OPÉRA Inc.

5000 Series

Digital Gas Detector/Controller

Operation Manual

Member of BACnet International

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1.0 GENERAL DESCRIPTION

The Opera series 5000 gas detectors offer commercial building owner's the precision to assure the health and safety to occupants with the tightest possible controls on energy consumption. It is a versatile, self-contained dual gas sensor that is network ready for either peer-to-peer (master slave) operation or central control for a smooth integration into new or existing energy management systems.

1.1 Applications:

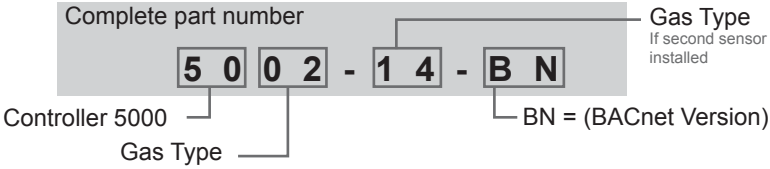
- Vehicle Emissions
- Combustible Gases
- Refrigerant Gas Leak Detection
- Industrial Health and Safety

1.2 Features:

- Stand-alone operation with 3 adjustable alarm relays, indicators and strobe
- BTL listed Smart Sensor
- BACnet MS/TP RS485 interface (Optional)
- CAN network interface for master-slave operation or central control
- Pre-calibrated plug-and-play sensor modules
- Impact resistant splash proof enclosure.

2.0 MODEL SELECTION GUIDE

Example:



		Gas Type	Range
NH_3	Ammonia	04	0-250 ppm
Ar	Argon (O_2 depletion)	23	0-50% O_2
C_4H_{10}	Butane	05	0-50% LEL
CO_2	Carbon Dioxide	15	0-2000 ppm
CO_2	Carbon Dioxide	15	0-5000 ppm
CO	Carbon Monoxide	02	0-100 ppm
$CO\ H_2nil$	Carbon Monoxide	02H2nil	0-100 ppm
CO	Carbon Monoxide	02-250	0-250 ppm
CL_2	Chlorine	17	0-10 ppm
$C_2H_4(OH)_2$	Ethylene glycol	01	0-1000 ppm
C_2H_5OH	Ethanol	01	0-1000 ppm
	HCFCs	13	
	HFCs	20	
He	Helium (O_2 depletion)	23	0-25% O_2
$H_2O\ in\ air$	Humidity (relative)	25	0-100% RH
H_2	Hydrogen	08	0-50% LEL
H_2S	Hydrogen sulfide	16	0-50 ppm
C_4H_{10}	Iso-butane	05	0-50% LEL
C_3H_7OH	Iso-propyl Alcohol	01	0-1000 ppm
CH_4	Methane	05	0-50% LEL
CH_3OH	Methanol	01	0-1000 ppm
	Nitrogen (oxygen depletion)	23	0-50% O_2
NO_2	Nitrogen dioxide	14	0-10 ppm
$VOCs$	Organic Vapors	01	0-1000 ppm
O_2	Oxygen	22	0-50% O_2
C_3H_8	Propane	06	0-50 % LEL

3.0 SPECIFICATIONS

Outputs:

