HIGH PERFORMANCE SIGNAL CONDITIONING AND DAQ

Pair advanced signal conditioning with modern A/D conversion technology in a single DAQ system

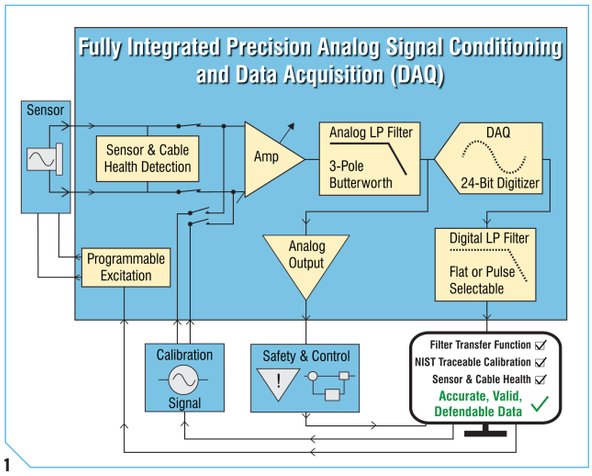
Making accurate measurements of any physical system requires the output from a sensor – a transducer designed to convert mechanical phenomena into an analog electrical signal – to be recorded digitally so it can be analyzed, displayed, and stored with modern computation. The measurement process therefore consists of two essential functions: conditioning of the electrical signal produced by the sensor, and sampling of the conditioned waveform (i.e. A/D conversion). With advances in hardware and computational speed, modern data acquisition systems (DAQs) designed to perform these functions are now widely available at relatively low cost. However, while most modern DAQs excel at high-performance A/D conversion, few include advanced signal conditioning circuitry to ensure the fidelity of the sampled waveform.

The benefits of high-performance signal conditioning should not be overlooked, especially in harsh test conditions or variable field environments where the spectrum of ambient noise sources is poorly constrained. Properly designed analog conditioning circuitry should not just amplify the signal and prevent aliasing – benefits typically associated with signal conditioners – but also provide precise sensor excitation, real-time monitoring of sensor and cable health, and extensive self-test capability to ensure measurements are robust and repeatable.

To date, a measurement system that provides these features with A/D conversion has required two separate systems: a stand-alone analog front end paired with a standard DAQ. For decades, Precision Filters (PFI) has been a global leader in providing the former for some of the most challenging aerospace applications. Its latest offering combines the best signal conditioning with the latest DAQ technology to provide an all-in-one solution for wide-ranging applications (Figure 1).

The all-new Precision SDAS (Figure 2) is a 16-channel DAQ system that integrates Precision Filters' signal conditioning with 24-bit A/D converter technology. It comes in configurations to accommodate dynamic strain, charge, IEPE, and bridge-type sensors, covering a range of measurements. The 24-bit digitizers support synchronized sampling rates of up to 312.5 kilosamples per second per channel, allowing for 135 kHz analog signal bandwidth measurements. Digital filtering modes support optimized frequency response for time or frequency domain analysis. Digital calibration ensures unparalleled accuracy from the sensor interface through A/D conversion. Multiple SDAS units can be distributed around a test article, with precise time-stamping and synchronization via the IEEE-1588-2008 (IEEE-1588v2 PTP) protocol or IRIG-B. Data is streamed over a 1 GB Ethernet to the host for analysis and storage.

An intuitive desktop GUI interface provides control of multiple SDAS systems, real-time FFT and time domain analysis, and recording of data to disk. Multiple TCP/IP connections can be made to simultaneously stream data to other clients while recording data. The SDAS system is easily scalable, supporting test configurations ranging from a few channels to thousands of channels.



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1 // Fully integrated signal conditioning and DAQ (SDAS)

The SDAS system features Precision's signal conditioning technology, including charge amplifier designs compatible with piezoelectric accelerometers and pressure sensors operating in extreme environments. Also offered is the company's proven balanced constant current (BCC) technology for measuring dynamic strain, and the ability to obtain accurate 5th-wire temperature measurements from Kulite pressure sensors for thermal compensation.

The SDAS includes real-time sensor health monitoring, an invaluable asset for test setup and real-time monitoring and validation. Each SDAS system is equipped with buffered and conditioned analog outputs that can drive third-party DAQ systems, control systems, safety systems, and other applications.

The SDAS also has a suite of built-in self-test capabilities to allow quick in-situ Go/No-go verifications and full NIST-traceable yearly calibrations. \\

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2 // Precision Filters SDAS16