



HDO9000

High Definition Oscilloscopes

Getting Started Guide



HDO9000-MS High Definition Mixed Signal Oscilloscope 40 GS/s



Measure	P1 feat(C1)	P2 feat(C1)	P3 feat(C1)	P4 range(UHfHz)	P5 pkpk(F3)	P6 height(Evol)	P7 max(F6)	P8 ...
width	4.5360 MHz	-712 ps	50.847 %	23.68 ps	> 0.00 kHz	635 mV	8.3 dBm	
mean	4.9884 MHz	-13 fs	49.9571 %	23.68 ps	> 0.37 kHz	635 mV	9.3836 dBm	
min	4.9055 MHz	-1.720 ns	49.578 %	23.68 ps	> 0.00 kHz	635 mV	8.3 dBm	
max	5.0957 MHz	1.781 ns	50.422 %	23.68 ps	> 27.84 kHz	635 mV	9.7 dBm	
sdw	42.85 MHz	398.3 ps	102.9 m%		> 13.81 kHz		-2.9952 dBm	
sum	28.961e+3	28.935e+3	28.961e+3	1	29	1	29	
minv								

Ch	1	2	3	4	5	6	7	8
1	100 mV/div	10.0 MHz	20.0 ps/div	20.0 MHz	1.00 nV/div	10.0 MHz	20.0 ps/div	2.5752 MHz
2	100 mV/div	10.0 MHz	20.0 ps/div	20.0 MHz	1.00 nV/div	10.0 MHz	20.0 ps/div	2.5752 MHz

HD	10 Bits	2 MS	20.0 ps/div	Stop	0 mV
			10 GS/s	Edge	Positive



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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 so unique to our instruments. This Getting Started Guide is designed to cover important safety and installation information for your oscilloscope, along with some basic operating procedures so you're quickly working with waveforms.

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INTRODUCTION



**HD09000 High Definition
Oscilloscopes**

About the HDO9000 Oscilloscopes

HDO9000 high definition oscilloscopes leverage HD1024 technology to deliver 10 bits of resolution on up to 4 GHz of bandwidth. HD1024 technology ensures that optimal resolution is always provided under each measurement condition for exceptional signal fidelity. The integration of a large, bright 15.4" capacitive touch screen and the MAUI with OneTouch user interface results in an unsurpassed user experience. Equipped with a 40 GS/s sample rate and an extensive toolbox, the HDO9000 ensures uncompromised measurement performance when debugging in high definition.

HD1024

HD1024 high definition technology enables dynamic reconfiguration of the ADC to achieve 10 bits of vertical resolution. By automatically determining the best ADC configuration under each specific measurement condition, the HDO9000 always provides the optimal resolution. The 10-bit acquisition system leverages the unique HD1024 high definition technology and the low noise system architecture to provide superior signal fidelity up to 4 GHz, resulting in ENOB in excess of 7 bits.

MAUI with OneTouch

MAUI with OneTouch introduces a new paradigm for oscilloscope user experience. Dramatically reduce setup time with revolutionary drag-and-drop actions to copy and setup channels, math functions and measurement parameters without lifting a finger. Use common gestures like pinch, swipe and flick to intuitively interact with the oscilloscope. Quickly enable a new trace or parameter using the "Add New" button, and turn off any trace or parameter with a simple flick of the finger.

Mixed Signal Option

With embedded systems growing increasingly more complex, powerful mixed signal debug capabilities are an essential part of modern oscilloscopes. The 16 integrated digital channels and set of tools designed to view, measure and analyze analog and digital signals enable fast debugging of mixed signal designs. Flexible analog and digital cross-pattern triggering across all 24 channels provides the ability to quickly identify and isolate problems in an embedded system.

Comprehensive Analysis Tools

HDO9000 has the most comprehensive trigger, decode, math, measurement and application toolsets available. Use tracks, trends and histograms to enhance understanding of complex behaviors. Navigate waveforms in the frequency domain using spectrum analyzer type controls. WaveScan® Search and Find allows you to search a single acquisition using more than 20 different criteria. LabNotebook concisely documents and stores your results.

