TELEDYNE LECROY
Everywhere**you**look™

Getting Started Manual
WaveRunner 6 Zi
and 12-Bit HRO
Oscilloscopes

WaveRunner 6 Zi and
12-Bit HRO Oscilloscopes
Getting Started Manual
January 2013

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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 oscilloscope 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 or 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 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 Teledyne LeCroy are covered solely by the warranty of the original equipment manufacturer.

922136-00 Rev A
January 2013

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Welcome

Thank you for purchasing a Teledyne LeCroy product. We're certain you'll be pleased with the detailed features so unique to our instruments.

With 16 times more resolution, unmatched accuracy and impressive signal fidelity, Teledyne LeCroy High Resolution Oscilloscopes are a new breed of instrument delivering **more vertical resolution**, **unmatched accuracy**, **impressive signal fidelity**, and **true 12 bit vertical resolution**.

This **WaveRunner6 Zi** and **12-Bit HRO** Getting Started Manual is designed to cover important safety and installation information for your oscilloscope, along with standard procedures so you're quickly working on waveforms. The Teledyne LeCroy website at teledynelecroy.com maintains the most current specification information and the online help file on your instrument may be accessed for more comprehensive documentation. Sections of the online help residing on your oscilloscope may be printed and transferring the help file itself to a USB memory device is a fairly common procedure. For details on how to access your online help file can be found in a .pdf file on the desktop of your oscilloscope or you can search for **Operator's Manual for Zi Oscilloscopes** on the Teledyne LeCroy website at teledynelecroy.com.

When your product is delivered, verify that all items on the packing list or invoice copy have been shipped to you. Contact your nearest Teledyne 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.

We truly hope you enjoy using Teledyne LeCroy's fine products.

Sincerely,

David C. Graef

Teledyne LeCroy Corporation
Vice President and Chief Technology Officer

How This Manual Is Organized

First, we cover your instrument's unique hardware and software features in the following sections:

- Hardware
- Basic Controls
- Probe and Signal Connection Interfaces
- Display Dashboard
- Turning on Channels and Traces

Essential Core Oscilloscope Functions

This section covers the essential Teledyne LeCroy oscilloscope core functions, such as:

- Timebase
- Sampling Modes
- Vertical
- Trigger
- Viewing
- Zooming
- Measuring
- Math
- Masks
- Customization
- LabNotebook
- Save/Recall
- Utilities

Reference

The Reference section is set aside and covers items like **Certifications,** how to **Contact Teledyne LeCroy for Support,** and to always maintains the most current specification information. The website should always be checked for frequent updates.

Safety Instructions

This section contains instructions that must be observed to keep the instrument operating in a correct and safe condition. You are required to follow generally accepted safety procedures in addition to the precautions specified in this section. **The overall safety of any system incorporating this instrument is the responsibility of the assembler of the system.**

Symbols

These symbols appear on the instrument's front or rear panels and in its documentation to alert you to important safety considerations.

⚠ **CAUTION** of potential damage to instrument, or **WARNING** of potential for bodily injury. Attend to the accompanying information to protect against personal injury or damage. Do not proceed until conditions are fully understood and met.

⚡ High voltage. Risk of electric shock.

⏚ Measurement ground connection.

⏚ Safety (protective) ground connection.

∿ Alternating Current.

⏻ Standby Power (front of instrument).

Precautions

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

Maintain ground. This product is grounded through the power cord grounding conductor. To avoid electric shock, connect only to a grounded mating outlet.

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

Observe all terminal ratings. Do not apply a voltage to any input (C1, C2, C3, C4 or EXT) that exceeds the maximum rating of that input. Refer to the front of the oscilloscope for maximum input ratings.

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

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.

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

Do not operate with suspected failures. Do not use the product if any part is damaged. Obviously incorrect measurement behaviors (such as failure to calibrate) might indicate impairment due to hazardous live electrical quantities. Cease operation immediately and sequester the instrument from inadvertent use.

Operating Environment

Temperature: 5 to 40 °C.

Humidity: Maximum relative humidity 80 % for temperatures up to 31° C decreasing linearly to 50 % relative humidity at 40° C (or at the upper operational temperature limit).

Altitude: Up to 10,000 ft (3,048 m) at or below 25° C.

Cooling

The instrument relies on forced air cooling with internal fans and vents. Take care to avoid restricting the airflow to any part of the oscilloscope. Around the sides and rear, leave a minimum of 15 cm (6 inches) between the instrument and the nearest object. At the bottom, the oscilloscope feet (up or down) provide adequate clearance.

⚠️ **CAUTION.** Do not block oscilloscope vents. Always keep the area beneath the oscilloscope clear of paper and other items.

The instrument also has internal fan control circuitry that regulates the fan speed based on the ambient temperature. This is performed automatically after start-up.

Cleaning

Clean only the exterior of the oscilloscope using a damp, soft cloth. Do not use harsh chemicals or abrasive elements. Under no circumstances submerge the instrument or allow moisture to penetrate it. Avoid electric shock by unplugging the power cord from the AC outlet before cleaning.

⚠️ **CAUTION.** Do not attempt to clean internal parts. Refer to qualified service personnel.

Calibration

The oscilloscope is calibrated at the factory prior to being shipped. The recommended calibration interval is one year. Calibration should be performed by qualified personnel only.

The oscilloscope software includes automatic and manual calibration functions.

⚠️ **CAUTION.** It is required that all inputs be removed from the oscilloscope prior to performing a manual calibration.

Schedule an annual factory calibration as part of your regular maintenance. 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.

Power

AC Power Source

100-240 VAC (+/-10%) at 50/60 Hz (+/-5%)
100-120 VAC (+/-10%) at 400 Hz (+/-5%)
Installation Category: 300V CAT II

Manual voltage selection is not required because the instrument automatically adapts to line voltage.

Power Consumption

8-BIT MODELS:
Power Consumption (Nominal): 425 Watts (425 VA)
Max Power Consumption (with all PC peripherals, active probes connected to 4 channels, and MSO active): 500 Watts (500 VA)

12-BIT MODELS:
Power Consumption (Nominal): 325 Watts (325 VA)
Max Power Consumption (with all PC peripherals, active probes connected to 4 channels, and MSO active): 425 Watts (425 VA)

Power consumption in Standby Mode: 15 Watts

Power and Ground Connections

The instrument is provided with a 10A/250V 18AWG rated grounded cord set containing a molded three-terminal polarized plug and a standard IEC320 (Type C13) connector for making line voltage and safety ground connections.

The AC inlet ground is connected directly to the frame of the instrument. For adequate protection again electric shock, connect to a mating outlet with a safety ground contact.

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

Standby Power

The **Standby Power** button controls the operational state of the oscilloscope. Press the button to switch the instrument On or into Standby mode (Off).

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

Powering off does not disconnect the oscilloscope from the AC power supply. The only way to fully power down the instrument is to shut down then unplug the AC power cord from the outlet. We recommend unplugging the instrument if it will be unused for a long period of time.

Hardware

The Front of Your Oscilloscope

Numbered labels on this image correspond with descriptions on the following table.

Number and Description		
1. Power Button **2.** Channel Inputs **3.** EXT Input and AUX Output connectors	**4.** Ground Connector and Probe Calibration Hook **5.** USB Connections and Teledyne LeCroy Bus Port **6.** Front Panel Control	**7.** Rotating Display Release Switch **8.** Touch Screen Stylus

Rotating and Tilting the Display

The display panel allows for **Rotation** and **Tilting** adjustments. These adjustments allow you to position your instrument with unmatched versatility.

Rotate and Tilt your display using the following instructions:

Note: Your oscilloscope should always be firmly planted on a solid supporting surface at all times.

ROTATING THE DISPLAY

Rotate the display by firmly grasping the left side of the display. Use your thumb to push upward on the release switch (on the front-left side of the display), and then use your wrist to forcibly rotate the display in an upward, clockwise twisting motion until the display locks into portrait position.

Rotating the display from landscape (horizontal) to portrait (vertical) positioning.

Note: For models without a latch on the left side of the display, grip the same side firmly and rotate in an upward, clockwise twisting motion. The track clicks in and out of the two positions without the use of the latch.

The user interface then adjusts its layout from landscape (horizontal) to portrait (vertical). This setup is ideal for viewing high-amplitude signals.

The Rotating Display shown in portrait layout position.

Reverse the process by grasping the now upper side of the display. Again, use your thumb to push upward on the release switch; but, now use your wrist to forcibly rotate the display in a downward, counter-clockwise twisting motion until the display locks back into landscape position.

The user interface then adjusts the layout back from portrait (vertical) to landscape (horizontal).

TILTING THE DISPLAY

The display can be tilted (while in either Landscape or Portrait mode) into Upward or Downward positioning for convenience.

Tilt the display by firmly grasping the far left side of the display and the far right side of the front panel. Use your wrists to forcibly tilt the display by pushing the upper-portions forward (to tilt upward) or the lower-portions backward (to tilt downward) until the desired positioning is reached.

Tilting the display by pushing the upper-portions of the display/front panel forward - tilting the display from downward to upward positioning.

I/O Panel

The I/O Panel is located on the right side (facing) of the instrument as follows:

Note: A Teledyne LeCroy Bus (LBUS) connection is located on the **The Front of Your Oscilloscope** (on page 3).
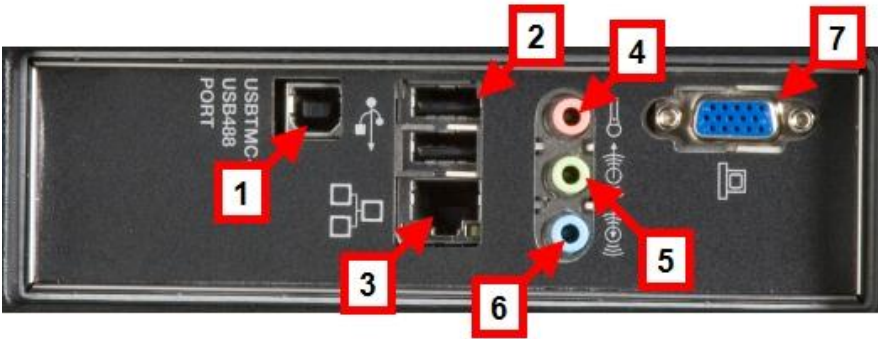
Numbered labels on the following **I/O Panel** image correspond with descriptions on the following table.

Number and Description		
1. USB488 Connection	**4.** Microphone Connection	**6.** Line In Connection
2. USB A Connections	**5.** Speaker Connection	**7.** External VGA Monitor Connection
3. Ethernet Port		

Note: Contact a system administrator when connecting to any internal LAN.

The Back of Your Oscilloscope

The AC Power Plug is located on the back panel of your instrument.

Removable Hard Drive Option

The WaveRunner 6 Zi and 12-Bit HRO have a removable hard drive option available. The remainder of this topic explains how to properly remove and reinstall the WaveRunner 6 Zi and 12-Bit HRO removable hard drive.

PLEASE NOTE THE FOLLOWING:

- The WaveRunner 6 Zi and 12-Bit HRO removable hard drive option must be specified when ordering and installed at the Teledyne LeCroy factory. Contact your Teledyne LeCroy representative for details using **Contact Teledyne LeCroy for Support**.

- When this option is ordered, a removable hard drive is installed inside your oscilloscope and an additional removable hard drive is also provided.

- Never attempt to extract a removable hard drive without powering down your instrument first.

⚠ **WARNING.** Only removable hard drives supplied by Teledyne LeCroy should ever be used in your instrument. Teledyne LeCroy drives bear a Teledyne LeCroy sticker and serial number indicating the intended oscilloscope model with which it's supposed to be used.

When extracting your removable hard drive (if you have this option) hand-turn and remove the screws, and then remove the cover from the back of your oscilloscope.

Hand-turn and remove the screws, and then remove the cover from the back of your oscilloscope.

Finally, to make sure the removable hard drive cover is returned in the correct direction to the back of your oscilloscope, a sill or lip on the inside of the cover should be situated so it pushes downward on the removable hard drive.

Return the cover so the inner sill or lip pushes downward on the removable hard drive.
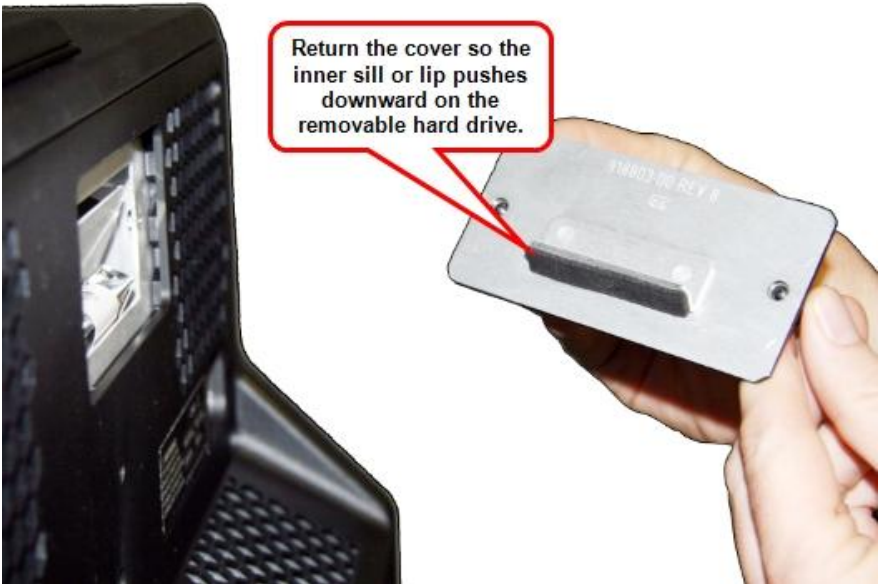
Basic Controls

Hardware and Software Controls

The following Basic Control topics cover the general usage of the **hardware** buttons located on the oscilloscope's front panel and the screen control interface elements of the **software**.

Front Panel Controls

Note: Many specific Front Panel Controls directly correspond with Screen Layout Controls. For example, the Print front panel general control button corresponds with the Hardcopy function at Utilities → Utilities Setup → Hardcopy.

The following picture shows the **Front Panel Control**.

Front panel for WaveRunner 6 Zi and 12-Bit HRO oscilloscopes.

Front Panel Control Groupings

The front panel is divided into sections based on various functions. The following topics explain these sections in more detail.

Miscellaneous Controls and WaveStream Indicator

This topmost section of the front panel provides the following functions:

- **Touch Screen** - By default this button's blue backlit LED is ON and the touch screen is enabled. By pressing this button and turning off the LED, the touch screen is then disabled.

- **Print** - Press this button and it automatically executes the based on the settings you've made as described in **Printing and Hardcopy Functions** (on page 147).

  You can set the oscilloscope to automatically spool directly to a **printer**, to a **file**, an **email** (with attachment), or to the **clipboard**.

- **Scope Setup** - Press once and the **Scope Setup** flyout menu is shown. The **Scope Setup** flyout menu quickly provides access to **Auto Setup**, **C1 Find Scale**, **C2 Find Scale**, **C3 Find Scale**, **C4 Find Scale**, and **Default Setup** buttons. These functions perform various automatic setup configurations to your instrument. This corresponds to the **Auto Setup...** selection on the menu bar from the **Vertical**, **Timebase**, or **Trigger** menus.
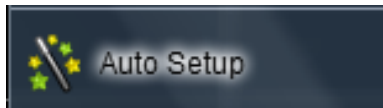
  Press the **Auto Setup...** button on the flyout menu to perform a full auto setup. Press a **Channel Find Scale** button on the flyout menu to perform a quick auto setup for that channel only.

Press the **AUTO SETUP...** front panel button twice to perform the last selection from the **Auto Setup...** flyout menu (the default is to perform a full auto setup).

If Auto Setup is run when no channels are turned on, all channels are affected. When more than one channel is turned on, the first channel with a signal applied to it is automatically set up for edge triggering.

Perform an autosetup of all these functions together by pressing the **Auto Setup...** front panel button.

- **Clear Sweeps** - Press to clear data from multiple sweeps (acquisitions) including: persistence trace displays, averaged traces, parameter statistics, and Histicons. During waveform readout, cancels readout. This is the same as pressing **Clear Sweeps** on the **Measure → Measure Setup...** or **Math → Math Setup dialogs**.

- **WaveStream** - Indicates when WaveStream mode is ON. Refer to **WaveStream Mode** (on page 89) for more information.

- **Intensity** - Press to toggle between WaveStream OFF and ON for Analog Persistence and WaveStream ON for Color Persistence. When you turn the knob, if WaveStream is ON, the WaveStream display intensity changes. When you turn the knob, if WaveStream is OFF, changes the Intensity setting. Corresponds with the screen menu selection: **Display → Display Setup** (on page 84).

Trigger Front Panel Controls

- **Level** - Pressing this button sets the trigger level to 50%. Turn the knob to change the trigger threshold level. The threshold level is indicated on the Trigger label.

- **READY and TRIG'D Indicators** - The READY indicator is lit when the trigger is armed. TRIG'D is lit momentarily when a trigger occurs. A fast trigger rate causes the light to stay lit continuously.

- **Setup** - Press once to open the **Trigger Setup...** dialog. Corresponds with screen menu selection: **Trigger → Trigger Setup...**. Press the Trigger SETUP front panel button again to close the **Trigger Setup...** dialog.

- **Trigger Scan** - Pressing the Trigger Scan button opens the TriggerScan dialog to help you quickly find rare waveform glitches and anomalies.

- **Source** - This button directly selects through the available **Source** field values (C1, C2, C3, C4, Dig, EXT, and Line) usually accessed on the **Setup** section of the main **Trigger** dialog.

- **Slope** - This button directly selects through the available **Slope** field values (Positive, Negative, or Either) usually accessed on the **Setup** section of the main **Trigger** dialog.

- **Coupling** - This button directly selects through the available **Coupling** field values - DC, AC, LFR (Low-Frequency Rejection), or

HFR (High-Frequency Rejection) - usually accessed on the **Setup** section of the main **Trigger** dialog.

- **Auto** - Press to turn on **Auto Trigger** mode, which triggers the oscilloscope after a time-out, even if the trigger conditions are not met.

- **Normal** - Press to turn on **Normal Trigger** mode, which triggers the oscilloscope each time a signal is present that meets the conditions set for the type of trigger selected.

- **Single** - Press to turn on **Single Trigger** mode, which arms the oscilloscope to trigger once (single-shot acquisition) when the input signal meets the trigger conditions set for the type of trigger selected. If the scope is already armed, it will force a trigger.

- **Stop** - Press to prevent the scope from triggering on a signal. If you boot up the instrument with the trigger in **Stop** mode, a **no trace available** message is shown. Press the Trigger AUTO front panel button to display your trace.

Horizontal Front Panel Controls

Note: Horizontal front panel controls can be applied to **signals**, **Math**, **Zoom**, or **Memory** traces. See **Math, Zoom, and Memory Indicators and Controls** (on page 25) for more information.

- **Delay** - Press to toggle between a zero horizontal delay value and the previous horizontal delay value. Turn to change the horizontal delay value.

- **Time/Div** - Turn to set the time/division of the oscilloscope timebase (acquisition system). When using this Horizontal control on a Math, Zoom, or Memory trace, you can press this button to toggle between fixed and variable adjustments. Turn the knob to change the value.

Vertical Front Panel Controls

Note: Vertical front panel controls can be applied to **signals**, **Math**, **Zoom**, or **Memory** traces. See **Math, Zoom, and Memory Indicators and Controls** (on page 25) for more information.

- **Channels** - The channel buttons (1 - 4 and Digital) control both channel ON/OFF and which channel is active for the Vertical Offset and Volts/Div knobs controls. If a channel is OFF, pressing that channel button turns it on and makes it active. If a channel button is ON, pressing that channel button makes it active, and then pressing it a second time turns it OFF.

- **Offset** - Press to toggle between a zero vertical offset value and the previous vertical offset value for the selected channel. Turn to change the vertical offset value for the selected channel.

- **Gain** - Press to toggle between fixed and variable gain adjustment. Turn to change the gain value.

Math, Zoom, and Memory Indicators and Controls
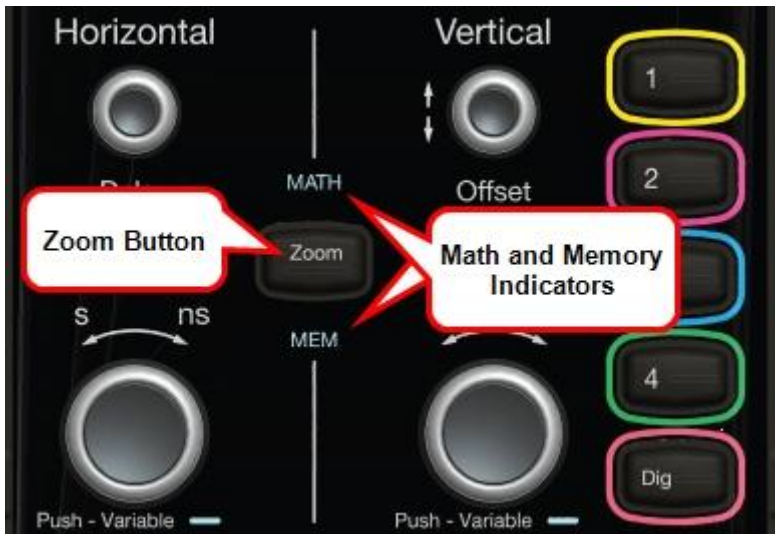
- When pressed, the Zoom automatically creates a Zoom trace of all active channels. Math and Memory traces must first be enabled on their respective dialogs in **Math → Math | Memory Setup...** for use by the front panel controls.

- When Math, Zoom, or Memory traces are enabled - see **Math → Math | Zoom | Memory Setup...**, respectively - the corresponding indicator light illuminates and the Horizontal and Vertical controls specifically control the Math, Zoom, or Memory trace.

- The **Push - Variable** function on the **Time/Div** front panel control for Horizontal only applies to Math, Zoom, or Memory traces and not Channels. Press the button to toggle between fixed and variable adjustments or turn the knob to change the value.

The WavePilot Control Area and The SuperKnob

The **WavePilot Control Area** contains buttons that correspond to specific functions. These function buttons are used together with the **SuperKnob** to provide increased instrument control at your fingertips.

The SuperKnob is a joystick-like knob in the center of the WavePilot Control Area used to make selections or provide specific values.
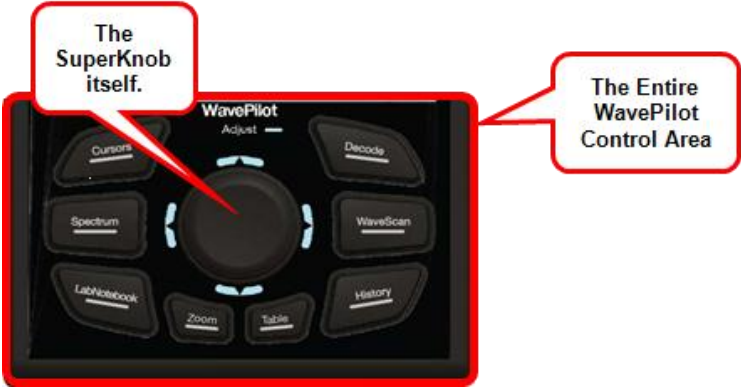
The SuperKnob shown on the WavePilot Control Area.

SUPERKNOB FIELD CONTROL AND THE ADJUST HELP FLYOUT MENU

Whenever you access a non-text entry or file browsing control on a dialog, the Adjust Help Flyout menu is shown.

The Probe Attenuation control value being changed using the SuperKnob.

Control values can be adjusted using the touch screen, a connected mouse, or by use of the SuperKnob. Turning the SuperKnob moves through available control values and, as indicated by the Help Flyout menu, pressing the SuperKnob provides Toggle Variable functionality; meaning, fine and coarse adjustments (if available for the particular control) may be selected for use.

The WavePilot Control Area provides powerful control of **Cursors**, **Decode**, **WaveScan**, **History**, **LabNotebook**, and **Spectrum** by their respective function buttons on the front panel. Based on the function button selected, additional functions are then available on the SuperKnob.

PLEASE NOTE THE FOLLOWING:

- Not all functions have a function assigned to each (or any) **left**, **right**, **up**, or **down** SuperKnob control. Some only have one or two controls. Deactivated SuperKnob control directions are shown as un-labeled and grayed-out on respective Help Flyout menus.

- The name of the current mode being used is shown vertically on the left side of the Help Flyout menu.

- When a function button is pressed and the SuperKnob control changes, a corresponding clearly-labeled, **Help Flyout** menu indicates additional functions available when using the SuperKnob to joystick in **left**, **right**, **up**, or **down** directions.
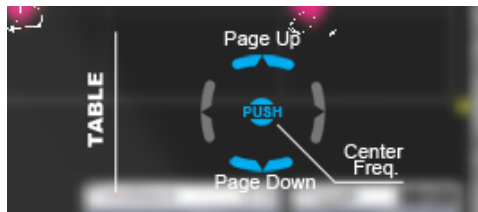
The Table Mode Help Flyout menu for the Spectrum Function button.

- Some models have **Table** and **Zoom** LED indicators along with **Adjust**. Others have only an **Adjust** LED with **Zoom** and **Table** buttons containing backlit LEDs.

ZOOM AND TABLE BUTTONS
The Zoom and Table buttons may (or may not) provide additional control for a specific WavePilot funciton you have selected.

Zoom Button
With the Zoom button selected (for a function that has the Zoom control) you can twist the SuperKnob dial to **adjust the zoom value for your displayed waveform**.

Table Button
With the Table control selected (for a function that has the Table control) you can joystick up or down to **Page Up** or **Down** through the table results. You can also twist the SuperKnob dial to **sequentially navigate each row of the table results**.

CURSORS

Use the SuperKnob to adjust Cursors by pressing the **Cursors** function button. Once pressed, the Cursors Help Flyout menu is shown.

Note: For more information about the use of Cursors, see **Measuring with Cursors** (on page 95).

Horizontal, Off, and Vertical

Pressing the Cursor Function button moves through states for **Horizontal Absolute**, **Horizontal Relative**, **Vertical Absolute**, **Vertical Relative**, and **Off**.

LED's surrounding the SuperKnob provide visual indication of cursor status as follows:

- When **opposing LED's (Top/Bottom and Left/Right) are lit**, the cursors are in a **Relative** state.

- When **no LED's surrounding the SuperKnob are lit**, the cursors are in an **Absolute** or **Off** state.

Using the SuperKnob with Cursors

The SuperKnob joystick is used for cursor control while in Horizontal and Vertical states in the following manner:

- **Horizontal** - Cursors Help Flyout menu is shown with instructions for left and right joystick use of the SuperKnob described as **Leftmost** and **Rightmost**. When either is selected, you can twist the SuperKnob to adjust the respective cursor.

- **Vertical** - Cursors Help Flyout menu is shown with instructions for left and right joystick use of the SuperKnob described as **Topmost** and **Bottommost**. When either is selected, you can twist the SuperKnob to adjust the respective cursor.

- **Pushing the SuperKnob button** changes the cursor control from the two available states with the added state of tracking (moving the pair together in parallel).

- **You can force cursors to swap identities** in the event where one is adjusted past the level of its other extreme. Meaning, if you were to adjust a bottommost cursor above its respective topmost cursor, the bottommost would then become the topmost and vice versa.

Note: Zoom and Table buttons are not used for Cursors.

DECODE

When first pressing the **Decode** function button, the Serial Decode dialog is shown. Subsequent presses of the Decode function button produce the following results:

- If you **haven't** enabled a Decode signal, it **Closes** the Serial Decode dialog.

- If you **have** enabled a Decode signal, it **Closes** the Serial Decode dialog and **disables** the Decode signal.

- If you **have** enabled a Decode signal, and the Serial Decode dialog is closed or a different dialog is currently opened (say, the Zoom dialog), the Serial Decode dialog is **Opened**.

Zoom and Table Buttons for Decode
The Zoom and Table buttons are used as described in **The WavePilot Control Area and The SuperKnob Overview** (on page 25). Decode tables are shown beneath the main display area.

WAVESCAN

When first pressing the **WaveScan** function button, the **WaveScan** dialog is shown with table data showing in a column to the left of the main display area. Subsequent presses of the **WaveScan** function button produce the following results:

- WaveScan is turned **On** and you click Close on the WaveScan dialog or open a different dialog (say, the Zoom dialog), and then click the WaveScan function button, the WaveScan dialog is **Opened**.

- WaveScan is turned **Off** and the WaveScan dialog is **Closed**.

The Zoom and Table buttons are used as described in **The WavePilot Control Area and The SuperKnob Overview** (on page 25).

HISTORY

When first pressing the **History** function button, the **History** dialog is shown with table data showing in a column to the left of the main display area. Subsequent presses of the **History** function button produce the following results:

- History is turned **On** and you click Close on the History dialog or open a different dialog (say, the Zoom dialog), and then click the History function button, the History dialog is **Opened**.

- History is turned **Off** and the History dialog is **Closed**.

On the History dialog, a **Capacity** control is provided.

Note: A default value for the **Capacity** control is generated based on your instrument's specific Acquisition Memory Setting (it also varies based on specific setups, configurations, and settings at any given time).

The Zoom and Table buttons are used as described in **The WavePilot Control Area and The SuperKnob Overview** (on page 25).

