WatchGas Sensors

Characterization, Cross sensitivity and Application

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Calibration Gas: Represents a recommended calibration gas and it's concentration. Using a significantly lower concentration can result in an unstable calibration, while using a much higher concentration can accelerate sensor consumption. When the sensor is routinely operated outside its typical range, the calibration gas should be chosen as close as possible to the actual concentrations and gas type in use. For example, a CO sensor used in the 200–500 ppm range is preferably calibrated with 500 ppm CO rather than 50 ppm, with the understanding that higher calibration concentrations will shorten sensor lifetime.

Calibration Flow Rate: Recommended calibration gas flow rate most common is 0.5 to 1 liter, but can be gas and product dependent.

Cross-Sensitivity: Every sensor has some cross-sensitivity, where the sensor responds to other gases that are not filtered out and can react on the electrode. It is very important to be aware of potentially cross-sensitive compounds when interpreting data.

Range: The normal operating concentration of a sensor where the best linearity is found. Exceeding the normal operating range may result in erroneous readings and long recovery times, but should not permanently damage the sensor as long as the Max Overload is not exceeded.

Max Overload: The maximum exposure concentration. Exceeding this value will likely give erroneous readings and cause permanent damage to the sensor. Ammonia sensors often fail because they have been exposed to over 200 to 300 ppm.

Resolution: The smallest change on the display, that is, the minimum concentration of the target chemical that the sensor is capable of detecting.

Response Time (T90): The time for a sensor to reach 90% of its final stable reading. Typically an exposure of twice the T90 time is required to get a stable reading. Response times of sensors and instruments may be different. The response time of instrument is dependent on sensor response time and test conditions like calibration gas flow rate, temperature etc.

Bias/Equilibration: Some electrochemical sensors (NO, NH_3) require a bias voltage to detect the gas, while most do not. Unbiased sensors require at least 10 minutes to stabilize. Once installed, any sensor bias stays on, even when the meter is off. Therefore, even biased sensors are ready for immediate use when the instrument
is turned on again, and the equilibration time is needed only when first installed or if the battery becomes completely drained. Biased Oxygen sensors can require up to 60 minutes of stabilization time

Temperature Range: The normal operating temperature of the sensor. Sensors embody physico-chemical processes, which slow down when cooled and speed up when heated. Storing and using detectors outside in the winter may result in low readings if not recalibrated at the temperature of use. Storing detectors in hot cars in the summer may result in high readings and even dry out the sensors. Allowing a meter to return to normal operating temperature typically restores readings.

Pressure Range: The normal operating pressure of the sensor is typically atmospheric pressure, approximately 1013 mbar (1.013 bar / 14.7 psi) ± 10%. Some sensors may exhibit a transient response to sudden pressure changes, which can cause a temporary alarm condition.

Operating Humidity: Normal operating humidity. Typically 15 to 90% relative humidity, "non-condensing." Condensing humidity blocks the diffusion pathway, lowering the reading, and consistently high humidity can dilute the electrolyte and cause the cell to burst. Running or storing for extended periods in <10% RH gas can dry out the electrolyte and make the sensor inoperable.

Drift: The amount the sensor output may change over time, expressed in % per month.

Storage Life: The recommended maximum time a sensor should be stored in its original packaging before being installed in an instrument.

Storage Temperature: The recommended temperature to store sensors prior to use.
Operating Life: The expected useable life of the sensor after it is installed, as long as the "Storage Life" was not exceeded before installation as well as the sensor is not exposed to harsh environments or high exposure.
Correction Factor (CF): A correction factor is a numerical multiplier used to adjust a sensor reading when the measured gas is different from the calibration gas. Since sensor sensitivity varies between gases, the displayed value may not equal the true concentration. Applying the correction factor gives a better estimate of the actual gas concentration, although it remains approximate and depends on operating conditions and sensor condition.
% LEL: Lower Explosive Limit is used to express the concentration of a flammable gas in air as a percentage of the minimum concentration at which that gas can ignite or explode when exposed to an ignition source. It is widely used in gas detection and safety systems to indicate how close conditions are to becoming explosive, so that alarms and automatic shutdowns can be triggered before the atmosphere reaches a dangerous level.

