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WaveRunner 9000 Oscilloscopes

Getting Started Guide

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Welcome

Thank you for buying a Teledyne LeCroy product. We're certain you'll be pleased with the detailed features unique to our instruments. This guide is intended to help you set up a WaveRunner 9000 oscilloscope and learn some basic operating procedures, so you're quickly working with waveforms.

- See the *MAUI Oscilloscopes Remote Control and Automation Manual* for comprehensive information on remote control of WaveRunner 9000.
- See the *WaveRunner 9000 Oscilloscopes Operator's Manual* for detailed information on the operational features of the WaveRunner 9000.

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

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Introducing WaveRunner 9000

The WaveRunner 9000 combines a superior oscilloscope experience with an extensive toolbox to shorten debug time. MAUI® with OneTouch is the most unique touch screen interface on any oscilloscope, providing unsurpassed efficiency in oscilloscope operation. Offering 500 MHz to 4 GHz of bandwidth, up to 40 GS/s sample rate (on "M" models), long memory and a versatile toolset, the WaveRunner 9000 is unbelievably powerful and insanely easy to use.

MAUI® with OneTouch

MAUI with OneTouch introduces a new paradigm for oscilloscope user experience. Dramatically reduce set up time with revolutionary drag-and-drop actions to copy and change channels, math functions and measurement parameters without lifting a finger. Use familiar touch screen gestures like pinch, swipe and flick to intuitively interact with the instrument. Quickly enable new traces or parameters using the "Add New" button, and turn them off with a simple flick of the finger.

Mixed Signal Option

The 16 integrated digital channels on "-MS" models, combined with tools designed to view, measure and analyze both analog and digital signals, enable fast debugging of mixed signal designs. Flexible analog and digital cross-pattern triggering across all 20 channels provides the ability to quickly identify and isolate problems in an embedded system.

Comprehensive Analysis Tools

WaveRunner 9000 has the most comprehensive trigger, decode, math, measure and application toolsets available in its class. Apply statistical and frequency analysis tools to enhance understanding of complex behaviors. WaveScan® lets you to search acquisitions using more than 20 criteria, while LabNotebook concisely documents and stores your results.

Key Specifications

Detailed specifications are on the product datasheet at teledynelecroy.com.

	Standard Models	"M" Models
Bandwidth	500 MHz to 4 GHz	
Analog Channels	4	
Memory per Channel	up to 32 Mpts/ch	up to 128 Mpts/ch
Sample Rate	up to 20 GS/s	up to 40 GS/s
Vertical Resolution	8-bit	
Digital Channels (optional)	16	
Digital Sample Rate	1.25 GS/s	
Min. Digital Pulse Width	2 ns	
Max. Digital Input Frequency	250 MHz	

Safety

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

Symbols



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



Ground terminal



Alternating current



WARNING. Risk of electric shock or burn.



Power On/Standby

Operating Environment

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

Power

AC Power	100-240 VAC ($\pm 10\%$) at 50/60 Hz ($\pm 10\%$) or 100-120 VAC ($\pm 10\%$) at 400 Hz ($\pm 5\%$) Automatic AC Voltage Selection	
Consumption	Standard Models	"M" Models
Nominal	285 W / 285 VA	415 W / 415 VA
Maximum*	375 W / 375 VA	500 W / 500 VA
Standby	10 W	10 W

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

Measuring Terminal Ratings

Ratings apply to inputs C1-C4 and Ext In.

Maximum Input Voltage	50 Ω coupling ≤ 5 Vrms 1 M Ω coupling ≤ 400 Vpk max. (Peak AC ≤ 10 kHz + DC) derating at 14 dB/decade from 10 kHz to 2 MHz, 10 Vpk max. above 2 MHz
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Measuring terminals have no rated measurement category (CAT) per IEC/EN 61010-1:2010. Measuring terminals are not intended to be connected directly to supply mains.

Precautions

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

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



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

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

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

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

Use indoors only.

Keep product surfaces clean and dry.

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

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

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

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

Front of Oscilloscope



- A. Capacitive Touch Screen Display
- B. Front Panel
- C. Power On/Standby Button
- D. Input Channels 1-4
- E. EXT In
- F. AUX Out
- G. USB 2.0 Port
- H. Mixed Signal Interface
- I. Cal Out and Ground Terminals
- J. Tilting Feet

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

The **front panel** houses hard controls for different acquisition settings. Operate the instrument using front panel controls, touch screen controls, or a mix that is convenient for you. See "Front Panel" on p.9.

Channels 1–4 are used to input analog signal. **EXT** can be used to input an external trigger signal.

AUX out can be configured to send a pulse to another device upon a trigger event or Pass/Fail outcome.

Cal out emits a signal that can be used to compensate passive probes. WaveRunner 9000 oscilloscopes are compatible with the included passive probes and all ProBus active probes that are rated for the oscilloscope's bandwidth. Probe specifications and documentation are at teledynelecroy.com/probes.



Supplied with the Mixed Signal models, the digital leadset connects to the **mixed signal interface** to input up-to-16 lines of digital data. Two digital banks with separate threshold and hysteresis controls make it possible to simultaneously view data from different logic families. Each flying lead has a signal and a ground connection. A variety of ground extenders and flying ground leads are available for different probing needs.

To achieve optimal signal integrity, connect the ground at the tip of the flying lead for each channel used in measurements. Use either the provided ground extenders or flying ground leads to make the ground connection.



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

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

Powering On/Off

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



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

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



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

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



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

Side of Oscilloscope



- A. HDMI 1.4 and DisplayPort 2.0 Ports**
- B. USB 3.1 Gen 1 Ports (4)**
- C. Ethernet Ports (2)**
- D. Audio Mic and Speaker**
- E. USBTMC Port (1) for remote control**

Connecting to External Devices/Systems

See the *WaveRunner 9000 Oscilloscopes Operator's Manual* for more instructions on connecting to external devices.

Audio/USB Peripherals

Connect the device to the appropriate port. These connections are “plug-and-play” and do not require further configuration. Use the Windows control panel to make adjustments. Choose **File > Minimize** to go to the Windows desktop.

External Monitor

The HDMI and DisplayPort interfaces support Ultra HD monitors. Connect the monitor to a video output on the side of the instrument. You can use an adapter if it does not have an HDMI or DP cable. Go to **Display > Display Setup > Open Monitor Control Panel** to configure display settings using the Windows control panel. Be sure to select the oscilloscope as the primary display.

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

Note: The oscilloscope touch screen uses Fujitsu drivers. Because of potential conflicts, external monitors with Fujitsu drivers cannot be used as touch screens, only as displays.

LAN

WaveRunner 9000 is preset to accept a DHCP network address over a TCP/IP connection. Connect an ENET cable from either port to a network access device. Go to **Utilities > Utilities Setup > Remote** to find the IP address.

To assign the oscilloscope a static IP address, open **Net Connections** from the Remote dialog and use the Windows networking dialogs to configure the device address. Go to **File > File Sharing** to configure email.

Remote Control

You can control the instrument over a LAN using VICP (TCP/IP) or VXI-11 (LXI). Use a standard ENET cable to connect to a network access point, and be sure the instrument is on the same subnet as the controller. You can also connect directly using TCP/IP, but depending on the controller, you may need to use a cross-over cable.

Note: To connect the instrument to a remote PC running MAUI Studio, choose VICP (TCP/IP). To use LXI on Windows 10 oscilloscopes, switch to the Administrative User LCRYADMIN (p.41).

