

## Description

This sensor gives information concerning carbon dioxide (CO2) concentration levels, the essential element in air quality monitoring and control in occupied buildings. This device has new sophisticated features as Scaling Control function where the user can scale the analogue output as trigger concentrations to connect and control ventilators, motorized grilles, air dampers...and different actuators devices where this proportional analogue output is accepted. The device analog and digital outputs are isolated from the main power supply

Current and incoming legislation requires CO2 gas monitoring within building environments for optimal control of air quality. Moreover, such CO2 gas monitoring is employed within demand control ventilation systems used for building heating ventilation and air conditioning.

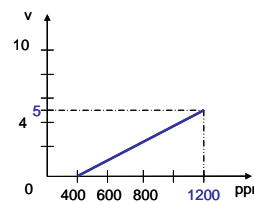


## Features

- NDIR Dual, long life, reliability. No calibration required
- 400-4000 ppm CO2 measurement sensor range
- 16 bits MODBUS RTU word – MODBUS parameters remotely can be changed
- Isolated outputs from the main power supply
- **Unique MAC Address** identifier for remote control and web applications
- Configurable baudrate by console, 9600 bps by default
- Configurable physical MODBUS Address by console (default 16)
- Configurable Settings: Thresholds, PPM levels and intensity LED lights
- **Scaling Function- Configurable Analogue Output Range**
- Configurable Digital Output (max. load 150 mA) locally  
*Trigger – 800 ppm by default*
- PID Controller Working Mode – Setpoint also configurable by BMS

## Application Areas

- Indoor Air Quality Measurement in Offices, Schools, nurseries, kindergartens, Cinemas, Conference rooms, hotels and residential areas
- DCV- Demand Controlled Ventilation for energy savings
- HVAC applications for building management
- Home air quality control

1. SENSOR MODE			
Range ppm definition Options			TRIGGER Digital Output
(1.1) Range 1	(1.2) Range 2	(1.3) Manual. <b>Scaling Function</b>	
0 ... 4000 ppm	0 ... 2500 ppm	[x1,x2]=[0, 4000]	
Analogue Output Configuration			800 ppm (Hys 100 ppm)
0 - 10v (voltage)	4 - 20mA (current)	<p><b>(1.3) Manual y=f(x)</b>                      [y1,y2]=[0,10v] in voltage                      [y1,y2]=[0,20mA] in current  <u>example:</u>                      Output [V]                      y1=0, y2=5 v,                      x1=400, x2=1200                      0 v is 400 ppm                      5 v is 1200 ppm</p> 	
2. PID Controller MODE			
Definition parameters Kp, Ki, Kd	Set point	Output	
if Kd=0 -> PI controller if Ki=0, Kd=0 -> P controller	600, 900, 1200 ppm <i>Configurable also manually by jumpers</i>	Analogue Output	Digital Output

$$u_{PID}(t) = k_p e(t) + k_i \int e(t) dt + k_d \frac{d}{dt} e(t)$$

Default Setting  
configurations

## Technical Specifications

CO2 specification		Outputs	
Measurement Principle	NDIR -Non dispersive infrared technology-	<b>Modbus Communications</b>	<b>Modbus RTU</b> 1200-2400- <b>9600</b> ...19200 bps Configurable data rate EIA-485 physical layer
Sensor Type	Dual Beam Dual wavelength	<b>Analogue Output</b>	4-20mA/0-10 v* <i>*Configurable output Range</i>
Measurement Range	400 – 4000 ppm CO2 by volume	<b>Digital Output</b>	Solid state Relay max. 150mA load <i>trigger – 800 ppm by default</i>
Resolution	< 20 ppm CO2		
Accuracy	± 5% of reading		
Pressure Dependence	0.13 % of reading per mm Hg		
Response Time	< 3 minutes for a 90% step change		
Warm up Time	< 30 seconds operational < 15 minutes full accuracy		

