MLD-EK Evaluation kit

Evaluation Kit for MLD-MN & MLD-S4 Series

Valid for

- ✔ **MLD-EK01 (12V)**
- ✔ **MLD-EK02 (24V)**
- ✔ **MLD-EK03 (USB 12/24V)**

(MLD Detector not included)

MLD GAS DETECTOR

SOFTWARE INCLUDED

USER MANUAL

File: UM003-03

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Notice and General Warning

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.
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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. MLD DETECTOR GENERAL INFORMATION:

1.1. Automatic Identification Gas ID

The following Gas code are reported in the MLD Data Section, Gas ID cell.

ID	Gas Description	MLD Series			
		MLD Refrigerants	MLD Flammables	MLD Hydrogen	MLD Methane
0	No gas	✔	✔	✔	✔
1	Hydrogen		✔	✔	
2	Hydrogen mixture		✔		
3	Methane		✔		✔
4	Light gas		✔(R-290)		
5	Medium Gas		✔(R-290)		
6	Heavy gas		✔		
7	Refrigerant	✔			
253	Unknown Gas	✔	✔	✔	✔
254	Under Range – Concentration less than 0 %LEL	✔	✔	✔	✔
255	Over Range – Concentration greater than 100 %LEL	✔	✔	✔	

1.2. Wiring Connection

MLD Colour wiring table and specification

N°	Wire Colour	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)

2. SYSTEM OVERVIEW

2.1. MLD detector Measurement Principles

The MLD is a detector that combines the latest NevadaNano MPS sensor technology (micro-machined membrane with an embedded Joule heater and resistance thermometer) with a dedicated electronic that add additional features to the MPS sensor allowing the MLD to be fully compliant to several international rules and reaching the IP65 grade.

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 and is converted in analogue outputs, Modbus and programmable dry contact actions by a dedicated electronic.

2.2. Introduction to the Evaluation Kit for MLD detector

The Evaluation Kit for MLD has been developed to provide an easy interface for PC, in order to evaluate performances and features of the MLD detector via Modbus communication port. This EK includes the Modbus converter RS485 to USB-A for PC, a DC Voltage Supply for the MLD detector and the MLD Evaluation Tool SW.

Figure 1

2.3. Evaluation Kit Contents

- RS485 to USB A-Male converter for Laptop or PC
- DC Voltage power supply at 12Vdc and/or 24Vdc (3 options available):
  - AC Power Supply 12Vdc (MLD-EK-01)
  - AC Power Supply 24Vdc (MLD-EK-02)
  - Adjustable USB Power Supply 12-24Vdc (MLD-EK-03)
- Link to download the MLD-EK software to install on your PC (the software is developed to run on Windows ver. 7 or later): https://gvzcomp.it/images/files/Software/MLD-EK-software.zip
- User Manual (or QR code to download it)

2.4. System setup

The MLD gas detector receives power from an external 12 or 24Vdc power source and interfaces with a PC via RS485 – USB converter.

The user interacts with the detector using the MLD-EK interface.

With this application, the user can:

- Establish communication with the sensor
- Examine all data in real time
- Modify communication parameters
- Modify relays intervention levels and behaviour
- Read the errors and alarm codes
- Reset the alarms
- Export data Log

3. CONFIGURATION PROCEDURE

The user must first install the MLD-EK software.

1. Run MLD-EK software before connecting the MLD (Figure 2)

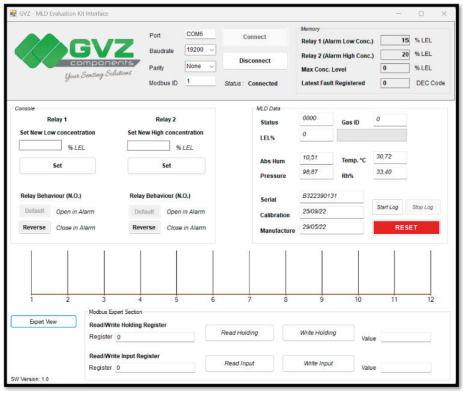


Figure 2

2. Connect the USB-A end to the USB port on your computer and then connect the RS485 connector to TX and RX of MLD as shown below (Figure 3)
   GREY&PINK wire ➔ + TX/RX
   WHITE wire ➔ - TX/RX