LABNOTEBOOK
When first pressing the **LabNotebook** function button, the LabNotebook dialog is shown. The button toggles between opening and closing the LabNotebook dialog - unless you already have LabNotebook entries stored. With LabNotebook entries already stored subsequent presses of the LabNotebook function button:

- opens the **LabNotebook** dialog and your first **My Notebook Entry** is shown on the display area in Preview mode.

- closes the **LabNotebook** dialog and the **My Notebook Entry** preview.

As mentioned, with LabNotebook entries already stored a subsequent press of the LabNotebook function button shows the preview along with the dialog. You can then turn the SuperKnob to move through entries shown in **My Notebook Entries** on the LabNotebook dialog. Pushing the SuperKnob performs a Flashback (Recall) of the stored entry selected in the My Notebook Entries on the LabNotebook dialog.

Note: Zoom and Table buttons are not used for LabNotebook.

SPECTRUM
When first pressing the **Spectrum** function button, the Spectrum dialog is shown with table data showing in a column to the left of the main display area. Subsequent presses of the **Spectrum** function button produce the following results:

- Spectrum Analysis is turned **Off** and the SpectrumAnalyzer dialog is **Closed**.

- Spectrum Analysis is turned **On** and you click Close on the SpectrumAnalyzer dialog or open a different dialog (say, the Zoom dialog), and then click the Spectrum function button, the SpectrumAnalyzer dialog is **Opened**.

Zoom and Table buttons are used as described in **The WavePilot Control Area and The SuperKnob Overview** (on page 25). In addition, a spectrum-specific **Table** control functionality **Centers the Frequency** of your displayed waveform when the SuperKnob is pressed based on the particular **Frequency** row you have selected from the Spectrum table displayed to the left of the main display area.
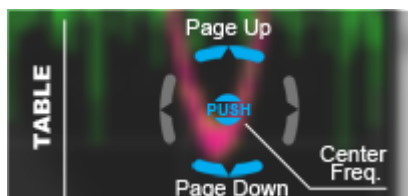
The Table Help Flyout menu for the Spectrum Function button.

Probe / Signal Connection Interfaces

Probe Interfaces

Teledyne LeCroy oscilloscopes utilize one or more proprietary probe interfaces providing a complete measurement solution from probe tip to oscilloscope display. Compared to standard BNC and Probe Ring interfaces, this intelligent interconnection between your instrument and the probe or accessory eliminates the guesswork and errors that occur when probe settings are made manually, and also offers the following important signal fidelity advantages:

- Upon connection to the oscilloscope channel, the probe is recognized and some setup information, such as input coupling and attenuation, is performed automatically.

- System (probe plus oscilloscope) gain settings are automatically calculated and displayed based on the probe attenuation.

- Active probes typically provide automatic matching of probe to oscilloscope response using probe response data stored in an on-board EEPROM. This ensures the best possible combined probe plus oscilloscope channel frequency response without requiring the user to perform any de-embedding procedure.

Probe interfaces differ in bandwidth, so the interfaces contained on your oscilloscope depend on the bandwidth rating of the oscilloscope model you purchased.

When a probe is connected, it is recognized and an additional tab with the probe model name is displayed to the right of the C1 tab.

The channel dialog layout showing Input A's ProLink interface controls setup after connection.

This additional tab contains specific information on the connected probe. In addition, default values for the probes coupling and attenuation (which may not be changed) are automatically downloaded from the probe, and these settings along with other attributes are shown on the corresponding probe dialog.

The dialog showing the connected probe's control attributes.

ProBus Interface

The ProBus interface contains a 6-pin power and communication connection and a BNC signal connection to the probe. It offers both 50 Ω/1 MΩ input impedance and provides probe power and control for a wide range of probes such as high impedance passive probes, high impedance active probes, current probes, high voltage probes, and differential probes. ProBus also includes sense rings for detecting passive probes. The ProBus interface may also have a BNC-terminated cable connected directly to it.

ProBus is based on a BNC connector and, depending on the exact BNC connector used and the oscilloscope design, is rated for up to 4 GHz with 50 Ω coupling or up to 1 GHz for 1 MΩ coupling (depending on the exact model purchase).

Probes

Teledyne LeCroy offers a variety of passive and active probes for use with your X-Stream oscilloscope. Visit **teledynelecroy.com** for specifications and ordering information.

- **Current Probes** - Current Probes measure the current passing through a wire; current probes do not use the traditional probing style of placing a tip onto a test point. Instead, a wire is placed inside the jaw of the probe, which allows the probe to measure the current (in Amps).

- **Active Probes** - There are two different types of active probes: **single-ended** and **differential**.

   Single-Ended - A single-ended active probe is associated with measuring voltages at high frequencies. Measurement with an active probe requires a test point and a ground point. The ground (also called earth) acts as a zero reference for the test point measurement.

   Differential Probes - Differential active probes are like two probes in one. Instead of measuring a test point in relation to a ground point (like single-ended active probes), differential probes measure the difference in voltage of a test point in relation to another test point.

- **Passive Probes** - Passive probes measure voltages at lower frequencies (<500 MHz). They have higher input capacitance (input C) and do not need power to operate (unlike active probes). At higher frequencies, higher input capacitance loads the test circuit, attenuating the signal. This is why active probes are used in high frequency applications. Passive probes also measure voltage in reference to ground.

- **High Voltage Probes** - These are active, single-ended probes designed to safely measure high voltages. They measure the voltage in reference to ground.

Passive Probe Compensation

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

1. Attach the connector end of your passive probe to any channel.

2. Connect the probe end to the CAL output connector at the front of the oscilloscope. Ground the probe.

3. Adjust the trim pot at the connector end of the probe until the square wave is as flat as possible.
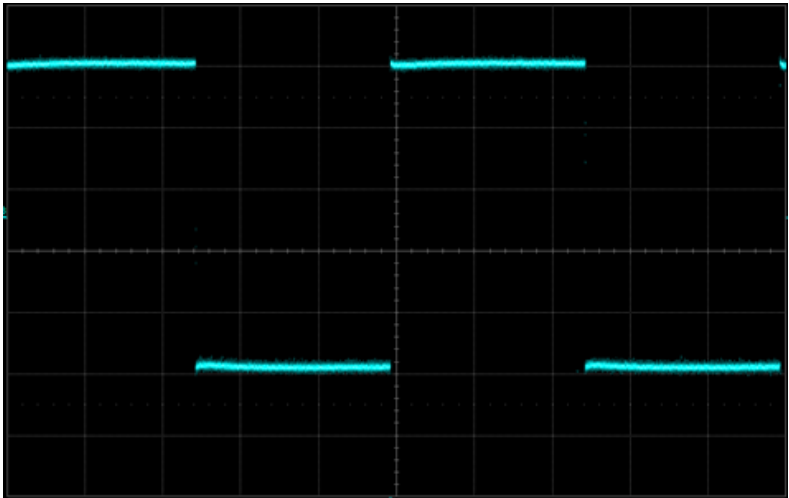
Display Dashboard

Screen Layout, Groupings, and Controls

The instrument's screen is divided into the following main sections:

- **Menu Bar**
- **Signal Display Grid**
- **Descriptor Labels**
- **Dialog(s)**
- **The Message Bar**

Note: Many front panel controls directly correspond with screen layout controls. For example, the **Print** front panel general control button corresponds with the **Hardcopy** function set from **Utilities → Utilities Setup → Hardcopy**.

Menu Bar

The top of the screen contains a menu bar of commonly used functions. Whenever you touch one of these buttons and make a selection from its drop-down menu, the dialog area at the bottom of the screen displays the corresponding dialog.

Specific Menu Bar functions are referenced using arrow-separated path descriptions. For example, the **Save Setup** function is referenced as **File → Save Setup...**.

PLEASE NOTE THE FOLLOWING:

For common oscilloscope operations, you don't need to use the top menu bar (since you can access most dialogs from the Front Panel or from the Descriptor Labels). However, it is the only way to access setup or other dialogs for **Display Setup**, **Save or Recall Waveform**, **Save or Recall Setups**, **Print Setup**, **Vertical (Channel), Horizontal, or Trigger Status**, **Memory (Reference Waveform) Setup**, **Pass/Fail Setup**, or **Utilities and Preferences Setup...**.

The Quick Access Toolbar

The Quick Access portion of the toolbar is located on the right side of the menu bar. It contains the Rotate Display button.
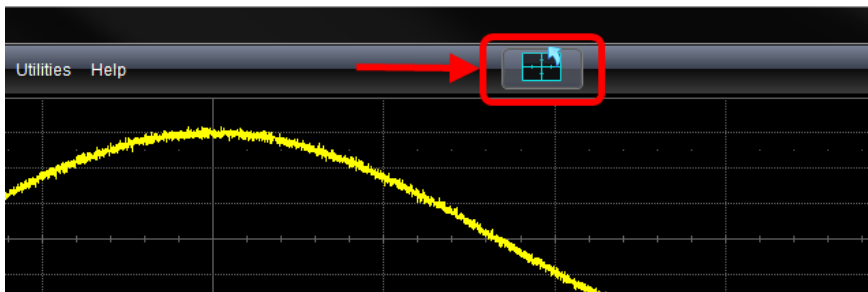

When the display is rotated, touch this button to adjust the user interface to a portrait layout. The button toggles from portrait layout back to landscape.

For additional information on rotating and tilting the display, refer to **Hardware and Software Controls** (on page 17).

The Signal Display Grid

The grid area is divided into 8 vertical divisions and 10 horizontal divisions just like any other oscilloscope. Set up the signal display area by touching **Display → Display Setup...** from the menu bar.

The **Display** dialog offers a choice of grid combinations and can also set the grid intensity.
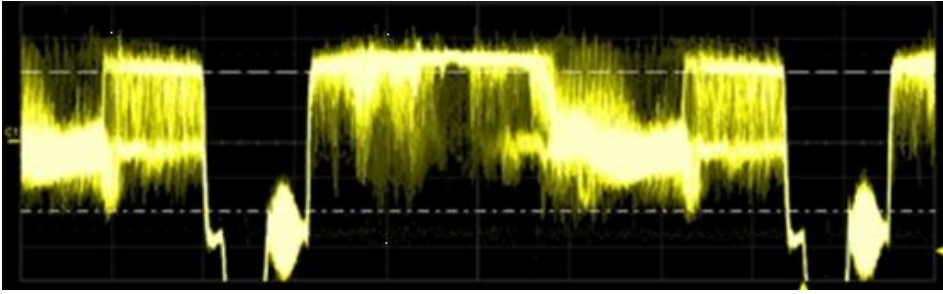
There are several indicators on the grid to help you understand the following:

- **Trigger Delay** - This indicator is located along the bottom edge of the grid. Trigger delay allows you to see the signal prior to the trigger time.
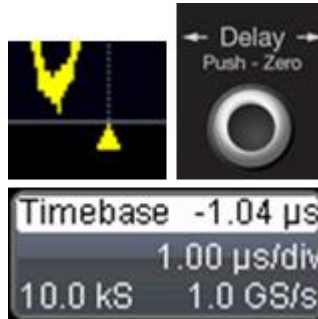
    All trigger delay values (including post-trigger delay, shown here) are displayed in the Timebase Descriptor Label. Zero delay is the horizontal center of the oscilloscope display.

    The default setting (Time) is for delay readout (in seconds) and to move proportionately when the timebase knob is turned. If you want to set delay (Div) to a fixed position on the grid, and then have it stay fixed as the timebase changes, go to **Utilities → Preference Setup...** and select the **Acquisition** dialog to make the setting.

- **Post-trigger Delay** - This is indicated by a left-pointing arrow to the lower-left of the grid. Pre-trigger delay is indicated by a right-pointing arrow to the lower-right of the grid.
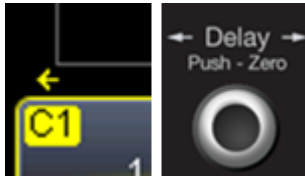
- **Trigger Level** - This indicator is located at the right edge of the grid. It tracks the trigger level as you reposition the trace up or down, or change scale. When triggering is stopped, a hollow arrow indicates where the new level ends up when triggering resumes.

Push the LEVEL knob to reset the level to 50%.

- **Zero Volts Level** - This indicator is located at the left edge of the grid. Change the zero volts level by turning the vertical **OFFSET** knob. Push the knob to reset the indicator to the middle of the grid.
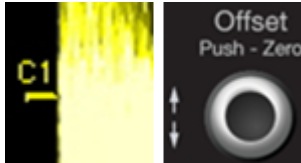
Signal Display Grid Pop-Up Menu

On the Signal Display Grid, the Pop-up menu provides assistance while using the oscilloscope.

Clicking on a waveform opens a pop-up menu. From this pop-up menu, you can perform the following functions:

- Open the Setup dialog for the trace
- Turn the trace descriptor label off
- Open the Math dialog for the trace
- Open the Measure dialog for the trace
- Annotate the selected trace

Trace Descriptor Labels

Shown just beneath the grid display, these boxes provide a summary of your channel, timebase, and trigger settings.

When a trace is selected its corresponding descriptor label is shown highlighted.
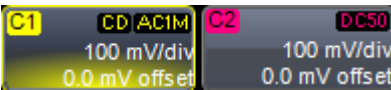
The C1 Trace Descriptor Label is selected; C2 is not.

Make vertical or horizontal channel adjustments by touching the respective label. The setup dialog for the function is shown beneath.

Channel trace labels show the vertical settings for the trace and cursor information (if cursors are in use). The title bar of the label includes indicators for (SinX)/X interpolation, waveform inversion (INV), deskew (DSQ), coupling (DC/GND), bandwidth limiting (BWL), and averaging (AVG). These indicators have a long and short form, respectively.

The long and short forms of trace descriptor indicators.

Besides channel traces, math and parameter measurement labels are also displayed. Labels are displayed only for traces that are turned on.

Vertical and horizontal trace descriptor (labels) are displayed below the grid. They provide a summary of your channel, timebase, and trigger settings. Make vertical or horizontal channel adjustments by touching the respective label. The setup dialog for the function is shown beneath.

TimeBase trace descriptor labels show the **trigger delay setting**, **time per division**, and **sampling information.**

Timebase	0 ns
	200 ns/div
10.0 kS	5.00 GS/s
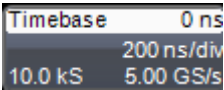
Trigger trace descriptor labels show the trigger mode (Auto, Normal, or Stopped). It also shows the coupling (DC), trigger type (Edge), source (C1), level (0 mV), and slope (Positive).

Trigger	C1 DC
Auto	0 mV
Edge	Positive
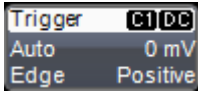
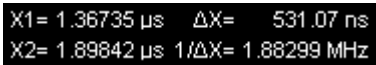Setup information for horizontal cursors, including the time between cursors and the frequency, is shown beneath the TimeBase and Trigger trace descriptor labels.

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

Actions for Trace Buttons

You can access the same functions as the ones produced when using the Signal Display Grid Pop-Up menu just by clicking a trace-descriptor label, which shows its corresponding dialog. From the respective dialog, you're able to access the same functions as Actions for Trace X buttons.

- Open the Setup dialog for the trace.
- Open the Math dialog for the trace.
- Open the Measure dialog for the trace.
- Annotate the selected trace.

For more information, see the Actions for Trace Buttons section of **Dialog Area** (on page 42).

Annotating Traces

The instrument gives you the ability to add an identifying label, bearing your own text, to a waveform display:
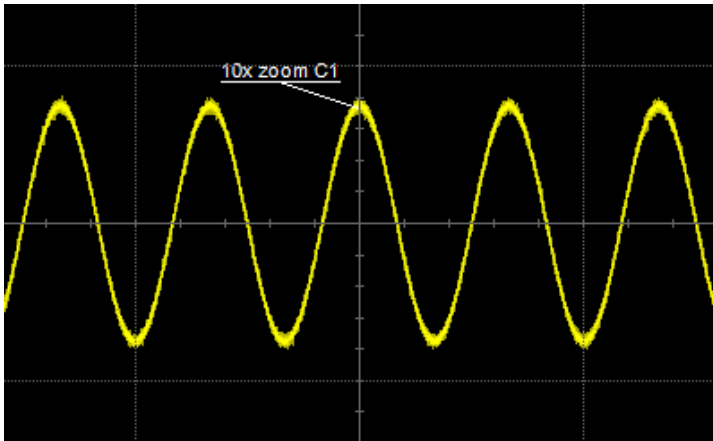
For each waveform, you can create multiple labels and turn them all on or all off. Also, you can position them on the waveform by dragging or by specifying an exact horizontal position.

Touch the waveform you want to annotate right on the display grid, and then touch **Set label...** on the pop-up menu. A dialog box opens in which to create the label. The first time creating a waveform label, **Label1** is provided as default text when the **Add label** button is touched.
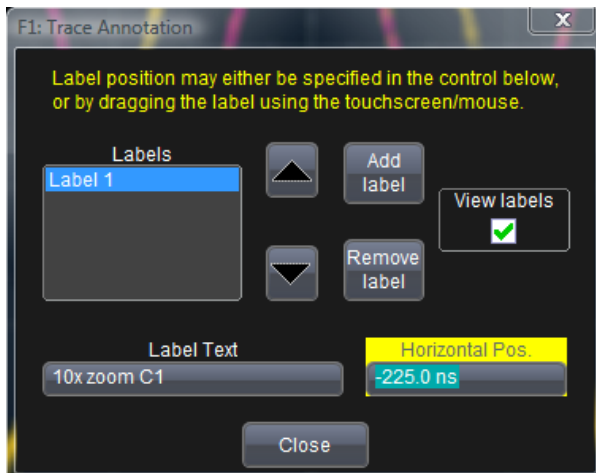
From this pop-up you can **edit** existing annotations, change the label **placement** on the waveform, **add** labels, **remove** labels, and **toggle the visibility**. The following bullets show you how.

- If you are modifying an existing label, under **Labels** touch the label you want to change.

> **Note**: If the dialog for the trace you want to annotate is currently displayed, you can touch the label button at the bottom to display the Trace Annotation setup dialog.
>
>
>
> You may place a label anywhere you want on the waveform. Labels are numbered sequentially according to the order in which they are added, and not according to their placement on the waveform.
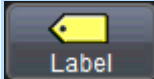
- If you want to change the label's text, touch inside the **Label Text** field. A pop-up keyboard appears for you to enter your text. Touch **O.K.** on the keyboard when you are done. The edited text automatically appears in the label on the waveform.

- Precisely place the label by touching inside the **Horizontal Pos.** field and provide a horizontal value, using the pop-up numeric keypad.

- Add another label by touching the **Add label** button. Delete a label by selecting the label from the list, and then touching the **Remove label** button.

- Make labels visible by touching the **View labels** checkbox.

Dialog Area

The lower portion of your oscilloscope screen is where information is shown, selections are made, and data is input. These screens are organized into tabular displays, subtabs, or pop-up dialogs. The dialog area is controlled by **Touch Screen Controls** and **Front Panel Controls**.

Touch Screen Controls

Various touch screen user interface controls are provided for easily entering data. Their functionality is described in this topic and you'll see them referenced throughout the documentation.

POP-UP SELECTOR CONTROLS

When Pop-Up selector controls are touched, sometimes a very small box is shown right inside the control - as in the following control for **Coupling** on the C1 dialog.

Pop-Up Selector Control for smaller values.

Other times, a larger box is shown after touching a control. This larger Pop-Up has categorical buttons along the left column along with labels (and sometimes descriptions) for the selectable entry values.
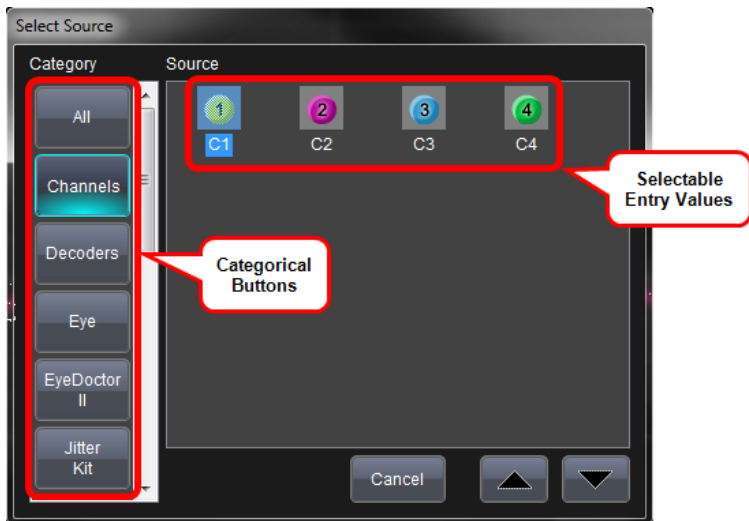
Pop-Up Selector Control for values with varied types.

TEXT ENTRY CONTROLS

Most controls can be touched once and you can then provide a value using an attached (or double-touch/click to use the Virtual, on-screen) keyboard.
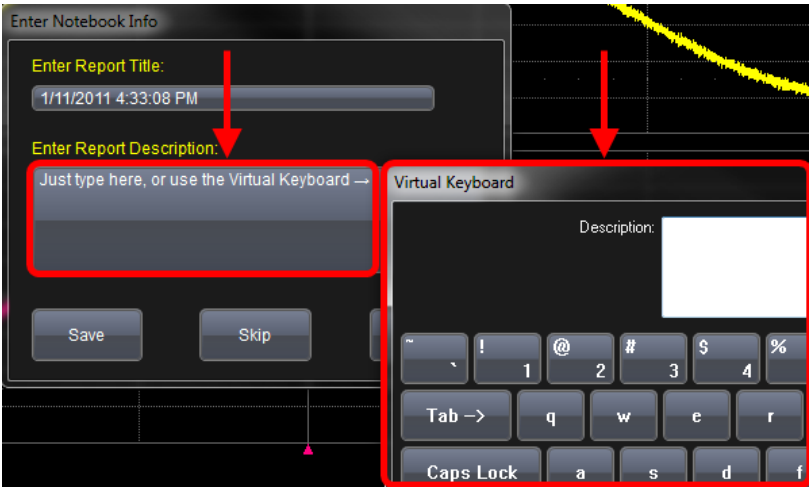
Text entry field for LabNotebook using the Virtual Keyboard.

FOLDER/FILE BROWSING CONTROLS

These controls allow for navigation to or from folders (on the hard drive or memory device) for retrieving or storing items such as waveforms, LabNotebook entries, to name a few.
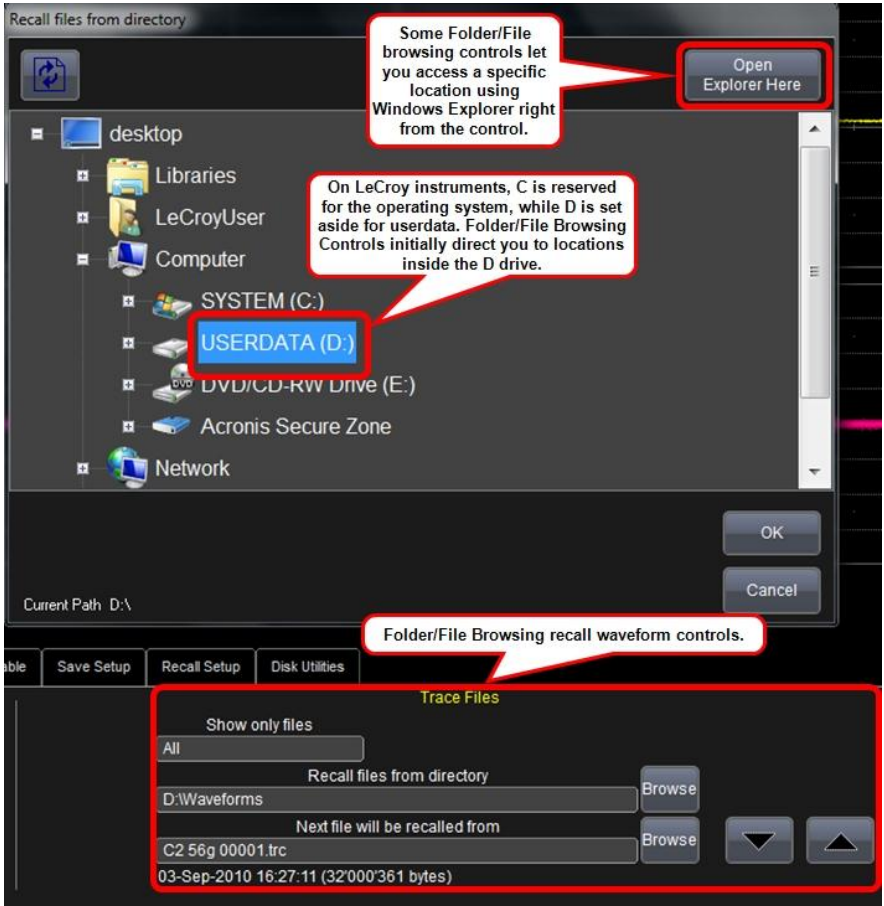
Folder/File Browsing recall waveform controls.

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

FLYOUT MENU CONTROLS

Flyout Menus provides a variety of solutions for a particular main area of functionality. It does this by providing a set of buttons subdividing the control into more specific functions on the right-side of the display.

An example of Flyout Menu Controls is seen in the **Setup** front panel button.

Setup Flyout Menu control.

PRECISION DATA ENTRY CONTROLS

Certain fields requiring precise value entry assist you by having precision entry means. When these controls are selected, you can provide values as follows:

Keyboard

Touch inside a text entry control and you can manually type the value in using an attached (or double-touch/click to use the Virtual, on-screen) keyboard.
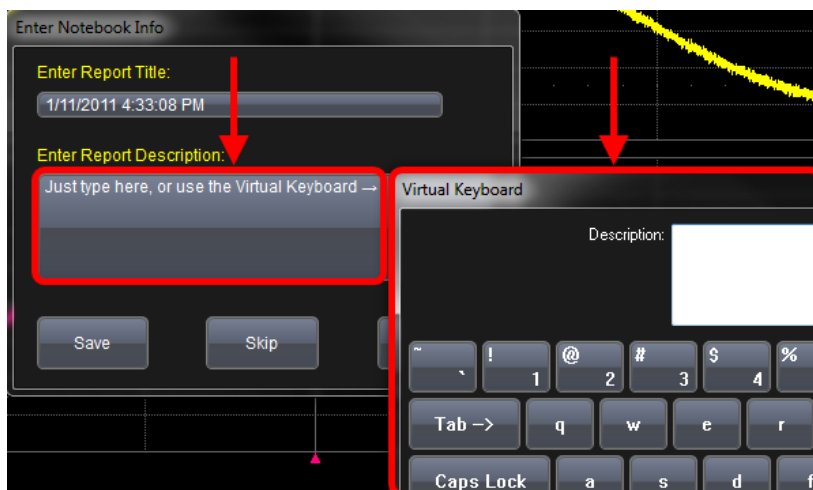
Text entry field for LabNotebook using the Virtual Keyboard.

Slider Bar

Some models provide what is known as a **Slider Bar** along the bottom of the screen **when a keyboard is attached** to the instrument. The Slider Bar allows you to select your entered value by moving a horizontal slider (left to right provides low to high amounts).

Pop-Up Keypad

Some models provide a pop-up Keypad when you touch twice in the same control. A keypad button is also provided on the slider bar (on models that have the slider bar) which shows the pop-up keypad when touched.

For many controls, once the Pop-Up Keypad is shown the **Front Panel Controls** (on page 18) can be used to adjust the value in the pop-up. The Pop-Up contains **Up** and **Down** arrow buttons, **Set to Max**, **Default**, and **Min** buttons, and the **Keypad** itself for providing your value.

The slider bar also has a handy default value button for quickly entering the default for the control.

Default and Keypad Buttons on the Slider Bar are only shown on 7, 8, and 9 Zi models (with a keyboard attached).

UNIQUE WaveRunner 6 Zi and 12-Bit HRO and 12-Bit HRO FEATURE: The 6 Zi and 12-Bit HRO provides touch-screen interface controls in a different manner. See **The WavePilot Control Area and The SuperKnob Overview** in the online help.

Shortcut Toolbar

Several dialogs contain common functions accessible from a row of buttons that can save you having to select the respective function from the menu bar or the Signal Display Grid Pop-Up Menu.

For example, at the bottom of the Channel Setup dialog, these buttons (sometimes labeled as **Actions**) perform the following functions:

- **Measure** - Opens the Measure menu. You can then select a parameter from this menu without leaving the Channel Setup dialog. The parameter automatically appears below the grid.

- **Zoom** - Creates a zoom trace of the channel trace whose dialog is currently displayed.

- **Math** - Opens the Math menu. You can then select a math function from this menu without leaving the Channel Setup dialog. A math trace of the channel whose dialog is currently open is automatically displayed.

- **Decode** - Opens the main Serial Decode dialog where protocol option measurements can be applied to signals.

- **Store** - Loads the channel trace into the next available memory location (M1 to M4).

- **Find Scale** - Automatically performs a vertical scaling that fits the waveform into the grid.

- **Next Grid** - Automatically moves the channel trace whose dialog is currently open onto the next grid. If you have only one grid displayed, a new grid will be created automatically, and the trace moved.

   Note: This button is not available on all oscilloscope models.

- **Label** - Enables you to attach identifying labels to your waveforms. The labels are preserved when the waveform is saved as a LabNotebook entry and when saved to file.

