Combustible (LEL) Sensor Correction Factor

SemeaTech combustible (LEL) sensors are capable of detecting a wide range of flammable gases. These sensors are sensitive to various hydrocarbons, including methane, propane, and other organic vapors through oxidation. When a flammable gas contacts the heated catalyst, it combusts internally, causing a temperature increase that alters the resistance of the active element and then it is converted into an electrical signal. The strength of signal is proportional to the concentration of the gas.

LEL sensors require a certain amount of oxygen to function properly, typically at least 10-15% Vol in the air. If the oxygen concentration drops below this level, the sensor's ability to detect flammable gases significantly diminishes. This is because the combustion process is hindered, leading to incomplete oxidation and a lower sensor response. Conversely, excessively high oxygen concentrations may cause false alarms.

Methane sensitivity and the correction factor of LEL sensors may change over time due to various factors related to sensor aging and usage. The primary factor is sensor degradation. The components of the sensor, including the catalyst used for methane detection, can degrade due to exposure to environmental factors, contaminants, or prolonged use, which affect performance and accuracy. This can also result from calibration drift and changes in temperature and humidity.

LEL sensors are typically calibrated with a specific gas, such as methane, but they are capable of detecting various combustible gases. Correction factors are applied to ensure accurate measurements across different gases. These factors adjust the sensor's readings to reflect the actual concentration of the detected gas.

Correction factors are used in various calibration scenarios for LEL sensors to ensure accurate %LEL measurements of different gases：

Methane is the most common reference gas to do the LEL sensors calibration. When calibrating with methane, multiply the reading by the Correction Factor (CF Value) to obtain the actual %LEL of the measured gas.

For example: To measure ethanol gas, multiply the methane LEL percentage by 1.7 (the CF value for ethanol) to get the LEL reading for ethanol.

If the calibration process uses non-methane standard gas, such as calibrating LEL sensor with isopropanol (CF value: 2.6), and then the sensor is used to measure the concentration of ethylbenzene (CF value: 2.8) in the ambient environment, the actual concentration of ethylbenzene can be calculated as: LEL sensor reading × (2.8/2.6).

Chemical (Gas or Vapor)	100% LEL (Vol%)	CF (Methane Calibrated)	Chemical (Gas or Vapor)	100%LEL (Vol%)	CF (Methane Calibrated)
Acetaldehyde	4.0	1.81	Cyclopropane	2.4	1.51
Acetate, n-propyl	2.0	1.62	Decane, n-	0.8	3.40
Acetic acid	4.0	3.41	Dichloroethane, 1,2-	6.2	1.52
Acetic anhydride	2.7	2.00	Dichloromethane	13.0	1.01
Acetone	2.5	2.21	Dicyclopentadiene	0.8	1.80
Acetylene	2.5	2.80	Dimethylamine	2.8	1.50
Alcohol ketone	/	3.50	Dimethylbutane	1.2	2.70
Allyl alcohol	2.5	1.70	Dimethylformamide	2.2	1.50
Ammonia	15.0	0.80	Dimethylpentane, 2,3-	1.1	2.31
Aniline	1.3	3.00	Dimethyl sulfide	2.2	2.30
Artificial coal gas	/	1.00	Dimethyl sulfoxide	2.6	1.30
Benzene	1.2	2.20	Dioxane, 1,4-	2.0	2.50
Butadiene, 1,3-	2.0	2.50	Diesel fuel	0.6	5.01
Butane, n-	1.9	2.00	Ethane	3.0	1.40
Butane, i-	1.8	1.81	Ethanol	3.3	1.70
Butanol, n-	1.4	3.00	Ethene	2.7	1.40
Butanol, i-	1.7	2.50	Ethyl acetate	2.0	2.20
Butanol, t-	2.4	1.80	Ethylamine	3.5	1.40
Butanone	1.8	1.75	Ethyl benzene	0.8	2.80
Butene-1	1.6	2.10	Ethyl bromide	6.8	0.90
Butene-2, cis	1.7	2.10	Ethyl chloride	3.8	1.71
Butene-2, trans	1.8	1.90	Ethyl ether	1.9	2.30
Butyl acetate	1.7	1.80	Ethyl formate	2.8	2.40
Butyric acid	2.0	2.40	Ethyl mercaptan	2.8	1.80
Carbon disulfide	1.3	/	Ethyl methyl ether	2.0	2.30
Carbon monoxide	12.5	1.20	Ethyl pentane	1.2	2.40
Carbonyl sulfide	12.0	1.00	Ethylene	2.7	1.00
Chlorobenzene	1.3	3.00	Ethylene oxide	3.0	2.30
Chloropropane, 1-	2.6	1.80	Formaldehyde	/	1.00
Cyanogen	6.6	1.10	Gasoline	1.3	2.12
Cyclohexane	1.3	2.50	Glacial acetic acid	/	1.60
Cyclohexanone	1.1	1.80	HC	1.0	1.10

