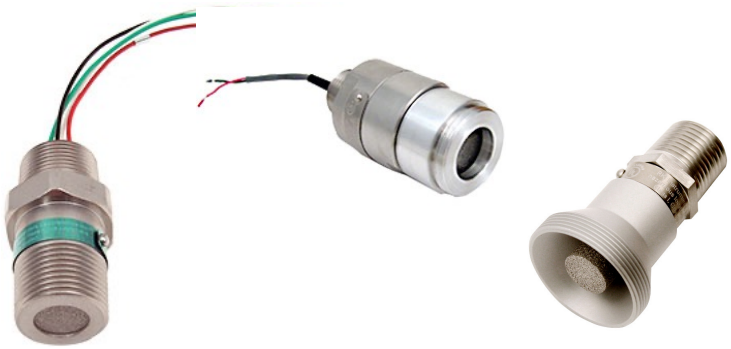
Gas Detection Basics



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Safety vs Process Control

- RKI's products mostly address safety applications
- A few of RKI's products may also address some process control applications
- **SAFETY**
  - Protecting life and property/assets
  - Gases normally not present
  - Detect occasional leaks if they occur
- **PROCESS CONTROL**
  - Adjusting processes based on the gas present
  - Gases normally present

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Types of Gases/Compounds

- Combustibles ----------
  - Flammable gases and vapors
    - Most are also toxic
    - Organic compounds (HC's)

Propane
Hexane

- "Toxics" ----------
  - Usually refers to non-hydrocarbons
    - Inorganic compounds (Non-HC's)
    - Several inorganic compounds are also combustible

H_2S
CO
Inorganic HC

- Inerts ----------
  - Non-reactive gases
    - Usually are N2, He, Ar

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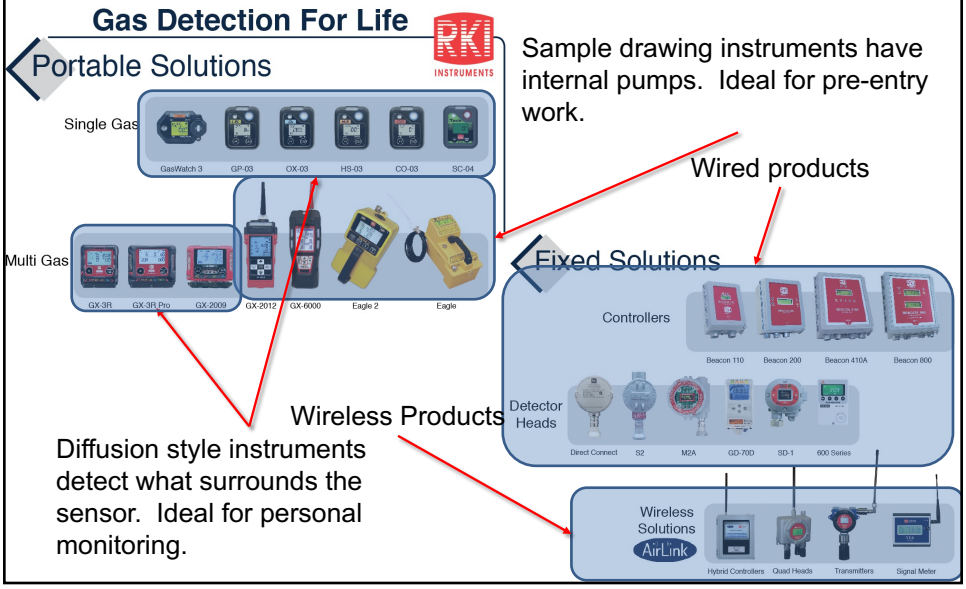
Product Family



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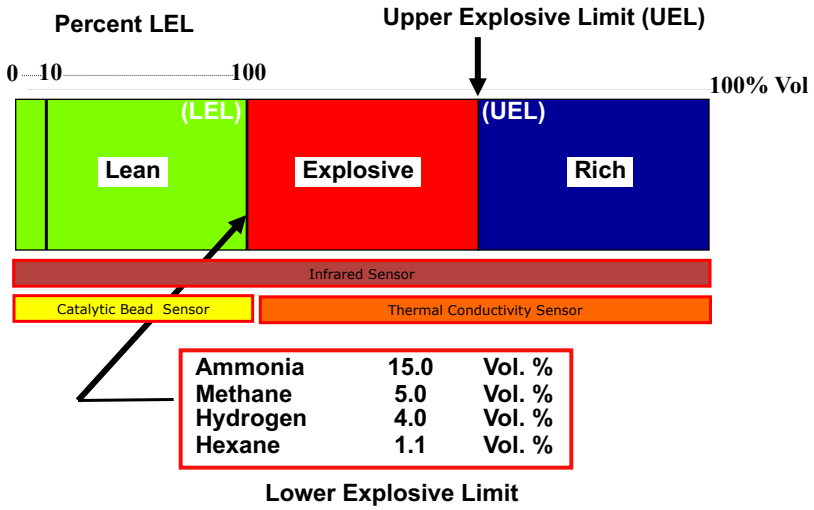
Flammability Band



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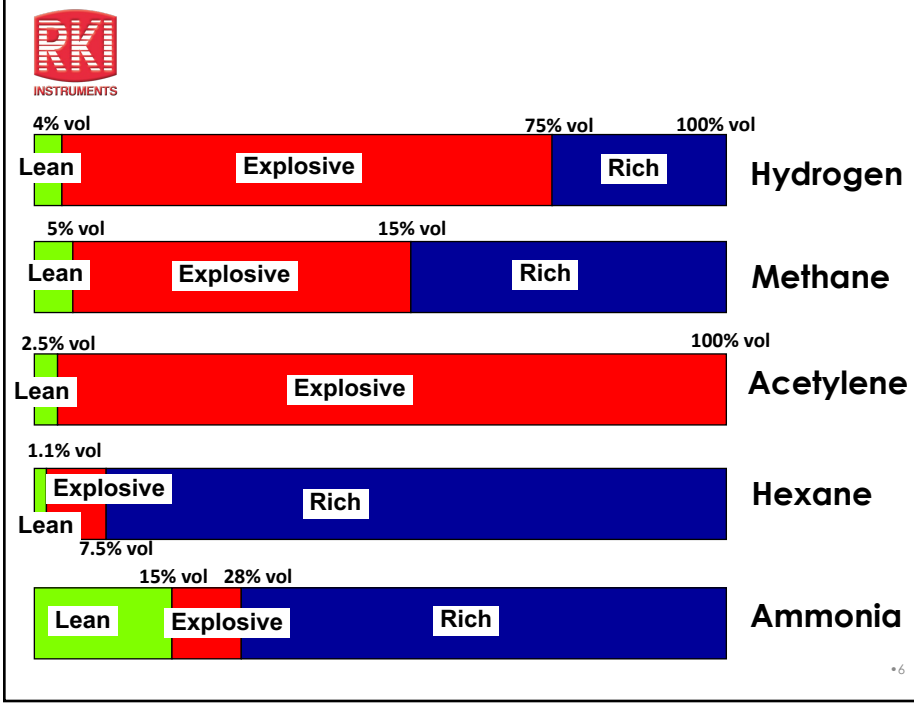

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Area Classifications

NEC Division System Gas Groups		
Area	**Group**	**Representative Materials**
Class I, Division 1 & 2 Div 1: ARE present Div 2: COULD be present	A	Acetylene
	B	Hydrogen
	C	Ethylene
	D	Propane
Class II, Division I & 2 No approvals for this Class	E (Division 1 only)	Metal dusts, such as magnesium
	F	Carbonaceous dusts, such as carbon & Charcoal
	G	Non-conductive dusts, such as flour, grain
	None	Ignitable fibers/flyings, such as cotton lint, flax & rayon

7

Toxicity

TLV's & PEL's: Threshold Limit Values & Permissible Exposure Levels

TWA
- Time Weighted Average:
  -Average Exposure over 8 hours

STEL
- Short Term Exposure Limit:
  -Average Exposure over 15 minutes

C
- Ceiling:
  -Not to be exceeded for any length of time

IDLH
- Immediately Dangerous to Life and Health:
  -30 minutes of exposure may result in permanent physiological damage

Agencies
- **ACGIH**: **A**merican **C**onference of **G**overnmental **I**ndustrial **H**ygienists
- **NIOSH**: **N**ational **I**nstitute of **O**ccupational **S**afety and **H**ealth
- **OSHA**: **O**ccupational **S**afety and **H**ealth **A**dministration

8

Inerts

- Oxygen deficiency
  - Permissible Low Levels Exposure
    - ✓ Oxygen sensor used to measure the displacement of oxygen by an inert compound
    - ✓ Typical first alarm points at 19.5% Vol. or 18.0% Vol. (Decreasing Alarm Logic)

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9

Sensor Technologies

- Catalytic - requires 10%vol oxygen present
  - ✓Combustibles- %LEL
- Metal Oxide Semiconductor (MOS)
  - requires 10%vol oxygen present
  - ✓Combustibles- PPM, % LEL
- Infrared – does not require oxygen be present
  - ✓Combustibles- %LEL, % Vol.
  - ✓Carbon Dioxide- PPM, % Vol.

•10

10

Sensor Technologies

- Thermal Conductivity –
  - ✓Combustibles- % Vol.
- Electrochemical – *Fixed: requires 2-5%vol oxygen present*
  - ✓Inorganic gases/Compounds PPB, PPM
- Galvanic (Partial Pressure) –
  - ✓Oxygen - %Vol.
- Galvanic (Capillary) -
  - ✓Oxygen - %Vol

•11

11

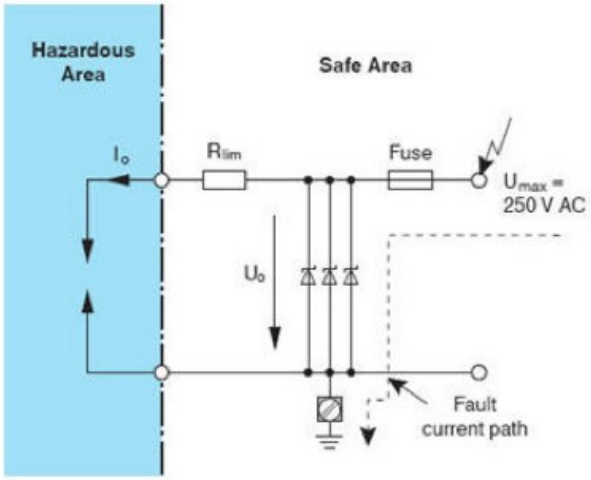
Sensor Technologies

- Zirconia
  - ✓PPM, %Vol O2
- Paper Tape –
  - ✓Formaldehyde, Inorganic gases – PPM

•12

12

Intrinsic Safety



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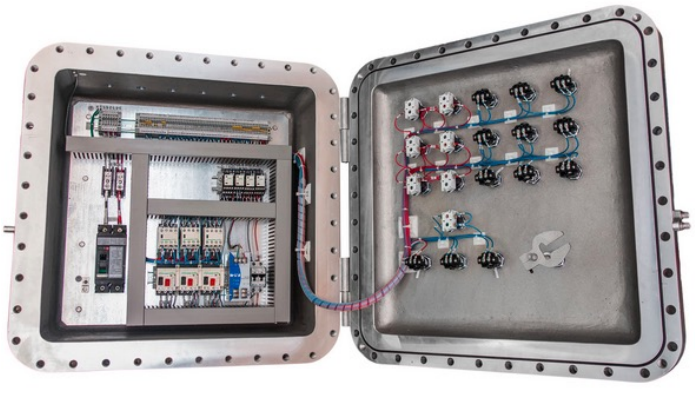
13

Explosion Proof



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14

Catalytic Bead Combustible Gas Sensor

15

Principle of Operation

- The catalytic bead sensor consists of two coils of fine platinum wire each embedded in a bead of alumina, connected electrically in a Wheatstone bridge circuit. One of the pellistors is impregnated with a special catalyst which promotes oxidation while the other is treated to inhibit oxidation. Current is passed through the coils so that they reach a temperature at which oxidation of a gas readily occurs at the bead treated with the platinum cataylist (500-550˚ C). Passing combustible gas raises the temperature further which increases the resistance of the platinum coil in the catalysed bead, leading to an imbalance of the bridge. This output change is linear, for most gases, up to and beyond 100% LEL, response time is a few seconds to detect alarm levels (around 20% LEL), at least 10% oxygen by volume is needed for the oxidation.

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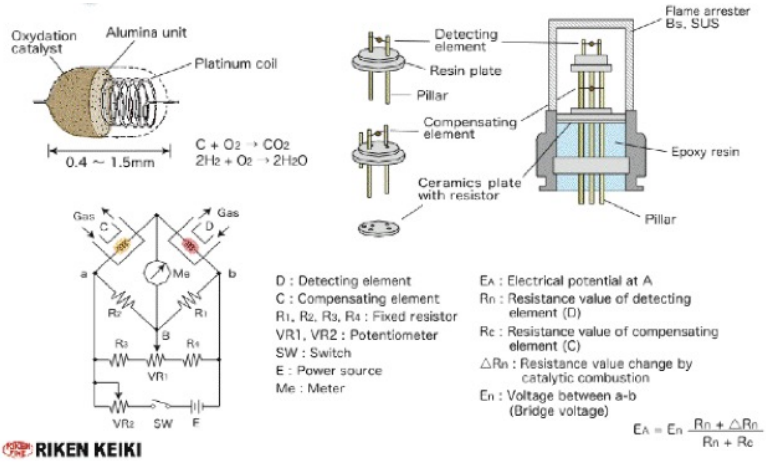
16

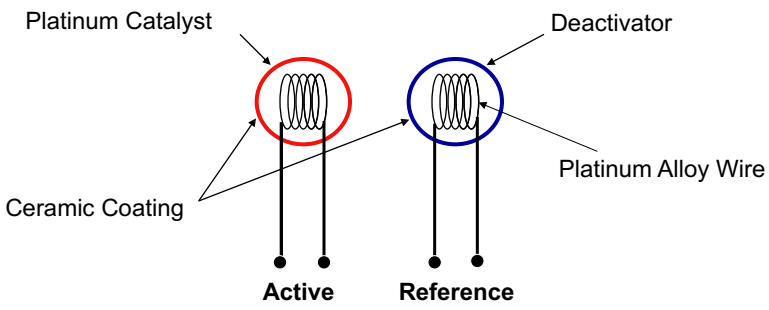
Catalytic Bead Sensor



RIKEN KEIKI

17

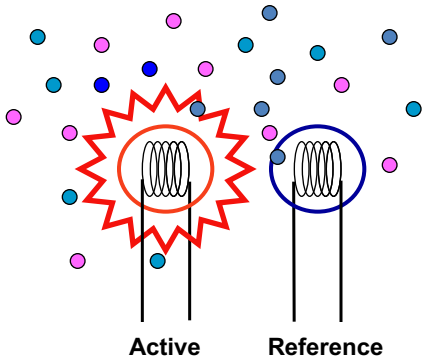
Catalytic Bead Sensor



Four Wire Catalytic Bead Combustible Gas Sensor
Constant Current

18

Catalytic Oxidation



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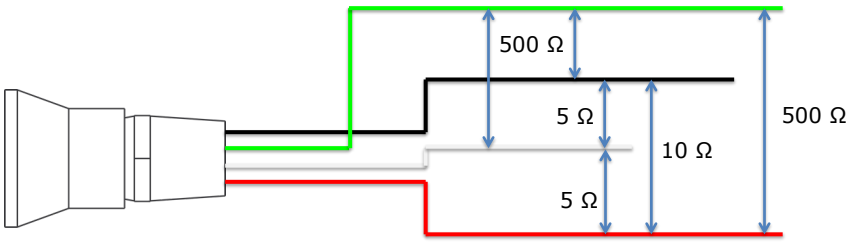
19

Catalytic Bead Sensor



Resistance values are approximate and will vary slightly Between sensors. H2 specific sensors will be approximately 3 Ohms per leg.