- **Probe Cal - Cable Deskew** - Opens the Probes Cal. dialog where various Gain, Offset, Skew, Source, and Advanced controls are available for probe signal calibration.

Another example is seen in the buttons appearing at the bottom of the Measure **Px** dialogs. The button may be selected in order to display the functions named on the buttons (sometimes labeled as **Actions**):
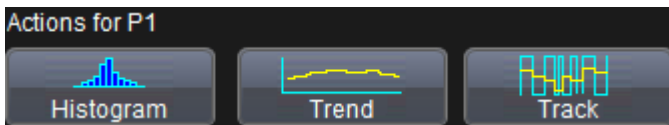
Actions for Trace buttons on the Cx dialog.

Using these buttons allow you to remain in the Measure dialog while setting up a Math trace on a parameter measurement.

Message Bar

At the bottom of the oscilloscope display is a narrow message bar. The current date and time are displayed at the far right. Status, error, or other messages are also shown in this area.

Turning on Channels and Traces

PLEASE NOTE THE FOLLOWING:

- If you want to display each trace on its own grid automatically, enable Autogrid by touching **Display → Autogrid** from the menu bar.

- You can turn channels on and off using the software, for more information see **Vertical Overview** (on page 61)

- On the front panel, press a channel select button to display the trace descriptor label for that input channel and turn on the channel.

- Turn on a math function trace by touching **Math → Math Setup...** from the menu bar. Touch the corresponding **On** checkbox to activate the desired trace.

- You can also quickly create traces (and turn on the trace label) for math functions and memory traces, without leaving the Vertical Adjust dialog, by touching the icons at the bottom of the Vertical Adjust dialog.
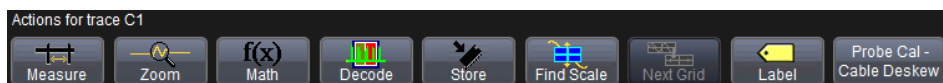
Whenever you turn on a channel, math, or memory trace using either the **menu bar** or **trace descriptor label**, the dialog at the bottom of the screen automatically switches to the vertical setup or math setup dialog for that selection.

You can configure your traces from here, including math setups.

The Trace Dialog is shown on the lower (dialog) portion of the screen. The tab is labeled with the corresponding channel number as follows:
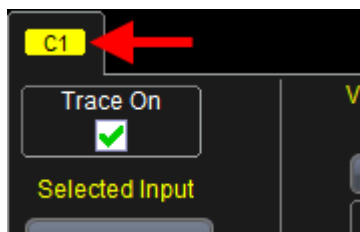
Timebase

Overview

You can access Timebase settings using the front panel **Horizontal** controls, the **Timebase → Horizontal Setup...** on the menu bar, or by touching the Timebase trace descriptor label. The main **Timebase** dialog is then shown and contains sections for **Sampling Mode**, **Timebase Mode**, and **Real Time Memory**.

A section specifically used for combining channels is located on the **far right of the main Timebase dialog**. This section varies based on your oscilloscope model.

Timebase Setup and Control

1. With the Timebase dialog showing, touch inside the **Time/Division** data entry control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

2. Touch inside the **Delay** data entry control and provide a value.

Sampling Modes

Overview

Depending on your timebase, you can choose **Single-shot Sampling Mode** (below), also known as Real Time mode, **Sequence Sampling Mode** (on page 53), or **RIS Sampling Mode** (on page 59) mode sampling.

Newer instruments offer **Roll Mode** (on page 60)

Some instruments also offer **Roll Mode** (on page 60).

Selecting a Sampling Mode

1. Touch **Timebase → Horizontal Setup...** from the menu bar.
2. In the **Timebase** dialog, touch a **Sample Mode** button.
3. If you chose **Sequence Mode**, touch the **Sequence** tab. The **Sequence** dialog is shown. Use the following controls to provide details for controls such as **Number of Segments**, **Enable Timeout**, **Timeout** (value), **Display Mode**, and **Show Sequence Trigger Times**.

Single-shot Sampling Mode

Basic Capture Technique

A single-shot acquisition is a series of digitized voltage values sampled on the input signal at a uniform rate. It is also a series of measured data values associated with a single trigger event. The acquisition is typically stopped a defined number of samples after this event occurs: a number determined by the selected trigger delay and measured by the timebase. The waveform's horizontal position (and waveform display in general) is determined using the trigger event as the definition of time zero.

You can choose either a pre- or post-trigger delay. Pre-trigger delay is the time from the left-hand edge of the display grid forward to the trigger event, while post-trigger delay is the time back to the event. You can sample the waveform in a range starting well before the trigger event up to the moment the event occurs. This is 100% pre-trigger, and it allows you to

see the waveform leading up to the point at which the trigger condition was met and the trigger occurred. (The instrument offers up to the maximum record length of points of pre-trigger information.) Post-trigger delay, on the other hand, allows you to sample the waveform starting at the equivalent of 10,000 divisions after the event occurred.

On fast timebase settings, the maximum single-shot sampling rate is used. But for slower timebases, the sampling rate is decreased and the number of data samples maintained.

The relationship between sample rate, memory, and time can be simply defined as:

$$Capture\ Interval = 1/Sample\ Rate\ X\ Memory$$

and

$$Capture\ Interval/10 = Time\ Per\ Division$$

Sequence Sampling Mode – Working with Segments

Using Sequence Mode, thousands of trigger events can be stored as segments into the oscilloscope's memory (the exact number depends on oscilloscope model and memory options). This is ideal when capturing many fast pulses in quick succession or when capturing few events separated by long time periods. The instrument can capture complicated sequences of events over large time intervals in fine detail, while ignoring the uninteresting periods between the events. You can also make time measurements between events on selected segments using the full precision of the acquisition timebase.

Sequence mode offers a number of unique capabilities:

- You can acquire up to four channels simultaneously.

- You can minimize dead time between trigger events for consecutive segments.

- You can view time stamps for acquisitions.

- You can zoom segments or used them as input to math functions.

- You can combine sequence mode with an advanced trigger to isolate a rare event, capture all instances over hours or days, and view/analyze each afterwards.
- You can use Sequence mode in remote operation to take full advantage of the instrument's high data-transfer capability.

In Sequence mode, the complete waveform consists of a number of fixed-size segments acquired in single-shot mode (see the instrument specifications for the limits). The oscilloscope uses the sequence timebase setting to determine the capture duration of each segment as 10 x time/div. With this setting, the oscilloscope uses the desired number of segments, maximum segment length, and total available memory to determine the actual number of samples or segments, and time or points.
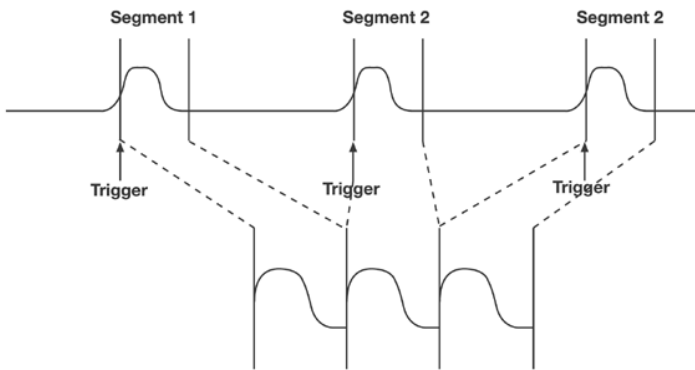
How the instrument captures segments

Sequence Display Modes

The instrument gives you a choice of five ways to display your segments:

- **Adjacent**

- **Waterfall (cascaded)**

- **Mosaic (tiled)**
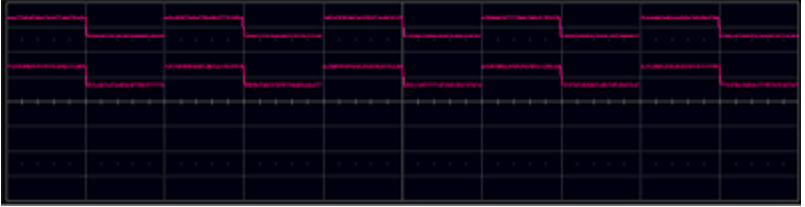
- **Overlay**
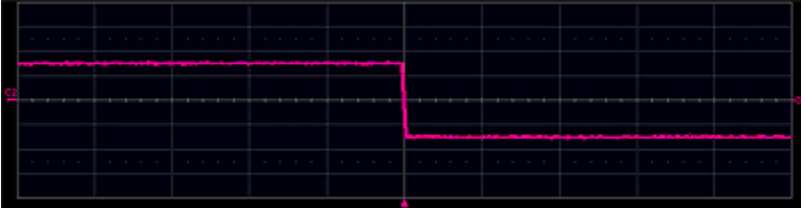
- **Perspective**
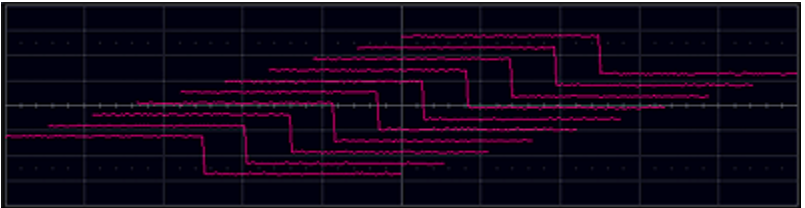
Note: some display modes have limitations on the number of segments that can be shown at one time.

Sequence Mode Setup

When setting up Sequence Mode, you define the number of fixed-size segments acquired in single-shot mode (see the instrument specifications for the limits). The oscilloscope uses the sequence timebase setting to determine the capture duration of each segment. Along with this setting, the oscilloscope uses the number of segments, maximum segment length,

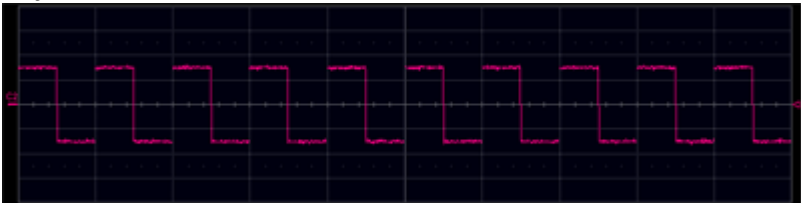and total available memory to determine the actual number of samples or segments, and time or points.
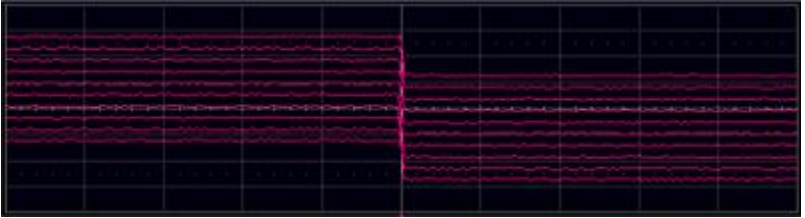

Setting up Sequence Mode (Adjacent)

1.   Touch **Timebase → Horizontal Setup...** on the menu bar.

2.   Click the **Sequence** tab.

3.   Under **Acquisition Settings**, touch inside the **Num Segments** data entry control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

> **Note**: The number of segments you choose to display can be less than the total number of segments in the waveform. For example, in the pop-up images above, the number of display segments is 10, but the total number of segments entered in the timebase dialog's **Num Segments** control is 100.

4.   Touch the **Enable Timeout** checkbox.

5.   Touch inside the **Timeout** data entry control and provide a timeout value.

> **Note**: Use the sequence mode timeout to automatically interrupt the sequence acquisition if the timeout value is exceeded without a valid trigger. The timeout period accounts for instances when a **Num Segments** miscount occurs for some reason and the oscilloscope waits indefinitely for

an unforthcoming segment. During that time, no oscilloscope functions are accessible. By means of a timeout value, however, the acquisition will be completed, the waveform displayed, and control of the oscilloscope returned to the user after the timeout has elapsed.

6. Under **Display Settings**, touch inside the **Display mode** control, and select a sequence mode display from the pop-up menu.

7. Touch the SINGLE trigger front panel button.

Note: Once a single acquisition has started, you can interrupt the acquisition at any time by pressing the **SINGLE** front panel button a second time or by pressing the **STOP** front panel button. In this case, the segments already acquired will be retained in memory.

Zooming Segments in Sequence Mode

You can zoom individual segments easily using the **QUICKZOOM** front panel button. When you zoom, the zoom traces default to Segment 1. Channel descriptors indicate the total number of segments acquired. Zoom descriptors indicate [Seg #] and #Segments in the Zoom. You can scroll through the segments using **ZOOM** front panel position knob.
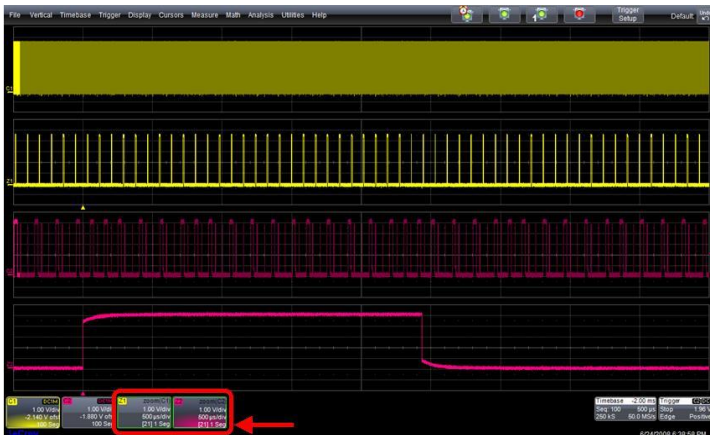
Sample Zoom of Segments in Sequence Mode

1. Touch the front panel **Quickzoom** button.

2. Turn the **ZOOM** front panel position knob to scroll through the segments.

3. To vary the degree of zoom, touch the newly created **Zx** trace label. The setup dialog for the zoom (Z1 to Z4) opens. It shows the current horizontal and vertical zoom factors.

4. If you want to increase or decrease your horizontal or vertical zoom in small increments, touch the **Var.** checkbox to enable variable zooming. Now with each touch of the **zoom control** buttons, the degree of magnification changes by small increments.

OR

If you want to zoom in or out in large standard increments with each touch of the zoom control buttons, leave the **Var.** checkbox unchecked.

OR

If you want to set exact horizontal or vertical zoom factors, touch inside the Horizontal **Scale/div** data entry control and enter a time-per-div value, using the pop-up numeric keypad. Then touch inside the Vertical **Scale/div** control and enter a voltage value.

Displaying an Individual Segment

1. Touch **Math → Math Setup...** on the menu bar.

2. Touch a function tab **Fx** showing its corresponding dialog.

3. On the dialog, touch inside the **Operator1** control and select the **Segment** button from the pop-up menu.

4. In the dialog on the right, touch the **Select** tab.

5. Touch inside the **First Selected** data entry control and select the first segment you want to display. Use the same method to provide a value in the **Number of Selected** data entry control.

> **Note**: In Persistence mode, the segments are automatically overlaid one on top of the other in the display. In non-Persistence mode, they appear separately on the grid.

Viewing Time Stamps

You can view time stamps for each segment.
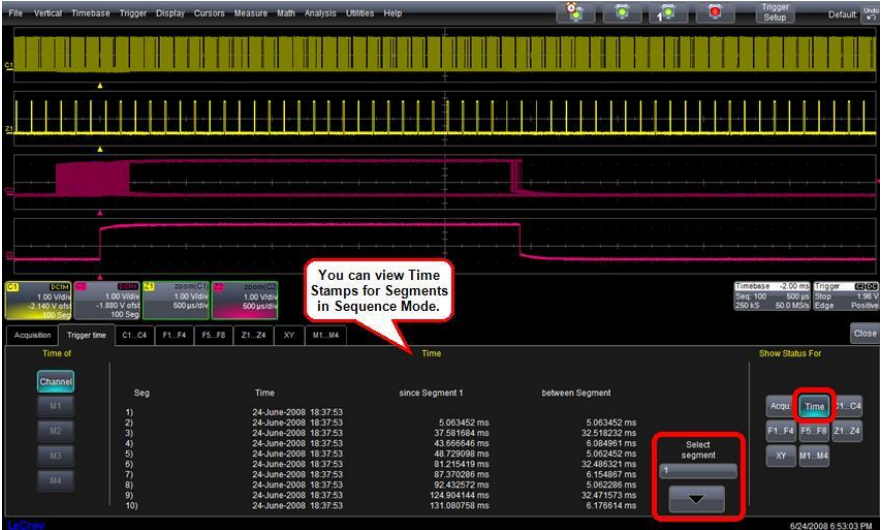
View Segment Time Stamps

1. Touch **Timebase → Acquisition Status** on the menu bar.
   OR
   Touch **Vertical → Channel Status** on the menu bar.

2. Touch the **Trigger Time** tab.

3. Under **Show Status For**, touch the **Time** button.

4. Touch inside the **Select Segment** control and enter a segment number value (you can also touch the arrow buttons to scroll through segment times).

RIS Sampling Mode for Higher Sampling Rates

RIS (Random Interleaved Sampling) is an acquisition technique that allows effective sampling rates higher than the maximum single-shot sampling rate. It is used on repetitive waveforms with a stable trigger. The maximum effective RIS sampling rate is achieved by making multiple single-shot acquisitions at maximum real-time sample rate. The bins thus acquired are

positioned approximately 5 ps (200 GS/s) apart. The process of acquiring these bins and satisfying the time constraint is a random one. The relative time between ADC sampling instants and the event trigger provides the necessary variation.

The instrument requires multiple triggers to complete an acquisition. The number depends on the sample rate: the higher the sample rate, the more triggers are required. It then interleaves these segments (in the following graphic) to provide a waveform covering a time interval that is a multiple of the maximum single-shot sampling rate. However, the real-time interval over which the instrument collects the waveform data is much longer, and depends on the trigger rate and the amount of interleaving required.
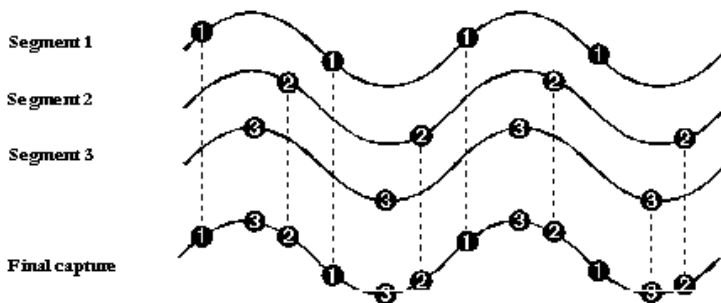
Note: RIS mode is not available when the oscilloscope is operating in **fixed sample** or DBI 25 - 45 GHz) modes as covered in **Smart Memory** (available in the online help files) and **Combining Channels** topics, respectively.

Roll Mode

Roll mode displays, in real time, incoming points in single-shot acquisitions that have a sufficiently low data rate. The oscilloscope rolls the incoming data continuously across the screen until a trigger event is detected and the acquisition is complete. The parameters or math functions connected to each channel are updated every time the roll mode buffer is updated, as if new data is available. This resets statistics on every step of Roll mode that is valid because of new data.

Note: If the processing time is greater than the acquire time, the data in memory gets overwritten. In this case, the instrument issues a **Channel data is not continuous in ROLL mode!!!** warning and rolling starts over again.

Vertical

Overview

You can access Vertical settings using the front panel **Vertical** controls, by selecting **Vertical→ Channel Setup...** on the menu bar, or by touching the Channel trace descriptor label. The following screen-shot shows the **C1 Vertical** dialog on a LabMaster as an example. For each channel, a corresponding **Vertical** dialog contains sections with respective controls.

1. **Channel Controls** (below) let you set up individual channels.
2. **Actions for Trace C1 Buttons** (on page 63) let you perform certain actions on the channel, such as Math, Zoom, and Measure actions.
3. **Pre-Processing Controls** (on page 64) let you set up pre-process controls, such as cable de-embedding and interpolation.

Channel Controls

The individual Channel Controls section of the dialog provides the following functions for your respective channel:

- **Channel Inputs** - For each channel, you can set the Channel Input to either Input A (Upper) or Input B (Lower). The Channel Row LED Indicators display which input is set for each channel.

  PLEASE NOTE THE FOLLOWING:

  - Not all oscilloscope models have Upper and Lower Channel Inputs. In those cases, no Selected Input buttons are provided.
  - **Slave Acquisition Modules** indicate alternative, or B channels, on named LED indicators.

- **Vertical Scale** - For each channel, you can set the vertical scale or sensitivity and choose whether to use fixed or variable gain adjustment.

- **Vertical Offset** - For each channel, you can select between zero vertical offset or to set the offset to a specific value.

- **Coupling** - The maximum input voltage depends on the input used. Values are displayed on the front of the oscilloscope. Whenever the voltage exceeds this limit, the coupling mode automatically switches from DC 50 Ω to GROUND. You then have to manually reset the coupling to DC 50 Ω.

  ⚠ **CAUTION**.While the unit does provide this protection, damage can still occur if extreme voltages are applied

- **Bandwidth** - Each oscilloscope contains only the Full selection and those bandwidths less than the rated oscilloscope bandwidth. Anti-aliasing filters are applied to limit bandwidth at lower sample rates, regardless of bandwidth limit selection.

- **Probe** - Teledyne LeCroy's **ProBus**, **ProLink**, and **2.92 mm** system automatically senses probes and sets their attenuation for you. For each channel, the probe attenuation can also be set manually.

Setting Up Channels

1. Touch **Vertical → Channelx Setup...** from the menu bar.

2. Touch inside the **Trace On** checkbox to display the trace.

3. On pertinent model oscilloscopes, under **Selected Input**, touch the **Input A (Upper)** button or **Input B (Lower)** button. Otherwise, no Selected Input buttons are provided.

4. Turn the **VERTICAL GAIN** front panel knob for the selected channel.
   OR
   Touch inside the **Volts/Div** field and enter a value. Click the **keypad** button to enter a value using the pop-up keypad, or use the up/down arrows.

   The set voltage is shown on the trace descriptor label and in the Volts/Div field in the dialog.
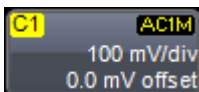
5. Turn the **VERTICAL OFFSET** adjust front panel knob directly above the channel button whose waveform you want to move vertically. Or you can touch inside the **Offset** field and type in a value on the pop-up keypad. To set the vertical offset to zero, touch the **Zero** button directly below the **Offset** field.

6. Touch inside the **Coupling** control and select a coupling mode from the pop-up menu.

7. Touch inside the **Bandwidth** control and provide a Bandwidth Limit value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

8. Touch inside the **Probe Atten.** data entry control if you want to set the attenuation manually, and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

Actions for Trace C1 Buttons

Actions for Trace C1 buttons provide quick access to various functions for your respective channel. The following functions are available:
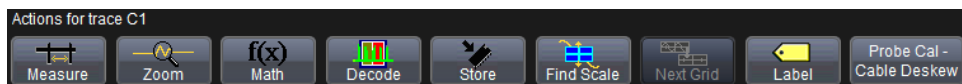
- **Measure** - Turn on a Measurement trace. Choose a measurement parameter from the Measurement pop-up window to determine a wide range of waveform properties. For example, you can use measurement parameters to automatically calculate many attributes of your waveform, like rise-time, rms voltage, and peak-to-peak voltage.

- **Zoom** - QuickZoom automatically displays a zoom of the channel or trace on a new grid.

- **Math** - Turn on a Math trace. Choose a Math function from the Math pop-up window.

- **Decode** - Shows the main Decode dialog.

- **Store** - Transfers the current trace into a corresponding memory trace.

- **Find Scale** - Automatically calculates peak-to-peak voltage, and chooses an appropriate Volts/Div scale to fully display the waveform.

- **Next Grid** - This button transfers a copy of your waveform into another grid. If another grid is not showing, the system creates a new grid for you.

  Note: This button is disabled while using Auto Grid.

- **Label** - Shows the Trace Annotation pop-up where you can provide label text and positioning information.

Pre-Processing Controls

Pre-Processing is meant as before Math processing. Pre-Processing controls provide the following functions for your respective channel:
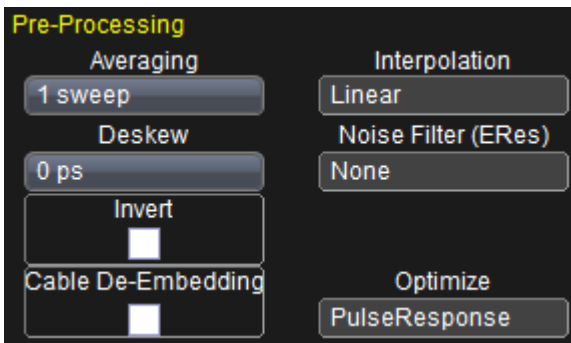
- **Averaging** - Specifically performs continuous averaging or the repeated addition, with unequal weight, of successive source waveforms. It is particularly useful for reducing noise on signals drifting very slowly in time or amplitude. The most recently acquired waveform has more weight than all the previously acquired ones: the continuous average is dominated by the statistical fluctuations of the most recently acquired waveform. The weight of old waveforms in the continuous average gradually tends to zero (following an exponential rule) at a rate that decreases as the weight increases.

- **Deskew** - Adjusts the horizontal time offset by the amount entered. The valid range is dependent on the current timebase setting. Pre-processing deskew and the Math deskew function perform the same activity.

- **Invert** - Invert the waveform for the selected channel.

- **Cable De-Embedding** - When making measurements on serial data signals, losses in the cables used in the test setup can reduce the accuracy of your signal (for example, signal amplitude and risetime), as well as introduce Inter-Symbol Interference. These cable effects can dramatically alter your serial data measurements and potentially create mask test violations.

  The Cable De-Embedding option allows you to quickly specify the characteristics of the cables (typically found on the cable's data sheet) in your test setup and analyze your signal with the effects of the cables removed.

  > **Note**: The **Cable De-Embedding** checkbox is only available if you have the option. Learn more about this software option and **Contact Teledyne LeCroy for Support**.

- **Interpolation** - Linear interpolation, which inserts a straight line between sample points, is best used to reconstruct straight-edged signals such as square waves. (Sinx)/x interpolation, on the other hand, is suitable for reconstructing curved or irregular wave shapes, especially when the sample rate is 3 to 5 times the system bandwidth.

- **Noise Filter** - Enhanced Resolution (ERES) filtering increases vertical resolution, allowing you to distinguish closely spaced voltage levels. The tradeoff is reduced bandwidth. The functioning of the instrument's ERES is similar to smoothing the signal with a simple, moving-average filter. Use ERES on single-shot waveforms, or where the data record is slowly repetitive (when you cannot use averaging). Use it to reduce noise when your signal is noticeably noisy, but you do not need to perform noise measurements. It also may be used when performing high-precision voltage measurements: zooming with high vertical gain, for example.

Response Optimization Modes

Frequency response and group delay of the oscilloscope contributes to the pulse response characteristics of the oscilloscope. By slightly adjusting these characteristics using digital signal processing, the characteristic response of the oscilloscope can be optimized for your specific application.

Frequency response is defined as the decrease in the magnitude response with respect to frequency. A fourth-order Bessel roll-off slightly attenuates the frequencies near the bandwidth rating of the oscilloscope while a brick-wall frequency response passes slightly higher frequency content.

Group delay is defined as the rate of change of the total phase shift with respect to angular frequency through a device or transmission medium. Amplifiers in analog oscilloscopes typically have some group delay at the highest frequencies. This inherent group delay minimizes the preshoot present on a step response and provides the traditional pulse response with no preshoot before the step. When zero group delay is provided at all frequencies, preshoot and overshoot is equalized.

Teledyne LeCroy provides three choices for Response Optimization Mode selection. These choices combine a frequency and group delay response to optimize the oscilloscope for particular applications.

- **Pulse Response** - A group delay compensation minimizing preshoot, this selection most resembles the response of an analog oscilloscope by controlling group delay to be slightly non-zero at the highest frequencies. In addition, a fourth-order Bessel frequency response is implemented.
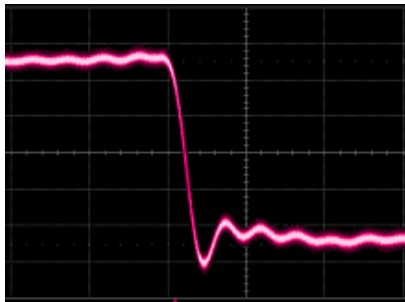
- **Eye Diagram** - Flat group delay compensation resulting in equalized preshoot and overshoot. This selection improves the symmetry of serial eye diagrams. In addition, a fourth-order Bessel frequency response is implemented.
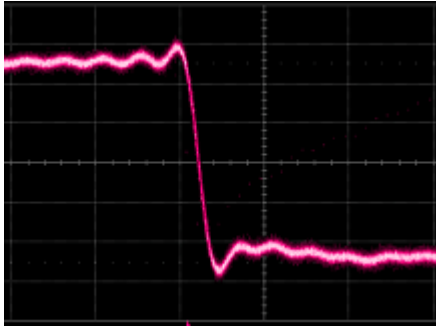
- **Flatness** - Flat group delay compensation with a brick-wall frequency response. While this provides the fastest rise time, there is also a slight penalty of more preshoot and overshoot compared to Eye Diagram mode. This selection is most often used in narrow-band RF measurements where it is desired to maintain constant magnitude response over the oscilloscope passband.
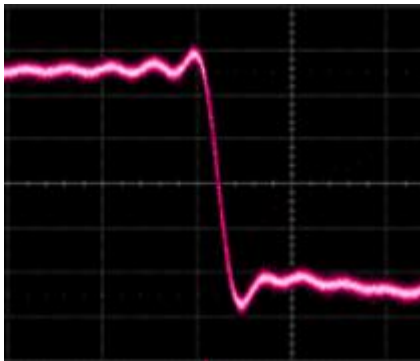
Trigger

Overview

Triggering is the way an oscilloscope selects an exact moment in time on a signal to then be shown on the screen. If the pattern of a signal happens to be repetitive, a continuous waveform pattern is inherently visible on the display.