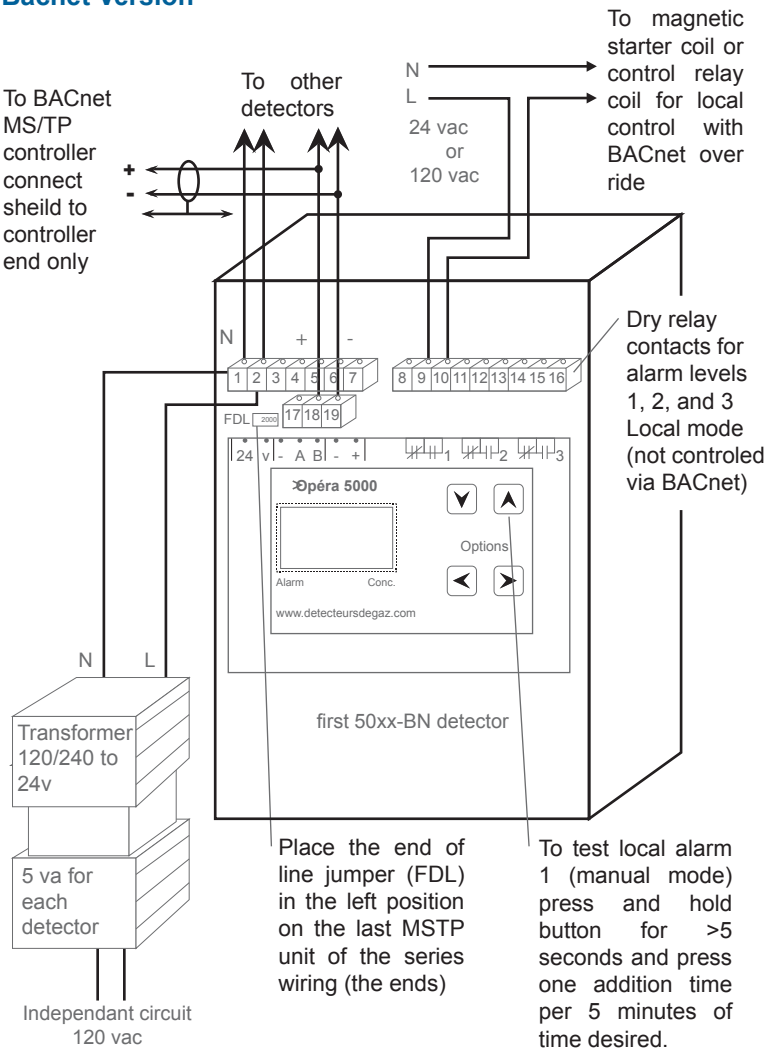
- Digital networks
    - CAN network for central control or peer-to-peer
    - BACnet MS/TP RS485 (BTL listed) (Optional)
- Relays SPDT, 5 amp @ 125 vac, non-inductive
    - On delay; 0-999 seconds (16 minutes)
    - Off delay; 0-999 seconds (16 minutes)

User Interface:

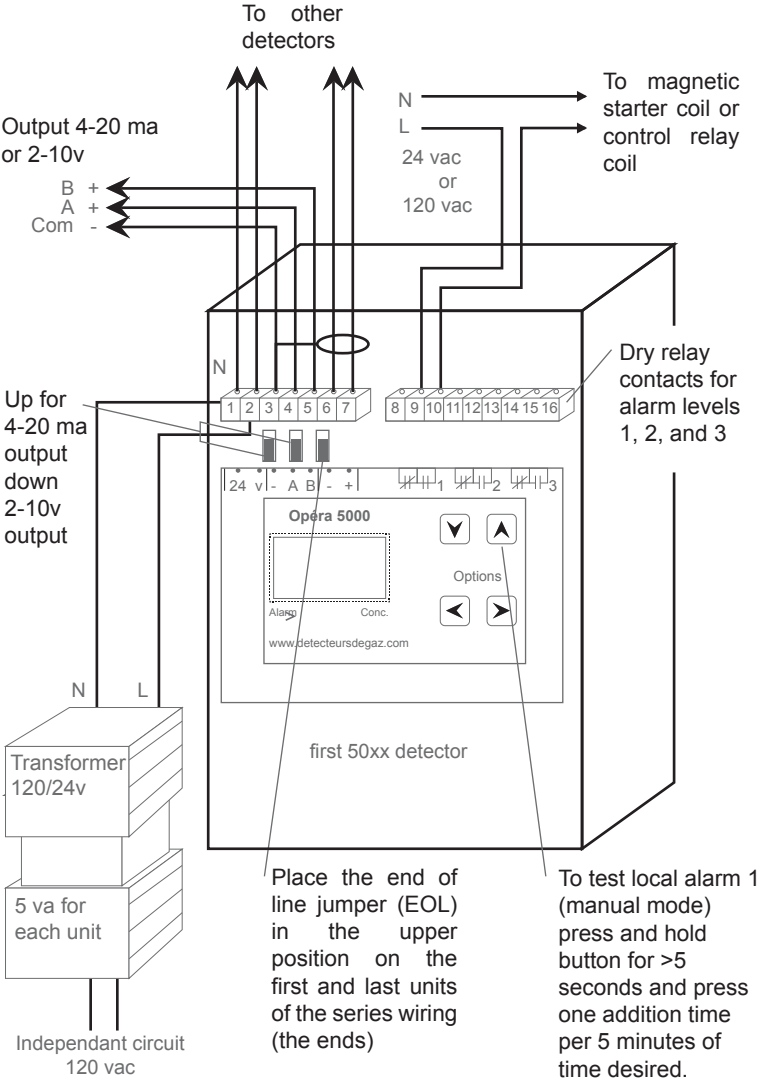
- LCD display shows gas concentration, user settings, calibration controls
- Audible alarm, 80 db on level 3 at 1 meter
- 4 pushbutton user keypad
- Password control for settings

