USER MANUAL AIRSENSE

Release 2_0

USER MANUAL AIRSENSE

INDEX

1. Electrical Characteristics

Power Supply	
Power Supply Voltage Range	12 … 40 Vdc
Power with gas probe	<= 1,2 Watt
Current Consumption	50 mA Max @24 Vdc

Environmental	
Operative Temperature	-20 …. +50 °C
Operative Humidity	30% ÷ 90% without condensation
Operative Pressure	1013 ± 10% hPa
Storage Temperature	-25 …. +65 °C

Measurements	
Warm up time	1..2 minutes
Stabilization time	2 minute

Warning and Alarm	
Numbers of Relays	3 Settable for warning and alarm status

Relays Characteristics	
Max Contact load	3 A
Max Contact Voltage	250 Vac / 30 Vdc
Contact material	AgSnO2
Mechanical Endurance	1×10^7
Dielectric Strength	4 kV

Enclosure	
Material type	Alluminium
Dimensions	115 mm x 90 mm x 86 mm
Weight	1 Kg
IP protection	IP54
Mounting	4 holes for 4 mm diameter

Serial Communication	
Physical Standard	RS485
Protocol	Modbus RTU
Max Baud rate	115200 B/s
Serial settable Parameters	Databit, Parity, Stop bit, Baudrate
Available Register Maps	Accessible Registers Modbus

Analog Communication	
Analog Current Standard	4 .. 20 mA
Current mode	Sink or source settable
Load resistance	270 ohm
Critical / Measure / Overload	2 mA / 4..20 mA / 22 mA

| Cables	
Inflexible	0,2 – 2,5 mm²
Flexible, multiwires	0,2 – 2,5 mm²
Signal RS485 Cables	Shielded and twisted cables 2x0.75 mm2