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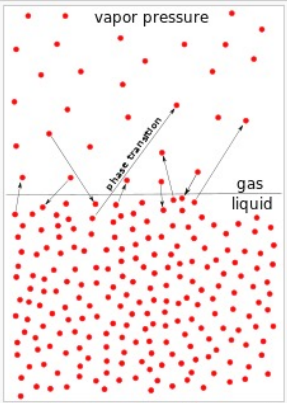
20

Catalytic Bead Sensor

- Sensor current for fixed systems can be adjusted to "tune" the gas sensor for specific gas to be detected
- Methane, Propane, Iso Butane, Pentane & Hexane Detection (NC-6241)
  - Set at 148 mA
- Hydrogen (NC-6241)
  - Set at 130 mA
- Hydrogen Specific (NC-6205)
  - Set at 115 mA

21

Vapor Pressure



The picture shows the particle transition, as a result of their vapor pressure, from the liquid phase to the gas phase and converse.

22

Hydrocarbon Comparison

Standard Temp and Pressure

gas

liquid

Formula	Name	Ign Temp Deg. F	Flash Point Deg. F	100% LEL	Vapor Density
CH4	Methane	999	Gas	5.0	0.60
C2H6	Ethane	882	Gas	3.0	1.00
C3H8	Propane	842	Gas	2.1	1.60
C4H10	Butane	550	Gas	1.9	2.00
C5H12	Pentane	500	<-40	1.5	2.50
C6H14	Hexane	437	-7	1.1	3.00
C7H16	Heptane	399	25	1.05	3.50
C8H18	Octane	403	56	1.00	3.90
C9H20	Nonane	401	88	0.80	4.40
C10H22	Decane	410	115	0.80	4.90

* %volume equivalent

•23

23

Common Failures

- Reading pegs either upscale or downscale
  - Open Active or Reference detector element
  - Excessive vibration can damage the filaments
  - Liquids or corrosion can cause output failure
- Unstable or Erratic Operation
  - Reading can be slow to respond or slow to recover due to contamination of the sensor elements and or contamination of the flame arrestor

•24

24

Common failures

- Low span on test gas
  - Deterioration of the catalyst caused by continuous exposure to flammable gas, repeated exposure to high concentrations of gas, contamination or age of the sensor.
- Exposure to catalyst poisons such as:
  - Silicone compounds
  - Chlorinated hydrocarbons
  - Corrosive gases or vapors
  - Leaded gasoline

25

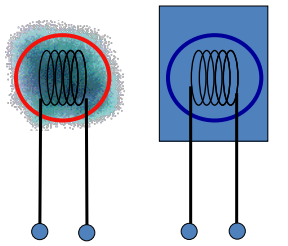
Thermal Conductivity Gas Sensor

26

Thermal Conductivity

Reference element contained out of gas stream

Temperature coefficient of air is different than gas causing temperature of coil to cool increasing resistance. No catalytic activity on sensor.



Active **Reference**

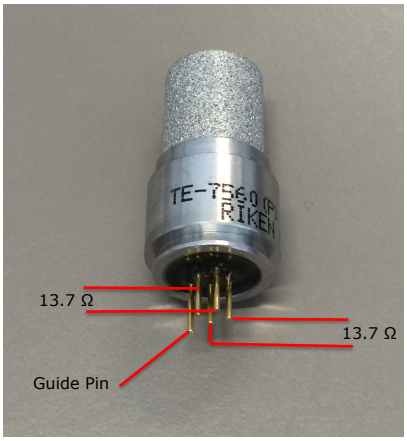
•27

27

TC Troubleshooting

- TC sensors may open causing instrument to fail.
- Contamination can cause the sensor to respond improperly or become unstable.

TE-7560 H2 Detector



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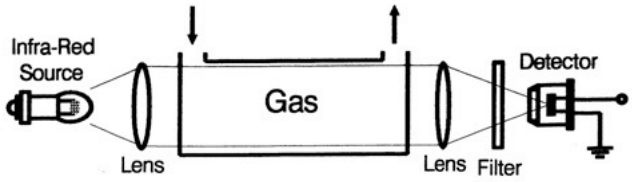
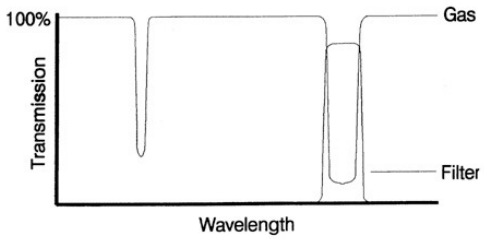
28

Infrared
Gas Sensor

29

Sample Draw NDIR Sensor





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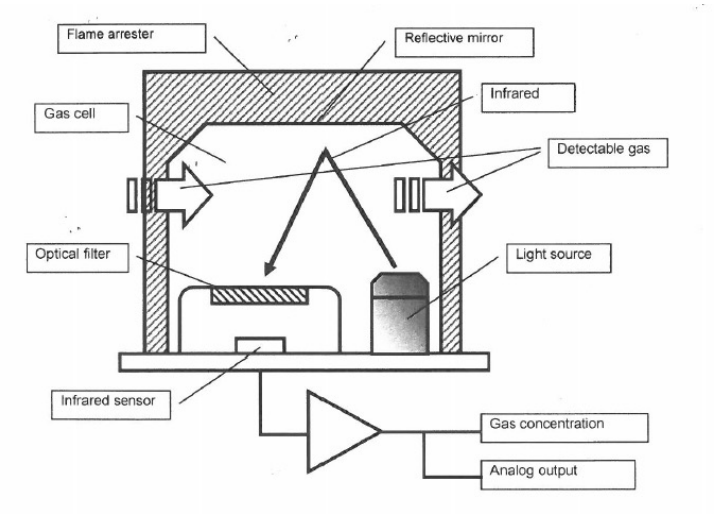
30

Diffusion IR Sensor



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31

NDIR Troubleshooting

- Contamination of the sensor will reduce energy reaching sensor causing high output. Contaminants consist of:
  - Dust
  - Moisture/Liquid
- Open IR source will cause output to peg upscale

•32

32

CAT vs TC vs IR

Sensor Type	Pros	Cons
Catalytic Bead	Linear output, responds to most hydrocarbons, low cost, long life, can be used for ppm HC detection	Affected by catalyst poisons, not suitable for wet or high vibration areas, requires oxygen to operate, not suitable for measuring gas above 100% LEL
Infrared	Not affected by catalyst poisons, long life, requires less frequent calibration,	Non linear output, not suitable for high vibration or humid areas, will not respond to certain compounds such as hydrogen and acetylene. Not suitable for low ppm detection.

•33

33

CAT vs TC vs IR

Sensor Type	Pros	Cons
Thermal conductivity	Long life, does not require oxygen to operate, sensors available for methane and hydrogen,	Not suitable for ppm combustible detection,

•34

34

Galvanic Oxygen Gas Sensor

35

Galvanic Sensor

Principle of Operation

- The oxygen sensor is a galvanic fuel cell with a gas-permeable Teflon membrane at one end. Any gas that is in contact with the sensor membrane will diffuse through the membrane and dissolve in a thin layer of weak acetic acid gel electrolyte. Oxygen reduces at the gold cathode and lead oxidizes at the anode.
- At the cathode:
  - $O_2 + 2H_2O + 4e^- \Rightarrow 4\ OH^-$
- At the anode:
  - $2Pb + 4OH^- \Rightarrow 2\ PbO + 2H_2O + 4e^-$
- The flow of electrons from the anode to the sensing cathode via an external electronic circuit is directly proportional to the amount of oxygen in the gas phase and varies linearly with the partial pressure of the oxygen in the gas stream. The electrolyte conducts the ionic current, generated by the migrating OH- groups.

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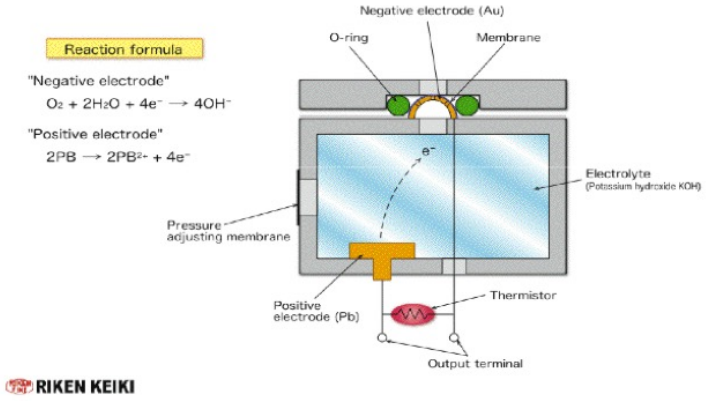
36

Galvanic Oxygen Sensor



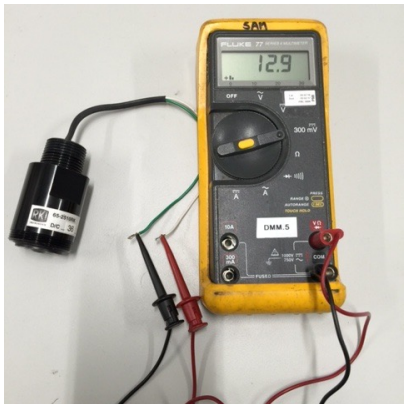
Typical output: 11-18 mV in fresh air

37

Oxygen Sensor Troubleshooting

Replace Sensor if:

- Voltage is outside specifications
- Unstable output
- Will not zero with N2 applied
- Leaking
- Corroded or contaminated



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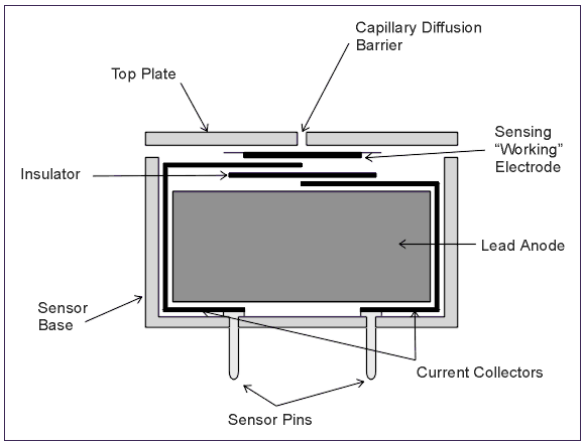
Capillary Oxygen Sensor

39

Capillary Oxygen Sensor



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Metal Oxide Semiconductor Gas Sensor

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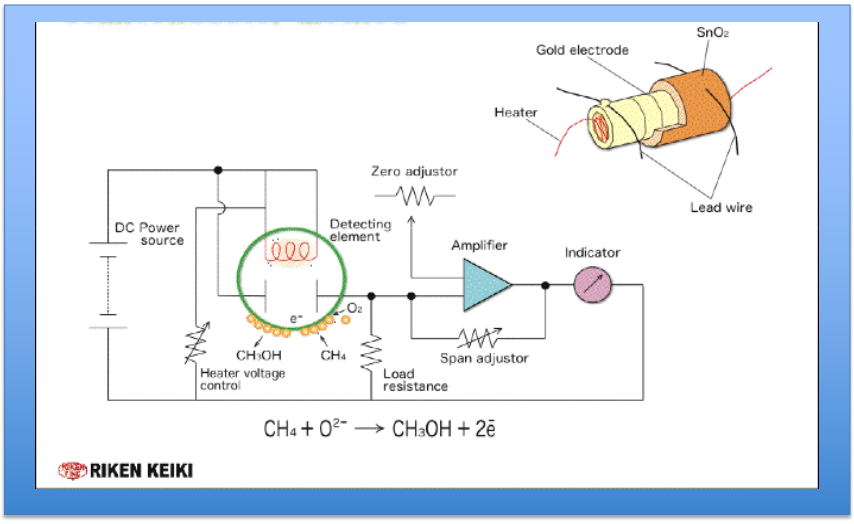
41

MOS Sensor



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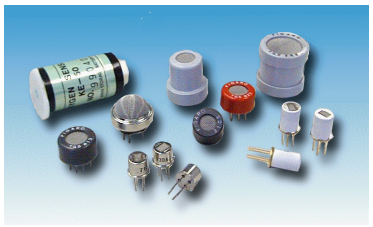
MOS Troubleshooting

- Contamination of oxide layer will cause unstable or erratic output
- Improper heater voltage will cause sensor to function improperly



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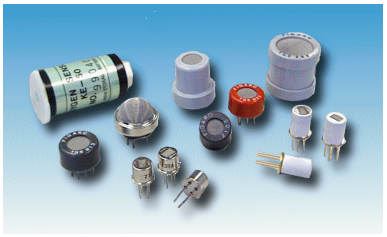
43

MOS Sensor

- Non linear output
- Responds to many different gases, non-specific
- May respond to moisture
- Broadband gas sensor



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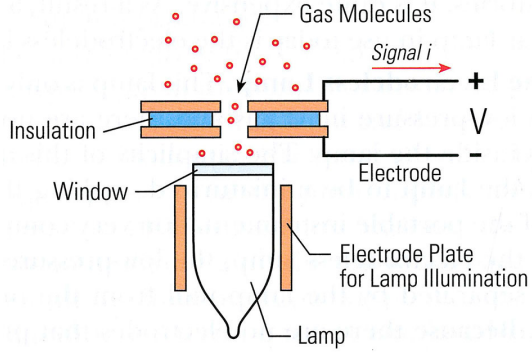
44