USBTMC and GPIB (with the optional USB-GPIB adapter) can also be used to make a remote connection. To change the remote control setting from the default VICP (TCP/IP), go to **Utilities > Utilities Setup > Remote**.

Printer

WaveRunner 9000 supports USB printers that are compatible with the Windows OS installed on the oscilloscope. Connect the printer to any host USB port, then go to **File > Print Setup > Print** and select **Printer** to configure settings. Choose **Properties** to open the Windows print dialog.

Aux Out and Cal Out

The oscilloscope can output a pulse upon a trigger event or Pass/Fail outcome. Connect a BNC cable from Aux Out on the front of the instrument to the other device. Go to **Utilities > Utilities Setup > Aux Output** to configure the output.

The Cal Out hook on the front can be set to output a direct current or square wave of custom amplitude and frequency. Use the Aux Output dialog to configure Cal Out.

Reference Clock

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



- A. Built-in Carrying Handle
- B. Ref In and Ref Out to input/output external Reference Clock
- C. AC Power Inlet
- D. Kensington Lock

Front Panel

Most of the front panel controls duplicate functionality available through the touch screen display. They are covered in more detail in the Basics section and in the *WaveRunner 9000 Oscilloscopes Operator's Manual*. Below are some special front panel controls.

- A. Auto Setup** turns on and configures all channels with a signal attached. The edge trigger level is set to the signal mean.
- B. Default Setup** returns all channels to the factory default settings.
- C. Clear Sweeps** resets math and measurement counters.
- D.** The **Touch Screen** button enables or disables touch screen functionality.
- E.** The **Print** button captures the screen and handles it according to your Print setting (print to file on USB drive, create LabNotebook entry, etc.). It can be set to capture only the grid rather than the full screen.
- F.** The **User button** can be configured to perform your choice of functions: save LabNotebook, waveform or setup files; save setups or waveforms to internal memory, etc. See the *Operator's Manual* for instructions.
- G.** The front panel **Adjust** knob changes the value in the highlighted data entry field when turned. Pushing the Adjust knob toggles between coarse (stepped) or fine adjustments when the knob is turned.



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

Many front panel buttons light to indicate the function is active.



Touch Screen Display

The entire display is active. Use your finger to touch, drag-and-drop, swipe, pinch and flick. Many controls that display information also work as “buttons” to access other functions. If you have a mouse installed, you can click anywhere you can touch to activate a control; in fact, you can alternate between clicking and touching, whichever is convenient for you.



A. Menu Bar

B. Grid

C. Cursor

D. Trigger Level Indicator

E. Trigger Time Indicator

F. Trace Descriptor Box

G. Add New Box

**H. Timebase and Trigger
Descriptor Boxes**

**I. Horizontal Cursor
Readout**

J. Setup Dialogs

A drop-down **menu bar** lets you access set up dialogs and other functions. All functionality can be accessed through either the menu bar or other touch screen shortcuts.



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

The **grid** displays the waveform traces. It can be configured to show different grid modes.

Cursors show where measurement points have been set. Touch-and-drag cursor indicators to quickly reposition the measurement point. Horizontal cursor readouts appear below the Timebase and Trigger descriptors.

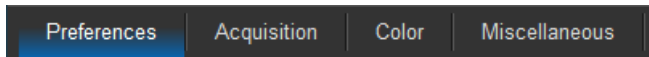
Trigger Level and **Trigger Time** indicators appear at the edge of the grid when a trigger is set, color-coded to match the trigger channel.

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

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

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

Dialogs appear at the bottom of the display for entering set up data. The top dialog will be the main entry point for the selected function. Related dialogs appear as a series of tabs behind the main dialog.



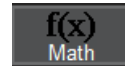
A **toolbar** along the bottom of the main Channel, Math, Memory and Digital dialogs initiates frequent actions without closing the underlying dialog. The actions always apply to the active (highlighted) trace.



Apply measurement parameters.



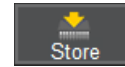
Display a zoom of the trace.



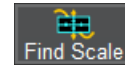
Apply a math function to the trace.



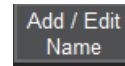
Open the Serial Decode dialog (if decoder options installed; else disabled).



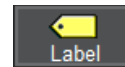
Copy the active trace to the corresponding internal memory (e.g., C2 to M2).



Scale the waveform to fit the grid.



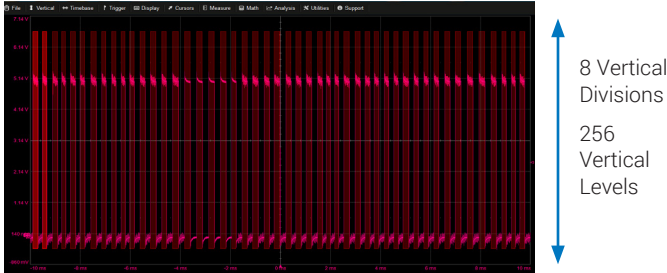
Add a custom name to the trace.



Apply a custom label to the trace.

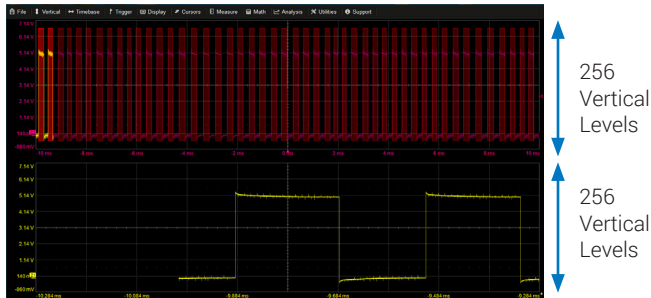
Changing the Display

The grid is 8 Vertical divisions representing 256 Vertical levels and 10 Horizontal time divisions. The value represented by each division depends on the scale settings of the traces that appear on it.



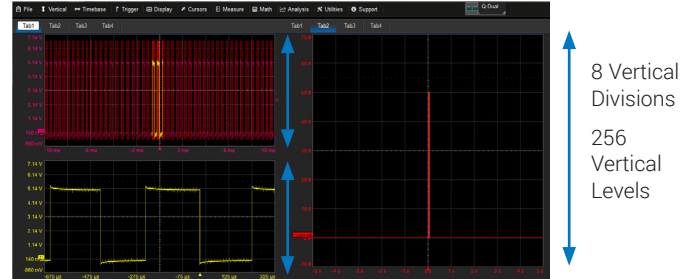
Multi-Grid Display

The grid area can contain multiple grids each representing the full number of Vertical levels. A variety of multi-grid modes are available.



Q-Scope Multi-Tab Display

If you have installed the Q-Scope option, the grid area can be divided into multiple tabs. Each tab can show a single grid or a multi-grid mode.



Display Mode vs. Grid Mode

The **Display Mode** determines whether the touch screen has a single display or tabs each representing a separate Q-scope display. The **Grid Mode** allows selection of a particular grid style in each display.

By default, the oscilloscope is in **Normal Display Mode** (a single display with no tabs) with the **Auto Grid Mode** enabled. **Auto** adds a grid for each new trace, up to 16 grids, until no more grids are available. Other grid modes create a fixed number and orientation of grids; the icon shows the result.

The various **Q-Scope Display Modes** divide the screen into tabbed displays. Many of the same grid functions you can perform in **Normal** mode, such as moving traces to other grids, you can also perform in the **Q-Scope** modes.

