

# Product Data Sheet

P/N : GS+A3CO

**GS+A3CO**  
Carbon Monoxide Sensor (CO)

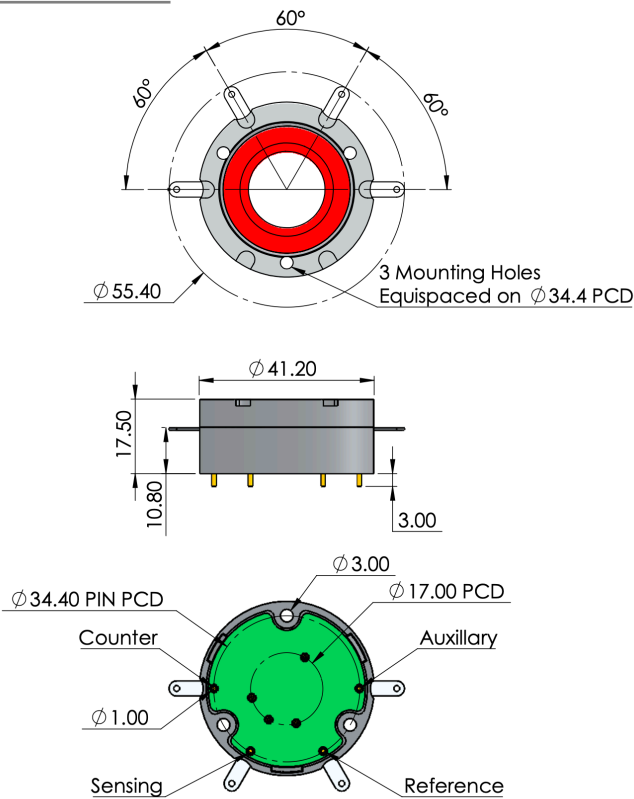
**Introduction**     The GS+A3CO is a premium high quality robust CO sensor, ideal for use in portable emissions gas detectors.

**Key Features:**     High stability, fast response and recovery, robust environmental performance.

| Net Sensor Performance Characteristics |                        |
|--|------------------------|
| Output signal                          | 75 ± 25 nA / ppm       |
| Typical Baseline Range (pure air)      | ±5 ppm CO equivalent   |
| Filter Capacity                        | To remove acid gases   |
| T90 Response Time                      | < 40 seconds           |
| Measurement Range                      | 0 - 2,000 ppm          |
| Maximum Overload                       | 4,000 ppm              |
| Linearity                              | Linear up to 4,000 ppm |
| Repeatability                          | < ±2% CO equivalent    |
| Recommended Load Resistor              | 10 ohms                |
| Resolution (Electronics dependent)     | < 1 ppm typical        |

| Environmental Details        |                  |
|------------------------------|------------------|
| Temperature Range Continuous | -20°C to +50°C   |
| Pressure Range               | 800 to 1200 mbar |
| Operating Humidity Range     | 15% to 90% RH    |

**Important Note:**  
All performance data is based on conditions at 20°C, 50%RH and 1 atm, using DD Scientific recommended circuitry.  
Sensor performance is temperature dependent, and please contact DD Scientific for temperature performance other than 20°C.



**Product Dimensions**  
All dimensions in mm  
All tolerances ±0.15 mm

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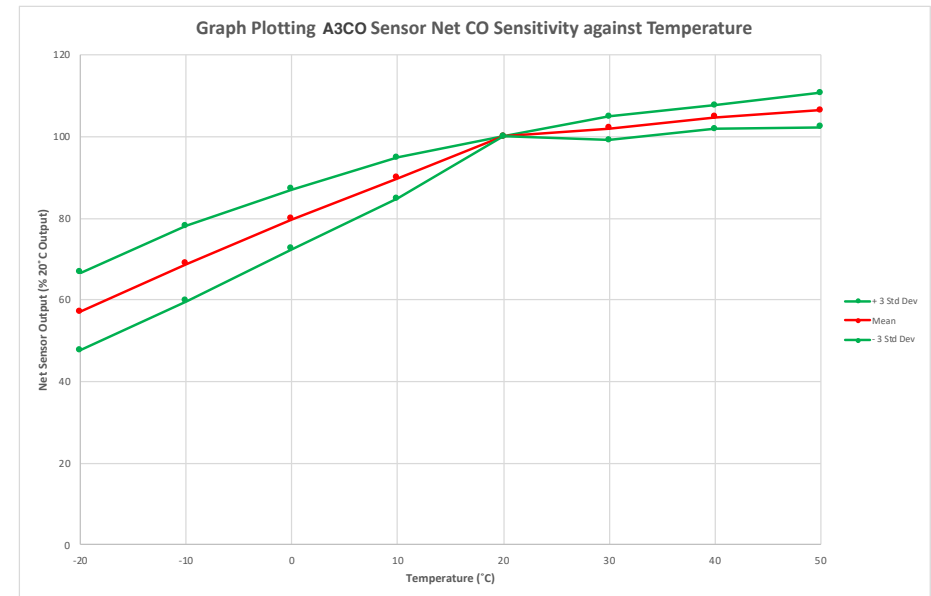
## Lifetime Details

|                          |                                 |
|--------------------------|---------------------------------|
| Long Term Output Drift   | < 1% per month                  |
| Recommended Storage Temp | 0°C to 20°C                     |
| Expected Operating Life  | > 36 months in air              |
| Standard Warranty        | 24 months from date of dispatch |

