by Wayne Mackey

Abstract: No engineer wants test equipment

An often-quoted speech by a machine tool executive began with, “Last year my company sold over 2 million quarter-inch drill bits. None of my customers wanted them. They wanted quarter-inch holes.” Likewise, test engineers need to know if their device is doing exactly what it should be doing. Test equipment is just the tool to get that job done. But like a dull drill bit, each piece of test equipment on the bench isolated on “mute” obstructs engineers from getting their job done right. Sharpen your test bench by intelligently sharing across equipment boundaries, automatically recording and analyzing test data, and providing quick and easy Q&A support.

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Can everyone see my screen?

The essential test bench is a power supply and function generator as sources, coupled with a DVM and an oscilloscope as receivers. They are the foundation of electrical engineering education and measurement, but not “smart” on their own. On a smart bench, each piece of test equipment hardware connects seamlessly with other test equipment and uses *smart bench instrument, laboratory, and remote learning software* to communicate, eliminate mundane tasks, simplify complex settings, and facilitate remote collaboration.

An engineer must manually set up, measure, record, and analyze standalone test equipment results. In each of these essential processes missteps and inconsistencies can and do occur. But

many parts of these processes don't add any discovery value to the job that an engineer needs to do. They are predictable, rote, or recurring.

Smart power supplies and function generators communicate their status and settings to smart DVMs and oscilloscopes without compromising any creative or innovative elements of test. Smart DVMs and oscilloscopes interleave their data providing composite on-screen numerical and visual insights. *Smart bench instrument software* snapshots every setting and piece of data from every piece of equipment with the push of a button.

No smart test bench should be an island and no team member should have to work alone. The test group needs to see every setting, screen, and measurement - whether they are present at the bench or working from their home or dorm room. "Hands-on" becomes "sign-in" with *smart bench remote learning software*. Institutions and companies need to optimize equipment allocation and maximize up-time. Smart bench equipment communicating its status automatically and integrating it lab-wide with *smart bench laboratory software* for quick and accurate decisions eliminates laboratory leaders' guesswork.

This session is being recorded

Connecting and sharing in real-time is not enough. A smart test bench automatically stores, analyzes, and synthesizes test equipment data and transforms it for use in getting the test engineer's and the test laboratory leader's jobs done.

The engineer's job is to know that the device under test is doing exactly what it should. That applies equally to students, hobbyists, and professionals. Data from early tests or courses feed into later ones. But data that early tests do not capture and store is useless later. Every test bench comprises sources and receivers. *Smart bench instrument software* enables smart DVM and oscilloscope receiver devices to automatically send all their data alongside their smart source device's settings into the cloud. The software analyzes bench-wide data history resident in the cloud automatically against known standard tests, customized sequences, and prior measurements.

The laboratory leader's job is different, but equally supported by *smart bench laboratory software*. Detailed lab-wide equipment history from last year or last semester provide insights into allocations, utilization, and uptime to achieve better performance. Out of date or out of calibration equipment obscures results and confuses learning. The big-picture view of the status of all equipment in the lab enables the leader to predict update and calibration issues instead of reacting to them. The laboratory leader uses *smart bench laboratory software* history data to justify new equipment purchases when it is time to expand.

Documentation is a necessary evil for engineers and laboratory leaders. *Smart bench instrument software* and *smart bench laboratory software* take that pain away by providing repeatable and professional composite overviews, charts, and tables. Reusable lesson plans correlate directly to specific test setups. Standard output report formats enhance consistent analyses and simplify grading or data review.

Questions answered in chat

A smart test bench is only as smart as its user's ability to access its power. Intuitive interfaces and well thought out software go a long way in harnessing the power of a smart bench. But no artificial intelligence anticipates every issue. The solution is committed support from experts for student's, engineer's, and lab leader's questions, independent of their experience level. Paraphrasing an old quip, "If you think support is expensive, try ignorance".

Support as an option results in too many users without the answers they need when they need them. Expert support leverages decades of experience and taps into the best source of information for a smart test bench – the people who designed the equipment and wrote the software. If your test bench equipment is on "mute" from support, it's time for a new smart bench.

Next slide please

If your 'job to be done' is to cut down a mighty forest, when should you pause to sharpen your ax? You can't afford to ignore a bench full of old, disconnected test equipment that is perpetually on "mute". Competent test engineers and students may find a way to get the job or assignment done manually. But the price paid is in wasted time, error escapes, and higher total costs. Test equipment on "mute" can't keep up with better universities, competitors or with your student's or customer's longer-term demands. It's time to sharpen your ax. To learn more about Keysight's exciting new Smart Bench Essentials solution that unmutes your bench, {follow this link}.

Sidebar / Use case: Smart bench rescue in the Signals lab

Sue is a fourth-year electrical engineering student at one of California's premier universities. She has a signals lab assignment due tomorrow. Her lab group of four haven't been able to meet in the lab since they discovered a glitch in their original circuit. Each team member took on redesigning an element that leveraged their experience. The parts are all redesigned. It's time to put them together, test them, and do the project write-up.

But there are problems. The lab is locked on Sunday. Tim, their best hardware guy, is sick in his dorm room. Javier, their test lab equipment guru, had to drive home over the weekend for a family emergency. Cecilia, their best report writer, needs some specific test information to work her magic. That leaves Sue to pull it all together.

The first step is to get into the lab. Sue emails their TA, Ben, who checks his *smart bench laboratory software* and sees that a grad student, Ashley, will be in the same lab Sunday at 11am finishing her thesis. Ben verifies that all the equipment Sue needs is available and calibrated and books Sue's group onto bench #5 for 3 hours. Ben adds an update to Ashley's lab reservation. *Smart bench laboratory software* automatically changes Bench #5's status for that time slot to "busy" and sends an email update to Sue's professor, campus security, and Ashley.

Ashley unlocks the door to the building when Sue and Cecilia arrive. Sue logs into her *smart bench instrument software* account on Bench #5. She pulls up the custom test equipment setup file from last semester's Signals class and verifies that all four bench instruments have set themselves to last semester's exact prior state. She connects the group's redesigned project circuit board and focuses testing on the redesigned elements. Tim and Javier have signed into their *smart bench remote learning software*, verifying that they can see all the attached instruments, their settings, and the data as it appears in each test on the bench. The group shares ideas and verifies that every aspect of the new design is working.

Cecilia has already envisioned the project final report. She enters the capture and analyze portion of *smart bench instrument software* and loads scenarios and standard analysis toolsets that document their tests and simplify the presentation of the results. She shares the report data with the group using *smart bench remote learning software*. *Smart bench instrument software* automatically logs a backup file that their professor can review with their report. They sign off Bench #5 on *smart bench laboratory software* and let their TA Ben know that the assignment will be complete and turned in on time.