MSA XCell® **Two-Tox Sensors**

Technical Brief

The Safety Company

As sensor technology continues to evolve, the ability to detect two gases using a single sensor package has helped to drive down size, cost and maintenance. While use of a dual gas sensor is nothing new, it is important to understand the technologies that enable this capability, as well as limitations in some cases. MSA's XCell Two-Tox Sensors incorporate the latest sensor technology, delivering high level accuracy while making false alarm concerns due to cross-channel interference a thing of the past.

DETECTING TWO GASES USING CROSS-SENSITIVITIES

Two gases can be detected by using natural cross sensitivity associated with a secondary gas on a single sensing element (electrode). For example, a sensor electrode designed and optimized for CO has natural cross-sensitivity to many volatile organic compounds (VOCs). If these compounds are not filtered, the sensor would respond to them. It is for this reason that currently available electrochemical CO sensors offer integrated filters. Some gases are difficult to filter; for example, hydrogen is such a small molecule that it travels through filtering, causing a reaction on a typical CO sensor. Available hydrogen-resistant sensors are designed for changes in the actual electrochemistry to achieve the necessary performance. By using a known cross-sensitivity response factor, concentrations can be estimated when reacting with the a given electrode, but this is not a true two-gas sensor. While this process may be a means to provide warning to end users, it is not overly accurate, as users calibrate using only one gas, and cross-sensitivities can change over time as sensors lose sensitivity.

DISCRETE SENSOR ELECTRODES

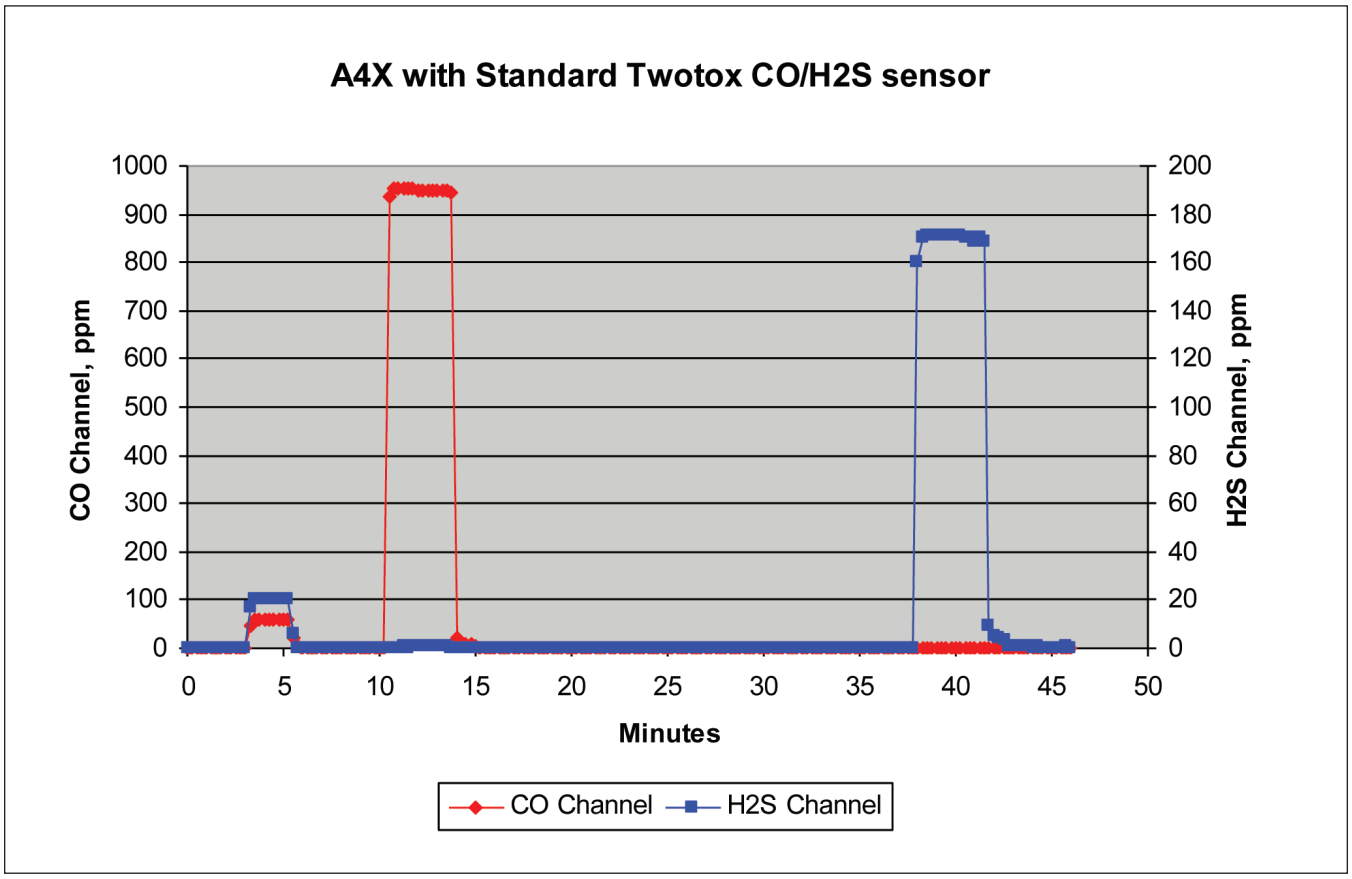
Further developments concerning two-gas sensors include introduction of a second sensing or working electrode that is designed specifically for the alternate gas. Each sensing electrode reacts to and is calibrated by a separate target gas, providing accurate readings for two gases throughout the sensor's life. The issue with many of these sensors is that their electrode partitioning design allows for undesirable cross-channel interference. The CO electrode provides some response to H_2S and vice versa, leading to a generally inaccurate calibration, as both gases are applied at once. This process can also result in false readings in the field, especially within changing environmental conditions.