But without a regular signal pattern, the oscilloscope requires controls to determine what specific point in time (when a trigger is met) to show the signal on the display. This is accomplished and affected in a variety of ways.

Some trigger settings allow for pre-trigger, post-trigger, and a delay between the time of the trigger event and the time when the display is refreshed (or swept) and the waveform is again shown on the screen.

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

- **Simple Triggers** - activated by basic waveform features or conditions such as a positive or negative slope, and hold-off

- **SMART Triggers** - sophisticated triggers that enable you to use basic or complex conditions for triggering. Use SMART Triggers for signals with rare features, like glitches.

- **Measurement Trigger** - triggers that allow you to leverage parameter measurements as waveform trigger conditions. A measurement trigger is either the only trigger or the final trigger in a chain of trigger events including hardware triggers.

- **MultiStage Triggers** - varied forms of triggers including **Cascaded**, **QualFirst**, and **Qualified** allowing varied combinations of triggers and trigger stages.

- **Serial Triggers** - provide serial data protocol specific triggering for a wide variety of standards.

Trigger Types

There are a set of standard Trigger Types. These Triggers are basic waveform features or conditions such as a positive or negative slope, and hold-off and are available on all oscilloscopes along with tools like **Software Assisted Trigger** and **Trigger Scan**.

In addition, there are more sophisticated triggers for setting basic or complex conditions. These include **Smart Triggers**, **Serial Trigger**, **Measurement Triggers**, and **MultiStage Triggers**.

Learn more and **Contact Teledyne LeCroy for Support**.

Edge

A simple trigger, Edge trigger is activated by basic waveform features or conditions such as positive or negative slope, and holdoff.

Note: On **WaveMaster 8 Zi** and **Zi-A** and **LabMaster** 9 **Zi-A**, up to 15 GHz bandwidth is available while Edge Triggering (provided no holdoff is selected).

Width
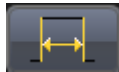
Width trigger allows you to define a positive- or negative-going pulse width bounded by a voltage level, above or below an occurring trigger. Or you can specify a pulse width and voltage range, within or outside an occurring trigger.

Pattern (Logic)

Logic trigger enables triggering on a logical combination (pattern) of five inputs: CH1, CH2, CH3, CH4, and AUX (sometimes referred to as EXT on legacy oscilloscope models). You have a choice of four Boolean operators (AND, NAND, OR, NOR), and you can stipulate the high or low voltage logic level for each input independently.

Smart

These are a specific set of sophisticated trigger types. Smart trigger types are used to set conditions on signals with rare features, like the glitches and others as follows:

WINDOW

A smart trigger occurs when a signal enters or exits a window defined by adjustable thresholds.

INTERVAL

While Glitch trigger performs over the width of a pulse, **Interval** trigger performs over the width of an interval - the signal duration (the period) separating two consecutive edges of the same polarity: positive to positive or negative to negative. Use interval trigger to capture intervals that fall short of, or exceed, a given time limit. In addition, you can define a width range to capture any interval that is itself inside or outside the specified range - an Exclusion trigger by interval.

GLITCH

Glitch trigger is a simpler form of Width trigger. Use Glitch trigger when you want to define a fixed pulse-width time or time range only. Glitch trigger makes no provision for voltage levels or ranges.

DROPOUT

Used primarily in single-shot applications, and usually with a pre-trigger delay, **Dropout** trigger can detect lost signals. The trigger is generated at the end of the timeout period following the last trigger source transition.

RUNT

The **Runt** trigger occurs when a pulse crosses a first threshold line, but fails to cross a second threshold line before re-crossing the first. Other defining conditions for this trigger are the edge (triggers on the slope opposite to that selected) and runt width.

SLEW RATE

SlewRate trigger activates a trigger when the rising or falling edge of a pulse crosses two threshold levels: an upper level and a lower level. The pulse edge must cross the thresholds faster or slower than a selected period of time.

Measurement
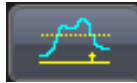
This trigger type allows you to leverage parameter measurements as waveform trigger conditions. A measurement trigger is either the only trigger or the final trigger in a chain of trigger events including hardware triggers.

TV

Not available on all instruments, **TV** triggers provide stable triggering on standard or custom composite video signals. Use them on PAL, SECAM, NTSC, or HDTV systems.

MulitStage

Touching this **MultiStage** trigger type shows the additional MultiStage types on the dialog. Select from **Cascaded**, **QualFirst**, and **Qualified** as follows:

CASCADED

The Cascaded trigger allows you to define successive trigger **Stages** (referred to as Stage **A**, **B**, **C**, and **D**) as **arm**, **trigger/arm**, **trigger/arm**, **trigger** criteria, respectively.

QUALFIRST

In single trigger mode, **QualFirst** arms the oscilloscope on the A event, and then triggers on all subsequent B events.

Note: This button is enabled when using the sequence sampling mode. It is commonly used in sequence mode for disk drive applications with the index pulse defined as the A qualifier signal and the servo gate signal as the B triggering events.

QUALIFIED A-B

In single trigger mode, **Qualify A-B** arms the oscilloscope on the A event, and then triggers on the B event. If the oscilloscope is in Normal trigger mode, it automatically resets after the B event. Arm trigger events can be set for **Edge**, **Pattern**, **State**, and **PatState**. State is briefly explained as follows:

State
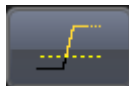
The **State** trigger is a level-qualified trigger which requires that the qualifying signal remain above or below a specified voltage level for a trigger to occur. For State trigger, you specify the time or number of events after the signal has gone above or below the voltage level when you want the trigger to occur.

Serial Trigger

Protocol-enabled serial trigger capabilities are available as options on several oscilloscope models.

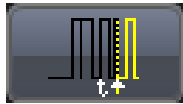**SERIES-SPECIFIC FEATURE**: On earlier model oscilloscopes, such as legacy versions of WaveJet, WaveRunner, WaveSurfer (including Xi/Xs non-A/B models, and Legacy SDA models include a set of Serial protocol tools as part of the core components.

Clock and Data Recovery (CDR)

SERIES-SPECIFIC FEATURE: 80-bit Serial Trigger (without decode capability) is standard on SDA model oscilloscopes and optional on WavePro, WaveMaster, and DDA model oscilloscopes. The CDR feature is optional for the WaveRunner 6 Zi family, including 8b/10b decode.

Trigger Settings

Horizontal and Vertical adjustments are typically made for all trigger types using either the **Delay** or **Level** knobs on the front panel of the instrument or their respective controls on the **Timebase** setup dialog.

- **Horizontal**: Turn the **DELAY** knob in the HORIZONTAL control group to adjust the trigger's horizontal position. Or, touch inside the **Delay** control and provide a value on the **Timebase** dialog using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** .

  The trigger location is shown by a marker under the grid.

  Post-trigger delay is indicated by a left-pointing arrow at the lower-left of the grid.

The time value is given in the title line of the **Timebase** label at the lower-right of the grid.

- **Vertical:** Turn the **LEVEL** knob in the TRIGGER control group to adjust the trigger's vertical threshold.

  Turn this knob to adjust the level of the trigger source or the highlighted trace. Level defines the source voltage at which the trigger will generate an event: a change in the input signal that satisfies the trigger conditions.

  Alternatively, in the Trigger dialog, you can touch inside the **Level** control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42). Quickly set a level of zero volts by touching the **Zero Level** button.

  An arrow on the right side of the grid shows the threshold position. This arrow is only visible if the trigger source is displayed.

Trigger Setup

Based on your **Trigger Type** selection, sections of the main Trigger dialog and additional dialogs altogether vary.

Most trigger types have **Type**, **Setup**, and **Level** selections. The following sections explain some of the standard setup configurations for different trigger types.


1. Make your **Type** selection by touching the button corresponding to the desired trigger.

2. Touch inside the trigger **Source** control for your first **Setup** configuration and select a source on which to trigger.

3. If available, touch inside the **Coupling** control and select a coupling mode.

Coupling refers to the type of signal coupling at the input of the trigger circuit. Choices of trigger coupling vary by oscilloscope model.

With DC coupling, all of the signal's frequency components are coupled to the trigger circuit for high-frequency bursts.

4. Touch inside the trigger **Slope** control and choose the direction of the trigger voltage transition used for generating a particular trigger event.

The selection is then shown to the right of the dialog as follows for a Positive Slope selection on an Edge Trigger.
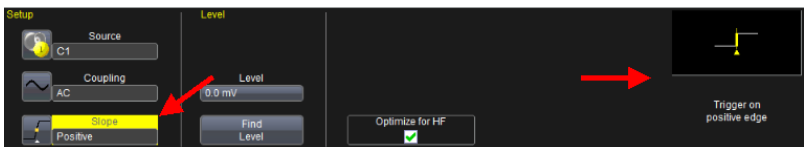
Edge trigger works on the selected edge at the chosen level. The slope (positive or negative) is specified on the Trigger label permanently shown to the lower-right of the grid.

4. **Level** defines the source voltage at which the trigger circuit generates an event (a change in the input signal that satisfies the trigger conditions). The selected trigger level is associated with the chosen trigger source. Note that the trigger level is specified in volts and normally remains unchanged when the vertical gain or offset is modified.

The Amplitude and Range of the trigger level have limits as detailed in the datasheet specifications regularly maintained on **teledynelecroy.com**.

Touch inside the **Level** data entry control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).
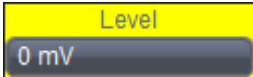
Provide a voltage level (in millivolts).

PLEASE NOTE THE FOLLOWING:

- Once specified, **Trigger Level** and **Coupling** are the only parameters remaining unchanged as you switch from trigger mode to trigger mode for each trigger source.

- Some additional controls and dialogs for triggers that differ are provided in the following topics as examples.

Optimize for HF

The Optimize for HF checkbox can be used on an **Edge** trigger to reject high or low frequencies.
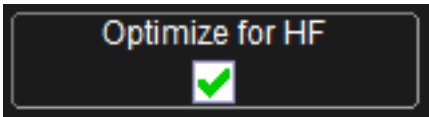
The checkbox is marked by default; meaning, the instrument is optimized for high-frequency waveforms.

Note: If you are measuring a waveform that is 10 MHz or slower, be sure to unmark the checkbox to avoid triggering on an incorrect slope.

Width Condition is

Width triggers (and other triggers equipped with conditional logic) have conditional logic settings as follows.

Your **Width Condition** can be specified as **Less Than**, **Greater Than**, **In Range** and **Out Of Range**.

In Range and Out Of Range conditions can be further set with **Upper** and **Lower Values** (for **Limits**), or **Nominal width** and **Delta** (for **Delta**).

**Note**: Width Condition settings are summarized on the far right of the dialog.

Holdoff by Time or Events

Holdoff is an additional condition of Edge and Pattern triggers. It can be expressed either as a period of **time** or an **event** count. Holdoff disables the trigger circuit for a given period of time or number of events after the last trigger occurred. Events are the number of occasions on which the trigger condition is met. The trigger resumes when the holdoff has elapsed and its other conditions are met.

Select the holdoff by touching the **Time** or **Events** buttons on the **Holdoff** dialog.
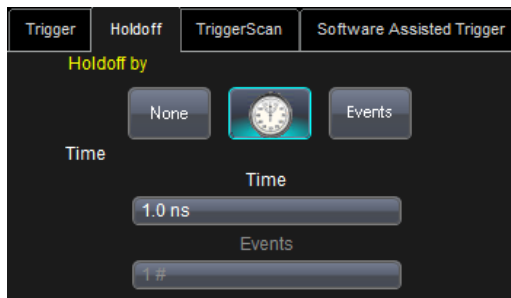
Now, click the corresponding control and provide a value.

Use holdoff to obtain a stable trigger for repetitive, composite waveforms. For example, if the number or duration of sub-signals is known you can disable them by choosing an appropriate holdoff value. Qualified triggers operate using conditions similar to holdoff.

HOLD OFF BY TIME
Sometimes you can achieve a stable display of complex, repetitive waveforms by placing a condition on the time between each successive trigger event. This time would otherwise be limited only by the input signal, the coupling, and the instrument's bandwidth. Select a positive or negative slope, and a minimum time between triggers. The trigger is generated when the condition is met after the selected holdoff time, counted from the last trigger. The delay is initialized and started on each trigger.
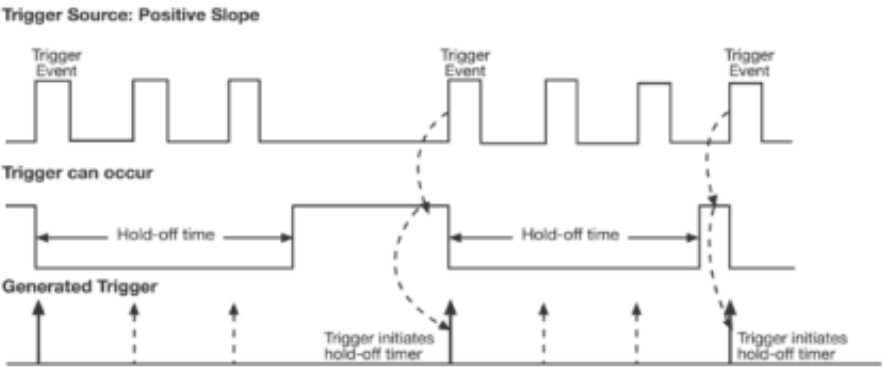
Edge Trigger with Holdoff by Time. The bold edges on the trigger source indicate that a positive slope has been selected. The broken upward-pointing arrows indicate potential triggers, which would occur if other conditions are met. The bold arrows indicate where the triggers actually occur when the holdoff time has been exceeded.

HOLD OFF BY EVENTS

Select a positive or negative slope and a number of eventwis. An event is the number of times the trigger condition is met after the last trigger. A trigger is generated when the condition is met after this number, counted from the last trigger. The count is restarted on each trigger. For example, if the event number is two, the trigger occurs on the third event.
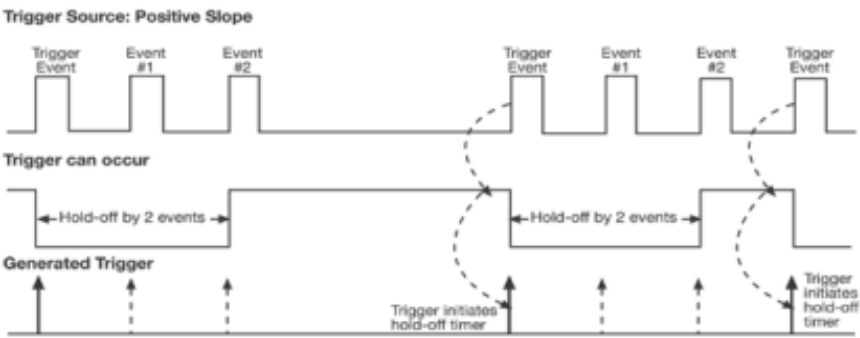
Edge Trigger with Holdoff by Events (in this example, two events). The bold edges on the trigger source indicate that a positive slope has been selected. The broken, upward-pointing arrows indicate potential triggers, while the bold ones show where triggers actually occur after the holdoff expires.

Auxiliary Input Trigger

Some instrument models provide auxiliary input trigger capability. It's done as a pattern trigger, on the **Ext** dialog.
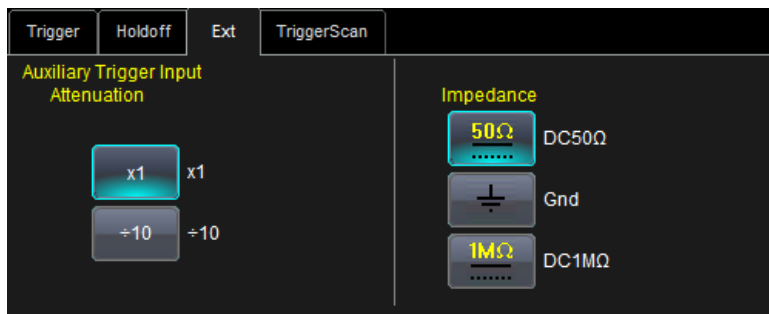
Select **X1**, or **÷10**. You can also select from **DC50Ω**, **Gnd**, and **DC1MΩ Impedance** values.

TriggerScan

TriggerScan is a debugging tool (available for any trigger type) that helps you quickly find rare waveform glitches and anomalies. With TriggerScan, you can build a list of trigger setups to look for rare events and automatically sequence through each one. TriggerScan can use any type of trigger setup available including edge, width, and qualify as well as Smart Triggers (such as, glitch and runt triggers). TriggerScan automates two key processes in triggering rare events:

1. Trains the system by looking at normal acquired waveforms. During the training, the oscilloscope analyzes the waveforms to determine what waveforms normally look like. Using this information, it generates a list of smart trigger setups to trigger on abnormal situations.

2. Loads the smart trigger setups from the Trainer and cycles through these. As triggers occur, they are overlaid on the screen. All acquisition settings are preserved and you can use all the functions of the oscilloscope to find the root cause of these anomalies including, WaveScan, Histograms, and advanced analysis.

Training TriggerScan

The TriggerScan Trainer inspects a currently acquired waveform and automatically builds a list of common trigger setups used to find rare events.

PLEASE NOTE THE FOLLOWING:

- You must acquire and display at least 3 cycles of a signal before running the Trainer.

- You should run the Trainer if you want to change the trigger types or if you change the channel or signal.

1. Touch **Trigger → Trigger Setup...** from the menu bar.

2. On the **Trigger** dialog, click the **TriggerScan** tab.

3. Touch the **Trainer** button and select a channel as the source for the training on the **Trigger Scan Trainer** pop-up. Also choose the types of triggers the Trainer should use to train the system and then touch the **Start Training** button. The training begins. When it is complete, a list of smart trigger setups is displayed in the Trigger List.

Starting TriggerScan

After you have run the Trainer, the Trigger List displays a list of smart trigger setups. You can add or remove trigger setups. You can also update the selected smart trigger setup. Once you have made any changes to the Trigger List, you are ready to start scanning.

1. Touch **Trigger → Trigger Setup...** from the menu bar.

2. On the **Trigger** dialog, click the **TriggerScan** tab and its corresponding dialog is shown.

3. If you want to add a new trigger setup, touch the **Trigger** tab and set the new trigger as desired on the **Trigger** dialog. Then, back on the **TriggerScan** dialog, touch the **Add New** button to append the new trigger to the **Trigger List**.

4. If you want to replace the selected trigger setup with the current trigger setup, highlight the setup in the Trigger List and touch the **Update Selected** button.

5. If you want to show a specific trigger setup on the Trigger List, highlight its corresponding row on the list, and then touch the **Load Selected** button.

> **Note**: If you want to delete all trigger setups in the Trigger List, touch the **Delete All** button.

6. If you want to delete a trigger setup, highlight the setup in the Trigger List and touch the **Delete Selected** button.

7. All trigger setups can be deleted regardless of selections on the Trigger List with one step by touching the **Delete All** button.

5. Once you have made any changes to the Trigger List, touch the Trainer button and then restart the scan by touching the **Start Training** button on the Trigger Scan Trainer pop-up. The oscilloscope automatically sequences through all the trigger setups.

   PLEASE NOTE THE FOLLOWING:

   - You can tune the dwell time that the oscilloscope waits before loading the next trigger setup using the **Dwell Time** data entry control.
   - If you have Persistence display mode enabled, all trigger events are recorded on the display. Refer to the **Persistence Setup** (on page 88) topic for instructions on enabling Persistence display mode.
   - If you want TriggerScan to stop when the next oscilloscope trigger, check the **Stop On Trigger** checkbox. You can use this to isolate specific trigger setups.

Saving TriggerScan Setups

You should save TriggerScan setups once you have made any modifications to the Trigger List. The current Trigger List is not be preserved after exiting the application unless you save it.

1. On the **TriggerScan** dialog, touch inside the **Setup File Name** data entry control and providing a file name using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

OR

Touch the **Browse** button and select a location and file name.

2.   Touch the **Save Setup...** button.

Note: You can load previously saved TriggerScan setups by touching the **Browse** button, locating the file, and then touching **Load Setup...**.

Viewing Waveforms

Display

Oscilloscope display grids present the trace information in a voltage vs. time format. The oscilloscope analog-to-digital converter (ADC) information is displayed vertically on the grid with the ADC bits divided proportionally according to their amplitude on the grid. Channel traces are typically 8-bits of vertical data, whereas Math traces are 16-bits of vertical data. Teledyne LeCroy grids consist of eight vertical divisions.

When displaying channel traces on the grid, use of less than full-grid amplitude results in some reduced vertical resolution and accuracy. For instance, if a channel trace is displayed as two divisions high on a grid, the number of ADC bits utilized is...

$$2/8 * 2^8 \text{ or } 64 \text{ bits}$$

This is quite less than the full 8-bit resolution. Such a reduction in vertical resolution may be acceptable if the primary measurement consideration is for rough timing measurements; however, if vertical accuracy or extreme timing accuracy is a requirement, it is better to increase the amplitude of the signal to utilize close to maximum grid height. In order to accomplish this while still providing the ability to view many signals at one time on the oscilloscope display Teledyne LeCroy provides **multi-grid** capability. This creates multiple oscilloscope grids, each with 8-bit vertical resolution, and allows many full-resolution grids (but vertically smaller in grid height) for concurrent display without affecting the vertical resolution.

Different grid displays are available based on instrument and installed software packages. For example, some displays show side-by-side, instead of vertically stacked grids. The additional grid displays offer more convenient views of multiple waveforms. Refer to your instrument datasheet at **teledynelecroy.com** for detailed information as to which grid displays are provided with your oscilloscope.

Display Setup

Access and adjust the different display configurations on our oscilloscope using the following steps:

> **Note**: Not all grid styles are available on all instruments. Grid styles vary based on both oscilloscope model and whether or not you have the SDAII software option loaded on your oscilloscope. Learn more about software options and **Contact Teledyne LeCroy for Support**.

1. Touch **Display → Display Setup...** on the menu bar.

2. Touch one of the **Display combination buttons**.
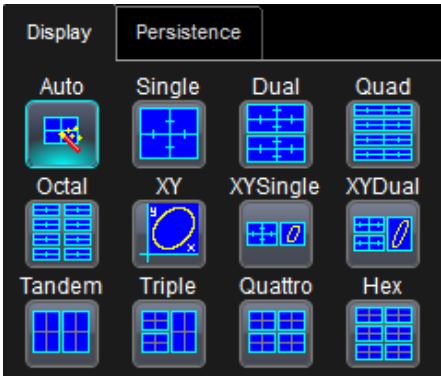
PLEASE NOTE THE FOLLOWING:

- Small images label each **Display combination** button and indicate its corresponding grid configuration.

- **Autogrid** automatically adds or deletes grids as you select more or fewer waveforms to display.

- If more than a certain amount of display setups are available for your oscilloscope, a **Grid** control is shown and presents the **Select Grid** pop-up when touched.
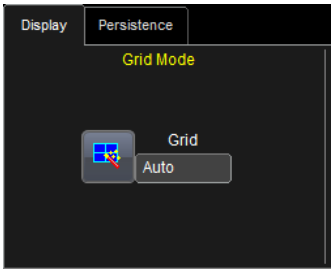
3. Touch inside the **Grid Intensity** data entry control.

4. Provide a value from 0 to 100 (percent).
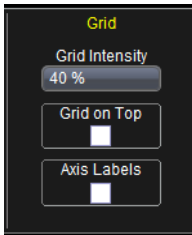
5. Touch the **Grid on top** checkbox if you want to superimpose the grid over the waveform.

    > **Note**: Depending on the grid intensity, some of your waveforms may be hidden from view when the grid is placed on top. To undo, simply uncheck **Grid on top**.

6. Touch the **Axis labels** checkbox to permanently display the values of the top and bottom grid lines (calculated from volts/div) and the extreme left and right grid lines (calculated from the timebase).

7. Choose a line style for your trace: solid Line or Points.

8. Touch inside the trace **Intensity** data entry control if you want to change the value.

9. Enter a value from 0 to 100.

> **Note**: Access the Monitor tab for external monitor display settings. Refer to the **External Display** topic for more details.

SEQUENCE MODE DISPLAY

Set up a Sequence Mode display by first selecting a **Sequence** trigger mode in the **Timebase → Horizontal Setup** dialog. You must also have entered a **Num Segments** value. For more information on setting up Sequence Mode, see the **Sequence Sampling Mode** (on page 53) topic.

1. Touch **Display → Display Setup...** on the menu bar.

2. Touch inside the **Display Mode** control and select a display mode from the pop-up menu.

    Touch inside the **Num seg displayed** control and enter a value, using the pop-up keypad.
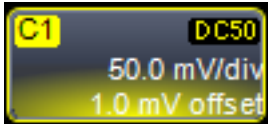
    Touch inside the **Starting at** control and enter a value.

Moving Traces from Grid to Grid

You can move traces from grid to grid with the touch of a button.

Moving a Channel or Math Trace

1. Touch the trace descriptor label for the waveform you want to move.

2. Touch the **Next Grid** button.
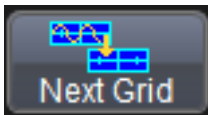
Note: If you have more than one waveform displayed on only one grid, a second grid automatically opens when you select **Next Grid**.

Displays Containing Masks

Since masks are pixel-based display renderings, you can think of them as part of the Display feature set on your instrument. Masks and mask testing are applied to waveforms as part of **Pass/Fail** functionality accessed from **Analysis → Pass/Fail** from the menu bar.

Note: For more detailed information about Masks and other Pass/Fail functionality, such as removing a mask from your display, refer to **Mask Testing** (on page 124).

Dual Display Grid Selection

Make a dual grid display selection for showing on an external display (once properly connected to the I/O panel) by selecting **Display → Display Setup...**.
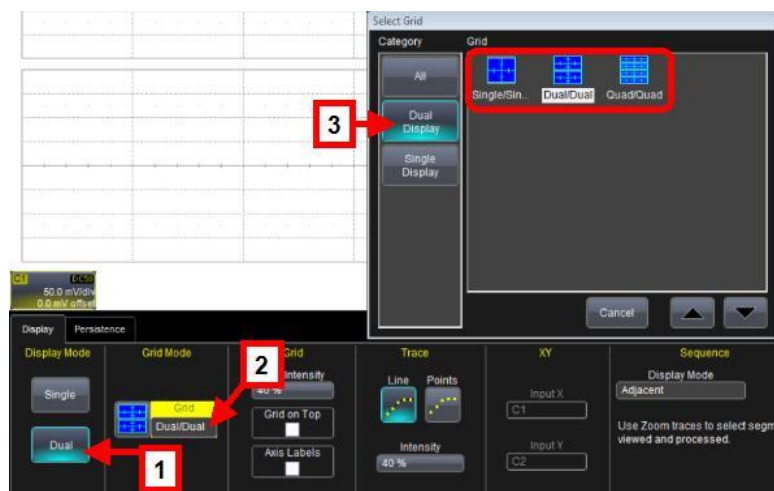
Note: First-time setup may show a different Display tab. Fix this by touching **File → Exit** on the menu bar and re-launching the oscilloscope software using the **Start DSO** shortcut on the desktop.

1. Touch the **Dual** button on the Display Mode section.
2. Touch inside the **Grid** control on the Grid Mode section of the dialog. The **Select Grid** pop-up is shown.
3. Touch the **Dual Display** category and choose from **Single/Single**, **Dual/Dual**, and **Quad/Quad** options.

Your grid selection is now shown on both displays.

Persistence

Persistence Overview

The Persistence feature helps you display your waveform and reveal its idiosyncrasies or anomalies for a repetitive signal. Use Persistence to accumulate on-screen points from many acquisitions to see your signal change over time. The instrument persistence modes show the most frequent signal path in three-dimensional intensities of the same color, or graded in a spectrum of colors.

You can show persistence for up to eight inputs for any channel, math function, or memory location (M1 to M4).

Persistence Setup

Touch **Display → Persistence Setup...** on the menu bar.

Now, touch the **Persistence On** checkbox and refer to the following scenarios based on your needs.

Persistence Setup for All Input Channels at Once

1. Touch the **All Locked** button.
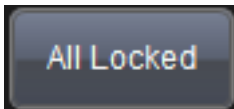
2. Touch one of the **Mode** buttons.

3. Touch the **Show last trace** checkbox if you want the last trace displayed.

4. Touch inside the **Saturation** data entry control and provide a whole number integer.

   For more information on saturation, see the **Saturation Level** topic.

5. Touch inside the **Persistence time** data entry control and make a selection from the pop-up menu.

Persistence Setup for Each Input Channel Individually

1. Touch the **Per Trace** button.

2. Touch one of the **persistence mode** buttons next to an input channel.

   To turn off persistence for an individual channel, touch the left-most persistence mode button next to the channel.
   OR

For each input channel, touch its tab to set up persistence for that channel.

