read and strictly followed by all persons installing, using, servicing and inspecting the product. The product can only fulfil its intended functions if installed, used and controlled according to the specifications described. Factory settings (alarms tripping points and system parameters) are reported in this document unless specified directly in the label placed on the back. This manual is part of the product and must always be kept near the device for reference. Verify that power supply voltage is correct before connecting the device.

1.4. Installer and Operator Responsibilities

This unit must be installed by a suitably qualified technician who will install this unit in accordance with these instructions and the standards in their particular industry/country. It is the installer's and operator's responsibility to ensure that all MLDs are installed and used in compliance with all national and local regulations and requirements. Operators of the unit should be aware of the regulations and standards in their industry/country for the operation of this unit. These notes are only intended as a guide and the manufacturer bears no responsibility for misuse, installation and operation of this product. The MLD device must be checked by an expert for correct installation and functioning before starting the measuring operation. Failure to install and operate the unit in accordance with these instructions and with industry guidelines may cause serious injury including death and the manufacturer will not be held responsible in this regard.

1.5. Maintenance

Even if the MLD detector doesn't need any calibration during his operating life, regular maintenance must be performed by checking its correct function. Do not clean the device with corrosive chemical products, solvents or aggressive detergents. Do not spray the device with cleaning or polishing aerosols IMPORTANT: Pass a damp cloth on the detector enclosure before maintain it: electrostatic spark risk.

1.6. Liability

GVZ Components will assume no liability if the device is not used properly or as intended.
The installer and operator are solely responsible for the interpretation and the use of the product.
If the product is not used, maintained or repaired according to the specifications in the user manual, product liability claims as well as claims, arising from any guarantees that GVZ Components assumes for the product, Shall be considered void.

2. GENERAL DESCRIPTION

2.1. Device Description

MLD detector consists on a single gas concentration monitoring unit composed by enclosure, harness, electronics and precalibrated gas sensor. It is robust, extremely poison-resistant, factory-calibrated with 15+ years of expected lifetime without any recalibration process needed.
The values of the gas concentration, temperature, humidity, atmospheric pressure, other relevant data and status messages are available via digital Modbus output. Two analogue outputs are available in voltage and in current providing the gas concentration level and faults. Two relays are also included in order to switch ON/OFF when both the two programmable alarms thresholds are exceeded. In case of malfunction the fault relay and the analogue outputs change into fault state. The fault message is present and can be deeper investigated only via Modbus.
Uniquely via Modbus the temperature, humidity and atmospheric pressure can be read.

For proper use, the detector must be tested. The frequency and nature of testing may be determined by local regulation or standards.
EN378 and the F-GAS Regulation require an annual check in accordance with the manufacturer's recommendation. Suitably qualified operators of the unit should be aware of the regulations and standards set down by the industry/country for the testing of this unit. This manual is only intended as a guide and, insofar as permitted by law, the manufacturer accepts no responsibility in the event of any change of alarm level, for testing or operation of this unit.
The testing of the unit must be carried out by a suitably qualified technician, and must be done:
• In accordance with this manual
• In compliance with locally applicable guidelines and regulations.

2.2. Measurement Principles

The device combines the latest NevadaNano MPS sensor technology (micro-machined membrane with an embedded Joule heater and resistance thermometer) with a dedicated electronic converter.
The presence of a flammable or refrigerant gas causes changes in the thermodynamic properties of the air/gas mixture; these properties are measured by the transducer, processed by patent-pending algorithms to report an accurate concentration that is converted in analogue outputs, Modbus and programmable dry contact actions by a dedicated electronic.

2.3. List of gas detected

Based on MPS sensor on board the MLD can detect the following gas with the range and accuracy as indicated below:

MLD Gas ref.	Gas Type (Refrigerant Code)	Measuring Range	Resolution	Accuracy (0-50 %LEL) guaranteed across full environmental range (ISO 10156)	Accuracy @25%LEL garanteed across full environmental range (ISO817/ASHRAE 34)	Accuracy ≤25 %LEL @ 20 °C - 50 %RH (UL60335-2-40)
01	-					
02	Propane (R290)	0-100% LEL	0.1% LEL	±6% LEL		
03	HFC (R32)	0-100% LEL	0.1% LEL		±3% LEL	±2.5% LEL
04	HFO (R454B)	0-100% LEL	0.1% LEL		±5% LEL	±2.5% LEL
05	HFO (R454C)	0-100% LEL	0.1% LEL		±5% LEL	±2.5% LEL
06	Butane/Isobutane/ Ethane/Propylene (R600/R600a/R170/ R1270)	0-100% LEL	0.1% LEL	±5% LEL		
07	Hydrogen	0-100% LEL	0.1% LEL	±5% LEL		
08	Methane	0-100% LEL	0.1% LEL	±3% LEL		
X8	Methane [extended range]	50-1M ppm	1 ppm	±10% reading		
09	-					
10	HFC (R404A)	400-2500 ppm	1 ppm		200 ppm	
11	HFC (R407C)	400-2500 ppm	1 ppm		200 ppm	

**New gases are under continuous development and they will be added to new MLD versions.*
Please check our website for further updates.

