# SEC 2000 Millenium Infrared Gas Detector

**Instruction and Operation Manual** 

Sensor Electronics Corporation 5500 Lincoln Drive Minneapolis, Minnesota 55436 USA (952) 938-9486 Fax (952) 938-9617 Email: sales@sensorelectronic.com Web site: www.sensorelectronics.com

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# **Sensor Electronics Corporation**

Sensor Electronics Corporation (SEC) is an innovative manufacturer of fixed system gas detection equipment, for combustible gases, oxygen and toxic gases.

## **Fixed Systems**

Sensor Electronics Corporation offers a complete line of fixed systems. Available in stand-alone and wall mount configurations, these versatile systems can be tailored to meet the most demanding industrial applications. Our fixed systems are designed for continuous, multi-location monitoring and feature recorder outputs for long term data storage and software packages for PC based annunciation and recording.

## Commitment

Our quality and service are uncompromising. We back each of our products with a one-year warranty on all materials and workmanship. We offer technical support, user training and on-site service and maintenance of equipment to meet the needs of our customers.

# **Gas Detection Service**

Individually designed maintenance packages are available for specific customer needs. Service begins with verification of the system installation that includes an initial system check and calibration. We then offer customer training programs (on-site and at factory) to insure that technical personnel fully understand operation and maintenance procedures. When on-the-spot assistance is required, service representatives are available to handle any questions or problems immediately.

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## **I. SPECIFICATIONS**

# SEC 2000 Transmitter with SEC MILLENIUM Infrared Sensor

#### Millenium Sensors:

Hydrocarbon P/N 142-0280 (Specify gas type and range when ordering). Carbon Dioxide P/N 142-0617 (Specify gas range when ordering).

Alarms:

Optional relay contacts for low, mid, high and fault

**Output (digital):** 

RS-485 LAN, maximum 4000 feet/68 ohms

#### Relay, Type and Rating:

SPDT: 8 Amps @ 250 VAC 8 Amps @ 30 VDC

**Operating Voltage:** 24 VDC. Operating range: 18 to 32 VDC measured at the detector head

#### Max. Current Draw (@24VDC):

250mA average 450mA peak 290mA average (with relays) 490mA peak (with relays)

Max. Power Consumption:

6 watts 7 watts (with relays)

#### **Construction:**

Transmitter: Explosion-proof aluminum housing, Class 1, Division 1, Groups B, C and D Sensor: Explosion-proof 316 stainless steel housing, Class 1, Division 1, Groups B, C and D

## **II GENERAL DESCRIPTION**

## **SEC 2000 MILLENIUM**

The SEC 2000 MILLENIUM is a combination of the SEC MILLENIUM Infrared gas detector and the SEC 2000 transmitter.

The SEC 2000 MILLENIUM is a digital gas detector, that is designed to provide alarm signals when gas concentrations reach preset levels.

#### Features

- Operate as a stand-alone gas detector with optional relay outputs.
- An industry standard 4-20 mA output enables it to be connected to existing analog systems.
- Four (4) 8 amp SPDT relays respond to Low, Mid and High gas alarms as well as any fault conditions.
- An RS-485 digital output enables the SEC 2000 MILLENIUM to communicate to a SEC 4100 System Monitor or a PC running SEC Supervision Software. The SEC 2000 MILLENIUM network can be connected on a single twisted shielded pair of wires, reducing cabling and installation costs.
- The operating parameters (relay action, alarm set values, sensor configuration, etc.) are stored in a non-volatile memory and can be viewed or changed using the SEC 2500 Hand Held Programmer using either the RS-485 digital highway, or by plugging directly into any SEC 2000 MILLENIUM.
- Each SEC 2000 MILLENIUM has a unique programmable identification number. This allows the SEC 2500 Hand Held Programmer to communicate to any specific SEC 2000 MILLENIUM or any other SEC 2000 MILLENIUM (peer to peer communication), anywhere on the network via the data highway. By using either the RS-485 data highway or by plugging directly into any SEC 2000 MILLENIUM, the communication can be established.
- The calibration sequence is user-friendly and requires only one person. The SEC 2000 MILLENIUM defaults to normal operation if the calibration push-button is inactive for fifteen (15) minutes.

