Explosion Proof Gas Sensor
Instruction Manual

Thank you for your purchase of a EXP-SNR-TG-EC Series gas sensor from Larson Electronics.

WARNING

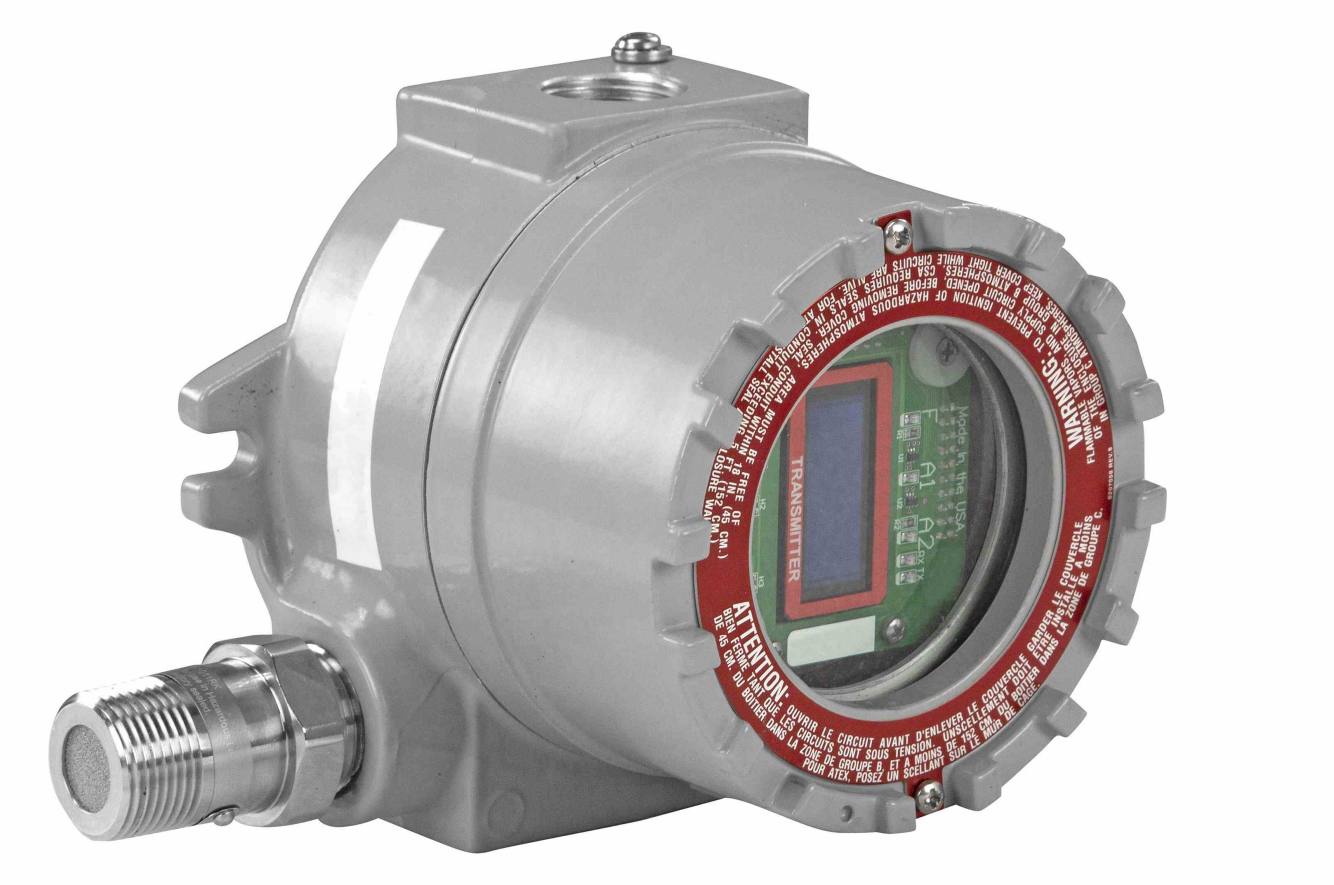
TO AVOID THE RISK OF FIRE, EXPLOSION OR ELECTRIC SHOCK, THIS PRODUCT SHOULD BE INSTALLED, INSPECTED AND MAINTAINED BY A QUALIFIED ELECTRICIAN ONLY, IN ACCORDANCE WITH ALL APPLICABLE ELECTRICAL CODES.

TO AVOID ELECTRIC SHOCK:

- BE CERTAIN ELECTRICAL POWER IS OFF BEFORE AND DURING INSTALLATION AND MAINTENANCE.
- PRODUCT MUST BE CONNECTED TO A WIRING SYSTEM WITH AN EQUIPMENT-GROUNDING CONDUCTOR.

TO AVOID EXPLOSION:

- MAKE SURE THE SUPPLY VOLTAGE IS WITHIN THE VOLTAGE RATING.
- ENSURE THE MARKED T RATING IS LESS THAN THE IGNITION TEMPERATURE OF THE HAZARDOUS ATMOSPHERE.
- DO NOT OPERATE IN AMBIENT TEMPERATURES ABOVE THOSE INDICATED ON THE PRODUCT NAMEPLATE.
- DO NOT OPERATE IF THE LENS, CORD, SEALS, HOUSING, RECEPTACLES, ETC. IS CRACKED OR DAMAGED. IF SO, DISCONTINUE USE AND CONTACT MANUFACTURER FOR REPLACEMENT PARTS.
- ALL FASTENERS SHOULD BE PROPERLY SEATED.



Specifications

Table 1 lists specifications for the EXP-SNR-TG-EC.

Table 1: EXP-SNR-TG-EC Specifications

Target Gas/Detection Range	**Combustible Gas/Carbon Dioxide (CO_2)** • Catalytic LEL: 0 - 100% LEL, 1% LEL increments (CH_4 calibration unless otherwise specified. H_2 specific detector available) • Catalytic CH_4 ppm: 0 - 9000 ppm, 20 ppm increments • IR (infrared) CH_4 LEL: 0 - 100% LEL, 1% LEL increments • IR HC LEL: 0 - 100% LEL, 1% LEL increments (propane calibration) • IR CH_4 Volume: 0 - 5.00% volume, 0.01% increments • IR CH_4 Volume: 0 - 100 % volume, 1% increments • IR CO_2 ppm: 0 - 5,000 ppm, 20 ppm increments • IR CO_2 Volume: 0 - 5.00 % volume, 0.01% increments • IR CO_2 Volume: 0 - 50.0 % volume, 0.1% increments • IR CO_2 Volume: 0 - 100 % volume, 1% increments **Oxygen** • Oxygen (O_2): 0 - 25.0 % volume, 0.1% increments **CO/H_2S** • Carbon Monoxide (CO): 0 - 300 ppm, 1 ppm increments • Carbon Monoxide (CO): 0 - 200 ppm, 1 ppm increments • Carbon Monoxide (CO): 0 - 100 ppm, 1 ppm increments • Hydrogen Sulfide (H_2S): 0 - 100 ppm, 1 ppm increments **Toxic** • Ammonia (NH_3): 0 - 75.0 ppm, 0.1 ppm increments • Arsine (AsH_3): 0 - 1.50 ppm, 0.01 ppm increments • Chlorine (Cl_2): 0 - 3.00 ppm, 0.01 ppm increments • Chlorine (Cl_2): 0 - 10.0 ppm, 0.1 ppm increments • Chlorine Dioxide (ClO_2): 0 - 1.00 ppm, 0.01 ppm increments • Hydrogen Cyanide (HCN): 0 - 15.0 ppm, 0.1 ppm increments • Phosphine (PH_3): 0 - 1.00 ppm, 0.01 ppm increments • Sulphur Dioxide (SO_2): 0 - 6.00 ppm, 0.01 ppm increments
Alarm Settings (Alarm 1/Alarm 2)	**Ammonia:** 12 ppm/25 ppm **Arsine:** 0.20 ppm/0.50ppm **Carbon Dioxide 0 - 5,000 ppm:** 2,500 ppm/5,000 ppm **Carbon Dioxide 0 - 5.00%:** 0.50 %/3.00 % **Carbon Dioxide 0 - 50.0%:** 50.0%/50.0% **Carbon Dioxide 0 - 100%:** 100%/100% **Carbon Monoxide (all ranges):** 25 ppm/50 ppm **Chlorine (0 - 3.00 ppm):** 0.50 ppm/1.50 ppm **Chlorine (0 - 10.0 ppm):** 1.0 ppm/3.0 ppm **Chlorine Dioxide (0 - 1.00 ppm):** 0.10 ppm/0.20 ppm **Combustible Gas (%LEL):** 10 %LEL/50 %LEL **Combustible Gas (0-100%Volume):** 100 %/100 % **Hydrogen Cyanide:** 5.0 ppm/10.0 ppm **Hydrogen Sulfide:** 10 ppm/50 ppm **Methane (ppm):** 5000 ppm/8000 ppm **Methane (0-5.00%Volume):** 0.5%/2.5 % **Oxygen:** 19.5%(decreasing)/23.5%(increasing) **Phosphine:** 0.10 ppm/0.30 ppm **Sulphur Dioxide:** 1.00 ppm/2.00 ppm

Table 1: EXP-SNR-TG-EC Specifications

Construction (housing)	Explosion-proof Junction Box, NEMA 4X		
Area Classification	Explosion-proof for Class I, Groups B, C, and D (Combustible, CO_2, CSA Type CO and H_2S, and CSA Type oxygen)		
Sampling Method	Diffusion		
Input Power	10 - 30 VDC		
Controls	• Three push button switches • Three magnetic switches for non-intrusive calibration		
Weight	4.5 lbs.		
Signal Output	• 4 to 20 mA with impedance maximums listed below -12 VDC input: 500 ohms impedance max -24 VDC input: 1000 ohms impedance max • RS-485 Modbus		
		Explosion Proof	**Non-Explosion Proof**
Operating Temperature	**Catalytic LEL/ppm**	-40°C to 75°C	N/A
	Oxygen	-20°C to 45°C	-20°C to 50°C
	H_2S	-40°C to 40°C	-40°C to 50°C
	CO	-5°C to 40°C	-20°C to 50°C
	Toxic (ESM-01)	N/A	-10°C to 40°C
	Toxic (CT-7 Series)	N/A	-20°C to 40°C
	Infrared Combustible	-20°C to 50°C	-40°C to 50°C
	Infrared CO_2	-20°C to 50°C	-40°C to 50°C
Accuracy	Catalytic Combustible Gas (LEL range): ± 5% of reading or ± 2% LEL (whichever is greater) Catalytic CH_4 (ppm range): ± 5% of reading or ± 50 ppm (whichever is greater)** IR Combustible Gas/IR CO_2: ± 5% of reading or ± 2% of full scale (whichever is greater) Oxygen: ± 0.5% O_2 Hydrogen Sulfide: ± 5% of reading or ± 2 ppm H_2S (whichever is greater) Carbon Monoxide: ± 5% of reading or ± 5 ppm CO (whichever is greater) Toxic Sensors (ESM-01 Type and CT-7 Series Type): ± 10% of reading or ± 5% of full scale (whichever is greater)		

* These are factory settings. See "Viewing & Changing EXP-SNR-TG-EC Parameters" to change the alarm settings.
**Independent of zero drift.

WARNING: ***When using the EXP-SNR-TG-EC, you must follow the instructions and warnings in this manual to assure proper and safe operation of the EXP-SNR-TG-EC and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the EXP-SNR-TG-EC as described in this manual.***

Chapter 2: Description

Overview

This chapter describes external and internal components of the EXP-SNR-TG-EC Transmitter.

External Description

This section describes the junction box and all external components of the EXP-SNR-TG-EC transmitter.

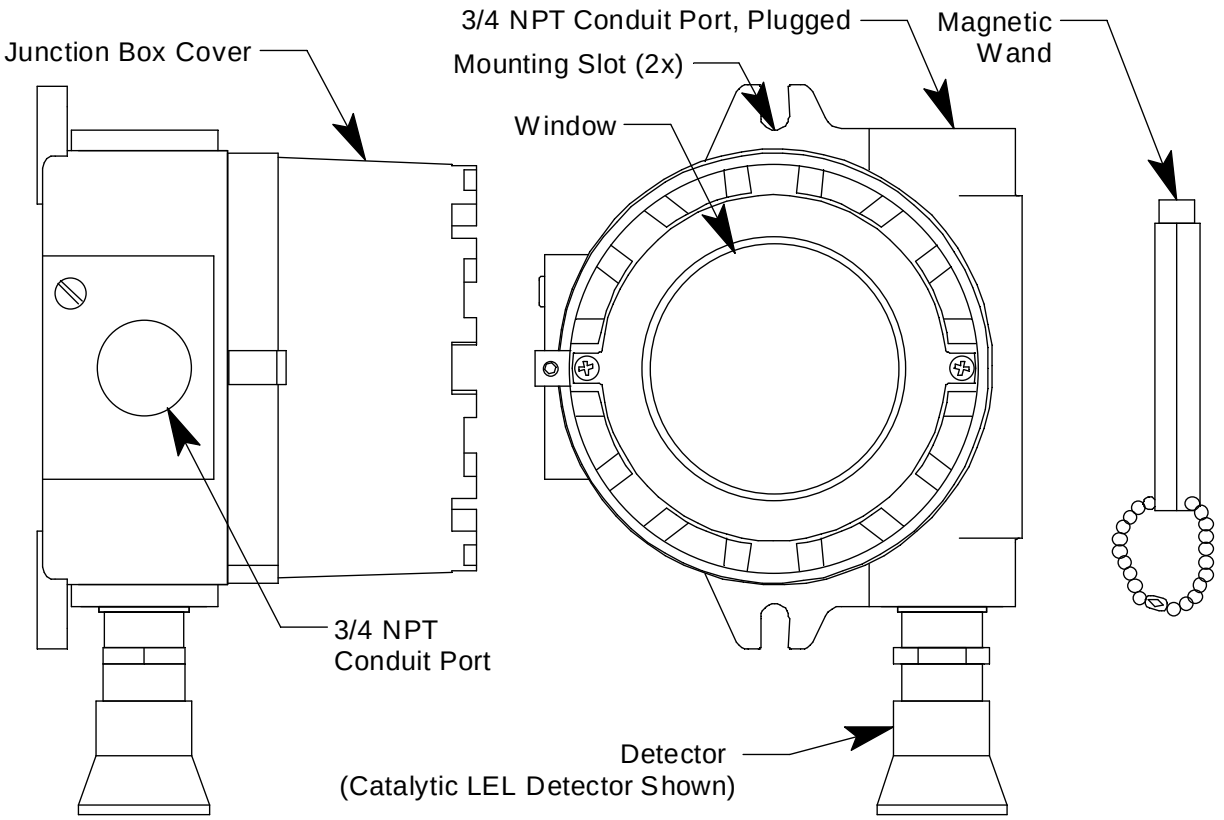


Figure 1: EXP-SNR-TG-EC External Components

Junction Box

The sensor's cast aluminum junction box is dust and weather resistant. The junction box also protects the EXP-SNR-TG-EC and all connections made to it. Use the three 3/4 NPT conduit ports to mount the detector to the junction box (factory installed in the bottom port) and connect wiring from an external device (left port). The top port is shipped with a factory installed and sealed conduit plug to avoid leaks into the junction box. If necessary, the conduit plug can be removed and the top port can be used for wiring.

WARNING: ***If the top conduit port is used for wiring, be sure to seal the threads to ensure water does not enter the junction box. See "Wiring the EXP-SNR-TG-EC Transmitter" for complete wiring instructions.***

Use the junction box's two mounting holes to mount the EXP-SNR-TG-EC to a vertical surface at the monitoring site. The window in the cover on the front of the junction box allows you to view the OLED display and use the magnetic wand to actuate the magnetic control switches so you can perform non-intrusive calibration. Removing the cover allows you to access the interior of the junction box.

Magnetic Wand

The magnetic wand is a short plastic rod with a magnet in one end. It is used to actuate the magnetic control switches on the control PCB while the junction box cover is still installed so that non-intrusive calibration can be performed.

Gas Detector

The gas detector senses the target gas and is mounted in a 3/4 NPT conduit port on the right bottom side of the EXP-SNR-TG-EC. A variety of detectors may be used with the EXP-SNR-TG-EC. See the sections below for descriptions of each type of detector.

Catalytic Detectors

The catalytic detectors have a 1/2 NPT thread and require a 3/4 NPT x 1/2 NPT reducer to install in the detector port.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the catalytic detectors.

Table 2: Catalytic Detectors

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
Combustible Gas, 0 - 100% LEL	65-2640RK	61-0140RK (Catalytic UL version)
	65-2640RK-05	61-0140RK-05 (Catalytic CSA version)
Hydrogen, 0 - 100% LEL	65-2641RK	NC-6205-01 (Catalytic UL version, hydrogen specific)
	65-2641RK-05	NC-6205-05 (Catalytic CSA version, hydrogen specific)
Methane, 0 - 9000 ppm	65-2647RK	61-0140RKA (Catalytic UL version)
	65-2647RK-05	61-0140RKA-05 (Catalytic CSA version)

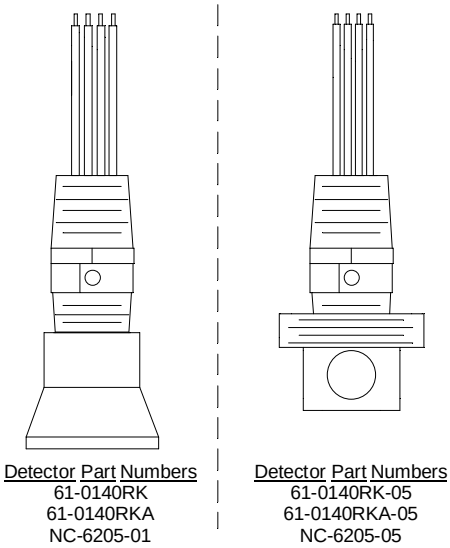


Figure 2: Catalytic Sensors

Infrared (IR) Detectors

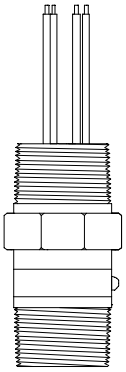
The IR combustible detectors are generally used instead of the catalytic combustible detectors in applications where there may be catalyst poisons such as silicone present or where oxygen is not present in the monitoring environment.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the infrared (IR) detectors.

Table 3: Infrared (IR) Detectors

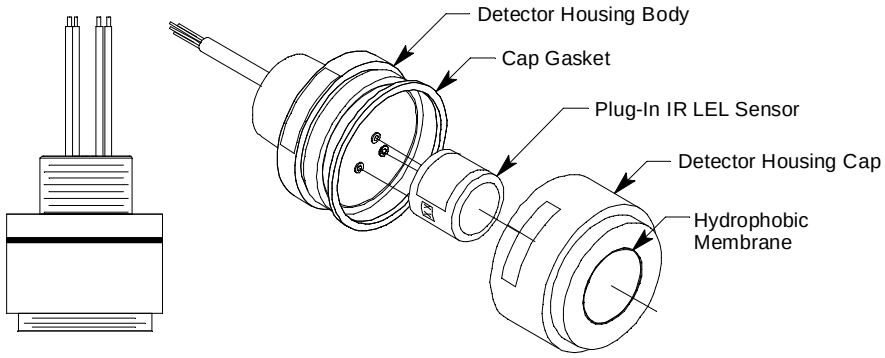
Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
CH_4, 0 - 100% LEL	65-2649RK-CH4	61-0190RK-CH4 (UL)
	65-2664RK-CH4	61-0197RK-CH4
CH_4, 0 - 5.00% volume	65-2649RK-CH4-5	61-0190RK-CH4 (UL)
CH_4, 0 - 100% volume	65-2658RK-CH4	61-0192RK-CH4 (UL)
	65-2665RK-CH4	61-0199RK-CH4
CO_2, 0 - 5,000 ppm	65-2660RK-02	61-0191RK-02 (UL)
	65-2661RK-02	61-0198RK-02
CO_2, 0 - 5% volume	65-2660RK-03	61-0191RK-03 (UL)
	65-2661RK-03	61-0198RK-03
CO_2, 0 - 50% volume	65-2660RK-05	61-0191RK-05 (UL)
	65-2661RK-05	61-0198RK-05
CO_2, 0 - 100% volume	65-2660RK-10	61-0191RK-10 (UL)
	65-2661RK-10	61-0198RK-10
HC, 0 - 100% LEL (cal. to propane)	65-2649RK-HC	61-0190RK-HC (UL)
	65-2664RK-HC	61-0197RK-HC

XP, Non-Replaceable-Sensor Type



Detector Part Numbers
61-0190RK-CH4
61-0190RK-HC
61-0191RK-02
61-0191RK-03
61-0191RK-05
61-0191RK-10
61-0192RK-CH4
61-0192-HC

Non-XP, Replaceable-Sensor Type



Detector Part Numbers
61-0197RK-CH4
61-0197RK-HC
61-0198RK-02
61-0198RK-03
61-0198RK-05
61-0198RK-10
61-0199RK-CH4

Figure 3: Infrared (IR) Sensors

Oxygen Detectors

There are three types of oxygen detectors available: a non-explosion proof partial pressure type, a non-explosion proof capillary type with a replaceable sensor, and an explosion proof (CSA) capillary type with a replaceable sensor. The capillary type's output is less susceptible to variations in atmospheric pressure than the partial pressure type. The CSA type oxygen detector (65-2514RK) and the non-explosion proof capillary type detector (65-2494RK) has a replaceable plug-in sensor inside the detector housing. The entire oxygen detector must be removed if replacement is required for the 65-2510RK.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the oxygen detectors.

Table 4: Oxygen Detectors

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
Oxygen, 0 - 25%	65-2643RK-05	65-2514RK (capillary, CSA)
	65-2644RK	65-2510RK (partial pressure)
	65-2666RK	65-2494RK (capillary)

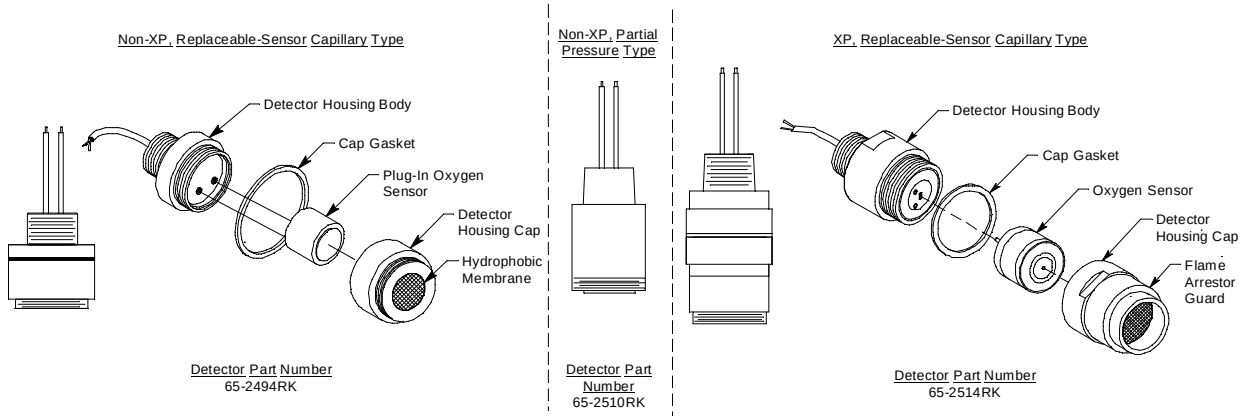


Figure 4: Oxygen Detectors

CO and H_2S Detectors

Both types of CO and H_2S detectors (explosion-proof and non-explosion-proof) have replaceable plug-in sensors inside the detector housing.

