LECROY
WAVEEXPERT 9000
NRO 9000
SDA 100G

GETTING STARTED MANUAL

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Introduction

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

The information contained in this guide also appears in greater detail in the on-line Help manual resident in the scope and is also available at www.lecroy.com.

⚠ Safety Requirements

This section contains information and warnings that must be observed to keep the scope 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

Where the following symbols appear on the scope'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 is used to denote a grounded frame or chassis terminal.

This symbol shows that the switch is a Standby (power) switch. When it is pressed, the scope's state toggles between operating and Standby mode. This switch is not a disconnect device. The instrument can only be placed in a complete Power Off state by unplugging the power cord from the AC supply.

This symbol is used to denote "Alternating Current."

The ESD symbol indicates a potential hazard. It calls attention to the susceptibility of the equipment to electrostatic discharge (ESD) induced damage if anti-static measures are not taken.

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. It is applicable to 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.

Operating Environment

The scope is intended for indoor use and should be operated in a clean, dry environment with an ambient temperature within the range of 5 °C to 40 °C.

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

⚠ **WARNING**

The scope must not be operated in explosive, dusty, or wet 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 voltage levels. Refer to Specifications for more details.

CAUTION

ESD sensitive: The sampling modules inputs are highly static sensitive. A grounding strap must be worn at all times when handling the modules.

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Installation (Overvoltage) Category II refers to local distribution level, which is applicable for equipment connected to the mains supply (AC power source).

Installation (Overvoltage) Category I refers to signal level, which is applicable for 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 grounded equipment, in which protection against electric shock is achieved by Basic Insulation and by means of a connection to the protective earthing conductor in the building wiring.

Note:

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

Installation (Overvoltage) Categories II (Mains Supply Connector) & I (Measuring Terminals)

Pollution Degree 2

Protection Class I

Cooling

The scope 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 rear of the SCOPE. To ensure adequate ventilation it is required to leave a 10 cm (4 inch) minimum gap around the sides and rear of the instrument.

⚠ **CAUTION**

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

⚠ **CAUTION**

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

AC Power Source

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

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

Depending on the accessories installed (sampling modules, PC port plug-ins, etc.), the scope can draw up to 400 W (400 VA).

The power supply of the scope is protected against short circuit and overload by a 5x20 mm fuse (T6.3 A/250 V).

Note:

The scope 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 scope 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.

In Standby mode the scope is still connected to the AC supply. The instrument can only be placed in a complete Power Off state by physically disconnecting the power cord from the AC supply.

The scope should be positioned to allow easy access to the socket-outlet. To disconnect the scope from the AC supply, unplug the instrument's power cord from the AC outlet after the scope is placed in Standby state.

See "Standby (Power) Switch and scope Operational States" section for more information.

⚠ **WARNING**

Electric 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.

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Standby (Power) Switch and Scope Operational States

The front Standby (Power) switch controls the operational state of the scope. This toggle switch is activated by momentarily pressing and releasing it.

The scope's factory settings result in only two basic scope states: On or Standby. In the case of Standby, the scope is powered off with the exception of some "housekeeping" circuitry (approximately 12 watts dissipation). The scope can only be placed in a complete power off state by unplugging the instrument's power cord from the primary power source (AC outlet). It is recommended that the power cord be unplugged from the AC outlet if the scope is not being used for an extended period of time.

The user has the ability to change the scope original factory settings via the "Power Options Properties" menu in Windows by following the path: Settings – Power Options. It is important to note that the Windows Power Option named "Standby" provides control of only the scope's computer subsystems (CPU, hard drive, etc.) and does not affect the other subsystems within the scope. In general, these other subsystems remain fully powered. For additional information on setting these Power Options, see the Windows Help menu or other related technical documentation. Regarding control buttons, the scope uses only a power button/switch and therefore references to a sleep button are not applicable.

The scope can always be placed in the Standby state -- Power Off (except for some "housekeeping" circuits) -- by pressing and holding in the Standby toggle switch for approximately 5 seconds.

Fuse Replacement

Set the scope Standby (power) switch to Standby mode and disconnect the power cord before inspecting or replacing the fuse. Open the black fuse holder (located at the rear of the instrument directly to the right of the AC inlet) using a small, flat-bladed screwdriver. Remove the old fuse, replace it with a new 5x20 mm IEC 127 Time Lag ("T" rated) 6.3 A / 250 V fuse, and reinstall the fuse holder.

> ⚠️ **WARNING**
>
> For continued fire protection at all line voltages, replace the fuse with the specified type and rating only. Disconnect the power cord before replacing fuse.

Calibration

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

Cleaning

Clean only the exterior of the scope, 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.

⚠ **WARNING**

No operator serviceable parts inside. Do not remove covers.

Refer servicing to qualified personnel.

Abnormal Conditions

Operate the scope 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 scope depends on careful reading of all instructions and labels.

⚠ **WARNING**

Any use of the scope in a manner not specified by the manufacturer may impair the instrument's safety protection. The scope 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.

Be Sure to Read this 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.

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.

