Selecting the Correct DAQ and Amplifier Pairing for Precision Sensor Performance

When selecting a measurement solution, an analog full-bridge sensor, such as a load cell, torque sensor or pressure sensor, is one piece of the puzzle. A complete solution also requires an analog-to-digital signal converter to enable data-logging and/or system automation. This is where a standalone DAQ or PLC with analog inputs comes into play.

Navigating specifications and terminology can be confusing. Typical questions that are asked pertain to what hardware a client needs to interface with their existing or newly purchased system. In order to select the appropriate hardware, it's important to understand the key specifications of a DAQ or PLC and how they affect the desired readout from the sensor.

To understand the performance of your future DAQ or PLC, it's best to start with the resolution it provides. The resolution is based on the number of noise-free bits the ADC in your DAQ or PLC can read at your desired sampling rate (how often you want to read the analog sensor signal). This is important because it represents the minimum voltage your DAQ or PLC can theoretically measure. We say theoretical because outside factors can affect your resolution, such as off-axis loading, mechanical vibrations, frequency response to applied loads, electrical noise, etc.

Once you determine the necessary resolution, you need to establish if your DAQ or PLC can support the sensor's input voltage or excitation requirements. Full-bridge sensors generate their output signal as a ratio of the input voltage. Simply put, an unstable input leads to an unstable output. Your DAQ or PLC needs to provide a stable input voltage source to ensure the sensor provides a known, consistent output signal.

Next you will need to understand the importance of signal conditioning. Signal conditioning is the process where an incoming signal is modified so it is more suitable for capture by a PLC or DAQ. Analog sensor signals are susceptible to electrical noise, which can distort or skew

Figure 1: Amplifiers provide a clean, precision analog signal for your PLC

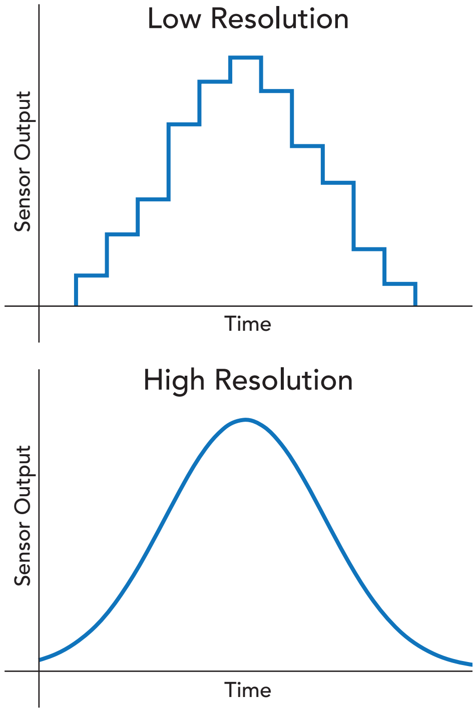

Figure 2: DAQ resolution is the difference between signal measurement and one with steps

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measurements. Noise needs to be filtered out before you can capture an accurate signal. DAQs and PLCs designed to interface directly with full-bridge sensors will include band pass and other forms of signal conditioning and filtration. These filters eliminate some effects on accuracy by removing electrical noise above and below the analog sensor's signal range.

The final component for your DAQ system is amplification. A full-bridge sensor can output a signal in the nanovolt through millivolt range. When your DAQ or PLC is limited to measuring volts, you will need an amplifier to convert millivolts to a larger signal. Some PLCs and DAQs come with built-in amplification; others will require an external amplifier. What if your existing DAQ or PLC doesn't provide built-in amplification, signal conditioning, and a stable power source for sensor excitation? In that case, you'll need an amplifier to fill in the shortfalls in your instrumentation supporting your full-bridge sensor.

With this knowledge in hand, you will be better equipped to select a system that best fits your needs and maximize the value, capability, and performance of your DAQ or PLC. You will also know the exact questions to ask your chosen supplier in order to ensure that the system performs accurately.

