Reference Manual
00809-0100-4311, Rev AA
May 2019

Net Safety™ SC311

Infrared Combustible Sensor

NET SAFETY™

EMERSON™

Important instructions

Net Safety™ designs, manufactures, and tests products to function within specific conditions. Because these products are sophisticated technical instruments, the owner and operation personnel must strictly adhere to both the information printed on the product nameplate and all instructions provided in this manual prior to installation, operation, and maintenance.

⚠ WARNING

Explosions and hazardous substances

Installing, operating, or maintaining a Net Safety product improperly could lead to serious injury or death from explosion or exposure to dangerous substances.

Comply with all information on the product, in this manual, and in any local and national codes that apply to this product.

Use Net Safety parts and work procedures specified in this manual.

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

Notice

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Net Safety does not assume responsibility for the selection, use, or maintenance of this product. Responsibility for proper selection, use, and maintenance of any Net Safety product remains solely with the purchaser and end user.

To the best of Net Safety's knowledge, the information herein is complete and accurate. Net Safety makes no warranties, expressed or implied, including implied warranties of merchantability and fitness for a particular purpose, with respect to this manual, and in no event, shall Net Safety be liable for any incidental, punitive, special, or consequential damages, including, but not limited to, loss of production, loss of profits, loss of revenue, or use and costs incurred including without limitation for capital, fuel and power, and claims of third parties.

Warranty

Three years

1 Introduction

1.1 Models covered

The Net Safety™ SC311 infrared combustible gas sensor is designed specifically for use with the Net Safety Millennium II transmitter (models M21, M22, or M2B). This sensor is both versatile and reliable for fast, accurate, and continuous monitoring of gases in extreme environments.

The sensor consists of an explosion-proof enclosure (housing) rated for hazardous locations and a replaceable sensor module. This sensor must only be used with a Net Safety Millennium II series transmitter. If the sensor is connected to any other model of transmitter, it will not function and may damage the sensor or transmitter.

1.2 Service support

For technical support, contact your local Emerson representative or the Technical Support department at +1 866 347 3427 (toll free) or Safety.CSC@Emerson.com.

1.3 Return of material

To expedite the repair and return of this product, proper communication between the customer and the factory is important.

Prerequisites

Before returning a product for repair, call +1 866 347 3427 (toll free) or email Safety.CSC@emerson.com for a Return Material Authorization (RMA) number.

On the return of the equipment, include the following information:

1. RMA number provided to you by Net Safety™.
2. Company name and contact information.
3. Purchase order, from your company, authorizing repairs or request for quote.

Procedure

1. Ship all equipment, prepaid to:
   Emerson Automation Solutions

   6021 Innovation Blvd

   Shakopee, MN 55379

2. Mark all packages with *Return for Repair* and include RMA number and type of return (e.g., return for evaluation).
   Pack items to protect them from damage and use anti-static bags or aluminum-backed cardboard as protection from electrostatic damage.

Important
All equipment must be shipped prepaid. Emerson will not accept collect shipments.

1.4 Product recycling/disposal

Consider recycling equipment and packaging. Dispose of the product and packaging in accordance with local and national legislations and regulations.

2 Install

2.1 Unpack and inspect

Carefully remove all the components from the packaging and check them against the enclosed packing list. Inspect all components for any obvious damage such as broken or loose parts. If you find any components missing or damaged, notify your local Net Safety™ representative or the factory immediately.

2.2 Locate sensor

Prior to installation, plan where to place the sensor. Although there are no absolute rules determining the quantity of detectors or location of a sensor, consider the following points.

⚠ CAUTION

Avoid placing the sensor where it may be exposed to splashing or direct water sprays. A splashguard may be required to protect the sensor.

- Carefully locate the sensor in an area where gases may potentially accumulate, considering that light gases tend to rise and heavy gases tend to accumulate in low areas.
- Use redundant systems to enhance protection and reliability.
- Consider the air movement patterns within the facility.
- Consider the construction of the facility, such as trenches where heavy gases or peaks where light gases may accumulate.
- Seek advice from experts knowledgeable about the primary gas to be detected.
- Refer to the regulatory publications that discuss guidelines for your industry.

2.3 Direct mount or sensor separation

2.3.1 Direct mount

You can attach the sensor directly to a Net Safety™ Millennium II transmitter and place it in an appropriate location for detecting the target gas or separate the sensor and remotely mount it away from the transmitter.

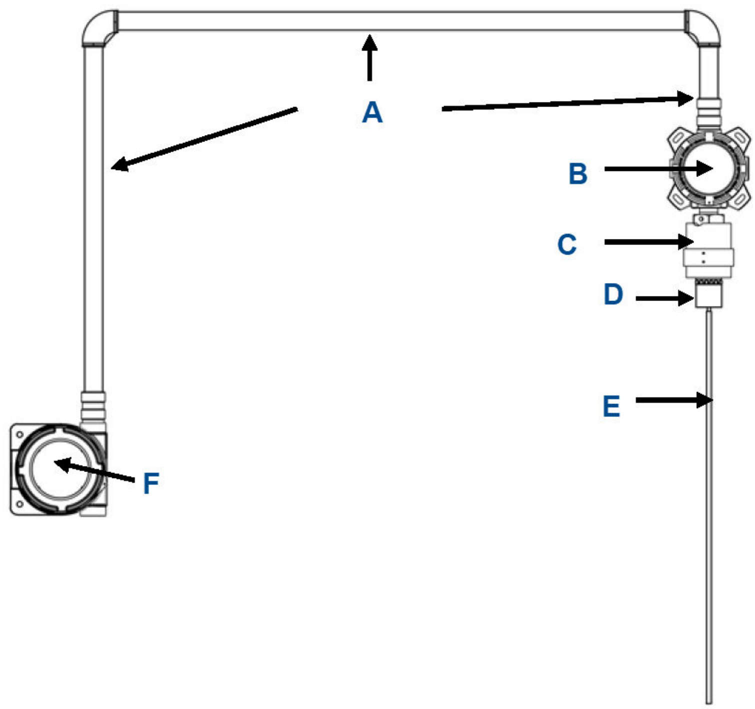
Make sure the sensor is accessible for calibration and maintenance purposes and that the transmitter is accessible and visible.

2.3.2 Remote mount

If mounting the sensor remotely, make sure it is connected to a certified junction box. Locate the transmitter near eye-level for easy access and the mount the sensor where gas is likely to accumulate.

To ease the calibration process, attach a calibration cup (CCS-1) to the bottom of the sensor housing and run calibration tubing from the calibration cup to a convenient place for applying calibration gas, eliminating the need to access the sensor directly. To compensate for distance, you may decrease the calibration tubing length so that the end of the tubing to the gas canister is still accessible or increase the calibration gas flow rate between the calibration gas cylinder and sensor. Refer to Figure 2-1 for an example of sensor separation.