Take advantage of 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

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8.4 <u>Governing Law; Jurisdiction; Venue.</u> This EULA will be governed by and construed in accordance with the laws of the State of New York, USA, without regard to its choice of law provisions. The United Nations Convention on Contracts for the International Sale of Goods will not apply to this EULA. Exclusive jurisdiction and venue for any litigation arising under this EULA is in the federal and state courts located in New York, New York, USA and both parties hereby consent to such jurisdiction and venue for this purpose.

8.5 <u>Assignment.</u> This EULA and the rights and obligations hereunder, may not be assigned, in whole or in part by you, except to a successor to the whole of your business, without the prior written consent of LeCroy. In the case of any permitted assignment or transfer of or under this EULA, this EULA or the relevant provisions will be binding upon, and inure to the benefit of, the successors, executors, heirs, representatives, administrators and assigns of the parties hereto.

8.6 <u>Notices.</u> All notices or other communications between LeCroy and you under this EULA will be in writing and delivered personally, sent by confirmed fax, by confirmed e-mail, by certified mail, postage prepaid and return receipt requested, or by a nationally recognized express delivery service. All notices will be in English and will be effective upon receipt.

8.7 <u>Headings.</u> The headings used in this EULA are intended for convenience only and will not be deemed to supersede or modify any provisions.

8.8 <u>Acknowledgment.</u> Licensee acknowledges that (a) it has read and understands this EULA, (b) it has had an opportunity to have its legal counsel review this EULA, (c) this EULA has the same force and effect as a signed agreement, and (d) issuance of this EULA does not constitute general publication of the Software Product or other Confidential Information.

Installation

Hardware Connections for WaveMaster, WavePro, SDA, and DDA Models
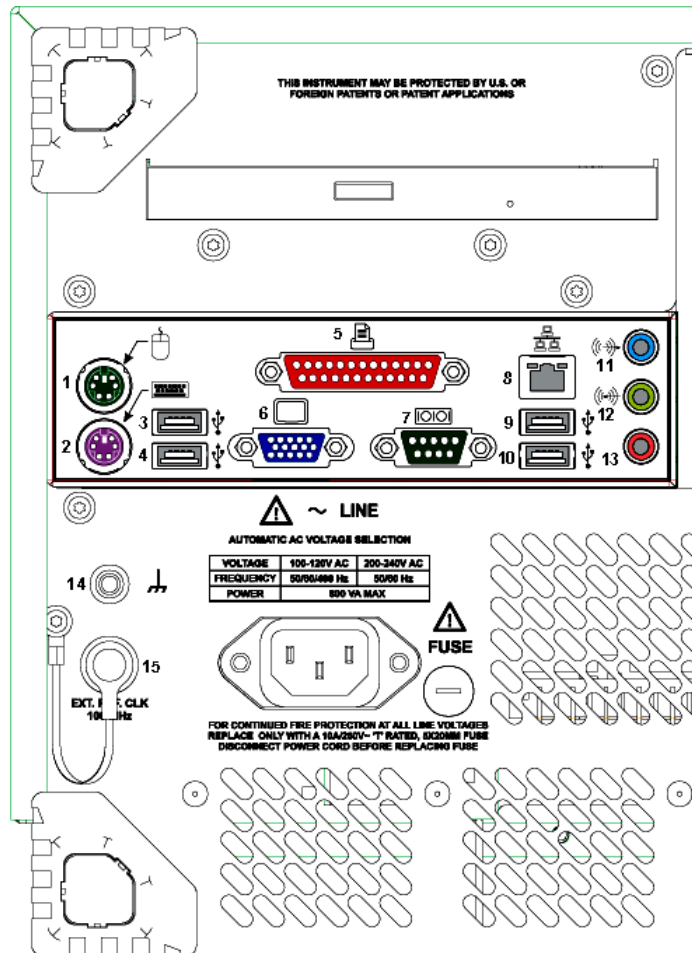
Rear Panel Diagram: (1) Mouse Port; (2) Printer Port; (3) USB Port; (4) USB Port; (5) Centronics Port;(6) External VGA Monitor; (7) RS-232-C Port; (8) Ethernet Port; (9) USB Port; (10) USB Port; (11) Line In; (12) Speakers; (13) Microphone; (14) Ground Connector; (15) Gated Trigger

SOFTWARE

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

1. In the tool bar, touch **Utilities**.

2. In the dialog area, touch **Status**.

Default Settings

You can reset the scope to default settings by simply pressing the **DEFAULT SETUP** button on the front panel. The default settings are as follows:

Vertical	Timebase	Trigger
100 mV/div	1.00 ns/div	Internal
0 V offset	10.0 kS/s, -12 ns delay	TDR
	Sequential acquisition	Auto trigger mode

Adding a New Option

To add a software option you will need a code to enable the option. Call LeCroy Customer Support at 1-800-553-2769 to place an order and receive the code.

Restoring Software

Restarting the Application

Upon initial power-up, the scope will load the application software automatically. If you exit the application and want to reload it, touch the scope shortcut icon on the desktop.

If you minimize the application, touch the scope logo button in the task bar at the bottom of the screen, then touch **Maximize**.

Restarting the Operating System

If you need to restart the Windows® operating system, you will have to reboot the scope by pressing and holding the power switch in for 10 seconds, then turning the power back on.

