ECD MOD

Universal controller with built-in sensor carbon dioxide (CO2)

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1. Subject

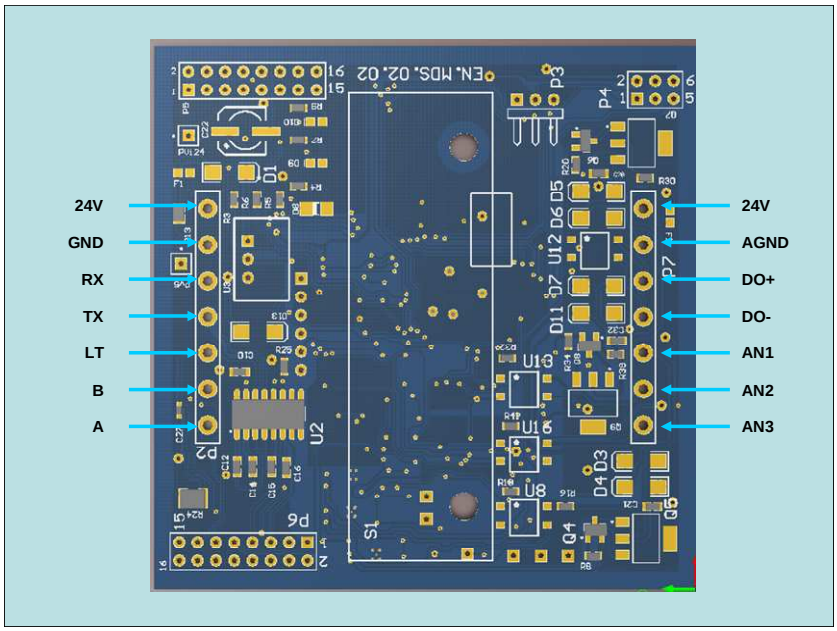
This manual describes the functionalities of the ECD MOD sensor with configurable Analogue outputs and solid state relay digital output . With these instructions the user will config ure the outputs and some parameters of the sensor: range and scaling output function, thresholds, state of the relay, histeresys, baudrate, Modbus address, trigger value and state of the digital output…

2. POWER

The input is DC 0-24 or DC 0-12

3. OUTPUTS

The sensor has 3 different outputs –see figure: MODBUS, Analog 4-20mA 0-10V and a configurable digital output. A standard configuration suitable for the more common applications.
The default configuration can be changed if necessary through a console RS-232 3-pin port.



4. CONSOLE INTERFACE

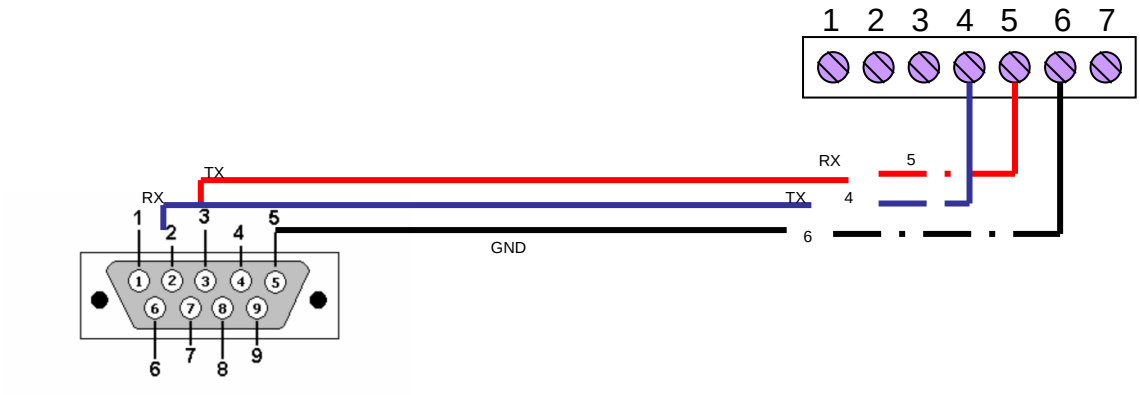
The parameters of the RS-232 port are:

- Baud rate 9600 bps
- Parity: None
- Stop bits: 1
- No handshake.

