RAQ's

Rarely Asked Questions

Strange but true stories from the call logs of Analog Devices

Slow "starting" ADCs (or the beneficial effects of in diagnosing converter problems)

Q. *To save power, my ADC is powered up only to make a measurement. The system is very accurate in continuous operation, but completely unpredictable when power is strobed.*

A. As a by product of the security-obsessed Soviet system, Russians can be very reluctant to provide all the details of an applications problem. Alexei, whom I met at a seminar in Novosibirsk in Siberia, was no exception. He complained that his ADC (analog-to-digital converter) was badly out of specification and sometimes did not work at all, but was reluctant to provide details of his system. So I provided some vodka, caviar and blinis, and we toasted Mother Russia, Catherine the Great, the Trans-Siberian Express, and analog engineers everywhere. He loosened up and revealed that he was only powering his ADC for just long enough to do a conversion and then shutting it down again.

Microprocessors reset with each start, but few ADCs do, so after power-up their logic is randomized. The first conversion (or in some pipelined converters the one when the initial data exits the pipeline) resets the logic, but the first results may be totally wrong.

Furthermore, not only the data output is affected. The EOC (end of conversion) or "busy" output may also be confused—if this output is used to initiate the next conversion, the system may not self-start on power-up. If such latch-up always occurs, the problem will be recognized during system design, but if it only occurs occasionally (as with the original ADC84 in the 1970s) the problem can be overlooked—with dire results.

Data converters should perform one or more "dummy" conversions after power-up before the conversion results are actually used. During these "dummy" conversions the output data, and anomalous behavior of EOC or other logic outputs, should be ignored by the system.

Such problems rarely occur in converters with "sleep" circuitry where the supply is still present but the device is switched to a low consumption standby mode for power saving.

Logic is not the only possible cause of start-up errors in converters. Thermal stabilization, capacitance charging, and slow starting of regenerative current mirrors can all degrade reference accuracy for many milliseconds after power-up.

Alexei programmed some dummy conversions and I boarded the Trans-Siberian Express for Vladivostok leaving a working system, and a happy, if over fed, engineer behind me.

To learn more about behavioral problems in ADCs & how to avoid them
Go to:
http://rbi.ims.ca/4394-504

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Have a question involving a perplexing or unusual analog problem? Submit your question to:

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