• An on-board microprocessor provides continuous self-diagnostics and identifies problems using fault codes.

## III. CIRCUITRY SEC 2000 MILLENIUM

The electronic circuitry for the SEC 2000 MILLENIUM typically consists of four (4) circular printed circuit boards contained within the enclosure. The circuit boards are designed in a modular fashion and are easily removed and replaced. At the bottom of the SEC 2000 MILLENIUM is a base plate with three (3) support posts attached. Each module has three holes, which line up with the support posts. The modules slide onto these support posts and into place in the stack.

#### **Power Supply/Terminations Module**



The Power Supply/Terminations Module incorporates signal processing circuitry for the gas sensor, an analog output, an A/D converter, and the power supply required by the rest of the SEC 2000 MILLENIUM circuitry.

TB 3 is the power and data highway wiring connections. TB 1 is the SEC Millenium sensor wiring connections.

The Processor and Power Supply Modules are each connected together mechanically with standoffs and electrically with circuit board headers. These three (3) modules slide onto the three (3) support posts and are held in place by a top plate.

#### **Processor Module**



The Processor Module plugs into the topside of the Power Supply Module and is secured to this module with standoffs. The Processor Module contains the microprocessor and associated logic circuitry which control operation of the SEC 2000 MILLENIUM. Also located on the Processor Module are a D/A converter a watchdog timer, and an EEPROM. The EEPROM retains the operating characteristics of a particular SEC 2000 MILLENIUM (i.e., gas type, range, relay operation, etc.) even when there is no power applied to the device.

#### **Relay Module**



The Relay Module is connected with a 10-conductor ribbon cable to the Power Supply Module. The Relay Module consists of four (4) relays and associated driving circuitry. The four (4) relays, which correspond to Low, Mid, High and Fault conditions, are each sealed SPDT, and rated for 8 amps at 30 VDC or 230 VAC. The SEC 2000 MILLENIUM is capable of operation without the Relay Module installed.

## **Control and Indicators**

#### Internal Controls

**O SP:** This control is used to adjust the SEC 2000 MILLENIUM's analog output (4 to 20 mA). The adjustment potentiometer is located on the Power Supply/Terminations Module. This is primarily a factory adjustment. Refer to Section V, for further details.

#### MILLENIUM Sensor

The gas sensor is typically mounted in one of the openings on the SEC 2000 MILLENIUM's enclosure. Protruding from the sensor are four (4) wires, which terminate in the terminal socket plug. This plug connects to a mating socket located on the Power Supply Terminations Module. The SEC MILLENIUM can be remotely mounted up to 1000 feet away from the SEC 2000 transmitter.

#### **Optional Equipment**

#### SEC 2500 Hand Held Programmer

The SEC 2500 Hand Held Programmer is designed to be used in conjunction with the SEC 2000 MILLENIUM. The SEC 2500 can be used to perform the following functions:

• Calibration of the SEC 2000 MILLENIUM.

• Displaying and changing the SEC 2000 MILLENIUM operating characteristics including gas type, gas units, range, decimal places in display, calibration gas value, and SEC 2000 MILLENIUM identification number.

• Displaying and changing operating parameters of the individual SEC 2000 MILLENIUM relays, including alarm set levels, off delay from 0 to 255 minutes, latching or non-latching operation, and normally energized or de-energized operation.

• Manually toggling each individual relay on and off to verify operation.

• Resetting latching relays.

• Displaying a sensor synopsis which includes SEC 2000 MILLENIUM identification number; fault code status; gas type; current gas level; range; calibration gas value; date of last calibration; active relays, if

any; logic voltage input voltage; and current analog output level.

The SEC 2500 communicates with the SEC 2000 MILLENIUM one of two (2) ways:

• **RS-485 Wired Connection:** A data communications cable is plugged into the SEC 2500 and hard-wired to the Data A and Data B of the RS-485 data highway. The SEC 2500 can then communicate individually with any SEC 2000 MILLENIUM installed on the RS-485 network.