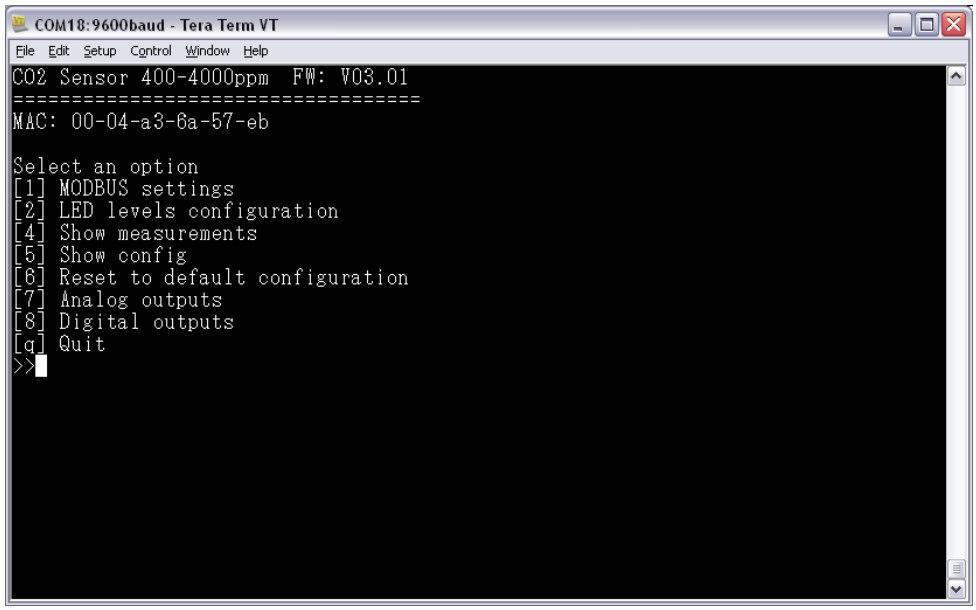
These parameters can't be modified

The cable to connect to the sensor is a NULL MODEM CABLE.
The user must connect in the other side to PC to serial connector:
Pins 5 GND, 2 RX, 3 TX – DE-9 male connector or use a Serial-USB adaptor if the PC doesn't use Serial female connection.

The connections must follow the next diagram:



5. Initial menu



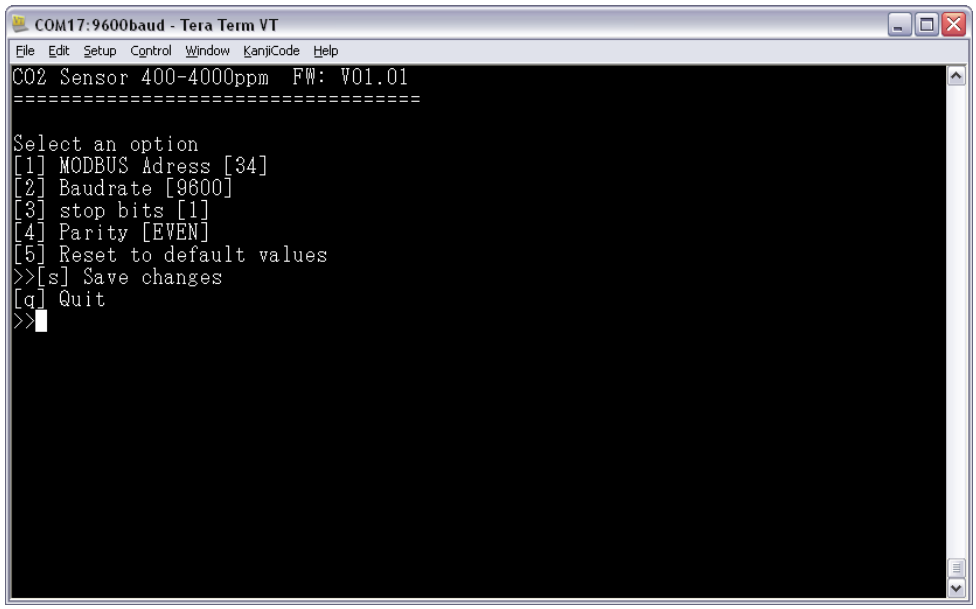
This is the top of the tree menu. It can be reached at any time by pressing '**Esc**' character or '**q**' to go through the complete menu tree.

At the top we can see the unique **MAC address of the sensor *(EUI-48 format)***

6. MODBUS Menu

Allow to set the parameters of the MODBUS serial port. Parameters are self explanatory. All parameters will take effect on saving.

Please enter [s] to take effect on the current memory device



6.1. MODBUS default values

Address: 16
Baudrate: 9600 bps
Stop bits: 1
Parity: Even

6.2. MODBUS data

Input registers

100: CO2 measured value
101: Time reference
102: Last measurement value before the current (reg 100)
103: Maximum value measured since start-up
104: Minimum value measured since start-up

Bytes of the MAC address MAC0-MAC1-MAC1-MAC3-MAC4-MAC5 *(EUI-48 format)*

105: MAC 0
106: MAC 1
107: MAC 2
108: MAC 3
109: MAC 4
110: MAC 5

Holding registers
Input registers 100 to 104 are mapped to holding registers 100 to 104

All registers are read only!

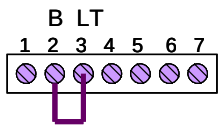
105: Setpoint

In the PID version this WRITE/READ register allows to set up and read the PID setpoint from the MODBUS side.

