SEC 3100 Transmitter

Instruction and Operation Manual

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

Sensor Electronics Corporation (SEC) designs and manufactures innovative fixed system gas detection equipment, for combustible gases, oxygen, carbon dioxide and toxic gases.

Commitment
Our quality and service are uncompromising. We back each of our products with a two-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.

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 would 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 20th and 21st 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.
Table of Contents

I. SPECIFICATIONS

II. GENERAL DESCRIPTION

III. OPERATION
   Installation and Startup
   Fault Codes

IV. MAGNETIC SWITCH OPERATION

V. FIGURES
   Figure 1 – Overall Layout
   Figure 2 – SEC 3100 Wiring
   Figure 3 – SEC Sensor Separation Kit
I. SPECIFICATIONS

Model:
SEC 3100 Transmitter

For use with:
SEC Millenium and SEC Signature series infrared sensors and SEC 3000 Toxic and Oxygen gas sensors.

Part Number: SEC 3100100

Output (analog):
4-20 mA (Source type), max. 1000 Ohm load at 24 VDC supply voltage

Output (digital):
RS485 LAN (isolated)

Output (relays):
Three (3) Alarm, Low, Mid High. One (1) Fault
Rated for 8 Amps 30 VDC or 220VAC

Display:
LCD (backlit)

Construction:
Epoxy coated aluminum
Class 1, Division 1, Groups B, C and D

Operating Temperature Rating:
-40° to +158° F at 0 to 99% RH (non-condensing)
(-20° to +70°C)

Operating Voltage:
24 VDC
Operating range: 18 to 30 VDC measured at the detector head

Max. Current Draw: (at 24 VDC with sensor)
Average: 250 mA
Peak: 500 mA

Installation Category: Cat. I, Pollution Degree 2
II GENERAL DESCRIPTION

CONVENTIONS
The following conventions are used in this manual.

⚠️ Warning Statement

--- VDC (DC Voltage)

SEC 3100

The SEC 3100 transmitter is designed to be used with the SEC Millenium, SEC Signature infrared gas sensors or SEC 3000 toxic gas detectors. The SEC 3100 is a microprocessor based intelligent transmitter continuously monitoring information from the gas sensor. The LCD of the SEC 3100 displays the gas concentration and sensor status. The SEC 3100 has one (1) “Alarm” LED and one (1) “Status” LED. The SEC 3100 also has three (3) magnetic switches located around the circumference of the unit. This manual will describe the operation and use of the SEC 3100 transmitter.

Features
- Explosion Proof
- Back lighted LCD Display
- Low Cost
- Plug and play toxic, oxygen and combustible gas sensors
- Self-check system
- 4-20 mA output
- RS-485 Interface (Isolated)
- Optional alarm and fault relays
- Non-intrusive programming
- Non-intrusive calibration
- Removable, non-volatile, time stamped data logging
- Optional IS barrier
- Digital communication link to SEC 3000 and SEC Millenium Gas Detectors
- Multi port housing for easy installation

III. OPERATION

Installation and Startup

⚠️ Warning: The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The first step in the installation process is to establish a mounting location for the SEC 3100 transmitter and gas sensor. Select a location that is typical of the atmosphere to be monitored or close to the anticipated source of a dangerous gas.

It is very important that the SEC 3100 and gas sensor be properly located enabling it to provide maximum protection. The most effective number and placement of sensors vary depending on the conditions of the application. When determining where to locate gas sensors the following factors should be considered.

- What are the characteristics of the gas that is to be detected? Is it lighter or heavier than air? If it is lighter than air the sensor should be placed above the potential gas leak. Place the sensor close to the floor for gases that are heavier than air. Note that air currents can cause a gas that is heavier than air to
rise. In addition, if the temperature of the gas is hotter than ambient air or mixed with gases that are lighter than air, it could also rise.

- How rapidly will the gas diffuse into the ambient air? Select a location for the sensor that is close to the anticipated source of a gas leak.

- Wind or ventilation characteristics of the immediate area must also be considered. Movement of air may cause gas to accumulate more heavily in one area than in another. The detector should be placed in the areas where the most concentrated accumulation of gas is anticipated. For outdoor applications with strong wind conditions, it may require the sensors to be mounted closer together and on the down wind side, to the anticipated area of a gas leak. Also take into consideration for indoor applications, the fact that many ventilation systems do not operate continuously.