3. Touch one of the **mode** buttons.

4. Touch the **Show last trace** checkbox if you want the last trace displayed.
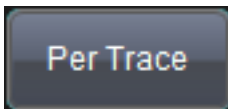
5. Touch inside the **Saturation** data entry control and enter a whole number integer,.

6. Touch inside the **Persistence time** data entry control and make a selection from the pop-up menu.

7. If you want to return all input channel setups to their default settings, touch the **Reset All** button.
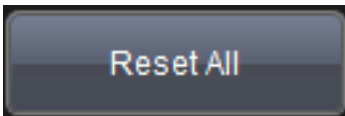
WaveStream Display Mode
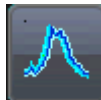
This fast viewing mode provides brightness-graded intensity with a decay time similar to the action of phosphor on an analog screen.

WaveStream mode operates at up to 80 GS/s with an update rate of up to several thousand waveforms/second for better capture of higher frequency abnormal events.

Adjusting Trace Intensity

The **INTENSITY** knob adjusts the brightness of your trace.

The intensity value is shown in the bottom-right corner of the screen.
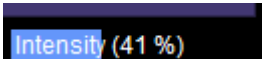
PLEASE NOTE THE FOLLOWING:

Pushing the **Intensity** knob changes the Persistence status in the following ways.

- **OFF** - When the button hasn't been pushed, it may be turned to control the trace **Intensity** control value.

- **Analog Persistence** - When the button is pushed once, the waveform resembles a trace on a phosphor oscilloscope. Turning the knob affects persistence with a blended form of **Intensity** and **Saturation**. As the knob is turned clockwise, the **Intensity** value increases while the **Saturation** value decreases. The opposite occurs when the button is turned counter clockwise.
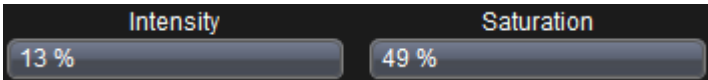
- **Color Persistence** - The button behaves the same way as Analog. However, the grid display shows a color waveform where red indicates most frequent occurrences while blue denotes the less frequent.

Instead of using the knob, you can provide values for **Intensity** (same control on Display and Persistence dialogs) or **Saturation** controls.

Zooming Waveforms

Overview

You can magnify a selected region of a waveform using the Zoom function. On Zi model oscilloscopes, you can display up to four Zoom (Z1 - Z4) and eight Math Zoom traces (F1 - F8). You can zoom:

- A single channel - covered in **To Zoom a Single Channel** (on page 92).

- **A math or memory trace** - known as **Zooming Memory or Math Function Traces**.

- **Multiple waveforms at once** - covered in **To Zoom Multiple Waveforms Quickly** (on page 94).

- **Segments in a sequence** - found in **Sampling Modes → Sequence Sampling Mode** (on page 53)

You can also use the Multi-Zoom Math function to create time-locked zoom traces for selected waveforms. For more information, refer to **Math → Multi-Zoom**).

At any time, you can zoom a portion of a channel waveform or Memory/Math function trace by touching and dragging a rectangle around any part of the input waveform, see the **To Zoom by Touch-and-Drag** (on page 94) topic. The zoom trace will size itself to fit the full width of the grid. The degree of magnification, therefore, will depend on the size of the rectangle that you draw.

You can also use the front panel **QUICKZOOM** button to create multiple zooms, one for each displayed input channel. For more information, see the **To Zoom Multiple Waveforms Quickly** (on page 94) topic.

Previewing Zoomed Waveforms

When you zoom a waveform, a preview of the zoomed area is shown on the **Preview** section of the **Zx** dialog.

Zooming a Single Channel

The **Zoom** button appears as a standard button at the bottom of the channel **Cx Vertical Adjust** setup dialog for you to create a zoom trace of your input waveform.
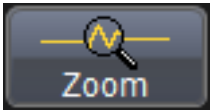
1. On the menu bar, touch **Vertical → Channel X Setup...**.
   OR
   Touch the channel trace descriptor label for a displayed channel.
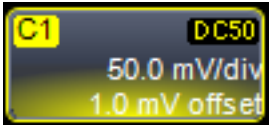
2. Touch the **Zoom** at the bottom of the **Cx Vertical Adjust** dialog. A zoom trace (one of Z1 to Z4) is created for the selected channel.
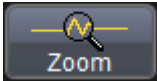
3. Vary the degree of zoom by touching the newly created **Zx** trace label. The setup dialog for the zoom (Z1 to Z4) opens. It shows the current horizontal and vertical zoom factors.

4. If you want to increase or decrease your horizontal or vertical zoom in small increments, touch the **Var.** checkbox to enable variable zooming. Now with each touch of the zoom control buttons, the degree of magnification changes by a small increment.

OR

If you want to zoom in or out in large standard increments with each touch of the zoom control buttons, leave the **Var.** checkbox unchecked.

OR

If you want to set exact horizontal or vertical zoom factors, touch inside the Horizontal **Scale/div** data entry control and provide a time-per-div value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42). Then touch inside the Vertical **Scale/div** control and enter a voltage value.

PLEASE NOTE THE FOLLOWING:

To reset the zoom to x1 magnification, touch **Reset Zoom** in the dialog. You can also use the Zoom and Math front panel knobs to adjust the horizontal and vertical zoom.

- **Horizontal Position** - Press to reset the horizontal zoom position to zero. Turn to change the horizontal position of the selected math or zoom trace.

- **Horizontal Ratio** - Press to toggle between fixed and variable horizontal zoom ratio adjustment. Turn to change the horizontal zoom ratio of the selected math trace.

- **Quick Zoom** - Press to automatically display 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. Pressing this button also turns off all other traces.

- **Vertical Position** - Press to reset the vertical zoom position to zero. Turn to change the vertical position of the selected math or zoom trace.

- **Vertical Ratio** - Press to toggle between fixed and variable vertical zoom ratio adjustment. Turn to change the vertical zoom ratio of the selected math trace.

Touch-and-Drag Zooming

1. Touch and drag a rectangle around any part of an input channel waveform, math trace, or memory trace. The **Zoom** (Z1 to Z4) dialog opens.

Note: If you have enclosed a combination of channel and math or memory traces in the rectangle, a pop-up **Rectangle Zoom Wizard** is shown. Touch a **Zoom** button (Z1 to Z4).

2. Turn off the zoom traces by touching the **Undo** button at the top-right corner of the screen.

OR
Uncheck the **Trace On** checkbox in the dialog for each zoom trace.
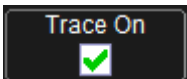
Quickly Zooming Waveforms

Quickly create a Zoom trace by either pressing the front panel **Zoom** button or touching the Zoom button on the respective channel dialog.
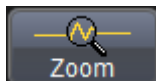
Turning Off Zoom

Turn off a Zoom by either pressing the front panel **Zoom** button again.

OR

On the corresponding Zoom dialog, touch the **Trace On** checkbox to remove the check mark and disable the zoom trace.
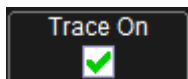
Measuring with Cursors

Overview

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

- **Horiz(ontal)** (generally Time or Frequency) cursors are markers that you move horizontally along the waveform. Place them at a desired location along the time axis to read the signal's amplitude at the selected time.

- **Vert(ical)** (Voltage) cursors are lines that you move vertically on the grid to measure the amplitude of a signal.

Cursor Types

Each cursor locates a point on the waveform. The cursor values can be read in the descriptor label for the trace. Use the **Position** data entry controls at the right side of the dialog to place the cursors precisely. The **Readout** icons depict what is being measured for each measurement mode.

Cursor Types include **Absolute**, **Delta**, **Abs+Delta**, and **Slope**. The following topic explains them and other cursor information in a bit more detail.

Cursors Setup

Quickly Displaying Cursors

Cursors can always be quickly turned on and off from the **touch screen** or the **front panel control**, respectively as follows:

- Touch **Cursors** on the menu bar and make cursor control selections as desired. **Off**, **Horizontal Abs**, **Horizontal Rel**, **Vertical Abs**, and **Vertical Rel** options are available on the menu.

- Press the **CURSOR TYPE** button on the front panel repeatedly for all the available cursor types on your instrument. Turn the **CURSORS** knobs to adjust the position of the cursor.

**PLEASE NOTE THE FOLLOWING**:

- The bottom cursor knob adjusts relative cursors. It does not work with absolute cursor types.

- Previously setup cursor positions are preserved for subsequent displays. Changing cursor positions or measurement modes are always available using **touch screen** or **front panel control** methods as previously mentioned.

The Cursors Dialog

Whether using **touch screen** or **front panel control** methods (as previously mentioned) to access cursors, the **Cursors** dialog is then shown.
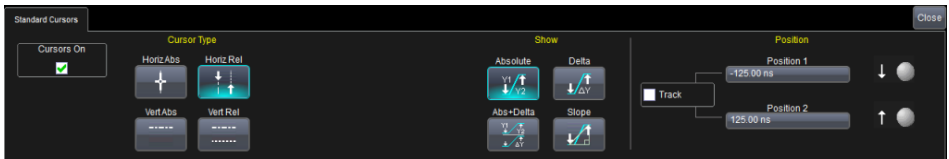
CURSORS ON

Mark or unmark the **Cursors On** checkbox to turn cursors on and off as desired.

CURSOR TYPE CONTROLS

Select your **Cursor Type** from **Horizontal Abs**, **Horizontal Rel**, **Vertical Abs**, and **Vertical Rel** options shown. Subsequent controls on the dialog are shown, hidden, enabled, or disabled based on the **Cursor Type** selection made.

- **Horizontal Abs** - Provides a single, dashed, vertical line and cross-hair marking for the specific cursor location. None of the **Show** controls are provided; however, the Position 1 control is enabled on the right of the dialog.

- **Horizontal Rel** - Provides two, dashed, vertical lines and cross-hair markings for the specific cursor locations. Since there are two cursors involved, controls for **Show** along with **Track**, and **Position 1** and **2** are available on the dialog.

- **Vertical Abs** - Provides a single, dashed, horizontal line and cross-hair marking for the specific cursor location. None of the **Show** controls are provided; however, the Position 1 control is enabled on the right of the dialog.

- **Vertical Abs** - Provides a single, dashed, horizontal line and cross-hair marking for the specific cursor location. None of the **Show** controls are provided; however, the Position 1 control is enabled on the right of the dialog.

SHOW (FOR RELATIVE CURSOR TYPES)

Show controls (**Absolute**, **Delta**, **Abs+Delta**, and **Slope**) become available on the dialog when Relative Cursors (**Horizontal** or **Vertical Rel** cursor types) are chosen.

For **Horizontal** and **Vertical Rel** cursor types, you can also specify **Position 1** and **2** time values for your cursor locations. You also have the option to mark the **Track** checkbox which allows you to move your Position 1 cursor (using the touch-screen display or front panel control) and have both cursors then move together and maintaining their relative distance from their originally specified positions.

The **Show** controls essentially display cursor value results on the signal's corresponding **Trace Descriptor** label as follows:

- **Absolute** - The Trace Descriptor label shows **specific voltages** for the position location values provided.

- **Delta** - The Trace Descriptor label shows the **difference between the specific voltages** for the position location values provided.

- **Abs+Delta** - The Trace Descriptor label shows both the **specific voltages** and the **difference between the specific voltages** for the position location values provided.

- **Slope** - The Trace Descriptor label calculates the **slope** based on the position location values provided.

Cursors on Math Functions

You can place cursors on a math function whose X-axis has a dimension other than time (FFT, for example). With a Math trace setup for either an FFT or a Histogram, if you then access the **Standard Cursors** dialog (**Measure → Cursors Setup...**) , an **X-Axis** control is made available where you can choose from available units. The following shows cursors on a histogram and therefore an appropriate selection for **V (histo)** is available.
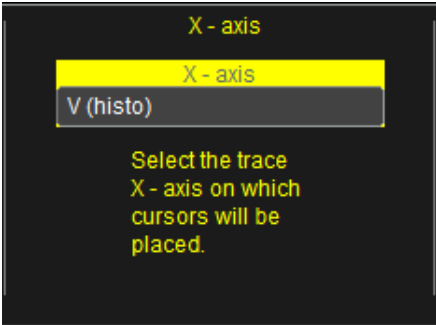
Measurement Parameters

Overview

Parameters are measurement tools that 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.

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.

Turning On Parameters

1. Touch **Measure → Measure Setup...** on the menu bar.

2. Touch the **On** checkbox for each parameter you want to enable.

3. Touch the **Show Table** checkbox to display the parameters below the grid.

Quick Access to Parameter Setup Dialogs

You can quickly gain access to a parameter setup dialog by touching the parameter table below the grid. For example, touch within the **P1** cell to display the P1 setup dialog.
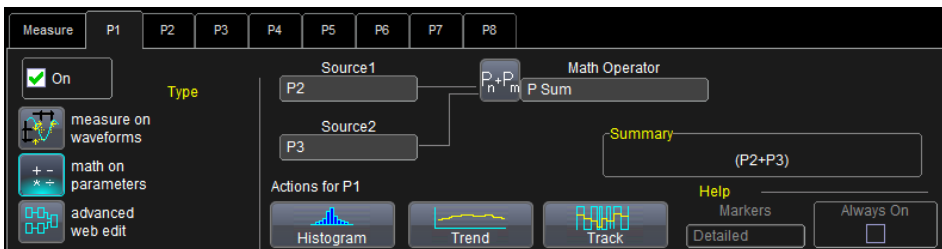
Touch the **Measure** cell to the far left to display the main Measure dialog.

Parameter Setup

1. Touch the parameter tab (**Px**) of an unused location or one that you want to change.

2. Under **Type**, select a measurement type:

   Measure On Waveforms applies measurements directly on the waveform as indicated on the **Source1** control.

   Math On Parameters performs math (addition, subtraction, multiplication, division) on parameters indicated on the **Source1** and **Source2** controls.

   Advanced Web Edit uses Teledyne LeCroy's Processing Web for measurement setup. This feature, available with the XWEB option, allows you to chain practically unlimited math functions together for operation on your waveform measurements.

3. Touch inside the **Source1** field and select a channel, math trace, memory trace, or other waveform to be measured.

4. If you selected **Measure On Waveforms**, touch inside the **Measure** field and select a parameter from the pop-up menu.

   OR
   If you selected **Math On Parameters**, touch inside the **Math Operator** data entry field and select a math function from the pop-up menu.

5. In the mini-dialog to the right of the main setup dialog, touch the **Gate** tab to narrow the span of measurement - as covered in the **Measure Gate** topic (available in the online help files).

6. Touch the **Accept** tab to define parameter values to be used in the measurement - as covered in the **Qualified Parameters** topic (available in the online help files).

Measure Modes

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

Standard Vertical Parameters

These are the default Standard Vertical Parameters:

Vertical							
mean	sdev	max.	min.	ampl	pkpk	top	base

Standard Horizontal Parameters

These are the default Standard Horizontal Parameters:

Horizontal							
freq	period	width	rise	fall	delay	duty	num points

Selecting Measure Modes

1. Touch **Measure → Measure Setup…** on the menu bar.

2. Under **Measure Mode**, select the **Std Vertical** or **Std Horizontal** buttons.

   Note: You can customize parameters by touching **My Measure**. Learn more in the Customize a Parameter topic (available in the online help files).

3. Touch inside the **Source** data entry control and choose a source for which the measurements should apply.

Help Markers

Help Markers clarify parameter measurements by displaying movable cursors and a visual representation of what is being measured. For the **at level** parameters, Help Markers make it easier to see where your waveform intersects the chosen level. This feature also displays the hysteresis band that you have set about that level.

You also have the option, by means of an **Always On** checkbox, to leave the Help Markers displayed after you have closed the Help Markers setup dialog.

You have a choice of **Simple** or **Detailed** views of the markers:

- The **Simple** selection produces cursors and Measure Gate gate posts. The gate posts are independently placeable for each parameter.

- The **Detailed** selection produces cursors, Measure Gate gate posts, a label identifying the parameter being measured, and a level indicator and hysteresis band for **at level** parameters (not part of Standard Horizontal or Standard Vertical parameters).
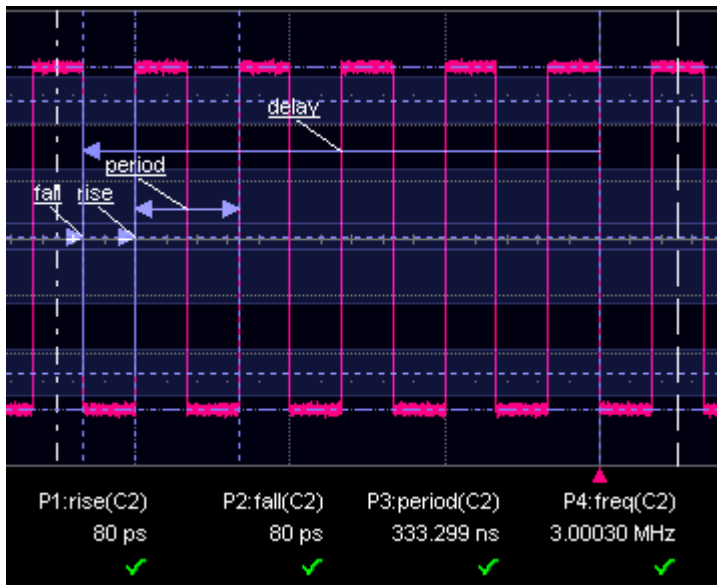
Standard Horizontal Parameter Help Markers
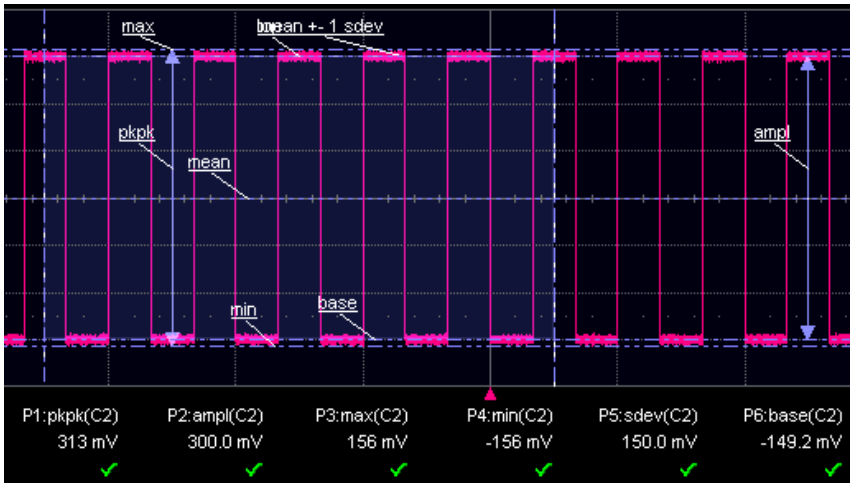
Standard Vertical Parameter Help Markers

Help Markers Setup

1. Touch **Measure → Measure Setup...** on the menu bar.

2. Select a Measure Mode: **Std Vertical**, **Std Horizontal**, or **My Measure**.

3. Touch the **Show All** button to display Help Markers for every parameter being measured on the displayed waveform.
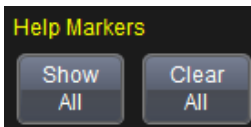
4. Touch a **Px** for any listed parameter; it doesn't matter which.

5. On the **Px** dialog, touch inside the **Help Markers** control and select **Simple** or **Detailed**. The **Simple** selection produces cursors and Measure Gate gate posts. The gate posts are independently placeable for each parameter. The **Detailed** selection produces cursors, Measure Gate gate posts, a label identifying the parameter being measured, and a level indicator and hysteresis band for "at level" parameters.

   NOTE: The choice of **Simple** or **Detailed** is applied to all parameters.

6. Touch the **Always On** checkbox if you want to continuously display Help Markers for this parameter.

TURNING OFF HELP MARKERS

1. Touch the **Clear All** button to turn off Help Markers for all parameters.
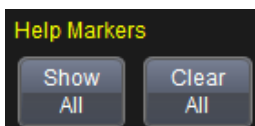
2. Turn off Help Markers for individual parameters by touching the **Px** tab for the parameter in question. Then uncheck the **AlwaysOn** checkbox. When you close this dialog, the Help Markers for this parameter are no longer shown.

Measurement Parameter Analysis

Overview

Teledyne LeCroy provides a variety of unique capabilities for advanced measurement parameter analysis. Most Teledyne LeCroy oscilloscopes calculate measurements for all instances in the acquisition. This provides the ability to rapidly and thoroughly analyze a long memory acquisition and calculate thousands or millions of parameter values, or find anomalous measurements. A variety of views are then provided allowing quick and easy measurement value understanding, as follows:

- **Histograms** provide a view of the measurement parameter distribution. See **Create and View a Histogram** (on page 106).

- **Tracks** provide a time-correlated view of a measurement parameter compared to other acquired channels or calculated math traces. A common usage for track is to observe the modulation of a signal, such as amplitude, frequency, or pulse width modulation. See **Creating a Track View** (on page 113).

- **Trends** provide a view of the measurement parameter over an extended period of time and over multiple acquisitions. See **Creating and Viewing a Trend** (on page 112).

- **Pass/Fail Testing** (on page 114) allows definition of the normal or abnormal measurement parameter value with a definable pass/fail action alerting the operator when a condition is met.

- **WaveScan** allows searching through a single acquisition for a measurement parameter that meets a variety of conditions, or scanning through multiple acquisitions with allowable trigger actions when conditions are met. In addition, a variety of views can be used to understand the specific behaviors of searched or scanned measurement parameters. See **Introduction to WaveScan** (on page 127).

These capabilities are only possible with the measurement of every occurrence of a measurement parameter in a long acquisition.

Both Track and Trend are tools that can be used to plot measurement data and observe variations with respect to time. Differences between Track and Trend are summarized in the following table:

Characteristic	Track	Trend
Representation	Parameter value vs. time	Parameter value vs. event
Behavior	Non-cumulative (resets after every acquisition). Unlimited number of events	Cumulative over several acquisitions up to 1 million events
Time Correlation to Other Data	Yes	No
Monitors an Evolution in the Frequency Domain	Yes	No. Trend points are not evenly spaced in time and therefore cannot be used for an FFT.
Monitors the Evolution of a Measurement Parameter over Several Acquisitions	No. Track resets after every acquisition.	Yes
Ensures No Lost Measurement Data	Yes. Maximum time period that can be	No. Since data can be accumulated over many

Characteristic	Track	Trend
	captured is limited by acquisition memory and sampling rate.	acquisitions, and since the oscilloscope takes time to calculate measurement values and to display data before the trigger is re-armed, data can be missed.

In general, Track is the tool to use if you want to capture a continuous stream of data spaced closely together.

To understand the change in a parameter with time, Trend can be used if your data is spaced widely apart and longer than the dead-time of the oscilloscope between acquisitions. Think of Trend as a strip chart recorder for your oscilloscope.

Creating and Viewing a Histogram

Histograms are graphical representations of data which divides it into intervals or bins. These intervals/bins are plotted on a bar chart such that the bar height relates to the number of data points inside each interval/bin. Various histograms can be setup using **Measure** or **Math** dialogs. Thumbnail versions of Histograms are called **Histicons**. Also, **Persistence** can be applied to Histograms.

PLEASE NOTE THE FOLLOWING:

1. The number of sweeps comprising the histogram is shown on the trace descriptor label.

2. The range of a histogram is limited to the portion of the trace that is visible on screen. That is, if you zoom in on a trace, the histogram does not contain data for that part of the original (no longer visible) trace.

Single Parameter Histogram Setup

Setup a single parameter histogram can be done from **Measure** or **Math** dialogs. The following sections demonstrate both methods.

SINGLE PARAMETER HISTOGRAM SETUP USING MEASURE

Touch **Measure → Measure Setup...** on the menu bar to access the **Measure** dialog. The **My Measure** button should be selected by default on the **Measure** dialog.

There are two ways to select parameters when setting up your measurement. They only differ in the order of the steps.

- **Using the Px Buttons on the Measure Dialog** - After directly touching a **Px** button on the **Measure** dialog, the **Select Measurement** pop-up is shown.
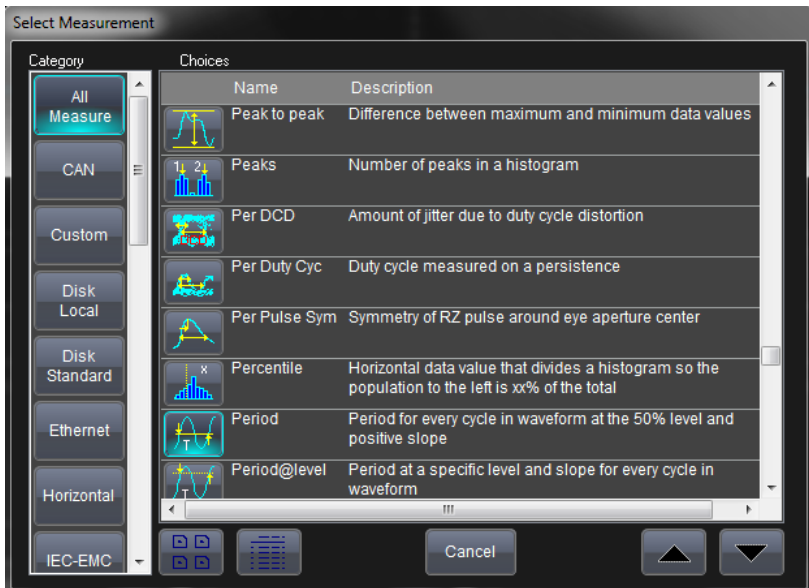
The Select Measurement pop-up.

- **Using a Corresponding Px Tab/Dialog** - After directly accessing a corresponding **Px** dialog, touch the **Measure** control and the **Select Measurement** pop-up is shown.

Regardless of how you performed the previously described initial steps, at this point access your corresponding **Px** dialog to change other setup items as follows:

1. Touch inside the **Source1** control and select an input waveform from the **Select Source** window.

2. Touch inside the **Measure** field and select a parameter from the **Select Measurement** window.

3. Touch the **Histogram** button at the bottom of the dialog. After touching this button, the **Math selection for Histogram** pop-up is shown. Select the desired **Math Trace** in which to store the results.

4. Touch the **Close** button when you are finished.

Touch the **trace descriptor label** for the math trace just created for the results, and then touch the **Histogram** tab to access its right-hand dialog.
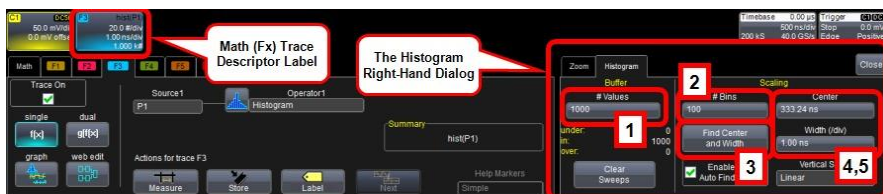
Numbered callouts on the previous image correspond with the following explanations.

1. On the **Buffer** side of the **Histogram** right-hand dialog, touch **#Values** and provide a value.

2. On the **Scaling** side of the **Histogram** right-hand dialog, touch **#Bins** and provide a value.

3. Center the histogram by touching the **Find Center and Width** button.

4. Instead of using the **Find Center and Width** button, you can provide specific **Center** and **Width** values using their respective controls and providing values using the pop-up numeric keypad.

SINGLE PARAMETER HISTOGRAM SETUP USING MATH

Access the main Math dialog by selecting **Math → Math Setup...** on the menu bar.

There are two ways to select your math operator during setup. They only differ in the order of the steps.

- **Using the Fx Buttons on the Math Dialog** - After directly touching an **Fx** button on the **Math** dialog, the **Select Math Operator** pop-up is shown.

Math functions are categorized into Basic and Special.

- **Using a Corresponding Fx Tab/Dialog** - After directly accessing a corresponding **Fx** dialog, touch the **Operator** control and the **Select Math Operator** pop-up is shown.

Regardless of how you performed the previously described initial steps, at this point access your corresponding **Fx** dialog if you want to change other setup items as follows:
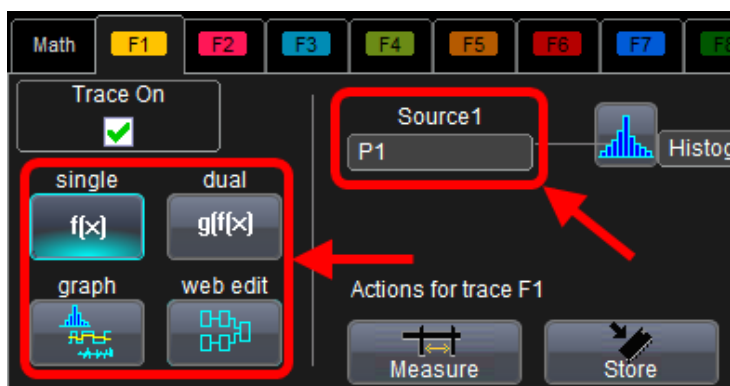
- You can modify the source of your waveform used on a Math trace using the **source (Source 1)** control.

- On the far left of the Fx dialog, the single and dual buttons are available for one math function or math-on-math, respectively.

- The **web edit** button is used to access the Processing Web and sequence highly-detailed math functionality.

- Touch the **Graph** button, and then touch inside the **Graph with** control to select a graph mode (in this case **Histogram**).

