

e*Scope™ Remote Control Puts Network-Connected Oscilloscope on Your PC Desktop



COMPUTING
COMMUNICATIONS
VIDEO

▶ Easy to Use Web-based Remote Control

Imagine an oscilloscope that you can connect to your prototype in the lab, then operate from your desk in another building. Or one that lets your factory experts personally supervise—without ever leaving their benches—measurements by field technicians troubleshooting equipment. The TDS3000B Series of digital phosphor oscilloscopes with e*Scope remote control transforms this vision into a reality.

Full-Featured Remote Control Through Standard Internet Connections

The TDS3000B Series oscilloscopes are uniquely equipped for many remote control applications due to their e*Scope™ Web-based remote control capability. This feature effectively integrates the TDS3000B oscilloscope with any PC through an Internet or intranet connection.

e*Scope provides access to all front panel controls on the oscilloscope, as well as displaying a faithful reproduction of the oscilloscope's screen. No special interfaces or application packages are required.

Getting Started: How to Activate e*Scope Remote Control

The core features that make e*Scope remote control possible are the TDS3000B oscilloscope's built-in Ethernet port, its ability to store an IP (Internet Protocol) address (the oscilloscope's unique identity on the Internet), and special internal browser pages that appear when the TDS3000B starts up.

Two e*Scope operating modes are available: basic and advanced. The basic mode relies on resources housed entirely within the oscilloscope. It serves the Home, Data, Status, and Configure pages directly to the connected PC via the internet, an intranet connection, or a hardwired Ethernet cable. Using the basic mode, you can display waveforms, send commands, and upload or download waveform and setup files by typing in commands on the Data page.

e*Scope™ Remote Control

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Following is a brief procedure to get your e*Scope remote functions up and running:

1. **Get an IP address for the instrument:** From your organization's network administrators, get an address for the specific TDS3000B instrument. An IP address contains 4 sets of up to three numbers, separated by periods (i.e. 128.181.240.94).
2. **Store the IP address in your TDS3000B:** Go to your oscilloscope's front panel and select menu options in this order: Utility, System, I/O, Ethernet Settings, Change Ethernet Settings. The address menu is shown in Figure 2.

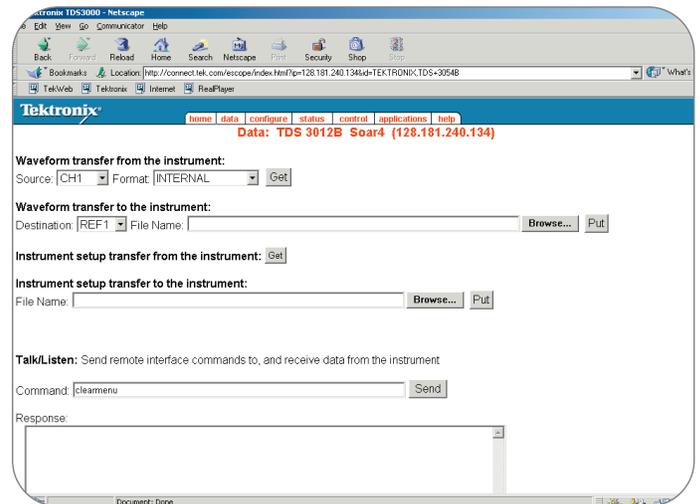


► **Figure 1.** TDS3000B IP address menu.

3. **Select a control method that meets your needs:** If your PC is connected to the Internet and your oscilloscope and PC are on the same side of your company's firewall, proceed with either the basic or advanced control method.

Method 1: Basic Control Option

Enter your oscilloscope's IP address into your Web browser window. This will take you to the e*Scope home page housed in your oscilloscope. Click on the Data tab at the top of the page. From the Data page (Figure 2) you can type in commands and control the oscilloscope.

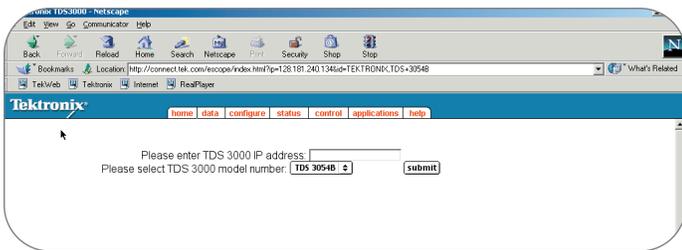


► **Figure 2.** Data page housed on your TDS3000B oscilloscope. Type commands here, or go to the Control tab to download your oscilloscope's graphical user interface.