Figure 2-1: Example of Sensor Separation



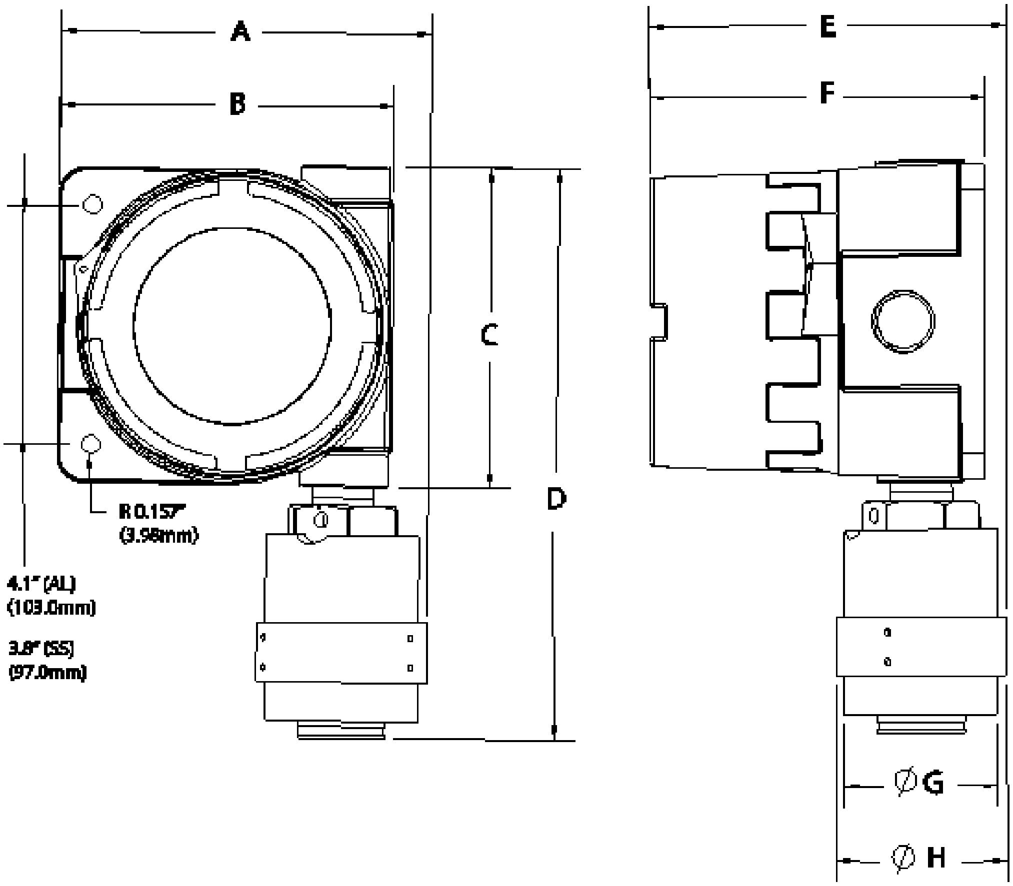
A. *Conduit*
B. *Separation junction box*
C. *Net Safety™ Millennium II SC311 sensor*
D. *CCS-1 calibration cup*
E. *Calibration tubing*
F. *Net Safety Millennium II transmitter*

For tubing lengths less than 10 ft. (3 m), use an 0.5 LPM regulator; for lengths greater than 10 ft. (3 m), use a 1.0 LPM regulator. On initial install, confirm readings directly at the transmitter by applying a known gas concentration to the sensor and comparing the output results. Readings should be accurate to the calibration gas concentration used, taking into account the sensor accuracy specifications in .

2.4 Dimensions

The following tables outline the dimensions of the sensor when connected to either the Net Safety™ Millennium II transmitter or the Net Safety Millennium II basic transmitter/ junction box. Both the transmitter and sensor enclosures are offered in aluminum and stainless steel.

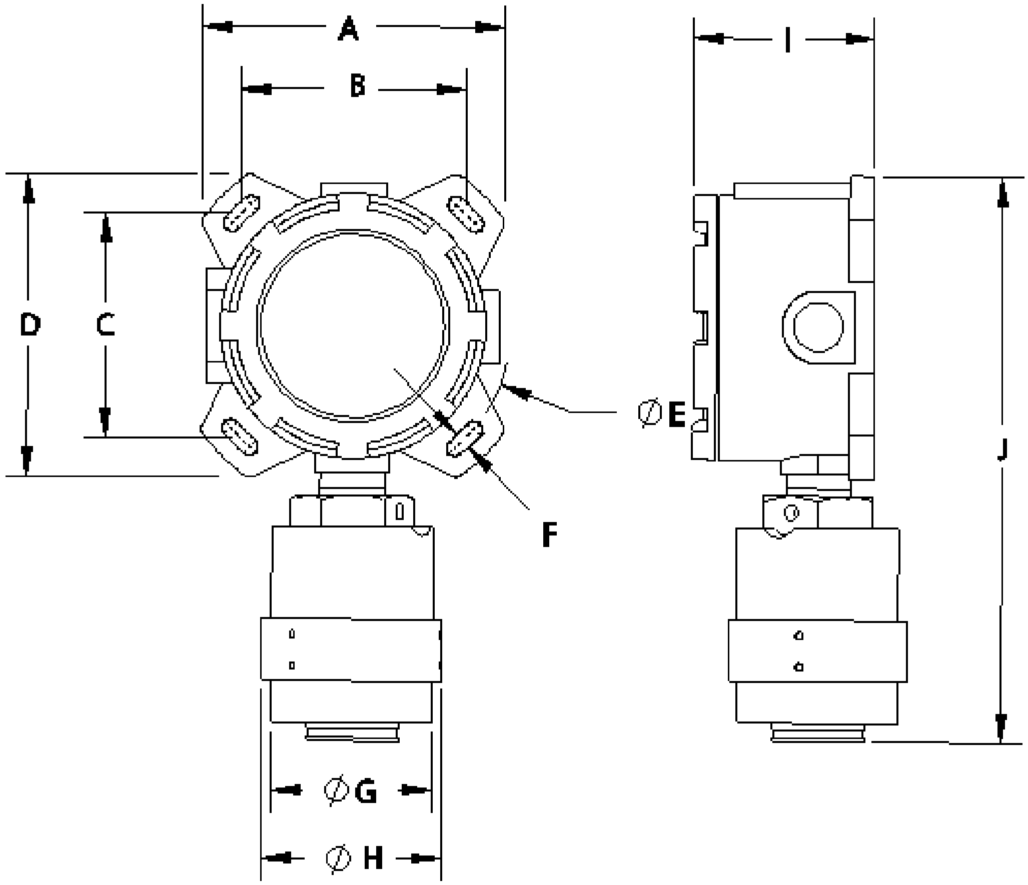
Figure 2-2: Net Safety Millennium II (M21 or M22) Enclosure and Sensor Dimensions



