

Catalytic Gas Sensor Conversion K-Factors

Catalytic combustible gas detection systems are best used for detection of a specific gas or vapor type, although they will respond to a variety of flammable vapor species. The Instrument Society of America (ISA) recommends always calibrating your catalytic sensor with the specific vapor type that is expected to be detected at the jobsite whenever possible. This recommendation means that every project requires some investigation as to the gas hazard(s) expected to be detected before specifying the calibration gas.

While Det-Tronics catalytic gas detection systems are capable of accurately measuring literally hundreds of different flammable gases, only a handful of pre-mixed, compressed calibration gas types are offered. This means that whenever a gas or vapor must be detected for which there is not a matching calibration gas mixture offered, a conversion "K" factor must be used by the technician performing the calibration procedure to ensure proper sensitivity to the vapor is provided by the system.

In a typical calibration, a known concentration (typically one-half of the sensor's full scale detection range) of the actual gas or vapor that is expected to be detected should be used to calibrate the system. Det-Tronics calibration gas should always be used to ensure proper system calibration performance and accuracy. Calibration gas should not be used if the oxygen concentration within the gas is listed at less than 20% by volume.

A conversion "K" factor must be used in the calibration of the system whenever detection of gases/vapors other than the gas used in the actual calibration process will occur. See Table #1 following for the current list of Det-Tronics "K" factors. The "K" factor represents the relative sensor response ratio of the calibration gas to the detected gas. The "K" factor is used within the "K" factor Equation to determine the proper transmitter output level (span setpoint) when the sensor is exposed to the calibration gas.

The "K" factor Equation is as follows:

$$C \times K = S$$

where,

C =	Concentration of the calibration gas, in % L.F.L.
K =	Conversion "K" factor for the gas to be monitored with the given calibration gas
S =	Corrected combustible gas transmitter calibration span output level (span setpoint)

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Example: Gas/vapor to be detected: Gasoline vapors
Calibration Gas: 50% L.F.L Propane in air
"K" factor: 1.04

$$\begin{array}{rclclcl} \text{Equation:} & & \mathbf{C} & \times & \mathbf{K} & = & \mathbf{S} \\ & & 50 & \times & 1.04 & = & 52 \end{array}$$

For proper system sensitivity to Gasoline vapors, the transmitter span setpoint should be adjusted to read **52%** L.F.L when the sensor is exposed to **50%** L.F.L Propane in air mixture calibration gas.

If more than one calibration gas type and "K" factor is listed for a gas to be detected, generally the best calibration gas to use is that which provides a "K" factor closest to value 1.0 (one). Note that the presence of Methane gas as a potential detectable gas is an exception. Always use Methane calibration gas if Methane is expected to be present within the protected area.

If a specific gas/vapor and "K" factor is not listed within Table #1, then "K" factor testing by Det-Tronics Sensor Engineering dept. is required. There is a \$100.00 fee per sample for this service. Det-Tronics may not accept some items for testing, such as hazardous, toxic, carcinogenic, pyrophoric, or hypergolic materials. In this case, an estimated "K" factor may be provided based upon the Material Safety Data Sheet (M.S.D.S.), previous test data and engineering judgement. All requests for testing must be accompanied with a M.S.D.S for that material before any shipment of the material is made. Recent Minnesota State law also may preclude Det-Tronics from accepting or handling certain hazardous materials. Following is the recommended procedure for requests for "K" factor testing:

1. The request for "K" factor testing, complete with appropriate M.S.D.S., should be issued to Det-Tronics Customer Service Dept. A purchase order issued to Det-Tronics for testing services will be required upon request approval.
2. A one ounce sample of liquids or 7.5 liters of gaseous materials shall be packaged and shipped in the appropriate container to attn: Gas Sensor K-Factor Test Lab.
3. A Material Safety Data Sheet must accompany each sample to be tested.
4. Technical information typically required for each compound includes: specific gravity, molecular weight, vapor density, flashpoint, lower and upper flammability limit.
5. All sample materials will be returned to the customer after test completion for proper disposal.

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Conversion "K" Factors

Table #1 is applicable to all current Det-Tronics Combustible Gas Sensors including all CGSS-series sensor part numbers, as well as all 225006-XXX, 226530-XXX, 226531-XXX, 225957-XXX, 226999-XXX, and 226931-XXX series sensor part numbers.

Table #1 is **not** applicable to Det-Tronics C7061C series sensors (part numbers 003699-XXX), used with R8460/8466 and U8700A - D gas detection systems.

Table #1

Gas to be detected	Type of Calibration Gas		
	Methane	Hydrogen	Propane
Acetaldehyde	0.96	0.97	0.79
Acetic Anhydride	1.46	0.97	1.00
Acetone	1.44	1.65	1.04
Acetonitrile	-	-	1.10
Acetylene	1.12	1.56	0.95
Ammonia	1.06	1.40	0.83
Benzene	1.56	1.79	1.13
Butadiene	1.35	1.80	1.08
Butane	1.47	1.75	1.10
Calsol Thinner 325	-	-	1.70
Cyclohexane	1.49	1.70	1.07
Cumene	-	-	1.70
Dichloroethane	-	-	1.12
Dicyclopentadiene	2.06	1.63	1.51

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Gas to be detected	Type of Calibration Gas		
	Methane	Hydrogen	Propane
Diethyl Ether	1.20	1.11	0.97
Diesel fuel oil #2	-	-	2.30
Dimethylformamide	1.68	1.20	1.24
Ethane	1.24	1.41	0.89
Ethanol	1.26	1.43	0.91
Ethyl Acetate	-	-	1.12
Ethylbenzene	1.80	-	1.40
Ethylene	1.03	1.17	0.74
Ethylene Dichloride	-	-	1.12
Formaldehyde	0.69	0.65	0.54
Freon 142B	2.77	2.47	2.03
Gasoline	1.45	1.65	1.04
Heptane	-	-	1.42
Hexane	1.87	2.14	1.35
1-Hexene	1.27	1.36	1.04
Hydrogen	0.88	1.00	0.63
Isobutane	1.47	1.75	1.10
Isobutylene	1.11	1.46	0.89
Isopentane	1.50	1.71	1.08
Isoprene	0.97	0.86	0.82
Isopropyl Alcohol	1.31	1.22	1.09
Jet Fuel A	-	-	1.70
Jet Fuel JP-5	-	-	1.90

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Gas to be detected	Type of Calibration Gas		
	Methane	Hydrogen	Propane
Methane	1.00	1.14	0.72
Methanol	0.96	1.09	0.69
Methyl Acrylate	1.62	1.47	1.40
Methyl Ethyl Ketone	1.66	1.90	1.20
Methylisobutyl Ketone	-	-	1.25
Naptha (VM & P)	1.69	1.82	1.47
Pentane	1.50	1.72	1.08
Propane	1.39	1.59	1.00
Propylene	1.20	1.37	0.86
Stoddard Solvent	1.47	1.33	1.22
Styrene	-	-	1.90
Tetrahydrofuran	1.21	1.07	1.02
Toluene	1.69	1.94	1.22
Trimethyl amine	1.19	1.08	1.03
Xylene	1.75	2.20	1.33