Photo Ionization Detector

- A PID is a broadband VOC detection technique



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45

Partial List of PID Detectable Compounds

						Lamp Photon Energy		
Chemical Name	Alternate Name	Formula	CAS no.	IE* (eV)	11.7 eV	10.6 eV	10.0 eV
Acetaldehyde		C2H4O	75-07-0	10.23	1.5	3.4	ZR*
Acetamide		C2H5NO	60-35-5	9.69	NA*	2	NA
Acetic acid		C2H4O2	64-19-7	10.66	2.6	36.2	ZR
Acetic anhydride		C4H6O3	108-24-7	10.14	2	4.0	NA
Acetoin	3-Hydroxybutanone	C4H8O2	513-86-0	~9.8	NA	1	NA
Acetone	2-Propanone	C3H6O	67-64-1	9.69	1.4	0.7	1.2
Acetone cyanohydrin		C4H7NO	75-86-5	11.09	1	ZR	ZR
Acetonitrile		CH3CN	75-05-8	12.2	100	ZR	ZR
Acetophenone	Methyl phenyl ketone	C8H8O	98-86-2	9.29	NA	0.6	NA
Acetyl bromide		C2H3BrO	506-96-7	10.24	NA	3	NA
Acetylene		C2H2	74-86-2	11.4	2	ZR	ZR
Acetylglycine, N-		C4H7NO3	543-24-8	9.4	NA	2	NA
Acrolein		C3H4O	107-02-8	10.22	1.2	3.2	NA
Acrylic Acid		C3H4O2	79-10-7	10.6	2	2.7	ZR
Acrylonitrile		C3H3N	107-13-1	10.91	1.2	ZR	ZR
Alkanes, n-, C6+		CnH2n+2	N/A	~10	NA	1	NA
Allyl acetoacetate		C7H10O3	1118-84-9	~10	NA	1.5	ZR
Allyl alcohol		C3H6O	107-18-6	9.63	1.7	2.1	NA
Allyl bromide	3-Bromopropene	C3H5Br	106-95-6	9.96	NA	3.0	NA
Allyl chloride	3-Chloropropene	C3H5Cl	107-05-1	10.05	0.7	4.5	NA
Allyl glycidyl ether		C6H10O2	106-92-3	~10	NA	0.8	NA
Allyl propyl disulfide		C6H12S2	2179-59-1	~8.5	NA	0.4	NA
Ammonia		NH3	7664-41-7	10.18	5.7	8.5	NA
Amyl acetate, sec-		C7H14O2	628-63-7	9.9	1	1.8	2
Amyl alcohol		C5H12O	71-41-0	10	4	3.5	NA
Amyl alcohol, tert-		C5H12O	75-85-4	9.8	NA	1.5	NA
Anethole		C10H12O	104-46-1	~9	NA	0.4	NA
Aniline		C6H7N	62-53-3	7.70	NA	0.48	0.80
Anisole		C7H8O	100-66-3	8.21	1	0.5	NA
Anisyl aldehyde		C8H8O2	123-11-5	~9	NA	0.4	NA
Argon		Ar	7440-37-1		ZR	ZR	NA

46

Chemical Name	Alternate Name	Formula	CAS no.	IE* (eV)	Lamp Photon Energy		
					11.7 eV	10.6 eV	10.0 eV
Arsine		AsH3	7784-42-1	9.89	3	2.5	NA
Asphalt, petroleum fumes			8052-42-4	~9	NA	1.0	NA
Benzaldehyde		C7H6O	100-52-7	9.49	1	0.9	1.5
Benzene		C6H6	71-43-2	9.244	0.4	0.46	0.59
Benzene thiol	Thiophenol	C6H5SH	108-98-5	8.32	NA	0.7	0.8
Benzoic acid		C7H6O2	65-85-0	9.30	NA	0.7	NA
Benzonitrile	Cyanobenzene	C7H5N	100-47-0	9.62	2	0.7	0.8
Benzoquinone, o-		C6H4O2	583-63-1	9.3	NA	1	NA
Benzoquinone, p-		C6H4O2	106-51-4	10.01	NA	1	NA
Benzoyl bromide		C7H5BrO	618-32-6	9.65	NA	2	NA
Benzyl 2-phenylacetate		C15H14O2	102-16-9	~9	NA	0.5	NA
Benzyl acetate		C9H10O2	140-11-4	~9	NA	0.6	NA
Benzyl alcohol		C7H8O	100-51-6	8.26	0.9	1.3	1.1
Benzyl chloride		C7H7Cl	100-44-7	9.14	0.28	0.48	NA
Benzyl formate		C8H8O2	104-57-4	9.32	0.66	0.8	NA
Benzyl isobutyrate		C11H14O2	103-28-6	~9	NA	0.5	NA
Benzyl nitrile		C8H7N	140-29-4	9.39	NA	1	NA
Benzyl propionate		C10H12O2	122-63-4	~9	NA	0.5	NA
Benzylamine		C7H9N	100-46-9	7.56	NA	0.6	NA
Biphenyl	Diphenyl	C12H10	92-52-4	8.23	NA	0.4	0.6
Borneol		C10H18O	507-70-0	~9	NA	0.8	NA
Boron trifluoride		BF3	7637.07.2	15.5	ZR	ZR	ZR
Bromine		Br2	7726-95-6	10.55	0.74	15	ZR
Bromine pentafluoride		BrF5	7789-30-2	13.17	ZR	ZR	ZR
Bromo-2,2-dimethylpropane, 1-	Neopentyl bromide	C5H11Br	630-17-1	10.04	NA	2	NA
Bromo-2-chloroethane, 1-		C2H4BrCl	107-04-0	10.57	NA	8	ZR
Bromo-2-methylpentane, 1-		C6H13Br	25346-33-2	10.09	NA	2	NA
Bromoacetone		C3H5BrO	598-31-2	9.73	NA	1	NA
Bromoacetylene		C2HBr	593-61-3	10.31	NA	4	ZR
Bromobenzene		C6H5Br	108-86-1	8.98	0.2	0.3	0.3
Bromobutane, 1-		C4H9Br	109-65-9	10.13	NA	1	NA
Bromobutane, 2-		C4H9Br	78-76-2	10.01	NA	1.5	NA
Bromochloromethane		CH2ClBr	74-97-5	10.77	NA	ZR	ZR
Bromocyclohexane		C6H11Br	108-85-0	9.87	NA	3	NA
Bromoethane		C2H5Br	74-96-4	10.29	NA	5.0	NA
Bromoethanol, 2-		C2H5BrO	540-51-2	10.00	NA	2	NA
Bromoethyl methyl ether, 2-		C3H7OBr	6482-24-2	10.00	2	2.5	NA
Bromofluoromethane		CH2FBr	373-52-4	~11	NA	ZR	ZR
Bromoform	Tribromomethane	CHBr3	75-25-2	10.48	0.5	2.8	ZR
Bromopentane, 1-	n-Pentyl bromide	C5H11Br	110-53-2	10.1	NA	2	NA
Bromopropane, 1-	n-Propyl bromide	C3H7Br	106-94-5	10.18	0.6	1.3	NA
Bromopyridine, 3-		C5H4BrN	625-55-1	9.75	NA	2	NA
Bromopyridine, 3-		C5H4BrN	1120-87-2	9.94	NA	2	NA
Bromotrifluoromethane		CF3Br	75-63-8	11.78	NA	ZR	ZR
Bromotrimethylsilane		C3H9BrSi	2857-97-8	10.00	NA	2	NA
But-2-ynal		C4H4O	1119-19-3	10.2	NA	3	NA
But-3-ynal		C4H4O	52844-23-2	9.85	NA	1.5	NA
Butadiene diepoxide, 1,3-		C4H6O2	1464-53-5	10.00	1.2	4.0	NA
Butadiene, 1,3-		C4H6	106-99-0	9.07	1.1	0.8	0.8
Butane, n-		C4H10	106-97-8	10.63	2	44	ZR
Butanedione, 2,3-	Biacetyl, Diacetyl	C4H6O2	431-03-8	9.56	NA	0.4	NA
Butanoic acid		C4H8O2	107-92-6	10.17	NA	5.0	NA
Butanol, 1-		C4H10O	71-36-3	10.04	1.4	4.0	NA

47

Electrochemical Toxic Gas Sensor

48

Electrochemical Sensors

5 Key Factors that separate Riken sensors from the competition

- Electrode material
- Bias voltage
- Electrolyte
  - Sulfuric acid
  - Potassium Iodide
  - Potassium Iodate
- Reaction area of electrode
- Electrolyte reaction

•49

49

Electrochemical Sensors

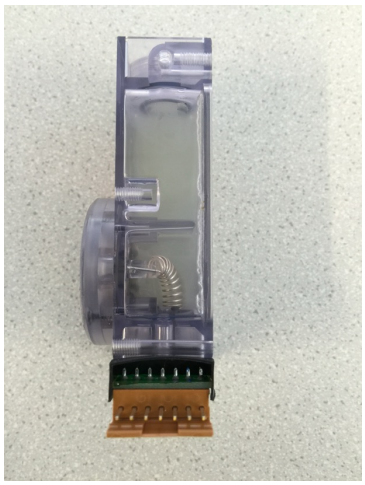
- Long life (2+ years)
- Excellent stability
- High degree of selectiveness
- Easy to replace and calibrate

•50

50

Electrochemical Sensors

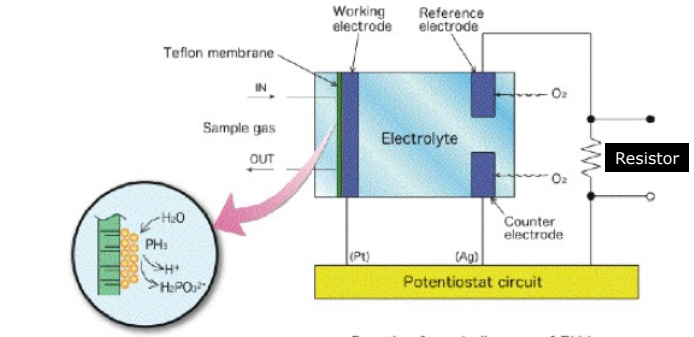
- May require bias stabilization period
- Replace if:
  - Sensor has low span
  - Sensor is unstable
  - Unable to set zero
  - Electrolyte is contaminated
  - Sensor is leaking



•51

51

Electrochemical Sensors



Reaction formula (In case of PH_3)

Working electrode : $PH_3 + 3H_2O \rightleftarrows H_2PO^{3-} + 7H^+ + 6e^-$

Reference electrode : $3/2\ O_2 + 6H^+ + 6e^- \rightleftarrows 3H_2O$

Counter electrode : $1/2\ O_2 + 2H^+ + e^- \rightleftarrows H_2O$

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•52

52

Sensor Troubleshooting

Symptom	Probable Cause	Corrective Action
• Catalytic bead LEL sensor will not zero	• Open or high offset sensor • Open wire in sensor circuit • Defective LEL sensor amplifier (if applicable)	• Replace sensor • Ring out sensor wiring, especially if sensor is remote mounted from controller or amplifier. Replace wiring as needed. • Replace amplifier as required. • Note: To assist in troubleshooting, swap sensor and/or amplifier from a known working unit to confirm problem. Also, relocate sensor and/or amplifier and attach directly to main controller to confirm if wiring problem.
• Catalytic bead LEL sensor readings are unstable or random spiking up or downscale	• Sensor element has intermittent connection or corroded • Loose wire • Noise created by EMI or RFI • Defective pre-amp • Defective amplifier	• Replace sensor • Tighten all wiring terminals • Make sure sensor wires are shielded and properly grounded. Note: Do not attach ground wires in the transmitter housing and at the controller. Tape off drain wire in the amplifier housing and connect the drain wire at the ground terminal at the controller. • If shielded and grounded correctly, increase alarm delay as needed
• Catalytic bead LEL sensor will not span with calibration gas	• Sensor catylast depleted and/or sensor is contaminated • Incorrect test gas • Incorrect sensor type • Incorrect amplifier or LEL sensor current setting	• Replace sensor • Verify proper gas concentration and that gas is in air if using a catalytic bead sensor • Make sure that the sensor being calibrated is for the proper gas. Example H2 specific sensor installed and calibrating using methane. • Make sure that amplifier current is properly set for the correct sensor

53

Sensor Troubleshooting

Symptom	Probable Cause	Corrective Action
• Electrochemical toxic gas sensor will not zero in fresh air or with zero emissions air applied or will not span using calibration gas.	• Sensor is expired • Sensor pre-amp is bad • Amplifier (if applicable) is bad	• Replace sensor as required • Replace sensor pre-amp • Replace amplifier if needed. • Note: If there are other same sensors on the system that are working properly, swap components, such as sensor, then pre-amp then amp to determine what component has failed.
• Electrochemical toxic gas sensor will not span with test gas.	• Electrochemical sensor expired • Test gas expired • Incorrect test gas	• Replace sensor • Replace test gas • Verify that calibration gas is of the proper type and concentration
• Oxygen sensor can not be set to fresh air value (20.9%)	• Expired oxygen sensor • Sensor output too low or too high	• Replace oxygen sensor • For partial pressure oxygen sensors, measure across the White and Green wires for output. Normal output in fresh air should be between 12 and 18 mV DC. • Capillary oxygen sensors must be measured pluged into their respective preamp housing.
• Infrared LEL gas sensor will not zero with fresh air applied.	• Open IR source in sensor • Open wire in detector line	• Replace IR sensor • Ring out wires in sensor circuit to verify none are open or shorted.
• Infrared LEL gas sensor will not span with calibration gas.	• Sensor contaminated • Improper gas being used	• Replace IR LEL sensor • Verify that the test gas is the proper type for the sensor.

54

Understanding Date Codes

- Each RKI Sensor has a date code to determine warranty begin date.
  - The date code may be a small adhesive label on the sensor or may be read from the serial number on the sensor.
  - Example: S/N 792D01278AT
    - Date code is 79 (Mfg. date)
    - First numeral is the year (2017)
    - Second numeral is the month (August)
    - Months are coded 1=Jan to 9= Sept. Oct.= X, Nov. = Y and Dec. = Z.
    - Note: Warranty for this sensor starts on December 2017 based upon D/C sticker 7Z.

