Operator's Manual

LeCroy Waverunner Ethernet Option

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Introduction

The 10BaseT Ethernet option allows you to control the LeCroy Waverunner over a network, or through a direct connection between the oscilloscope and a computer. The connection is made through the Ethernet port located at the rear of the oscilloscope.

This chapter introduces the basic capabilities for control of the Waverunner oscilloscope over the Ethernet interface.

The Waverunner Remote Control Manual gives a complete description of the GPIB commands. These commands apply to control of the oscilloscope via Ethernet, as well as through the GPIB interface.

Implementation Standard

To the greatest extent possible, these remote commands conform to the IEEE 488.2* standard, which may be considered as an extension of the IEEE 488.1 standard, dealing mainly with electrical and mechanical issues.

Connections

The oscilloscope can be connected to the PC via Ethernet using a TCP/IP network protocol. This connection can be made through a network, or directly between the oscilloscope's Ethernet interface and a computer using a crossover network cable.

* ANSI/IEEE Std. 488.2–1987, *IEEE Standard Codes, Formats, Protocols, and Common Commands*. The Institute of Electrical and Electronics Engineers Inc., 345 East 47th Street, New York, NY 10017, USA.

ScopeExplorer

ScopeExplorer is a free PC-based connectivity tool that interfaces a LeCroy Digital Oscilloscope to the Windows 95/98 or Windows NT/2000 desktop. It is available on CD-ROM as well as from the internet at www.lecroy.com.

Scope Explorer provides the following connectivity features:

Remote control terminal

This provides a teletype-like terminal that allows standard remote control commands to be sent to the scope, and the scope's response to be displayed. Features are provided to allow sequences of commands to be piped to the scope from a file, and the scope's responses to be piped into another file.

Image capture and storage

This feature allows a pixel-for-pixel copy of the scope's display to be transferred to the PC, and displayed and/or printed. A single key press (or button push) will transfer this image to the Windows Clipboard ready for pasting into any Windows application. It also supports automatic refresh of the captured image at periodic intervals.

Panel file (scope setup) capture, storage, and playback

The entire front panel setup of the scope can be captured with this feature and stored on the PC with a long descriptive filename. The captured panel can then be transferred back to the scope at a later date to reproduce the setup.

Trace capture, storage, playback, and conversion to ASCII

Waveforms acquired by the Waverunner can be transferred to the PC and stored in either the compact LeCroy Binary format, or an ASCII version that allows compatibility with PC-based analysis products, such as Microsoft's Excel or Mathsoft's MathCad. Pre-captured LeCroy Binary waveforms can be converted into ASCII files individually or in batches.

Virtual Front Panel

The Waverunner can be controlled remotely using the virtual front panel feature. A virtual panel with front panel knobs and buttons is presented on the Windows display, and may be used to control the scope. (**Note:** The virtual front panel may not reflect exactly the front panel of the Waverunner, but is still useful for control.)

ActiveDSO

This **ActiveX™** control enables LeCroy oscilloscopes to be **controlled by**, and to **exchange data with**, a variety of Windows applications that support the ActiveX standard. MS Office programs, Internet Explorer, Visual Basic, Visual C++, Visual Java, and Matlab (v5.3) are a few of the many applications that support ActiveX controls. ActiveDSO is available on CD-ROM or on the internet at www.lecroy.com

With **ActiveDSO** you can develop your test program using standard GPIB commands. For easy integration of your scope data with your Windows Application (through GPIB, RS-232, or Ethernet 10BaseT) ActiveDSO, helps you:

- Generate a report by importing scope data right into Excel or Word.
- Archive measurement results on the fly in a Microsoft Access Database.
- Automate tests using Visual Basic, Java, C++, Excel (VBA).

The ActiveDSO control hides the intricacies of programming and provides a simple and consistent interface to the controlling application. With less than 10 lines of VBA (Visual Basic for Applications) code in an Excel macro the spreadsheet can recover pre-scaled waveform data from a remote instrument.

The ActiveDSO control can also be embedded visually in any OLE automation compatible client, and can be used manually without any need for programming. It will run on any PC running Windows 95, Windows 98, or Windows NT.

There are two fundamental ways to use the control:

- As a visible object embedded in an OLE Automation compatible Client (PowerPoint for example) showing a captured display image. See Embedded Control Example for more details.
- As an invisible object accessed via a scripting language (Visual Basic for Applications, for example) to remotely control an instrument. See Accessing from VBA for more details.

VBA (Visual Basic for Applications) is the programming language built into many of the more recent Windows applications. It is a

subset of Visual Basic that makes it very simple to utilize the services of OLE Automation Servers and ActiveX Controls.

The following VBA subroutine demonstrates how easy it is to connect to a Waverunner Oscilloscope and send remote commands to it.

```
Sub LeCroyDSOTest()
   Dim o As Object
      Set o = CreateObject("LeCroy.ActiveDSOCtrl.1")
   Call o.AboutBox              ' Present the control's About box
   Call o.MakeConnection("IP: 172.28.11.26)  'Connect to device on LAN
   Call o.WriteString("BUZZ BEEP", True)  ' Make the DSO beep
End Sub
```

Example Syntax:

Boolean controlName.WriteString

The WriteString method has the following arguments.

Argument	**Description**
controlname	The name of the ActiveDSO control object.
textString	String, Text string to send to the device.
EOI	Boolean, TRUE = terminate with EOI

Returns: True on success, False on failure.

Remarks: This method sends a string command to the instrument.