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

Extended Display

If you have a second monitor connected, you can extend the display of traces across both the oscilloscope screen and the external monitor. Select **Extend Grids on 2nd Monitor** from the Display dialog, then choose a grid mode from the Extended Display pop-up menu. Both screens will share this grid mode. Drag-and-drop descriptor boxes to move traces between the displays.

Note: When a Q-Scape Display Mode is extended, only Tab 1 is moved to the second display.



Oscilloscope with an extended display.

Line and Intensity



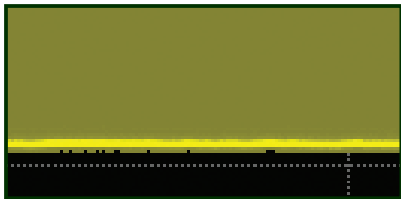
The trace style can be set to a series of separate sample **Points** or a continuous vector **Line**.

Grid Intensity makes the grid lines dimmer or brighter relative to the trace.

When more data is available than can actually be displayed, **Trace Intensity** helps to visualize significant events by applying an algorithm that dims less frequently occurring samples. The front panel **Intensity button** sets the Adjust knob to control the trace intensity setting.



Trace with Intensity 100%



Trace with Intensity 40%.

Working With Traces

Trace Descriptor Boxes

Channel (C1-C4), Zoom (Z1-Z8), Math (F1-F8), Memory (M1-M4) and Digital (Digital1-Digital4) descriptor boxes appear along the bottom of the grid area when a trace is turned on. Descriptor boxes summarize, activate, arrange and configure the traces they represent.

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

Trace Context Menu

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

Active vs. Inactive Trace

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

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

C1	AC1M
500 mV/div	
0 mV offset	

Inactive. Controls will not work for this trace.

C1	AC1M
500 mV/div	
0 mV offset	

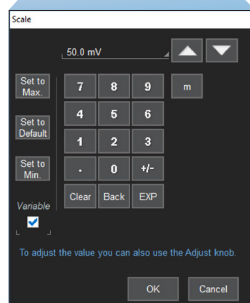
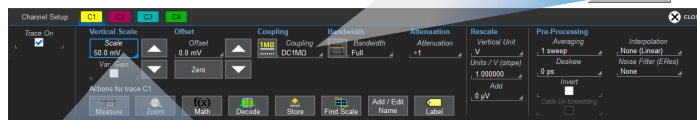
Active. Controls will work for this trace.

Adjusting Settings

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

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

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



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

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

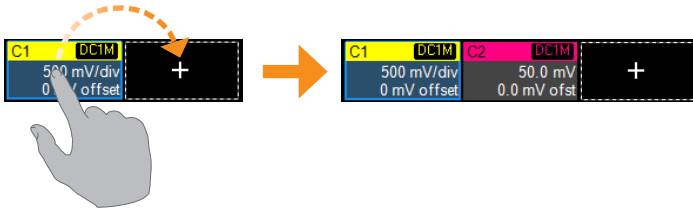
MAUI with OneTouch

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

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

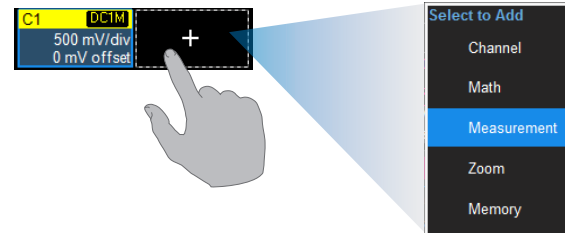
Turn On

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



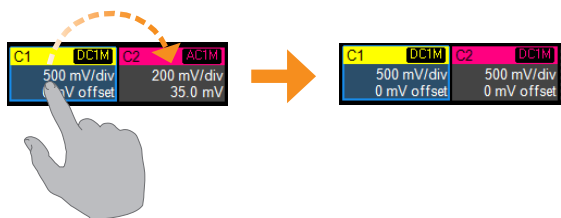
If there is no descriptor box of the desired type on the screen to drag, touch the Add New box and choose the trace type from the pop-up menu.

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

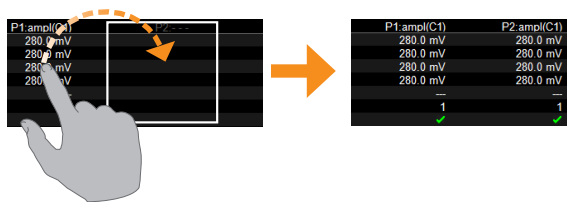


Copy Setups

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

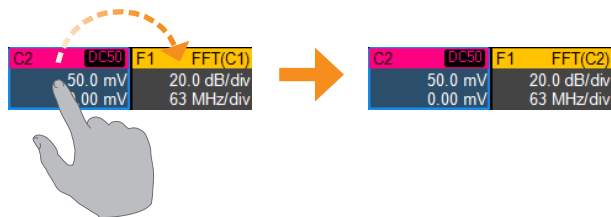


To copy the setup of a measurement (Pn), drag-and-drop the source descriptor box onto the target column of the Measure table. You can do the same for a query (Qn) on the Pass/Fail readout table.

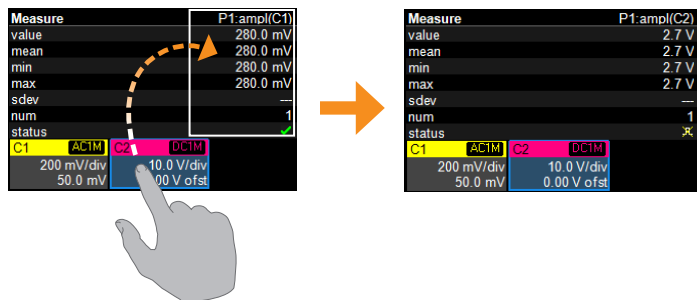


Change Source

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

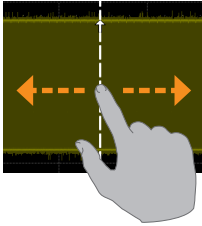


To change the source of a measurement, drag-and-drop the descriptor box of the desired source onto the parameter (Pn) column of the Measure table. You can do the same to a query (Qn) on the Pass/Fail readout table.

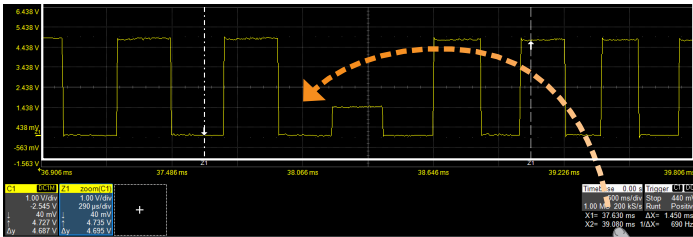


Position Cursors

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

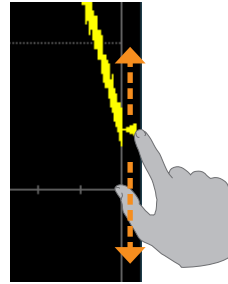


To place horizontal cursors on zooms or other calculated traces where the Horizontal Scale has forced cursors off the grid, drag the cursor readout from below the Timebase descriptor to the grid where you wish to place the cursors. The cursors are set at either the 5 (center) or 2.5 and 7.5 divisions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

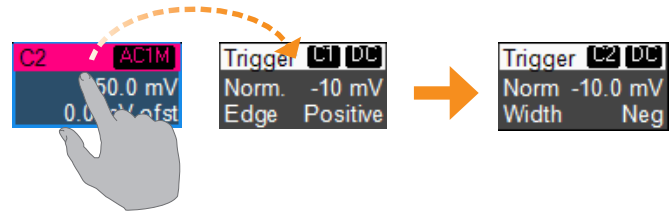


Change Trigger

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

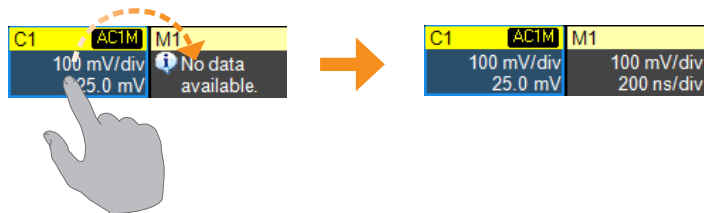


To change the trigger source channel, drag-and-drop the desired channel (Cr) descriptor box onto the Trigger descriptor box. The trigger will revert to the last trigger set on that channel.



