

# SEC 3000 Gas Detector

## Instruction and Operation Manual

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Part Number 75-3000 Version 091404-001

### **Commitment**

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

### **Gas Detection Service**

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

### **Warranty**

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

Fuses and Batteries.

Warranty is voided by abuse including rough handling, mechanical damage, alteration or repair. This warranty covers the full extent of SEC liability and SEC is not responsible for removal, replacement costs, local repair costs, transportation costs or contingent expenses incurred without prior written approval. Sensor Electronics Corporation's obligation under this warranty shall be limited to repair or replacement of any product that has been returned to Sensor Electronics Corporation for warranty consideration. This warranty is expressly in lieu of any and all other warranties expressed or implied, and all other obligations or liabilities on the part of Sensor Electronics Corporation including but not limited to, the fitness for a particular purpose. In no event shall Sensor Electronics Corporation be liable for direct, incidental, or consequential loss or damage of any kind connected with the use of its products or failure to function or operate properly.

### **Year 2000 Compliance**

All Sensor Electronics products have been tested and are certified by Sensor Electronics to accurately process date/time and date/time related data from, into and between the 20<sup>th</sup> and 21<sup>st</sup> centuries. Sensor Electronics products neither contain nor create any logical or mathematical inconsistency, will not malfunction, and will not cease to function when processing date/time data.

Please contact Sensor Electronics for further information.

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# I. SPECIFICATIONS

**Model:** SEC 3000 Gas Detector

**Available gases:**

Ammonia	Carbon Monoxide	Hydrogen
Nitric Oxide	Oxygen	Phosgene
Bromine	Chlorine	Chlorine Dioxide
Fluorine	Hydrogen Peroxide	Ozone
Hydrogen Chloride	Hydrogen Cyanide	Hydrogen Fluoride
Hydrogen Sulfide	Nitrogen Dioxide	Sulfur Dioxide
Arsine	Diborane	Germane
Hydrogen Selenide	Phosphine	Silane
Formaldehyde		

*Please note that this list is not all-inclusive. The SEC 3000 sensors can be calibrated for other toxic gases provided a calibration gas is available. For more please contact Sensor Electronics Corporation.*

**Model Number:** SEC3000

**Detection Method:** Electrochemical or Galvanic

**Aspiration:**

Diffusion

Optional sample draw (requires 1 liter per minute sample flow rate)

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

**Output (Digital)** Interactive Interface Available On The Calibration (White) Wire

**Response Time:** Varies for type of sensing element

**Construction:** 316 Stainless Steel Explosion Proof

**Accuracy:** +/- 5%

**Operating Temperature Rating:**

-40° to +70°C at 0 to 99% RH (non-condensing)

**Operating Voltage:**

24 VDC  $\overline{=}$  Operating range: 18 to 32 VDC measured at the detector head

**Power Consumption:** 1 Watt Max.

**Max. Current Draw:** 40 mA (at 24 VDC)

**Approvals:** CSA: Class 1, Division 1, Groups B,C,D

**Installation Category:** Cat. I, Pollution Degree 2

## II GENERAL DESCRIPTION

### CONVENTIONS

The following conventions are used in this manual.



Warning Statement



VDC (DC Voltage)

### SEC 3000

The SEC 3000 toxic gas detector is a microprocessor based intelligent gas detector that continuously monitors toxic gases and vapors ideally suited for use in harsh environments. The SEC 3000 is a stand-alone device providing a continuous 4 to 20 mA output.

### Features

- *Compact low cost design*
- *No field gas calibration required*
- *Intrinsically Safe and explosion proof*
- *Universal control board*
- *Interchangeable sensor modules for oxygen and toxic gases*
- *Temperature compensated sensor*
- *Stand alone gas detector with 4-20 mA sourced output*
- *Corrosion resistant 316 stainless steel housing construction*
- *Long life electrochemical sensors*
- *Optional heater with closed loop temperature control ensures accuracy in low temperature applications*

*Can Be Coupled With SEC3100 Transmitter to Provide*

- *Alarm and Fault Relays*
- *Isolated RS485 Modbus Interface*
- *Lighted LCD Display*
- *Magnetic Switches For Unit Calibration Configuration*

## III. OPERATION

### Installation and Startup



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

The first step in the installation process is to establish a mounting location for the SEC 3000. Select a location that is typical of the atmosphere to be monitored or close to the anticipated source of a dangerous gas.