At this point, access the Histogram right-hand dialog by touching the Histogram tab on the far-right of the screen. Follow the final 1 - 4 steps in the previous **Single Parameter Histogram Setup Using Measure** instructions.

Viewing Thumbnail Histograms (Histicons)

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

1. On the menu bar, touch **Measure**, then one of the Measure Mode buttons: **Std Vertical**, **Std Horizontal**, or **My Measure**.

2. Touch the **Histicons** checkbox to display thumbnail histograms below the selected parameters.

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

Persistence Histogram

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

Note: This math operation is different than the Histogram math operation and is not affected by **Center** and **Width** settings made on any existing Histograms.

PERSISTENCE HISTOGRAM SETUP

1. Touch **Math → Math Setup...** on the menu bar.

2. Either directly touch an **Fx** button on the Math dialog and select your Math Operator, or touch an **Fx** tab to show its corresponding dialog and touch the Operator1 dialog to select your Math Operator. Select **Phistogram** from the **Select Math Operator** pop-up.

3. With your math operator selected and the Fx dialog shown, touch inside the **Source1** field and select a source from the pop-up.

4. Touch the **Phistogram** tab to access its right-hand dialog. Now, touch the **Slice Direction** control and select **Horizontal** or **Vertical** slice from the pop-up.

5. Touch inside the **Slice Center** field and enter a value using the pop-up keypad.

6. Touch inside the **Slice Width** field and enter a value, using the pop-up keypad.

Persistence Trace Range

Using this math operator, you can enter the percent of the persistence trace population to use in creating a new waveform.

Note: See previous sections for details around setting up a math trace and selecting your math operator if needed.

Persistence Sigma

Using this math operation, you can enter a scale, measured in standard deviations, by which to create a new waveform.

Creating and Viewing a Trend

1. In the menu bar, touch **Measure → Measure Setup...**.

2. Touch one of parameter tabs **Px** showing its corresponding dialog.

3. Now, on the dialog, 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.
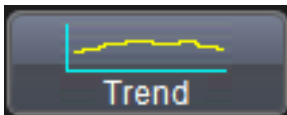
   Now, from the **Math selection for Trend** menu, select a math function location **Fx** in which to store the **Trend** display. The Trend is then shown along with its respective trace descriptor label for the selected math function.

6. Touch the newly displayed Trend math function trace label to change settings on the Trend dialog (located on the Trend tab at the lower-right side of the screen).

Note: Turning off a trace for which trend data is being collected resets the trend. If it is necessary to continue data collection for the trend, first create a zoom trace of the channel trace (before turning off the channel trace).
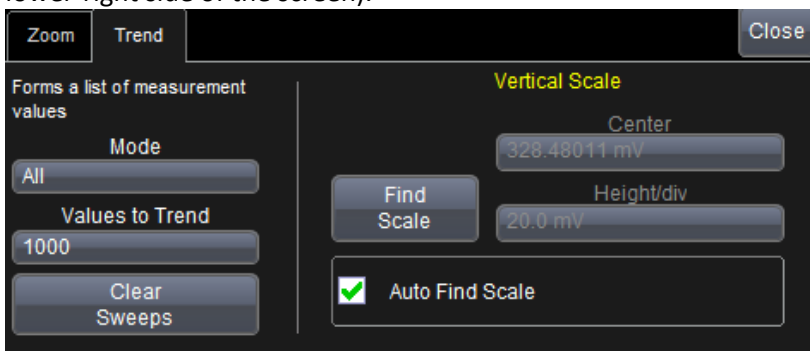
Creating a Track View

1. In the menu bar, touch **Measure → Measure Setup...**.

2. Touch a parameter tab **Px** and its corresponding dialog is shown.

3. Now, on the dialog, 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.

   Now, from the **Math selection for Track** menu, select a math function location (**Fx**) on which to store the Track display. The Track is then shown along with its respective trace descriptor label for the selected math function.
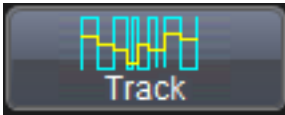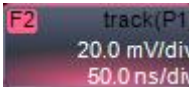

6. Touch the newly displayed Track math function trace label if you want to change any settings in the **Track** dialog:
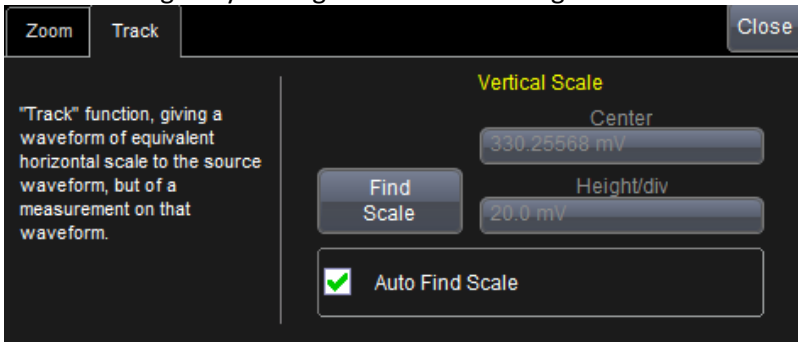
Pass-Fail Parameter Testing

Pass/Fail Parameter Testing Overview

Access the main **Pass/Fail** dialog by selecting **Analysis → Pass/Fail Setup...** from the menu bar. The main **Pass/Fail** dialog is shown.
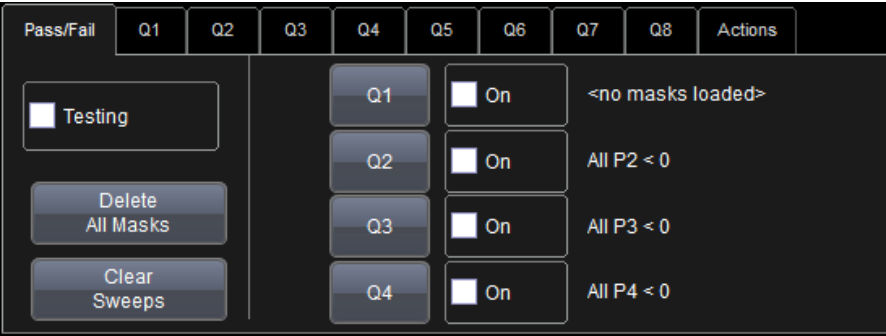
Access the respective **Qx** dialogs either by touching a **Qx** button on this main Pass/Fail dialog, or touching a **Qx** tab as described in **Displays Containing Masks** (on page 86).

When you have each of the **Qx** dialogs configured and enabled as desired, you can then begin your testing and turn them all on or off using the **Testing** checkbox on the main Pass/Fail dialog. You can also specify Actions for all or some of your conditions using the Actions dialog.

Testing and Enabling Pass/Fail Conditions

Beside each Qx button on the main Pass/Fail dialog is a corresponding Qx checkbox.
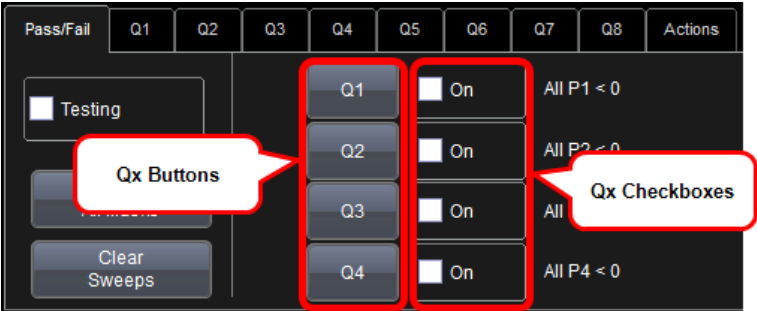
Use either these checkboxes or the ones on each respective **Qx** dialog to enable the specific condition for use.
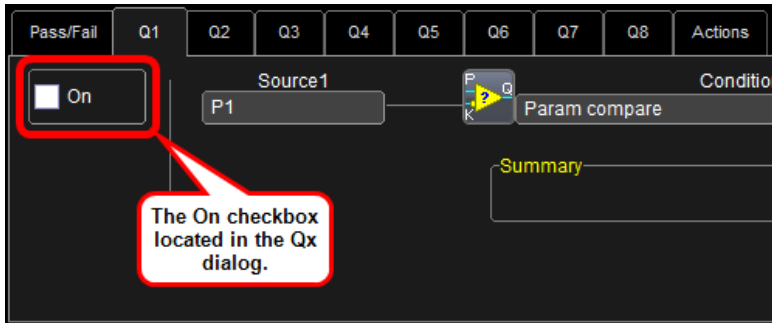
The On checkbox located in the Qx dialog.

When you have each of the **Qx** dialogs configured and enabled as desired, you can then begin your testing and turn them all on or off using the **Testing** checkbox on the main Pass/Fail dialog.
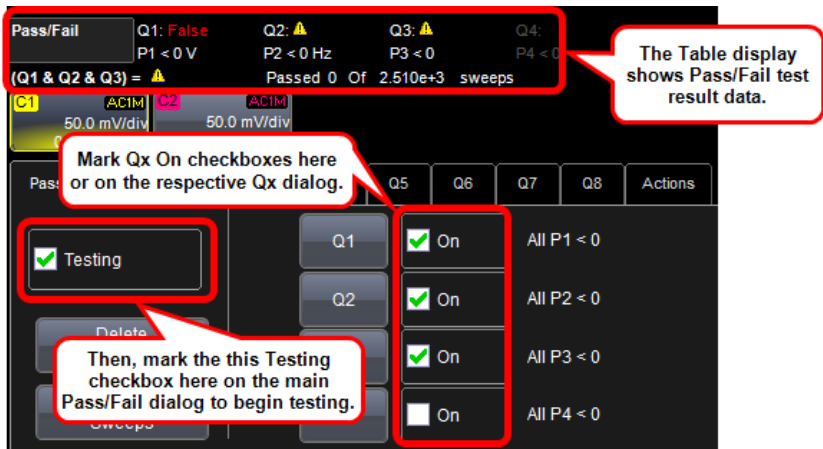
Your test data is shown on the Table display area shown in the previous screen-shot.

Pass/Fail Setup on Qx Dialogs

The Qx dialog contains several controls for specifying your Pass/Fail setup.

MAIN QX DIALOG CONTROLS
Use the **Source1** control to specify the waveform you'll use for your Condition.

Set your Pass/Fail condition by touching the **Condition** control on the corresponding Qx dialog. The Pass/Fail Condition pop-up is shown.
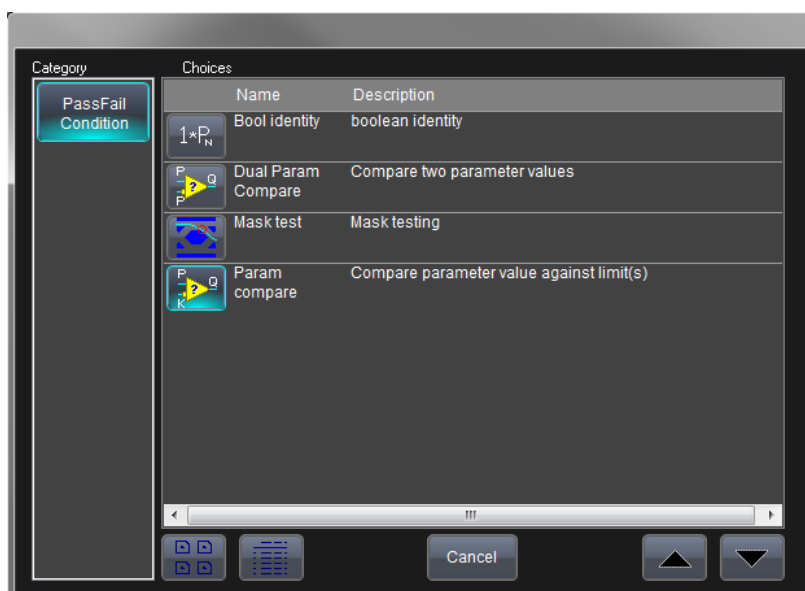
Select the desired condition.

Note: Right hand dialogs back on the corresponding Qx dialog vary based on the Pass/Fail condition selected.

The following sections cover the right hand dialogs for **Bool identity** and **Param and Dual Param Compare**. The **Mask test** condition is covered in **Mask Testing** (on page 124).

CONDITION-BASED RIGHT-HAND DIALOGS
The following provide some explanation about the different Conditions and their respective right-hand dialogs.

Boolean Identity
This condition simply passes the input values through as the desired result.

Param and Dual Param Compare
Using the Param Compare conditions, each Pass/Fail input (**Qx**) can compare a different parameter result to a user-defined limit (or statistical range) under a different condition.

Comparing a Single Parameter

1. With the ParamCompare condition selected on a Qx dialog, touch inside the **Compare Values** field and select **All** or **Any** from the pop-up menu. By selecting **All**, the test are true only if every waveform falls within the set limit. Selecting **Any** makes the test true if just one waveform falls within the limit.

2. Touch inside the **Condition** field on the **ParamCompare** part of the dialog and select a math operator from the pop-up menu.

3. Touch inside the **Limit** field and enter a value using the pop-up numeric keypad. The value entered acquires the dimensions corresponding to the parameters being tested.

   For example, if you are testing a time parameter, the unit is seconds.

   If you choose either **WithinDeltaPct** or **WithinDeltaAbs** from the **Condition** menu (respectively, previous), you also have the choice of setting the limit by means of the statistical buttons (relating to standard statistical limits) at the bottom of the **ParamCompare** dialog:
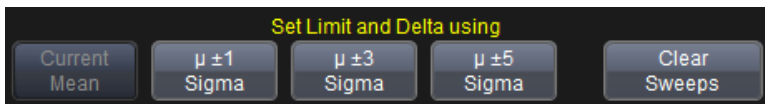
Comparing Dual Parameters

In **Dual Parameter Compare** mode, your oscilloscope can take parameter results measured on two different waveforms and compare them to each other. If desired, set your test to be true if **Any** or **All** waveforms fit the criteria set by the comparison condition. Setups are conveniently shown in

the Summary box of the **Qx** dialog as follows (shown on the Dual Param Compare right-hand dialog):
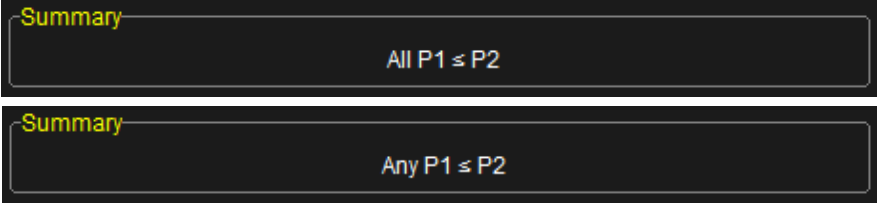
1. Touch **Analysis → Pass/Fail Setup...** from the menu bar.

2. Touch one of the **Qx** tabs and a setup dialog for the position is shown.

3. Touch inside the **Condition** field in the main dialog and select **DualParamCompare**.

4. Touch inside the **Source1** and **Source2** fields and select a source from the pop-up menu.

5. Touch inside the **ParamCompare** mini-dialog field and select a source from the pop-up menu.

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

   By selecting **All**, the test are true only if every waveform falls within the set limit. Selecting **Any** makes the test true if just one waveform falls within the limit.

7. Touch inside the **Condition** field on the **ParamCompare** part of the dialog and select a math operator from the pop-up menu.

8. Touch inside the **Limit** field and enter a value, using the pop-up numeric keypad. This value takes the dimension of the parameter that you are testing. For example, if you are testing a time parameter, the unit is seconds.

9. If you choose either **WithinDeltaPct** or **WithinDeltaAbs** from the **Condition** menu respectively, touch inside the **Delta** field and enter a value.

THE ACTIONS DIALOG

Various configurations can be made to all or some of your Pass/Fail conditions using the **Actions** dialog.
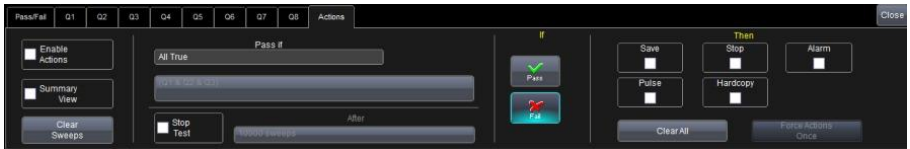
By touching the **Stop Test**checkbox in the **Actions** dialog, you can set up the test to end after a predetermined number of sweeps that you decide.
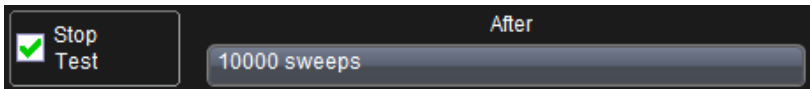
You can also decide the actions to occur upon your waveforms' passing or failing, by selecting one or all of the following:

- stop
- audible alarm
- print image of display
- emit pulse (if available)
- save waveform

The Pulse checkbox (shown right) causes a pulse to be output through the Aux Out connector at the front of the oscilloscope.

This pulse can be used to trigger another oscilloscope. You can set the amplitude and width of the pulse as described in Auxiliary Output Signals.

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

Pass/Fail Boolean Conditions	
All True	All False
Any True	Any False
All Q1 to Q4 **Or** All Q5 to Q8	Any Q1 to Q4 **And** Any Q5 to Q8

PASS/FAIL TESTING SETUP

1. Touch **Analysis → Pass/Fail Setup...** on the menu bar.

2. Touch the **Actions** tab.

3. Touch the **Enable Actions** checkbox. This causes selected actions to occur on your waveform's passing or failing a test.

4. Touch the **Summary View** checkbox to enable a line of text (as follows) showing a concise status of the last waveform and keeping a running count of how many sweeps have passed.

Last = True   Passed   1   Of   1 sweeps ✔

5. Touch inside the **Pass If** control, and select a Boolean condition from the choices shown.

6. If you want to set up the test to end after a finite number of sweeps, touch the **Stop Test** checkbox. Then touch inside the **After** data entry control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

7. Use either the **Pass** or **Fail** button on the **If** section of the dialog to set actions taking place when your waveform passes or fails the test.

✔ Pass   ✗ Fail

8. The **Then** section of the dialog provides **stop test**, **sound alarm**, **print result**, **emit pulse**, or **save** (the waveform) actions. If you want to have the results printed (and your oscilloscope is not equipped with a printer) make sure your instrument is connected to a local or network printer. Learn more in the **Printing and Hardcopy Functions** topic (available in the online help files).

9. If you want to save your waveform automatically, touch the **Save Setup...** checkbox. This takes you out of the current dialog and opens the **Save Waveform** dialog. Learn more in the **Save Recall → Saving and Recalling Waveforms** topic (available in the online help files).

10. Test Pass/Fail conditions by touching the **Force Actions Once** button. Press the **Clear All** button to quickly uncheck all checkboxes and make new selections.

Math

Math Traces and Functions Overview

Teledyne LeCroy offers a deep toolset of math functions always growing and changing to provide superior functionality.

Note: To find out which math tools are available in each optional package or for any detailed explanations about specific functionality, it's always a good idea to check the more comprehensive online help onboard your instrument, datasheet materials regularly maintained on the Teledyne LeCroy website at **teledynelecroy.com**, or confer with your Teledyne LeCroy sales representative.

The extreme power of Teledyne LeCroy's math functions is most evident when used:

- to perform mathematical functions on waveforms displayed on any channel **Cx**.
- to perform mathematical functions on waveforms recalled from memory **Mx**.
- as a source input waveform **Fx** in order to perform computations in sequence.
- as parameters **Px**.

Instruments offering more than one math trace provide even more enhanced capabilities. For example:

- setting up Trace F1 as the difference between Channels 1 and 2
- having trace F2 provide the average of F1
- having trace F3 provide the integral of F2

- go even further and display the integral of the averaged difference between Channels 1 and 2.

You can even chain traces and/or functions to another trace or function. For instance:

- making Trace F1 an average of Channel 1.

- making Trace F2 an FFT of F1.

- making Trace F3 a zoom of F2.

Math Setup

Access the main Math dialog by selecting **Math → Math Setup...** on the menu bar.

There are two ways to select your math operator during setup. They only differ in the order of the steps.

- **Using the Fx Buttons on the Math Dialog** - After directly touching an **Fx** button on the **Math** dialog, the **Select Math Operator** pop-up is shown.

- **Using a Corresponding Fx Tab/Dialog** - After directly accessing a corresponding **Fx** dialog, touch the **Operator** control and the **Select Math Operator** pop-up is shown.

Regardless of how you performed the previously described initial steps, at this point access your corresponding **Fx** dialog if you want to change other setup items as follows:
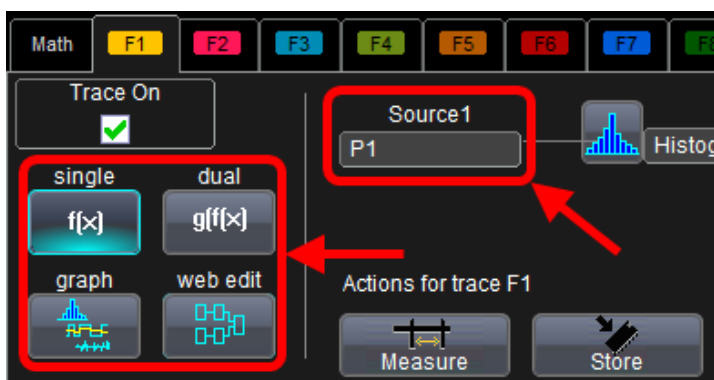
- You can modify the source of your waveform used on a Math trace using the **source (Source 1)** control.

- Touch the **Single** function button if you want to perform just one math function on the trace, or touch the **Dual** function button to perform math on math (shown respectively, as follows).

- Touch the **Graph** button, and then touch inside the **Graph with** control to select a graph mode.

- Use the **web edit** button to access the Processing Web and form sequence highly detailed math functionality.

Mask Testing

Users may load or create a pixel-based mask on the display grid using a variety of methods. Test conditions can be set, and a pass/fail result returned based on whether the condition was found to be true or false. The source of the mask is always a trace (Channel, Zoom, Math waveform).

Creating a Mask

1. After selecting **Analysis → Pass/Fail**, the **Pass/Fail** dialog is shown.
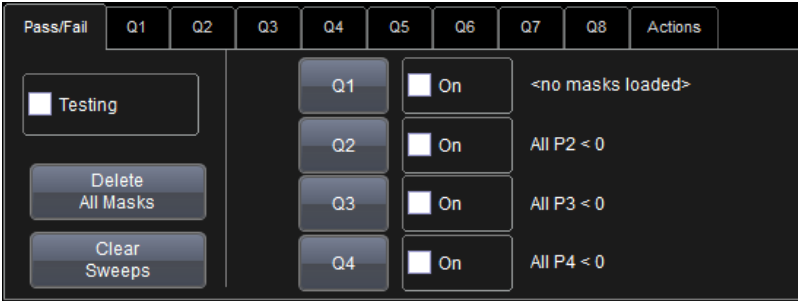
- If you touch the Q1 button, a pop-up is shown where you can select the **Mask test** Pass Fail Condition.
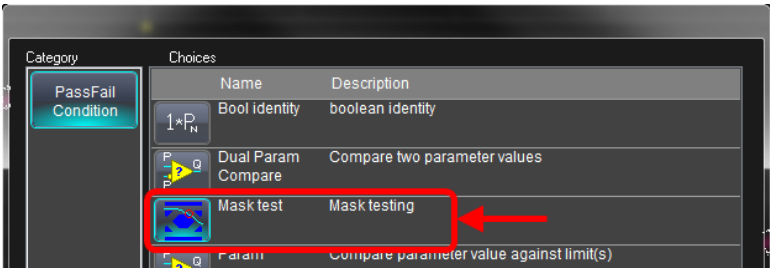
Now, the Q1 dialog is shown and shows the Mask test condition selected.
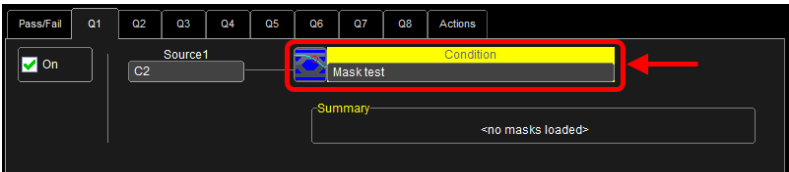
- If you touch the Q1 tab, the Q1 dialog is shown. Touching the Condition control shows the same pop-up where you can select the **Mask test** Pass Fail Condition.

2. With the **Mask test** Pass Fail Condition selected, the **Test**, **Load Mask**, **Make Mask**, and **Gate** right-hand dialogs are shown and are where you manage, make, and apply gates to your mask.
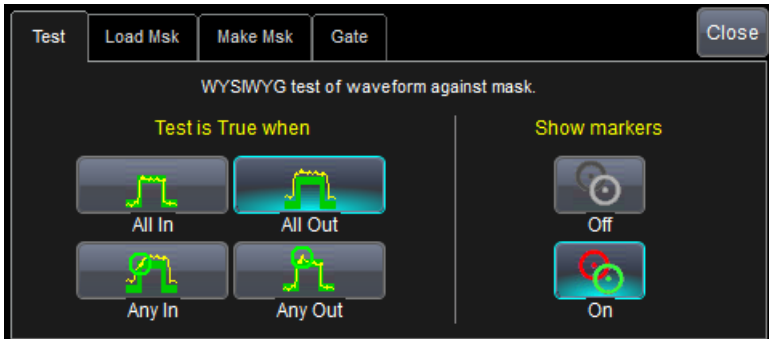
For more detailed information about these right-hand dialogs, refer to **Pass/Fail Testing** (on page 114).

Quick Access to Pass/Fail Setup Dialogs

You can quickly gain access to the **main Pass/Fail** dialog, a **(Qx)** setup dialog, or the **Actions** dialog, by touching one of the following respective sections below the grid display.
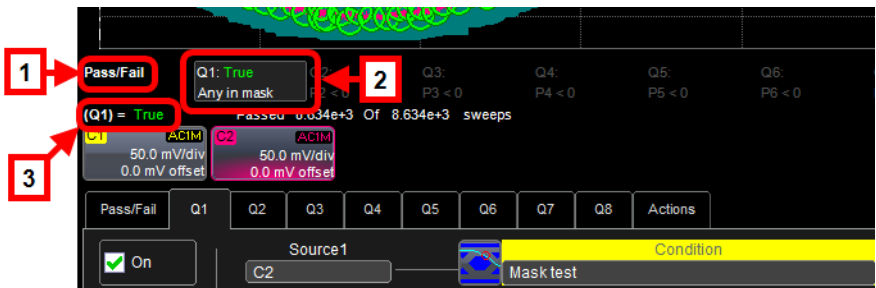
Removing a Mask from the Display

Quickly remove a mask by accessing the **Qx** dialog. On the **Load Mask** right-hand dialog, click the **Delete** button.
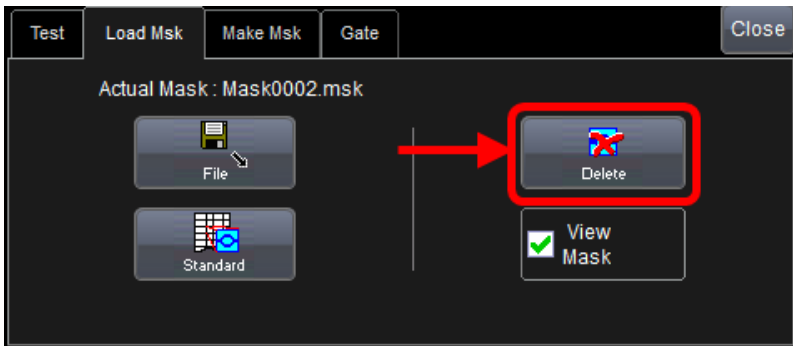
Mask testing can be done using an existing mask, or by using a mask created from your actual waveform, with vertical and horizontal tolerances that you define. Existing masks can be loaded from a floppy disk or from a network.

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

Masks that you create from your waveform can be confined to just a portion of the trace by use of a measure gate. Refer to the **Measure Gate** online help topic for more information on how this feature works.

Right-Hand Dialogs

- On the **Test** right-hand dialog, make a selection in the **Test is True when** group of buttons (as follows).

NOTE: The previous selection is for **All In** and means the test is False when a single waveform falls outside the mask.

From the **Show Markers** section of the dialog, choose whether or not to have mask violations displayed by touching either the **Off** or **On** button.

- When loading a pre-existing mask, use the **Load Mask** right-hand dialog. Using the **File** button, you can then enter the file name or browse to its location.

- When creating a new mask, use the **Make Mask** right-hand dialog.

  Touch the **Browse** button to create a file name and location for the mask if you want to save it.

  Touch inside the **Ver Delta** and **Hor Delta** fields and enter boundary values, using the pop-up numeric keypad. You can also use the **Make from Trace** button to instantly create a mask from a new waveform.

- When creating a new mask, use the **Make Mask** right-hand dialog.

- On the **Gate** right-hand dialog, you can enter values in the **Start** and **Stop** fields to constrain the mask to a portion of the waveform. Or, you can simply touch and drag the Gate posts, which initially are placed at the extreme left and right ends of the grid.

WaveScan Overview

WaveScan enables you to search for unusual events in a single capture, or to scan for an event in many acquisitions over a long period of time. You can select from more than 20 search modes (frequency, rise time, runt, duty cycle, etc.), apply a search condition (slope, level, threshold, hysteresis), and begin scanning in a post-acquisition environment. Since the scanning modes are not simply copies of the hardware triggers, but software triggers, the capability is much greater.

