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WaveRunner® Xi Series

Getting Started Manual

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WaveRunner® Xi Series Oscilloscopes



Getting Started Manual

February 2007

LeCroy

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INTRODUCTION

This brief guide includes important safety and installation information for your WaveRunner Xi Series oscilloscope, along with brief operating procedures to get you started capturing, viewing, and analyzing your waveforms.

You can change the user interface language at any time from the Utilities dialog.

The information contained in this guide also appears in greater detail in the on-line Help manual. This searchable manual is resident in the scope and also supplied on CD-ROM, shipped with your scope.

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SAFETY REQUIREMENTS

This section contains information and warnings that must be observed to keep the instrument operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the safety precautions specified in this section.

Safety Symbols and Terms

Where the following symbols or terms appear on the instrument's front or rear panels, or in this manual, they alert you to important safety considerations.



This symbol is used where caution is required. Refer to the accompanying information or documents in order to protect against personal injury or damage to the instrument.



This symbol warns of a potential risk of shock hazard.



This symbol is used to denote the measurement ground connection.



This symbol is used to denote a safety ground connection.



This symbol shows that the switch is a On/Standby switch. When it is pressed, the scope's state toggles between Operating and Standby state. This switch is not a disconnect device. To completely remove power to the scope, the power cord must be unplugged from the AC outlet after the scope is placed in Standby state.



This symbol is used to denote "Alternating Current."

CAUTION

The CAUTION sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause damage to equipment. If a CAUTION is indicated, do not proceed until its conditions are fully understood and met.

WARNING

The WARNING sign indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause bodily injury or death. If a WARNING is indicated, do not proceed until its conditions are fully understood and met.

CAT I

Installation (Overvoltage) Category rating per EN 61010-1 safety standard and is applicable for the oscilloscope front panel measuring terminals. CAT I rated terminals must only be connected to source circuits in which measures are taken to limit transient voltages to an appropriately low level.

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Operating Environment

The instrument is intended for indoor use and should be operated in a clean, dry environment. Before using this product, ensure that its operating environment will be maintained within these parameters:

Temperature: 5 to 40 °C

Humidity: Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C.

Altitude: Up to 2,000 m

Note: Direct sunlight, radiators, and other heat sources should be taken into account when assessing the ambient temperature.

The design of the instrument has been verified to conform to EN 61010-1 safety standard per the following limits:

Installation (Overvoltage) Categories II (Measuring Terminals)

Pollution Degree 2

Protection Class I

Note: Installation (Overvoltage) Category II refers to local distribution level, which is applicable to equipment connected to the mains supply (AC power source). Installation (Overvoltage) Category I refers to signal level, which is applicable to equipment measuring terminals that are connected to source circuits in which measures are taken to limit transient voltages to an appropriately low level.

Pollution Degree 2 refers to an operating environment where normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected.

Protection Class 1 refers to a grounded equipment, in which protection against electric shock is achieved by Basic Insulation and by means of a connection to the protective ground conductor in the building wiring.



WARNING

The scope must not be operated in explosive, dusty, or wet/damp atmospheres.



CAUTION

Protect the scope's display touch screen from excessive impacts with foreign objects.



CAUTION

Do not exceed the maximum specified front panel terminal (CH1, CH2, CH3, CH4, EXT) voltage levels. Refer to Specifications for more details.



CAUTION

Do not connect or disconnect probes or test leads while they are connected to a voltage source.

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Cooling Requirements

The instrument relies on forced air cooling with internal fans and ventilation openings. Care must be taken to avoid restricting the airflow around the apertures (fan holes) at the sides and front of the scope. To ensure adequate ventilation it is required to leave a 15 cm (6 inch) minimum gap around the sides, front, and rear of the instrument.

AC Power Source

The instrument operates from a single-phase, 100 to 240 V_{rms} ($\pm 10\%$) AC power source at 50/60 Hz ($\pm 5\%$), or single-phase 100 to 120 V_{rms} ($\pm 10\%$) AC power source at 400 Hz ($\pm 5\%$).

No manual voltage selection is required because the instrument automatically adapts to line voltage.

Depending on the accessories installed (front panel probes, PC port plug-ins, etc.), the instrument can draw up to 300 W (300 VA); 1 GHz and 2 GHz models: 340 W (340 VA)



CAUTION

Do not block the ventilation holes located on both sides of the scope.



CAUTION

Do not allow any foreign matter to enter the scope through the ventilation holes, etc.

Note:

The instrument automatically adapts itself to the AC line input within the following ranges:

Voltage Range:	90 to 264 V_{rms}	90 to 132 V_{rms}
Frequency Range:	47 to 63 Hz	380 to 420 Hz

Power and Ground Connections

The instrument is provided with a grounded cord set containing a molded three-terminal polarized plug and a standard IEC320 (Type C13) connector for making line voltage and safety ground connection. The AC inlet ground terminal is connected directly to the frame of the instrument. For adequate protection against electrical shock hazard, the power cord plug must be inserted into a mating AC outlet containing a safety ground contact. Use only the power cord specified for this instrument and certified for the country of use.

The scope should be positioned to allow easy access to the socket-outlet. To completely remove power to the scope, unplug the instrument's power cord from the AC outlet.

It is recommended that the power cord be unplugged from the AC outlet if the scope is not to be used for an extended period of time.

Calibration

The recommended calibration interval is one year. Calibration should be performed by qualified personnel only.



WARNING

Electrical Shock Hazard!

Any interruption of the protective conductor inside or outside of the scope, or disconnection of the safety ground terminal creates a hazardous situation.

Intentional interruption is prohibited.



CAUTION

The outer shells of the front panel terminals (CH1, CH2, CH3, CH4, EXT) are connected to the instrument's chassis and therefore to the safety ground.

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Cleaning

Clean only the exterior of the instrument, using a damp, soft cloth. Do not use chemicals or abrasive elements. Under no circumstances allow moisture to penetrate the instrument. To avoid electrical shock, unplug the power cord from the AC outlet before cleaning.

Abnormal Conditions

Operate the instrument only as intended by the manufacturer.

If you suspect the scope's protection has been impaired, disconnect the power cord and secure the instrument against any unintended operation.

The scope's protection is likely to be impaired if, for example, the instrument shows visible damage or has been subjected to severe transport stresses.

Proper use of the instrument depends on careful reading of all instructions and labels.



WARNING

Electrical Shock Hazard!

No operator serviceable parts inside.
Do not remove covers.

Refer servicing to qualified personnel.



WARNING

Any use of the scope in a manner not specified by the manufacturer may impair the instrument's safety protection. The instrument and related accessories should not be directly connected to human subjects or used for patient monitoring.

WHEN YOUR SCOPE IS DELIVERED

Check that You Have Everything

First, verify that all items on the packing list or invoice copy have been shipped to you. Contact your nearest LeCroy customer service center or national distributor if anything is missing or damaged. If there is something missing or damaged, and you do not contact us immediately, we cannot be responsible for replacement.

NOTE: THE WARRANTY BELOW REPLACES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. LECROY SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT OR OTHERWISE. THE CUSTOMER IS RESPONSIBLE FOR THE TRANSPORTATION AND INSURANCE CHARGES FOR THE RETURN OF PRODUCTS TO THE SERVICE FACILITY. LECROY WILL RETURN ALL PRODUCTS UNDER WARRANTY WITH TRANSPORT PREPAID.

Warranty

The oscilloscope is warranted for normal use and operation, within specifications, for a period of three years from shipment. LeCroy will either repair or, at our option, replace any product returned to one of our authorized service centers within this period. However, in order to do this we must first examine the product and find that it is defective due to workmanship or materials and not due to misuse, neglect, accident, or abnormal conditions or operation.

LeCroy shall not be responsible for any defect, damage, or failure caused by any of the following: a) attempted repairs or installations by personnel other than LeCroy representatives or b) improper connection to incompatible equipment, or c) for any damage or malfunction caused by the use of non-LeCroy supplies. Furthermore, LeCroy shall not be obligated to service a product that has been modified or integrated where the modification or integration increases the task duration or difficulty of servicing the oscilloscope. Spare and replacement parts, and repairs, all have a 90-day warranty.

The oscilloscope's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without warranty of any kind covering detailed performance. Products not made by LeCroy are covered solely by the warranty of the original equipment manufacturer.

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Maintenance Agreements

We offer a variety of services under the heading of Maintenance Agreements. These give extended warranty and allow you to budget maintenance costs after the initial three-year warranty has expired. Installation, training, enhancements, and on-site repairs—among other services—are available through special supplemental support agreements. Inquire at your LeCroy customer service center or national distributor.

Windows License Agreement

LeCroy's agreement with Microsoft prohibits users from running software on LeCroy X-Stream oscilloscopes that is not relevant to measuring, analyzing, or documenting waveforms.

End-user License Agreement For LeCroy® X-Stream Software

The software in this product is made available under license from LeCroy Corporation. For full details of the End User License Agreement, please refer to the Copyright section in the On-line Help.

POWER-UP AND INSTALLATION

Power-Up



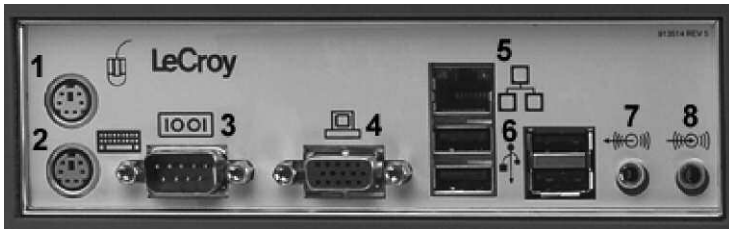
Press the power switch at bottom-left of the front of the scope to apply or remove power. Hibernate mode is not supported.



Caution

Do not change the **System standby** and **System hibernates** settings from their default **Never** selections in the Windows® “Power Options” dialog.

Hardware Connections



(1) Mouse¹; (2) Keyboard; (3) RS-232-C Port; (4) External VGA Monitor; (5) Ethernet Port; (6) 4 USB Ports; (7) Line In; (8) Speakers

Software

You can find out the scope’s software and hardware configuration as follows:

1. In the menu bar, touch **Utilities**.
2. In the dialog area, touch **Status**.

Adding a New Option

To add a software option you will need a code to enable the option. Call LeCroy Customer Support to place an order and receive the code.

Restoring Software

Restarting the Application

Upon initial power-up, the scope will load the instrument application software automatically.

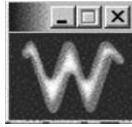
- If you exit the application and want to reload it, touch the shortcut icon on the desktop.



¹ The mouse and keyboard supplied with your scope are USB devices that can be plugged into any available USB connector.

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- If you minimize the application, touch the desktop icon to maximize it.



Restarting the Operating System

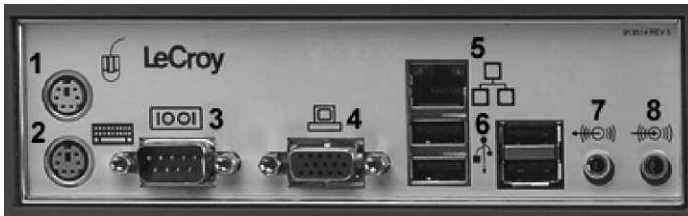
If you need to restart the Windows® operating system, you will have to reboot the scope by pressing the power switch, then turning the power back on after a ten-second wait.

External Monitor

Your WaveRunner Xi Series scope's motherboard contains a dual-video chip that enables you to extend the scope's desktop over two monitors, or to display a clone of the scope screen on an external monitor. In the extended mode, for example, you could view the scope UI on the scope itself and another application, such as Excel®, on the external monitor, or vice versa. You also have the option to turn off the scope monitor and view the scope UI on just the external monitor.

Monitor Hookup

1. Connect the external monitor to the VGA port on the side of the instrument (item **4**).



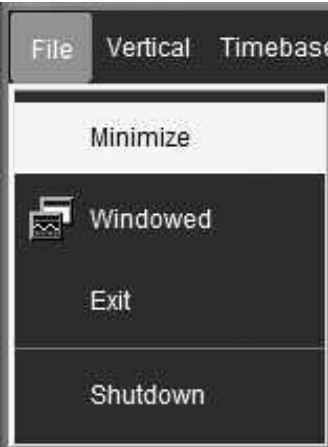


2. Plug in the monitor's power cord, and apply power to the monitor.

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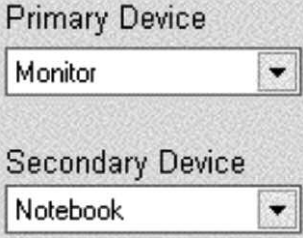

Video Setup

After boot-up, configure the monitors as follows:

Note: A mouse is required for dual monitor use.

 A screenshot of a software application's File menu. The menu is open, showing options: Minimize, Windowed, Exit, and Shutdown. The 'Minimize' option is highlighted.	<ol style="list-style-type: none">1. Minimize the scope UI by selecting Minimize from the File menu.
 A screenshot of the Windows system tray. The Intel monitor icon is highlighted with a mouse cursor. Other icons include network, volume, and system clock showing 9:17 AM.	<ol style="list-style-type: none">2. In the system tray portion of the task bar, click the Intel® monitor icon.
 A screenshot of the Intel extreme graphics 2 for mobile pop-up menu. The menu is open, showing options: Graphics Properties..., Graphics Options, and Exit Tray. The 'Graphics Properties...' option is highlighted.	<ol style="list-style-type: none">3. From the Intel® extreme graphics2 for mobile pop-up menu, select Graphics Properties...

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	<p>4. From the Display Devices dialog, select a display mode:</p> <p>Note: In these dialogs the scope monitor is referred to as “Notebook,” and the external monitor simply as “Monitor.”</p>
	<p>5. From the Primary Device drop-down menu, select which monitor you want to be the primary display, that is, which will be the one to show the scope UI. If the external monitor is considerably larger than the scope’s monitor, you may want to make it the primary device. Whichever monitor is not selected as primary will automatically appear in the Secondary Device box.</p>
 <p><i>This setting determines mouse pointer movement from one monitor to the other.</i></p>	<p>6. Drag and drop the monitor icons as appropriate. For example, if the secondary monitor (#2) sits to the left of the primary monitor (#1), the monitor 2 icon should be placed to the left of the monitor 1 icon. You can also place one icon on top of the other if the monitors will be arranged vertically.</p>



7. Click **Display Settings** and set the resolution (screen area) and color palette for the external monitor.



Caution

To maintain proper functioning of the scope display, do not change these settings for the Notebook (scope) monitor.

8. Click **OK**.

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PROBES

Your WaveRunner Xi scope is supplied with one PP008 passive probe for each channel. The PP008 is a miniature high impedance passive probe. Its high input resistance and low capacitance make it ideal for general purpose probing of signals with frequency content from DC through several hundred MHz. The PP008 has a large selection of connection accessories, supplied standard with the probe and available from LeCroy as optional accessories.

The PP008 is designed for use with 600 MHz and lower LeCroy WaveRunner Xi series oscilloscopes. Refer to the PP008 Instruction Manual.

LeCroy also offers a variety of passive and active probes for use with your WaveRunner Xi Series scope. Visit www.lecroy.com for specifications and ordering information.