## Cross - Sensitivity Data (Net Sensor Performance)

| GAS               | CONC.     | GS+A3CO    |
|-------------------|-----------|------------|
| Hydrogen Sulphide | 25 ppm    | 0 ppm CO   |
| Sulphur dioxide   | 200 ppm   | 0 ppm CO   |
| Nitrogen Dioxide  | 200 ppm   | ≈ -1ppm CO |
| Nitric Oxide      | 1,000 ppm | 0 ppm CO   |
| Hydrogen *        | 500 ppm   | <1 ppm CO  |
| Hydrogen *        | 2000 ppm  | <4 ppm CO  |

\* Using auxiliary electrode compensation



### Poisoning:

DD Scientific sensors are designed to operate in a wide range of harsh environments and conditions. However, it is important that exposure to high concentrations of solvent vapors is avoided, both during storage, fitting into instrument and operation. When using sensors on printed circuit boards (PCB's), degreasing agents should be used prior to the sensor being fitted.

## Intrinsic Safety Data

|                     |        |
|---------------------|--------|
| Maximum at 2000 ppm | 0.3 mA |
| Maximum o/c Voltage | 1.3 V  |
| Maximum s/c Current | <1.0 A |

**GS+A3CO meets sensor requirements outlined in:**

**EN50379**

**WARNING:** By the nature of the technology used, any electrochemical gas sensor offered by DD Scientific can potentially fail to meet specification without warning. Although DD Scientific Ltd makes every effort to ensure the reliability of our products of this type, where life safety is a performance requirement of the product, we recommend that all sensors and instruments using these sensors are checked for response to gas before use.

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### A3CO Sensor Operation:

In order to minimise the effect of hydrogen cross sensitivity on the net sensor performance, thus providing a true value for the CO content of the gas being tested, the output from the Auxiliary electrode should always be subtracted from the output of the Sensing electrode.

The Auxiliary electrode output will always be predominantly due to the hydrogen content of the gas stream, with the sensitivity to CO on this electrode being typically < 5% of that on the sensing electrode.

It cannot be guaranteed that the Sensing / Auxiliary electrode performance is identical when it comes to the relative levels of Hydrogen sensitivity, therefore calibration of both Sensing and Auxiliary electrodes to both CO and H<sub>2</sub> (typically in the form of two test gases, CO and a CO / H<sub>2</sub> mixture) is required.

From the values generated during this calibration, the level of Auxiliary signal amplification can be determined, commonly referred to as the Gain value, and when applied to the signal before subtraction from the sensing electrode, this amplified signal will ensure that the effect of hydrogen is all but eradicated.

Step by Step this calibration would be as follows:

- 1: Record the clean air output current for both electrodes (**S<sub>zero</sub>** and **A<sub>zero</sub>**)
- 2: Expose the sensor to a known concentration of Carbon Monoxide [CO], recording the stable output current for both electrodes (typical 3 min exposure), calling these points of data **S<sub>co</sub>** and **A<sub>co</sub>**
- 3: The sensor can then be exposed to a CO / H<sub>2</sub> gas mixture of known concentrations ([Mix CO] and [Mix H<sub>2</sub>]), and once a stable signal has been achieved from both electrodes (typical 3 min exposure), record the output current of both electrodes, referring to these data points as **S<sub>mix</sub>** and **A<sub>mix</sub>**
- 4: Using these 6 separate electrode outputs, in conjunction with the known gas concentrations from each stage of the calibration process, it is possible to determine the Gain value required for each individual sensor, such that the Net sensor output (with any potential effect due to the presence of H<sub>2</sub> removed) can be calculated, and presented to via the instrument display as a ppm CO value.

- 5: The calculations that follow outline the various steps that are required:

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|   |                    |   |   |
|---|--------------------|---|---|
| Step A: Sensing Electrode CO Sensitivity (A):<br>(uA/ppm)   | A                  | = | $\frac{S_{CO} - S_{zero}}{[CO]}$                              |
| Step B: Auxiliary Electrode CO Sensitivity (B):<br>(uA/ppm) | B                  | = | $\frac{A_{CO} - A_{zero}}{[CO]}$                              |
| Step C: Sensing Electrode H2 Sensitivity (C):<br>(uA/ppm)   | C                  | = | $\frac{(S_{mix} - S_{zero}) - (A \times [Mix CO])}{[Mix H2]}$ |
| Step D: Auxiliary Electrode H2 Sensitivity (D):<br>(uA/ppm) | D                  | = | $\frac{(A_{mix} - A_{zero}) - (B \times [Mix CO])}{[Mix H2]}$ |
| Step E: Gain Value (no units):                              | Gain               | = | $\frac{C}{D}$   |
| Step F: Net Sensor CO Sensitivity:<br>(uA/ppm)              | Net CO Sensitivity | = | $A - (Gain \times B)$   |

As mentioned above, the values above can now be used to ensure that the instrument display (ppm CO) will be as accurate as possible, when using the final equation:

$$\text{Displayed CO Concentration (ppm)} = \frac{\text{Sensing Output} - (\text{Gain} \times \text{Auxiliary Output})}{\text{Net CO Sensitivity}}$$

It is important to note that all six of the electrode outputs above can and will be affected by the temperature in which the sensor is held. In particular, as the ambient temperature increases the H2 sensitivity will increase quite dramatically, altering the sensor gain, and with that potentially introducing error to the displayed CO concentration.

It is highly recommended that the effect of temperature on these critical parameters be fully understood, and incorporated within the instrument software to be able to correct for the effect of temperature on the accuracy of the instrument display.

## Recommended Operating Circuit:

