

WavePro HD Oscilloscopes Getting Started Guide





700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
1.800.5.LECROY • teledynelecroy.com

WavePro HD Oscilloscopes

Getting Started Guide

© 2019 Teledyne LeCroy, Inc. All rights reserved.

Unauthorized duplication of Teledyne LeCroy documentation materials is strictly prohibited. Customers are permitted to duplicate and distribute Teledyne LeCroy documentation for internal educational purposes.

Teledyne LeCroy is a trademark of Teledyne LeCroy, Inc. Other product or brand names are trademarks or requested trademarks of their respective holders. Information in this publication supersedes all earlier versions. Specifications are subject to change without notice.

930286-00 Rev A,
July, 2019

Welcome

Thank you for buying a Teledyne LeCroy product. We're certain you'll be pleased with the detailed features unique to our instruments. This guide is intended to help you set up a WavePro HD oscilloscope and learn some basic operating procedures, so you're quickly working with waveforms.

- See the *MAUI Oscilloscopes Remote Control and Automation Manual* for comprehensive information on remote control of WavePro HD.
- See the *WavePro HD Oscilloscopes Operator's Manual* for detailed information on the operational features of the WavePro HD.

Both manuals can be downloaded from the Oscilloscope Manuals page on our website at: teledynelecroy.com/support/techlib

Introduction

Introducing WavePro HD Oscilloscopes	2
Safety	2

Overview

Front of Oscilloscope	4
Powering On/Off	5
Back and Side of Oscilloscope	6
Connecting to External Devices/Systems	7
Front Panel	9
Touch Screen Display	10

Basics

Changing the Display	12
Working with Traces	14
MAUI with OneTouch	15
Vertical	20
Digital	22
Horizontal (Timebase)	24
Navigating Long Acquisitions	26
Triggers	30

Zoom	32
------	----

Cursors	34
---------	----

Measurements & Statistics	35
---------------------------	----

Math	36
------	----

Memories (Reference Waveforms)	37
--------------------------------	----

Saving and Sharing Data	38
-------------------------	----

Maintenance

Cleaning	39
Activating Software Options	39
Calibration	39
Firmware Updates	40
Switching Users	40
Service	41

Reference

Software Options	42
Support	43
Windows License Agreement	43
Warranty	43
Certifications	44

Introducing WavePro HD

With up-to-5 Gpts of acquisition memory, WavePro HD 12-bit oscilloscopes capture events occurring over long periods of time, while maintaining high sample rate for visibility into the smallest details.

WavePro HD oscilloscopes contain a sophisticated acquisition and memory management architecture that makes 5 Gpt acquisitions fast and responsive. More memory means more visibility into system behavior.

Long memory and high sample rates capture both millisecond-scale trends and picosecond-scale glitches. WavePro HD oscilloscopes are equipped with an advanced user interface that makes it easy to find features, navigate directly using timebase position knobs, or set up zoom traces for analysis—whichever you prefer. Apply analysis tools to any type of trace with ease.

WavePro HD can acquire 250 ms of data at the full 20 GS/s sample rate—and always with 12 bits of resolution. Oscilloscopes with less memory require trading off sample rate for acquisition time.

WavePro HD has the greatest breadth and depth of tools to simplify any debug task. More standard math, measure, pass/fail and other toolsets provide faster and more complete insight into circuit problems. Comprehensive low-speed serial data triggers and decoders provide the best causal analysis, while powerful serial data jitter analysis toolsets and compliance packages simplify complex validation. History Mode lets you scroll back in time to view previous acquisitions and isolate anomalies. WaveScan® lets you search acquisitions using more than 20 criteria, while LabNotebook concisely documents and stores your results.

A wide selection of low voltage, high voltage and current probes will accurately measure every signal in your circuit. The new 8 GHz ProBus2 interface is backwards-compatible to the 20+ year legacy of ProBus-compatible probes.

Key Specifications

Detailed specifications are maintained on the product page at teledynelecroy.com.

	WP 254HD WP 254HD-MS	WP 404HD WP 404HD-MS	WP 604HD WP 604HD-MS	WP 804HD WP 804HD-MS
Bandwidth, 2 Ch	2.5 GHz	4 GHz	6 GHz	8 GHz
Bandwidth, 4 Ch	2.5 GHz	4 GHz	4 GHz	4 GHz
Analog Channels	4			
Vertical Resolution	12-bit			
Sample Rate (per Ch)	10 GS/s			
Sample Rate (Intlv'd)	20 GS/s			
Std. Memory (per Ch)	50 Mpts			
Max. Memory (Intlv'd)	5 Gpts			
Digital Inputs (-MS only)	16			
Max. Digital Input Freq.	250 MHz			
Digital Sample Rate	1.25 GS/s			
Digital Memory	125 Mpts			

Safety

Observe generally accepted safety practices in addition to the precautions specified here.

Symbols



CAUTION of potential damage to equipment, or **WARNING** of potential bodily injury. Refer to manual. Do not proceed until the information is fully understood and conditions are met.



WARNING. Risk of electric shock or burn.



Frame or chassis terminal



Alternating current



Power On/Standby

Operating Environment

Temperature	5 °C to 40 °C
Humidity	5% to 90% RH (non-condensing) up to 31 °C decreasing linearly to 50% RH at 40 °C
Altitude	Up to 10,000 ft (3,048 m) at or below 30 °C

Power

AC Power	100-240 VAC ($\pm 10\%$) at 50/60 Hz ($\pm 10\%$) or 100-120 VAC ($\pm 10\%$) at 400 Hz ($\pm 5\%$) Automatic AC Voltage Selection
Consumption Nominal	400 W / 400 VA
Maximum*	525 W / 525 VA
Standby	10 W

* All PC peripherals and active probes connected to four channels.

Measuring Terminal Ratings

Ratings apply to inputs C1-C4 and Ext In.

Maximum Input Voltage	50 Ω coupling \leq 5 Vrms 1 MΩ coupling \leq 400 Vpk max. (Peak AC \leq 10 kHz + DC derating at 15 dB/decade from 10 kHz to 1.6 MHz, 10 Vpk max. above 1.6 MHz)
------------------------------	--

Measuring terminals have no rated measurement category (CAT) per IEC/EN 61010-1:2010. Measuring terminals are not intended to be connected directly to supply mains.

Precautions

Use proper power cord. Use only the power cord shipped with this instrument and certified for the country of use.

Maintain ground. The AC inlet ground is connected to the frame of the instrument. Connect line cords only to outlets with safety ground contacts.

 **WARNING.** Interrupting the protective conductor inside or outside the oscilloscope, or disconnecting the safety ground terminal, creates a hazardous situation. Intentional interruption is prohibited.

Connect and disconnect properly. Do not connect/disconnect probes or test leads while they are connected to a live voltage source.

Observe all terminal ratings. Do not apply a voltage to any input that exceeds the maximum rating of that input. Refer to the markings next to the BNC terminals for maximum allowed values.

Use only within operational environment listed. Do not use in wet or explosive environments.

Use indoors only.

Keep product surfaces clean and dry.

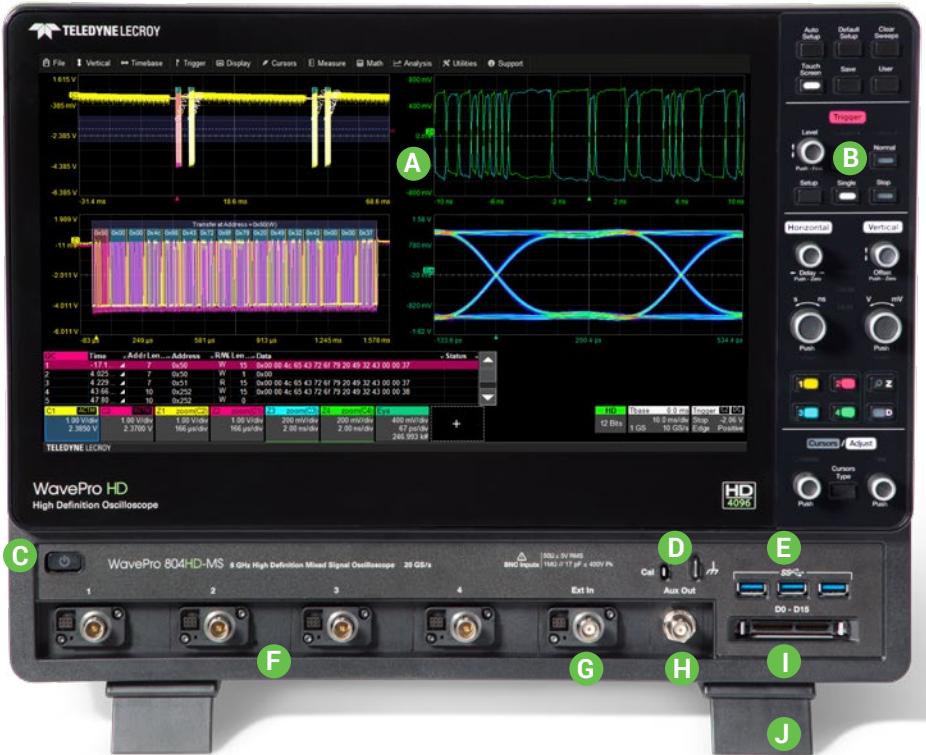
Do not block the cooling vents. Leave a minimum six-inch (15 cm) gap between the instrument and the nearest object. Keep the underside clear of papers and other objects.

Exercise care when lifting and carrying. Unplug and use the built-in carrying handle to move the instrument.

Do not remove the covers or inside parts. Refer all maintenance to qualified service personnel.

Do not operate with suspected failures. Check body and cables regularly. If any part is damaged, cease operation immediately and sequester the instrument from inadvertent use.

Front of Oscilloscope



A. Touch Screen Display

B. Front Panel

C. Power Button

D. Calibration and Ground Terminals

E. USB 3.1 Ports (3)

F. Channel Inputs

G. Ext In

H. Aux Out

I. Mixed Signal Interface

J. Tilting Feet

The **touch screen display** is the principal viewing and control center of the oscilloscope. See p.10 for an overview of its components.

The **front panel** houses buttons and knobs that control different oscilloscope settings. Operate the instrument using front panel controls, touch screen controls, or a mix that is convenient for you.

Front mounted **host USB 3.1 ports** can be used for transferring data or connecting peripherals such as a mouse or keyboard.

The **mixed signal interface** connects the digital leadset to input up-to-16 digital lines (on -MS models).

Calibration output terminal is used to compensate passive probes. The **Ground terminal** may be connected to a grounding wrist strap or the ground lead on probes.

Channels 1–4 are used to input analog signal. The connectors are equipped with the new ProBus2 interface, compatible with either legacy ProBus or new ProBus2 probes. They can also accept a conventional BNC cable.

Note: The BNC inputs are rated to 8 GHz but will require a precision adapter (available from Teledyne LeCroy Service) to accept SMA cables.

The **tilting feet** change the angle of display for easier viewing.

Powering On/Off

Plug the line cord only into a grounded AC power outlet. See Power in "Safety" for ratings. Press the **Power button** to turn on the oscilloscope. The LED on the button will light to show the oscilloscope is operational.

 **CAUTION.** Do not power on or calibrate with a signal attached.

Press the Power button again or use the **File > Shutdown** menu option to execute a proper shut down process and preserve settings.

 **CAUTION.** Do not press and hold the Power button. This will execute a hard shutdown, but may not preserve setups and data.

The Power button does not disconnect the oscilloscope from the AC power supply, but puts it into "Standby" mode. Some "housekeeping" circuitry continues to draw power. The only way to fully power down the instrument is unplug the AC line cord from the outlet. We recommend unplugging the instrument if it will remain unused for a long period of time

 **CAUTION.** Do not change the Windows® Power setting to System Standby or System Hibernate. Doing so may cause failure.

Back and Side of Oscilloscope



A. Built-in Carrying Handle

B. Removable Solid State Drive

C. AC Power Inlet

D. Kensington Lock

E. Ref In and Ref Out Connectors

F. USBTMC port for remote control
and data transfer



G. Speaker Out and Mic In

H. Ethernet Ports (2)

I. USB 3.1 Ports (4)

J. HDMI and DisplayPort Out
to external monitors

Connecting to External Devices/Systems

After start up, configure external connections using the menu options listed below. See the *WavePro HD Oscilloscopes Operator's Manual* for more detailed instructions.

Audio/USB Peripherals

Connect the device to the appropriate port. These connections are "plug-and-play" and do not require any further configuration. Use the Windows control panel to make adjustments. To go to the Windows desktop, choose **File > Minimize** or swipe from the far left of the screen.

External Monitor

WavePro HD supports UHD monitors (up to 4096x2304 resolution). Connect the monitor cable to the HDMI or DisplayPort output on the side panel (you can use a convertor if the cable has a different interface). Go to **Display > Display Setup > Open Monitor Control Panel** to configure display settings. Be sure to select the instrument as the primary display.

To use the Extend Grids feature, configure the second monitor to extend, not duplicate, the oscilloscope display. If the external monitor is touch screen enabled, the MAUI user interface can be controlled through touch on the external monitor.

LAN

WavePro HD is preset to accept DHCP network addressing over a TCP/IP connection. Just connect an ENET cable from a port on the side panel to a network access device. Go to **Utilities > Utilities Setup > Remote** to find the IP address.

To configure a Static IP address, touch **Net Connections** on the Remote dialog and enter the IP address.

Go to **Utilities > Preference Setup > Email** to configure email settings.

Printer

WavePro HD supports USB printers that are compatible with the Windows OS installed on the oscilloscope. Connect the printer to any host USB port, then go to **File > Print Setup** and select **Printer** to configure printer settings. Touch **Properties** to open the Windows Print dialog.

Remote Control

You can control the instrument over a LAN using VICP (TCP/IP) or VXI-11 (LXI). Use a standard ENET cable to connect to a network access point, and be sure the instrument is on the same subnet as the controller. To use LXI, switch to the Administrative User LCRYADMIN (p.40).

Note: You can also connect directly using TCP/IP, but depending on the controller, you may need to use a cross-over cable.

USBTMC and GPIB (with the optional GPIB card) can also be used to make a remote connection.

To change the remote control setting from the default VICP (TCP/IP), go to **Utilities > Utilities Setup > Remote**.

Trigger Out

To send a trigger pulse to another device, connect a BNC cable from Aux Out on the front of the instrument to the other device. Go to **Utilities > Utilities Setup > Aux Output** and choose to output Trigger.

Reference Clock

To input or output a reference clock, connect a BNC cable from Ref In or Ref Out to the other instrument. Go to **Timebase > Horizontal Setup > Clock Source** to configure the clock.

Probes

WavePro HD oscilloscopes are compatible with the included passive probes and most Teledyne LeCroy **ProBus** and **ProBus2** active probes that are rated for the oscilloscope's bandwidth. Probe specifications and documentation are available at teledynelecroy.com/probes.

Digital Leadset

Delivered with the purchase of a Mixed Signal (-MS) model, the **digital leadset** enables input of up-to-16 lines of digital data. Lines can be organized into two logical groups representing different buses and renamed appropriately.

The digital leadset features two digital banks with separate threshold and hysteresis controls, making it possible to simultaneously view data from different logic families.



Each flying lead has a signal and a ground connection. A variety of ground extenders and flying ground leads are available for different probing needs. To achieve optimal signal integrity, connect the ground at the tip of the flying lead for each channel used in measurements. Use either the provided ground extenders or ground flying leads to make the ground connection.

To connect the leadset to the oscilloscope, push the connector into the mixed signal interface below the front panel until you hear a click.

To remove the leadset, press in and hold the buttons on each side of the connector, then pull out to release it.



Front Panel

Most of the front panel controls duplicate functionality available through the touch screen display. They are covered in more detail in the Basics section and in the *WavePro HD Oscilloscopes Operator's Manual*.

Shortcut buttons arranged across the top of the front panel give quick access to commonly used functions.

The **Touch Screen button** enables or disables touch screen functionality.

The **Save button** performs the last action you set on the Save dialog: save a setup file, waveform file, memory, screen image or LabNotebook.

The **User button** can be configured to perform your choice of functions: save LabNotebook, waveform or setup files; save setups or waveforms to internal memory; "print" the screen to a file or to hardcopy; find optimal Vertical Scale for a selected channel, etc. See the *Operator's Manual* for instructions.

When cursors are turned off, the Cursor knobs act as the **Adjust knobs**. They raise/lower the value when a data entry field is selected, or raise/lower trace intensity when a waveform is selected. Pushing the Adjust knobs returns settings to the default value.



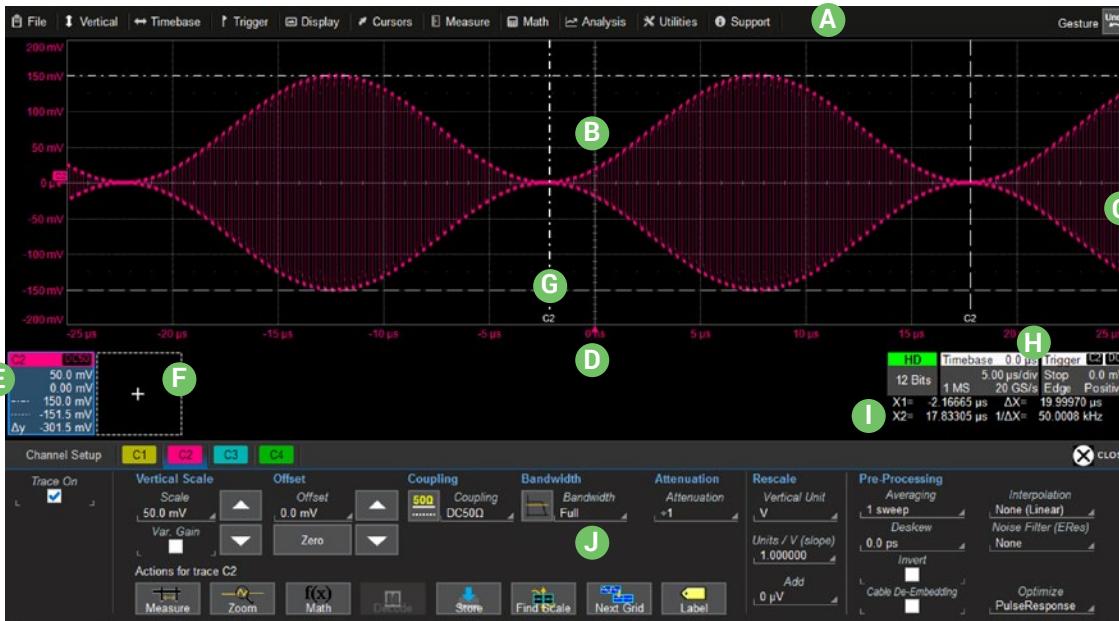
All the knobs on the front panel function one way if turned and another if pushed like a button. The first label describes the knob's principal "turn" action; the second label describes its "push" action.

Many front panel buttons light to indicate which functions and traces are active. The labels for Trigger, Horizontal, Vertical and Cursors/Adjust also light in the color of the trace that is currently associated with these knobs.



Touch Screen Display

The entire display is a capacitive touch screen. Use your finger or a capacitive stylus (not included) to touch, double-touch, touch-and-drag, or draw a selection box. Many controls that display information also work as "buttons" to access other functions. If you have a mouse installed, you can click anywhere you can touch to activate a control; in fact, you can alternate between clicking and touching, whichever is convenient.



- A. Menu Bar
- B. Grid Area
- C. Trigger Level Indicator
- D. Trigger Time Indicator
- E. Trace Descriptor Boxes
- F. Add New Box
- G. Cursor Markers
- H. Timebase and Trigger Descriptor Boxes
- I. Horizontal Cursor Readout
- J. Setup Dialogs

A **menu bar** of drop-down menus lets you access all functionality.



If an action can be “undone” (such as recalling a setup), a small **Undo button** appears at the far right of the menu bar. Click this to return to the previous oscilloscope display.

The **grid area** displays the waveform traces. You can adjust the brightness of the graticule, or change the number and style of grids.

Trigger level (vertical axis) and **trigger time** (horizontal axis) indicators appear on the grid when a trigger is set, color-coded to match the source.

Cursors show where measurement points have been set. Touch-and-drag cursor indicators to quickly reposition the measurement point. Vertical cursor readout appears on the Channel descriptor box; Horizontal cursor readout appears below the Timebase and Trigger descriptor boxes.

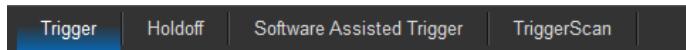
Trace descriptor boxes appear along the bottom of the grid area, one for each open trace. They adjust in size and detail as more are opened.