The values written from the MODBUS are not stored on the sensor internal EEPROM. This will cause the values to return to the last RS-232 configured values on sensor reset.

NOTE: When seen from the MODBUS side it is a 16 bit **unsigned int** register. Then no decimal part is allowed. From the RS232 side it is a 32 bit **float** then non integer values are allowed. This can produce a mismatch when a non integer is configured from the RS-232.
From the Modbus side it will be read only the integer part.

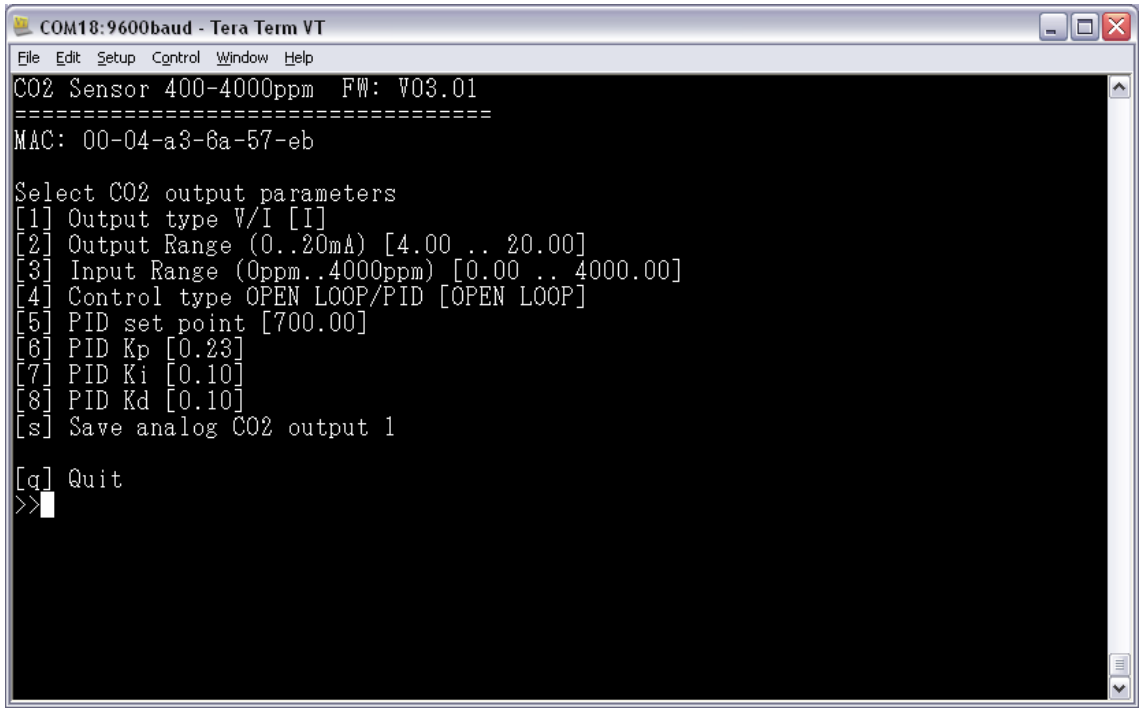
LT Connection:
On the last Modbus Sensor or if an unique Modbus sensor is installed the LT terminal connection (3) must be connected to the B-RS485 Terminal (2)



7. Analog Outputs Menu.

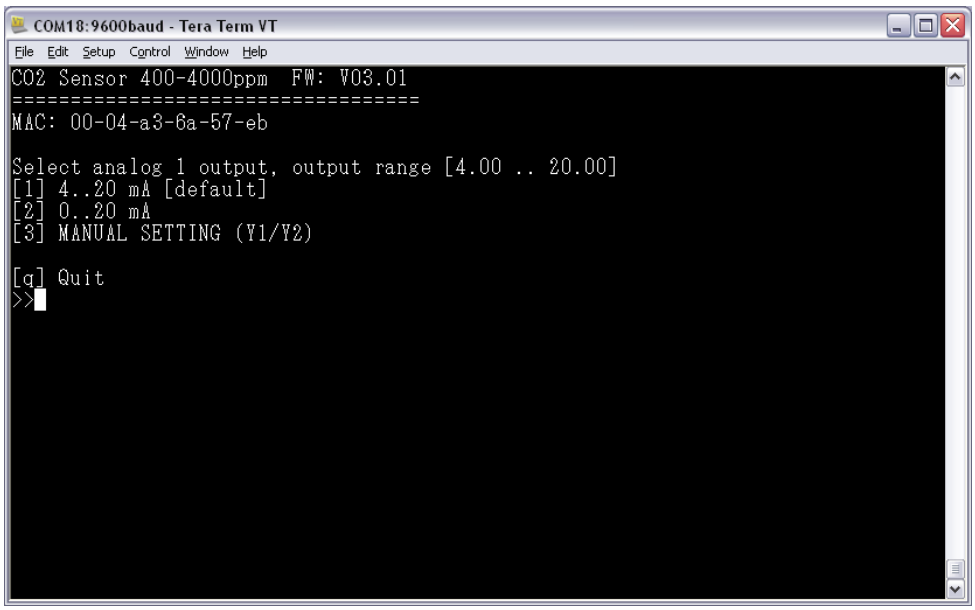
There are two types of outputs available Voltage and current. In both cases it is possible to configure the input range and the output span.

