



## WaveMaster 8000HD

### Oscilloscopes

### Getting Started Guide

# Introducing WaveMaster 8000HD

WaveMaster® 8000HD is the only high bandwidth oscilloscope designed for all stages of product development, whether first-silicon characterization, link validation over channels or debugging across the entire the protocol stack. No other oscilloscope supports more engineering tasks with more unique tools.

This guide is intended to help you set up a WaveMaster 8000HD oscilloscope and learn some basic operating procedures so you're quickly working with waveforms. Also see the:

- *WaveMaster 8000HD Oscilloscopes Operator's Manual* for detailed information on the operation of the WaveMaster.
- *MAUI® Oscilloscopes Remote Control and Automation Manual* for comprehensive information on remote control of the WaveMaster.

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

# Key Specifications

Detailed specifications are on the product datasheet at [teledynelecroy.com](http://teledynelecroy.com).

	Standard Models		DBI Models
Bandwidth	20 GHz	25 or 33 GHz	50, 59 or 65 GHz
Analog Channels (4 standard either input or 2 DBI)	4 ProBus® 4 ProLink	4 ProBus 4 ProAxial™	4 ProBus 4 ProAxial 2 1.85 mm (DBI)
Digital Channels (optional)	16 with MSO option; 9 or 18 with HDA125		
Vertical Resolution	12 bits standard		
Memory per Channel*	200 Mpts/ch standard Up to 8 Gpts/ch optional		
Analog Sample Rate**	160 GS/s		1.85 mm inputs: 320 GS/s All other inputs: 160 GS/s
Digital Sample Rate	2.5 GS/s with MSO option 12.5 GS/s with HDA125		

\* 500 Mpts/ch, 2 Gpts/ch and 8 Gpts/ch memory options available. SDA models include 500 Mpts/ch memory upgrade.

\*\*Maximum value with Enhanced Sample Rate (ESR).

# Safety

The safety of any system incorporating the instrument is the responsibility of the assembler of the system.

# Symbols

These safety symbols appear on the instrument or in documentation.



**CAUTION** of potential damage to equipment, or **WARNING** of potential injury. Refer to the 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

<b>Temperature</b>	5 °C to 40 °C
<b>Humidity</b>	Maximum RH 80% (non-condensing) up to 31 °C decreasing linearly to RH 50% at 40 °C
<b>Altitude</b>	Up to 10,000 ft (3,048 m) at or below 30 °C

## Power

<b>AC Power</b>	100-240 VAC (±10%) at 50/60 Hz (±10%) Automatic AC Voltage Selection	
<b>Consumption</b>	<b>Standard Models</b>	<b>DBI Models</b>
Nominal	1125 W	1175 W
Maximum*	1250 W	1300 W
Standby	15 W	15 W

\* All PC peripherals and active probes connected to all channels.



**WARNING.** Secure the power cord with the cable clamp at all times. Failure to do so creates a fire hazard.

## Measuring Terminal Ratings

<b>ProBus Inputs</b>	50 Ω coupling ≤ 5 Vrms  1 MΩ coupling ≤ 400 Vpk max. (Peak AC ≤ 10 KHz + DC); derating at 18 dB/decade from 10 KHz to 1 MHz; 5 Vpk max. above 1 MHz
<b>ProLink Inputs</b>	50 Ω coupling ±2 Vmax
<b>ProAxial Inputs</b>	50 Ω coupling ±2 Vmax
<b>1.85 mm (DBI) Inputs</b>	50 Ω coupling ±2 Vmax

Measuring terminals have no rated measurement category (CAT) per EN IEC 61010-2-30:2021.

Measuring terminals are not intended to be connected directly to supply mains.

## Precautions

**Observe all generally accepted safety procedures.**

**Use proper power cord.** Use only the power cord shipped with this instrument and certified for country of use. Secure the cord at all times.

**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 cables 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 terminals for maximum allowed values.

**Use only within operating environment listed here.** 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 the instrument to move it.

**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 secure the instrument from inadvertent use.

## Front of Oscilloscope



The **Front Panel (A)** houses acquisition controls. 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.

The capacitive **Touch Screen (B)** is also used for control, as well as display. See p.10.

The **Power/Standby button (C)** puts the oscilloscope into operational or "standby" mode, see p.12.

**Channels 1-4 (D)** are arranged in two rows of low- and high-bandwidth connectors, which vary by model. See p.13.

**Aux In (E)** can be used for external trigger or line input. **Aux Out (F)** emits a configurable pulse or continuous signal. In MAUI, go to **Utilities > Utilities Setup > Aux Output** to configure the Aux signal.

The **Fast Edge output (G)** emits a square wave with ~40 ps rising edge for deskewing channels.

Connect ground leads/wrist straps to the **Ground terminal (H)**.

The **Cal Out hook (I)** emits a signal that can be used to compensate passive probes. Go to **Utilities > Utilities Setup > Aux Output** to configure the Cal signal.

The **Mixed-Signal Input (J)** connects to the digital leadset.

**USB 3.2 Gen1x1 and USB-C Gen1x1 ports (K)** can be used to host peripherals or USB drives.

## Side of Oscilloscope



**Speaker and Mic (A)** connect to external audio devices.

**Ethernet Ports (B)** connect the oscilloscope to your LAN.

**USB 3.2 Gen2x1 Ports (C)** can host peripherals or be used for high-speed data transfer.

**HDMI and DisplayPort (D)** outputs connect to external monitors.

Use the **Built-in Handles (E)** to lift the instrument safely.

## Back of Oscilloscope



**Removable Hard Drive (F)**. See p.6.

Clamp the power cable to the **AC Power Inlet (G)**. See p.12.


