

IST Toxic and Combustible Gas Sensors

FOR THE SEMICONDUCTOR INDUSTRY

The following information should be used in conjunction with IST's informational brochures regarding stationary and portable model numbers MP24 rackmount, MP200 wallmount, and IQ series portables.

There are a number of gases used in the semiconductor industry and there is no single type of sensor which will monitor all of these different gases most effectively. However, IST instruments are designed to be used with most of the currently available sensor technologies to optimize the effectiveness of the application. IST currently offers solid-state, electrochemical, catalytic, and IR sensors (for CO₂ and CH₄) to meet the demands of even the most rigorous applications. The following is a discussion of each sensor type and the pros and cons of each.

1. HYDROGEN GAS

IST's solid-state sensor is undisputably the best sensor for H₂ applications. The sensor is very sensitive to H₂ and can be detect hydrogen from the low ppm range all the way up to combustible ranges, whether in air or inert gas backgrounds. In fact, the IST solid-state sensor was chosen by NASA's space shuttle program for the main propulsion engine test program to detect H₂ in a helium background at -40 C.

The advantage of the IST solid-state sensor are:

- 1) It detects both low ppm and high gas concentrations.
- 2) They have indefinite life expectancy. Many sensors installed over 25 years ago are still working today.
- 3) No maintenance costs because the sensor does not burn out. The sensors are stable, reliable, and come with a 3-year factory warranty.
- 4) If required, the sensor can be configured to detect H₂ selectively.

Sensor Specifications:

Sensor Type:	Hydrogen Solid-State Sensor
Range:	100 ppm full scale up to %LEL. Configurable to any range.
Temperature:	-40 to +60 C
Humidity:	10% – 95% non-condensing
Sensor Life:	20 years or more. Comes with 3-year warranty.
Selectivity:	Detects H ₂ only for normal applications.

The alternative for the solid-state sensor for H₂ detection is the catalytic sensor. To detect hydrogen, the catalytic sensor needs to operate at very low temperatures with small signal outputs, the combination of which causes the sensor to lose sensitivity prematurely.

2. Hydride Gases

Even though solid-state sensors have long life and good reliability, hydride gas applications with this sensor have one major drawback: the solid-state sensor is generally not selective enough for many of the hydride TLV applications. In a typical application, there are many chemicals used in the area including members of the alcohol family, which will cause the solid-state sensor to go into alarm. Therefore, for most TLV applications, IST recommends use of the electrochemical sensor. However, in applications where simple leak and reliable long-term detection is needed, the solid-state sensor would be the best choice. Since IST instrumentation is designed to be interchangeable between solid-state and electrochemical sensors, the cost of changing from one sensor technology to another is minimal.

For electrochemical sensors, IST also provides its affordable EZ-Cal service in which factory calibrated sensors are automatically sent to customers every six months. The customer needs then to merely swap out the existing sensor with the factory calibrated sensor. The whole process takes under one minute per sensor and providing fresh, accurate sensors at a minimum of time and expense. IST electrochemical sensors are available for the gases listed on the table on the next page. Ranges listed are arbitrary and can be configured to the customer's needs.



Table 1

Gas	Symbol	EL Range	SS Range	TLV
Ammonia	NH ₃	100 ppm	50 ppm	25.00 ppm
Arsine	AsH ₃	1	1	0.05
Bromine	Br ₂	5	20	0.10
Chlorine	Cl ₂	5	5	0.50
Chlorine Dioxide	ClO ₂	10	10	0.10
Diborane	B ₂ H ₆	1	10	0.10
Fluorine	F ₂	5	20	0.10
Germane	GeH ₄	5	10	0.20
Hydrogen Bromide	HBr	50	50	3.00
Hydrogen Chloride	HCl	50	50	5.00
Hydrogen Fluoride	HF	10	50	3.00
Nitrogen Oxide	NO ₂	20	20	3.00
Phosgene	COCl ₂	1	50	0.10
Phosphine	PH ₃	1	3	0.30
Silane	SiH ₄	50	10	5.00
Oxygen	O ₂	ppm to deficiency	n/a	n/a
Ozone	O ₃	1	5	0.10
Nitrogen Trifluoride	NF ₃	50	50	10.00
Tetraethyl Orthosilicate	TEOS	50	100	10.00

HYDRIDE SENSOR SPECIFICATIONS:

Sensor Type:	Electrochemical Sensor	Hydride Solid-State Sensor
Range:	Listed in Table 1. Others available; consult factory.	Listed in Table 1. Others available; consult factory.
Temperature:	0° to 40°C	-40° to +60°C
Humidity:	20 – 90% relative humidity, non-condensing	10% - 95% non-condensing
Sensor Life:	1 – 2 years; comes with 1-year warranty	10 years or more; come with 3-year warranty
Selectivity:	Very good	Non-selective

SENSOR TRANSMITTER TECHNICAL SPECIFICATIONS:

Model Numbers:	4-20IQ, SM95
Power:	14-24 VDC
Current Drain:	400 mA
Output Current:	4-20 mA non-isolated (isolated optional) or 100 to 500 µA
Temperature:	-40° to +60°C
Humidity:	15% - 96% non-condensing
Controls:	4-20IQ: Span, zero, heater, and alarm setpoints. Magnetic wand to activate switches for non-intrusive automated calibration. SM95: Conventional pot adjustment for zero, span, and heater.
Display:	4-20IQ: LED display SM95: None
Fault:	Output current goes to 0 mA
Dimensions:	4-20IQ: 4.54"H x 7.82"L x 5.05"W (116mm x 200mm x 129mm) Weight: 3.89 lbs (1.77 kg) SM95: 2.85"H x 8.87"L x 3.8"W (73mm x 226mm x 97mm) Weight: 2.9 lbs. (1.32 kg)
Case:	UL, CSA Certified Class I, Division I, Groups B,C, and D CELENEC Approvals Pending Approvals for use with solid state sensors only