From the Analog output menu we can configure the available outputs. There is one menu for each output.

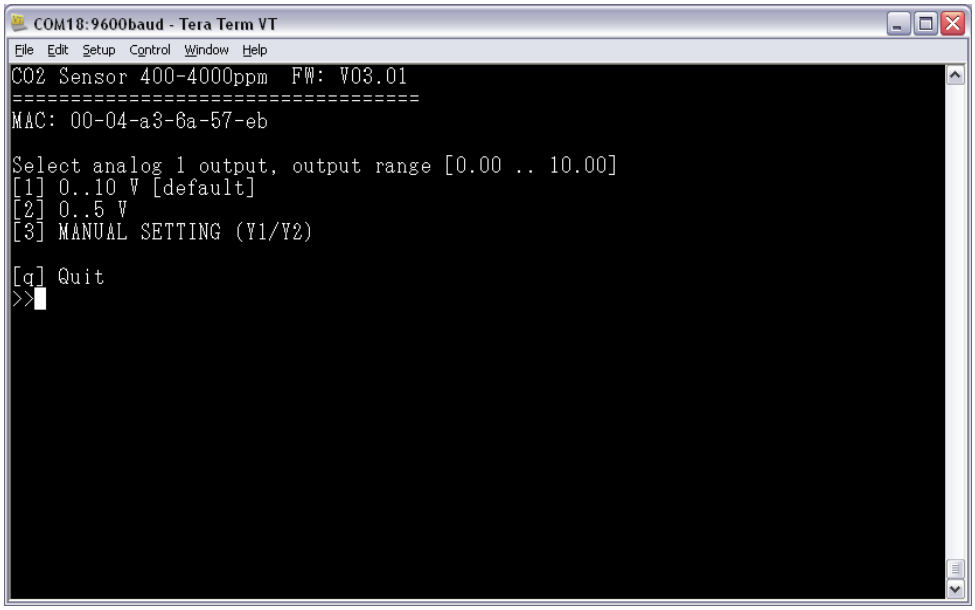


Option description
[1] Output type: To select between current or voltage types
[2] Output range: Allow to configure the output span

Current outputs:



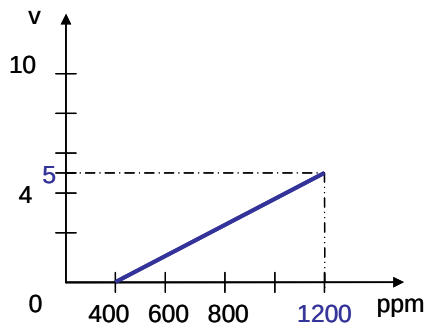
Voltage outputs



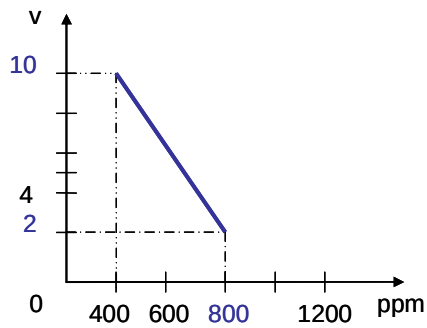
In both cases there are 2 standard options as well as a **manual option.**
This manual option is a new feature called on the datasheet as **Scaling Function*:**

** This means that the system integrator can configure the analogue output (current or voltage) as lineal function depending of any ppm concentration of the sensor range, positive or negative function. For a better understanding you can see the following samples and figures:*

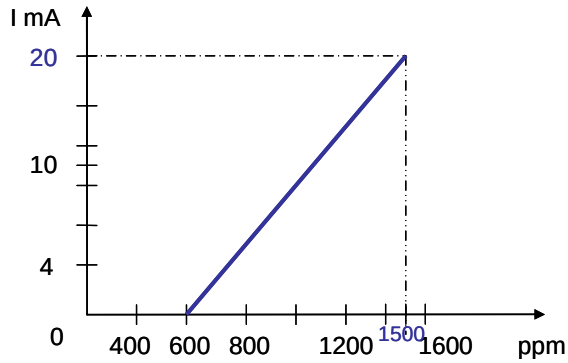
[y1,y2]=f[x1,x2]
[y1,y2]=[0,10] v
[x1,x2]=[0,4000] ppm
x1=400, x2=1200 ppm
y1=0v, y2=5v