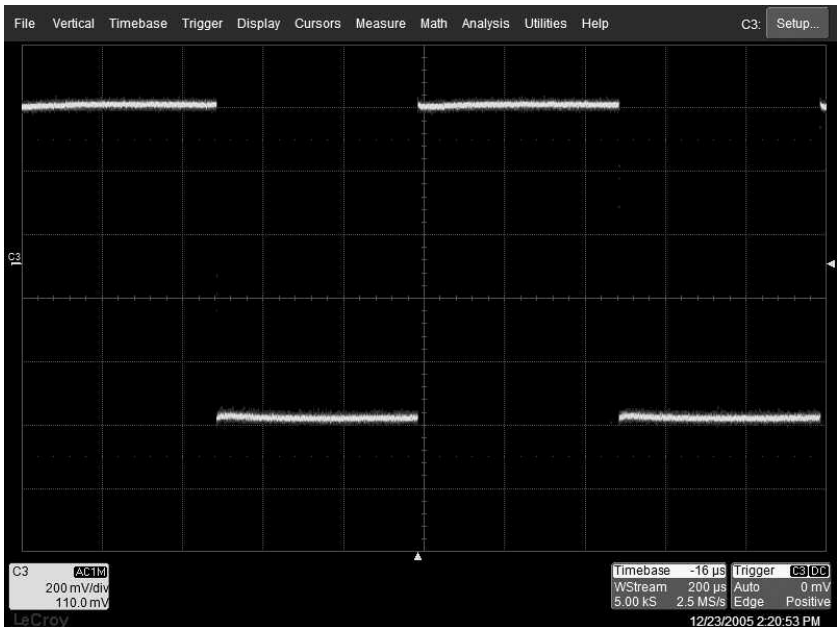
Current Probes	Current Probes measure the current passing through a wire; current probes do not use the "traditional" probing style of placing a tip onto a test point. Rather, a wire is placed inside of the "jaw" of the probe, which then allows the probe to measure the current (in Amps).
Active Probes	There are two different types of active probes: "single-ended" and "differential." Single-ended: A single-ended active probe is associated with measuring voltages at high frequencies. Measurement with an active probe requires a test point and a ground point. The ground (also called earth) acts as a zero reference for the test point measurement.
Differential Probes.	Differential active probes are like two probes in one. Instead of measuring a test point in relation to a ground point (like single-ended active probes), differential probes measure the difference in voltage of a test point in relation to another test point.
Passive Probes	Passive probes measure voltages at lower frequencies (<400 MHz). They have higher input capacitance (input C) and do not need power to operate (unlike active probes). At higher frequencies, higher input capacitance loads the test circuit, attenuating the signal. This is why active probes are used in high frequency applications. Passive probes also measure voltage in reference to ground.
High Voltage Probes	These are active single ended probes that are designed to measure high voltages (safely). They measure the voltage in reference to ground.

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Probe Compensation

Passive probes must be compensated to flatten overshoot. This is accomplished by means of a trimmer at the connector end of the probe.

1. Attach the connector end of your PP008 probe to any channel.
2. Connect the probe end to the CAL output connector at the front of the scope.
3. Adjust the trim pot at the connector end of the probe until the square wave is as flat as possible.





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FRONT PANEL CONTROLS

Front Panel Buttons and Knobs

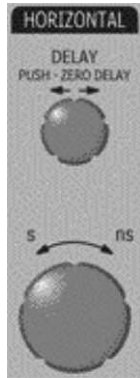
The control buttons of the WaveRunner Xi Series front panel are logically grouped into analog and special function areas. Analog functions are included in the **Horizontal**, **Trigger**, and **Vertical** groups of control buttons and knobs.

The following table provides an explanation of the front panel push buttons and knobs:

Trigger Controls	
	<p>LEVEL – Selects the trigger threshold level. The Level is indicated in the Trigger descriptor label:</p>  <p>Push the LEVEL knob to have the scope find the level automatically.</p>
	<p>SETUP – Displays the trigger setup dialog. Push the button again to close the dialog.</p>
	<p>AUTO – Triggers the scope after a time-out, even if the trigger conditions are not met.</p>
	<p>NORMAL – Triggers the scope each time a signal is present that meets the conditions set for the type of trigger selected.</p>
	<p>SINGLE – Arms the scope to trigger once (single-shot acquisition) when the input signal meets the trigger conditions set for the type of trigger selected. If the scope is already armed, it will force a trigger.</p>
	<p>STOP – Prevents the scope from triggering on a signal.</p>

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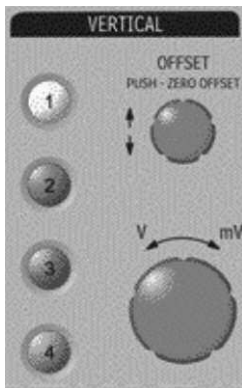
Horizontal Controls



DELAY – Horizontally positions the scope trace on the display so you can observe the signal prior to the trigger time. Push the button to reset the delay to zero. A second push returns the delay to the previous setting. *Delay* adjusts the pre- and post-trigger time.

TIME/DIVISION – Sets the time/division of the scope timebase (acquisition system).

Vertical Controls



OFFSET – Adjusts the vertical offset of a channel.

VOLTS/DIV – Adjusts the Volts/Division setting (vertical gain) of the channel selected.

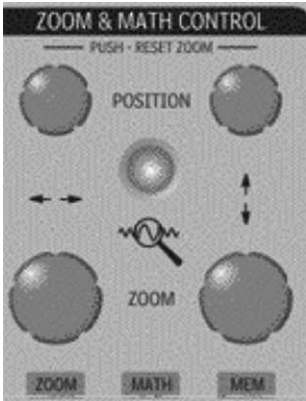
CHANNEL BUTTONS – If the channel is already ON, the channel button makes the channel active.

If the channel is OFF, the channel button turns the channel ON.


When the channel is active, the channel button is lit, and the **OFFSET** and **VOLTS/DIV** knobs are dedicated to that channel.


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Zoom Control Knobs




QuickZOOM – Automatically displays magnified views of up to four signal inputs on multiple grids. With four input signals, the signals are displayed along with four zoom traces, each on its own grid. This button turns off all other traces and redefines all math functions to be zooms of channels.

 **POSITION** – Adjusts the horizontal position of a zoom trace on the display. The zoom region is highlighted in color on the source trace. Unlike Delay, the position is not calibrated to the trigger position.

 **ZOOM** – Adjusts the horizontal zoom (magnification factor) of the selected zoom trace.

 **POSITION** – Adjusts the vertical position of the selected zoom trace on the display. Unlike Offset, the position is not calibrated to the 0 V reference.

 **ZOOM** – Adjusts the vertical zoom (magnification factor) of the selected zoom trace on the display.

INDICATOR LAMPS – The three lamps at the bottom of the panel are lit according to the kind of trace you are zooming or whose position you are adjusting: channel trace, math trace, or memory trace. The exact trace that is active has a solidly colored descriptor label.

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Special Features Controls



INTENSITY – This knob adjusts the intensity of your trace. Pushing the button toggles between WaveStream fast-viewing mode and real-time mode.

WAVESTREAM LAMP – This lamp lights when the scope is displaying in WaveStream fast-viewing mode.

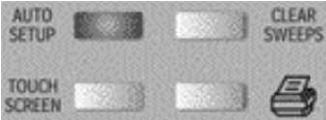

CURSOR TYPE – This push button turns on the cursors, then cycles through the four different cursor types with each additional push:



ADJUST FINE – This dual-function knob controls the placement of the top or left cursor. When the knob is in Cursor mode, the **CURS** lamp is lit.

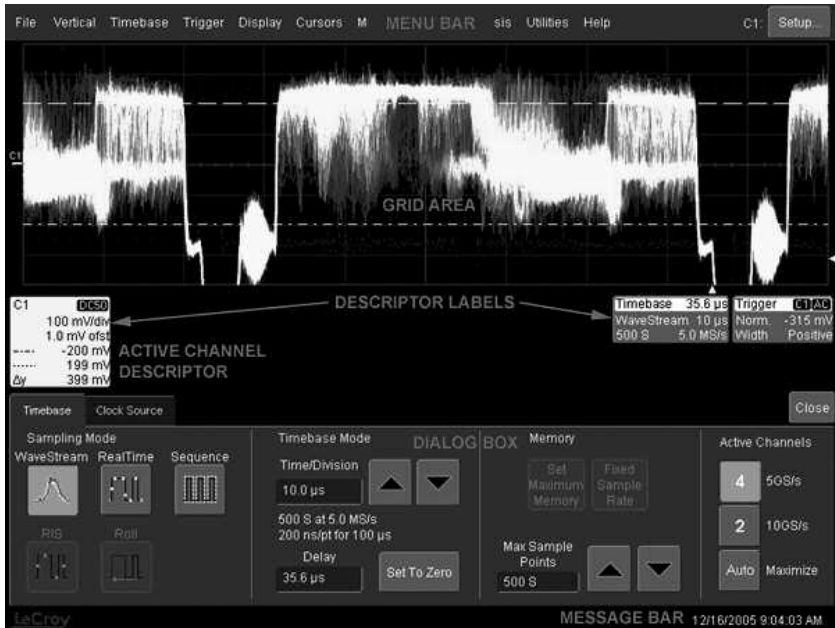
When you click in any data entry field in any dialog, the knob automatically switches from cursor placement mode to adjustment mode, and the **ADJ** lamp lights. This allows you to dial in fine-grained values. When you close the dialog, the knob reverts to cursor placement mode.

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	<p>ADJUST COARSE – This dual-function knob controls the placement of the bottom or right cursor. When the knob is in Cursor mode, the CURS lamp is lit.</p> <p>When you click in any data entry field in any dialog, the knob automatically switches from cursor placement mode to adjustment mode, and the ADJ lamp lights. This allows you to dial in coarse-grained values. When you close the dialog, the knob reverts to cursor placement mode.</p>
<p>General Control Buttons</p> 	<p>AUTO SETUP – Automatically sets the scope's horizontal timebase (acquisition system), vertical gain and offset, as well as trigger conditions, to display your signal.</p> <p>TOUCH SCREEN – Activates or deactivates the touch screen.</p> <p>CLEAR SWEEPS – Clears data from multiple sweeps (acquisitions) including: persistence trace displays, averaged traces, parameter statistics, and Histicons. During waveform readout, cancels readout.</p> <p> PRINT SCREEN – Prints the displayed screen to a file, a printer, the clipboard, or attaches it as an e-mail. You can select the device and format it in the Utilities, Hardcopy dialog.</p>



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UNDERSTANDING DISPLAY INFORMATION



Menu Bar Buttons

The menu bar buttons at the top of the scope's display are designed for quick setup of common functions.

	At the right end of the menu bar is a quick setup button that, when touched, opens the setup dialog associated with the trace or parameter named beside it. The named trace or parameter is the one whose setup dialog you last opened.
	The Setup... button also appears as an Undo button after the Autosetup front panel button is pressed and after a zoom. If you want to undo these operations, you must select Undo immediately after you perform the Autosetup or zoom; i.e., there can be no intervening operations.

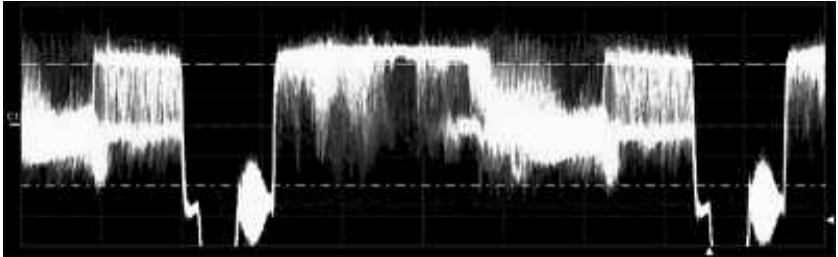
For common oscilloscope operations, you will not need to use the menu bar, since you can access most dialogs from the front panel or from the descriptor labels. However, it is the only way to access the following functions:

- Display Setup
- Save or Recall Waveform





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- Save or Recall Setups
- Printer Setup
- Vertical (Channel), Horizontal, or Trigger Status
- Memory (Reference Waveform) Setup
- Pass/Fail Setup
- Utilities and Preferences Setup
- Help Manual

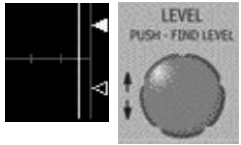
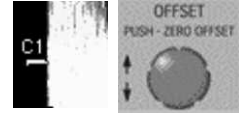
Grid Area



The grid area contains several indicators to help you understand triggering. Indicators are coded to the channel colors (yellow here for channel 1).

  <div data-bbox="128 911 362 1003"> <p>Timebase -107.2 μs</p> <p>20.0 μs/div</p> <p>2.00 MS 10 GS/s</p> </div>	<p>Trigger Delay – This indicator is located along the bottom edge of the grid. Trigger delay allows you to see the signal prior to the trigger time.</p> <p>All trigger delay values (including post-trigger delay, shown here) are displayed in the Timebase Descriptor Label. Zero delay is the horizontal center of the oscilloscope display.</p> <p>The default setting (Time) is for the delay to be read out in seconds, and to move proportionately when the timebase knob is turned. If you want to set delay (Div) to a fixed position on the grid and then have it stay fixed as the timebase changes, go to Utilities, Preferences, Acquisition.</p>
 	<p>Post-trigger Delay – This is indicated by a left-pointing arrow below-left of the grid. Pre-trigger delay is indicated by a right-pointing arrow below-right of the grid.</p>

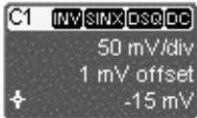
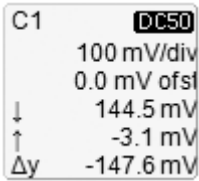



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 The image shows a portion of a grid with a vertical line and a horizontal line intersecting. A small white triangle points to the right edge of the grid. To the right is a circular knob with a hollow arrow pointing up and down. Text above the knob reads "LEVEL" and "PUSH - FIND LEVEL".	<p>Trigger Level – This indicator is located at the right edge of the grid. It tracks the trigger level as you reposition the trace up or down, or change scale. When triggering is stopped, a hollow arrow indicates where the new level will be when triggering resumes.</p> <p>Push the LEVEL knob to reset the level to 50%.</p>
 The image shows a portion of a grid with a vertical line and a horizontal line intersecting. A small white triangle points to the left edge of the grid. To the right is a circular knob with a hollow arrow pointing up and down. Text above the knob reads "OFFSET" and "PUSH - ZERO OFFSET".	<p>Zero Volts Level – This indicator is located at the left edge of the grid. To change the zero volts level, turn the VERTICAL OFFSET knob. Push the knob to reset the indicator to the middle of the grid.</p>

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Trace Descriptors

Vertical and horizontal trace descriptor labels are displayed below the grid. They provide a summary of your channel, timebase, and trigger settings. To make adjustments to these settings, touch the respective label to display the setup dialog for that function.

 	<p>Channel trace labels show the vertical settings for the trace, as well as cursor information if cursors are in use. In the title bar of the label are also included indicators for (SinX)/X interpolation, waveform inversion (INV), deskew (DSQ), coupling, bandwidth limiting (BWL), and averaging (AVG). These indicators have a long and short form:</p> <table border="1" data-bbox="452 583 905 732"> <tr><td>AVG</td><td>A</td></tr> <tr><td>SINX</td><td>S</td></tr> <tr><td>INV</td><td>I</td></tr> <tr><td>DSQ</td><td>DC</td></tr> <tr><td>DC</td><td>D</td></tr> <tr><td>Coupl</td><td>C</td></tr> <tr><td>BWL</td><td>B</td></tr> </table> <p>Besides channel traces, math and memory trace labels are also displayed. Labels are displayed only for traces that are turned on.</p> <p>As a visual aid, an active channel (i.e., the one whose settings can be adjusted by the front panel knobs) is displayed in solid color.</p>	AVG	A	SINX	S	INV	I	DSQ	DC	DC	D	Coupl	C	BWL	B
AVG	A														
SINX	S														
INV	I														
DSQ	DC														
DC	D														
Coupl	C														
BWL	B														
	<p>The title bar of the TimeBase label shows the trigger delay setting. Time per division and sampling information is given below the title bar.</p>														
	<p>The title bar of the Trigger label shows the trigger mode: Auto, Normal, or Stopped. Below the title bar is given the coupling (DC), trigger type (Edge), source (C1), level (0 mV), and slope (Positive).</p>														
	<p>Shown below the Timebase and Trigger labels is value information for horizontal cursors, including the time between cursors and the frequency.</p>														

Dialog Boxes

The dialog area occupies the bottom one-third of the screen. To expand the signal display area, you can minimize each dialog box by touching the **Close** tab at the right of the dialog box.

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Message Bar

The message bar continually displays the time and date. It also displays scope status and error messages.

ALTERNATE ACCESS METHODS








The instrument often gives you more than one way to access dialogs and menus.

Mouse and Keyboard Operation

In the procedures, we focus on touch-screen operation. But if you have a mouse connected to the instrument, you can click on objects instead of touching them. Likewise, if you have a keyboard connected, you can use it to enter data instead of using the virtual keyboard provided by the instrument.