Legal Disclaimer TN-018:

SENSORS FOR COMBUSTIBLE GASES AND VAPORS

Combustible Gases and Vapors – LPC Sensor

PERFORMANCE

Sensor Type	**MEMS catalytic bead**
Gases Detected	**Up to C5**
Range	**0 to 100%**
Resolution	**1%**
Response Time (T90)	**< 12 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**2.9 V to 3.1 V**
Storage Life	**2 years in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**50% LEL of CH_4**
Part Number(s)	**SST-SPARE-X1**
Supported Instruments	**SST4 Micro**

Cross-Sensitivity Data, Low Power Catalytic Sensor

Gas	CF (EU Standard)	CF (US Standard)
Acetylene	1.3	1.4
Ethane	1.4	1.8
Ethylene	1.3	1.5
Hexane	2.3	2.5
Hydrogen	1.6	1.6
Iso-Butane	1.6	2.2
Methane	1.0	1.0
N-Butane	1.3	1.5
N-Pentane	1.8	2.5
Propane	1.3	1.6

Combustible Gases and Vapors – LPC – 1 Series Sensor

PERFORMANCE

Sensor Type	**MEMS catalytic bead**
Gases Detected	**Up to C5**
Range	**0 to 100%**
Resolution	**1%**
Response Time (T90)	**< 12 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**2.9 V to 3.1 V**
Storage Life	**2 years in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**50% LEL of CH_4**
Part Number(s)	**SST-SPARE-X4**
Supported Instruments	**SST4 Pump; SST5**

Cross-Sensitivity Data, Low Power Catalytic Sensor

Gas	CF (EU Standard)	CF (US Standard)
Acetylene	1.3	1.4
Ethane	1.4	1.8
Ethylene	1.3	1.5
Hexane	2.3	2.5
Hydrogen	1.6	1.6
Iso-Butane	1.6	2.2
Methane	1.0	1.0
N-Butane	1.3	1.5
N-Pentane	1.8	2.5
Propane	1.3	1.6

Combustible Gases and Vapors – HP CAT Sensor

PERFORMANCE

Sensor Type	**Protected catalytic bead**
Gases Detected	**Most combustible gases and vapors**
Range	**0 to 100% LEL**
Resolution	**1% LEL**
Response Time (T90)	**< 20 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**3.3 V**
Drift	**< 3% signal/month**
Storage Life	**6 months in sealed container**
Operating Life	**5 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**50% LEL of CH_4**
Part Number(s)	**SST-SPARE-X2**
Supported Instruments	**SST4 Mini; SST4 Pump**

Cross-Sensitivity Data, High Power Catalytic Sensor

Gas	CF (EU Standard)	CF (US Standard)
Acetylene	2.7	2.8
Ethane	1.5	1.4
Ethylene	1.4	1.4
Hexane	2.2	2.3
Hydrogen	1.0	1.1
Iso-Butane	2.1	1.7
Methane	1.0	1.0
N-Butane	2.1	2.0
N-Pentane	2.6	2.2
Propane	1.7	1.6

Combustible Gases and Vapors – NDIR LEL sensor

PERFORMANCE

Sensor Type	**NDIR (Non-dispersive infrared, Dual-channel)**
Gases Detected	**CH_4**
Range	**0 to 100% LEL**
Resolution	**1% LEL**
Response Time (T90)	**< 30 sec**
Power Consumption	**<2 mW**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**2.9 V to 5 V**
Storage Life	**2 years in sealed container**
Operating Life	**>2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**50% LEL of CH_4**
Part Number(s)	**SST-SPARE-X3**
Supported Instruments	**SST4 Mini; SST4 Pump, SST5**

Cross-Sensitivity Data, NDIR Sensor

Gas	CF (EU Standard)	CF (US Standard)
Ethane	0.4	0.5
Ethylene	1.9	2.2
Iso-Butane	0.5	0.7
Methane	1.0	1.0
N-Butane	0.3	0.4
N-Heptane	0.7	0.7
N-Pentane	0.5	0.7
Propane	0.4	0.5

OXYGEN SENSORS

Oxygen (O_2) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 25% Vol.**
Max Overload	**30 %Vol.**
Resolution	**0.1% Vol.**
Response Time (T90)	**< 10 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**-400 to -600 mV**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>5 years in air**
Warranty	**2 years from date of shipmen**

CONFIGURATION

Calibration Gas	**18% O_2**
Zero Gas:	**99.9% N_2**
Part Number(s)	**SST-SPARE-O**
Supported Instruments	**SST1; SST4; SST5**