The **Add New box** sits next to the trace descriptor boxes. Use it to turn on new traces or the Measure table. See MAUI with OneTouch on p.15.

Timebase and Trigger descriptor boxes appear at the right of the display. Timebase and Trigger settings only apply to channel traces. Touch the descriptor box to open the corresponding set up dialog.

Dialogs appear at the bottom of the display for entering set up data. The top dialog will be the main entry point for the selected function.

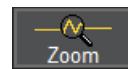
For convenience, related dialogs appear as a series of tabs behind the main dialog. Touch the tab to open the dialog



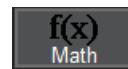
The **Action toolbar** on the main Channel, Math and Memory dialogs offers shortcuts to common actions so you don't have to leave the underlying dialog. Actions always apply to the active (highlighted) trace.



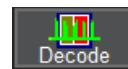
Apply up-to-12 measurement parameters



Display a zoom of the trace



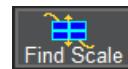
Apply a math function to the trace



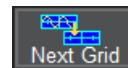
Open the Serial Decode dialog (if decoders are installed)



Copy the active trace to the corresponding internal memory (e.g., C2 to M2)



Scale the waveform to fit the grid



Move the active trace to the next grid



Apply a custom label to the trace

Changing the Display

Grid Mode

The grid is 8 Vertical divisions representing 4096 Vertical levels and 10 Horizontal time divisions. The value represented by each division depends on the scale settings of the traces that appear on it.



The grid area can contain multiple grids, each representing the full number of vertical levels, so vertical precision is always maintained.



By default, the oscilloscope has the **Auto** grid mode enabled. Auto adds a grid for each new trace, up to 20 grids, until no more grids are available. Other grid modes create a fixed number and orientation of grids; the icon shows the result.

To modify the touch screen display, choose **Display > Display Setup** from the menu bar and make your selections from the Display dialog.

Extended Display

If you have a second monitor connected, select **Extend Grids on 2nd Monitor** from the Display dialog, then choose a grid style from the Extended Display pop-up menu. Both displays will share this grid style. Drag-and-drop descriptor boxes to move traces between the displays.



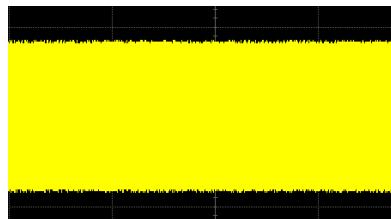
Oscilloscope with an extended display.

Line, Intensity, and Persistence

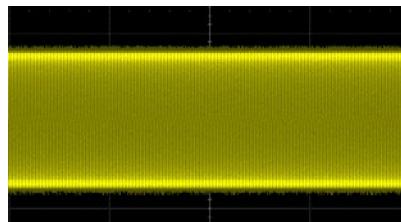
The trace style can be set to a series of separate sample **Points** or a continuous vector **Line**.

Grid Intensity makes the graticule dimmer or brighter relative to the trace.

When more data is available than can actually be displayed, **Trace Intensity** helps to visualize significant events by applying an algorithm that dims less frequently occurring samples.



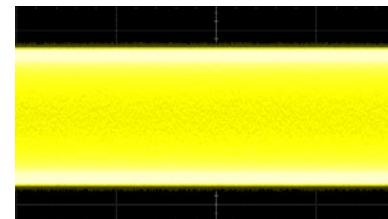
Intensity 100%



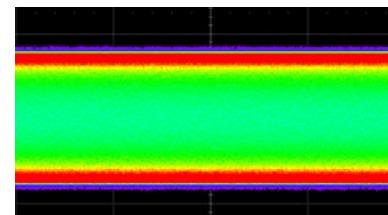
Intensity 15%



With the trace selected (and cursors off), turn the front panel **Adjust knobs** to control the Trace Intensity.



Intensity 15% with Analog Persistence



Intensity 15% with Color Persistence

Working with Traces

Trace Descriptor Boxes

Channel (C1-C4), Zoom (Z1-Z12), Math (F1-F12), Memory (M1-M12), and Digital (Digital1-Digital4) descriptor boxes appear along the bottom of the grid area when a trace is turned on. Descriptor boxes are used to summarize, activate, arrange, and configure the traces they represent.

C1	DC1M	F1	FFT(C1)	Z1	zoom(C1)	M1
50.0 mV	20.0 dB/div	50.0 mV	50.0 mV	50.0 mV	50.0 ns/div	50.0 ns/div
0.0 mV ofst	500 MHz	5.00 ns/div				

Trace Context Menu

The trace context menu is a quick way to apply math, measurements, or labels to traces. To open the context menu, right-click with your mouse or touch-and-hold on the trace descriptor box until a white circle appears, then release.

Active vs. Inactive Trace

Although several traces may be open and appear on the display, only one at a time is *active*. This is true for all traces, regardless of the type. All actions apply to the active trace until another is selected.

Touch a trace or its descriptor box to *activate* it and bring it to the *foreground*. When the descriptor box appears highlighted in blue, front panel controls and touch screen gestures apply to that trace.

C1	DC50
100 mV/div	
0.0 mV ofst	

Inactive. Controls will not work for this trace.

C1	DC50
100 mV/div	
0.0 mV ofst	

Active. Controls will work for this trace.

Adjusting

On setup dialogs, many entries can be made by selecting from the pop-up menu that appears when you touch a control.



On some pop-up menus, you can choose to display options as a **list** or as **icons**.

When an entry field appears highlighted in blue after touching, it is *active* and the value can be modified by turning the front panel knobs. Fields that don't have a dedicated knob (as do Vertical Level or Horizontal Delay) can be modified using the **Adjust knobs**.



If you have a keyboard installed, you can type entries in an active (highlighted) data entry field. Or, you can touch again, then "type" the entry using the **virtual keypad** or **virtual keyboard**.

To use the virtual keypad, touch the soft keys exactly as you would a calculator. When you touch OK, the calculated value is entered in the field.

MAUI with OneTouch

Touch, drag, swipe, pinch and flick can be used to create and change setups with one touch. Just as you change the display by using the setup dialogs, you can change the setups by moving different display objects. Use the setup dialogs to refine OneTouch gestures to precise values.

As you drag-and-drop, valid targets are outlined with a white box. When you're moving over invalid targets, you'll see the "Null" symbol (Ø) under your finger tip or cursor.

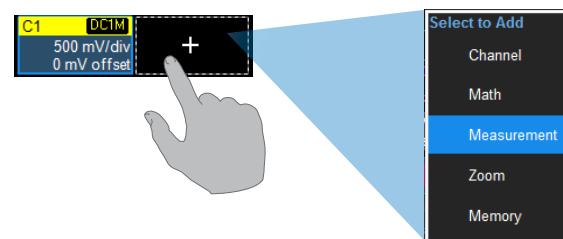
Turn On

To turn on a new channel, math, memory or zoom trace, drag any descriptor box of the same type to the Add New ("+" box). The next trace in the series will be added to the display at the default settings. It is now the active trace.



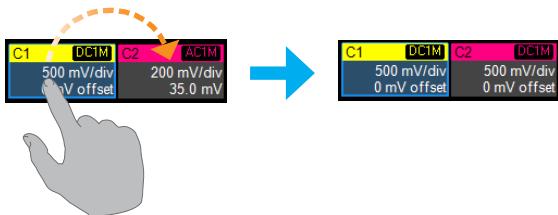
If there is no descriptor box of the desired type on the screen to drag, touch the Add New box and choose the trace type from the pop-up menu.

To turn on the Measure table when it is closed, touch the Add New box and choose Measurement.

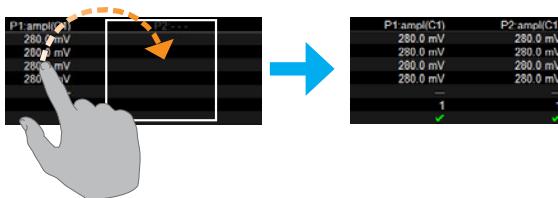


Copy Setups

To copy the setup of one trace to another of the same type (e.g., channel to channel, math to math), drag-and-drop the source descriptor box onto the target descriptor box.

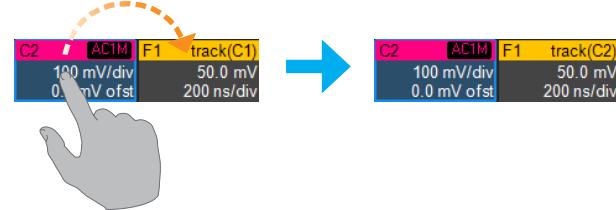


To copy the setup of a measurement (P_n), drag-and-drop the source column onto the target column of the Measure table. You can do the same for a query (Q_n) on the Pass/Fail readout table.

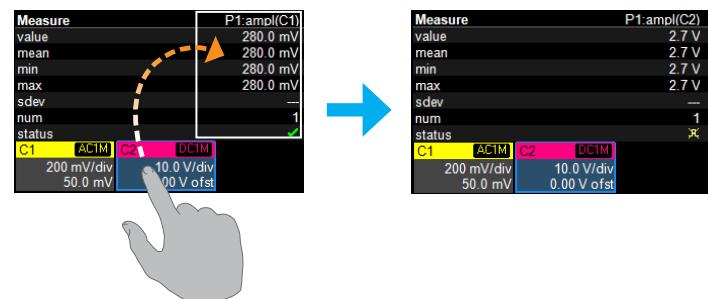


Change Source

To change the source of a math, zoom or memory trace, drag-and-drop the descriptor box of the desired source onto the target descriptor box. You can also drop it on the Source field of the target setup dialog.

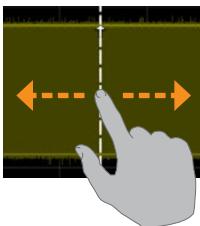


To change the source of a measurement, drag-and-drop the descriptor box of the desired source onto the parameter (P_n) column of the Measure table. You can do the same to a query (Q_n) on the Pass/Fail readout table.