4.0 INSTALLATION

Bacnet Version



4.0 INSTALLATION *(Continued)*



4.1 Installation Guidelines

All wiring must conform to local building codes, regulations and laws.

1. Use ½ in EMT conduit for all wiring.
2. Install enclosed 120/24 vac transformer, 5 va per sensor or controller, using 18 to 20 AWG two conductor wire. Do not tie the secondary to ground. Connect multiple sensors. Ensure that the polarity of the connections are the same at each sensor or controller.
3. Connect relay contacts (usually relay 1) to ventilation system. Use a magnetic starter so that the sensor contacts energize the starter coil and not the fan motor directly.
4. For multiple sensors, chain a shielded twisted pair cable 20 to 24 AWG from screw 6 and 7 on one sensor, to the next and continue chain to the last sensor. Maintain the same polarity on each unit. Do not use star configuration. T connections should be less than 3 meters (10 feet) from the chain. Best to make all chain connections at the sensors to avoid T connections.
5. Move the end-of-line jumper (the third one on the right) to the on position (UP) on the first sensor, or controller, on the chain and the last sensor/controller on the chain. A controller can be located anywhere on the chain. Ensure its EOL jumper is off if it is in the middle. Any address assigned to a sensor/controller can be in any location on the chain.

4.2 Installation Guidelines *(Continued)*

6. Power on the units. They will display the gas type and reading. To verify if the sensors are communicating correctly, change setting no. 56 from 0 to 1 to turn on the network display. Press ↑ and ← simultaneously to save then press and hold ← for a few seconds. The unit will display each sensor connected. If the unit does not display the other sensors scrolling by, check the following;

    - each unit has a unique address, setting 39, with no duplicates
    - end-of-line jumpers are set on units at ends of cable only
    - polarity of the communication cable and the 24 vac
    - wire connections for shorts, etc.

7. To test communication, press and hold the up button on sensor for 5 seconds to start manual mode (5 minutes). This will close the relay 1 on that unit and all of the other units on the network.

5.0 OPERATION

5.1 Screen Display

The LCD shows the type of gas and the current gas concentration, depending on the model of sensor module plugged in. If two sensor modules are installed, the display will alternate between them.

The bottom left corner will also display the alarm status;

1 indicates alarm 1 on, according to the settings 0, 1, 2 or activated by another sensor on the CAN network via setting 36. This is usually the low gas level alarm.

2 indicates alarm 2 on. Per settings 3, 4, 5 or if activated by another sensor on CAN network per setting 37.