It is very important that the SEC 3000 be properly located to enable it to provide maximum protection. The most effective number and placement of sensors vary depending on the conditions of the application. When determining where to locate sensors the following factors should be considered.

- What are the characteristics of the gas that is to be detected? Is it lighter or heavier than air? If it is lighter than air the sensor should be placed above the potential gas leak. Place the sensor close to the floor for gases that are heavier than air or for vapors resulting from liquid spills. Note that air currents can cause a gas that is heavier than air to rise. In addition, if the temperature of the gas is hotter than ambient air or mixed with gases that are lighter than air, it could also rise.
- How rapidly will the gas diffuse into the ambient air? Select a location for the sensor that is close to the anticipated source of a gas leak.
- Wind or ventilation characteristics of the immediate area must also be considered. Movement of air may cause gas to accumulate more heavily in one area than in another. The detector should be placed in the areas where the most concentrated accumulation of gas is anticipated. For outdoor applications with strong wind conditions, it may require the sensors to be mounted closer together and on the down wind side, to the anticipated area of a gas leak. Also take into consideration for indoor applications, the fact that many ventilation systems do not operate continuously.
- The sensor should be accessible for maintenance.
- Excessive heat or vibration can cause premature failure of any electronic device and should be avoided if possible.
- Follow all national and local installation codes and practices.

The SEC 3000 has a  $\frac{3}{4}$ " NPT threaded connector for mounting the detector to a junction box. SEC can provide a junction box with terminals for this purpose.

A user-supplied junction box can be used providing it has the appropriate sized NPT conduit entries. The junction box must be suitable for use in the application and location in which it is being installed. After the device has been installed, a calibration is required. Refer to the Calibration section of this manual.

#### Wiring connections

Red wire: 18 to 32 VDC ===

Black wire: DC Common

Blue wire: 4 to 20 mA output

White wire: Smart Calibration Wire (data wire)

Earth Ground: Two (2) grounding screws on SEC 3000 housing.

Wire sizing:

0 to 500 feet, recommended wire gauge size 16 AWG

501 to 1000 feet, recommended wire gauge size 14 AWG

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

### Warm-up

When power is applied to the detector, it enters a one (1) minute warm-up mode. The output current will be 0.8 mA during the warm up time period. At the end of the warm-up period with no faults present, the detector automatically enters the normal operating mode (4 mA). If a fault is present after warm-up, the detector current output will indicate a fault. See the following chart for fault code status. Some electrochemical sensors will take up to 24 hours to stabilize. Newly installed sensors should be calibrated after they have been allowed to stabilize.

### Normal

In the normal operating mode, the 4 to 20 mA signal levels correspond to the detected gas concentration. The detector continuously checks for system faults or initiation of calibration and automatically changes to the appropriate mode.

The 4 to 20 mA output of the SEC 3000 is a non-isolated current source.

### Current Output and Corresponding Status

<u>Current Output</u>	<u>Status.</u>
0-20 mA	Normal measuring mode
0.0 mA	Unit Fault
0.8 mA	Unit warm up
1.2 mA	Zero drift fault
1.6 mA	Calibration fault
2.0 mA	Unit spanning
2.2 mA	Unit zeroing
4-20 mA	Normal measuring mode
4.0 mA	Zero gas level
5.6 mA	10% Full Scale
8.0 mA	25% Full Scale
12 mA	50% Full Scale
16 mA	75% Full Scale
20 mA	Full scale
>20 mA	Over-range

Once the fault is cleared the SEC 3000 will automatically resume normal operation.