Cross-Sensitivity Data, O_2 Sensor

Gas	Concentration	Response
NH_3	20 ppm	0 ppm
CO_2	5000 ppm	0 ppm
CO	50 ppm	0 ppm
Cl_2	1 ppm	0 ppm
Hydrocarbons	1 %vol	0 ppm
H_2	100 ppm	0 ppm
HCN	10 ppm	0 ppm
Isopropanol (C_3H_7OH)	1000 ppm	0 ppm
NO	25 ppm	0 ppm
NO_2	10 ppm	0 ppm
SO_2	20 ppm	0 ppm
O_3	0.5 ppm	0 ppm

Oxygen (O_2) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 25% Vol.**
Max Overload	**30 %vol**
Resolution	**0.1% Vol.**
Response Time (T90)	**< 20 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**-600 mV**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**18% O_2**
Zero Gas:	**99.9% N_2**
Part Number(s)	**SST-SPARE-O-E**
Supported Instruments	**SST1E**

Cross-Sensitivity Data, O_2 Sensor

Gas	Concentration	Response (% O_2 equivalent)
CO_2	5%	0.0 %
H_2	0.2%	-0.2%

ELECTROCHEMICAL POLYMER SENSORS FOR TOXIC GASES

Ammonia (NH_3) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**200 ppm**
Resolution	**0.5 ppm**
Response Time (T90)	**< 130 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>3 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**50 ppm NH_3, balance N_2**
Part Number(s)	**SST-SPARE-A**
Supported Instruments	**SST1**

Cross-Sensitivity Data, NH_3 Sensor

Gas	Concentration	Response
SO_2	50 ppm	0 ppm
CO	50 ppm	0 ppm
CO_2	1 000 ppm	0 ppm
Cl_2	10 ppm	-1 ppm
Hydrocarbons	/	n.e*
H_2	100 ppm	0 ppm
HCN	10 ppm	<-5 ppm
Isopropanol (C_3H_8O)	1 000 ppm	n.e*
NO	25 ppm	<-3 ppm
NO_2	10 ppm	-10 ppm

*- not estimated

Ammonia (NH_3) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**100 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 60 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**50 ppm NH_3, balance N_2**
Zero Gas:	**99.9% N_2**
Part Number(s)	**SST-SPARE-A-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, NH_3 Sensor

Gas	Concentration	Response
Cl_2	5 ppm	-2.9 ppm
CO	500 ppm	0.0 ppm
H_2	500 ppm	0.0 ppm
H_2S	10 ppm	0.0 ppm
NO	50 ppm	0.0 ppm
SO_2	10 ppm	-6.4 ppm
NO_2	10 ppm	-7.6 ppm

Carbon Monoxide (CO) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 2000 ppm**
Max Overload	**2000 ppm**
Resolution	**1 ppm**
Response Time (T90)	**< 10 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>5 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**100 ppm CO, balance N_2**
Part Number(s)	**SST-SPARE-M**
Supported Instruments	**SST1; SST4**

Cross-Sensitivity Data, CO Sensor

Gas	Concentration	Response
NH_3	50 ppm	0 ppm
CO_2	1 000 ppm	0 ppm
Cl_2	1 ppm	0 ppm
CH_4	1 %vol	0 ppm
H_2	100 ppm	20 ppm
H_2S	50 ppm	0 ppm
HCN	50 ppm	0 ppm
C_3H_8O	1 000 ppm	0 ppm
NO	25 ppm	n.e*
NO_2	10 ppm	0 ppm
SO_2	10 ppm	0 ppm
R-OH	1 000 ppm	0 ppm
Ethylene (C_2H_4)	10 ppm	0 ppm

*- not estimated

Carbon Monoxide (CO) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 1500 ppm**
Max Overload	**1500 ppm**
Resolution	**1 ppm**
Response Time (T90)	**< 20 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**100 ppm CO, balance N_2**
Part Number(s)	**SST-SPARE-M-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, CO Sensor

Gas	Concentration	Response
Cl_2	10 ppm	0.3 ppm
H_2	100 ppm	10.2 ppm
H_2S	15 ppm	0.0 ppm
NO_2	10 ppm	0.0 ppm
SO_2	20 ppm	0.0 ppm
NH_3	50 ppm	0.3 ppm
NO	50 ppm	2.4 ppm