System Recovery – Windows XP Scopes

Your 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 rear of the scope.

> **Note:** The recovery process will produce a replica of the operating system and oscilloscope application software to the revision levels that were current at the time the oscilloscope was manufactured. Any further revisions of the application software, Windows operating system, and virus scan definition files will not be upgraded 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 not be overwritten 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:

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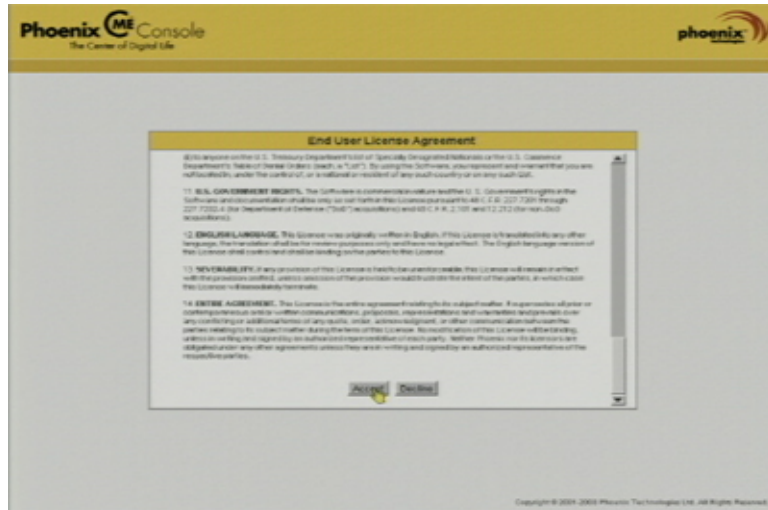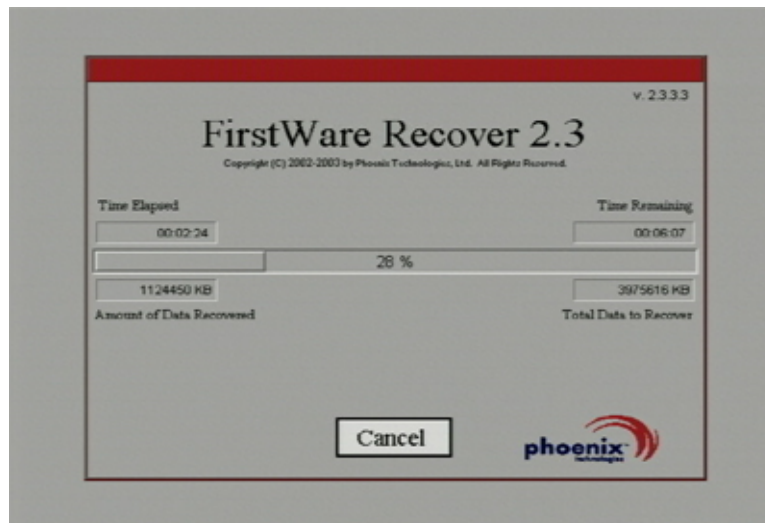

6. The Phoenix cME Console main page is displayed. Click **Click here to start recover**:

X-STREAM
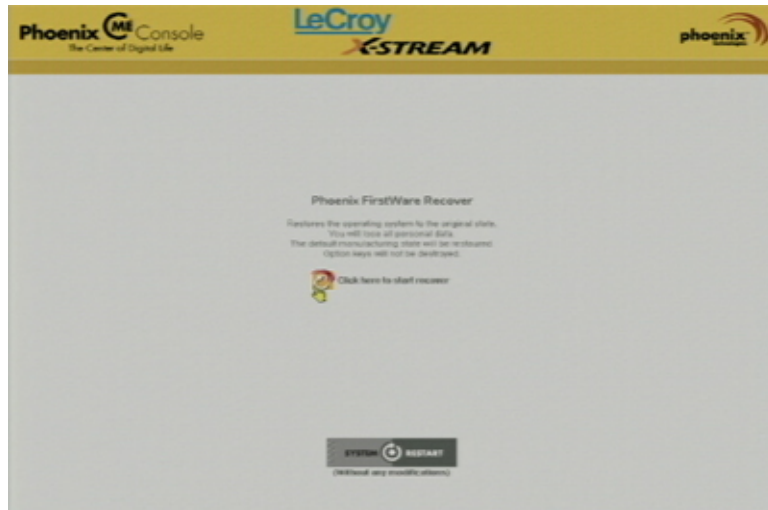
7. The FirstWare Recover splash screen is displayed momentarily:
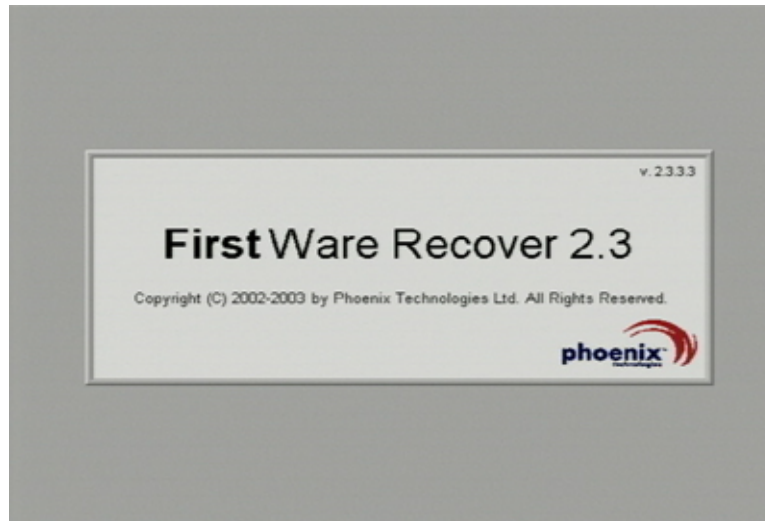
8. The recovery starts, and the FirstWare Progress screen is displayed. No further selections are required. The recovery takes about 10 minutes.