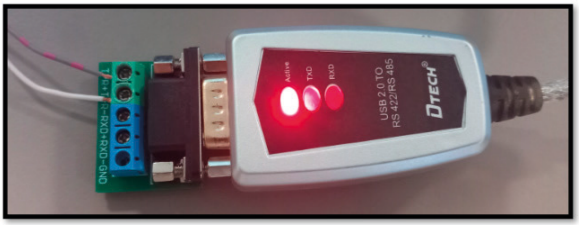


Figure 3

3. Check the USB serial port connected (COM_*) in the computer devices section (Figure 4)

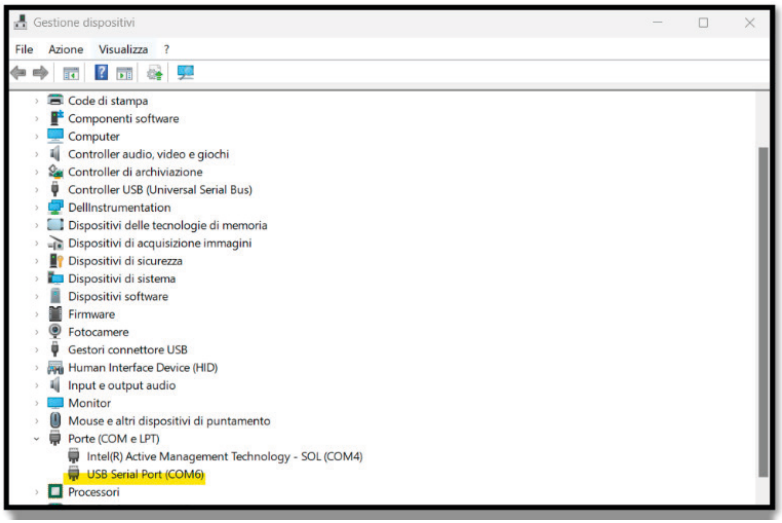


Figure 4

4. In MLD-EK select the correct COM_* and set the MLD default values in Serial Port Setting as shown (Figure 5)

Baudrate	19200
Parity Bits	None
Stop Bits :	1
Modbus ID address	1

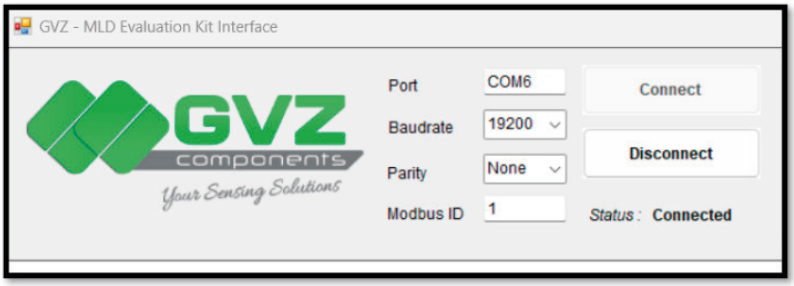


Figure 5

5. Connect the MLD to the external power supply
   BLACK wire ➔ - (GND)
   RED wire ➔ + (VDC)
6. Wait for the internal MLD initialization (~30 seconds).
   During this stage the Green Led blinks (Figure 6a). During the initialization period the Relays and LEDs are in Alarm condition (open circuit & LEDs ON) and **Modbus output is not reported**.
   In this starting routine the sensor can't report any gas concentration and any external intervention is not possible. **Once initialization is complete**, the Relays and red LEDs are no longer in alarm (Figure 6b) and Green LED is ON. All the **Modbus output can be acquired by MLD-EK**.