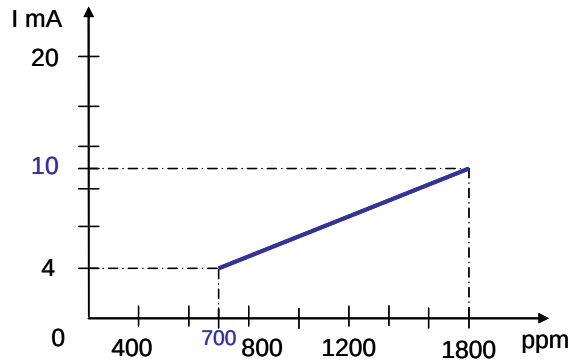
[y1,y2]=f[x1,x2]
[y1,y2]=[0,10] v
[x1,x2]=[0,4000] ppm
x1=400, x2=800 ppm
y1=10v, y2=2v



[y1,y2]=f[x1,x2]
[y1,y2]=[0,20] mA
[x1,x2]=[0,4000] ppm
x1=600, x2=1500 ppm
y1=0 mA, y2=20mA



[y1,y2]=f[x1,x2]
[y1,y2]=[0,20] mA
[x1,x2]=[0,4000] ppm
x1=700, x2=1800 ppm
y1=4mA, y2=10mA

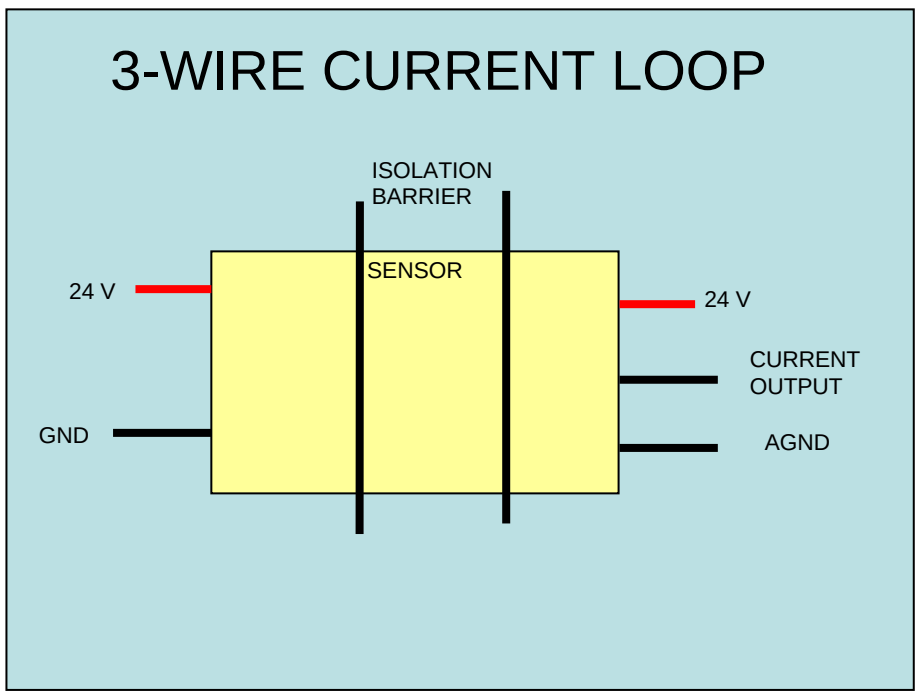


[4] Control type; To select between SENSOR (OPEN LOOP) or PID modes

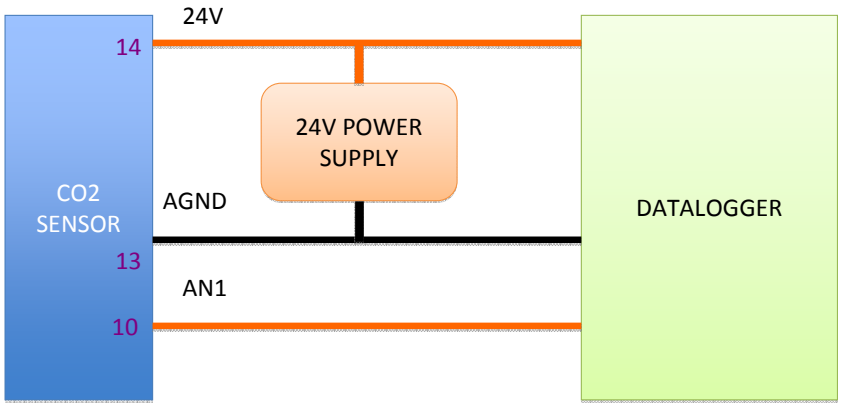
Menus from 5 to 8 allow to configure the PID parameters

To connect an **analogue 4-20mA or 0-10v output** follows the next diagrams according with the commented options:

