ELECTROCHEMICAL & % LEL
ANALYZERS

Safety, Stack & Environmental Monitoring

CO₂, CO, O₂, O₃, SO₂, H₂S, NO, NO₂, NH₃, HCl, Cl₂,
PH₃, SiH₄, HCN, H₂, ETO, Formaldehyde, % LEL

MODEL 1000   GAS ANALYZERS
**Introduction**

The **Model 1000** Analyzers are reliable, flexible and versatile instruments based on electrochemical sensors for the measurement of chlorine (Cl₂), hydrogen cyanide (HCN), carbon monoxide (CO) other toxic gases in the workplace. These analyzers have an optional setpoint meter that can be used to control outside air vents or alarm if the gas is above an alarm level. These products are available in a NEMA 4 wall mount configuration.

Other Continuous Analyzers include the Model 201-B PID or FID Analyzer for total VOCs, a thermal conductivity detector (TCD), Model 204 and a Model 210 Paramagnetic Oxygen Analyzer. The addition of these new Analyzers greatly improves the capability and range of process analyzers from PID.

**Principle of Operation**

Amperometric techniques can use two or three electrode systems for detection. A membrane is used to separate the phase being measured (air containing a toxic gas) from the electrolyte where the measurement takes place. The oxygen electrode was first described by Clarke in 1956 and is perhaps the best known of this type. Here, a fixed potential is applied to one electrode and the current generated by oxygen being consumed according to:

\[ \text{O}_2 + 2\text{H}_2\text{O} + 2e^- \rightarrow [\text{H}_2\text{O}_2] + 2\text{OH}^- \]

is measured.

Various organic and inorganic compounds can be sensed at an electrode interface by applying a voltage that is equivalent to the oxidation or reduction potential. As the appropriate compounds diffuse to the electrode, they will be oxidized or reduced and will produce a current (proportional to concentration). This signal is amplified and displayed on the digital meter. The calibration value for each sensor is stored in the processor memory for later retrieval. Other types of electrochemical sensors include potentiometric types such as NH₃ and CO₂.

**Applications**

**Hydrocarbons & Methane (CG or TCD)**
- Drying oven % LEL
- Pill Coating % LEL
- Stack & Vent monitoring % or % LEL
- Monitoring workplace atmospheres
- Control outside makeup air to minimize air exchanges and keep toxic gas levels at a minimum
- Detection of leaks from processes
- Monitor/Control the buildup of indoor air pollutants
- Safety Monitoring
- Stack gas monitoring- SO₂, NOₓ, CO₂
- O₂- Sampling systems available
- Scrubblers outlets- efficiency of HCl, NH₃, H₂S

**Features**-

- **Automatic Restart**- In the event of a power outage, the instrument will automatically restart
- **Wide operating range** with no range changing necessary- **16 Bit ADC**
- **Push button calibration**- automatically adjusts response
- **RS232 digital output**- can print to a serial printer or print to a PC; **4-20 mA analog** output (optional for single channel) to interface to PLC or DCS system. For multichannel data acquisition, the RS485 output is required.
- Stored calibration values
- Audible alarm- internal
- Datalogging (programmable) for 7,000 points
- Easy to calibrate; Turn on/off functions via simple keypad
- Interchangeable electrochemical detectors
- Battery operation is available as an option

**CO₂, CO, O₂, O₃, SO₂, H₂S, NO, NO₂, NH₃, HCl, Cl₂, HCN, H₂, ETO, Formaldehyde**
### Specifications

**Electrochemical Sensors, CG, & TCD sensors are available (see back Page Table 1).**

**Available in two configurations:**
- Single component or Multiple component (2-4 sensors); 1 CG or TCD plus 3 electrochemical sensors

**Measurement mode:** Continuous

**Response time:** 20-50 sec. to 90%

**Zero drift:** Automatic compensation; <1-2% per month

**Span drift:** less than 2% every month

**Single alarm:** customer programmable

**Wide range of response:** from ppm to 100%

**Readout:** 5½ digit LCD smart panel meter with backlighting

**Standard output:** RS232; optional outputs- 4-20 mA & RS485

**Enclosure:** Wall (NEMA 4)-General Purpose 6.75” W x 10 3/8” H x 6” D;

- **Weight:** 7.4 pounds

**Power requirements:** 100-240VAC, 1 amp

**Range:**

Sensors can be used for safety or environmental monitoring at low ppm levels. Oxygen can be measured at % levels or ppm levels depending on the application. A special oxygen sensor is available for measuring oxygen in stack gases where the acid gases can interfere with operation. For a number of combustion gases such as: SO₂, NO, NO₂, hundreds to thousands of ppm can be measured instead of low ppm. These electrochemical sensors have filters to minimize interferences. The CG and TCD measure low % levels to 100% respectively.

