MICRO THERMO TECHNOLOGIES™

Refrigerant Leak Detector
023-064X Technical Manual

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Micro Thermo Technologies, 12855 rue Brault, Mirabel, QC, Canada, J7J 0C4 Fax: 450-668-2695
Phone: 450-668-3033 Toll Free Canada: 1-888-664-1406 Toll Free USA: 1-888-920-6284

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Safety Information

This manual describes information required to install, operate and maintain series 6000 gas detectors. Read and study before attempting to install or operate sensors. Installation and operation not in accordance with this manual can result in sickness or death. Relay connections may be used to control 120 vac equipment. Ensure power is disconnected from relays before attempting to service this unit.

1 General Description

023-064X series gas detectors are versatile, self-contained gas sensor monitors, used for automated ventilation control and/or warning systems. They can easily be networked together, with or without a central controller into groups.

1.1 Applications:

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

1.2 Features:

- Stand-alone operation with 1 adjustable alarm relay, indicators and strobe
- BACnet Laboratory (BTL) listed Smart Sensor, up to 76,800 baud
- BACnet MS/TP RS485 interface
- CAN network interface for master-slave operation or central control via a controller.
- Pre-calibrated plug-and-play sensor modules avoid the need to recalibrate when upgrading expired sensors.
- Impact resistant, water resistant enclosure, with top wire entry and drip proof wire guide.

1.3 Ordering information

Model Number	Type of refrigerant (Sensor Range 0-100%)	
023-0642 HFC	R513	0-1200 ppm
	R134a	0-2000 ppm
023-0362 (replacement module)	R152a (R414b)	0-600 ppm
	R402a (HP-80)	0-600 ppm
	R404a (HP-62)	0-800 ppm
	R407a (R407f, R438a)	0-1400 ppm
	R408a	0-800 ppm
	R409a	0-600 ppm
	R410a (R448a, R449a)	0-1400 ppm
	R500	0-800 ppm
	R502	0-800 ppm
	R507 (AZ-50)	0-800 ppm
023-0643 HCFC	R21	0-600 ppm
	R22	0-1000 ppm
023-0363 (replacement module)	R141b	0-900 ppm
	R142b	0-800 ppm
	R401a (MP-39)	0-1200 ppm
(023-0642 recommended)	R402a (HP-80)	0-1500 ppm
(023-0642 recommended)	R408a	0-1500 ppm
(023-0642 recommended)	R409a	0-1500 ppm
(023-0642 recommended)	R502	0-1500 ppm

1.4 Specifications

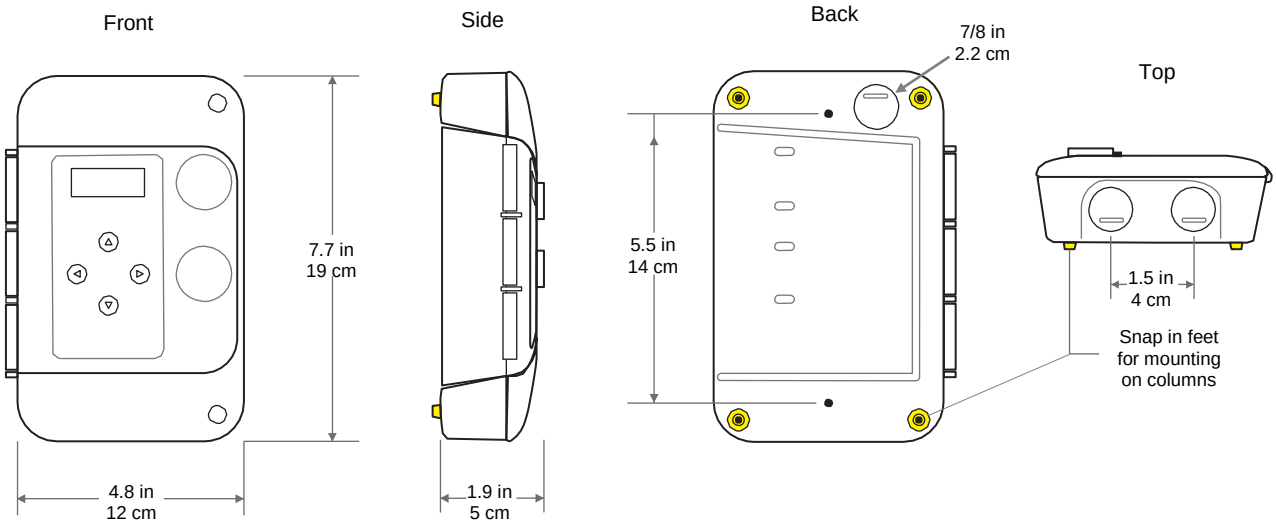
- Supply 24 vac 50/60 hz (17-28 vac) 0.21 amps, 5 va
- Relay SPDT, 5 amp @ 125 vac, non-inductive
  On delay; 0-999 seconds (16 minutes) Off delay; 0-999 seconds (16 minutes)
- 2 analog output 4-20 ma or 2-10v jumper configurable
- Operating temperature -20 ºC to 40 ºC (-4 ºF to 104 ºF) -40 ° under some conditions
- For indoor use
- Flame resistant Polycarbonate ABS enclosure rated UL94-V0, 5VB, and 5VA
- Standards. Conforms to UL61010-1, CSA C22.2
  61010-1-12, ANSI/ISA 61010-1, CSA C22.2 no. 205-12
- Pollution degree 2
- Installation category II
- Altitude 2000 m (6500 ft)
- Humidity max 80% rh. 80% to temperatures up to 31 ºC (88 ºF),
  decreasing linearity to 50% rh at 40 ºC (104 ºF)

