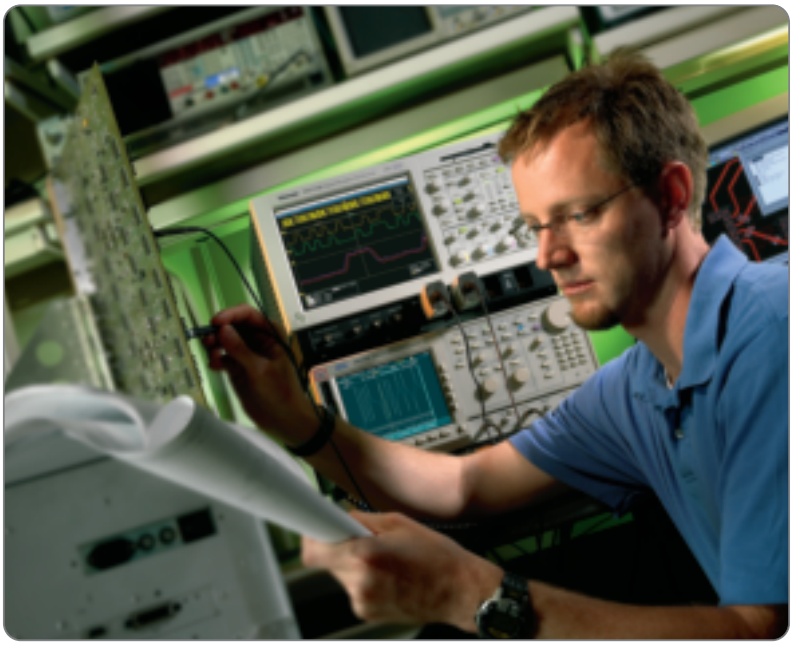
# MultiView Zoom™ Simplifies Navigation of Long Records to Speed Debugging and Analysis



**Certain design applications depend on the ability to examine and compare long records of information. Efficiently navigating through millions of samples of data can be daunting without the proper tools. MultiView Zoom features in the TDS/CSA7000/B and TDS6000 Series oscilloscopes allow you to easily examine and compare multiple waveform regions to speed troubleshooting.**

## Introduction

Designers evaluate the performance of high-speed, high-data-density designs – such as magnetic storage peripherals and electrical or optical communications interfaces – by comparing the characteristics of brief segments within extremely long records of waveform information. In some cases, testing is used to confirm consistency in the repeated segments; in others, extensive searches are made for elusive anomalies to get to the root causes of problems in designs.

Searching through long records to verify performance or find anomalies is a repetitive and very tedious process. Typically, a search requires switching controls back and forth between overview mode and one or more zoom regions to locate areas of interest and examine them more closely. Most searches involve scrolling through long data sets to compare the responses of hundreds of repeated activities. The fatigue and the frustration of repeatedly dealing with awkward controls make it difficult to concentrate on the task and impacts productivity.

TDS/CSA7000B and TDS6000 Series oscilloscopes feature MultiView Zoom™, a powerful set of tools and simple, intuitive controls that ease the tasks of comparing multiple waveform regions and examining long time histories in detail. As many as four zoom regions can be defined and displayed simultaneously to reveal signal behavior at different resolutions. All regions can be scrolled – locked together or independently – throughout the full record. Zoom regions can be opened on zoom waveforms to provide for detailed analysis of data while retaining overviews for reference. Each level of zoom increases magnification of the waveform.

This application note will be devoted to a discussion of the MultiView Zoom feature and how it is used to easily tackle real-world challenges in serial data validation and compliance, and magnetic and optical storage device design. The application scenarios that follow are not intended to define comprehensive procedures for their respective measurements. Rather, they summarize the basic steps to optimize the MultiView Zoom feature to make long records more easily navigable and usable.