• **Direct-Wired Connection:** A data communications cable is plugged into the SEC 2500 and a connector on the other end is plugged into a connector located on the SEC 2000 MILLENIUM microprocessor board.

For more detailed operation of the SEC 2500 Hand Held Programmer, refer to the Instruction Manual for this unit.

#### **Sensor Separation Kit**

A Sensor Separation Kit is available so the sensor may be installed remote from the SEC 2000 MILLENIUM. The kit consists of an explosion proof housing, with terminal block for terminating wire connections.

Consult Factory for the recommended maximum distances that the sensor should be located from the SEC 2000 MILLENIUM. Cable runs should be made with shielded cable within properly grounded conduit.

## **IV. OPERATION**

#### Installation and Startup

The SEC 2000 MILLENIUM should be securely attached at the mounting location using bolts through the mounting flanges at the base of the SEC 2000 MILLENIUM enclosure. If the detector is to be wall-mounted, 1/2 inch standoffs are required to bring the SEC 2000 MILLENIUM away from the wall slightly, allowing easier access to the sensor.

Field wiring must be brought to the SEC 2000 MILLENIUM. Using shielded cable is highly recommended to prevent electrical interference from affecting the operation of the SEC 2000 MILLENIUM. The wiring must be installed in accordance with applicable local electrical codes with special care and attention given to installations in a classified hazardous area. When installing the units in outdoor applications, extra care must be taken to ensure the wire entry is properly sealed to prevent water from getting into the housing.

With the SEC 2000 MILLENIUM in place, unscrew and remove the domed lid from the SEC 2000 MILLENIUM enclosure. Using an flat blade screwdriver, remove the three (3) screws from the SEC 2000 MILLENIUM face plate holding the top two modules in place. Slide the board module assembly up over the three support posts and off of the stack.

#### Power

Connect the positive supply wire to the terminal block, on the Power Supply module, position marked "+24 VDC" by placing the stripped end of the wire into the side of the terminal block and securely tightening the screw on top. Connect the negative supply wire to the terminal block position marked "COM".

If shielded wire has been used, cut the shield off at the detector. The shield of the cable should be open at the detector junction box and connected to earth ground at the power supply. Ensure that the shield is clipped short and insulated with electric tape to prevent accidental grounding at the open end.

The supply wires must be sized so that they are able to supply the specified voltage (18-32 VDC) to the SEC 2000 MILLENIUM at the rated current (see Specifications, Section I).

#### **Analog Output**

The analog output connection is made at the terminal block position marked "4-20 mA". This connection is optional but will provide a 0-20 mA sourcing output

signal (with respect to COM) which corresponds to the selected full scale of the SEC 2000 MILLENIUM.

#### RS-485

The RS-485 consists of two connections, Data A and Data B. It is recommended that the RS-485 wires be a twisted pair and shielded. The RS-485 connection is optional but is required if the SEC 2000 MILLENIUM is to be installed on a digital network with other SEC 2000s or monitoring devices.

Connect the Data A wire to the terminal block position marked "Data A". Connect the Data B wire to the terminal block position marked "Data B".

In total, the RS-485 wiring should not exceed 4000 feet or 68 ohms. If the wiring is to exceed 4000 feet or 68 ohms, a SEC 4850 RS-485 Repeater must be used. Please consult Factory for further details.

#### Sensor

The SEC 2000 MILLENIUM is supplied with a terminal block plug that connects with a terminal block socket on the Power Supply Module.

The sensor may also be installed remote from the SEC 2000 MILLENIUM using extension wiring. Consult factory for the recommended maximum distances that the sensor should be located from the SEC 2000 MILLENIUM. Cable runs should be made with shielded cable within properly grounded conduit.

#### Relays

There are four relays on the module; Low, Mid, High and Fault. Each relay has three terminal block positions; Normally Open, Common, and Normally Closed. The relay's dry contacts are shown on the module itself in the non-energized condition.



The load connected through each of the relays must not exceed 8 amps at 30 VDC or 230 VAC.

**NOTE:** During normal operation, the fault relay is always energized (de-energized upon alarm). All other relays can be set to be normally energized or normally de-energized using the SEC 2500 Hand Held Programmer.