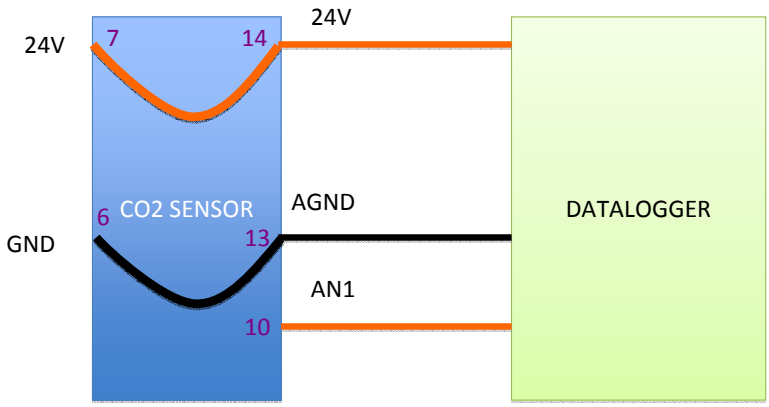
The sensor is built as follows with the power and GND isolated and the user can choose the isolated option by default using an optional power supply or use a bridge between the 7-14 and 6-13 terminals to have a non isolated device with a single power supply (see 2nd draw)



3-WIRE ISOLATED CONNECTION – option 1



3-WIRE NON ISOLATED CONNECTION – option 2



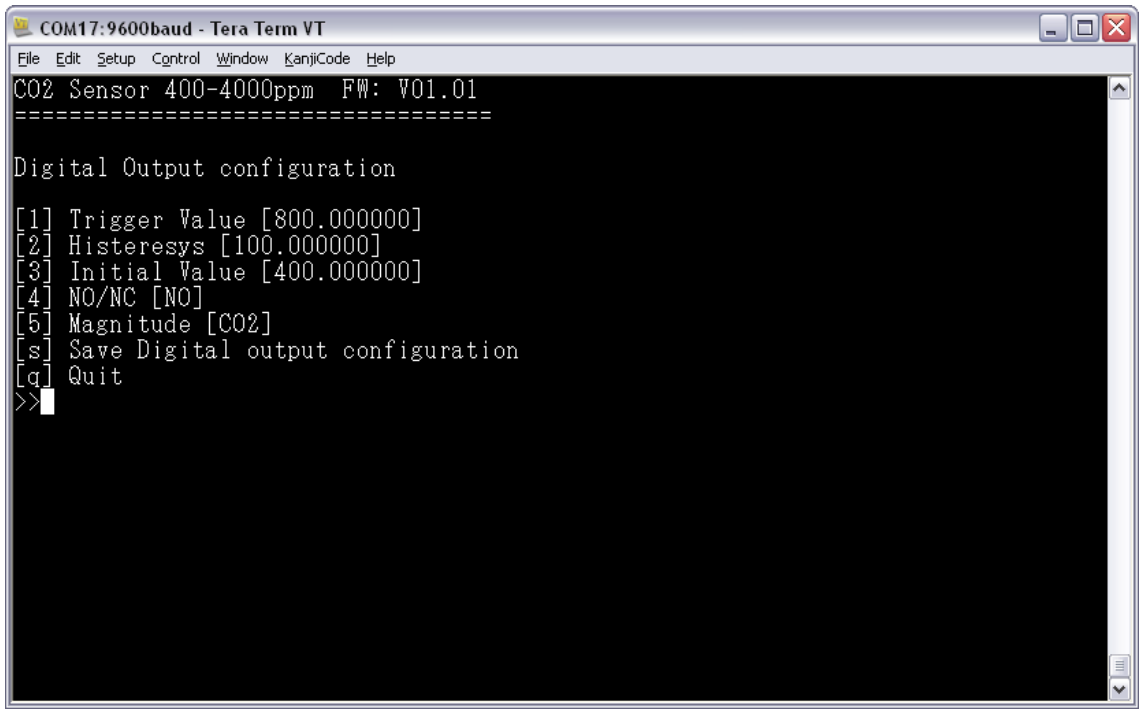
In case of VOLTAGE output the connections are the same pins.

Remember to disconnect the receiver when changing configuration in order to avoid short circuit currents

8. Digital Output Menu.

In brackets we could see the values on the temporary configuration. When saved these values are applied to the current configuration and stored in the EEPROM memory.

Please enter [s] to take effect on the current memory device



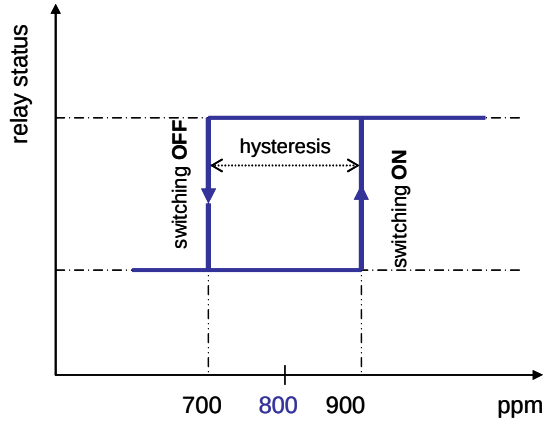
1: Set the trigger value
2: Set the histeresys
3: The initial value for the magnitude.
4: Normally open or closed
5: Sets the Magnitude. Only CO2 is possible
S: Save configuration in the EEPROM. Configuration will not take effect until saved

If the relay is set to NO (Default) it will close when the measure is above trigger value + histeresys value. If it's set to NC will work as the opposite.