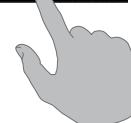
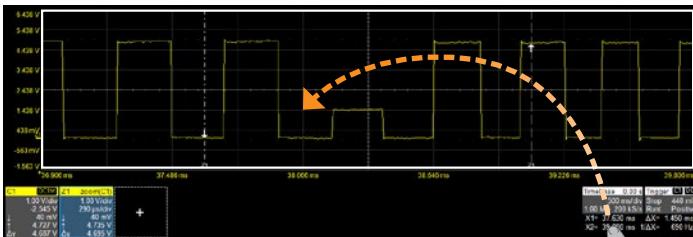


Position Cursors

To change cursor measurement time/level, drag cursor markers to new positions on the grid. The cursor readout will update immediately.

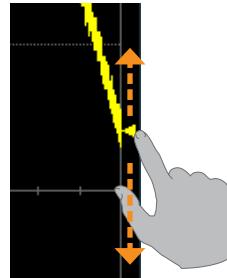


To place horizontal cursors on zooms or other calculated traces where the Horizontal Scale has forced cursors off the grid, drag the cursor readout from below the Timebase descriptor to the grid where you wish to place the cursors. The cursors are set at either the 5 (center) or 2.5 and 7.5 divisions of the grid. Cursors on the source traces adjust position accordingly.

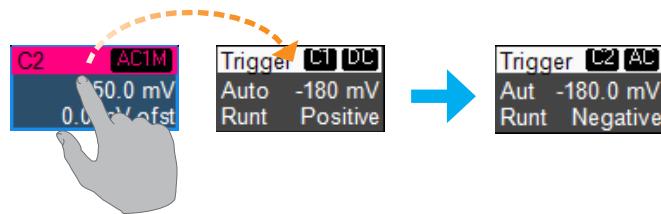


Change Trigger

To change the trigger level, drag the Trigger Level indicator to a new position on the Y axis. The Trigger descriptor box will show the new Level.

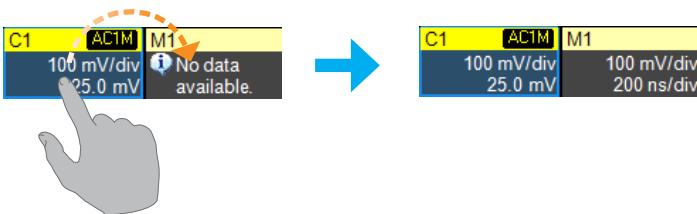


To change the trigger source channel, drag-and-drop the desired channel (C_n) descriptor box onto the Trigger descriptor box. The trigger will revert to the last coupling and slope/polarity set on that channel.



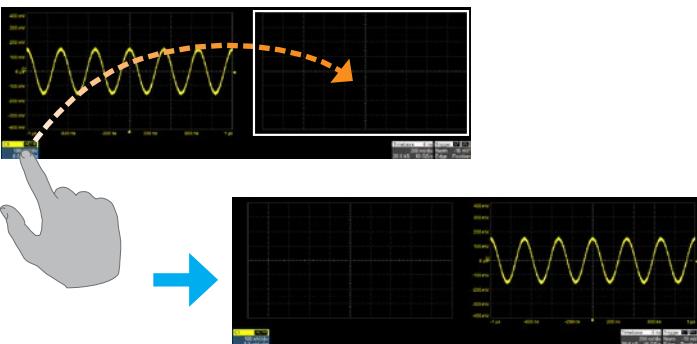
Store to Memory

To store a trace to internal memory, drag-and-drop its trace descriptor box onto the target memory (M_n) descriptor box.



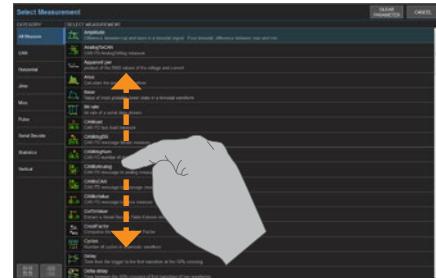
Move Trace

To move a trace to a different grid, drag-and-drop the trace descriptor box onto the target grid.



Scroll

To scroll long lists of values or readout tables, swipe the selection dialog or table in an up or down direction.

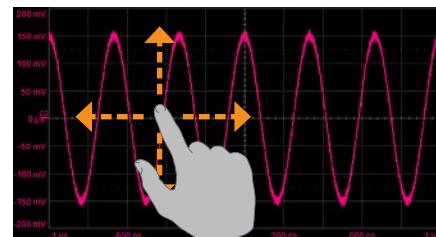


Pan

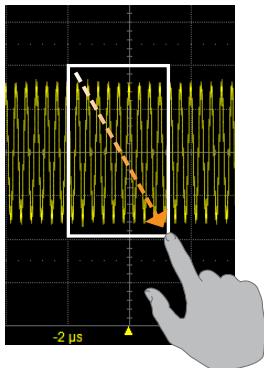
To pan a trace, activate it to bring it to the forefront, then drag the waveform trace right/left or up/down. If it is the source of any other trace, that trace will move, as well.

To pan at an accelerated rate, swipe the trace right/left or up/down.

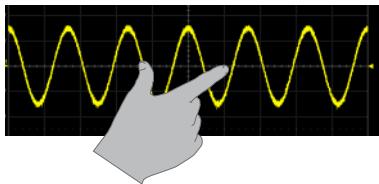
Tip: Panning/swiping is an easy way to position a trace in the Analysis Zone.



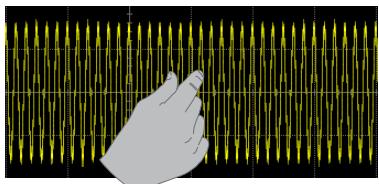
Zoom



To create a new zoom trace, touch then drag diagonally to draw a selection box around the portion of the trace you want to zoom. Touch the Zn descriptor box to open the zoom factor controls and adjust the zoom exactly.



To "zoom in" on any trace, unpinch two fingers over the trace horizontally.



To "zoom out" on any trace, pinch two fingers over the trace horizontally.

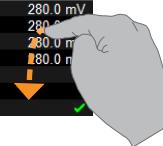
Turn Off

To turn off a trace, flick the trace descriptor box toward the bottom of the screen.



To turn off a measure parameter or Pass/Fail query, flick the Pn or Qn cell toward the bottom of the screen. If it's the last active cell of the table, the table will close.

Measure	P1:amp(C1)	P2:amp(C1)
value	280.0 mV	280.0 mV
mean	280.0 mV	280.0 mV
min	280.0 mV	280.0 mV
max	280.0 mV	280.0 mV
sdev	—	—
num	1	1
status	✓	✓

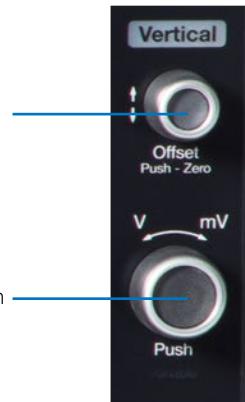


Vertical

Vertical controls adjust analog traces along the Y axis. Traces represent eight Vertical divisions of the source signal at the selected number of Volts or Amperes per division. The zero level is at the center grid line unless you add positive or negative Offset. The front panel Volts knob also controls the Vertical Scale of zoom, math and memory traces.

From the Front Panel

Raise/lower **Offset** from zero. Push to return to zero Offset.



Raise/lower **Volts/div.**. Push to toggle between coarse and fine scale adjustments.



Turn on/activate trace and open setup dialog.

Quick Zoom all traces.

Channel Descriptor Box

C2	DC50
50.0 mV	Coupling
0.00 mV	Volts/div (Gain)
---- 150.0 mV	Offset
----- -151.5 mV	Vertical Cursor Positions
Δy -301.5 mV	

Pre-Processing Summary List
(changes from default state)

Coupling

Volts/div (Gain)

Offset

Vertical Cursor Positions

From the Touch Screen

Channel descriptor: Touch **Channel descriptor** once to reactivate the trace, twice to reopen the Cn dialog.

Enter **Attenuation** for third-party probes.

Refine **Volts/div or Offset**.

Enter **Coupling**.

Enter signal **Bandwidth**.

Optionally, change **Vertical Unit** of grid or **Rescale** trace.

Make other **Pre-processing** settings.

Note: Averaging, Interpolation and ERes are disabled on >500 Mpts acquisitions.

Digital

On Mixed Signal instruments, Digital selections are added to the Vertical menu, and the front panel Vertical knobs control active Digital line and bus traces.

From the Front Panel

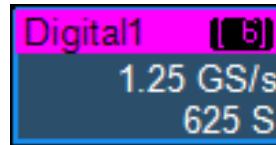
Turn **Offset** to raise/lower group **Vertical Position**, the top of lowest bit relative to center.



Turn **Volts** to raise/lower **Group Height**, the total Vertical divisions occupied by group.

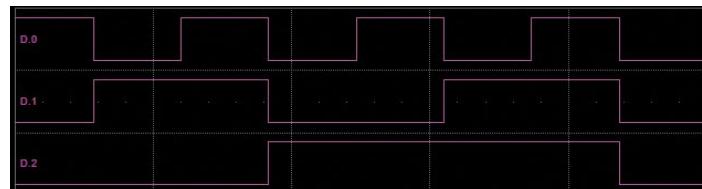
Turn on/activate digital traces.

Digital Descriptor Box



- # Digital Lines in Group
- Digital Sample Rate
- Digital Memory

Digital Display Modes



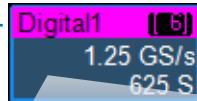
Line trace shows high, low and transition points for each line.



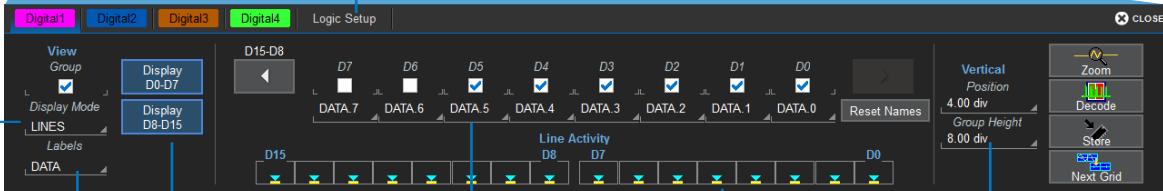
Bus trace collapses lines into hex values.

From the Touch Screen

Touch **Digital descriptor** once to activate digital trace, twice to open Digitaln dialog.



Choose a **Display Mode** of individual digital lines, bus trace or both.



Optionally, choose a new **Label** for the lines. Select Custom to enter unique names.