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Heptane, n-	1.1	2.41	Methylpentane	1.2	2.71
Hexadiene, 1,4-	2.0	1.50	Methyl propionate	2.5	2.12
Hexane, n-	1.1	2.32	Methyl n-propyl ketone (2-pentanone)	1.5	2.70
Hydrazine	2.9	2.10	Methyl vinyl ether	/	1.50
Hydrogen	4.0	1.10	Naphthalene	0.9	2.90
Hydrogen cyanide	5.6	2.00	Natural gas	5.0	1.05
Hydrogen sulfide	4.0	/	Nitromethane	7.3	2.11
Isobutene (Isobutylene)	1.8	1.50	Nonane, n-	0.8	3.20
Isobutyraldehyde	/	1.60	Octane, n-	1.0	2.90
Isopropane	2.2	1.61	Paint (xylene)	/	2.50
Isopropanol	2.0	2.60	Pentane, n-	1.5	2.20
Kerosene	0.7	7.50	Pentane, i-	1.4	2.30
Leaded gasoline	1.3	2.10	Pentane, Neo-	1.4	2.50
Liquefied petroleum	1.7	2.05	Pentene, 1-	1.5	2.30
Methane	5.0	1.00	Petroleum ether	/	1.31
Methanol	6.0	1.50	Phosphine	1.6	0.30
Methyl acetate	3.1	2.20	Propane	2.1	1.60
Methylamine	4.9	1.30	Propanol, n-	2.2	2.00
Methyl bromide	10.0	1.10	Propene	2.0	1.50
Methyl chloride	8.1	1.30	Pentane, n-	1.5	2.20
Methylcyclohexane	1.2	2.60	Pentane, i-	1.4	2.30
Methyl ether	3.4	1.70	Pentane, Neo-	1.4	2.50
Methyl ethyl ketone	1.4	2.60	Pentene, 1-	1.5	2.31
Methyl formate	4.5	1.90	Petroleum ether	1.1	2.30
Methyl hexane	1.2	2.40	Petroleum solvent	1.1	2.50
Methyl isobutyl ketone	1.4	3.00	Phosphine	1.6	0.30
Methyl mercaptan	3.9	1.60	Propane	2.1	1.60
Methylpentane	1.2	2.71	Propanol, n-	2.2	2.00
Methyl mercaptan	3.9	1.60	Methyl isobutyl ketone	1.4	3.00

Chemical (Gas or Vapor)	100% LEL (Vol%)	CF (Methane Calibrated)	Chemical (Gas or Vapor)	100% LEL (Vol%)	CF (Methane Calibrated)
Propylamine, n-	2.0	2.11	Trimethylamine	2.0	1.90
Propylene	2.0	1.22	Trimethylbutane	1.2	2.31
Propylene oxide	2.3	2.60	Turpentine	0.8	2.90
Propyl ether, iso-	1.4	2.31	Unleaded gasoline	1.1	2.50
Propyne	1.7	2.30	Vinyl chloride	3.6	1.81
Styrene	1.1	2.51	Xylene, m-	1.1	2.70
Tetrahydrofuran	2.3	2.00	Xylene, o-	0.9	3.00
Toluene	1.1	2.61	Xylene, p-	1.1	2.81
Triethylamine	1.2	2.50			
Propene	2.0	1.51			

CF Value Table

Caution:

1. Several gases and substances may cause LEL sensors to experience baseline shifts and sensitivity loss:
- Silicones: Catalyst in LEL sensors will be poisoned when exposure to silicone compounds.
- Sulfur Compounds: Mainly Hydrogen Sulfide (H_2S) will poison the catalyst to decrease the sensitivity and lead to baseline shifts.

2. Different airway designs, sampling methods and pre-processing methods can affect CF values.