•55

55

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Acetic Acid

Part Number: ES-K233-CH3COOH
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol	0.0 ppm
Ammonia (NH3)	39.4	0.0 ppm
Arsine (AsH3)	1	0.0 ppm
Bromine (Br2)	1	19 ppm
Butane (C4H10)	1.0% vol	0.0 ppm
Carbon Dioxide (CO2)	1.0 % vol	0.0 ppm
Carbon Monoxide (CO)	286.6	0.0 ppm
Chloroform (CHCl3)	0.69% vol	0.0 ppm
Chlorine (Cl2)	0.8	15 ppm
Chlorine Trifluoride (ClF3)	1	17 ppm
Diborane (B2H6)	10	0.0 ppm
Disilane (Si2H6)	10	0.0 ppm
Ethanol (C2H5OH)	10% vol	0.0 ppm
Fluorine (F2)	2.0	24 ppm
Flon 14 (CF4)	1% vol	0.0 ppm
Flon 16 (C2F6)	1% vol	0.0 ppm
Hydrogen (H2)	99.9% vol	0.0 ppm
Hydrogen Bromide (HBr)	5.6	3.8 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	3.0	38 ppm
Hydrogen Cyanide (HCN)	20	-7.5 ppm
Hydrogen Fluoride (HF)	6	86 ppm
Hydrogen Sulfide (H2S)	32.8	-1.9 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	3.0% vol	0.0 ppm
Iodine (I2)	1	15 ppm
Methane (CH4)	99.9% vol	0.0 ppm
Methanol (CH3OH)	10% vol	0.0 ppm
Nitric Acid (HNO3)	5.0	32 ppm
Nitric Oxide (NO)	102.4	0.0 ppm
Nitrogen Dioxide (NO2)	101	56 ppm
Nitrogen Trifluoride (NF3)	1.0	0.0 ppm
Ozone (O3)	5	66 ppm
Phosgene (COCl2)	1	0.0 ppm
Phosphine (Ph3)	1.1	0.0 pm
Silane (SiH4)	10	0.0 ppm
Sulfur Dioxide (SO2)	10	37.5 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ammonia (NH3)

Part Number: ES-23PX-NH3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 75 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	30.0	-24.0
Acetone ((CH3)2CH)	1% vol.	0.0
Carbon Dioxide (CO2)	1.6% vol.	-8.0
Carbon Monoxide (CO)	300.0	0.0
Carbon Tetrafluoride (CF4)	1% vol.	0.0
Chlorine (Cl2)	2.7	-3.0
Ethanol (C2H5OH)	1% vol.	0.0
Fluorine (F2)	5.0	-10.0
Hexafluroethane R-116 (C2F6)	1% vol.	0.0
Hydrogen (H2)	5% vol.	3.0
Hydrogen Chloride (HCl)	9.0	-21.0
Hydrogen Cyanide (HCN)	10.0	0.0

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	-34.0
Hydrogen Sulfide (H2S)	30.0	0.0
I.P.A. ((CH3)2CHOH)	1.0% vol.	0.0
IsoButane (C4H10)	1% vol.	0.0
Methane (CH4)	10% vol.	0.0
Methanol (CH3OH)	1% vol.	0.0
Nitric Acid (HN03)	9.0	-9.0
Nitric Oxide (NO)	100.0	0.0
Nitrogen Dioxide (NO2)	7.7	-3.0
Nitrogen Trifluoride (NF3)	50.0	0.0
Ozone (O3)	10.0	-3.0
Phosphoric Acid (H3PO4)	50.0	-0.3

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ammonia (NH_3)

Part Number: ES-23R-NH3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 75 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Arsine (AsH3)	0.51	- 0.1
Carbon Dioxide (CO2)	2500 ppm @ 3 min.	-0.4
	16% vol. @ 20 min.	1.2
Carbon Monoxide (CO)	100.00	0.00
Diborane (B2H6)	5.34	0.90
Diethyl Triamine (H2N(CH2CH2NH)2H)	30.00	0.00
Ethylamine ((CH3)2NH)	30.00	23.00
Hydrogen (H2)	2% vol. @ 3 min.	1.80
	99.9% vol. @ 8 hours	73.20

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	20.00	-10.0
Hydrogen Sulfide (H2S)	33.00	1.60
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol.	1.00
Nitrogen Dioxide (NO2)	96.00	-43.7
Phosphine (Ph3)	0.59	-0.1
Silane (SiH4)	13.90	-0.2
Sulfur Dioxide (SO2)	52.00	-17.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Arsine (AsH3)

Part Number: ES-23AH-ASH3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2% vol.	0.0
Ammonia (NH3)	150.0	0.0
Butyl Acid (CH3COO(CH2)3CH3)	1% vol.	0.0
Chlorine (Cl2)	1.0	-0.7
Fluorine (F2)	3.0	0.0
Hydrogen (H2)	1% vol.	0.1
Hydrogen Cyanide (HCN)	10.0	0.09

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	1.0	0.6
I.P.A. ((CH3)2CHOH)	1% vol.	0.0
Nitric Oxide (NO)	8.0	-0.5
Sulfur Dioxide (SO2)	5.0	0.07
Toluene (C6H5CH3)	1% vol.	0.0
Trichloroethylene (CHCl:CCl2)	1% vol.	0.0
Xylene (C6H4(CH3)3)	.4% vol.	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Arsine (AsH3)

Part Number: ES-23AHS-ASH3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 - 0.2 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol.	0.006
Acetylene (C2H2)	4.3	0.050
Carbon Dioxide (CO2)	99.8% vol.	0.013
Carbon Monoxide (CO)	300	0.018
Chlorine (Cl2)	0.25	-0.050
Diborane (B2H6)	0.67	0.050
Disilane (Si2H6)	0.14	0.050
Ethylene (C2H4)	.17% vol.	0.050
Germanium Tetrahydride (GeH4)	0.18	0.050
Hydrogen (H2)	.8 % vol.	0.050
Hydrogen Bromide (HBr)	1.5	0.050
Hydrogen Chloride (HCl)	1.4	0.050

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	8.3	0.050
Hydrogen Selenide (SeH2)	0.059	0.050
Hydrogen Sulfide (H2S)	0.06	0.050
I.P.A. ((CH3)2CHOH)	1% vol.	0.008
Methanol (CH3OH)	1% vol.	0.002
Nitric Oxide (NO)	15	0.050
Nitrogen Dioxide (NO2)	0.29	-0.050
Ozone (O3)	0.24	0.050
Phosphine (Ph3)	0.034	0.050
Silane (SiH4)	0.3	0.050
Sulfur Dioxide (SO2)	0.4	0.050
Toluene (C7H8)	1% vol.	0.009

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Bromine (Br2)

Part Number: ES-K233-Br2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	16.5
Ammonia (NH3)	39.4	0.0
Carbon Dioxide (CO2)	1% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.0
Chlorine Trifluoride (ClF3)	1.0	0.9
Ethanol (C2H5OH)	10% vol.	0.0
Fluorine (F2)	2.0	1.3
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	2.0
Hydrogen Cyanide (HCN)	20.0	-0.4

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	4.6
Hydrogen Sulfide (H2S)	32.8	-0.1
Iodine (I2)	1.0	0.8
I.P.A. ((CH3)2CHOH)	3% vol.	0.0
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10% vol.	0.0
Nitric Acid (HN03)	5.0	1.7
Nitrogen Dioxide (NO2)	101.0	3.0
Ozone (O3)	5.0	3.5
Phosgene (COCl2)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

BTBAS

Part Number: ES-23RV-BTBAS
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement			**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Ammonia (NH3)	2.5	1 ppm

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RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Carbon Monoxide (CO)

Part Number: ES-23-CO
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	1 – 150 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Carbon Monoxide (CO)	5%	1.00
Ethane (C2H6)	62.00	1.00
Ethylene (C2H4)	10.00	1.00
Hydrogen (H2)	50.00	1.00
Hydrogen Sulfide (H2S)	20.00	0.00
IsoButane (C4H10)	1%	0.00

Gas	PPM Gas Applied	Reading
Methane (CH4)	5%	0.00
Nitric Oxide (NO)	25.00	54.00
Nitrogen Dioxide (NO2)	10.00	-3.00
Propylene (C3H6)	10.00	1.00
Sulfur Dioxide (SO2)	21.00	0.00

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Carbon Monoxide (CO)

Part Number: ES-81-CO
Sensor Application: EAGLE

Technical Specifications			
Measuring Principle	Amperometric 2-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 300 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	10.0	1.0
Benzene (C6H6)	1% vol.	1.0
Carbon Dioxide (CO2)	no response	1.0
Carbon Monoxide (CO)	1.0	1.0
Chlorine (Cl2)	no response	1.0
Ethane (C2H6)	no response	1.0
Ethylene (C2H4)	10.0	1.0
Hexane (C6H14)	3% vol.	1.0
Hydrogen (H2)	30.0	1.0

Gas	PPM Gas Applied	Reading
IsoButane (C4H10)	no response	1.0
Methane (CH4)	no response	1.0
Methanol (CH3OH)	0.4	1.0
Nitric Oxide (NO)	0.2	1.0
Nitrogen Dioxide (NO2)	no response	1.0
Pentane (C5H12)	2% vol.	1.0
Sulfur Dioxide (SO2)	2.0	1.0
Toluene (C7H8)	5% vol.	1.0
Xylene (C8H10)	1% vol.	1.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Carbon Monoxide (CO) with filter

Part Number: ES-231-CO w/ filter
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.60 % vol	25 ppm
Acetylene (C2H2)	19 ppm	25 ppm
Arsine (AsH3)	2.5 ppm	25 ppm
Carbon Dioxide (CO2)	5.00 % vol	0 ppm
Ethanol (C2H5OH)	43 ppm	25 ppm
Ethylene (C2H4)	110 ppm	25 ppm
Hydrogen (H2)	530 ppm	25 ppm
Hydrogen Sulfide (H2S)	1.7 ppm	25 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	35 ppm	25 ppm

Gas	PPM Gas Applied	Reading
Methane (CH4)	5000 ppm	0 ppm
Methanol (CH3OH)	85 ppm	25 ppm
Nitric Oxide (NO)	8.0 ppm	25 ppm
Nitrogen Dioxide (NO2)	12 ppm	-25 ppm
Ozone (O3)	11 ppm	-25 ppm
Phosphine (Ph3)	2.5 ppm	25 ppm
Silane (SiH4)	2.7 ppm	25 ppm
Sulfur Dioxide (SO2)	9.2 ppm	25 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Carbon Monoxide (CO)

Part Number: ES-1531-CO
Sensor Application: Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 300 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Chlorine (Cl2)	0.40	-1.0
Ethylene (C2H4)	0.90	1.0
Hydrogen (H2)	0.60	1.0
Hydrogen Chloride (HCl)	0.05	1.0
Hydrogen Cyanide (HCN)	0.40	1.0

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	3.50	1.0
Nitric Oxide (NO)	.25	1.0
Nitrogen Dioxide (NO2)	0.60	-1.0
Sulfur Dioxide (SO2)	0.65	1.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Carbon Monoxide (CO)

Part Number: ES-1821-CO

Sensor Application: GX-2001, GX-2003, GasWatch 2

Technical Specifications			
Measuring Principle	Amperometric 2-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 300 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	10,000 ppm	2 ppm
Acetylene (C2H2)	490 ppm	25 ppm
Ammonia (NH3)	60 ppm	1 ppm
Chlorine (Cl2)	13 ppm	-1ppm
Ethylene (C2H4)	49 ppm	25 ppm
Hydrogen (H2)	72 ppm	25 ppm
Hydrogen Chloride (HCl)	89 ppm	-1 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	1,300 ppm	25 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	530 ppm	25 ppm
Nitrogen Dioxide (NO2)	140 ppm	25 ppm
Nitric Oxide (NO)	72 ppm	25 ppm
Ozone (O3)	1.9 ppm	1 ppm
Sulfur Dioxide (SO2)	32 ppm	25 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorine (Cl2)

Part Number: ES-K233-Cl2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 3 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	16.5
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.0
Carbon Dioxide (CO2)	1.0% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine Trifluoride (C1F3)	1.0	0.9
Ethanol (C2H3OH)	10% vol.	0.0
Fluorine (F2)	2.0	1.3
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HC1)	3.0	2.0
Hydrogen Cyanide (HCN)	20.0	-0.4

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	4.6
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3.0% vol.	0.0
Iodine (I2)	1.0	0.8
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10% vol.	0.0
Nitric Acid (HN03)	5.0	1.7
Nitrogen Dioxide (NO2)	101.0	3.0
Ozone (O3)	5.0	3.5
Phosgene (COC12)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorine (Cl2)

Part Number: ES-K239B-CL2
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 -3 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Ammonia (NH3)	39.7 ppm	0.0 ppm
Bromine (Br2)	10 ppm	0.0 ppm
Carbon Dioxide (CO2)	1.0% vol	0.0 ppm
Carbon Monoxide (CO)	100.2 ppm	0.0 ppm
Chlorine (Cl2)	0.8 ppm	0.8 ppm
Fluorine (F2)	2.0 ppm	0.4 ppm
Halocarbon 14 (CF4)	490 ppm	0.0 ppm
Hydrogen (H2)	100% vol	0.0 ppm
Hydrogen Chloride (HCl)	5.9 ppm	0.0 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0 ppm	0.0 ppm
Hydrogen Sulfide (H2S)	30.7 ppm	-0.3 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.3% vol	0.0 ppm
Methane (CH4)	100% vol	0.0 ppm
Nitric Oxide (NO)	101.2 ppm	0.0 ppm
Nitrogen Dioxide (NO2)	48.5 ppm	0.1 ppm
Ozone (O3)	0.5 ppm	0.0 ppm
Phosphine (Ph3)	1.0 ppm	0.0 ppm
Sulfur Dioxide (SO2)	50.1 ppm	0.0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorine Dioxide (ClO2)

Part Number: ES-23AH-CL2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol.	0.0
Ammonia (NH3)	150.0	0.0
n-Butyl Acetate (CH3COO(CH2)3CH3)	1 % Vol.	0.0
Bromine (Br2)	0.8	1.2
Chlorine (Cl2)	1.0	2.0
Ethanol (C2H5OH)	1.3% vol.	0.0
Fluorine (F2)	4.0	2.4
Hydrogen (H2)	1% vol.	0.0
Hydrogen Chloride (HCl)	6.0	-0.88
Hydrogen Cyanide (HCN)	8.0	0.00

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	1.0	-2.59
I.P.A. ((CH3)2CHOH)	1.1% vol.	0.0
Ethanol (CH3OH)	1% vol.	0.0
Nitrogen Dioxide (NO2)	8.0	11.0
Ozone (O3)	0.6	1.2
Sulfur Dioxide (SO2)	5.0	0.0
Toluene (C6H5CH3)	1% vol.	0.0
Trichloroethylene (CHCl:CCl2)	1.1% vol.	0.0
Xylene (C6H4(CH3)3)	0.6% vol.	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorine (Cl2)

Part Number: ES-K233-Cl2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 3 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	16.5
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.0
Carbon Dioxide (CO2)	1.0% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine Trifluoride (C1F3)	1.0	0.9
Ethanol (C2H3OH)	10% vol.	0.0
Fluorine (F2)	2.0	1.3
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HC1)	3.0	2.0
Hydrogen Cyanide (HCN)	20.0	-0.4

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	4.6
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3.0% vol.	0.0
Iodine (I2)	1.0	0.8
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10% vol.	0.0
Nitric Acid (HN03)	5.0	1.7
Nitrogen Dioxide (NO2)	101.0	3.0
Ozone (O3)	5.0	3.5
Phosgene (COC12)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorine Trifluoride (ClF3)

Part Number: ES-K233-ClF3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	19.5
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.2
Carbon Dioxide (CO2)	1% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.2
Ethanol (C2H5OH)	10% vol.	0.0
Fluorine (F2)	2.0	1.5
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	2.4
Hydrogen Cyanide (HCN)	20.0	-0.5

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	5.5
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3% vol.	0.0
Iodine (I2)	1.0	1.0
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10% vol.	0.0
Nitric Acid (HN03)	5.0	2.0
Nitrogen Dioxide (NO2)	101.0	3.5
Ozone (O3)	5.0	4.1
Phosgene (COCl2)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.4

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Diborane (B2H6)

Part Number: ES-23AY-B2H6
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 0.30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Arsine (AsH3)	0.1	0.09
Hydrogen (H2)	2 % vol	0.21
Phosphine (PH3)	1	0.78
Silane (SiH4)	14	1.51
Hydrogen Selenide (SeH2)	0.2	0.03
Chlorine (Cl2)	0.8	-0.12
Ammonia (NH3)	40	0.49

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCL)	5	0.10
I.P.A. ((CH3)2CHCO	5 % vol	0.02
Nitrogen Monoxide (NO)	24	0
Nitrogen Dioxide (NO2)	3.6	-0.43
Hydrogen Sulfide (H2S)	0.3	0.12
Germane (GeH4)	0.4	0.02
Acetone ((CH3)2CO)	20 % vol	0.02

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Disilane (Si2H6)

Part Number: ES-23AH-SIH4
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2% vol.	0.0
Ammonia (NH3)	150.0	0.0
Butyl Acid (CH3COO(CH2)3CH3)	1% vol.	0.0
Xylene (C6H4(CH3)3)	4,000	0.0
Arsine (AsH3)	1.04	4.9
Ethanol (C2H5OH)	1% vol.	0.0
Chlorine (Cl2)	2.0	-6.2
Diborane (B2H6)	1.0	0.4
Ethyl Acetate (CH3CO2H5)	4,000	0.4
Fluorine (F2)	3.0	-0.4
Hydrogen (H2)	1% vol.	0.8