## IV. CALIBRATION

### SEC 3000

The SEC 3000 is factory calibrated zeroed and spanned with calibration gas. After the SEC 3000 is installed under power for 24 hours it should be calibrated (zeroed and spanned) with calibration gas.

Calibration frequency is dependant on the application and installation requirements. Typical calibration of the gas sensors should be done on a quarterly basis.

The SEC 3000 sensor board is factory programmed with the following parameters. The parameters can be changed using the SEC 3000 PC Link software package. Refer the SEC 3000 PC Link Instruction Manual for additional information.

Gas Type  
Range  
Calibration Gas  
Calibration Date  
Sensor Bias Voltage (Not Adjustable)

If the calibration gas concentration is known, the SEC 3000 sensor can be zeroed and spanned in the field. The SEC 3000 can also be calibrated using the SEC 3000 PC Link software package. Refer the SEC 3000 PC Link Instruction Manual for additional information.

#### **Hardwire Calibration Method (For declassified areas)**

Before beginning calibration attach the SEC 3000 Calibration Adaptor (PN 1421468) to the SEC 3000 sensor housing. The zero and span gas flow should be regulated to 1.0 liter per minute (LPM).

##### Zeroing the SEC 3000

Apply clean air or zero air (nitrogen for oxygen sensor).

Connect calibration wire (white wire on SEC 3000) to negative (black wire of SEC 3000, common of the power supply) for ten (10) seconds, upon release the sensor will automatically enter the zero calibration routine. The electronics will automatically adjust the sensor's signal to the new zero reference level. During the zero calibration routine, the current output of the SEC 3000 will briefly go to 2.2 mA. Although this can be accomplished manually, installation of a switch (contact closure) can accomplish the zeroing procedure. It is recommended that this switch be a momentary type switch to prevent it from inadvertently being left in the calibrate position. If after 20 seconds the calibration lead has not been removed from common, the SEC 3000 will ignore the signal and continue operation as normal.

##### Spanning the SEC 3000

Apply the correct span gas concentration to the sensor (20.9% volume of O<sub>2</sub> for oxygen sensor).

Connect calibration wire (white wire on SEC 3000) to positive (red wire of SEC 3000, +24 VDC of the power supply) for ten (10) seconds; upon release the sensor will automatically enter the span calibration routine. The electronics will automatically adjust the sensor's signal to the new span reference level. During the span calibration routine, the current output of the SEC 3000 will briefly go to 2.0 mA. Although this can be accomplished manually, installation of a switch (contact closure) can accomplish the spanning procedure. It is recommended that this switch be a momentary type switch to prevent it from inadvertently being left in the calibrate position. If after 20 seconds the calibration lead has not been removed from +24 VDC, the SEC 3000 will ignore the signal and continue operation as normal.



## **V. MAINTENANCE**

The SEC 3000 does not normally require routine maintenance other than calibration. The only consumable item on the SEC 3000 is the sensing element. The toxic gas sensing element will typically last for 2 years of operation.

## **VI. Parts List**

<b>Part Number</b>	<b>Description</b>
142	SEC 3000 PC Link software package
142	Sensor Separation Kit
1421468	Cal Adapter
1421467	Splash Guard
1421467	Sample Draw Adapter