2. Electrical connections and pinout

Cable glande

| + | -- |
| A | B |

Power **Rs485** **REL 1**

Dip Switch
0 1 2 3 4 5

+24 VDC **GND**

| + | -- | **A   B**

CNT 1 **Rs485** **REL 1**

CNT 2 **CNT 3**
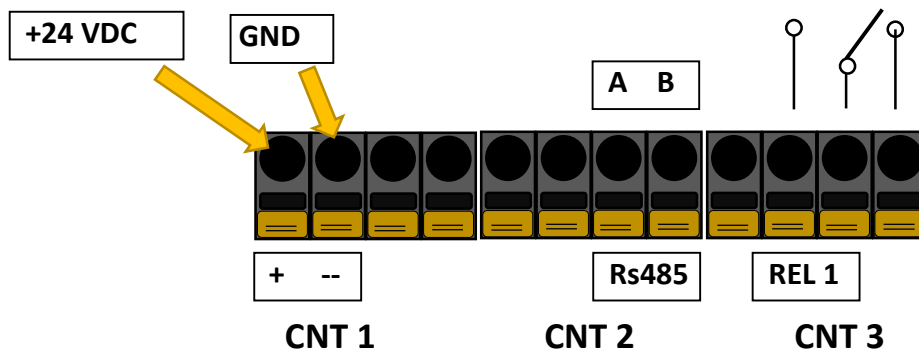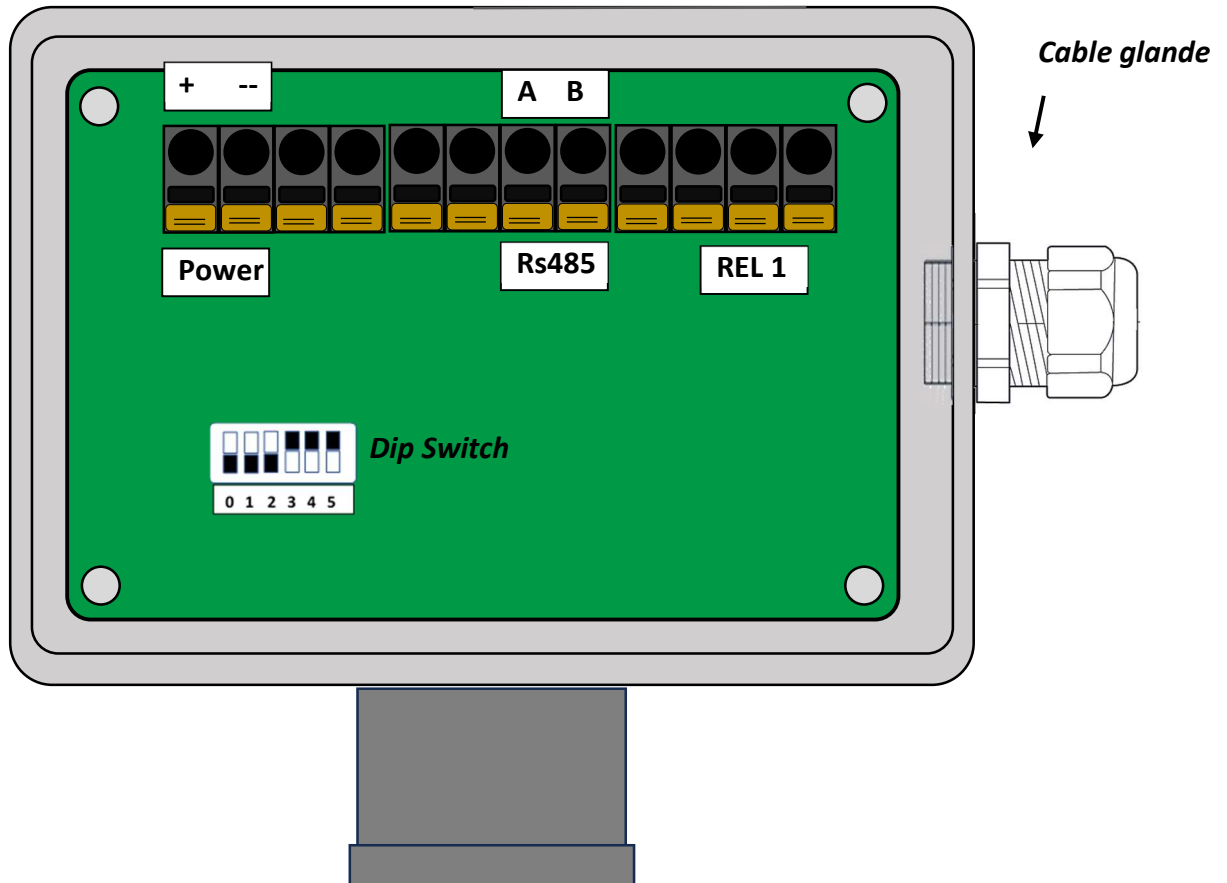
Connection 1		
1	CN1.1	+24 Vdc
2	CN1.2	GND
3	CN1.3	- mA
4	CN1.4	+ mA