For instance, there is no frequency trigger in any oscilloscope, yet WaveScan allows for quick frequency scans. You can accumulate a data set of unusual events separated by hours or days, enabling faster debugging. The events are time stamped, table indexed, and event rows can be selected for individual viewing.

You can also set actions to occur automatically when unusual events are found: stop the acquisition, emit an audible beep, output a pulse as shown in **Auxiliary Output Signals** (on page 153), print the screen as shown in **Printing and Hardcopy Functions** (on page 147), save waveforms as shown in **Saving and Recalling Waveforms** (on page 138), or create a LabNotebook™ entry as shown in **My Lab Notebook Overview** (on page 131).

Idx	Edge Time
1	-749.101 ns
2	-415.846 ns
3	-82.201 ns
4	250.898 ns
5	584.399 ns
6	918.099 ns
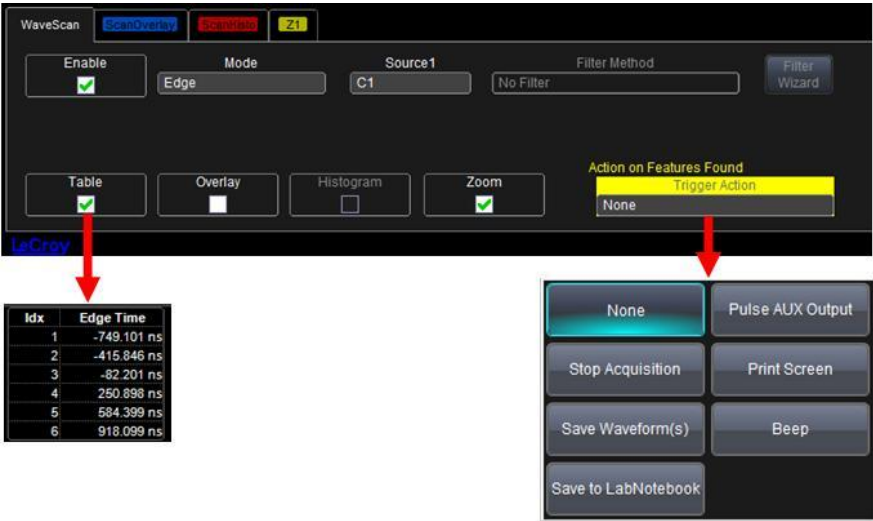
Signal Views

WaveScan provides distinct views of your signal:

- **Source View** highlights all occurrences of edges that meet your criteria.

- **Scan Overlay** places all captured edges one on top of the other in a separate grid. You can apply monochromatic persistence in this view.

- **Scan Histogram** provides a statistical view of edges that meet your search criteria.

- **Zoom View** allows you to expand a waveform feature vertically and horizontally; to apply further processing (using **Measure**); to **Store** it, or to apply a descriptive **Label** to the feature (as shown on the Actions portion of the trace dialog).

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

Search Modes

Use the **Mode** control to select an appropriate Search to locate anomalies during acquisition. When each of the following modes are selected, a corresponding right-hand dialog provides additional controls. The following modes are available:

- **Edge Mode** – Designed for detecting the occurrence of edges; selectable slope and level.

- **Non-monotonic Mode** – For detecting threshold re-crosses; selectable slope, hysteresis, and level.

- **Runt Mode** – For detecting pulses failing to cross a threshold; selectable polarity and thresholds.

- **Measurement Mode** – For filtering and performing parameter measurements.

- **Measurement Mode** – Searches from 2 to 64 bits; ideal for bursted patterns where a PLL cannot lock.

- **Bus Pattern Mode** – Searches from 2 to 64 bits; enhances MSO search capabilities.

Parameter Measurements

Besides parameter measurements made during acquisition, post-acquisition measurements can also be made. The number of parameters available depends on the options loaded on your instrument. Measurements are made only on the events defined by your filter (search criteria). A **Filter Wizard** is provided to quickly establish statistical criteria such as ±1, 3, or 5 sigma.

Sampling Mode

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

Customization Overview

The instrument provides powerful capability to add your own parameters, functions, display algorithms, or other routines to the oscilloscope user interface without having to leave the instrument application environment. You can customize the instrument to your needs by using the power of programs such as Excel™, Mathcad™, and MATLAB™, or by scripting in VBS. Whichever method you use, the results appear on the instrument's display together with the signals that you started with. This ability offers tremendous advantages in solving unique problems for a large range of applications, with comparatively little effort from you.

Instrument customization provides these important capabilities:

- Export data to programs, without leaving the instrument.
- Get results back from those programs, and display them on the instrument, without leaving the instrument application environment.
- Once the result is returned, perform additional oscilloscope operations, such as measuring with cursors, applying parameters, or performing additional functions on the waveform, in exactly the same way as for a normal waveform.
- Program the oscilloscope yourself.

The instrument does not just provide connectivity with data downloads to other programs. It provides true customizable interaction with these other programs, and allows you to truly customize the oscilloscope to do the exact job you want it to do. The advantages to this are many:

- Use the standard processing power of the instrument to do most of your calculations.
- Write only the function, parameter, display algorithm, etc. that specifically applies to your needs.
- You can view the final result on the instrument display, and use all of the instrument's tools to understand the result.
- You can do additional processing on the result by applying standard instrument parameters, functions, etc. to the returned result, or even more powerfully, adding chained customized functions. For example, you can do an Excel calculation on a result with a MATLAB function applied to it.

Documenting Work with LabNotebook

Overview

Teledyne LeCroy's LabNotebook feature extends the documentation capabilities of your oscilloscope. It allows you to create an annotated notebook entry containing all displayed waveforms, the setup of the DSO, and user-supplied annotations. The notebook entry can then be converted to hardcopy format - .pdf, .rtf, or .html - and printed or e-mailed. You can also use the default report layout or configure your own, and even substitute your own company logo in the header.

Notebook entries are stored in an internal database and are available for recall at any time. Besides storing the waveform data, LabNotebook also stores your panel setups and parameter measurements. You can also back up the database to external media.

The Flashback feature allows you to recall the state of the DSO at a later date, including the saved waveforms and the DSO setup, so you can make additional measurements. A keyword filter makes it easy to find and recall a specific notebook entry.

You can choose which notebook to use for your entries, and label the notebook by project or user. This is especially useful if the oscilloscope is shared among several users and/or used for different projects as data can be kept separate how you see fit. Similarly, hardcopy reports can be stored in different folders.

Note: If your external monitor is connected, the LabNotebook automatically opens on the external monitor.

LabNotebook Dialog

When LabNotebook is accessed by **File → LabNotebook** on the menu bar, the main **LabNotebook** dialog is shown by default.

This dialog is where you can **store** and **create** LabNotebook entries. You also can **View**, **Create**, **E-Mail**, and select an **output format** for your reports.

Numbered sections on this dialog correspond with the following explanations.

1. You can **create a notebook entry** by either:

   - Touching **File → Create Notebook Entry** on the menu bar.
   - Touching the **Create** button on the main LabNotebook dialog.

   Regardless, the **Enter Notebook Info** pop-up is shown where you can provide a title and comments for the entry. By default, the entry is titled with the current date and time.

   Touch inside the **Title** control and provide a value using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42). If desired, touch inside the **Description** field, provide information and touch **Save**.

   PLEASE NOTE THE FOLLOWING:

   - When an entry is first created and Report Title and Description information is provided, your new entry is shown along with **The Drawing Toolbar** at the top of the screen.
   - When finished and the **Done** button is touched from the Drawing Toolbar, your new entry is shown on the **My Notebook Entries** list.

2. **My Notebook Entries** list shows the entries you've already stored on your instrument. With a stored entry selected on the **My Notebook Entries** section of the dialog, you can do the following:

3. Touch the **Flashback (Recall)** button to return your instrument to the state it was in when the Notebook Entry was saved. Exit Flashback by touching the Undo Flashback button in the top-right corner of the screen, or touch the Auto Trigger front panel control.

PLEASE NOTE THE FOLLOWING: The flashback feature currently recalls the DSO Setup, and all displayed waveforms. Some of result data is not recalled, including:

- **Persistence data** - While it is saved in hardcopy and is printed on the report, it is not recalled during Flashback.
- **Histogram data** - Histograms internally have a 32-bit resolution, but when stored into a trace file and recalled during flashback they are clipped to 16-bits.
- **Floating point waveforms** - Certain math operations result in the creation of floating point waveforms with much higher resolution than can be stored in a 16-bit waveform file. This extra resolution is not preserved when traces are recalled using flashback.
- **Cumulative Measurements** - Any measurements on when the Lab Notebook entry is created are not saved individually in the database (other than being embedded in the hardcopy image). This means that when flashback is used, the measurements are recomputed using the recalled waveform data. Normally, this doesn't pose a problem; however, if cumulative measurements were on when the entry was stored and the cumulative measurements accumulated data from multiple acquired waveforms, they lose their history and show instead only the results from the stored waveforms.

4. You can use the **Up** and **Down** arrows to move through your **My Notebook Entries** list one row at a time. If you have a large amount of entries, touch the **Filter** button and the **Filter Entries** pop-up is shown.

   Provide a **Date** and/or **Keyword** and touch the **Find Now** button to apply your filter to the **My Notebook Entries** list.

5. Use the **View**, **Create Report**, and **E-Mail** buttons as desired.

   - The **View** button shows a preview of your report.
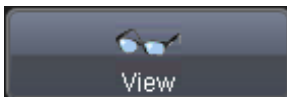
     Exit the preview by touching the Close button at the right of the dialog.

- Create your report by first touching inside the **Format** control and selecting a format from the pop-up.

  Now, touch the **Create Report** button. In the **Create Report** window, select a folder to contain the report. Touch inside the **File name** control and enter a name using the pop-up keyboard. Click **OK** to create the report.

- The **E-Mail** button automatically sends the report data to the account you've specified in Preferences. See, **E-Mail** (on page 161) for more information.

- The **More Actions** button shows the **Specific Entry** dialog for the entry selected on the **My Notebook Entries** list. Using this dialog is explained in **Managing Notebook Entry Data** in the online help.
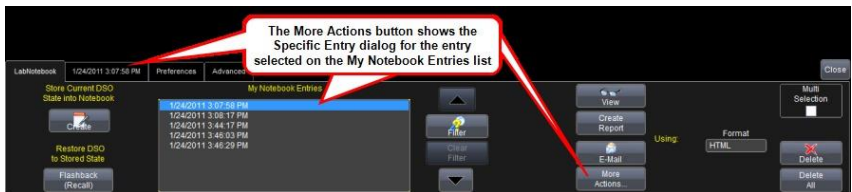
Note: Make personalized settings to your LabNotebook reports using .

6. You can select the **Format** of your LabNotebook entry from **HTML**, **RTF**, and **PDF** choices. The **Delete** button removes the specific row selected on the **My Notebook Entries** list while the **Delete All** button removes every entry on the list.

7. Marking the **Multi Selection** checkbox shows the **Select All**, **Clear All**, **Select**, **Clear**, and **Print** buttons.

The **Select All**, **Clear All**, **Select**, and **Clear** buttons are used to select/deselect multiple entries on the **My Notebook Entries** list. The **Print** button can only be used for Multi Selection printing of **My Notebook Entries** from the main LabNotebook dialog.

> **NOTE**: If selected in **Preferences**, your entry can show your waveforms in **print colors**. This means it's printed on a white background in order to save printer ink. Otherwise, waveforms are shown on a black background.

8. Use the **Delete** button to delete the selected entry (or entries if the Multi Selection checkbox is marked). The **Delete All** button can be used to remove all notebook entries shown on the My Notebook Entries list with the touch of a single button.

Save/Recall

Overview

The **Save/Recall** section allows for storage and retrieval of **Waveforms**, **Table Data**, and **Instrument Setups**. It even provides **Disk Utilities** for arranging the file/folder structure on your instrument's hard drive.

Directly access each Save/Recall dialog (**Waveform**, **Table**, **Setups**, and **Disk Utilities** on the **File** menu on the menu bar.
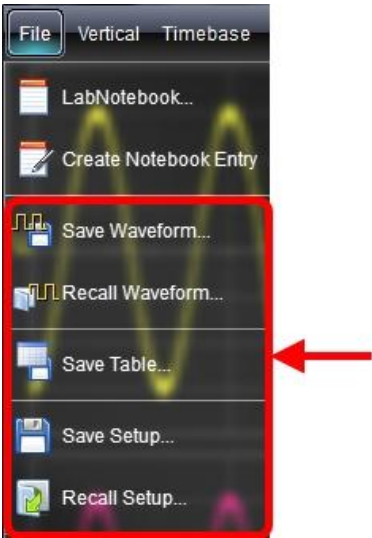
A main Save/Recall dialog is shown providing buttons to access the aforementioned dialogs for specific Save/Recall functions.

NOTE: While the **Disk Utilities** (on page 156) is the final dialog of these Save/Recall functions, it's actually considered part of the **Utilities** menu and is therefore covered in that section of the documentation.

Saving and Recalling Setups

The Save/Recall Setup dialogs allow for quick saving and recalling of up to six oscilloscope panel settings internally on your instrument. If desired, you can also save and recall your oscilloscope panel settings as an .lss file to a specific hard disk location, a network location, or USB drive.

Saving Oscilloscope Setup(s)

Access the **Save Setup...** dialog by either selecting **File → Save Setup...** from the menu bar or clicking the **Save Instrument Setup** button on the main Save/Recall dialog. Now use one of the following two methods to save setup(s).

SAVING SETUP(S) INTERNALLY ON YOUR INSTRUMENT
Save your settings **internally on your instrument** by touching inside one of the six **SetupX** data entry controls on the **Save to Internal Setup...** part of the screen and providing a name. Now, touch its corresponding **Save** button directly to the left.

Your setup file is then saved to the **D:\Internal Setups** location on your instrument and the current date/time is shown above the **SetupX** data entry control.

OR

SAVING SETUP(S) DIRECTLY TO A FILE
Save your setup(s) **directly to a file** by touching the **File** button on the **Save To** section on the dialog. Now, touch inside the **Save files in directory** control and provide a path to the destination folder. Or touch **Browse** to navigate to the destination folder. Finally, touch the **Save Now** button.

Recalling Oscilloscope Setup(s)

Access the **Recall Setup...** dialog by either selecting **File → Recall Setup...** from the menu bar or clicking the **Recall Instrument Setup** button on the main Save/Recall dialog. Now use one of the following two methods to save setup(s).

RECALLING SETUP(S) INTERNALLY ON YOUR INSTRUMENT
Recall your settings located **internally on your instrument** by touching inside one of the six **Recall** buttons on the **Recall From Internal Setup...** part of the screen.

Each Recall button is labeled with a corresponding setup storage slot. If a setup is stored, **SetupX** is shown along with the **date/time of the save**, otherwise, the slot is labeled **Empty**.

OR

RECALLING SETUP(S) DIRECTLY FROM A FILE

Recall your setup(s) **directly from a file** by using controls on the **Recall From File** section on the right side of the dialog. Touch inside the **Recall panel from file** data entry control and provide a path to the destination folder. Or touch **Browse** to navigate to the destination folder. Finally, touch the **Recall Now** button.

Recalling Default Settings

Your instrument's default settings can be recalled at any time using the **Recall Default** button.

Saving and Recalling Waveforms

Saving Waveforms

The Save Waveform dialog is used to save displayed waveforms to either a memory trace or to text or binary file formats.

Access the **Save Waveform** dialog by either selecting **File → Save Waveform** from the menu bar or clicking the **Save Waveform** button on the main Save/Recall dialog.

Use the numbered sections of this Save Waveform dialog, which correspond with the following explanations, to properly save your waveform(s).

1. Select either **Memory** or **File** by touching either respective button on the **Save To** portion of the dialog.

    Note: When **Memory** is selected, only **Source** and **Destination** controls are shown on the Save Waveform dialog. When **File** is selected, many

more controls are available. Regardless, the controls are used as explained in the following steps.

2. Touch inside the **Source** control and select a source from the **Select Source** pop-up. The source can be any trace; for example, a channel (C1–C4), math function (F1–F4), or a waveform stored in non-volatile RAM (M1–M4).

3. **Destination** - Click to show the available memory traces when saving to memory.

4. Touch inside the **Trace Title** data entry control to change the default name of your waveforms (if desired).

    Note: You can change the name but not the sequence number.

    ⚠️ **CAUTION.** If you use a name ending with a number instead of a letter, the instrument may truncate the number. This is because, by design, the first waveform is automatically numbered 0, the second 1, and onward. For example, if you want to use waveform name **XYZ32** but it is not preceded by waveforms XYZ0 through XYZ31, the waveform is renumbered with the next in sequence. If you need to use a number in your waveform's name, append an alpha character at the end of the number: **XYZ32a**, for example.

5. If you are saving to a file, touch the **Data Format** control and select a format type.

    - **Binary** - saves the file to Teledyne LeCroy's binary file format. This format is documented in various Remote Control Manuals for Teledyne LeCroy Oscilloscopes. Selecting **Binary** results in the smallest possible file size, and is recommended when recalling waveforms to Teledyne LeCroy instruments.

        Note: Binary files can be converted to ASCII using Teledyne LeCroy utilities such as **ScopeExplorer** or **WaveStudio**.

    - **ASCII** -Text output file (.txt extension).
    - **MATLAB** - Text output file compatible with MATLAB (.dat extension).
    - **Excel** - Text output file compatible with Excel (.csv extension).
    - **MathCad** - Text output file compatible with Excel (.prn extension).

Depending on your selection, you may need to touch the **SubFormat** control and select a subformat.

- **Word** - Available when selecting the Binary format, specifies the samples in the output file are represented with 16 bits. Always use this option unless Byte mode is pre.
- **Byte** - Available when selecting Binary format, specifies the samples in the output file are represented with 8 bits.

  Note: Using this option can result in a loss of output file resolution.

- **Amplitude only** - Specifies the output file include amplitude data for each sample, but not sample time information.
- **Time and Amplitude** - Specifies the output file include both time and amplitude data for each sample.
- **With Header** - Specifies to include a header with scaling information.

If you select **ASCII**, touch the **Delimiter** control and select a delimiter character from the pop-up menu. Choose from **comma**, **space**, **semicolon**, or **tab** delimiters.

PLEASE NOTE THE FOLLOWING:

- Select **Audio** to save your waveforms into the .wav format.
- The **WaveML** format, which enables XML output, is used for persistence traces.

Vector Signal Analysis (VSA) Support Software Option

Before we continue saving our waveform, users with the VSA Support Software option can choose **With Header** from the **SubFormat** control.
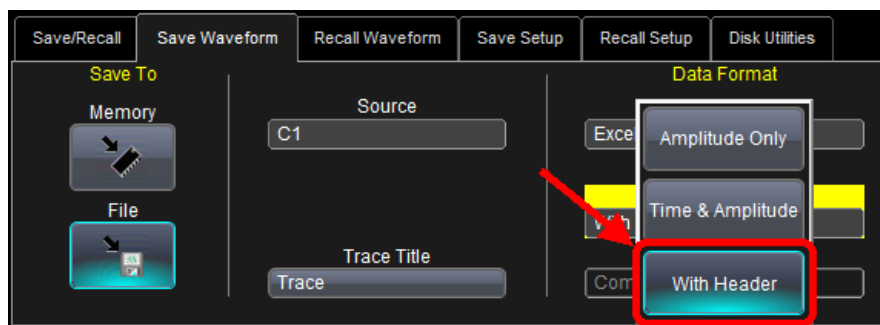
This stores the waveform in **VSA recall** format for later use.

Note: An Analysis function also comes with the VSA Software which can send signal traces to VSA as a recording (time domain) file.

6. You can use the **Auto Save** feature to automatically save a waveform to disk after each new trigger. You can enable Auto Save from the **Save Waveform** dialog by touching one of the **Auto Save** buttons.

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

   ⚠ **CAUTION.** Selecting **Fill** can quickly use up all the hard disk space on your instrument.

7. Touch the **Browse** button next to the **Save file in directory** control and navigate to the location where you want the file saved. The file name is assigned automatically and is shown under the control.

8. Finally, touch the **Save Now!** button.

Recalling Waveforms

Note: Only .trc files saved in binary format can be recalled into the oscilloscope.

Access the **Recall Waveform** dialog by either selecting **File → Recall Waveform** from the menu bar or clicking the **Recall Waveform** button on the main Save/Recall dialog.
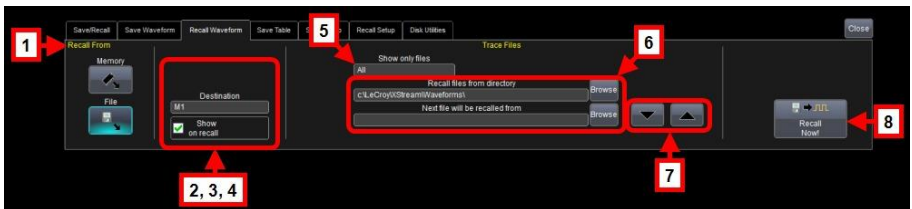
Use the numbered sections of this Recall Waveform dialog, which correspond with the following explanations, to properly recall your waveform(s).

1. Select either **Memory** or **File** by touching either respective button on the **Recall From** portion of the dialog.

   Note: When **Memory** is selected, only **Source**, **Destination**, and **Show on recall** controls are shown on the Recall Waveform dialog. When **File** is selected, many more controls are available. Regardless, the controls are used as explained in the following steps.

2. If recalling from Memory, touch inside the **Source** control and select a source stored in non-volatile RAM (M1–M4) from the **Select Source** pop-up.

3. Touch inside the **Destination** control and select a location for storage (memory or file) from M1 to M4.

4. **Show on Recall** - Mark this checkbox to have the memory trace shown on the grid display after recalling the waveform.

5. When saving a File, touch inside the **Show only files** control and select an area to limit the search (**channels**, **math functions**, or **memory**).

6. Touch inside the **Recall files from directory** data entry control and provide the path. You can also touch the **Browse** button and navigate to the file. Touch inside the **Next file will be recalled from data entry** control and provide the path or, touch the **Browse** button to navigate to the file.

7. **Up /Down arrows** - Use these buttons to cycles through files in the selected folder from the **Show only files** control.

8. When finished, touch the **Recall Now!** button.

Utilities

Utilities Setup

Utilities settings are divided into three main sections: **Utilities**, **Disk Utilities**, and **Preferences** as seen when accessing **Utilities** from the menu bar.

Utilities

Selecting **Utilities → Utilities Setup...** shows the main **Utilities** dialog by default. The following controls are available from this dialog:
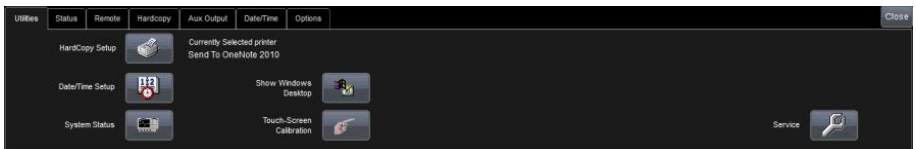
- The **HardCopy Setup**, **Date/Time Setup**, and **System Status** buttons all open their corresponding dialogs.

  Note: To the right of the **HardCopy Setup** button, display text indicates your currently selected printer for convenience.

- When touched, the **Show Windows Desktop** button instantly minimizes the oscilloscope (and any other) applications.

Maximize the application by touching the shortcut icon located on the lower-right of the screen.

- A sequence of calibration screens are shown when the **Touch-Screen Calibration** button is touched. These screens instruct you to touch a series of displayed crosses in order to improve precision and accuracy when using your touch screen.

  PLEASE NOTE THE FOLLOWING:

  - Use a stylus for this procedure. Using your finger for the calibration prompts provides insufficient accuracy for the procedure.
  - The calibration procedure times out after ten seconds pass and no cross is touched.
  - Avoid parallax errors by placing your line of sight directly in front of each cross before touching it.

- The **Service** button is a section of the application reserved for qualified Teledyne LeCroy personnel. When touched, an access code pop-up is shown enabling Teledyne LeCroy technicians access to various service dialogs inside the oscilloscope software.

  Contact Teledyne LeCroy for more information using **Contact Teledyne LeCroy for Support**.

Status

Control values are shown for information about your instrument. Among them include your Hardware and Software options.

View the oscilloscope's system status (including software and hardware configurations) on this Status dialog. The dialog displays read-only system information including **model number**, **serial number**, **firmware version**, and **installed software and hardware options**.

Adding Software Options

New software options can be added after purchasing a code and then enabling the option on the oscilloscope. Call Teledyne LeCroy Customer Support to place an order and receive the code.

Note: For more information about Teledyne LeCroy Software Options, **Contact Teledyne LeCroy for Support**.

- After adding new software options, the entire oscilloscope application needs to be restarted. Do this by touching the desktop shortcut.

- Restart the Windows® operating system on your instrument (if necessary) by rebooting the oscilloscope. Do this by pressing the power switch, and then turning the power back on after a ten-second wait.

Upon initial power-up, the oscilloscope automatically loads the instrument application software along with any additional software options.

Remote Communication

Use the **Remote** dialog to setup remote communication. You can select a network communication protocol, establish network connections, and configure the Remote Control Assistant log from the **Remote** dialog. The choice of communication protocols is limited to TCPIP, GPIB, and USB488 (on specific models).

PLEASE NOTE THE FOLLOWING:

- GPIB is an option that either requires a GPIB card to be installed in an open card slot on your oscilloscope or the use of an external USB to GPIB Teledyne LeCroy accessory. Your particular oscilloscope may support both, or only one of the options/accessories. For more information about which Teledyne LeCroy GPIB options and accessories your oscilloscope supports, **Contact Teledyne LeCroy for Support**.

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

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

REMOTE COMMUNICATION SETUP

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

1. On the **Remote** dialog, make a **Port** selection: **TCPIP** (transmission control protocol/Internet protocol) or **GPIB** (general purpose interface bus). If you do not have a GPIB card installed, the GPIB selection will not be accessible.

2. If you are using GPIB, set a GPIB address by touching inside the **GPIB Address** data entry control and provide an address.
   OR

   If you are using TCPIP, press the **Net Connections** button; the Windows **Network Connections** window opens. You can reconfigure the oscilloscope's connection if it is already connected to the network or make a new connection.

Note: Your instrument allows you to restrict remote control access to certain clients. To restrict access, under **Security**, touch the **Yes** button and enter the IP addresses or domain name server names you want to restrict separated by a comma.

CONFIGURING THE REMOTE CONTROL ASSISTANT EVENT LOG

1. Under **Remote Control Assistant**, touch inside the **Log Mode** data entry control. Select **Off**, **Errors Only**, or **Full Dialog** from the pop-up menu.

2. Export the contents of the event log to an ASCII text file by touching the **Show Remote Control Log** button. The **Event Logs** pop-up is shown. Touch inside the **DestFilename** data entry control and provide a file name using your preferred input control method.

Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

Then, touch the **Export to Text File** button.

Printing and Hardcopy Functions

Your instrument provides the ability to output files to printers or plotters print to file, or e-mail your files. Any Microsoft Windows® supported printer is supported by your instrument.

The following Printing and Hardcopy procedures are explained here.

- **Printer Setup**
- **Adding Printers and Drivers**
- **Default Printer Setup**
- **Printing Screen Images**
- **Printing**
- **Clipboard**
- **File**
- **E-mail**

PRINTER SETUP

1. Touch **File → Print Setup...** on the menu bar. The Utilities **Hardcopy** dialog opens.

   OR

   Press the PRINT front panel button. Then, touch the **Print Setup...** button on the **Print** flyout menu.

   OR

   Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab.

2. On the Hardcopy dialog, touch the **Printer** icon.

3. Under **Colors**, touch the **Use Print Colors** checkbox if you want the traces printed on a white background.

   Note: A white background saves printer toner. (You can change the printer colors in the **Utilities → Preference Setup → Color** dialog.)

4. Touch inside the **Select Printer** control and choose a printer from the pop-up menu.

5. Touch the **Properties** button to see your printer setup.

4. Touch the icon for the layout **Orientation** you want: portrait or landscape.

5. Touch the **Hardcopy Area** control to choose which part of the screen you want to print from the pop-up menu.

Choose **Grid Area Only** if you do not need to print the dialog area and you only want to show the waveforms and grids. Choose **DSO window** if you want to print the dialogs with the waveforms and grids. Choose **Full Screen** if you want to print the entire screen.

ADDING PRINTERS AND DRIVERS

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

1. Touch **File → Print Setup...** on the menu bar.
    OR
    Press the PRINT front panel button. Then, touch the **Print Setup...** button on the **Print** flyout menu.

    OR

    Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab.

2. On the Utilities **Hardcopy** dialog, touch the **Printer** icon.

3. Touch the **Add Printer** button. A Microsoft Windows® Printer window opens where you can add a printer.
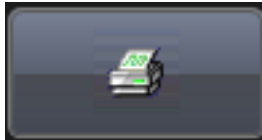
PRINTING A SCREEN IMAGE

You can print in one of three ways:

- Press the **PRINT** front panel button. Then, touch the **Print Now** button on the **Print** flyout menu.

- Touch **File → Print** on the menu bar.
- Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab.

    On the **Hardcopy** dialog, touch the **Print Now** button.