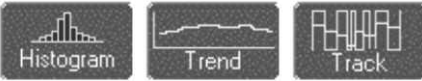
Tool Bar Buttons

The procedures also focus on the use of the menu bar at the top of the screen to access dialogs and menus. On several dialogs, however, common functions are accessible from a row of buttons that save you a step or two in accessing their dialogs. For example, at the bottom of the Channel Setup dialog, these buttons perform the following functions:

	Calls up the Measure menu. You can then select a parameter from this menu without leaving the Channel Setup dialog. The parameter automatically appears below the grid.
	Creates a zoom trace of the channel trace whose dialog is currently displayed.
	Calls up the Math menu. You can then select a math function from this menu without leaving the Channel Setup dialog. A math trace of the channel whose dialog is currently open is automatically displayed.
	Loads the channel trace into the next available memory location (M1 to M4).
	Automatically performs a vertical scaling that fits the waveform into the grid.
	Automatically moves the channel trace whose dialog is currently open onto the next grid. If you have only one grid displayed, a new grid will be created automatically, and the trace moved.
	Enables you to attach identifying labels to your waveforms. The labels are preserved when the waveform is saved as a LabNotebook entry and when saved to file.

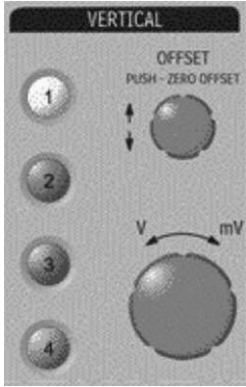
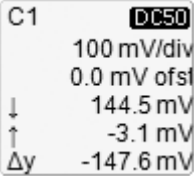

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Another example is these buttons that appear at the bottom of the Measure **Px**¹ dialogs. Each button opens a menu from which to choose a math trace (F1 to Fx) to display the functions named in the buttons:







By using these buttons you can remain in the Measure dialog to set up other options.

TURNING ON TRACES

	<p>1. To turn on a channel trace, push a front panel channel select button to display the trace label for that input channel. While this turns on the trace, it leaves the current dialog displayed.</p> <p>If you want to also display the vertical setup dialog for the channel trace, touch the trace label twice. The first touch will make the channel active; the second will open its setup dialog. The appearance of the selected trace label will change to solid color when active:</p> 
	<p>2. To turn on a math function trace, touch Math in the menu bar, then touch Math Setup... in the drop-down menu. Touch the On checkbox for the trace you want to activate.</p>

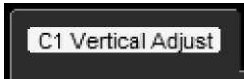
¹ The number of parameters and math traces available depends on the software options loaded on your scope.

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 Math	 Measure	3. You can also turn on traces for math functions, parameters, and memory traces without leaving the Vertical Adjust dialog by touching the icons at the bottom of the Vertical Adjust dialog.
 Zoom	 Store	

Whenever you turn on a channel or math trace from the menu bar at the top of the screen, the dialog at the bottom of the screen automatically switches to the vertical setup or math setup dialog for that selection. You can then configure your traces.

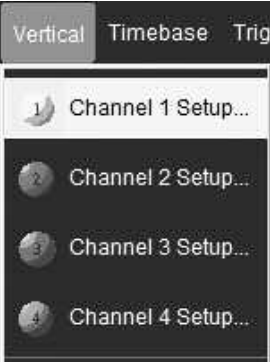
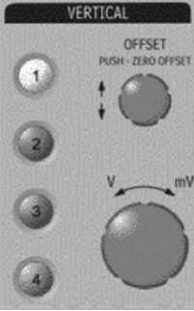
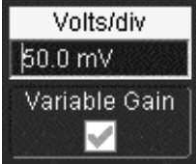
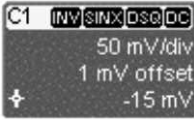
The channel or math trace number appears in the tab of the appropriate dialog, signifying that all controls and fields are dedicated to the selected trace:



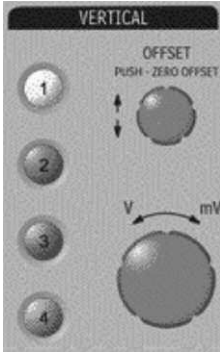
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VERTICAL SETTINGS AND CHANNEL CONTROLS

Adjusting Sensitivity

	<p>1. Touch Vertical in the menu bar, then Channel 1, for example, in the drop-down menu.</p> <p>Touch inside the Trace On checkbox to display the trace. Or, use the VERTICAL front panel buttons to turn it on.</p>
	<p>2. Turn the volts per division knob. Or you can touch inside the Volts/Div field and type in a value using the pop-up keypad.</p> 
	<p>3. The voltage that you set is displayed in the Volts/Div field and in the trace descriptor label.</p>

Adjusting the Waveform's Position



Turn the vertical offset adjust knob directly above the channel button whose waveform you want to move vertically. Or you can touch inside the **Offset** field and type in a value on the pop-up keypad. To set the vertical offset to zero, press the vertical offset adjust knob for the channel you want to adjust:

Coupling

Your choices of coupling are as follows:




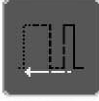

- AC 1 M Ω
- DC 1 M Ω
- DC 50 Ω
- GROUND

To make a coupling selection, touch inside the **Coupling** field and choose a coupling mode from the pop-up menu.

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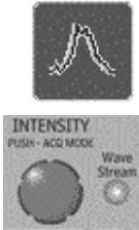
SAMPLING MODES

Depending on your timebase, the following sampling modes are available:

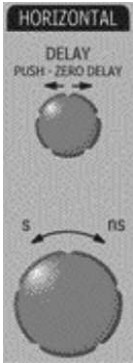
	<p>WaveStream Mode – This fast viewing mode provides brightness-graded intensity with a decay time similar to the action of phosphor on an analog screen. WaveStream mode operates at up to 10 GS/s with an update rate up to 8000 waveforms/second for better capture of higher frequency abnormal events.</p>
	<p>Real Time Mode – A single-shot (real time) acquisition is a series of digitized voltage values sampled on the input signal at a uniform rate.</p>
	<p>Sequence Mode – In sequence mode, the complete waveform consists of a number of fixed-size segments acquired in single-shot mode.</p>
	<p>Roll Mode – This mode is invoked automatically for slow acquisitions when the time per division is 200 ms/div or greater. Roll mode will sample at 2 MS/s (depending on memory availability).</p>
	<p>RIS Mode – Random Interleaved Sampling is an acquisition technique that allows effective sampling rates higher than the maximum single-shot sampling rate. It is used on repetitive waveforms with a stable trigger.</p>

Using WaveStream Fast Viewing Mode

Adjusting Trace Intensity

	<p>The INTENSITY knob adjusts the brightness of your trace. Pushing the button toggles between WaveStream fast-viewing mode and real-time mode.</p>
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TIMEBASE SETUP



Set up the timebase by using the front panel **Horizontal** controls, just as for analog scopes.

Combining of Channels

Channels can be combined to increase sample rate (WaveRunner 64Xi and 62Xi only) or memory in order to capture and view a signal in all its detail. When you combine channels, uncombined channels like EXT BNC remain available for triggering, even though they are not displayed.

In 2-channel operation, channels 2 and 3 are active. In Auto operation, you can use channel 1 or 2, and channel 3 or 4. On the paired channels the maximum sampling rate is doubled and the record length is greatly increased:



Ch 1 & Ch 3	10 GS/s
Ch 1 & Ch 4	10 GS/s
Ch 2 & Ch 3	10 GS/s
Ch 2 & Ch 4	10 GS/s

As you can see, sampling can be maximized to 10 GS/s for any combination of two channels, except a combination of channels 1 and 2, or channels 3 and 4, which yield 5 GS/s. The basic rule is to choose either channel 1 or 2 for your first input, and either channel 3 or 4 for the second input.

Refer to Acquisition Modes in the specifications for maximum sample rates.

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To Combine Channels

	1. Touch the Timebase descriptor label.
	2. Under Active Channels , touch 4, 2, or Auto. The maximum sample rate is shown alongside each button.

TRIGGERING

Simple Triggers

Edge Trigger on Simple Signals



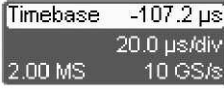
The instrument uses many waveform capture techniques that trigger on features and conditions that you define. These triggers fall into two major categories:

- **Standard Triggers** – activated by basic waveform features or conditions such as a positive or negative slope, and hold-off .
- **SMART Triggers** – sophisticated triggers that enable you to use basic or complex conditions for triggering.



Use Edge Triggers for simple signals, and the SMART Triggers for signals with rare features, like glitches.

Controlling Edge Triggering

Horizontal





	<p>Turn the DELAY knob in the HORIZONTAL control group to adjust the trigger's horizontal position. Or, touch inside the Delay field in the timebase setup dialog and enter a value, using the pop-up keypad.</p> <p>The trigger location is shown by a marker below the grid.</p>
	<p>Post-trigger delay is indicated by a left-pointing arrow below-left of the grid.</p>
	<p>The time value is given in the title line of the TimeBase label below-right of the grid.</p>

Vertical


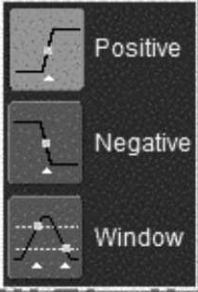
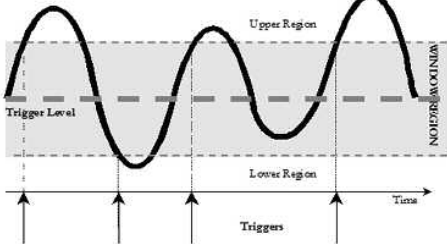
	<p>Turn the LEVEL knob in the TRIGGER control group to adjust the vertical threshold of the trigger or the highlighted trace. Level defines the source voltage at which the trigger will generate an event: a change in the input signal that satisfies the trigger conditions.</p>
	<p>Alternatively, in the "Trigger" dialog, you can touch inside the LEVEL field and type in a value, using the pop-up numeric keypad. To quickly set a level of zero volts, push the front panel Level button.</p>

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To Set Up an Edge Trigger

 <p>The screenshot shows the TRIGGER menu with options: TRIG'D, SETUP (circled), TO, NORMAL, SINGLE, and STOP.</p>	<p>1. Push the front panel trigger SETUP button.</p>
 <p>A button labeled "Edge Trigger".</p>	<p>2. Touch the Edge trigger button.</p>
 <p>The Source selection menu shows options: C1, C2, C3, C4, Ext, Ext/10, Line, and Pattern.</p>	<p>3. Touch inside the Source field and select an input from the pop-up menu.</p> <p>C1 through C4 are abbreviations for Channel 1 through Channel 4.</p> <p>Ext and Ext/10 allow you to trigger on the External Input of the oscilloscope. Ext input is ± 0.5 V. Ext/10 input is ± 5.0 V.</p> <p>Line is for triggering on the Positive or Negative excursion of the AC power line.</p>
 <p>The Level setting screen shows a display of "0 mV" and buttons for "Set to Max.", "Set to Default", and "Set to Min." along with up/down arrow buttons.</p>	<p>4. Touch inside the Level field. In the pop-up numeric keypad, enter a value in millivolts or use the up/down buttons to increase or decrease the value in increments of 1 mV. Or, touch one of the preset value buttons for triggering on low frequencies.</p>

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	<p>5. Touch inside the Coupling field and select a coupling type.</p> <p>DC – All the signal's frequency components are coupled to the trigger circuit for high frequency bursts or where the use of AC coupling would shift the effective trigger level.</p> <p>AC – The signal is capacitively coupled. DC levels are rejected, and frequencies below 50 Hz are attenuated.</p> <p>LFREJ – The signal is coupled through a capacitive high-pass filter network, DC is rejected and signal frequencies below 50 kHz are attenuated. For stable triggering on medium-to-high frequency signals.</p> <p>HFREJ – Signals are DC coupled to the trigger circuit, and a low-pass filter network attenuates frequencies above 50 kHz; used for triggering on low frequencies.</p>
	<p>6. Choose Positive, Negative, or Window slope.</p> <p>Window slope sets a threshold above and below the trigger level beyond which the signal must pass to generate a trigger. The slope can be either positive or negative.</p> 

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7. Select the holdoff by touching the **Holdoff** tab, then the **Time** or **Events** button. Using the pop-up numeric keypad, enter a value and specify the unit of time, or use the up/down buttons to increase or decrease the time value in increments of 200 ps. Or, touch one of the preset value buttons.

STANDARD TRIGGERS






<p>Edge</p> 	<p>Use Edge trigger for simple, repetitive signals. This trigger is activated by basic waveform features or conditions such as a positive or negative slope, and hold-off.</p>
<p>Width</p> 	<p>Width trigger allows you to define a positive- or negative-going pulse width bounded by a voltage level, above or below which a trigger will occur. Or you can specify a pulse width and voltage range, within or outside of which a trigger will occur.</p>
<p>Qualified</p> 	<p>The Qualified (A-B) trigger allows arming of the trigger on Event A and triggering on Event B. If the arming event is a Pattern that occurs once (Pattern) or that occurs and stays satisfied (PatState), then the triggering event can be an Edge, Width, Glitch, or Interval condition. This functionality is identical to LeCroy's previous "Qualify" and "State" triggers, but presented in a different UI.</p>
<p>Pattern</p> 	<p>Pattern trigger enables triggering on a logical combination (pattern) of five inputs: CH1, CH2, CH3, CH4, EXT. You have a choice of four Boolean operators (AND, NAND, OR, NOR), and you can stipulate the high or low voltage logic level for each input independently.</p>
<p>TV</p> 	<p>TV triggers provide stable triggering on standard or custom composite video signals. Use them on PAL, SECAM, or NTSC systems. Use CUSTOM setup for other standards.</p>
<p>Serial</p> 	<p>Serial trigger allows a serial trigger condition to be set from within the oscilloscope, using an easy-to-understand interface.</p>

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SMART TRIGGERS



SMART Triggers are defined as follows:

<p>Glitch</p> 	<p>Glitch trigger is a simpler form of Width trigger. Use Glitch trigger when you want to define a fixed pulse-width time or time range only. Glitch trigger makes no provision for voltage levels or ranges.</p>
<p>Interval</p> 	<p>While Glitch trigger performs over the width of a pulse, Interval trigger performs over the width of an interval: the signal duration (the period) separating two consecutive edges of the same polarity (positive to positive or negative to negative). Use interval trigger to capture intervals that fall short of, or exceed, a given time limit. In addition, you can define a width range to capture any interval that is itself inside or outside the specified range; i.e., it can be used as an Exclusion trigger by interval.</p>
<p>Dropout</p> 	<p>Used primarily in single-shot applications, and usually with a pre-trigger delay, Dropout trigger can detect lost signals. The trigger is generated at the end of the timeout period following the last trigger source transition. You can select a timeout period from 2 ns to 20 s.</p>
<p>Runt</p> 	<p>The runt trigger is programmed to occur when a pulse crosses a first threshold line and fails to cross a second threshold line before recrossing the first. You can select both voltage thresholds within a time range of 100 ps to 20 s. Other defining conditions for this trigger are the edge (triggers on the slope opposite to that selected) and runt width.</p>
<p>Slew Rate</p> 	<p>Slew rate trigger activates a trigger when the rising or falling edge of a pulse crosses two threshold levels: an upper level and a lower level. The pulse edge must cross the thresholds faster or slower than a selected period of time. You can select both thresholds within a range of 2 ns to 20 s.</p>

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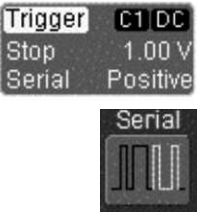


SERIAL TRIGGER AND DECODE

A variety of Serial Data standards, such as Inter-IC (I²C) and Serial Peripheral Interface (SPI), govern communication between microprocessors and peripherals. I²Cbus TD and SPIbus TD are unique oscilloscope tools from LeCroy that greatly enhance your ability to debug and analyze embedded controllers that use I²C or SPI Bus communications.

The serial triggers are integrated into the oscilloscope — no external hardware is used — and are selected through the normal oscilloscope trigger menus. I²C and SPI signals are input to the oscilloscope through normal passive or active probes, such as LeCroy's ZS Series of high impedance active probes. Decoding is accessed from the Analysis pull-down menu in the menu bar. The decoding is overlaid on top of the appropriate channel, and is intuitively presented and color-coded for quick understanding. Included is a Search capability for specific messages, and a table to display protocol data in summary form underneath the oscilloscope grid.

