

BUILDING ROBUST VALIDATION TECHNOLOGY INTO A COMPLETE DAQ

The SDAS data acquisition system combines industry-leading signal conditioning, modern A/D conversion technology, and extensive self-test capability in a single package

Ensuring accuracy and validity in mechanical testing and measurement operations requires more than simply connecting an analog sensor to an A/D converter. Test engineers must verify proper operation across the entire measurement chain, from the sensor through the analog conditioning circuitry to the digitizing hardware and visualization software. Potential sources of measurement corruption are manifold – particularly in harsh test environments – and often not recognized until data are recorded and analyzed. For tests that are not easily repeatable due to long setup lead times and preparation, such critical errors are costly and unacceptable.

The Precision Filters (PFI) SDAS family of data acquisition systems was designed to ensure end-to-end performance of the measurement system can be easily and efficiently verified prior to data collection. In addition to combining the industry's most advanced 24-bit sigma delta A/D architecture with an analog signal conditioning front end that is unmatched in the data acquisition market, the SDAS features built-in verification, validation, and calibration capabilities that enable operators to identify and correct problems at test time. These capabilities go beyond the SDAS hardware itself to ensure the health of measurement sensors and interconnecting cables. Importantly, these features are integrated into a single control system dashboard that provides simultaneous monitoring of measurement system performance with output data displays.

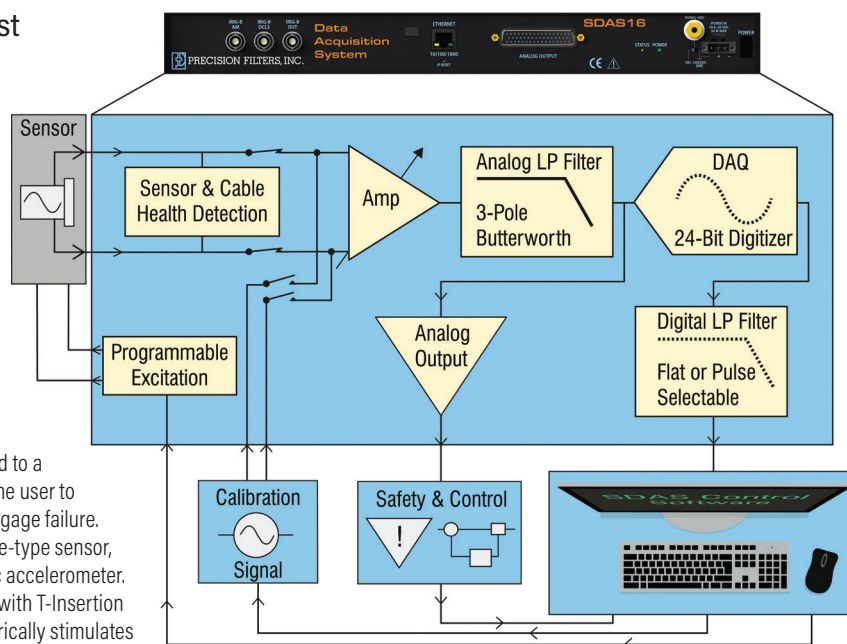
Consider strain gage measurements, which commonly employ complicated wiring schemes with long cable runs, multiple connection points, high-temperature and high-impedance small diameter wires, and sometimes even slip rings. Each of these presents a potential source of error which, collectively, adds significant uncertainty to

the measurement of strain. For example, a sudden increase in gage resistance is often a sign of gage failure. To monitor this possibility, the SDAS provides real-time monitoring of the total "loop resistance" in the measurement circuit, which can be continuously compared to a preset limit and alert the user to signs of an impending gage failure.

Or consider a charge-type sensor, such as a piezoelectric accelerometer. The SDAS is equipped with T-Insertion capability, which electrically stimulates the attached sensor to output a known proportional charge signal that can be tracked through the signal chain for end-to-end verification of measurements made by the sensor.

The cables connecting a high-speed measurement chain are often overlooked – that is, essentially treated as "lossless" with perfect signal transmission – but can interact with the measurement sensor to cause unintended electrical filtering. This can reduce measurement bandwidth and, in extreme cases, may require shortening cable runs or modifying the sensor used. For this reason, the SDAS provides the ability to measure this "cable roll-off" prior to test time, showing the user the effective bandwidth over which signal attenuation is less than a desired value, for example 5%.

The SDAS also includes automated Go/No-Go and Factor Acceptance Test (FAT) routines that have long distinguished PFI's analog front ends. The Go/No-Go uses calibrated DC and AC substitution voltages to quickly verify proper operation of the unit prior to commencing a measurement. All data



1 // SDAS Data Acquisition System

critical system parameters are measured and confirmed, including channel gain, sensor excitation levels, DC offset, noise, and common mode rejection (CMRR). These tests are NIST-traceable and the results recorded for documenting quality assurance.

The FAT adds yet another layer of measurement validation by automating a NIST-traceable test sequence that makes use of an external test subsystem to sequentially verify an extensive set of performance benchmarks. The SDAS test subsystem easily integrates with the main unit and is programmed, along with the Go/No-Go and other performance checks described above, from a single desktop software client. ▯

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