The CO detectors include a charcoal filter disk which is held onto the sensor with a rubber retaining boot. The charcoal filter disk scrubs out interfering gases to which the CO sensor responds such as H_2S and certain hydrocarbons.

The 65-2428 and 65-2428-01 explosion-proof H_2S detectors both include a rubber boot and a spacer which help ensure that the sensor remains plugged into the detector housing body. The only difference between the 65-2428 and the 65-2428-01 is that the sensor used in the 65-2428-01 is resistant to degradation caused by frequent exposure to low levels of H_2S or occasional exposure to high levels of H_2S.

The 65-2495RK non-explosion-proof H_2S detector includes an adhesive-backed gasket inside the detector housing cap which helps ensure that the sensor remains plugged into the detector housing body.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the CO and H_2S detectors.

Table 5: CO and H_2S Detectors

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
CO, 0 - 300 ppm	65-2646RK-05	65-2438 (CSA)
	65-2663RK	65-2496RK
CO, 0 - 200 ppm	65-2646RK-05-02	65-2438-01
CO, 0 - 100 ppm	65-2646RK-05-01	65-2438-01
H_2S, 0 - 100 ppm	65-2645RK-05	65-2428 (CSA)
	65-2645-05-07	65-2428-01 (CSA)
	65-2662RK	65-2495RK

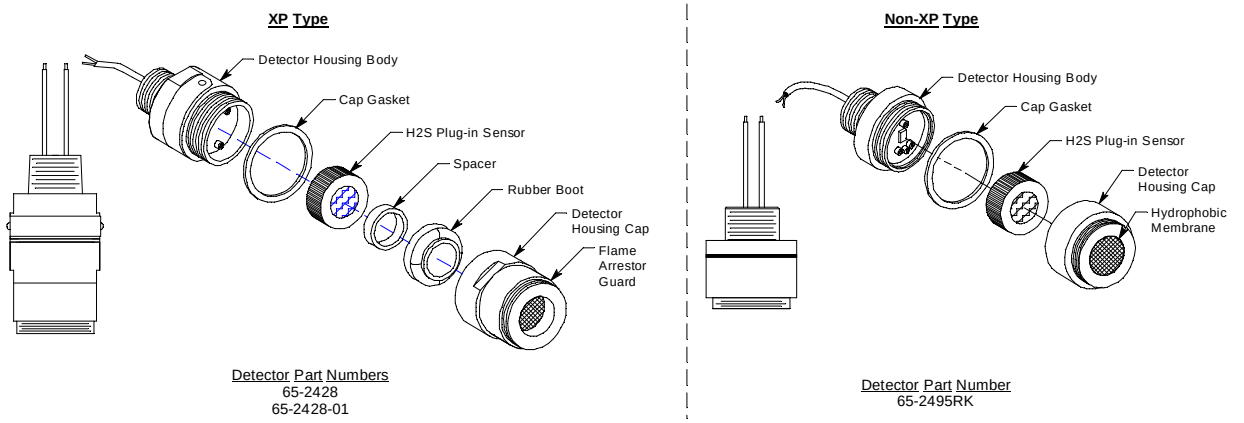


Figure 5: H_2S Detectors

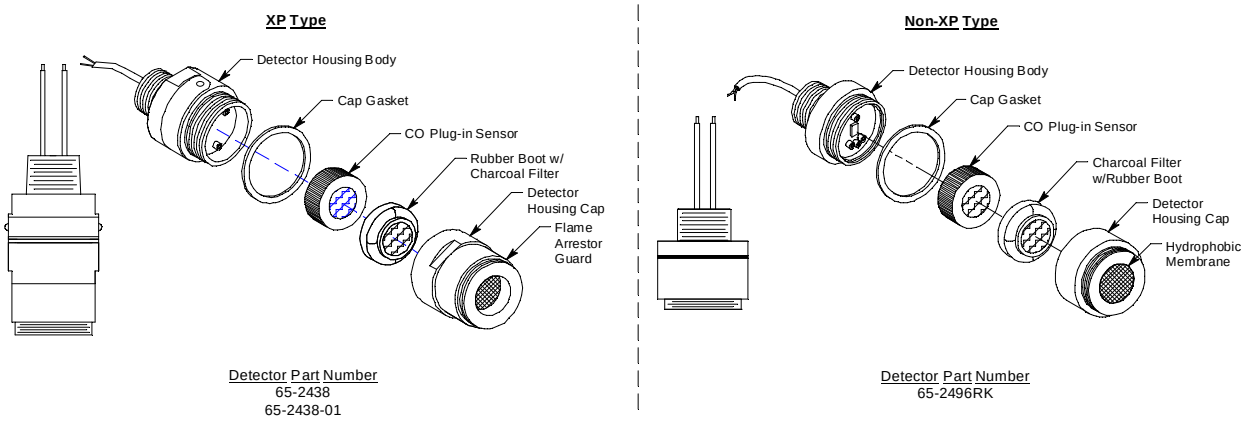


Figure 6: CO Detectors

ESM-01 Detectors

The construction of the various ESM-01 detectors is similar. Each of the ESM-01 detectors has a different replaceable plug-in sensor that protrudes through the detector housing cap. Although ESM-01 detectors look the same except for the plug-in detector, the detector housing which includes the detector socket and conditioning circuitry is specific to a sensor type. For example, a detector housing from a Cl_2 detector cannot be used with an NH_3 detector. One of the two detector wires is color coded for each specific detector type. The ESM-01 detectors include a removable splashguard that screws onto the detector housing cap. When it is necessary to apply gas to an ESM-01 detector, remove the splashguard to allow access to the sensor that protrudes through the detector housing cap. You can then push the appropriate ESM-01 calibration cup onto the sensor.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the ESM-01 detectors.

Table 6: ESM-01 Detectors

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
AsH_3, 0 - 1.5 ppm	65-2648RK-ASH3	65-2300RK-ASH3

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
Cl_2, 0 - 3 ppm	65-2648RK-CL2	65-2300RK-CL2
Cl_2, 0 - 10 ppm	65-2648RK-CL-10	65-2300RK-CL-10
HCN, 0 - 15 ppm	65-2648RK-HCN	65-2300RK-HCN
NH_3, 0 - 75 ppm	65-2648RK-NH3	65-2300RK-NH3
PH_3, 0 - 1 ppm	65-2648RK-PH3	65-2300RK-PH3
SO_2, 0 - 6 ppm	65-2648RK-SO2	65-2300RK-SO2

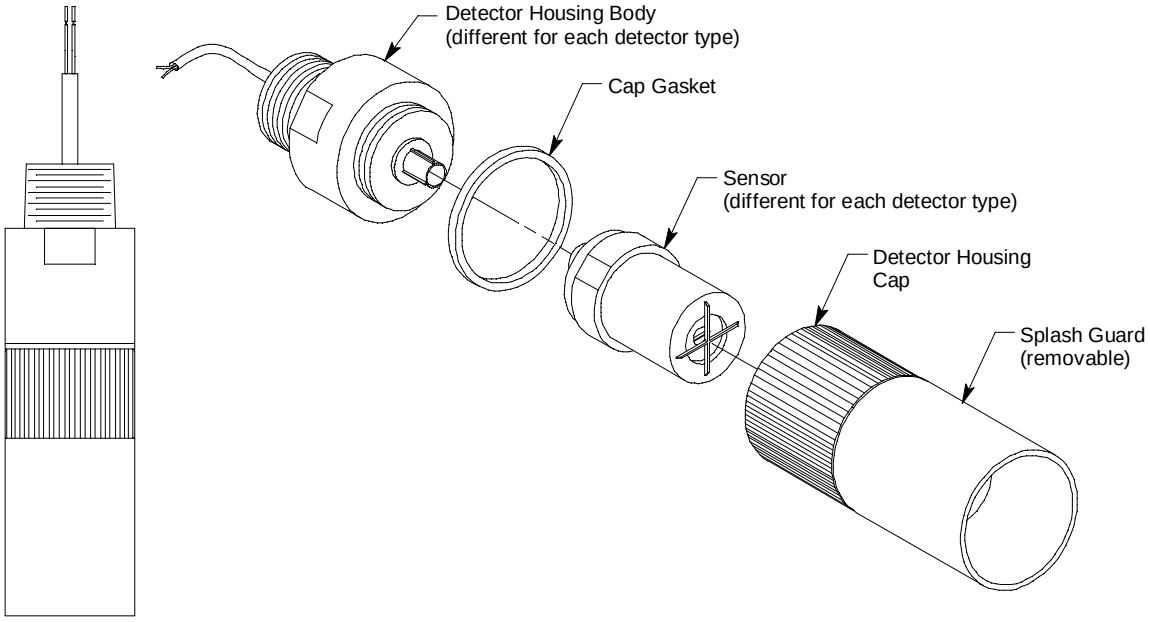


Figure 7: ESM-01 Type Detector

CT-7 Series Detectors

The CT-7 Series detectors for Cl_2 and ClO_2 have a replaceable plug-in sensor inside the detector housing. An adhesive backed gasket inside the detector housing cap helps ensure that the sensor remains plugged into the detector housing body.

The table below outlines the EXP-SNR-TG-EC part numbers and replacement detector part numbers for the CT-7 Series detectors.

Table 7: CT-7 Series Detectors

Target Gas, Range	EXP-SNR-TG-EC Part Number	Detector Used
Cl_2, 0 - 3 ppm	65-2670RK-CL2	65-2302-CL2
Cl_2, 0 - 10 ppm	65-2670RK-CL210	65-2302-CL2-10
ClO_2, 0 - 1 ppm	65-2670RK-CLO2	65-2302-CLO2

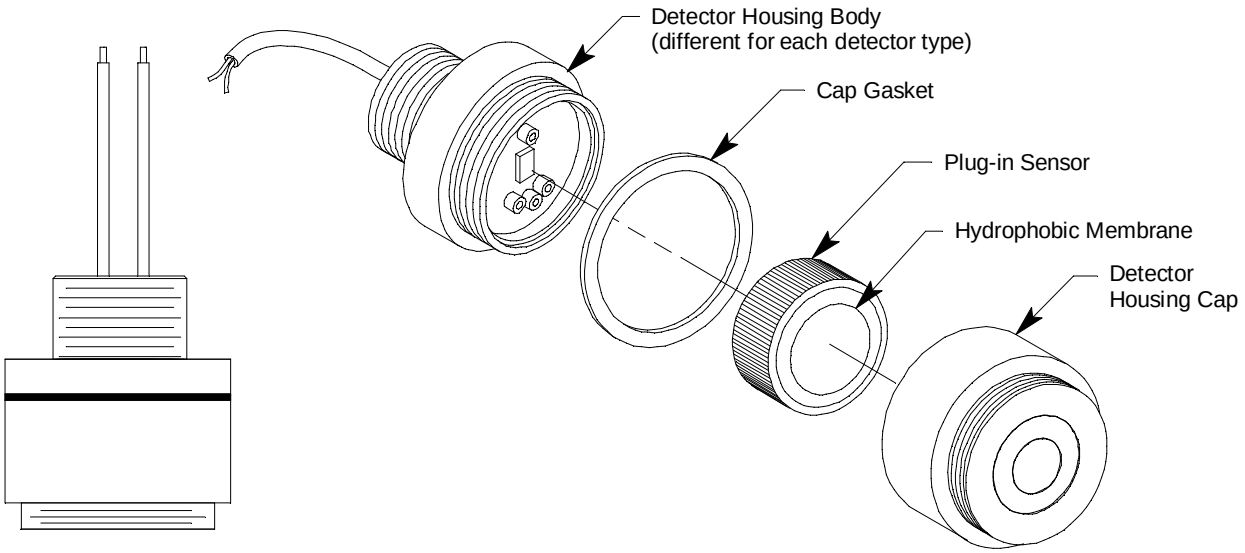


Figure 8: CT-7 Series Detectors

Internal Description

This section describes the internal components of the EXP-SNR-TG-EC. The internal components of the EXP-SNR-TG-EC include the terminal PCB which provides for all the wiring connections to the EXP-SNR-TG-EC and the control PCB which displays the gas reading and has

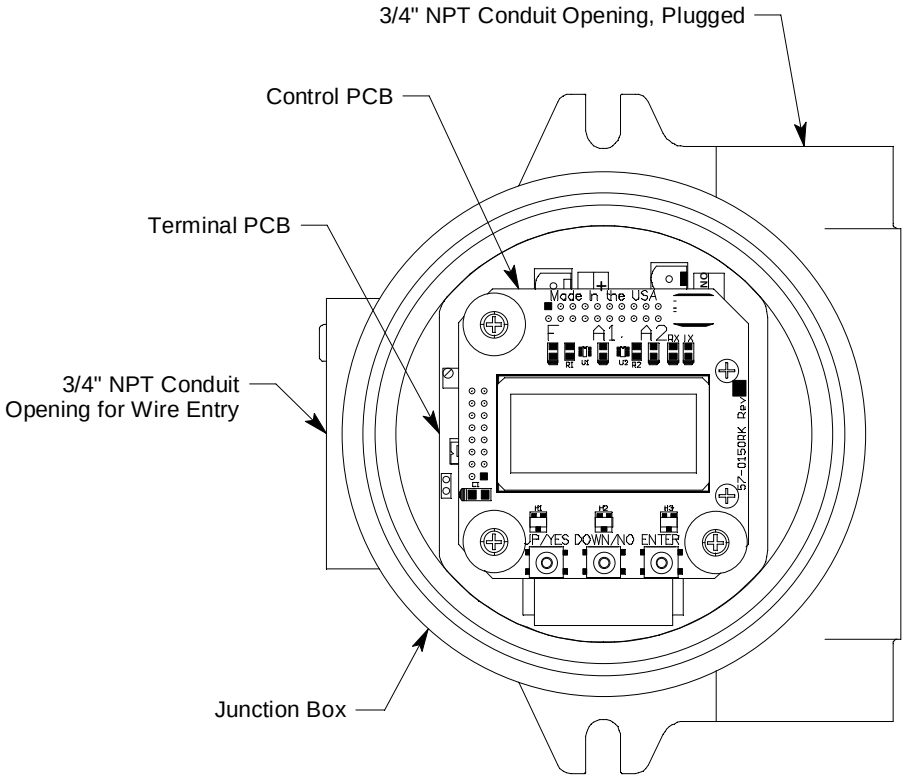


Figure 9: EXP-SNR-TG-EC Internal Components

Terminal PCB

The terminal PCB is encapsulated in epoxy for protection against moisture and physical damage. It is mounted into the rear of the junction box with three standoffs and rests on a thin layer of foam. A banana jack is screwed into each of the standoffs and is used for mounting the control PCB. The terminal PCB converts the electrical output from the detector to a signal which can be displayed by the OLED display, a 4 - 20 mA signal (that is proportional to the detection range), and an RS-485 Modbus output signal. The 4 - 20 mA signal may be used by a recording device, gas monitor controller, or programmable controller. The Modbus output may be used to connect the EXP-SNR-TG-EC to a Modbus network. The terminal PCB also controls three relays: one fail and two gas alarm.

Two columns of plug-in style terminal strips are used to make all wiring connections to the EXP-SNR-TG-EC. The column on the left consists of the power/signal, detector, and Modbus terminal strips. The column on the right consists of the relay terminal strips. A 20 position connector at the bottom of the terminal PCB is used to connect the terminal PCB to the control PCB with a ribbon cable. A 5 position connector on the left side of the terminal PCB is used by factory or field service personnel to program the EXP-SNR-TG-EC. On the combustible and CO_2 versions of the EXP-SNR-TG-EC, a factory adjust pot just above the programming connector is used to set the detector current.

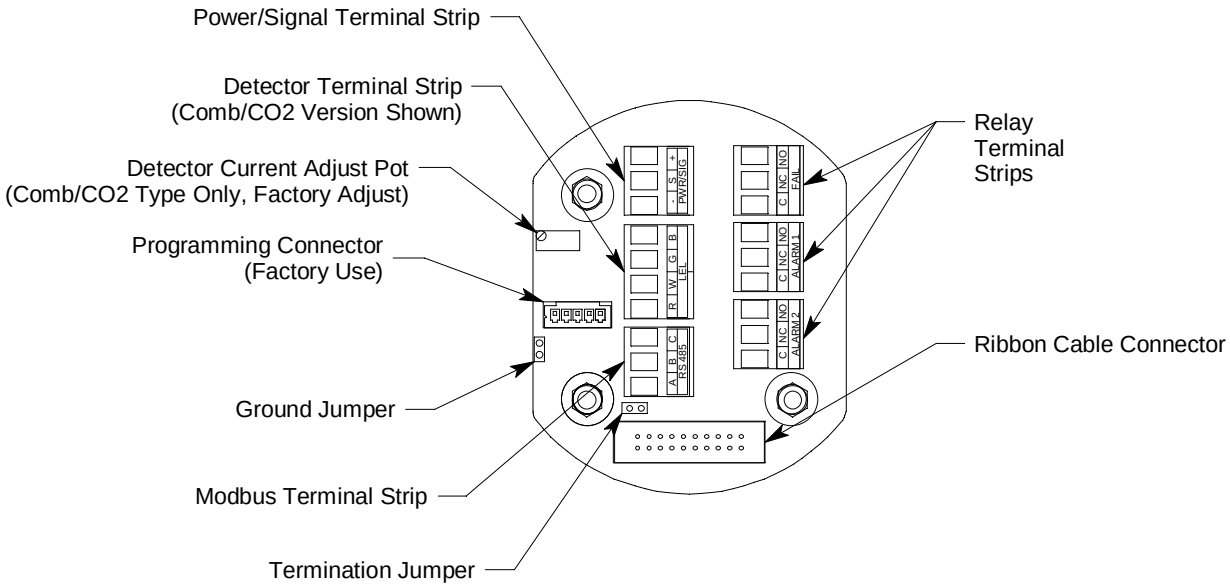


Figure 10: Terminal PCB Component Location

Power/Signal Terminal Strip

The power/signal terminal strip is a three position plug-in style terminal strip located at the top of the left terminal column. It is used to connect 24 VDC power to the EXP-SNR-TG-EC and to connect the 4 - 20 mA output signal to a device.

The signal output, the S terminal, does not have to be connected for the EXP-SNR-TG-EC to function. The S terminal is used if you want to connect the 4 - 20 mA output signal to another device such as a gas monitoring controller, chart recorder, or programmable controller (PLC).

Detector Terminal Strip

The detector terminal strip is a four position plug-in style terminal strip and is the middle terminal strip in the left terminal column. For a combustible or CO_2 EXP-SNR-TG-EC, all four terminals are used to connect the detector to the EXP-SNR-TG-EC. For a toxic or oxygen EXP-SNR-TG-EC, only two of the terminals are used for connecting a detector; two terminals are dedicated for connecting a toxic detector and two are dedicated for connecting an oxygen detector (only one

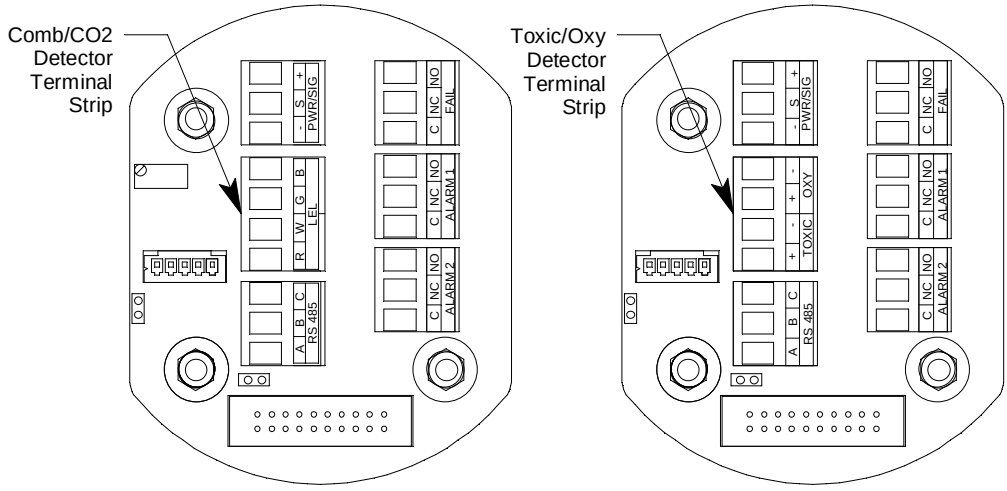


Figure 11: Detector Terminal Strip

NOTE: The detector is factory-wired to the EXP-SNR-TG-EC. See "Wiring the EXP-SNR-TG-EC Transmitter" for all wiring procedures related to EXP-SNR-TG-EC.

Modbus Terminal Strip

The Modbus terminal strip is a three position plug-in style terminal strip and is the bottom terminal strip in the left terminal column. It allows connection of the EXP-SNR-TG-EC into a Modbus network.

Relay Terminal Strips

The right column of terminal strips consists of, from top to bottom, the fail, alarm 1, and alarm 2 relay terminal strips. They are three-position plug-in style terminal strips. The relay terminal strips are used to connect devices such as lights and horns that are controlled by the relay contacts. The relay contacts are rated at 115 VAC, 5 amps. The relay contacts may also be used to control higher rated relays.

Termination Jumper

A two pin header with a termination jumper installed is located below the Modbus terminal strip. Leave this jumper installed unless directed to remove it for a Modbus installation. See "Chapter 8: RS-485 Modbus Output" for a description of using the EXP-SNR-TG-EC in a Modbus system.

Ground Jumper

A two pin header with a jumper installed is located along the left side of the terminal PCB. Leave this jumper installed unless directed to remove it for a Modbus installation. See "Chapter 8: RS-485 Modbus Output" for a description of using the EXP-SNR-TG-EC in a Modbus system.

Control PCB

The OLED display and control switches are located on the control PCB. It is installed on top of the terminal PCB by lining up its three spacing standoffs with the banana jacks in the terminal PCB PCB.

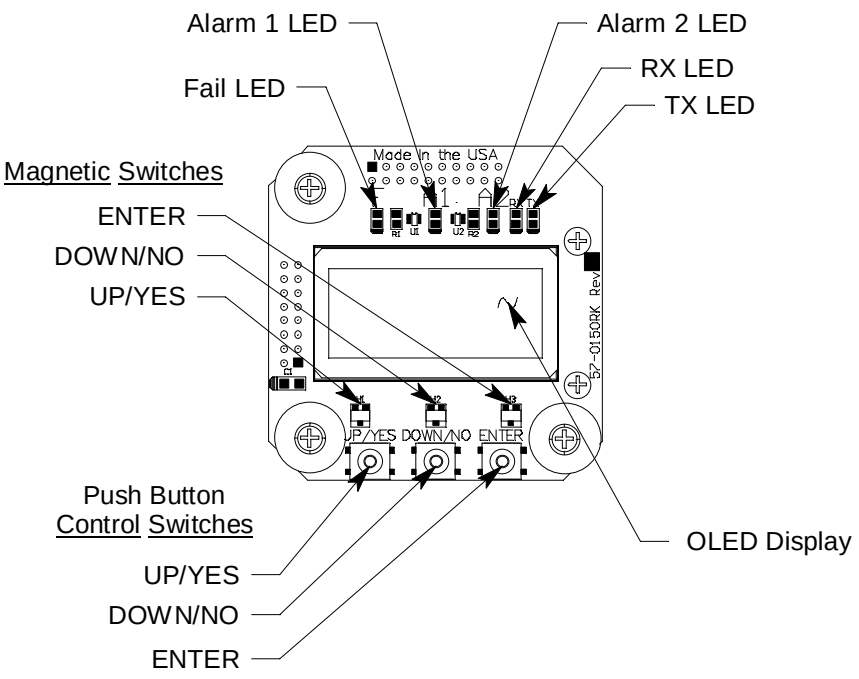


Figure 12: Control PCB Component Location

OLED Display

The OLED display is located at the top of the control PCB. It indicates the current gas reading and displays messages and parameters in the sensor's programs.