Chlorine (Cl_2) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 50 ppm**
Max Overload	**50 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 40 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm Cl_2, balance N_2**
Part Number(s)	**SST-SPARE-CL2-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, Cl_2 Sensor

Gas	Concentration	Response
NH_3	10 ppm	<-1.4 ppm
CO	500 ppm	0.0 ppm
H_2	500 ppm	0.0 ppm
H_2S	25 ppm	0.0 ppm
Ethylene (C_2H_4)	100 ppm	0.0 ppm
SO_2	10 ppm	0.8 ppm
NO_2	10 ppm	4.1 ppm
NO	50 ppm	0.5 ppm

Ethylene Oxide (ETO) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**500 ppm**
Resolution	**0.5 ppm**
Response Time (T90)	**< 150 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**+ 300mV**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm ETO balance N_2**
Part Number(s)	**SST-SPARE-ETO-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, ETO-C Sensor

Gas	Concentration	Response
CO	50 ppm	38.0 ppm
Ethylene (C_2H_4)	50 ppm	87.0 ppm
Acetylene (C_2H_2)	50 ppm	115.0 ppm
Isobutylene (C_4H_8)	50 ppm	58.0 ppm
C_2H_5OH	100 ppm	78.0 ppm

Hydrogen (H_2) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 1000 ppm**
Max Overload	**2000 ppm**
Resolution	**1 ppm**
Response Time (T90)	**< 10 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**> 5 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**200 ppm H_2 balance Air**
Part Number(s)	**SST-SPARE-H2**
Supported Instruments	**SST1**

Cross-Sensitivity Data, H_2 Sensor

Gas	Concentration	Response
NH_3	50 ppm	0 ppm
CO_2	1 000 ppm	0 ppm
CO	200 ppm	1 000 ppm
Cl_2	5 ppm	0 ppm
CH_4	1 %vol	0 ppm
HCN	10 ppm	0 ppm
C_3H_8O	1 000 ppm	0 ppm
NO	25 ppm	0 ppm
NO_2	10 ppm	0 ppm
HCl	20 ppm	0 ppm
HF	3 ppm	0 ppm
H_2S	10 ppm	0 ppm
SiH_4	5 ppm	0 ppm
SO_2	10 ppm	0 ppm

Hydrogen (H_2) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 2 %vol**
Max Overload	**4 %vol**
Resolution	**0.01%**
Response Time (T90)	**< 55 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**> 5 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**1 %vol (10 000 ppm) H_2 balance Air**
Part Number(s)	**SST-SPARE-H2HR**
Supported Instruments	**SST1**

Cross-Sensitivity Data, H_2 Sensor

Gas	Concentration	Response
NH_3	50 ppm	0 ppm
CO_2	1 000 ppm	0 ppm
CO	200 ppm	1 000 ppm
Cl_2	5 ppm	0 ppm
CH_4	1 %vol	0 ppm
HCN	10 ppm	0 ppm
C_3H_8O	1 000 ppm	0 ppm
NO	25 ppm	0 ppm
NO_2	10 ppm	0 ppm
HCl	20 ppm	0 ppm
HF	3 ppm	0 ppm
H_2S	10 ppm	0 ppm
SiH_4	5 ppm	0 ppm
SO_2	10 ppm	0 ppm

Hydrogen Chloride (HCl) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 50 ppm**
Max Overload	**50 ppm**
Resolution	**0.2 ppm**
Response Time (T90)	**< 75 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm HCl balance N_2**
Calibration Zero Gas	**Clean ambient air or Zero air**
Part Number(s)	**SST-SPARE-HCl-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, HCl Sensor

Gas	Concentration	Response
CO	100 ppm	0.3 ppm
SO_2	20 ppm	0.4 ppm
NO	20 ppm	0.2 ppm
NO_2	10 ppm	-9.3 ppm
H_2S	25 ppm	31.0 ppm
H_2	1 000 ppm	0.2 ppm

Hydrogen Cyanide (HCN) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 50 ppm**
Max Overload	**50 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 70 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm HCN balance N_2**
Calibration Zero Gas	**Clean ambient air or Zero air**
Part Number(s)	**SST-SPARE-HCN-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, HCN Sensor

Gas	Concentration	Response
CO	50 ppm	0.0 ppm
SO_2	5 ppm	12.0 ppm
NO_2	5 ppm	-10.8 ppm
NO	10 ppm	0.0 ppm
H_2S	5 ppm	11.2
Ethylene (C_2H_4)	20 ppm	0.0