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	1.0	0.9
Hydrogen Cyanide (HCN)	10.0	0.8
Hydrogen Fluoride (HF)	6.0	0.7
Hydrogen Sulfide (H2S)	1.0	4.1
I.P.A. ((CH3)2CHOH)	1% vol.	0.0
Nitric Acid (HN03)	10.0	-1.4
Phosphine (PH3)	0.5	4.4
Silane (SiH4)	8.0	3.3
Sulfur Dioxide (SO2)	5.0	0.4
Toluene (C6H5CH3)	1% vol.	0.0
Trichloroethylene (CHCl:CCl2)	1% vol.	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Fluorine (F2)

Part Number: ES-K233-F2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 5 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	25.3
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.5
Carbon Dioxide (CO2)	1.0% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.6
Chlorine Trifluoride (ClF3)	1.0	1.3
Ethanol (C2H5OH)	10.0% vol.	0.0
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	3.1
Hydrogen Cyanide (HCN)	20.0	-0.6

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	7.1
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3.0% vol.	0.0
Iodine (I2)	1.0	1.3
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10.0% vol.	0.0
Nitric Acid (HN03)	5.0	2.6
Nitrogen Dioxide (NO2)	101.0	4.6
Ozone (O3)	5.0	5.3
Phosgene (COCl2)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	3.1

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hexafluorobutadiene (C4F6)

Part Number: 65-FV-017
Sensor Application: FP-260AGZS

Technical Specifications			
Measuring Principle	Pyrolyzer + photoelectric photometry	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 5.0 ppm	**Repeatability**	+/- 5% of reading
Resolution	+/- 30% of indication value	**Measuring Cycle**	20 seconds

Operating Conditions			
Temperature Range	10°C to 35°C	**Life Expectancy**	1 month (no alarms)
Humidity Range	30-60% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol	0 ppm
Chlorine (Cl2)	2 ppm	Over scale
HFE-7100 (C4F9OCH3)	100 ppm	2.6 ppm
HFE-7200 (C4F9OC2H5)	100 ppm	1.5 ppm
HT-70 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	1.3 ppm
HT-90 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	2.2 ppm
HT-135 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	4.0 ppm

Gas	Gas Applied	Reading
HT-200 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	3.1 ppm
Halocarbon 22 (CHClF2)	20 ppm	Over Scale
Halocarbon 123 (C2HCl2F3)	50 ppm	Over Scale
Hydrogen Chloride (HCl)	4 ppm	0 ppm (over scale after 5 min)
Hydrogen Fluoride (HF)	6 ppm	0 ppm (1.1 ppm after 5 min)
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	0 ppm
Methanol (CH3OH)	1% vol	0 ppm

TYPICAL INTERFERING GASES

SENSOR : **ES-23E**
GAS : **N2H4**
Voltage : +150mV
Flow rate : 0.5 L/min
Adaptor type : B

Gas	Chemical formula	Concentration	Indication rading
Hydrogen	H_2	9.8%	2 ppm
IPA	$(CH_3)_2CHOH$	1.00%	0.22 ppm
Methyl alcohol	CH_3OH	1.00%	0.04 ppm
Acetone	$(CH_3)_2CO$	1.00%	0.9 ppm
Toluene	$C_6H_5CH_3$	1.00%	2.0 ppm
Carbon dioxide	CO_2	99.90%	-0.02 ppm
Carbon monoxide	CO	300 ppm	0.11 ppm
Acetylene	C_2H_2	43 ppm	2 ppm
Ethylene	C_2H_4	244 ppm	2 ppm
Chlorine	Cl_2	10 ppm	-0.22 ppm
Bromine	Br_2	—	—
Fluorine	F_2	-11 ppm	-2 ppm
Ozone	O_3	-14 ppm	-2 ppm
Nitrogen dioxide	NO_2	14 ppm	2 ppm
Nitrogen monoxide	NO	9 ppm	2 ppm
Sulfur dioxide	SO_2	10 ppm	2 ppm
Hydrogen sulfide	H_2S	27 ppm	2 ppm
Hydrogen Bromide	HBr	2.8 ppm	2 ppm
Hydrogen fluoride	HF	10 ppm	0.65 ppm
Phosphine	PH_3	0 ppm	2 ppm
Arsine	AsH_3	0.5 ppm	2 ppm
Silane	SiH_4	20 ppm	2 ppm
Disilane	Si_2H_6	4.4 ppm	2 ppm
Diborane	B_2H_6	20 ppm	2 ppm
Germane	GeH_4	9 ppm	2 ppm
Hydrogen selenium	SeH_2	0.41 ppm	2 ppm
Hydrogen cyanide	HCN	15 ppm	1.64 ppm
Hydrogen chloride	HCL	2.4 ppm	2 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Bromide (HBr)

Part Number: ES-23E-HBR
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 9 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	210.0	7.6
Acetone ((CH3)2CO)	2.07% vol.	2.0
Arsine (AsH3)	0.14	0.8
Carbon Dioxide (CO2)	99.9% vol.	0.0
Carbon Monoxide (CO)	287.0	0.2
Chlorine (Cl2)	10.0	-0.2
Diborane (B2H6)	5.4	0.8
Disilane (Si2H6)	7.8	5.7
Ethylene (C2H4)	1,020.0	6.1
Fluorine (F2)	15.0	-3.7
Germanium Tetrahydride (GeH4)	1.6	0.6
Hydrogen (H2)	2.03% vol.	0.5
Hydrogen Chloride (HCl)	5.0	6.0

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	10.0	0.5
Hydrogen Selenide (SeH2)	1.0	7.2
Hydrogen Sulfide (H2S)	2.6	0.3
I.P.A. ((CH3)2CHOH)	1.51% vol.	0.3
Methanol (CH3OH)	5.18% vol.	0.2
Nitric Oxide (NO)	20.0	5.0
Nitrogen Dioxide (NO2)	16.7	1.6
Ozone (O3)	6.0	-0.9
Phosphine (PH3)	1.0	6.4
Silane (SiH4)	14.1	2.4
Sulfur Dioxide (SO2)	10.0	2.7
Toluene (C6H5CH3)	0.75% vol.	2.5

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Chloride (HCl)

Part Number: ES-23E-HCL
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	2 % vol	1.6 ppm
Arsine (AsH3)	0.14	0.7 ppm
Carbon Dioxide (CO2)	99.9 % vol	0 ppm
Carbon Monoxide (CO)	287	0.1 ppm
Chlorine (Cl2)	10.0	-0.1 ppm
Diborane (B2H6)	5.4	0.7 ppm
Disilane (Si2H6)	15.6	9.5 ppm
Fluorine (F2)	15.0	-3.1 ppm
Germanium Tetrahydride (GeH4)	1.6	0.5 ppm
Hydrogen (H2)	2.0 % vol	0.4 ppm
Hydrogen Bromide (HBr)	7.9	6.9 ppm
Hydrogen Fluoride (HF)	10	0.4 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Selenide (SeH2)	1.0	6.0 ppm
Hydrogen Sulfide (H2S)	2.6	0.2 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.5 % vol	0.2 ppm
Methanol (CH3OH)	5.2 % vol	0.1 ppm
Nitric Oxide (NO)	98.4	21.2 ppm
Nitrogen Dioxide (NO2)	16.7	1.3 ppm
Ozone (O3)	6.0	-0.8 ppm
Phosphine (Ph3)	1.0	5.3 ppm
Silane (SiH4)	14.1	2.0 ppm
Sulfur Dioxide (SO2)	50.7	9.6 ppm
Toluene (C7H8)	0.75 % vol	2.1 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Chloride (HCl)

Part Number: ES-K233-HCL
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3COOH)	100.0	25.1
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.6
Carbon Dioxide (CO2)	1%	0
Carbon Monoxide (CO)	286.6	0.0
Carbon Tetrafluoride (CF4)	1.0	1.4
Chlorine (Cl2)	1.0	1.6
Ethanol (C2H5OH)	10.0% vol	0.0
Fluorine (F2)	2.0	2.1
Hydrogen (H2)	99.9% vol	0.0
Hydrogen Bromide (HBr)	5.6	0.3
Hydrogen Cyanide (HCN)	20.0	-0.6

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6.0	7.0
Hydrogen Sulfide (H2S)	32.8	-0.1
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	3.0% vol	0.0
Iodine (I2)	1.0	1.3
Methane (CH4)	99.9% vol	0.0
Methanol (CH3OH)	10.0% vol	0.0
Nitric Acid (HNO3)	5.0	2.6
Nitrogen Dioxide (NO2)	101.0	3.9
Ozone (O3)	5.0	5.3
Phosgene (COCl2)	1.0	0.0
Phosphine (Ph3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	3.2

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Cyanide (HCN)

Part Number: ES-23-HCN
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Carbon Dioxide (CO2)	21 % vol	1.0
Carbon Monoxide (CO)	17	4.0
Ethane (C2H6)	264	1.0
Ethylene (C2H4)	42	1.0
Hydrogen (H2)	212	1.0
Hydrogen Sulfide (H2S)	85	0.0
IsoButane (C4H10)	4.2 % vol	0.0

Gas	PPM Gas Applied	Reading
Methane (CH4)	21 % vol	0.0
Nitric Oxide (NO)	106	54.0
Nitrogen Dioxide (NO2)	42	-3.0
Propane (C3H8)	4,250	1.0
Propylene (C3H6)	42	1.0
Sulfur Dioxide (SO2)	89	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Cyanide (HCN)

Part Number: ES-23DH-HCN
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	3360 ppm	15 ppm
Acetylene (C2H2)	30.07 %vol	15 ppm
Ammonia (NH3)	7750 ppm	15 ppm
Carbon Monoxide (CO)	1430 ppm	15 ppm
Chlorine (Cl2)	10.4 ppm	-15 ppm
Ethane (C2H6)	616 ppm	15 ppm
Hydrogen (H2)	0.33 %vol	15 ppm
Hydrogen Chloride (HCl)	56.66 ppm	15 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	4.49 ppm	15 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	9.89 % vol	15 ppm
Nitric Oxide (NO)	3360 ppm	15 ppm
Nitrogen Dioxide (NO2)	5.25 ppm	-15 ppm
Ozone (O3)	4.42 ppm	-15 ppm
Silane (SiH4)	2.64 ppm	15 ppm
Sulfur Dioxide (SO2)	5.81 ppm	15 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Fluoride (HF)

Part Number: ES-23PX-HF
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 9 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3COOH)	30 ppm	9 ppm
Acetone ((CH3)2CO)	1 % vol	0 ppm
Ammonia (NH3)	25 pmm	-2 ppm
Arsine (AsH3)	1 ppm	0 ppm
Carbon Dioxide (CO2)	1.6 % vol	3 ppm
Carbon Monoxide (CO)	300 ppm	0 ppm
Carbon Tetrafluoride (CF4)	1 % vol	0 ppm
Chlorine (Cl2)	2.7 ppm	4.4 ppm
Diborane (B2H6)	10 ppm	0 ppm
Disilane (Si2H6)	10 ppm	0 ppm
Ethanol (C2H5OH)	1 % vol	0 ppm
Fluorine (F2)	5 ppm	4 ppm
Hydrogen (H2)	5 % vol	-1 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Bromide (HBr)	10 ppm	0 ppm
Hydrogen Chloride (HCl)	9 ppm	8 ppm
Hydrogen Cyanide (HCN)	10 ppm	0 ppm
Hydrogen Sulfide (H2S)	30 ppm	0 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1 % vol	0 ppm
Methane (CH4)	10 % vol	0 ppm
Nitric Oxide (NO)	100 ppm	0 ppm
Nitrogen Dioxide (NO2)	7.7 ppm	1 ppm
Nitrogen Trifluoride (NF3)	50 ppm	0 ppm
Ozone (O3)	5 ppm	2.4 ppm
Phosphine (Ph3)	1 ppm	0 ppm
Phosphoric Acid (H3PO4)	50 ppm	0.1 ppm
Silane (SiH4)	10 ppm	0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Fluoride (HF)

Part Number: ES-K233-HF
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 9 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3COOH)	100.0	21.5
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.3
Carbon Dioxide (CO2)	1.0% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.3
Chlorine Trifluoride (ClF3)	1.0	1.1
Ethanol (C2H5OH)	10.0% vol	0.0
Fluorine (F2)	2.0	1.7
Hydrogen (H2)	99.9% vol	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	2.6

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	20.0	-0.5
Hydrogen Sulfide (H2S)	32.8	-0.1
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	3.0% vol.	0.0
Iodine (I2)	1.0	1.1
Methane (CH4)	99.9% vol	0.0
Methanol (CH3OH)	10.0% vol	0.0
Nitric Acid (HNO3)	5.0	2.2
Nitrogen Dioxide (NO2)	101.0	3.9
Ozone (O3)	5.0	4.5
Phosgene (COCl2)	1.0	0.0
Phosphine (Ph3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.6

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Iodine (HI)

Part Number: ES-23E-HI
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 5 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	210.0	5.0
Acetone ((CH3)2CO)	2.07% vol.	1.3
Arsine (AsH3)	0.14	0.6
Carbon Dioxide (CO2)	99.9% vol.	0.0
Carbon Monoxide (CO)	287.0	0.1
Chlorine (Cl2)	10.0	-0.1
Diborane (B2H6)	5.4	0.6
Disilane (Si2H6)	15.6	7.4
Ethylene (C2H4)	1,020.0	4.0
Fluorine (F2)	15.0	-2.4
Germanium Tetrahydride (GeH4)	1.6	0.4
Hydrogen (H2)	2.03% vol.	0.3
Hydrogen Bromide (HBr)	7.9	5.4

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	8.0	6.2
Hydrogen Fluoride (HF)	10.0	0.3
Hydrogen Selenide (SeH2)	1.0	4.7
Hydrogen Sulfide (H2S)	2.6	0.2
I.P.A. ((CH3)2CHOH)	1.51% vol.	0.1
Methanol (CH3OH)	5.18% vol.	0.1
Nitric Oxide (NO)	98.4	16.6
Nitrogen Dioxide (NO2)	16.7	1.0
Ozone (O3)	6.0	-0.6
Phosphine (PH3)	1.0	4.1
Silane (SiH4)	14.1	1.6
Sulfur Dioxide (SO2)	50.7	7.5
Toluene (C6H5CH3)	.75% vol.	1.6

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Peroxide (H2O2)

