

# New Integrated Oscilloscope is an Information Center for the Design Process



COMPUTING  
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VIDEO

► The Tektronix TDS7000 Series digital phosphor oscilloscope bridges the gap between the oscilloscope and the larger design environment.

With today's aggressive time-to-market schedules, distributed team design, and the need to publish information instantly on the web, the oscilloscope can no longer afford to work in isolation. It must integrate into the design process. It must provide information equally to project personnel at the next desk and in the next time zone. And it must be a partner with networked workstations.

Although many digital oscilloscopes can connect to networks via Ethernet, their connections are best suited for one-way data transactions from the instrument to the network. An alternative solution, the PC-based oscilloscope card, doesn't solve the problem entirely, either.

Ethernet and PC-based oscilloscope cards have provided many digital oscilloscopes with the connectivity needed by engineers. However, both present limitations in some situations when used in isolation. Today's escalating time-to-market pressures and worldwide design teams demand a higher level of connectivity.

Clearly, the effective joining of the oscilloscope with the computer's architecture is a solution waiting to happen. To accomplish this, three things must occur:

1. The oscilloscope must implement an open operational model like that of the PCs and workstations that engineers use in other steps of the design process.
2. The oscilloscope must be capable of uncompromised interfacing and interaction with both departmental networks and the Internet itself.
3. The oscilloscope must continue to deliver state-of-the-art measurement performance.

## New DPO Brings Two Worlds Together

The new Tektronix TDS7000 Series digital phosphor oscilloscope (DPO) finally bridges the gap between the oscilloscope and the larger design environment. One touch transforms the familiar waveform display screen into a Windows® 98 desktop. The TDS7000 is the first instrument that can be a high-performance oscilloscope, a full-fledged Windows PC, or both at the same time – whatever is right for the task at hand (Figure 1).

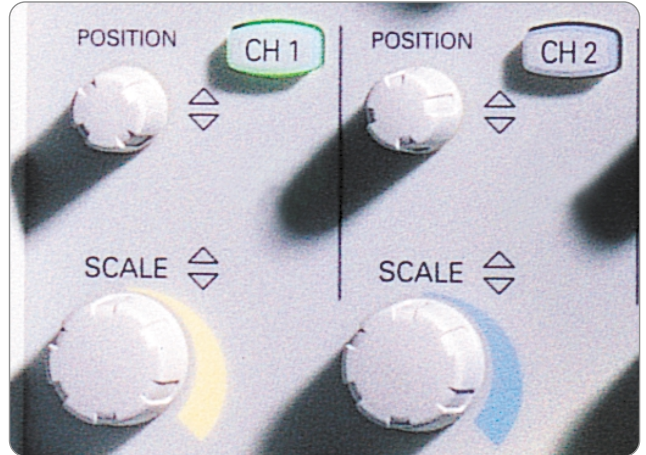
The TDS7000 is a true DPO with real-time sample rates up to 20 GS/s and bandwidths up to 4 GHz. It also offers the features that are innate in Windows 98 computer platforms: industry standard connections (including USB) to peripherals and printers, as well as a proven LAN interface for network communications.