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.

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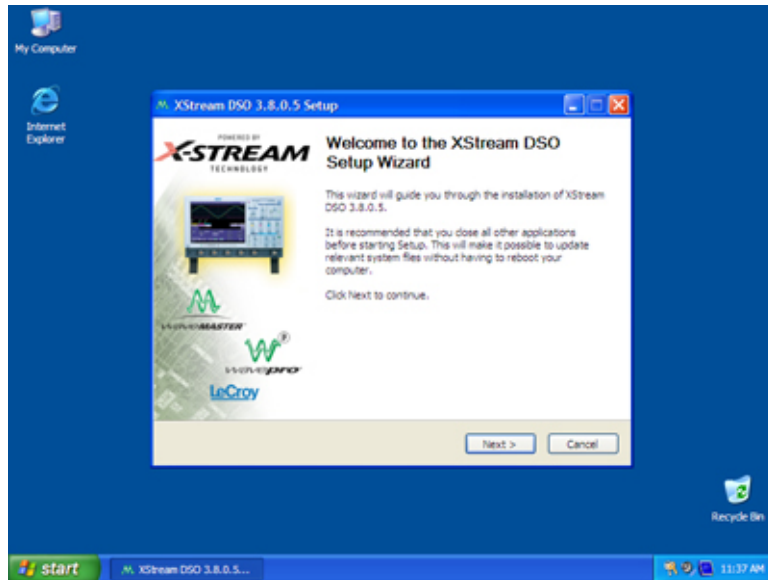
10. When the X-Stream installation is completed, reboot the scope.

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 rear 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.
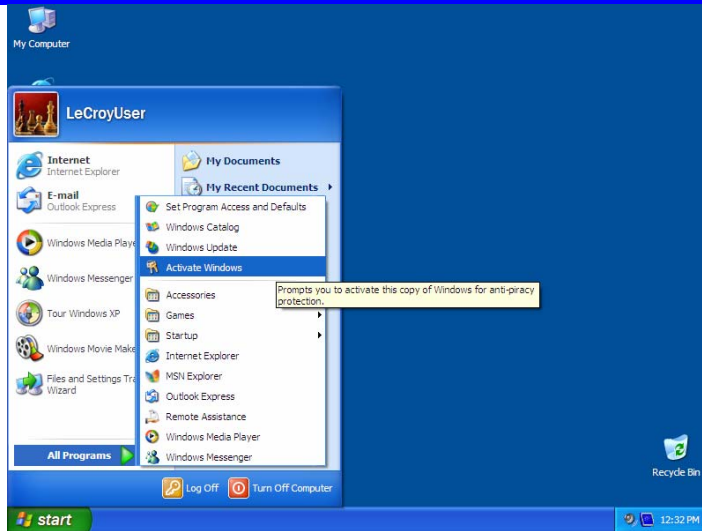
2. Select an activation method: internet or phone. Then click **Next**.
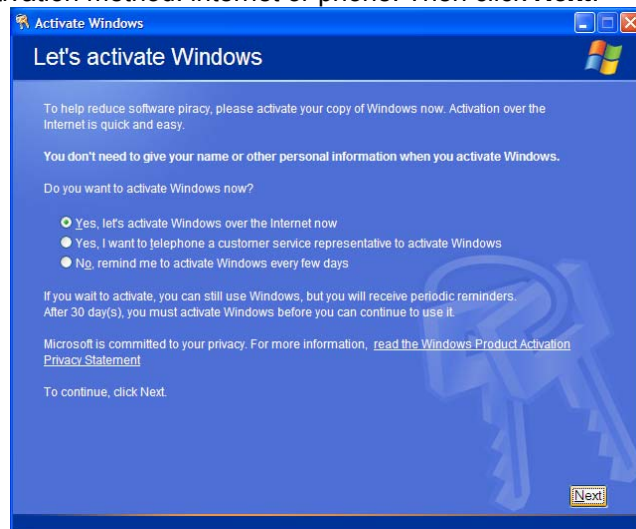
3. If you elected to activate by internet, enter the Activation ID (Product Key) number when prompted to do so, then click **Next**. Windows Activation will begin.

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.