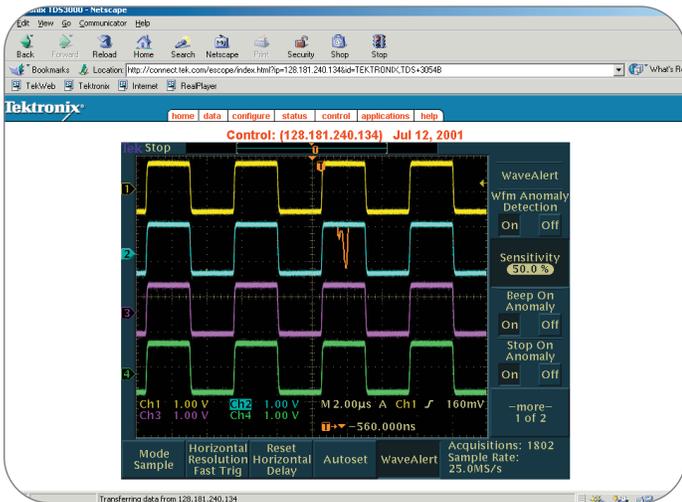
To control your TDS3000B through its graphical user interface, click the Control tab at the top of the browser window. When you click this tab, your connected oscilloscope will retrieve the Control page (Figure 4) from <http://www.tektronix.com>. Once the Control page is cached on your Web browser, your connection with the Tektronix web site ends, and commands and data go directly between your PC and oscilloscope.

Method 2: Advanced Control Option

From your browser, go to <http://connect.tek.com/esclope>. Enter your oscilloscope's IP address as shown in Figure 3. This will take you to the e*Scope home page housed in your oscilloscope. Click the Control tab at the top of the page. Your oscilloscope will then retrieve the Control page, as described in the previous paragraph. The Control page reproduces the oscilloscope's graphical user interface.



▶ **Figure 3.** <http://connect.tek.com/esclope>.



▶ **Figure 4.** Control page from www.tektronix.com/esclope cached on your Internet browser. Using your mouse or computer keyboard, you can control your oscilloscope.

From its own internal perspective, the remote oscilloscope sees e*Scope commands as GPIB instructions. But neither the oscilloscope nor the controlling PC require a separate GPIB interface. e*Scope's standard command set encompasses all front panel controls and display settings. In addition, the e*Scope Data page provides a means to execute any valid GPIB instruction by typing in text strings on the Data page.

The common foundation of e*Scope operation is connectivity and communication through conventional network protocols, including the Internet. e*Scope relies on standard Web browsers and conventional Internet data transactions. Various networking paths between the PC, the oscilloscope and the remotely served Control page are possible, giving you complete independence from the connect.tek.com/esclope home page if preferred. The initial e*Scope connection is just one of several ways to connect and control the TDS3000B with e*Scope.

Operating a remote TDS3000B oscilloscope with e*Scope has a comparable "look and feel" to interacting with any dynamic Web site. It is this characteristic that makes e*Scope so powerful and easy to use.

Networking Considerations and Firewall Issues

All of the networking configurations depicted in this document are simplified to the extent that they do not show a firewall between the oscilloscope and the PC that controls it. In the real world, most institutions have firewalls designed to resist intrusion. These require special arrangements before they will admit e*Scope instructions coming from the outside. In many companies, networks within the company itself may be separated by firewalls.

If your PC and oscilloscope are on opposite sides of your organization's firewall, see your network administrator to find a suitable solution.

Following are several common approaches:

A **Virtual Private Network (VPN)** makes the external PC appear as if it is attached to the internal enterprise LAN. This allows your network administrators to supervise and control the connection between your oscilloscope and the external computer.

A **Reverse Proxy** makes the oscilloscope look like it is outside the firewall. To the external PC, the oscilloscope appears to be on the Internet at a special URL.