Hydrogen Cyanide (HCN-F) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 50 ppm**
Filter	**Eliminate H_2S**
Max Overload	**50 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 120 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm HCN balance N_2**
Calibration Zero Gas	**Clean ambient air or Zero air**
Part Number(s)	**SST-SPARE-HCNF-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, HCN Sensor

Gas	Concentration	Response
CO	50 ppm	0.0 ppm
H_2S	5 ppm	0.7 ppm
Ethylene (C_2H_4)	20 ppm	0.0 ppm
SO_2	5 ppm	< 12.5 ppm
NO_2	5 ppm	-15.1 ppm
NO	10 ppm	<-3.1 ppm

Hydrogen Sulfide (H_2S) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 300 ppm**
Max Overload	**300 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 20 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**25 ppm H_2S balance N_2**
Part Number(s)	**SST-SPARE-H-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, H_2S Sensor

Gas	Concentration	Response
Cl_2	10 ppm	-1.4 ppm
CO	100 ppm	0.0 ppm
NO	50 ppm	0.0 ppm
NO_2	10 ppm	-2.8 ppm
SO_2	20 ppm	0.0 ppm
Ethylene (C_2H_4)	100 ppm	0.0 ppm
NH_3	50 ppm	0.0 ppm
H_2	1 000 ppm	0.2 ppm

Hydrogen Sulfide (H_2S) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 500 ppm**
Max Overload	**500 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 10 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>3 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**25 ppm H_2S balance N_2**
Part Number(s)	**SST-SPARE-H**
Supported Instruments	**SST1; SST4**

Cross-Sensitivity Data, H_2S Sensor

Gas	Concentration	Response
CO_2	1 000 ppm	0 ppm
NH_3	50 ppm	0 ppm
CO	50 ppm	3 ppm
CH_4	1 %vol	0 ppm
Cl_2	10 ppm	-1.5 ppm
C_3H_8O	1 000 ppm	n.e*
H_2	100 ppm	3 ppm
HCN	10 ppm	0 ppm
SO_2	10 ppm	n.e*
NO	25 ppm	0 ppm

*- not estimated

Methyl Mercaptan (CH_4S) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**200 ppm**
Resolution	**0.01 ppm**
Response Time (T90)	**< 10 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>3 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm CH_4S balance N_2**
Part Number(s)	**SST-SPARE-MM**
Supported Instruments	**SST1**

Cross-Sensitivity Data, CH_4S Sensor

Gas	Concentration	Response
CO_2	1 000 ppm	0 ppm
CO	50 ppm	3 ppm
Cl_2	10 ppm	-1.5 ppm
CH_4	1 %vol	0 ppm
HCN	10 ppm	0 ppm
C_3H_8O	1 000 ppm	n.e*
NO	25 ppm	0 ppm
SO_2	10 ppm	n.e*

*- not estimated

Nitrogen Dioxide (NO_2) – Mini Sensors

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 20 ppm**
Max Overload	**50 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 15 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**5 ppm NO_2 balance Air**
Part Number(s)	**SST-SPARE-NO2-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, NO_2 Sensor

Gas	Concentration	Response
Cl_2	5 ppm	2.2 ppm
CO	300 ppm	0.0 ppm
H_2	500 ppm	0.0 ppm
NH_3	20 ppm	0.0 ppm
NO	25 ppm	0.0 ppm
H_2S	10 ppm	0.0 ppm
SO_2	10 ppm	0.0 ppm
C_2H_4	100 ppm	0.0 ppm

Nitric Oxide (NO) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**100 ppm**
Resolution	**0.2 ppm**
Response Time (T90)	**< 30 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**25 ppm NO balance N_2**
Part Number(s)	**SST-SPARE-NO-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, NO Sensor

Gas	Concentration	Response
NH_3	50 ppm	0.0 ppm
CO	500 ppm	0.0 ppm
H_2	1 000 ppm	0.0 ppm
H_2S	10 ppm	0.3 ppm
C_2H_4	100 ppm	0.0 ppm
SO_2	10 ppm	1.0 ppm
NO_2	10 ppm	0.8 ppm

Phosphine (PH_3) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 20 ppm**
Max Overload	**50 ppm**
Resolution	**0.01 ppm**
Response Time (T90)	**< 30 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1 % signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>3 years in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**5 ppm PH_3 balance N_2**
Part Number(s)	**SST-SPARE-P**
Supported Instruments	**SST1**