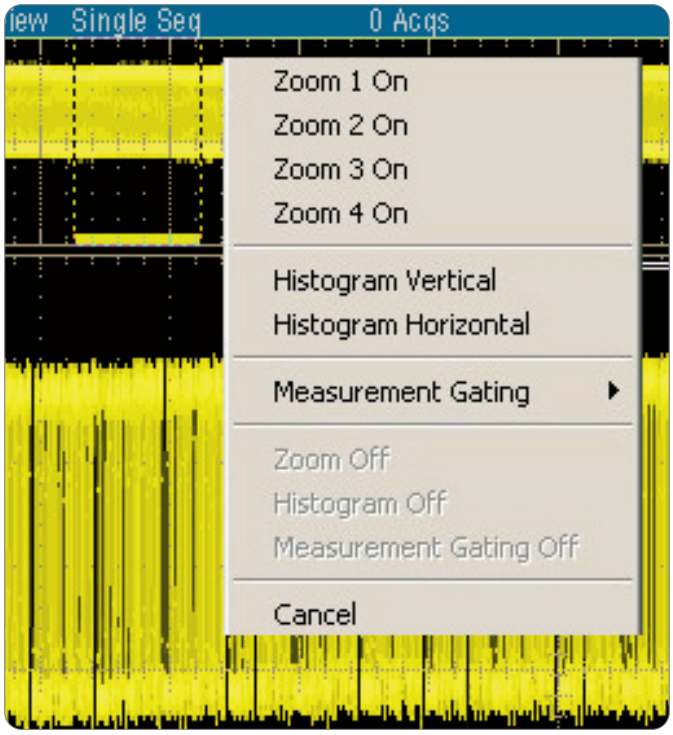
### MultiView Zoom – simple yet powerful analysis tools

MultiView Zoom replaces tedious manual processes with a unique graphical "touch-and-tap" user interface and simple, straightforward controls to let you quickly compare multiple waveform regions and examine long time histories.

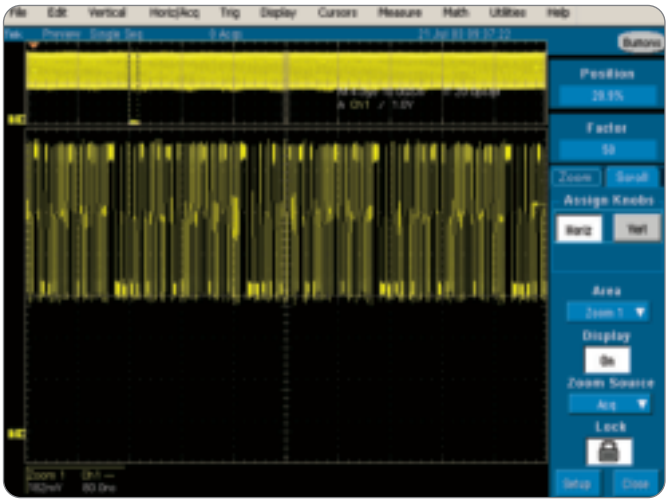
Simply touch the screen to define the region of the displayed waveform you want to zoom and tap one of the four "Zoom" screen selections (Figure 1). The zoomed segment of waveform you defined immediately appears below the original. Reposition the zoom region in the original acquisition by moving the scroll slider with your finger and use a front panel control wheel for fine adjustment of position.

The controls are just as convenient with a mouse. Point to select a region to zoom, drag the region to a new position, and finely adjust position using the mouse scroll wheel. Your hand never leaves the mouse and operations are performed quickly and intuitively. Fatigue is reduced in these high-use situations because your hand remains comfortably resting on the bench.

Apply a similar simple point-and-click process to create up to four different zoom regions on each signal and use them as overlays to visually align the regions of waveforms. Each of the zoom waveforms with its scroll slider is displayed in its own color (Figure 3). Once the regions are aligned, lock some or all of their relative positions together and scroll through the original deep records to compare signal behavior – either manually or automatically.