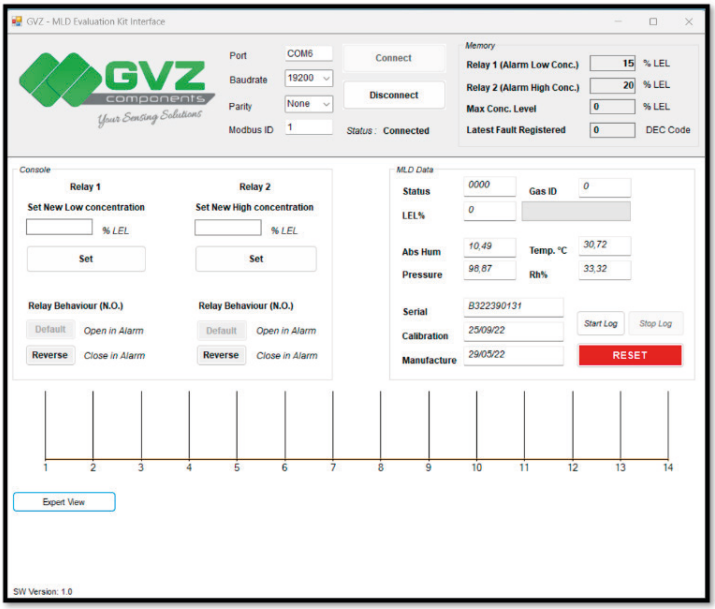
Figure 6a

Figure 6b

7. Click "Connect" button on Serial Port Setting in the MLD-EK window to receive the Modbus information.

4. MLD-EK WINDOW

The MLD-EK window (Figure 7) can be divided in eight sections for a better understanding:



Serial Port Setting:

User can set the parameters to configure the communication from the device to MLD-EK

Memory:

User can read MLD saved data and memory

Console:

User can easily set 1st low concentration alarm and 2nd high concentration alarm. It's also easy to change the relays status (Default = open in alarm, Reverse = close in alarm)

MLD Data:

Real time MLD data are reported.

Export log buttons:

Start log and Stop Log (+ Export in csv) are used to export the MLD data.

Reset button:

User can reset the 2°nd alarm and memory

Concentration graph:

%LEL vs Time visual representation

Expert view:

User can read or write Input and Holding Modbus register using Modbus command (See Section 8 of this manual)

5. MLD DATA SECTION

In this section user can view real-time data transmitted by the sensor. The window displays the Status Code (Table 10.2), gas ID (gas identification Table 10.1), and the %LEL. Additionally, it provides extra information such as temperature, relative humidity, absolute humidity and pressure. User can also find the sensor's serial number (not the device's), useful for complete traceability, and both the factory's calibration and manufacturing date.
Furthermore, there are buttons to export the reading log in CSV format (see Chapter 9) and the reset button (see Chapter 8).

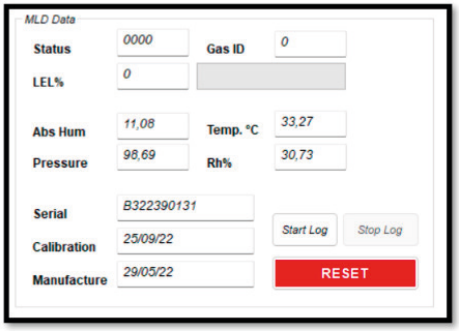


Figure 8

6. CONSOLE SECTION

6.1. Set new alarm levels & relays behaviour

Procedure to set new 1st relay low concentration alarm:

1. In the Relay 1 console type the new %LEL concentration and click Set button (Figure 9a)
2. The new concentration is reported also in Memory section (Figure 9b)

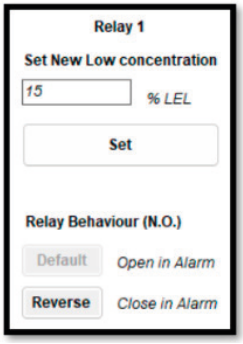


Figure 9a

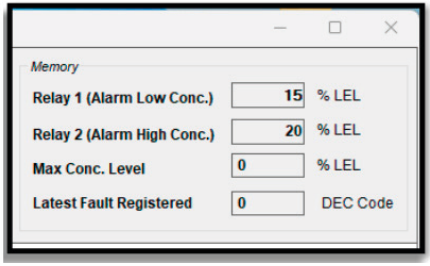


Figure 9b

Procedure to set new 2nd relay high concentration alarm.

