
▲ Measurement Computing Corporation's WebDAQ 316 Internet-Enabled Thermocuple Data Logger.

SPECIAL REPORT

# DATA DEMANDS

## Turnkey use, portability, and real-time analysis among customers' DAQ must-haves

**By Mike Hockett,** Editor-in-Chief

Consisting of sensors, data acquisition measurement hardware, and a computer with programmable software, data acquisition systems have taken on immense importance over the years amid the rise of the Industrial Internet of Things and real-time data analysis. Other factors such as infrastructure investment, growth of the renewable energy grid, and demand from enterprise for strategic decision-making have all contributed to the need for new innovations in data acquisition systems (DAQs).

We at *Evaluation Engineering* last provided an in-depth report on trends and new products in the data acquisition systems in our June 2018 issue, and vendors have been busy since. Here, suppliers including B&K Precision, Digilent, Diversified Technical Systems, imc DataWorks, Keysight, Measurement Computing, Spectrum Instrumentation, Silicon Designs, and Yokogowa all weigh in on the trends, challenges, customer demands, and new solutions driving data acquisition systems forward. Read on to see what they told us.

### What's trending?

What market movers have vendors of data acquisition systems been observing as of late?

***Yusuf Chitalwala, test & measurement marketing manager at Yokogawa:*** "This is still a strong and competitive market. The trend to note is that more and more design and development engineers need faster data capture rates and real-time analysis. There is a growing need to combine multiple different types of measurements and real-time analysis under one measurement system. Real-time analysis is the key. With the electrification of transportation and the increased emphasis on energy conversion, there has been a shift in the types of measurement needs."

***Jamie Pederson, product marketing manager for B&K Precision:*** "As the price of DAQs continues to fall, we envision a point where the design will have a dedicated DAQ per channel. In preparation for this, B&K Precision is developing new products to take advantage of this change to provide our customers with improved performance and value."

***Peter Anderson, general manager of Measurement Computing Corporation:*** "The driving trend in the last 1-2 years is the desire to take measurements closer to the DUT for the following reasons: lower wiring costs, less susceptibility to noise, and the ability to control the system locally. In the IoT lexicon, this is referred to as "edge computing." MCC is responding to this request by providing web-based solutions and supporting low-cost Linux computers and controllers like Arduino and Raspberry Pi and popular Linux programming environments like Python. Low-cost computers and controllers are an efficient and lightweight method to create measurement nodes close to the DUT."

***Steve Johnson, president of Digilent:*** "Wireless data acquisition is trending, opening up a wide range of new applications in remote and continuous monitoring. When coupled with open, web-compatible software interfaces, these devices make it simple and inexpensive to harness IoT software platforms to bring measurements and useful information to web pages and mobile devices."

***Andrew Jesudowich, sales & operations manager at imc DataWorks:*** "Digitization, the Internet of Things, remote monitoring of data, controlling of a vehicle or its buses remotely, automatic data transfer and ultimately analysis, and networking of platforms using standard digital vehicle bus protocols combined with connectivity to the cloud. IoT and distributed system topologies are driving the trend toward more autonomous operation of the measurement and control system."

***Oliver Rovini, technical director at Spectrum Instrumentation:*** "We've seen mainly two trends in the last year: a demand for higher dynamic range at high signal rates like 16-bit resolution; and an increasing demand for high continuous data throughput and high computing."

***Fumitoshi Ide, product manager, Data Acquisition Field Design Division at Hioki USA:*** "Control circuit boards and control devices have been reaching new levels of performance in recent years in a diverse range of fields, including automobiles, power devices, and aerospace. These increases in performance are driving growth in the number of test points, creating demand for the ability to measure more than 100 signal channels at high speed."

***Bernard Ang, product marketing at Keysight Technologies:*** "We feel a few megatrends are driving the innovation of the DAQ systems and technologies. Industry 4.0's growing usage of robotic arms, sensors, and automation is expected to be driven by the IIoT. This technology trend of IIoT with intelligent manufacturing will require various sensors to be deployed in the ecosystem. As the demand for connected devices increases alongside growing demands for more centralized applications with data analytics to be performed remotely, a strong and efficient communications protocol test and connected DAQ systems is needed."

## Challenges

What are the biggest challenges vendors are facing when it comes to making innovations in data acquisition systems?