If EOI is set to TRUE then the device will start to interpret the command immediately. This is normally the desired behavior.

If EOI is set to FALSE then a command may be sent in several parts with the device starting to interpret the command only when it receives the final part which should have EOI set TRUE.

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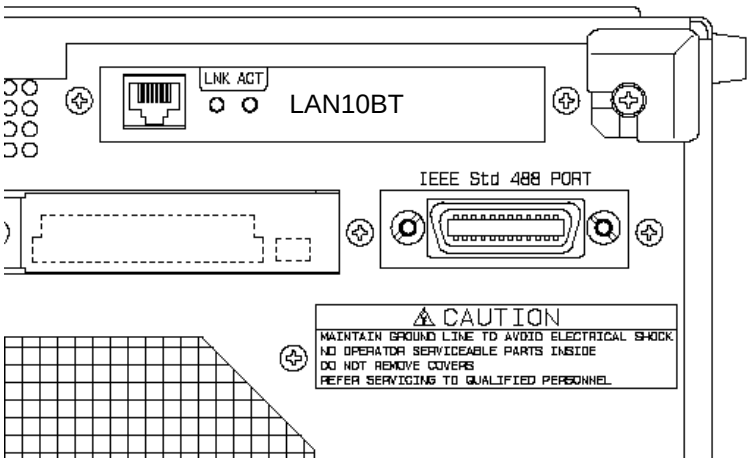
Connecting the Waverunner to its Host

This chapter describes connecting the Waverunner oscilloscope to the host PC or network over the standard 10BaseT Ethernet. Windows NT and Windows 95 operating systems are supported.

Scope Rear Panel

The LAN connector is shown in the following illustration.



- Supports IEEE 802.3 Ethernet standards
- Supports 10BASE-T
- Status LEDs:
  - **LNK** shows the status of the link integrity
  - **ACT** shows receive or transmit activity
- Adapted to Waverunner's small peripherals connector

PC Requirements

For acceptable operational performance with the Waverunner oscilloscope, the following are the minimum PC requirements:

- Pentium class PC
- 32 MB RAM
- 10 MB free disk space
- Windows 95 or Windows NT
- Ethernet Adapter supporting 10BaseT, with a standard RJ45 connection

Ethernet Connection

The Waverunner oscilloscope operates over a standard 10BaseT Ethernet connection. The instrument can be plugged into a network or operated from a direct connection to a host computer. A different type of cable is required for each of these connections. For a direct connection to the PC, a *crossover* cable is required, whereas the network connection is made using a *straight* cable.

The Waverunner oscilloscope has an IP address assigned to it at the factory: it *does not* support Dynamic Host Configuration Protocol (DHCP) or any other automatic address resolution scheme. You may change this IP address to accommodate your network setting.

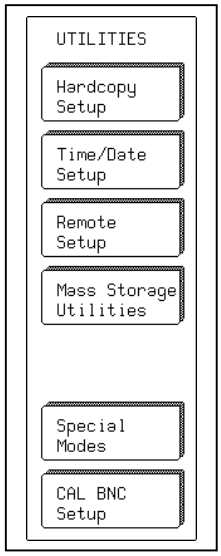
The factory-assigned IP address is: **172.25.1.2**
The factory-assigned Mask is: **255.255.0.0**
The factory-assigned Gateway is: **172.25.0.1**

Configuring Waverunner to Communicate with a PC Connected to the Network

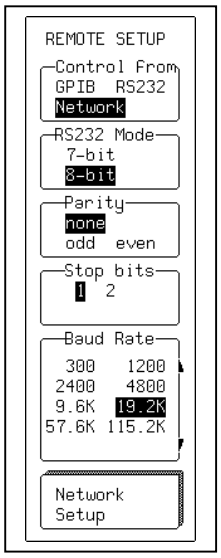
If your computer is already configured, obtain the following settings for the Waverunner from your network administrator:

IP address
Subnet Mask
Default Gateway

1. Press the UTILITIES button on the oscilloscope's front panel. The "Utilities" menu is displayed.



2. Select **Remote Setup** by pressing its front panel menu button. The "REMOTE SETUP" menu is displayed.



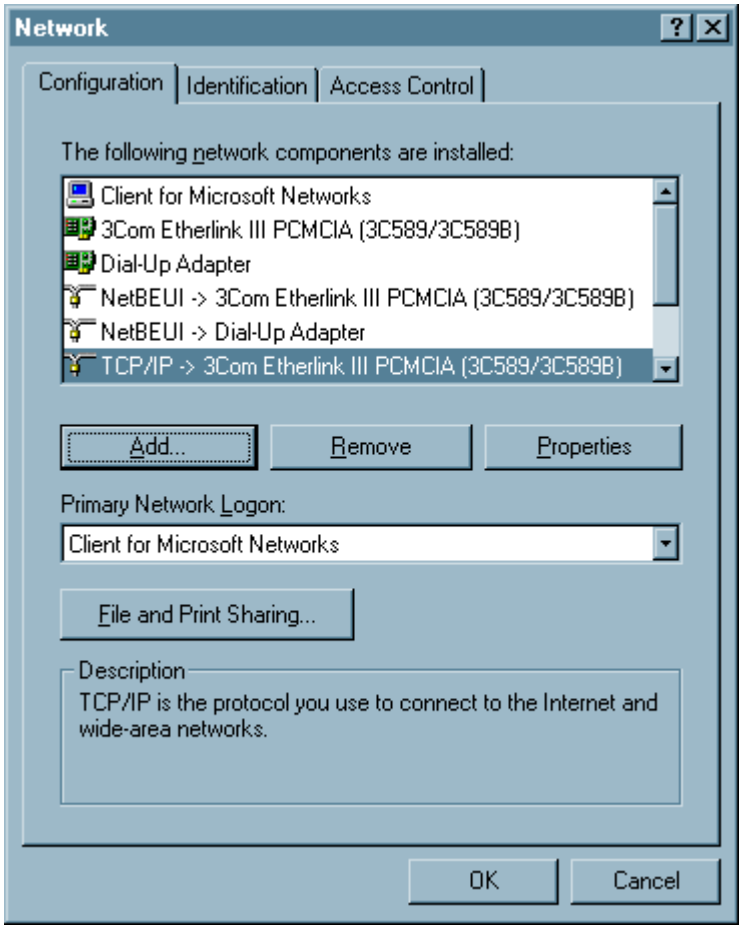
3. Select **Network Setup** with its front panel menu button; "TCP/IP Network Setup" is displayed. Verify or modify the Ethernet settings via the oscilloscope's front panel controls.