1. In the Relay 2 console type the new %LEL concentration and click Set button (Figure 10a)
2. The new concentration is reported also in Memory section (Figure 10b)

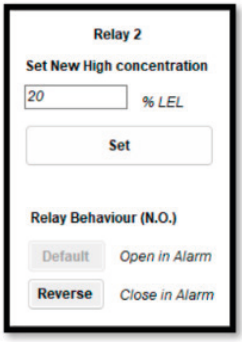


Figure 10a

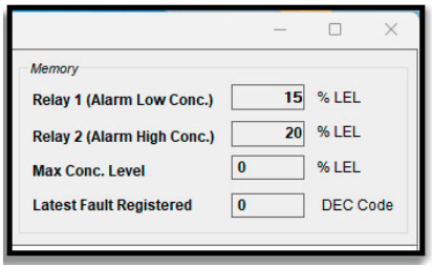


Figure 10b

The relays status is in "open in alarm" condition by default for intrinsic safety. It is possible to reverse the relays to "close in alarm" status (for direct activation of small loads/buzzer/Light) by clicking on Reverse button. The chosen selection become light grey coloured.

7. MEMORY SECTION

In this section (Figure 11) it is possible to read the 1st and 2nd %LEL alarm level set, the maximum concentration level (only when the first alarm is triggered) measured by the detector and it is also possible to read the Latest Fault code detected.

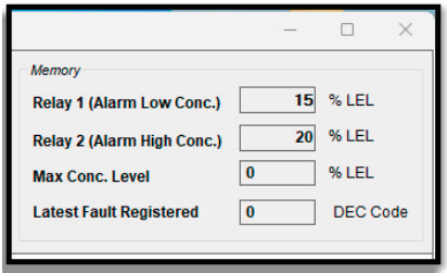


Figure 11

Note: *The latest fault registered value can be critical (no return to normal status) or temporary (self-return to normal status). For example, error HEX 2300 (Environmental: Temp. Press. Or Humid. is out of range) is temporary. Error HEX 2500 (microcontroller error) is critical, therefore the latching function keeps the 2nd relay in alarm status even after the micro is back to a normal working mode. (See Section 8 of this manual to proceed with 2nd alarm reset).*

To reset the memory (max concentration level reached and fault code registered) click on the Reset button.

8. RESET ALARM & RESET BUTTON

The MLD has 2 relays:

1st Low concentration alarm **with auto reset function** (15 sec after no gas presence)

2nd High concentration and Fault **with latching function** that **requires manual intervention**.

To reset the 2nd alarm, when the gas concentration is back to zero, click on **Reset** button.

Note: This procedure will reset also the latest alarm memory and fault memory code (See Section 11.1 of this manual). Take note of the values reported before cancelling them!

9. EXPORT LOG

It is also possible to create a log file of all the parameters monitored and provided by the MLD detector (Figure 12).