Accessing Serial Decode Triggers

Serial triggers can be accessed in two ways:


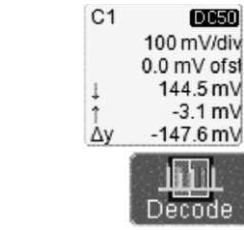
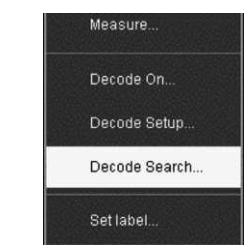
	Touch the Trigger descriptor label. Then select the Serial trigger type in the dialog box.
	Alternatively, touch Trigger in the menu bar, and select Trigger Setup... from the drop-down menu. Then select the Serial trigger type in the dialog box.
	Choose the appropriate serial trigger. This opens a trigger setup dialog for your choice of serial trigger.

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Serial Decode and Decode Setup

These dialogs provide the ability to set the oscilloscope up for protocol decoding of serial data messages, with display of the protocol data overlaid on the signal. They also allow quick and easy access to oscilloscope zooming, searching, table display, and table export.

The serial decode and decode setup dialogs are accessed in any the following ways:

	<p>Touch Analysis in the menu bar, then Serial Decode... in the drop-down menu.</p> <p>This will open the Serial Decode summary dialog, and provide access to Decode Setup.</p>
	<p>Touch the Channel or Memory Descriptor Box to open the respective dialog box, and touch the Decode button in the bottom toolbar.</p>
	<p>Touch a Channel, Memory, or Math trace to open a pop-up dialog that displays a shortcut to the Decode Setup dialog box</p>

See the on-line **Help** in your scope for details of operation of Serial Trigger.

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WAVEFORM MEASUREMENTS





Measuring with Cursors

Cursors are important tools that aid you in measuring signal values. Cursors are markers—lines, cross-hairs, or arrows—that you can move around the grid or the waveform itself. Use cursors to make fast, accurate measurements and to eliminate guesswork. There are two basic types:

- **Horizontal** (Time or Frequency) cursors are lines that you move horizontally along the waveform. Place them at a desired location along the time axis to read the signal's amplitude at the selected time.
- **Vertical** (Voltage) cursors are lines that you move vertically on the grid to measure the amplitude of a signal.

Cursor Measurement Icons

The **Show** icons depict what is being measured for each measurement mode.

Absolute 	Each cursor locates a point on the waveform. The cursor values can be read in the descriptor label for the trace. Use the Position fields at the right side of the dialog to place the cursors precisely.
Delta 	This is the difference in Y values. The value can be read in the descriptor label for the trace.
Abs+Delta 	Displays absolute and delta cursors together.
Slope 	This gives the slope between cursors.

If there are non-time-domain waveforms displayed, there will also be a menu offering choices of x-axis units: **s** or **Hz**, for example.

```
C2      DC50
      100 mV/div
      0.0 mV ofst
↓      143.8 mV
↑      152.2 mV
Δy     8.4 mV
```

Cursor information is displayed in the channel, math, zoom, and memory trace descriptor labels. It is also displayed below the Timebase and Trigger descriptor labels:

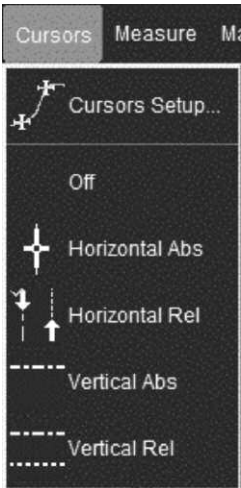
```
X1= 1.36735 μs   ΔX=   531.07 ns
X2= 1.89842 μs  1/ΔX= 1.88299 MHz
```


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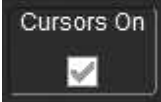
Cursors Setup

Quick Display




At any time, you can change the display of cursor types (or turn them off) without invoking the “Cursors Setup” dialog, as follows:

	<ol style="list-style-type: none">1. In the menu bar, touch Cursors, then Off, Horizontal Abs, Horizontal Rel, Vertical Abs, or Vertical Rel.2. The cursors displayed will assume the positions previously set up. If you want to change their position or measurement mode, in the menu bar touch Cursors, then Cursors Setup in the drop-down menu.
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Full Setup

	<ol style="list-style-type: none">1. In the menu bar, touch Cursors, then Cursors Setup. The “Standard Cursors” dialog opens.
	<ol style="list-style-type: none">2. In the dialog area, touch the Cursors On checkbox to display them.

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	<p>3. Touch one of the Horizontal or Vertical mode buttons: Relative or Absolute.</p>
	<p>4. If you chose a Relative mode, also touch a readout parameter button: Y position, delta Y, Y position plus delta, or slope.</p>
	<p>5. If you chose a Relative mode, touch inside the Position 1 and Position 2 fields and type in a value for each cursor. You can also use the Cursors knobs on the front panel to place the cursors. If you chose an Absolute mode, do the same for your single cursor.</p> <p>6. If you chose a Relative mode and you would like both cursors to move in unison as you adjust the position, touch the Track check box to enable tracking.</p> <p>7. Push the front panel Cursor Type button to quickly change the type of cursors in use.</p>

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PARAMETER MEASUREMENTS

Waveform analysis typically begins with the measurement of parameters. Parameter measurement tools determine a wide range of waveform properties. Use them to automatically calculate many attributes of your waveform, like rise time, rms voltage, and peak-to-peak voltage, for example.

There are parameter modes for the amplitude and time domains, custom parameter groups, and parameters for pass and fail testing. You can make common measurements on one or more waveforms.

Measure Modes

The selections for Measure Mode allow you to quickly apply parameters for standard vertical and standard horizontal setups, and custom setups.

Pass and fail parameters can be customized, too. You can accumulate and display statistics on each parameter's average, lowest, highest, and standard deviation.

Standard Vertical Parameters

These are the default Standard Vertical Parameters:

mean	Mean
sdev	Standard deviation
max	Maximum
min.	Minimum
ampl	Amplitude
pkpk	Peak-to-peak

Standard Horizontal Parameters

These are the default Standard Horizontal Parameters:

freq	Frequency
period	Period
width	Width
rise	Risetime
fall	Fall time
duty	duty cycle






Custom Measurements with My Measure

You can choose to customize up to six parameters by touching **My Measure** and then selecting the measurements desired.


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Status Symbols

Below each parameter appears a symbol that indicates the status of the parameter, as follows:

	A green check mark means that the scope is returning a valid value.
	A crossed-out pulse means that the scope is unable to determine top and base; however, the measurement could still be valid.
	A downward pointing arrow indicates an underflow condition.
	An upward pointing arrow indicates an overflow condition.
	An upward-and-downward pointing arrow indicates an underflow and overflow condition.

Statistics



Measure	P1:Vl@x(C2)
value	149 mV
mean	148.81 mV
min	149 mV
max	149 mV
sdev	—
num	1

You can turn on statistics by checking the **Statistics On** checkbox in the Measure main dialog. A table of values is then displayed below the grid.

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WAVESCAN™ ADVANCED SEARCH AND ANALYSIS

LeCroy's WaveScan Advanced Search and Analysis tool can be used in the following ways:

- **Capture and Search** – Take a single acquisition, set a search mode, and apply a filter (i.e., create a search condition).
- **Scan** – Set a search mode, apply a filter, and take multiple acquisitions to scan for unusual events (i.e., create a software condition for a hardware trigger).
- **Analyze** – Use ScanOverlay and ScanHisto to further analyze the filtered events.

You can select from more than 20 search modes (frequency, rise time, runt, duty cycle, etc.), apply a search condition (slope, level, threshold, hysteresis), and begin scanning in a post-acquisition environment. Since the scanning modes are not simply copies of the hardware triggers, the capability is much greater.

For instance, there is no “frequency” trigger in any oscilloscope, yet WaveScan allows frequency to be quickly scanned for. You can accumulate a data set of unusual events that are separated by hours or days, enabling faster debugging. The events are time stamped and indexed in a table from which you can select them for viewing individually.

You can also set actions to occur automatically when unusual events are found: stop the acquisition, emit an audible beep, output a pulse, print the screen, save the waveform, or create a LabNotebook entry.

Refer to your scope's on-line Help for more information about WaveScan.

WaveScan Signal Views

WaveScan provides several views of your signal:

- **Source** view highlights all occurrences of edges that meet your criteria.
- **Zoom** view allows you to expand a waveform feature vertically and horizontally; to apply further processing; to store it, or to apply a descriptive label to the feature.
- **Scan Histogram** provides a statistical view of edges that meet your search criteria.
- **Scan Overlay** places all captured edges one on top of the other in a separate grid. You can apply persistence in this view.

Note: The number of grids displayed varies from one to three grids depending on which views are enabled. WaveScan handles this function automatically, and there is no option to move traces from one grid to another, as would be the case under normal (non-WaveScan) operation.

WaveScan Search Modes

Search modes are used to locate anomalies during acquisition.

- **Edge** – for detecting the occurrence of edges; selectable slope and level
- **Non-monotonic** – for detecting threshold re-crosses; selectable slope, hysteresis, and level
- **Runt** – for detecting pulses that fail to cross a threshold; selectable polarity and thresholds
- **Measurement** – for defining a measurement with a filtering (search or scan) criteria

Parameter Measurements

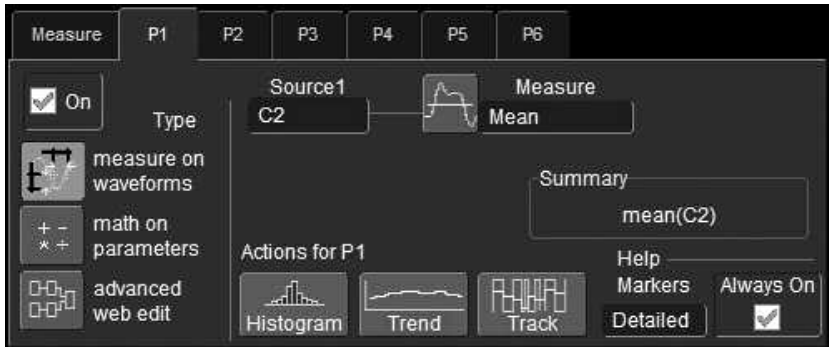
In WaveScan, parameter measurements are used to set up a filtering (search or scan) criteria. When WaveScan finds an event that meets the measurement and filter criteria, it highlights the area (search and scan) and (optionally) can perform an action (scan). The number of parameters available depends on the options loaded on your instrument. Measurements are made only on the events defined by your filter (search criteria). A Filter Wizard is provided to quickly set up a measurement to find rare events, such as ± 1 , 3, or 5 sigma.

Sampling Mode

Whenever WaveScan is enabled, the instrument reverts to Real-time sampling mode.

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PARAMETER ANALYSIS



Trend Measurements

A trend of a measurement parameter is a line graph with a measurement point from each subsequent signal acquisition plotted on the graph.

1. In the menu bar, touch **Measure**, then **Measure Setup...** in the drop-down menu.
2. Touch one of parameter tabs **P1** through **P6**.
3. Touch inside the **Source1** field and select an input waveform from the pop-up menu.
4. Touch inside the **Measure** field and select a parameter from the pop-up menu.
5. Touch the **Trend** button at the bottom of the dialog.

Track View

A Track View of a measurement parameter is a unique and specialized graph that is time correlated to the signal being measured. The Track View applies to a single-shot acquisition and plots the variation of a parameter (such as width) for each cycle in time-correlated sequence with the waveform. Track View lets you locate a problematic signal feature including width, period, amplitude, and more.

To set up a Track View, follow the steps above, except touch the **Track** button at the bottom of the dialog.

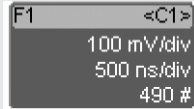
JitterTrack View

A JitterTrack View is similar to a Track View but is applicable to a specialized set of timing parameter measurements used to analyze cycle-to-cycle timing variation, including clock jitter, and to aid in tracking the variation to its source. JitterTrack is available with the optional XMAP or JTA2 WaveShape Analysis packages.

HISTOGRAMS

Creating and Viewing a Histogram

Note: The number of sweeps comprising a histogram is displayed in the bottom line of the trace descriptor label:

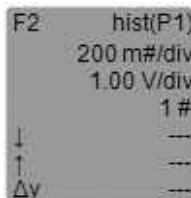
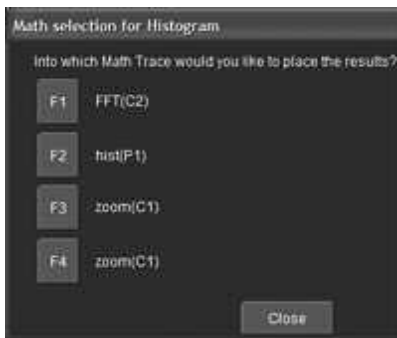


F1 <C1>
100 mV/div
500 ns/div
490 #

To Set Up a Single Parameter Histogram

From Measure Dialog

1. In the menu bar, touch **Measure**, then **Measure Setup**.
2. Touch the **My Measure** button.
3. Touch one of tabs **P1** through **Px**.
4. Touch inside the **Source1** field and select an input waveform from the pop-up menu.
5. Touch inside the **Measure** field and select a parameter from the pop-up menu.
6. Touch the **Histogram** button at the bottom of the dialog.
7. Touch a math trace in which to place the resulting histogram, then close the pop-up menu.



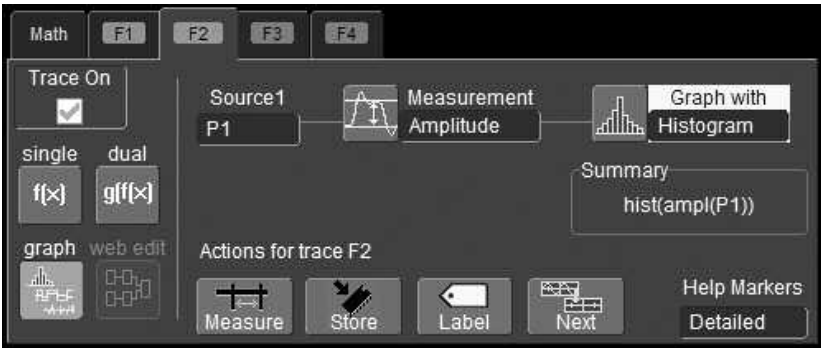
F2 hist(P1)
200 m#/div
1.00 V/div
1 #
↓
↑
Δy

8. Touch the math trace label for the math trace you just created.

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9. In the dialog to the right, touch the Histogram tab.
10. Under "Buffer," touch inside the #Values field and enter a value.
11. Under "Scaling," touch inside the #Bins field and enter a value from 20 to 2000.
12. Touch the Find Center and Width button to center the histogram. Or touch inside the Center, then the Width, fields and enter a value using the pop-up numeric keypad.



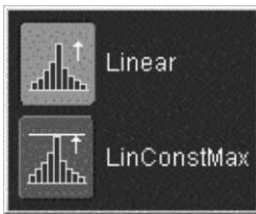
From Math Dialog

1. In the menu bar, touch Math, then Math Setup.
2. Touch one of function tabs F1 through Fx.
The number of math traces available depends on the software options loaded on your scope.
3. Touch the Graph button.
4. Touch inside the Source1 field and select a source from the pop-up menu.
5. Touch inside the Measurement field and select a parameter from the pop-up menu.

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6. Touch inside the **Graph with Histogram** field and select **Histogram** from the pop-up menu.
7. In the dialog to the right, touch the **Histogram** tab.
8. Under “Buffer,” touch inside the **#Values** field and enter a value.
9. Under “Scaling,” touch inside the **#Bins** field and enter a value from 20 to 2000.
10. Touch the **Find Center and Width** button to center the histogram. Or touch inside the **Center**, then the **Width**, fields and enter a value using the pop-up numeric keypad.
11. Touch inside the Vertical Scale field and select **Linear** or **Linear Constant Max** from the pop-up menu:



A linear histogram will continue to grow as values are accumulated.

A linear-constant-maximum histogram will continually rescale itself to remain well within the grid.

To View Thumbnail Histograms



Histicons are miniature histograms of parameter measurements that appear below the grid. These thumbnail histograms let you see at a glance the statistical distribution of each parameter.

1. In the menu bar, touch **Measure**, then one of the Measure Mode buttons: **Std Vertical**, **Std Horizontal**, or **My Measure**.
2. Touch the **Histicons** checkbox to display thumbnail histograms below the selected parameters.