Cross-Sensitivity Data, PH_3 Sensor

Gas	Concentration	Response
CO_2	1 000 ppm	0 ppm
CO	100 ppm	34 ppm
Cl_2	50 ppm	0 ppm
CH_4	1 %vol	0 ppm
HCN	5 ppm	0.18 ppm
NO_2	5 ppm	-0.93 ppm
HCl	5 ppm	0.14 ppm
HF	5 ppm	0.14 ppm

Sulfur Dioxide (SO_2) – Micro Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**100 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 55 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 1% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**>3 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm SO_2 balance N_2**
Part Number(s)	**SST-SPARE-S**
Supported Instruments	**SST1**

Cross-Sensitivity Data, SO_2 Sensor

Gas	Concentration	Response
NH_3	50 ppm	0 ppm
CO_2	1 000 ppm	0 ppm
CO	50 ppm	0 ppm
Cl_2	10 ppm	-1 ppm
Hydrocarbons	/	n.e*
H_2	100 ppm	0 ppm
HCN	10 ppm	< 5 ppm
C_3H_8O	1 000 ppm	n.e*
NO	25 ppm	<-3 ppm

*- not estimated

Sulfur Dioxide (SO_2) – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 40 ppm**
Max Overload	**40 ppm**
Resolution	**0.1 ppm**
Response Time (T90)	**< 45 sec**
Temperature Range	**-40° F to 140° F (-40° C to 60° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**2 years in air**
Warranty	**2 years from date of shipment**

CONFIGURATION

Calibration Gas	**5 ppm SO_2 balance N_2**
Part Number(s)	**SST-SPARE-S-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, SO_2 Sensor

Gas	Concentration	Response
H_2S	25	< 1.0
Cl_2	10	-7.2
CO	100	0.0
H_2	2 000	0.0
Ethylene (C_2H_4)	100	0.0
NH_3	50	1.0
NO_2	10	-5.9
NO	20	0.0
C_2H_5OH	2 000	0.0

Xs Sensor – Mini Sensor

PERFORMANCE

Sensor Type	**Electrochemical**
Range	**0 to 100 ppm**
Max Overload	**100 ppm**
Resolution	**0.5 ppm**
Response Time (T90)	**< 60 sec**
Temperature Range	**-4° F to 122° F (-20° C to 50° C)**
Pressure Range	**Atmospheric ±10%**
Operating Humidity	**5 to 95% RH non-condensing**

PHYSICAL & LIFE

Bias	**No bias**
Drift	**< 2% signal/month**
Storage Life	**1 year in sealed container**
Operating Life	**1 year in air**
Warranty	**1 year from date of shipment**

CONFIGURATION

Calibration Gas	**10 ppm Isobutylene balance Air**
Part Number(s)	**SST-SPARE-XS-E**
Supported Instruments	**SST1E; SST5**

Cross-Sensitivity Data, Xs Sensor

Gas	CF
Acetylene (C_2H_2)	1.60
Butadiene (C_4H_6)	0.61
CO	0.93
Ethanol (C_2H_5OH)	8.80
Ethene (C_2H_4)	3.60
Ethyl Mercaptan (C_2H_5SH)	0.80
HCN	4.50
H_2S	0.16
Isobutylene (C_4H_8)	1.00
Isopropanol (C_3H_8O)	5.20
CH_4S	0.50
NO	3.30
PH_3	0.25
SO_2	0.89

CALIBRATION

WatchGas SST units are calibrated using the **WatchGas Device Link APP**. By selecting the calibration function in the app, the user initiates the process. Zero calibration begins automatically, accompanied by a countdown displayed on the device. After completion, the device proceeds to span calibration, which is also guided by an automatic countdown. The required calibration gas and calibration time depend on the sensor type and specific unit. These details are provided in **Table 1**, including the corresponding gas and calibration duration for each unit. **Micro Sensor:** Represents sensors utilized in SST1 unit. **Mini Sensor**: Represents sensors utilized in SST1E unit.

Zero calibration is performed under normal atmospheric conditions, without covering the sensors. For span calibration; a calibration cap is placed over the sensor, and the appropriate concentration of calibration gas is applied. The pre-calibration treatment (soaking time) depends on the sensor type and is not the same for all sensors. Sensors such as HCN and HCl require longer pre-calibration treatment, in relation to sensors for CO or H_2S. This is described in the datasheets of the respective units and in Technical Notes **TN-014** and **TN-021**.