3 indicates alarm 3 on. Per settings 6, 7, 8 or if activated by another sensor on CAN network per setting 38.

M indicates manual override mode active. Useful to start ventilation system without the risk of leaving it on (and freezing the space in winter). Press and hold ↑ for 5 seconds to start manual mode. Then click again to increase time from 5 to 60 minutes. This activates alarm 1, 2, or 3 (per setting 69) and sends alarm transmit messages in settings 9-17. The unit will return to automatic operation after the time runs down. To cancel manual mode press ↓ several times to reduce time left to run. It will take a few seconds to stop.

T indicates alarm 1 on due to high ambient temperature, setting 51. Useful for summer ventilation.

5.2 Settings

User settings are factory pre-loaded with default values to facilitate set up and can be changed at any time. Upgrading firmware will not affect user settings.

Alarm thresholds should be set to suit local regulations. Default values for these are general guidelines only.

5.3 Displaying Settings

Press → and ← to move through the settings. If the keypad lock is on then enter the password first. The screen will display the setting number 0, 1, 2, etc plus the short description (eg; AL1) and the current setting value.

5.4 Changing Settings

Press the ↑ or ↓ buttons to increase or decrease the setting.
To save, press ↑ and ← buttons at the same time. The word “OK” will appear. If you do not see “OK” and the new value it is because the buttons were not pressed simultaneously. Try again.

5.5 Settings

Sensor A (left socket) settings

No.	Name	Description	Range	Default (CO/NO_2)
0	AL1	Alarm 1 threshold, activates relay 1		25
1	A1D-	Alarm 1 Delay on (seconds)	0-999	30
2	A1D+	Alarm 1 Delay off (seconds)	0-999	20
3	AL2	Alarm 2 threshold, activates relay 2		35
4	AL2D-	Alarm 2 Delay on (seconds)	0-999	30
5	AL2D+	Alarm 2 Delay off (seconds)	0-999	20
6	AL3	Alarm 3 threshold, activates relay 3 sounder		75
7	A3D-	Alarm 3 Delay on (seconds)	0-999	180
8	A3D+	Alarm 3 Delay off (seconds)	0-999	20
9	A1Tx	Alarm 1 transmit message, CAN network	0-255	1
10	A1Tx	Alarm 1 transmit message, CAN network	0-255	
11	A1Tx	Alarm 1 transmit message, CAN network	0-255	
12	A2Tx	Alarm 2 transmit message, CAN network	0-255	2
13	A2Tx	Alarm 2 transmit message, CAN network	0-255	
14	A2Tx	Alarm 2 transmit message, CAN network	0-255	
15	A3Tx	Alarm 3 transmit message, CAN network	0-255	3
16	A3Tx	Alarm 3 transmit message, CAN network	0-255	
17	A3Tx	Alarm 3 transmit message, CAN network	0-255	
18	AL1	Alarm 1 threshold, activates relay 1		0.5

5.5 Settings *(Continued)*

Sensor B (right socket) settings

No.	Name	Description	Range	Default (CO/NO_2)
19	A1D-	Alarm 1 Delay on (seconds)	0-999	30
20	A1D+	Alarm 1 Delay off (seconds)	0-999	20
21	AL2	Alarm 2 threshold, activates relay 2		1.0
22	A2D-	Alarm 2 Delay on (seconds)	0-999	30
23	A2D+	Alarm 2 Delay off (seconds)	0-999	20
24	AL3	Alarm 3 threshold, activates relay 3 sounder		2
25	A3D-	Alarm 3 Delay on (seconds)	0-999	180
26	A3D+	Alarm 3 Delay off (seconds)	0-999	20
27	A1x	Alarm 1 transmit message, CAN network	0-255	1
28	AL1Tx	Alarm 1 transmit message, CAN network	0-255	
29	A1Tx	Alarm 1 transmit message, CAN network	0-255	
30	A2Tx	Alarm 2 transmit message, CAN network	0-255	2
31	A2Tx	Alarm 2 transmit message, CAN network	0-255	
32	A2Tx	Alarm 2 transmit message, CAN network	0-255	
33	A3Tx	Alarm 3 transmit message, CAN network	0-255	3
34	A3Tx	Alarm 3 transmit message, CAN network	0-255	
35	A3Tx	Alarm 3 transmit message, CAN network	0-255	
36	X>R1	Receive message to activate reelay 1, CAN network	0-255	1
37	XR2	Receive message to activate reelay 2, CAN network	0-255	2