1.5 User Interface:

- Back lit LCD display shows gas concentration, user settings and alarm status
- Red LED alarm indicators, gas level 1 and 2
- High intensity white LED strobe on level 3
- Audible alarm, 85 db at 1 meter (3.3 ft)
- 4 pushbutton ▲▼◄► user keypad
- Password control for settings

1.6 Gas sensor spec:

- Sample frequency, continuous, maximum 1 second
- Response time to gas is less than 30 seconds to 90% reading
- Type of sensing element is electro-chemical for toxic gases, semiconductor for refrigerants
- Coverage is maximum 50 feet each side of sensor with no obstructions
- Sensor Memory Module type of gas, scale, sensor calibration points, zero, gain



2 Installation

Important. All wiring must conform to local building codes, regulations and laws. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.1 Sensor Placement

Coverage

Guidelines for sensor placement of diffusion type sensors are based on the reasonable delay for gas to get from the source to the sensor. All sensors are created equal in this regard.

- For air quality control of exhaust emissions and accumulations of toxic gases the generally acceptable maximum radius of coverage is 50 feet (15 meters). Approximately 7500 square feet (700 square meters).
- For leak detection of combustible gases, ammonia, refrigeration gases the maximum radius is 30 feet (10 meters) since they can escape more quickly and the risk is greater.

The radius of coverage of any sensor does not extend beyond any obstruction that impedes natural circulation of air. This includes walls, stairs, elevators, shelving with solid fill, tool chests, etc. The sensor must "see" the area of coverage; if not, another sensor(s) is required.

Mounting Heights

Mounting heights for gas sensors are based on their density, relative to air. There are three groups;

1. A gas lighter than air will be more concentrated near the ceiling; hydrogen, methane (natural gas), ammonia, helium. Install at 1 to 3 feet from ceiling.
2. A gas similar density to air will be diluted in air equally at all levels; - carbon monoxide, nitrogen dioxide, hydrogen sulfide, oxygen, carbon dioxide. Install from 3 feet (1 meter) off floor to one half of the ceiling height. For vehicle emissions carbon monoxide detectors combined with nitrogen dioxide detectors are installed at 3 to 5 feet (1 to 2 meters) from the floor when the ceiling is 7 to 10 feet high. If the ceiling height is higher than 10 feet, for example for heavy equipment, the carbon monoxide detectors are installed at 3 to 5 feet (1 to 1.5 meters) from the floor as per the requirements of the Canada building code and the nitrogen dioxide detectors should be installed at 50% of the ceiling height and above the vehicle height. If the exhaust pipes of diesel vehicles are below the vehicles, then the nitrogen dioxide detectors should be installed at 3 to 5 feet (1 to 1.5 meters) from the floor. In all cases the detectors must be installed above obstructions blocking circulation of air in front of the detectors; example, maintenance garages in automobile dealerships where tool chests, work tables and storage racks typically line all walls.
3. A gas heavier than air will concentrate near the floor; - HFCs, HCFCs, propane, chlorine, most organic vapors, butane. Install 1-3 feet (30cm to 1 meter) from floor.

For all types of sensors avoid drafts, obstacles, aerosols, silicones. Place sensors in the center of its coverage area as much as possible.