Note: For measurements set up in My Measure, you can quickly display an enlarged histogram of a thumbnail histogram by touching the Histicon you want to enlarge. The enlarged histogram will appear superimposed on the trace it describes. This does not apply to “Std Vertical” or “Std Horizontal” measurements.

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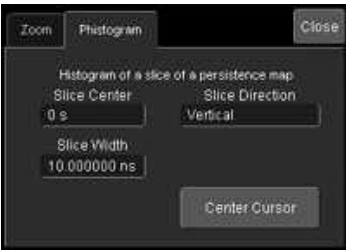
Persistence Histogram

You can create a histogram of a persistence display also by cutting a horizontal or vertical slice through the waveform. You also decide the width of the slice and its horizontal or vertical placement on the waveform.

This math operation is different from the “Histogram” math operation and is not affected by **Center** and **Width** settings made there.

To Set Up Persistence Histograms

1. In the menu bar, touch **Math**, then **Math Setup**.
2. Touch one of function tabs **F1** through **Fx**. The number of math traces available depends on the software options loaded on your scope.
3. Touch inside the **Source1** field and select a source from the pop-up menu.

	4. Touch inside the Operator1 field and select Phistogram from the Select Math Operator menu.
	5. Touch the “Phistogram” tab, then touch inside the Slice Direction field and select Horizontal or Vertical slice from the pop-up menu. 6. Touch inside the Slice Center field and enter a value, using the pop-up keypad. 7. Touch inside the Slice Width field and enter a value, using the pop-up keypad. Note: You can use the front panel ADJUST knobs in the Cursors group to move the Slice Center line and the Slice Width boundary lines.

Persistence Trace Range

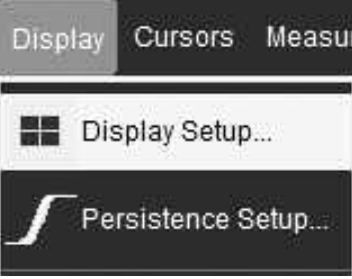
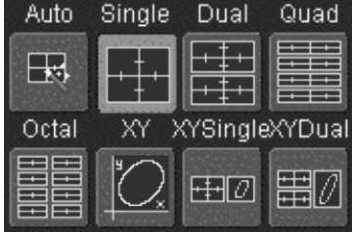

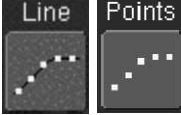
This math operation has a field where you can enter the percent of the persistence trace population to use in creating a new waveform.

Persistence Sigma

This math operation has a field where you can enter a scale, measured in standard deviations, by which to create a new waveform.

DISPLAY FORMATS

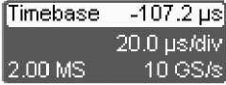



Display Setup

	<ol style="list-style-type: none"> 1. In the menu bar, touch Display; then touch Display Setup in the drop-down menu.
	<ol style="list-style-type: none"> 2. Touch one of the Grid combination buttons. Auto automatically adds or deletes grids as you select more or fewer waveforms to display.
	<ol style="list-style-type: none"> 3. Touch inside the grid Intensity field and enter a value from 0 to 100 using the pop-up keypad. 4. Touch the Grid on top checkbox if you want to superimpose the grid over the waveform. Depending on the grid intensity, some of your waveform may be hidden from view when the grid is placed on top. To undo, simply uncheck Grid on top. 5. Touch the Axis labels checkbox to permanently display the values of the top and bottom grid lines (calculated from volts/div) and the extreme left and right grid lines (calculated from the timebase).
	<ol style="list-style-type: none"> 6. Choose a line style for your trace: solid Line or Points.

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Sequence Mode Display

To a set up Sequence Mode display, you must first have selected **Sequence** trigger mode in the Timebase “Horizontal” dialog. You must also have entered a **Num Segments** value, as follows:

	<ol style="list-style-type: none"> 1. Touch the Timebase descriptor label.
	<ol style="list-style-type: none"> 2. In the Timebase dialog, touch the Sequence mode button.
	<ol style="list-style-type: none"> 3. Select the Sequence tab. Under “Acquisition Settings,” touch inside the Num Segments field and enter a value from 2 to 500. 4. Touch inside the Timeout field and enter a value from 10 ms to 100 s. Then check the Enable Timeout checkbox.
	<ol style="list-style-type: none"> 5. Touch inside the Display Mode field and select a mode from the pop-up menu. See the on-line Help for an explanation of these modes. 6. Touch inside the Num Seg Displayed field and enter a value. You cannot select a value higher than that set in Num Segments under “Acquisition Settings.” 7. Touch inside the Starting at field and enter a value.


Note: The maximum value that you can enter for **Starting at** depends on the **Num Segments** value you entered under “Acquisition Settings.” It also depends on the **Num Seg Displayed** value you entered. For example, if you had entered a value of 500 in **Num Segments**, and a value of 10 in **Num Seg Displayed**, the maximum value you can enter as a starting segment is 491 so that 10 segments can be seen.


Persistence Setup

The analog Persistence feature displays your waveform and reveals its anomalies for a repetitive signal. Use Persistence to accumulate on-screen points from many acquisitions to see your signal change over time. The instrument persistence modes show the most frequent signal path “three-dimensionally” in intensities of the same color, or graded in a spectrum of colors.


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Saturation Level

 <p>Analog</p>	<p>When you select Analog mode from the Persistence dialog, each channel is assigned a single color. As a persistence data map develops, different intensities of that color are assigned to the range between a minimum and a maximum population. The maximum population automatically gets the highest intensity, the minimum population gets the lowest intensity, and intermediate populations get intensities in between these extremes. See the on-line Help for more information.</p>
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 <p>Color</p>	<p>Color mode persistence, selected by touching Color, works on the same principle as the Analog persistence feature, but instead uses the entire color spectrum to map signal intensity: violet for minimum population, red for maximum population. A saturation level of 100% spreads the intensity variation across the entire distribution; at lower saturation levels the intensity will saturate (become the brightest color) at the percentage value specified. Lowering this percentage causes the pixels to be saturated at a lower population, and makes visible those rarely hit pixels not seen at higher percentages.</p>
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3-Dimensional Persistence

 <p>3d</p>	<p>By selecting 3d, you can create a topographical view of your waveform from a selection of shadings, textures, and hues. The advantage of the topographical view is that areas of highest and lowest intensity are shown as peaks and valleys, in addition to color or brightness. The shape of the peaks (pointed or flat) can reveal further information about the frequency of occurrences in your waveform.</p> <p>The instrument also gives you the ability to turn the X and Y axes of the waveform through 180° of rotation from -90° to +90°.</p>
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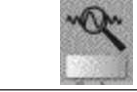

Show Last Trace

For most applications, you may not want to show the last trace because it will be superimposed on top of your persistence display. In those cases turn off **Show Last Trace** by touching the checkbox. However, if you are doing mask testing and want to see where the last trace is falling, turn **Show Last Trace** on.

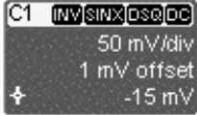

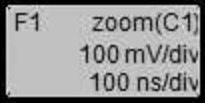


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Zooming Waveforms



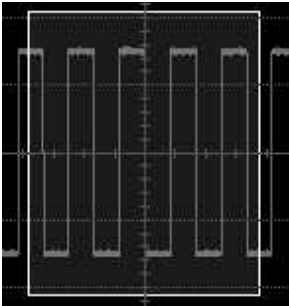


	<p>The Zoom button appears as a standard button at the bottom of the channel Cx Vertical Adjust setup dialog if you want to create a zoom trace of your input waveform. The zoom trace created by this method is designated Z1 to Z4.</p>
	<p>The front panel “QuickZoom” button creates multiple zooms, one for each displayed input channel. The zoom traces created by this method are designated Z1 to Z4.</p>
	<p>At any time, you can also zoom a portion of a waveform, or multiple waveforms, by touching and dragging a rectangle around any part of the input waveform. The zoom trace will size itself to fit the full width of the grid. The degree of magnification, therefore, will depend on the size of the rectangle that you draw.</p> <p>When you zoom a waveform by this method, a representation of the zoomed area will appear in a thumbnail Preview in the Zx dialog.</p>

To Zoom a Single Channel

	<p>1. Touch the channel trace label for a displayed channel.</p>
	<p>2. Touch the Zoom button at the bottom of the Cx Vertical Adjust dialog. A zoom trace (one of Z1 to Z4) will be created of the selected channel in a separate grid.</p>
	<p>3. To vary the degree of zoom, touch the newly created Zx trace label. The setup dialog for the zoom trace opens. It shows the current horizontal and vertical zoom factors.</p>
	<p>4. If you want to increase or decrease your horizontal or vertical zoom in small increments, touch the Var. checkbox to enable variable zooming. Now with each touch of the zoom control buttons, the degree of magnification will change by a small increment.</p> <p>To zoom in or out in large standard increments with each touch of the zoom control buttons, leave the Var. checkbox unchecked. To set exact horizontal or vertical zoom factors, touch inside the Horizontal Scale/div field and enter a time-per-div value, using the pop-up numeric keypad. Then touch inside the Vertical Scale/div field and enter a value.</p>
	<p>5. To reset the zoom to x1 magnification, touch Reset Zoom in the dialog. To turn off the zoom trace, touch the QuickZoom button or uncheck the Trace On checkbox.</p>

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To Zoom by Touch-and-Drag

	<ol style="list-style-type: none">1. Touch and drag a rectangle around any part of an input channel waveform, math trace, or memory trace, or any combination of these. If all traces are channel traces, zooms designated Z1 to Z4 appear in a separate grid automatically.
	<ol style="list-style-type: none">2. If the traces are non-channel, or a combination of channel traces and math or memory traces, a Rectangle Zoom Wizard appears. Select the traces to be zoomed, then touch Zoom All Selected. Channel zooms will appear in a separate grid. The zoom of the math or memory trace will appear on the same grid as the source trace.
	<ol style="list-style-type: none">3. Turn the front panel zoom POSITION knobs to adjust the vertical and horizontal position of the zoom. Turn the front panel Zoom knobs to control the vertical and horizontal magnification factor of the zoom.

To Turn Off Zoom

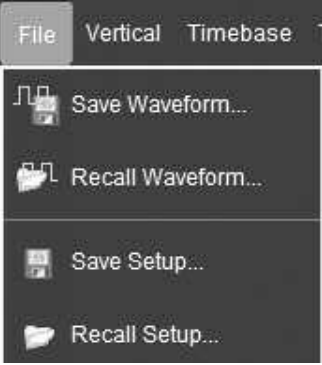
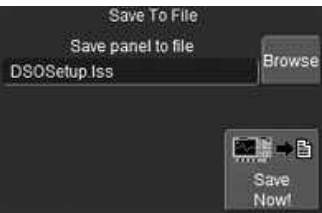

1. Touch the trace label for the zoom you want to turn off.
2. Touch the **Trace On** checkbox to delete the check mark and disable the zoom trace.

SAVE AND RECALL

Saving and Recalling Scope Settings

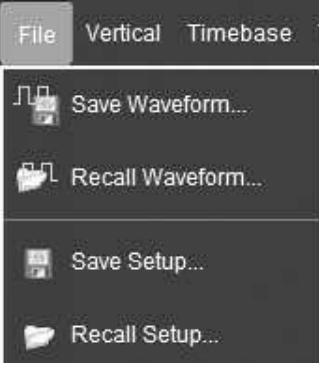


You can save or recall scope settings to or from hard disk, floppy disk, or LAN location.

To Save Scope Settings

	<ol style="list-style-type: none">1. In the menu bar, touch File; then touch Save Setup... in the drop-down menu. Or, press the Save/Recall front panel button, then touch the "Save Setup" tab.
	<ol style="list-style-type: none">2. To Save To File, touch inside the Save panel to file field and enter the path to the destination folder. Or touch Browse to navigate to the destination folder. Then touch Save Now.
	<ol style="list-style-type: none">3. To save to folder Internal Setup on the scope's hard drive, touch inside a SetupX field and use the pop-up keyboard to enter a file name. Touch Save alongside the field. The file is deposited in D:\Internal Setup, and the current date is displayed above the field.

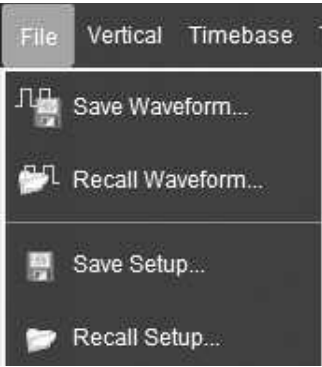

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To Recall Scope Settings

	<p>1. In the menu bar, touch File; then touch Recall Setup... in the drop-down menu.</p>
	<p>2. To Recall From File, touch inside the Recall panels from file field and use the pop-up keyboard to enter the path to the source folder. Or touch Browse to navigate to the source folder. Then touch Recall Now.</p>
	<p>3. To recall settings from folder D:\ Internal Setups on the scope's hard drive, touch Recall alongside the file you want to recall.</p>

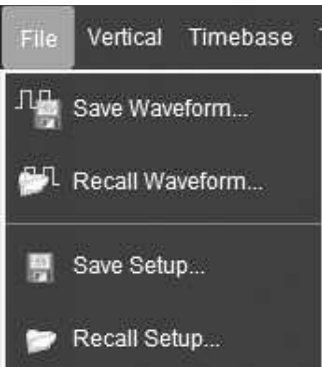
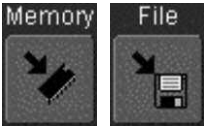
Getting Started Manual

To Recall Default Settings


 <p>The screenshot shows a menu bar with 'File', 'Vertical', and 'Timebase'. The 'File' menu is open, displaying options: 'Save Waveform...', 'Recall Waveform...', 'Save Setup...', and 'Recall Setup...'.</p>	<ol style="list-style-type: none">1. In the menu bar, touch File; then touch Recall Setup... in the drop-down menu.
 <p>The screenshot shows a button with a right-pointing arrow and a waveform icon, labeled 'Recall Default'.</p>	<ol style="list-style-type: none">2. Touch the button under Recall Default.

Saving and Recalling Waveforms

To Save Waveforms

 <p>The screenshot shows a menu bar with 'File', 'Vertical', and 'Timebase'. The 'File' menu is open, displaying options: 'Save Waveform...', 'Recall Waveform...', 'Save Setup...', and 'Recall Setup...'.</p>	<ol style="list-style-type: none">1. In the menu bar, touch File; then touch Save Waveform... in the drop-down menu.
 <p>The screenshot shows two buttons side-by-side. The left button is labeled 'Memory' and has a right-pointing arrow and a memory chip icon. The right button is labeled 'File' and has a right-pointing arrow and a floppy disk icon.</p>	<ol style="list-style-type: none">2. In the "Save Waveform" dialog, touch the Save To Memory or File button.

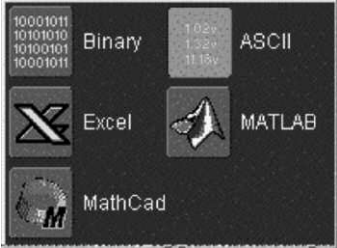

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	<ol style="list-style-type: none"> 3. Touch inside the Source field and select a source from the pop-up menu. The source can be any trace; for example, a channel (C1C4), math function (F1F4), or a waveform stored in non-volatile RAM (M1M4). 4. Touch inside the Trace Title field if you want to change the default name of your waveforms. Use the pop-up keyboard to type in the new name. <p>Note: You can change the name but not the sequence number.</p>
-----------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------




CAUTION

If you use a name that ends in a number instead of a letter, the instrument may truncate the number. This is because, by design, the first waveform is automatically numbered 0, the second 1, etc. For example, if you want to use waveform name “XYZ32” but it is not preceded by waveforms XYZ0 through XYZ31, the waveform will be renumbered with the next available number in the sequence. If you need to use a number in your waveform’s name, it is recommended that you append an alpha character at the end of the number: “XYZ32a” for example.

	<ol style="list-style-type: none"> 5. If you are saving to file, touch the Data Format field and select a format type from the pop-up menu. If you select ASCII or Excel, also touch the SubFormat field and select either Time Data or Time & Ampl. Then touch the Delimiter field and select a delimiter character from the pop-up menu: comma, space, semicolon, or tab.
	<ol style="list-style-type: none"> 6. Touch the Browse button for the Save file in directory field and browse to the location where you want the file saved. The file name is assigned automatically and is shown below the field.