- The sensor should be accessible for maintenance.

- Excessive heat or vibration can cause premature failure of any electronic device and should be avoided if possible.

- Follow all national and local installation codes and practices.

The SEC 3100 has three (3) ¾” NPT threaded connectors for mounting and wiring the sensor and transmitter into a permanent installation.

Field wiring connections are made on the backside of the SEC 3100 printed circuit board (PCB). For wiring details refer to Figure 2 in the back of the manual.

Power wire sizing:
0 to 500 feet, recommended wire gauge size 16 AWG
501 to 1000 feet, recommended wire gauge size 14 AWG

Shielded cable is recommended. Wiring should be installed in metal conduit with no other cabling in the same conduit.

**Warm-up**
When power is applied to the SEC 3100, it enters a one (1) minute warm-up mode. The output current will be 0.8 mA during the warm up time period. At the end of the warm-up period with no faults present, the SEC 3100 automatically enters the normal operating mode (4.0 mA with no gas present). If a fault is present after warm-up, the detector current output and LCD will indicate a fault. The Fault LED will also indicate the fault.

**Normal**
In the normal operating mode, the 4 to 20 mA signal levels correspond to the detected gas concentration. The transmitter continuously checks for and displays system faults or initiation of calibration and automatically changes to the appropriate mode.
The 4 to 20 mA output of the SEC 3100 sensor is a non-isolated current source.

### Current Output and Corresponding Status

<table>
<thead>
<tr>
<th>Current Output</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20 mA</td>
<td>Normal measuring mode</td>
</tr>
<tr>
<td>0.0 mA</td>
<td>Unit Fault</td>
</tr>
<tr>
<td>0.2 mA</td>
<td>Reference channel fault</td>
</tr>
<tr>
<td>0.4 mA</td>
<td>Analytical channel fault</td>
</tr>
<tr>
<td>0.8 mA</td>
<td>Unit warm up</td>
</tr>
<tr>
<td>1.0 mA</td>
<td>Optics fault</td>
</tr>
<tr>
<td>1.2 mA</td>
<td>Zero drift fault</td>
</tr>
<tr>
<td>1.6 mA</td>
<td>Calibration fault</td>
</tr>
<tr>
<td>2.0 mA</td>
<td>Unit spanning</td>
</tr>
<tr>
<td>2.2 mA</td>
<td>Unit zeroing</td>
</tr>
<tr>
<td>4.0 mA</td>
<td>Zero gas level (0% of full scale)</td>
</tr>
<tr>
<td>5.6 mA</td>
<td>(10% of full scale)</td>
</tr>
<tr>
<td>8.0 mA</td>
<td>(25% of full scale)</td>
</tr>
<tr>
<td>12 mA</td>
<td>(50% of full scale)</td>
</tr>
<tr>
<td>16 mA</td>
<td>(75% of full scale)</td>
</tr>
<tr>
<td>20 mA</td>
<td>Full scale (100% of full scale)</td>
</tr>
<tr>
<td>20.1-23 mA</td>
<td>Over-range (&gt; 100% of full scale)</td>
</tr>
</tbody>
</table>

Once the fault is cleared the SEC 3100 will automatically resume normal operation.

<table>
<thead>
<tr>
<th>Flash Rate</th>
<th>Output Current</th>
<th>Unit StatusLabel</th>
<th>Possible Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4-20ma</td>
<td>Unit Running</td>
<td>Unit is measuring gas and adjusting 4-20ma output accordingly.</td>
</tr>
<tr>
<td>2</td>
<td>2.2ma</td>
<td>Unit Zero Calibrating</td>
<td>Unit going through its zero calibration procedure.</td>
</tr>
<tr>
<td>3</td>
<td>2.0ma</td>
<td>Unit Spanning</td>
<td>Unit going through its spanning procedure.</td>
</tr>
<tr>
<td>5</td>
<td>0.8ma</td>
<td>Unit Warm-up</td>
<td>Only for one minute after unit power-up</td>
</tr>
<tr>
<td>6</td>
<td>0.0ma</td>
<td>Power-up Fault</td>
<td>Hard Fault (refer to gas sensor manual)</td>
</tr>
</tbody>
</table>
| 7          | 1.6ma          | Calibration Fault| 1. Attempt Unit Span with no gas  
2. Attempt Unit Zero with gas                                                       |
| 8          | NA             | NA               | Currently Not Used                                                              |
| 9          | 0.0ma          | Unit Fault       | Hard Fault (refer to gas sensor manual)                                          |
| 10         | 1.0ma          | Optics Fault     | Clean sensor's windows                                                           |
| 11         | 1.2ma          | Zero Drift Fault | Hard Fault (refer to gas sensor manual)                                          |
| 12         | 0.0ma          | Configuration Fault | Hard Fault (refer to gas sensor manual)                                           |
| 16         | 0.2ma          | Reference Channel Fault | Hard Fault (refer to gas sensor manual)                                         |
| 17         | 0.4ma          | Active Channel Fault | Hard Fault or Unit Zero with gas                                                |
IV. MAGNETIC SWITCH OPERATION