***Anderson, Measurement Computing:*** "The increases in digital-to-analog converter technology has slowed as the market becomes satisfied with the current speed/resolution curves of today and chip manufacturers put more emphasis into developing low-power ICs. With this maturation of DAQ technologies, new products cannot rely on simply better DAQ performance, but rather greater O/S and computer support along with ease-of-use features for continued growth."

***Huy Nguyen, sales manager, aerospace & defense at Diversified Technical Systems (DTS):*** "Customers are adding more channels to tests, but they still need ultra-low size, weight and power (SWaP). Especially with hyper velocity missile development and unmanned platforms, they are looking for alternative DAQ that can fit onboard test articles."

***Ang, Keysight:*** "At Keysight, our biggest DAQ challenges include:

- Ensure product stability and accuracy for users. We have implemented autocalibration features to reduce temperature drift error and internal drift error due to time.
- Make the calibration processes simple and less cumbersome. One of the ways we have accomplished this is to remove the need to calibrate individual modules; we only calibrate the DAQ mainframe.
- Make our new DAQ970A backward traceable and a drop-in replacement for its predecessors concerning functionality, software coding, and specifications.
- Ability to synchronize with peer instruments such as power supplies, signal sources, and more, using Keysight's BenchVue application software without software programming.
- A lot of effort put into ease-of-setup because of many DAQ modules with different behaviors and functions
- Ensuring multiple channel synchronization and setup works perfectly and reliably over time."

***Chitalwala, Yokogawa:*** "As energy efficient technologies gain wider adoption, the need for reliability in testing for efficiency, performance, and safety has become greater. As innovators and precision makers, it is always challenging to design and develop test instruments to meet the ever-changing demands of design and development engineers. High resolution, faster sampling, high accuracy, isolation, compact size, ease-of-use and cost-effectiveness—combining all these attributes into one instrument is a challenge. Designing equipment with customer parts versus COTS devices has its own tradeoffs."

***Molly Bakewell Chamberlin, strategic technical marketing agent for Silicon Designs, and Kati Cole, director of sales and marketing at Silicon Designs:*** "Silicon Designs has always maintained the philosophy of "let the customer drive R&D." To Silicon Designs, that means that their core competency remains the design and manufacture of rugged, accurate, industrial-grade MEMS capacitive accelerometer modules and chips. As such, all current and future plans for their G-Logger data acquisition systems will be entirely derived from any customer expressed need for additional features or functionality to better support individual customer test setups. Any future R&D efforts at Silicon Designs specific to the G-Logger will therefore be derived entirely from customer feedback and special requests, as to any next-generation features. The company has no plans to segue into the DAQ market beyond their G-Logger product, which exists as a helpful accessory for Silicon Designs customers."

## What are customers asking for?

With demand for better data acquisition as a constant, what specific features are customers asking vendors to provide?

***Jesudowich, imc DataWorks:*** "Turnkey solutions—full instrumentation including


▲ Keysight's Model DAQ970A Data Acquisition System, with modules stacked.

various sensor technologies, measurement and control hardware, software for management, analysis and reporting of testing results, and application knowledge and support for the full solution."

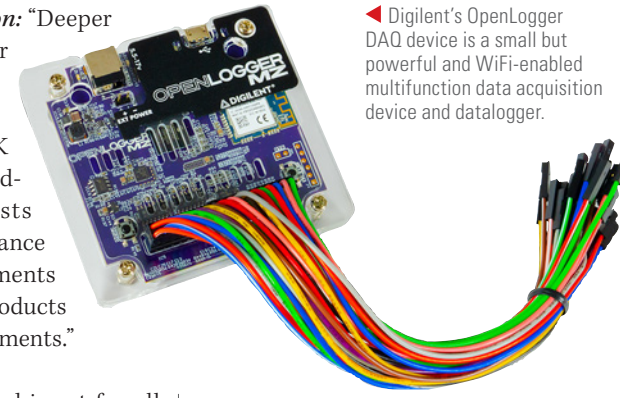
*Nguyen, DTS:* "Small, modular, low mass, low power. Instrumentation that can be embedded on or in a test article without altering test dynamics. By the time that customers get to DTS, they have already made big investments (time, money, engineering, manufacturing, simulation testing) to get a test article to prove out in real life. DTS is the insurance to validate their hard work and investment."