## MODBUS REGISTERS

INPUT REGISTERS	HOLDING REGISTERS
Unsigned integer 16 bits i.e. <b>protocol-message address counts</b> from 0	Unsigned integer 16 bits i.e. <b>device address counts</b> from 1 (401001 is identified by address 100)
<b>100</b> CO2 measured value	<b>101</b> CO2 measured value
<b>101</b> Time reference	<b>102</b> Time reference
<b>102</b> Last measurement value before the current (reg 100)	<b>103</b> Last measurement value before the current (reg 100)
<b>103</b> Maximum value measured since start-up	<b>104</b> Maximum value measured since start-up
<b>104</b> Minimum value measured since start-up	<b>105</b> Minimum value measured since start-up
<b>105</b> MAC0 *	<b>106</b> SetPoint (PID VERSION, if no PID this value is set to 0)
<b>106</b> MAC1	<b>107</b> <b>Modbus Address</b> range [1..247] if the set value is out of range the register is set to 1
<b>107</b> MAC2 * <b>Bytes of the MAC address format</b> MAC0-MAC1-MAC1-MAC3-MAC4-MAC5 (EUI-48 format)	<b>108</b> <b>Baudrate</b> 2400 9600 (default) 19200 38400 57600 <i>If other different value from last ones is entered or not integer value the device writes the default baudrate: 9600 bps</i>
<b>108</b> MAC3	<b>109</b> <b>Stop bits</b> 1:1 (default) 2:2
<b>109</b> MAC4	<b>110</b> Parity 0: None 1: Even (default) 2: odd
<b>110</b> MAC5	<b>111</b> WRITE REG Usually is set to 0 value If this register is set to 1 the latest MODBUS registers is saved and return to 0 value (as default)
	<b>112</b> <b>PID value</b>

### To modify remotely the MODBUS setting -STEPS:

1. Write the registers 107, 108, 109, 110 to the desired value
2. Set the 111 register to 1 value and at this moment the new configuration is taken and the MODBUS configuration is reset to the new
3. This last register 111 is turn automatically to 0 value.

Default thresholds \* Configurable setting explanation in the User Manual:

PPM1	●	Level1: green x < 500 ppm
PPM2	✱	Level 2: green flashing when $500 \leq \text{ppm} < 700$ ppm
PPM3	●	Level 3: yellow when $700 \leq \text{ppm} < 1200$ ppm
PPM4	✱	Level 4: yellow flashing when $1200 \leq \text{ppm} < 1800$
PPM5	●	Level 5: red when $1800 \leq \text{ppm} < 2500$
PPM6	✱	Level 6: red flashing when $\text{ppm} \geq 2500$ ppm

Hysteresis for the threshold/level values:

Levels 1,2,3:  $\pm 30$  ppm  
Levels 4,5,6:  $\pm 80$  ppm

Trigger Hysteresis:  $\pm 100$  ppm

## Electrical Specifications

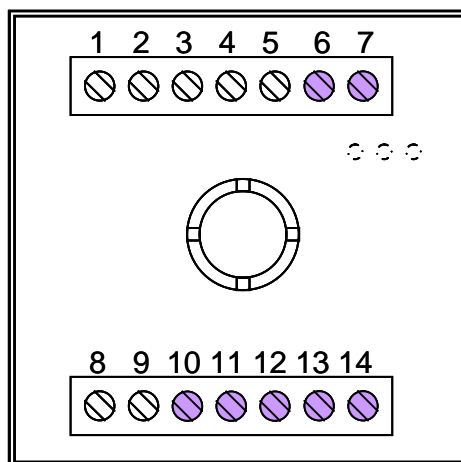
Power supply	24 Vdc (7-28 Vdc)
Power consumption	14-45 mW
Operating Temperature	0 ~ +40° C
Storage Temperature	-20 ~ + 50 °C
Operating Humidity	0 ~ 95% non-condensing
Electrical connection	screw terminals max. 1.5 mm2

## General Specifications

Regulatory Compliance	CE Mark: EMC 2004/108/EC, RoHS 2011/65/EU, WEEE CFR47, Part15 Class A EN61000-6-2, EN61000-6-3
Casing Material	ABS UL94-V0
Protection Class	IP20
Housing color	White
Dimensions	80x80x25 mm 3.15x3.15x0.98 "
Weight	0.089 kg