Part Number: ES-23DH-H2O2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 3 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.0 % vol	1.0 ppm
Ammonia (NH3)	250 ppm	1.1 ppm
Arsine (AsH3)	5.2 ppm	5.0 ppm
Carbon Dioxide (CO2)	99.9 % vol	0.1 ppm
Carbon Monoxide (CO)	1250 ppm	4.1 ppm
Chlorine (Cl2)	7.2 ppm	-4.1 ppm
Diborane (B2H6)	4.5 ppm	4.1 ppm
Disilane (Si2H6)	1.0 ppm	4.1 ppm
Germanium Tetrahydride (GeH4)	1.1 ppm	4.1 ppm
Hydrogen (H2)	0.25 % vol	4.1 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	14.5 ppm	4.1 ppm
Hydrogen Selenide (SeH2)	5.2 ppm	4.1 ppm
Hydrogen Sulfide (H2S)	3.2 ppm	4.1 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.0 % vol	1.4 ppm
Methane (CH4)	1.0 % vol	no response
Nitrogen (N2)	99.9 % vol	0.03 ppm
Nitric Oxide (NO)	100 ppm	-0.29 ppm
Nitrogen Dioxide (NO2)	4.8 ppm	-4.1 ppm
Phosphine (Ph3)	0.5 ppm	2.0 ppm
Sulfur Dioxide (SO2)	4 ppm	4.1 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Sulfide (H2S)

Part Number: ES-23AH-H2S
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2 % vol	0 ppm
Ammonia (NH3)	150 ppm	0 ppm
Butyl Acetate (CH3COO(CH2)3CH3)	1 % vol	0 ppm
Chlorine (Cl2)	1 ppm	-1.2 ppm
Fluorine (F2)	3 ppm	0 ppm
Hydrogen (H2)	1 % vol	0.18 ppm
Hydrogen Chloride (HCl)	1 ppm	0.2 ppm
Hydrogen Cyanide (HCN)	10 ppm	0.16 ppm

Gas	PPM Gas Applied	Reading
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1 % vol	0 ppm
Nitric Oxide (NO)	8 ppm	-0.8 ppm
Silane (SiH4)	1 ppm	0.1 ppm
Sulfur Dioxide (SO2)	5 ppm	0.12 ppm
1,1,1-Trichloroethane (C2H3CL3)	1 % vol	0 ppm
Toluene (C7H8)	1 % vol	0 ppm
Xylene (C8H10)	0.4 % vol	0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Sulfide (H2S)

Part Number: ES-87A-H2S
Sensor Application: EAGLE

Technical Specifications			
Measuring Principle	Amperometric 2-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	50.0	1.0
Benzene (C6H6)	1,000	no response
Carbon Dioxide (CO2)	1,000	no response
Carbon Monoxide (CO)	800.0	1.0
Chlorine (Cl2)	1,000	no response
Ethane (C2H6)	1,000	no response
Ethylene (C2H4)	600.0	1.0
Hexane (C6H14)	1,000	no response
Hydrogen (H2)	1,500.0	1.0
IsoButane (C4H10)	1,000	no response

Gas	PPM Gas Applied	Reading
Methane (CH4)	1,000	no response
Methanol (CH3OH)	500.0	1.0
Nitric Oxide (NO)	20.0	1.0
Nitrogen Dioxide (NO2)	33.0	1.0
Pentane (C5H12)	1,000	no response
Propylene (C3H6)	1,000.0	1.0
Sulfur Dioxide (SO2)	7.0	1.0
Toluene (C7H8)	1,000	no response
Xylene (C8H10)	1,000	no response

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Sulfide (H2S)

Part Number: ES-1537-H2S
Sensor Application: Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Carbon Monoxide (CO)	0.08	1.0
Chlorine (Cl2)	0.25	-1.0
Ethylene (C2H4)	0.0	1.0
Hydrogen (H2)	0.02	1.0
Hydrogen Chloride (HCl)	0.0	1.0

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	0.0	1.0
Nitric Oxide (NO)	0.05	1.0
Nitrogen Dioxide (NO2)	0.20	-1.0
Sulfur Dioxide (SO2)	0.15	1.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Sulfide (H2S)

Part Number: ES-1827-H2S

Sensor Application: GX-2001, GX-2003, GasWatch 2

Technical Specifications			
Measuring Principle	Amperometric 2-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	10,000	0.5
Acetylene (C2H2)	41	10
Ammonia (NH3)	170	1
Chlorine (Cl2)	8.6	-1
Ethylene (C2H4)	280	10
Hydrogen (H2)	170	10

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	55	1
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	330	10
Nitric Oxide (NO)	210	10
Nitrogen Dioxide (NO2)	46	-10
Ozone (O3)	3.8	-1
Sulfur Dioxide (SO2)	50	10

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrogen Sulfide (H2S)

Part Number: ES-237-H2S
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	750 ppm	0.0 ppm
Carbon Monoxide (CO)	100 ppm	3.5 ppm
Hydrogen (H2)	2000 ppm	16.2 ppm
Hydrogen Chloride (HCl)	6 ppm	0.2 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	400 ppm	13.4 ppm
Methane (CH4)	5.7 % vol	-0.1 ppm

Gas	PPM Gas Applied	Reading
Nitric Oxide (NO)	100 ppm	0.8 ppm
Nitrogen Dioxide (NO2)	50 ppm	-8.8 ppm
Phosphine (Ph3)	0.54ppm	0.2 ppm
Silane (SiH4)	7.83 ppm	2.2 ppm
Sulfur Dioxide (SO2)	50 ppm	8.7 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Acetic Acid (CH3COOH)

Part Number: ES-733PX-CH3COOH
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol.	0.0
Carbon Dioxide (CO2)	2000	8.0
Chlorine (Cl2)	1.0	10.0
Ethanol (C2H5OH)	1% vol.	0.0
Freon 14 (CF4)	1% vol.	0.0
Freon 116 (CF3-CF3)	1% vol.	0.0
Fluorine (F2)	5.0	12.0
Hydrogen (H2)	5% vol.	-3.0
Hydrogen Chloride (HCl)	10.0	30.0

Gas	PPM Gas Applied	Reading
I.P.A. ((CH3)2CHOH)	1% vol.	0.0
Methane (CH4)	10% vol.	0.0
Methanol (CH3OH)	1% vol.	0.0
Methyl Acetate (CH3COOCH3)	5,000.0	0.0
n-Butyl Acetate (CH3COO(CH2)3CH3)	5,000.0	0.0
Nitric Oxide (NO)	100.0	0.0
Nitrogen Dioxide (NO2)	7.7	3.0
Nitrogen Trifluoride (NF3)	50.0	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Iodine (I2)

Part Number: ES-K233-I2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	19.6
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.2
Carbon Dioxide (CO2)	1% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.2
Chlorine Trifluoride (ClF3)	1.0	1.2
Ethanol (C2H5OH)	10% vol.	0.0
Fluorine (F2)	2.0	1.5
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	2.4

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	20.0	-0.5
Hydrogen Fluoride (HF)	6.0	5.5
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3% vol.	0.0
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10% vol.	0.0
Nitric Acid (HN03)	5.0	2.0
Nitrogen Dioxide (NO2)	101.0	3.6
Ozone (O3)	5.0	4.2
Phosgene (COCl2)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	3.1

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Nitrogen Dioxide (NO2)

Part Number: ES-23AH-NO2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol.	0.0
Ammonia (NH3)	50.0	0.0
Chlorine (Cl2)	0.5	0.9
Ethanol (C2H5OH)	1% vol.	0.0
Fluorine (F2)	5.0	3.7
Hydrogen (H2)	2% vol.	-1.2
Hydrogen Chloride (HCl)	4.4	-0.6
Hydrogen Fluoride (HF)	6.0	0.2

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	1.2	-1.7
I.P.A. ((CH3)2CHOH)	1% vol.	0.0
Nitric Oxide (NO)	103.0	4.0
Nitrogen Trifluoride (NF3)	20.0	0.0
Ozone (O3)	1.5	4.2
Sulfur Dioxide (SO2)	15.9	0.0
Toluene (C6H5CH3)	1% vol.	0.0
Trichloroethylene (CHCl:CCl2)	1% vol.	0.0

ES干渉データー覧表(代表例)

X-1966-3
2005.4.7(IY)

SENSOR TYPE : ES-23SD

GAS : H2Se

TLV (ppm) : 0.05

ｶﾞｽ名	GAS	TLV (ppm)	GAS CONCENTRATION	INDICATION	等価濃度(単位)	等価/許容濃度比	推奨代表検知	備考
ﾎｽﾌｨﾝ	PH3	0.3	0.08 ppm	0.05 ppm	0.08 ppm	0.267	◎	
ｱﾙｼﾝ	AsH3	0.05	0.11 ppm	0.05 ppm	0.11 ppm	2.2		
ｼﾗﾝ	SiH4	5	1.5 ppm	0.05 ppm	1.5 ppm	0.3	◎	
ｼﾞｼﾗﾝ	Si2H6	5	0.72 ppm	0.05 ppm	0.72 ppm	0.144		SiH4と同等の許容濃度
ｼﾞﾎﾞﾗﾝ	B2H6	0.1	3.2 ppm	0.05 ppm	3.2 ppm	32		
ｹﾞﾙﾏﾝ	GeH4	0.2	0.62 ppm	0.05 ppm	0.62 ppm	3.1		
水素	H2		0.74 vol%	0.05 ppm	0.74 vol%	×××		
一酸化炭素	CO	25	0.5 vol%	0.05 ppm	0.5 vol%	200		
ｵｿﾞﾝ	O3	0.1	0.23 ppm	-0.05 ppm	-0.23 ppm	-2.3		
塩素	Cl2	0.5	0.16 ppm	-0.05 ppm	-0.16 ppm	-0.32		
二酸化窒素	NO2	3	0.21 ppm	-0.05 ppm	-0.21 ppm	-0.07		
一酸化窒素	NO	25	160 ppm	-0.05 ppm	-160 ppm	-6.4		
ｱﾝﾓﾆｱ	NH3	25	310 ppm	0.05 ppm	310 ppm	12.4		
二酸化硫黄	SO2	2	1.8 ppm	0.05 ppm	1.8 ppm	0.9		
硫化水素	H2S	10	0.056 ppm	0.05 ppm	0.056 ppm	0.006		
塩化水素	HCL	2	0.26 ppm	0.05 ppm	0.26 ppm	0.13		
ｲｿﾌﾟﾛﾋﾟﾙｱﾙｺｰﾙ(IPA)	(CH3)2CHOH	400	1 vol%	0.013 ppm	3.846 vol%	96.15		
ｱｾﾄﾝ	(CH3)2CO	750	1 vol%	0.019 ppm	2.632 vol%	35.09		
ﾌﾛﾘﾅｰﾄFX-3300			3.7 vol%	0.007 ppm	26.43 vol%	×××		
HFE-7100(3M製)			22 vol%	0.003 ppm	366.7 vol%	×××		

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Nitric Oxide (NO)

Part Number: ES-23A-NO
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	100.0	50.0
Acetone ((CH3)2CO)	6.1% vol.	50.0
Ammonia (NH3)	2.5% vol.	50.0
Bromine (Br2)	-8.7	50.0
Carbon Dioxide (CO2)	1,000	0
Carbon Monoxide (CO)	.29% vol.	50.0
Chlorine (Cl2)	-11.0	50.0
Ethylene (C2H4)	.12% vol.	50.0
Fluorine (F2)	-24.0	50.0
Hydrogen (H2)	1.7% vol.	50.0
Hydrogen Bromide (HBr)	5.4	50.0
Hydrogen Chloride (HCl)	3.1	50.0

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	120.0	50.0
Hydrogen Sulfide (H2S)	0.43	50.0
Iodine (I2)	5.4	50.0
	-3.6	50.0
I.P.A. ((CH3)2CHOH)	7% vol.	50.0
Methanol (CH3OH)	5% vol.	50.0
Nitrogen Dioxide (NO2)	36.0	50.0
Nitrogen Trifluoride (NF3)	1.5% vol.	50.0
Ozone (O3)	-28.0	50.0
Sulfur Dioxide (SO2)	39.0	50.0
Toluene (C6H5CH3)	46% vol.	50.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Nitrogen Trifluoride (NF3)

Part Number: ES-23AH-NO2/NF
Sensor Application: Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Ammonia (NH3)	242.6	0.0
Carbon Dioxide (CO2)	2,435	0.0
Chlorine (Cl2)	2.0	0.1
Hydrogen (H2)	5,000	0.1
Hydrogen Chloride (HCl)	13.5	1.7
Hydrogen Fluoride (HF)	6.0	0.0

Gas	PPM Gas Applied	Reading
I. P.A. ((CH3)2CHOH)	5,000	6.0
Methane (CH4)	5,000	0.0
Nitric Oxide (NO)	101.6	0.0
Nitrogen Dioxide (NO2)	104.6	6.3
Ozone (O3)	2.2	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ozone (O3)

Part Number: ES-K233-O3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3C00H)	100.0	22.7
Ammonia (NH3)	39.4	0.0
Bromine (Br2)	1.0	1.5
Carbon Dioxide (CO2)	1.0% vol.	0.0
Carbon Monoxide (CO)	286.6	0.0
Chlorine (Cl2)	1.0	1.5
Chlorine Trifluoride (ClF3)	1.0	1.3
Ethanol (C2H5OH)	10.0% vol.	0.0
Fluorine (F2)	2.0	1.9
Hydrogen (H2)	99.9% vol.	0.0
Hydrogen Bromide (HBr)	5.6	0.2
Hydrogen Chloride (HCl)	3.0	2.7

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	20.0	-0.5
Hydrogen Fluoride (HF)	6.0	6.3
Hydrogen Sulfide (H2S)	32.8	-0.1
I.P.A. ((CH3)2CHOH)	3.0% vol	0.0
Iodine (I2)	1.0	1.2
Methane (CH4)	99.9% vol.	0.0
Methanol (CH3OH)	10.0% vol.	0.0
Nitric Acid (HN03)	5.0	2.3
Nitrogen Dioxide (NO2)	101.0	4.1
Phosgene (COCl2)	1.0	0.0
Phosphine (PH3)	1.1	0.0
Sulfur Dioxide (SO2)	10.0	2.9

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Octafluorocyclopentene (C5F8)

Part Number: 65-FV-017
Sensor Application: FP-260AGZS

Technical Specifications			
Measuring Principle	Pyrolyzer + photoelectric photometry	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 5.0 ppm	**Repeatability**	+/- 5% of reading
Resolution	+/- 30% of indication value	**Measuring Cycle**	20 seconds

Operating Conditions			
Temperature Range	10°C to 35°C	**Life Expectancy**	1 month (no alarms)
Humidity Range	30-60% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol	0 ppm
Chlorine (Cl2)	2 ppm	Over Scale
HFE-7100 (C4F9OCH3)	100 ppm	2.0 ppm
HFE-7200 (C4F9OC2H5)	100 ppm	1.1 ppm
HT-70 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	0.9 ppm
HT-90 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	1.6 ppm
HT-135 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	3.1 ppm

Gas	Gas Applied	Reading
HT-200 CF3((OC3F6)n(OCF2)m)OCF	100 ppm	2.4 ppm
Halocarbon 22 (CHClF2)	20 ppm	Over Scale
Halocarbon 123 (C2HCl2F3)	50 ppm	Over Scale
Hydrogen Chloride (HCl)	4 ppm	0 ppm (over scale after 5 min)
Hydrogen Fluoride (HF)	6 ppm	0 ppm (0.5 ppm after 5 min)
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	0 ppm
Methanol (CH3OH)	1% vol	0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ozone (O3)

Part Number: ES-23AH-O3
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 - 5.00 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol	0 ppm
Ammonia (NH3)	50	0 ppm
Chlorine (Cl2)	0.5	0.3 ppm
Ethanol (C2H5OH)	1% vol	0 ppm
Fluorine (F2)	5	1.3 ppm
Hydrogen (H2)	2% vol	-0.4 ppm
Hydrogen Sulfide (H2S)	1.2 ppm	-0.6 ppm