Connection 2		
1	CN2.1	nc
2	CN2.2	GND ISO
3	CN2.3	A RS485
4	CN2.4	B RS485

Connection 3		
1	CN3.1	nc
2	CN3.2	N. Open
3	CN3.3	Common
4	CN3.4	N. Close

3. Drawing

Dimensions are in mm

115 mm

56 mm

90 mm

28 mm

AirSense
Gas detector

SN

56 mm
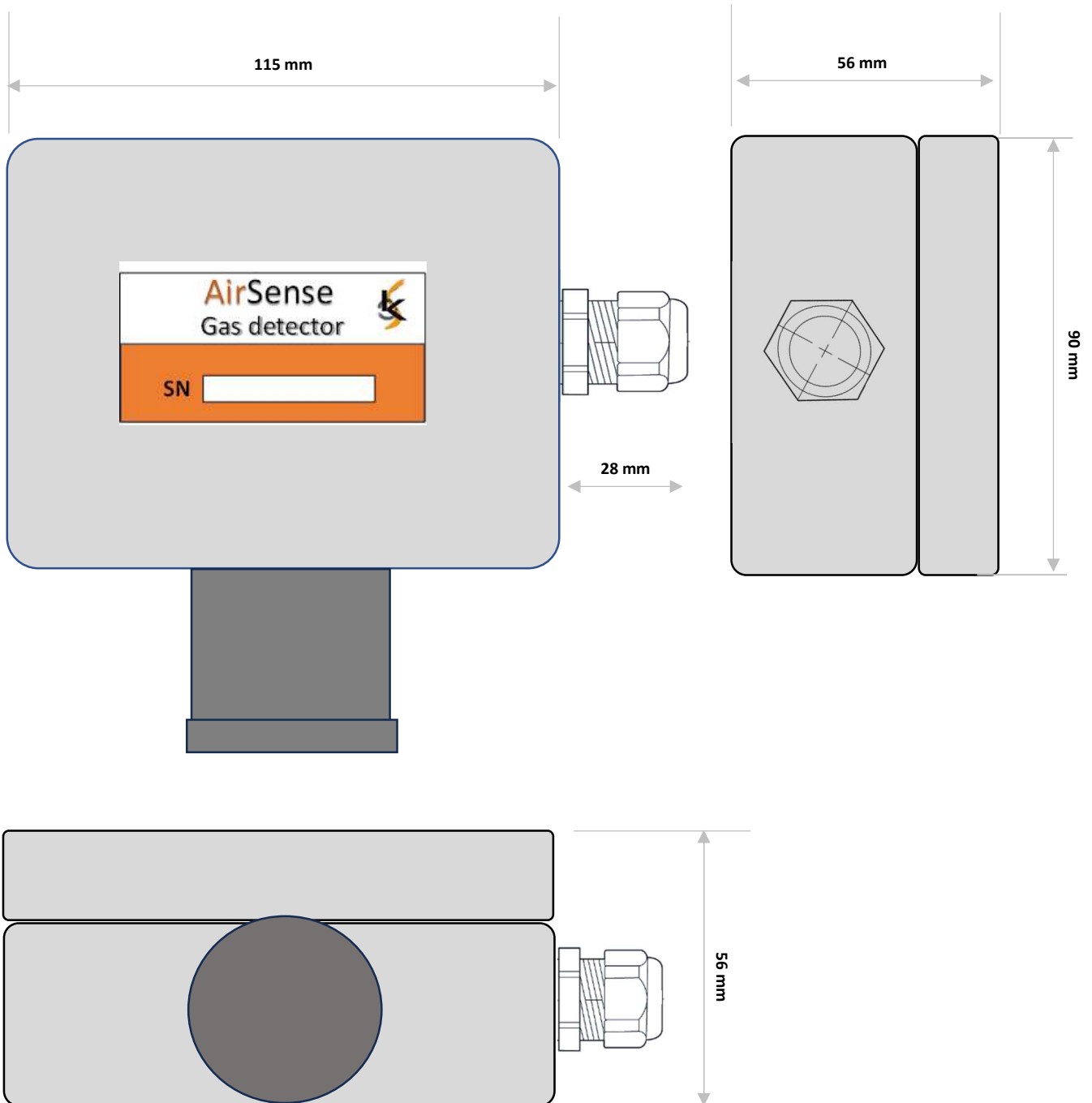
4. Principle of operation of the Detector

A fixed oxygen depletion alarm or oxygen deficiency monitor is an oxygen sensor that constantly monitors a defined space, can check third-party systems, and can indicate an accident audibly and visually.

