Brainstorm: Test and Measurement

What is the most challenging part of the testing process?

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Establishing a test procedure that enables a consumer quality “out of the box” experience is certainly challenging. This is particularly true for embedded products that are intended for use by the engineers who will be developing the finished product since they are intentionally not complete to the degree a finished product is.

Since software and hardware product designers are so familiar with a product and its features it is sometimes hard for them to decide what to expose to the developer and what to suppress. A separate “product test” team often establishes the test, initialization and test sequences. This model helps by providing separation from the product designers but familiarity can hinder the test team too. The test team may overlook what a customer will stumble on when initializing the silicon, board or software. One method of addressing this is to establish an independent team of engineers (possibly even engineering students) who are not familiar with the product to quantitatively score the out of box experience focusing on areas for improvement. Ideally this process is repeated with fresh teams until the desired score is achieved.

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Test applications often involve less than ideal measurement environments where common mode noise and ground loops can greatly affect the accuracy of low level

signal measurements. When measuring signals, users often assume that the grounds of their signals and their measurement system are at the same potential. When the measurement instrument and signal source are at different ground potentials—oftentimes it is not apparent that ground references from various sensors such as thermocouples, RTDs, strain gages, etc., are at different voltage potentials—the difference in potential is called common-mode voltage. If the difference in ground potential is large enough, current flows between the signal and your measurement system; this is called a ground loop. Factors that can contribute to these ground differences are extensive wiring from long runs, crosstalk from motors or generators, or high source impedance from the signal source. Without recognizing this extraneous voltage, the measurement system "sees" this noise or common mode voltage as the actual signal. These unwanted noise sources lead to measurement errors.

ISO-Channel technology eliminates ground loop problems by using a differential, isolated, floating front-end. To measure floating signal sources, ISO-Channel technology uses differential analog input signals, a 24-bit Delta-Sigma A/D converter for each channel, and channel-to-channel isolation.

 **Scott Gulas, Texas Instruments,** www.ti.com **[1]**

Being part of the Precision Analog group at Texas Instruments, a lot of people would assume the hardest part of our job is guaranteeing 1pA bias current on an amplifier or 1 LSB nonlinearity on a 16-bit data converter. And given that the test engineer is tasked to measure 10x better than the specification, it's an analog measurement challenge where 2nd and 3rd order effects come into play every day. But the most challenging part of the test process is not making these ultra-precise measurements, it's deciding what to measure in the first place. Simply put, test is a search for defects. How do you detect a defect in a transistor in the bias circuitry that will cause the device to not start up properly with a slow ramping power supply at cold temperature? To find these defects, it takes a creative look into what might go wrong in the manufacturing of the device, and often providing design for test circuitry to peek inside and test internal components more directly. By definition, analog parts have an infinite number of conditions they can be put into; the hardest part of our job is making sure there isn't one that will cause an issue for our customers.

http://www.ecnmag.com/articles/2012/04/brainstorm-test-and-measurement?qt-video_of_the_day=0

Links:
[1] http://www.ti.com/
[2] http://www.datatranslation.com/