Configuring a PC That Is Not Connected to the Network

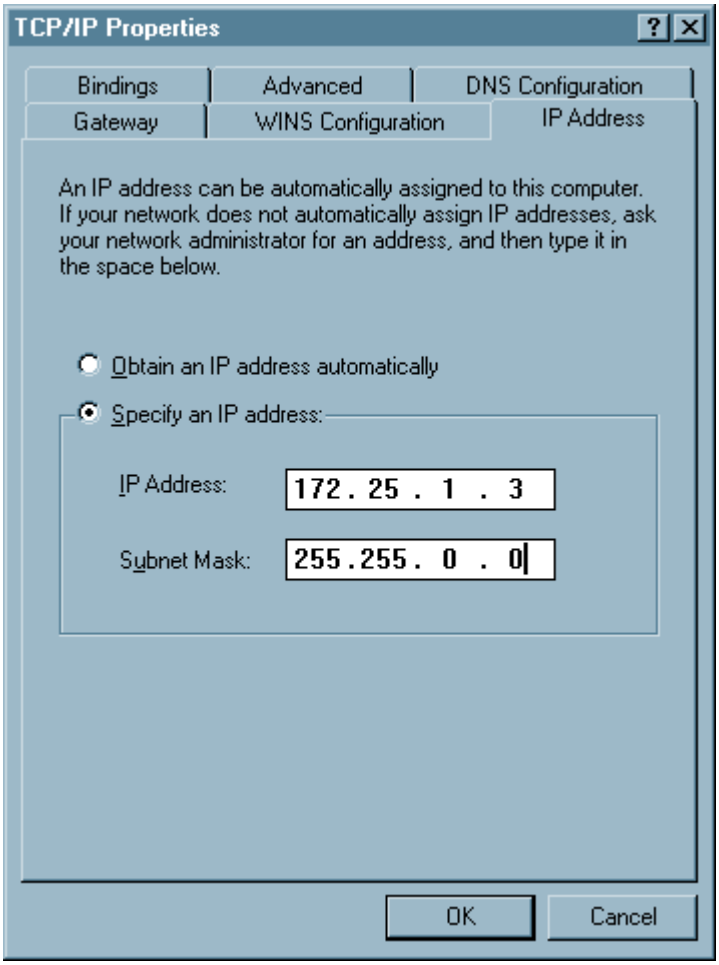
Note: ***The following examples assume that the host PC operates from Windows™ 95. The connection procedure for Windows NT is similar.***

Before establishing a direct connection between the oscilloscope and the host computer, the PC must first be properly configured. A specific TCP/IP address must be assigned — known as "static addressing." But this means that the PC *cannot* be set up to obtain its IP address from a DHCP server. To set the host PC's static address with Windows 95:

1. Select Start → Settings → Control Panel.
2. Double-click the Network icon in the Control Panel. A network dialog box similar to this one appears:



3. If the TCP/IP protocol is not listed, you will have to add it. Follow your operating system user guide to add the TCP/IP protocol and bind it to the Ethernet adapter.



4. Double-click the TCP/IP -> line. A dialog box similar to the one below appears. Select Specify an IP address:

5. If this has already been selected, the computer's static address is set and nothing more needs to be done. Cancel out of the TCP/IP and network dialog boxes, and close the control panel.
6. If the address has not already been selected, fill in the IP address and subnet mask as shown above. The subnet mask for 172.25.x.x is 255.255.0.0. If the computer will not be plugged into a network, the above address (or almost any address within the chosen subnet) will do. The only address that will not work is the same one as that of the oscilloscope to be controlled.
7. Now click OK in the TCP/IP Properties dialog box. Depending on the operating system and version, you may need to reboot the computer. If so, a dialog box should alert you to this.