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 A dark grey button with a white waveform icon and a right-pointing arrow above the text "Save Now!".	7. Touch Save Now .
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------

Auto Save

You can also enable Auto Save from this dialog by touching one of the Auto Save buttons:



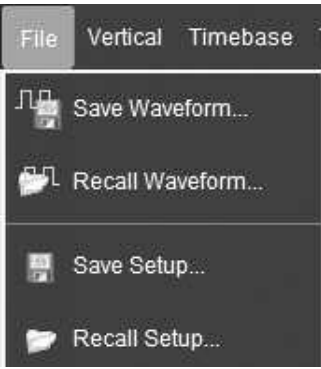

Wrap (old files overwritten) or **Fill** (no files overwritten).




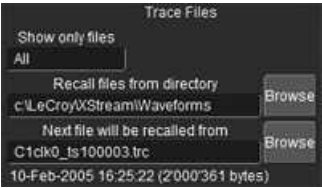

CAUTION

If you select **Fill**, you can quickly use up all disk space on your hard disk.

To Recall Waveforms

 A screenshot of the "File" menu. The menu bar shows "File", "Vertical", and "Timebase". The "File" menu is open, showing options: "Save Waveform...", "Recall Waveform...", "Save Setup...", and "Recall Setup...".	1. In the menu bar, touch File ; then touch Recall Waveform... in the drop-down menu.
 Two buttons side-by-side. The left one is labeled "Memory" and has a memory chip icon with an arrow pointing to it. The right one is labeled "File" and has a floppy disk icon with an arrow pointing to it.	2. In the "Recall Waveform" dialog, touch the Recall From or button.

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	<p>3. If you selected Memory, touch inside the Source field and select a memory location: M1 to M4.</p>
	<p>4. If you selected File, touch inside the Destination field and select a memory location in which to store the file.</p> <p>A. Touch inside the Show only files field and select an area to limit the search to: channels, math functions, or memory.</p> <p>B. Touch inside the Recall files from directory field and enter the path, using the pop-up keyboard. Or touch the Browse button to navigate to the file.</p> <p>C. Touch inside the Next file will be recalled from field and enter the path, using the pop-up keyboard. Or touch the Browse button to navigate to the file.</p>
	<p>5. Touch Recall Now.</p>

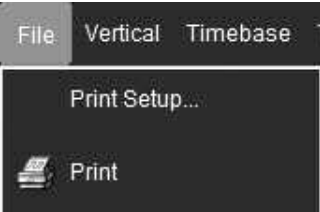

Getting Started Manual

PRINTING AND FILE MANAGEMENT

The instrument gives you the ability to output files to a printer or plotter, to print to file, or to e-mail your files. Any Windows 2000 supported printer is supported by your instrument.

Printing

To Set Up the Printer

	1. In the menu bar, touch File , then Print Setup... in the drop-down menu. The Utilities Hardcopy dialog opens.
	2. In the dialog area, touch the Printer icon.



3. Under **Colors**, touch the **Use Print Colors** checkbox if you want the traces printed on a white background. A white background saves printer toner. (You can change the printer colors in the Preference dialog.)
4. Touch inside the **Select Printer** field. From the touch pad pop-up choose the printer you want to print to. Touch the **Properties** button to see your printer setup.
5. Touch the icon for the layout **Orientation** you want: portrait or landscape.
6. Touch the **Grid Area Only** checkbox if you do not need to print the dialog area and you only want to show the waveforms and grids.

To Print

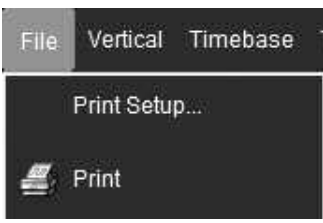



You can print in one of three ways:

- Press the printer button on the front panel.
- In the menu bar, touch **File**, then **Print** in the drop-down menu.
- Touch the **Print** button in the "Hardcopy" dialog.

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Adding Printers and Drivers

Note: If you want to add a printer driver, the driver must first be loaded on the scope.

	<ol style="list-style-type: none">1. In the menu bar, touch File, then Print Setup... in the drop-down menu. The Utilities Hardcopy dialog opens.
	<ol style="list-style-type: none">2. In the Hardcopy dialog, touch the Printer icon, then the Add Printer button.
	<ol style="list-style-type: none">3. Touch Add a printer in the Printers and Faxes window.
	<ol style="list-style-type: none">4. Follow the instructions displayed in the Add Printer Wizard.

Changing the Default Printer

1. If you want to change the default printer, minimize the instrument application by touching **File** in the menu bar, then **Minimize** in the drop-down menu.
2. Touch the **Start** button in the task bar at the bottom of the screen.
3. Select **Controls**, then **Printers and Faxes**.
4. Touch the printer you want to set as the default printer, then touch **File, Set as Default Printer**.

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Managing Files

Use the instrument's utilities to create waveform files on optional floppy disk, internal hard drive, or network drives.

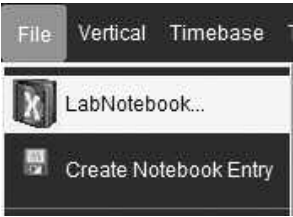


Hard Disk Partitions

The instrument's hard disk is partitioned into drive **C:** and drive **D:**. Drive C: contains the Windows operating system and the instrument application software. Drive D: is intended for data files.

DOCUMENTING YOUR WORK

The WaveRunner Xi LabNotebook feature simplifies the way waveforms, screen captures, and oscilloscope setup files are saved and documented. LabNotebook also provides an easy way to recall your settings with the Flashback feature. And it lets you create reports, showing your screen images, in pdf, html, or rtf output formats.






Creating a LabNotebook Entry

	<p>LabNotebook entries are easily created by selecting LabNotebook from the File menu, then clicking the Create button.</p>
	<p> Several annotation tools and colors are then put at your disposal to mark up your waveform. When you click Done, your mark-ups and scope settings are saved together in a database resident on the scope.</p> <p>Click the Create Report button to generate a hardcopy format that you can save to a network drive or external media. Or click the E-mail button to send the report to another location. Use the Flashback feature at any time to recall a Notebook entry, including scope setup, for further study.</p>

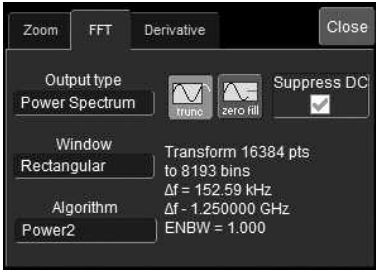


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WAVEFORM MATH

FFT Setup

	<p>1. In the menu bar touch Math, then Math Setup... in the drop-down menu.</p>
	<p>2. Touch a Math function trace button in the Math dialog: F1 through Fx. Select FFT from the pop-up menu.</p>
	<p>3. Touch the Single or Dual (function of a function) button if the FFT is to be of the result of another math operation.</p>
	<p>4. Touch inside the Source1 field and select a channel, memory, or math trace on which to perform the FFT. Touch inside the Operator1 field: Select FFT from the pop-up menu if you selected Single function.</p>
	<p>5. Select another math function from Operator1 if you selected Dual function. Then touch inside the Operator2 field and select FFT from the pop-up menu.</p>


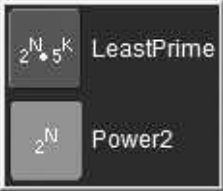
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	<p>6. Touch the FFT tab in the right-hand dialog.</p> <p>7. In the right-hand dialog, touch the FFT tab. Choose whether to Truncate¹ or Zero-fill² the trace display.</p> 
	<p>8. Touch the Suppress DC checkbox if you want to make the DC bin go to zero. Otherwise, leave it unchecked.</p> <p>9. Touch inside the Output type field, and make a selection from the pop-up menu.</p>

¹ When the FFT transform size does not match the record length, you can truncate the record and perform an FFT on the shorter record. This will increase the resolution bandwidth.

² Zero-fill is useful when the source data for the FFT comes from a math operation that shortens the record. This is commonly encountered in filtering operations like enhanced resolution. The missing data points are replaced by data values, whose amplitudes are interpolated to fit between the last data point and the first data point in the record. This guarantees that there is not a first-order discontinuity in the filled data. Since the data at the end of the record is “filled” data, it is advisable to select a weighting window other than rectangular to minimize the effect of the fill on the resulting spectrum.

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	10. Touch inside the Window field; select a window type.
	11. Touch inside the Algorithm field and select either Least Prime ¹ or Power2 ² from the pop-up menu.

¹ The default algorithm is a least primes algorithm that computes FFTs on transform sizes having lengths that can be expressed as factors of $2^N \cdot 5^K$. This is very compatible with the record lengths encountered in the oscilloscope, which are often multiples of 1, 2, 4, 5, or 10. or Power of 2 The other choice is a power of two algorithm where the record lengths are in the form of 2^N . The power of 2 algorithm generally runs faster than the least primes algorithm. The price that is paid is a record length that is not the same as the acquired signal. The power-of-two FFT uses the first 2^N points of the record. For example, if you acquire 500 points in your trace, the power-of-two FFT would only use the first 256 points.

² The other choice is a power of two algorithm where the record lengths are in the form of $2N$. The power of 2 algorithm generally runs faster than the least primes algorithm. The price that is paid is a record length that is not the same as the acquired signal. The power-of-two FFT uses the first $2N$ points of the record. For example, if you acquire 500 points in your trace, the power-of-two FFT would only use the first 256 points.

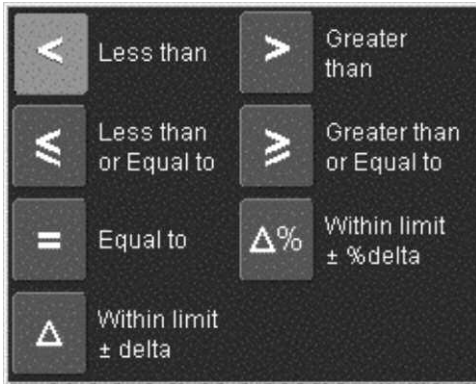
PASS/FAIL TESTING

Comparing Parameters



Each Pass/Fail input (**Qx**) can compare a different parameter result to a user-defined limit (or statistical range) under a different condition.

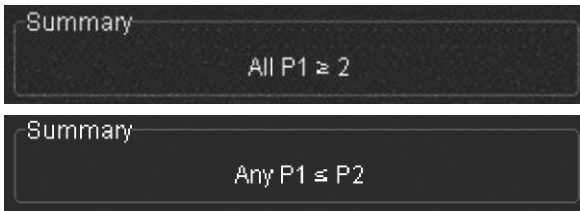
The conditions are represented by these comparison operators:



At the touch of a button, test results can also be compared to these standard statistical limits:

- current mean
- mean + 1 SD
- mean + 3 SD

In Dual Parameter Compare mode, your X-Stream scope gives you the option to compare to each other parameter results measured on two different waveforms. You can set your test to be true if Any waveform or All waveforms fit the criterion stipulated by the comparison condition. Your setup is conveniently shown in the Summary box of the **Qx** dialog. For example:



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Mask Tests



You have the choice to do mask testing by using an existing mask, or by using a mask created from your actual waveform, with vertical and horizontal tolerances that you define. Existing masks can be loaded from a floppy disk or from a network.

You can set your mask test to be True for waveforms All In, All Out, Any In, or Any Out. For example, if you select All In, the test will be False if even a single waveform falls outside the mask.

Masks that you create from your waveform can be confined to just a portion of the trace by use of a measure gate. (See Measure Gate for an explanation of how this feature works.)

Actions

By touching the **Stop Test** checkbox in the “Actions” dialog, you can set up the test to end after a predetermined number of sweeps that you decide. You can also decide the actions to occur upon your waveforms’ passing or failing, by selecting one or all of the following:



Save	Saves the waveform to the location that you specify.
Stop	Stops the test.
Alarm	Emits a beep.
Pulse	Emits a variable width and amplitude pulse.
Hardcopy	Prints an image of the display, saves it to file, or sends an e-mail.

The selection Pulse causes a pulse to be output through the Aux Out connector at the front of the scope. This pulse can be used to trigger another scope. You can set the amplitude and width of the pulse as described in “Auxiliary Output Signals” under Utilities.

Depending on your scope model, you can configure up to 8 pass/fail conditions. The Boolean conditions to determine if your waveform passes are as follows:

All True	All False
Any True	Any False
All Q1 to Q4 Or All Q5 to Q8	Any Q1 to Q4 And Any Q5 to Q8

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Setting Up Pass/Fail Testing

Initial Setup



1. Touch **Analysis** in the menu bar, then **Pass/Fail Setup...** in the drop-down menu.



2. Touch the Actions tab.
3. Touch the Enable Actions checkbox. This will cause the actions that you will select to occur upon your waveform's passing or failing a test.
4. Touch the Summary View to enable a line of text that shows concisely the status of your last waveform and keeps a running count of how many sweeps have passed.

Last = True Passed 1 Of 1 sweeps ✓

5. Touch inside the Pass If field, and select a Boolean condition from the pop-up menu.
6. If you want to set up the test to end after a finite number of sweeps, touch the Stop Test checkbox. Then touch inside the After field and enter a value, using the pop-up numeric keypad.



7. Under "If", touch either the Pass or Fail button to set the actions to occur upon your waveform's passing or failing the test.

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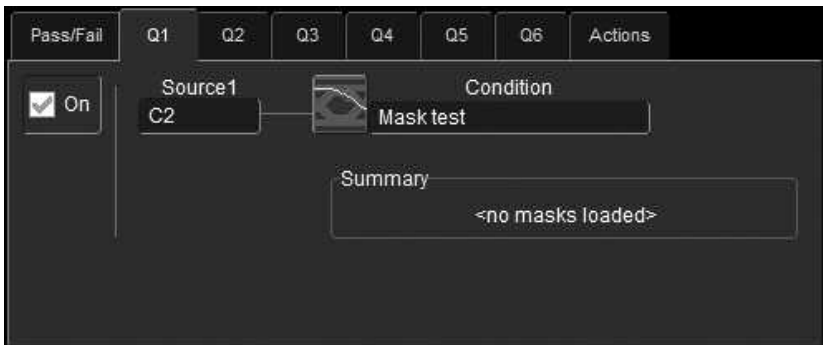
- Under "Then", touch the actions you want to occur: stop test, sound alarm, print result, emit pulse, or save the waveform. If you want to have the results printed and your scope is not equipped with a printer, be sure that it is connected to a local or network printer. See Printing.
- If you want to save your waveform automatically, touch the Save Setup. This will take you out of the current dialog and will open the "Save Waveform" dialog. See Saving and Recalling Waveforms.
- Test your Pass/Fail conditions by touching the Force Actions Once button. Press the Clear All button to quickly uncheck all checkboxes if you want to change your selections.

Comparing a Single Parameter



- Touch **Analysis** in the menu bar, then **Pass/Fail Setup...** in the drop-down menu.

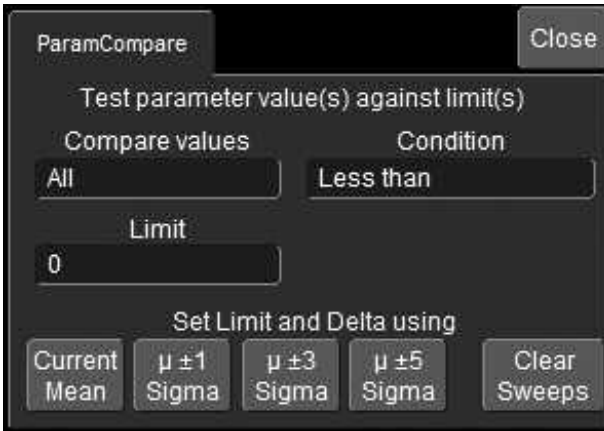
- Touch a **Qx** tab; a setup dialog for that position will open.



- Touch inside the **Source1** field and select a source from the pop-up menu.
- Touch inside the **Condition** field in the main dialog and select **ParamCompare**. A ParamCompare setup dialog opens to the right of the main dialog.



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5. Touch inside the **Compare Values** field and select **All** or **Any** from the pop-up menu.