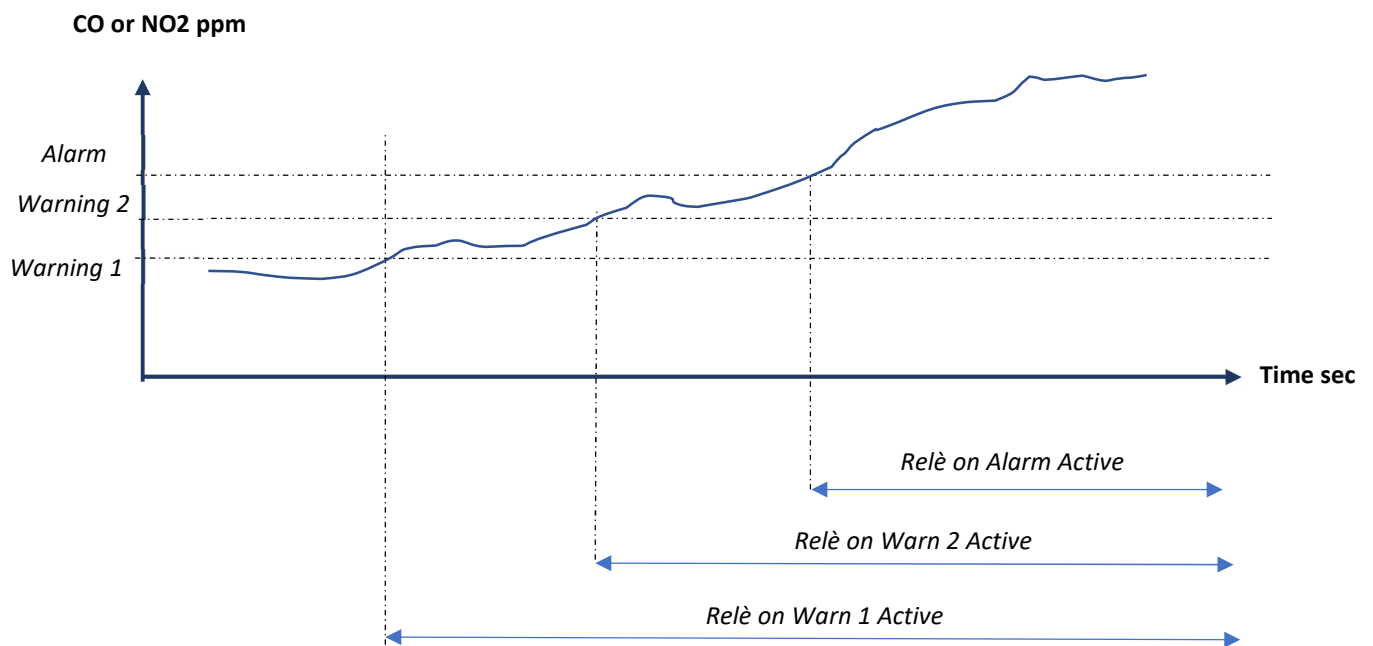The gas detector Airsense continuously monitors the Gas level in the enclosed area.

If the Gas (CO or No2) level in the air increase above some preset values, the alarm alerts occupants both inside and outside the room of the incident.

With Detector Airsense is possible to set the alarm with different level .

Warning 1 is the first level, it has a function like a pre alarm, so it is set on safety value.

Warning 2 is the second level of pre alarm , it has a function like a pre alarm, so it is set on safety value.

Alarm is the critical alarm. This could be set lower than warning 1 and warning 2 Level

CO or NO2 ppm

Alarm

Warning 2

Warning 1

Time sec

Relè on Alarm Active

Relè on Warn 2 Active

Relè on Warn 1 Active

5. Address of detector

The detector comunicates the data with Central Unit by RS485.
Each device has its own unique network address.
Do not connect devices with the same address in the same network.

How to set the address of the detector :

$2^5 = 32$
$2^4 = 16$
$2^3 = 8$
$2^2 = 4$
$2^1 = 2$
$2^0 = 1$
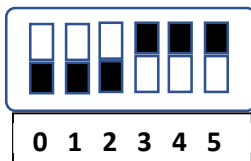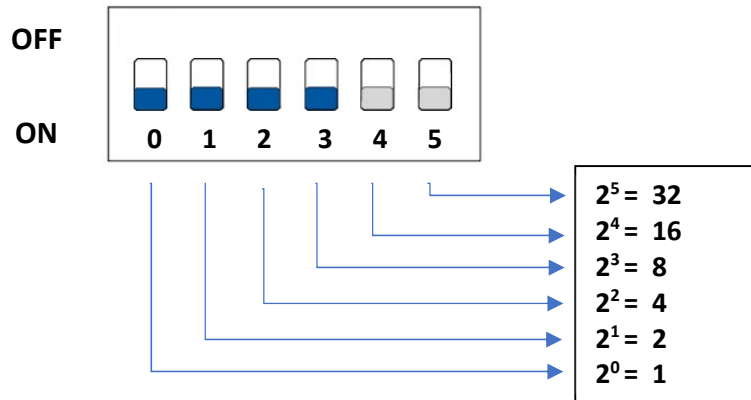
Example 1 : address = $2^0 + 2^1 + 2^2$ = 1 + 2 + 4 = 7
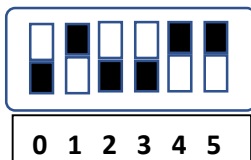
Example 2 : address = $2^0 + 2^2 + 2^3$ = 1 + 4 + 8 = 13