Making Physical Connection

To make the physical connection between the oscilloscope and the host computer:

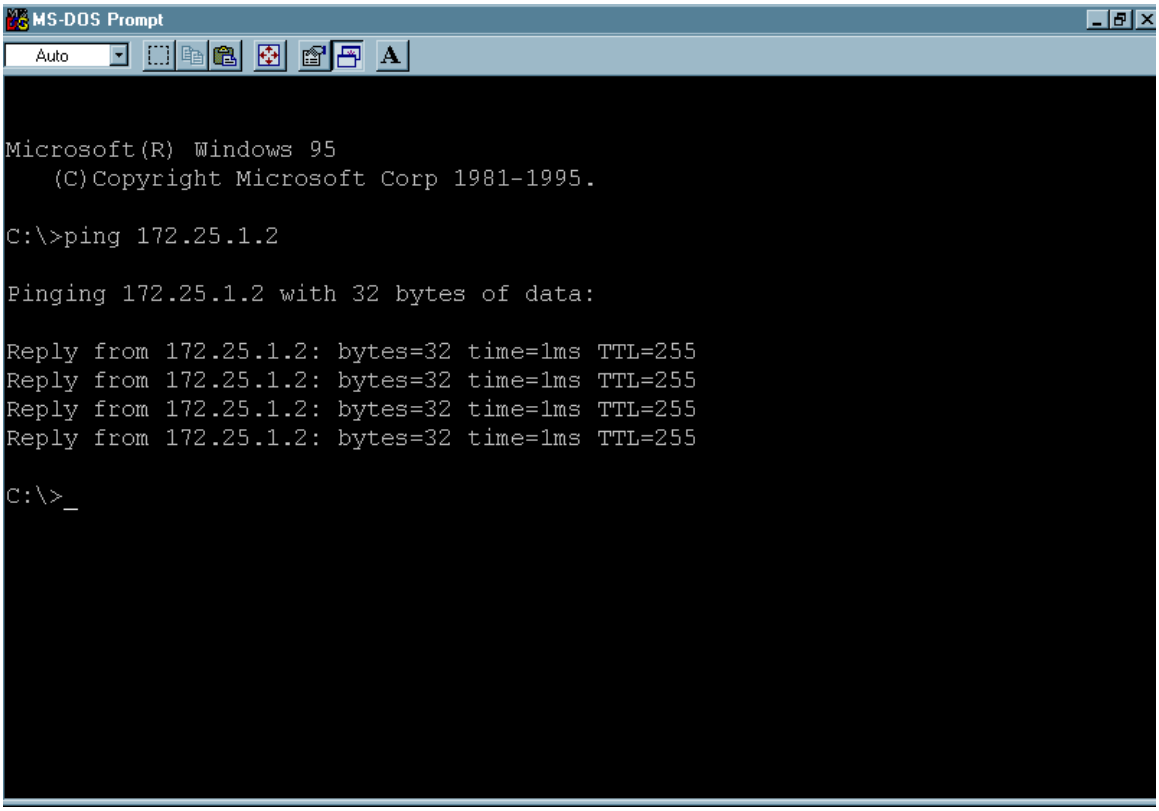
1. Connect the oscilloscope to the PC using a crossover cable (for direct connection).
2. Power the oscilloscope unit on.

Verifying Connection

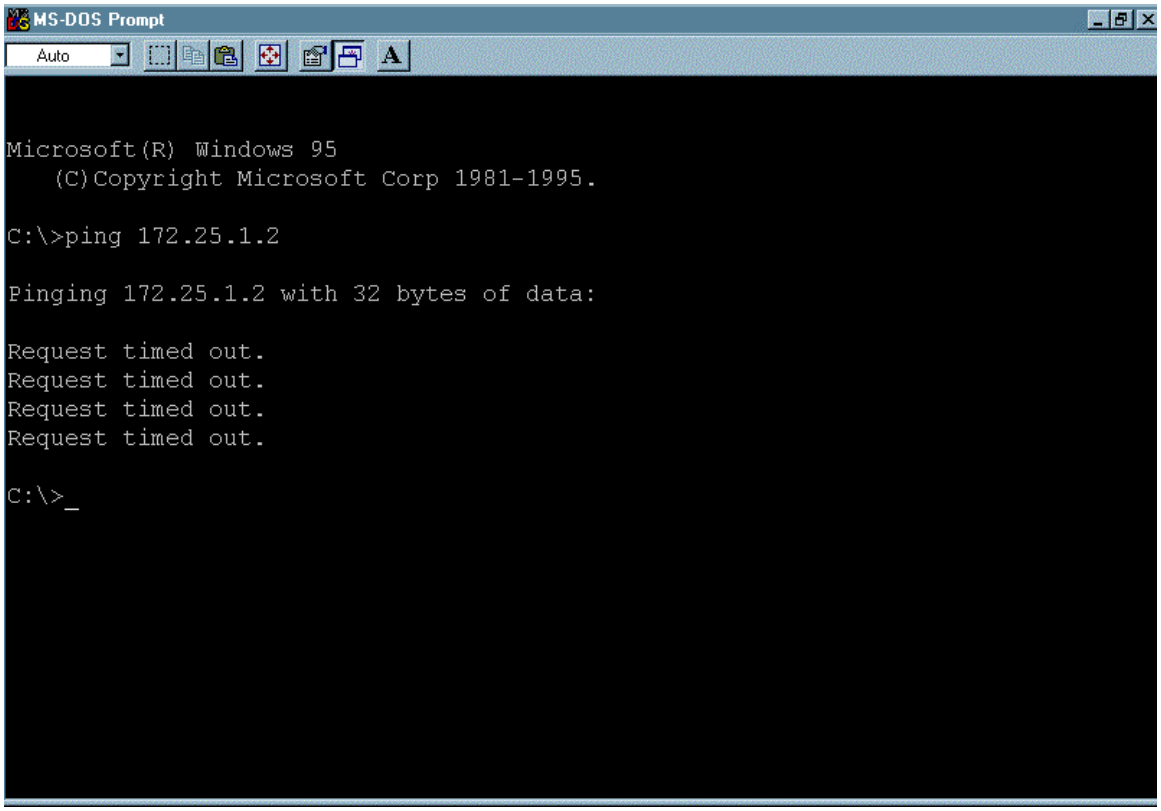
Note: ***If your PC does not have TCIP/IP, see the dedicated Windows™ 95 or NT User's Manuals for installation instructions.***