By selecting **All**, the test will be true only if every waveform falls within the limit that you will set. By selecting **Any**, the test will be true if just one waveform falls within the limit.

6. Touch inside the **Condition** field in the “ParamCompare” mini-dialog and select a math operator from the pop-up menu.



7. Touch inside the Limit field and enter a value, using the pop-up numeric keypad. This value takes the dimensions of the parameter that you are testing. For example, if you are testing a time parameter, the unit is seconds. If you chose either **WithinDeltaPct** or **WithinDeltaAbs** from the **Condition** menu, you also have the choice of setting the limit by means of the statistical buttons at the bottom of the “ParamCompare” dialog:



Comparing Dual Parameters



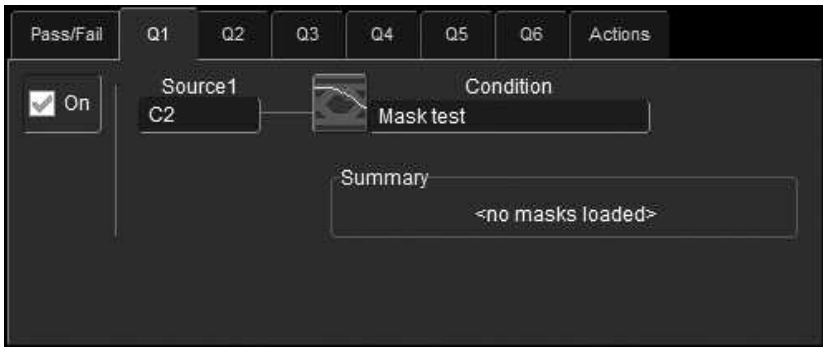
To set up Dual Parameters, follow the steps under “Comparing a Single Parameter” above, except you will select the **Dual Param Compare** condition.

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Setting Up Mask Testing



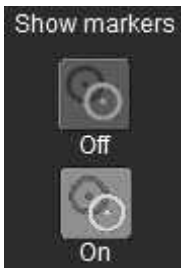
1. Touch **Analysis** in the menu bar, then **Pass/Fail Setup...** in the drop-down menu.



2. Touch a **Qx** tab; a setup dialog for that position will open.
3. Touch inside the Source1 field and select a source from the pop-up menu.



4. Touch inside the **Condition** field in the main dialog and select **Mask Test**.



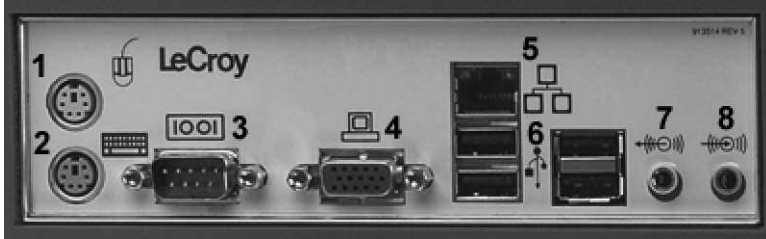
- From the “Test” mini-dialog, make a selection in the **Test is True when** group of buttons.
This selection means, for example, that if you select **All In** the test will be False if even a single waveform falls outside the mask.
- From **Show Markers**, choose whether or not to have mask violations displayed.
- If you are loading a pre-existing mask, touch the **Load Mask** tab, then the **File** button. You can then enter the file name or browse to its location.
- If you want to make a mask from your waveform, touch the **Make Mask** tab.
- Touch inside the **Ver Delta** and **Hor Delta** fields and enter boundary values, using the pop-up numeric keypad.
- Touch the **Browse** button to create a file name and location for the mask if you want to save it.
- Touch the **Gate** tab, then enter values in the **Start** and **Stop** fields to constrain the mask to a portion of the waveform. Or, you can simply touch and drag the Gate posts, which initially are placed at the extreme left and right ends of the grid.

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REMOTE CONTROL OPERATION

Refer to the *Remote Control Manual* supplied on CD with your scope for more information.

You can fully control your instrument remotely by using either the optional GPIB (General Purpose Interface Bus) port or the LAN communication port on the scope's rear panel, shown below (8). The only actions for which you must use the front panel controls are the powering up of the scope and the setting of remote control addresses.



Waverunner Xi back panel, including the LAN port (5) used for remote control.

Standards

LeCroy remote control commands conform to the GPIB IEEE 488.2¹ standard. This may be considered an extension of the IEEE 488.1 standard, which deals mainly with electrical and mechanical issues.

Program Messages

You control the oscilloscope remotely using program messages that consist of one or more commands or queries. The program messages you send from the external controller to the WaveMaster oscilloscope must conform to precise format structures. The oscilloscope will execute all program messages sent in the correct form, but will ignore those with errors.

¹ANSI/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*

AUTOMATION

Refer to the *Automation Manual* supplied on CD with your oscilloscope for more information.

In addition to supporting the familiar ASCII-based remote commands that have been used to control all LeCroy scopes for many years, all of the Windows-based "X-Stream" instruments fully support control by Automation interfaces based on Microsoft's Component Object Model (COM). Using COM, the controlling application can run directly on the instrument without requiring an external controller; or, alternatively, it can run using Microsoft's distributed COM standard (DCOM) on a networked computer.

Standards

Automation is a Microsoft technology, formerly referred to as "OLE Automation," that has primarily been used to enable cross-application macro programming. It is based upon the Component Object Model (COM), which is similar in nature to CORBA, more commonly found in the UNIX world.

An application that "exposes Automation Objects" is referred to as an "Automation Server." Automation Objects expose "Automation Interfaces" to the controlling "Automation Client." This manual describes these Automation objects and interfaces in detail.

It is important to note that Automation itself is not language dependent; it can be used from any programming language that supports COM. LeCroy's usage, however, concentrates mainly on the use of Automation from the Visual Basic Script (VBScript) language for several reasons, including the fact that it is one of the easiest to use. Also, it is the language that X-Stream instruments use for setup files. In addition, the VBScript interpreter is installed by default on all X-Stream instruments and, therefore, is available without your having to purchase any additional software.

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UTILITIES

Status

The status read-only dialog displays system information including serial number, firmware version, and installed software and hardware options.

To Access Status Dialog

1. In the menu bar, touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Status** tab.

Remote Communication

The Remote dialog is where you can select a network communication protocol, establish network connections, and configure the Remote Control Assistant log. The choice of communication protocols is limited to TCPIP and GPIB.

Note: GPIB is an option and requires a GPIB card to be installed in a card slot at the rear of the scope.

Note: The instrument uses Dynamic Host Configuration Protocol (DHCP) as its addressing protocol. Therefore, it is not necessary to set up an IP address if your network supports DHCP. If it does not, you can assign a static address in the standard Windows 2000 network setup menu.

The Remote Control Assistant monitors communication between your PC and scope when you are operating the instrument remotely. You can log all events, or errors only. This log can be invaluable when you are creating and debugging remote control applications.

To Set Up Remote Communication

If you are connecting the scope to a network, first contact your Information Systems administrator. If you are connecting the scope directly to your PC, connect a GPIB or Ethernet cable between them.



1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Remote** tab.
3. Make a **Port** selection: **TCPIP** (transmission control protocol/Internet protocol) or **GPIB** (general purpose interface bus). If you do not have a GPIB card installed, the GPIB selection will not be accessible.

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4. If you are using GPIB, set a GPIB address by touching inside the **GPIB Address** field and entering an address.
5. Touch the **Net Connections** button; the Windows **Network Connections** window appears.
6. Touch **Create a new connection** and use the Windows Network Connection Wizard to make a new connection; or, touch Local Area Connection to reconfigure the scope's connection if it is already connected to the network.

To Configure the Remote Control Assistant Event Log

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Remote** tab.
3. Touch inside the **Log Mode** field and select **Off, Errors Only**, or **Full Dialog** from the pop-up menu.
4. To export the contents of the event log to an ASCII text file, touch the **Show Remote Control Log** button: the "Event Logs" popup window appears. Touch inside the **DestFilename** field and enter a file name. Then touch the **Export to Text File** button.

Hardcopy

Printing



Refer to Printing under "File Management" (page 69).

Clipboard



This selection prints to the clipboard so you can paste a file into another application (like MS Word, for example).

To Print from the Clipboard

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Hardcopy** tab.
3. Under **Colors**, touch the **Use Print Colors** checkbox if you want the traces printed on a white background. A white background saves printer toner.
4. Touch the **Grid Area Only** checkbox if you do not need to print the dialog area and you only want to show the waveforms and grids.
5. Touch the **Print Now** button.

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File



Choose **File** if you want to output the screen image to storage media such as floppy drive or hard drive. When outputting to floppy disk, be sure to use a preformatted disk.

To Print to File

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Hardcopy** tab, then the **File** icon.
3. Touch inside the **File Format** field and select a graphic file format from the pop-up menu.
4. Under **Colors**, touch the **Use Print Colors** checkbox if you want the traces printed on a white background. A white background saves printer toner.
5. Touch inside the **Directory** field and type the path to the folder you want to print to, using the pop-up keyboard. Or touch the **Browse** button and navigate to the folder.
6. Touch inside the **File Name** field and enter a name for the display image, using the pop-up keyboard.
7. Touch the **Grid Area Only** checkbox if you do not need to print the dialog area and you only want to show the waveforms and grids.
8. Touch the **Print Now** button.

E-Mail









The instrument also gives you the option to e-mail your screen images, using either the MAPI or SMTP protocols. Before you output to e-mail from the Utilities dialog, you first have to set up the e-mail server and recipient address in **Preference Setup**.

To Send E-mail

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Hardcopy** tab, then the **E-mail** button.
3. Touch inside the **File Format** field and select a graphic file format from the pop-up menu.
4. Under **Colors**, touch the **Use Print Colors** checkbox if you want the traces printed on a white background. A white background saves printer toner.
5. Touch the **Prompt for message to send with mail** checkbox if you want to include remarks with the image.
6. Touch the **Grid Area Only** checkbox if you do not need to print the dialog area and you only want to show the waveforms and grids.
7. Touch the **Print Now** button.

Aux Output

In addition to a calibration signal, the following signals can be output through the AUX OUTPUT connector:

	Square Wave
	Trigger Out – can be used to trigger another scope.
	DC Level – a reference level.
	Trigger Enabled – can be used as a gating function to trigger another instrument when the scope is ready.
	Pass/Fail – allows you to set a pulse duration from 1 ms to 500 ms; generates a pulse when pass/fail testing is active and conditions are met.
	Aux Output Off – turns off the auxiliary output signal.

To Set Up Auxiliary Output

1. In the menu bar, touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Aux Output** tab.
3. If you simply want a 1 kHz, 1 V square wave, touch the button so labeled.
4. If you want a specialized output, touch one of the buttons under **Use Auxiliary Output For**.
5. Touch inside the **Amplitude** field and enter a value, using the pop-up numeric keypad. If you want a TTL level signal, touch the **TTL Level** checkbox. The **Amplitude** field will accordingly become unavailable.
6. If you selected Square Wave, touch inside the **Frequency** field and enter a value, using the pop-up keypad. You can set a value from 5.0 Hz to 5 MHz.
7. If you selected Pass/Fail, touch inside the **Pulse Duration** field and enter a value from 1 ms to 500 ms, using the pop-up numeric keypad.

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Date & Time

The instrument gives you the choice of manually setting the time and date or getting it from the Internet. If you elect to get the time and date from the Internet, you need to have the scope connected to the Internet through the LAN connector on the rear panel. You can also set time zones and daylight savings time.

To Set Time and Date Manually

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Date/Time** tab.
3. Touch inside each of the **Hour**, **Minute**, **Second**, **Day**, **Month**, and **Year** fields and enter a value, using the pop-up numeric keypad.
4. Touch the **Validate Changes** button.

To Set Time and Date from the Internet

The Simple Network Time Protocol (SNTP) is used.

1. Ensure that the scope is connected to the Internet through the LAN connector at the rear of the scope.
2. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
3. Touch the **Date/Time** tab.
4. Touch the **Set from Internet** button.

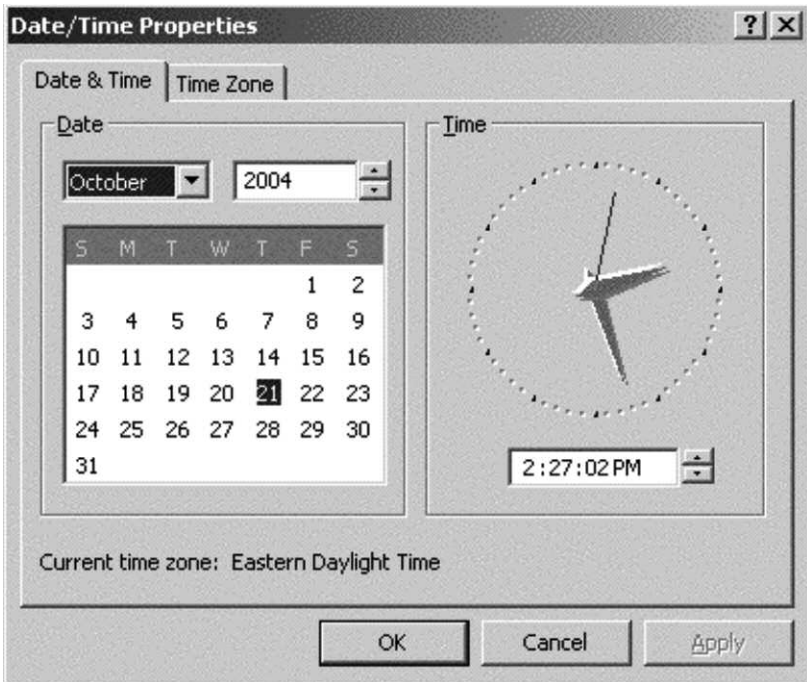
To Set Time and Date from Windows

1. In the menu bar touch **Utilities**, then **Utilities Setup...** in the drop-down menu.
2. Touch the **Date/Time** tab.
3. Touch the **Windows Date/Time** button:



4. Use the **Time & Date Properties** window to configure the time, including time zone.

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Options

Use this dialog to add or remove software options. For information about software options, contact your local LeCroy Sales and Service office, or visit our Web site at www.lecroy.com/options.

Options that you purchase, such as JTA2, add performance to your instrument. This added performance is seen in the new math functions or parameters that you can choose from when doing Measure or Math setups.

Service



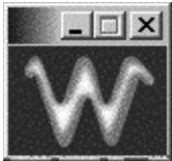
This button provides access to service dialogs, which are for the sole use of LeCroy service personnel. A security code is required to gain access.

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Show Windows Desktop



Touching the **Show Windows Desktop** button in the main “Utilities” dialog minimizes the instrument application to reveal the underlying desktop. To maximize the application, touch the shortcut icon.



Touch Screen Calibration



Touching the **Touch-Screen Calibration** button starts the calibration procedure. During the procedure, you will be prompted to touch the center of a small cross in 5 key locations on the touch screen.

Because sufficient accuracy cannot be achieved using your finger, use a stylus instead for this procedure. The calibration has a ten-second timeout in case no cross is touched.

To avoid parallax errors, be sure to place your line of sight directly in front of each cross before touching it.

Built-in Stylus Holder

Your WaveRunner Xi is supplied with a touch screen stylus. Use the stylus for more precise touch screen operation. There is also a built-in stylus holder at lower-right of the front panel.



Preferences

Audible Feedback

You can elect to have audible confirmation each time you touch a screen or front panel control.

1. In the menu bar touch **Utilities**; then touch **Preferences** in the drop-down menu.
2. Touch the “Audible Feedback” **Enable** checkbox so that the scope emits a beep with each touch of the screen or front panel control.

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Auto-calibration

You can choose to have your instrument automatically recalibrate itself whenever there is a significant change in ambient temperature. If you do not enable this option, the scope will only recalibrate at startup and whenever you make a change to certain operating conditions.

1. In the menu bar touch **Utilities**; then touch **Preferences** in the drop-down menu.
2. Touch the "Automatic Calibration" **Enable** checkbox.

Language Selection

You can choose to display screen control names in a language other than English by touching inside the "Language" field and making a selection from the pop-up menu. This change takes effect immediately with requiring a reboot of the scope.