### Startup

After the wiring has been completed and the unit reassembled, power can be applied to the SEC 2000 MILLENIUM.

For one minute after power up, the relays will be inactive. During the one minute period, the analog output will remain at 4 mA.

If more than one SEC 2000 MILLENIUM is being installed on an RS-485 network, each must be assigned a unique identification number.

If identification numbers have not been or are incorrectly assigned at the factory, each SEC 2000 MILLENIUM must be powered up one at a time, and have new identification numbers assigned to them using the SEC 2500 Hand Held Programmer, the SEC 4100 or Supervision Plus. If it is impractical to power up each individual SEC 2000 MILLENIUM, detach the power connector from all power supply boards except one. After a new identification number has been assigned to the SEC 2000 MILLENIUM, replace the power connector on the next unit and assign a new identification number. Duplicate ID numbers on the data highway will cause communication problems.

If desired, the configuration and programming information contained in each individual SEC 2000 MILLENIUM processor module may be checked and changed if necessary using the SEC 2500 Hand Held Programmer (refer to the SEC 2500 Instruction Manual).

### Monitoring

After the one minute warm up period, the SEC 2000 MILLENIUM is ready for use as a fixed gas detector. If connected to a monitoring device on an RS-485 network, the SEC 2000 MILLENIUM will report its status and programming information after being polled. The SEC 2000 MILLENIUM generates a continuous 4-20 mA signal, representative of the gas level display reading.

For a SEC 2000 MILLENIUM hydrocarbon detector, the concentration of combustible gas is displayed in terms of a percentage of the lower explosive limit (LEL). 100% LEL represents the minimum concentration of combustible gas in air that will cause an explosion.

For a SEC 2000 MILLENIUM carbon dioxide detector, the concentration of CO2 gas is displayed in terms of a percentage of volume (VOL). 1% VOL equals 10,000 PPM. Normal air contains approximately 300 PPM CO2.

#### Alarms

The most important function of the SEC 2000 MILLENIUM is to activate alarms when gas concentrations approach dangerous levels. There are three (3) levels of alarm for gas concentration on the SEC 2000 MILLENIUM; Low, Mid, and High. They are independently adjustable using the SEC 2500 Hand Held Programmer or Supervision Plus.

All alarms activate on rising gas concentrations. When gas concentration exceeds the low alarm setpoint the low alarm relay will activate. When gas concentration exceeds the mid alarm setpoint the mid alarm relay will activate. When gas concentration exceeds the high alarm setpoint, the high alarm relay will activate.

If a fault condition exists, the fault alarm relay will activate.

#### Normally Energized/De-energized

The action of the gas alarms can be independently set to normally energized or normally de-energized using the SEC 2500. Normal condition is defined as power applied to the SEC 2000 MILLENIUM with no gas alarms in effect.

**NOTE:** The fault alarm is normally energized, and is de-energized in alarm conditions.

#### Latching/Non-latching

The action of all relays can be independently set to latching or non-latching using the SEC 2500. If an alarm is non-latching, the corresponding relay will deactivate (reset) when the alarm condition has passed. A latched relay can then be deactivated (reset) using the SEC 4100, SEC 2500, SEC Supervision Plus.

In the case of the latching low alarm only, the low alarm relay can be acknowledged (using the SEC 4100, SEC 2500 or SEC Supervision Plus) when the low alarm condition still exists. This is true only if the gas concentration is below the mid alarm set level. Once acknowledged and the low alarm is cleared, the relay will reset automatically.

#### **Off Delay**

All gas alarms can be configured to have an off delay. If an off delay has been set, the alarm relay will remain active after the alarm condition has passed for the period of time specified as the off delay. After this period of time, the alarm relay will automatically deactivate (reset). The off delay for each alarm can be independently set, using the SEC 2500 or Supervision Plus, to any value within the range of 0-255 minutes. During the time that the off delay is in effect, the alarm relay can not be reset using the SEC 2500. This feature applies to non-latching alarms only. The off delay timer is not effected by or deactivated (reset) using the SEC 4100, SEC 2500 or SEC Supervision Plus.