Example 3 : address = $2^1 + 2^3$ = 2 + 8 = 10

6. Modbus Communication

The Airsense Detector can communicate with external equipment through RS485 line and with Modbus RTU Protocol. The Detectors of the AirSense series use the Modbus RTU transmission protocol to tr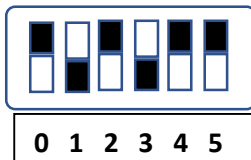ansmit data (on serial TX and USB ports). Modbus is the most widespread serial communication protocol among industrial electronic devices.
Modbus allows communication between different devices connected to the same network; it is used to connect a supervisor computer with a remote terminal unit (RTU) in supervision control and data acquisition systems.

The default configuration of the communication protocol is as follows:
- Data length: 8 bits
- Parity: none;
- Stop bit: 1 bit.
- Data transmission speed settable from 9600 to 115200 Baud

The detector has:
- one RS485 serial port for transferring to PC (master) the instantaneous measurements made by the unit connected to be used in case a multi-detectors in connection network

The RS485 connection line must be made using a twisted and shielded communication cable (minimum 3 conductors) preferably equipped with the following characteristics:
- Flexible
- Category 5 or higher
- 4 conductors Ø 0.5 mm^2
- With shield

The maximum connection distance between the first and last device connected to the RS485 line must be 1200 meters. For short connection distances (<5 meters) the cable used may not have a shield. For longer distances or in environments particularly affected by noise and electrical and electromagnetic disturbances, it is necessary to use shielded cables.

The protection shield should be connected to a ground terminal on one end of the RS485 line in order to discharge induced disturbances to the ground. Do not connect the GND reference terminal of the RS485 line to the ground terminal or to the protection screen; this could cause circulation of anomalous currents to different potentials.

The RS485 serial line supports up to a maximum of 32 connected devices. For very long data lines, it is advisable to insert protections against over voltages (voltages induced on the data line from atmospheric discharges and differences in ground potential). Never use the star connection. It is preferable to connect the devices in parallel in enter-exit mode rather than to create a main bus with numerous branches.