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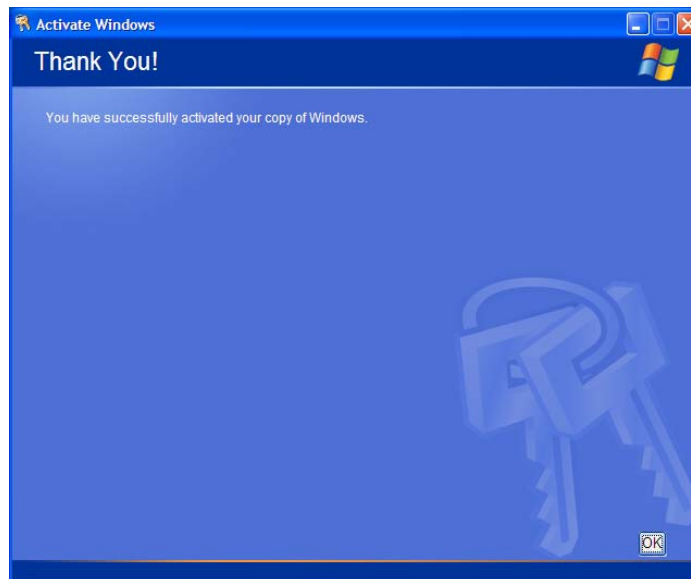
X-STREAM

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.

Connecting to a Signal

Electrical Modules

The sampling modules are equipped with RF connectors of different types depending on the bandwidth of the particular module, as indicated in the table below. The modules have male connectors, and each module is shipped with a female-to-female adapter that matches the connector type. This adapter should be attached to the module whenever possible, as it will protect the connector on the module from possible damage caused by incorrect threading of cables or connectors.

The connector types on the modules are named according to the inside diameter of their outer conductor. This diameter must be matched within any connectors or cables attached to the module in order to maintain the specified bandwidth.
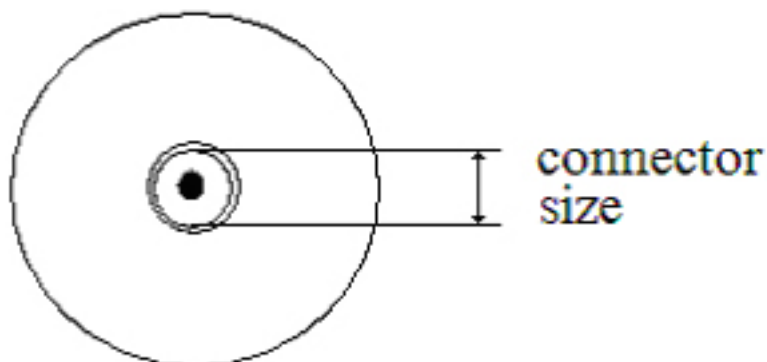
Module	Bandwidth	Connector Type
ST-20	20 GHz	2.92 mm
SE-30	30 GHz	2.92 mm
SE-50	50 GHz	2.40 mm
SE-70	70 GHz	1.85 mm
SE-100	100 GHz	1 mm

Connector Torque

In order to maintain bandwidth performance and minimize loss, connections to the instrument modules should be torqued to the appropriate tightness. The connectors all have standard 3/8 inch nuts on them and should be torqued to 8 in-lbs. using an appropriate torque wrench. The 100 GHz module has a unique connector that requires a smaller torque value of 4 in.-lbs. This module is supplied with the appropriate torque wrench.

Optical Modules

Several optical modules are also available for use with the WaveExpert mainframe. The modules are outlined in the table below. Optical modules are available in single-mode and multimode configurations. The single-mode modules are designed to operate over wavelengths in the 1280 to 1620 nm range, while the multimode module covers the 750 to 1620 nm range. Single-mode and multimode fibers are characterized by different diameters. Multimode fiber, as its name implies, allows many "modes" or group velocities to propagate, while single-mode allows only one. The diameter of multi-mode fiber is much larger than that of single-mode fiber (50 to 62.5 nm vs. 9.5 nm) so connecting a multimode fiber to a single-mode one will result in a large amount of signal attenuation caused by the difference in area of the connector faces. Since the energy in a multimode signal is spread out into the many modes propagating in the fiber, at the boundary with the single-mode fiber only one of these modes will pass through.

Module	Wavelength Range	Fiber Type	Fiber Diameter
SO50	1280-1620 nm	Single mode	10 µm
SO25	1280-1620 nm	Single mode	10 µm
SO10	750-1650 nm	Multimode	62.5 µm
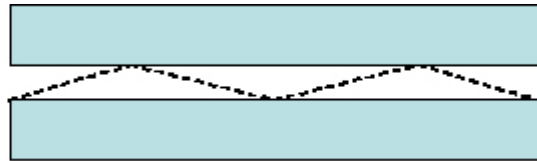
Single-mode fiber has a narrow core diameter that allows only one mode to propagate. This type of fiber is very low loss, so it is the choice for long-haul communications.
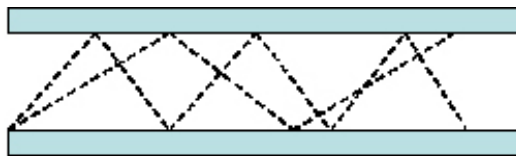
Multimode fiber has a much wider core diameter that allows many modes to propagate. This type of fiber has higher loss, but is less costly, is easier to work with, and is the choice for LAN and other short-haul applications.