Gas	PPM Gas Applied	Reading
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	0 ppm
Nitric Oxide (NO)	103	1.5 ppm
Nitrogen Dioxide (NO2)	4.2	1.6 ppm
Nitrogen Trifluoride (NF3)	20	0 ppm
Sulfur Dioxide (SO2)	15.9	0 ppm
Trichloroethylene (TCE)	1% vol	0 ppm
Toluene (C7H8)	1% vol	0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ozone (O3)

Part Number: ES-K239C-O3
Sensor Application: Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 0.6 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3COOH)	40	0
Acetaldehyde (CH3CHO)	1,000	0
Ammonia (NH3)	40.3	0
Carbon Dioxide (CO2)	1%	0
Carbon Monoxide (CO)	286.6	0
Chlorine (Cl2)	0.8	0.9
Ethane (C2H6)	1,000	0
Ethanol (C2H5OH)	10%	0
Ethylene (C2H4)	1,000	0
Fluorine (F2)	2	0
R 14 (CF4)	1,000	0
Hydrogen (H2)	100%	0

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	3	0
Hydrogen Fluoride (HF)	6	0
Hydrogen Peroxide (H2O2)	5	1
Hydrogen Sulfide (H2S)	27.7	0
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.5%	0
Methane (CH4)	100%	0
Methanol (CH3OH)	10%	0
Nitric Acid (HNO3)	2	0
Nitrogen Dioxide (NO2)	96	2.3
Phosphine (Ph3)	1	0
Sulfur Dioxide (SO2)	10.4	0
TEOS (Si(OC2H5)4)	15	0

RKI Sensor Specification

Features: Good warm-up time
Good zero stability
Fast response time

Phosphine (PH_3)

Part Number: ES-23AH-PH3
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0-1.00 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2% vol.	0.0
Ammonia (NH3)	150.0	0.0
Arsine (AsH3)	1.0	0.47
Butyl Acetate (CH3COO(CH2)3CH3)	1.0% vol.	0.0
Chlorine (Cl2)	1.0	-0.6
Chlorine Trifluoride (ClF3)		
Diborane (B2H6)	10.0	0.38
Disilane (Si2H6)	1.0	0.06
Fluorine (F2)	3.0	0.0
Hydrogen Chloride (HCl)	1% vol.	0.09

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	10.0	0.08
Hydrogen Selenide (SeH2)	0.1	0.21
Hydrogen Sulfide (H2S)	1.0	0.5
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol.	0.0
Nitric Oxide (NO)	8.0	-0.4
Silane (SiH4)	1.0	0.05
Sulfur Dioxide (SO2)	5.0	0.06
1,1,1-Trichloroethane (C2H3CL3)	1.0% vol.	0.0
Toluene (C7H8)	1.0% vol.	0.0
Xylene (C8H10)	0.4% vol.	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Silane (SiH4)

Part Number: ES-23AH-SIH4
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2% vol.	0.0
Ammonia (NH3)	150	0.0
Arsine (AsH3)	1.04	11.9
Butyl Acid (CH3COO(CH2)3CH3)	1.0% vol.	0.0
Chlorine (Cl2)	2.0	-15.0
Diborane (B2H6)	1.0	1.0
Disilane (Si2H6)	3.3	8.0
Ethanol (C2H5OH)	1.0% vol.	0.0
Ethyl Acetate (CH3CO2H5)	0.4% vol.	1.0
Fluorine (F2)	3.0	-1.0
Hydrogen (H2)	1% vol.	2.0

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	20.0	1.0
Hydrogen Cyanide (HCN)	10.0	2.0
Hydrogen Fluoride (HF)	6.0	1.8
Hydrogen Sulfide (H2S)	1.0	10.0
I.P.A. ((CH3)2CHOH)	1.0% vol.	0.0
Nitric Acid (HN03)	10.0	-3.3
Phosphine (PH3)	0.5	10.6
Sulfur Dioxide (SO2)	5.0	1.0
Toluene (C6H5CH3)	1.0% vol.	0.0
Trichloroethylene (CHCl:CCl2)	1% vol.	0.0
Xylene (C6H4(CH3)3)	0.4% vol.	0.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Silane (SiH4)

Part Number: ES-23DH-SIH4
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.0 % vol	0.34 ppm
Ammonia (NH3)	250 ppm	0.35 ppm
Arsine (AsH3)	5.2 ppm	5.0 ppm
Carbon Dioxide (CO2)	99.9 % vol	0.03 ppm
Carbon Monoxide (CO)	5000 ppm	5.0 ppm
Chlorine (Cl2)	29 ppm	-5.0 ppm
Diborane (B2H6)	18 ppm	5.0 ppm
Disilane (Si2H6)	3.8 ppm	5.0 ppm
Germanium Tetrahydride (GeH4)	4.4 ppm	5.0 ppm
Hydrogen (H2)	1.0 % vol	5.0 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	58 ppm	5.0 ppm
Hydrogen Selenide (SeH2)	21 ppm	5.0 ppm
Hydrogen Sulfide (H2S)	13 ppm	5.0 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.0 % vol	0.43 ppm
Nitrogen (N2)	99.9 % vol	0.01 ppm
Nitric Oxide (NO)	100 ppm	-0.09 ppm
Nitrogen Dioxide (NO2)	19 ppm	-5.0 ppm
Phosphine (Ph3)	4.1 ppm	5.0 ppm
Sulfur Dioxide (SO2)	16 ppm	5.0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Sulfur Dioxide (SO2)

Part Number: ES-23A-SO2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	8.2% vol.	15.0
Acetylene (C2H2)	140.0	15.0
Ammonia (NH3)	2.9% vol.	15.0
Bromine (Br2)	13.0	-15.0
Carbon Dioxide (CO2)	1,000	no response
Carbon Monoxide (CO)	0.37% vol.	15.0
Chlorine (Cl2)	17.0	-15.0
Ethylene (C2H4)	0.16% vol.	15.0
Fluorine (F2)	39.0	-15.0
Hydrogen (H2)	2.0% vol.	15.0
Hydrogen Bromide (HBr)	7.6	15.0
Hydrogen Chloride (HCl)	5.1	15.0

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	200.0	15.0
Hydrogen Sulfide (H2S)	0.56	15.0
I.P.A. ((CH3)2CHOH)	11.0% vol.	15.0
Iodine (I2)	8.8	15.0
	5.6	-15.0
Methanol (CH3OH)	8.9% vol.	15.0
Nitric Oxide (NO)	65.0	15.0
Nitrogen Dioxide (NO2)	59.0	15.0
Nitrogen Trifluoride (NF3)	1.9% vol.	15.0
Ozone (O3)	45.0	-15.0
Toluene (C6H5CH3)	74% vol.	15.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Sulfur Dioxide (SO2)

Part Number: ES-23E-SO2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 30 ppm (or 0 – 15 ppm)	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.0 % vol	0.23 ppm
Ammonia (NH3)	1.3 % vol	10 ppm
Chlorine (Cl2)	180 ppm	-10 ppm
Ethylene (C2H4)	54 ppm	10 ppm
Hydrogen (H2)	2.1 %vol	10 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Chloride (HCl)	30 ppm	10 ppm
Hydrogen Sulfide (H2S)	2.8 ppm	10 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.0 % vol	1.5 ppm
Nitric Oxide (NO)	6.2 ppm	10 ppm
Nitrogen Dioxide (NO2)	20 ppm	10 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Sulfur Dioxide (SO2)

Part Number: ES-238-SO2
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 10 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.0 % vol	0.05 ppm
Ammonia (NH3)	2700 ppm	2.0 ppm
Carbon Dioxide (CO2)	99.9 % vol	0.1 ppm
Carbon Monoxide (CO)	490 ppm	2.0 ppm
Chlorine (Cl2)	3.6 ppm	-2.0 ppm
Ethanol (C2H5OH)	1.0 % vol	0.1 ppm
Ethylene (C2H4)	210 ppm	2.0 ppm
Hydrogen (H2)	1000 ppm	2.0 ppm
Hydrogen Chloride (HCl)	19 ppm	2.0 ppm
Hydrogen Cyanide (HCN)	5.2 ppm	2.0 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Fluoride (HF)	6 ppm	0 ppm
Hydrogen Sulfide (H2S)	1.5 ppm	2.0 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	3.4 % vol	2.0 ppm
Methane (CH4)	100 % vol	0 ppm
Methanol (CH3OH)	1.0 % vol	0 ppm
Nitric Oxide (NO)	1200 ppm	2.0 ppm
Nitrogen Dioxide (NO2)	1.8 ppm	-2.0 ppm
Ozone (O3)	1.5 ppm	-2.0 ppm
Silane (SiH4)	0.63 ppm	2.0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Nitric Oxide (NO)

Part Number: ES-23A-NO
Sensor Application: EAGLE, Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 100 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetylene (C2H2)	100.0	50.0
Acetone ((CH3)2CO)	6.1% vol.	50.0
Ammonia (NH3)	2.5% vol.	50.0
Bromine (Br2)	8.7	-50.0
Carbon Dioxide (CO2)	1,000	0
Carbon Monoxide (CO)	.29% vol.	50.0
Chlorine (Cl2)	11.0	-50.0
Ethylene (C2H4)	.12% vol.	50.0
Fluorine (F2)	24.0	-50.0
Hydrogen (H2)	1.7% vol.	50.0
Hydrogen Bromide (HBr)	5.4	50.0
Hydrogen Chloride (HCl)	3.1	50.0

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	120.0	50.0
Hydrogen Sulfide (H2S)	0.43	50.0
Iodine (I2)	5.4	50.0
	3.6	-50.0
I.P.A. ((CH3)2CHOH)	7% vol.	50.0
Methanol (CH3OH)	5% vol.	50.0
Nitrogen Dioxide (NO2)	36.0	50.0
Nitrogen Trifluoride (NF3)	1.5% vol.	50.0
Ozone (O3)	28.0	-50.0
Sulfur Dioxide (SO2)	39.0	50.0
Toluene (C6H5CH3)	46% vol.	50.0

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Hydrazine (N2H4)

Part Number: ES-23E-N2H4
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 4 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1% vol	0.9 ppm
Acetylene (C2H2)	43	2 ppm
Arsine (AsH3)	0.5	2 ppm
Carbon Dioxide (CO2)	99.9%	-0.02 ppm
Carbon Monoxide (CO)	300	0.11 ppm
Chlorine (Cl2)	10	-0.22 ppm
Diborane (B2H6)	20	2 ppm
Disilane (Si2H6)	4.4	2 ppm
Ethylene (C2H4)	244	2 ppm
Fluorine (F2)	11	-2 ppm
Germanium Tetrahydride (GeH4)	9	2 ppm
Hydrogen (H2)	9.8% vol	2 ppm
Hydrogen Bromide (HBr)	2.8	2 ppm
Hydrogen Chloride (HCl)	2.4	2 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	15	1.64 ppm
Hydrogen Fluoride (HF)	10	0.65 ppm
Hydrogen Selenide (SeH2)	0.41	2 ppm
Hydrogen Sulfide (H2S)	27	2 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	0.22 ppm
Methanol (CH3OH)	1% vol	0.04 ppm
Nitric Oxide (NO)	9	2 ppm
Nitrogen Dioxide (NO2)	14	2 ppm
Ozone (O3)	14	-2 ppm
Phosphine (Ph3)	0	2 ppm
Silane (SiH4)	20	2 ppm
Sulfur Dioxide (SO2)	10	2 ppm
Toluene (C7H8)	1% vol	2.0 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Diethylamine

Part Number: ES-23RV-CH32NH
Sensor Application: Fixed Systems

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Ammonia (NH3)	23 ppm	30 ppm
Arsine (AsH3)	0.51 ppm	-0.1 ppm
Carbon Dioxide (CO2)	2,500 ppm	-0.5 ppm
Carbon Monoxide (CO)	100 ppm	0.0 ppm
Di-amylamine (CH3(CH2)4NH(CH2)4CH3	5 ppm	1.3 ppm
Diborane (B2H6)	5.34 ppm	1.2 ppm
Diethylenetriamine (NH2CH2CH2)2NH	30 ppm	0 ppm
Hydrogen (H2)	2% vol	2.3 ppm
Hydrogen (H2)	99.9% vol	95.2 ppm
Hydrogen Chloride (HCl)	20 ppm	-13 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Sulfide (H2S)	33 ppm	2.1 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	1.3 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	9.4% vol	0.7 ppm
Methanol (CH3OH)	1% vol	0 ppm
Nitrogen Dioxide (NO2)	96 ppm	- 56.8 ppm
Phosphine (Ph3)	0.59 ppm	-0.2 ppm
Silane (SiH4)	13.9 ppm	-0.3 ppm
Sulfur Dioxide (SO2)	52 ppm	-22.1 ppm
Tri-amylamine (C5H11)3N	5 ppm	0.7 ppm
Trimethylamine (CH3)3N	6 ppm	4.5 ppm
t-buthylamine (CH3)3CNH2	5 ppm	3.5 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Chlorinetrifluoride ClF3

Part Number: ES-K233C-S-CLF3
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 0.6 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetic Acid (CH3COOH)	100 ppm	19.5 ppm
Acetone ((CH3)2CO)	1% vol	0 ppm
Ammonia (NH3)	39.4 ppm	0.0 ppm
Arsine (AsH3)	1 ppm	0 ppm
Butane (C4H10)	1% vol	0 ppm
Carbon Dioxide (CO2)	1% vol	0 ppm
Carbon Monoxide (CO)	286.6 ppm	0 ppm
Diborane (B2H6)	10 ppm	0 ppm
Disilane (Si2H6)	10 ppm	0 ppm
Ethanol (C2H5OH)	10% vol	0 ppm
Halocarbon 14 (CF4)	1% vol	0 ppm
Halocarbon 116 (C2F6)	1% vol	0 ppm
Hydrogen (H2)	99.9% vol	0 ppm
Hydrogen Bromide (HBr)	5.6 ppm	0.2 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	20 ppm	-0.5 ppm
Hydrogen Sulfide (H2S)	32.8 ppm	-0.1 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	3% vol	0 ppm
Methane (CH4)	99.9% vol	0 ppm
Methanol (CH3OH)	10% vol	0 ppm
Nitric Acid (HNO3)	5 ppm	2 ppm
Nitric Oxide (NO)	102.4 ppm	0 ppm
Nitrogen Dioxide (NO2)	101 ppm	3.5 ppm
Ozone (O3)	5 ppm	< 1.5 ppm
Phosgene (COCl2)	1 ppm	0.0 ppm
Phosphine (Ph3)	1.1 ppm	0 ppm
Silane (SiH4)	10 ppm	0 ppm
Sulfur Dioxide (SO2)	10 ppm	2.4 ppm

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Ozone (O3)

Part Number: ES-K239C-O3
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications			
Measuring Principle	Amperometric 3-electrode sensor	**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 1 ppm	**Repeatability**	+/- 5% of reading
Resolution	1% of full scale	**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions			
Temperature Range	-20°C to +45°C	**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing	**Warranty**	1 Year