# Cross Sensitivity Table

## Gas Sensor

Interfering Gas

	NH <sub>3</sub>	Cl <sub>2</sub> **	HF	HCl	HCN	H <sub>2</sub> S	SO <sub>2</sub>	CO	H <sub>2</sub>	O <sub>2</sub>	NO	NO <sub>2</sub>	Hydride	SiH <sub>4</sub>	COCl <sub>2</sub>	Form.	ETO
NH <sub>3</sub>	-	N	0.05	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CO	0.05	N	N	0.005	N	0.002	N	-	0.1	N	N	0.001	N	N	N	0.5	0.5
H <sub>2</sub>	0.02	N	N	0.01	0.01	0.001	0.005	0.1	-	N	0.001	0.001	0.00002	0.001	N	0.05	0.05
NO	N	N	N	1.5	3	0.4	0.04	0.1	N	N	-	N	N	0.3	0.1	0.8	0.8
O <sub>2</sub>	*	N	N	*	*	*	*	*	*	-	*	*	*	*	N	N	N
Cl <sub>2</sub> **	-0.1	-	1	N	N	N	-0.1	N	N	(1)	N	0.5	N	N	0.1	N	N
HCl	N	N	0.5	-	N	N	N	N	N	N	N	-0.3	N	N	0.05	0.2	0.2
HCN	N	-0.08	-0.1	0.01	-	N	0.15	0.1	N	N	N	-0.07	N	N	0.5	0.1	0.1
HF	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N	N
H <sub>2</sub> S	0.3	-0.1	-0.3	3	N	-	N	N	N	N	N	-2.5	N	N	N	2	2
NO <sub>2</sub>	N	0.2	0.2	0.2	0.5	0.1	-0.8	N	N	N	N	-	N	N	-1	0.1	0.1
SO <sub>2</sub>	N	-0.01	1	0.5	2.0	0.1	-	N	N	N	N	-1	N	N	0.2	0.4	0.4
Hydride	0.5	N	N	1.5	4.0	0.5	2	N	N	N	1	-2	-	1	N	2	2
SiH <sub>4</sub>	0.5	N	N	1.5	4.0	0.5	2	N	N	N	1	-2	1	-	N	2	2
CO <sub>2</sub>	N	N	N	N	N	N	N	N	N	(2)	N	N	N	N	N	N	N
CH <sub>4</sub>	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
CH <sub>3</sub> SH	N	-0.04	-0.1	1	N	0.3	N	N	N	N	N	-0.8	N	N	N	1	1
C <sub>2</sub> H <sub>2</sub>	0.03	N	N	N	0.04	-0.01	0.02	0.1	0.1	N	0.05	N	0.00005	0.005	N	1.2	1.2
C <sub>2</sub> H <sub>4</sub>	N	N	N	N	N	N	N	0.1	0.1	N	N	N	N	N	N	1	1
C <sub>2</sub> H <sub>6</sub> O	0.01	N	N	0.01	0.02	0.005	0.05	N	N	N	0.001	0.001	0.00001	0.01	N	2	2

Cross sensitivity data was developed by exposure of sensors to gas concentrations below 100 PPM. Sensors may show either transient or continuous responses different from those listed above if exposed to very high concentrations of gas. The values shown are the equivalent signal generated by the sensor when exposed to 1 PPM of the indicated gas. For instance, exposure of a chlorine (oxidant) sensor to 1 PPM of nitrogen dioxide would produce a sensor signal equivalent to 0.2 PPM chlorine.

Negative numbers indicate gases that can cause low readings when present with the target gas

\* Indicates a three electrode sensor that requires a minimum of 5% oxygen for proper operation.