Click on Start Log button to start the reading. To export this file in .csv click on Stop Log and save the Log file on your PC in the preferred folder.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Time	Status	LEL%	ID Gas	Temp	Press	Rh	AbsH	Serial nÂ°	Mem last	Mem Malf Code	
2	12/10/2023 17:06	0	0	0	33,12	100,21	29,6	10,59	B3223901	0	0	
3	12/10/2023 17:06	0	0	0	33,12	100,21	29,63	10,59	B3223901	0	0	
4	12/10/2023 17:06	0	0	0	33,11	100,21	29,59	10,59	B3223901	0	0	
5	12/10/2023 17:06	0	0	0	33,12	100,21	29,6	10,59	B3223901	0	0	
6	12/10/2023 17:06	0	0	0	33,12	100,21	29,59	10,58	B3223901	0	0	
7	12/10/2023 17:06	0	0	0	33,11	100,2	29,6	10,58	B3223901	0	0	
8	12/10/2023 17:06	0	0	0	33,11	100,2	29,6	10,58	B3223901	0	0	
9	12/10/2023 17:06	0	0	0	33,11	100,21	29,6	10,59	B3223901	0	0	
10	12/10/2023 17:06	0	0	0	33,12	100,21	29,57	10,57	B3223901	0	0	
11	12/10/2023 17:06	0	0	0	33,11	100,21	29,57	10,58	B3223901	0	0	
12	12/10/2023 17:06	0	0	4	33,12	100,2	29,58	10,58	B3223901	0	0	
13	12/10/2023 17:06	0	6	4	33,12	100,21	29,57	10,58	B3223901	0	0	
14	12/10/2023 17:06	0	6	4	33,12	100,21	29,57	10,58	B3223901	0	0	
15	12/10/2023 17:06	0	6	4	33,12	100,21	29,57	10,58	B3223901	0	0	
16	12/10/2023 17:06	0	5	4	33,11	100,2	29,55	10,57	B3223901	0	0	
17	12/10/2023 17:07	0	5	4	33,11	100,21	29,57	10,57	B3223901	0	0	
18	12/10/2023 17:07	0	5	0	33,11	100,21	29,59	10,59	B3223901	0	0	
19	12/10/2023 17:07	0	0	0	33,13	100,21	29,57	10,58	B3223901	0	0	

Figure 12

10. EXPERT VIEW MODBUS COMMAND

Pressing the Expert View button, the Modbus Expert Section will appear (Figure 13).

Figure 13

Once the Expert View is active, the MLD data parameters are frozen, and they will resume only when a Read or Write command is sent for the Input Registers or Holding Registers.

In this section is possible to Read the Modbus Input Register and Read or Write the Modbus Holding Register.

The address and parameters to input are described in the following chapters.

Input Register ➔ It is possible to read individual Input Registers (see Chapter 10.1). To do this, you need to specify the register address and click on **Read Input Register**.

Example: If you want to check the current temperature, you can set the Register to 4 and click on **Read Input** button.

Holding Register ➔ It is possible to adjust or read specific MLD settings using Holding Registers (see Chapter 10.2, 10.3 and 10.4)

Example: if you want to modify the concentration of the first alarm, you should use Register 100 and set the new alarm (15 %LEL) value in decimal (15) and click on Write Holding Register. If you want to read the %LEL value for the first alarm saved you should use Register 100 and click on **Read Holding Register**.

Unlike Input Registers, which are only for reading, Holding Registers are used for reading or configuration.

Note: In the "*Expert View,*" you have the capability to access and modify specific register data, but the continuous readings will remain paused until you send the necessary Read or Write commands to the input or holding registers as needed.

10.1. Modbus Input registers

Address	Register	Format
01	Status register: See Figure12	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

10.2. Read Modbus Holding register

To read the following MLD behaviour (table below) you need to recall the specific holding register.

Address	Register	Format	Default Value	Customer
01	Alarm relay contact behaviour	16-bit	0	
02	(On %LEL alarm: 0 open; 1 close)	16-bits	0	
100	Al2/Fault relay contact behaviour	signed 16-bit	10	
200	(On sensor error: 0 open; 1 close)	signed 16-bit	20	
210	Gas concentration 1st alarm %LEL (Ex: 10 for 10 %LEL)	16-bits	0	
214	Gas concentration 2nd alarm %LEL (Ex: 20 for 20 %LEL)	16-bits	0	
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	

(*) See chapter 9.4

10.3. Write Modbus Holding registers

The following address can be used in Holding Register to set new parameters:

Change Low concentration Alarm Relay behaviour

Address	Write Decimal	1st Alarm relay contact behaviour
01	1	OPEN at selected %LEL
01	0	CLOSE at selected %LEL

Change High concentration Alarm / Malfunction Relay behaviour

Address	Write Decimal	2nd Alarm & Malfunction relay contact behaviour
02	1	OPEN on 2nd Alarm & Malfunction
02	0	CLOSE on 2nd Alarm & Malfunction

Set % LEL for Relays Activation / Deactivation

Address	Write Decimal	2nd Alarm & Malfunction relay contact behaviour
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

10.4. Configurable parameters only with Program Mode PIN to GND

The following functions are configurable only with pin PROGRAM MODE (PM) connected to GND, while they are always available for reading.