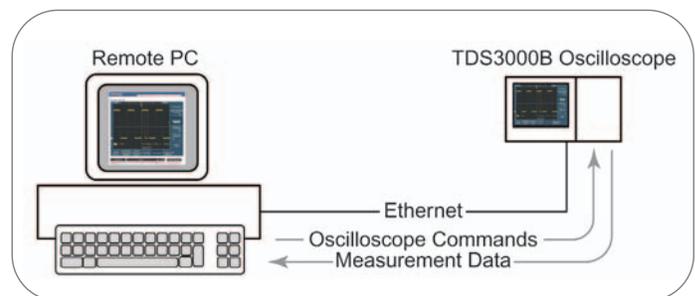
The **Port Forwarding** approach forwards the port for the server outside the firewall. The oscilloscope's IP address becomes the IP address of the gateway. In some cases, you will need to change the oscilloscope's http port number to something other than its default 80 to prevent conflicts with other Web servers with the same default gateway address.

Integrating e*Scope Remote Control Into Your Environment

The preceding "Getting Started" section has outlined some simple ways to get e*Scope remote control running for the first time. This section will go into more detail about the several possible networking layouts for e*Scope. The simplest connection requires only a crossover Ethernet cable, while the more flexible configurations require you to connect to the instrument at its own unique IP address via the Internet.

Using e*Scope Without a Network

The fastest and simplest way to implement e*Scope remote control is to connect the TDS3000B oscilloscope directly to a computer with a standard "null modem" ethernet cable, as shown in Figure 5, or through a hub. Both the PC and the instrument need to be set up on the same subnet in this simple connection. You can assign an address to the TDS3000B through its Utility menu.



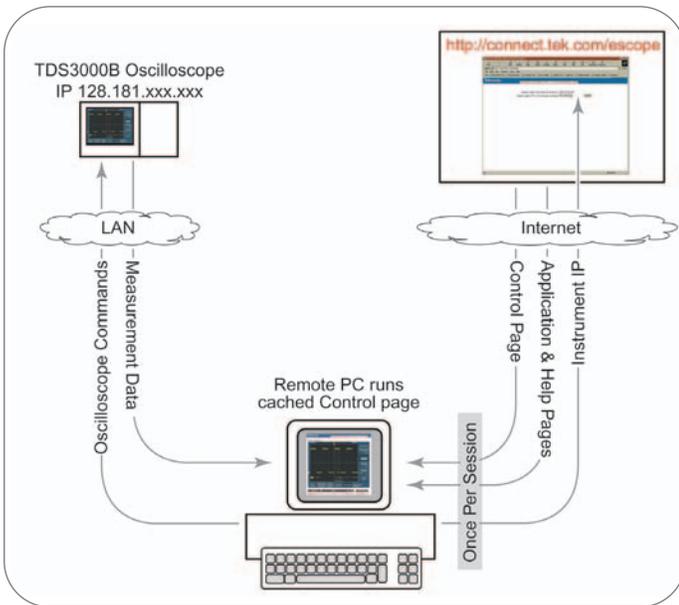
► **Figure 5.** e*Scope can be set up for text-based commands via remote control without a network connection.

The TDS3000B contains its own e*Scope Data page on which you can enter remote programming commands in text form. When you go to <http://<your IP address>>, the e*Scope home page appears on your PC monitor. It contains an image of the oscilloscope's screen, refreshed periodically, and displays waveforms and measurement results.

This home page resides within your TDS3000B. You can control the oscilloscope's modes, ranges, and measurements, view the results, and using the right-click on your mouse, print or store the screens you see on your PC.

Initial Network Connection

Figure 6 shows the "initial" network connection for e*Scope operation. It begins with a connection to the Tektronix e*Scope Web site, which provides a full-featured graphical remote control interface. It is also the starting point for the other e*Scope networking configuration approaches.



▶ **Figure 6.** The e*Scope initial network connection provides a graphical interface for a remote control session. The Control page is cached locally while the Application and Help pages are served on demand from the Tektronix e*Scope site.

When you submit an IP address on the e*Scope login page, the e*Scope server sends to your PC a group of control pages for your TDS3000B. This initial e*Scope connection delivers graphical control over the full range of TDS3000B features:

- ▶ Uncompromised, remote control of the oscilloscope, just as though you were operating it from the front panel.
- ▶ Duplication of the TDS3000B screen on your PC screen, including the same active, "clickable" menus.
- ▶ Every knob and button has an equivalent clickable control on the PC screen.