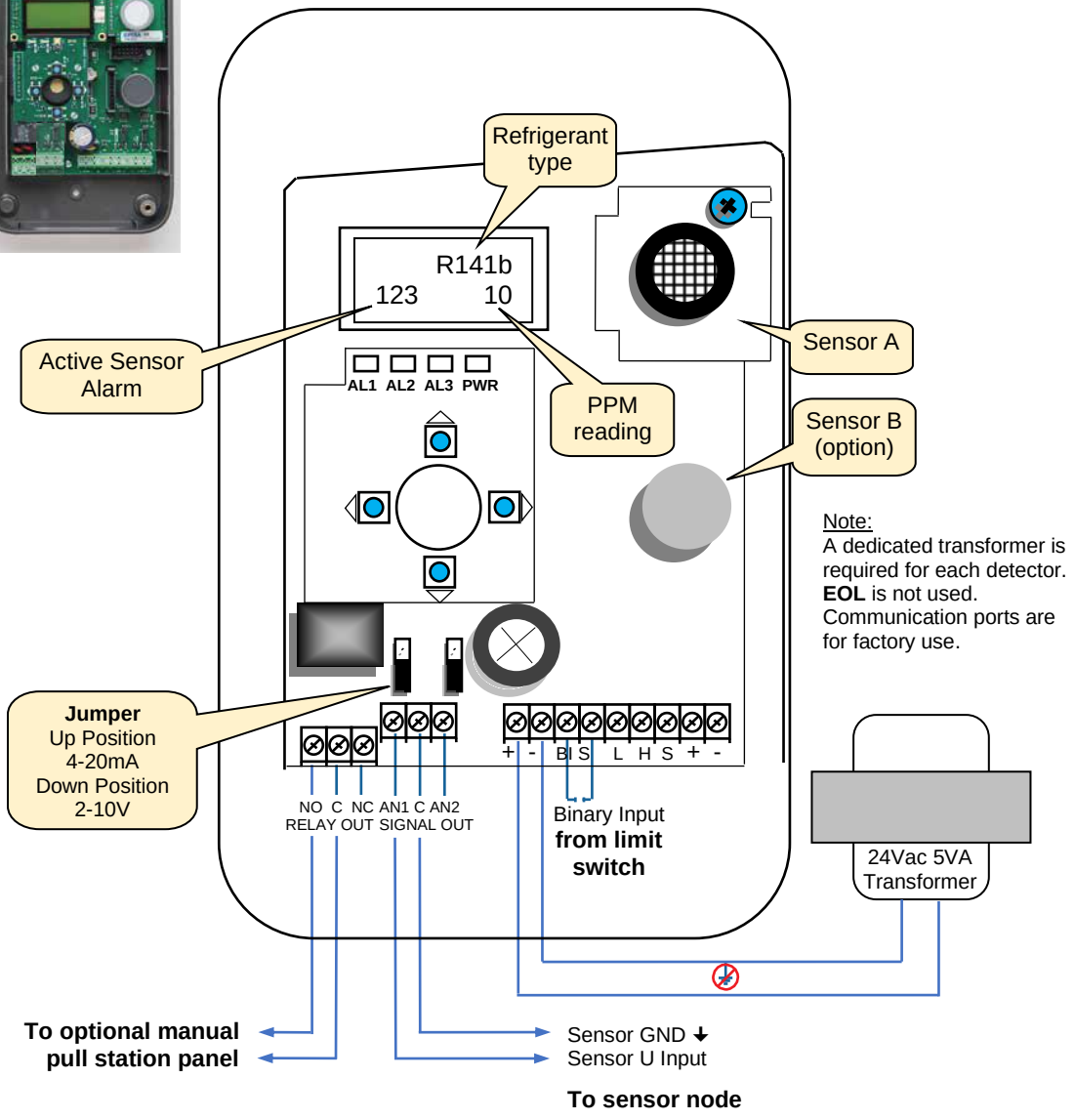
2.2 Maintenance guide

Visual verification recommended frequency: once per week. The system incorporates monitoring software which checks the operation of the circuits. This software is always running when the unit is powered on. Ensure that the unit is installed on an independent circuit. It is recommended that the unit be checked once per week to ensure that it is on, by the presence of reading on the display.

Verification of communication and calibration of sensors recommended frequency: once per year. It is recommended that sensor be verified with standardized bottled gas mixtures by the manufacturer or other qualified specialist or the sensor plug-in module be replaced with a new or factory calibrated module. The communication between the sensor and control systems should be tested. A report of compliance should be supplied and available on the site.

2.3 Physical installation:

This device is frequently used with a Manual Pull Station panel, MTT number 961-0001



Open a knock-out hole for wiring.