Types of connection with RS485 twisted wires
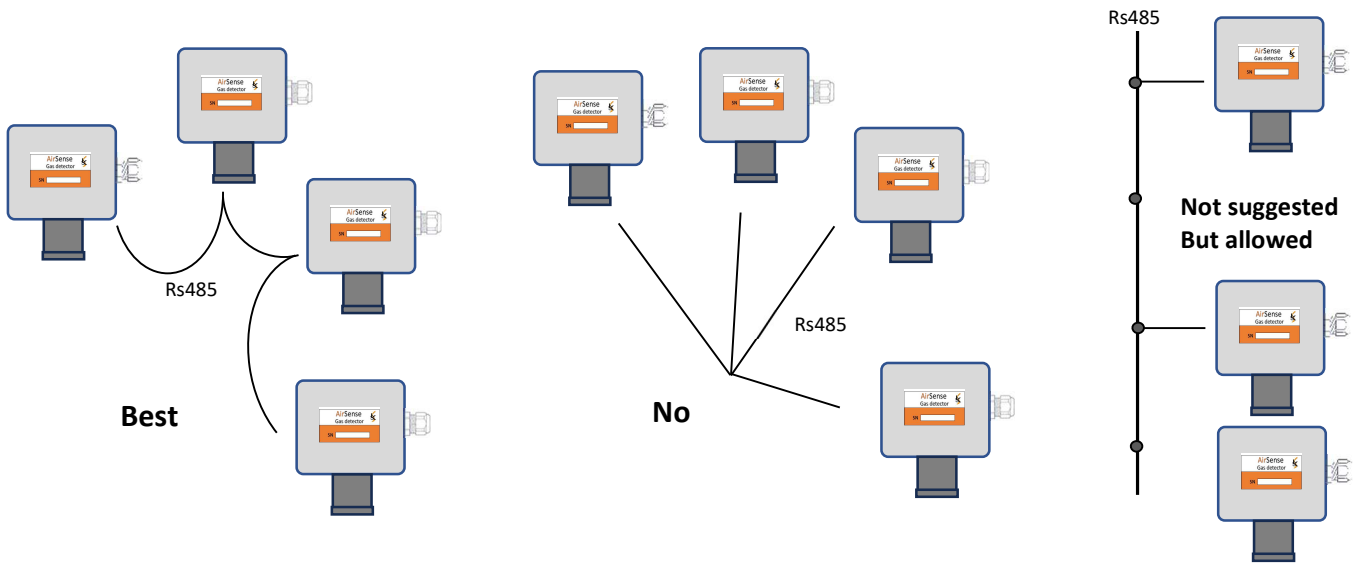
Protocol ModBus

The detectors send the data to the remote unit PC o PLC using protocol communication Modbus RTU
The detector uses the followinf functions
Function 04 to read the measure and some dynamic data.
Function 06 to write some allowed registers and parameters in the flash memory

FUNCTION 04.

This function is used to read the status of the Detectors without to change the parameters of it and to read the registers.

Request :

< Addr> < Funct Code > < Addr High > < Addr Low > < Data High > < Data Low > <CRC 1> <CRC2>

Addr	=	address of destination detector	
Funct Code	=	04	
Addr High	=	Start address high byte	= 0
Addr Low	=	Start address low byte	= 0
Data High	=	End address high byte	= number of registers bytes
Data Low	=	End address low byte	= number of registers bytes
CRC 1	=	Byte 1 of CR Calculation with previous bytes	
CRC 2	=	Byte 1 of CR Calculation with previous bytes	

Positive Answer :

< Addr> < Funct Code > <N. Regs>< Data H1> < Data L1 >… < Data Hn > < Data Ln >… <CRC 1> <CRC2>

Addr	=	address of destination slave module
Funct Code	=	04
N. Regs	=	Numbers of registers sent in the frame
Data Hn	=	data high byte of registers[n]
Data Ln	=	data low byte of registers[n]
CRC 1	=	CRC byte high
CRC 2	=	CRC byte low

Error Code :

<0x8 and Function code> <error code> <CRC 1> <CRC2

0x84 0x01	In case of error in CRC fields.
0x84 0x02	in case of data (16 bit high+low) is grater than 0x00FF

Example :

Command to read the status of Detector 01 starting from address registers = 0.
The command reads all registers (4).

Request :	TX : - 01 04 00 00 00 14 F0 C9	(8 bytes)
Answer :	RX : - 01 04 14 xx xx xx xx xx xx xx xx	(20 bytes + 3 + 2 = 25 bytes)

Address	Description	BYTES	VALUES	
0	Status of Detector	High Byte of Word		
1	Status of Detector	Low Byte of Word		
2	Gas Measure Instant	High Byte of Word	0… 1000	
3	Gas Measure Instant	Low Byte of Word		
4	Gas Measure_Average	High Byte of Word	0… 1000	
5	Gas Measure_Average	Low Byte of Word		
6	PPM CO – NO2	High Byte of Word	0 … 30%	
7	PPM CO – NO2	Low Byte of Word		
8	Gas Measure_Derivative	High Byte of Word	0 … 90 °C	
9	Gas Measure_Derivative	Low Byte of Word		
10	Temperature Average	High Byte of Word	0… 1000	
11	Temperature Average	Low Byte of Word		
12	Status Relays	High Byte of Word	See SetUp Relays Paragraph	
13	Status Relays	Low Byte of Word		