▶ ***Figure 1.*** *Touch and tap single level menu for MultiView Zoom control.*

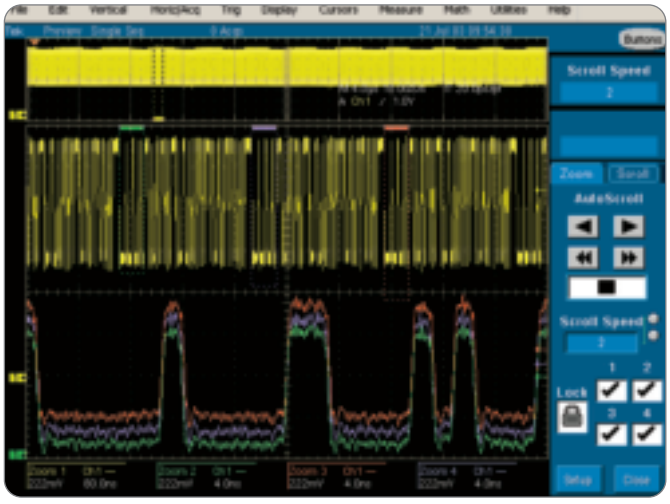


▶ ***Figure 2.*** *Revealing a repeating pattern.*

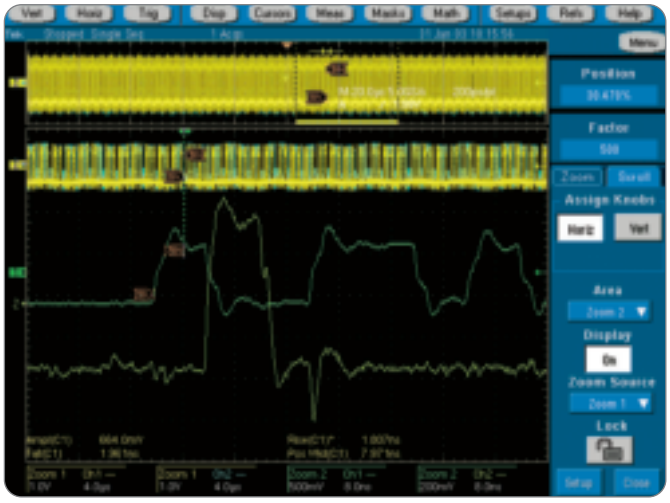
Discover and explore repeating patterns in a long record in detail with the zoom-on-zoom feature. Often, the full view of a long record is merely a band of light. By expanding a portion of the waveform, you can determine if there are any patterns. Figure 2 shows the original record at the top and the zoomed portion within the outlined region of the original below it, revealing a repeating pattern. In Figure 3, three zoom regions have been "drilled down" from the expanded waveform to reveal greater detail at the positions indicated by the color scroll sliders and they are locked for auto-scrolling through the long record.

Easily keep track of elements while scrolling and zooming with on-screen annotation of setup and measurement results. Flags on each waveform indicate the reference position where the measurement is made. Reference readings on flags indicate the levels set for that measurement – rise time measured at 10% to 90% or 20% to 80% for example. Dashed lines show other reference marks for an individual measurement.

Automatically display the position and automated measurement values on the screen of every zoom region by combining measurement annotation capabilities with MultiView Zoom. Display comparisons, such as rising edge timing between two signals, with the screen-based cursors (Figure 4). Measurement annotation gives you confidence that you're making the measurement you want on the correct part of the waveform. And if you're making many similar measurements, such as delays among several lanes in a multi-lane serial bus system, you can clearly see that each measurement is set up correctly.



▶ ***Figure 3.*** *Multiple zoom regions of a repeated pattern.*



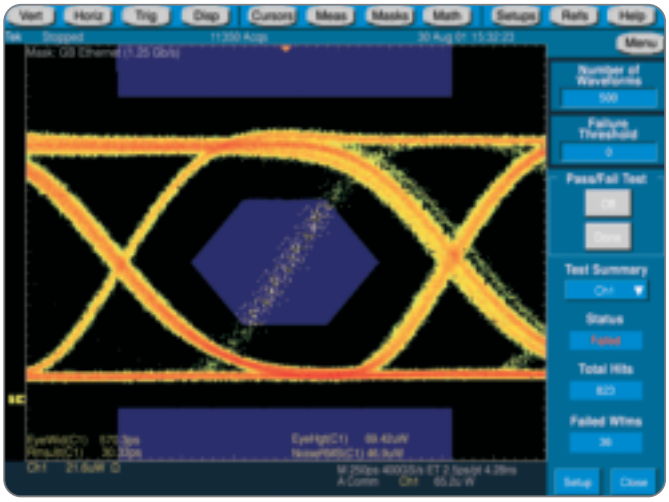
▶ ***Figure 4.*** *Measurement annotations on a MultiView Zoom display.*