Wire the power on 24VAC+ and the common on 24VAC-
Wire the Sensor A signal output from AN1 and the signal ground on the G terminal

Make sure the jumper above the AN1 terminal is towards down to send 2-10V signal on the AN1 output
Place the AN2 jumper towards down to send 2-10V signal on the AN2 output
Place the according jumper towards up in the case you need to send 4-20mA signal on the output.

Dry contact wiring on the terminal block NO C NC to be connected to the manual pull station.

The jumper EOL is not used in this application and don't have any effect.

Replace the cover and screws.

3 Local user settings

3.1 Sensor configuration

Press the right arrow button ► to enter configuration
Use 0 AL1 to determine the threshold of Sensor A at which the relay should operate (default is 400ppm). Setting 1 A1Del is the set time (default is 30 sec), 2 A1Off is the reset time (default is 20 sec). The relay reset by its own, there is no need to acknowledge an alarm.
To set the audible alarm use the 6 AL3, 7 A3Del and 8 A3Off
See section 3.2 User settings list.

Default display scale is R22 or R507 and it can be changed by the user.
*To view the current settings on the model 023-064X, press **right** ► until you reach the desired setting.*
To modify press up ▲ or down▼. See section User settings list for more information.
*To save, press left ◄ and up ▲ buttons at the same time. The appearance of **OK** will confirm successful save.*

Example: To set the reading scale for R141b you have to change the gas type as follow:
*Press **right** ► to display the value for 57 Ref-A (hold arrow to speed up) then press up ▲ to change gas type (see available gas type and their ppm range at section Ordering information).*

3.2 User settings list

To view the current settings on the model 023-064X, press right ► several times.
To modify the current setting press up ▲ or down ▼.
To save, press **left** and **up** arrows ◄ and ▲ at the same time. The appearance of **OK** will confirm successful save.

Setting Code		Definition	Display	Maximum value	default
Sensor A (first module, plugged into the top slot)				Firmware rev 2B29.9	
	Sensor B (second module, plugged into the bottom slot)				
00	18	Alarm 1 and relay limit	AL1	sensor scale	400ppm
01	19	Alarm 1 set time (seconds)	A1Del	999	5s
02	20	Alarm 1 reset time (seconds)	A1Off	999	300s
03	21	Alarm 2 limit	AL2	sensor scale	400ppm
04	22	Alarm 2 set time	A2Del	999	5s
05	23	Alarm 2 reset time	A2Off	999	300s
06	24	Alarm 3 limit	AL3	sensor scale	400ppm
07	25	Alarm 3 set time	A3Del	999	5s
08	26	Alarm 3 reset time	A3Off	999	5s
40		sensor A analog output zero (factory set)	AnZA	255	
41		sensor A analog output span (factory set)	AnSA	255	
42		sensor B analog output zero (factory set)	AnZB	255	
43		sensor B analog output span (factory set)	AnSB	255	
44		℃ temperature display 0=off 1=on	Temp	0/1	0
45		audio alarm 3 off/on	Aud	0/1	1
49		Keyboard security lock, 0=off, 1=on	KBL	0/1	0
50		Temperature modify/correct	TMod	-9/+9℃	
51		High temperature alarm limit (alarm 1)	ATHi	0-99℃	60
52		Warm up delay, disables alarms on power up	W/U	0-99 mins	60
55		Low temperature alarm limit (alarm 3)	ATLo	0-99℃	0
56		Network Display on/off (non BACnet version)	Net	0/1	0
57		sensor A refrigerant ppm scale	Ref-A	Refrig list	Rx
58		sensor B refrigerant ppm scale	Ref-B	Refrig list	Rx

Where default Rx is R507 for 023-0642 and R22 for 023-0643

3.3 Test

Analog output

To test the output signal, power the sensor and wait for the warm-up period to expire
Press right ► several times until you see 40 AnZA. Press up ▲ or down ▼ to fine tune the output.
Use 40 AnZA to force sensor A output to 2V (4mA) (min range 0 ppm)
Use 41 AnSA to force sensor A output to 10V (20mA) (max range)
Use 42 AnZB to force sensor B output to 2V (4mA) (min range 0 ppm)
Use 43 AnSB to force sensor B output to 10V (20mA) (max range)

Relay output

To force the relay output 1 for 5 minutes, press up ▲ for more than 5 sec. Add 5 minutes each time you press up ▲.
"MAN" or "M" at the left of the display will tell that the relay is overridden.
To cancel the relay override, press down ▼.