Known Gas Interferences

Gas	Gas Applied	Reading
Acetic Acid (CH3COOH)	40 ppm	0 ppm
Acetaldehyde (CH3CHO)	1,000 ppm	0 ppm
Ammonia (NH3)	40.3 ppm	0 ppm
Carbon Dioxide (CO2)	1% vol	0 ppm
Carbon Monoxide (CO)	286.6 ppm	0 ppm
Chlorine (Cl2)	0.8 ppm	0.9 ppm
Ethane (C2H6)	1,000 ppm	0 ppm
Ethanol (C2H5OH)	10% vol	0 ppm
Ethylene (C2H4)	1,000 ppm	0 ppm
Fluorine (F2)	2 ppm	2 ppm
Halocarbon 14 (CF4)	1,000 ppm	0 ppm
Hydrogen (H2)	100% vol	0 ppm
Hydrogen Chloride (HCl)	3 ppm	0 ppm

Gas	Gas Applied	Reading
Hydrogen Fluoride (HF)	6 ppm	0 ppm
Hydrogen Peroxide (H2O2)	5 ppm	1 ppm
Hydrogen Sulfide (H2S)	27.7 ppm	0 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1.5% vol	0 ppm
Methane (CH4)	100% vol	0 ppm
Methanol (CH3OH)	10% vol	0 ppm
Nitric Acid (HNO3)	2 ppm	0 ppm
Nitrogen Dioxide (NO2)	96 ppm	2.3 ppm
Ozone (O3)	0.6 ppm	0.6 ppm
Phosphine (Ph3)	1 ppm	0 ppm
Sulfur Dioxide (SO2)	10.4 ppm	0 ppm
Tetraethyl Orthosilicate (TEOS)	15 ppm	0 ppm

〒13-18-001
0137-03 1/1

INTERFERENCE DATA (Example) 2002年7月15日

Sensor type : ES-1821

Meas. gas : CO

(With charcoarl filter CF-1821)

Interference gas	Chemical formula	Gas concentration	Indication value
Hydrogen	H_2	72 ppm	25 ppm
Hydrogen sulfide	H_2S	1300 ppm	25 ppm
Sulfer dioxide	SO_2	32 ppm	25 ppm
Nitric oxide	NO	72 ppm	25 ppm
Nitrogen dioxide	NO_2	140 ppm	25 ppm
Ammonia	NH_3	60 ppm	1 ppm
Hydrogen chloride	HCl	89 ppm	-1 ppm
Ozone	O_3	1.9 ppm	1 ppm
Fluorine	F_2	510 ppm	-25 ppm
Chlorine	Cl_2	13 ppm	-1 ppm
Ethylene	C_2H_4	49 ppm	25 ppm
Acetylene	C_2H_2	490 ppm	25 ppm
IPA	$(CH_3)_2CHOH$	530 ppm	25 ppm
Acetone	$(CH_3)_2CO$	10000 ppm	2 ppm
Tluene	$C_6H_5CH_3$	5.2 %	25 ppm
Xylene	$C_6H_4(CH_3)_2$	1.6 %	25 ppm
Naphtha	—	6000 ppm	0 ppm

テ22-18-001
0138-01 1/1

INTERFERENCE DATA (Example) 2001 10 9

Sensor type : ES-1827
Meas. gas H_2S

Interference gas	Chemical formula	Gas concentration	Indication value
Hydrogen	H_2	170 ppm	10 ppm
Carbon monoxide	CO	110 ppm	10 ppm
Sulfer dioxide	SO_2	50 ppm	10 ppm
Nitric oxide	NO	210 ppm	10 ppm
Nitrogen dioxide	NO_2	46 ppm	-10 ppm
Ammonia	NH_3	170 ppm	1 ppm
Hydrogen chloride	HCl	55 ppm	1 ppm
Ozone	O_3	3.8 ppm	-1 ppm
Chlorine	Cl_2	8.6 ppm	-1 ppm
Ethylene	C_2H_4	280 ppm	10 ppm
Acetylene	C_2H_2	41 ppm	10 ppm
IPA	$(CH_3)_2CHOH$	330 ppm	10 ppm
Acetone	$(CH_3)_2CO$	10000 ppm	0.5 ppm

EC0006-12

RKI Sensor Specification

Features: Fast warm-up time
Good zero stability
Quick response time

Disilane (Si2H6)

Part Number: ES-23AH-SI2H6
Sensor Application: GD-K8A, GD-K7D2

Technical Specifications				
Measuring Principle	Amperometric 3-electrode sensor		**Accuracy**	+/- 10 % of reading
Range of Measurement	0 – 15 ppm		**Repeatability**	+/- 5% of reading
Resolution	1% of full scale		**T_{90} Response time (20°C, 2 min. exposure)**	90 seconds

Operating Conditions				
Temperature Range	-20°C to +45°C		**Life Expectancy**	2-3 Years
Humidity Range	10-95% RH, Non Condensing		**Warranty**	1 Year

Known Gas Interferences

Gas	PPM Gas Applied	Reading
Acetone ((CH3)2CO)	1.2% vol	0.0 ppm
Ammonia (NH3)	150	0.0 ppm
Arsine (AsH3)	1.04	4.9 ppm
Butyl Acetate (CH3COO(CH2)3CH3)	1% vol	0.0 ppm
Chlorine (Cl2)	2.0	-6.2 ppm
Diborane (B2H6)	1.0	0.4 ppm
Ethanol (C2H5OH)	1% vol	0.0 ppm
Ethyl Acetate (CH3CO2H5)	0.4% vol	0.4 ppm
Fluorine (F2)	3	-0.4 ppm
Hydrogen (H2)	1% vol	0.8 ppm
Hydrogen Chloride (HCl)	1.0	0.9 ppm

Gas	PPM Gas Applied	Reading
Hydrogen Cyanide (HCN)	10	0.8 ppm
Hydrogen Fluoride (HF)	6.0	0.7 ppm
Hydrogen Sulfide (H2S)	1.0	4.1 ppm
Isopropyl Alcohol (IPA) ((CH3)2CHOH)	1% vol	0.0 ppm
Nitric Acid (HNO3)	10	-1.4 ppm
Phosphine (Ph3)	0.5	4.4 ppm
Silane (SiH4)	8	3.3 ppm
Sulfur Dioxide (SO2)	5	0.4 ppm
Toluene (C7H8)	1% vol	0.0 ppm
Trichloroethylene (TCE)	1% vol	0.0 ppm
Xylene (C8H10)	0.4% vol	0.0 ppm

干渉ガス影響一覧表(代表例)

2005 年 3 月 28 日

センサ型式　：**ES-23DH**
測定対象ガス：**GeH_4 0-0.8ppm**
設 定 電 位　：0mV
設 定 流 量　：0.25 L/min

Gas name　Chemical Formula　gas concentration　Indication

ガス名	化学式	ガス濃度	指示値
ホスフィン	PH_3	0.19 ppm	0.20 ppm
アルシン	AsH_3	0.24 ppm	0.20 ppm
シラン	SiH_4	0.23 ppm	0.20 ppm
ジシラン	Si_2H_6	0.18 ppm	0.20 ppm
ジボラン	B_2H_6	0.81 ppm	0.20 ppm
セレン化水素	SeH_2	0.92 ppm	0.20 ppm
三フッ化リン	PF_3	1.1 ppm	0.20 ppm
窒素	N_2	99.99 %	0.011 ppm
水素	H_2	450 ppm	0.20 ppm
二酸化炭素	CO_2	99.9 %	0.028 ppm
一酸化炭素	CO	220 ppm	0.20 ppm
オゾン	O_3	0.42 ppm	-0.20 ppm
塩素	Cl_2	1.5 ppm	-0.20 ppm
二酸化窒素	NO_2	0.98 ppm	-0.20 ppm
一酸化窒素	NO	100 ppm	-0.072 ppm
アンモニア	NH_3	250 ppm	0.27 ppm
二酸化イオウ	SO_2	0.83 ppm	0.20 ppm
硫化水素	H_2S	0.70 ppm	0.20 ppm
塩化水素	HCl	2.6 ppm	0.20 ppm
イソプロピルアルコール	$(CH_3)_2CHOH$	1.0 %	0.38 ppm
エチルアルコール	C_2H_5OH	1.0 %	0.027 ppm
メチルアルコール	CH_3OH	1.0 %	0.00 ppm
アセトン	$(CH_3)_2CO$	1.0 %	0.30 ppm
フロリナートFX-3300	C_8F_{18}	3.7 %	0.014 ppm
フロリナートHFE-7100	$C_4F_9OCH_3$	22 %	-0.007 ppm

IPA
Ethanol
methanol
Acetone
Fluorinert

*1 ： 引用文献を下記に示す。
PF_3 は研究報告書 EC9799-26。エチルアルコールとメチルアルコールは社内レポート310-970128、H_2 と HC と IPA とアセトンは EC9605-08、フロリナートは EC9999-25、他の干渉ガスのデータは研究報告書 EC9605-06 からそれぞれ引用した。
*2 ： トルエン、o-キシレン、p-キシレン、酢酸エチル、ラッカーシンナーは研究報告書 EC0199-24 より SiH_4 センサでの干渉値から計算で求めた。
*3 ： 半導体材料ガスについては、センサ 3 台の平均値を採用した。
*4 ： 他の干渉ガスについては、3 台のセンサの中で、最も干渉影響を受けたものの値を採用した。

RKI INSTRUMENTS, INC.

Specialists in Gas Detection

RKI-GL-0004

Guidelines for Sensor Replacement (Field Service & Repair)

(Rev E)

Originator: **Steve Peluffo (Technical Services Manager)**
Approved By: **Bob Pellissier (President)**
Issued Date: **10/04/16**

Department Training Records ***(Required / Optional / Manager)***

Name	Initial	Date	Name	Initial	Date

Ref #: RKI-GL-0004

GUIDELINES FOR SENSOR REPLACEMENT (FIELD SERVICE & REPAIR)

The purpose of this document is to provide guidelines as to when and why instrument sensors should be replaced. Proactive replacement of dated sensors will ensure that instruments will continue to function properly and meet our customer's needs.

1. SENSOR REPLACEMENT GUIDELINES FOR PORTABLE AND FIXED SYSTEMS
    a. OXYGEN SENSORS
        i. Sensor is over 2.5 years old covering:
            1. OS-BM2 (Micro Partial Pressure, GX-2001, 2003, 2009, GX-2012, GX-6000, GasWatch, OX-01, OX-03)
            2. 65-1025RK (Capillary cell, fixed systems)
            3. Other fixed system oxygen sensors not noted
        ii. Sensor is over 4 years old for the following:
            1. 65-2510RK (Partial Pressure, fixed systems with OS-B11 sensor)
            2. 65-1051RK (Partial Pressure, GX-82, 86, 91, OX-82, OX-90, OX-07 Series with OS-B12 sensor)
            3. 65-1058RK (Partial Pressure, GX-94, GX-8000 & RX-8000 with OS-BM1 sensor)
            4. 65-0601RK (Partial Pressure, Eagle, Eagle 2, XP-204A and others using OS-B3 sensor)
            5. OSU-OXY (GD-70D)
        iii. Output of sensor is unstable
        iv. Sensor can not be zeroed
        v. Span can not be set / fails calibration
        vi. Response does not meet established T-90 for the specific sensor
        vii. Voltage output is outside the acceptable tolerance for the specific sensor
        viii. There is evidence of leakage, physical damage or contamination
        ix. Customer requests sensor be replaced
    b. CO, H2S & OTHER TOXIC GAS SENSORS
        i. Sensor is over 3 years old covering:
            1. ES-1821 (Micro CO for GX-2001, 2003, 2009, GX-2012, GX-6000, GasWatch, CO-01, CO-03 (3 year Warranty)

2. ES-1827i (Micro H2S GX-2001, 2003, GX-2012, GX-6000, GasWatch, HS-01, HS-03 (3 year Warranty).
3. ES-23 HCl & O3, ES-K233 HCl, ES-K239C-O3
4. ESU series sensors (GD-70D)
5. ESM series sensors (SC-01 & Eagle 2)

ii. Sensor is over 4 years old covering:

1. 65-2005RK (Eagle, & Eagle 2 CO)
2. ES-87RW-H2S (Eagle 2)
3. 65-2035RK (Eagle H2S)
4. 65-2008RK (GX-94 CO)
5. 65-2038RK (GX-94 H2S)
6. 65-2003RK (CO sensor for GX-82, 86, 90, 91)
7. All fixed system toxic gas sensors excluding sensors listed in paragraph “i” above.
8. Output of sensor is unstable
9. Response does not meet established T-90 for the specific sensor
10. Sensor can no longer be calibrated
11. There is evidence of leakage, physical damage or contamination
12. Customer requests sensor be replaced

c. CATALYTIC COMBUSTIBLE GAS SENSORS (all)

i. Output of sensor is unstable
ii. Sensor can not be zeroed
iii. Response does not meet established T-90 for the specific sensor
iv. Sensor can no longer be calibrated or meet the following criteria:

1. Response does not meet or exceed 120% of calibration set point. Example: when testing a sensor with 50% LEL methane, the maximum span should be 60% LEL or above. For instruments that auto adjust, replace sensor if sensor can no longer be calibrated.

v. There is evidence of physical damage or contamination
vi. Customer requests sensor be replaced

d. THERMAL CONDUCTIVITY (TE-), MOS (SGU & SH-8641), INFRARED HC, CH4 & CO2, IONIZATION SENSOR FOR PYROLYZER, GD-S8DG AND GD-DS77DG SERIES, PID Sensors (all)

i. Output of sensor is unstable
ii. Sensor can not be zeroed
iii. Response does not meet established T-90 for the specific sensor
iv. Sensor can no longer be calibrated
v. There is evidence of physical damage or contamination
vi. Customer requests sensor be replaced

2. Notes: if customers choose **not** to have sensors replaced that exhibit the problems as noted above other than age, the instrument is to be returned **without calibration certificate or calibration sticker** as the instrument does not meet our requirements

for operation. A note will be made on the repair report documenting that the sensor(s) were not replaced due to customer instruction.

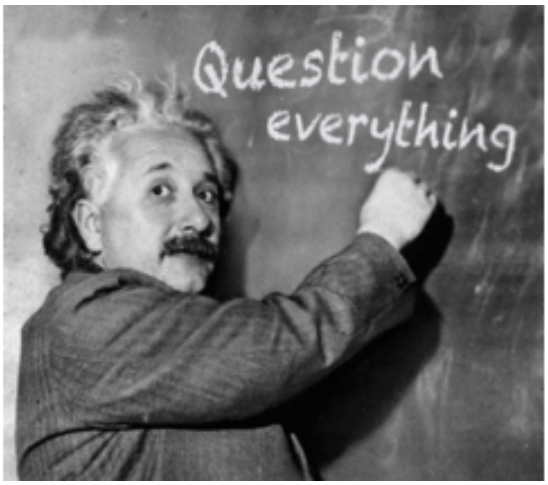
3. If the sensors are over the recommended replacement age but perform to all other published specifications, can be calibrated and customer requests the sensor **not** be replaced, calibration will be performed, calibration certificate and calibration sticker will be provided, and a note made on the repair report indicating that sensors were not replaced due to customer request.

   The above are only guidelines, please consult the Technical Services Manager or Senior Management for exceptions to the above.

Issued by: **Steve Peluffo**

Revision E
10/04/16

Questions?



57