## V. CALIBRATION

#### SEC 2000 MILLENIUM

The MILLENIUM sensor is span gas calibrated at the factory for the type of gas that is to be detected. There is a label on the sensor stating what type of gas it has been calibrated for.

Calibration consists of exposing the SEC 2000 MILLENIUM sensor to a zero air level.

The frequency of calibration (rezeroing) should not need to be more then once a year after an initial zero calibration after installation and a zero calibration 6 months after initial installation date.

#### Calibration

The SEC 2000 MILLENIUM may be calibrated using SEC 2500 Hand Held Programmer or Supervision Plus. For a complete description of calibration using SEC 2500 or Supervision Plus, please refer to the respective instruction manuals. The SEC MILLENIUM sensor can also be calibrated by connecting the MILLENIUMs white sensor to DC common for 10 seconds and removing it. Once the white wire is removed the sensor is zeroed. This is also described in the SEC MILLENIUM's Instruction Manual.

#### WARNING:

DO NOT POWER UP THE SEC 2000 MILLENIUM WHILE THE ENCLOSURE LID IS REMOVED AND IT IS SITUATED IN A HAZARDOUS AREA.

**NOTE**: At any point during the calibration sequence, if the SEC 2000 MILLENIUM is left unattended for more than fifteen (15) minutes, it will automatically return to the normal operating mode.

### Analog Output Calibration

The SEC 2000 MILLENIUM analog output is factory adjusted and generally should not have to be field adjusted. If it is discovered that the 4-20 mA output does not exactly correspond to the instrument's range, the following procedure can be used to calibrate the analog output.

1. Remove power from the SEC 2000 MILLENIUM. Unscrew and remove the domed lid from the enclosure.

2. Using a flat blade screwdriver, remove the three (3) screws from the SEC 2000 MILLENIUM face plate holding the top two (2) modules in place. Slide the two (2) board module assembly up over the three (3) support posts and off of the stack.

3. Connect a 4-20 mA measuring device to SEC 2000 MILLENIUM analog output. Apply power to the SEC 2000 MILLENIUM.

#### WARNING:

DO NOT POWER UP THE SEC 2000 MILLENIUM WHILE THE ENCLOSURE LID IS REMOVED AND IT IS SITUATED IN A HAZARDOUS AREA.

4. Locate the potentiometer (refer to Figure 3 in the drawing section of this manual) on the Power Supply Module. Adjust this control until the analog output measured corresponds to exactly 4 mA.

5. Remove power to the SEC 2000 MILLENIUM.

6. Remove the voltmeter and reassemble the SEC 2000 MILLENIUM.

## VI. MAINTENANCE

#### General

General maintenance of the SEC 2000 MILLENIUM consists primarily of periodic checks to be sure that the sensor remains at zero and that it is responsive to gas. If the SEC 2000 MILLENIUM on-board relays are used to control any auxiliary equipment, they can be tested using the manual relay control function of the SEC 2500. Refer to the SEC 2500 manual for more information regarding manual relay control.

#### Faults

In the event of an operating problem, the SEC 2000 MILLENIUM will generate a fault. The fault relay will

become de-energized the SEC 2000 MILLENIUM analog output will fall to 0 mA.

Using the SEC 2500 the fault can be identified. The following are probable causes and possible remedies for the faults.

#### FL 11 – Sensor Fault

This fault code is generated if the output current of the sensor has dropped to 0 mA.

#### FL 15 – Calibration Error

This fault code is also generated immediately following a calibration when an error has occurred during the calibration routine.

#### FL 21 - Logic voltage out of tolerance

This fault code is generated when the voltage powering the logic circuitry of the SEC 2000 MILLENIUM falls below or rises above its nominal value of 5 volts by more than 5%. This voltage is generated on the Power Supply Module. To correct this fault condition, the Power Supply Module must be repaired or replaced.

#### FL 23 - Supply voltage out of tolerance

This fault code is generated when the DC voltage powering the SEC 2000 MILLENIUM falls below or rises above its nominal value of 24 volts by more than 25%. To correct this fault condition, adjust the system power supply within the range of 18-32 VDC.