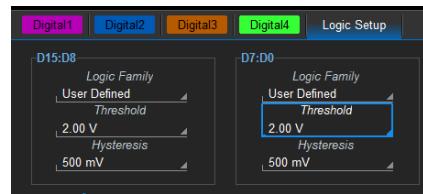
Use **Display buttons** to switch between lead banks as you select lines.

Use checkboxes to select the **lines in the group**. Optionally, enter a unique **line name** in the field beneath.

Line Activity Indicators show the state of each digital line: high, low or transitioning.

Enter trace **Vertical Position** and **Group Height** in divisions.

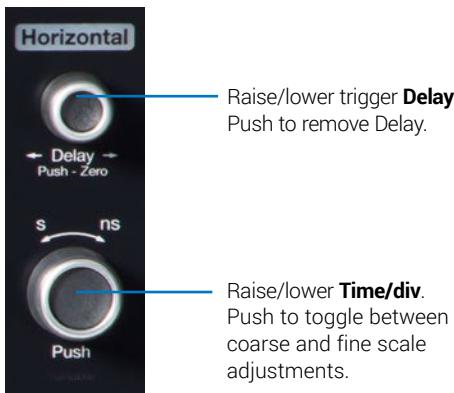
On the Logic Setup tab, choose a standard **Logic Family**, or enter a custom **Threshold** and **Hysteresis**. Separate controls allow you to set different values for each lead bank.



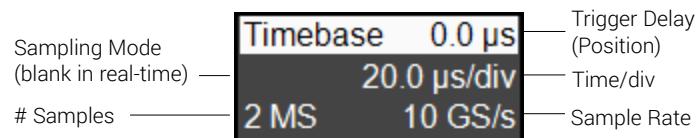
Horizontal (Timebase)

Horizontal controls adjust traces along the X axis. Analog traces usually represent one acquisition of the source signal for 10 divisions of the selected Time per division. The trigger event is shown at the center of the grid, unless you add positive or negative Delay time, which shifts the trigger point left or right. The front panel Time/div knob also controls the Horizontal Scale of zoom, math and memory traces, allowing you to "zoom in" to see more detail or "zoom out" to see the bigger picture.

From the Front Panel



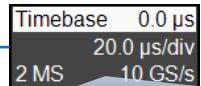
Timebase Descriptor Box



From the Touch Screen

Touch **Timebase**

descriptor to open
Timebase dialog.



Select **Sampling Mode**.

Refine **Time/div** and **Delay**.

Set To Zero removes Delay.

Memory, sample rate, and acquisition length for each channel, based on other selections. Note it can vary between channels within the same acquisition.

Set Maximum Memory possible at Time/div, or use a **Fixed Sample Rate**.

Use **4** standard or **2** interleaved channels for higher sample rate and memory (also higher bandwidth in 6 and 8 GHz models). **Auto** will automatically choose based on which channels have signal.

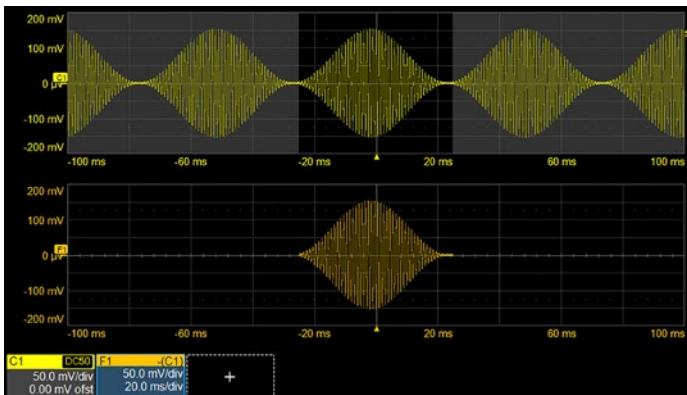
Change Time/div in reference to **Center (50%)** of display, or **Lock to Trigger Position** (see pp.28-29).

Navigating Long Acquisitions

For signal acquisitions >500 Mpts, measurements and math calculations take place on only the center 500 Mpts—the "Analysis Zone". This area is marked on the source channel trace by grey shading applied outside of it (over the part not analyzed). You may need to reposition the trace so that the portion you wish to analyze falls within the Analysis Zone. Also, you may wish to shorten the time it takes to complete a complex analysis by analyzing only the most significant part of the acquisition. This can be easily done using Timebase controls and/or Zoom.

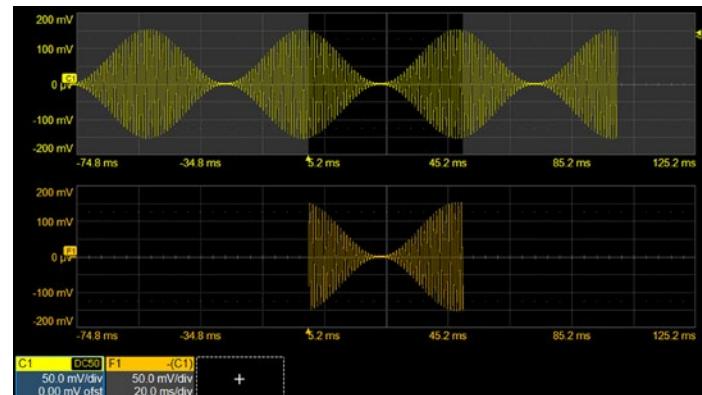
Navigating with Horizontal Delay

Stop acquisition, then pan/swipe or turn the Horizontal Delay knob until the part of the trace you wish to analyze is within the Analysis Zone.



Shading over source trace shows edges of Analysis Zone on long acquisition.

Truncated math trace reveals extent of Analysis Zone.

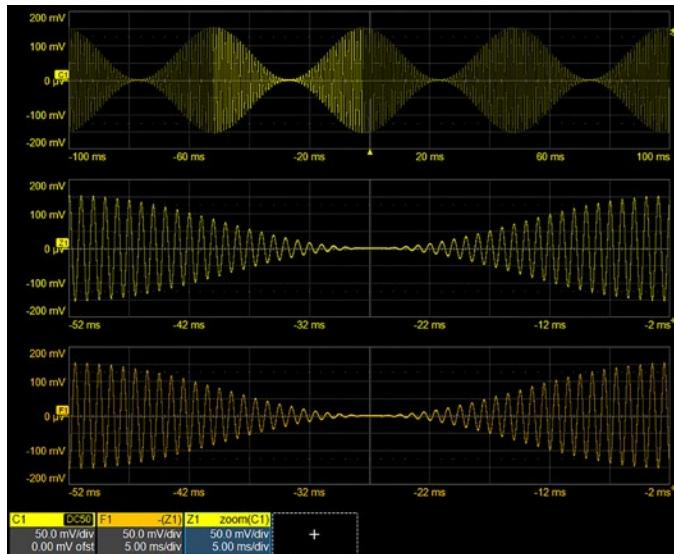


Math trace now shows how adding Delay shifts Analysis Zone.

Note: Your next acquisition will reflect any change to your Timebase settings. If you wish to preserve your initial acquisition settings, save the setup to internal memory before navigating, then recall it before you resume acquisition.

Navigating with Zoom

Stop acquisition, then create a zoom trace of the area you wish to analyze. Apply math and measurements to the zoom rather than the channel trace.

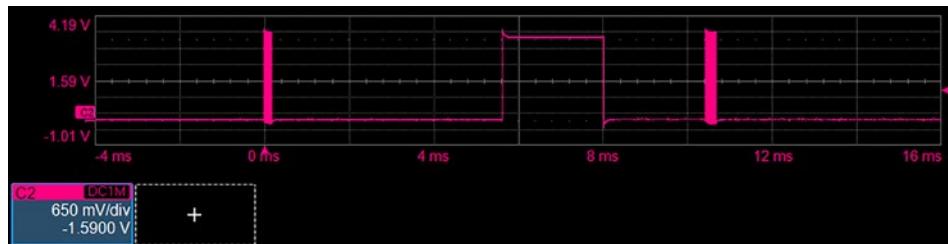


*Math applied to a zoom is calculated on the entire trace (up to 500 Mpts).
Highlighting on the source trace shows the zoomed area being analyzed.*

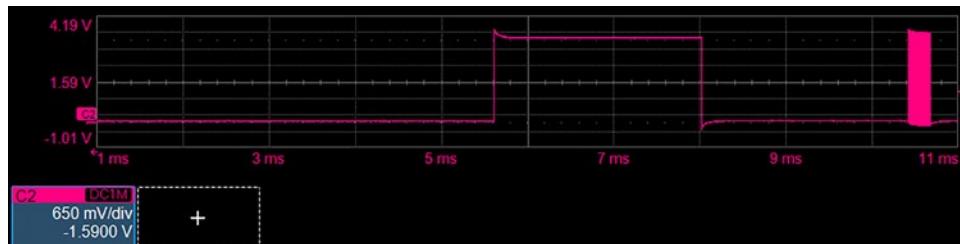
Navigation Reference

Changing the Navigation Reference setting can also help to reposition the acquired trace for analysis by selecting for different regions of the trace to remain centered as the Time/div changes:

Centered (50%) scales divisions equally so that whatever is at the center (50%) grid line remains at the center of the display. Other events move in reference to the center as Time/div changes. With this setting, the trigger point could potentially move off the grid as the scale changes.

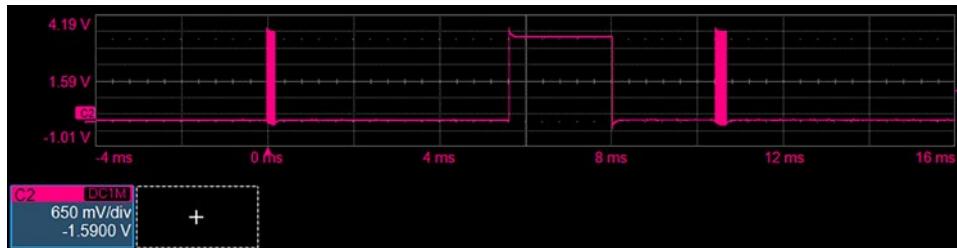


Timebase at 2 ms/div with -6.5 ms Delay shifting the trigger left of the center of the grid.