The SEC 3100 has three (3) magnetic switch pickups on the Display PCB. The picture below shows the location of the magnetic switches labeled UP, DOWN and ENTER. Placing a magnet in close proximity to one of the switches will cause the following operations to occur.

<table>
<thead>
<tr>
<th>Switch</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER</td>
<td>Enter Menu Mode, Selects a menu to Enter</td>
</tr>
<tr>
<td>UP</td>
<td>Moves up through Menu selections</td>
</tr>
<tr>
<td>DOWN</td>
<td>Moves down through Menu selections</td>
</tr>
</tbody>
</table>

For further details on gas sensor calibration refer to the appropriate SEC sensor instruction manual.

The LCD contrast potentiometer, (POT1) is located under the protective faceplate shown above on the front side (LCD side) of PCB to the left of the LCD.
V. MENU OPERATION

Initial Power Up Sequence of the SEC 3100

SYSTEM BOOT PROCESS
--- WAIT FOR SYNC ---

SYSTEM BOOT PROCESS
-WAIT FOR SENSOR -

INITIALIZING

WARM UP
ID: xx
SN: xxxxx
TYP: x.x
VER: x.x

WARM UP
ID: xx
0-20.0PPM
WF6
ENT TO ABORT

0
ID: 1
0-20.0 PPM
WF6
MC - REMOVED

In normal operating mode. Actual gas concentration will be displayed to the left of ID #, Range, Gas Type, MC (Memory Card) status.
Selecting Enter when the SEC 3100 is in normal operating mode will advance to the following display:

Selecting Enter will allow the operator to safely remove the Memory Card.

Arrow Down

Entering the INFO menu will display the following screen

Selecting Enter at UNIT INFO displays the following:

SN is the SEC 3100 serial number. VER is the SEC 3100 software version number. Selecting Enter again will return the display to the main info menu.

The following are the other INFO sub displays and descriptions. To return back to the main INFO menu from the sub menus, select Enter.

Sensor Status Menu

Sensor Status Menu

Sensor Status Menu

Sensor Status Menu

Select Exit to go back to
Main Menu and Sub Menus

**Calibration Menu**
Used to calibrate the gas sensor.

**Alarm Menu**
Used to set alarm level set points and parameters.

**Relay Menu**
For setting alarm relay On & Off delay & Energized states.

**Network Menu**
Used to set Zone #, ID # and Select Online

**Hide Menu**
Hide is used to blank the display up to low alarm setting

**Self Test Menu**
Generates a signal on the display. RS485 & 4-20 mA

**Date Time Menu**
Sets the date and time in the real time clock.

**Exit** back to normal operation.
Calibration Menu

Using the Up and Down arrows allows the operator to move the cursor (*) to select a function.

To Zero the sensor apply clean air (N2 for an oxygen sensor) and select enter. The following will be displayed.

Then the following will be displayed.

Once complete the following will be displayed. The sensor has been successfully zeroed.

Arrow down to CAL. VAL to verify the span gas calibration value matches the value of the span gas calibration on hand. If not, select Enter and the following screen will appear.

Using the Up and Down arrows will allow the operator to change the calibration gas value of the sensor to match the calibration gas used to span the sensor. Once the correct value is displayed select Enter and the sensor will be uploaded with the new calibration gas value.
To Span the sensor with calibration gas use the Up and Down arrows to select the following display.

To Span the sensor with calibration gas use the Up and Down arrows to select the following display.