Table 1 of registers returned with function 04 Dynamic Values

Status OF Detector :

STATUS_INIT	1	During Initailization
STATUS_MEASURE	2	During Normal Measure
STATUS_WARNING_1	3	Status Of Warning 1
STATUS_WARNING_2	4	Status of Warning 2
STATUS_ALARM	5	Status of Alarm
STATUS_FAILURE	6	Status of Failure
STATUS_SERVICE	7	Status of Service

Address	Description	Available	Range
4000	Reserved	Reserved	
4001	Type of Sensor	Writeable	
4002	Enabled	Writeable	1 = YES 0 = NO
4003	Address	Writeable	1… 32
4004	Baudrate	Writeable	0 = 9600 1 = 19200 2= 38400 4 = 115200
4005	WarmUp Time	Writeable	1… 100 Seconds
4006	Warning Level 1	Writeable	PPM Value
4007	Warning Level 2	Writeable	PPM Value
4008	Alarm Level	Writeable	PPM Value
4009	Temperature Level	Writeable	10…100 °C * *10 273 = 27,3 °C
4010	SetUp Relay 1	Writeable	See Relay SetUp Paragraph
4011	SetUP Relay 2	Writeable	See Relay SetUp Paragraph
4012	SetUp Relay 3	Writeable	See Relay SetUp Paragraph
4013	SetUP Buzzer	Writeable	See Relay SetUp Paragraph
4014	Calibration X0 Value	Writeable	Raw Value of the Calibration point 0 digital value
4015	Calibration Y0 Value	Writeable	Raw Value of the Calibration point 0 PPM Value
4016	Calibration X1 Value	Writeable	Raw Value of the Calibration point 1 digital value
4017	Calibration Y1 Value	Writeable	Raw Value of the Calibration point 1 PPM value
4018	Zone	Writeable	Read the Relay of Central Unit linked with detector
4019	Rele_CPU	Writeable	Read the zone of the detector

Table 2 of registers returned with function 04 Static Values

FUNCTION 06.

This function is used to write the parameters of the Detectors.

Request :

< Addr> < Funct Code > < Addr High > < Addr Low > < Data High > < Data Low > <CRC 1> <CRC2>

Addr	=	address of destination detector
Funct Code	=	06
Addr High	=	Address high byte = High Byte of address
Addr Low	=	Address low byte = High Byte of address
Data High	=	Data high byte = High Byte of data to save
Data Low	=	Data low byte = Low Byte of data to save
CRC 1	=	Byte 1 of CR Calculation with previous bytes
CRC 2	=	Byte 1 of CR Calculation with previous bytes

Positive Answer :

< Addr> < Funct Code > <N. Regs> < Address H> < Address L > < Data H > < Data L > <CRC 1> <CRC2>

Addr	=	Address of destination slave module	
Funct Code	=	06	
N. Regs	=	Numbers of registers sent in the frame (4)	
Addr High	=	Address high byte	= High Byte of address
Addr Low	=	Address low byte	= High Byte of address
Data High	=	Data high byte	= High Byte of data to save
Data Low	=	Data low byte	= Low Byte of data to save
CRC 1	=	CRC byte high	
CRC 2	=	CRC byte low	

Error Code :

<0x8 and Function code> <error code> <CRC 1> <CRC2

0x84 0x01   In case of error in CRC fields.

0x84 0x02   in case of data (16 bit high+low) is grater than 0x00FF

Example :

Command to write the Warning 1 of Detector 01   (Address Parameter Warning 1 = 06) (See Table 3)

Request :	TX : - 01 06 00 06 00 00 69 CB	(8 bytes)
Answer :	RX : - 01 06 04 00 06 00 00 69 CB	(9 bytes)