At start up the initial value is assumed for the magnitude. If the value is over or under the trigger value the relay is set accordingly depending on NO or NC parameter. From this moment on the histeresys value is used to figure out the relay position.

8.1 Default parameters:

Trigger: 800 ppm
Histeresys: 100 ppm
Initial value: 400 mA
NO/NC: NO
Magnitude: CO2 (in this model only CO2 is available).



Trigger: 800 ppm
Histeresys: 100 ppm
NO/NC: NO

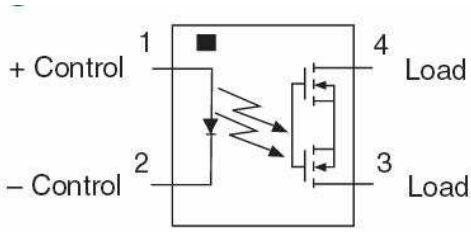
Examples Digital output state:

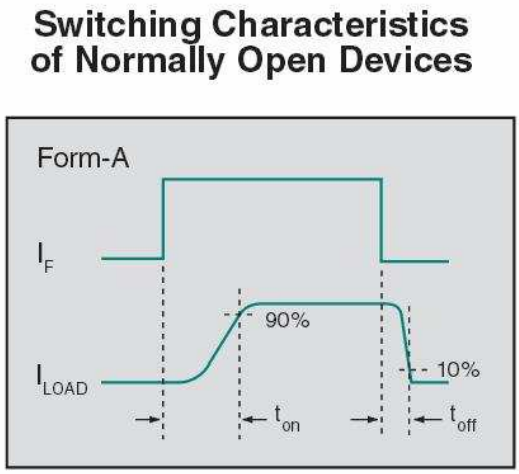
a) ppm = 1400
NO
Trigger value = 1000
Histeresys = 50
Relay position = CLOSED

b) ppm = 1400
NC
Trigger value = 1000
Histeresys = 50
Relay position = OPEN

c) ppm = 450
NO
Trigger value = 1000
Histeresys = 50
Relay position = OPEN

The digital output is a CMOS solid state relay:





Digital output **absolute maximum** ratings

Parameter Ratings Units	Rating	Units
Blocking Voltage	60	Vp
Total Power Dissipation	400	mW
Isolation Voltage	1500	Vrms

Electrical characteristics:

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Output Characteristics						
Load Current						
Continuous [1]	I_F=2mA	I_L	-	-	100	mA_{rms} / mA_{DC}
Peak	t=10ms	I_{LPK}	-	-	±350	mA_p
On-Resistance [2]	I_L=100mA	R_{ON}	-	-	16	Ω
Off-State Leakage Current	V_L=60V_p	I_{LEAK}	-	-	1	µA
Switching Speeds						
Turn-On	I_F=5mA, V_L=10V	t_{on}	-	-	10	ms
Turn-Off		t_{off}	-	-	10	ms
Output Capacitance	V_L=50V, f=1MHz	C_{OUT}	-	25	-	pF