**NOTE**: A low voltage fault can be caused by high wire losses, or high contact resistance at wire connections.

#### FL 34 - EEPROM write fault

When any information is changed in the SEC 2000 MILLENIUM memory, the microprocessor will verify the change by reading back the entire content of the EEPROM. Fault code 34 is generated when the programmed information and the information read back do not agree. To correct this fault condition, the processor module must be repaired or replaced.

#### CnFg - Incomplete configuration in EEPROM

This message is generated when there is not enough information programmed into the SEC 2000 MILLENIUM memory. This condition generally occurs only when an unconfigured SEC 2000 MILLENIUM is powered up for the first time or when a blank EEPROM has been installed in the Processor Module. To correct this condition, all configuration parameters must be entered into the SEC 2000 MILLENIUM memory using the SEC 2500 Hand Held Programmer.

#### VII. Warranty

Sensor Electronics Corporation (SEC) warrants products manufactured by SEC to be free from defects in workmanship and materials for a period of two (2) years from date of shipment from the factory. Any parts returned freight pre-paid to the factory and found defective within the warranty will be repaired or replaced, at SEC's option. SEC will return repaired or replaced equipment pre-paid lowest cost freight. This warranty does not apply to items which by their nature are subject to deterioration or consumption in normal service. Such items may include:

#### Fuses and Batteries.

Warranty is voided by abuse including rough handling, mechanical damage, alteration or repair. This warranty covers the full extent of SEC liability and SEC is not responsible for removal, replacement costs, local repair costs, transportation costs or contingent expenses incurred without prior written approval.

Sensor Electronics Corporation's obligation under this warranty shall be limited to repair or replacement of any product that has been returned to Sensor Electronics Corporation for warranty consideration.

This warranty is expressly in lieu of any and all other warranties expressed or implied, and all other obligations or liabilities on the part of Sensor Electronics Corporation including but not limited to, the fitness for a particular purpose. In no event shall Sensor Electronics Corporation be liable for direct, incidental, or consequential loss or damage of any kind connected with the use of it's products or failure to function or operate properly.

#### Year 2000 Compliance

All Sensor Electronics products have been tested and are certified by Sensor Electronics to accurately process date/time and date/time related data from, into and between the 20<sup>th</sup> and 21<sup>st</sup> centuries.

Sensor Electronics products neither contain nor create any logical or mathematical inconsistency, will not malfunction, and will not cease to function when processing date/time data.

Please contact Sensor Electronics for further information.

## VIII. Parts List

Stock Number	Description
142-0549	Relay Module
157-1013C	Microprocessor Module
142-0724	6", 10 conductor., Ribbon cable
172-0175C	SEC 2500 Hand Held Programmer
147-1000C	SEC 2500 Data Communications Cable
190-1000	SEC 2001 Sensor Separation Kit
142-0593	SEC MILLENIUM Splash Guard
142-0594	SEC MILLENIUM Replacement Hydrophobic Filter
142-0595	SEC MILLENIUM Calibration Adapter
142-0962	SEC MILLENIUM Sample Draw Adapter

SEC 2000 Millenium HC	Combustible (% LEL)	Part No.
RANGES:	Complete Unit	173-0153C
Standard: 0-100% LEL	No Relays, Display or Push Button	173-1153C
Specify Calibration Gas	No Display or Push Button	173-2153C
	No Relays	173-3153C
	No Relays or Push Button	173-4153C
	No Push Button	173-5153C
X-varies for gas type	Millenium HC Sensor (only)	142-0280X

SEC 2000 Millenium CO2	Carbon Dioxide (% VOL)	Part No.
RANGES:	Complete Unit	174-0153C
Standard: 0-2% VOL	No Relays, Display or Push Button	174-1153C
Alternate: 0-5% VOL	No Display or Push Button	174-2153C
Specify Range	No Relays	174-3153C
Other ranges can be	No Relays or Push Button	174-4153C
provided with SEC Signature	No Push Button	174-5153C
X-varies for gas range	Millenium CO2 Sensor (only)	142-0617X

## IX. Drawing Section