4 Operation

The power supplied should be between 17 to 28 vac or between 21 to 30 vdc. If the power is too high or too low the sensor will not work properly.

Each time the unit is powered on with proper power, the relay is disabled and the analog outputs stay at 0 during the warm up period. This is to allow time for the sensor to warm up and to avoid false alarm due to high readings of the cold sensor. The warm up timer may be cancel by pressing any arrow. The reading may take a few more minutes to stabilize as the sensor may need more warm-up time if it was not powered for many days. The warm up time can be changed to up to 255 sec with the 52 W/U user setting. After power-up it will take 48 hours for maximum accuracy to be obtained, although accuracy is very good after an hour.
When the gas concentration is higher than the threshold set by AL1 for the time A1Del the relay is energized. The display will display 1 at the bottom left of the display. The relay will de-energized A1Off seconds after the gas concentration drops below the threshold.
AL1 is for relay settings, AL2 is for alarm 2 settings and AL3 is for alarm 3 and buzzer settings.
See section 3.2 User settings list to change any setting.
The buzzer may sound when alarm 3 activates. To silence the buzzer, press any arrow.

See section 3.3 Test for override and test commands.

5 Calibration

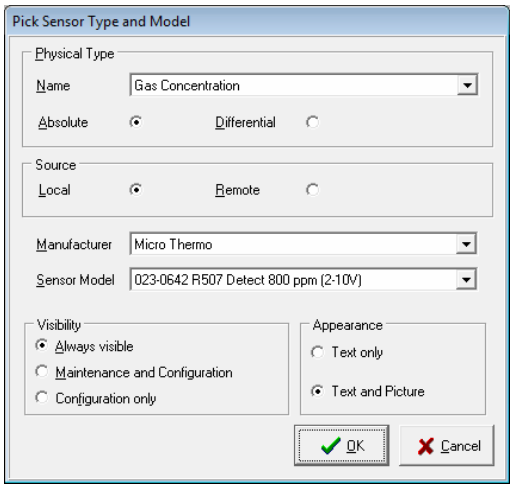
Procedure specifically for refrigerant sensors:
1. Use certified bottled calibration gas mixed with air only, not nitrogen. Ensure that sensors are powered on for a minimum of the break-in period for the sensor. For these sensor types, this is two days.
2. Inject bottled span gas and wait until the gas reading stops going up. The span gas used must be within the range of sensor's scale. Use a flow rate of 0.1 LPM to 0.5 LPM. The gas fitting to sensor should have a small outlet hole. If not, the pressure will increase and distort the reading (high).
3. Adjust the blue potentiometer on the module to set the sensor reading displayed to that of the bottle mix. Do not change the factory calibration constants in calibration mode as above.
4. Remove span gas mix and supply air. Sensor will return to zero.
5. If sensor does not return to zero, it needs replacement

Mode conveniently you can order a new replacement sensor module factory calibrated
See section 1.3 Ordering information

6 MT Alliance installation

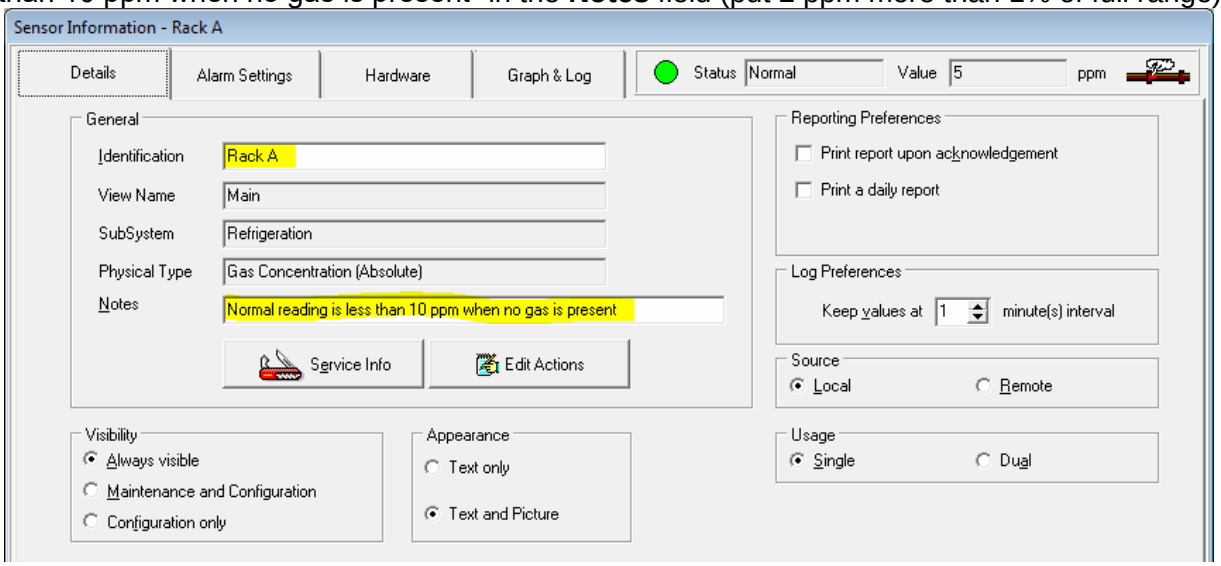
Log into MT Alliance. You must have **technician refrigeration configuration** permissions.
Enter configuration Mode.
Select and zoom in the view where the sensor is located.
From the **Components box** Pick and drop a Sensor

