The detectors protected by hardware interlock systems [1-7] depend on the accurate measurement of temperature and humidity. Expanding upon the Detector Support Group’s (DSG) interlock system work [8-12] using Sensirion’s digital integrated temperature and humidity sensors (SHT85), DSG is developing hardware and software to support the enhanced features of the Sensirion SHT35 sensors.

Compared to SHT85, SHT35 incorporates enhanced signal processing capabilities and features in a digital interface in a smaller, surface-mount package at a lower cost. Table 1 summarizes the specifications of SHT35.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>Accuracy ±1.5% RH</td>
</tr>
<tr>
<td></td>
<td>Long-term drift</td>
</tr>
<tr>
<td></td>
<td>&lt;0.25% RH/year</td>
</tr>
<tr>
<td></td>
<td>Operating range</td>
</tr>
<tr>
<td></td>
<td>0–100% RH</td>
</tr>
<tr>
<td></td>
<td>Resolution</td>
</tr>
<tr>
<td></td>
<td>0.01% RH</td>
</tr>
<tr>
<td></td>
<td>Repeatability</td>
</tr>
<tr>
<td></td>
<td>0.08% RH</td>
</tr>
<tr>
<td>Temperature</td>
<td>Accuracy ±0.1°C</td>
</tr>
<tr>
<td></td>
<td>Long-term drift</td>
</tr>
<tr>
<td></td>
<td>&lt; 0.03 °C/year</td>
</tr>
<tr>
<td></td>
<td>Operating range</td>
</tr>
<tr>
<td></td>
<td>−40 to 125 °C(^1)</td>
</tr>
<tr>
<td></td>
<td>Resolution</td>
</tr>
<tr>
<td></td>
<td>0.01°C</td>
</tr>
<tr>
<td></td>
<td>Repeatability</td>
</tr>
<tr>
<td></td>
<td>0.04 °C</td>
</tr>
<tr>
<td>Communication</td>
<td>Interface</td>
</tr>
<tr>
<td></td>
<td>I²C</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>range</td>
</tr>
<tr>
<td></td>
<td>2.15–5.5 V</td>
</tr>
<tr>
<td>Measurement</td>
<td>duration</td>
</tr>
<tr>
<td></td>
<td>12.5 ms</td>
</tr>
<tr>
<td>Average current</td>
<td>consumption</td>
</tr>
<tr>
<td></td>
<td>1.7 μA</td>
</tr>
<tr>
<td>Package size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5 x 2.5 x 0.9 mm(^2)</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$8.60 (qty-50)(^3)</td>
</tr>
</tbody>
</table>

\(^1\)SHT85 operating range: −40–105°C

\(^2\)SHT85 package size: 3.7 x 18.8 x 2.1 mm

\(^3\)SHT85 cost: $20.58 (qty-50)

TABLE I. SHT35 specifications.

The SHT35 digital interface supports two addresses on a single I²C bus. This feature is advantageous for the dual-sensor boards used in the hardware interlock systems; with two sensors sharing the I²C bus, the total number of conductors required for the hardware interlock system is reduced.

The SHT35 features an alert mode, which functions as a humidity and temperature watchdog. When operated in the periodic data acquisition mode, the alert mode monitors the humidity and temperature. When the preset limits, for the temperature or humidity or both, is met or exceeded, Fig. 1, the dedicated alert output pin goes high. Additionally, a status register bit can be read to determine whether the cause of the alert condition was due to temperature or humidity or both.

When the monitored values return to the range within the preset limits, the output of the alert pin goes low. The internal block diagram for the Sensirion SHT35 is shown in Fig. 2. The sensor’s alert mode can be used to trigger the hardware interlock system’s interlocks—temperature or humidity or both.
To support the watchdog functions, I2C addressing, status register, and interface to hardware interlock systems, DSG is developing a software package for the SHT35 sensor. The three-part package includes code to generate the I2C clock and data signals from the readout controller, a custom data acquisition program [13] that will read out individual sensors, and the Field Programmable Gate Array (FPGA) Command Engine and System Scan Engine that supports the initialization, programming, and scanning of multiple sensors. Figure 3 shows the SHT35 LabVIEW FPGA command engine block diagram. The section highlighted in red programs the SHT35 alert mode limits.

In conclusion, the development of the hardware and software to support the enhanced features of the Sensirion SHT35 sensor is progressing well.