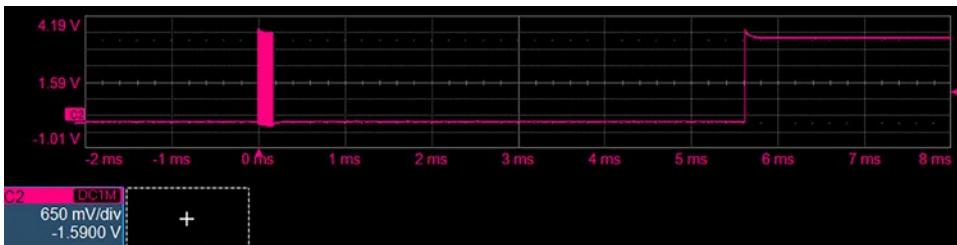


Timebase changed to 1 ms/div with Navigation Reference set to Centered (50%). Note how with this setting, the trigger event has shifted off the grid to the left as time "expands", but the center of trace remains in the same place.

A Navigation Reference of **Lock to Trigger** rescales divisions around the trigger point. The trigger event remains in place as Time/div changes, while other events move in reference to the trigger. If the trigger is currently placed at time zero, this will appear to behave the same as Centered, but the difference will be apparent if you have used Delay to shift the trigger position.



Same 2 ms/div Timebase with Timebase Reference set to Lock to Trigger starts the same as when Centered.

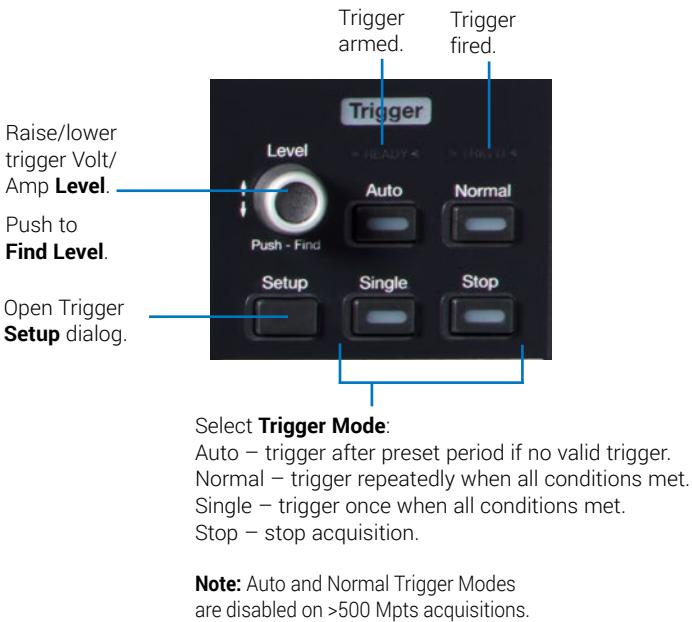


Now, when the Timebase is changed to 1 ms/div, the trigger event remains at its current position, but the rest of the trace shifts to the right as time "expands." The values associated with each horizontal grid division are different than when centered, although Time/div is still 1 ms/div.

Triggers

Triggers tell the oscilloscope when to perform an acquisition. The acquisition starts as soon as the trigger is armed *and* all trigger conditions are met, unless postponed by a Holdoff count of time or number of trigger events. Trigger types and modes are described at more length in the *WavePro HD Oscilloscopes Operator's Manual*.

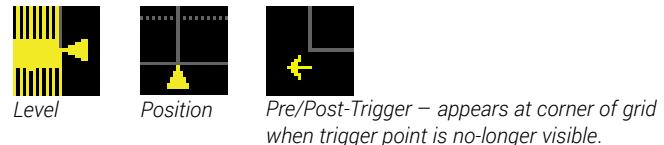
From the Front Panel



Trigger Descriptor Box



Trigger Indicators



From the Touch Screen

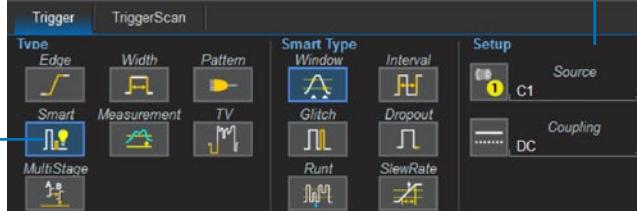
Touch **Trigger descriptor** to open Trigger dialog.



Choose trigger **Source** channel.

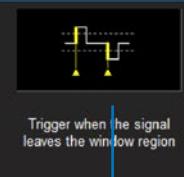
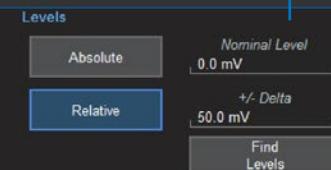
Set trigger **Levels**, or **Find Levels** based on the input signal mean.

Choose trigger **Type**.



Holdoff tab will appear when Edge or Pattern type is selected.

Set other **conditions**, such as **Slope** and **Coupling** (vary by trigger type).



Icon summarizes the trigger selections.

Zoom

Zoom traces display a magnified portion of another trace. Any trace can be zoomed, although Zoom is most useful for channel traces, as it allows you to see the source at the original Timebase at the same time as the Zoom "close up." Zoom is also useful for analyzing regions of >500 Mpts acquisitions that fall outside the center Analysis Zone. Use the Zoom trace as the source for measurements or math functions.

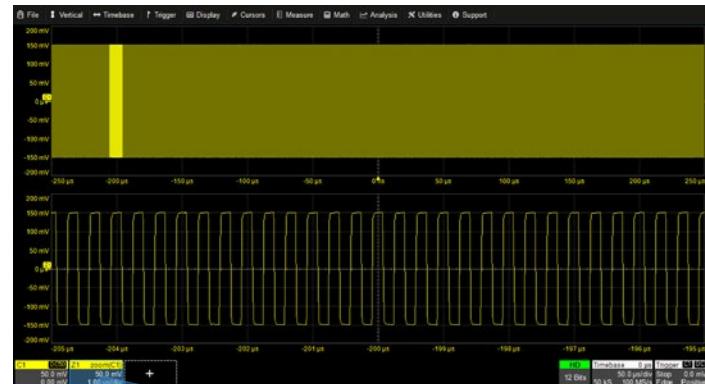
From the Front Panel



Adjust **Horizontal Scale** to change zoom magnification.

When you use the front panel Zoom button, a new Zoom trace is created for every open trace, showing a 10x magnification of the source trace.

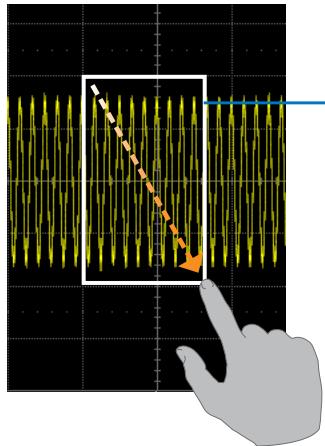
The zoomed portion of the original trace is highlighted, so that the area corresponding to the zoom is more visible.



C1	DC50	Z1	zoom(C1)
50.0 mV		50.0 mV	
0.00 mV		1.00 μ s/div	

The **Zoom descriptor box** shows the **Zoom Source** and **Horizontal Scale**, which differs from the Timebase.

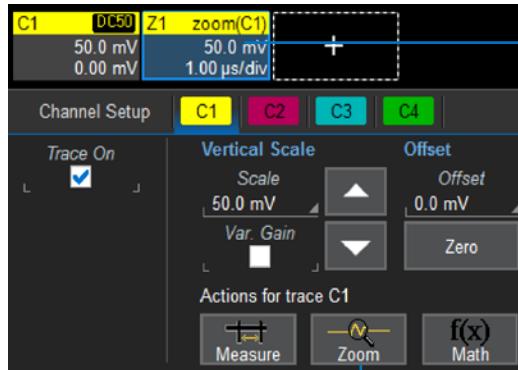
From the Touch Screen



Drag diagonally to draw a **rectangle** over the portion of the source trace you wish to zoom. The horizontal region is expanded to the width of the grid, while the vertical region is rescaled proportionally.

Repeat on another section to reposition the same Zoom trace or create another Zoom trace.

OR



Zoom descriptor
opens Zoom dialog
to make other
adjustments.

On the source trace setup dialog,
touch **Action Toolbar Zoom button**
to create a new zoom of just that
source trace.

Cursors

Cursors set measurement points on the Vertical or Horizontal axis of a trace (or both). The five preset cursor types are described in more detail in the *WavePro HD Oscilloscopes Operator's Manual*.

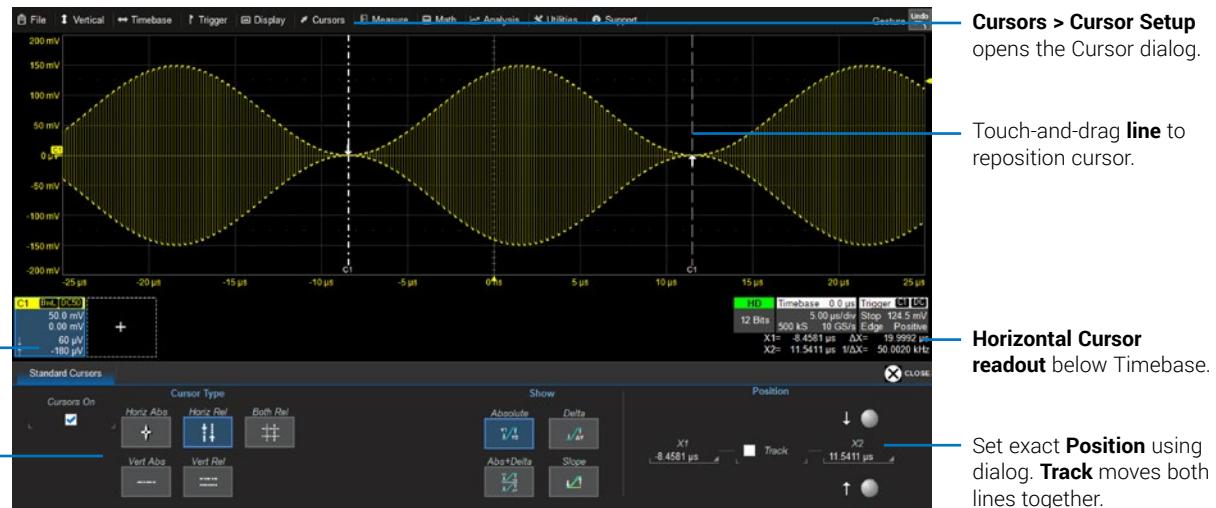
From the Front Panel



Adjust **cursor position**.
Push to select different lines when using Both Rel cursors.

Apply cursor.
Continue pressing to cycle through all **Cursor Types**.

