TERADYNE

Technical Article

Modular Oscilloscopes vs. Digitizers

Modular instruments are a powerful option in the test equipment designer's tool kit – especially in automatic test equipment (ATE) applications that require high channel density and digital programmability. They provide all of the needed test functions, without the added expense and size of benchtop instruments. Modular digitizers are often used in the front end of modular instruments, since analog signals need to be converted into digital form for analysis and processing. ATE designers are often challenged when using modular digitizers, because digitizers are not as capable as benchtop oscilloscopes – particularly when it comes to breadth of measurement features and functions. Modular oscilloscopes go beyond the limitations of digitizers to overcome this challenge for the ATE designer.

Why Use Modular Instruments?

Test system designers have many options available to meet their test requirements. One of their fundamental choices is whether to use benchtop test equipment and/or modular instruments. Today's modular instruments can be used in most test applications, including product research and development, incoming inspection, final test, quality assurance, and ATE. They provide very high channel density and complete test functionality, without the added expense and size of benchtop instruments. Modular instruments are particularly well suited for ATE, since they include excellent software tools for programmability and automated control. They also provide excellent multi-instrument synchronization, a critical characteristic in most ATE. Many standard platforms are available – including PCI, PXI, and VXI – that provide varied choices for a variety of applications (See Figure 1). For many test applications, modular instruments are a better choice than benchtop versions.

Features Common to Both Modular Oscilloscopes and Modular Digitizers

Both modular digitizers and modular oscilloscopes are used in ATE systems, converting analog input signals into digital form for analysis and processing. The basicspecifications are very similar for modular digitizers and modular oscilloscopes. They include vertical resolution, sampling rate, analog bandwidth, memory capacity, number of input channels, basic triggering, programmatic control, and variable input scaling. Size, power consumption and cost are also similar for modular digitizers and modular oscilloscopes. Both digitizers and oscilloscopes must transfer some data to the system PC or controller for further processing, but modular oscilloscopes provide much more on-board processing than modular digitizers. As a result, modular oscilloscopes can typically provide information about waveform characteristics more quickly and with less data transfer than digitizers can.

Figure 1:
VXI, PCI, & PXI Instruments

Modular Oscilloscopes Have Clear Advantages Over Digitizers

In all but the most basic and low performance measurement scenarios, modular oscilloscopes offer significant advantages over digitizers. By using modular oscilloscopes, the ATE designer has all of the flexibility, functionality, high performance, and rich set of measurement features that are available in a benchtop oscilloscope. This simplifies and speeds up the ATE design task and ensures that the ATE meets all of its design requirements, while using a minimum amount of external resources and processing power. Modular oscilloscopes have specific advantages and unique features in the areas of triggering, signal acquisition and conditioning, waveform math and analysis, and graphical user interface.

Unique Features of Modular Oscilloscopes

Modular oscilloscopes provide a broad range of functions and features, including most of those available in benchtop oscilloscopes. Most of these extended features and functions are not available in modular digitizers. The extended features that are available in modular oscilloscopes – but not included in modular digitizers – include advanced triggering, flexible analog signal conditioning, advanced acquisition modes, onboard waveform measurement and analysis, flexible segmented memory, and an intuitive graphical user interface (See Figure 2).

Advanced Triggering

Modular oscilloscopes provide a variety of triggering options, including rising/falling edge, event count, pattern, pulse width, glitch, video, and multi-event cascading triggers. Advanced triggering helps oscilloscope users capture elusive events that digitizers may miss.

Flexible Analog Input Signal Conditioning

Modular oscilloscopes provide a variety of flexible input signal conditioning ranges. Some modular oscilloscopes have 15 input voltage ranges and maximum input voltage limits up to 300 Vpeak. These specifications are similar to those found on benchtop oscilloscopes. In an ATE environment, it can be inconvenient or impossible to add external signal conditioning to an instrument. Modular oscilloscopes that offer a large number of input ranges and high voltage inputs are better suited than digitizers are to measuring a variety of signals.

Advanced Acquisition Modes

Modular oscilloscopes provide numerous advanced signal acquisition modes. These include averaging, envelope detection, peak detect, high resolution, and equivalent time. These advanced acquisition modes provide more waveform acquisition flexibility than what is available with digitizers.