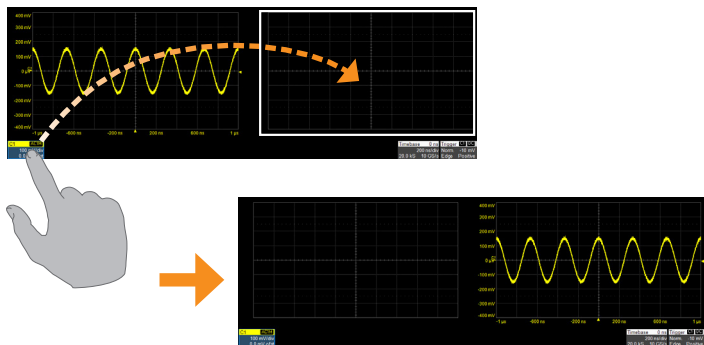
Store to Memory

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



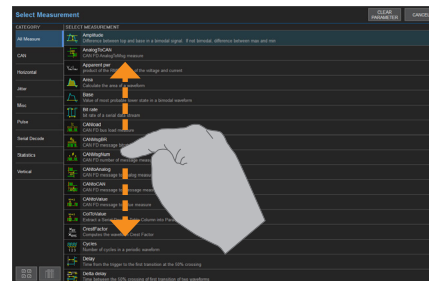
Move Trace

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



Scroll

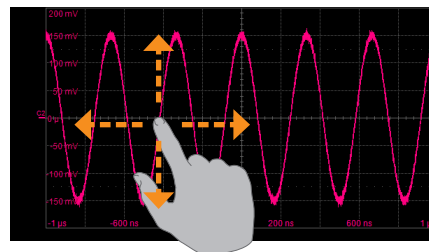
To scroll long lists of values or readout tables, swipe the selection dialog or table in an up or down direction.



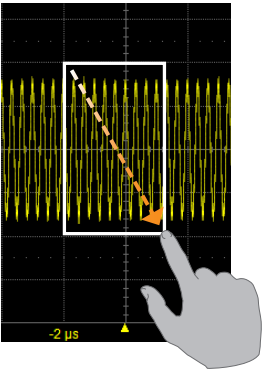
Pan

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

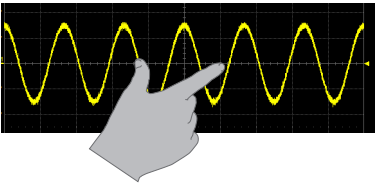
To pan at an accelerated rate, swipe the trace right/left or up/down.



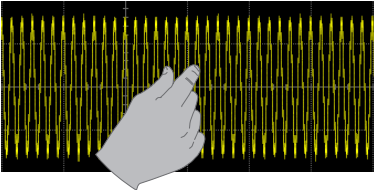
Zoom



To create a new zoom trace, touch then drag diagonally to draw a selection box around the portion of the trace you want to zoom. Touch the Z1 descriptor box to open the zoom factor controls and adjust the zoom exactly.



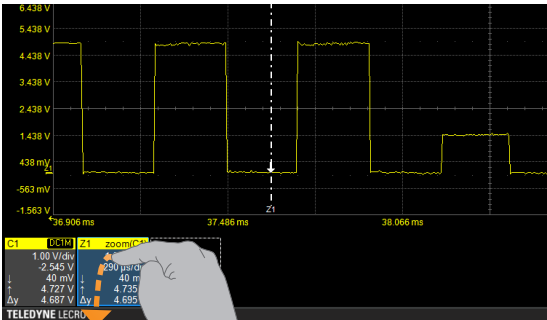
To "zoom in" on any trace, unpinch two fingers over the trace horizontally.



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

Turn Off

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



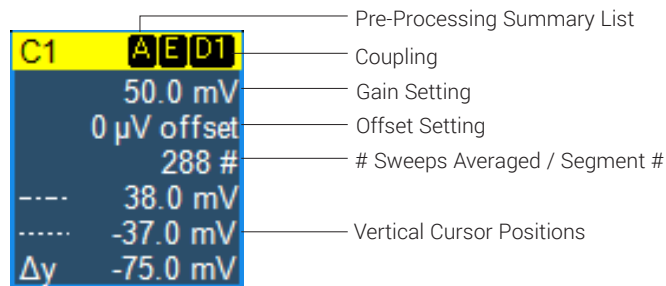
Vertical (Channel)

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

From the Front Panel

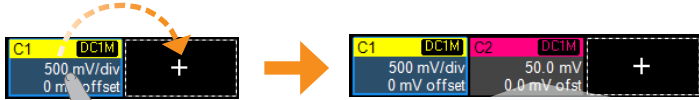


Channel Descriptor Box



From the Touch Screen

Drop a channel descriptor on the **Add New box**, or touch the Add New box and choose **Channel**. Touch new **C_n descriptor** to open the C_n setup dialog.



Enter **Attenuation** for passive and other vendors' probes.

Enter **Volts/div** and **Offset**.

Enter **Coupling** for cables/probes.

Apply optional **Bandwidth Filters**.

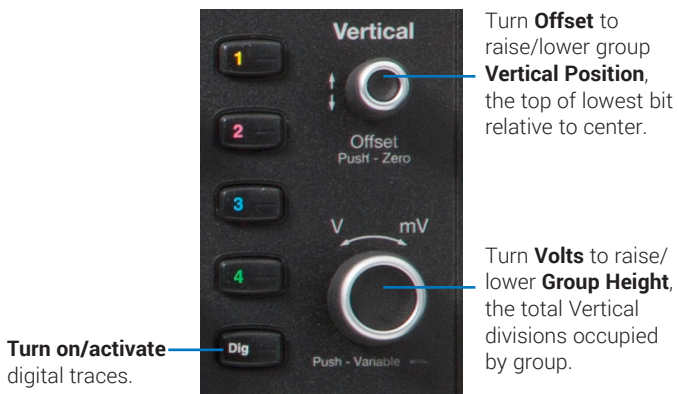
Rescale channel trace, or change **Vertical Unit** of grid.

Make any other **Pre-Processing** settings.