In this configuration, the Control page resides in your computer's browser cache. After closing a session, you can resume operation immediately if your browser has not cleared its cache, or you can quickly restore the cache by visiting www.connect.tek.com.

The initial network connection is efficient and easy to use. Response times to the commands you send from the cached pages are similar to the same actions executed in the direct connection described earlier.

e*Scope™ Remote Control

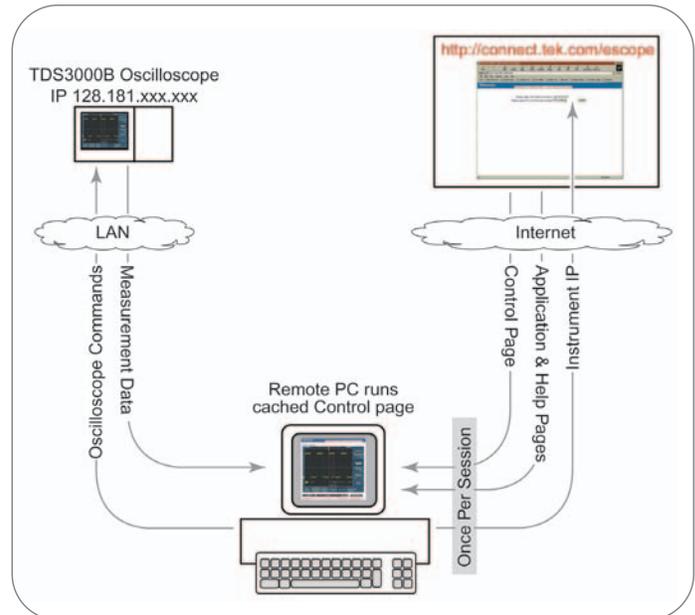
► Application Note

Installing and Running the e*Scope Control Pages on a Remote PC

Some TDS3000B users may find it more efficient to serve their own copy of the e*Scope Login and Control pages from a PC or network server rather than going through the Tektronix site for each session. The e*Scope pages are available, free, to all TDS3000B users through the Tektronix e*Scope Web site (<http://connect.tek.com/escape>).

The flow of information and commands is shown in Figure 7. The Tektronix e*Scope Web site provides the Login page and Control page in executable form. Unlike the cached browser pages, they are permanently stored on your own PC, eliminating the need to contact the Tektronix Web site when you want to control a remote TDS3000B oscilloscope.

Even in this downloaded, locally-stored configuration, the Application and Help pages are always served by the Tektronix Web site. Selecting the tabs for these pages redirects your inquiry to the Tektronix site, which serves them to your PC. The tabs are inactive when the TDS3000B is not connected to the Internet.



► **Figure 7.** The e*Scope Login and Control pages can be downloaded to the user's PC for permanent installation there. After the first use, it is no longer necessary to connect to the Tektronix website for these resources; instead, they are served by the PC.

To use the locally served configuration, visit the e*Scope site, register, and download the e*Scope Login and Control pages. These are provided in a compressed, self-extracting (.ZIP) file that appears as an icon on your PC desktop. Double-click on this file to install it.

Launching e*Scope after it is stored on your local PC is identical to starting up any other Windows application. When e*Scope is launched, it opens your browser and prompts you for the IP address of the remote TDS3000B oscilloscope.

