MSA XCell® Pulse Technology; **Pulse Check**

The Safety Company

Technical Brief

MSA's patented XCell Pulse Technology provides a reliable sensor interrogation method that identifies and corrects for changes in output sensitivity. This pulse check is part of a highly efficient and cost effective bump test method for MSA portable gas detectors that include XCell Pulse Technology. When the pulse check (which runs automatically at startup or is user-activated) is combined with an exhalation or flow check, this innovative technology allows MSA portable instrument users to extend time between calibrations. **Notably, users can conduct daily bump tests without use of costly calibration accessories or bottled test gas.** Users can also conduct bump tests anywhere, anytime, while not disrupting worker productivity. This process yields significant savings of in terms of cost and time spent conducting bump tests prior to each day's use in accordance with best industry practices.

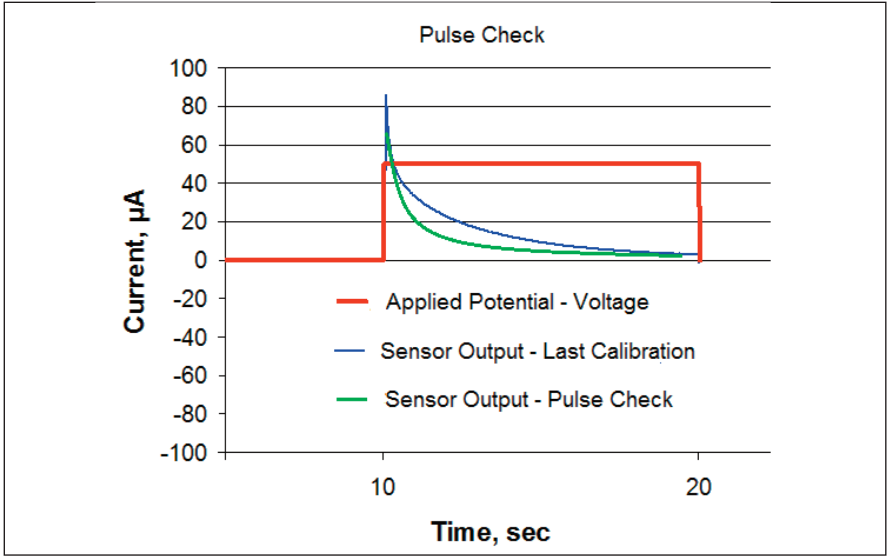
The pulse check uses MSA's patented[1] technology to calculate gas response by applying an electronic pulse to the sensor and analyzing the response curve. Through proprietary algorithms, MSA can quantify gains and losses in output sensitivity that result in real-time accuracy adjustments during the pulse check. Users not only save time, but can also more easily comply with industry best practice of testing detector function daily. Users can also rest assured of accurate indication of sensor functionality.

HOW THE PULSE CHECK INTERROGATION WORKS

The pulse check calculates the change in sensor output response electronically. A voltage pulse is applied to the sensor and response is analyzed and used to indicate sensor output sensitivity, and verify that internal sensor components are functioning properly.

Sensor output sensitivity is comprised of quantifiable aspects of internal sensor components. Sensitivity can be measured without use of bottled gas. The pulse check analysis determines output sensitivity changes using measurements associated with sensor's electrode catalytic loading and increases or decreases in ionic conductivity. Calculated sensitivity is based upon a regression model that uses initial sensitivity levels from the most recent calibration, and measured changes in sensor response function to subsequent electronic checks. Calculated sensitivity is compared to stored sensitivity from the last gas calibration and the previous pulse check to determine sensor accuracy. Output from regression is used to determine whether sensors require recalibration or if they are within acceptable variation from the previous calibration's sensitivity level.

If a difference is measured in sensor response within an acceptable range, a correction will be applied to measured output to adjust sensor response for accuracy without use of calibration gas. Such adjustment is possible due to MSA's application-specific integrated circuit (ASIC) used in MSA's XCell® Sensors. In short, MSA's new Pulse Technology ensures that: a) sensor is present and operating within predetermined sensitivity limits, and b) is corrected to account for drift or change since the last calibration or pulse check event. If output signal has drifted outside of the acceptable range, the instrument will notify the user that gas calibration is necessary. To ensure accuracy over time, MSA recommends gas calibration every 60 days when using XCell Pulse Technology.



1 *Other devices offered in the marketplace can determine sensor function, but MSA holds the only patents to analyze sensor accuracy and adjust the signal as needed.*

Figure 1 shows test results of actual sensor performance during an extreme test where relative humidity was switched from ambient lab conditions to 85% RH, down to 15% RH, back to 85% RH, a finally ending at 15% RH over a 4-month period. Massive changes in humidity cause electro-chemical sensors to gain and lose ionic conductivity as the sensor electrolyte gains and loses water. Increases in water result in higher output signals while dry conditions cause drops in output sensitivity. This condition is one of the major causes of sensor drift in use.