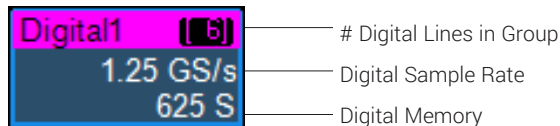
Digital

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

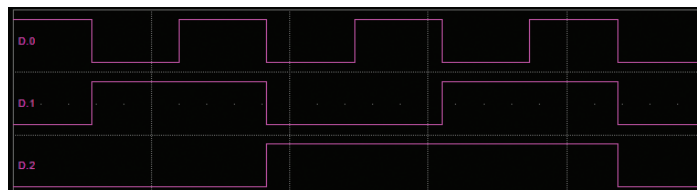
From the Front Panel



Digital Descriptor Box



Digital Displays



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



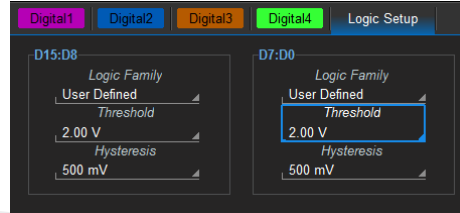
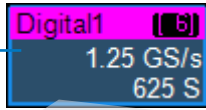
Bus trace collapses lines into hex values.



Activity indicators show when line is high, low, or transitioning.

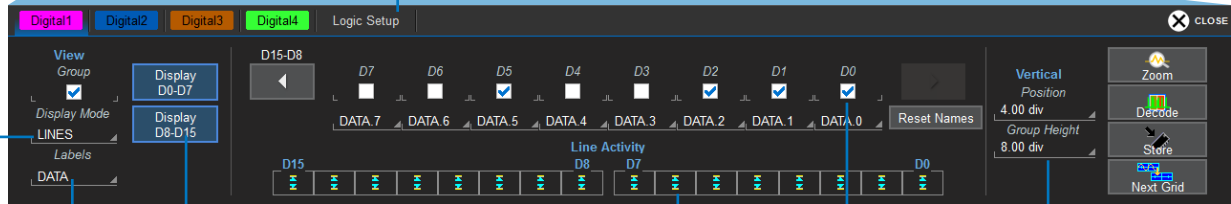
From the Touch Screen

From the menu bar, choose **Vertical>Digital n Setup**. Touch **Digitaln** descriptor to open Digitaln setup dialog.



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

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



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

Display buttons switch lead banks as you select lines.

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

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

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

Horizontal (Timebase)

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

From the Front Panel



Raise/lower trigger **Delay**.
Push to remove Delay.

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

Timebase Descriptor Box

Sampling Mode (blank in real-time)	Timebase	0 ns	Trigger Delay (Position)
# Samples	Seq: 10	200 ns	Time/div
	20.0 kS	10 GS/s	Sample Rate

From the Touch Screen

Touch the **Timebase** descriptor to open Timebase setup dialog.

Timebase 0 ns
Seq: 10 200 ns
20.0 kS 10 GS/s

Enter **Time/div.**

Select **Sampling Mode**.

The screenshot shows the Timebase setup dialog with the following settings:

- Timebase:** 0 ns
- Seq:** 10, 200 ns
- Sampling Rate:** 20.0 kS, 10 GS/s
- Sampling Mode:** Sequence (selected)
- Timebase Mode:**
 - Time/Division: 200 ns
 - 10 seg x 20 kS at 10 GS/s
 - 100 ps/pt for 2 μ s
 - Delay: 0 ns
 - Set To Zero button
- Real Time Memory:**
 - Maximum Sample Points: 1.60 MS
 - Set Maximum Memory button (selected)
 - Fixed Sample Rate button
- Active Channels:**
 - 4 (selected) at 10GS/s
 - 2 at 20GS/s
 - Auto Maximize

Optionally, enter **Delay**, (negative) time before trigger or (positive) time after trigger event to show.

Set To Zero removes Delay.

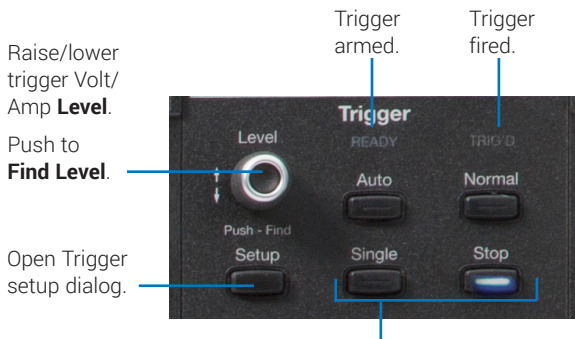
Enter fixed **Sampling Rate** or **Maximum Points** of memory to use in acquisition.

Lower number of **Active Channels** to increase sample rate and memory.

Trigger

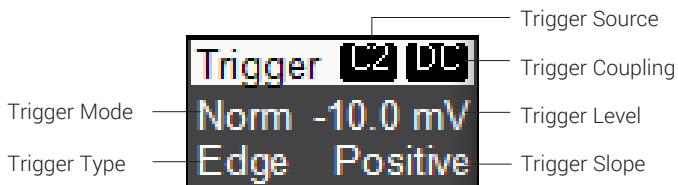
Triggers tell the oscilloscope when to perform an acquisition. The acquisition starts as soon as the trigger is armed *and* all trigger conditions are met, unless postponed by a Holdoff count of time or number of trigger events. Trigger types and modes are described at more length in the *WaveRunner 9000 Oscilloscopes Operator's Manual*.

From the Front Panel



Select **Trigger Mode**:
 Auto – trigger after preset period if no valid trigger.
 Normal – trigger repeatedly when all conditions met.
 Single – trigger once when all conditions met.
 Stop – stop acquisition.

Trigger Descriptor Box



Trigger Indicators



Level



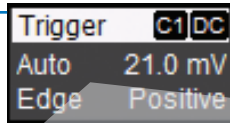
Position



Pre/Post-Trigger – appears at corner of grid when trigger point is no-longer visible.

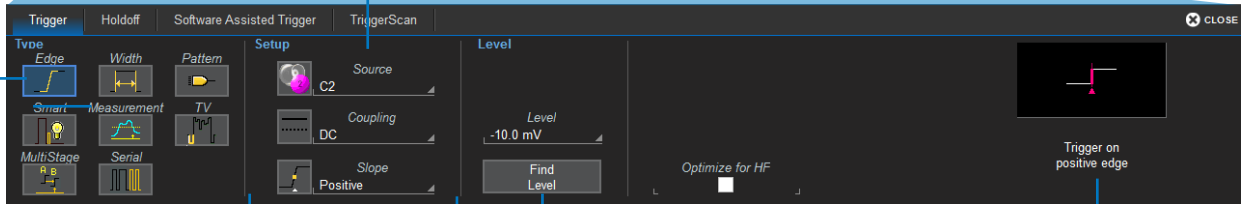
From the Touch Screen

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



Choose trigger **Source** channel.

Choose trigger **Type**.



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

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

Icon summarizes the trigger selections.

Zoom

Zoom traces (Zn) display a magnified portion of another trace. Any trace can be zoomed, although Zoom is most useful for channel traces, as it allows you to see the source at the original Timebase at the same time as the Zoom "close up."