### Options

- 4-20 mA output (single sensor);
- RS485 output (multiple sensors)

**Single alarm setpoint:** Customer Programmable

Data acquisition and storage using DataWorks software

**X Proof:** explosion proof enclosure

(see 900 transmitters)

### Sampling Systems

One of the most difficult challenges is to deliver a sample stream saturated with water at an elevated temperature to the analyzer without any change in the composition of the compounds to be measured. A photo of one of our sample conditioning system is shown below. For additional information, please contact PID Analyzers.

The system below requires only compressed air for operation and removes all liquid water from the sample. It can be used in a Class I Div 1 area.

We also offer heat exchangers and heated sample lines for other types of samples. A heated permeation sampling system is ideal for SO₂ and NOx from combustion sources.
**DataWorks**

Data Works is PIDs data collection and logging software that can be used with a wide variety of Sensor or Analyzer outputs such as Ethernet, RS485 & 4-20 mA. The latter two outputs are for long distance transmission of data as shown in Table I below. In-plant installations are typically 4-20 mA or RS485 because of the long distances involved 1,000-5,000'.

Each day at midnight, a new CSV or text file is created and named (by date). These files can be directly imported into EXCEL.

**Table I**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Range ppm</th>
<th>Detection Limit</th>
<th>ResponseTime (s)</th>
<th>Interferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>0-3,000</td>
<td>0.1</td>
<td>30</td>
<td>Amines</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>0-10,000</td>
<td>10</td>
<td>45</td>
<td>Acid Gases</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>0-1,000</td>
<td>0.5</td>
<td>15</td>
<td>H₂, C₂H₄</td>
</tr>
<tr>
<td>Chlorine</td>
<td>0-10</td>
<td>0.1</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>ETO</td>
<td>0-100</td>
<td>0.1</td>
<td>30</td>
<td>MEK, Ethanol</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>0-100</td>
<td>0.1</td>
<td>30</td>
<td>Oxygenated HC</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>0-100</td>
<td>0.1</td>
<td>50</td>
<td>C₃H₄, H₂S, SO₂</td>
</tr>
<tr>
<td>Hydrogen Chloride</td>
<td>0-100</td>
<td>0.1</td>
<td>15</td>
<td>SO₂, NO₂</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>0-100</td>
<td>0.1</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>0-5,000</td>
<td>0.1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Nitric oxide</td>
<td>0-250</td>
<td>0.1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Nitric oxide-SG</td>
<td>0-20</td>
<td>0.1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>0-200</td>
<td>0.1</td>
<td>15</td>
<td>NO₂</td>
</tr>
<tr>
<td>Nitrogen Dioxide-SG</td>
<td>0-200</td>
<td>0.1</td>
<td>15</td>
<td>NO₃, H₂S</td>
</tr>
<tr>
<td>Oxygen</td>
<td>0-30%</td>
<td>0.1%</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Oxygen-SG**</td>
<td>0-30%</td>
<td>0.1%</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>0-2%</td>
<td>0.1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Ozone</td>
<td>0-2</td>
<td>0.02</td>
<td>75</td>
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<tr>
<td>Phosphine</td>
<td>0-5</td>
<td>0.05</td>
<td>40</td>
<td>SiH₄, GH₄, B₂H₆</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>0-5</td>
<td>0.1</td>
<td>20</td>
<td>NO₂</td>
</tr>
<tr>
<td>Sulfur Dioxide-SG</td>
<td>0-5000</td>
<td>0.1</td>
<td>20</td>
<td>NO₂ filter</td>
</tr>
<tr>
<td>Silane</td>
<td>0-5</td>
<td>0.05</td>
<td>30</td>
<td>AsH₃, PH₃, B₂H₆</td>
</tr>
<tr>
<td>Combustible Gas</td>
<td>0-100%LEL</td>
<td>0.1%</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity 0-100% v/v</td>
<td>0.1%</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SG= Stack Gas Sensor, ** Uses acidic electrolyte to prevent interferences from acid gases

**Model 900- Infrared Transmitters**

PID Analyzers offers a new explosion proof transmitters (electrochemical, combustible gas, IR and TCD for chemical loading, leaks, waste water treatment... applications. The 4-20 mA transmitter is in an explosionproof junction box at or near the sensor. The readout unit can be located > 300 meters away in the control room. The sensor is designed for Class I Groups BCD.

**Applications for Transmitters**

Chemical plants
Refineries
Solvent Mfg., Unloading chemicals