From the Touch Screen



Measurements & Statistics

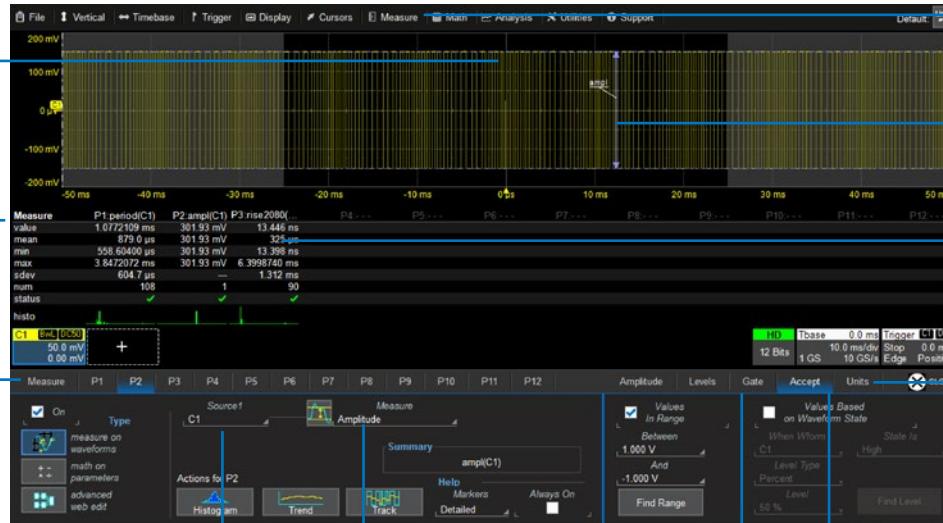
Measurements are waveform parameters that can be expressed as numerical values, such as amplitude or frequency. You can set up-to-12 simultaneous measurements and view the active readout in a table below the grid. Statistics can be displayed, along with histicons, a miniature histogram of the statistical distribution. You can also gate measurements to limit them to a specific region of the trace.

Note: Measurements are constrained to the center 500 Mpts on >500 Mpts acquisitions. Shading shows the edges of this Analysis Zone.

Analysis Zone on
>500 Mpts acquisitions.

Touch table **Measure**
column to re-open
Measure dialog.

Use Measure dialog
to turn on **Statistics**
and **Histicons**.



Choose **Source** trace to be measured and **Measurement**.

Enter **Gates** (in div) to constrain measured area, or just drag gate markers from edge of grid.

Accept measurements based on range of values or state of second, qualifying waveform.

Measure > Measure Setup opens the Measure dialog.

Help Markers show what is being measured on waveform.

Touch **Pn** cell to re-open **Parameter** setup.

Select **Unit** in which measurement is displayed.

Math

Math creates a new trace that displays the result of applying a mathematical function (e.g., Sum, Product, FFT) to one or more source traces. One important distinction between math functions and measurement parameters is that the result of math is always another waveform, whereas the result of measurement is a number. The math trace always opens in a separate grid from the source and can be viewed along side it. Operations can be chained by using one math function as a source for the other, by creating Dual functions or by creating complex processing webs with Advanced Web Edit.

Note: Math calculations are constrained to the center 500 Mpts on >500 Mpts acquisitions.



Math trace units
and scale on **Fn**
descriptor box.

Math tab to turn on/off
multiple math traces.

Fn tab to set up/change
single math function.

Choose **Source** trace(s)
to operate on and math **Operator**.

Use **Zoom controls** to change math trace
Horizontal/Vertical Scale. Make other settings on
the math **function subdialog** (vary by operation).

Math > Math Setup or
front panel Math button
opens the Math dialog.

Rescale trace using
multiplier or additive
constant, or override
Unit in which function is
displayed.

Memories (Reference Waveforms)

Memories are traces stored for reference. They can be recalled to the display for comparison with other traces. A memory can be zoomed or measured for better analysis of historical data. You can store up-to-12 internal memories (M1-M12). After that, new memories will overwrite previously stored data. Internal memories persist only until the oscilloscope is rebooted. To store memories indefinitely, save them to an external file by choosing **File > Save Waveform**. The file can then be recalled into internal memories for viewing by choosing **File > Recall Waveform**. Only memory files saved with the .trc extension can be recalled.



Memory trace units
and scale on

Mn descriptor box.

Memories tab to
turn on/off multiple
memories. **Mn tab** to
save new memory.

Choose trace to save to
memory (it must be visible
on the grid). **Copy Now** to
save.

Optionally, add **Notes**
describing memory before saving.

Math > Memory Setup
opens the Memories
dialog.

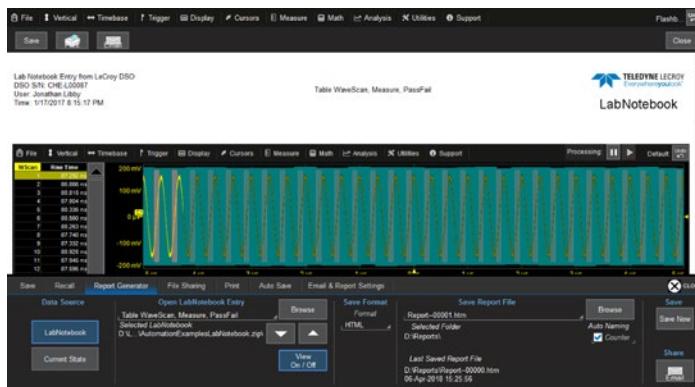
Saving and Sharing Data

Use the oscilloscope **File menu** options to save and recall data. See the *WavePro HD Oscilloscopes Operator's Manual* for more information on using these features.

LabNotebooks

LabNotebooks store setups, waveform data, and screen image as they were at the moment of capture. Creating a LabNotebook can be as simple as pressing the Save or User button as you work. Recall LabNotebooks to restore the oscilloscope to the exact state it was in when the file was saved. Waveforms and tables are displayed as they were for new analyses to be performed. Use LabNotebooks to generate preformatted PDF/HTML reports.

Note: LabNotebook is disabled on >500 Mpts acquisitions.



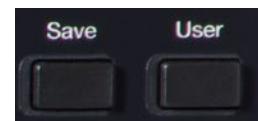
Setup, Waveform and Table Data

The current oscilloscope configuration can be saved to internal setup panels or setup (.LSS) files and later recalled.

Waveform data can be stored to trace (.TRC) files and later recalled into memories to restore the waveform display to the screen.

Table data can be saved to either ASCII (.TXT) or Excel (.CSV) files.

Screen Captures



The Save or User button can be configured to capture the screen and save the image to file using your Screen Image Preferences for file format, print area and color palette.

File Sharing

If the oscilloscope is networked, LabNotebooks, reports and other user data files can be emailed directly from the instrument or saved to accessible network devices. The oscilloscope can be added to a LAN via TCP/IP or directly connected to a PC via USBTMC to transfer data.

Files can also be transferred to a USB drive through any of the host USB ports. Stored user data files are located on the D: drive.

Cleaning

Clean the outside of the WavePro HD using a soft cloth moistened with water or isopropyl alcohol solution. Do not use harsh or abrasive cleansers. Dry thoroughly before using. Do not submerge the instrument or allow moisture to penetrate it.

Activating Software Options

To purchase an option (p.42), contact your Teledyne LeCroy sales representative. You will receive a license key via email that activates the optional features on the oscilloscope. To install the key on the oscilloscope:

1. From the menu bar, choose **Utilities > Utilities Setup > Options**.
2. Touch **Add Key**.
3. Enter the new **license key** and click **OK**.
4. Reboot the instrument.

Calibration

The WavePro HD is calibrated at the factory prior to being shipped. The calibration is run at 23 °C (± 2 °C) and is valid for temperatures ± 5 °C of the original calibration temperature. Within this temperature range, the WavePro HD will meet all specifications once warmed up.

Warm up the WavePro HD for at least 20 minutes prior to each use. You will see a message on the oscilloscope that it is still warming up. Specifications are not guaranteed during the warm up period.

Dynamic calibrations may occur during operation to maintain specified performance. These are managed by the software in such a way as to cause least disruption to your work.

We recommend manual calibration if using the oscilloscope in an environment more than ± 5 °C from the calibration temperature, or if it has been over one month since the previous calibration. From the menu bar, choose **Utilities > Preference Setup > Calibration**. The Calibration dialog will tell you if calibration is needed. There are two routines for selection:

Calibrate All calibrates all possible combinations of vertical and horizontal settings at the current environmental conditions. This calibration is valid for the current temperature ± 5 °C and may take over 60 minutes to complete.

Calibrate Current Setting calibrates the current vertical and horizontal setting at the current environmental conditions. This calibration is valid at this setting only for the current temperature ± 5 °C and takes about 10 seconds to complete.



CAUTION. Remove all inputs before calibrating the oscilloscope.

Schedule factory calibration once per year. Contact your local Teledyne LeCroy office for service.

Firmware Updates

Free firmware updates are available periodically from the Teledyne LeCroy website at teledynelecroy.com/support/softwaredownload. Registered users will receive email notification when a new update is released.

 **CAUTION.** Do not install any XStreamDSO software version prior to 8.6.1.8 on WavePro HD oscilloscopes. Doing so will disrupt the normal behavior of the software, unless you run the recovery procedure. To download and install the update:

1. From the oscilloscope desktop (File > Exit) or a remote PC, launch the browser and visit the software download page at the URL above.
2. Click the link to **Oscilloscope Downloads > Firmware Upgrades**.
3. Enter the required model information and account login. If you don't yet have an account, create one now.
4. Follow the instructions to save the installer to a location on the oscilloscope D: drive or a USB storage device.
5. On the oscilloscope, use Windows Explorer to browse to the installer file (**xstreamdsoinstaller_x.x.x.x.exe**) and double-click it to launch the XStream Setup wizard.
6. If prompted, enter the password **SCOPEADMIN**, all uppercase.
7. Follow the wizard prompts.
8. When installation is complete, power cycle the instrument.

 **CAUTION.** The installation may take several minutes, depending on the length of time since your last update. Do not power down the oscilloscope at any point during the installation process.

Switching Users

Windows 10 oscilloscopes are by default set to operate from the LeCroyUser account, but you must run the oscilloscope from the Administrative User, LCRYADMIN, in order to change Windows settings, run certain compliance packages or use LXI remote control.

Note: To install software or change Windows settings, it is sufficient to supply the administrative user password, SCOPEADMIN.