Dimensions	Stainless steel		Aluminum	
	in.	mm	in.	mm
A	5.9	150	6.3	160
B	5.1	130	5.6	142
C	4.6	117	5.4	137
D	8.9	226	9.7	246
E	6.0	152	6.0	152
F	5.8	147	5.7	145
G	2.6	66	2.6	66

Dimensions	Stainless steel		Aluminum	
	in.	mm	in.	mm
H	2.9	74	2.9	74

Figure 2-3: Net Safety Millennium II Basic (M2B) or Junction Box (JB) Enclosure and Sensor Dimensions



Dimensions	Stainless steel		Aluminum	
	in.	mm	in.	mm
A	4.7	119	4.8	122
B	3.6	91	3.6	91
C	3.6	91	3.6	91
D	4.7	199	4.8	122
E	5.1	130	5.1	130
F	0.3	7.6	0.3	7.6
G	2.6	66	2.6	66

Dimensions	Stainless steel		Aluminum	
	in.	mm	in.	mm
H	2.9	74	2.9	74
I	2.8	71	3.0	76
J	8.9	226	9.0	229

2.5 Wire

2.5.1 Field installation

⚠ WARNING

Follow guidelines

Failure to follow safety instructions could result in serious injury or death.

Ensure only qualified personnel perform the installation.

Electrical shock

Electrical shock could cause death or serious injury.

Use extreme caution when making contact with the leads and terminals.

Explosions

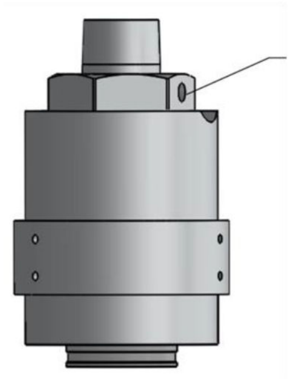
Do not open the transmitter, sensor, or junction box enclosure when in a classified area or when an explosive atmosphere may be present unless the power to the transmitter and sensor has been removed.

Wiring codes and regulations may vary.
Wiring must comply with all applicable regulations relating to the installation of electrical equipment in a hazardous area and is the installer's responsibility.
If in doubt, consult a qualified official before wiring the system.
When separating the sensor from the transmitter, Emerson highly recommends using shielded cable to protect against interference caused by extraneous electrical or electromagnetic noise.
In applications where the wiring is installed in a conduit, do not use the conduit for wiring to other equipment.

2.5.2 External ground

In order to ensure proper operation of the sensor, an external ground is required. The external ground must be connected to the grounding point on the enclosure according to IECEx requirements. Refer to Figure 2-4 for grounding connection location.

Figure 2-4: External Grounding Point



A. *External earth ground point*

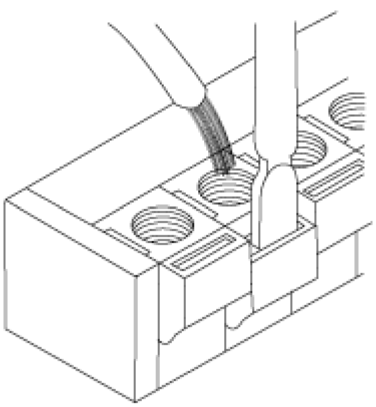
2.5.3 Wire sensor

⚠ WARNING

Do not open the transmitter, sensor, or junction box enclosure when in a classified area or when an explosive atmosphere may be present unless the power to the sensor has been removed.

When connecting cable wires, use a small flathead screwdriver to gently press down and hold the spring connector open. Insert the appropriate wire into the open connector hole, releasing the screwdriver to secure the wire. Refer to Figure 2-5.

Figure 2-5: Terminal Connection



Connect sensor wires to the sensor terminals in the applicable transmitter. Refer to the Table 2-1 for the wire colors and their purposes..

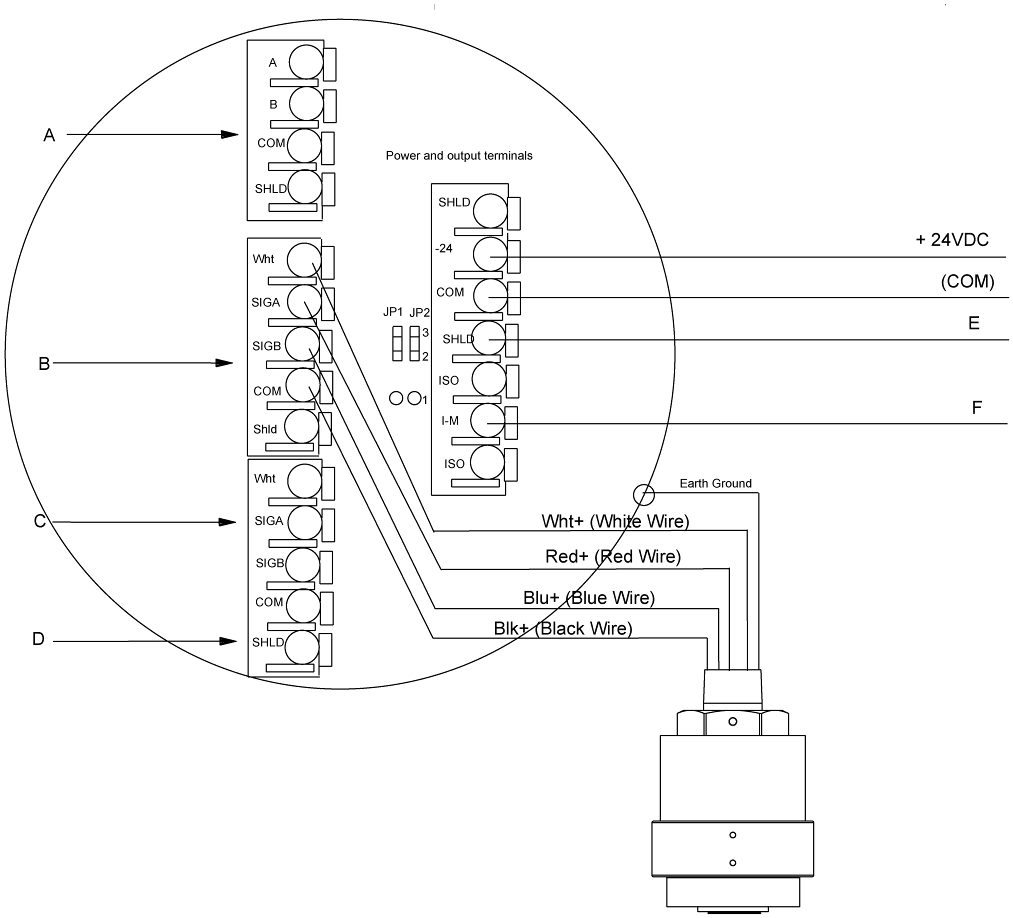
Table 2-1: Sensor wires and Millennium II series Terminal definitions

Sensor wire	White	Red	Blue	Black	Green
Marked	+Vdc	Sig A	Sig B	COM	

Table 2-1: Sensor wires and Millennium II series Terminal definitions *(continued)*

Function	10.5 - 32 Vdc connection	Communi-cation signal A	Communi-cation signal B	Common/ supply ground	Earth ground

Figure 2-6: Net Safety Millennium II M21 Sensor Wiring



A. *Modbus® terminals*
B. *Channel 1 sensor terminals*
C. *Channel 2 sensor terminals*
D. *Net Safety™ Millennium II transmitter terminal board*
E. *Channel #1 4-20 mA signal*
F. *Channel #2 4-20 mA signal*

2.5.4 Installation checklist

Review the following checklist prior to turning on power to the sensor after completing installation.