Control Buttons

The EXP-SNR-TG-EC includes three push button switches that allow you to enter the sensor's operating modes, navigate through the modes, update settings, and save changes to the settings. The push button switches are located along the bottom edge of the control PCB (see Figure 12). The UP/YES button is on the left, the DOWN/NO button is in the middle, and the ENTER button is on the right.

Table 8: EXP-SNR-TG-EC Control Button Functions

Switch	Function
UP (YES)	• Saves settings • Changes the displayed setting • Enters the Calibration Program • Enters Gas Type Mode (press with DOWN/NO button) • Enters Configuration Mode (press with ENTER button)
DOWN (NO)	• Cancels setting changes • Changes the displayed setting • Enters Gas Type Mode (press with UP/YES button) • Enters Modbus Mode (press with ENTER button) • Displays the Information Screen
ENTER	• Initiates operations • Enters Configuration Mode (press with UP/YES button) • Enters Modbus Mode (press with DOWN/NO button) • Functions as an alarm reset switch

Just above each push button switch is a magnetic switch with the same function as the push button switch below it. The magnetic switches are for use in non-intrusive calibration. They are actuated by bringing the magnetic wand close enough to them to actuate them. Although the magnetic switches have the same functions as the push button switches, it is not practical to use them for operations other than calibration because it is not possible to actuate two magnetic switches at once with only one magnetic wand. Since displaying the Information Screen only requires the use of one switch, the wand may be used to show the Information Screen (see “Information Screen”).

Status LEDs

The EXP-SNR-TG-EC includes five status LEDs that are located above the display (see Figure 12).

- Fail LED
  The fail LED turns on when the EXP-SNR-TG-EC is experiencing a fail condition. A fail condition can be caused by a detector failure or low detector signal.
- Alarm 1 LED
  The alarm 1 LED is on when the EXP-SNR-TG-EC is experiencing an alarm 1 condition.
- Alarm 2 LED
  The alarm 2 LED is on when the EXP-SNR-TG-EC is experiencing an alarm 2 condition.
- RX & TX LED’s
  These LED’s indicate data being received (RX) and transmitted (TX) when the sensor's Modbus output is operating.

Chapter 3: Installation & Startup

Overview

This chapter describes procedures to mount the EXP-SNR-TG-EC Transmitter in the monitoring environment and wire it to input power and devices.

Mounting the EXP-SNR-TG-EC Transmitter

1. Select a mounting site that is representative of the monitoring environment. Consider the following when you select the mounting site.
   - Select a site where the EXP-SNR-TG-EC is not likely to be bumped or disturbed. Make sure there is sufficient room to perform start-up, maintenance, and calibration procedures.
   - Select a site where the target gas is likely to be found first. For lighter gases, mount the detector near the ceiling; for heavier gases, mount the detector near the floor.
2. At the monitoring site, use #10 screws through the junction box's two mounting holes to secure the junction box to a vertical surface. Figure 13 - Figure 20 show the outline and mounting dimensions for each version of the EXP-SNR-TG-EC. Mount the EXP-SNR-TG-EC with the detector facing down as shown in the following figures.

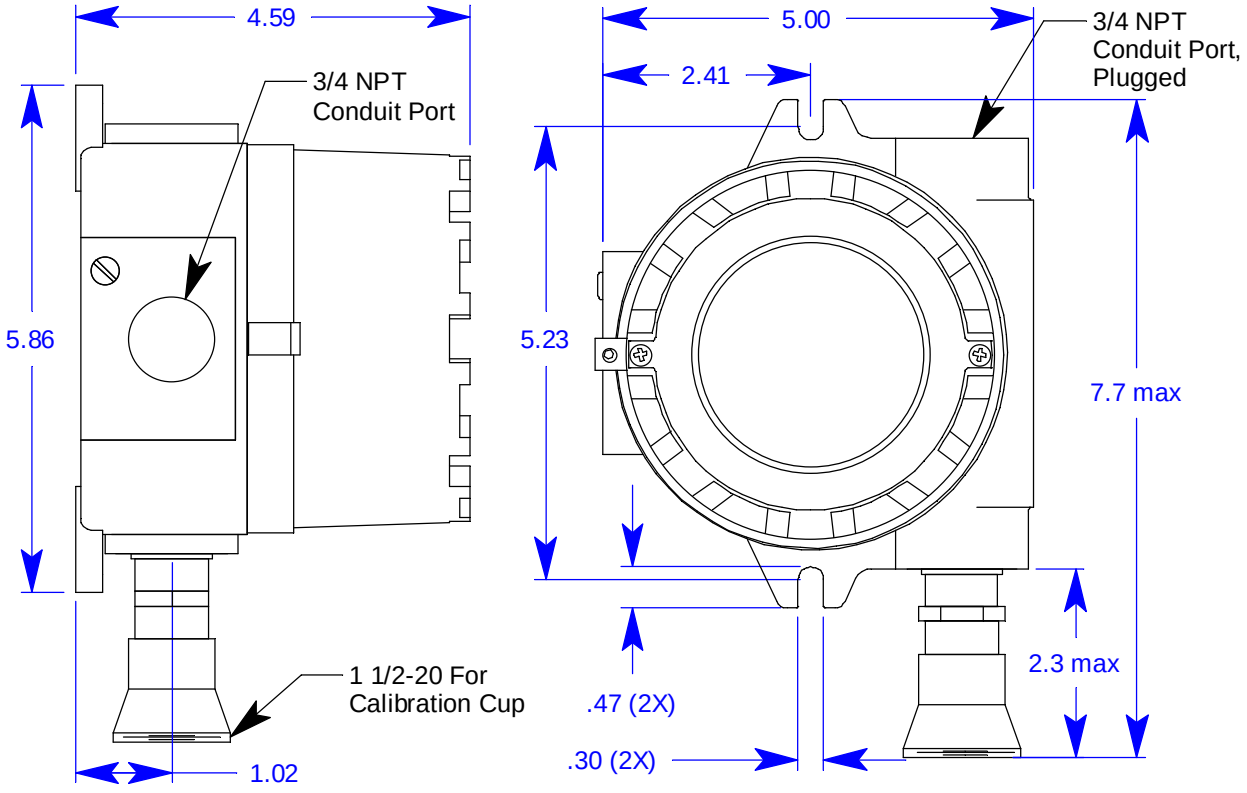


Figure 13: Outline & Mounting Dimensions, Catalytic LEL and ppm, UL Version

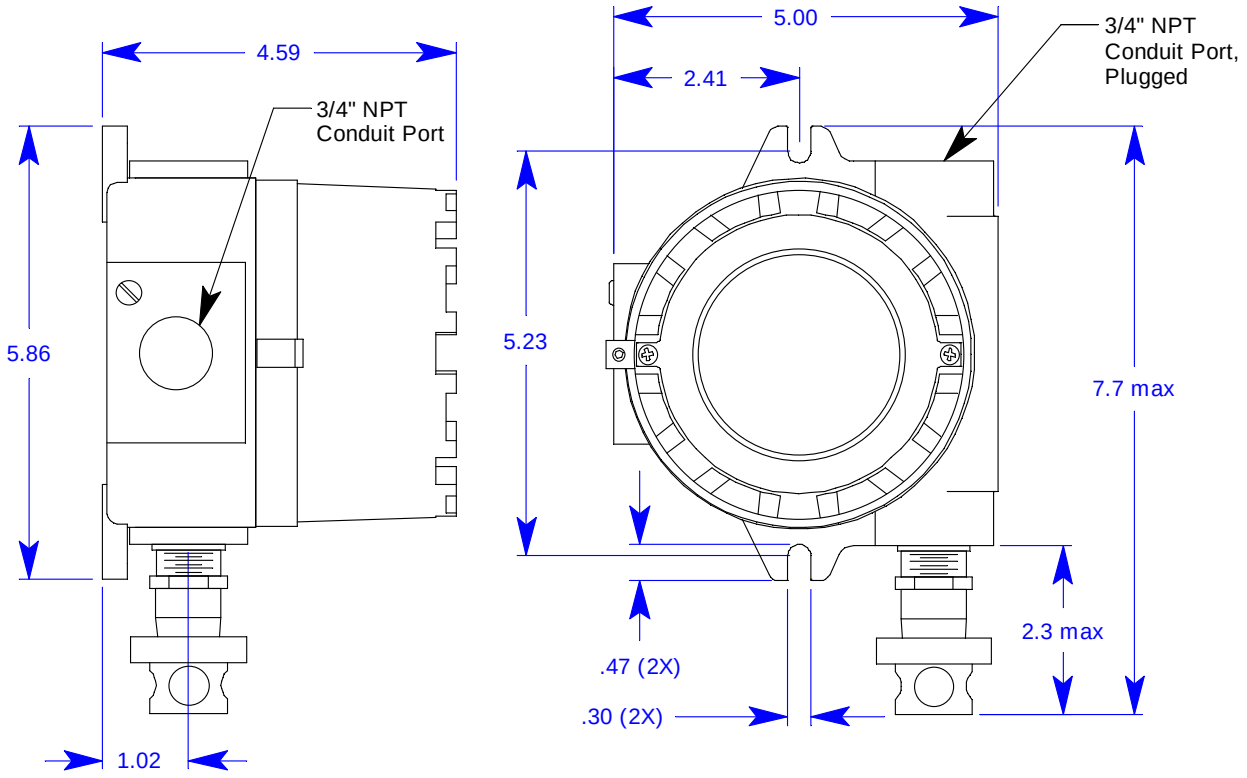


Figure 14: Outline & Mounting Dimensions, Catalytic LEL and ppm, CSA Version

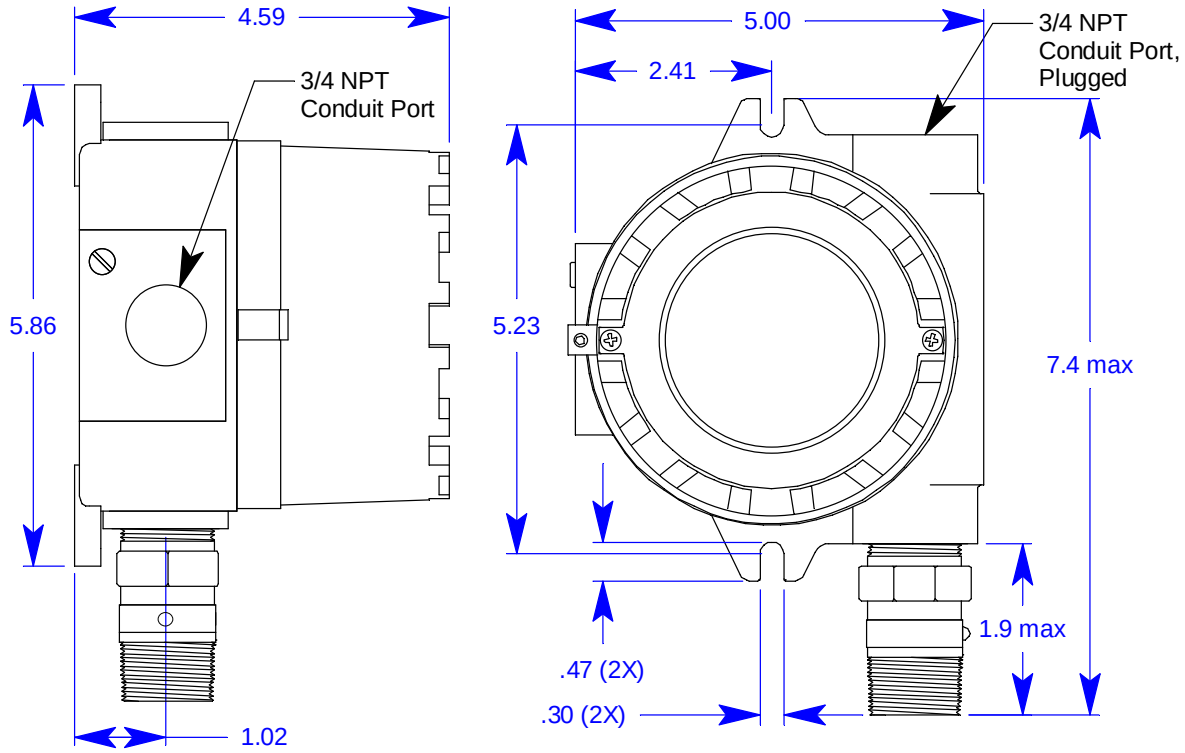


Figure 15: Outline & Mounting Dimensions, IR Combustible & CO_2

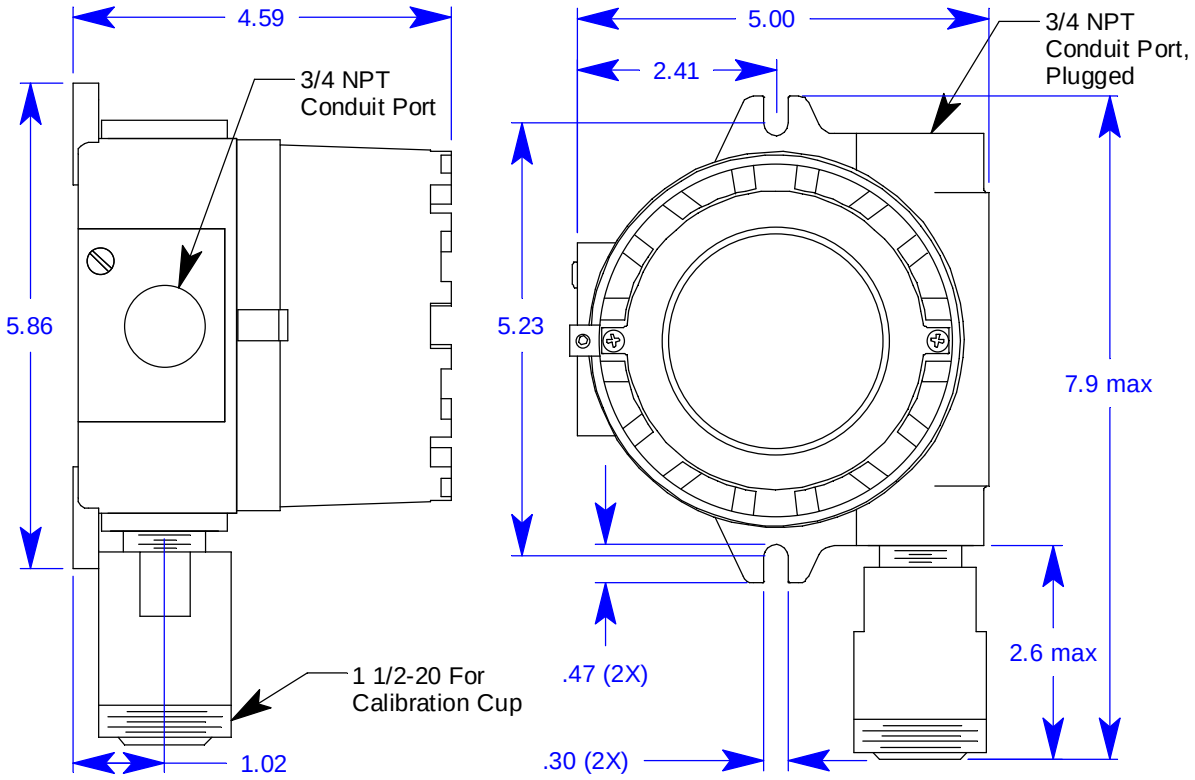


Figure 16: Outline & Mounting Dimensions, Oxygen, Partial Pressure Type

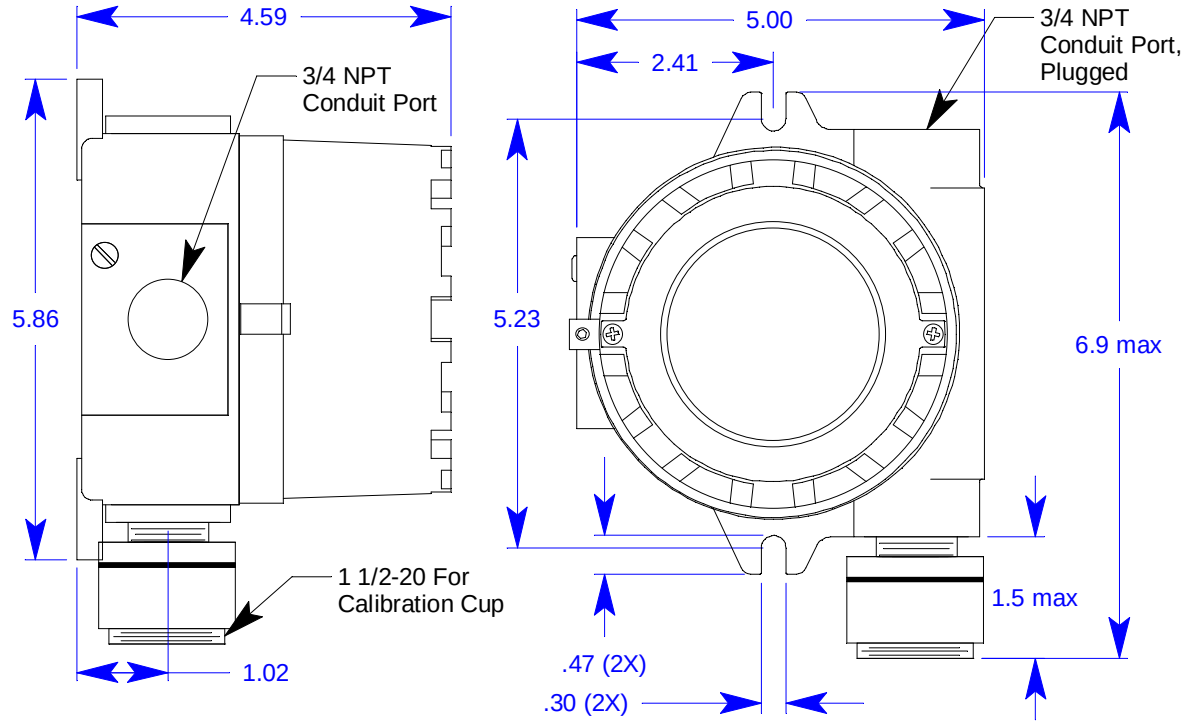


Figure 17: Outline & Mounting Dimensions, Replaceable Sensor, H_2S, CO, and Oxygen, Non Explosion Proof

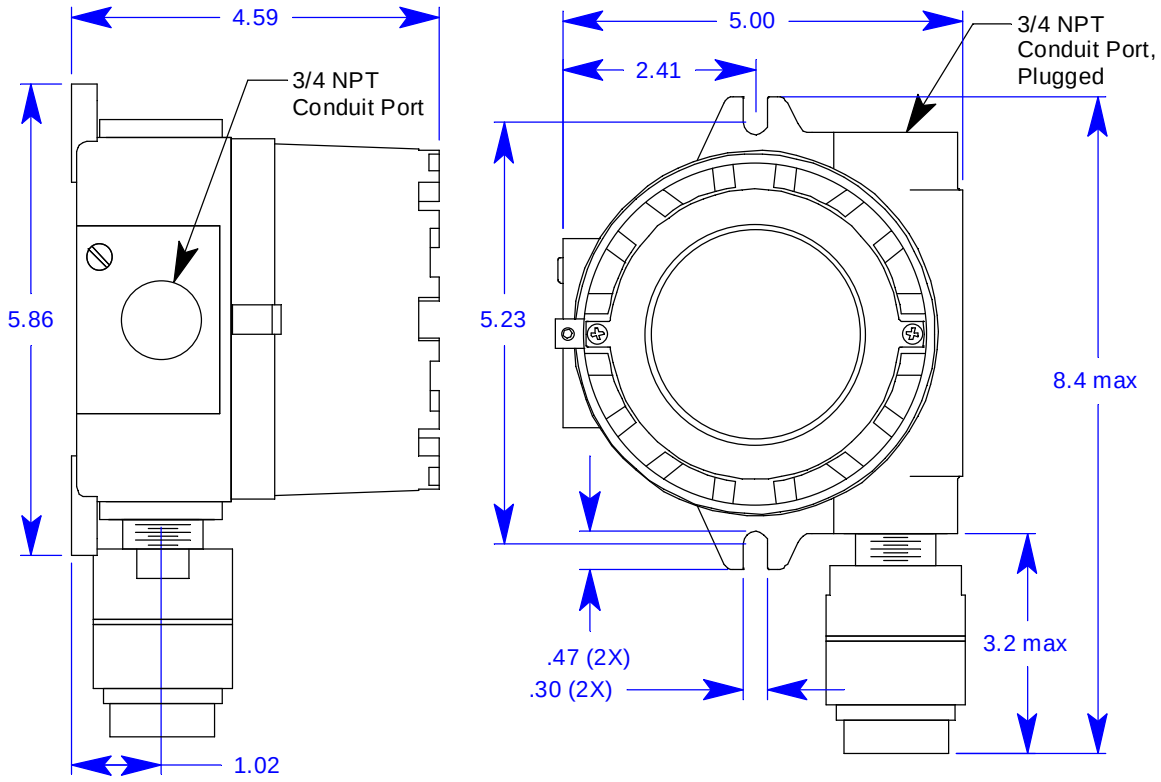


Figure 18: Outline & Mounting Dimensions, H_2S, CO, and Oxygen, CSA, Explosion-Proof