Actual performance is the result of the detector after exactly 20 ppm H_2S is applied. *Calculated performance* is the measured sensor performance, calculated using a regression model. *Corrected performance* is what the detector would actually display based upon Pulse Technology algorithm and the correction calculation. Additional verification at multiple temperature and humidity extreme conditions was conducted as part of the scientific process with similarly acceptable results.

In addition to this extreme testing, several sensors were tested in use conditions typical of Houston, Texas climate. Figure 2 represents sensor performance in a simulated environment cycling from 20° C (68° F) 90% relative humidity (RH) to 34° C (93° F) 55% RH over a 60-day period. Multiple sensors were subjected to this evaluation with a high level of accuracy within this time period.

Use of an electronic check combined with an exhalation flow check with MSA interrogation sensors can provide users with significant productivity and cost savings resulting from reduction in required calibration gas and easier bump test coordination of your MSA portable instrument fleet. See bulletins 0802-107-MC and 0802-105-MC for further information. Sensors with MSA Pulse Technology include onboard ASIC to provide fast, simple and positive indication of instrument functionality.

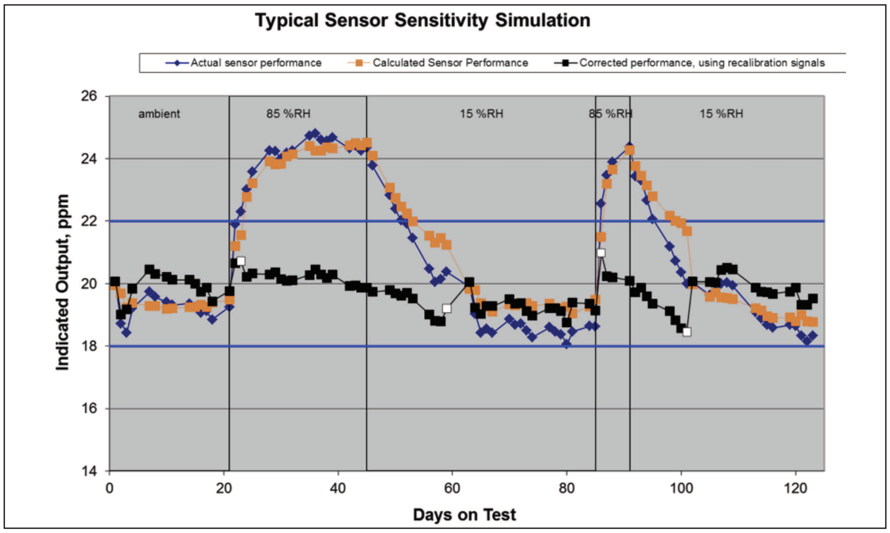


Figure 1

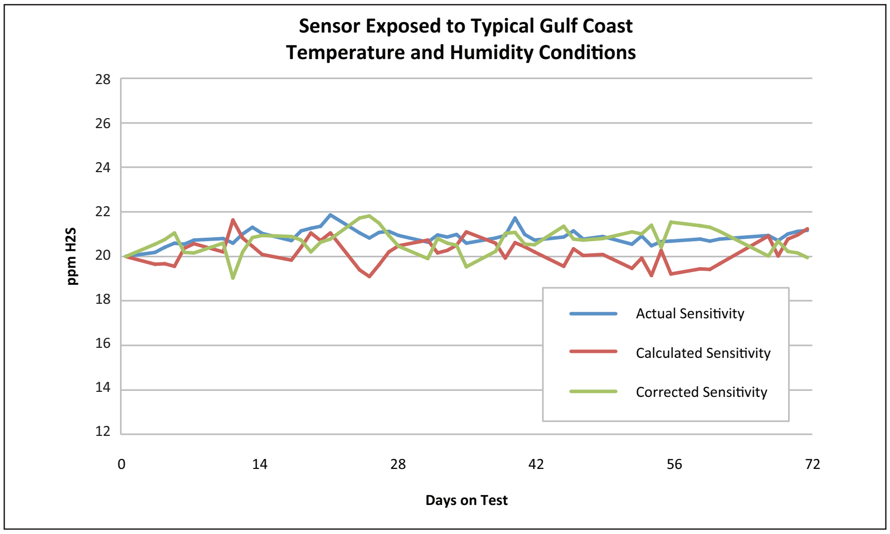


Figure 2

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