In each approach, any sensor response sends an analog signal to the instrument that provides a gas response indication. This analog signal, however, does introduce the possibility of electronic cross-channel interference due to electronic noise that can further lead to false alarms or inaccurate readings.

XCELL TWO-TOX SENSOR

MSA XCell Two-Tox Sensors incorporate the approach of using two separate sensor inlets combined with two discrete working electrodes. MSA offers a patent-pending mechanical design to completely partition the two working electrodes to eliminate the cross-channel issue seen with older two gas sensor designs. Target gas selectivity is further optimized through selective filtration at the sensor inlet and choice of electrode catalyst. MSA's XCell Sensor platform also incorporates an ASIC (Application Specific Integrated Circuit) chip on each sensor. By miniaturizing sensor controlling electronics and placing them inside the sensor and **not** inside the detector itself, XCell Sensors provide superior stability, accuracy and repeatability. Furthermore, the ASIC allows for digital signal processing, meaning that XCell Two-Tox Sensors communicate with a digital signal that provides much greater immunity to electronic or magnetic interference. The combination of mechanical design, electrochemistry and electronic circuit design allows for XCell Two-Tox Sensor superior performance in many areas.

The following table illustrates the effect of H_2S/CO interference on the alternate channel when exposed to CO and H_2S at moderate and high levels. The red line indicates CO, the blue line H_2S. At four to five minutes on the time scale, a standard quad gas cylinder was used. Here we see discrete signals that stabilize and recover quickly. Secondly, higher concentrations of CO and then H_2S were introduced. In both instances, the specific channel for the target gas responds correctly with no cross-sensitivity or interference on the alternate gas channel.



This design approach is incorporated into the following MSA XCell Two-Tox Sensors:

- CO/H_2S
- H_2S-LC/SO_2
- CO/NO_2
- CO-H_2/H_2S (hydrogen-resistant CO)
- CO/H_2S-LC (low concentration H_2S)

MSA XCell Two-Tox Sensors are available with MSA ALTAIR® 4X, 5X and 2XT Gas Detectors.

Please contact MSA for availability.

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ID 0802-107-MC / Feb 2014