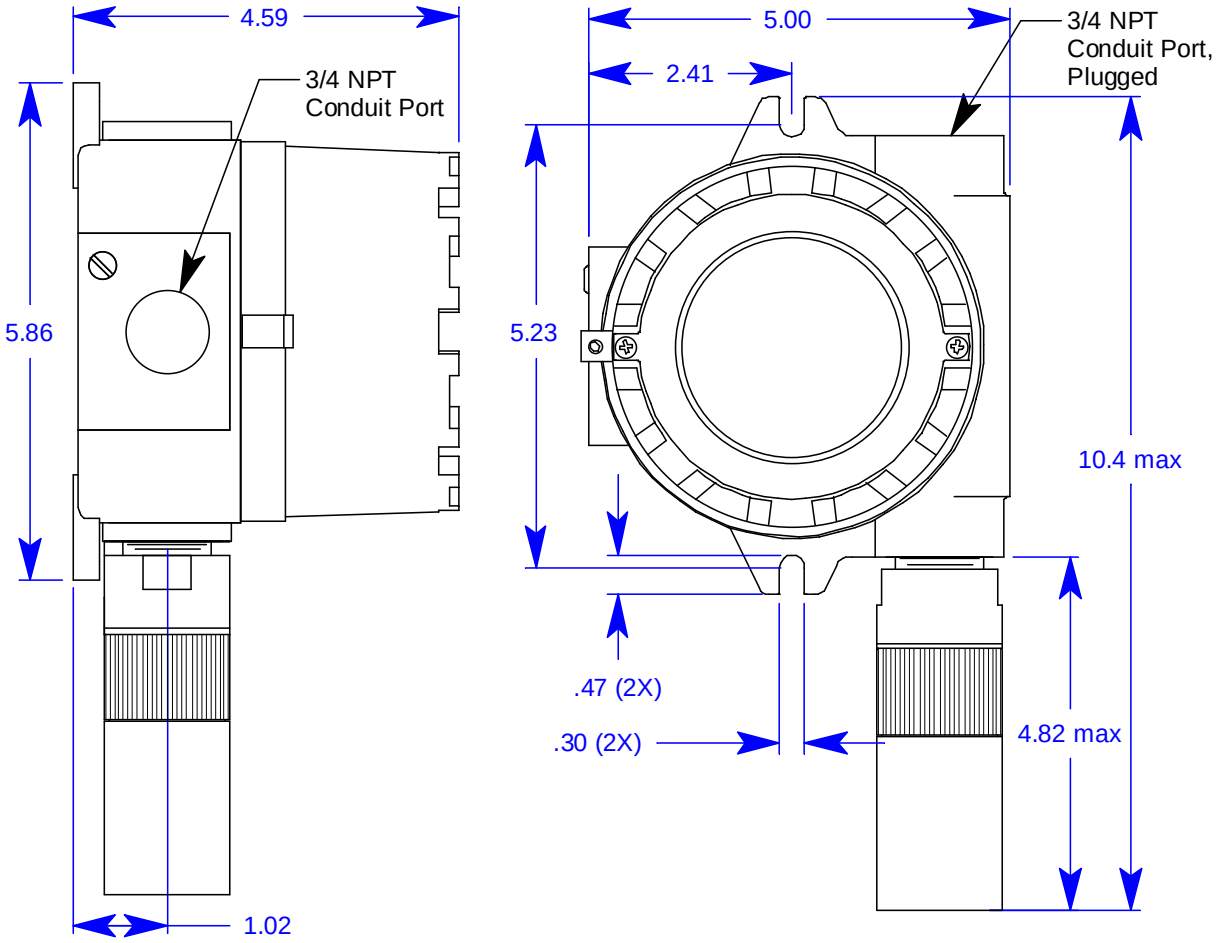


Figure 19: Outline & Mounting Dimensions, ESM-01 Toxic

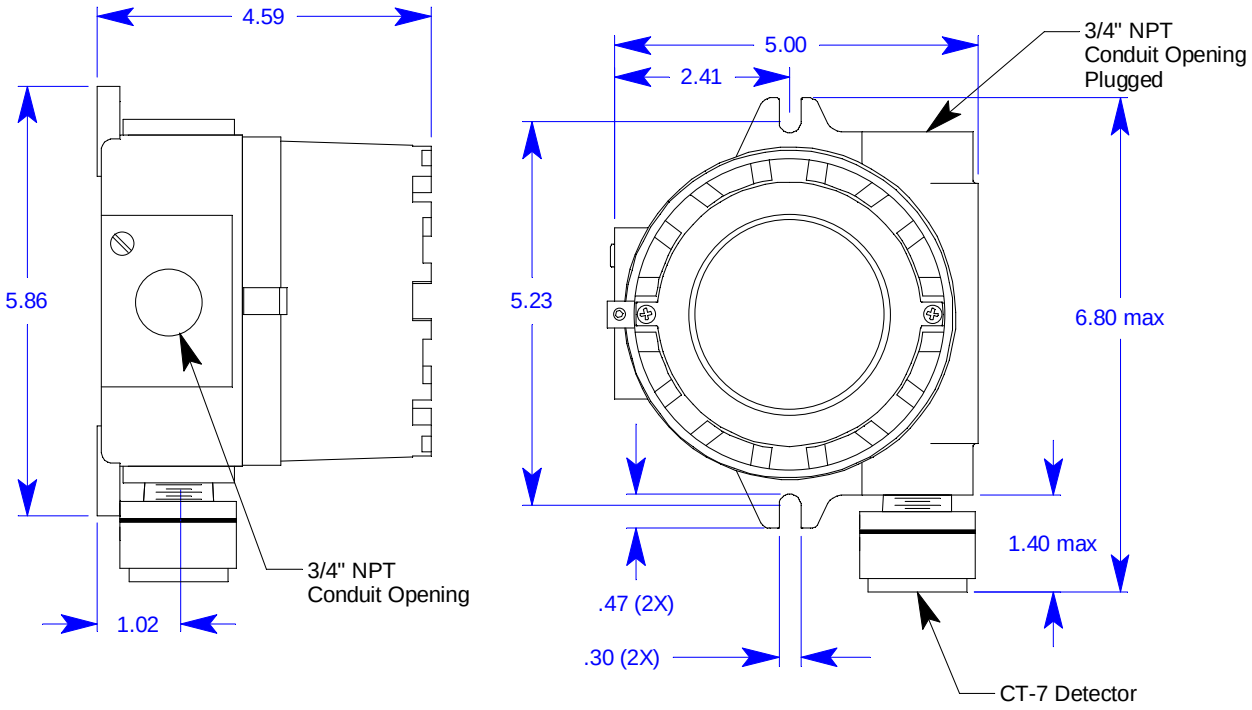


Figure 20: Outline & Mounting Dimensions, CT-7 Series

Wiring the EXP-SNR-TG-EC Transmitter

WARNING: ***Always verify that the power source is OFF before making any wiring connections.***

1. Remove the junction box cover.
2. Grasp the control PCB by its edges.
3. Gently pull until the control PCB is pulled away from the banana jacks. Take care not to pull too hard and damage the cable which connects the control and terminal PCBs.
4. Let the control PCB hang by the cable. The terminal strips are now visible on the terminal PCB. The control PCB may be left hanging while wiring is done. If desired, the control PCB may be disconnected from the cable and set aside while wiring.
5. The detector leads are factory wired. Verify that the detector leads are wired to the detector terminal strip as shown in the applicable figure below:

   Catalytic LEL/Catalytic ppm/IR Combustible/IR CO_2 Detectors

   The wiring for these types of detectors is the same. Red wire to terminal labeled LEL R, white wire to terminal labeled LEL W, green wire to terminal labeled LEL G, black wire to terminal labeled LEL B.

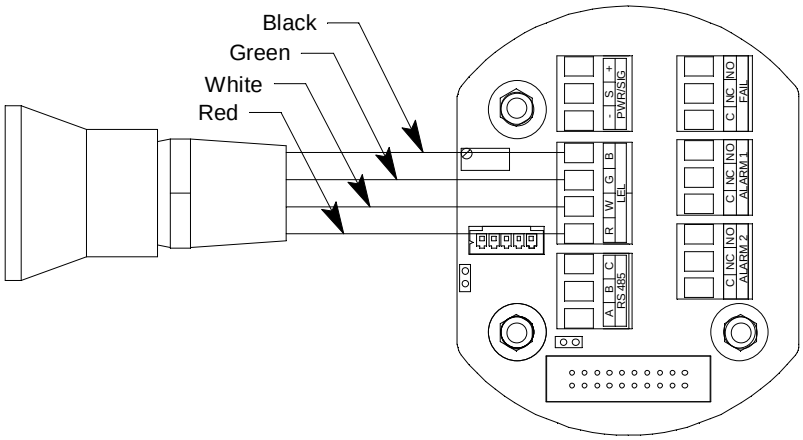


Figure 21: Catalytic LEL and ppm Detector Wiring

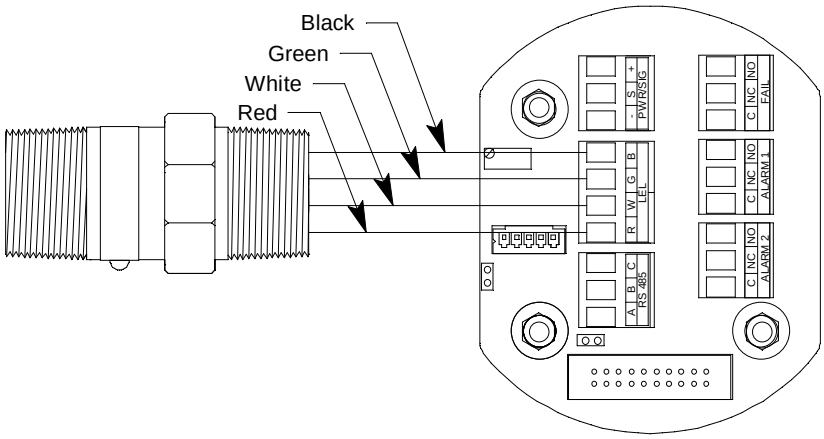


Figure 22: IR Combustible/IR CO_2 Detector Wiring

Oxygen Detectors: Partial Pressure, Capillary Type, and CSA Capillary Type

The wiring for all the oxygen detectors is the same. White wire to terminal labeled OXY +, green wire to terminal labeled OXY -.

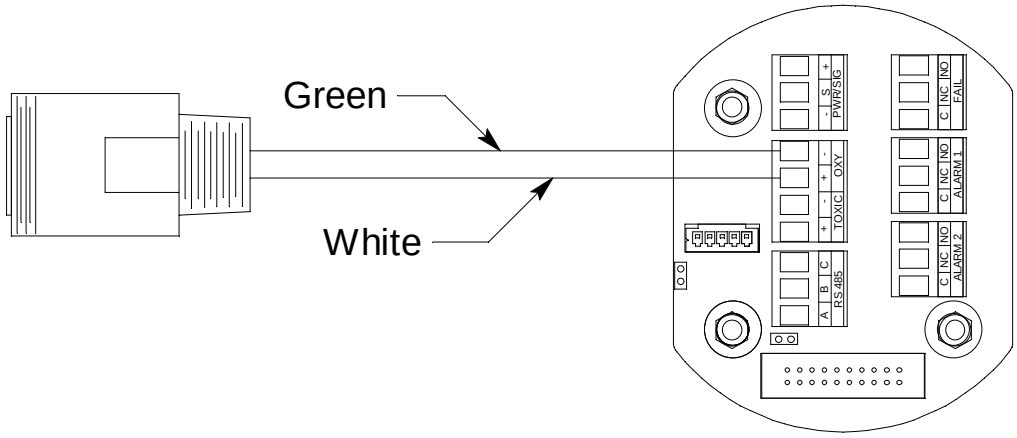


Figure 23: Partial Pressure Oxygen Detector Wiring

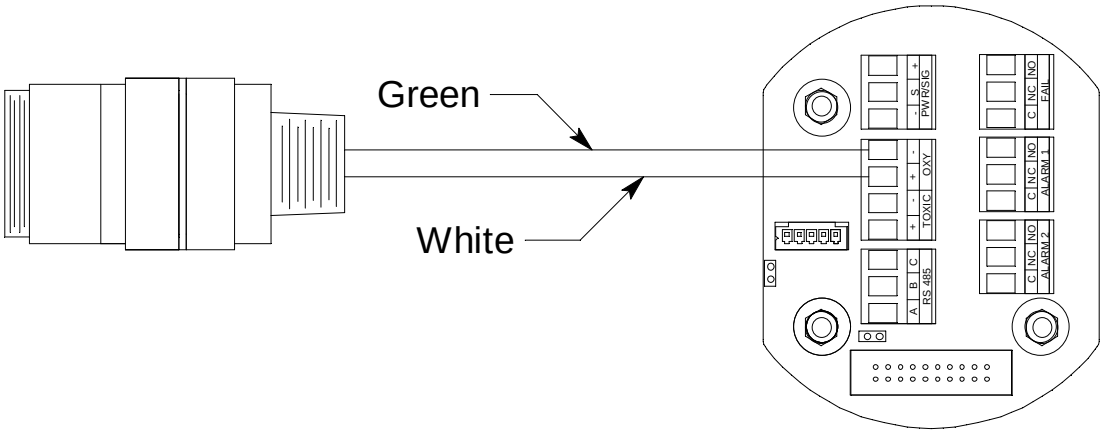


Figure 24: CSA Capillary Type Oxygen Detector Wiring

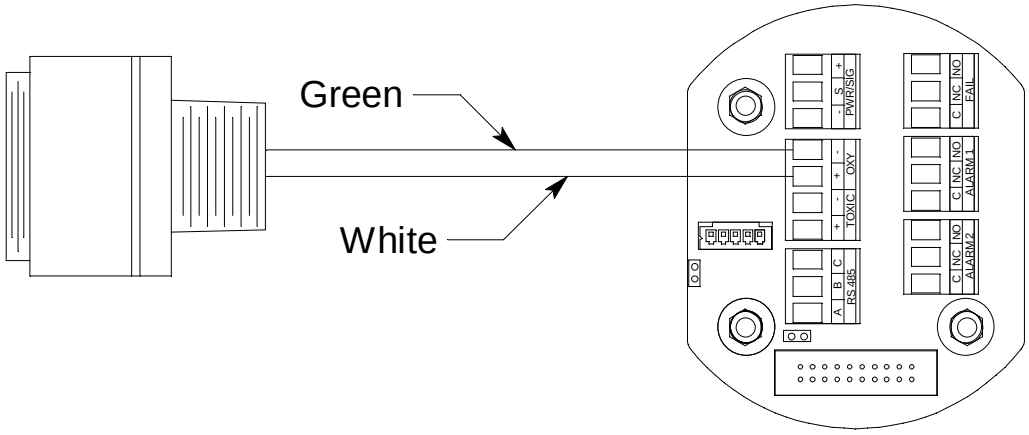


Figure 25: Capillary Type Replaceable Sensor Oxygen Detector Wiring

CSA Type CO or H_2S Gas Detectors

Red wire to terminal labeled TOXIC +, black wire to terminal labeled TOXIC -.

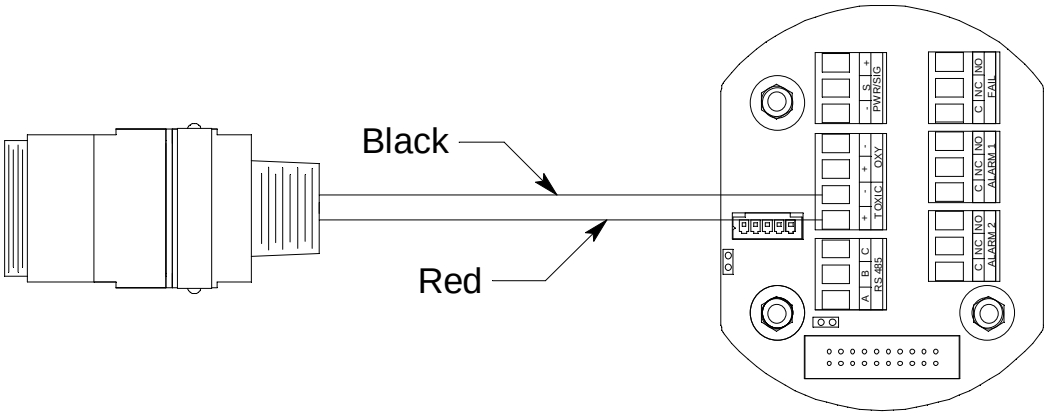


Figure 26: H_2S/CO Detector Wiring, CSA

Non Explosion Proof CO or H_2S Gas Detectors

Red wire to terminal labeled TOXIC +, black wire to terminal labeled TOXIC -.

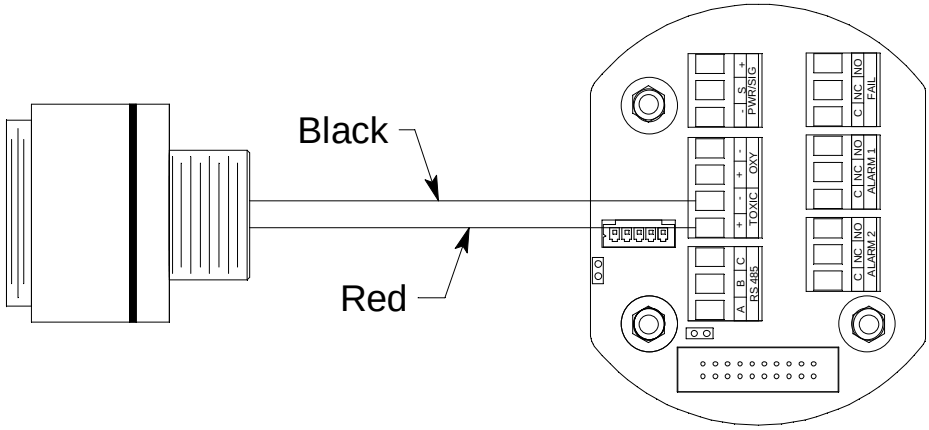
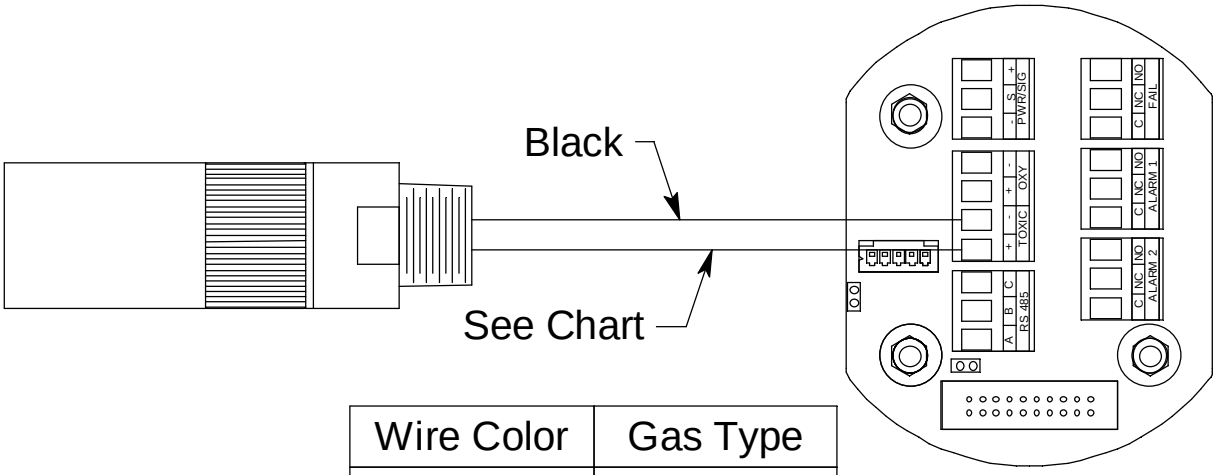


Figure 27: H_2S/CO Detector Wiring

ESM-01 Toxic Detectors

The ESM-01 toxic detectors have one black wire and one color coded wire. Connect the color coded wire (see chart below) to the terminal labeled TOXIC + and the black wire to the terminal labeled TOXIC -.

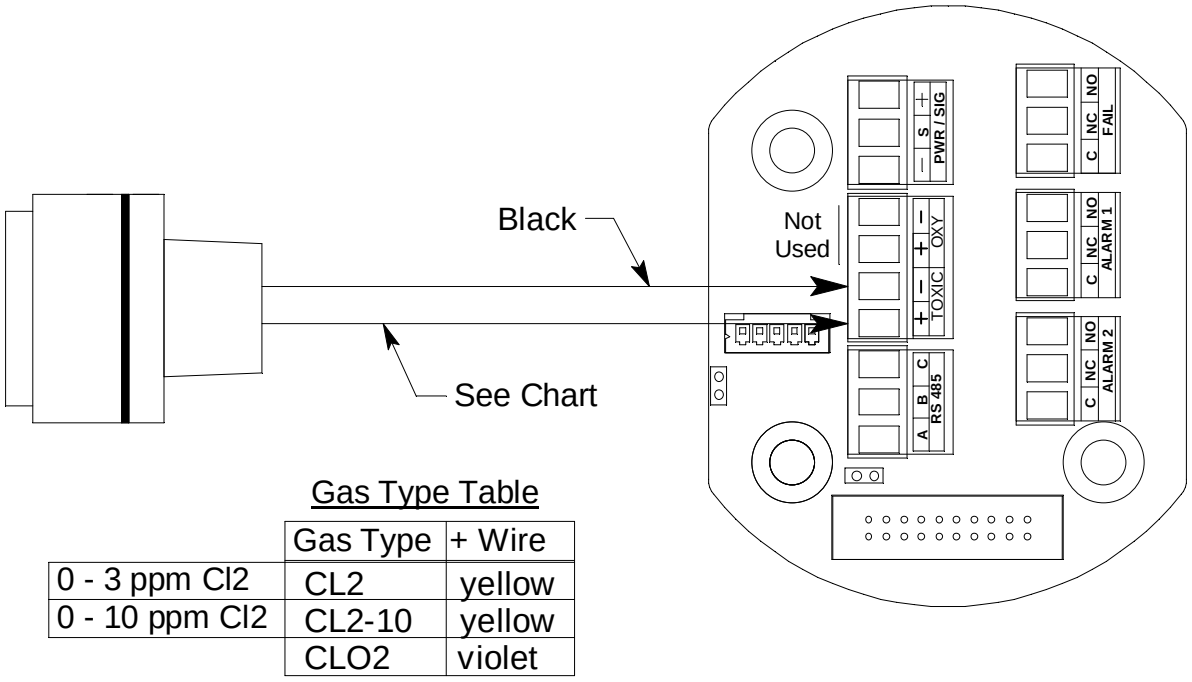


Wire Color	Gas Type
Brown	AsH3
Yellow	Cl2
Red	NH3
Green	PH3
Blue	SO2

Figure 28: ESM-01 Toxic Detector Wiring

CT-7 Series Toxic Detectors

The CT-7 Series toxic detectors have one black wire and one color coded wire. Connect the color coded wire (see chart below) to the terminal labeled TOXIC + and the black wire to the terminal labeled TOXIC -.



Gas Type Table

	Gas Type	+ Wire
0 - 3 ppm Cl2	CL2	yellow
0 - 10 ppm Cl2	CL2-10	yellow
	CLO2	violet

Figure 29: CT-7 Series Toxic Detector Wiring

6. To gain access to a plug-in terminal strip for wiring, pull it out of its socket by grasping the wall between two terminal positions with needle nose pliers and pulling. Be careful not to exert too much force on the wall to avoid damage to the terminal strip. The detector terminal strip and the alarm 1 relay terminal strip may be removed by grasping them with your fingers if the adjacent terminal strips have been removed.

WARNING: ***If the EXP-SNR-TG-EC is installed in a hazardous location, use appropriately rated conduit, conduit fittings, and appropriate construction technique that complies with the local electrical code.***
In addition, use appropriately rated conduit, conduit fittings, and appropriate construction technique to maintain the NEMA 4X environmental rating of the junction box and avoid water entering the junction box at the conduit ports.

---

7. Guide multi conductor shielded cable or cables or wires in conduit through the conduit port on the left side of the junction box.

WARNING: ***If the top conduit port is used for wiring, be sure to seal the threads to ensure water does not enter the junction box. A conduit seal, which is normally required to maintain the junction box's hazardous location rating, will also help to prevent water from entering through the top port.***

The number of cables or wires needed will depend on whether the EXP-SNR-TG-EC is wired to a gas monitoring controller or just to power, whether any relays are used, and whether the Modbus output is used.

NOTE: If the EXP-SNR-TG-EC is being wired to a PLC or DCS device, see "Appendix B: PLC and DCS Device Wiring", then continue with step 8.

Use the following recommendations to determine how to wire the EXP-SNR-TG-EC:

- If Modbus connections will not be used and only the PWR/SIG connections will be used, use a two or three conductor shielded cable or two or three wires in conduit for connections to the power/signal terminal strip depending on whether or not the signal (S) terminal is used. The S terminal has a 4 - 20 mA output, but if you do not need to monitor this signal and do not connect to the S terminal to access this signal, the EXP-SNR-TG-EC will still function completely.

Table 9: Wire Size for PWR/SIG Connections

Max Distance to Controller w/18 Gauge Wire	Max Distance to Controller w/ 16 Gauge Wire	Max Distance to Controller w/14 Gauge Wire
2,500 ft.	5,000 ft.	8,000 ft.

- If the PWR/SIG connections and one or more relays are used, route the connections to the EXP-SNR-TG-EC in conduit. Use shielded cable in the conduit for the PWR/SIG connections and unshielded cable or individual wires for the relay connections. Make sure any wire or cable used for relay wiring is appropriately rated for the power that it

NOTE: If shielded cable is used for the PWR/SIG connections, leave the cable shield's drain wire insulated and disconnected at the EXP-SNR-TG-EC. You will connect the opposite end of the cable's drain wire at the controller or device.

- If the EXP-SNR-TG-EC will be wired into a Modbus network, see "Chapter 8: RS-485 Modbus Output".

See Figure 30 below for field wiring connections to the EXP-SNR-TG-EC.

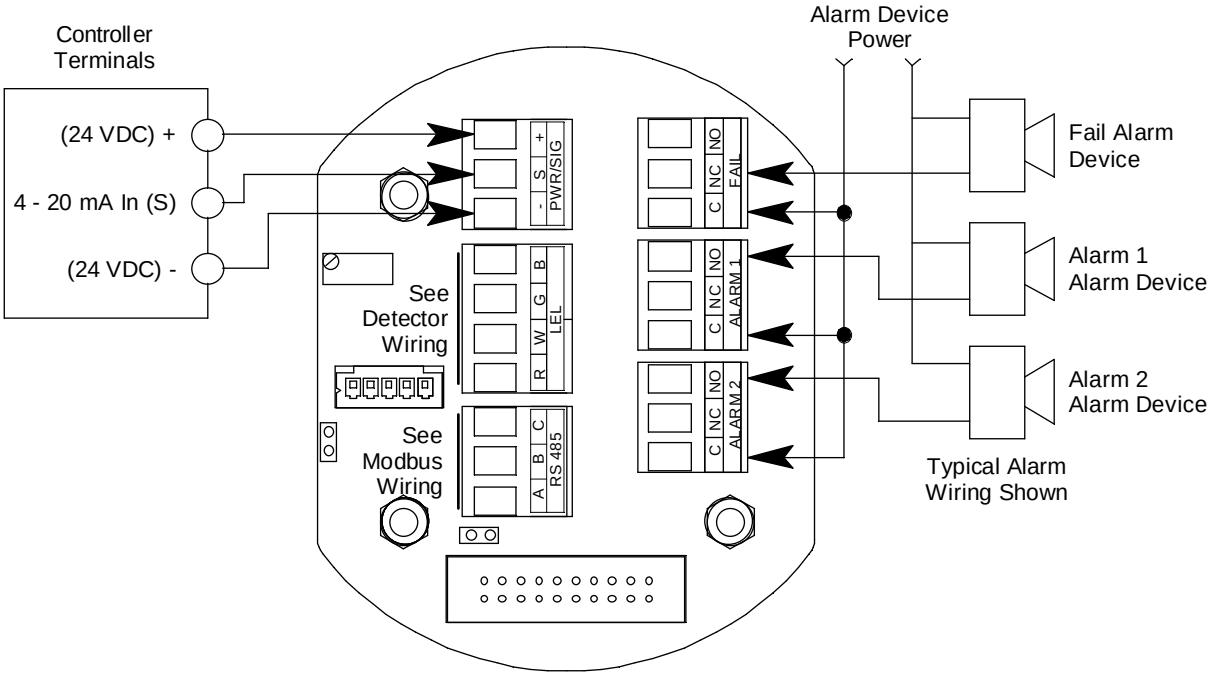


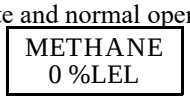
Figure 30: Wiring the EXP-SNR-TG-EC to a Controller and Alarm Devices

8. Re-install the control PCB (and ribbon cable if necessary). Be sure the ribbon cable is routed down below the control PCB so it will not be damaged by the cover when it is screwed back on.
9. Secure the junction box cover to the junction box.
10. Make controller, device, and relay connections as appropriate. If shielded cable is used for the PWR/SIG connections, connect the cable shield's drain wire to an available chassis ground at the gas monitoring controller, recording device, or programmable controller.

Start Up

Introducing Incoming Power

1. Complete the installation procedures described earlier in this manual.
2. Verify that all wiring connections are correct and secure.
3. Turn on the incoming power.
4. If necessary, turn on the controller or other monitoring device that is connected to the EXP-SNR-TG-EC.
5. The OLED display will indicate the firmware version when the EXP-SNR-TG-EC is first powered up and will then count down a one minute warm-up period before normal operation begins. During normal operation, the display will indicate the target gas and current gas reading. Verify that the display is indicating the target gas and current gas reading after the warm-up period is complete and normal operation begins.



NOTE: Allow the sensor's detector to warm up for 15 minutes before you continue with the next section, "Adjusting the Fresh Air Reading."

Adjusting the Fresh Air Reading

When the EXP-SNR-TG-EC is shipped, it is factory calibrated. If a full calibration is desired at startup, see "Calibration, Combustible Gas, CO2, and Toxic Versions" or "Calibration, Oxygen Version".

Verify that the EXP-SNR-TG-EC is in a fresh air environment (environment known to be free of the target gas and combustible or toxic gas vapors and of normal oxygen content, 20.9%).

CAUTION: *If you suspect the presence of combustible gas, CO_2, toxic gas, or that the oxygen content is not normal in the monitoring environment, use the calibration kit and the zero air calibration cylinder to introduce "fresh air" to the detector and verify an accurate fresh air setting. See the "Calibration, Combustible Gas, CO2, and Toxic Versions" or "Calibration, Oxygen Version" for instructions on how to use a zero air cylinder when performing a fresh air adjustment.*

Non-Intrusive Fresh Air Signal Adjustment

If the EXP-SNR-TG-EC is installed in a classified area and non-intrusive zero adjustment is required, follow the instructions below, **but do not remove the junction box cover**. Use the magnetic wand accessory to actuate the magnetic switches instead of pushing the control switch buttons. To actuate a magnetic switch and perform the same operation as pressing a control switch button, touch the magnet in the end of the magnetic wand to the sensor's glass cover directly over the magnetic switch you wish to actuate. Touching the glass and removing the wand is the same as pressing and releasing a button. Touching the glass and keeping the wand in place is the same as pressing and holding a button.

WARNING: ***The EXP-SNR-TG-EC is not an active gas monitoring device during the fresh air adjustment procedure. The 4-20 mA output signal will "freeze" at 3.5 mA for a toxic, combustible gas, or CO_2 EXP-SNR-TG-EC, or at 17.4 mA for an oxygen EXP-SNR-TG-EC, and all relays will remain in their non-alarm state while the EXP-SNR-TG-EC is in Calibration Mode. The output signal will not indicate current readings and the relays will not resume operating normally until the EXP-SNR-TG-EC is in normal operation again.***

NOTE: While in the calibration program, if there is no switch activity for the calibration time-out period the unit will return to normal operation. The factory set time-out is 15 minutes. If you want a different time-out period, see "Viewing & Changing EXP-SNR-TG-EC Parameters" for instructions to change the calibration time-out.

Combustible Gas, CO_2, and Toxic Versions, Adjusting the Fresh Air Reading

1. While in normal operation, press and hold the UP/YES button for 5 seconds to enter Calibration Mode. Release the button when the following screen appears**.**

```
Calib?
YES/NO
```

2. Press and release the UP/YES button to continue. The display will indicate the target gas and **CAL Mode** for a few seconds before showing **FreshAir Adjust?**.
3. Press and release the UP/YES button. **ENTER** will alternate with **FreshAir** on the top display line and the current gas reading will be on the bottom display line.
4. Press and release the ENTER button. The EXP-SNR-TG-EC will perform a zero operation and the display will indicate **SPAN w/Cal Gas?**.
5. Press and release the DOWN/NO button. The display will indicate **Leaving CAL Mode** and the EXP-SNR-TG-EC will return to normal operation.

Oxygen Version, Adjusting the Fresh Air Reading

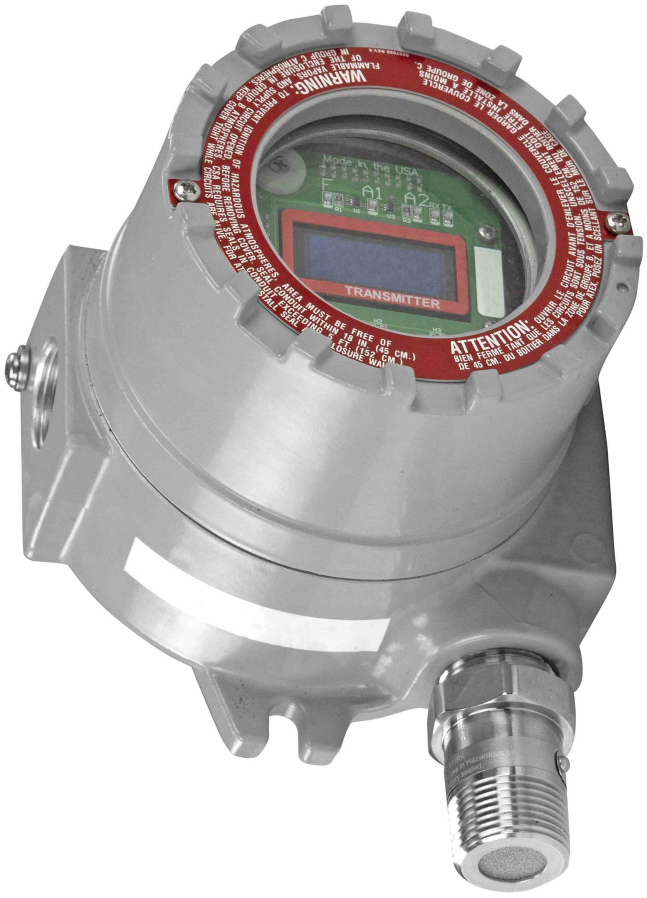
1. While in normal operation, press and hold the UP/YES button for 5 seconds to enter Calibration Mode. Release the button when the following screen appears.

```
Calib?
YES/NO
```

2. Press and release the UP/YES button to continue. The display will indicate **OXYGEN CAL Mode** for a few seconds before showing **FreshAir Adjust?**.
3. Press and release the UP/YES button. **ENTER** will alternate with **FreshAir** on the top display

line and the current oxygen reading will be on the bottom display line.

4. Press and release the ENTER button. The EXP-SNR-TG-EC will perform a span operation and then the display will indicate **ZERO w/Cal Gas?**.
5. Press and release the DOWN/NO button. The display will indicate **Leaving CAL Mode** and the EXP-SNR-TG-EC will return to normal operation.



Chapter 4: Operation

Overview

This chapter describes the EXP-SNR-TG-EC in normal operation. This chapter also describes the EXP-SNR-TG-EC in alarm 1, alarm 2, and fail conditions and suggests responses to these conditions.

Normal Operation

Normal operation is defined as follows:

- The start-up procedure is complete.
- The EXP-SNR-TG-EC is not indicating an alarm 1, alarm 2, or fail condition.
- The EXP-SNR-TG-EC is not in Calibration, Configuration, or Gas Type modes.

During normal operation, the EXP-SNR-TG-EC simultaneously displays the current gas reading, unit of measure, and target gas. The example below illustrates a typical combustible gas EXP-SNR-TG-EC.

```
METHANE
0 %LEL
```

Information Screen

The Information Screen displays the sensor's operating voltage and firmware and hardware information. To display the Information Screen, do the following:

1. Press and hold the DOWN/NO button for 3 seconds. The Information Screen will appear.

```
24.2V
v6.0L 2A
```

2. Continue holding the DOWN/NO button to keep the Information Screen on the display. The top line indicates the operating voltage that is connected to the EXP-SNR-TG-EC. The second line indicates the firmware that is running, version 6.0 in this example, and the sensor's hardware version, version 2A in this example. This information may be useful if you need to contact the factory with questions about the EXP-SNR-TG-EC.
3. Release the DOWN/NO button when you are done viewing the Information Screen. The display will return to the normal operation screen within a couple of seconds.

4 - 20 mA Signal Output Operation

The output at the S terminal of the power/signal terminal strip is a 4 - 20 mA signal that corresponds to the detection range of the EXP-SNR-TG-EC. During normal operation, this signal tracks the gas concentration on the OLED display.

There are several circumstances where the signal output will not track the display reading but will behave as follows:

- When the EXP-SNR-TG-EC is in its warm-up period, the signal output will be fixed at 1.2 mA.
- When the sensor's gas type is changed, the EXP-SNR-TG-EC will enter Configuration Mode for you to verify the parameter settings. When you exit Configuration Mode, the display will indicate **NEEDS CALIBRATION** and will continue to indicate this until Calibration Mode is entered and a calibration is performed. In this situation, the signal output will be fixed at 3.5 mA for LEL and toxic versions and 17.4 mA for oxygen versions from the time Gas Type Mode is entered until the EXP-SNR-TG-EC is calibrated and returns to normal operation.
- If you enter Calibration Mode, Configuration Mode, Gas Type Mode, or Modbus Mode, the signal output will be fixed at 3.5 mA for combustible gas, CO_2, and toxic versions and 17.4 mA for oxygen versions until the EXP-SNR-TG-EC returns to normal operation.
- If the sensor's input power decreases below 9.5 volts so that the EXP-SNR-TG-EC is in a low power alarm, the signal output is fixed below 2.4 mA until the low power alarm is cleared.
- If the M2 goes into a fail condition, after a 30 second delay, the signal output is fixed below 2.4 mA until the fail alarm is cleared. During the 30 second delay, the signal output follows the detector output. In the case of a downscale reading, the display and the signal output continue to track the reading down to -99% of full scale (1.15 mA).

Alarm Indications

NOTE: The EXP-SNR-TG-EC includes alarm on and alarm off delay settings for alarm 1 and alarm 2. The alarm indications described in this section operate according to the factory set alarm settings. See Table 11 for all the factory settings.

Table 10: Visual and Audible Alarm Indications

Condition	Cause	Visual Indication(s)
Alarm 1[1]	Increasing (decreasing for O_2) gas reading at or above the alarm 1 setpoint	• A1 LED is on • Gas reading alternates with **ALARM-1** message
Alarm 2[1]	Increasing gas reading at or above the alarm 2 setpoint	• A2 LED is on • Gas reading alternates with **ALARM-2** message
Fail	• Disconnected or misconnected detector wiring • Display reading at -10% of full scale or lower • Defective components	• F LED is on • **FAIL** message replaces gas reading *NOTE: There is a 30 second delay on the fail condition.*
Low Power	DC power source less than 9.5 volts.	• F LED is on • **LowPower** message and actual voltage of incoming DC power

* ***[1]If the EXP-SNR-TG-EC is in both an alarm 1 and an alarm 2 condition, both alarm LEDs are on and the display alternates between the gas reading and the ALMS 1&2 message.***

NOTE: You can select normally energized (N. EN) or normally de-energized (N. DE-EN) alarm 1 and alarm 2 relay settings in Configuration Mode. The following sections describe the standard factory setting for these relays which is N. DE-EN.

The fail relay is factory set as N. EN and is not user-adjustable.

Alarm 1 Condition

Alarm 1 Condition Indications

When the gas reading reaches the alarm 1 setpoint, the EXP-SNR-TG-EC senses an alarm 1 condition. The EXP-SNR-TG-EC alerts you to an alarm 1 condition as follows:

- The A1 LED turns on.
- The gas reading alternates with the **ALARM-1** message.
- The alarm 1 relay energizes.

Responding to an Alarm 1 Condition

1. Follow your established procedure for a low level combustible or toxic gas condition or a decreasing oxygen concentration condition.
2. After the gas reading falls below (above for oxygen) the alarm 1 setpoint, press the ENTER button to reset the alarm 1 circuit. Resetting the alarm 1 circuit turns off the A1 LED, resets the

OLED display, and de-energizes the alarm 1 relay.

NOTE: If the ENTER button is pressed while the EXP-SNR-TG-EC is in an alarm 1 condition, the A1 LED will flash but all other indications will remain unchanged.

You cannot de-energize the alarm 1 relay until the gas reading falls below (above for oxygen) the alarm 1 setpoint.

Alarm 2 Condition

Alarm 2 Condition Indications

When the gas reading reaches the alarm 2 setpoint, the EXP-SNR-TG-EC senses an alarm 2 condition. The EXP-SNR-TG-EC alerts you to an alarm 2 condition as follows:

- The A2 LED turns on.
- The gas reading alternates with the **ALARM-2** message.
- The alarm 2 relay energizes.

NOTE: If the EXP-SNR-TG-EC is in both an alarm 1 and alarm 2 condition, both the A1 and A2 LEDs will be on, the gas reading will alternate with the **ALMS 1&2** message, and both alarm relays will energize**.**

Responding to an Alarm 2 Condition

1. Follow your established procedure for a high level combustible or toxic gas condition or an increasing oxygen concentration condition.
2. After the gas reading falls below the alarm 2 setpoint, press the ENTER button to reset the alarm circuit. Resetting the alarm circuit turns off the A2 light, resets the OLED display, and de-energizes the alarm 2 relay.

NOTE: If the ENTER button is pressed while the EXP-SNR-TG-EC is in an alarm 2 condition, the A2 LED will flash but all other indications will remain unchanged.

You cannot de-energize the alarm 2 relay until the gas reading falls below the alarm 2 setpoint.

Fail Condition

Fail Condition Indications

The EXP-SNR-TG-EC indicates a fail condition for any of the following:

- The detector wiring is disconnected or incorrectly connected.
- The display reading is -10% of full scale or lower.

When the EXP-SNR-TG-EC senses a fail condition, it alerts you

as follows:

- The F LED turns on.
- The gas reading is replaced by the **FAIL** message.

NOTE: The fail alarm has a 30 second delay.

Responding to a Fail Condition

1. Verify that the detector wiring is correctly and securely connected.
2. If the EXP-SNR-TG-EC has a replaceable plug-in sensor, verify that the replaceable plug-in sensor in the detector housing is properly installed.

Low Power Alarm

Low Power Alarm Indications

The EXP-SNR-TG-EC senses a low power condition when the DC power source is

WARNING: ***While in a low power condition, the EXP-SNR-TG-EC is not an active gas monitor.***

When the EXP-SNR-TG-EC senses a low power condition, it alerts you as follows:

- The F LED turns on.
- The message **LowPower** is indicated on the top line of the OLED display and the input voltage is displayed on the bottom line of the OLED display.
- The fail relay de-energizes.

NOTE: The low power alarm cannot be cleared using the ENTER button.

When the voltage increases to 10.0 volts, the low power alarm is cleared and the EXP-SNR-TG-EC will begin its warm-up sequence.

Responding to a Low Power Condition

1. Determine and correct the cause of the low power condition.
2. When the input power increases above 10.0 volts, the EXP-SNR-TG-EC will begin its warm-up sequence.
3. Verify that the EXP-SNR-TG-EC enters normal operation after its warm-up sequence. If necessary, perform a fresh air adjustment. See “Adjusting the Fresh Air Reading”.

Chapter 5: Configuration Mode

Overview

This chapter describes how to view and change EXP-SNR-TG-EC parameters using Configuration Mode. It is accessed using the program buttons.

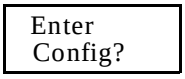
Configuration Mode includes a 5-minute time-out feature. If you do not press a control button for 5 minutes, the EXP-SNR-TG-EC automatically returns to normal operation.

NOTE: If the EXP-SNR-TG-EC returns to normal operation because of a time-out, it enters a warm-up period just as it does when it is first turned on.

If you are installing a new EXP-SNR-TG-EC, it has been setup at the factory. Use Configuration Mode only if you want to change the sensor's setup. If you want to change the detector type see “Chapter 6: Gas Type Mode”.

Viewing & Changing EXP-SNR-TG-EC Parameters

1. While in normal operation, simultaneously press and hold the UP/YES and ENTER buttons for 5 seconds to enter Configuration Mode. Release the buttons when the following screen appears.



2. If you want to exit Configuration Mode, press and release the DOWN/NO button and the EXP-SNR-TG-EC will return to normal operation.
   If you want to continue in Configuration Mode, press and release the UP/YES button. The target gas and the full scale will be displayed for a few seconds before the first adjustable parameter, the alarm 1 setpoint, is displayed.
3. If you want to change the currently displayed parameter, use the UP/YES and DOWN/NO buttons to adjust it to the desired setting, then press ENTER to continue to the next parameter. If the currently displayed parameter is OK, press the ENTER button to proceed to the next parameter.
   Table 11 lists the EXP-SNR-TG-EC parameters you can set. Table 11 also lists the factory set value for each parameter.

Table 11: Configuration Parameters

Parameter (Factory Set Value)	Description
ALARM-1 (level) (See EXP-SNR-TG-EC Specifications)	The gas reading at which the EXP-SNR-TG-EC initiates an alarm 1 condition.
ALARM-1 (activation) (Decrease for oxygen EXP-SNR-TG-EC, Increase for all other types)	Indicates if the alarm 1 circuit is activated by gas readings increasing (**Increase**) or decreasing (**Decrease**) to the ALARM-1 Level.
ALARM-1 (relay action) (N. DE-EN)	If set as **N. DE-EN**, the alarm 1 relay is de-energized in normal operation and energizes when an alarm 1 condition is initiated. If set as **N. EN**, the alarm 1 relay is energized in normal operation and de-energizes when an alarm 1 condition is initiated.
ALARM-1 (relay reset) (LATCH)	If set as **LATCH**, you must press the ENTER button to reset the alarm 1 circuit after the alarm 1 condition passes. If set as **SELF-RST**, the EXP-SNR-TG-EC automatically resets the alarm 1 circuit after the alarm 1 condition passes.
A1 OnDy (alarm 1 on delay) (1 secs)	The amount of time the EXP-SNR-TG-EC delays activation of the alarm 1 circuit once an alarm 1 condition is initiated. It can be set in 1 second increments from 0 - 60 seconds, in 1 minute increments from 1 - 15 minutes, and in 15 minute incre-ments from 15 - 60 minutes.
A1 OffDy (alarm 1 off delay) (0 sec.)	The amount of time the EXP-SNR-TG-EC delays turning off the alarm 1 circuit once an alarm 1 condition passes. This parameter appears only if the alarm 1 relay reset setting is set to **SELF-RST**. It can be set in 1 second increments from 0 - 60 seconds, in 1 minute increments from 1 - 15 minutes, and in 15 minute increments from 15 - 60 minutes.
ALARM-2 (level) (See EXP-SNR-TG-EC Specifications)	The gas reading at which the EXP-SNR-TG-EC initiates an alarm 2 condition.
ALARM-2 (activation) (Increase for all types)	Indicates if the alarm 2 circuit is activated by gas readings increasing (**Increase**) or decreasing (**Decrease**) to the ALARM-1 Level.
ALARM-2 (relay action) (N. DE-EN)	If set as **N. DE-EN**, the alarm 2 relay is de-energized in normal operation and energizes when an alarm 2 condition is initiated. If set as **N. EN**, the alarm 2 relay is energized in normal operation and de-energizes when an alarm 2 condition is initiated.
ALARM-2 (relay reset) (LATCH)	If set as **LATCH**, you must press the ENTER button to reset the alarm 2 circuit after the alarm 2 condition passes. If set as **SELF-RST**, the EXP-SNR-TG-EC automatically resets the alarm 2 circuit after the alarm 2 condition passes.
A2 OnDy (alarm 2 on delay) (1 secs)	The amount of time the EXP-SNR-TG-EC delays activation of the alarm 2 circuit once an alarm 2 condition is initiated. It can be set in 1 second increments from 0 - 60 seconds, in 1 minute increments from 1 - 15 minutes, and in 15 minute incre-ments from 15 - 60 minutes.
A2 OffDy (alarm 2 off delay) (0 sec.)	The amount of time the EXP-SNR-TG-EC delays turning off the alarm 2 circuit once an alarm 2 condition passes. This parameter appears only if the alarm 2 relay reset setting is set to **SELF-RST**. It can be set in 1 second increments from 0 - 60 seconds, in 1 minute increments from 1 - 15 minutes, and in 15 minute increments from 15 - 60 minutes.

Table 11: Configuration Parameters (Continued)

Parameter (Factory Set Value)	Description
ZeroSupp (0.0% of the **detection range** in terms of the detection units for carbon dioxide channel types, 0.5% **oxygen** for oxygen types, 2% of the **detection range** in terms of the detection units for all other types)	The zero suppression feature helps prevent "jumpy" readings near the fresh air reading. For example, if the zero suppression setting for a combustible LEL detector is **2.0% LEL,** the EXP-SNR-TG-EC will display a reading of 0% LEL for gas readings from -2% LEL to 2% LEL. It is settable from 0 to 6% of the detection range.
FILTER (5 secs)	The filter feature helps "smooth out" jumpy or noisy signals from the detector. You can set the filter from 0 seconds to 60 seconds in 5 seconds increments. The displayed gas reading is the average reading over the previous time period defined by the filter setting. So if the filter is set to 5 seconds, the displayed gas reading is the average over the past 5 seconds.
CAL Time (15 mins)	The calibration time-out sets the amount of time after the last button push while in Calibration Mode that the EXP-SNR-TG-EC will wait before returning to normal opera-tion. If the calibration time-out is set to **15 mins**, then EXP-SNR-TG-EC will return to normal operation automatically 15 minutes after the last button push.
Auto Zero (Disabled for carbon dioxide channels; Enabled for all other channel types)	If set to **Enabled**, the sensor's firmware will monitor the zero (fresh air) reading and make automatic zero adjustments under precisely specified conditions if it determines that a reading change is due to normal sensor drift. If set to **Disabled**, the Auto Zero function is turned off.

4. When you have scrolled through all the adjustable parameters, **SAVE IT? YES/NO** appears on the display.
5. If you do not wish to save the adjustments and want to exit Configuration Mode, press and release the DOWN/NO button. The **DO OVER? YES/NO** message will display. Press and release the DOWN/NO button. The **ABORT? YES/NO** message will display. Press the UP/YES button to return to normal operation.

   If you wish to change some of the adjustments made, press and release the DOWN/NO button. The **DO OVER? YES/NO** message will display. Press and release the UP/YES button. The **Re-do Config** message will display and the EXP-SNR-TG-EC will return to the first adjustable parameter. Go back to step 3 and continue.

   If you wish to save the adjustments made, press and release the UP/YES button. **Config Saved** is indicated on the display for a few seconds and the EXP-SNR-TG-EC returns to normal operation.

Chapter 6: Gas Type Mode

Overview

This chapter describes how to use Gas Type Mode to select the sensor's gas type. The gas type determines the target gas and detection range. The combustible gas/CO_2 and toxic/oxygen sensors have a different terminal PCB and run on different firmware. Your EXP-SNR-TG-EC will only have gas type choices available that it can support.

Gas Type Mode includes a 5-minute time-out feature. If you do not press a button for 5 minutes, the EXP-SNR-TG-EC automatically returns to normal operation.

NOTE: If the EXP-SNR-TG-EC enters normal operation because of a program time-out, it enters a warm-up period just as it does when it is first turned on.

Selecting the Gas Type

1. While in normal operation or during the warm-up sequence, press and hold the UP/YES and DOWN/NO buttons for five seconds. Release them when the following screen appears.

   ```
   Select
   GasType?
   ```

2. If you want to exit Gas Type Mode, press and release the DOWN/NO button. The display will indicate **NO CHANGE** and the EXP-SNR-TG-EC will return to normal operation.
   If you want to continue in Gas Type Mode, press and release the UP/YES button. The top display line will indicate **GasType?** and the bottom display line will indicate the target gas choice.

3. Use the UP/YES or DOWN/NO button to scroll through the choices of target gas. Table 12 and Table 13 below list the choices of target gas for the EXP-SNR-TG-EC.

Table 12: Combustible Gas/CO_2 Gas Types

Gas Type Choices	Detection Range
HC	0 - 100% LEL
iBUTANE	0 - 100% LEL
PROPANE	0 - 100% LEL
HEXANE	0 - 100% LEL
HYDROGEN	0 - 100% LEL
METHANE	0 - 100% Volume
METHANE	0 - 100% LEL
CO2	0 - 5,000 ppm

Table 12: Combustible Gas/CO_2 Gas Types

Gas Type Choices	Detection Range
CO2	0 - 2,000 ppm
CO2	0 - 100% volume
CO2	0 - 50.0% volume
CO2	0 - 5.00% volume
METHANE	0 - 5.00% volume
METHANE	0 - 8980 ppm*
*Use this gas type for 0-9000 ppm CH_4. 8980 ppm is the highest displayed value. Anything higher is displayed as **OVER**.	

Table 13: Toxic/Oxygen Gas Types

Gas Type Choices	Detection Range
H2S	0 - 100 ppm
CO	0 - 300 ppm
CO	0 - 200 ppm
CO	0 - 100 ppm
CL2	0 - 3.00 ppm
CL2	0 - 10.0 ppm
NH3	0 - 75.0 ppm
SO2	0 - 6.00 ppm
ASH3	0 - 1.50 ppm
B2H6	0 - 5.00 ppm
CLO2	0 - 1.00 ppm
F2	0 - 3.00 ppm
GEH4	0 - 1.50 ppm
HCL	0 - 15.0 ppm
HCN	0 - 15.0 ppm
HF	0 - 9.00 ppm
NO	0 - 100 ppm
O3	0 - 1.00 ppm
PH3	0 - 1.00 ppm

Table 13: Toxic/Oxygen Gas Types

Gas Type Choices	Detection Range
SIH4	0 - 15.0 ppm
OXYGEN	0 - 25.0% volume

NOTE: Consult factory for availability of detectors for toxic EXP-SNR-TG-EC types not listed in "EXP-SNR-TG-EC Specifications".

4. When the desired target gas is on the display, press and release the ENTER button. The display will ask **SAVE IT? YES/NO**.
5. To discard the gas type change, press and release the DOWN/NO button. The display will ask **DO OVER? YES/NO**. Press the DOWN/NO button. The display will ask **ABORT? YES/NO**. Press the UP/YES button. The EXP-SNR-TG-EC will return to normal operation without changing the gas type.
   To save the gas type, press and release the UP/YES button. The display will indicate **Gas Type Updated**, the display will indicate the target gas and the detection range for a few seconds, and then the EXP-SNR-TG-EC will enter Configuration Mode automatically so that the parameter settings in Configuration Mode can be verified or changed.
6. While in Configuration Mode press and release the ENTER button to accept the displayed parameter setting and move to the next one. Use the UP/YES and DOWN/NO buttons to adjust a setting. See "Chapter 5: Configuration Mode" for a complete description of Configuration Mode.
7. When you have reviewed and accepted the last item in Configuration Mode by pressing the ENTER button, display will ask **SAVE IT? YES/NO**.
8. To save the configuration settings, press and release the UP/YES button.The display will indicate **Config Saved** and the EXP-SNR-TG-EC will begin its warm-up sequence.
   To discard the settings and review them again, press the DOWN/NO button. The display will ask **DO OVER? YES/NO**. Press the UP/YES button and the display will indicate **Re-do Config**, then display the target gas and the detection range for a few seconds before returning to Configuration Mode. Repeat steps 6 - 8 until the settings are as desired.
9. After the EXP-SNR-TG-EC completes its warm-up sequence, the display will indicate **CAL NEEDED**. Since the gas type has been changed, a successful calibration must be performed before the EXP-SNR-TG-EC can enter normal operation.
10. Press and release the UP/YES button to enter Calibration Mode. Normally, you must hold the UP/YES button for 5 seconds to enter Calibration Mode, but since a calibration is required, only a momentary push is needed to enter Calibration Mode after changing the gas type.
11. See "Calibration, Combustible Gas, CO2, and Toxic Versions" or "Calibration, Oxygen Version" for calibration instructions.

NOTE: When calibrating an EXP-SNR-TG-EC after changing the gas type, the EXP-SNR-TG-EC will not ask if you want to calibrate, or whether you want to perform a fresh air adjustment, span adjustment or zero adjustment. Since a complete calibration is required, the calibration sequence will proceed without asking if you want to perform certain operations.

Chapter 7: Maintenance

Overview

This chapter describes procedures for performing preventive maintenance, troubleshooting, calibrating the EXP-SNR-TG-EC, and replacing field replaceable parts. It includes separate procedures for
calibrating the combustible gas/CO_2/toxic and oxygen versions of the EXP-SNR-TG-EC.

Preventive Maintenance

This section describes a recommended preventive maintenance schedule to ensure the optimum performance of the EXP-SNR-TG-EC. It includes daily, quarterly, and biannual procedures.

Daily

Verify a display reading of zero (20.9% for an oxygen EXP-SNR-TG-EC). Investigate significant changes in the reading.

Quarterly

Calibrate sensors that do not have an IR detector as described in “Calibration, Combustible Gas, CO2, and Toxic Versions” or “Calibration, Oxygen Version”. See “Calibration Frequency” for a discussion of calibration frequency guidelines.

Biannually

Calibrate sensors that have an IR detector as described in “Calibration, Combustible Gas, CO2, and Toxic Versions”. See “Calibration Frequency” for a discussion of calibration frequency guidelines.

Troubleshooting

The troubleshooting guide describes symptoms, probable causes, and recommended action for problems you may encounter with the EXP-SNR-TG-EC.

NOTE: This troubleshooting guide describes EXP-SNR-TG-EC problems only. If the EXP-SNR-TG-EC is connected to a controller, see the controller operator's manual for problems you may encounter with the controller.

Table 14:Troubleshooting the Combustible Gas Detector

Condition	Symptom(s)	Probable Causes	Recommended Action
No Power	The display backlight is off and the display screen is blank.	• The power wiring is disconnected or misconnected. • The display cable is disconnected or misconnected.	1. Verify that the wiring to the power source or controller is correct and secure. 2. Verify that the ribbon cable connecting the terminal PCB to the control PCB is securely installed. This ribbon cable plugs into a connector on the top edge of the control PCB and on the bottom of the terminal PCB. 3. If the power difficulties continue, contact for further instruction.
Frequent or Suspect Alarms	The EXP-SNR-TG-EC alerts you to frequent or suspect alarms while the fresh air readings remain on zero (20.9 for oxygen).	• The EXP-SNR-TG-EC is experiencing false readings due to RFI or EMI. • The detector wiring is disconnected, misconnected, or intermittent.	1. Verify that the EXP-SNR-TG-EC wiring is properly shielded. See "Wiring the EXP-SNR-TG-EC Transmitter". 2. Verify that the detector wiring is correct and secure. 3. Increase the alarm on delay setting in Configuration Mode. 4. If the frequent or suspect alarm difficulties continue, contact for further instruction.
Flickering Display	The display reading flickers often.	• The EXP-SNR-TG-EC is experiencing false readings due to RFI or EMI. • The noise filter setting is too low. • The zero suppression setting is too low. • The display screen is malfunctioning.	1. Verify that the EXP-SNR-TG-EC wiring is properly shielded. See "Wiring the EXP-SNR-TG-EC Transmitter". 2. Verify that the detector wiring is correct and secure. 3. Increase the filter setting in Configuration Mode. 4. Increase the zero suppression setting in Configuration Mode. 5. If the display difficulties continue, contact for further instruction.

Table 14:Troubleshooting the Combustible Gas Detector (Continued)

Condition	Symptom(s)	Probable Causes	Recommended Action
Fail Condition	• EXP-SNR-TG-EC indicates a fail condition. • Controller indicates a fail condition	• The detector wiring to the terminal PCB is disconnected or misconnected. • The wiring from the EXP-SNR-TG-EC to the controller is disconnected or misconnected. • The detector fresh air signal is low enough to cause a fail condition. • The detector is malfunctioning. • The terminal or display PCB is malfunctioning.	1. Verify that the detector wiring is correct and secure. 2. Verify that the wiring between the EXP-SNR-TG-EC and the controller is correct and secure. 3. Calibrate the EXP-SNR-TG-EC. 4. If the fail condition continues, replace the detector. 5. If the fail condition continues, contact for further instruction.
Slow or No Response/ Difficult or Unable to Calibrate	• Unable to successfully set the fresh air or span (zero for oxygen) reading during calibration. • EXP-SNR-TG-EC requires frequent calibration. ***Note:*** *See "Calibration Frequency" for calibration frequency guidelines.*	• The calibration cylinder is low, out-dated, or defective. • For non-XP CO, H_2S, or O_2 detectors: The membrane on the detector housing cap is blocked with dirt of some other particulate contamination. • For CT-7 Series detectors: The hydrophobic membrane on the plug-in sensor face is blocked with dirt or some other particulate contamination. • The detector is malfunctioning. • The terminal PCB is malfunctioning.	1. Verify that the calibration cylinder contains an adequate supply of a fresh test sample. 2. For non-XP CO, H2S, or O2 detectors: Check the face of the detector housing cap and remove any particulate contamination from the hydrophobic membrane, if necessary. If the membrane appears saturated with contamination or is damaged, replace the membrane as described in "Replacing the Hydrophobic Membrane (Non-XP CO, H_2S, and O_2 Detectors)". 3. For CT-7 Series detectors: Check the plug-in sensor face and remove any particulate contamination from the hydrophobic membrane, if necessary. If the membrane appears saturated with contamination or is damaged, replace the membrane as described in "Replacing the Hydrophobic Membrane (CT-7 Series Toxic Detector)". 4. If the calibration/response difficulties continue, replace the detector. 5. If the calibration/response difficulties continue, contact for further instruction.

Calibration Frequency

Some sensors have IR (infrared) type detectors, such as an EXP-SNR-TG-EC for CO_2 or an LEL EXP-SNR-TG-EC with an IR
detector. Most of the sensors do not have an IR detector. For example, an H_2S EXP-SNR-TG-EC has an electrochemical detector and some of the combustible sensors use catalytic detectors. The sensors that use IR detectors typically need less frequent calibration as is discussed below. See Table 3,
"Infrared (IR) Detectors," to see which sensors are IR versions.

Although there is no particular calibration frequency that is correct for all applications, a calibration frequency of every 3 to 6 months for sensors that do not have an IR detector and every 6 to 12 months for sensors that have an IR detector is adequate for most EXP-SNR-TG-EC applications. Unless experience in a particular application dictates otherwise, Larson Electronics recommends a calibration frequency of every 3 months for sensors that do not have an IR detector and every 6 months for sensors that have an IR detector.

If an application is not very demanding, for example detection in a clean, temperature controlled environment where the toxic or combustible target gas is not normally present, and calibration adjustments are minimal at calibration, then a calibration frequency of every 6 months for a non-IR EXP-SNR-TG-EC or 12 months for an IR EXP-SNR-TG-EC is adequate.

If an application is very demanding, for example if a combustible or toxic gas is present often and in significant concentrations or the environment is not well controlled, then more frequent calibration than every 3 months for a non-IR EXP-SNR-TG-EC or every 6 months for an IR EXP-SNR-TG-EC may be necessary. For combustible gas detection with an EXP-SNR-TG-EC that uses a catalytic detector, if potential catalyst poisons are known or likely to be present, more frequent calibration than every 3 months will be necessary.

Calibration, Combustible Gas, CO_2, and Toxic Versions

This section describes how to calibrate the combustible gas, CO_2, and toxic gas versions of the EXP-SNR-TG-EC. It includes procedures to prepare for calibration, enter Calibration Mode, adjust the fresh air (zero) setting, adjust the span setting, and return to normal operation. See the next section,
"Calibration, Oxygen Version" for instructions to calibrate an oxygen EXP-SNR-TG-EC.

WARNING: ***The EXP-SNR-TG-EC is not an active gas monitoring device during the calibration procedure. The 4-20 mA output signal will "freeze" at 3.5 mA and all relays will remain in their non-alarm state while the EXP-SNR-TG-EC is in Calibration Mode. The output signal will not indicate current readings and the relays will not resume operating normally until the EXP-SNR-TG-EC is in normal operation again.***

Special Note About Calibrating a ClO_2 Detector

Larson Electronics recommends using a ClO_2 generator to set the ClO_2 detector's response reading. The flow rate on the generator needs to be set to 0.5 LPM and it is recommended that 0.5 ppm ClO_2 be used. If a ClO_2 generator is used for calibration, the steps related to the use of a calibration gas cylinder in the instructions below can be disregarded.

Preparing for Calibration

NOTE: The following procedure assumes the use of a calibration kit which includes a calibration gas cylinder, a zero air cylinder, a fixed flow regulator with an on/off knob, a calibration cup for the appropriate sensor, and a short piece of sample tubing to connect the regulator to the calibration cup.

WARNING: ***Larson Electronics recommends that you dedicate a regulator for use with chlorine (Cl_2) gas and that you do not use that dedicated regulator for any other gases, particularly hydrogen sulfide (H_2S).***

NOTE: While in the calibration program, if there is no switch activity for the calibration time-out period the unit will return to normal operation. See "Viewing & Changing EXP-SNR-TG-EC Parameters" for instructions to set the calibration time-out.

NOTE: The following procedure assumes that the target gas is present in a high enough concentration to affect the fresh air (zero) reading. If a fresh air environment can be verified, applying zero air to the detector is not necessary when setting the zero (span for oxygen) reading.

CAUTION: *If calibrating a CT-7 Series EXP-SNR-TG-EC, allow the instrument to warm up for 15 minutes before performing a calibration.*

1. Connect the calibration kit sample tubing to the calibration cup hose barb.
2. Screw the calibration cup onto the detector.

NOTE: For an ESM-01 detector, you must unscrew the removable splashguard from the detector housing cap so you can push the appropriate calibration cup onto the ESM-01 sensor. Make sure to use the correct calibration cup for the sensor being used. There is a Cl_2 type calibration cup for a Cl_2 sensor, an NH_3 type calibration cup for an NH_3 sensor, and a general type (usually labeled SO_2) calibration cup for all other ESM-01 sensors.

3. Connect the fixed flow regulator to the calibration cup using the sample tubing.

NOTE: When calibrating an NH_3 ESM-01, the 0.25 LPM flowrate regulator must be used. All other sensors require a 0.5 LPM flowrate regulator.

Non-Intrusive Calibration

If the EXP-SNR-TG-EC is installed in a classified area and non-intrusive calibration is required, follow the instructions below, but do not remove the junction box cover. Use the magnetic wand accessory to actuate the magnetic switches instead of pushing the control switch buttons. To actuate a magnetic switch and perform the same operation as pressing a control switch button, touch the magnet in the end of the magnetic wand to the sensor's glass cover directly above the magnetic switch you wish to actuate. Touching the glass and removing the wand is the same as pressing and releasing a button. Touching the glass and keeping the wand in place is the same as pressing and holding a button.

Calibration Gas Response Memory Feature

The EXP-SNR-TG-EC has the capability to “remember” the detector’s response to the calibration gas after the gas is removed from the detector during the fresh air and span adjustment procedure. This feature enables one person to perform a calibration if the detector is mounted remotely from the EXP-SNR-TG-EC. When zero air is applied to the EXP-SNR-TG-EC during a fresh air adjustment, the EXP-SNR-TG-EC will freeze the display reading at the lowest response and the EXP-SNR-TG-EC will continue to display this reading and retain it in its memory until the fresh air adjustment procedure is completed. When calibration gas is applied to the EXP-SNR-TG-EC during a span adjustment, the EXP-SNR-TG-EC will freeze the display reading at the highest response to the calibration gas. The calibration gas can then be removed and the EXP-SNR-TG-EC will continue to display this reading and retain it in its memory until the span adjustment procedure is completed.

Adjusting the Fresh Air Reading

1. While in normal operation, press and hold the UP/YES button for 5 seconds to enter Calibration Mode. Release the button when the following screen appears.

Calib?
YES / NO

2. If you want to continue with calibration, press and release the UP/YES button. The display will indicate the target gas and **CAL Mode** for a few seconds before showing **FreshAir Adjust?**. If you want to exit Calibration Mode, press and release the DOWN/NO button. The EXP-SNR-TG-EC will indicate **Leaving CAL Mode** and the EXP-SNR-TG-EC will return to normal operation.
3. To continue with adjusting the fresh air reading, press and release the UP/YES button. **ENTER** will alternate with **FreshAir** on the top display line and the current gas reading will be on the bottom display line.
   To skip adjusting the fresh air reading, press and release the DOWN/NO button. The display will indicate **SPAN w/Cal Gas?**. Skip to the next section, “Adjusting the Span Setting”.
4. Screw the zero air cylinder into the fixed flow regulator.
5. Turn the regulator knob counterclockwise to open the regulator.

6. Allow zero air to flow for two minutes. If there was gas present causing a reading on the EXP-SNR-TG-EC, the reading should decrease and stabilize after two minutes.
7. Turn the regulator knob clockwise to close the regulator.
8. Unscrew the zero air cylinder from the fixed flow regulator leaving the calibration cup on the detector. The EXP-SNR-TG-EC will continue to display the minimum gas response on the display and retain the response level in its memory.
9. Press and release the ENTER button. The EXP-SNR-TG-EC will perform a fresh air adjustment and the display will indicate **SPAN w/Cal Gas?**.

NOTE: If the fresh air adjustment fails, see "Troubleshooting" for recommended actions.

Adjusting the Span Setting

1. If you want to continue with adjusting the span setting, press and release the UP/YES button. **APPLY** will alternate with **SPAN Gas** on the top display line and the current gas reading will be on the bottom display line.
   If you want to skip adjusting the span reading, press and release the DOWN/NO button. The display will indicate **Leaving Cal Mode** and the EXP-SNR-TG-EC will return to normal operation.
2. Screw the calibration gas cylinder into (onto for an H_2S cylinder) the fixed flow regulator.
3. Turn the regulator knob counterclockwise to open the regulator (or start the flow of gas from a generator).
4. Allow calibration gas to flow for two minutes. The gas reading should be stable after two minutes.
5. Turn the regulator knob clockwise to close it (or stop the flow of gas from a generator).
6. Unscrew the calibration gas cylinder from the fixed flow regulator and unscrew the calibration cup from the detector. For an ESM-01 detector, pull the calibration cup off of the ESM-01 sensor and screw the splashguard back onto the detector housing cap. The EXP-SNR-TG-EC will continue to display the maximum gas response on the display and retain the response level in its memory.
7. Adjust the gas reading up or down to match the calibration gas cylinder concentration by using the UP/YES and DOWN/NO buttons, then press and release the ENTER button.
8. The EXP-SNR-TG-EC will perform a span operation. The display will indicate **SPAN Gas PASS** for a few seconds, then indicate **SPAN Gas SAVED** before indicating **Leaving CAL Mode** for a few seconds.

NOTE: If the span adjustment fails, see "Troubleshooting" for recommended actions.

9. The display will now alternate between the normal operation screen and the message **REMOVE CAL GAS** for 1 minute. If the calibration gas has not been removed from the detector, remove it now to avoid unwanted alarms.
   During this 1 minute period, the signal output will remain fixed at 3.5 mA and the relays will remain in their non-alarm state to avoid unwanted alarms while the calibration gas clears from the detector. At the end of the 1 minute period, the **REMOVE CAL GAS** message will stop appearing and the EXP-SNR-TG-EC will return to normal operation.
10. Store the components of the calibration kit in a safe place.