Serial Bus Trigger, Decode, Measure/Graph, Eye Diagrams

Isolate events using the serial bus trigger and view color-coded protocol information on top of analog or digital waveforms. Timing and bus measurements allow quick and easy characterization of a serial data system. Measurement data can be graphed to monitor system performance over time. Identify physical layer anomalies with eye diagram mask testing and mask failure locator.

Specifications

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

Key Specifications	
Bandwidth	1 GHz–4 GHz
Resolution	10-bit
Analog Channels	4
Sample Rate (4 Ch/2 Ch)	20 GS/s / 40 GS/s
Memory (4 Ch/2 Ch)	64 Mpts / 128 Mpts
Digital Channels	16
Digital Sample Rate	1.25 GS/s
Min. Detectable Pulse Width	2 ns
Max. Input Frequency	250 MHz

Materials List

Check that you have all the parts listed here. Contact Teledyne LeCroy immediately if any part is missing.

- 1 oscilloscope
- 4 passive probes
- 1 AC power cord (rated for country)
- 1 protective front cover
- 1 Getting Started Guide
- 1 Oscilloscope Security Certificate
- 1 Oscilloscope Registration Card
- 1 Calibration Document

HDO9000-MS models include:

- 1 digital leadset
- 5 flying ground leads
- 20 ground extenders
- 22 XL microgrippers

General Safety Information

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

Symbols

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



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



WARNING. Risk of electric shock.



Measurement ground connection.



Alternating Current.



On/Standby power.

Precautions

- **Use proper power cord.** Use only the power cord shipped with this instrument and certified for the country of use.
- **Maintain ground.** This product is grounded through the power cord grounding conductor. To avoid electric shock, connect only to a grounded mating outlet.
- **Connect and disconnect properly.** Do not connect/disconnect probes or test leads while they are connected to a voltage source.
- **Observe all terminal ratings.** Do not apply a voltage to any input (C1-C4, EXT, AUX, or D1-D15) that exceeds the maximum rating of that input. Refer to the front of the oscilloscope for maximum input ratings.
- **Use only within operational environment listed.** Do not use in wet or explosive atmospheres.
- **Use indoors only.**
- **Keep product surfaces clean and dry.**
- **Exercise care when lifting and carrying.** Always use the built-in carrying handle.
- **Do not block the cooling vents.** Leave a minimum six-inch gap between the instrument and the nearest object. Keep the underside clear of papers and other objects.
- **Do not remove the covers or inside parts.** Refer all maintenance to qualified service personnel.
- **Do not operate with suspected failures.** Inspect all parts regularly and do not use the product if any part is damaged. Cease operation immediately and sequester the instrument from inadvertent use.

Operational Environment

Temperature: 5° to 40° C

Humidity: Maximum relative humidity 90% for temperatures up to 31° C decreasing linearly to 50% relative humidity at 40° C

Altitudes: up to 3,000 m (at < 30° C)

Power and Grounding

The instrument operates from a single-phase, 100 to 240 Vrms ($\pm 10\%$) AC power source at 50/60 Hz ($\pm 5\%$) or a 100 to 120 Vrms ($\pm 10\%$) AC power source at 400 Hz ($\pm 5\%$). The instrument automatically adapts to the line voltage. Manual voltage selection is not required.

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



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

Maximum power consumption with all accessories installed (e.g., active probes, USB peripherals, digital leadset) is 500 W (500 VA)

Power consumption in Standby mode is 15 W.

Cleaning

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



CAUTION. Do not attempt to clean internal parts.

Calibration

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

HD09000 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.

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. Manuals, tutorials, application notes, white papers, and videos are available to help you get the most out of your Teledyne LeCroy products.

The *HDO9000 Oscilloscopes Operator's Manual* can be downloaded from teledynelecroy.com/support/techlib under Manuals > Oscilloscopes. This .PDF document contains more extensive procedures for operating your oscilloscope 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 at the number listed in this guide to make Technical Support requests by phone or email. You can also submit Technical Support requests via the website at teledynelecroy.com/support/techhelp.

SET UP



**HD09000 High Definition
Oscilloscopes**

The Front of Your Oscilloscope



- A** Capacitive Touch Screen Display
- B** Front Panel
- C** Power Button
- D** Channel Inputs
- E** EXT Input
- F** USB 2.0 Port
- G** Aux Output
- H** Mixed Signal Interface
- I** LBUS Port
- J** Ground and Calibration Output Terminals
- K** Tilting Feet

The **capacitive touch screen display** is the principal viewing and control center of the oscilloscope. See “Touch Screen Display” on p.16 for an overview of its components and capabilities.