The optical modules come standard with an FC-PC connector, and adapters are available for a variety of other optical connector types. Adapters can be easily swapped on the optical module front panel by pressing the release latch on the bottom of the connector while pulling on it. The exposed fiber end can be cleaned using alcohol and/or an optical fiber cleaner.

Front Panel Controls

Front Panel Buttons and Knobs

The control buttons of the instrument's front panel are logically grouped into analog and special functional areas. Analog functions are included in the Horizontal, Trigger, and Vertical groups of control buttons and knobs.

Sometimes you may want to change a value without using the numeric keypad. In that case, simply touch once inside the data entry field in the scope dialog area (the field will be highlighted in yellow), then use the Adjust group of buttons and single knob to dial in values into the selected field.

By default, the control knob makes coarse adjustments (that is, digits to the left of the decimal point). Press the **FINE** button to adjust digits to the right of the decimal point. To enter exact values, you can also display a keypad by touching twice inside the data entry field.

Example Data Entry Field
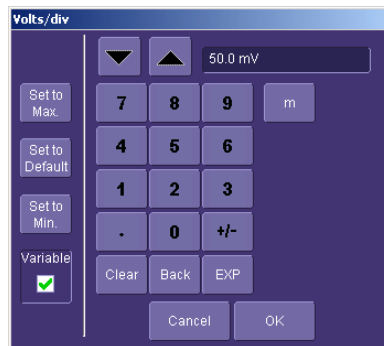
Example Pop-up Numeric Keypad

Then use the keypad to type in the value. The **SELECT** button steps through a dialog from one control to the next.

Note: You can set the granularity (delta) of the coarse adjustment in two ways:

• By pressing and holding the Fine front panel button while turning the Adjust knob. In this case you can read the changing delta in the data entry field that is selected:

• By double-tapping inside the data entry field, then touching the **Advanced** checkbox in the pop-up numeric keypad. The keypad presents **Coarse** delta up/down buttons to set the delta:
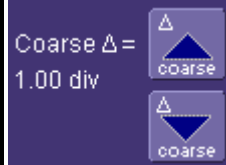
In the pop-up keypad, be sure to leave the **Fine** checkbox unchecked to adjust the coarse delta.

On-screen Toolbars, Icons, and Dialog Boxes

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:

 .

This button also appears as an undo button after front panel buttons Autosetup and

QUICKZOOM are pressed. If you want to perform an Undo operation, it must be the very next operation after you perform the Autosetup or QuickZoom operation.

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Vertical Knobs and Buttons:
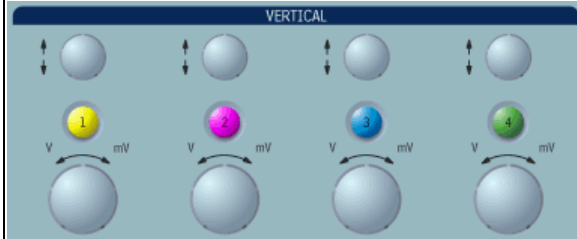
VERTICAL	**OFFSET –** Adjusts the vertical offset of a channel.
	VOLTS/DIV – Adjusts the Volts/Division setting (vertical gain) of the channel selected.
	CHANNEL BUTTONS – Turn a channel on or off. These buttons activate the dialog that lets you change the channel's setup conditions including coupling, gain, and offset. They are used also to select multiple grids, to automatically set the gain (Find Scale), or to automatically display a zoom of the signal. Press twice to toggle the trace on and off.

Horizontal Knobs and Buttons:

HORIZONTAL	**DELAY –** Horizontally positions the scope trace on the display so you can observe the signal prior to the trigger time.
	TIME/DIVISION – Sets the time/division of the scope timebase (acquisition system).
	CALIBRATE – Calls up the SMART Memory dialog from the Horizontal setup menus.
	ZERO DELAY – Sets the horizontal delay to zero. The trigger point is positioned at the left edge of the display grid.
	SETUP – Activates the TIMEBASE menu to allow you to select acquisition conditions, including the sample mode, maximum memory length, etc.

Trigger Knobs and Buttons:
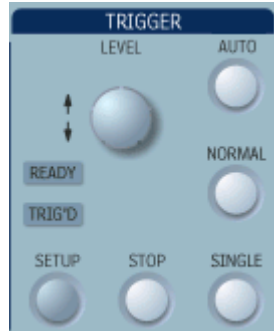
	LEVEL – Selects the trigger threshold level when the trigger signal is connected to the Trigger input. The Level is indicated in the **Trigger** label.
	SETUP – Activates the trigger setup menu to select the trigger type and the trigger conditions.
	STOP – Prevents the scope from triggering on a signal. If you boot up the instrument with the trigger in Stop mode, the message "no trace available" will be displayed.
	AUTO – Acquires data in a free-running mode. This allows viewing of a signal even though trigger conditions are not net. The waveform is unsynchronized in this mode and the CIS timebase, if selected, will be unlocked.
	NORMAL – Sampling is controlled by the signal applied to the trigger input: one sample per edge of the trigger in SEQ timebase and one sample per edge of the phase-locked clock in CIS mode.
	SINGLE – Acquires enough samples to fill the selected memory length. This will generally require hundreds to thousands of trigger edges.

