

Shunt checks on a sensor are often performed by momentarily connecting a precision resistor in parallel with one of the sensor's "arms," thus generating a known simulated signal from the sensor. This check confirms that the wires to the sensor are not broken or shorted, that the sensor impedance is as expected, and verifies the complete signal path from the sensor to the analog-to-digital converter.

Shunt emulation eliminates the need for conventional shunt resistors, either external or internal to the data acquisition system, when performing shunt checks. TDAS PRO, TDAS PRO LAB and TDAS G5 systems offer this shunt emulation feature to perform shunt checks.

Shunt checks are performed within the TDAS Control software as part of test preparation for data collection. The shunt emulation circuit functions as the equivalent of an infinitely variable shunt resistor by injecting a precisely-calculated, software-controlled current into the sensor. The amount of measured signal deflection is directly related to the connected bridge resistance and the integrity of the cabling.

Advantages

Shunt emulation has several advantages:

- It automatically scales the applied shunt signal to 100% of the requested range. For example, if you request the full-scale range to be +/-500 G on a head accelerometer, the TDAS Control software will set up the channel for a range of approximately 600 G and then scale the shunt check to deflect 500 G.
- Every time you run the TDAS calibration routine, many parameters are checked, including excitation voltage, channel gain and offset. Applying a shunt test is a great way to run a comprehensive cross-check that will catch all common problems. If a wire breaks, the bridge resistance has changed, or a transducer is simply not plugged in, the deflection of the shunt test will be different than expected. TDAS Control software allows you to set tolerance limits on the shunt deflection, thus providing an easy and automatic way to catch transducer or wiring problems. When an out-of-tolerance condition is identified, the software warns the operator so that a problem sensor can be inspected, repaired, or replaced before conducting a test.
- It eliminates the need to install external shunt resistors inside sensor plugs and is much more reliable than the old approach.

Shunt check results can be used to cross-check the accuracy of a data channel or used to actually determine the scale factor. TDAS Control software supports both methods, but DTS always recommends using a shunt test result as a check only. (Note: TDAS G5 supports shunt emulation only.)

What is Shunt Emulation?

Cautions

While simple in concept and generally easy to use, implementing meaningful shunt checks can present challenges. If you are not sure how to properly implement a shunt check protocol, please contact DTS for assistance. DTS systems have many standard self-test diagnostic features, but it is essential to properly implement this feature to achieve best results. Carefully consider the following when using shunt emulation:

- Shunt checks, including shunt emulation, should not be performed on active (amplified) sensors (e.g., most rate gyros, amplified 0-5 volt output accelerometers, etc.).
- Shunt checks may work poorly on transducers that have unstable or unknown bridge resistances. Some piezo-resistive sensors utilize sensing elements that vary in resistance by several percent over temperature even though the output sensitivity remains fairly stable. Some judgment may be required when deciding if a given sensor may be shunt-checked reliably.
- Some transducers employ unbalanced bridges or contain gage materials that do not have predictable resistance. In these cases, it may be difficult to accurately determine the equivalent resistance. Fortunately, the majority of common sensors used in safety testing exhibit stable and predictable bridge resistance.
- If no bridge resistance data is available, a workable, equivalent bridge resistance may be obtained by simply trying different values in the Sensor Information File (SIF) until the shunt check agrees with the expected deflection. This empirical method is only valid if the user knows for certain that the subject transducer is already working correctly and reading accurately. Empirically adjusting a shunt test on a miscalibrated transducer does not validate the sensor or its data.

How to use Shunt Emulation with TDAS

To make best use of shunt emulation, you must know the nominal resistance of the bridge. Using the TDAS Control software, edit the SIF by selecting *Emulation* in the "Shunt Resistor" field and entering the resistance value in the "Bridge Res." field. The software uses this value to calculate the appropriate shunt emulation settings.

Most bridge transducers employ balanced bridges with predictable resistance. For example, load cells virtually always have resistances at or near 350 or 700 ohms. Standard Endevco 7264A, B, and C accelerometers have 500 ohm (+Sig arm) half-bridges. For these transducers, simply entering 350, 500 or 700 ohms as the resistance value will result in an automatic shunt check within 2%.

The bridge resistance needed for the software can generally be found on the sensor manufacturer's data sheet. TDAS Control software does a complete end-to-end cross-check which includes the connectors and wiring, thus the resistance stated is often a few ohms lower than what is needed due to cable resistance in series with the bridge. For example, an Endevco 7264C with a specified bridge resistance of 500 ohms will actually have a typical resistance at the connector between 505 and 510 ohms.