**LBUS connector (H)** for mixed-signal device HDA125.

**10 MHz Ref In and Ref Out (I)** connectors.

**USBTCM (J)** over 3.1 Gen1 connector.

## Removing the Hard Drive

The oscilloscope features a removable solid state hard drive (SSD).

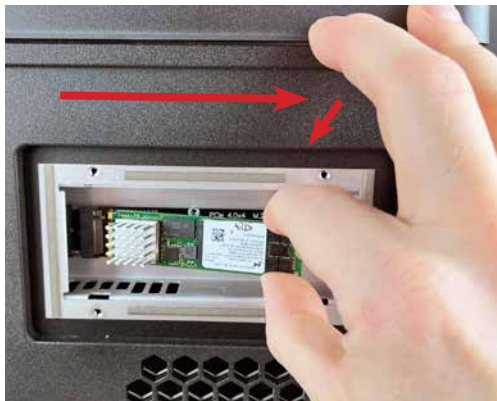
 **CAUTION:** The hard drive is **not** hot swappable. Power down the oscilloscope before removing the hard drive cover.

To remove the SSD:

1. Loosen the four outer screws and remove the cover.
2. Remove the inner retention screw from the drive.



3. Slide the SSD to the right then pull it out.



Reverse the steps to replace the drive.

## Connecting the HDA125

The HDA125 High-speed Digital Analyzer enables input of either 9- or 18-lines of high-speed digital data.

Following is the recommended sequence for connecting the HDA125 to the oscilloscope:

1. Close the oscilloscope application by choosing **File > Exit** from the menu bar. You do not need to power down.
2. Assemble and connect the HDA125 to the oscilloscope:
  - Connect the HDA125 leadset to the HDA125 unit.
  - Connect the LBUS cable from the back of the HDA125 to the front of the oscilloscope. Be sure the head is turned so that the wedge fits into the groove at the top of the connector. Fasten the thumb screws.
  - Connect the USB 3.0 cable into USB 3.0 ports on both instruments.
3. Connect the power cable to the HDA125 DC IN and plug it into a grounded outlet.
4. Power up the HDA125.
5. Relaunch the oscilloscope application by double-clicking the **Start DSO** desktop icon.

See the *HDA125 User Manual* for detailed instructions.

## Connecting the MSO Digital Leadset

Delivered with the Mixed Signal Oscilloscope option, the **digital leadset** inputs up-to-16 lines of digital data.

**Note:** The MSO digital leadset and the HDA125 cannot be used concurrently. The HDA125 will be the prioritized digital input.

The leadset features two digital banks with separate threshold and hysteresis controls, making it possible to simultaneously view data from different logic families. Lines from either bank can be organized into two logical groups and renamed appropriately.



Each flying lead has a signal and a ground connection. Ground extenders are available for different probing needs.

**Note:** To achieve optimal signal integrity, connect the ground at the tip of each flying lead used in measurements.

To connect the leadset, push the connector into the oscilloscope's **mixed-signal interface** until you hear a click.

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

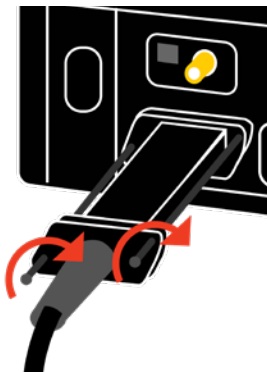


## Connecting Probes

Most low-bandwidth probes can be attached simply by pressing the connector box onto the top-row ProBus inputs. Use care when connecting Differential High-bandwidth (DH Series) Probes to the oscilloscope ProLink or ProAxial inputs.

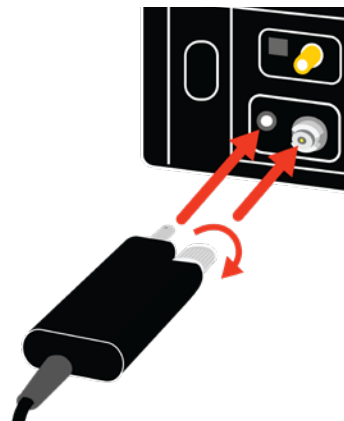
### DHxx-PL

1. Align the probe connector box squarely with the ProLink input and push in until you hear a click.
2. Finger-tighten the thumb screws to secure. **Do not overtighten!**



### DHxx-PX

1. If present, remove the Planar-Crown®-to-2.92mm adapter from the ProAxial input.
2. Insert the probe power connector (left side) into the oscilloscope input. Be sure the keying grooves on the connector and receptacle align.
3. Hold the connector box square to the oscilloscope input as you start to tighten the RF connector screw (right side) to ensure proper alignment of the thread.
4. Keeping the connector box square to the oscilloscope, finger-tighten the Planar Crown connector screw.





## Connecting to Other External Devices/Systems

### 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 video interfaces support Ultra HD monitors. Connect the monitor to any port on the back of the instrument. You can use an adapter if the cable has a different interface. Choose **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.

### Printer

WaveMaster 8000HD supports USB printers that are compatible with the Windows OS installed on the oscilloscope. Connect the printer to any USB port, then go to **File > Print Setup > Print** and select **Printer** to configure settings. Choose **Properties** to open the Windows print dialog.

### LAN

WaveMaster 8000HD is preset to accept a DHCP 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 oscilloscope 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 use VICP (TCP/IP) to connect the oscilloscope directly to a controller.