The physical connection and the PC's TCP/IP configuration can be verified using the "ping" command, available on both Windows™ 95 and Windows™ NT with TCP/IP network protocol installed. In order to check the network connection between the PC and the oscilloscope:

3. Start MS-DOS Prompt
4. Type ping <ip_address>, where <ip_address> is the static address assigned to the oscilloscope. The dialog box on the next page illustrates the result of a successful "ping", with the Ethernet connection shown established. The IP address of the oscilloscope in this case is 172.25.1.2, the factory default address.



The ping command has sent a message to the instrument and waited for a response. If a timeout occurs, as is shown in the box on the next page, the IP address used for the destination (the oscilloscope) is *incorrect* or not within the subnet mask of the PC's IP address.



Network Connection

Check with your network administrator before connecting the oscilloscope to a network. Incorrect addresses on a network can cause both the network and the oscilloscope to behave strangely. However, a network connection ought to be as simple as plugging the oscilloscope into the network. *Proper connection can be verified by following the verification instructions in the previous section.*

If you are concerned mainly with system throughput, network connection is *not* recommended because the network traffic will slow down the oscilloscope's data transfer rate.

Note: The default Gateway is assigned as "172.25.0.1". Unless your network has this Gateway available, you must ensure the computer and the oscilloscope are on the same subnet.

Changing IP Address

Once the IP address is changed, the unit will no longer respond to the original address.

If the network settings are unknown or accidentally set to invalid values, they can be recovered by following the procedure above.

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Introduction to Software Tools

The Waverunner software tools allow you to develop your own application specific programs quickly and easily. These tools are *ActiveDSO™* and *ScopeExplorer™*. The files for all software described here are to be found on the CD-ROM.

ActiveDSO

Based on Microsoft's ActiveX control technology, *ActiveDSO* gives leverage to widely available Microsoft software tools, and makes programming within the Microsoft environment easier. *ActiveDSO* simplifies the computer's interface with the Waverunner and programming within Visual C++, Visual Basic, or any other ActiveX compatible applications. For example, Microsoft Excel can even be used to control and retrieve data directly from the Waverunner. This tool becomes part of the target application and provides seamless access to the full power of the Waverunner.

ScopeExplorer

This PC-based connectivity tool integrates LeCroy instruments with Windows 95 or Windows NT PCs. Connected to the PC through the Ethernet port and using *ScopeExplorer,* the Waverunner stores data and images in the computer. Because it is designed specifically for use with LeCroy instruments, *ScopeExplorer* allows these tasks to be completed with only a few keystrokes or mouse clicks.

Using *ActiveDSO*

***ActiveDSO* is highly suitable for fast program development in the Microsoft environment. This program is a control of ActiveX, the software technology developed by Microsoft as a subset of its COM model.**

ActiveDSO facilitates programming with the Waverunner by providing a ready interface between the instrument and the host computer. Programs such as Visual C++, Visual Basic, or Visual Basic for Applications (VBA) can be used under remote control without concern for interfacing complications. *ActiveDSO* acts as the key design structure allowing effective integration of software from the different manufacturers supporting ActiveX containment.

Control Instantiation

This ActiveX component can be instantiated more than once by using the Visual Basic function **CreateObject**. Once the object is created, invoking the connection method will initialize it. ActiveDSO enables control of the Waverunner from a variety of PC desktop applications. The complexities of programming with Ethernet are fully encapsulated in this control. For example, with less than 10 lines of VBA code in an Excel macro the spreadsheet can recover pre-scaled waveform data from the Waverunner (see the on-line Excel example in ActiveDSO).

ActiveDSO control can be used in two fundamental ways:

1. As a visible object embedded in an OLE automation compatible client (PowerPoint, for example) showing a captured Waverunner display image. See the Embedded Control example below for more details.
2. As an invisible object accessed through a scripting language (VBA, for example) to remotely control the Waverunner. See VBA example below for more details.

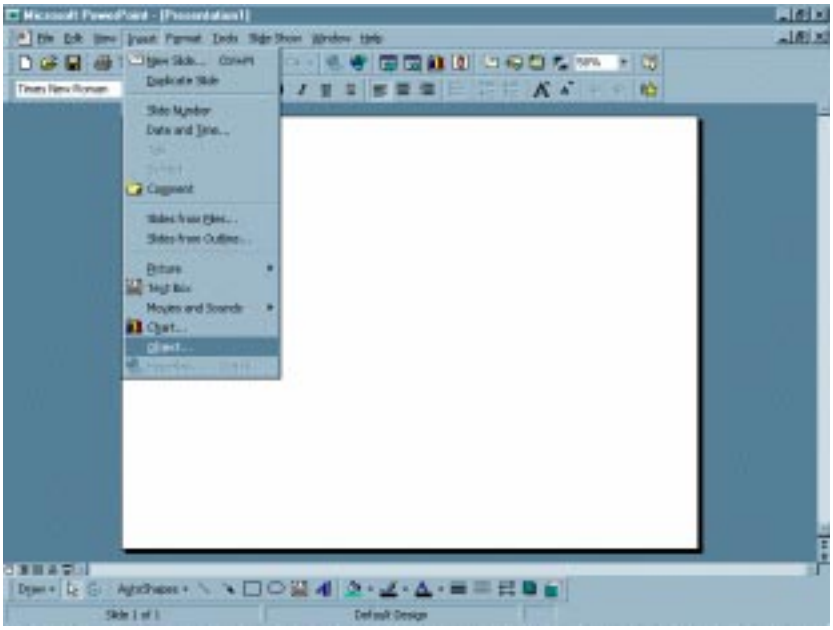
The *ActiveDSO* control may be embedded in any ActiveX containment-capable client, and may be used manually without need of any programming or scripting.