Address	Description	Allowed	Range	Default Value
0	Reserved	Reserved		n.a.
1	Reserved	Reserved		n.a.
2	Enabled	Writeable	1 = YES 0 = NO	1
3	Address	Writeable	1… 32	1
4	Baudrate	Writeable	0 = 9600 1 = 19200 2= 38400 4 = 115200	0 = 9600
5	WarmUp Time	Writeable	1… 100 Seconds	10
6	Warning Level 1	Writeable	1… 500 Level % *10 209 = 20,9 %	190
7	Warning Level 2	Writeable	1… 500 Level % *10 209 = 20,9 %	180
8	Alarm Level	Writeable	1… 500 Level % *10 209 = 20,9 %	170
9	Temperature Level	Writeable	10…100 °C * *10 273 = 27,3 °C	450
10	Set Up Relays 1	Writeable	See Relay SetUp Paragraph	n.a.
11	SetUP Relays 2	Writeable	See Relay SetUp Paragraph	n.a.
12	SetUp Relay 3	Writeable	See Relay SetUp Paragraph	n.a.
13	SetUP Buzzer	Writeable	See Relay SetUp Paragraph	n.a.
14	Calibration X0 Value	Writeable	Raw Value of the Calibration point 0 digital value	480
15	Calibration Y0 Value	Writeable	Raw Value of the Calibration point 0 PPM Value	600
16	Calibration X1 Value	Writeable	Raw Value of the Calibration point 1 digital value	209
17	Calibration Y1 Value	Writeable	Raw Value of the Calibration point 1 PPM value	
18	Zone	Writeable	Set the zone of the detector	1
19	Rele_CPU	Writeable	Set the Relay of Central Unit linked with detector	1
20	Offset Temp	Reserved	Offset of temperature calibration	0
21	Last Calibration	Reserved	Last calibration type 15 = 15% 17 = 17%	17%

Table 3 of registers saved in flash memory and used with Function 06

7. Warning and precautions

⚠️ **Before operating, read this manual thoroughly and retain it for future reference.**
Non-respect of these instructions may reduce performances and safety of the devices and cause danger for people and property. The products must be installed, operated, serviced and maintained by qualified personnel in compliance with applicable standards and regulations. Open the devices only for connection use and don't repair or modify the devices, if malfunction or failure should occur during operation, send unit to the factory for inspection. No responsibility is assumed by Kairos S.r.l. for any consequences deriving from the use of this material.

⚠️ **RISK OF DAMAGE**

Carefully observe the connection methods and the relative polarity. Switch on the power supply make sure that the detectors are connected correctly and that there are no polarity inversions
The inversion of polarity if kept for a long time can damage the device.

Do not power the sensor with a voltage higher than that prescribed in this manual.

1. **Input voltage**: VIN = 24 Vdc. Range: 21 .. 30 Vdc.
Connect PE (Protective Earth) wire before connecting other wires and keep it as short as possible, PE wire must have cross section equal or higher than line wires. Connection of both PE terminals is not mandatory.

2. **Mains protection**: devices are NOT equipped with internal fuses.
Use external breaking and protection devices as circuit breakers characteristic C, properly rated for the operating voltage and with min. Overcurrent protection must be provided.
The device is protected against overvoltage and against polarity inversion for short time.
Wiring: 1..2 mm² pullup type terminal blocks, wire isolation stripping length 8mm, tightening torque 0.5-0.6Nm, use only 60/75 Class1 copper wires.
Warning! Before operating on the device, disconnect power line and don't turn on the device during the connection phase.
Connect every wire and after check and turn on the detector.

3. **Overload / Short circuit / Overtemperature protections**: The power supply goes in protection mode after short circuit condition. The output is protected against overvoltage generated by the connected devices. The RS485 is opto-isolated

10. **Warranty**: detector is guaranteed to be free from factory defects for two years from delivery date.
Failures caused by misuse, external and/or abnormal events (e.g. mains overvoltage, surges, etc.) or non-respect of above points, are not covered by warranty. Opening the housing for repair makes warranty to be no longer valid.
Warning! Non-respect of above indications may result dangerous and reduce performances and safety.
Kairos S.r.l. has the right to change product specifications, ratings and data without previous advice

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DECLARATION
We hereby declare that the products is in compliance with EU Standards, therefore it bears the CE mark