To switch to the LCRYADMIN account:

1. Exit the XStreamDSO application by choosing **File > Exit**.
2. Open the Windows **Start menu** .
3. Hover over the **Teledyne LeCroy logo**  and select user **LCRYADMIN**.
4. Enter the administrative password **SCOPEADMIN** (all uppercase).
5. Double-click the **StartDSO icon** on the oscilloscope desktop.

To return to the default user, repeat this procedure selecting **LeCroyUser** and entering the password **lecroyservice** (all lowercase).

You may create as many new users on the oscilloscope as you wish provided you are logged in as LCRYADMIN when doing so. Use the standard Windows tools to add users.

Note: As long as there are any Standard (non-administrative) users, the oscilloscope will reboot into the last active Standard user, regardless of whether you've switched to an administrative user. The only way to change this is to give LeCroyUser and all other users Administrator privileges. Contact Customer Support for instructions on changing user privileges and creating new users on the oscilloscope.

Service

If the WavePro HD cannot be serviced on location, contact your service center for a **Return Material Authorization (RMA)** code and instructions where to ship the product. All products returned to the factory must have an RMA.

Return shipments must be prepaid. Teledyne LeCroy cannot accept COD or Collect shipments. We recommend air freighting. Insure the item you're returning for at least the replacement cost.

Follow these steps for a smooth product return.

1. Remove all accessories from the instrument.
2. Label the instrument with:
 - The RMA
 - Name and address of the owner
 - Description of failure or requisite service.
3. Pack the instrument in its original shipping box, or an equivalent carton with adequate padding to avoid damage in transit. Do not include the manual.
4. Mark the outside of the box with the shipping address. Be sure to add:
 - ATTN: <RMA code assigned by Teledyne LeCroy>
 - FRAGILE
5. **If returning a product to a different country:** contact Teledyne LeCroy Service for instructions on completing your import/export documents.

Service Plans

Extended warranty, calibration, and upgrade plans are available for purchase. Contact your Teledyne LeCroy sales representative or customersupport@teledynelecroy.com to purchase a service plan.

Service Centers

For a complete list of Teledyne LeCroy offices by country, including our sales and distribution partners, visit: teledynelecroy.com/support/contact

Teledyne LeCroy
700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977, USA
teledynelecroy.com

Sales and Service:

Ph: 800-553-2769 / 845-425-2000
FAX: 845-578-5985
contact.corp@teledynelecroy.com

Support:

Ph: 800-553-2769
customersupport@teledynelecroy.com

Software Options

These are just some of the software options available to enhance the operation of a WavePro HD oscilloscope. After activating your license key (p.39), the options are added to the oscilloscope's menu bar.

Advanced Customization Package (WPHD-XDEV) lets you insert custom measurement parameters and math functions into the oscilloscope's real-time processing stream. Scripts can be written right on the oscilloscope or called from external applications, such as MATLAB. Language support for VBScript, MATLAB Script, MathCad Script, Excel VBA, and C/C++.

Digital Filter Package (WPHD-DFP2) implements a set of linear-phase FIR and IIR filters to remove undesired spectral components such as noise.

DDR Debug Toolkit (WPHD-DDR*-TOOLKIT) provides test, debug and analysis tools for the entire DDR design cycle. Available for DDR2, DDR3, and DDR4 signal analysis.

JITKIT (WPHD-JITKIT) makes it easy to understand the basic system jitter performance of clock signals and clock-data activities through a wide variety of common jitter measurements.

Eye Doctor II (WPHD-EYEDRII) provides channel emulation and de-embedding tools. It seamlessly integrates into SDA III software for eye diagram and jitter analysis.

Virtual Probe (WPHD-VIRTUALPROBE) helps to understand the characteristics of signals where a physical probe cannot be placed. Can be used to remove or add effects of fixtures for which only an S-parameter model exists.

SDA III (WPHD-SDAIII, WPHD-SDAIII-Complete-LINQ) delivers integrated jitter and timing analysis for clock and data signals. The -Complete-LINQ option delivers multi-lane capabilities fully integrated with Eye Doctor II and Virtual Probe software for a complete signal integrity toolkit.

VectorLINQ (WPHD-VECTORLINQ) Vector Signal Analysis software options offer an extensive toolset for demodulation and analysis of RF and IQ modulated signals.

Spectrum Analyzer (WPHD-SPECTRUM) creates an RF Spectrum Analyzer-like environment for analyzing frequency-dependent effects. Use the FFT on the oscilloscope with little or no concern about the details of setting up an FFT.

Power Analysis Software (WPHD-PWR) provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits, such as device power switching, control loop modulation and line power harmonics.

Many **Serial Trigger & Decode Options** provide added insight when debugging serial data protocols. Options are offered as trigger and decode (D/TD); plus serial data measure/graph and eye diagram tests (DME/TDME); plus Symbolic decoding (DME/TDME Symbolic). Physical layer test packages (TDMP) are also available for some protocols.

QualiPHY ensures physical layer compliance for a large number of serial data protocols. For the most up to date list of decoder and QualiPHY options, go to teledynelecroy.com/serialdata.

Support

Online Documentation

Online Help is available by selecting **Support > Dynamic Help** from the oscilloscope display menu bar. You can also select **Support > OneTouch Help** for a demonstration of MAUI with OneTouch.

Teledyne LeCroy publishes a free Technical Library on its website at teledynelecroy.com/support/techlib. Manuals, tutorials, application notes, white papers, and videos are available to help you get the most out of your Teledyne LeCroy products.

The *WavePro HD Oscilloscopes Operator's Manual* can be downloaded from the Technical Library under **Manuals > Oscilloscopes**. This PDF contains more extensive operating procedures than are found here.

The Datasheet published on the product page contains the detailed product specifications.

Technical Support

Registered users can contact their local Teledyne LeCroy service center to make Technical Support requests by phone or email. For a complete list of offices, visit teledynelecroy.com/support/contact.

You can also submit Technical Support requests via the website at teledynelecroy.com/support/techhelp.

Windows License Agreement

The XStreamDSO oscilloscope application runs on the Microsoft Windows operating system. Teledyne LeCroy's licensing agreement with Microsoft prohibits users from installing third-party software on oscilloscopes that is not relevant to measuring, analyzing or documenting waveforms.

Warranty

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. TELEDYNE 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. TELEDYNE LECROY WILL RETURN ALL PRODUCTS UNDER WARRANTY WITH TRANSPORT PREPAID.

The product is warranted for normal use and operation, within specifications, for a period of three years from shipment. Teledyne 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.

Teledyne 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 Teledyne LeCroy representatives; b) improper connection to incompatible equipment; or c) for any damage or malfunction caused by the use of non-Teledyne LeCroy supplies. Furthermore, Teledyne 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 instrument. Spare and replacement parts, and repairs, all have a 90-day warranty.

The instrument'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 Teledyne LeCroy are covered solely by the original manufacturer's warranty.

Certifications

Teledyne LeCroy certifies compliance to the following standards as of the time of publication. Please see the EC Declaration of Conformity document shipped with your product for current certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

The instrument meets intent of EC Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications listed in the Official Journal of the European Communities:

EN 61326-1:2013 and EN 61326-2-1:2013, EMC requirements for electrical equipment for measurement, control, and laboratory use¹

Electromagnetic Emissions:

EN 55011:2016+A1:2017, Radiated and Conducted Emissions Group 1, Class A²

EN 61000-3-2:2014, Harmonic Current Emissions, Class A

EN 61000-3-3:2013, Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

EN 61000-4-2:2009, Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes⁴

EN 61000-4-3:2006+ A2:2010, RF Radiated Electromagnetic Field, 3 V/m 80-1000 MHz; 3 V/m 1400 MHz-2 GHz; 1 V/m 2 GHz-2.7 GHz

EN 61000-4-4:2012, Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines⁴

EN 61000-4-5:2014+A1:2017, Power Line Surge, 1 kV AC Mains L-N, L-PE, N-PE⁴

EN 61000-4-6:2014, RF Conducted Electromagnetic Field, 3 Vrms 0.15 MHz-80 MHz

EN 61000-4-11:2004+A1:2017, Mains Dips and Interruptions, 0%/1 cycle, 70%/25 cycles, 0%/250 cycles^{4,5}

¹ To ensure compliance with all applicable EMC standards, use high-quality shielded interface cables.

² Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.

³ This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

⁴ Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

⁵ Performance Criteria "C" applied for 70%/25 cycle voltage dips and for 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:^{*}

Teledyne LeCroy Europe GmbH

Im Breitspiel 11c
D-69126 Heidelberg
Germany
Tel: + 49 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

The instrument complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

AS/NZS CISPR 11:2015, Radiated and Conducted Emissions, Group 1, Class A

Australia / New Zealand Contacts:^{*}

RS Components Pty Ltd.

Suite 326 The Parade West

Kent Town, South Australia 5067

RS Components Ltd.

Units 30 & 31 Warehouse World

761 Great South Road

Penrose, Auckland, New Zealand

* Visit teledynelecroy.com/support/contact for the latest contact information.

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The oscilloscope meets intent of EC Directive 2014/35/EU for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

EN 61010-2:030:2010, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits

The design of the instrument has been verified to conform to the following limits put forth by these standards:

- Mains Supply Connector: Overvoltage Category II, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).
- Measuring Circuit Terminals: No rated measurement category. Terminals not intended to be connected directly to the mains supply.
- Pollution Degree 2, use in operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

U.S. NATIONALLY RECOGNIZED AGENCY CERTIFICATION

The oscilloscope has been certified by Underwriters Laboratories (UL) to conform to the following safety standard and bears the UL Listing Mark:

UL 61010-1 Third Edition, Safety standard for electrical measuring and test equipment

CANADIAN CERTIFICATION

The oscilloscope has been certified by Underwriters Laboratories (UL) to conform to the following safety standard and bears the cUL Listing Mark:

CAN/CSA-C22.2 No. 61010-1-12, Safety requirements for electrical equipment for measurement, control and laboratory use

Environmental Compliance

END-OF-LIFE HANDLING



The instrument is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2012/19/EU and 2013/56/EU on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The instrument is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

This instrument and its accessories conform to the 2011/65/EU RoHS2 Directive.

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System.

Intellectual Property

All patents pertaining to the WavePro HD can be found on our website at:

teledynelecroy.com/patents/

930286-00 Rev A,
July, 2019