

## Gas sensors for

RTM2200, RPM2200, EQF3200 und EQF3220 und A<sup>2</sup>M4000

SARAD offers a wide range of gas sensors for various applications. These sensors can be mostly integrated into the enclosure of the instrument. Of course it is also possible to integrate OEM sensors chosen by the customer if the output signals are compatible with our instruments.

Due to the big number of target gases, different measurement principals with different behaviour regarding range, uncertainty, cross sensitivity and ambient conditions must be considered. Each user should clarify in advance the conditions and requirements for his application to select the best suited sensor.

Beside very complex and expensive analysis methods like gas chromatography or infrared gas spectroscopy, three major measurement principals are commonly used for monitoring and testing:

<b>Non-dispersive infrared sensors (NDIR)</b>	<b>Semiconductor sensors based on metal oxide</b>	<b>Electrochemical Sensors</b>
High accuracy (sometimes below 1%)	Less accuracy (10%)	Less accuracy (5%), better than metal oxide
Wide measurement range (variable by size of gas gauge)	High sensitivity for low gas concentrations	High sensitivity for low gas concentrations
Long term stable (dependent on light source and receiver)	Good long term stability (but sensitive against silicon gases)	Less long term stable by catalytic processes, periodical replacement required
Low cross sensitivity to other gases	Moderate cross sensitivity	Moderate cross sensitivity
High power consumption	Medium power consumption	Low power consumption
Expensive	Sensor elements inexpensive	Sensor elements more expensive than metal oxide, depending on target gas

Table 1 – comparison of operational principals

With respect to the most frequent application fields we offer a number of standard sensors for our monitors. We use our own gas transmitters in case of semiconductor and electrochemical sensors. In case of NDIR sensors we implement parts from leading companies in this field.

### Semiconductor sensors

This kind of sensors is mostly used in the field of gas testing for safety purposes. The combination of CO and combustible gases (Methane) offers a phantastic addition for Radon monitors used in mines or underground facilities. If these sensors are used under moderate and smooth conditions, they will be also suitable for monitoring applications.

The SARAD transmitter contains always two different gas sensors. Various combinations of target gases are possible:

	Carbon monoxide (CO)	Methane (CH4)	Combustible gases	Ammonia (NH3)
Carbon monoxide (CO)		X	X	
Methane (CH4)	X		X	X
Combustible gases	X	X		X
Ammonia (NH3)		X	X	

Table 2 – Combinations of semiconductor sensors

The sensors are normally placed at the front panel so that they are easily accessible for replacement. If it is necessary to insert the sensors in a closed gas loop, a special cap with hose terminals is available. This cap can be also used for calibration with test gases. Our transmitter is compensated for temperature and humidity changes.

Carbon monoxide (CO)	50 ... 1000 ppm
Methane (CH4)	500 ... 10000 ppm
Ammonia (NH3)	30 ... 300 ppm
General combustible gases	500 ... 10000 ppm
FCKW (CFC)	5 ... 100 ppm

Table 3 – list of available semiconductor based gas sensors

The transmitters are connected to the internal serial bus system of the monitor. Therefore it is possible to connect multiple transmitters.

## NDIR sensors

The two very important soil gases, Methane and Carbon dioxide, can be measured by non-dispersive infrared technology. This principal of operation allows very accurate measurements in the percentage range of the target gas concentration. By the variation of the sensor gauge is it possible to create several measurement ranges for best fitting to the application.

We integrate the sensors into the internal gas loop of our monitors. Due to the space requirements, the standard 25 cm wide instrument enclosure must be replaced by a 32 cm wide housing. As an alternative, the sensor can be placed in an external box with hose terminals and cable connection. This enables the mounting into external gas channels.

Carbon Dioxide (CO2)	0 ... 10% 0 ... 25% 0 ... 50% 0 ... 100%
Methane (CH4)	0 ... 1% 0 ... 2.5% 0 ... 5% 0 ... 20% 0 ... 100%

Table 4 – list of available NDIR gas sensors

## Electrochemical sensors

Electrochemical sensors offer the widest range of target gases. They offer good repetition accuracy and are used for monitoring as well as gas safety tests. The life time of the sensor elements is limited by the chemical processes of the electrolyte. Normally, two years of operation are guaranteed. The chemical process takes also place if no circuit voltage is applied. Therefore, a cyclic replacement is strictly required.

Oxygen (O <sub>2</sub> )	0... 25%
Hydrogen Sulfide (H <sub>2</sub> S)	0... 50 and 0...2000 ppm
Phosphene (PH <sub>3</sub> )	0... 10 and 0 ...2000 ppm
Hydrogen Cyanide (HCN)	0... 100 ppm
Hydrogen Chloride / Hydrogen Bromide	0... 100 ppm
Chlorine (Cl <sub>2</sub> )	0... 20 ppm
Nitrogen Dioxide (NO <sub>2</sub> )	0... 20 ppm
Nitrogen Monoxide (NO)	0... 250 ppm
Sulfur Dioxide (SO <sub>2</sub> )	0... 100 and 0... 2000 ppm

Table 5 – list of available electrochemical gas sensors

Our transmitters offer an analogous output signal of 0...5V and can be directly connected to the sensor inputs of our monitors. The electrical mechanical design allows simple cascading of multiple sensors on a rail to save space and to keep the internal gas volume as low as possible. Dependent on the number of sensors which shall be integrated, a wider enclosure (32 cm instead of 25 cm) may be required. If no analogous inputs of the monitor are occupied by other analogous sensors, up to eight electrochemical gas transmitters can be connected in parallel.