With Wireless Embedded Everywhere, LocoLabs Turns to MDO4000 for Cross-Domain Debug Versatility

Customer Solution Summary

April 2013

Challenge

Intent on staying the “rev-zero” company, LocoLabs is always on the lookout for tools to improve quality and efficiency. Wireless has become pervasive in custom embedded product designs, and LocoLabs faced challenges correlating time and frequency domains using existing instrumentation to fully validate complex wireless designs.

Solution

The Tektronix MDO4000 mixed domain oscilloscope with four analog, 16 digital and one RF input, provided the cross-domain versatility LocoLabs needed to efficiently validate and qualify designs, and to identify the source of any problems. Time correlation and triggering across domains; the familiar, easy-to-learn user interface; increased screen size, enabling more signals with longer capture windows to be displayed and the depth of triggering capabilities were also important features.

Benefits

Rev-zero means that when LocoLabs delivers an embedded design to its customers, the design works right the first time, no revisions. Having the MDO4000 in the lab contributes to LocoLabs’ ability to maintain this high standard of quality on tight deadlines, efficiently and reliably.

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The Rev-Zero Team

LocoLabs doesn’t claim to be your standard, run of the mill embedded design house. The Silicon Valley-based product design firm instead says it can tackle the toughest embedded design problems around, whether in consumer electronics, commercial robotics, video or wireless—a broad spectrum to be sure.

And the firm doesn’t only design new products. Companies around the Valley often turn to the rev-zero team when they experience problems. For example, LocoLabs has been called on to resolve “stop ship” events for multi-billion dollar Silicon Valley firms with random field failures. These systems use off-the-shelf components in standard systems over industry standard busses. In such cases, the LocoLabs team, led by a collection of hardware and software engineering veterans from around the industry, has to dive in and quickly identify the root cause, devise a solution and get production lines back up and running.

Given the diversity of clients and projects on tap, LocoLabs has tended to rent test equipment—including oscilloscopes,

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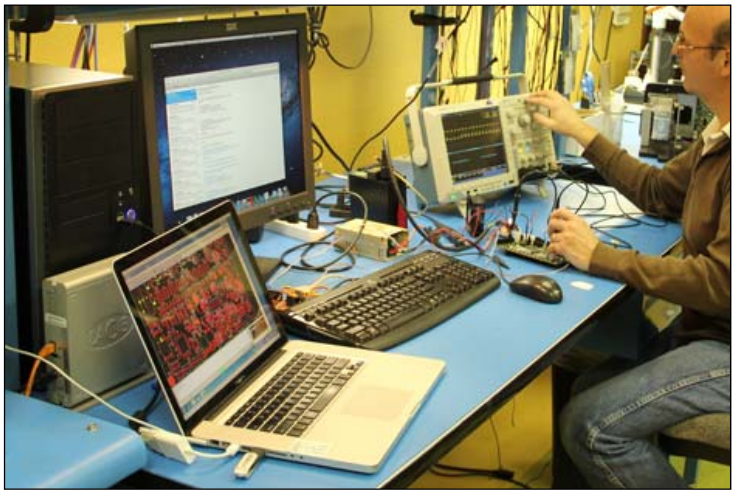
Tektronix Traveling Scope Bar

LocoLabs was not only able to see the MDO4000 in action during a tradeshow they attend annually but they were able to be hands-on and put it through the paces.



Tektronix MDO4000 in the bring-up lab at LocoLabs

Oscar Medina appreciates the MDO4000's ability to measures signals in both time and frequency domains as he qualifies a design.

logic analyzers and spectrum analyzers—on an as-needed basis for circuit tuning, verification and qualification work. Problems arise when a needed piece of equipment isn't available on short notice.

Another interesting challenge has been the explosion of wireless. "It's getting to the point where almost 100 percent of the designs we work on have some wireless component. It's because of the nature of embedded; everyone expects devices to be connected," says Brad Hoffert, LocoLabs co-founder. "We see a lot of Wi-Fi, Bluetooth, as well as custom radio link requests. For example, we worked with a company to build an autonomous GPS tracking system using a 900MHz link for people who want to automatically track and film themselves while participating in a sporting event. Recently, this product was successfully launched via KickStarter as the SoloShot."

For embedded engineers, wireless adds another layer of design test and validation complexity because of the need to precisely time-correlate analog, digital and RF signals to get a complete system view. This means it's no longer enough to have equipment that can test analog and digital in the time domain. The frequency domain is becoming equally important.

Another driver is the need to conserve power whenever possible, either to extend battery life or to lower costs in server rooms. And, engineers also need to look at the frequency domain to track down noise sources or to meet EMI requirements.