Calibration, Oxygen Version

This section describes how to calibrate the oxygen version of the EXP-SNR-TG-EC. It includes procedures to prepare for calibration, enter Calibration Mode, set the fresh air (span) reading, set the zero reading, and return to normal operation.

WARNING: ***The EXP-SNR-TG-EC is not an active gas monitoring device during the calibration procedure. The 4-20 mA output signal will "freeze" at 17.4 mA and all relays will remain in their non-alarm state while the EXP-SNR-TG-EC is in Calibration Mode. The output signal will not indicate current readings and the relays will not resume operating normally until the EXP-SNR-TG-EC is in normal operation again.***

Preparing for Calibration

NOTE: The following procedure assumes the use of a calibration kit which includes a zero air (20.9% oxygen) calibration cylinder to set the fresh air reading, a 100% nitrogen (0% oxygen) calibration gas cylinder to set the zero reading, a fixed flow regulator with an on/off knob, a calibration cup, and a short piece of sample tubing to connect the regulator to the calibration cup. A cylinder with up to an 18% oxygen concentration may be used instead of a 100% nitrogen cylinder to set the zero reading.

NOTE: While in calibration mode, if there is no switch activity for the calibration time-out period the unit will return to normal operation. See "Viewing & Changing EXP-SNR-TG-EC Parameters" for instructions to set the calibration time-out.

NOTE: The following procedure assumes that the oxygen concentration in the calibration area is not normal, 20.9%, but is oxygen deficient. If a fresh air environment can be verified, applying zero air to the detector is not necessary when adjusting the fresh air (span) setting.

1. Connect the calibration kit sample tubing to the calibration cup hose barb.
2. Screw the calibration cup onto the detector.
3. Connect the fixed flow regulator to the calibration cup using the sample tubing.

Non-Intrusive Calibration

If the EXP-SNR-TG-EC is installed in a classified area and non-intrusive calibration is required, follow the instructions below, but do not remove the junction box cover. Use the magnetic wand accessory to actuate the magnetic switches instead of pushing the control switch buttons. To actuate a magnetic switch and perform the same operation as pressing a control switch button, touch the magnet in the end of the magnetic wand to the sensor's glass cover directly above the magnetic switch you wish to actuate. Touching the glass and removing the wand is the same as pressing and releasing a button. Touching the glass and keeping the wand in place is the same as pressing and holding a button.

Calibration Gas Response Memory Feature

The EXP-SNR-TG-EC has the capability to "remember" the detector's response to the calibration gas after the gas is removed from the detector during the fresh air or zero adjustment procedure. This feature enables one person to perform a calibration if the detector is mounted remotely from the EXP-SNR-TG-EC. When zero air is applied to the EXP-SNR-TG-EC during a fresh air adjustment, the EXP-SNR-TG-EC will freeze the display

reading at the highest response and the EXP-SNR-TG-EC will continue to display this reading and retain it in its memory until the fresh air adjustment procedure is completed. When calibration gas is applied to the EXP-SNR-TG-EC during a zero adjustment, the EXP-SNR-TG-EC will freeze the display reading at the lowest response to the calibration gas. The calibration gas can then be removed and the EXP-SNR-TG-EC will continue to display this reading and retain it in its memory until the zero adjustment procedure is completed.

Adjusting the Fresh Air Setting

1. While in normal operation, press and hold the UP/YES button for 5 seconds to enter Calibration Mode. Release the button when the following screen appears.

   ```
   Calib?
   YES / NO
   ```

2. If you want to continue with calibration, press and release the UP/YES button to continue. The display will indicate **OXYGEN CAL Mode** for a few seconds before showing **FreshAir Adjust?**.
   If you want to exit Calibration Mode, press and release the DOWN/NO button. The EXP-SNR-TG-EC will indicate **Leaving CAL Mode** and the EXP-SNR-TG-EC will return to normal operation.
3. To continue with adjusting the fresh air (span) reading, press and release the UP/YES button. **ENTER** will alternate with **FreshAir** on the top display line and the current oxygen reading will be on the bottom display line.
   To skip adjusting the fresh air reading, press and release the DOWN/NO button. The display will indicate **ZERO w/Cal Gas?**. Skip to the next section, “Adjusting the Zero Setting”.
4. Screw the zero air cylinder into the fixed flow regulator.
5. Turn the regulator knob counterclockwise to open the regulator.
6. Allow zero air to flow for 2 minutes. If the oxygen concentration in the area is less than 20.9, the reading should stabilize after 2 minutes.
7. Turn the regulator knob clockwise to close the regulator.
8. Unscrew the zero air cylinder from the fixed flow regulator leaving the calibration cup on the detector. The EXP-SNR-TG-EC will continue to display the maximum gas response on the display and retain the response level in its memory.
9. Press and release the ENTER button. The EXP-SNR-TG-EC will perform a fresh air adjustment and the display will indicate **ZERO w/Cal Gas?**

NOTE: If the fresh air adjustment fails, see “Troubleshooting” for recommended actions.

Adjusting the Zero Setting

1. If you want to continue with adjusting the zero setting, press and release the UP/YES button. **APPLY** will alternate with **ZERO Gas** on the top display line and the current oxygen reading will be on the bottom display line.
   If you want to skip adjusting the zero reading, press and release the DOWN/NO button. The display will indicate **Leaving Cal Mode** and the EXP-SNR-TG-EC will return to normal operation.
2. Screw the 100% nitrogen gas cylinder into the fixed flow regulator.
3. Turn the regulator knob counterclockwise to open the regulator.
4. Allow gas to flow for 2 minutes. The gas reading should be stable after 2 minutes.

5. Turn the regulator knob clockwise to close the regulator.
6. Unscrew the nitrogen cylinder from the fixed flow regulator and unscrew the calibration cup from the detector. The EXP-SNR-TG-EC will continue to display the minimum gas response on the display and retain the response level in its memory.
7. Adjust the oxygen reading up or down to match the 100% nitrogen cylinder oxygen concentration of 0 by using the UP/YES and DOWN/NO buttons.

NOTE: If a cylinder other than a 100% nitrogen (0% oxygen) cylinder is used to set the zero reading, such as a cylinder with 12% oxygen, set the zero reading to match the cylinder's oxygen concentration.

8. Press and release the ENTER button. The EXP-SNR-TG-EC will perform a zero operation. The display will indicate **ZERO Gas PASS** for a few seconds, then indicate **ZERO Gas SAVED** before indicating **Leaving CAL Mode** for a few seconds.

NOTE: If the zero adjustment fails, see "Troubleshooting" for recommended actions.

9. The display will now alternate between the normal operation screen and the message **REMOVE CAL GAS** for 1 minute. If the calibration gas has not been removed from the detector remove it now to avoid unwanted alarms.
   During this 1 minute period, the signal output will remain fixed at 17.4 mA and the relays will remain in their non-alarm state to avoid unwanted alarms while the calibration gas clears from the detector. At the end of the 1 minute period, the **REMOVE CAL GAS** message will stop appearing and the EXP-SNR-TG-EC will return to normal operation.
10. Store the components of the calibration kit in a safe place.

Replacing Components of the EXP-SNR-TG-EC

Replacing the Gas Detector

NOTE: For EXP-SNR-TG-EC versions that do not have a replaceable plug-in sensor, or if you determine that it is necessary to replace the entire detector, use the procedure in this section to change the entire detector. For EXP-SNR-TG-EC versions that include a replaceable plug-in sensor, see the appropriate instructions in the sections that follow this one to replace the plug-in sensor.

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Remove the junction box cover.
3. Grasp the control PCB by its edges.
4. Gently pull until the control PCB is pulled away from the banana jacks. Take care not to pull too hard and damage the cable which connects the control and terminal PCBs.
5. Let the control PCB hang by the cable. The terminal strips are now visible on the terminal PCB. The control PCB may be left hanging while wiring is done. If desired, the control PCB may be disconnected from the cable and set aside while wiring.
6. Remove the detector terminal strip from its socket.

7. Disconnect the detector leads from the detector terminal strip. Note the position of the color-coded leads as you remove them.
8. Unscrew the detector from the junction box.
9. Guide the replacement detector leads through the bottom conduit port of the junction box, then screw the mounting threads of the detector into the conduit port. If necessary for environmental conditions, apply thread sealant or Teflon tape to the hub and/or detector threads to seal them.
10. Connect the detector leads to the detector terminal strip as follows:
    - Catalytic Combustible Gas Detector, IR Combustible Gas Detector, and IR CO_2 Detector

      Red wire to terminal labeled LEL RED, white to terminal labeled LEL WHT, green wire to terminal labeled LEL GRN, black wire to terminal labeled LEL BLK.
    - CO or H2S Gas Detector

      Red wire to terminal labeled TOXIC +, black wire to terminal labeled TOXIC -.
    - ESM-01 Toxic Gas Detector or CT-7 Series Toxic Gas Detector

      Color coded wire to terminal labeled TOXIC +, black wire to terminal labeled TOXIC -. See Figure 28 and Figure 29 for the wire color coding.
    - Oxygen Gas Detector

      Green wire to terminal labeled OXY +, white wire to terminal labeled OXY -.
11. Re-install the detector terminal strip into its socket.
12. Re-install the control PCB (and ribbon cable if necessary). Be sure the ribbon cable is routed down below the control PCB so it will not be damaged by the cover when it is screwed back on.
13. Secure the junction box cover to the junction box.
14. Turn on or reconnect power to the EXP-SNR-TG-EC.

NOTE: Allow the replacement detector to warm up for 15 minutes before you continue with the next step.

15. Calibrate the replacement detector as described in “Calibration, Combustible Gas, CO2, and Toxic Versions” or “Calibration, Oxygen Version”.

Replacing the CO, H_2S, or CT-7 Series Plug-in Sensor

NOTE: This procedure is applicable for: the CSA type, explosion proof CO and H_2S detectors, the non-explosion proof CO and H_2S detectors, and the CT-7 Series detectors.

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector cap from the housing body. Make sure not to lose the cap gasket. See Figure 5, Figure 6, and Figure 8 for illustrations of the detectors.
3. Unplug and remove the sensor.

4. If you are replacing a CO sensor, remove the rubber boot and charcoal filter from the old sensor.

NOTE: Larson Electronics recommends replacing the charcoal disk filter whenever a CO sensor is replaced.

If you are replacing the 65-2428 explosion-proof H_2S detector's sensor, remove the rubber boot and spacer from the old sensor.

5. Remove the replacement sensor from its packaging and remove the wire jumper. This wire jumper is installed on the sensor pins for shipment or storage but must be removed for the sensor to operate properly when installed in a detector.

WARNING: ***The sensor will not operate properly if the wire jumper is not removed.***

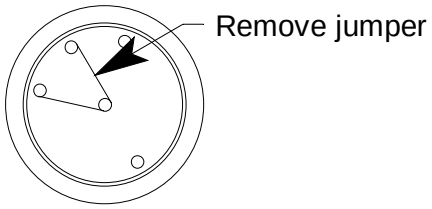


Figure 31: Plug-In Sensor Jumper Removal

6. If you are replacing a CO sensor, install the rubber boot and charcoal filter onto the new sensor's face.
   If you are replacing the 65-2428 explosion-proof H_2S detector's sensor, install the rubber boot and spacer on the new sensor's face.
7. Carefully match the replacement sensor's male pins with the 4-socket pattern in the top section and plug it in.
8. Make sure the cap gasket is in place and screw the detector cap back onto the housing body.
9. Turn on or reconnect power to the EXP-SNR-TG-EC.

CAUTION: *Allow the replacement sensor to warm up for 15 minutes before you continue with the next step.*

10. Calibrate the detector as described in "Calibration, Combustible Gas, CO2, and Toxic Versions".

Replacing the CO Sensor Charcoal Filter

The charcoal filter is used to scrub out interfering gases from the environment being monitored, such as H_2S and certain hydrocarbons. If you are experiencing unexplained upscale readings on a CO EXP-SNR-TG-EC, the charcoal filter may be saturated and no longer scrubbing out interfering gases and it may be necessary to change the charcoal filter.

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector housing cap from the housing body. Make sure not to lose the cap gasket. See Figure 6 for an illustration of the CO detector.
3. Remove the rubber retaining boot with the charcoal filter disk from the sensor.
4. Replace the charcoal filter disk in the rubber retaining boot and install the boot onto the sensor.

5. Make sure that the cap gasket is in place and screw the detector cap back onto the housing body.
6. Turn on or reconnect power to the EXP-SNR-TG-EC.

Replacing an Oxygen Plug-in Sensor

NOTE: This procedure is applicable for both the CSA type, explosion proof oxygen detector (65-2514RK) and non-explosion proof, replaceable sensor oxygen detector (65-2494RK).

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector cap from the detector housing body. Take care not to lose the cap gasket. See Figure 4 for an illustration of the oxygen detectors.
3. Unplug and remove the sensor.
4. Carefully match the replacement sensor's male pins with the 2-socket pattern in the top section and plug it in.
5. Make sure the cap gasket is in place and screw the detector cap back on to the detector housing.
6. Turn on or reconnect power to the EXP-SNR-TG-EC.

NOTE: Allow the replacement sensor to warm up for 15 minutes before you continue with the next step.

7. Calibrate the detector as described in "Calibration, Combustible Gas, CO2, and Toxic Versions".

Replacing an ESM-01 Plug-in Sensor

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector cap from the detector housing body. Take care not to lose the cap gasket. If the splashguard begins to unscrew from the detector cap, make sure to remove the detector cap also. See Figure 7 for an illustration of the ESM-01 detector.
3. Unplug and remove the sensor.
4. Carefully match the replacement sensor's plug with the socket in the housing body and plug it in.

WARNING: ***The ESM-01 detectors cannot be changed from one type to another. Replace the plug-in sensor only with the same type of ESM-01 sensor.***

5. Make sure the cap gasket is in place and screw the detector cap back onto the housing body. If the splash guard was unscrewed from the detector cap, screw it back onto the detector cap.
6. Turn on or reconnect power to the EXP-SNR-TG-EC.

NOTE: Allow the replacement sensor to warm up for 15 minutes before you continue with the next step.

7. Calibrate the detector as described in "Calibration, Combustible Gas, CO2, and Toxic Versions".

Replacing the Hydrophobic Membrane (Non-XP CO, H_2S, and O_2 Detectors)

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector housing cap from the detector housing body.
3. Gently pry up the edge of the white hydrophobic membrane with a small flat blade screwdriver or a similar tool.
4. Peel off the hydrophobic membrane. It may be necessary to clean off the detector housing cap face to remove any residue left from the adhesive backed membrane.
5. Install the new membrane in the recess on the face of the detector housing cap.
6. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
7. Turn on or reconnect power to the EXP-SNR-TG-EC.

Replacing the Hydrophobic Membrane (CT-7 Series Toxic Detector)

1. Turn off or disconnect power to the EXP-SNR-TG-EC.
2. Unscrew the detector housing cap from the detector housing body.
3. Unplug the plug-in sensor from the four-socket pattern in the detector housing body.
4. Gently pry up the edge of the white hydrophobic membrane from the sensor face with a small flat blade screwdriver or a similar tool.
5. Peel off the hydrophobic membrane. It may be necessary to clean off the sensor face to remove any residue left from the adhesive backed membrane.
6. Install the new membrane on the face of the plug-in sensor.
7. Plug the sensor back into the four-socket pattern in the detector housing body.
8. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
9. Turn on or reconnect power to the EXP-SNR-TG-EC.

Chapter 8: RS-485 Modbus Output

Overview

This chapter describes the sensor's RS-485 Modbus output and how to configure the EXP-SNR-TG-EC to make use of it. It also discusses how to wire the EXP-SNR-TG-EC into a Modbus system.

The EXP-SNR-TG-EC provides an RS-485 serial communications interface. It is a Modbus Slave Device, supporting 2-wire RS-485 Modbus RTU serial communications.

Wiring the EXP-SNR-TG-EC in a Modbus System

The EXP-SNR-TG-EC is a 2-wire Modbus RTU device. When wiring the EXP-SNR-TG-EC into a Modbus system, adhere to standard Modbus wiring practices per the Modbus Over Serial Line Specification and Implementation Guide V1.0 or later. This document can be found online at www.modbus.org/specs.php.

The Modbus protocol supports a maximum of 247 unique slave addresses (1-247). The sensor's line driver provides for up to 128 sensors to be connected together without the need for a repeater. Figure 34 & Figure 35 below illustrate typical EXP-SNR-TG-EC wiring configurations. If more than 128 sensors need to be connected together, RS-485 repeater(s) should be used such that no more than 128 sensors reside on any given network segment.

CAUTION: *The network segment can only support 128 units if same sensors are being used. The use of any other instruments will lower the number of units that may reside on any given network segment.*

The MODBUS terminal strip is located on the terminal PCB (see Figure 9). The following signals are available at the Modbus terminal strip:

Table 15: Modbus Terminal Strip Signals

Modbus Terminal Label (RS-485 Name)	Modbus Signal Name
A	D0
B	D1
C	Common

Ground Jumper

The EXP-SNR-TG-EC includes a 2-pin ground header (see Figure 10) that is used when the EXP-SNR-TG-EC is used in a Modbus system. Every EXP-SNR-TG-EC is supplied with a ground jumper (a jumper block) installed onto this header. If the EXP-SNR-TG-EC isn't wired into a Modbus system or if it is wired into one as shown in Figure 33, the ground jumper should be installed. If the EXP-SNR-TG-EC is wired in a Modbus system as shown in Figure 32, the ground jumper should be removed.

Recommended Modbus Wiring

The recommended Modbus wiring for the EXP-SNR-TG-EC is illustrated in Figure 32 below. In this configuration, 5 wires are used for wiring the EXP-SNR-TG-EC into a Modbus system. Figure 32 also illustrates typical alarm device wiring. The ground jumper must be removed in this wiring

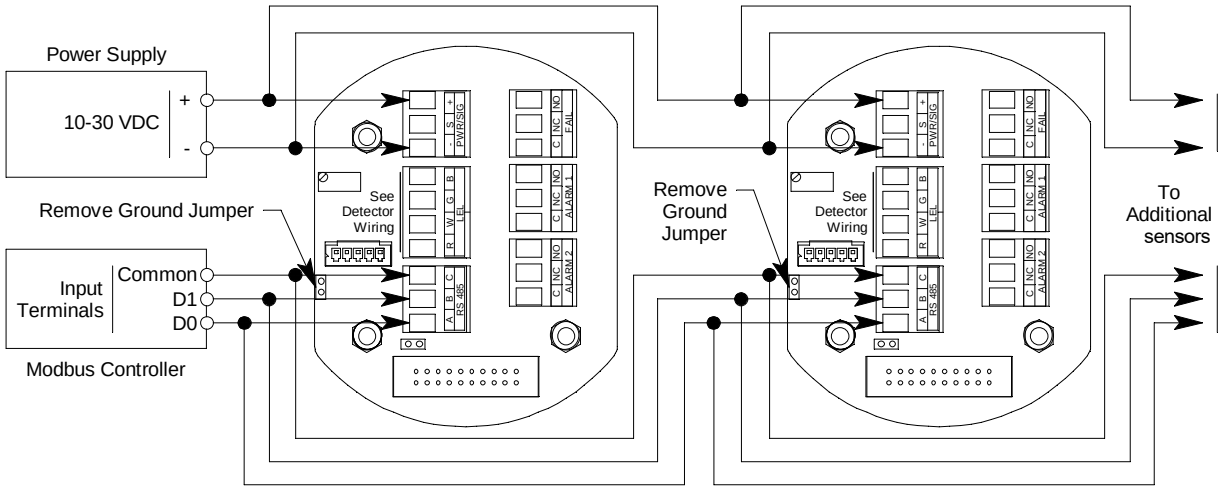


Figure 32: Recommended Modbus Wiring

Adding an EXP-SNR-TG-EC to an Existing M2 Modbus Installation with Recommended Wiring

An EXP-SNR-TG-EC can be wired into an existing M2 Modbus system. The shape of the terminal PCB will be different but the wiring connections are identical and the ground jumper on the EXP-SNR-TG-EC must still be removed.

Alternate Modbus Wiring For Existing Installations

Although the wiring shown in Figure 32 is recommended, it is possible to wire the EXP-SNR-TG-EC into a Modbus system with only 4 wires in situations where a pre-existing system is being replaced and wiring is already in place. This should only be done if wiring for a system that is being replaced is already installed and it is not practical to run another wire. See Figure 33 below for this wiring configuration. In this configuration, the wire between the “C” terminal on the EXP-SNR-TG-EC and the Common terminal on the Modbus controller is omitted. Instead, the Common terminal on the Modbus controller is connected to the “-” of the 24 VDC power supply.

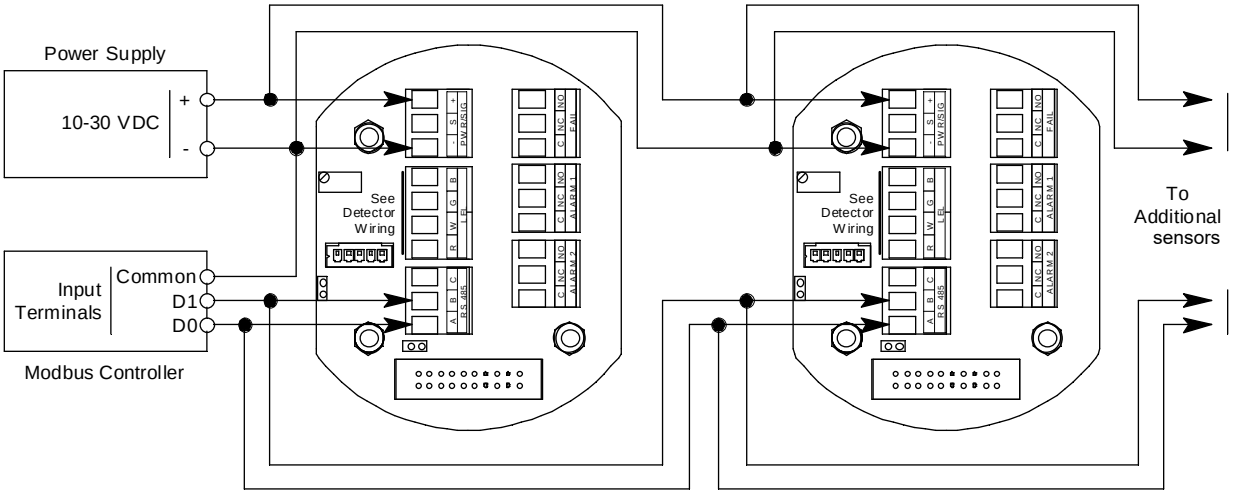


Figure 33: Alternate Modbus Wiring

Adding an EXP-SNR-TG-EC to an Existing M2 Modbus Installation with Alternate Wiring

An EXP-SNR-TG-EC can be wired into an existing M2 Modbus system. The shape of the terminal PCB will be different but the wiring connections are identical and the ground jumper on the EXP-SNR-TG-EC must still remain installed.