- Ensure transmitter and sensor are properly and firmly mounted.
- Ensure that stopping plug is tightened on any unused conduit entries.

- Ensure transmitter and sensor are not being obstructed, transmitter and sensor are accessible, and target gas is not inhibited from reaching sensor.
- Remove the red protective plastic cap/cover from sensor mouth.
- If calibration cups or splash guards are fitted to sensor, ensure a snug fit.
- Ensure adherence to applicable local guidelines and requirements on wiring and sealing of equipment in hazardous and non-hazardous areas.
- Ensure that proper shielding and grounding practices are adhered to and local codes are being followed.
- Check system operational voltage and conditions and ensure that they are within the applicable specifications of the sensor.
- Verify wiring at all termination and junction points (transmitter, junction box, and power supply).
- If the sensor housing has been opened, ensure that the sensor module is properly seated and making a good connection. Refer to Replace sensor for more details.
- Perform initial calibration as per Calibrate.

3 Operate

3.1 Configuration settings

You can access all configuration settings for the Net Safety™ SC311 through the Net Safety Millennium II series of transmitters.When using the Net Safety Millennium II transmitter, access configuration settings by selecting menu options through the main display.

Tip
Refer to the relevant transmitter manual prior to calibrating.

3.2 Power up

When power is applied to the sensor by the transmitter, a warm-up routine will begin, and the sensor will be automatically tested to ensure proper functioning. The warm-up time for the Net Safety™ SC311 is typically 90 seconds. Refer to the Net Safety Millennium II Transmitter Reference Manual or the Net Safety Millennium II Basic Transmitter Reference Manual for status indicators during this period.

3.3 Communication

The Net Safety™ SC311 sensor uses a proprietary protocol to communicate with the Net Safety Millennium II series transmitters.

Never connect these sensors to a device other than Net Safety Millennium II series transmitters. Selected DIP switches and menu options allow communication between transmitters and sensors. The sensor's memory stores configuration settings. Incorrect settings will cause sensors not to communicate properly with transmitters. If any problems develop, see Troubleshoot.

3.4 Net Safety™ Millennium II basic transmitter configuration

When using the Net Safety SC311 with the Net Safety Millennium II basic transmitter, set the transmitter DIP switch as follows.

Table 3-1: Net Safety Millennium II Basic Transmitter DIP Switch 2 Positions

Gas curve	Position 1	Position 2	Position 3	Position 4
Methane (0)	Off	Off	Off	Off
Propane (1)[1]	On	Off	Off	Off
n-Butane (2)[1]	Off	On	off	Off
Iso-Pentane (3)[1]	On	On	Off	Off
n-Pentane (4)[1]	Off	Off	On	Off

Table 3-1: Net Safety Millennium II Basic Transmitter DIP Switch 2 Positions *(continued)*

Gas curve	Position 1	Position 2	Position 3	Position 4
Ethane (5)	On	Off	On	Off
Iso-Butane (6)(1)	Off	On	On	Off
Ethylene (7)	On	On	On	Off
Hexane (8)(1)	Off	Off	Off	On
Propylene (9)	On	Off	Off	On

(1) Gas is not third party performance verified.

3.5 Fault conditions

The sensor provides a number of fault conditions that the transmitter translates into an analog or fault relay output. These fault conditions are outlined in the following table:

Table 3-2: Fault Conditions

Fault condition	Analog output (mA)	Fault relay output
Span calibration failure	2.5	Fault
Zero calibration failure	2.5	Fault
Sensor over-range	2.5	Fault
Low temperature	2.5	Fault
High temperature	2.5	Fault
Low voltage	2.5	Fault
High voltage	2.5	Fault
Replace sensor (during calibration cycle)	Momentary 2.5	Momentary fault
Memory fault	2.5	Fault
Power supply fault	2.5	Fault

4 Output

4.1 Alarm and fault outputs

Sensor alarm and fault outputs are generated by the Net Safety™ Millennium II series transmitters based on communication with sensors; however, some output values, registers, etc. may vary depending on sensor type. The default alarm levels (points) for the sensor are: 20 percent for the low level and 40 percent for the high level.

4.1.1 Other available outputs

All available outputs are associated with the Net Safety™ Millennium II series transmitters. These outputs are: 4-20 mA output, relay output, RS 485 Modbus® (RTU) output and HART® communication output. Refer to the Net Safety Millennium II Basic Transmitter Reference Manual or the Net Safety Millennium II Multichannel Transmitter Reference Manual for more information.

4.1.2 Modbus registers

Table 4-1 below shows the user accessible Modbus registers and meaning.

Table 4-1: Modbus Registers

Register #	Meaning	Readable	Writeable
40001	Concentration value as calculated by sensor	X	
40002	Sensor status	X	
40003	Sensor temperature	X	
40009	Select target gas	X	X
40101	Resets the sensor		X
40102	Initialize zero & span (1)		X
40104	Zero only (2)		X

(1) To calibrate sensor, enter channel number.
(2) To zero sensor, enter channel number.

Note
For the Net Safety™ Millennium II Basic Transmitter enter `1` in register 40102 to calibrate the sensor and `1` in register 40104 to zero the sensor.

5 Maintenance

5.1 Calibrate

Note

According to instrumentation best practices, the Net Safety™ SC311 should be powered up for at least 30-60 minutes prior to completing the first calibration.

You must calibrate the infrared sensor with the target gas for the application and the gas the sensor is programmed for. The calibration gas can be either air or nitrogen based.

Calibrate the sensor every twelve months. In environments where the sensor may be routinely exposed to gas concentrations or airborne contaminants, verify or calibrate the sensor more frequently. The calibration gas must be between 5 and 113 °F (-15 and 45 °C) to meet accuracy specifications.

Since external factors can affect the sensor's ability to properly detect gas, Emerson highly recommends quarterly inspections and bump tests to ensure proper operation of the gas detection system.

If using accessories with the sensor, calibrate with these accessories in place.