# Integrated Oscilloscope

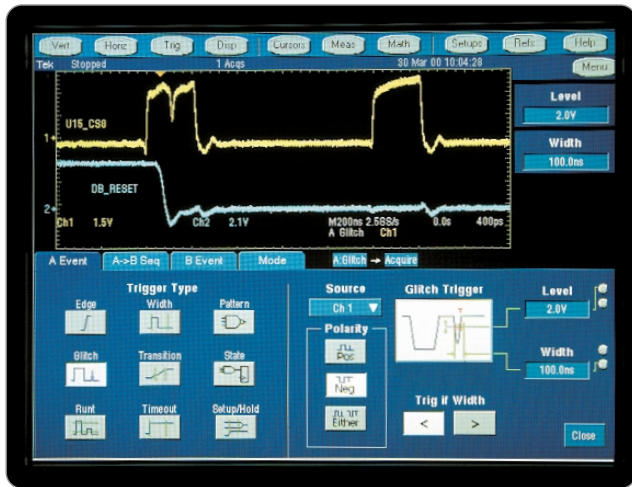
► Technical Brief



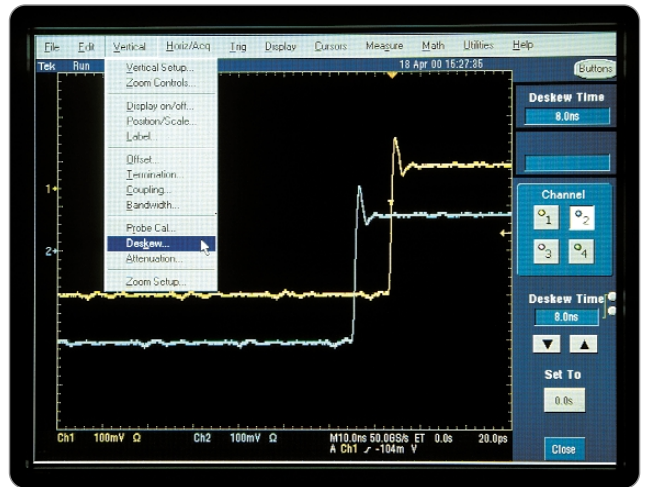
► **Figure 1.** The TDS7000 Series digital phosphor oscilloscope.



► **Figure 2a.** Direct controls.



► **Figure 2b.** Touch screen settings.



► **Figure 2c.** Menubar access.

## An Oscilloscope that Transforms the Design Process

The TDS7000 has the potential to change the way designers work. With its powerful measurement features combined with the access to integrated analysis applications and communication tools, the TDS7000 brings a new level of efficiency to four crucial engineering activities:

- Capturing measurement results
- Documenting the information
- Distributing and accessing design information
- Performing extended analysis

## Capturing Measurement Results

Although it is not the intent of this document to detail the TDS7000's acquisition features, the instrument's uniqueness begins with its user interface. Unlike other oscilloscopes, the TDS7000 user interface accommodates the individual engineer's control and display preferences.

### A User Interface with Three Faces

Hardware knobs and buttons have never been surpassed for ease of use in operating oscilloscopes. The TDS7000 is equipped with a full complement of per-channel vertical controls as well as discrete controls for the horizontal and trigger systems (Figure 2a).

These fixed hardware functions are supplemented by a wealth of touch-screen-based settings and modes. At the top of the screen, a tool bar offers tasks grouped by instrument function such as vertical, horizontal and trigger.

Touching a control on the screen brings up a graphical setup display for the respective function, such as Trigger Setup (Figure 2b).

The third “face” of the TDS7000 is its menu-style interface. All of the tool bar functions can be accessed via a Windows-style menu bar. For an engineer who works all day long at a PC workstation, this interface allows him or her to move smoothly into the measurement context without missing a beat. It is also a good way for new users to scan the feature set and become familiar with the instrument (Figure 2c).

### Documenting the Information

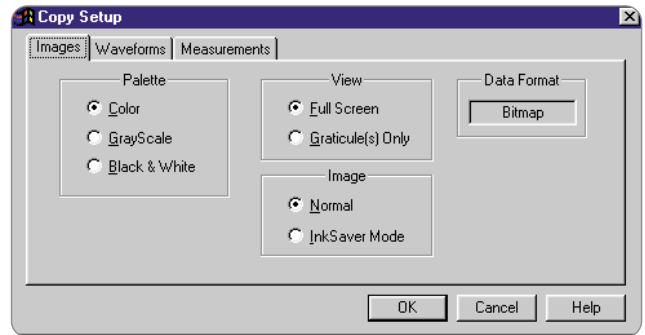
When the TDS7000 screen displays a captured waveform, that image is completely portable to other applications without any intermediate format conversions or exporting steps. Using the standard Copy (Ctrl-C) and Paste (Ctrl-V) commands and the Windows Clipboard, it is easy to place a waveform image into a written document.

#### Working with a Built-in Lab Notebook

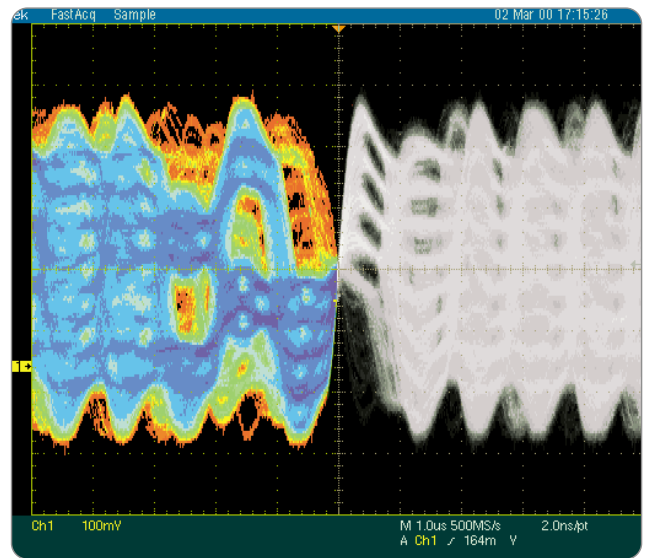
One convenient publishing tool is the WordPad application that is part of every Windows 98 installation. The application accepts waveform images taken from the oscilloscope display screen with the Copy command and provides a basic but flexible set of text editing tools. Using WordPad, it is possible to produce printed documents with readability features such as bold headings, bulleted text, and justified paragraphs.