The **front panel** houses buttons and knobs that control different oscilloscope settings. Operate the instrument using front panel hard controls, display soft controls, or the mix of both that is convenient for you. See “Front Panel” on p.26 for more information.

The **Power button** turns on the oscilloscope. See “Powering On/Off” for more information about shutting down.

Channels 1–4 are signal inputs to the oscilloscope; **Ext** is for inputting an external trigger or external sample clock.

Aux Out connector sends device trigger enabled, trigger out, or pass/fail output to another device.

The **LBUS port** may be used with the optional 8-Channel Sync to provide precise synchronization with other instruments, or the HDA125-xx-LBUS for high-speed digital analysis and triggering.

Ground and calibration output terminals are used to compensate passive probes. HDO9000 oscilloscopes are compatible with the included passive probes and all Teledyne LeCroy ProBus active probes that are rated for the oscilloscope’s bandwidth. Probe specifications and documentation are available at teledynelecro.com/probes.

Supplied with Mixed Signal (-MS) oscilloscopes, the digital leadset connects to the **mixed signal interface** to input of 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 ground flying 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.



The Side of Your Oscilloscope



- A** **USB 2.0 Ports** (2)
- B** **Ethernet Port** (1) for LAN connection or remote control
- C** **DisplayPort Ports** (2) for external monitor
- D** **USB 3.1 Ports** (4)
- E** **DVI Port** for external monitor
- F** **Audio In/Out:** Speaker, Mic, and Line-In for external audio devices
- G** **USBTMC Port** (1) for remote control

Connecting

After start up, configure the oscilloscope as described below to support physical connections to the oscilloscope inputs/outputs. See the *HDO9000 Oscilloscopes Operator's Manual* for detailed instructions.

LAN

HDO9000 accepts DHCP network addressing. Connect an Ethernet cable from the LAN port on the side panel to a network access device. Go to **Utilities > Utilities Setup > Remote** and select TCPIP to obtain a network connection and 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 **Utilities > Preference Setup > Email** to configure email settings.

Printer

HDO9000 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 **Utilities > Utilities Setup > Hardcopy** to configure printer settings.

Audio/USB Peripherals

Connect the device to the appropriate port. These connections are “plug-and-play”. Use the Windows control panel to make adjustments. Choose **File > Minimize** to go to the Windows desktop.

Remote Control

To use TCPIP or LXII, connect from the LAN port on the side panel to the controller. To use USB, connect from the USBTMC port. Go to **Utilities > Preference Setup > Remote** to configure remote control.

External Monitor

HDO9000 supports WQXGA monitors with up to 2560x1600 resolution. Connect the monitor cable to the DisplayPort output on the side of the instrument (you can use a converter if the cable has a different interface). Monitors using the DVI interface are also supported. Configure display settings using the Windows control panel. Be sure to configure the oscilloscope as the first monitor.

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 software 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.

External Sample Clock

To input an external sample clock, connect a BNC cable from EXT on the front of the instrument to the clock source device. Go to **Timebase > Horizontal Setup > Clock Source** to configure the clock.

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.

Auxiliary Output

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 signal.

The Back of Your Oscilloscope



- A Built-in Carrying Handle**
- B Ref In and Ref Out** connectors to input/output an external Reference Clock signal
- C AC Power Inlet** for the AC line cord
- D Kensington Lock**

Powering On/Off

Connect the line cord rated for your country to the AC power inlet on the back of the instrument, then plug it into a grounded AC power outlet. (see Power and Grounding on p.5).

Press the **Power button** on the front to switch on the instrument.



CAUTION. Do not change the instrument's Windows® Power Options from the default Never to System Standby or System Hibernate modes.



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

Use the **File > Shutdown** menu bar option to switch “off”. Pressing the Power button again will execute a shutdown, but we do not recommend doing this as it does not allow the Windows operating system to shut down properly, and memories and setup panels will not be saved.

The Power button and File > Shutdown do not disconnect the oscilloscope from the AC power supply; 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.