Then select **Absolute Gas Concentration Type**, **Local Source**, **Micro Thermo** Manufacturer and the **Sensor Model** and gas type you are going to monitor (pre-defined sensor model will be available in version MTA 8.5. For previous version create a user defined model at the next section or use the 023-034X series)

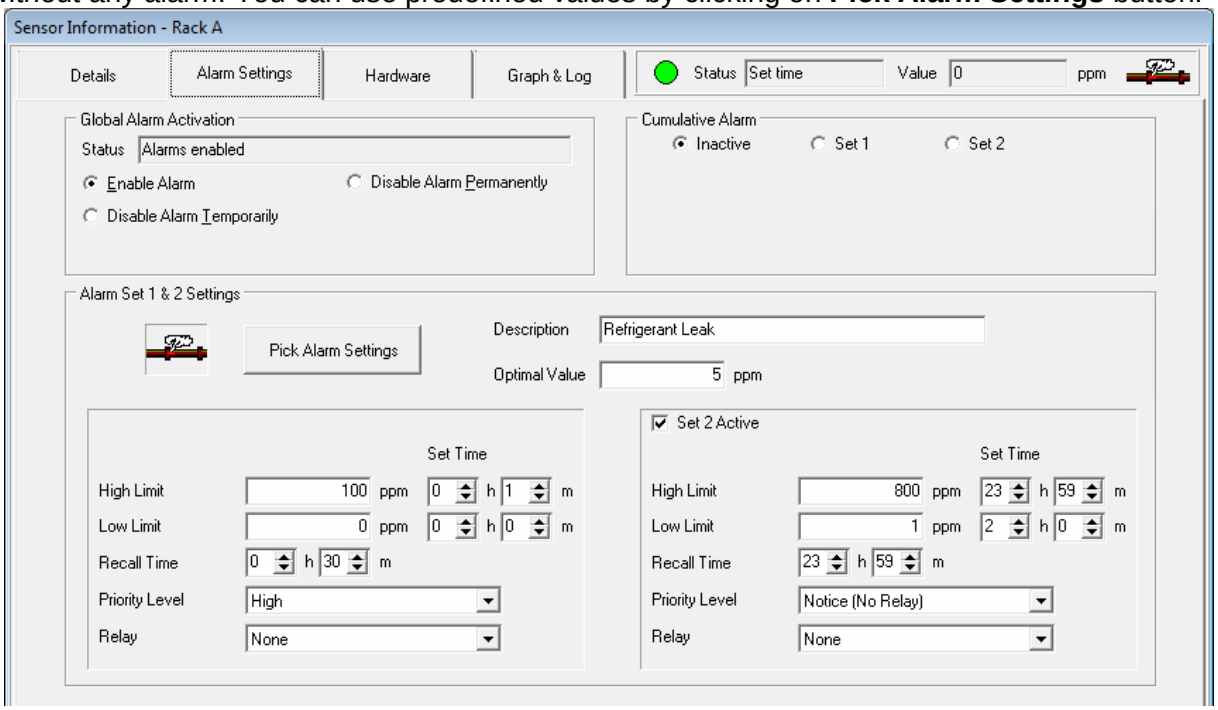


Click OK then click on the new button. 