There are specific steps to be followed when calibrating with the Net Safety Millennium II transmitters. Refer to the appropriate transmitter manual for calibration procedures. Follow these steps to obtain accurate results.

5.1.1 Calibrate with the Net Safety™ Millennium II Basic Transmitter

When using the IR sensor with the Net Safety Millennium II Basic Digital Transmitter Model, access a specific Modbus® register to select or change the target gas. Write to register 40009 using the preset single register command `0x06` to change the target gas. To select the target gas, enter the gas curve number that corresponds to the target gas from Table 5-1 below.

The table below outlines the primary detected gases of this sensor, however, multiple other gases are detectable. Please contact your representative regarding any gases not included in this table.

Table 5-1: Target Gas with Gas Curve Numbers

Target gas	Gas curve numbers
Methane	0
Propane	1
*n-Butane	2
*Iso-Pentane	3
*n-Pentane	4
Ethane	5

Table 5-1: Target Gas with Gas Curve Numbers *(continued)*

Target gas	Gas curve numbers
*Iso-Butane	6
Ethylene	7
*Hexane	8

* Indicates gases not performance certified.

When using the IR sensor with the Net Safety Millennium II Basic analog, analog HART® and relay transmitter models, make use of the transmitter's DIP Switch 2 positions, as seen in Table 5-2 below, to select the target gas, and then follow the normal calibration procedure to perform calibrations. Use 50% LEL of the specific gas to be detected for calibration. See Table 5-2 and Full Calibration / Normal Calibration Procedure below.

If calibration is not successful perform a manual reset. See Net Safety Millennium II Basic Reference Manual for manual reset.

Example: If the target gas is propane, set Dip Switch 2 position 1 in the ON position and positions, 2, 3 and 4 in the OFF position. This corresponds to propane (Curve 2); then use 50% LEL propane for calibration.

Table 5-2: Net Safety Millennium II Basic Transmitter DIP Switch 2 Positions/Combinations

Position 1	Position 2	Position 3	Position 4	Gas curves
OFF	OFF	OFF	OFF	Curve 1 (methane)
ON	OFF	OFF	OFF	Curve 2 (propane)
OFF	ON	OFF	OFF	* Curve 3 (n-butane)
ON	ON	OFF	OFF	*Curve 4 (iso-pentane)
OFF	OFF	ON	OFF	* Curve 5 (n-pentane)
ON	OFF	ON	OFF	Curve 6 (ethane)
OFF	ON	ON	OFF	*Curve 7 (iso-butane)
ON	ON	ON	OFF	Curve 8 (ethylene)
OFF	OFF	OFF	ON	*Curve 9 (hexane)
ON	OFF	OFF	ON	Curve 10 (TBA)
OFF	ON	OFF	ON	Curve 11 (TBA)
ON	ON	OFF	ON	Curve 12 (TBA)
OFF	OFF	ON	ON	Curve 13 (TBA)
ON	OFF	ON	ON	Curve 14 (TBA)
OFF	ON	ON	ON	Curve 15 (TBA)
ON	ON	ON	ON	Curve 16 (TBA)

* Indicates gases not performance certified

If the sensor's configuration setting (curve) is setup correctly as desired, refer to Millennium II Basic Transmitter calibration procedure below and/or Figure 5-1 before attempting calibration.

You can calibrate with either the magnet (non-intrusive) or the push button (intrusive).

Procedure

1. Confirm successful power up of transmitter, (green blip/blink of status LED every second: no fault indicated).
2. Bypass any output alarms (recommended).
3. For analog model connect a standard current meter to the transmitter's test jacks.

   This is not required but gives visual confirmation.
4. Press and hold the push button (or activate the reed switch using the magnet) for at least 15 seconds, the status LED flashes green fast and then goes solid green (first solid green).
5. Keep holding push button or magnet, after which status LED goes solid red. When this occurs, release push button or remove magnet.
6. When the current output is 3 mA (indicated by analog models) and the status LED is once again solid green (second solid green), apply zero gas (clean air).

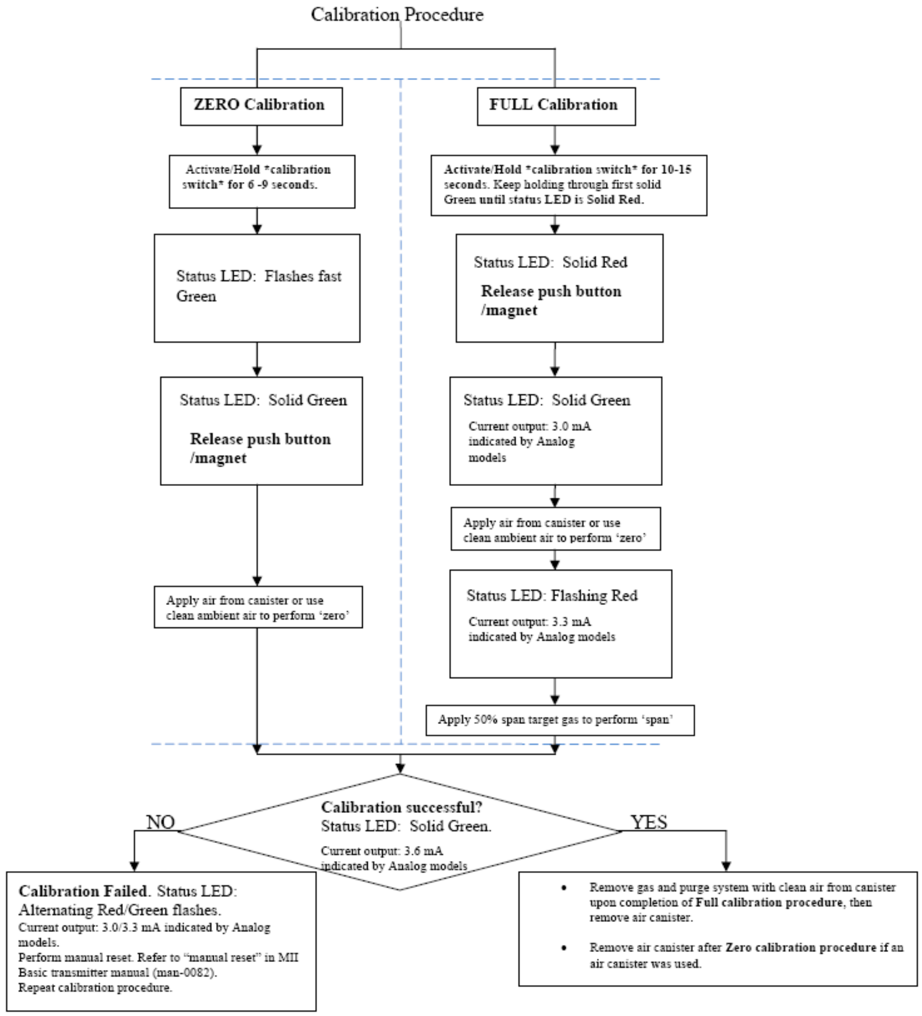
   Recommendation: Flow zero air at a rate of 0.5 liter per minute or more to the sensor.
7. When the current output is 3.3 mA (indicated by analog models) and the status LED is flashing red, apply specific calibration gas (50 percent of full span).