3. TECHNICAL SPECIFICATIONS

SPECIFICATION	DESCRIPTION
Power Supply	12 VDC with ±10% tolerance 24 VDC with ±10% tolerance 1,2W max
Consumption	<50 mA
Measurement Range	See gas table 2.3
Accuracy	See gas table 2.3
Response Time	1° Response 12.20 Sec - T90 <29.00 Sec (Test Gas R290 @25%LFL, According to IEC 60335-2-40: 2022 Annex LL.3)
IP rating	IP67

SPECIFICATION	DESCRIPTION	
Operating Temperature Range	-40° to 75°C	
Operating Humidity Range	0-100% RH	
Dimensions	89 x 128 x22 mm | 3.5" x 5.04" x 0.87" (MLD-MN) 89 x 128 x37 mm | 3.5" x 5.04" x 1.46" (MLD-S4)	
Weight	210g (1,5m cable) - 320g (3m cable)	
OUTPUTS		
Serial Communication	Modbus RS485	
Relays	1) Low Concentration Alarm 2) High Concentration Alarm + Fault status	
Output Relay Max Switching Voltage	12 VDC	24VDC
Output Relay Max Switching Current	2 A	824 mA (IEC 60079-11) *(max 261 mA for Hydrogen)*
Analogue Current Output	4-20 mA	
Analogue Volt Output	0.1-2.9 V	
Visual output (3x LEDs)	LED 1 GREEN => Status indication LED 2 RED => Alarm Low Conc. LED 3 RED => Fault or Alarm High Conc. See visualization details in table 6.2	
CERTIFICATIONS		
Approvals	Approvals CE; EMC ; Rohs ; IEC60335-2-40; EN60079-0 ; EN60079-11 ; IECEx: IECEx, ATEX SIL 2 conformity process is ongoing	

NOTE: Please contact GVZ Components for the Declaration of Conformity

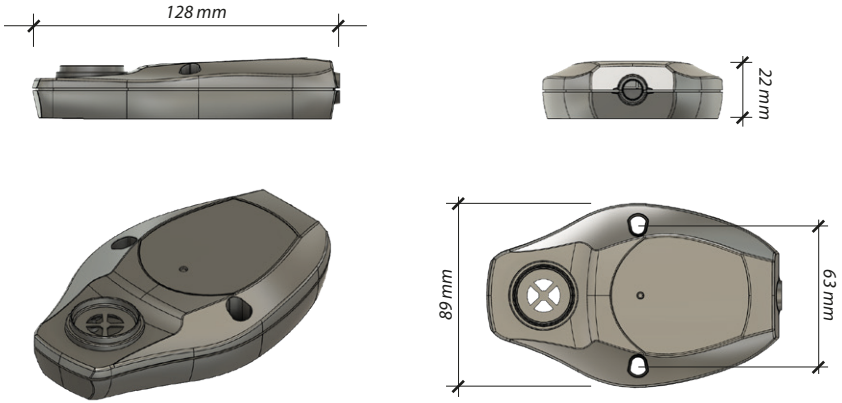
3.1. Consumption details

In the table below it is possible to see the power consumption of the MLD detector.
The consumption is affected by the two relays (Normally Open type) that, for safety reasons, are kept closed and therefore always powered.

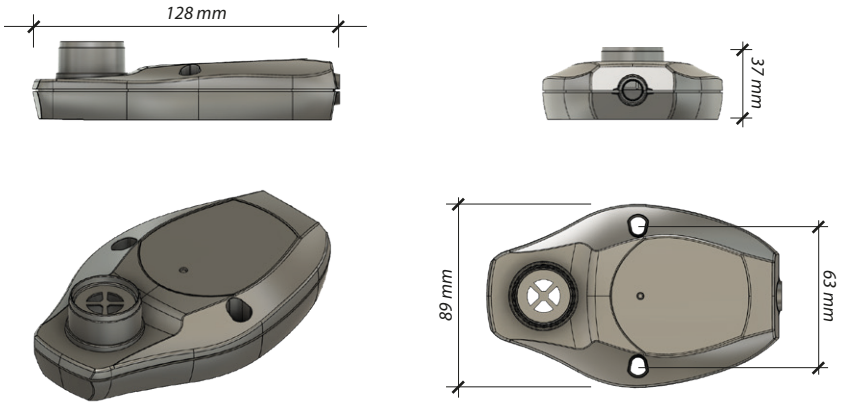
MLD version	Description	
	Standard	Peak (every 2 sec)
MLD standard: Normal monitoring mode with default relays setup (all always energized)	39mA	50mA
Custom version: Only Modbus without relays, LEDs and analogue outputs)	14mA	25mA

3.2. Technical drawing

MLD short nose version for Mini Package sensors



MLD long nose version for S4 Package sensors



4. MOUNTING INSTRUCTIONS

Please always cross-check documets with identification label on the device.

4.1. Site of Installation

While choosing the mounting location, please consider that ambient or local environment might alterate the measurement results. Carefully consider the following factors:

- External heat sources are not recommended near the installation site.
- Choose mounting location of the sensor according to the local regulations and physical characteristics of the gas.
- Consider ventilation conditions.