### Application #1: Serial Data Communications – finding needles in the haystacks

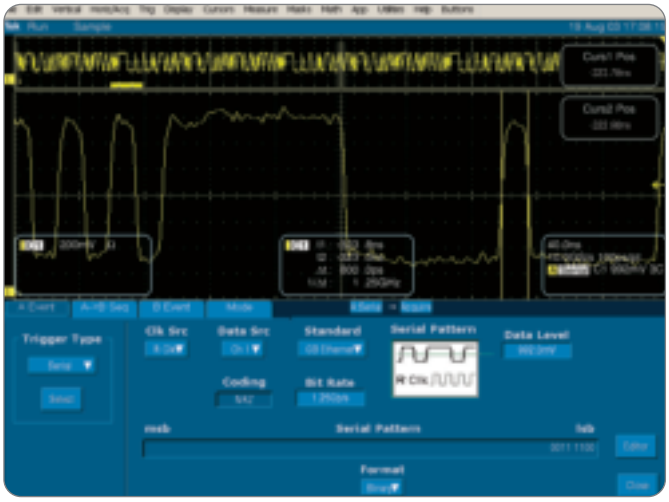
Emerging communications and computer standards, bus technologies, high-speed protocols and serial architectures dramatically increase system performance. However, these new technologies bring significant interoperability and compliance issues, while increasing circuit speeds and densities, interconnect bandwidth and system complexity dramatically increase the susceptibility of designs to subtle and elusive problems.

In communications and computer systems, logic errors can cause bits to appear at 1/2 unit intervals (UI) instead of at UI periods. It is relatively easy to detect the occurrence of a misaligned bit problem in an eye diagram test of a data transmission (Figure 5), but searching for the faulty bit that caused the error in a 2 gigabit/second serial stream of 8-bit words can be as challenging as finding the proverbial needle in the haystack – a mind-numbing experience.

Other common types of faults in such systems occur due to the misalignment of control logic with data words and conflict between control lines. In these cases, the first event may be detected by a trigger, but you may need a way to examine each succeeding event in the record. In these design applications, troubleshooting often depends on analyzing segments of information leading up to and following a fault condition. The resulting long memory acquisitions often appear as a "band of light" on the display due to the volume of data. Zoom displays can focus on hundreds of samples out of the millions acquired, but searching through all of those samples of data can be a daunting task. Typically, you need to repeatedly switch back and forth between zoom and normal resolutions – pushing buttons, navigating multiple layers of menus and manually positioning regions using control knobs. Without the proper tools, searching through long records to find anomalies can become tedious and time consuming. In Figure 6, the TDS7000B Series' serial pattern trigger is used to stop the acquisition and MultiView Zoom is applied to easily examine the region to isolate the faulty bit.

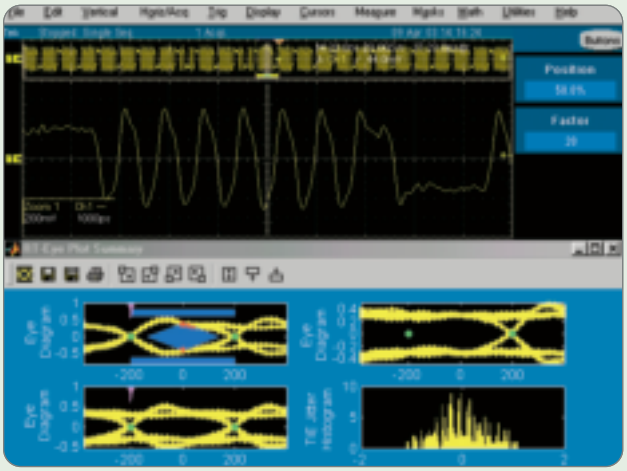


► ***Figure 5.*** *Eye diagram showing faulty bit.*



► ***Figure 6.*** *Zoomed region around faulty word.*

### TDSRT-Eye Software



▶ ***Figure 7.*** *A high-performance, real-time oscilloscope, paired with RT-Eye™ software, provides a turnkey solution for serial data validation and compliance.*

Tektronix high-performance oscilloscopes reveal high-resolution detail of the physical layer of communications designs, with eye diagrams and mask tests that allow verification of compliance to a wide range of standards. In addition, we offer the industry's broadest range of automated software applications to speed Pass/Fail testing to industry standards, such as XAUI, PCI Express, InfiniBand, Fibre Channel and more.