Apply span gas to the sensor for the appropriate amount of time in order for the sensor to stabilize. The gas reading is displayed to the right of ZERO. Once stable select Enter. This will go the display:

If calibration span gas is still present the display will read:

Apply clean air to the sensor to reduce this reading. The display will advance to the following:

This completes the calibration and the device can be put back into the normal operating mode. Arrow Down to

Enter

Enter again and the SEC 3100 returns to normal operation.
Alarm Menu

Select the Alarm Relay (LOW, MID, HI) using the down arrow. Once the cursor is on the alarm relay you wish to configure, hold the magnet over Enter. The example LOW will be used. The same operations can be used to set the MID or HI relays.

Selecting Enter will display the following screen allowing the alarm set point to be programmed. Using the Up and Down arrows will change the set point. Once the correct set point is displayed select Enter and the new value will be accepted.

Selecting Enter will allow the operator to change the operation of the relay operation from Non-Latching (NO) to Latching (YES).
Selecting Enter will allow the operator to change the operation of the relay operation from Active HI to Active LOW. HI activates the relay on a rising alarm level. LOW activates the relay when the alarm threshold falls below the alarm set point. Once the correct operation is selected, use the Down arrow to advance to the next menu item.

Selecting Exit will advance to the next menu.

This menu will allow the operator to select another relay to program. Or select Exit and the next display will be:

Selecting Enter on this display will put the SEC 3100 back into normal operation.
Selecting Enter will advance to the following menu.

Arrow down to the next screen will be

Select the Alarm Relay (LOW, MID, HI, FAULT) that is to be configured using the down arrow. Once the cursor is on the correct alarm relay, hold the magnet over Enter. The example LOW will be used. The same operations can be used to set the MID, HI, or FAULT relays.

Select Enter

Using the Up and Down arrows the operator can change the ON delay time for the relay to actuate after the alarm threshold has been exceeded. The time is measured in seconds (0-255). Once the correct time is displayed select Enter to accept the new value. Then Exit the menu and proceed on to the next selection.

In this example the Low alarm relay will actuate 30 seconds after the Low set point is exceeded.
Using the Up and Down arrows the operator can change the OFF delay time for the relay to turn OFF after the reading has decreased below the alarm point threshold. The time is measured in seconds (0-255). Once the correct time is displayed select Enter to accept the new value. Then Exit the menu and proceed on to the next selection.

In this example the Low alarm relay will stay energized for 60 seconds after the alarm has cleared.

Selecting Enter will allow the operator to change the operation of the relay coil from normally de-energized (ENERGIZED NO) to normally energized (ENERGIZED YES). Once the correct operation is selected, use the Down arrow to advance to the EXIT menu. Select Enter to go back to the Relay Menu.

This menu will allow the operator to select another relay to program. Or select Exit and the next display will be:

Selecting Enter will return the SEC 3100 into normal operation.
Network Menu

Select Enter

* NETWORK
HIDE

Select Enter to change the Zone number of the SEC 3100.

* ZONE     0          *
ID ONLINE EXIT

Use the Up and Down Arrows change the Zone number (0-255). Once the correct Zone number is displayed select Enter.

Arrow Down to ID. To change the ID number select Enter. Use the Up and Down Arrows to change the ID number (0-255). Once the correct ID number is displayed select Enter.

ZONE
* ID     1              *
ONLINE EXIT

Arrow Down to Online.

ZONE
ID
* ONLINE       YES
EXIT

Using Enter the operator can toggle between Online YES and Online NO. Online YES turns on the MODUS RS485 communication. Online NO turns the MODBUS RS485 communication off.

Arrow Down to Exit

ZONE
ID
ONLINE
* EXIT

Enter

* EXIT
Hide Menu

Using Enter the operator can toggle between Hide YES and Hide NO. The Hide function allows the operator to not display the gas reading until the Low Alarm threshold is exceeded. All outputs will function as normal when the Hide mode selected to YES.

Self Test Menu

Selecting Enter for the Self Test will make the sensor generate a 4-20 mA input into the SEC 3100 from 4 mA to 20 mA (0-fullscale). In the self test mode the SEC 3100 outputs are fully functional. The SEC 3100 will display the rising gas level, the 4-20 mA output will increase to 20 mA, the relays will actuate and the RS485 information will be transmitted to the control system. The following screen will be displayed:

Once the unit reaches full scale the SEC 3100 automatically returns to normal.
Time Date Menu

Entering this menu will allow the operator to set the time and date of the SEC 3100 real time clock.