   Recommendation: Flow span gas at a rate of 0.5 liter per minute to the sensor for direct sensor calibrations. If sensor is remotely mounted and long tubing run is used, increase gas flow rate (e.g. 1.0 liter per minute) to ensure tubing length does not affect calibration results.
8. When the current output is 3.6 mA (indicated by analog models) and the status LED is solid green, remove the gas.
9. Apply zero gas (clean air) again to purge the system.
   After the sensor is purged of gas, the detector will return to normal operation.

Note
When calibrating with the Net Safety Millennium II Basic Transmitter always use 50 percent span gas (half the scale). Calibration gas can be air balanced or nitrogen balanced for IR sensors. You can also access calibration instructions from the HART Communicator with the analog/HART model transmitter. For HART menu structure, see Net Safety Millennium II Basic Transmitter Reference Manual.

Zero calibration option: This option is useful if the sensor's zero point has drifted as a result of a change in the ambient conditions. Only select the zero calibration option if a sensor is only being zeroed (this not a complete calibration). It does not require the application of span gas, as only the sensor's zero point is adjusted. Ensure that no contaminants are present if the surrounding air is to be used for zeroing. If Zero calibration is needed, at Step 4, hold the push button or activate reed switch (for 6-9 seconds) using the magnet until the status LED goes solid green, and then release the switch. Zero calibration will begin immediately. See Figure 5-1 for additional reference.

Figure 5-1: Calibration Flow chart for Millennium II Basic Transmitter



Note

See the Net Safety Millennium II Basic Transmitter Reference Manual when locating calibration switch (push button) or magnetic switch.

5.1.2 Calibrate with the Net Safety™ Millennium II Multi-Channel Transmitter

The Net Safety Millennium II Transmitter allows monitoring and detection of various combustible gases. The following procedures are specific to this transmitter; follow them to ensure accurate calibration and detection of gases.

To select the target gas:

Procedure

1. Enter the Main menu, first by pressing any key to get the `enter main menu` prompt, then press **menu button 1** (**reed switch 1**) to select `yes`.
2. Select the up arrow key (**menu button 1** or **reed switch 1**) or down arrow key (**menu button 2** or **reed switch 2**), until `Select Gas Type` is displayed.
3. Select the **Enter** key (**menu button 3** or **reed switch 3**) to enter the option.
4. If configuring channel 1's gas type, select it with the **Enter** key (**menu button 3** or **reed switch 3**.
5. If configuring channel 2's gas type, use the down arrow key (**menu button 2** or **reed switch 2**) and then select it with the **Enter** key (**menu button 3** or **reed switch 3**).
6. If the gas type displayed is not the required target gas, select the down arrow key (**menu button 2** or **reed switch 2** until the desired target gas is found.
7. Activate the enter key (**menu button 3** or **reed switch 3**) to select the specific gas to be detected.
8. Use the down arrow key (**menu button 2** or **reed switch 2**) and then the **Enter** key (**menu button 3**or **reed switch 3**) until the main menu is completely exited.

   Refer to the Net Safety Millennium II Transmitter calibration procedure below and/or Figure 5-2 before attempting calibration. If the sensor's target gas is setup correctly as desired, follow the steps below for full calibration/normal calibration procedure.

   Important
   Always use 50 percent span gas (half the scale) of the specific target gas when calibrating this sensor.

   Note that if a calibration is not successful the transmitter will display the message `Span failed`, and you will have to initiate a manual reset. Refer to the Net Safety Millennium II Multi-Channel Transmitter Reference Manual for manual reset.

9. Enter the main menu, first by pressing any key to get the `enter main menu` prompt, and then pressing or selecting menu button 1 or reed switch 1 to select `yes`.
10. When `Calibrate Sensor?` is displayed, select the **Enter** key (**menu button 3**or **reed switch 3**).
11. When `Calibrate Sensor #1?` is highlighted, press the **Enter** key (**menu button 3**or **reed switch 3**) if calibrating this sensor.
12. If calibrating sensor 2, select the down arrow key (**menu button 2**or **reed switch 2**) to scroll to `Calibrate Sensor #2`?
13. When the desired sensor to be calibrated (1 or 2) is highlighted, activate the enter key (**menu button 3**or **reed switch 3**).
14. Select `YES` (**menu button 1**or **reed switch 1**) to confirm the selection.
15. Apply clean air when `Apply Clean Air` is displayed; then select `Z & Span` using ((**menu button 1**or **reed switch 1**) for normal calibration.

   The transmitter will display `Setting zero` as the sensor is being zeroed. (Ensure no contaminant gases are around if using ambient air).