It is easy to install a more comprehensive word processor such as Microsoft Word or even a presentation program like Microsoft PowerPoint. The TDS7000 allows Copy and Paste to any Windows application that accepts content from the Clipboard, including “paint” applications that let you draw symbols (such as circles or arrows) on the waveform to highlight areas of interest.

Any on-screen waveform image can be copied in either its full screen form (with all the surrounding controls and settings) or in a graticule-only format that captures just the trace and the graticule content. This calls attention to the important waveform features and eliminates on-screen buttons that might distract the reader (Figure 3).

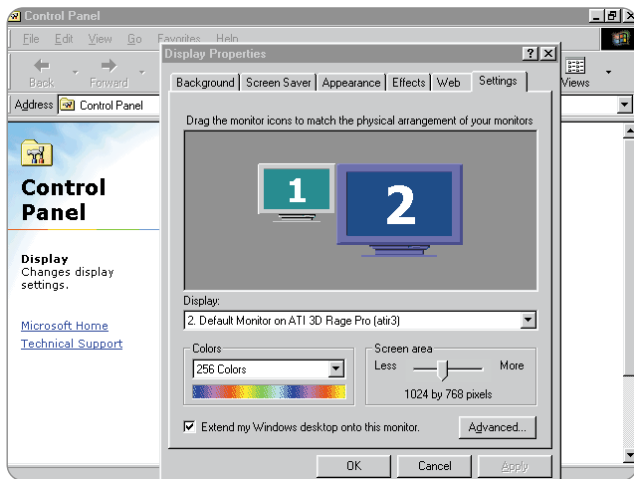


► Figure 3. Copy set up editing tool.



► Figure 4. Grayscale image format.

There is also a grayscale image format (Figure 4) that preserves DPO intensity grading levels yet produces a compact image file for electronic distribution and is suitable for monochrome printing.



► **Figure 5.** Display Properties dialog box.

To navigate between the oscilloscope application and any other Windows application like Word or Paint, simply press Alt-Tab, which is the traditional quick-key for switching between applications. The command changes from the current application display (the waveform screen) and brings the other active application to the front (Figure 5).

There is even a TDS7000 feature that makes it unnecessary to switch between displays. Windows 98 includes drivers to allow simultaneous operation of two displays. The TDS7000 provides a second monitor output specifically for this purpose (Figure 6).<sup>\*1</sup> The second Windows monitor can be used to display, for example, the WordPad application while the oscilloscope's built-in screen displays live waveforms.

<sup>\*1</sup> The second Windows monitor output is separate from the instrument's VGA output, which mirrors the image on the scope screen at all times. The VGA output allows the oscilloscope to display its screen image on a large-format monitor or projection unit.



► **Figure 6.** Photo of scope and PC monitors.

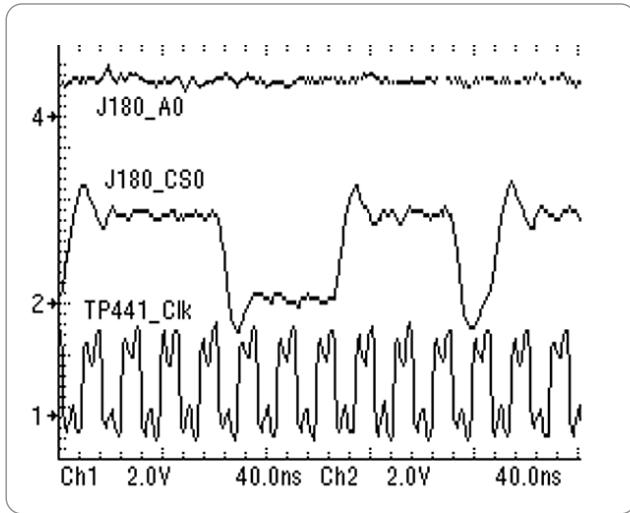
## Trace Labeling Completes the Lab Notebook Package

The other half of the TDS7000's lab notebook capability pertains to labeling the actual waveform traces. When the waveform images are slated for reproduction in black and white or grayscale formats, some kind of on-screen labeling is needed to keep waveforms sorted out.