Selecting Enter will locate a cursor (*) above the number allowing the operator to use the Up Down arrows to increase or decrease the numbers. Once the correct number is displayed, select Enter with the magnet and the cursor will advance to the next number.

Date is MM/DD/YYYY. Time is HH/MM/SS. Below is an example.

Enter from above display.

Arrow Up one number.

Enter

Continue with the sequence until the correct date appears. Then select Enter and the following will be displayed.

At this point the operator can advance to setting the correct time using the Down Arrow.

Time numbers are changed using the procedure as the Date numbers. Once the correct Time is programmed, select Enter and arrow down to Exit.
Select Enter

EXIT

Selecting Enter again will return the SEC 3100 to normal operation.
The Diagnostics Menu will allow the operator to enter the Locator Mode and Toggle Relays on and off to verify operation.

Selecting Enter will display the following:

The Locator function is normally generated by the SEC 3500 operator interface. It can be used at the SEC 3100 to function as a lamp test. Selecting Enter will turn the Locator on.

The Alarm and Fault LEDs will flash red and green alternately. Selecting Enter again will turn the Locator function off.

Arrow Down to Toggle Relays (manual relay control)

Selecting Enter will display the following:

Select the Alarm Relay (LOW, MID, HI, FAULT) that is to be configured using the down arrow. Once the cursor is on the correct alarm relay, hold the magnet over Enter. The example LOW will be used. The same operations can be used to manually control the MID, HI, or FAULT relays.

Selecting Enter will manually turn on the relay, selecting Enter again will turn off the relay.
Reset Relays Menu

The Reset Reset relays Menu will allow the operator to reset latched relays. Latched relays will be indicated by a blue flashing Alarm LED. Select Enter and any latched relays will be reset.
V. FIGURES

Figure 1 – Overall Layout
Figure 2 – SEC 3100 Wiring
Figure 3 – SEC Sensor Separation Kit
Figure 4 – Mounting SEC 3100 and SEC Millenium
Figure 5 – Mounting SEC 3100 and SEC 3000
LCD Display:
- Real Time Status
- Gas Type
- Gas Concentration
- Fault Identification
- Range
- ID Number
- Memory Card Status
- Interactive Menus
- Calibration
- Relay Programming
- ID & Zone Number

Field Wiring Port (2 x \( \frac{3}{4} \) in)
- Power
- 4-20 mA
- RS485 (MODBUS)
- Alarm Relays

Magnetic Switch (3)

Gas Sensor Port (1 x \( \frac{3}{4} \) in)
SEC 3000
SEC Millennium

Memory Data Card Slot

Alarm LED
- Green OK
- Yellow Low Alarm
- Orange Mid Alarm
- Red High Alarm

Fault LED
- Green OK
- Yellow Low Alarm
- Orange Mid Alarm
- Red High Alarm

Mounting holes (2)
TB 1
(12) LOW ALARM N.C.
(11) LOW ALARM COMMON
(10) LOW ALARM N.O.
(9) MID ALARM N.C.
(8) MID ALARM COMMON
(7) MID ALARM N.O.
(6) HIGH ALARM N.C.
(5) HIGH ALARM COMMON
(4) HIGH ALARM N.O.
(3) FAULT (N.E.) N.C.
(2) FAULT (N.E.) COMMON
(1) FAULT (N.E.) N.O.

TB 2
(1) 4-20 mA ANALOG OUTPUT
(2) DC COMMON
(3) +24 VDC
(4) DATA ISO COMMON
(5) RS485 DATA B
(6) RS485 DATA A

TB 3
(1) WHITE
(DATA/CAL)
(2) BLUE OR GREEN
(4-20 mA)
(3) RED
(+24 VDC)
(4) BLACK
(DC COMMON)

SENSOR ELECTRONICS CORPORATION
5500 LINCOLN DRIVE
MINNEAPOLIS, MINNESOTA 55436 USA
(T) 952.938.9486  (F) 952.938.9617
sales@sensorelectronic.com

FIGURE 2
BACK VIEW OF SEC 3100
SEC 3100 WIRING
FIGURE 3
SEC SENSOR SEPARATION KIT

Class 1, Div 1, Groups B,C,D
Terminals: 4
Dimensions in Inches
FIGURE 4
SEC 3100 – SEC Millenium Mounting
FIGURE 5
SEC 3100 – SEC 3000 Mounting