- Allow gas to pass through the sensor, even under adverse flow conditions and consider the possibility of gas dilution.
- Mount the MLD in a location with minimum vibration and temperature variation.
- In case of very adverse environmental conditions caused by dripping, splash, rain, condensation water or dusts in the atmosphere, which are above the IP 65 dust and water protection, additional accessories may be necessary to grant a proper use of the device.
- Provide adequate space around the sensor for maintenance.
- The installation height depends on the relative density of the monitored gas type.

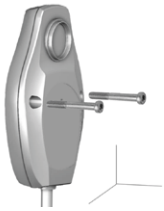
Note: The Gas Sensor should be installed and securely fastened to a rigid mounting surface or on its supporting easy fix plate.
For compliance with EN378, at least one detector shall be installed in any area where the EN378 applies. The location of detectors shall be chosen in relation to the refrigerant and they shall be located where the refrigerant leak might concentrate.

Gas type	Relative density (air = 1)	Recommended Mounting height
R290	1.5	Up to 0.3 m above floor
R32	1.8	Up to 0.3 m above floor
R454B	2.2	Up to 0.3 m above floor
R454C	3.1	Up to 0.3 m above floor
R600a	2.01	Up to 0.3 m above floor
H2	0.07	Ceiling

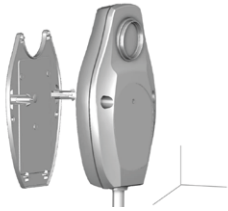
Table 4.1: Mounting heights examples

4.2. Installation Work

Assembly work must only be carried out under gas-free conditions.
The detector must be fixed, without opening the housing, with 2 screws (M4), placed in the dedicated holes or alternatively using its supporting fixing plate. The fixing plate is an accessory that can be easily fixed to a clean and smooth wall with a strong self-adhesive strip. Two press clips will hold the detector to the plate.



MLD-SPRT-01
Wall bracket for MLD gas detector with double-sided tape for smooth walls



The detector can be oriented in any position but the vertical one is preferred.
For Hydrogen detection is strongly recommended a ceiling mounting with the membrane facing downwards. If the gas leak doesn't reach the sensor, then no alarm will be triggered. It is extremely important to carefully select the sensor location. Also consider ease of access for maintenance.
The most common leak sources are valves, gauges, flanges, joints (brazed or mechanical), filling or draining connections, etc.

5. ELECTRICAL INSTALLATION

5.1. General Notes

Only a professional should perform the wiring and the connection of the electrical installation according to the wiring diagram in compliance with the relevant regulations and only in absence of power supply!

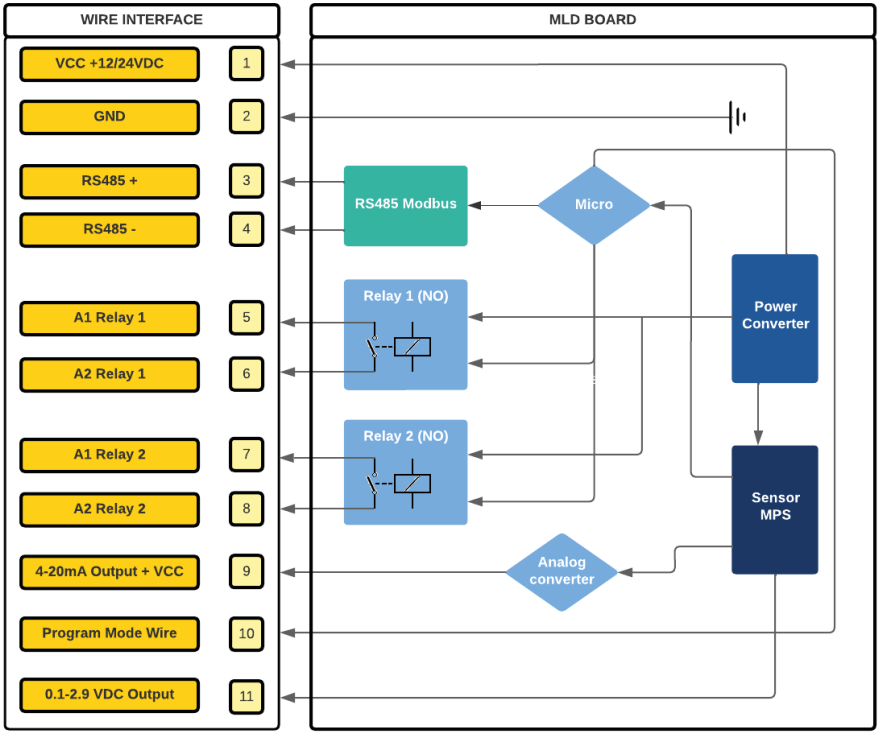
The MLD must installed only under gas-free and voltage-free conditions.

The MLD comes either with 150 or 300cm wire harness for specific connection, carefully verify the Voltage supply and cables colours.