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Wavepilot Control Knobs and Buttons:
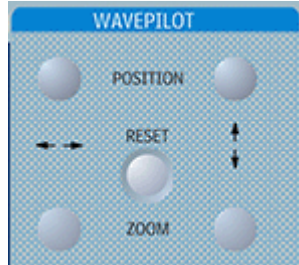
WAVEPILOT POSITION RESET ZOOM	➡ **POSITION –** Adjusts the horizontal position of a zoom trace on the display. The zoom region is highlighted in color on the source trace.
	➡ **ZOOM –** Adjusts the horizontal zoom (magnification factor) of the selected zoom trace.
	↕ **POSITION –** Adjusts the vertical position of the selected zoom trace on the display.
	↕ **ZOOM –** Adjusts the vertical zoom (magnification factor) of the selected zoom trace on the display.
	RESET – Resets the zoom factors.

Quick Set Buttons:
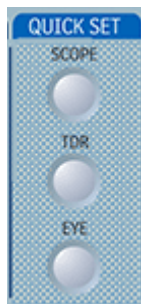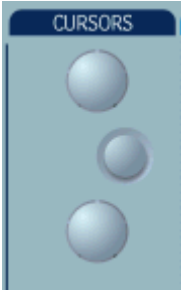
QUICK SET SCOPE TDR EYE	**SCOPE –** Takes the scope out of TDR or Eye mode.
	TDR – Provides access to the TDR setup dialog and sets the scope to TDR mode.
	EYE – Provides access to the Eye mode setup dialog and sets the scope to eye mode.
	The eye mode displays the eye pattern, using display persistence (infinite). The optional SDA analysis feature (standard on the SDA 100G) enables a high throughput eye pattern that collects data up to 20 times faster than the eye mode.

Special Features Buttons:

AUTO SETUP	**AUTO SETUP –** Automatically sets the scope's horizontal timebase (acquisition system), vertical gain and offset. The horizontal scale is set to 1 unit interval/division.
CURSORS	**CURSORS –** The center button calls up the "Standard Cursors" setup dialog. The other two buttons control the placement of the cursors on your waveform.
DEFAULT SETUP	**DEFAULT SETUP –** Sets the scope's horizontal timebase (acquisition system), vertical gain and offset, and trigger conditions to default settings. These conditions are: 100 mV/div, trigger input selected with 0 V threshold, Auto (free-run) trigger mode, channels 1 & 2 selected. Auto mode allows signals to be seen without a trigger, but the display is unsynchronized.
HELP	**HELP –** Displays the on-line Help manual. You can choose to receive control help, or to search for the information you need using the Table of Contents and Index. Control Help displays help for a particular button, menu item, data field, etc. contained in the dialogs.
SAVE / RECALL	**SAVE/RECALL –** Calls up the dialogs for saving and recalling waveforms and setups, and for disk utilities.
ANALOG PERSIST	**ANALOG PERSIST –** Provides a three dimensional view of the signal: time, voltage, and a third dimension related to the frequency of occurrence, as shown by a color-graded (thermal) or intensity-graded display.

![X-STREAM logo]

	QUICKZOOM (toggle switch) –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.
General Control Buttons:	
	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.
UTILITIES	UTILITIES – For setup of scope features including hardcopy devices and formats, date and time, and remote control interfaces, etc.; or for checking status, options, etc.
TOUCH SCREEN	TOUCH SCREEN – (toggle switch) Activates or deactivates the touch screen.
CLEAR SWEEPS	CLEAR SWEEPS – Clears data from multiple sweeps (acquisitions) including: persistence trace displays, averaged traces, parameter statistics, and Histicons. During waveform readout, cancels readout.
	STANDBY Lamp – The STANDBY lamp indicates when the scope has placed itself in standby mode. In this mode, current settings are retained.

Many of the menu bar buttons give you access to the same functions as do the front panel buttons. Refer to this Table of Equivalent Functions.

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

Sometimes you may want to change a value without using the numeric keypad. In that case, simply touch once inside the data entry field in the scope dialog area (the field will be highlighted in yellow), then use the **ADJUST** group of buttons and single knob to dial in values into the selected field.

By default, the control knob makes coarse adjustments (that is, digits to the left of the decimal

point). Press the **FINE** button to adjust digits to the right of the decimal point. To enter exact values, you can also display a keypad by touching twice inside the data entry field. Then

use the keypad to type in the value. The **SELECT** button steps through a dialog from one control to the next.
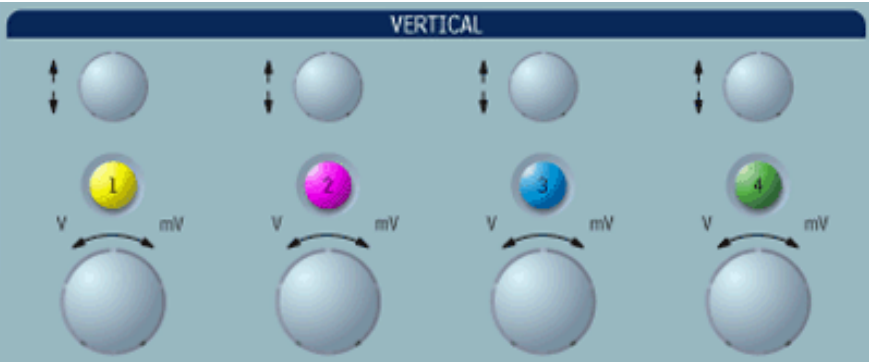
The following table provides an explanation of the front panel buttons and knobs:

On-screen Toolbars, Icons, and Dialog Boxes

Toolbar Buttons

The toolbar buttons at the top of the scope's display are designed for quick setup of common functions. Many of these buttons give you access to the same functions as do the front panel buttons.