**Note:** To use LXI on Windows 10 oscilloscopes, switch to the Administrative User LCRYADMIN (p.23).

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

### Auxiliary Device

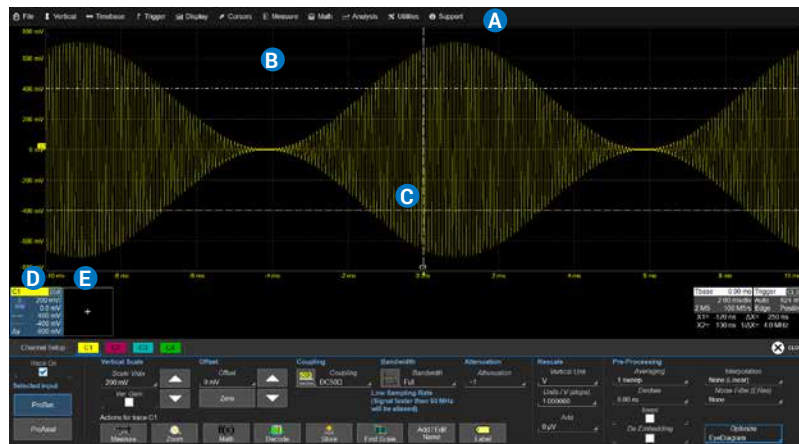
The oscilloscope can output a pulse upon a trigger event or Pass/Fail outcome, a direct current, or a square wave of custom amplitude and frequency. Connect a BNC cable from Aux Out on the front of the instrument to the other device. Go to **Utilities > Utilities Setup > Aux Output** to configure the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

### Reference Clock

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

## Touch Screen Display Features

The entire oscilloscope display is an active, capacitive touch screen. You can use a pointing device, touch or alternate between the two to operate it. Upon start up, the instrument loads the MAUI oscilloscope application.



### Grid Indicators



Zero Level



Last Trigger Level



Next Trigger Level



Trigger Time



Pre/Post-Trigger Delay – appears at corner of grid when trigger point is shifted off grid due to Delay time.

At the top is drop-down **menu bar** (A) of actions.



If an action can be undone (e.g., recall LabNotebook), **Undo** reverses it and restores the previous display.

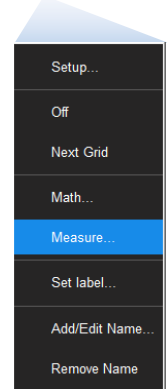
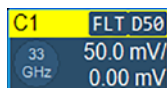
The eight vertical divisions of the **grid** (B) represent the entire 4096 vertical levels. The 10 horizontal divisions represent one acquisition of the full timebase. Numbers at the edge of the graticule show the values represented by each division.

Indicators around each grid show trigger times/levels relative to the traces displayed. Dragging Trigger Time or Trigger Level indicators changes Delay or Level for the next acquisition.

The grid can be divided into different multi-grid modes where each grid represents the full number of vertical levels and timebase. The default Auto Grid mode automatically adds a new grid (up to 20) each time a new trace is turned on.

To change grid mode, grid/trace intensity (brightness) or trace style, choose **Display > Display Setup** from the menu bar and make your selections on the Display dialog.

On the grid, various **cursors** (C) and **markers** intersect the trace to show measurement points. Vertical cursor readouts appear on trace descriptors; horizontal cursor readouts appear below the timebase and trigger descriptors.



Below the grids are **descriptor boxes** (D) for each open waveform trace ( $C_n$ ,  $F_n$ ,  $M_n$ ,  $Z_n$ , etc.) or graph, plus the trigger and timebase. Besides summarizing the current settings, selecting a descriptor box activates the trace and opens the corresponding setup dialog. You can also move traces/graphs by dragging their descriptor boxes to the desired grid.

No matter how many traces are turned on, only one trace at a time is **active**. When the descriptor box appears highlighted in blue, that trace is active, and all front panel controls and touch screen actions apply to that trace. The active trace is brought to the foreground of its grid, and grid labels and indicators refer to that trace. They will assume the trace color.

Right-click (touch-and-hold) on a descriptor box to open a **context menu** of actions you can apply to that trace, such as adding a measurement or label.

The **Add New box** (E) sits next to the trace descriptor boxes. Select it to turn on new traces or add new measurements.

Dialogs (F) appear at the bottom of the display for entering setup data. Different tabs hold related settings. Right-hand subdialogs (G) hold settings that apply only to the object on the left-hand dialog.

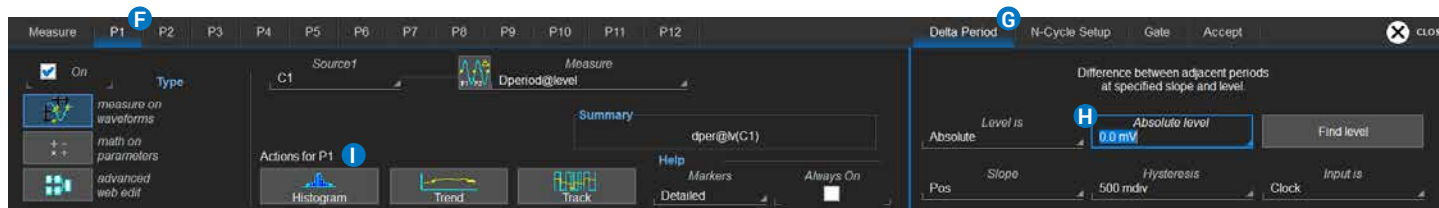


*The Virtual Keypad works like a calculator. When you select OK, the resulting value is entered in the field.*

When an **entry field** (H) is highlighted in blue, it is **active**. Numeric values can be modified by turning the Front Panel knobs. Many fields that don't have a dedicated knob can be modified using the Front Panel **Adjust knobs**.