5.2. Wiring Connection

MLD comes with a multi-wire cable with PVC conductor insulation and sheath.
The cable is self-extinguishing according to IEC 60332-1-2.
Length: standard 1,5m (or 3m) - Number of conductors: 11 x 0.25mm2

MLD Electrical connections:



MLD Color wiring table:

N°	Color	Connection
1	RED	V+ 12VDC or 24VDC
2	BLACK	GND
3	GREY&PINK	+ TX/RX Non inverting Modbus Signal
4	WHITE	- TX/RX Inverting Modbus Signal
5	BLUE	Relay Alarm 1 – A1
6	VIOLET	Relay Alarm 1 – A2
7	PINK	Relay Alarm 2 & Fault – A1
8	GREEN	Relay Alarm 2 & Fault – A2
9	YELLOW	Current output (4-20mA)
10	BROWN	Program Mode Wire (to be connected to GND only for programming)
11	RED&BLUE	Volt output (0.1-2.9V)
12	GREY	DO NOT USE (leave or cut)

6. DETECTOR COMMUNICATION WORKING PRINCIPLES

6.1. Startup and Measurement Sequence

1. Connect the selected Output (Alarm Relay, Malfunction Relay, Modbus, analogue).
2. Power ON the device (12VDC or 24VDC as specified on Label).
3. Wait for the internal checks of the detector (~30 seconds).
4. The device is ready for the first reading.
5. Get Reading (Modbus Input Register - Command: 0x04 Read).
6. Wait few seconds for the first measurement to complete.
7. Repeat process to get answer at desired frequency (≥ 2 sec).

During the initialization period the Relays and LEDs are in Alarm condition (open circuit & LEDs ON) and Modbus output is not reported. In this period the sensor is not capable of reporting gas concentrations and external interventions are not possible during this start routine.

Once initialization is complete, the MLD is ready to report gas concentrations, all the Modbus output are provided, the Modbus status is set to 0 and both the Relays and LEDs are no longer in alarm.

⇨ **The detector must be powered in air with no gas presence for zeroing.**

⇨ **It takes approximately 2 seconds to calculate and complete a measurement loop.**

6.2. Led indications

During the initialization phase, the green LED blinks slowly (1Hz) to indicate startup, and the red LED's switch on.
Once the initialization is complete, the green LED remains fixed and the red LEDs switch off.
In normal operating mode "monitoring mode" there are no fault indications, the gas concentration of the sensor is continuously polled and measured.
When gas is detected (and for the entire period of gas presence) and it exceeds the Alarm Level, the green LED blinks rapidly (2Hz) and the corresponding red LED lights up while the Relay is triggered.
The green LED will blink slowly as soon as the gas is no more detected. After 15 seconds, the green LED returns fixed and the 1st alarm LED switches off.
The detector is back in fully monitoring activity. When the high concentration threshold is reached, the 1st and the 2nd red LED switch ON and the relays are triggered.
The high concentration relay will remain triggered until a manual reset will be done.
Once the gas is not detected anymore, the green LED will blink slowly and after 15 seconds will be fully ON while the relay goes back to normal. The 2nd LED will be RED ON and the 2nd relay OPEN.
To reset the high concentration alarm, a manual operation is required (refer to section 6.4).
A complete view for all operating stages in default configuration, including the analogue outputs, are reported below:

STATUS DETECTOR	Status LED			Analog Ouput Volt/ Current [1]	Relays	
	Power	Alarm 1	Al2 / Flt		R1	R2
MLD Initialization	Blink @1Hz	Active	Active	0.1V / 4mA	open [3]	open [3]
Monitoring mode	Active			0.4V / 6mA	closed [4]	closed [4]
MONITORING: LOW CONCENTRATION GAS DETECTED						
Gas Detected [2] Low Concentration Alarm 1 active	Blink @2Hz	Active		0.4V to 2.0V 6 to 18.6 mA	open [3]	closed [4]
Return Alarm 1 - No Gas Detected Automatic Reset in 10 sec	Blink @1Hz	Active		0.4V / 6mA	open [3]	closed [4]
Monitoring mode After Automatic Alarm 1 Reset	Active			0.4V / 6mA	closed [4]	closed [4]
MONITORING: HIGH CONCENTRATION GAS DETECTED						
Gas Detected [2] High Concentration Alarm 1 & 2 active	Blink @2Hz	Active	Active	0.4V to 2.0V 6 to 18.6 mA	open [3]	open [3]
Return Alarm 1 - No Gas Detected Automatic Reset in 10 sec	Blink @1Hz	Active	Active	0.4V / 6mA	open [3]	open [3]
Monitoring mode After Automatic Alarm 1 Reset	Active		Active	0.4V / 6mA	closed [4]	open [3]
Monitoring mode After Manual Alarm 2 Reset	Active			0.4V / 6mA	closed [4]	closed [4]
MALFUNCTIONING						
Detected Fault			Active	2.9V / >19mA	closed [4]	open [3]

(1) During monitoring the value depends from the gas concentration (0-100%LEL)
(2) Low and high gas concentration thresholds can be customized
(3) Relay NO de-energized: contact open (Alarm State)
(4) Relay NO energized; contact closed (gas concentration below thresholds)

6.3. Faults Explanation

The MLD detector includes a self-diagnostic system for continuous monitoring of relevant functions and parameters, moreover it includes a processor-independent watchdog. These features in combination with electromechanical relays (energized during monitoring and kept closed) are able to put the device into "Fault" mode whatever an internal or external error occurs.
In case of fault mode, the green LED is OFF, the fault relay is switched ON (Open Circuit) and the 2nd corresponding LED is ON. If the fault mode clears automatically, the sensor returns to monitoring mode, sampling the gas concentration, without operator intervention, while the relay won't reset.
Even if the detector has returned to monitor the gas concentration, the fault indication remains (both 2nd Red LED and Relay) to allow the operator to identify the error anytime after the event.