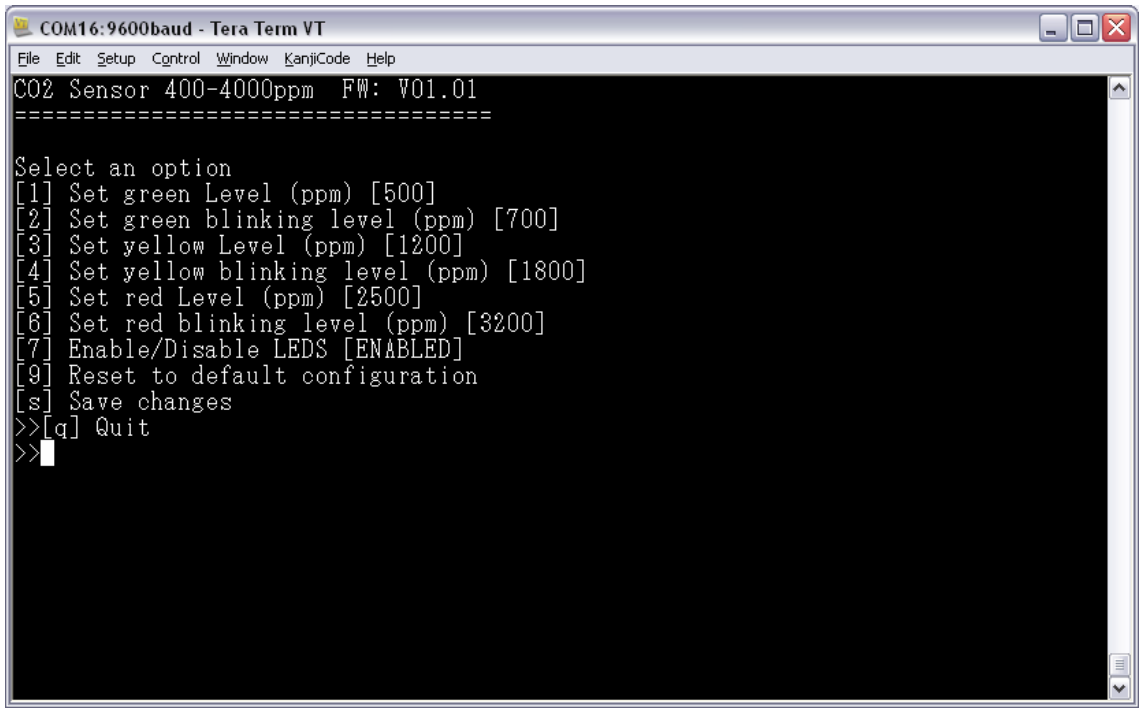
9 LED config menu.

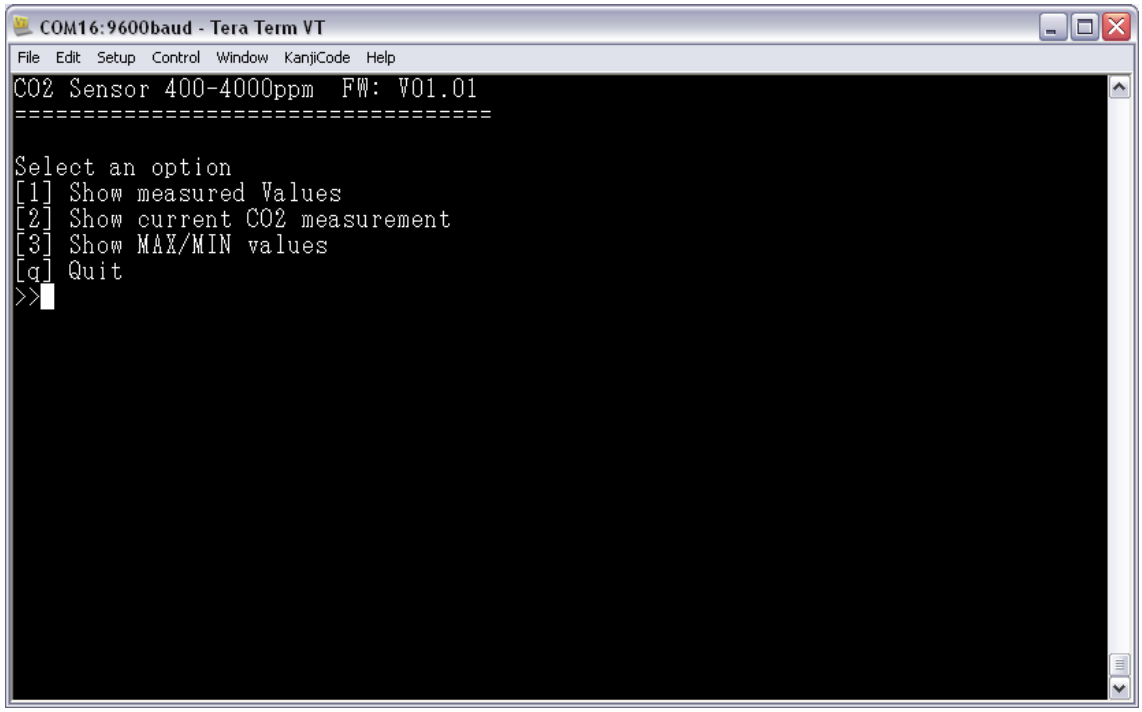
The sensor has three LEDs for indication purposes on the front. When the sensor starts all LEDs are turned on until the sensor heating time is exhausted. After this time the LEDs are set to show the CO2 ppm as configured on the sensor. If the LEDs remain on it indicates a faulty or missing CO2 sensor.

Under green level the green LED is turned on, above this level and under green blinking level, the green LED is blinking. Between green blinking level an yellow level the yellow LED is turned on, etc.

In this way we can have 3 x 2 = 6 levels of indication being the default parameters:
500, 700, 1200, 1800, 2500, 3200 ppm.
These levels can be modified as needed with the console LEDs config menu.

In applications where the LEDs flashing light is not adequate the LEDs can be turned off with option [7]



10 Show measurements menu.

Allow to see the measured values through the console interface. Several options are available.