Some entries are made by selecting from pop-up menus. Other entries can be made by typing, or you can touch twice and "type" the entry on the **virtual keypad/keyboard**.

An **Action Toolbar** (I) at the bottom of some dialogs lets you initiate frequent actions without having to navigate away from the underlying dialog. These actions always apply to the named trace.



*All right-hand subdialogs apply to the left-hand object. The Delta Period subdialog configures parameter P1. Other parameters may host different measurements.*

## Powering On/Off

Always secure the power cord with the clamp. Loosen the Philips head screw, insert the power cord receptacle completely into the AC inlet, then secure the clamp over the cord.



**WARNING.** To avoid a fire hazard, the power cord must be fully inserted and secured tightly to the clamp.



After securing the cord to the oscilloscope, connect it to a grounded AC power outlet. Press the **Power/ Standby Button** on the front to turn on the instrument. The button will light to show the oscilloscope is operational.



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

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



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

The Power button does not disconnect the oscilloscope from the AC power supply, but puts it into "Standby" mode. Some "housekeeping" circuitry continues to draw power. Only the power cord disconnects the product from the power source. We recommend unplugging the instrument if it will remain unused for a long period of time.



**CAUTION.** Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection.



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

## Setting Up Acquisition

This section provides an overview of the steps required to get a signal on the screen. All the acquisition settings, grid indicators and descriptor box symbols are explained in detail in the *Operator's Manual*.

### Auto Setup

The simplest way to configure a new acquisition of analog signals is to press the Front Panel **Auto Setup button** or choose **Timebase > Auto Setup** from the menu bar.

Auto Setup looks at each input channel to see where there is a live signal connected, then starts a RealTime acquisition using:

- 50% Edge trigger on the first, non-zero-level amplitude channel
- Horizontal Scale (Time/div) set so that waveforms are visible for at least 10 cycles over 10 horizontal divisions
- Vertical Scale (Volts/div) and Offset set so that waveforms occupy at least six vertical divisions (~75%) of the grid

The trigger Level and Delay (position), Vertical and Horizontal Scale (/div), and Offset are then easily adjusted using the Front Panel knobs.

However, you must perform the procedures that follow manually to:

- Use digital or mixed-signal input
- Use a vertical-axis unit other than volts
- Use a different trigger type or add trigger holdoff
- Change channel coupling or probe attenuation
- Add bandwidth filters or other types of signal pre-processing
- Use Sequence Mode (segmented) or other sampling
- Use an external reference clock signal

## Set Up Analog Channels

Channel settings control the units and scale of analog traces along the Y axis. Traces represent eight Vertical divisions of the source signal at the selected number of units/div. The zero level is at the center grid line unless you add positive or negative Offset.

To manually turn on and configure individual input channels:



Either push the **Front Panel Channel button**, or from the touch screen, select the **Add New box** and choose **Channel**. Touch the new **Channel descriptor box** to open the Channel (Cn) setup.

The individual Channel (Cn) setup dialogs are where you make your **Vertical Scale** (gain) and **Offset** settings, and enter general information about the channel such as **Coupling**, **Bandwidth** and probe **Attenuation**.

It is also where you can change vertical axis units, add pre-processing such as **Averaging**, **Interpolation** and **ERes**, **Invert** the trace, or enter **Deskew** time to correct for channel skew. All input settings are reflected on the Channel descriptor box. See the *Operator's Manual* for a list of processing codes.



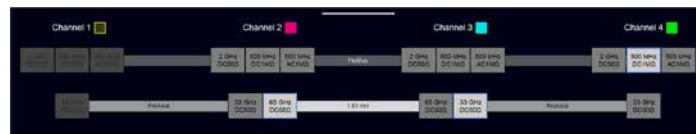
An especially important setting is the **Input** used for that channel, as this will determine the maximum available bandwidth and sample rate:

- ProLink or ProAxial are the outside four on the bottom row.
- DBI (1.85 mm) are the inside two on the bottom row.
- ProBus are the four left on the top row.

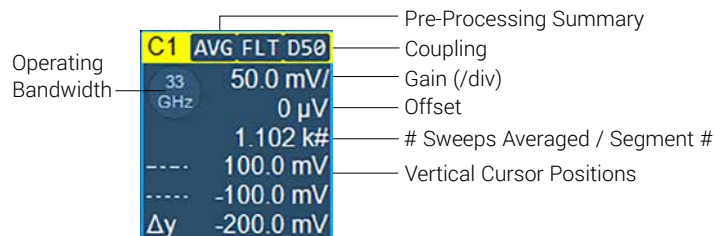
**Note:** For backward compatibility with remote control scripts, ProLink/ProAxial is Input A, DBI is Input B and ProBus is Input C, hence their order on the Channel dialog, which is the opposite of the oscilloscope.

Input selection can also be made on the Channel flyout menu:

1. Swipe up from the bottom of the screen or click the white bar.
2. Select the active inputs and coupling.
3. Select the checkboxes of the channels you wish to display.
4. Swipe down or click outside the menu to close it.



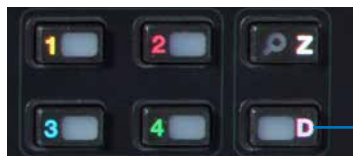
### Channel Descriptor Box



## Set Up Digital Inputs

On instruments equipped with the Mixed-Signal Option or the HDA125, digital groups are added to the Vertical menu, and the front panel Vertical knobs also control active Digital line and bus traces.