The TDS/CSA7000/B and TDS6000 Series oscilloscopes, equipped with RT-Eye™ (TDSRT-Eye) serial data compliance and analysis software (Figure 7) and proper probing solutions, provides the complete solution for analog validation and compliance testing of serial data buses.

### Application #2: Disk Storage – comparing thousands of repeated activities

Leading-edge magnetic and optical storage devices place severe demands on signal processing (read/write) ICs and I/O data transfer. The faster and faster signals needed to increase performance make it challenging to validate and characterize device performance in the mechanically noisy environment common to storage applications.

The comparison of aligned regions of waveform data is a critical technique to analyze the content of optical and magnetic storage devices. Ever-increasing aerial-densities and new read/write techniques have increased the complexity and the importance of testing to verify their performance. The quality and reliability of data storage and retrieval depends upon the consistency of the media and the recording/reading subsystems over millions of operations at millions of physical positions. To identify failure mechanisms in disk drive designs, you need to compare read channel information from hundreds of "good" and "bad" sectors. You may also need to evaluate electromechanical control loops using flexible comparison of servo bursts.

### Easily Navigating Long Records

The most common way to compare different regions is by overlaying them and horizontally scrolling through the rest of the waveform data. Once one of the events, such as a start of a drive sector, is located and examined, you can overlay it on the next occurrence to compare its characteristics in detail and reveal any deviations. The procedure is quick and easy:

1. Press the MultiView Zoom button on the front panel of the oscilloscope to zoom in on a region of interest. In Figure 8, we see the original waveform record at the top of the screen and a zoomed region of interest below it that represents the start of a sequence.
2. Select the second region that overlays the first region, as they are both starts of a sequence. In Figure 9, we see the original waveform record (Figure 8) shows a second start of a sequence overlaid on the first.
3. Scroll the two regions simultaneously. In Figure 10, the relative positions of the two regions in the original waveform are shown by the two scroll sliders – each in the color of the zoomed waveform.

With MultiView Zoom, you can easily scroll through the entire data set to align the initial event with each of hundreds or thousands of similar events and compare their characteristics. In the previous example, the two zoom regions were created and overlaid at the start of two sequences. The horizontal positions of the two zoom regions can be unlocked for positioning traces relative to one another and then locked in relative position to achieve simultaneous scrolling for comparison throughout the record. This type of scrolling clearly reveals major differences that appear at regular intervals at any point in the operating cycle.

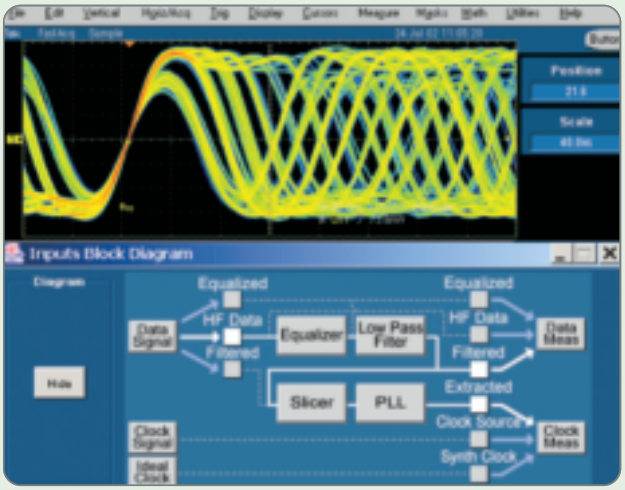
With the "AutoScroll" controls shown in Figure 10, scrolling is set to a comfortable rate so that you can sit back to observe the comparisons as both regions move through the record. The > button moves all locked zoom regions to the right at the speed indicated in the window. Scroll speed 1 moves traces 1 pixel at a time and scroll speed 10 moves traces one screen at a time. The >> and << buttons increase the speed by 5X.