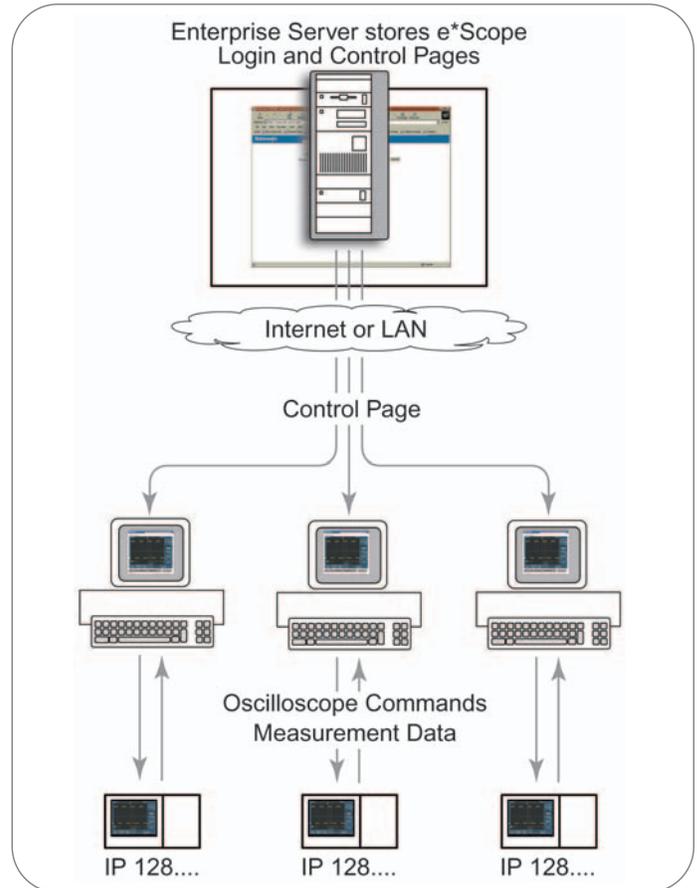
Controlling A TDS3000B Oscilloscope on your Network

To control a remote TDS3000B oscilloscope from any PC on a network, download a copy of the e*Scope Login and Control pages and place them on your own enterprise network server. Your server will then deliver the pages to PCs on your network as needed. Your server houses the Web site that e*Scope users within your enterprise contact to operate their TDS3000B oscilloscopes remotely or acquire cached copies of the Login and Control pages.

The connection and the information flow is depicted in Figure 8.

The procedure for installing the pages is the same as that used to download the application for a single-PC configuration, with the following exceptions:

- ▶ The install file will create a directory for the pages and store them there.
- ▶ Subsequently, you will invoke only this address directly to access the Login and Control pages.



▶ **Figure 8.** e*Scope pages can be housed and served from your own network server.

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▶ Application Note

Overview of e*Scope Web Pages

The e*Scope application is designed to work within your Web browser just as any other Web page would, appearing as a set of graphical pages that include active links, text entry boxes, and other HTML conventions.

At the top of every e*Scope page, there is a navigation bar with six tabs. On the Login page, the tabs are not active. On any subsequent page, clicking on a tab brings you to a new page with one of the following functions:

The **Home** page comes up automatically after you log in with an IP address. It shows the current display from the remote oscilloscope. On the Home page, you can set the refresh time (that is, how often your browser checks the remote oscilloscope and sends an update to your PC screen), but no oscilloscope controls are accessible.

Data is the default page for uploading and downloading waveform files and setups, for entering oscilloscope commands, and for receiving the measurement results in text form. The page does not include a screen display from the remote oscilloscope.

Configure is the page for defining URLs. Essentially it tells the e*Scope application where to look for the Control, Application, and Help pages. Default URLs stored in the oscilloscope refer the application to www.tektronix.com but this can be changed to direct the instrument to another network server.

Status displays the instrument status, including firmware version, application modules installed, and communication modules installed (e.g. RS-232).

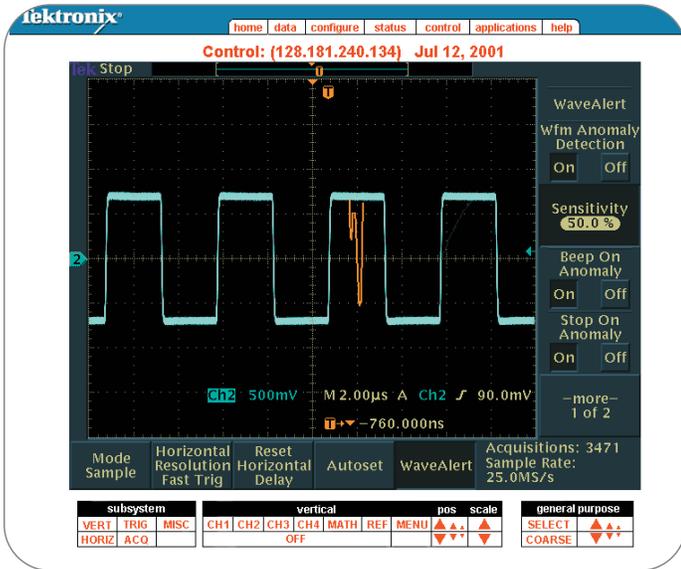
Control is the remote front panel, which includes both menus to control the remote oscilloscope, and the display from the oscilloscope screen.