On-board Waveform Analysis and Waveform Math

Modular oscilloscopes provide on-board waveform analysis and waveform math. Performing waveform analysis and math in the module is typically much faster than doing it in a separate

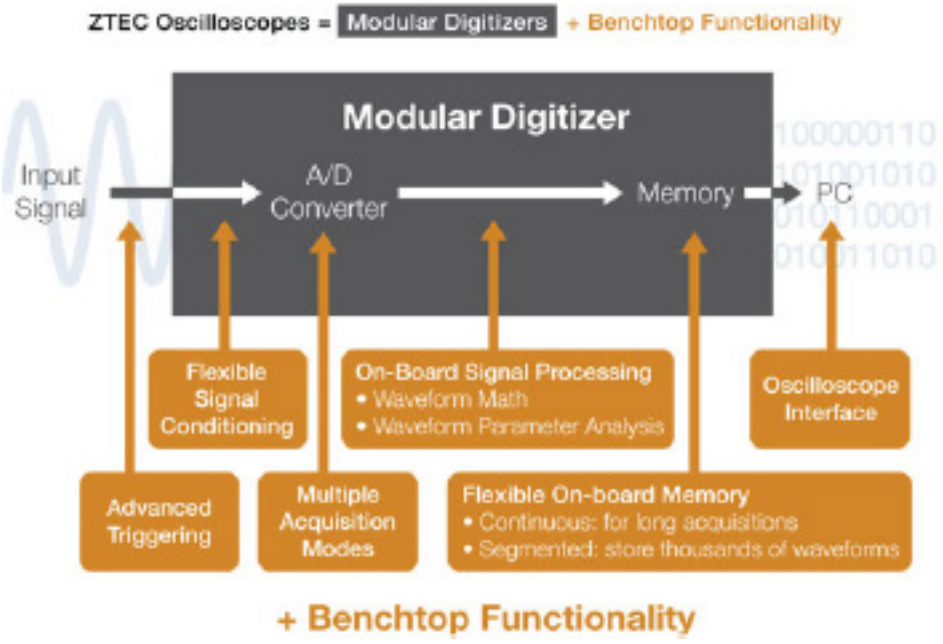

Figure 2: Modular Oscilloscope Features

PC or controller. Analysis and math functions may include add, subtract, multiply, FFT, derivative, integral, histogram, limit testing, mask testing, waveform parameter trending and calculation of 40+ parameters related to waveform behavior. On-board waveform math and analysis in modular oscilloscopes removes the need to transfer large amount of waveform data to an external PC or controller, like is necessary with digitizers.

Flexible Segmented On-board Memory

Modular oscilloscopes provide a significant amount of flexible segmented on-board memory. Up to 32,000 waveforms can be saved in oscilloscope memory for later analysis and viewing. The memory segments can be viewed either overlaid or individually. This feature provides insight into waveform behavior that is not possible with modular digitizers.

Intuitive Graphical User Interface

Modular oscilloscopes provide software that produces an easy-to-use and intuitive graphical user interface (GUI) on a computer display. This GUI provides manual instrument control and a user experience quite similar to that of a benchtop oscilloscope. Modular digitizers do not provide this capability and may require additional programming to create a quality GUI.

Conclusion

When test system requirements necessitate broad functionality and features, and extensive waveform math and analysis, test system design engineers are choosing modular oscilloscopes as the best solution for their designs. Modular oscilloscopes offer all of the features of benchtop oscilloscopes, along with the advantages of a modular instrument – including high channel density and flexible remote control and programmability.

What makes ZT-Series oscilloscopes different?

Benchtop Oscilloscopes vs. ZT-Series Modular Oscilloscopes

ZT-Series oscilloscopes offer:

1. Higher channel density
2. Easy integration using software tools
3. Multi-instrument synchronization
4. Responsive remote control

Modular Digitizers vs. ZT-Series Modular Oscilloscopes

ZT-Series oscilloscopes offer:

1. Advanced triggering
2. Flexible analog input signal conditioning
3. Advanced acquisition modes
4. On-board waveform analysis and waveform math
5. Flexible segmented on-board memory

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