To turn on and configure digital inputs:



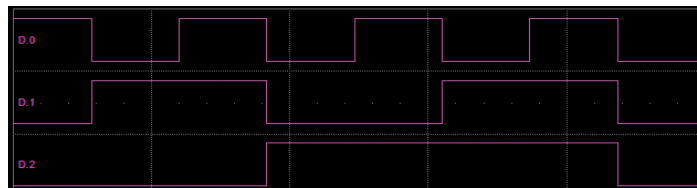
Push the **Front Panel D(igital)** button. This will also open the **Digital<sub>n</sub>** setup dialogs.

Each digital group (bus) is represented by a separate tab. Select the **Lines** from each lead bank that make up the group, choose a **Display Mode**, and set up the logic **Thresholds**.

Also use the Logic Setup dialog to **Invert** digital traces when needed.



## Digital Display Modes



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



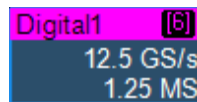
Bus trace collapses lines into hex values.



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

The digital group settings will appear on the Digital<sub>n</sub> descriptor box.

## Digital Descriptor Box



# Digital Lines in Group  
Digital Sample Rate  
Digital Memory

## Set Up Timebase

Horizontal settings control traces along the X axis. All inputs share the same trigger and timebase to ensure synchronization. One acquisition equals 10 divisions of the input signals for the selected Time/div, using the selected number of sample points (memory) taken at the selected sample rate.

Begin by selecting a **Sampling Mode** and entering the **Time/div**.

**Note:** Some trigger types and decoders only support RealTime sampling.

If you choose to use Sequence Mode (segmented) sampling, also enter the number and size of segments to capture on the **Sequence dialog**.

You can choose to **Set Maximum Memory** to use a fixed number of sample points or enter a **Fixed Sample Rate**.

**Note:** Only Fixed Sample Rate can be used for DBI acquisitions.

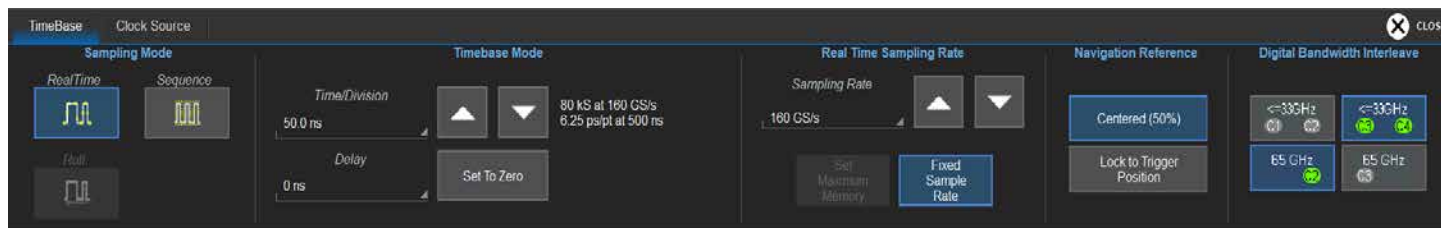
Finally, if desired, choose a reference **Clock Source** other than the oscilloscope's internal 10 MHz clock. The clock signal must be connected to the **Ref In** input.

### Timebase Descriptor Box

Sampling Mode	Timebase	0 ns	Trigger Delay
(blank in RealTime)		50.0 ns/div	Time/div
# Samples	40 kS	80 GS/s	Sample Rate

**Digital Bandwidth Interleave (DBI)** combines the acquisition capabilities of two channels into one, increasing bandwidth and sample rate. At the right of the Timebase dialog, choose high-bandwidth C2 to interleave C1 and C2, or high-bandwidth C3 to interleave C3 and C4. C1 and C4 are de-activated when DBI is enabled.

**Note:** Turning on DBI will automatically change the channel input selection to the 1.85 mm inputs. Be sure your sources are connected to the 1.85 mm inputs.

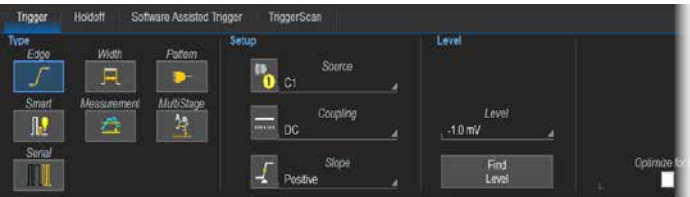
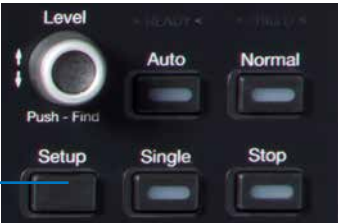


*Timebase dialog configured for DBI, combining C1 and C2 into high-bandwidth C2B.*

Set Up 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 trigger **Holdoff** count of time or number of trigger events.

Press the **Front Panel Setup** button or select the **Trigger descriptor box** to open the Trigger setup dialog.



Select a **Trigger Type**, then enter the trigger **Source** input and **Level**. You can press the **Front Panel Level knob** to set the trigger level to the mean of the trigger source signal.

Other settings, such as Coupling and Slope, will appear depending on the trigger type. Enter all the conditions that must be met by the trigger source signal to invoke a trigger.

When you're ready to acquire, use the Front Panel buttons or the Trigger drop-down menu to select a **Trigger Mode**:

**Auto** – triggers after preset period if there is no valid trigger event.

**Normal** – triggers repeatedly whenever all conditions are met.

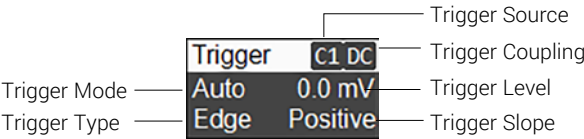
**Single** – triggers once when all conditions are met. The first press arms the trigger, the second press fires it on the next trigger event.