16. Apply 50 percent calibration gas when prompted.

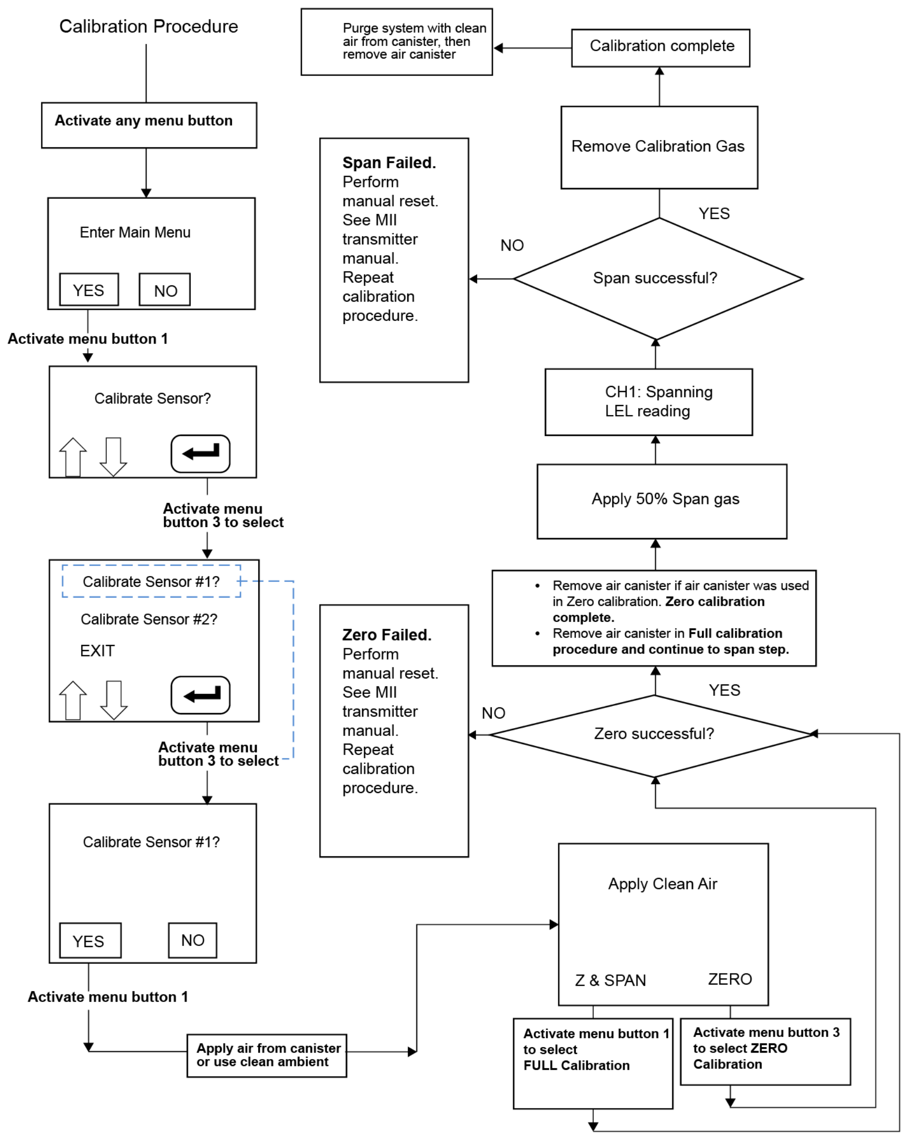
    Recommendation: Flow span gas at a rate of 0.5 liter per minute to the sensor for direct calibrations. If sensor is remotely mounted and long tubing run is used, increase gas flow rate (e.g. 1.0 liter per minute) to ensure tubing length does not affect calibration results.

17. The display will show `Spanning` with the gas value (`% LEL`) as the gas is detected.
18. Remove the calibration gas when `Remove Cal Gas` is displayed.
19. The transmitter displays `Cal Complete` when calibration is complete.
20. Apply zero gas (clean air) to purge system.

    Note
    Calibration gas can be air or nitrogen balanced. You can also access calibration instructions from the HART® Communicator with the single channel Net Safety Millennium II Transmitter model.

    Zero calibration option: This option is useful if the sensor's zero point has drifted as a result of a change in the ambient conditions. Only select the Zero calibration option if the sensor is only being zeroed (this not a complete calibration). The application of span gas is not required, as only the sensor's zero point is adjusted. Ensure that no contaminants are present if using the surrounding air for zeroing. If you need zero calibration, at Step 7 above, select `Zero` using **menu button 3**or **reed switch 3**.See Figure 5-2 for additional reference. The chart shows calibration steps for channel 1. Calibration steps for channel 2 are similar.

Figure 5-2: Calibration Flow chart for Net Safety Millennium II Multi-Channel Transmitter



5.1.3 Cross sensitivities

Infrared sensors react to most compounds containing a carbon-hydrogen bond (hydrocarbons) in varying degress, potentially providing a response from the sensors.

You need to consider other gases present within this particular application for their impact on this sensor. For more information, please contact the manufacturer.

5.2 Replace sensor

Emerson pre-calibrates sensors at the factory; however you must field calibrate as part of commissioning. When you cannot calibrate or the sensor is not operating properly, you may need to replace the sensor module.

⚠ WARNING

Do not open the transmitter, sensor, or junction box enclosure when in a classified area or when an explosive atmosphere may be present unless the power to the sensor has been removed.

⚠ CAUTION

Avoid touching any electronic components, as they may be susceptible to electrostatic discharge (ESD). Refer to Electrostatic sensitive device (ESD) for further information and proper handling instructions of electronic components.

Procedure

1. Remove power from the sensor.
2. Remove the locking ring by loosening the set crews with 1.5 mm Allen Key tool.
3. Remove the bottom part of the sensor enclosure by turning in a counter clockwise direction to expose sensor module.
4. Carefully remove the sensor module from the sensor housing by pulling on the gold sensor until the sensor cell and sensor board have been fully removed from the housing.

   In some cases, the sensor cell may disconnect from the board. This is normal, and you can easily fit the sensor cell back onto the sensor board.
5. Disconnect the wire assembly from the sensor board to remove the sensor from the housing.
6. Properly dispose of the old sensor module as per local guidelines and regulations.
7. Remove the replacement sensor module from its packaging, being careful not to touch any electronic components, as this may cause problems due to unwanted electrostatic discharge (ESD).
8. Connect the wire assembly from the sensor housing to the sensor board, being careful not to touch any electronic components on the board.
9. Align the replacement sensor module banana plugs with the standoffs in the housing and press the replacement sensor into place.
10. Install and hand-tighten the bottom part of the sensor enclosure by turning in a clockwise direction.
11. Install the locking ring by tightening the set screws with 1.5 mm Allen key tool.
12. Restore power to sensor via transmitter.

5.3 Troubleshoot

Emerson did not design sensors or transmitters to be repaired in the field. If problems should develop, first check for faulty wiring, confirm proper voltage to sensor, and attempt a calibration.

If problems persist, please contact the Flame and Gas Detection Customer Care team first by phone to try and resolve any issues. If issues cannot be resolved, please follow the procedure in Return of material.

5.4 Storage

Store the sensor and its electronic components/parts in locations free from dust, liquid spills, contaminants, and moisture.

Make sure the storage temperature is well within the limits of the certified temperatures of the equipment. See Specifications for certified temperatures.

5.5 Spare parts and accessories

Table 5-3: Available Spare Parts

Description	Net Safety™ Part Number
Calibration cup/splash guard	CCS-1
Calibration kit	CAL-KIT-1
Calibration gas	CAL-CYL-AIR (103 L air) CAL-CYL-BUT (103 L butane) CAL-CYL-ETH-A-50 (103 L ethylene) CAL-CYL-HYD (103 L hydrogen) CAL-CYL-METH (103 L methane) CAL-CYL-PENT (103 L pentane) CAL-CYL-PRO (103 L propane)
Ingress protection filter	IPF-001
Separation kit	JB-MPD-A: aluminum JB-MPD-S: 316 stainless steel
Replacement sensor module	SC311-100

Note
The Net Safety SC311 is not certified for performance when the calibration cup, ingress protection filter, or dust guard is attached.

5.6 Return of material

To expedite the repair and return of this product, proper communication between the customer and the factory is important.

Prerequisites

Before returning a product for repair, call +1 866 347 3427 (toll free) or email Safety.CSC@emerson.com for a Return Material Authorization (RMA) number.

On the return of the equipment, include the following information:

1. RMA number provided to you by Net Safety™.
2. Company name and contact information.
3. Purchase order, from your company, authorizing repairs or request for quote.