In table 7.9 possible errors, causes, related troubleshooting and device status are reported.

The MLD saves the last error in internal memory. It is possible also to recall the last Alarm and Fault event via Modbus (See Section 7.4). Once the alarm is reset via Modbus, the error is cancelled from the memory and cannot be recalled. When the cause of the error has been manually erased, the MLD gas detector restarts itself.

6.4. Alarms Reset

The Low concentration alarm is automatically reset if LEL level is lower than the preset threshold for more than 10 seconds. The High concentration alarm & Fault Alarm is not automatically reset but, for safety reasons, it can be reset manually only.
This can be done via Modbus (Input Address 300, Register = 1) or via hardware, connecting the PM (Program Mode wire) to ground for 1 second.
In case of hardware reset (PM wire to GND), the last error remains recorded and it can be analysed via Modbus until definitely cancelled once reset via Modbus (Input Address 300, Register = 1)
The acknowledgement of this "Latching" function requires that after the high concentration alarm has been triggered, the gas-free state has to be ensured directly reading the given concentration from MLD using the Modbus/analogue output, or with external measures if MLD is used only with relays functions (for example, checking with portable detector that leakage is no more present).
Only after having ascertained that there is no more gas present, it is possible to reset the pending Alarm 2 on the device manually or via Modbus.

7. MODBUS COMMUNICATION

This section describes the MLD Detector Modbus specifications and it provides useful information when this device must be integrated with a digital control unit.

7.1. Modbus basic parameters

Default Communication parameters: Modbus Default Address ID: 01

Baudrate	19200
Bits	8
Parity Bits	None
Stop Bits :	1

7.2. Modbus Input registers (Command:0x04 Read)

Address	Register	Format
01	Status register: See Table 9	16-bit
02	Concentration LEL% : LEL X 100 (e.g. 10%=1000)	signed 16-bit
03	Gas ID: See Table 10	signed 16-bit
04	Temperature °C: Temperature X 100 (e.g. 20°C=2000)	signed 16-bit
05	Pressure kPa: pressure X 100 (e.g. 500Kpa= 5000)	signed 16-bit
06	Relative humidity % RH: Rel hum X 100 (e.g. 20%= 2000)	signed 16-bit
07	Absolute humidity g/m3: Abs hum X 100 (e.g. 20g/m3=2000)	signed 16-bit
08	Serial number: 1 & 2 characters in ASCII	16 bits
09	Serial number: 3 & 4 characters in ASCII	16 bits
10	Serial number: 5 & 6 characters in ASCII	16 bits
11	Serial number: 7 & 8 characters in ASCII	16 bits
12	Serial number: 9 & 10 characters in ASCII	16 bits
13	Date of calibration: month	16 bits
14	Date of calibration: day	16 bits
15	Date of calibration: year	16 bits
16	Date of manufacture: month	16 bits
17	Date of manufacture: day	16 bits
18	Date of manufacture: year	16 bits
19	Hours since start	16 bits
20	Hours total	32 bits
21	(Undisclosed) Factory settings	//
22	(Undisclosed) Factory settings	//
23	(Undisclosed) Factory settings	//
24	(Undisclosed) Factory settings	//
25	(Undisclosed) Factory settings	//

7.3. Reading Modbus Holding registers (Command:0x03 Read)

Address	Register	Format	Default Values	Customer Values
01	Alarm relay contact behavior (on LEL% alarm: 0 open; 1 close)	16-bits	0	
02	Al2/Fault relay contact behavior (on sensor error: 0 open; 1 close)	16-bits	0	
100	Gas concentration 1st alarm LEL% (Ex: 10 for 10% LEL)	signed 16-bit	10	
200	Gas concentration 2nd alarm LEL% (Ex: 20 for 20% LEL)	signed 16-bit	20	
1000	MLD Modbus ID address	16-bits	1	
1001	Baudrate value (0=9600 bit/s; 1=19200 bit/s)	16-bits	1	
1002	Parity (0 = no parity; 2= 1 bit; 3= 2 bits)	16-bits	0	
1003	Stop bits (0=1 bit; 1=2 bits)	16-bits	0	

7.4. Latest alarms memory recall

In Modbus Holding Register (Command:0x03 Read) use the following addresses to check latest concentration alarm or latest fault alarm released.

Address	Read Decimal	Specification
210	% LEL Value	Latest concentration alarm release
214	See 7.9 Section	Latest malfunction code

To reset these memorized values, use Address 300 Value 1 in Modbus Holding Register (Command:0x06 Write) (see 7.11 Section)

7.5. Writing Modbus Holding registers (Command:0x06 Write)

Address	Register	Format
01	1° Al relay contact behavior (on LEL% alarm: 1 open; 0 close)	16-bits
02	2° Al/Flt relay behavior (on LEL% & Sensor fault : 1 open; 0 close)	16-bits
100	Gas concentration 1st alarm LEL%	signed 16-bit
200	Gas concentration 2nd alarm LEL%	signed 16-bit
300	2nd alarm & alarms memory reset via Modbus (Reset Value 1)	16-bits
1000*	MLD Modbus ID address	16-bits
1001*	Baudrate value (0=9600 bit/s; 1=19200 bit/s)	16-bits
1002*	Parity (0= NO PARITY; 2 = 1 bit ODD; 3= 2 bit EVEN)	16-bits
1003*	Stop bits (0=1 bit ; 1=2 bits)	16-bits

**Function available only with pin PROGRAM MODE (PM) tied to GND (Section 7.6).*

7.6. Program Mode function

In order to enter in Program Mode function, the corresponding pin (brown wire) must be connected to GND (black wire). With this configuration it is possible to modify the Modbus communication parameters.