Applications links you to TDS3000B application notes and other technical literature on the Tektronix Web site.

Help goes to the Tektronix Web site for assistance with e*Scope and Frequently Asked Questions (FAQ) about the TDS3000B and its application modules.

A Closer Look at the e*Scope Control Page

The Control page is the remote "front panel" for the TDS3000B oscilloscope, where you set the measurement parameters such as vertical and horizontal scale and trigger level, and view an image of the oscilloscope screen, including waveforms, the graticule, cursors, readouts, and menus. A typical Control page view appears in Figure 9.



▶ **Figure 9.** The Control page includes five subsystem menus. The Vertical menu shown here results from clicking on the "VERT" tab under the subsystem menu.

The e*Scope Control screen is divided into two areas in addition to the standard navigation header area: the **Display** area, which mirrors the actual screen display of the remote oscilloscope; and the **Front Panel Menu** area, which controls front panel functions not included in the display area.

The browser refreshes the display area automatically. The display itself is the same image you would see on the actual oscilloscope screen. You can activate "soft" buttons that appear within the screen window itself (such as the Horizontal Resolution or the Wfm Anomaly Detection On/Off button in Figure 9) by mouse-clicking on the screen.

The oscilloscope's "hard" controls (electromechanical buttons and knobs on the front panel) are operated by selecting and clicking on their equivalently-named tabs appearing in red text in the lower menu. The Subsystem and General Purpose menus are always visible.

Figure 9 is a full Control page view, including the Vertical menu. This is a result of clicking on the "VERT" tab under the subsystem menu. Each of the five subsystems brings up its own menu. One menu can be displayed at a time. Table 1 outlines the functions available via the front panel menu area of the e*Scope Control page. Together, the display area controls and the front panel menus encompass every TDS3000B control function.

In Figure 9, note the triangular symbols in the Pos, Scale, and General Purpose menus. These are the on-screen surrogates for front-panel rotary knob functions. With each mouse click, the Vertical and Horizontal position controls move the waveform in fractions of a division: ± 1 Division, $\pm .1$ Division, and $\pm .01$ Division for the large, medium, and small triangles respectively. Other functions are scaled as a percent of the range, depending on the control.

e*Scope™ Remote Control

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Table 1: e*Scope On-Screen Remote Controls

| Subsystem | |
|-----------------------------------------------------|--------------------------------------------------|
| Trigger—displays Trigger control panel | Vertical—displays Vertical control panel |
| ▶ Set to 50% | ▶ Channel 1 |
| ▶ Force Trigger | ▶ Channel 2 |
| ▶ B Trigger | ▶ Channel 3 |
| ▶ Menu | ▶ Channel 4 |
| ▶ Level Increase/Decrease; 1 Div, .1 Div, .01 Div | ▶ Math |
| | ▶ Reference |
| | ▶ Menu |
| | ▶ Off |
| | ▶ Position Up/Down; 1 Div, .1 Div, .01 Div |
| | ▶ Scale Increase/Decrease |
| Horizontal—displays Horizontal control panel | Miscellaneous—displays all other controls |
| ▶ Delay | ▶ Measure |
| ▶ Zoom | ▶ Save/Recall |
| ▶ Position Up/Down; 1 Div, .1 Div, .01 Div | ▶ QuickMenu |
| ▶ Scale Increase/Decrease | ▶ Hardcopy |
| | ▶ Cursor |
| | ▶ Display |
| | ▶ Menu Off |
| Acquire—displays Acquire control panel | |
| ▶ Run/Stop | |
| ▶ Autoset | |
| ▶ Single Sequence | |
| ▶ Menu | |
| ▶ Intensity Increase/Decrease | |
| General Purpose | |
| ▶ Select | |
| ▶ Coarse | |
| ▶ Increase/Decrease | |

e*Scope Applications

e*Scope offers complete front panel equivalency and display capability on a standard PC and browser. It opens up a wealth of applications that have until now required elaborate networking arrangements:

- ▶ Operate an oscilloscope without leaving the office

e*Scope lets you operate a centrally-located TDS3000B oscilloscope (in an engineering lab, for example) from a location that's more convenient for your other day-to-day work. By making measurements or observing the progress of a test from your regular office PC, you can accomplish your lab work while staying within easy reach of your telephone, files, and co-workers.