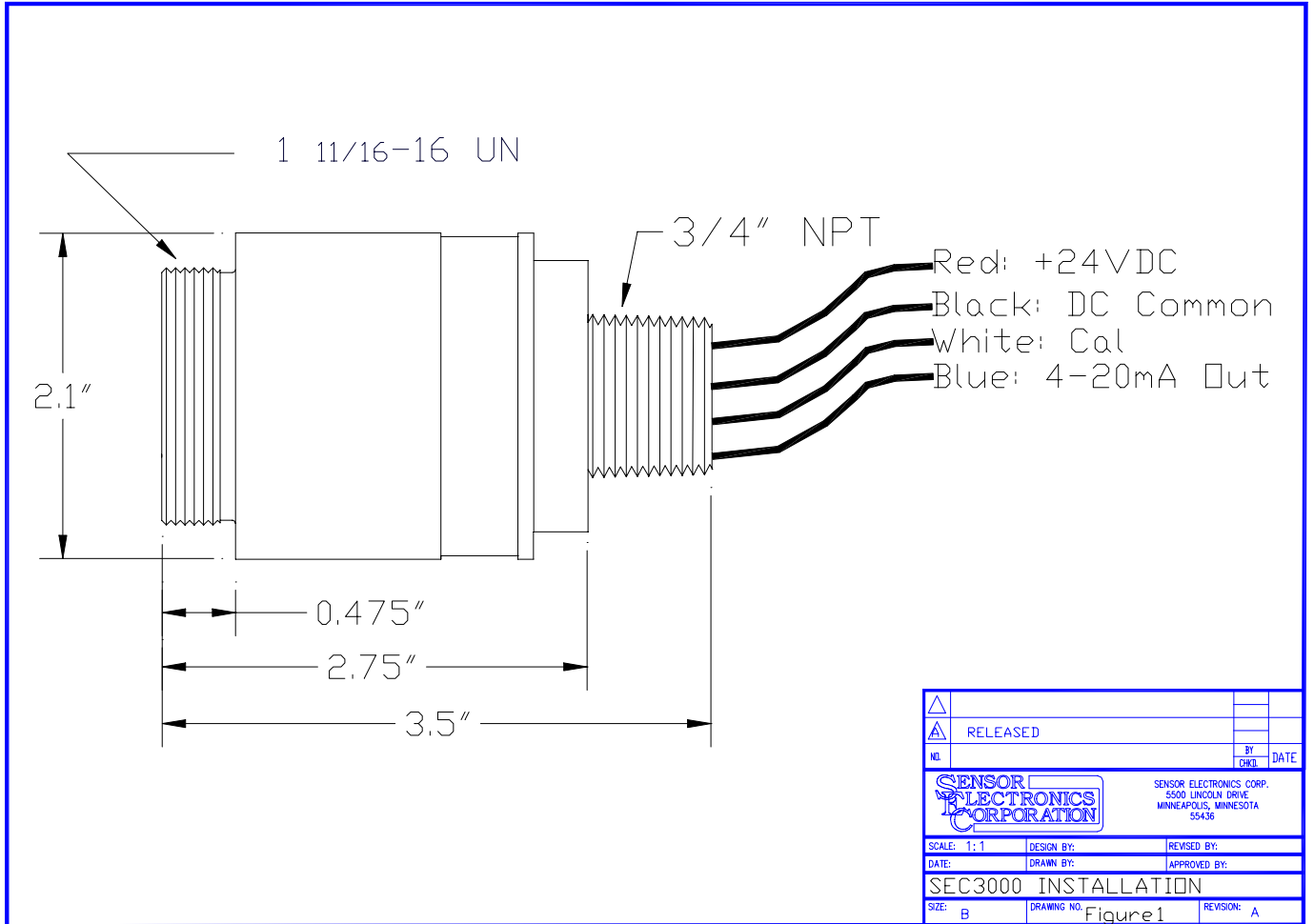
\*\* Data shown for the chlorine sensor refers to the sensor used for bromine, chlorine, chlorine dioxide, fluorine or ozone.