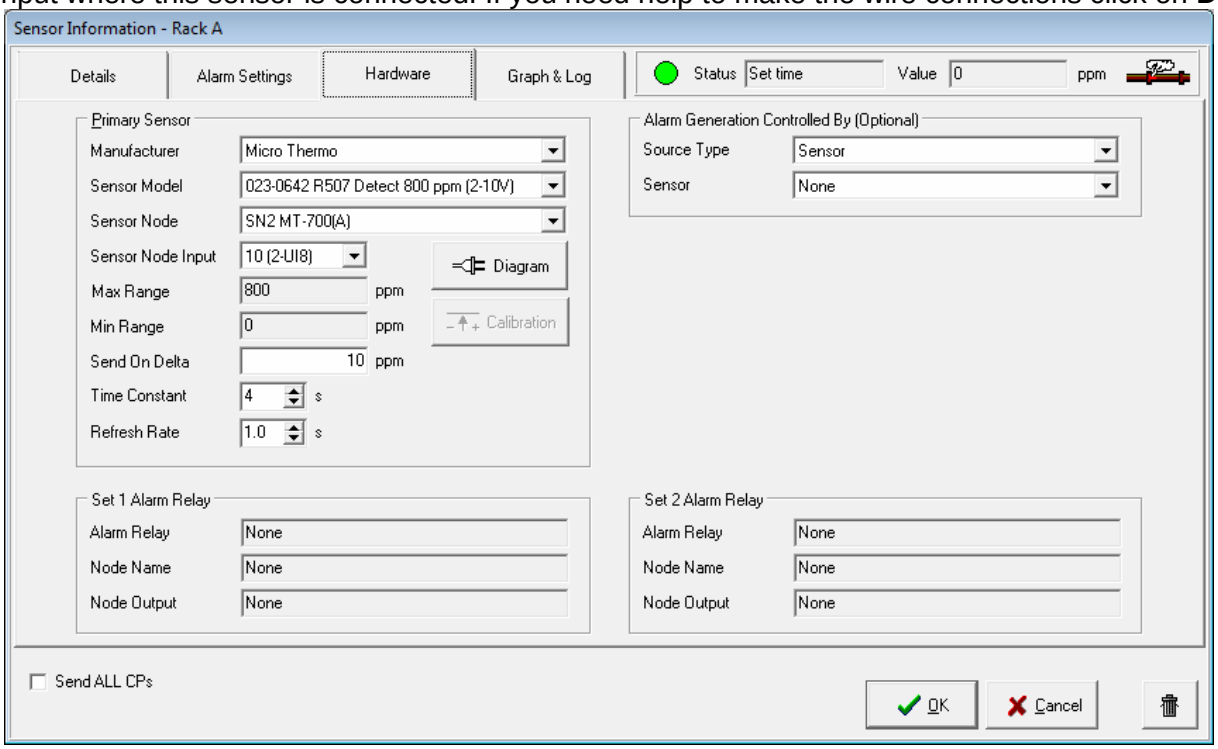
Select the **Detail** tab and enter a sensor name in the **Identification** field and put “Normal reading is less than 10 ppm when no gas is present” in the **Notes** field (put 2 ppm more than 1% of full range)



Select **Alarm Settings** tab to set the limit values and the set time inside which the monitoring should run without any alarm. You can use predefined values by clicking on **Pick Alarm Settings** button.



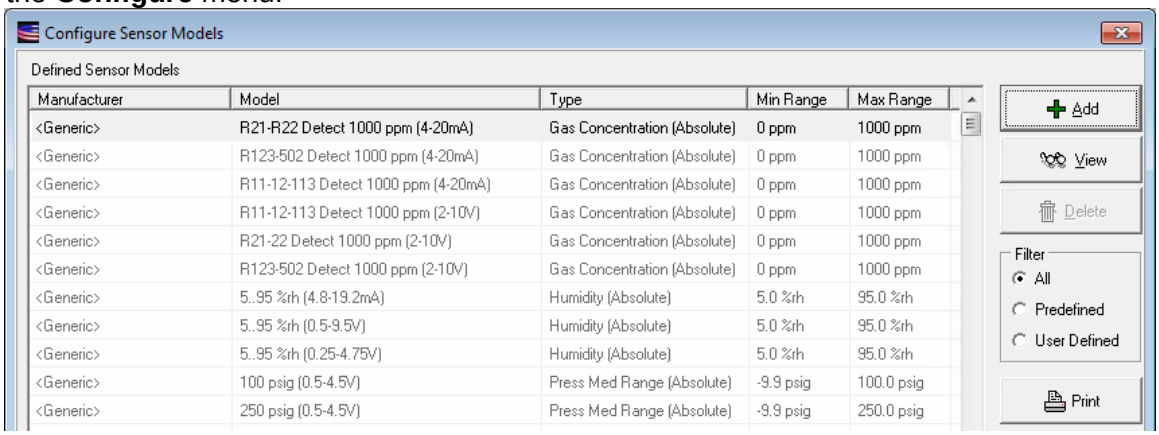
Select the **Hardware** tab to review the sensor manufacturer and model and where you can select the node and input where this sensor is connected. If you need help to make the wire connections click on **Diagram**.