Table 1: Calibration Gas & Time for SST1/SSTE Units.

Unit	Calibration Gas	Calibration Time (s)
SST1 CO	100 ppm CO	90
SST1 CH_4S	10 ppm CH_4S	120
SST1 H_2 High Range	10 000 ppm H_2	150
SST1 H_2 Low Range	200 ppm H_2	90
SST1 H_2S	25 ppm H_2S	90
SST1 NH_3	50 ppm NH_3	250
SST1 O_2	18 %vol O_2	90
SST1 PH_3	5 ppm PH_3	90
SST1 SO_2	10 ppm SO_2	120
SST1E Cl_2	10 ppm Cl_2	40
SST1E CO	100 ppm CO	90
SST1E ETO	10 ppm ETO	150
SST1E H_2S	25 ppm H_2S	90
SST1E HCl	10 ppm HCl	75
SST1E HCN	10 ppm HCN	90
SST1E HCN F	10 ppm HCN	480
SST1E NH_3	50 ppm NH_3	60
SST1E NO	25 ppm NO	30
SST1E NO_2	5 ppm NO_2	15
SST1E O_2	18 %vol O_2	90
SST1E SO_2	5 ppm SO_2	180
SST1E Xs	10 ppm Isobutylene (C_4H_8)	60

APPLICATIONS BY SENSOR GROUP

This section summarizes typical application areas for the sensors listed in this technical note. The intent is not to define a complete safety case for any individual installation, but to provide a practical reference for selecting sensor families according to the expected gas hazard, operating environment, and monitoring objective.

Combustible gases and vapors

Combustible gas sensors are typically used wherever flammable gases or vapors may accumulate and create an explosive atmosphere, including oil and gas facilities, petrochemical plants, fuel handling systems, tanks, silos, confined spaces, mining, marine environments, and maintenance activities involving hydrocarbons or solvent vapors. Catalytic bead LEL sensors are commonly applied for general hydrocarbon detection in oxygen-containing atmospheres and are particularly relevant where hydrogen, acetylene, or a broad mixture of combustible gases may be present. NDIR LEL sensors are often preferred where low-oxygen or inert conditions are possible, or where catalytic sensor poisoning by silicones, sulfur compounds, or other contaminants is a concern, because infrared combustible sensors do not require oxygen for the detection principle and are not poisoned in the same way as catalytic beads. Due to the unreliable recovery from poisoning, exposing the pellistor sensor to both H_2 and CH_4 helps to identify the type of poison. If the sensor responds to H_2 but not to CH_4, chemical poisoning is likely. If the sensor does not respond to either gas, a mechanical issue or severe, irreversible damage should be suspected. In practice, the selected combustible sensor should be matched to the expected gas, because response factors differ for methane, propane, pentane, hydrogen, acetylene, and other combustible gases.

Oxygen sensors

Oxygen sensors are used for atmosphere safety verification, especially before and during confined space entry, where both oxygen deficiency and oxygen enrichment can create serious risks. Typical applications include tank entry, vessel inspection, cargo holds, inert process areas, nitrogen-purged systems, fermentation areas and cryogenic gas storage. Oxygen measurement is normally used together with combustible and toxic gas monitoring, because a safe oxygen value alone does not prove that the atmosphere is free from toxic or flammable hazards.

Common toxic gas sensors

Common toxic gas sensors include CO sensors for combustion-related risks (with H_2-compensated versions where hydrogen is present), and H_2S sensors for wastewater, and confined spaces, often combined in portable multi-gas devices. NH_3 sensors are used in agriculture, SO_2 in combustion and emissions, while NO and NO_2 apply to exhaust and high-temperature processes. Reactive gases such as Cl_2 are typical in water treatment, and HCl in chemical, semiconductor and plastic industries, with attention to cross-sensitivity and environmental conditions. Specialty sensors include ETO (sterilization), PH_3 (fumigation), and HCN (fire and industrial hazards). A standard safety configuration typically combines O_2, LEL, CO, and H_2S sensors, with additional sensors selected based on the specific application, considering calibration range, background gases, humidity, temperature, response time, lifetime, and cross-sensitivity. The Xs sensor can serve as an alternative to a PID, providing a broad detection range when used with appropriate correction factors, making it an effective addition to standard 4-gas detection in SST5 units.