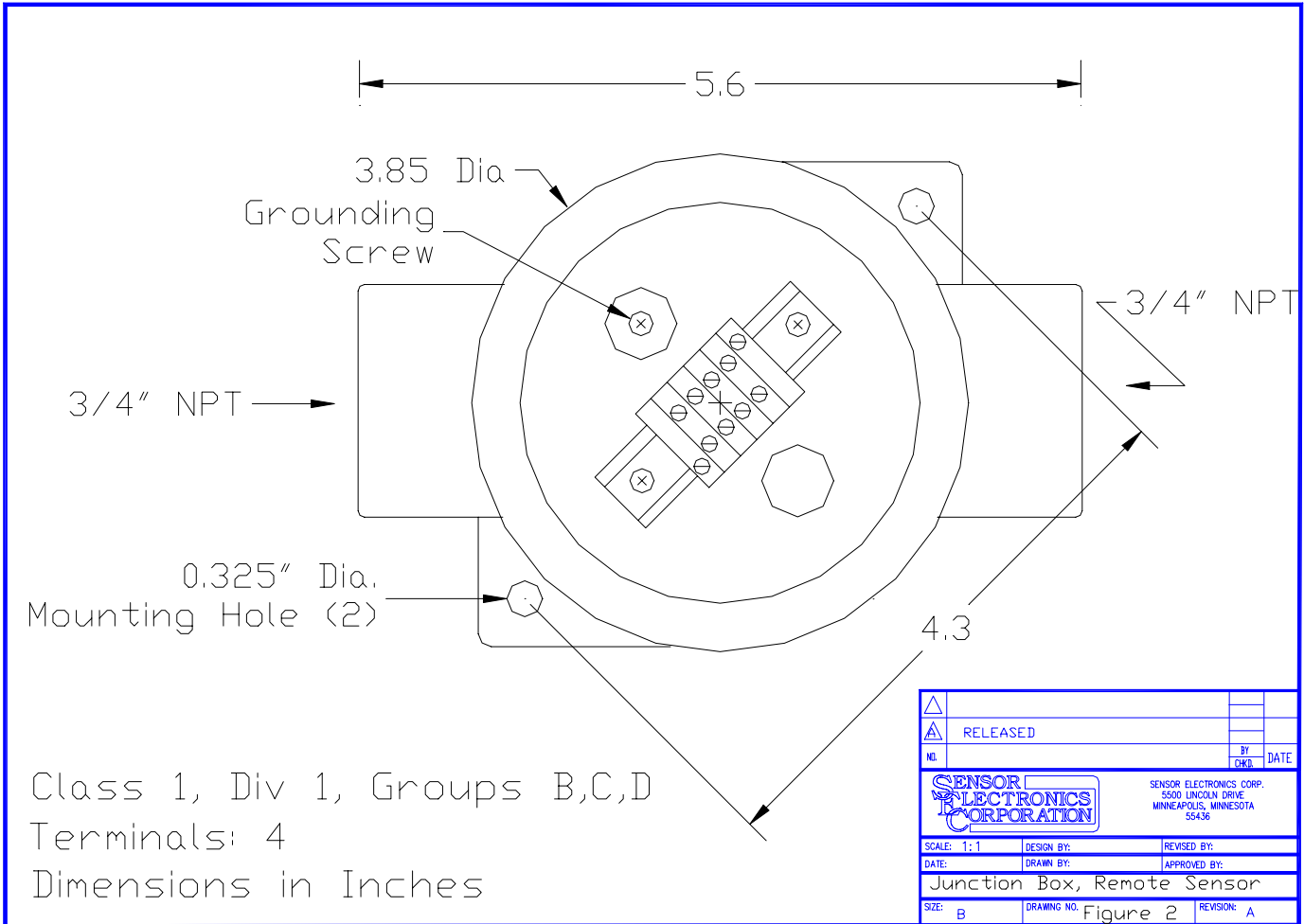
Oxygen sensors will respond to halogen gases at % levels but are unaffected by low PPM levels.

Oxygen sensor response will be affected by % levels of CO<sub>2</sub> but unaffected by low PPM levels.

## VII. Drawing Section

Figure #	Title
Figure 1	Wiring Diagram, SEC 3000
Figure 2	SEC Sensor Separation Kit





## Part Number Construction

	Gas Type	Range	Units	Wire/Cable	Wire Length
30	XX	XXXX	X	X	XXX

	Range Value (4 Places)	M: PPM	0: Wires	Inches Length Or S: Standard Length (24")
		B: PPB	1: Cable	
		V: %Vol		
		L: %LEL		
B2H6: 32				
AsH3: 32				
BCl3: 21				
BF3: 23				
Cl2: 11				
ClF3: 23				
CO: 16				
DCS: 21				
F2: 13				
H2: 18				
H2S: 24				
HBr: 23				
HCl: 21				
HF: 23				
NH3: 15				
O2: 19				
PH3: 32				
SiH4: 33				
SO2: 27				
TiCl4: 21				
WF6: 23				

Example: 0-100PPM Carbon Monoxide with 36 inches of wire  
P/N: 30160100M036