From the Front Panel

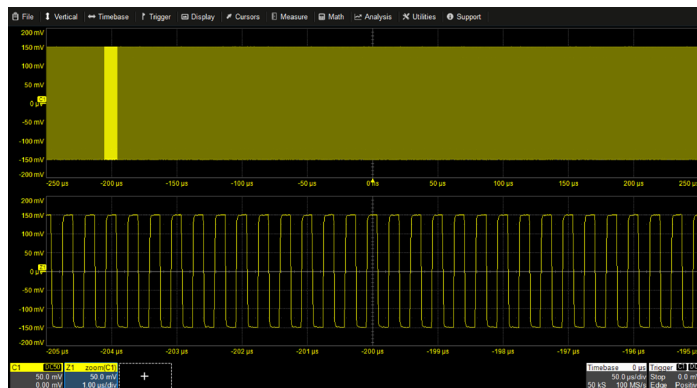


Adjust **Horizontal Scale** to change zoom magnification.

Create **Zoom** of all open traces.

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

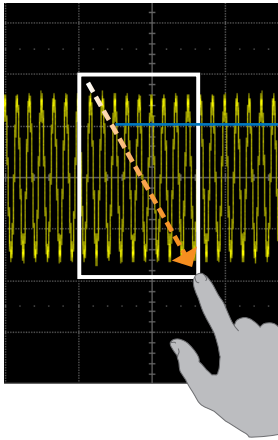
The zoomed portion of the source trace is highlighted, so that the area corresponding to the zoom is more visible.



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

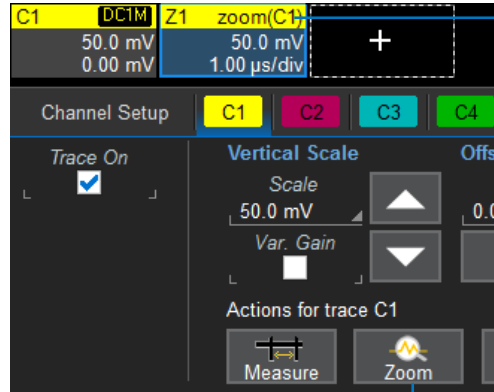
The **Zoom descriptor box** shows the **Zoom Source** and **Horizontal Scale**, which differs from the Timebase.

From the Touch Screen



Draw a **Zoom box** over a portion of the source trace.
Repeat on another section to reposition the Zoom trace.

OR



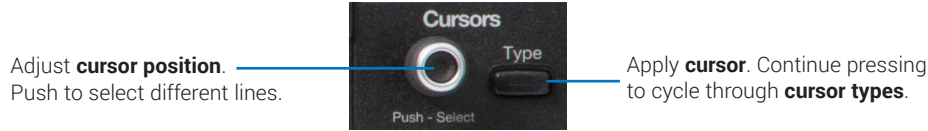
Zoom descriptor opens Zoom dialog to make other adjustments.

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

Cursors

Cursors set measurement points on the Vertical or Horizontal axis of a trace (or both). The five preset cursor types are described in more detail in the *WaveRunner 9000 Oscilloscopes Operator's Manual*. All show the absolute value where the cursor intersects the waveform and the delta of the two lines.

From the Front Panel



From the Touch Screen

Cursors > Cursor Setup opens the Cursor dialog.

Touch-and-drag **cursor** to reposition measurement point.

Vertical Cursor readout on descriptor boxes.

Choose **Cursor Type**.

Horizontal Cursor readout below Timebase. Drag onto zooms to reset cursors on the rescaled traces.

Set exact **Cursor Position** using dialog. **Track** moves both lines together.

Measurements and Statistics

Measurements are waveform parameters that can be expressed as numerical values, such as amplitude or frequency. You can measure up-to-eight parameters on one or more traces and view the active readout in a table below the grid. Statistics can be added to the readout, along with histograms, a miniature histogram of the statistical distribution. You can also gate measurements to limit them to a specific portion of the trace, or plot a histogram, trend or track of the measurement.

Touch **Measure** column to re-open Measure dialog if closed.

Measure dialog to add/remove **Statistics** and **Histograms**, turn on **Standard Measurements**, or **Clear Sweeps**.

Pn dialogs to configure user-defined measurement set.



Measure > Measure Setup opens the Measure dialog.

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

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

Action buttons quickly plot **Histogram**, **Trend** or **Track** of measurement.

Turn on **Help Markers** to show what is being measured on waveform.

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

Math

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



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

Units and scale on **Fn descriptor**.

Math tab to turn on/off functions.

Fn tab to set up/change function.

Make other settings on the **function subdialog** (varies by operation).

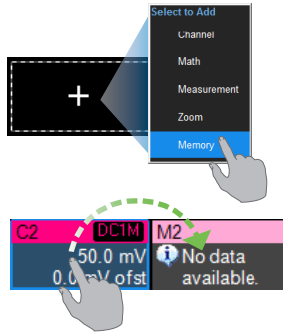
Choose **Source** trace(s) to operate on and math **Operator**.

Use **Zoom controls** to rescale math trace.

Memories (Reference Waveforms)

Memories are traces stored for reference that can be recalled to the display for comparison with other traces. A memory can be zoomed or measured for better analysis of historical data. You can store up-to-four internal memories (M1-M4). After that, new memories will overwrite previously stored data.

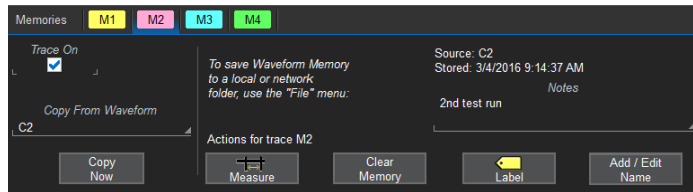
To store a new memory:



Touch the **Add New** box and choose **Memory** to turn on the next memory trace.

Then, drag the descriptor box of the trace you want stored onto the new Mn descriptor box.

OR

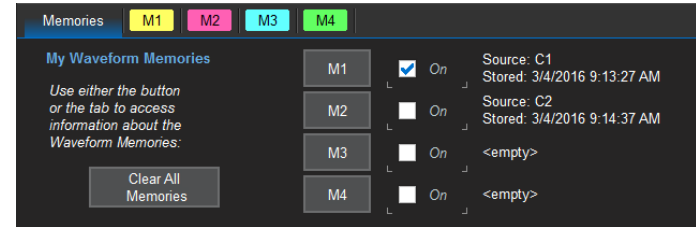


Choose **Math > Memory Setup**. On the Mn tab, select the trace you want stored in **Copy From Waveform**, then touch **Copy Now**.

Optionally, add **Notes** or **Labels** to the stored memory.

To recall a stored memory:

Press the front panel Mem(ory) button to open the Memories dialog, then check On next to M1-M4.



Internal memories persist only until the oscilloscope is rebooted. To store memories indefinitely, save them to a trace (.trc) file by choosing **File > Save Waveform**.

The trace file can later be recalled into one of the internal memories for viewing by choosing **File > Recall Waveform**. Only files saved with the .trc extension can be recalled.

WaveScan

Press the **WaveScan** front panel button to open the WaveScan dialogs. WaveScan Search and Find enables you to search for unusual events in a single capture, or to scan for a particular event in many acquisitions over a long period of time. A predefined set of scan modes (similar to trigger setups) enable a quick search for events of interest. The results are time stamped, tabulated, and can be selected for individual viewing.

Result table lists found events. Touch an event to zoom it.

Color overlays mark events on the source trace.

Zoom of selected event.

Choose scan **Mode** (event to find) and **Source** waveform to search.



Select different **views** of the scan: event table with/without time stamps, overlay or zoom.

Take **action** when an event is found, such as sounding a beep.