Note: The instrument uses the Print settings on the **Hardcopy** dialog to print the screen image.

So, you can either print from **File → Print** or from **Utilities → Utilities Setup...** (Hardcopy tab). However, the **Hardcopy** dialog provides some additional functionality like printing to the clipboard, or to a file. You can also choose to print the waveform and grids only, the waveform and grids with the dialog, or the entire screen. You can also e-mail your screen images.

PRINTING

Similar to Printing a Screen Image and alternatively to **File → Print** (and using the additional setting from the Hardcopy dialog) choose from either of the following methods to quickly print from your instrument:

- Press the PRINT front panel button. Then, touch the **Print Now** button from the Print flyout menu.
- Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab. On the Hardcopy dialog, touch the **Print Now** button.

CLIPBOARD

The **Clipboard** selection on the **Hardcopy** tab saves the screen image on the clipboard so you can paste a file into another application (like Microsoft Word, for example). Choose from either of the following methods to save a screen image to your clipboard:

- Press the PRINT front panel button. Then, touch the **Save Screen To Clipboard** button from the Print flyout menu.

Note: Once you have configured your **Clipboard** settings from the **Hardcopy** dialog (using the next procedure), you can touch the PRINT front panel button and touch **Save Screen To Clipboard** on the **Print** flyout menu. The instrument automatically uses the additional clipboard settings to save the screen image to the clipboard.

- Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab. On the Hardcopy dialog, touch the **Clipboard** button.
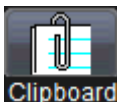
1. Touch the **Colors** control and choose **Standard** to print the screen as it appears, **Print** to print the waveforms on a white background, or **Black & White** to print the waveforms in black & white.

   Note: Choosing **Print** colors saves printer toner or ink.

2. Touch the **Hardcopy Area** control to choose which part of the screen you want to print. Choose **Grid Area Only** if you do not need to print the dialog area and you only want to show the waveforms and grids. Choose **DSO window** if you want to print the dialogs with the waveforms and grids. Choose **Full Screen** if you want to print the entire screen.

3. Touch the **Print Now** button.

FILE

The **File** selection on the **Hardcopy** tab saves the screen image as a file to storage media such as a USB drive or hard drive. Choose from either of the following methods to save a screen image to a file:

- Press the PRINT front panel button. Then, touch the **Save Screen To File** button from the Print flyout menu.

PLEASE NOTE THE FOLLOWING:

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

- Once you have configured your **Clipboard** settings from the **Hardcopy** dialog (using the next procedure), you can touch the PRINT front panel button and touch **Save Screen To File** on the **Print** flyout menu. The instrument automatically uses the additional file settings to save the screen image to the file.

- Touch **Utilities → Utilities Setup…** and click the **Hardcopy** tab. On the Hardcopy dialog, touch the **File** button.

1. Touch inside the **File Format** data entry control and select a graphic file format from the pop-up menu.
2. Touch the **Colors** control and choose **Standard** to print the screen as it appears, **Print** to print the waveforms on a white background, or **Black & White** to print the waveforms in black & white.

   Note: Choosing **Print** colors saves printer toner or ink (when you eventually do print from the file).

3. Touch inside the **File Name** data entry control and provide a name for the display image using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).
4. Touch inside the **Directory** data entry control and provide the folder path for the resulting printout. Or touch the **Browse** button and navigate to the folder.
5. Touch the **Hardcopy Area** control to choose which part of the screen you want to print. Choose **Grid Area Only** if you do not need to print

the dialog area and you only want to show the waveforms and grids. Choose **DSO window** if you want to print the dialogs with the waveforms and grids. Choose **Full Screen** if you want to print the entire screen.

6. Touch the **Print Now** button.

E-MAIL

The **E-mail** selection on the **Hardcopy** tab gives you the option to e-mail your screen images, using either the MAPI or SMTP protocols. Before you output to e-mail from the **Utilities** dialog, you first have to set up the e-mail server and recipient address in **Preference Setup...**. Choose from either of the following methods to e-mail your screen image:

- Press the PRINT front panel button. Then, touch the **Send Screen To E-mail** button from the Print flyout menu.

  Note: Once you have configured your **E-mail** settings from the **Hardcopy** dialog (using the next procedure), you can touch the PRINT front panel button and touch **Send Screen To E-mail** on the **Print** flyout menu. The instrument uses the additional e-mail settings automatically.

- Touch **Utilities → Utilities Setup...** and click the **Hardcopy** tab. On the Hardcopy dialog, touch the **E-Mail** button.

1. Touch inside the **File Format** data entry control and select a graphic file format from the pop-up menu.
2. Touch the **Colors** control and choose **Standard** to print the screen as it appears, **Print** to print the waveforms on a white background, or **Black & White** to print the waveforms in black & white.

   Note: Choosing **Print** colors saves printer toner or ink (when you eventually do print from the file).

3. Touch the **Prompt for message to send with mail** checkbox if you want to include remarks with the image.

4. Touch the **Hardcopy Area** control to choose which part of the screen you want to print. Choose **Grid Area Only** if you do not need to print the dialog area and you only want to show the waveforms and grids. Choose **DSO window** if you want to print the dialogs with the waveforms and grids. Choose **Full Screen** if you want to print the entire screen.
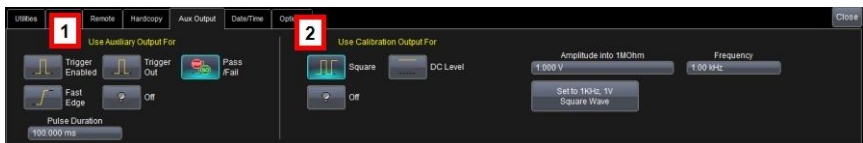

5. Touch the **Print Now** button.
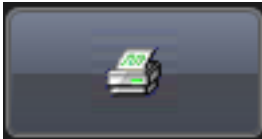
Aux Output

The **Aux Output** dialog allows you to specify Auxiliary and Calibration Output details.

1. If you want a specialized output, touch one of the following buttons under **Use Auxiliary Output For**: **Square Wave**, **Trigger Enabled**, **Trigger Out**, **Pass/Fail**, **or Off**.

Note: If **Pass/Fail** is selected on this **Use Auxiliary Output For** section of the dialog, a **Pulse Duration** data entry control is made available. Provide a value within your instrument's specified range (varied based on your specific model, refer to datasheet specifications at **teledynelecroy.com** for details) using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42).

2. On the Use Calibration Output For section of the dialog, choose **Square**, **DC Level**, or **Off**. If you want a 1 kHz, 1 V Square Wave, touch the **Set to 1 kHz, 1 V Square Wave** button.

    Additional controls are made available based on **Square** or **DC Level** selections as follows:

- If you selected **Square** on the **Use Calibration Output For** section of the dialog, a **Frequency** data entry control is made available. You can set a value using your preferred input control method.

- If you selected **Square** or **DC Level** on the **Use Calibration Output For** section of the dialog, an **Amplitude into 1 MΩ** data entry control is made available. Provide a desired value using your preferred input control method.

AUXILIARY OUTPUT SIGNALS

A calibration signal and the following additional signals can be output through the connector labeled AUX OUT on your oscilloscope. Use the Auxiliary Output to send the following signals to other instruments:

 Trigger Enabled - This function can be used as a gating function to trigger another instrument when the oscilloscope is ready.

 Trigger Out - This function can be used to trigger an external oscilloscope.

 Pass/Fail - Allows you to set a pulse duration (varied based on your specific model, refer to datasheet specifications at **teledynelecroy.com** for details); generates a pulse when pass/fail testing is active and conditions are met.

 Fast Edge - Some models provide this signal output used to deskew multiple channels. The Fast Edge connection varies based on model and is either SMA or BNC.

CALIBRATION OUTPUT SIGNALS

A calibration signal can be output from the Probe Calibration Hook on the front of the oscilloscope. The following Calibration Output Signals are available for use:

Square Wave - You can set a Frequency value (varied based on your specific model, refer to datasheet specifications at **teledynelecroy.com** for details).

DC Level - This is a reference level.

Off - This function turns off the Auxiliary Output signal.

Date/Time

From the **Date and Time** tab on the **Utilities** dialog, you can manually set the time and date or get it from the Internet. If you elect to get the date and time from the Internet, you need to have the oscilloscope connected to the Internet through the LAN connector on your instrument's I/O panel. You can also set time zones and daylight savings time.

1. You can **set the Date and Time manually** by providing a value in the **Hour**, **Minute**, **Second**, **Day**, **Month**, and **Year** using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** . After providing values, touch the **Validate Changes** button.

2. You can **set the Date and Time from the Internet** by first verifying that your oscilloscope is connected to the Internet, and then touching the **Set from Internet** button.

   Note: The Simple Network Time Protocol (SNTP) is used.

3. You can also set the Date and Time using Windows® by touching the Windows Date/Time button.

   Windows shows a **Date and Time Properties** pop-up where the date and time can be configured.
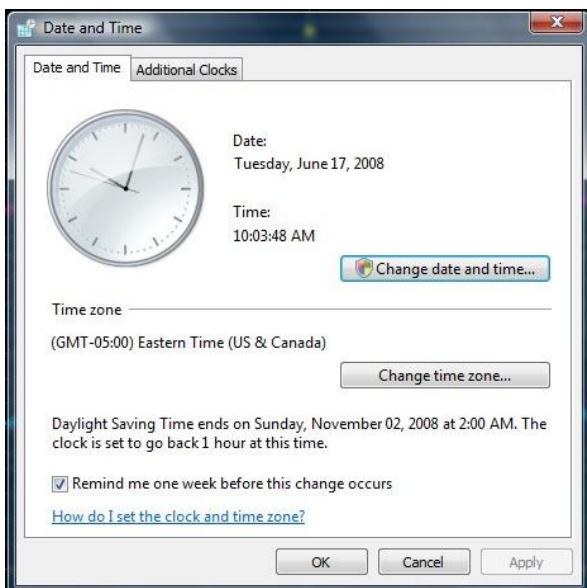
Options

The **Options** dialog is used to add or remove software options. Contact Teledyne LeCroy for more information using **Contact Teledyne LeCroy for Support,** or visit our Website at **teledynelecroy.com/options**.

This dialog also shows your **ScopeID** and **Serial #**.

Disk Utilities

Use the Disk Utilities dialog to arrange the file/folder structure on your instrument's hard drive. You can delete files, folders, or create new folders.

Note: All Disk Utilities can also be accomplished using the standard Microsoft Windows® file management tools.

Access the **Disk Utilities** dialog by selecting **Utilities → Disk Utilities** from the menu bar.

1. **Delete a single file** by first touching the **Delete** button on the dialog (just to make sure it's selected).

   - Now, touch inside the **Current folder** data entry control and provide the path to the folder containing the file for deletion. *OR*
   Touch the **Browse** button and navigate to the folder.
   - Touch inside the **File to be deleted** data entry control and provide a file name using your preferred input control method. Additional information on using the touch screen controls can be found in the **Dialog Area** (on page 42). *OR*
   Touch the **Browse** button and navigate to the file.

   > **Note**: You can also use the **up down arrows** to move through the files contained in the **Current folder** selected.

   With the desired file for deletion located, touch the **Delete File** button.

2. **Delete all files in a folder** by repeating the aforementioned **Delete a single file** process (up to the first bullet only using the **Current Folder** control).

   With the desired folder for deletion located, touch the **Empty Folder** button.

3. **Create a Folder** by first touching the **Create** button on the dialog (just to make sure it's selected).

   - Touch inside the **Current folder** data entry control and provide the path for folder creation and **be sure to include the folder name**.
   - Now, touch the **Create Folder** button.

> **Note**: **Disk Space** data for **Size**, **Free**, and **File(s)** is available on the far right of the dialog for convenience.

Preferences

Preference Setup Overview

A variety of customizable preferences can be set on your instrument. Access Preferences by touching **Utilities → Preference Setup...** on the menu bar. The main **Preferences** (below) dialog is shown by default with the following additional, tabbed dialogs also available:

- **Acquisition** (on page 159)
- **E-Mail** (on page 161)
- **Color** (on page 162)
- **Miscellaneous**

Remaining topics in this section cover these dialogs in a bit more detail.

Preferences

Selecting **Utilities → Preference Setup...** shows the main **Preferences** dialog by default. The following controls are available from this dialog:
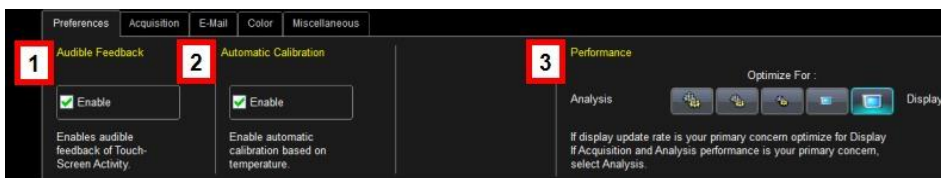
Numbered sections on this dialog correspond with the following explanations.

1. You can choose to have audible confirmation each time you touch a screen or front panel control by marking the **Enable** checkbox on the **Audible Feedback** section of the dialog. With Audible Feedback enabled, the oscilloscope beeps each time you touch the screen or a front panel control.

2. You can choose to have your instrument automatically re-calibrate itself whenever there is a significant change in ambient temperature by marking the **Enable** checkbox on the **Automatic Calibration** section of the dialog.

   Note: If you do not enable this option, the oscilloscope re-calibrates only at startup and whenever you make a change to certain operating conditions.

3. If the option is available on your oscilloscope, you can set up the oscilloscope to optimize either **Analysis** (acquisition and calculation speed) or **Display** (update rate/speed) using the buttons provided on the **Optimize For** section of the dialog.

   Available choices are presented as a spectrum with highest values at **Analysis** and **Display** extremes.

   Select one of the buttons for the desired performance optimization.

   Example reasoning for Analysis optimization would be its persistence or averaging usefulness. In such a case, giving higher priority to waveform acquisition at the expense of display update rate makes practical sense.

Acquisition

Access the **Acquisition** preference settings in the following manner:
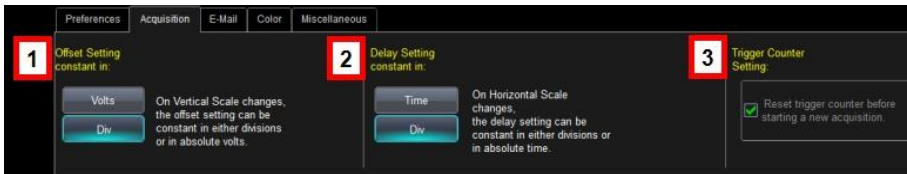
The Acquisition dialog (Trigger Counter Setting not available on all models).

Numbered sections on this dialog correspond with the following explanations.

1. On the **Offset Setting constant in** area of the dialog, touch either the **Div** or **Volts** button.

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

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

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

2. On the **Delay Setting constant in** area of the dialog, touch either the **Time** or **Div** button.

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

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

3. If this checkbox control is available on your oscilloscope, you can mark the **Reset trigger counter before starting a new acquisition** checkbox on the **Trigger Counter Setting** area of the dialog.

   This preference clears the trigger counter each time the oscilloscope issues an arm acquisition command and applies when you have set a trigger Holdoff condition in the Trigger dialog in either time or events:
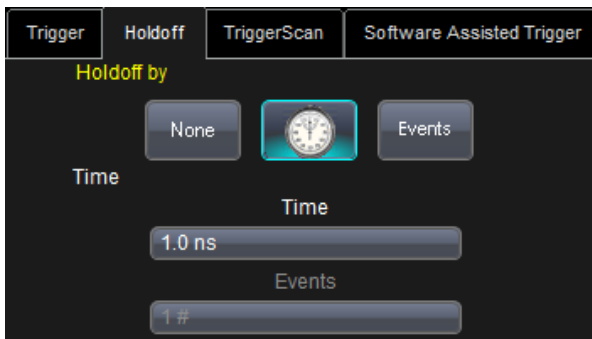
   The default condition of this control is off (unchecked).

ACQUISITION STATUS

For each general category of oscilloscope operation, you can view a summary of your setups. Access these status dialogs by making the following menu bar selections:

- **Vertical → Channels Status**

- **Timebase → Acquisition Status**

- **Trigger → Acquisition Status**

- **Math → Math Status**, **Zoom Status**, or **Memory Status**

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

E-Mail

Before you can send e-mail from the oscilloscope, configurations must be made on this dialog.

Numbered sections on this dialog correspond with the following explanations.

1. On the **E-Mail Server** section of the dialog, choose a server protocol from the following options:

   - **MAPI** (Messaging Application Programming Interface) is the Microsoft interface specification that allows different messaging and workgroup applications (including e-mail, voice mail, and fax) to work through a single client, such as the Exchange client. MAPI uses the default Windows e-mail application.

   - **SMTP** (Simple Mail Transfer Protocol) is a TCP/IP protocol for sending messages from one computer to another through a network. This protocol is used on the Internet to route e-mail. In many cases no account is needed.

2. Provide values on controls for **SMTP Server**, **Originator Address (From:)**, and **Default Recipient Address (To:)** on the **Configuration** section of the dialog based the MAPI or SMTP choice during the previous step.

   - **If you chose MAPI**, touch inside the **Originator Address (From:)** data entry field and provide the instrument's e-mail address. Then touch inside the **Default Recipient Address (To:)** data entry field and provide the recipient's e-mail address.

- **If you chose SMTP**, touch inside the **SMTP Server** data entry field and provide the name of your server. Touch inside the **Originator Address (From:)** data entry field and provide the instrument's e-mail address. Then touch inside the **Default Recipient Address (To:)** data entry field and provide the recipient's e-mail address.

3. The **Overview of E-Mail modes** section of the dialog provides helpful descriptions for your Server selection (made during the first step in this topic).

4. Use the **Send Test Mail** button to ensure proper E-Mail configuration by way of sending a confirmation message.

Color

You can customize the Colors used for **Channels**, **Math**, and **Memory** traces both when shown on your instrument and when used in print output.

Note: These color settings match a waveform on the grid display (both on-screen and printed) and show consistently on corresponding **dialogs**, **tables**, and **trace descriptor labels**.
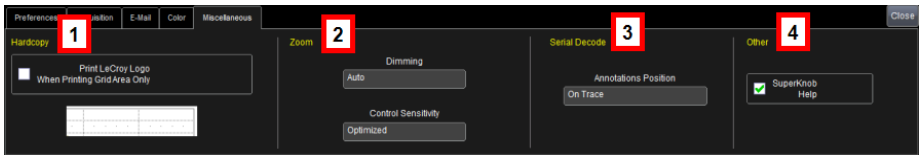

Numbered sections on this dialog correspond with the following explanations.

1. Make color selections for **Channels** (Screen and Print) by touching one of the color swatches. The Color pop-up control is shown and may be used to specify your desired color.

2. Just like Channels, make color selections for **Math Traces** (Screen and Print) by touching one of the color swatches. The Color pop-up control is shown and may be used to specify your desired color.

3. Again, just like Channels, make color selections for **Memory Traces** (Screen and Print) by touching one of the color swatches. The Color pop-up control is shown and may be used to specify your desired color.

4. You can use the **Factory default colors** button to instantly recall the original color settings for your instrument.

Note: Print colors are used only when the Colors control is set to Print on the Hardcopy dialog in **Utilities → Utilities Setup...** allowing colors to still appear when printed on white paper in order to save ink/toner. For convenience, the **Preview print colors** button is provided on this portion of the dialog. When the button is touched, a preview is generated on the grid display area. A subsequent touch of the button closes the preview.

Miscellaneous

Other Preference setting controls are shown on the Miscellaneous dialog as follows:

Numbered sections on this dialog correspond with the following explanations.

1. You can add the Teledyne LeCroy Logo to hardcopies of your grid display waveforms by marking the **Print Teledyne LeCroy Logo When Printing Grid Area Only** checkbox on the **Hardcopy** section of the dialog.

2. You can adjust the **Dimming** and **Control Sensitivity** of **Zoom** traces as follows:

    • Use the **Dimming** control to choose select **On**, **Off**, and **Auto** values. This controls the darkening/shading of waveform areas not part of the Zoom trace.

    • Use **Control Sensitivity** to choose **Legacy** or **Optimized** values

3. If you have **Serial Data Debug Solutions** installed on your oscilloscope, you can control Annotations being put **On Trace** (on all traces) or **On Noisy Trace** (only on noisy traces).

4. You can shut off the SuperKnob Help flyout menu by un-marking the **SuperKnob Help** checkbox on the **Other** section of the dialog.

System Recovery Tool

Restoring Software Using Acronis®

Your oscilloscope is designed to operate reliably for many years. The application software operating the instrument runs on a Windows platform. The loading or incomplete removal of additional Windows applications can cause problems in the stability of the operating system. Severe cases may require a reloading of the base operating system and oscilloscope application. Teledyne LeCroy provides you with an Acronis recovery application and a backup image in an extra partition on the instrument's hard drive.

PLEASE NOTE THE FOLLOWING:

- The recovery process produces a replica of the operating system and oscilloscope application software at the current revision levels when the oscilloscope was manufactured. Any further revisions of the application software, Windows operating system, and virus scan definition files are not automatically upgraded. Therefore, after completion of the disk image recovery, it is highly recommended to search vendor Web sites and upgrade the individual components to current revision levels.

- After the recovery procedure is completed, you must activate Windows, either by Internet connection to Microsoft's Web site or by telephone. Have your Windows Product Key number (located on the rear of the oscilloscope) handy during Widows reactivation.

- The current oscilloscope application software can be downloaded directly from the Teledyne LeCroy website at **teledynelecroy.com**. Since the calibration data for the oscilloscope is stored in the D: drive, current calibration constants are not overwritten during the recovery process.

Since third-party recovery software is used, our instructions certainly may not be the most definitive or current. We advise you to take advantage of resources available on the **Acronis** website - they maintain versions of their product manuals from the following locations:

Acronis True Image Home

http://www.acronis.com/homecomputing/download/docs/

Acronis True Image Echo Workstation

http://www.acronis.com/backup-recovery/advanced-workstation/index.html

Note: The following procedures cover basic steps for running the **True Image Echo Workstation**. For more definitive documentation refer to their aforementioned documentation resources.

Teledyne LeCroy provides you with a recovery application and a backup image in an extra partition on the instrument's hard drive. The recovery process is easy to perform, using the Recovery Wizard. After the recovery procedure is done, you must activate Windows, either by Internet connection to Microsoft's Web site or by telephone. Have your Windows Product Key number (shown on a sticker on your oscilloscope) handy during Widows reactivation.

Running the Acronis True Image Echo Workstation Recovery Application

1. Connect a network cable to the LAN port on the rear of the oscilloscope if you intend to activate windows through the Internet.

2. Connect a keyboard and a mouse to the oscilloscope.

3. Apply power to the oscilloscope.

4. As soon as the **Starting Acronis Loader... Press F11 for Acronis Startup Recovery Manager** message appears on the screen, press the **F11** key until the recovery software logo appears momentarily. The Acronis **True Image Echo Workstation** main window is displayed.

   Note: Do not press **F11** before you see the **Starting Acronis Loader** message or you will enter the MB boot sequence selection.

5. Select **Recovery** from the **Main Menu**. The **Restore Data Wizard** opens.

6. Click **Next** on the **Welcome** page.

7. On the **Backup Archive Selection** page, you choose the zone where the recovery partition is located. Choose **Acronis Secure Zone** (this is where the recovery data is located on your oscilloscope) and click **Next**.

8. On the **Backup Date Selection** page, choose the date when the backup was created and to which state you want to revert your system and click **Next**.

9. On the **Restoration Type Selection** page, select **Restore disks or partitions** and click **Next**.

10. On the **Partition or Disk to Restore** page, select **SYSTEM (C:)** as the source and click **Next**.

11. On the **Restored Partition Type** page, select **Active** and click **Next**.

> **Note**: If a window appears asking if you want to buy Acronis products, click **Do not show this message again** and click **OK**.

12. The **Restored Partition Size** page displays the Partition size for the restoration. Nothing needs to be changed, simply click **Next**.

13. On the **Next Selection** page, you will be asked if you want to restore another partition or hard disk drive. Select **No, I do not** and click **Next**.

14. The **Restoration Options** page displays additional options, such as what to do after the restoration is complete and error handling. Simply click **Next** to use the default selections.

15. A summary window is displayed indicating that Acronis True Image is ready to proceed with the recovery of the C: partition. Click **Proceed** to start the recovery process.

> **Note**: This takes approximately 4 to 15 minutes depending on the version of Operating system that is being restored. The progress is displayed on the screen

16. Once the restoration is complete, an Information window is displayed indicating that the **Data was successfully restored**. Click **OK**.

17. Click **Operations → Exit**. The oscilloscope will restart and begin installing the required software. A message is displayed asking if you want to install Microsoft Office PowerPoint Viewer.

18. Click **Yes** to install PowerPoint Viewer. The **InsallShield Wizard** for Adobe Flash Player opens.

19. To install Adobe Flash Player, click **Install** and then **Finish**. The X-Stream software installer screen appears.

20. Click **Next** to continue. The License Agreement page is displayed.

21. Click **I Agree**. The **Choose Components** page is displayed.

22. Select **all X-Stream components** and click **Install**.

   Note: A Windows Security window may be displayed indicating that Windows can't verify the publisher of this driver software. Choose Install this driver software anyway and then click Install.

23. When the X-Stream installation is completed, reboot the oscilloscope.

   Note: Now you must activate Windows® using an Internet connection to the Microsoft Web site or by telephone. When activating, have the Windows Product Key number handy (it is affixed to the rear of the oscilloscope).

Restarting the Application

Upon initial power-up, the oscilloscope automatically loads the instrument application software. If you exit the application and want to reload it, touch the **shortcut icon** on the desktop:

Start DSO

Note: Maximize the application by touching the shortcut icon located on the lower-right of the screen.
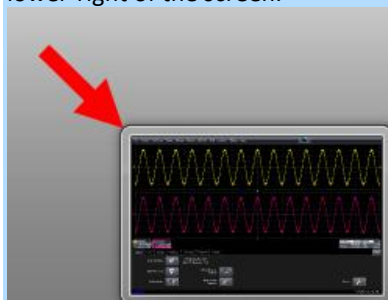
Restarting the Operating System

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

Reference

Specifications

Note: Specifications are subject to change without notice.

Please refer to the Teledyne LeCroy website at **teledynelecroy.com** where detailed specification information is regularly maintained on corresponding product datasheets.

Certifications

This section contains the instrument's Electromagnetic Compatibility (EMC), Safety and Environmental certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC
The oscilloscope meets intent of EC Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1:2006, EN 61326-2-1:2006 EMC requirements for electrical equipment for measurement, control, and laboratory use. [1]

Electromagnetic Emissions:
CISPR 11:2003, Radiated and Conducted Emissions Group 1, Class A [2][3]

EN 61000-3-2:2006 Harmonic Current Emissions, Class A

EN 61000-3-3/A2:2005 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:
EN 61000-4-2:2001 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes [4]

EN 61000-4-3:2006 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 [4]

EN 61000-4-4:2004 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines [4]

EN 61000-4-5:2006 Power line Surge, 1 kV AC Mains, L-N, L-PE, N-PE [4]

EN 61000-4-6:2007 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz [4]

EN 61000-4-11:2004 Mains Dips and Interruptions, 0%/1 cycle, 70%/25 cycles, 0%/250 cycles [4][5]

1 To ensure compliance with all applicable EMC standards, high quality shielded interface cables should be used.

2 Emissions which exceed the levels required by this standard may occur when the oscilloscope 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
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC
Oscilloscope 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):

CISPR 11:2003 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2006 and EN61326-2-1:2006.

Australia / New Zealand Contacts:

Vicom Australia Ltd.	Vicom New Zealand Ltd.
1064 Centre Road	60 Grafton Road
Oakleigh, South Victoria 3167	Auckland
Australia	New Zealand

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The oscilloscope meets intent of EC Directive 2006/95/EC 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:

- Overvoltage Category II: equipment intended to be supplied from the building wiring with a nominal supply voltage up to 300V.

- Measurement Category 0: oscilloscope measurement terminals that are not intended to be directly connected to the MAINS supply.

- Pollution Degree 2: an operating environment where normally only dry, non-conductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment.

- Protection Class I: grounded equipment in which protection against electric shock is achieved by Basic Insulation and a connection to the protective ground conductor in the building wiring.

U.S. NATIONALLY RECOGNIZED AGENCY CERTIFICATION

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

UL 61010-1 Second 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 cUL Listing Mark:

CAN/CSA-C22.2 No. 61010-1-04. Safety requirements for electrical equipment for measurement, control and laboratory use.

Environmental Compliance

END-OF-LIFE HANDLING
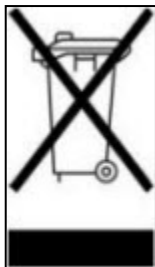
The instrument is marked with this symbol to indicate that it complies with the applicable European Union requirements to Directives 2002/96/EC and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

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 has been classified as Industrial Monitoring and Control Equipment, and is outside the scope of the 2011/65/EU RoHS Directive (Exempt until July 2017, per Article 4).

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System. Visit teledynelecroy.com to view the certificate.

End-User License Agreement for Teledyne LeCroy® X-Stream Software

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8.6. **Notices**. All notices or other communications between Teledyne 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.

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Windows® License Agreement

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

Contact Teledyne LeCroy

Teledyne LeCroy Service Centers	
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