5.6 General Settings

No.	Name	Description	Range	Default (CO/NO_2)
38	XR3	Receive message to activate sounder and relay 3 CAN network	0-255	3
39	Adr	Sensor identification address, CAN network	0-32	0
40	AnZA	Adjustment, analog output zero, output A (left) accessing code 40 will force analog output to zero	255	51
41	AnSA	Adjustment, analog output span, output A (left) accessing code 41 will force analog output to 10v	255	217
42	AnZB	Adjustment, analog output zero, output B (right) accessing code 42 will force analog output to zero	255	51
43	AnSB	Adjustment, analog output span, output B (right) accessing code 43 will force analog output to 10v	255	217
44	Temp	Temperature delay enable off/on	0/1	0
45	Aud	Local audio alarm enable on alarm 3	0/1	1
46	BAC	BACnet MSTP mode select 0 = BACnet communication disabled 1 = BACnet communication enabled	0/1/2	0
46	Net	CAN Network display on/off	0/1	0
47	BMA	BACnet MAC address	127	0
48	BBR	BACnet baud rate 0 = 9600 1 = 19200 2 = 38400 3 = 76800	3	
49	PASS	Keyboard lock	0/1	0

5.6 General Settings *(Continued)*

No.	Name	Description	Range	Default (CO/NO_2)
50	TMod	Tempurature modify/calibrate	-9/+9	0
51	T+/-	High tempurature alarm limit used for summer ventilation (alarm 1) Deg C	0-99	60
52	DEL	Warm up delay disables alarms (mins)	0-99	1
53	BMM	BACnet maximum MAC address	0-127	127
54	BDG	BACnet diagnostic display while accessing this option		
55	TALB	Low tempurature alarm limit (alarm 3) Deg C	0-99	
56	Net	Enable local display of all sensors on home screen CAN network	0/1	0
57	Ref-A	Refrigerant scale and type of gas for sensor A For model 5520: R507, R23, R134a, R152a, R492a, R404a, R407a, R408a, R410a, R500, R502, R507 For model 5513: RR22, R21, R141b, R142b, R401a, R402a, R408a, R409a, R502a		
58	Ref-B	As setting no. 57 but for sensor B (bottom socket)		
59	FltTx	Fault alarm transit message, CAN network	0-255	0
60	VDA	Analogue drive transmit message, sensor A (top) CAN network	0-255	0
61	VDAm	Analogue drive. Minimum percent of scale for zero output. Sensor A	0-100	0