Example: To verify the saved Modbus ID in the sensor set the Modbus Register to 1000 and click on **Reading Holding register**.

Functions available only with PM tied to GND		
Address		
1000*	MLD Modbus ID address	16-bits
1001*	Baud rate value (0=9600 bit/s; 1=19200 bit/s)	16-bits
1002*	Parity (0 = no parity; 2= 1 bit; 3= 2 bits)	16-bits
1003*	Stop bits (0=1 bit ; 1=2 bits)	16-bits

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.

IMPORTANT: Once the Program Mode PIN is grounded, the Modbus ID of the sensor automatically changes to 1 (from any previous ID set) : this is a control feature helpful when Modbus ID set in the detector is unknown.

Here is the procedure example for changing the Modbus ID from ID 1 (Default) to ID 2.

1. Select Modbus ID 1 in **Serial Port Setting** (Figure 14) at the top, as described in Chapter 2 (Configuration procedure).

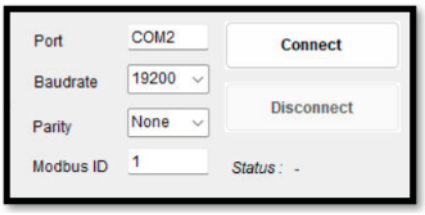


Figure 14

2. Establish the communication to MLD by pressing the Connect button.
3. Open the Expert View window (please note that automatic parameter reading is interrupted).
4. Set the Register to 1000 in the Holding Register, with a Value of 2 (for ID 2) (Figure 15).

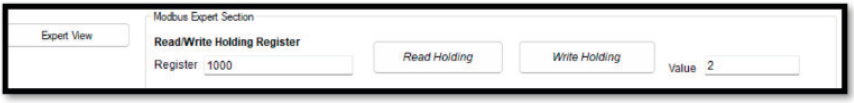


Figure 15

5. Ground the Program Mode PIN (Brown Wire) and leave to GND during the next steps.
6. Click on **Write Holding**.
7. Without closing the Expert View and while keeping the Program Mode PIN grounded, click Disconnect in Serial Port Setting.
8. Now disconnect the Program Mode PIN from grounding.
9. Set the Modbus ID to 2 in the **Serial Port Setting** at the top.
10. Click **Connect**.

To change the ID back to 1 or to check the saved ID in the sensor, follow the procedure hereafter:

1. Set the Modbus ID to 1 in Serial Port Setting at the top, as described in Chapter 2 (Configuration procedure).

IMPORTANT: Once the Program Mode PIN is grounded, the Modbus ID of the sensor automatically and temporarily (as long as the Brown Wire is grounded) changes to 1, this is a control feature helpful when Modbus ID set in the detector is unknown.

2. Ground the Program Mode PIN and leave to GND during the next steps.
3. Establish the communication to MLD by pressing the **Connect** button.
4. Move the cursor to **Expert View** and wait for the button to become enabled.
5. Click on **Expert View** button
6. Wait for the **Modbus Expert Section** window to open.
7. Set the Modbus Register to 1000 and the new ID to 1.
   a. **If the Modbus ID selected in Serial Port Setting matches the one you just set in the Holding Register Address 1000**, simply disconnect the Program Mode PIN.
   b. **If the new Modbus ID in Serial Port Setting is different from the one set in the Holding Register Address 1000**, follow these steps:
      a. Click Disconnect button in **Serial Port Setting**
      b. Disconnect the Program Mode PIN from ground.
      c. Select the new Modbus ID in **Serial Port Setting**.
      d. Click "Connect."