► ***Figure 8.*** *Original and first region.*

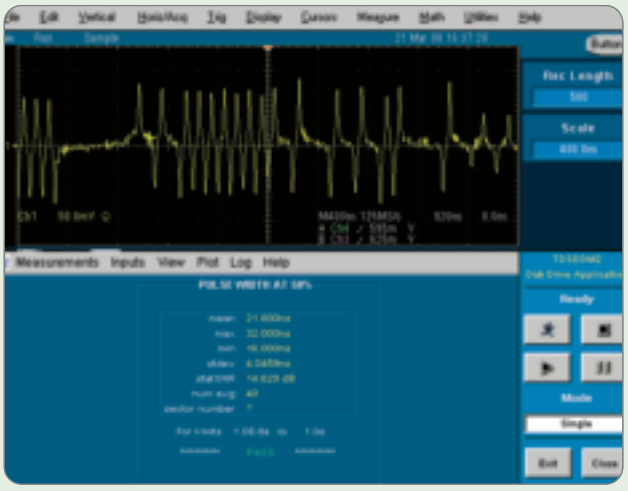
► ***Figure 9.*** *Second zoom region overlaid of interest on first.*

► ***Figure 10.*** *Two locked zoom regions being automatically scrolled.*

### TDSDVD and TDSDDM2 Software




▶ ***Figure 11.*** *Effectively develop next-generation optical designs using a high-performance, real-time oscilloscope equipped with TDSDVD software.*




▶ ***Figure 12.*** *A high-performance, real-time oscilloscope, coupled with TDSDDM2 software, offers the power and application-specific measurements needed for magnetic storage design.*

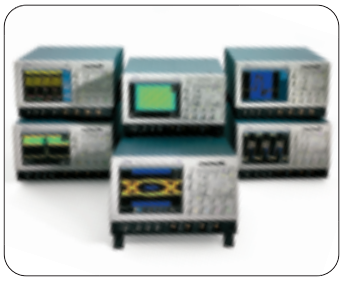
Tektronix high-performance oscilloscopes deliver superior acquisition and analysis of electronic signals found in magnetic and optical storage systems. Application software transforms the TDS/CSA7000/B and TDS6000 Series oscilloscopes into highly specialized analysis tools for magnetic and optical storage device design.

TDSDVD optical storage measurement and analysis software (Figure 11) offers the flexibility, analysis, time interval display and automatic application-specific measurements needed for optical storage systems design. Its unique TekFlex™ feature delivers unprecedented flexibility to dynamically modify digital signal processing (DSP) blocks – Equalizer, Low Pass Filter, Slicer and PLL – in next-generation optical storage designs.

TDSDDM2 disk drive analysis software (Figure 12) offers custom disk drive measurements – IDEMA measurements, such as TAA, PW50, Overwrite Resolution and Asymmetry, and PRML measurements, like autocorrelation NLTS and SNR – to develop magnetic storage systems.

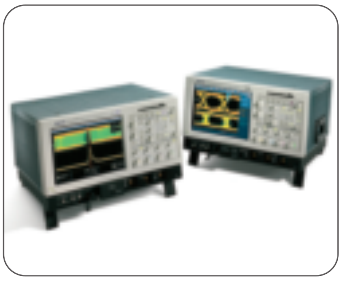
## Conclusion

Serial data communications validation and compliance and storage device design issues are representative of the challenges faced by those designers who must analyze long records of data to develop high-performance products. Analyzing long records is no longer a tedious, frustrating task. The TDS/CSA7000B and TDS6000 Series oscilloscopes offer a powerful MultiView Zoom feature that greatly improves the ability to verify performance and locate problems quickly and easily. Multi-level zoom regions allow far easier analysis of complex waveforms in fine detail using simple, intuitive controls.



## TDS7000/B Series Digital Phosphor Oscilloscopes

The TDS7000/B Series' unique combination of superior measurement fidelity, unrivaled analysis, and uncompromised usability makes it the ultimate test machine to simplify and speed the design of high-speed, complex systems. This family offers the industry's best solution to the challenging signal integrity issues faced by designers verifying, characterizing and debugging sophisticated electronic designs.



## CSA7000/B Series Communications Signal Analyzers

The CSA7000/B Series of communications signal analyzers reduces product development time by providing one tool that spans circuit development and physical layer testing. With this family, engineers can test designs for compliance to network communications standards as well as analyze critical internal parameters such as signal integrity, timing margins and jitter.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