Spectrum Analyzer

Use the **Spectrum** front panel button to launch the optional Spectrum Analyzer, which lets you easily use the Fast Fourier Transform (FFT) for frequency analysis. The controls are the same as you would find on an RF spectrum analyzer. You set the inputs and desired frequency span, and the oscilloscope automatically generates output in units relevant to the frequency domain. A spectrogram generator displays 2D or 3D renderings of historical data.

The screenshot displays the Spectrum Analyzer interface with several key components:

- Top Left:** A 'Spectrum Table' popup window listing markers with columns for 'Markers1', 'Abs. Freq.', and 'Abs. Amp.'. It contains five entries with their respective frequencies and amplitudes.
- Top Center:** A time-domain waveform plot showing a periodic signal with a green trace.
- Top Right:** A spectrogram plot showing frequency content over time, with a color scale from -3.8 V to 28.2 V.
- Bottom Center:** A frequency-domain spectrum plot showing power in dBm versus frequency in Hz, with a green trace and several peaks marked with circles.
- Bottom Left:** A control panel for 'Input Signal(s)' with options for '1 Input (or Diff. Probe)' and 'Input 1-Input2', and checkboxes for 'Enable Spectrum' and 'Enable Spectrogram'.
- Bottom Center:** A 'Spectrum Analyzer Setup' panel with controls for 'Center Freq.' (5.000 kHz), 'Freq. Span' (9.9 kHz), 'Resolution Bandwidth' (100 kHz), and 'Variable Span'.
- Bottom Right:** A 'Peaks / Markers' dialog box with tabs for 'Normal', 'Magnitude', 'Power Spectrum', and 'Power Density'. It includes options for 'Mode', 'Type', 'Background Removal', 'Scale', and 'Persistence'.

Popup table of peak or marker measurements.

FFT traces with marked peaks and frequencies.

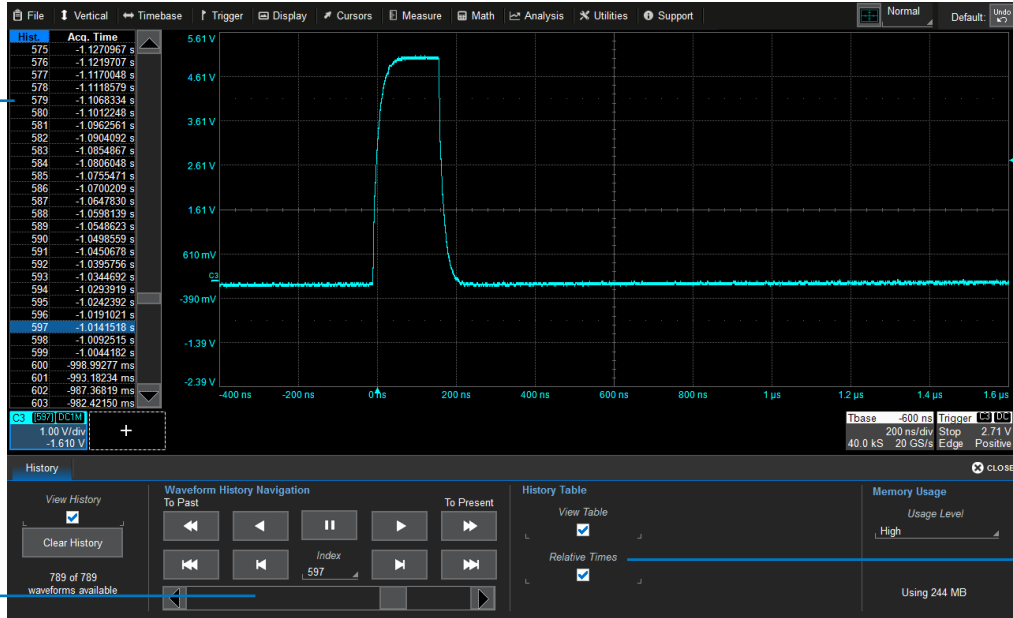
Use **Peaks/Markers** dialog to mark and tabulate peaks, set markers on frequencies, or launch table of frequencies.

Choose **input**. Set **frequency span** of interest. Choose **spectrum mode** and **type**. Choose Linear or Log scale **grid type**.

History Mode

The **History** front panel button puts the instrument into History Mode, allowing you to review any acquisition in the oscilloscope's history buffer, which automatically stores all acquisitions until full. Each record is indexed and time-stamped with either the absolute time since beginning of history or the time relative to where you are in the history. Not only can individual acquisitions be restored to the grid, you can "replay" history at varying speeds to capture detailed changes in the waveforms over time.

Select row of **History table** to view that acquisition.



Auto Play buttons and slider bar "replay" history to find events of interest.

View History table using absolute time or relative time.

Saving and Sharing Data

Use the oscilloscope **File menu** options to save and recall data. See the *WaveRunner 9000 Oscilloscopes Operator's Manual* for more information on using these features.

LabNotebooks

LabNotebooks are composite files (.LNB) containing setups, waveform data and screen image as they were at the moment of capture. Creating a LabNotebook can be as simple as pressing the Print button as you work. Flashback LabNotebooks to restore the oscilloscope to the exact state it was in when the file was saved. Waveforms and tables are displayed as they were for new analyses to be performed.

LabNotebook files can be edited, annotated and exported into a preformatted HTML, .RTF or .PDF report. They can also be extracted into their component setup, waveform and screen image files.



Setup, Waveform and Table Data

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

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

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

When multiple waveforms or tables are displayed, one command saves **All Displayed** to separate, autnamed files.

Screen Captures

The front panel **Print button** captures an image of the screen, which will then be handled according to your chosen Print method (sent to a printer, saved to an image file, etc.). Before printing or saving the capture, use the drawing tools to annotate the image, same as with LabNotebooks.



You can also use the touch screen **File > Save Screen Image**.

File Sharing

If the oscilloscope is networked, LabNotebooks, reports, and other user data files can be emailed directly from the instrument or saved to accessible network devices.

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

Software Options

Many software options are available to extend the capabilities of a WaveRunner 9000. To purchase an option, contact your Teledyne LeCroy sales representative. You will receive a license key via email that activates the optional features on the oscilloscope. To install the key on the oscilloscope:

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

Q-Scape Multi-Tabbed Display (WR9K-QSCAPE) architecture speeds your understanding of your design with 4x the display area. Configure each tab with the grid style you want. Quickly drag traces to new tabs.

Advanced Customization Package (WR9K-XDEV) supports user-defined measurement parameters and math functions. Algorithms can be created in your favorite programming language, such as MATLAB.

Cable De-embedding Option (WR9K-CBL-DE-EMBED) gives you the ability to quickly and easily remove the effect of cables by entering an attenuation table or attenuation constants that are typically provided by the cable manufacturer.

Digital Filter Package (WR9K-DFP2) implements a set of linear-phase Finite Impulse Response (FIR) and IIR filters to remove undesired spectral components such as noise.

Electromagnetic Compliance Package (WR9K-EMC) offers specialized measurements to test a design's susceptibility to EM discharge.

Electric-Telecom Pulse Mask Test (WR9K-ETPMT) performs automated compliance mask tests on a wide range of electrical telecom standards.

JITKIT (WR9K-JITKIT) makes it easy to understand the basic system jitter performance of clock signals and clock-data activities through a wide variety of common jitter measurements.

Eye Doctor II (WR9K-EYEDRII) provides the channel emulation and de-embedding tools for the next generation of serial data standards. It seamlessly integrates into Teledyne LeCroy's SDAX software for eye diagram and jitter analysis.