*Chamberlin & Cole, Silicon Designs:* "Over the years, Silicon Designs has found that its customers favor streamlined and simplified test setups. They prefer a simple, compact, accurate, cost-effective data acquisition system—preferably one that is also lightweight and portable. That ideal system would provide full data recording and playback functionality. It would not require the use of an additional power supply. Most importantly, Silicon Designs customers also want a data acquisition system of which they can be 100% assured will offer seamless direct compatibility with any of the company's own 8-32 VDC powered MEMS capacitive accelerometer modules. Due to the steady increase in customer requests for a simple data acquisition system with these specific criteria—expressly for use with Silicon Designs accelerometers and within smaller channel count applications—the company has recently introduced its own G-Logger DAQ series, in two unique models."

*Rovini, Spectrum Instrumentation:* "High channel counts and a working synchronization concept for multiple devices like digitizers and arbitrary waveform generators."

*Johnson, Digilent:* "Along with higher performance (speed, resolution), there is a need for smaller devices that can easily be embedded into mobile and other space-constrained applications, giving users insight into the health and environment of systems in real-time."

*Pederson, B&K Precision:* "Deeper memory, and greater accuracy, and resolution in a smaller, more cost-effective unit. B&K Precision is currently addressing these requests and will continue to advance with customer requirements by bringing to market products with expanded measurements."




◀ Digilent's OpenLogger DAQ device is a small but powerful and WiFi-enabled multifunction data acquisition device and datalogger.

*Ide, Hioki USA:* "Isolated input for all channels, simultaneous sampling of all channels, high resolution, high precision, and high-speed data transfer."

*Ang, Keysight:* "Here are just some of the key requests from our customers:

- Data logging over a long period for device reliability test
- Robust and rugged data acquisition systems with plenty of channels for simultaneous measurements
- Reliable thermal profiling and acoustical testing of electrical appliances
- Integrated signal conditioning and synchronous sampling across multiple sensors
- Real-time data enabling immediate parameters adjustment for testing
- Rapid control prototyping, simulations, and production testing.

*Anderson, Measurement Computing:* "In high-cost systems, power is the key as more high-tech features are combined in product designs. A good example of this is the automotive and aerospace market where multiple technologies are converging such as EV and autonomous vehicle. These systems need to have a high degree of control from a single vendor to offer the spectrum of solutions needed to keep up. In lower-cost systems, in which MCC specializes, customers have been asking for ways to integrate in open systems that support products and technologies from many vendors. Linux systems are gaining in popularity because of the large amount of open-source tools to integrate disparate technology from multiple vendors."

*Chitalwala, Yokogawa:* "High channel count, faster sampling rates, isolated measurements, and built-in analysis. Specifically, there has been an increased need for isolated high-speed analog measurements for power electronic circuitry."

## Now on the market

What new DAQ solutions have vendors launched lately?

*Johnson, Digilent:* "We just released our OpenLogger DAQ device—a very small but powerful and WiFi-enabled multifunction data acquisition device and datalogger. This product ships with a free browser-based tool (Waveforms Live) for setup, configuration, and real-time monitoring. Data can either be logged locally

▼ Launched this past April, B&K Precision's model DAS220-BAT is a lightweight and portable recorder.

to the PC or on the device's microSD card. OpenLogger joins her sister product OpenScope, targeted at higher speed (6MSPS) triggered acquisition tasks."

***Pederson, B&K Precision:*** "In April of this year, B&K Precision released model DAS220-BAT—a lightweight and portable recorder that includes a built-in battery that can operate for up to 15 hours and also serve as a backup in the event of power loss. The deep internal 32 GB of solid-state memory provides the space needed for extended periods of data logging. The DAS240-BAT features external analog inputs which help with cable management by allowing the user to leave the module connected to the DUT. These inputs are expandable from 20 to 200, and the DAS220-BAT has 10 analog inputs integrated for portability."

***Jesudowich, imc DataWorks:*** "We've recently introduced a new fiber-optic CAN measurement module, imc CANSAS-FBG-T8. It includes key features of:

- Safe temperature measurements in high voltage environments
- Clean measurement results despite high voltage environments
- Immune to electrostatic and electromagnetic interference
- Easy handling, thanks to small cable diameters
- 1 kHz sampling rate, 100 Hz bandwidth per channel"


◀ imc DataWorks' fiber-optic CAN measurement module, the imc CANSAS-FBG-T8.

***Anderson, Measurement Computing:*** "MCC has released a series of easy-to-configure and use web-enabled data loggers,

WebDAQ, for both temperature and sound and vibration measurements. These can be used in stand-alone and remote settings but can also be controlled through a REST API for application control and data retrieval by popular programs including Python, C++, and LabVIEW. MCC has also released professional-quality DAQ products in the Raspberry Pi HAT (Hardware Attached on Top) form factor. The first three releases are a 100kHz, 12-bit analog waveform capture module, a digital IO and analog output module, and a thermocouple measurement module."