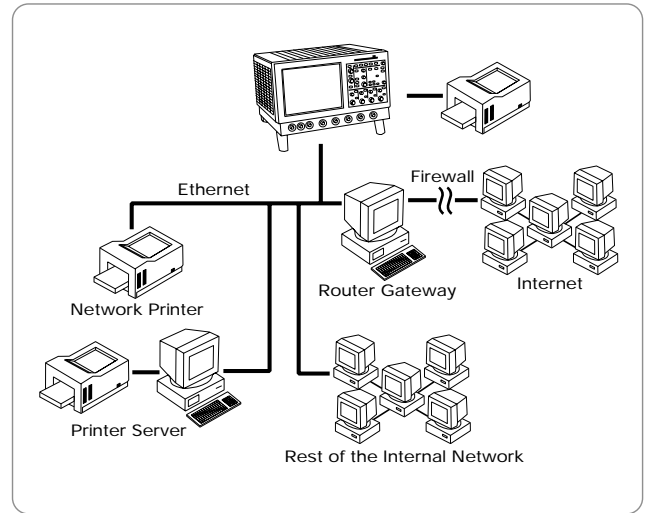
The TDS7000 Series provides trace labeling and text features to add the needed detail. A label can be assigned to each trace on the oscilloscope display, as shown in Figure 7.

Users can create and edit labels using a pop-up keyboard on the touch screen, or with an external keyboard. The Label field is available in the Vertical, Math or Reference waveform setup windows. Once created, labels can be graphically dragged into position or located horizontally and vertically using the multi-purpose knobs. If the image is to be printed, an Inksaver feature can be used to create a "negative" image of the screen with a colorless (white) background instead of black.





► **Figure 7.** Trace Labeling feature.



► **Figure 8.** Network line drawing.

### Distributing and Accessing Information

The TDS7000's standard LAN connection facilitates network file sharing (Figure 8). By setting up a common drive on the engineering network for design project data, every team member can access the archived information expediently. The drive appears on the desktop of every Windows PC on the network, including the TDS7000's integrated PC. Storing or retrieving a waveform image is as simple as dragging the file to the desktop disk icon. This direct connection saves time, maintains a design performance archive and reduces the likelihood of errors.

A network-connected TDS7000, with the addition of an email application such as Eudora or Microsoft Outlook, becomes a medium for instant communication of measurement results. Using the Cut and Paste methodology explained earlier, creating a WordPad document for the waveform, attaching it to an email, and sending it requires, at most, a minute's time.

With the TDS7000's networking ability, information can go both ways. Users can install web browsers from Netscape, Microsoft, and others. Through this portal, engineers can browse component databases and manufacturers' information, at the same time they are using the oscilloscope for measurements.

The TDS7000 does not overlook the need for local storage peripherals. It is equipped with an industry-standard USB connection that accepts mass storage devices such as rewriteable CD-ROMs and detachable hard disks.

WinZip and other Windows compression tools can shrink the size of a waveform image file by up to 98%. This makes it possible to deliver a meaningful number of waveform images on inexpensive, universal media – floppy disks – without ever leaving the oscilloscope system.

The TDS7000 Series oscilloscopes can directly communicate with Windows-compatible printers and printer networks using industry-standard drivers. The TDS7000's Windows platform frees you from having to depend on a limited range of printers supported by the oscilloscope manufacturer. Any printer that will work on a standard PC will work with a TDS7000 oscilloscope.