5.6 General Settings *(Continued)*

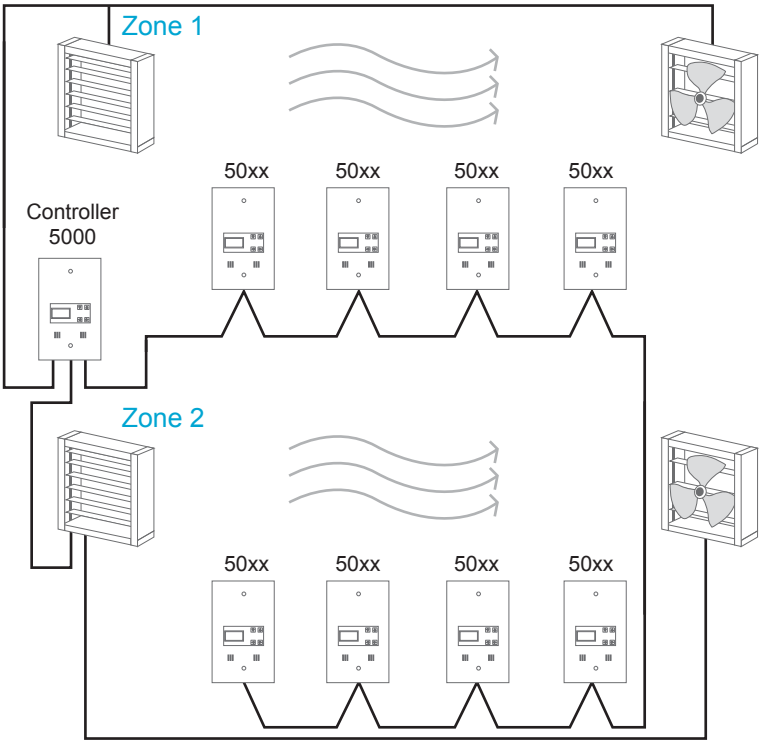
No.	Name	Description	Range	Default (CO/NO_2)
62	AMaxA	Analogue drive. Maximum percent of scale for full scale output. Sensor A	0-100	100
63	VDA<	External code received for variable speed drive, output A	255	0
64	ADTxB	Analogue drive transmit message, CAN network sensor B	0-255	0
65	AMinB	Analogue drive. Minimum percent of scale for zero output. Sensor B	0-100	0
66	AMaxB	Analogue drive. Maximum percent of scale for full scale output. Sensor B	0-100	100
67	VDB<	External code received for vairable speed drive, output B	0	0
68	Baud	Baud rate for CAN network Maximum network wire length is 1500 feet at rate 0 and 3000 feet at rate 1. Set Baud rate = 1 when used with model 5000 network	0-1	0
69	Man	Manual mode activates alarms 1, 1+2 or 1+2+3. See screen display section.	1-3	1

6.0 NETWORK CONFIGURATION

6.1 Using a Central Controller

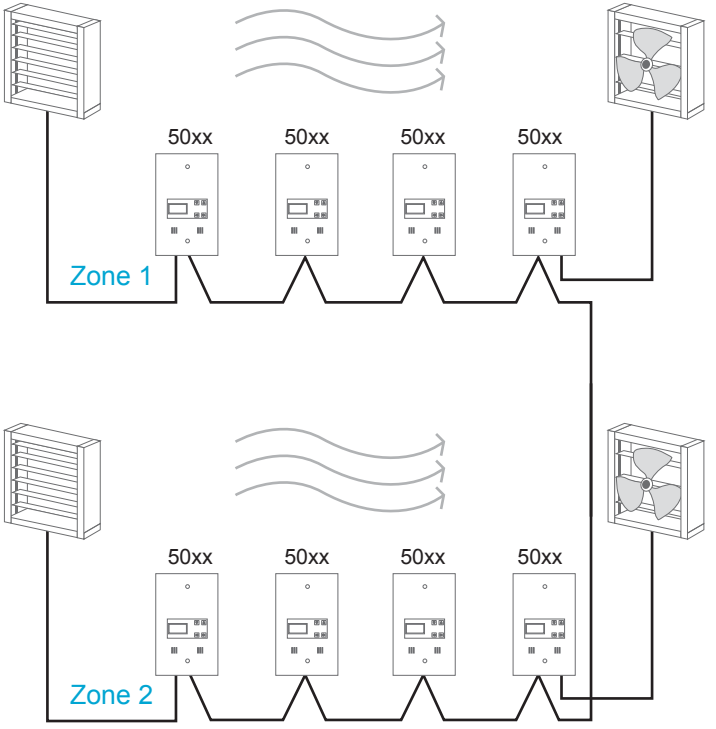
A basic model 5000 controller serves as the central connection point for the ventilation system. Model 50XX gas sensors transmit alarm messages to the central controller.