**Stop** – stops acquisition.

The trigger time is shown at the horizontal center of the grid, unless you add Delay to shift the acquisition window.

The trigger settings will appear on the Trigger descriptor box.

Trigger Descriptor Box





## Zoom

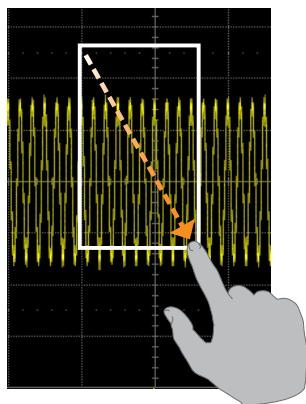
Zoom traces (Zn) display a magnified section of another trace, enabling you to examine your acquisitions in detail.



Press the **Front Panel Z(oom)** button to expand the center 1/10 of all open traces to the full acquisition window. The left knobs adjust zoom Horizontal Delay and Scale. The right knobs adjust zoom Vertical Offset and Scale. These knobs also control the position and scale of active Math function traces.



The **Action toolbar Zoom** button will expand the center 1/10 of the named trace to the full acquisition window.



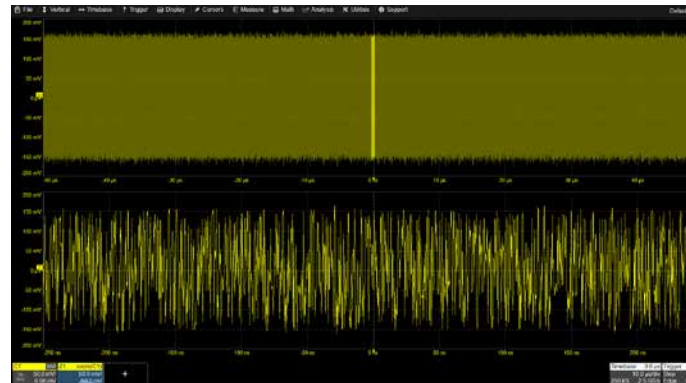
Using the touch screen, you can also **Rectangle Zoom** by drawing a box over a section of the source trace. That section will be scaled to the full acquisition window. Repeat on another section to reposition the Zoom.

Every time you zoom in this way, you create new zoom traces using the next available slot number, to the maximum 12.

**Note:** Pinch Zoom will modify the Horizontal Scale of the trace, rather than create a new zoom. When you Pinch Zoom a channel, you're changing the timebase for the next acquisition

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

Touch the zoom descriptor box to open the Zoom dialogs and refine the zoom scale and position. There, you can also add several zooms to a **Multi-zoom group** so they will track and rescale together.



C1	D50	Z1	zoom(C1)
16 GHz	50.0 mV/	50.0 mV/	50.0 ns/
	0.00 mV		

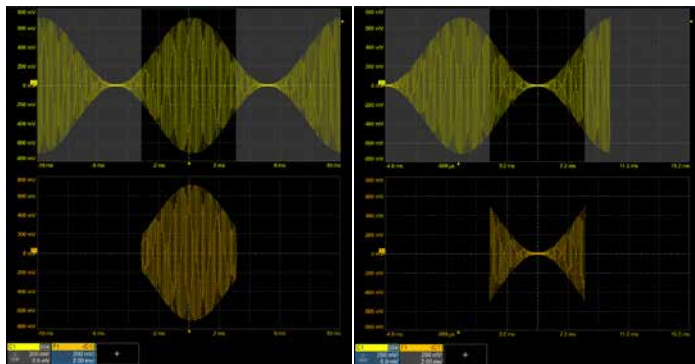
The **Zoom descriptor box** shows the **Zoom Source** and **Horizontal Scale**, which differs from the Timebase.

## Navigating Long Acquisitions

For acquisitions >500 Mpts, measurements and math calculations take place on only the center 500 Mpts—the "Analysis Zone". This area is marked on the source trace by grey shading applied outside of it (over the part not analyzed). You may need to reposition the trace so the desired region falls within the Analysis Zone. You can also shorten processing time by moving only the most significant part of the acquisition into the Analysis Zone.