Example: PowerPoint

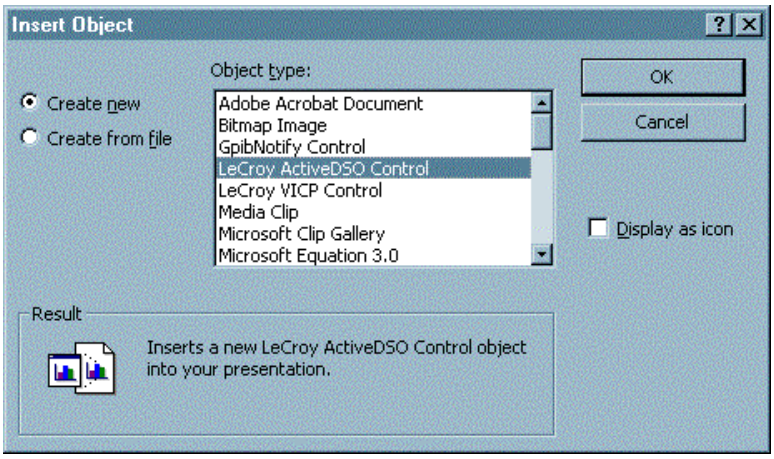
***Note:** This example assumes that PowerPoint 97 is being used. Earlier versions may not behave in the same manner.*

This example shows the control being embedded in a Microsoft PowerPoint slide. The waveform captured by the Waverunner can be easily imported into PowerPoint with just a few mouse clicks:

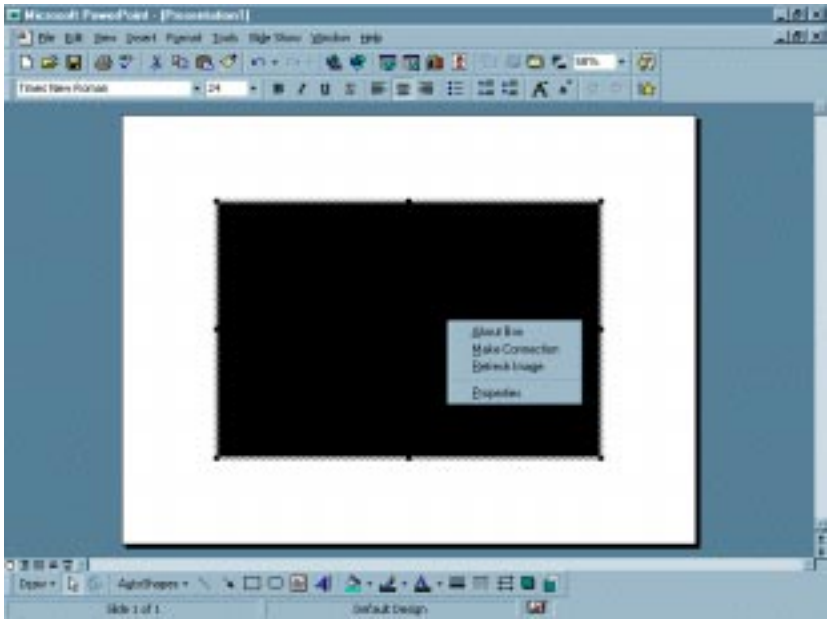
1. Ensure that the *ActiveDSO* files from the CD-ROM are installed on the PC.
2. Verify that the PC and Waverunner are properly connected to the Ethernet.
3. Open a new blank presentation in PowerPoint.
4. Select “Insert,” then **Object**, as shown here:



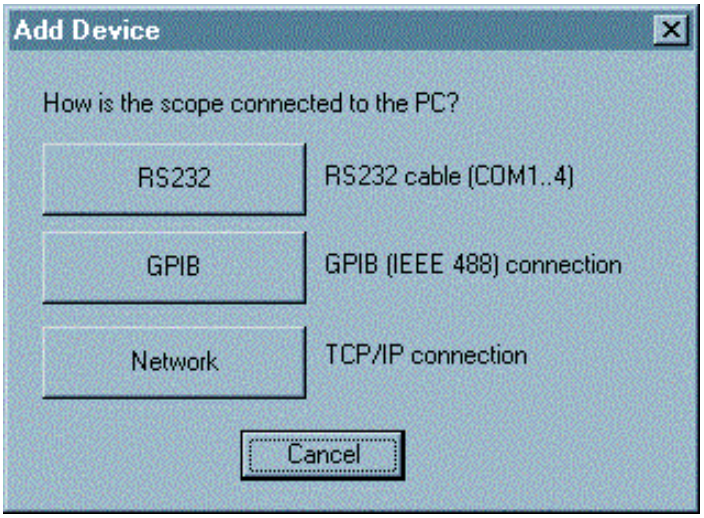
5. From the pop-up window, select LeCroy ActiveDSO object as shown here:



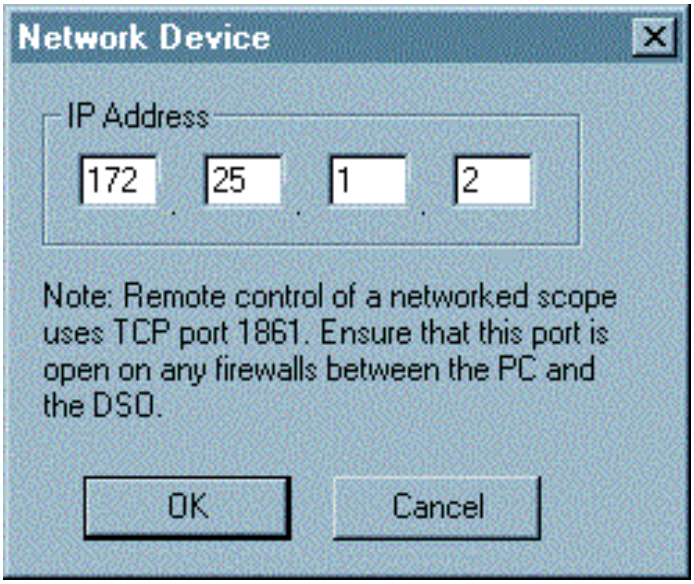
6. Right-click the object and select “Make Connection.”



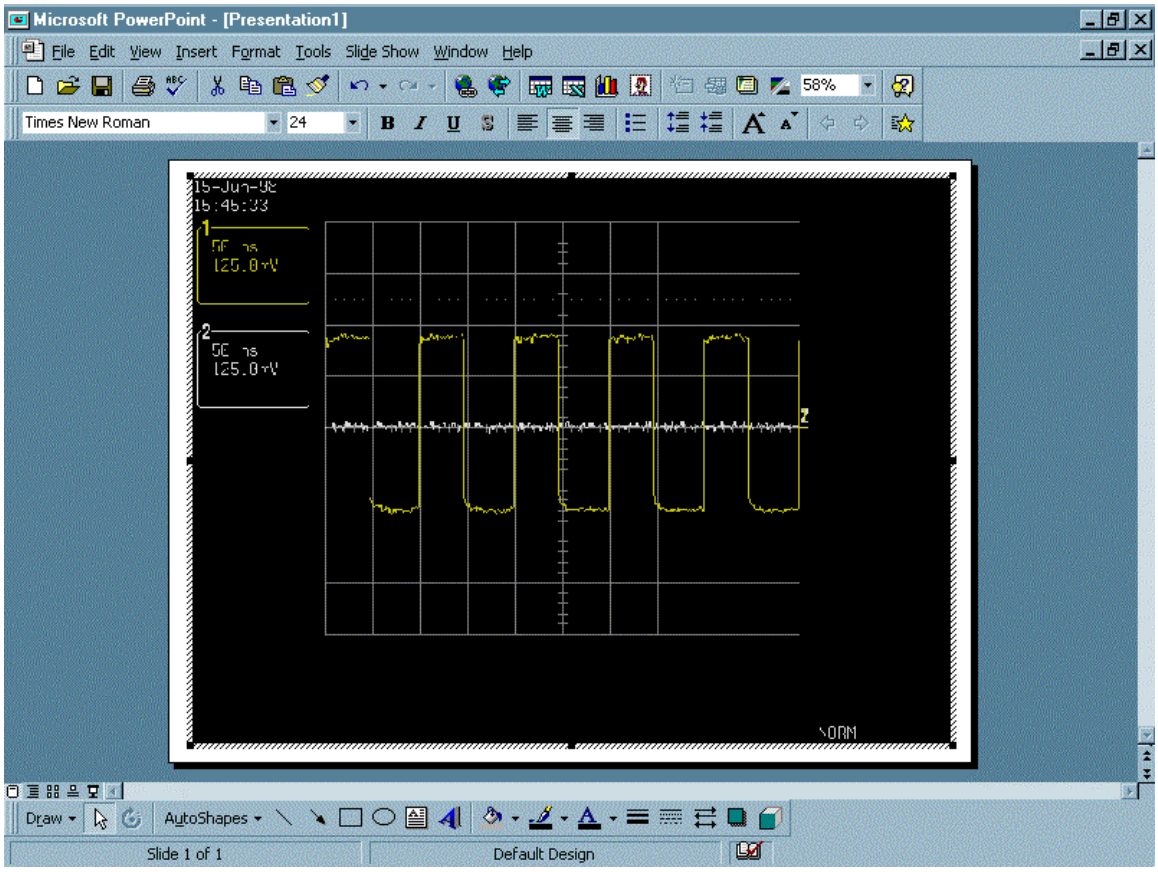
7. Select “Network TCP/IP connection” as shown here (“scope” = Waverunner):



8. Enter the Waverunner’s IP address and click “OK.”



9. Right-click the object again and select the **Refresh Image** menu item. A captured waveform will be displayed similar to the one shown here:



Waverunner's captured waveform imported into PowerPoint.

Once the *ActiveDSO*™ object has been properly set within the application, a macro script can be created utilizing an object method such as WriteString() to send `DISP ON, C1:TRA ON, TRMD AUTO` (see the *Remote Control Manual*). Then RefreshImage() method can be used to update the screen.