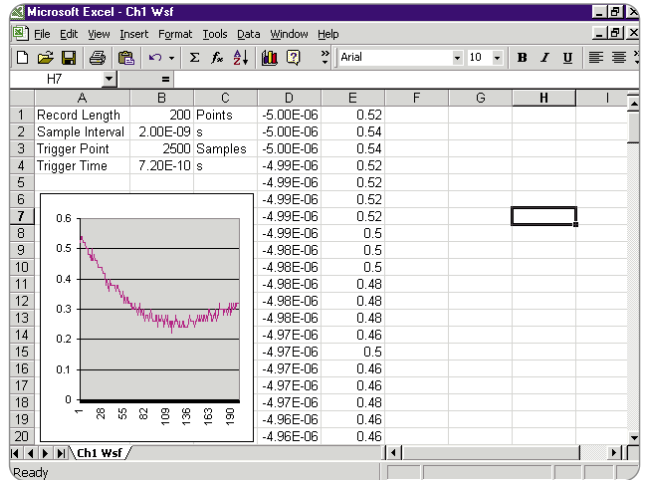
## Performing Extended Analysis

After a waveform is acquired and displayed on the screen, the next step is to interpret it.

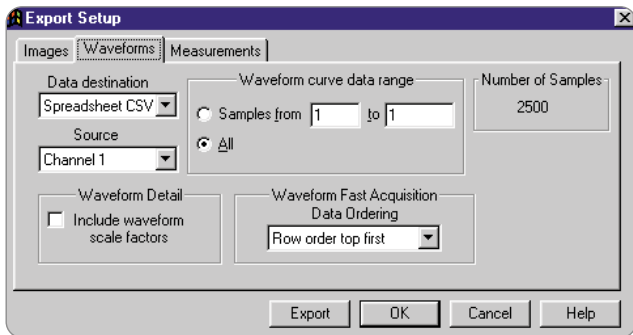
The TDS family contains extensive on-board, signal analysis functions. Equally important, all DPO models (including the TDS7000) feature an intensity-graded display that reveals frequency of occurrence characteristics that highlight irregularities in the signal. The TDS7000's built-in Windows application environment takes the TDS7000 to a new level of signal analysis.

Industry-standard Windows-compatible analysis and database applications can reside within the TDS7000. Some leading examples in this category are Microsoft Excel, MATLAB®, and Mathcad®. The waveform data in the oscilloscope's acquisition memory can be exported using a conventional Comma-Separated-Variable (CSV) format for importing into other applications.

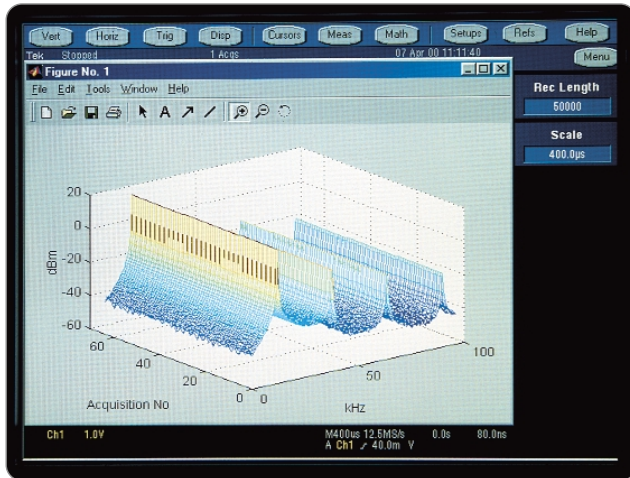
With these applications resident on-board, the TDS7000 becomes a self-contained analysis system (Figure 9 and 10).



► Figure 10. Sample data pasted into spreadsheet.



► Figure 9. Export Setup function.



► *Figure 11. MATLAB image.*

Analysis software can look at a waveform's sample points and derive statistical results, spectral analysis via FFT, and a wealth of other mathematical manipulations (Figure 11). These tools can also be used to accumulate data from many measurements, which can be used to extract trend summaries and overviews of longer-term phenomena. Another proven analysis application is Tektronix WaveStar, a Windows-based tool that simplifies waveform documentation and related chores.

The efficiency of an integrated measurement and analysis tool like the TDS7000 can greatly reduce the time required for common characterization tasks by providing local data reduction and feedback on results. For example, it might allow the engineer to quickly sort through a group of waveforms to determine their compliance with design center values.

## Summary

The TDS7000 raises oscilloscope technology and efficiency to the next level. It's not just a matter of more bandwidth or more record length; it is a re-thinking of the oscilloscope's role in the engineering department. With open access to an integrated Windows PC, the TDS7000 can not only acquire information, but can make the designer much more productive in archiving, analyzing and distributing that data. The TDS7000 is the first oscilloscope that is truly an information center for the design process.

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## For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology.

Please visit "Resources For You" on our Web site at [www.tektronix.com](http://www.tektronix.com)

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