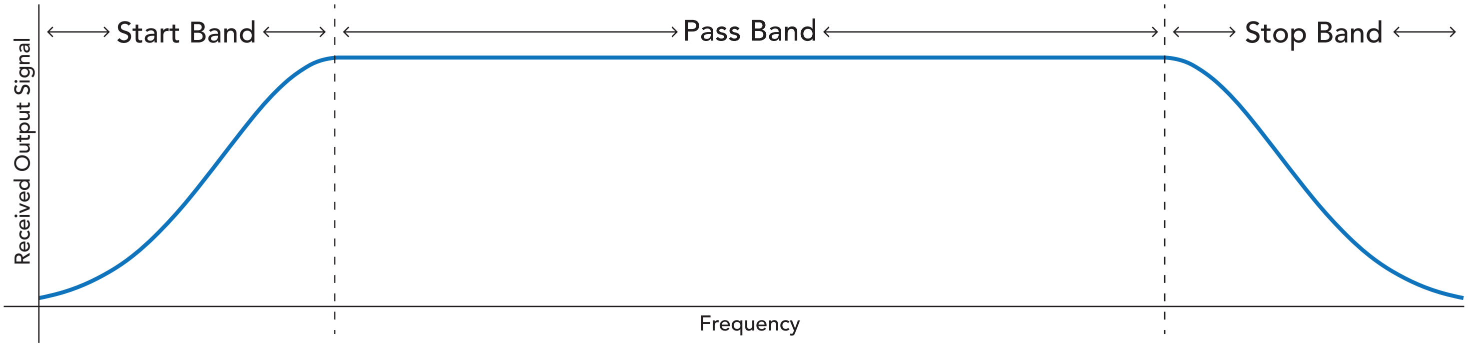

Figure 3: Signal filtration removes noise that affects the accuracy of the sensor's analog signal.

Introducing FUTEK's IAA Series — three in-line amplifiers for any full-bridge, strain gauge sensor with mV/V range outputs. These three models provide either voltage, current, or differential outputs. The sleek enclosure is durable allowing the amplifier to be used in a wide range of industrial environments and includes an integrated DIN clip. All of FUTEK's amplifiers are CE approved and RoHS compliant. We invite you to explore all of the features the IAA100, IAA200, and IAA300 have to offer.

IAA100

Spec Sheet Video Overview

The IAA100 is voltage strain gauge amplifier solution. The IAA100 is fast, featuring up to 25 kHz of bandwidth. The small, narrow design allows for two IAA strain gauge amplifiers to fit in the same space that would normally only accommodate one traditional amplifier. FUTEK's Electrical Engineering Team included removable screw terminals to allow for additional sensors integration. This amplifier also boasts 256 Selectable Shunt Combinations: 30kΩ, 43.7kΩ, 60.4kΩ, 87.6kΩ, 100kΩ, 150kΩ, 300kΩ, 432kΩ (DIP Switch).

IAA200

Spec Sheet Video Overview

The IAA200 is FUTEK's current strain gauge amplifier solution. Very similar to the IAA100, the IAA200 is an incredibly fast and robust load cell amplifier solution with up to 25 kHz of bandwidth. A digitally controlled remote shunt is also available to allow shunt verification and testing without disturbing the placement or setup of the amplifier. This amplifier also features an input range from 0.5 to 10.0 mV/V.

IAA300

Spec Sheet Video Overview

The IAA300 differential strain gauge amplifier is FUTEK's newest addition to the amplifier series. The IAA300 is the fastest available amplifier we have to offer with up to 50 kHz of bandwidth. We understand that not all of our customer's applications are conducted in lab-like situations, so our engineers ensure that the IAA300 differential strain gauge amplifier features ultra low output noise (2 mV p-p). The IAA300 is field configurable with easily adjustable dip switches, so you don't have to carry your tool belt to make adjustments.

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