Note: Every time the Program Mode pin is connected to GND the Modbus address ID goes to 01. Once disconnected it comes back to the original address.

7.7. Procedure to change the communication parameters

1. Tie Program Mode Pin (Brown wire) to GND, the device is automatically set to ID Address 01.
2. Choose the correct Address (ID, Baudrate…) on Holding Register (command: 0x06 Write) and send the new parameter on the Register (Ex: Address 1000, Register = 2 to set the new Device ID on 2)
3. Disconnect the PM pin from the GND and wait 2 second for reprogramming delayCheck that the procedures was successful reading the corresponding address in Modbus holding Register Read and verify the saved decimal value.

Check that the procedure was successful, reading the corresponding address in *Modbus Holding Register* and verify the saved value.

7.8. Automatic Identification Gas ID

The MLD detector is able to recognize the type of gas measured. At the Modbus Address 03 is reported one of the ID number reported below. In the table is possible to find the meaning of each ID.
It is not possible to identify the single A2L gas, all of them are included in the generic "refrigerants".

ID	GAS INDICATION
0	No gas
1	Hydrogen
2	Hydrogen mixture
3	Methane
4	Light gas mixture (R-290, R-170)
5	Medium gas mixture (R-600, R-600a)
6	Heavy gas mixture
7	Refrigerants
253	Unknown Gas
254	Under Range – Concentration less than 0 %LEL
255	Over Range – Concentration greater than 100 %LEL

7.9. Device Status, Alarms, Malfunctions and Troubleshouting

In the table below is reported the alarm or malfunction explanation and possible user action.
The value refers to the Modbus input register at Address n°1

Modbus Input Register (Address n°1)		Modbus Holding Register (Address 214)		Malfunction Explanation	Modbus Input Register % LEL (Addres n.2)	User Action
HEX	DEC	HEX	DEC			
0	0	0	0	MLD is operating normally, no errors	Normal	N/A
100	256	0001	1	Internally transmitted data failed checksum	N/A	Contact support
200	512	0002	2	Internally illegal or bad parameters specified	N/A	Contact support.
300	768	0003	3	Internally execution of command failed	N/A	Contact support.
400	1024	0004	4	Sensor insufficient memory for operation	N/A	Contact support.
500	1280	0005	5	Internally unknown Command ID specified	N/A	Contact support.
700	1792	0007	7	Internally incomplete or truncated command	N/A	Contact support.
2000	8192	0020	32	Analog out malfunction (only if AO functionality enabled)	-100 %LEL	Contact support.
2100	8448	0021	33	Internal voltage out of range	-100 %LEL	Contact support.
2200	8704	0022	34	Voltage out of Range	-100 %LEL	Contact support.
2300	8960	0023	35	Environmental (Temp., Press., Humid.) out of range	Normal	Use the sensor in working condition -40 to 75 °C, 0 to 100 %RH; and 80 to 120 kPa
2400	9216	0024	36	Environmental sensor malfunction	-100 %LEL	Contact support.
2500	9472	0025	37	Microcontroller error	-100 %LEL	Contact support.
2600	9728	0026	38	Sensor in initialization mode (10 cycles)	-100 %LEL	Wait 10 cycles (~20 sec) for sensor to initialize.
3000	12288	0030	48	Sensor output <-15%LEL; accuracy affected if flammable gas initially detected while in this condition	Normal	Wait for sensor to return to zero. If message persists >10 minutes, contact support.
3100	12544	0031	49	Condensation condition exists at sensor (out of specification)	Normal	Raise temperature and/or lower humidity
3200	12800	0032	50	Gas sensing element malfunction	-100 %LEL	Contact support.
3500	13568	0035	53	Sensor has detected condition indicative of human breath or humidity surge	Normal	Not breathe on sensor.

7.10. The gas concentration value in %LEL

The reported gas concentration is expressed in % of LEL and reported in Decimal value X100 (e.g. 10% LEL = 1000) at the Address 02 with Command: 0x04 Read.
For convenience here below it is possible to see the factory setup alarm relays thresholds and on the right column to write custom values if changed (Refer to paragraph 7.11).

