All Sensors ***Pressure Points*** are application tips to simplify designing with microelectromechanical (MEMS) pressure sensors and avoiding common pitfalls.

Pressure Point 8: Bandwidth vs. Signal to Noise Tradeoff

Knowing the pressure range is only one of the criteria for selecting the right pressure sensor.

"What is most often overlooked when selecting a pressure sensor is the bandwidth to signal to noise (S/N) tradeoff," says Tim Shotter, Director of New Product Development and Applications at All Sensors Corporation. "It is as fundamental a consideration as the gain bandwidth product term when selecting an op amp."

The tradeoff considerations are especially important in medical and other applications where dynamic signal analysis is performed. As with most analog systems, the greater the bandwidth, the lower the S/N ratio becomes. While this is generally understood, the impact of the compensation method on the bandwidth to S/N curve is less obvious.

As Shotter explains, "In general, a basic sensor (which has no factory compensation), has the greatest potential for the highest performance when viewed in terms of the bandwidth to S/N curve." However, this design approach also has the greatest cost and effort to amplify, calibrate and compensate for temperature effects.

To solve the problem, users cannot settle for the standard amplification that most MEMS pressure sensor companies supply. In most cases, for high performance applications, users will have to perform the amplification and signal conditioning themselves to get the performance they need. An All Sensors solution to this problem is provided in its BLVR Series Basic series and Low Pressure Millivolt Output family.

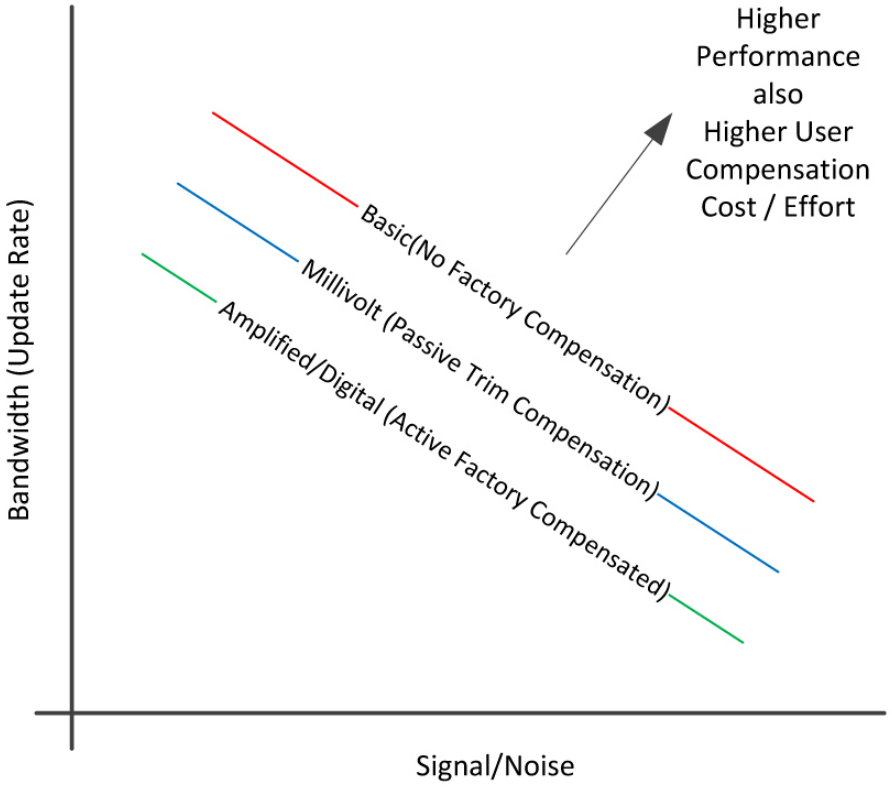

Figure 1: To get the highest performance for bandwidth and S/N, users may have to tradeoff an amplified version provided by the supplier and develop their own additional circuitry. Alternative pressure sensor products, such as All Sensors' Millivolt and Basic series (shown) provide an improved starting point.

General purpose amplified and digital sensors offer excellent calibration and thermal compensation however their S/N tends to be lower (compared to a Basic or Millivolt sensor) due to the use of lower power op amps and quantization noise. "Also, digital devices may suffer from factory prescribed update rates (bandwidth) which may or may not follow the application requirement unless the factory includes appropriate options for the update rate," says Shotter.

A trimmed Millivolt sensor has good compromise when considering the bandwidth to S/N. In this case, the part only needs user provided amplification and the amplifier noise can be tailored to the application. The output level of the Millivolt sensor is generally lower than a basic sensor, so the overall S/N curve is impacted compared to a Basic sensor even if the same op amp is used for both.

Targeting medical applications and others, All Sensor's BLVR Series Basic Sensor and Low Pressure Millivolt Output products are based on a dual die technology to reduce all output offset or common mode errors. Both series also incorporate another sensor-level design technology to reduce the overall supply voltage while maintaining comparable output levels to traditional equivalent basic sensing elements. The Low Pressure Millivolt Output family addresses 0 to 0.5" H_2O to 0 to 30" H_2O pressure ranges and the BLVR Series Basic Sensor series covers 0 to 1" H_2O to 0 to 30" H_2O pressure ranges.

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