Termination Jumper

The EXP-SNR-TG-EC includes a 2-pin termination header (see Figure 10) that is used when the EXP-SNR-TG-EC is used in a Modbus system. Every EXP-SNR-TG-EC is supplied with a termination jumper (a jumper block) installed onto this header. If the EXP-SNR-TG-EC is not used in a Modbus system, this jumper has no function. When the EXP-SNR-TG-EC is installed in a Modbus system, this jumper must be installed in an EXP-SNR-TG-EC that is at the end of a

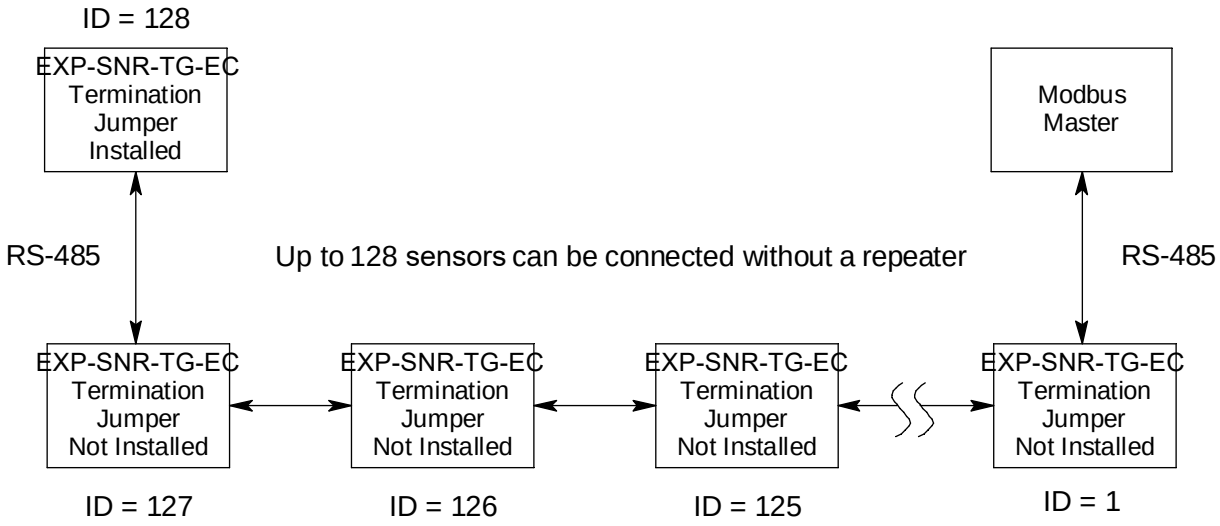


Figure 34: Multiple sensors in a Daisy Chain Configuration

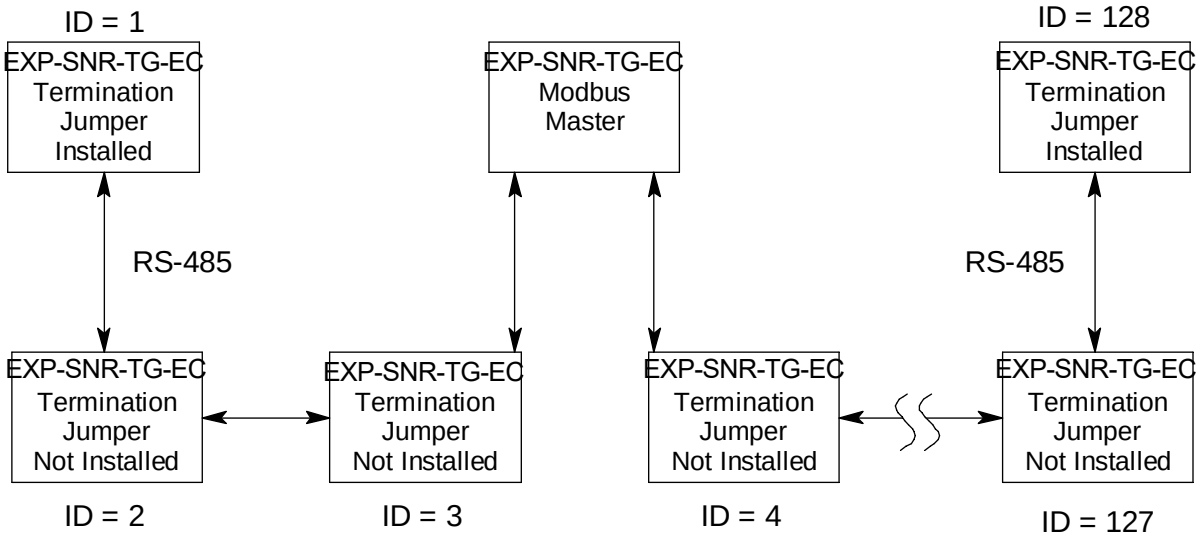


Figure 35: Multiple sensors in a Two Branch Configuration

Using the EXP-SNR-TG-EC in a 4-wire Modbus System

Although the EXP-SNR-TG-EC is a 2-wire Modbus RTU device, it can be used with a 4-wire Modbus controller if the system wiring is modified as follows:

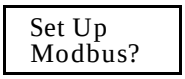
- Connect the controller's TxD0 and RxD0 wires together and use this connection as the 2-wire Modbus D0 signal.
- Connect the controller's TxD1 and RxD1 wires together and use this connection as the 2-wire Modbus D1 signal.
- Connect these D0 and D1 signals and the common wire from the controller to the 2-wire Modbus Network of sensors.

Modbus Mode

Modbus Mode allows you to configure various parameters relating to the Modbus setup of the EXP-SNR-TG-EC. Modbus Mode includes a 5-minute time-out feature. If you do not press a control button for 5 minutes, the EXP-SNR-TG-EC automatically returns to normal operation.

NOTE: If the EXP-SNR-TG-EC returns to normal operation because of a time-out, it enters a warm-up period just as it does when it is first turned on.

1. While in normal operation, simultaneously press and hold the DOWN/NO and ENTER buttons for 5 seconds to enter Modbus Mode. Release the buttons when the following screen appears.

2. To exit Modbus Mode, press and release the DOWN/NO button. The EXP-SNR-TG-EC will return to normal operation.
   To continue in Modbus Mode, press and release the UP/YES button. The current ENABLED/DISABLED setting will appear.
3. If you want to change the currently displayed parameter, use the UP/YES and DOWN/NO buttons to adjust it to the desired setting, then press ENTER to continue to the next parameter. If the currently displayed parameter setting is OK, press the ENTER button to proceed to the next parameter.
   Table 16 lists the EXP-SNR-TG-EC Modbus Mode parameters you can set. Table 16 also lists the factory set value for each parameter.

Table 16: Configuration Parameters

Modbus Mode Parameter	Available Settings & Description
Enabled/Disabled	Can be set to ENABLED or DISABLED (factory setting). Enables or disables the Modbus output.
Slave ID	The Slave ID can be set to values from 1 (factory setting) to 247. The EXP-SNR-TG-EC will only receive messages from the Master which are addressed to this Slave ID (except for broadcast messages which are received by all slaves).
Baud Rate	Can be set to 1200, 2400, 4800, 9600 (factory setting), 14440, & 19200.
Parity	EVEN (factory setting), ODD, NONE
Response Delay	The response delay can be set from 0 (factory setting) to 20 mS. This is an optional additional delay inserted by the EXP-SNR-TG-EC prior to returning a response message to the Master. It may be helpful in some installations where the Master's preparedness to receive responses might be delayed.

4. When you have scrolled through all the adjustable parameters, **SAVE IT? YES/NO** appears on the display.
5. If you do not wish to save the adjustments, press and release the DOWN/NO button. The **DO OVER? YES/NO** message will display. Press and release the DOWN/NO button. The **ABORT? YES/NO** message will display. Press the UP/YES button to return to normal operation.
   If you wish to change some of the adjustments made, press and release the DOWN/NO button. The **DO OVER? YES/NO** message will display. Press and release the UP/YES button. The **Re-do MB Setup** message will display and the EXP-SNR-TG-EC will return to the first adjustable parameter. Go back to step 3 and continue.
   If you want to save the adjustments made, press and release the UP/YES button. **Modbus Saved** is indicated on the display for a few seconds and the EXP-SNR-TG-EC returns to normal operation.

NOTE: All sensors on a Modbus network must be configured with the same baud rate and parity, and each EXP-SNR-TG-EC must have a unique slave ID. For an EXP-SNR-TG-EC to participate on a network, the ENABLED/DISABLED setting must be set to ENABLE.

Supported Modbus Functions

The EXP-SNR-TG-EC supports Function Code 03: Read Holding Registers and Function Code 16: Write Registers.

Function Code 03: Read Holding Registers

There are a total of 40 registers available to be read via this Function Code.

Registers 1 - 2

The format (bit & field assignments) for registers 1 - 2 is shown below in Table 17 - Table 18.

Table 17: Register 1, Numerical Reading with Sign & Decimal Point Bit & Field Assignments

Bit(s)	Value & Field
[15]	Sign of Reading 0 = Positive 1 = Negative
[14:13]	Format of Reading 0 = XXX (no decimal point) 1 = XX.X 2 = X.XX 3 = .XXX
[12:0]	Numerical value of display reading (8000 max)

Table 18: Register 2, Operating State, Alarms & Relays Bit & Field Assignments

Bit(s)	Value
[15:12]	Operating State 0 = Undefined 1 = Initialization 2 = Normal 3 = Warm-up 4 = Fail 5 = Calibration 6 = Post-Calibration 7 = Low Power 8 = Setup
[11]	Gas Type Change 0=Not Changed 1=Changed
[10]	Configuration Change 0=Not Changed 1=Changed
[9]	Calibration Activity Flag 0=No Calibration Activity 1=Calibration Activity Has Occurred
[8]	Fail Status 0 = Fail Not Asserted 1 = Fail Asserted

Table 18: Register 2, Operating State, Alarms & Relays Bit & Field Assignments (Continued)

Bit(s)	Value
[7:6]	Alarm 2 Status 0 = No Alarm 1 = Unacknowledged Alarm 2 = Acknowledged Alarm 3 = Unused Code
[5:4]	Alarm 1 Status 0 = No Alarm 1 = Unacknowledged Alarm 2 = Acknowledged Alarm 3 = Unused Code
[3]	Overscale Status 0 = Not Overscale 1 = Overscale
[2]	Fail Relay Status 0 = Not Energized 1 = Energized
[1]	Alarm 2 Relay Status 0 = Not Energized 1 = Energized
[0]	Alarm 1 Relay Status 0 = Not Energized 1 = Energized

Register 3

Register 3 is the supply voltage (0.1 volt per count).

Registers 4 - 11

The 16 bytes in these registers contain the same ASCII text information that is displayed on the sensor's OLED (not NULL Terminated).

Register 12

Register 12 is the range (full scale readout).

Register 13

Register 13 is the alarm 1 set point.
The decimal point location is the same as specified in Register 1.

Register 14

Register 14 is the alarm 2 set point.
The decimal point location is the same as specified in Register 1.

Registers 15 - 19

Registers 15 - 19 are the Gas Name ASCII String (NULL Terminated).

Registers 20 - 22

Registers 20 - 22 are the Gas Units String (NULL Terminated).

Register 23

Register 23 is the alarm 1 trigger.
0=Decreasing
1=Increasing

Register 24

Register 24 is the alarm 1 normal relay state.
0=Normally De-Energized
1=Normally Energized

Register 25

Register 25 is the alarm 1 relay reset.
0=Latching
1=Self-Resetting

Register 26

Register 26 is the alarm 1 ON delay.
Integer values are in seconds.

Register 27

Register 27 is the alarm 1 OFF delay.
Integer values are in seconds.

Register 28

Register 28 is the alarm 2 trigger.
0=Decreasing
1=Increasing

Register 29

Register 29 is the alarm 2 normal relay state.
0=Normally De-Energized
1=Normally Energized

Register 30

Register 30 is the alarm 2 relay reset.
0=Latching
1=Self-Resetting

Register 31

Register 31 is the alarm 2 ON delay.
Integer values are in seconds.

Register 32

Register 32 is the alarm 2 OFF delay.
Integer values are in seconds.

Register 33

Register 33 is zero suppression.
Toxics and LEL: 0%-6% of full scale
Oxygen: 0%-0.7% Oxygen
The decimal point location is the same as specified in Register 1.

Register 34

Register 34 is noise filter.
Integer values in seconds.
0-60 in 5 second increments.

Register 35

Register 35 is calibration timeout in minutes (5, 10, 15, 20, 25, or 30).

Register 36

Register 36 is calibration month (upper byte) and day (lower byte).
This is zero based (e.g. January=0 and the 1st=0).

Register 37

Register 37 is the calibration year.

Register 38

Register 38 is the calibration outcome.
Upper=Gas Operation
Lower=Air Operation

Calibration Outcome Codes:

1=Sensor Missing
2=Sensor Too Weak
3=Signal Too Strong
4=Not Enough Span
5=Negative Reading
6=Span Gas Value Is Not OK
7=Calculated Zero Is Too Low
8=Calculated Zero Is Too High
9=Zero Failure
10=Span Failure
11=Calibration Is Overscale
12=LEL Sensor Offset Is Too High
13=LEL Null Operation Failed
14=Operation Not Performed

Register 39

Register 39 is the auto-zero disable.
0=AutoZero Enabled
1=AutoZero Disabled

Register 40

Register 40 is the remote configuration register access level
0=None
1=Alarm Reset

Function Code 16: Write Registers

There are 21 registers in Function Code 16 that can be used to write to the EXP-SNR-TG-EC. This manual only describes Register 16 because it can be used to reset an alarm condition.

Register 16

Register 16 performs the same function as the ENTER button on the EXP-SNR-TG-EC. It is useful for remotely silencing alarms. With the EXP-SNR-TG-EC in an alarm condition, bit [0] can be used to silence it.

Table 19: Register 16, Button Function

NOTE: Register 40 in Function Code 03, the remote configuration register, must be set to 1 in order for Register 16 to work.

Bit	Value & Field
[0]	ENTER (used for “Alarm Reset”) 0=Not Pressed 1=Pressed

Appendix A: Control Button Quick Reference Guide

The sensor's control buttons allow access to operational modes, resetting of alarms, and display of the Information Screen. Table 21 shows which button combinations perform these functions and which parameters are available for adjustment while in the operational modes. While in these modes, display prompts showing a "?" require you to respond by pressing either the UP/YES (for yes) or DOWN/NO (for no) button. To change parameter settings, use the UP/YES and DOWN/NO buttons to get the desired setting, then press and release the ENTER button to accept the setting.

Table 21: Control Button Quick Reference Chart

Mode Entered or Function Performed	Button Combination	Adjustable or Viewable Parameters
Alarm Reset	Press and Release ENTER	n/a
Show Information Screen	Press and Hold DOWN/NO	• Input Voltage • EXP-SNR-TG-EC Version/ Revision Information
Calibration Mode	Press and Hold UP/ YES for 5 seconds	• Fresh Air Adjust • Span (or Zero for Oxygen) Adjust with Calibration Gas
Configuration Mode	Press and Hold UP/ YES & ENTER for 5 seconds	• Alarm Levels • Increasing or Decreasing Alarms • Normally Energized or Normally De-energized Relays • Latching or Self-resetting Alarms • Alarm On Delay • Alarm Off Delay (if self-resetting) • Zero Suppression • Noise Filter • Calibration Time-out Period
Gas Type Mode	Press and Hold UP/ YES and DOWN/ NO for 5 seconds	Gas Type
Modbus Mode	Press and Hold DOWN/NO and ENTER for 5 seconds	• Enable or Disable Modbus • Slave ID • Baud Rate • Parity • Response Delay

Appendix B: PLC and DCS Device Wiring

The EXP-SNR-TG-EC can be wired to a PLC or DCS device if desired.

1. Guide multi conductor shielded cable or cables or wires in conduit through the top conduit port of the junction box. The number of cables or wires needed will depend on whether any relays are used and whether the Modbus output is used. Use the following recommendations to determine how to wire the EXP-SNR-TG-EC:

   - If Modbus connections will not be used and only the PWR/SIG terminal strip connections will be used, use four conductor shielded cable or four wires in conduit for connections to the power/signal terminal strip.

Table 22: Wire Size for PWR/SIG Connections

Max Distance to Controller w/18 Gauge Wire	Max Distance to Controller w/ 16 Gauge Wire	Max Distance to Controller w/14 Gauge Wire
2,500 ft.	5,000 ft.	8,000 ft.

   - If the PWR/SIG terminal strip connections and one or more relays are used, route the connections to the EXP-SNR-TG-EC in conduit. Use shielded cable in the conduit for the PWR/SIG connections and unshielded cable or individual wires for the relay connections. Make sure any wire or cable used for relay wiring is appropriately rated for the power that it will carry.

NOTE: If shielded cable is used for the PWR/SIG connections, leave the cable shield's drain wire insulated and disconnected at the EXP-SNR-TG-EC. You will connect the opposite end of the cable's drain wire at the controller or device.

   - If the EXP-SNR-TG-EC will be wired into a Modbus network, see "Chapter 8: RS-485 Modbus Output".

See Figure 36 below for field wiring connections to the EXP-SNR-TG-EC.

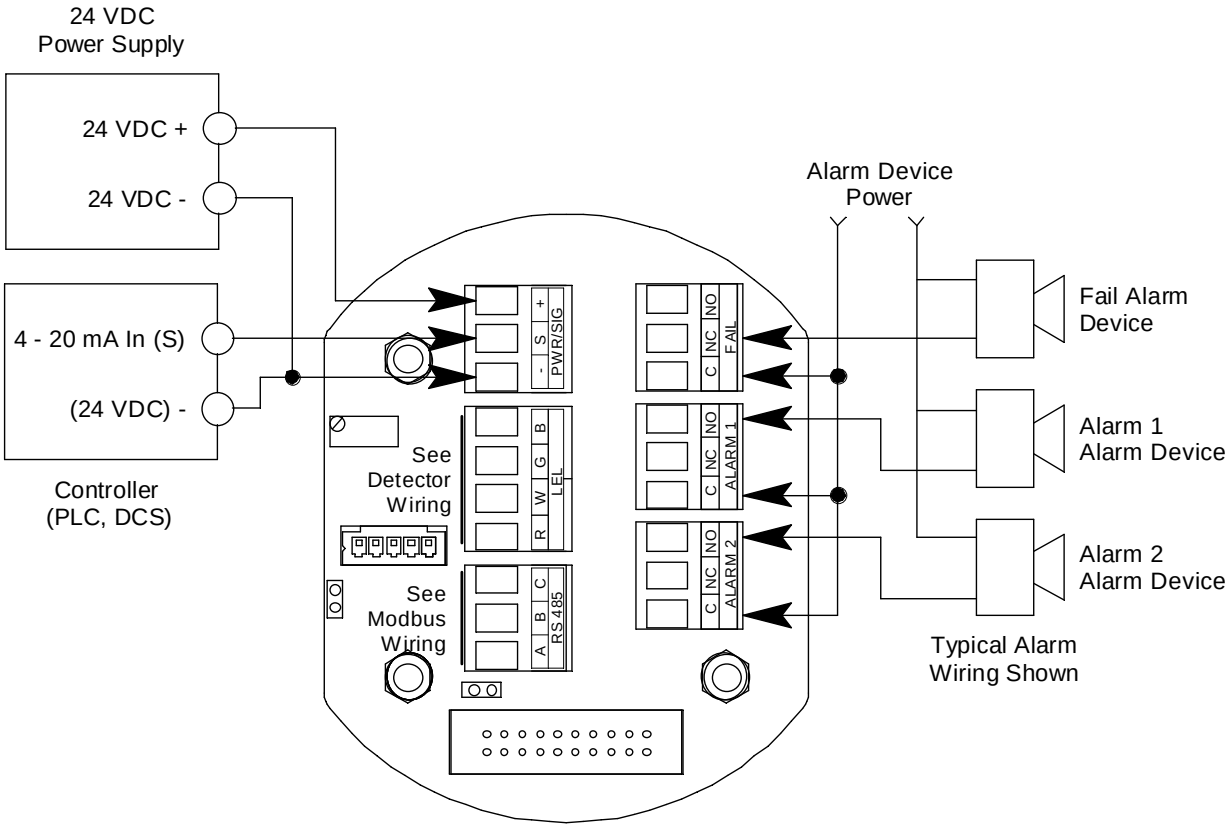


Figure 36: PLC and DCS Device Wiring

Appendix C: Function Code 16 Registers

The EXP-SNR-TG-EC supports Function Code 16 that allows writing to the EXP-SNR-TG-EC. There are 21 registers in this Function Code.

Register 1

Register 1 is the alarm 1 set point.
Value must be an integer. Any decimals are omitted.

Register 2

Register 2 is the alarm 1 trigger.
0=Decreasing
1=Increasing

Register 3

Register 3 is the alarm 1 relay state.
0=Normally De-Energized
1=Normally Energized

Register 4

Register 4 is the alarm 1 relay reset.
0=Latching
1=Self-Resetting

Register 5

Register 5 is the alarm 1 ON delay.
Integer value is in seconds.

Register 6

Register 6 is the alarm 1 OFF delay.
Integer value is in seconds.

Register 7

Register 7 is the alarm 2 set point.
Value must be an integer. Any decimals are omitted.
The decimal point location is the same as specified in Register 1 of Function Code 03.

Register 8

Register 8 is the alarm 2 trigger.
0=Decreasing
1=Increasing

Register 9

Register 9 is the alarm 2 relay state.
0=Normally De-Energized
1=Normally Energized

Register 10

Register 10 is the alarm 2 relay reset.
0=Latching
1=Self-Resetting

Register 11

Register 11 is the alarm 2 ON delay.
Integer value is in seconds.

Register 12

Register 12 is the alarm 2 OFF delay.
Integer value is in seconds.

Register 13

Register 13 is the zero suppression.
Toxics and LEL: 0%-6% Full Scale
Oxygen: 0%-0.7% Oxygen
Value must be an integer. Any decimals are omitted.

Register 14

Register 14 is the noise filter.
Integer value is in seconds (0-60 in 5 second increments).

Register 15

Register 15 is the calibration timeout.
Value is in minutes (5, 10, 15, 20, 25, or 30).

Register 16

Register 16 is explained in “Supported Modbus Functions” in the EXP-SNR-TG-EC manual.

Register 17

Register 17 is the calibration month (MSB) and day (LSB).
This is zero-based (e.g. January=0 and the 1st=0).

Register 18

Register 18 is the calibration year.

Register 19

Register 19 is for clearing change flags. When parameters are changed at the EXP-SNR-TG-EC, a flag is raised at the controller. This register can be used to clear those flags.

Table 23: Register 19, Clear Change Flags

Bit(s)	Value & Field
[15:2]	Unused
[1]	Write “1” to this bit to clear “Gas Type Changed” flag
[0]	Write “1” to this bit to clear “Configuration Changed” flag

Register 20

Register 20 is the AutoZero Disable.
0=AutoZero Enabled
1=AutoZero Disabled

Register 21

Register 21 is the Remote Configuration Register.
0=No Remote Configuration
1=Reset Alarm

USE AND CARE

Unauthorized modification may impair the function and/or safety of this device and could affect the life of the equipment. Always check for damaged or worn out parts before using the device. Store it in a secure place out of the reach of children when not in use. Inspect for good working condition prior to storage and before re-use.

REPLACEMENT PARTS

The EXP-SNR-TG-EC Series is designed to provide years of reliable performance. Should the need for replacement parts arise, please contact Larson Electronics.

THESE INSTRUCTIONS MAY NOT COVER ALL DETAILS OR VARIATIONS OF THIS PRODUCT FOR YOUR EQUIPMENT OR INSTALLATION REQUIREMENTS. SHOULD FURTHER INFORMATION NOT COVERED BY THESE INSTRUCTIONS BE REQUIRED, PLEASE CONTACT LARSON ELECTRONICS BY EMAIL AT SALES@LARSONELECTRONICS.COM OR BY PHONE AT 1-877-348-9680 FOR FURTHER ASSISTANCE.

PLEASE VISIT LARSONELECTRONICS.COM FOR **WARRANTY** AND **RETURN** INFORMATION.