Default low concentration alarm 1	**10% LEL**	*Custom low concentration alarm 1*	___% LEL
Default high concentration alarm 2	**20% LEL**	*Custom high concentration alarm 2*	___% LEL

7.11. Editable parameters via Modbus (WITHOUT reprogramming pin)

In Modbus Holding Register (Command:0x06 Write) use the following addresses to modify the parameters:

Low concentration Alarm

Address	Decimal Value	1st Alarm relay contact behavior
01	1	OPEN at selected LEL%
01	0	CLOSE at selected LEL%

High concentration Alarm / Malfunction

Address	Decimal Value	2nd Alarm & Malfunction relay contact behavior
02	1	OPEN on 2nd Alarm & Malfunction
02	0	CLOSE on 2nd Alarm & Malfunction

% LEL Relays Activation / Deactivation

Address	Decimal Value	Gas concentration Relay alarm (LEL%)
100	x	X% LEL (Ex : 8 = 8% LEL) [Range : 5 – 15 LEL]
200	x	X% LEL (Ex : 18 = 18% LEL) [Range : 16 – 100% LEL]
300	1	2nd alarm & Alarms memory reset via Modbus

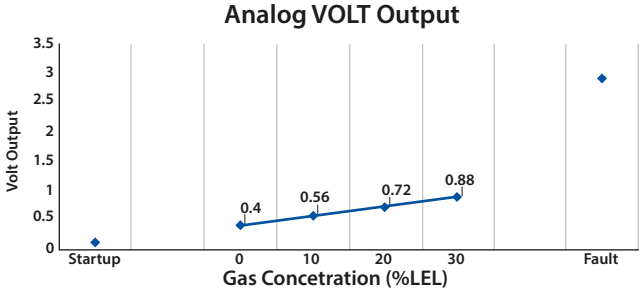
⇨ Note: SENSOR DATA FOR TEMPERATURE, HUMIDITY, AND PRESSURE

The MLD detector has a built-in sensor that measures temperature, humidity and pressure. These data are available to end users via specific Modbus addresses - as indicated in the previous pages - and are generally representative of environmental conditions. Please note, however, that the internal sensor measures conditions inside the sensor and the detector itself, which may not perfectly match environmental conditions due to slight self-heating by the internal electronics.
Typically, ambient readings provided by the MLD are slightly warmer than ambient (approximately 4-7°C) and have a lower relative humidity than ambient (approximately 10-20% RH), while the absolute humidity measured represents the same absolute humidity of the environment.
MLD environmental readings depend on the temperature and heating profile of the detector in the room area where installed and the proximity of the detector to other components that could generate additional heat.

ANALOG OUTPUTS

7.12. Volt Output (0.1-2-9 V)

The analogue output signal in voltage is generated with a digital to-analogue converter (DAC) included in the MPS sensor directly. The standard analogue output range is 0.4 V (0 %LEL) to 2.0 V (100 %LEL), linearly increasing by 0.016 V/%LEL.

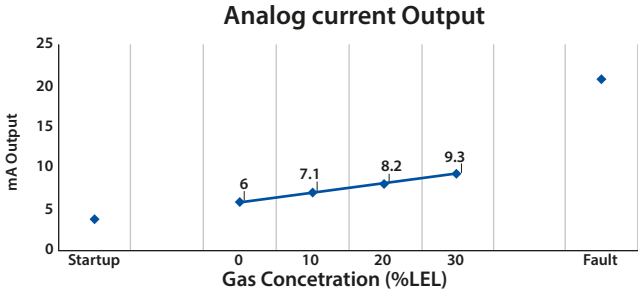


To calculate the LEL concentration from the output voltage must be used the following formula:
Concentration left (%LEL right) = (left (VOLT OUTPUT right) -0.4)/0.016

When the sensor is in INITIALIZATION PHASE, the voltage value reported is 0.1V.
When the sensor is in FAULT / MALFUNCTION PHASE, the voltage value reported is 2.9V.
In these two situations, the voltage level does not indicate any gas concentration cause outside the concentration range output: 0,4-2.0V

7.13. Analog 4-20mA Output

The analogue output in current is created transforming the direct voltage-analogue output by an operational amplifier of the MLD board. The signal provides a 4-20mA proportional output. Wires' cross section depends on the distance between the control panel and the detector.
The gas concentration output range is 6mA (0 %LEL) to 17mA (100 %LEL), linearly increasing by 0.11mA/%LEL.



To calculate the LEL concentration from the output voltage must be used the following formula:
Concentration left (%LEL right) =(left (CURRENT OUTPUT right) -6)/0.11

When the sensor is in INITIALIZATION PHASE, the current value reported is 4mA.
When the sensor is in FAULT / MALFUNCTION PHASE, the current value reported is 20mA.
In these two situations, the current level does not indicate any gas concentration cause outside the concentration range output: 6-17mA

8. MAINTENANCE

In European Community countries, gas operation tests and calibration procedures for gas detectors are required by current regulations. These regulations provide guidance on the choice, installation, use and maintenance of gas detection systems intended for industrial and civil use. According to regulations, all gas detectors must be checked noting the results of the tests carried out in a special register. This register must remain available to the competent authorities in the event of checks.
Although the MLD Gas Leakage detector does not require recalibration for its entire life, GVZ recommends a visual check of the state of the membrane and detector enclosure integrity; a functional check of the MLD based on: a) visual check: green LED status OK and red LEDs not in alarm, b) digital and analogue output functional check verifying the signals communication presence.

8.1. Frequency of maintenance

Inspection and maintenance must be carried out in accordance with standards in force EN60079-17 or IEC 60079-17, EN 60079-29-2, EN 62990-2 with whatever editions are in force or with other national standards. GVZ recommends the regular testing of fixed gas detection installations.
This type of test consists of injecting the calibration gas into the detector at a sufficient concentration (including the sensor accuracy) to activate the pre-set alarms.
The frequency of gas tests depends on the industrial application where the detector is in use.
We recommend checks at least every two years.
If a detector should fail to react in contact with the gas, its replacement is essential.