***Chitalwala, Yokogawa:*** "We released the DL350 Portable ScopeCorder a year back. It combines all the measurement and recording capabilities engineers need when they are away from their office or laboratories—all in one compact instrument. Some of the key features include: Portability, mobile, and modular; A4-sized compact chassis; up to 3.5 hours of battery power; resistive touchscreen for harsh environments; GPS recording; and 16-bit, 100MS/s, up to 8 channels."

***Chamberlin & Cole, Silicon Designs:*** "The G-Logger data acquisition system series from Silicon Designs is available in two unique models, known as the Model 3330 and Model 3340, respectively. Both are portable, low cost, USB-powered data acquisition systems, designed expressly for use with all Silicon Designs 8-32 VDC MEMS capacitive accelerometer modules. All models in the Silicon Designs G-Logger DAQ series provide the same quick, powerful monitoring and real-time data streaming, as well as analysis and display capabilities, as can be found in more expensive data acquisition systems, including 16-bit sample rates from 1 to 10,000 samples per-second-per-axis."

***Nguyen, DTS:*** "We recently released SLICE IP68, which is a modular, ultra-small DAQ in a waterproof, dustproof enclosure with IP68-rated connectors. It's a proven DTS form factor combined with unparalleled environmental durability that's allowing customers the ability to collect in situ vibration, strain and rotational data without special weatherproof enclosures


▲ Silicon Designs' Model 3330 and Model 3340 G-Logger Data Acquisition System.

or slip rings. UAVs, helicopters, rockets, military vehicles, and more."

***Ang, Keysight:*** "Keysight recently launched the DAQ970A Data Acquisition System, enabling our customers to sample more signals, faster. The successor of the popular 34970A/34972A DAQs, the Keysight DAQ970A comes with advanced built-in 6 ½ digits digital multimeter that enables users to measure with confidence, in terms of its accuracy. It has built-in signal conditioning circuitry that enables time and cost savings for configuring complicated test setups. The DAQ970A speeds test development

▼ Diversified Technical Systems' SLICE IP68 is a modular, ultra-small DAQ in a waterproof, dustproof enclosure with IP68-rated connectors.


times with fast measurement and scan rates with our new solid-state switch multiplexer module, offers expanded measurement types and ranges over its predecessors, and streamlines your test development process with our BenchVue test software."

***Rovini, Spectrum Instrumentation:*** "Spectrum has released a full range of 16-bit digitizers available for PCIe and LXI platform. Products range from 20 MS/s to 125 MS/s and can be synchronized up to 128 channels in one system. The PCIe products offer a high data throughput of more than 700 MByte/s allowing data acquisition and storage to disk arrays for hours."

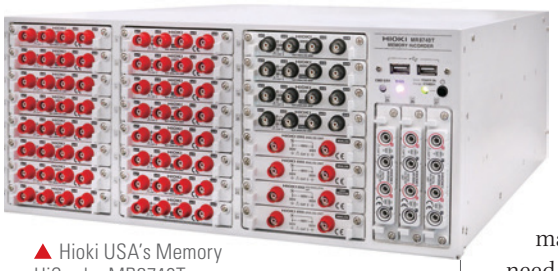

▲ Spectrum Instrumentation's 16-bit model DN.59X Ethernet digitizerNETBOX.

***Ide, Hioki USA:*** "We recently launched our Memory HiCorder MR8740T, which can measure up to 108 channels simultaneously; offers real-time data save to SSD unit with 5MB/s; and generates and measures signals with a single instrument."

## Applications

What specific applications are vendors' DAQs being used for?

***Johnson, Digilent:*** "Since our devices can run in a stand-alone mode, it is possible to embed them in mobile devices with a wireless connection back to PC. This has opened up some interesting applications in mobile robotics, drones, and machinery monitoring where wires or cables running back to a PC are impossible. Additionally, by running the device off a battery, the complete data acquisition system is isolated, allowing for inherently safe setups around high voltages."



▲ Hioki USA's Memory HiCorder MR8740T.