## Navigating with Horizontal Delay

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

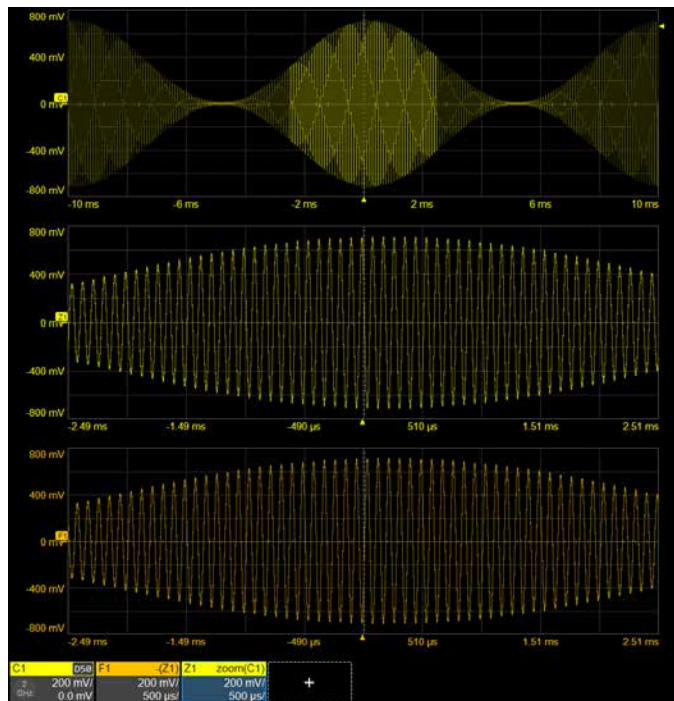


*Truncated math trace reveals extent of Analysis Zone.*

*Math trace now shows how Delay shifts Analysis Zone.*

## Navigating with Zoom

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

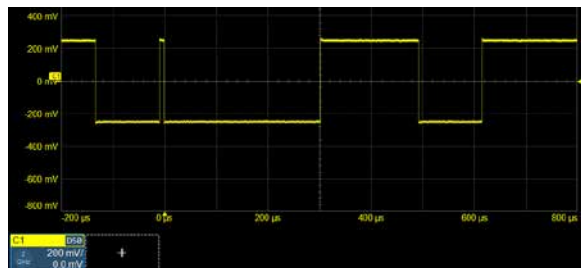


*Math applied to a zoom is calculated on the entire trace (up to 500 Mpts). Highlighting on the source trace shows the zoomed area being analyzed. This method has the advantage of preserving the original timebase.*

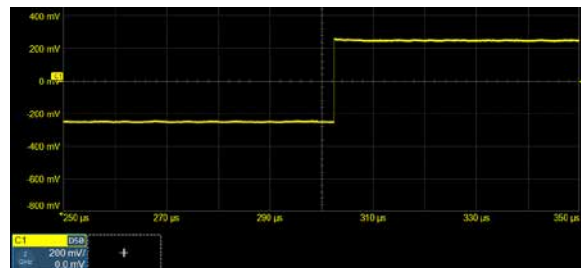
## Navigation Reference

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

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

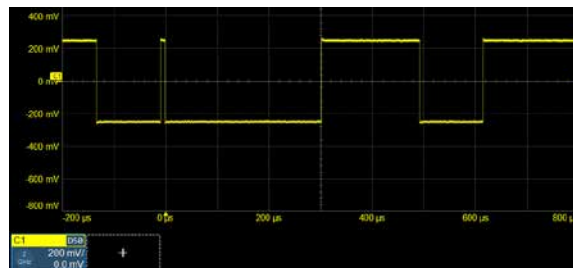


100  $\mu$ s/div Timebase with Navigation Reference set to Centered (50%).

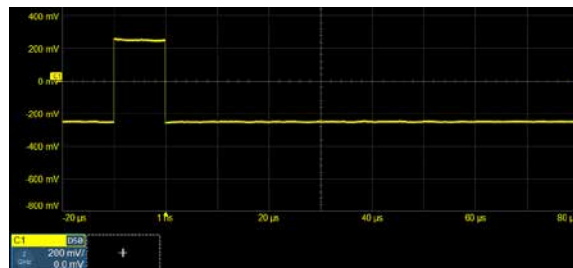


Timebase changed to 10  $\mu$ s/div. The trigger event has shifted off the grid to the left as time "expands," but the center of trace stays in place.

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



100  $\mu$ s/div Timebase with Navigation Reference set to Lock to Trigger.



Now, when Timebase is changed to 10  $\mu$ s/div, the trigger remains in place, but the rest of the trace shifts to the right as time "expands."

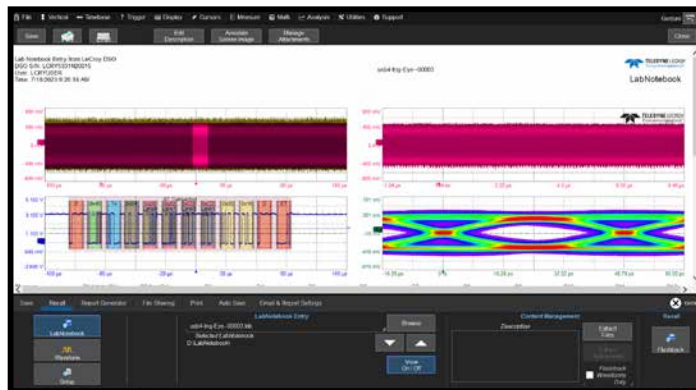
## Saving and Sharing Data

Use the oscilloscope **File menu** options to save and recall data. See the *WaveMaster 8000HD 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 **Save or User button** (when configured for LabNotebook). **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, the **All Displayed** command saves each to separate, autonamed files.

### Screen Captures



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

You can also choose **File > Save Screen Image** from the menu bar.

### File Sharing

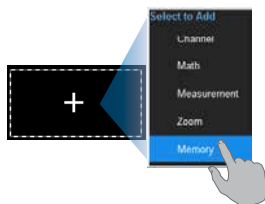
If the oscilloscope is networked, LabNotebooks, reports and other user data files can be emailed directly from the instrument or saved to accessible network devices.

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

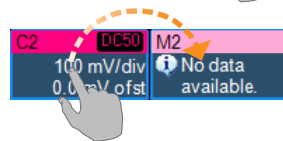
## Memories (Reference Waveforms)

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-twelve internal memories (M1-M12). After that, new memories will overwrite previously stored data.

To store a new memory:

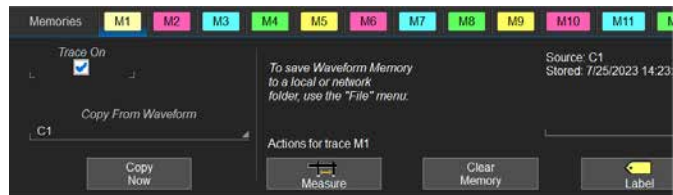


Touch the **Add New** box and choose **Memory** to turn on the next memory trace.