- ▶ Support field technicians working at customer sites

When field service technicians run into problems at a customer site, your company's image depends on prompt resolution of those problems. With e*Scope, your best factory technicians and engineers can "look over the shoulder" of the technician making measurements on the customer's equipment.

- ▶ Support customers' in-house maintenance programs

Frequently, customers prefer to handle maintenance and troubleshooting with their own personnel. However, they still need and expect your support when things go wrong, and your response can impact your business relationship with the customer. Here too, e*Scope can put your best factory experts on the case.

- ▶ Support distributed engineering and manufacturing facilities

Many companies have engineering and manufacturing sites at locations around the world. While this trend brings the product closer to its market or labor resources, it can also make it difficult for engineering to oversee the smooth integration of products into the manufacturing line.

e*Scope gives the designers and evaluation engineers the means to work cooperatively, in real time, with their peers in manufacturing. Together, they can design and verify manufacturing test procedures. In addition, e*Scope gives the design team a way to spot-check the performance of units coming off the production line.

- ▶ Monitor and modify measurement procedures after business hours

Almost every engineer has spent many evenings at the workbench, running tests on a new design, adjusting the measurement instrument, running more tests, and so on. e*Scope lets you conduct these measurements and make the adjustments from a connected PC at home.

- ▶ Archive or publish measurement data

e*Scope delivers your TDS3000B measurements to your network-connected PC. Once the results are in your PC, it is easy to store them on an engineering drive, print them, email them, or embed them in a report.

- ▶ Distance learning for TDS3000B users

e*Scope makes the TDS3000B an ideal tool for teaching measurement procedures to newly-hired technical personnel at distributors, service offices, and customer sites.

- ▶ Remote monitoring

In most communities, television stations' production facilities are located "downtown," while their transmitters are on a hill miles away. These transmitters must be monitored constantly to ensure consistent performance and reliability. The broadcaster's revenue stream depends on it.

Similarly, many functions within wireless mobile phone base stations lend themselves to remote monitoring if problems are suspected. Quality of Service programs depend on peak performance from this distant equipment.

A TDS3000B series oscilloscope at the transmitter site can be quickly and easily checked from a networked engineering PC in the production facility or central office. Should problems be suspected, the TDS3000B can be set up for different measurements or ranges to pinpoint the problem.

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▶ Application Note

Contact Tektronix

ASEAN Countries (65) 356-3900

Australia & New Zealand 61 (2) 9888-0100

Austria, Central Eastern Europe, Greece,
Turkey, Malta & Cyprus +43 2236 8092 0

Belgium +32 (2) 715 89 70

Brazil and South America 55 (11) 3741-8360

Canada 1 (800) 661-5625

Denmark +45 (44) 850 700

Finland +358 (9) 4783 400

France & North Africa +33 1 69 86 81 81

Germany +49 (221) 94 77 400

Hong Kong (852) 2585-6688

India (91) 80-2275577

Italy +39 (02) 25086 501

Japan (Sony/Tektronix Corporation) 81 (3) 3448-3111

Mexico, Central America & Caribbean 52 (5) 666-6333

The Netherlands +31 23 56 95555

Norway +47 22 07 07 00

People's Republic of China 86 (10) 6235 1230

Poland (48) 22 521 5340

Republic of Korea 82 (2) 528-5299

South Africa (27 11) 254-8360

Spain & Portugal +34 91 372 6000

Sweden +46 8 477 65 00

Switzerland +41 (41) 729 36 40

Taiwan 886 (2) 2722-9622

United Kingdom & Eire +44 (0)1344 392000

USA 1 (800) 426-2200

For other areas, contact: Tektronix, Inc. at 1 (503) 627-1924

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



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