SDA Expert (WR9K-SDAX) delivers integrated jitter and timing analysis for data signals to help you characterize your design, prove compliance, and determine why a device or host fails compliance.

DDR Debug Toolkit (WR9K-DDR*-TOOLKIT) provides test, debug and analysis tools for the entire DDR design cycle. The unique DDR analysis capabilities provide automatic Read and Write burst separation, bursted data jitter analysis, and DDR-specific measurement parameters. Available for DDR2, DDR3, DDR4 and DDR5 signal analysis.

Spectrum Analyzer (WR9K-SPECTRUM-1 and WR9K-SPECTRUM-PRO-2R) creates an RF Spectrum Analyzer-like environment for analyzing frequency-dependent effects. Use the FFT on the oscilloscope with little or no concern about the details of setting up an FFT.

Power Analysis Software (WR9K-PWR) provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits, such as device power switching, control loop modulation, and line power harmonics.

Serial Data Mask Package (WR9K-SDM) adds eye pattern mask testing capability to the instrument.

Many **Serial TDME Options** provide added insight when debugging serial data. For the latest list, go to teledynelecroy.com/serialdata.

Cleaning

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



CAUTION. Do not attempt to clean internal parts.

Language Selection

To change the language that appears on the oscilloscope touch screen, from the menu bar, choose **Utilities > Preference Setup > Preferences** and make your **Language** selection.

You can also select at power on by touching the Language icon when it appears at the upper-right of the touch screen.



Reboot the oscilloscope after changing language.

Calibration

The oscilloscope is calibrated at the factory prior to shipment. Schedule an annual factory calibration as part of your routine maintenance.

WaveRunner 9000 incorporates automatic calibration routines to maintain accuracy in between factory calibrations. Go to **Utilities > Preference Setup > Calibration** to select the method used:

Stored Calibration uses cached calibration files to recalibrate the instrument at start-up. As long as the oscilloscope is used at or near sea level within a temperature range of 19-30 °C, this calibration routine should be sufficient to maintain specified performance. The instrument will dynamically recalibrate if the temperature goes outside of the stored calibration range. If you know you will be operating outside this temperature range, do a Calibrate All to minimize recalibration.

Dynamic Calibration recalibrates the oscilloscope at start-up and every time there is a change to any of the acquisition settings that directly affect the performance of the ADCs. When one setup is calibrated at a particular ambient temperature, the calibration is entered in a calibration table and reused for the duration of the session. These calibration entries persist only for a single session; Dynamic Calibration restarts when the instrument is restarted or you change the principal acquisition settings.

Two manual calibration routines can be used to recalibrate immediately before sensitive measurements or when there is a significant change of environmental characteristics that could affect the performance of the ADCs:

Calibrate Current State calibrates at the current vertical and horizontal settings. This calibration takes 5 seconds but is valid for only this setup at the current temperature ± 2.5 °C.

Calibrate All calibrates all possible combinations of vertical and horizontal settings. This calibration is valid for the current temperature and takes about four to five hours. Perform it when the ambient temperature is stable from the time of calibration to the time of operation. We recommend that you run Calibrate All when:

- The instrument is operating outside the 19-30 °C range and the operating temperature changes while outside that range. Calibrate All is only valid for ± 2.5 °C of the last calibration temperature when operating outside of the 19-30 °C range.
- The instrument is moved to a new operating environment.
- It has been six months since the previous manual calibration.



CAUTION. Remove all inputs from the oscilloscope prior to manual calibration.

Firmware Updates

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

Consult your IT department/lab manager for the current LCRYADMIN user password, which is required for firmware installation and other Windows OS changes. User passwords at time of shipment are on a sticker on the body of the oscilloscope.



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

To download and install an update:



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

Switching Users

Windows 10 oscilloscopes are by default set to operate from the LeCroyUser account, but you may need to switch to the Administrative User, LCRYADMIN, to run certain compliance packages or use LXI remote control.

Note: To install software or change Windows settings, it is sufficient to supply the LCRYADMIN password. Consult your IT department/lab manager for the current passwords.

To switch to the LCRYADMIN account:

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

To return to the Standard user, repeat this procedure selecting user **LeCroyUser** and entering the LeCroyUser password.

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

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

Service

If the WaveRunner 9000 cannot be serviced on location, contact your service center for a **Return Material Authorization (RMA)** code and instructions where to ship the product. All products returned to the factory must have an RMA.

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

Follow these steps for a smooth product return:

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

Service Plans

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

Service Centers

For a complete list of Teledyne LeCroy offices by country, including our sales and distribution partners, visit: teledynelecroy.com/support/contact
Teledyne LeCroy
700 Chestnut Ridge Road
Chestnut Ridge, NY, 10977, USA
teledynelecroy.com

Sales and Service:

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

Support:

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

Support

Online Documentation

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

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

The *WaveRunner 9000 Oscilloscopes Operator's Manual* can be downloaded from the Technical Library under **Manuals > Oscilloscopes**. This PDF contains more extensive operating procedures than are found here.

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

Technical Support

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

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

Warranty

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

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

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

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

Certifications

Teledyne LeCroy certifies compliance to the following standards as of the time of publication.

European Council



The instrument bears this mark to indicate it conforms to all applicable European Council standards. Please see the EC Declaration of Conformity document shipped with your product for current certifications.

EMC DIRECTIVE

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

EN IEC 61326-1:2021 EMC requirements for electrical equipment for measurement, control and laboratory use

EN IEC 61326-2-1:2021 Particular requirements for sensitive test and measurement equipment for EMC unprotected applications ^{1, 2, 3}

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

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

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

LOW VOLTAGE DIRECTIVE

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

EN 61010-1:2010+A1:2019 Safety requirements for electrical equipment for measurement, control and laboratory use—Part 1: General requirements

EN 61010-2:030:2021 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:

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

END-OF-LIFE HANDLING / WEEE



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

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

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

Unless otherwise specified, all materials and processes are compliant with RoHS Directive 2011/65/EU in its entirety, inclusive of any further amendments or modifications of said Directive.

European Contact:*

Teledyne GmbH, European Division
 Im Breitspiel 11c
 D-69126 Heidelberg
 Germany
 Tel: + 49 6221 8270

United Kingdom

The instrument bears this mark to indicate conformity with health, safety, and environmental protection standards for products sold within Great Britain (England, Wales and Scotland). The design of the product has been verified to conform to the applicable harmonized standards and technical specifications, and with the relevant Union harmonization legislation.

Australia and New Zealand

The instrument bears this mark to indicate it complies with the EMC provision of the Australian Communication and Media Authority (ACMA) Radio Communications Act:

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

Australia / New Zealand Contacts:*

RS Components Pty Ltd.
 Suite 326 The Parade West
 Kent Town, South Australia 5067

RS Components Ltd.
 Units 30 & 31 Warehouse World
 761 Great South Road
 Penrose, Auckland, New Zealand

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

United States and Canada

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

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

UL 61010-2-030 Ed. 2-2018 – Particular requirements for equipment having testing or measuring circuits.

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

CAN/CSA-C22.2 No. 61010-2-030:18 – Particular requirements for equipment having testing or measuring circuits.

China

Unless otherwise specified, all materials and processes are compliant with the latest requirements of China RoHS 2.

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System.

Intellectual Property

All patents pertaining to the WaveMaster 8000HD are on our website at:

teledynelecroy.com/patents/