## Installation Diagram

### Back plate View

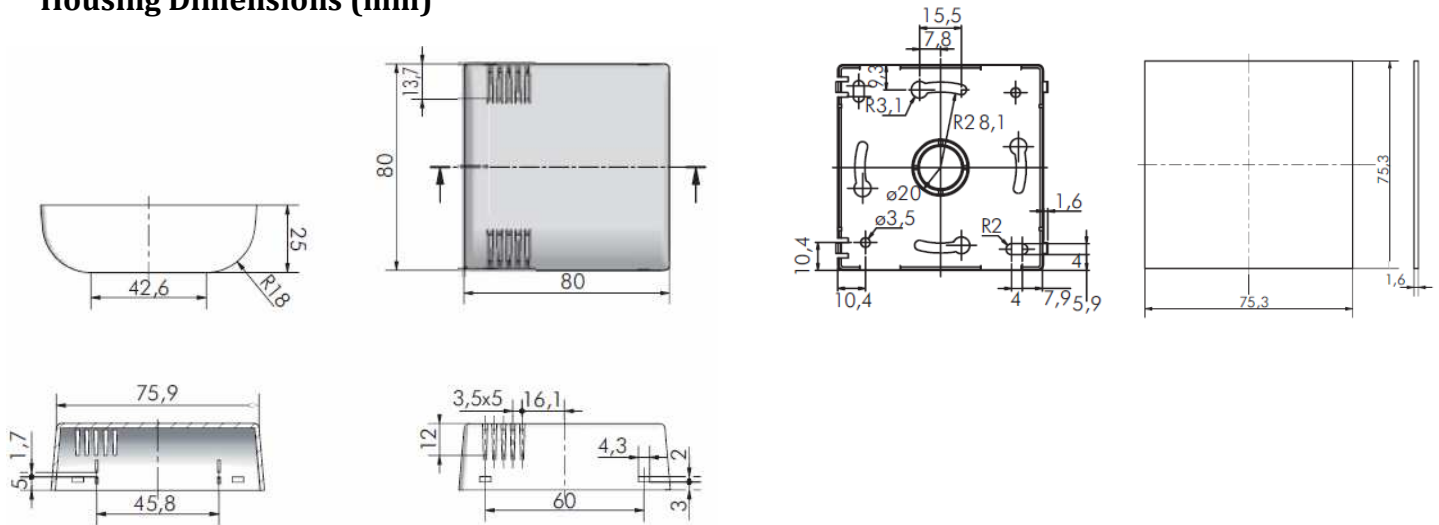


PIN	Signal
1	A-RS485
2	B-RS485
3	LT
4	Tx Console out
5	Rx Console input
6	GND
7	24Vdc
8	AN3 not used on this version
9	AN2 not used on this version
10	AN1 (CO2 out) default 0-10v
11	DO- solid state Relay
12	DO+
13	A-GND
14	A-24Vdc



Polarity connection of the power +/- must be observed!  
PINs 7/14 VOLTAGE and the GNDs pins 6/13 are isolated, **no internally connected!!!**

## Housing Dimensions (mm)



## Warnings & Troubleshooting Considerations:



When start up if all LEDs are permanently ON means: ● ● ●  
 Wrong CO2 measurements, faulty module, CO2 module ERROR COMMUNICATION!

## Ordering Info Codes

Product Name	Ref.	EAN-nr
CO2 Analog Sensor with Scaling Function (1AO+1DO )	<b>EN021501</b>	8437013200110
MODBUS-Analog NDIR dualbeam CO2 sensor (1AO+1DO )	<b>EN023551</b>	8437013200080
<a href="#">NBB-CO2PID82</a> - CO2 Sensor + PID controller output (1AO+1DO )	<b>EN026751</b>	8437013200059
<a href="#">NBB-CO2MODB83</a> - CO2 MODBUS PID CONTROLLER	<b>EN023861</b>	8437013200257