Example: VBA

VBA is the programming language built in to many of the more recent Windows applications. It is a subset of Visual Basic that makes using OLE Automation Servers and ActiveX Controls very simple. The following VBA subroutine demonstrates how easy it is to connect to an Waverunner and send remote commands to it.

```
Sub LeCroyDSOTest()
       Dim dso As Object

       Set dso = CreateObject("LeCroy.ActiveDSO.1")

       Call dso.AboutBox          Present          the
control's About box
       Call dso.MakeConnection("IP:172.25.1.2")
       Connect to the unit
       Call dso.WriteString("DISP ON", 1)
       Enable the internal display routine
       Call dso.WriteString("TRMD AUTO", 1)    Set
the trigger mode to AUTO
End Sub
```

To enter the VBA editor in members of the Microsoft Office suite:

1. Select Tools → Macro → Visual Basic Editor menu item.
2. When the VBA window appears, select the **Insert → Module** menu item.
3. Copy the above example into the editor window that appears.

To execute:

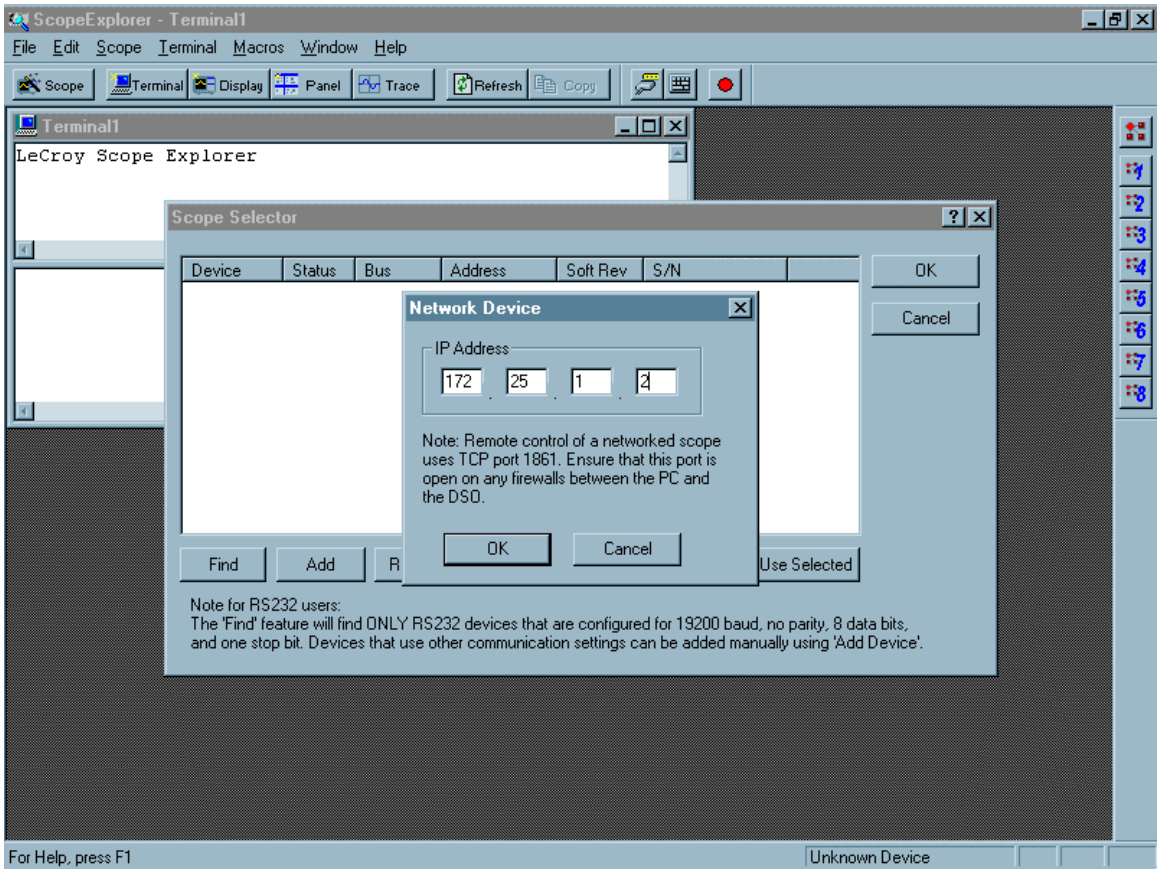
4. Position the text cursor within the subroutine.
5. Either select the Run → Run Sub/UserForm or press function key F5.

Note: ***For more information, see the ActiveDSO on-line Help. On-line Help contains VisualC++ example, explanations of ActiveDSO Methods and Properties.***

Using *ScopeExplorer*

1. Start *ScopeExplorer*.
2. Click on **Scope** → **Scope Finder**.
3. In the “Scope Selector” window, click “OK,” as shown below.
4. When the ADD DEVICE window opens, select "Network."

   (If you don’t see a “Network” button, press “ALT + N” simultaneously.)
5. A “Network Device” window will appear, as shown here:



6. Enter the IP address of the Waverunner in the “NETWORK DEVICE” window.

ScopeExplorer features:

- ***Terminal – Remote control commands can be sent and data can be retrieved using Terminal.***
- ***Image capture – Internal scope-like “screen” representation of the acquired waveform can be viewed with the Display button. Use the Refresh button to refresh the “screen” dump image.***
- ***IP address change – ScopeExplorer can be used to change the IP address of the Waverunner. See Chapter 2 for details.***

ScopeExplorer is supported for all LeCroy instruments. Additional information can found on the LeCroy web site: www.lecroy.com

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