This procedure is valid for configure all the parameters listed in table Chapter 10.4.

11. ADDITIONAL INFO

11.1. Device Status

Modbus Input Register In MLD Data Section	Modbus Holding Register In Memory Section	Malfunction Explanation	Modbus %LEL	User Action
HEX	DEC		(Address 02)	
0	0	MLD is operating normally, no errors		N/A
100	1	Internally transmitted data failed checksum	Normal	Contact support
200	2	Internally illegal or bad parameters specified	N/A	Contact support.
300	3	Internally execution of command failed	N/A	Contact support.
400	4	Sensor insufficient memory for operation	N/A	Contact support.
500	5	Internally unknown Command ID specified	N/A	Contact support.
700	7	Internally incomplete or truncated command	N/A	Contact support.
2000	32	Analog out malfunction (only if AO functionality enabled)	N/A	Contact support.
2100	33	Internal voltage out of range	-100 %LEL	Contact support.
2200	34	Voltage out of Range	-100 %LEL	Contact support.
2300	35	Environmental (Temperature, Pressure, Humidity) out of range	-100 %LEL	Use the sensor in working condition -40 to 75 °C, 0 to 100 %RH; and 80 to 120 kPa
2400	36	Environmental sensor malfunction	Normal	Contact support.
2500	37	Microcontroller error	-100 %LEL	Contact support.
2600	38	Sensor in initialization mode (10 cycles)	-100 %LEL	Wait 10 cycles (~20 sec) for sensor to initialize.
3000	48	Sensor output <-15%LEL; accuracy affected if flammable gas initially detected while in this condition	-100 %LEL	Wait for sensor to return to zero. If message persists >10 minutes, contact support.
3100	49	Condensation condition exists at sensor (out of specification)	Normal	Raise temperature and/ or lower humidity
3200	50	Gas sensing element malfunction	-100 %LEL	Contact support.
3500	53	Sensor has detected condition indicative of human breath or humidity surge	Normal	Not breathe on sensor.

11.2. How to test a gas

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 2A) 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 2B. Examples of incorrect (non-"real-world") gas delivery protocols are shown in Figure 2C. 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.)

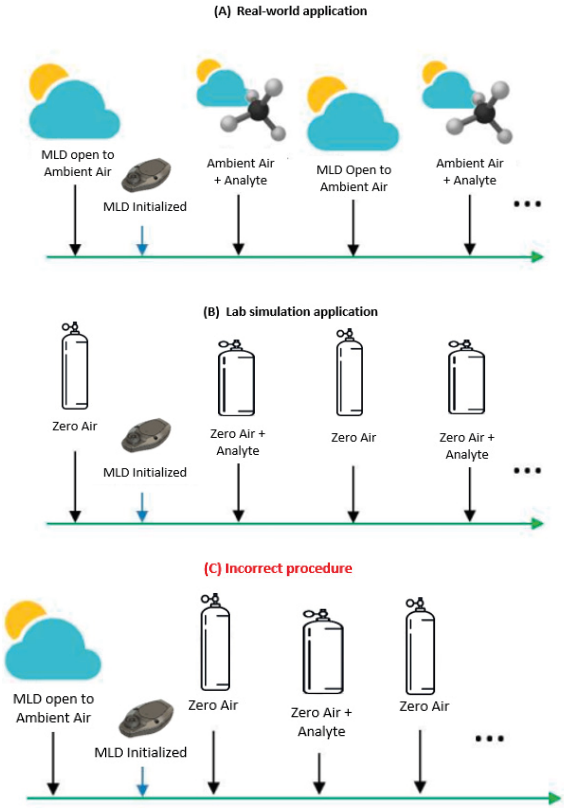


Figure 3 - MLD-Flow Adapter Accessory available on request

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.

Download the MLD-EK software tool at the following link:
https://gvzcomp.it/images/files/Software/MLD-EK-software.zip

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