A controller will display up to 32 sensors on the network (64 for dual units). It also displays their address, gas types, gas concentration, and alarm status for each. The two relays on board can be configured for different levels of gas or to operate different ventilation systems, zones or groups.



6.2 Using No central controller (master/slave operation)

One of the 50XX series gas sensors can perform the same function as the controller. It can activate the ventilation for all the sensors, or a group. The use of a dedicated controller is optional, - to add a display in some specific location, such as before entering a mechanical room or interface with several fan starters which are located in one place. The low cost of a basic controller makes it easy to use them to reduce costly field wiring where needed.



6.3 Defaults

Sensors are shipped pre-loaded with a default settings which can be changed in the field to suit the desired sequence with simple keypad input. Using the default settings, when one sensor goes into alarm level 1, 2 or 3 it activates its relays and transmits a message to all other sensors to activate their relays also. The ventilation system can be connected to any of the relays (usually level 1). This is essentially a one zone configuration.

6.4 Addresses

Set each sensor and controller to a different address (setting 39). 1, 2, 3, 4 etc. It is important to have no duplicates on the same network cable. Addresses are independent of groupings.

6.5 Creating Zones or groups

To control multiple zones, set the transmit message on sensors to different messages for different zones. The default transmit messages are 1, 2, 3 for alarm levels 1, 2, 3 for zone 1.

Set zone 2 sensors to transmit messages to 4, 5, 6
Set zone 3 sensors to transmit 7, 8, 9 and so on.

6.6 Output Relays

Relay number 1, 2 and 3 will activate if the gas on that sensor goes into alarm level 1, 2 or 3. It will also activate when it sees it's receive code (setting 36, 37) go by on the network, sent by other sensors.

The 5000 basic controller has no sensors on board so the relays will only activate if it sees it's receive codes. The 5000 controller could control two zones via its two relays. When no controller is used, the master needs to be a member of the group it is controlling.

7.0 MAINTENANCE GUIDE

All sensors are shipped from the factory pre-calibrated. To maintain accuracy and conformity with standards it is essential that they be calibrated by a qualified technician at least once per year using certified bottled gas mixtures.

7.1 Quick Test Caution

Opera does not approve the use of the so called “bump test”. Here, a gas of a higher concentration than the alarm level is simply injected into the sensor to cause the alarm to trigger. The gas in these bottles is a higher concentration than what is used for proper calibration. This only test the operation of the alarm with no regard for the intended alarm settings, similar to simply pressing a test button.

Use certified precision mixtures to adjust the sensitivity of the sensor due to normal wear and aging and guarantee that the designed alarm set points are respected. It will also indicate the general condition of a sensor that is due for replacement. So called “automatic calibration” or “self-test” will not provide this level of security.

7.2 Calibration Procedure

1. Use certified bottled calibration gas mixtures only. Ensure that sensors are powered on for a minimum of the break-in period for the sensor. For electro-chemical sensors this is only a few minutes.
2. Press the right arrow to enter settings
3. Press the ↑ and → at the same time to enter calibration mode. SAZ (sensor A zero) will display and the current gas reading on the top line
4. Inject bottled zero gas into first sensor at a rate of 0.5 to 2.0 liters per minute. Ensure that sensor fitting is not 100% sealed so as not to increase pressure
5. Adjust gas reading to zero with the ↑ and ↓ buttons
6. Press ↑ and ← at the same time to save
7. Press → The display will show SAS (sensor A span) and the current gas reading
8. Inject bottled span gas into first sensor and wait until the gas reading stops going up.
9. Adjust the reading to match the concentration in the bottle
10. Press ↑ and ← at the same time to save
11. If second sensor installed press → and repeat steps 3 to 10 for sensor B
12. Press left arrow to return to settings.