Table of Equivalent Functions

Display Buttons	Front Panel Push Buttons
File	
Vertical	
Timebase	

Trigger	
Cursors	
Zoom (icon in Channels dialog zooms one trace)	(zooms all displayed traces)
Timebase 0.00 ns / CIS 500 ps/div / 16.0 kS 310 fs/S (then TDR button) Timebase 0.00 ns / CIS 500 ps/div / 16.0 kS 310 fs/S (then Eye button)	
Utilities	

(then Utilities Setup...)	
Help	HELP

Scope Icons

The icons that you see in the dialog areas of the scope are touch sensitive. When selected, an icon changes color to show that it is active. The **Trigger** setup dialog is an example of this functionality.

Other icons, for example those located at the bottom of the **Vertical Adjust** setup dialog, are quick links to other functions, such as **Math** and **Measure**.

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.

Screen Layout

The scope screen is divided into three areas:

- tool bar
- signal display area
- dialog area

Tool Bar

The top of the screen contains a toolbar of commonly used functions. Whenever you touch one of these buttons, the dialog area at the bottom of the screen switches to show the setup for that function.

Signal Display Grid

You can set up the signal display area by touching **Display** in the toolbar. The display dialog offers a choice of grid combinations and a means to set the grid intensity.

Trace Descriptors

Vertical and horizontal trace descriptors, or 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.
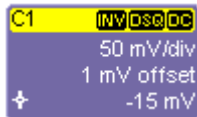
Channel trace labels show the vertical settings for the trace, as well as cursor information if cursors are in use. In the title bar of the label are also included indicators for coupling, waveform inversion (INV), deskew (DSQ), and averaging (AVG). These indicators have a long and short form, dependent on available space in the title bar of the label:

Besides channel trace labels, math and parameter measurement labels are also displayed. Labels are displayed only for traces that are turned on.
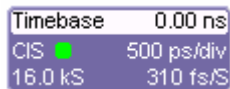
The title bar of the Timebase label shows the trigger delay setting. Time per division and sampling information is given below the title bar. The timebase in use is indicated above the record length as sequential (SEQ), coherent interleaved sampling (CIS) or random interleaved sampling (RIS).

The title bar of the Trigger label shows the trigger source: direct, prescale, or TDR. Below the title bar is given the mode (stop, auto, or normal), level (0 mV), and slope (Positive).

Shown below the TimeBase and Trigger labels is setup information for horizontal cursors, including the time between cursors and the frequency.

To Turn On a Channel Trace

1. On the front panel, press a channel select button, such as , to display the trace label for that input channel.

2. To turn on a math function trace, touch **Math** in the toolbar, then **Math Setup...** in the drop-down menu. Touch the **On** checkbox for the trace you want to activate.

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:

 , , , .

Whenever you turn on a channel, math, or memory trace via the toolbar, the dialog at the bottom of the screen automatically switches to the vertical setup or math setup dialog for that selection. You can configure your traces from here, including math setups.

The channel number appears in the Vertical Adjust tab of the "Vertical Adjust" dialog, signifying that all controls and data entry fields are dedicated to the selected trace.

Introduction to WaveShape Analysis

This section is a brief reference to the basic tools available to perform WaveShape Analysis in the time, frequency, and statistical domains.

Parameter Measurements

WaveShape 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:

Vertical	Description
mean	Mean
sdev	Standard deviation
max	Maximum
min.	Minimum
ampl	Amplitude
pkpk	Peak-to-peak
top	Top
base	Base

Standard Horizontal Parameters

These are the default Standard Horizontal Parameters:

Horizontal	
freq	Frequency
period	Period
width	Width
rise	Risetime
fall	Fall time
delay	Delay from trigger
duty	duty cycle
npoints	Number of points in waveform

Custom Measurements with My Measure

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

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 toolbar, touch **Measure**, then **Measure Setup…** in the drop-down menu.

2. Touch one of parameter tabs **P1** through **P8**.

3. Touch inside the **Source1** data entry field and select an input waveform from the pop-up menu.

4. Touch inside the **Measure** data entry 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.

1. In the toolbar touch **Measure**, then **Measure Setup…** in the drop-down menu.

2. Touch one of parameter tabs **P1** through **P8**.

3. Touch inside the **Source1** data entry field and select an input waveform from the pop-up menu.

4. Touch inside the **Measure** data entry field and select a parameter from the pop-up menu.

5. 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.

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