***Chamberlin & Cole, Silicon Designs:*** "When used in combination with Silicon Designs' 8-32 VDC MEMS capacitive accelerometer modules as part of a complete measurement system, the G-Logger DAQ series can be used to support a variety of zero-to-medium frequency instrumentation applications. These include automotive crash event detection, automotive and aerospace NVH, road load data acquisition (RLDA), vehicle dynamics, vibration and structural health monitoring, vehicle suspension testing, robotics, environmental simulation design, aircraft interior panel vibration monitoring, UAVs and satellite component monitoring, and aircraft flight and flutter testing."

***Anderson, Measurement Computing:*** "Both MCC WebDAQ and DAQ HAT products have been applied to machine condition monitoring and edge computing applications where customers are looking for lower-cost options to actively monitor asset health and send alerts if an issue needs to be addressed."

***Pederson, B&K Precision:*** "Our DAQs are used in a wide range of applications from power generation, manufacturing, and transportation, to name a few."

▼ Yokogawa's model DL850 ScopeCorder.

***Nguyen, DTS:*** "Customers are looking for instrumentation for performance validation and safety testing so they can take products to market. They've already made a huge investment in time, money, design, and maybe simulation testing, but they need real-world data. DTS miniature DAQ systems are delivering reliable and repeatable in situ test data. It's the validation they need to go to the next step."

***Ang, Keysight:*** "Our DAQ970A has built-in signal conditioners that make it suitable to measure multiple types of signals such as AC/DC voltage, AC/DC current, resistance, capacitance, diode, frequency, and period. It is suitable for performing multiple synchronous sensor testing, multiple battery temperature profiling, product temperature characterization, and more."

***Chitalwala, Yokogawa:*** "Our ScopeCorder series are used in a wide range of applications. To name a few:

- Construction and verification of automotive buses such as CAN/CAN FD, LIN, and SENT
- Motor evaluation in electric & hybrid electric systems
- Inverter development
- Testing of battery and safety systems in automotive
- ScopeCorders are typically used at the systems level for developing and troubleshooting complex systems"

***Jesudowich, imc DataWorks:*** "Application areas from automotive and e-mobility to (alternative) energy, aerospace, railway, mechanical/civil engineering."

## Tools

What tools are vendors offering for data reduction, analysis, and/or management?

***Ang, Keysight:*** "The BenchVue PC software perfectly complements the DAQ970A. It gives you the ability to control and configure multiple instruments together with the DAQ, data log, and view measurements in multiple displays. The BenchVue software comes with Test Flow,

an embedded application that helps you to create and analyze automated tests quickly—without any programming."

*Jesudowich, imc DataWorks:* "imc FAMOS is our powerful data analysis and visualization tool which enables engineers, technicians, and scientists to efficiently analyze and evaluate large amounts of data. Our product portfolio also offers a database solution: imc SEARCH, which allows for a wide variety of information that is important for test & measurement to be stored, searched, filtered, sorted, and subsequently evaluated using the imc FAMOS analysis software. A sophisticated storage technology provides fast access times for large data sets."

*Rovini, Spectrum Instrumentation:* "A combination of FPGA-based algorithms, like block average, and a standard software tool for acquisition, analysis, storage, and reporting, SBench 6, is available."

## Sensors Expo

Plenty of data acquisition systems—or solutions encompassing them—will be on display at the upcoming Sensors Expo June 25-27 in San Jose, CA, where Evaluation Engineering will be in attendance. Here's what vendors told us they'll be bringing to Sensors Expo in the area of DAQ.

*Chamberlin & Cole, Silicon Designs:* "Both Silicon Designs Model 3330 and Model 3340 G-Logger DAQ products will be on. The two models will also be featured as part of the company's award-winning "How Do You Track Vibration?" demo, used to illustrate how Silicon Designs single-axis and triaxial MEMS capacitive accelerometers support a variety of shock, vibration, mechanical stress and structural health monitoring applications."

*Jesudowich, imc DataWorks:* "Along with our aforementioned imc CANSAS-FBG-T8, we'll have the following products at Sensors Expo:

- MTP-NT Modular Telemetry—a small and flexible telemetry system with a modular design
- Dx Universal Telemetry—a particularly compact and lightweight multichannel telemetry
- CLSx Steering Effort Sensor—an ultra-slim sensor placed between the steering column and steering wheel that enables the original steering wheel of your vehicle to become a high-precision instrument that measures steering torque, angle, steering velocity and acceleration in x, y, and z directions"

*Johnson, Digilent:* "At Sensors Expo, Digilent will display the OpenLogger, OpenScope, and our other test and measurement devices like our popular Analog Discovery 2 portable USB multi-instrument." EE