Click **OK** to complete the connection. If the node is connected, you should get a green status right away even if the sensor is not powered.

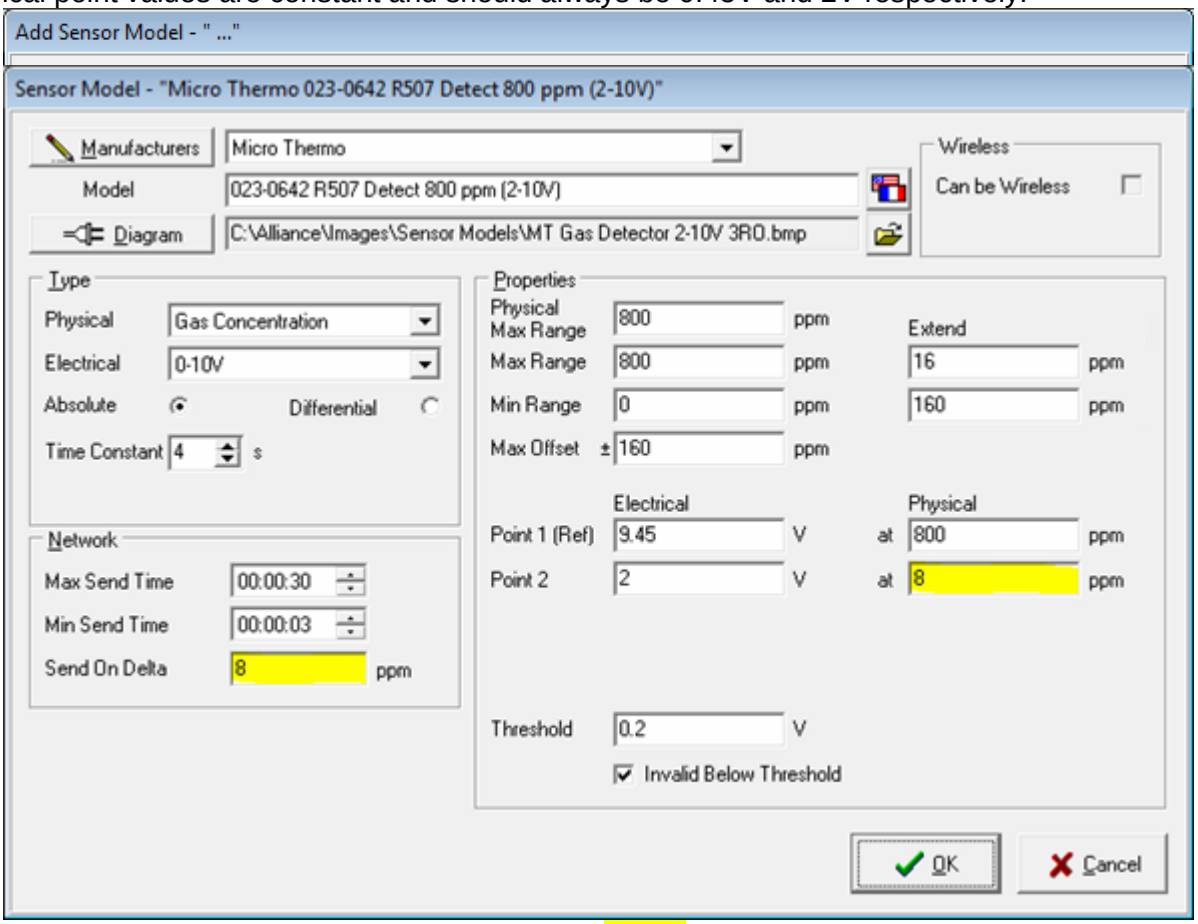
7 To add a missing Sensor model in the list

If the required 023-064X model does not exist on your site, you can create one with the **Sensor model** form in the **Configure** menu:



Click **Add** and fill the form using the gas type and range accordingly to the table at section 1.3 Ordering information

Electrical point values are constant and should always be 9.45V and 2V respectively.



Please pay special attention to put 1% of full range (8 ppm for 800 ppm) for Send On Delta and for the bottom signal range Point 2. For all sensor with ppm reading keeping a non-zero value at Point 2 is the way to allow the MT Alliance to monitor the heartbeat of the sensor while the sensor is showing 0 ppm.