This event - without the presence of failure signal - is considered as almost impossible and for this reason, if it happens please get immediate notice to our technical department, reporting the problem and the S/N to: *support@gvzcomp.it*
GVZ also recommends carrying out these checks every time an alarm condition is generated.
At each check, note the results of the tests carried out in a special register.
This register must remain available to the competent authorities in the event of checks.
If there are severe working conditions capable of altering the original characteristics of the device, maintenance operations must be carried out more frequently.

In the check process of the MLD gas detector, it is crucial to closely follow the established procedure to ensure accurate and reliable results.
As highlighted in Chapter 9, it is essential to use the same type of "air" as the carrier for both the "air-only" and "air + gas" conditions.

It's important to note that field testing, being conducted in ambient air, should utilize gas cylinders containing a mixture of the gas of interest and air rather than cylinders with other carrier gases. Using a gas other than air as the carrier for testing may lead to inaccurate or distorted results, as it does not reflect the real-world conditions of device usage.

8.2. Enclosure cleaning

Cleaning the plastic enclosure must be carried out with damp cloths or with cloths that do not accumulate electrostatic charges. The removal of dust using aggressive cleaning products other than water is prohibited and dangerous.

8.3. Membrane cleaning

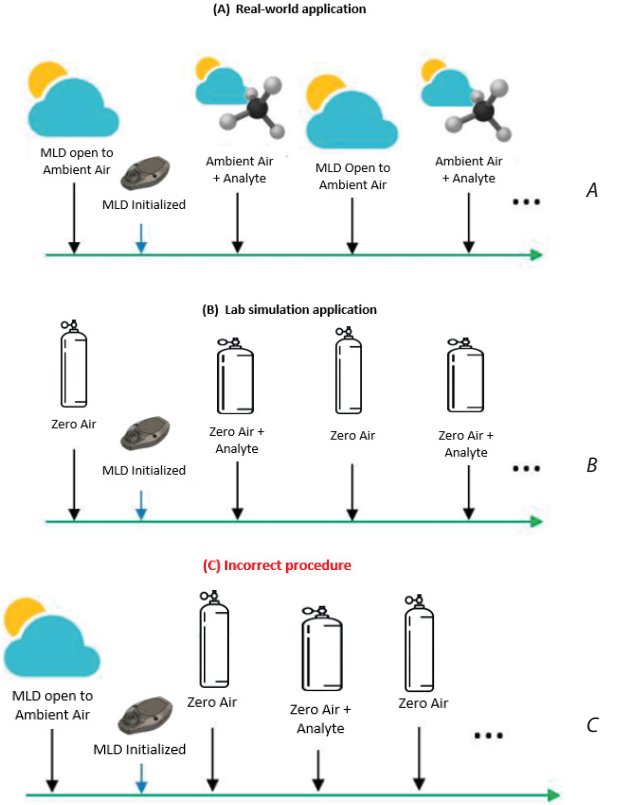
The MLD membrane should be cleaned with a soft brush in a manner to remove dust without touching it with hands. It is also possible to use compressed air paying attention to remain far from the detector (at least 20cm): too high pressure can bend, puncture and destroy the membrane itself and the sealing.

The membrane must not be touched in any way with bare hands, as this could compromise the IP protection level and the sensor's response to gases.

Note: The IP rating indicated on the instrument's label does not imply that the equipment will detect gases during and after exposure to such conditions of solid particle or liquid intrusion. If exposed to conditions representative of the IP classification, the detector must be checked and if there is damage to the membrane, it should be replaced. A replacement membrane kit is provided for this purpose.

9. HOW TO TEST MLD GAS DETECTOR

The MLD Gas Detector is capable of sensing the composition of the air. During operation, all composition variations due to environmental factors (temperature, pressure, and humidity) are automatically compensated out in order to report accurate gas concentration readings.
To adequately simulate the real-world application (Figure 1A) in a laboratory test environment, the same type of "air" must be used as the carrier for both the "air-only" condition and the "air + gas" condition. This methodology must be maintained throughout the test.
An example of a proper protocol is shown in Figure 1B. Examples of incorrect (non-"real-world") gas delivery protocols are shown in Figure 1C. In these cases, the analyte carrier gas is not the same as the baseline gas. Using a variation of the "incorrect" procedure will introduce a bias or offset into the MPS' measurements of analytes (just as, for example, testing a catalytic-bead type sensor using nitrogen as the carrier "air" would—since, in that case, the catalyst requires oxygen to work.)



MLD-Flow Adapter Accessory available on request

Figure 2 – (A) The real-world gas leak scenario. (B) The method for simulating the realworld scenario in a laboratory. Incorrect test procedures are shown in (C); in these cases, the carrier-only condition does not use the same "air" as the carrier + gas condition, causing inaccurate results.

Via Magenta 77/16A - 20017 Rho (MI) - Italy
Tel. +39 02 3340 0846
Email: info@gvzcomp.it
https://gvzcomp.it

To download this manual as PDF file

For any information regarding technical specifications, write to: *support@gvzcomp.it*