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

OR

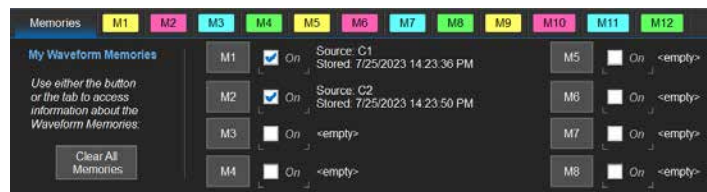


Choose **Math > Memory Setup**. On the  $M_n$  tab, select the trace you want stored in **Copy From Waveform**, then touch **Copy Now**.

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

To recall a stored memory:

Choose **Math > Memory Setup** to open the Memories dialog, then check the On box next to the desired memory.



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.

## 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 the oscilloscope thoroughly before using. Do not submerge the instrument or allow moisture to penetrate it.



**CAUTION.** Do not attempt to clean internal parts.

## Activating Software Options

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

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

## Calibration

The WaveMaster 8000HD is calibrated at the factory at 23 °C ( $\pm 2$  °C) prior to shipment. So that it maintains specified performance, it is factory set to perform an automatic calibration routine upon power up.

Warm the oscilloscope for at least 35-40 min. after power on to ensure it reaches a stable operating temperature and completes the calibration routine. You will see a warning message on the Calibration dialog when the oscilloscope is still in the warm-up phase. Specifications are not guaranteed during warm up.

After warm up, within  $\sim 20$ -35 °C ambient temperature, the instrument will use cached calibrations to meet all specifications, avoiding dynamic calibration to minimize disruptions.

If the internal temperature goes outside this range, the instrument will dynamically recalibrate. If the temperature varies by  $\pm 3$  °C of the last calibration temperature, the instrument will dynamically recalibrate again.

It is possible to manually recalibrate the oscilloscope for maximum accuracy. We recommend manual calibration if using the oscilloscope in an environment more than  $\pm 3$  °C from the last known calibration temperature, or if it has been over six months since the last calibration.



**CAUTION.** Remove all inputs before manually calibrating the oscilloscope.

From the menu bar, choose **Utilities > Calibration**. The Calibration dialog will tell you if calibration is needed. There are two routines for selection:

**Calibrate All** calibrates all possible combinations of vertical and horizontal settings at the current environmental conditions. We recommend Calibrate All every six months. This calibration is valid for all possible settings at the current temperature  $\pm 3$  °C and may take over an hour to complete. Calibrate All will remove any calibration over six months old, except for the original, factory calibration.

**Calibrate Current Setting** calibrates the current vertical and horizontal settings at the current environmental conditions. This calibration is valid *for these settings only* at the current temperature  $\pm 3$  °C and takes about 10 seconds to complete.

The Calibration dialog will inform you when calibration is complete and valid.

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

## Firmware Updates

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



**CAUTION.** Do not install any MAUI (XStreamDSO) version prior to 8.6.1.0 on Windows 10 oscilloscopes. Doing so will disrupt the normal behavior of the software, unless you run the recovery procedure.

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 XStream Setup wizard.
6. If prompted, enter the password **SCOPEADMIN**, all uppercase.
7. Follow the wizard prompts.
8. When installation is complete, power cycle the instrument.





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

## Switching Windows Users

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

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

To switch to the LCRYADMIN account:

1. Exit the 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 administrative password **SCOPEADMIN** (all uppercase).
5. Double-click the **StartDSO icon** on the oscilloscope desktop.

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

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

**Note:** As long as there are any Standard (non-administrative) users, the oscilloscope will reboot into the last active Standard user, regardless of whether you've 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 WaveMaster 8000HD cannot be serviced on location, contact your service center for a **Return Material Authorization (RMA)** code and instructions where to ship the product. All products returned to the factory must have an RMA.

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

Follow these steps for a smooth product return.

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

## Service Plans

Extended warranty, calibration, and upgrade plans are available for purchase. Contact your Teledyne LeCroy sales representative or [customersupport@teledynelecroy.com](mailto: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](https://teledynelecroy.com/support/contact)

Teledyne LeCroy  
700 Chestnut Ridge Road  
Chestnut Ridge, NY, 10977, USA  
[teledynelecroy.com](https://teledynelecroy.com)

### Sales and Service:

Ph: 800-553-2769 / 845-425-2000  
FAX: 845-578-5985  
[contact.corp@teledynelecroy.com](mailto:contact.corp@teledynelecroy.com)

### Support:

Ph: 800-553-2769  
[customersupport@teledynelecroy.com](mailto:customersupport@teledynelecroy.com)



## Support

### Online Documentation

Context-sensitive Help is available by choosing **Support > Dynamic Help** from the oscilloscope application menu bar. You can also choose **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](http://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 *WaveMaster 8000HD Oscilloscopes Operator's Manual* can be downloaded from the Technical Library under **Manuals > Oscilloscopes**. This PDF contains more extensive operating procedures than are 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](http://teledynelecroy.com/support/contact).

You can also submit Technical Support requests via the website at [teledynelecroy.com/support/techhelp](http://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 <sup>1, 2, 3</sup>

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

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

<sup>3</sup> 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 [teledynelecroy.com/recycle](http://teledynelecroy.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](http://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/](http://teledynelecroy.com/patents/)



**TELEDYNE LECROY**  
Everywhereyoulook™

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

## **WaveMaster 8000HD Oscilloscopes**

### **Getting Started Guide**

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935724-00 Rev A  
wavemaster-8000hd-gsg-eng\_05sep23.pdf  
September, 2023