Performance Optimization

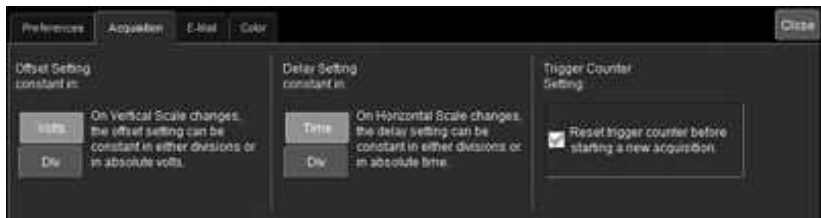
You can set up the scope to optimize either calculating speed or display speed. If the display update rate is of primary concern to you, optimize for Display. If acquisition and analysis are more important, optimize for analysis. Optimizing for analysis can be useful when persistence or averaging is used, giving higher priority to waveform acquisition at the expense of display update rate.

The choices are presented as a spectrum with highest values at the extremes:



1. In the menu bar touch **Utilities**; then touch **Preferences** in the drop-down menu.
2. Touch one of the optimization icons.

Acquisition



Offset Control

As you change the gain, this control allows you to either keep the vertical offset level indicator stationary (when **Div** is selected) or to have it move with the actual voltage level (when **Volts** is selected).

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The advantage of selecting **Div** is that the waveform will remain on the grid as you increase the gain; whereas, if **Volts** is selected, the waveform could move off the grid.

Note: Regardless of whether you select Volts or Div, the “Offset” shown in the channel setup dialog always indicates volts. However, when Div is selected for the Offset Control, the offset in volts is scaled proportional to the change in gain, thereby keeping the division on the grid constant.

1. In the menu bar touch **Utilities**; then touch **Preferences** in the drop-down menu.
2. Touch the **Acquisition** tab.
3. Under **Offset Setting constant in:**, touch either the **Div** or **Volts** button.

Delay Control

As you change the timebase, this control allows you to either keep the horizontal offset indicator stationary (when **Div** is selected) or to have it move with the trigger point (when **Time** is selected). The advantage of selecting **Div** is that the trigger point will remain on the grid as you increase the timebase; whereas, if **Time** is selected, the trigger point could move off the grid.

Note: Regardless of whether you select Time or Div, the “Delay” shown in the timebase setup dialog always indicates time. However, when Div is selected for Delay In, the delay in time is scaled proportional to the change in timebase, thereby keeping the division on the grid constant.

1. In the menu bar touch **Utilities**; then touch **Preferences** in the drop-down menu.
2. Touch the **Acquisition** tab.
3. Touch the **Offset/Delay** tab.
4. Under **Offset Setting constant in:**, touch either the **Volts** or **Div** button.
5. Under **Delay Setting constant in:**, touch either the **Time** or **Div** button.



Trigger Counter

Checking the **Reset trigger counter before starting a new acquisition** checkbox clears the trigger counter each time the scope issues an arm acquisition command. This applies when you have set a trigger Holdoff condition in the Trigger dialog in either time or events:

The default condition of this control is off (unchecked).

E-mail

Before you can send e-mail from the scope, it must first be configured.

- In the menu bar touch **Utilities**, then **Preference Setup...** in the drop-down menu.
- Touch the **E-mail** tab.
- Choose an e-mail server protocol: **MAPI** (Messaging Application Programming Interface) is the Microsoft interface specification that allows different messaging and workgroup applications (including e-mail, voice mail, and fax) to work through a single client, such as the Exchange client included with Windows 95 and Windows NT. MAPI uses the default Windows e-mail application (usually Outlook Express). **SMTP** (Simple Mail Transfer Protocol) is a TCP/IP protocol for sending messages from one computer to another through a network. This protocol is used on the Internet to route e-mail. In many cases no account is needed.
- If you chose MAPI, touch inside the **Originator Address (From:)** field and use the pop-up keyboard to type in the instrument's e-mail address. Then touch inside the **Default Recipient Address (To:)** field and use the pop-up keyboard to enter the recipient's e-mail address.
- If you chose SMTP, touch inside the **SMTP Server** field and use the pop-up keyboard to enter the name of your server. Touch inside the **Originator Address (From:)** field and use the pop-up keyboard to type in the instrument's e-mail address. Then touch inside the **Default Recipient Address (To:)** field and use the pop-up keyboard to enter the recipient's e-mail address.
- You can send a test e-mail text message by touching the **Send Test Mail** button. The test message reads "Test mail from [name of scope's e-mail address]."

Acquisition Status

For each general category of scope operation, you can view a summary of your setups. These dialogs are not accessible through the Utilities menu, but are instead accessed from the menu bar drop-down menus. The categories are as follows:

- Vertical – select **Channels Status . . .** from drop-down menu
- Timebase – select **Acquisition Status . . .** from drop-down menu
- Trigger – select **Acquisition Status . . .** from drop-down menu
- Math – select **Math Status . . .** from drop-down menu

In addition to these dialogs, summaries are also provided for XY setups, memory (M1-M4) setups, and time stamps for sequence mode sampling.

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SYSTEM RECOVERY

Your WaveRunner Xi series oscilloscope was designed to operate very reliably for many years. However, the application software that operates the instrument runs on a Windows platform. The loading or incomplete removal of additional Windows applications may eventually cause problems in the stability of the operating system. In severe cases, it may be necessary to reload the base operating system and oscilloscope application. This can be done by using a recovery routine to restore a clean copy of the image originally installed on the C: drive. Any user data and calibration data located within the D: partition will not be affected by the recovery process.

LeCroy has provided a recovery application, along with a backup image, in an extra partition on the instrument's hard drive. The recovery process is easy to perform, using the instructions provided below.

After the recovery procedure is done, you must activate Windows, either by internet connection to Microsoft's Web site or by telephone. For this you will need to supply the Windows Product Key number, which is affixed to the bottom of the scope.

Note: The recovery process will produce a replica of the operating system and oscilloscope application software at the revision levels that were current when the oscilloscope was manufactured. Any later revisions of the application software, Windows operating system, and virus scan definition files will not be loaded automatically. After completion of the disk image recovery, it is highly recommended that you search the vendors' Web sites to upgrade the individual components to their current revision level. The current oscilloscope application software can be downloaded directly from the LeCroy Web site at www.lecroy.com.

Since the calibration data for the oscilloscope is stored in the D: drive, the current calibration constants will be preserved during the recovery process.

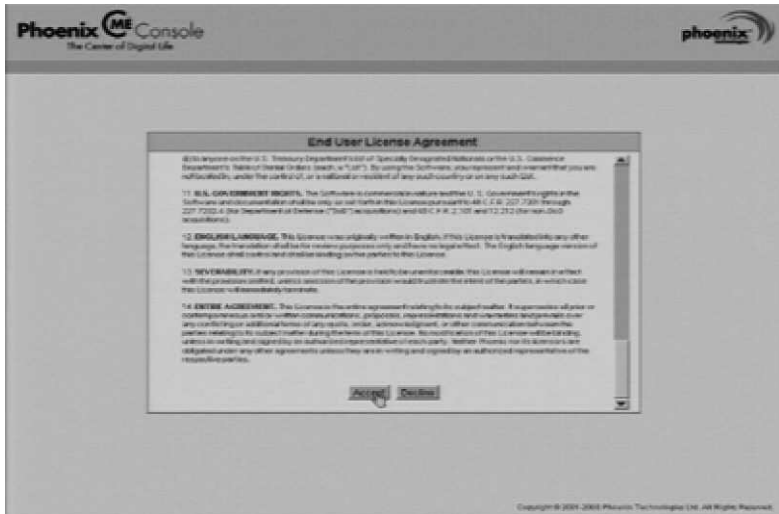
Recovery Procedure

1. Connect an network cable to the LAN port at the rear of the scope if you intend to activate windows through the internet.
2. Connect a keyboard and a mouse to the scope.
3. Apply power to the scope.
4. As soon as the LeCroy logo appears on the screen, press and hold down the **F4** key until the recovery software logo appears momentarily:



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5. Then the cME console End User License Agreement is displayed. Read the agreement, and click **Accept**:



6. The Phoenix cME Console main page is displayed. Click **Click here to start recover**:

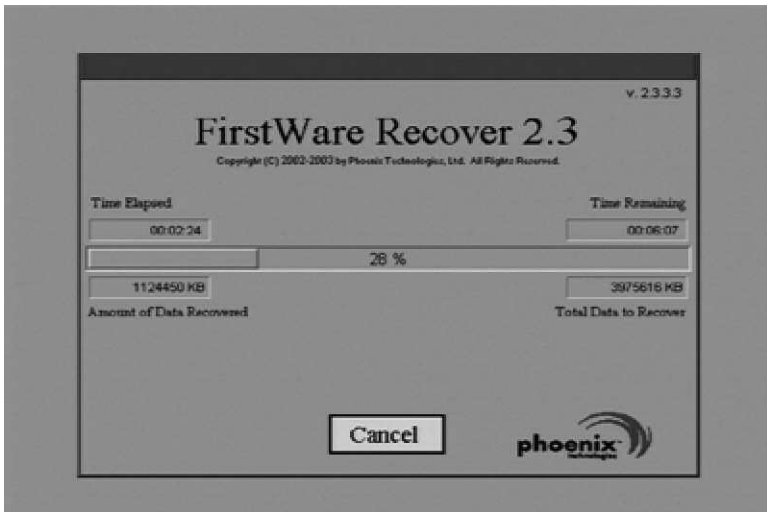


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7. The FirstWare Recover splash screen is displayed momentarily:



8. The recovery starts, and the FirstWare Progress screen is displayed. No further selections are required. The recovery takes about 10 minutes.



Note: The screen will blank on occasion for prolonged periods. This is normal and is not an indication of any malfunctioning of the recovery process.

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9. After the recovery is completed, the X-Stream software installer screen appears. Click **Next** to continue:



10. When the X-Stream installation is completed, reboot the scope.

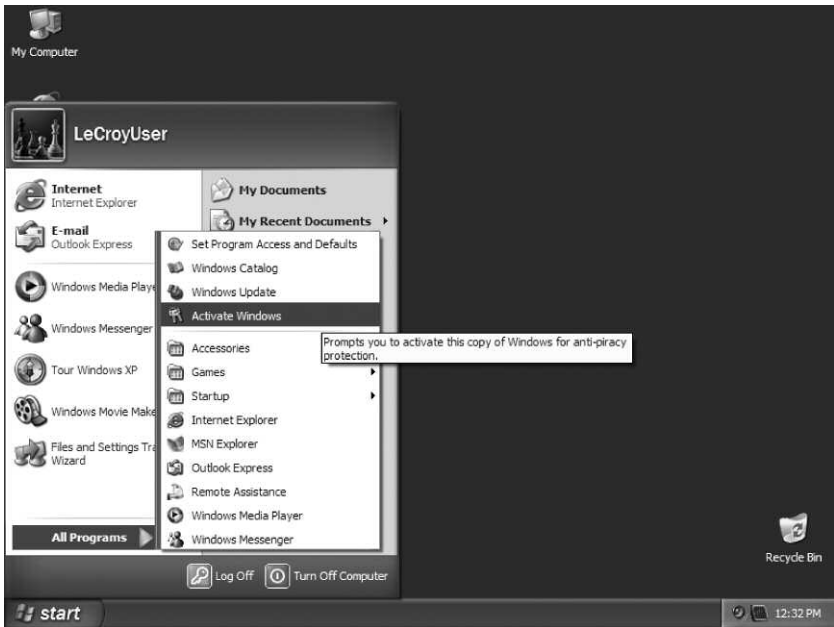
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Now you must activate Windows by internet connection to Microsoft's Web site or by telephone. For this you will need to supply the Windows Product Key number, which is affixed to the bottom of the scope.

Windows Activation

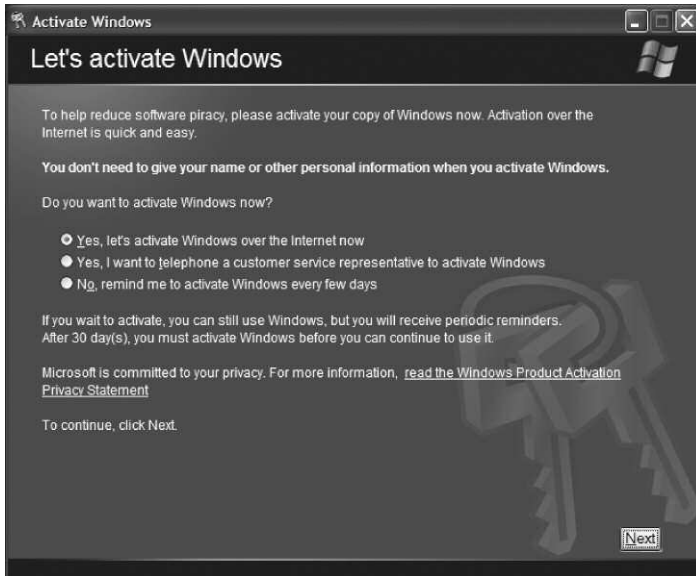
1. Click **Start** in the task bar, then select **All Programs** → **Activate Windows**.

Note: After Windows Activation is completed, this selection will no longer appear in the All Programs menu.



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2. Select an activation method: internet or phone. Then click **Next**.

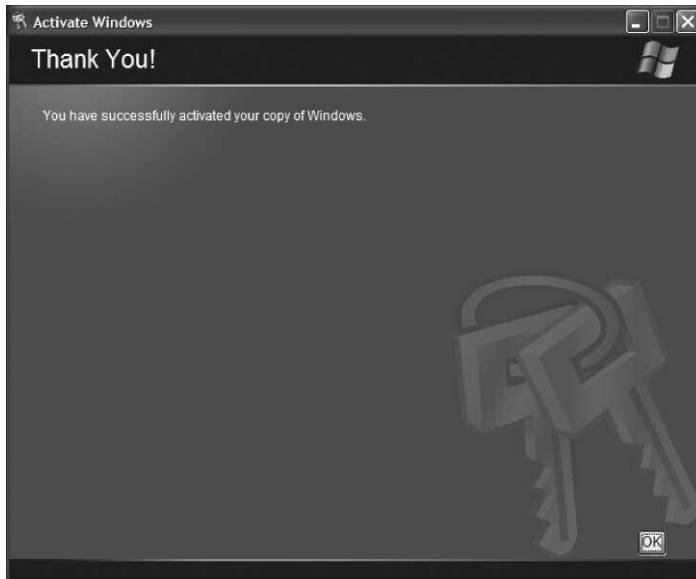


3. If you elected to activate by internet, enter the Activation ID (Product Key number on the bottom of the scope) number when prompted to do so, then click **Next**. Windows Activation will begin.
4. If you elected to activate by phone, select the country the scope is located in. Then dial the number provided. You will be asked to repeat over the phone the installation ID listed on the screen; then a 7-part number will be provided to you to enter in the empty boxes at the bottom of the screen. Click **Next** when you are done.

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5. When activation is completed, an acknowledgement screen will appear. Click **OK**.



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6. Check the revision levels of the X-Stream software, virus definitions, and Windows updates. Visit the vendors' Web sites and download all necessary updates.

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部件名称	有毒有害物质和元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁶⁺)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电缆组件	X	O	X	O	X	X
显示器	X	O	X	X	X	X
电源	X	X	X	O	X	X
风扇	X	O	X	O	X	X
处理电源	X	O	X	O	O	O
电源线	X	O	X	O	X	X
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
光源(如有)	X	O	X	O	X	X
烙铁(如有)	X	O	X	O	O	O
产品外壳(如有)	O	O	O	O	X	X
适配器模块(如有)	X	O	O	O	O	O
鼠标(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件: 参阅本手册“规范”部分规定的环境条件。

电池 EFUP: 3 年

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Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr ⁶⁺)	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Cable Assemblies	X	O	X	O	X	X
Display	X	O	X	X	X	X
Power Supply	X	X	X	O	X	X
Fans	X	O	X	O	X	X
Battery for Processor	X	O	X	O	O	O
Power Cord	X	O	X	O	X	X
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
CD Drive (if present)	X	O	X	O	X	X
Fuse (if present)	X	O	X	O	O	O
Product Case (if present)	O	O	O	O	X	X
Adapters/Modules (if present)	X	O	O	O	O	O
Mouse (if present)	X	O	X	O	X	X
<p>O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.</p>						
<p>X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.</p>						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

EFUP for Battery: 5 Years