A Visit to Scope Bar

To get the search going for an instrument that could meet LocoLabs' diverse requirements, Hoffert stopped by the Tektronix Scope Bar at the DesignCon West trade show, where he was able to put the MDO4000 through its paces and learn more about its feature set. He learned that the MDO4000 is the first and only oscilloscope to include a spectrum analyzer, providing support for analysis in both time and frequency domains, all time-correlated for a complete system view of interactions in a device.

Key features that stood out for Hoffert were "a nice big screen," intuitive operation, the depth of triggering options for serial buses and how all the capabilities worked together seamlessly.

"The ability to trigger across the four scope inputs and the logic analyzer is very powerful. We always wanted that functionality and then, when you throw in the RF, it pushed us over the decision edge," Hoffert says. "We use near-field probes quite a bit when we're analyzing radiated energy spectrums to reduce noise for EMI compliance."

The response from the engineering team when the MDO4000 arrived at LocoLabs helped to affirm that Hoffert had made a good choice.

"It was like kids at Christmas when this showed up in the lab. The energy in the lab when you have this in your toolkit, and you know it's there to stay, is exciting," says Susanna Hoffert, VP of Finance and Human Resources, and the lone non-engineer in the firm. "We pride ourselves on our rev-zero reputation. The multiple capabilities of the MDO4000 fit with our ethic of getting it right the first time no matter how complex the design challenge. Not to mention, we definitely like to play with cool new toys."

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Meeting the rev-zero standard, which LocoLabs has prominently displayed on its website, takes a team effort combined with the right test equipment, according to Hoffert. “We do a lot of pre-analysis, with the hardware, software and mechanical teams looking over the design before it’s released to fab. We design in a lot of ‘what if’ options into our boards (such as filters, alternate paths, serial clock resistors) to enable precise board tuning without requiring a spin. Having the MDO4000 allows this tuning and validation to be done quickly, to be done right and to be documented with an industry standard tool our customers will trust.”

> *“Our customers rely on our reputation; in turn we rely on Tektronix equipment in our lab as the state of the art reference standard for measurement and qualification to maintain that reputation.”*
>
> Brad Hoffert
> LocoLabs co-founder

Intuitive Operation

While there’s always a learning curve for any new instrument, LocoLabs’ senior hardware engineer Oscar Medina says the curve was especially short for the MDO4000. One advantage was the fact the logic analyzer and spectrum analyzer are integrated into an oscilloscope, an instrument that any electronics engineer knows well.

“The user interface was intuitive,” Medina says. “I figured it out without having to spend much time with the manual because there are so many hints. There are many places where a hint pops up on screen to show you when to use the A knob or the B knob and the buttons below. I quickly forgot I was using a new MDO.”

Whack-a-Mole

Needless to say, the MDO4000 was quickly pushed into service and is already paying dividends for LocoLabs. One project for a homeland security customer involved tracking down noise sources in a high voltage power supply. The specification for the power supply required less than 10 V of noise on a 3,000 VDC supply over a frequency range of 1 kHz to 1 GHz. Testing for this system involved radioactive samples, which meant testing had to be completed at the customer’s site three time zones away. Once again, the design needed to work correctly the first time – shipping this expensive, sensitive instrument multiple times for debugging and retesting was not an option.

“We had to measure the amount of noise in time and frequency domains. A regular oscilloscope would have only allowed me to measure the noise performance in the time domain,” Medina says. The MDO4000 proved to be a good tool for this effort because of its multi-domain support and its rich set of debugging tools for identifying when noise problems would show up and at what frequencies.

Once the problem conditions and frequencies were identified, the challenge was to determine if efforts to reduce noise had the desired outcome. Hoffert noted, “It’s like whack-a-mole, where you tune the circuit to whack down energy in one spectrum and it may pop up as increased energy in a different spectrum. You have to be careful to verify the entire energy spectrum after each tuning adjustment.”

“Using the MDO, we continued to tune and tweak the system which enabled us to meet our contract commitment to have this device perform at or better than the previous generation. In fact, it surpassed the previous generation and we didn’t have to spin any boards in order to do that. We were able to tune the circuits on those boards until we got them quieted. It went out, it worked, and the customer was so pleased they contracted us to design their next-gen system.”

Reputation Management

For LocoLabs, which puts more emphasis on engineering talent and resources than on advertising or marketing, reputation and word of mouth are critical. Hoffert believes having the Tektronix MDO4000 in the lab supports his firm’s superior reputation. “We pride ourselves on having the best and brightest cross-trained engineering talent and providing them with the best equipment.”

“Because of our strong reputation, Digi-Key asked us to be a Design Services Provider, one of only two in Silicon Valley when they started the program,” Hoffert says. “Our customers rely on our reputation; in turn we rely on Tektronix equipment in our lab as the state of the art reference standard for measurement and qualification to maintain that reputation.”

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