Procedure

1. Ship all equipment, prepaid to:

   Emerson Automation Solutions

   6021 Innovation Blvd

   Shakopee, MN 55379

2. Mark all packages with *Return for Repair* and include RMA number and type of return (e.g., return for evaluation).

   Pack items to protect them from damage and use anti-static bags or aluminum-backed cardboard as protection from electrostatic damage.

   Important
   All equipment must be shipped prepaid. Emerson will not accept collect shipments.

A Electrostatic sensitive device (ESD)

Definition Electrostatic discharge (ESD) is the transfer, between bodies, of an electrostatic charge caused by direct contact or induced by an electrostatic field.

The most common cause of ESD is physical contact. Touching an object can cause a discharge of electrostatic energy (ESD). If the charge is sufficient and occurs near electronic components, it can damage or destroy those components. In some cases, damage is instantaneous, and an immediate malfunction occurs. However, symptoms are not always immediate; performance may be marginal or seemingly normal for an indefinite period of time, followed by a sudden failure.

To eliminate potential ESD damage, review the following guidelines:

- Handle boards by metal shields, taking care not to touch electronic components.
- Wear grounded wrist or foot straps, ESD shoes, or heel grounders to dissipate unwanted static energy.
- Prior to handling boards, dispel any charge in your body or equipment.
- Ensure all components are transported and stored in static safe packaging.
- When returning boards, carefully package in the original carton and static protective wrapping.
- Ensure all personnel are educated and trained in ESD control procedures.

In general, exercise accepted and proven precautions normally observed when handling electrostatic sensitive devices. A warning label is placed on the packaging, identifying product using electrostatic sensitive semiconductor devices.

B Wire resistance table

Distance: feet (meters)	AWG #20 0.5 mm^2 (ohms)	AWG #18 0.8 mm^2 (ohms)	AWG #16 1.0 mm^2 (ohms)	AWG #14 2.0 mm^2 (ohms)
100 (30.5)	1.02	0.64	0.40	0.25
200 (61)	2.03	1.28	0.80	0.51
300 (91.4)	3.05	1.92	1.20	0.76
400 (121.9)	4.06	2.55	1.61	1.01
500 (152.4)	5.08	3.20	2.01	1.26
600 (182.9)	6.09	3.83	2.41	1.52
700 (213.4)	7.11	4.47	2.81	1.77
800 (243.8)	8.12	5.11	3.21	2.02
900 (274.3)	9.14	5.75	3.61	2.27
1000 (304.8)	10.20	6.39	4.02	2.53
1250 (381)	12.70	7.99	5.03	3.16
1500 (457.2)	15.20	9.58	6.02	3.79
1750 (533.4)	17.80	11.20	7.03	4.42
2000 (609.6)	20.30	12.80	8.03	5.05
2250 (685.8)	22.80	14.40	9.03	5.68
2500 (762)	25.40	16.00	10.00	6.31
3000 (914.4)	30.50	19.20	12.00	7.58
3500 (1066.8)	35.50	22.40	14.10	8.84
4000 (1219.2)	40.60	25.50	16.10	10.00
4500 (1371.6)	45.70	28.70	18.10	11.40
5000 (1524)	50.10	32.00	20.10	12.60
5500 (1676.4)	55.80	35.10	22.10	13.91
6000 (1828.8)	61.00	38.30	24.10	15.20
6500 (1981.2)	66.00	41.50	26.10	16.40
7000 (2133.6)	71.10	44.70	28.10	17.70
7500 (2133.6)	76.10	47.90	30.10	19.00
8000 (2438.4)	81.20	51.10	23.10	20.20
9000 (2743.2)	91.40	57.50	36.10	22.70
10000 (3048)	102.00	63.90	40.20	25.30

Resistance shown is one way. This figure should be doubled when determining closed loop resistance.

C Specifications

Voltage range	10.5 to 32 Vdc
Performance	
Response time	T50 < 4.3 sec T60 < 7.0 sec T90 < 11.0 sec(1)
Accuracy	± 5% LEL or 10% of applied, whichever is greater(1)
Zero drift	< 5% full scale per year
Repeatability	±2% LEL Full Scale
Detection range	0-100% LEL
Calibration frequency	12 months
Environmental	
Storage temperature	-40 °F to +158 °F (-40 °C to +70 °C)
Operating temperature	-40 °F to +167 °F (-40 °C to +75 °C)
Relative humidity	0 – 99% relative humidity, non-dondensing
Enclosure material (housing)	316 stainless steel and 6061 aluminum
Ingress protection	IP64
Weight	Stainless steel: 3.5 lb. (1.4 kg) Aluminum: 1 lb. (0.4 kg)
Separation	Up to 2000 ft. (610 m) with 18 AWG (1.02 mm^2) wire
Warranty	5 years

(1) Methane at room temperature

D Product certifications

D.1 North America

D.1.1 Hazardous locations

FM APPROVED

Class I, Division 1, Groups BCD T5

Class I, Zone 1, AEx/Ex d IIB +H_2 T5

-40 °C ≤ Ta ≤ +75 °C

D.1.2 Performance

CSA C22.2 No. 152: 2006

FM Class 6310, 6320: 2001

ANSI/ISA 12.13.01:2000

D.2 IECEx

Ex d IIB+H_2 T5 Gb

IECEx FMG 12.0007X

Special conditions for safe use:

1. Consult the manufacturer if dimensional inforation on the flameproof joints is necessary.
2. The flying leads of the Net Safety™ Millennium II sensor shall be suitably protected against mechanical damage and terminated within a terminal or junction facility suitable for the conditions of use.

D.3 FC models

Net Safety™ SC311 infrared sensors, models SC311x-100-ASSY-FC, when used with wireless capable Net Safety Millennium II transmitters, carry the following certifications. All certifications outlined above do not pertain to these models.

D.3.1 North America (-FC models)

Class I, Division 1, Groups BCD T5

Class I, Zone 1, AEx/Ex d IIB+ H_2 T5

-40 °C ≤ Ta ≤ +75 °C

CSA C22.2 No. 152 FM6320

D.3.2 IECEx (-FC models)

Ex d IIB+H_2 T5 Gb

-40 °C ≤ Ta ≤ +75 °C

IECEx FMG 12.0007X

Special conditions for safe use

1. Consult the manufacturer if dimensional information on the flameproof joints is necessary.
2. The flying leads of the Net Safety™ Millennium II sensor shall be suitably protected against mechanical damage and terminated within a terminal or junction facility suitable for the conditions of use.

E Ordering information

Model	
SC311	Net Safety™ Millennium II infrared combustible gas sensor
Housing	
A	Aluminum
S	Stainless steel
Range	
100-ASSY	100% LEL
Wireless	
FC	When used with wireless capable Net Safety Millennium II transmitters

00809-0100-4311
Rev. AA
2019

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