CAUTION. Do not place the instrument so that it is difficult to reach the power cord in case you need to quickly disconnect from AC power.

We recommend unplugging the instrument if it will remain unused for a long period of time.

Language Selection

To change the language that appears on the display, go to **Utilities > Preference Setup > Preferences** and make your **Language** selection. Restart the oscilloscope software after the language is selected.

If you wish to also change the language of the Windows operating system:

1. Choose File > Exit to close the oscilloscope application and show the Windows Desktop.
2. From the Windows task bar, choose Start > Control Panel > Clock, Language and Region.
3. Under Region and Language select Change Display Language.
4. Click the Install/Uninstall Languages button.
5. Select Install Language and Browse Computer or Network.
6. Click the Browse button, navigate to D:\Lang Packs\ and select the language you want to install. Follow the installer prompts.
7. After exiting the Control Panel, double-click the Start DSO icon on the desktop to restart the oscilloscope application.

Note: The available languages are: German, Spanish, French, Italian, and Japanese. Other language packs are available from Microsoft's website.

Software Activation

The oscilloscope operating software (firmware and standard applications) is active upon delivery.

To purchase a software 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 a license key:

1. Go to **Utilities > Utilities Setup > Options**.
2. Touch **Add Key**.
3. Enter the new **license key** and click **OK**.
4. Reboot the oscilloscope.

See Software Options on p.41 for information about the available options.

Firmware Updates

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

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



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

USER INTERFACE



**HD09000 High Definition
Oscilloscopes**

Touch Screen Display

The display uses capacitive touch panel technology, and the entire area is active. Use your finger to touch, drag-and-drop, swipe, pinch, and flick with the ease of a mobile device. 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 Area
- C** Trigger Level Indicator
- D** Trigger Time Indicator
- E** Cursor Markers
- F** Trace Descriptor Boxes
- G** Add New Box
- H** HD Descriptor Box
- I** Timebase and Trigger Descriptor Boxes
- J** Horizontal Cursor Readout
- K** 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 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 area** displays the waveform traces. It can be configured to show different grid styles.

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 input.

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

The **Add New box** sits next to the trace descriptor boxes. Use it to turn on new traces or the Measure table. See MAUI with OneTouch on p.21.

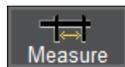
HD Descriptor box shows the ADC resolution at which the oscilloscope is operating.

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

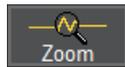
Dialogs appear at the bottom of the display for entering set up data. The top dialog will be the main entry point for the selected function. For convenience, related dialogs appear as a series of tabs behind the main dialog. Touch the tab to open the dialog.



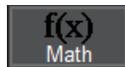
A **toolbar** along the bottom of the main Channel, Math, Memory and Digital dialogs applies common actions so that you don't have to leave the underlying dialog. They always apply to the active (highlighted) trace.



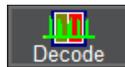
Apply up-to-8 measurement parameters.



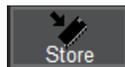
Display a zoom of the trace.



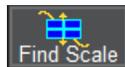
Apply a math function to the trace.



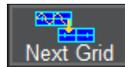
Open the Serial Decode dialog.



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



Scale the waveform to fit the grid.



Move the active trace to the next grid.



Apply a custom label to the trace.

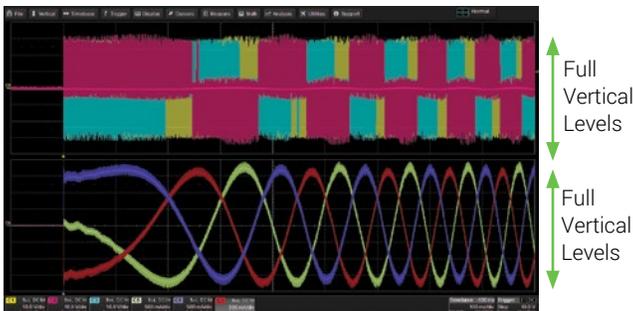
Changing the Display

The grid is 8 Vertical divisions representing the full number of 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.



By default, the oscilloscope has 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.

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

Extended Display

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



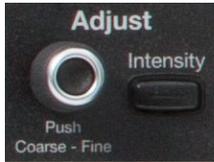
Oscilloscope with an extended display.

Line and Intensity

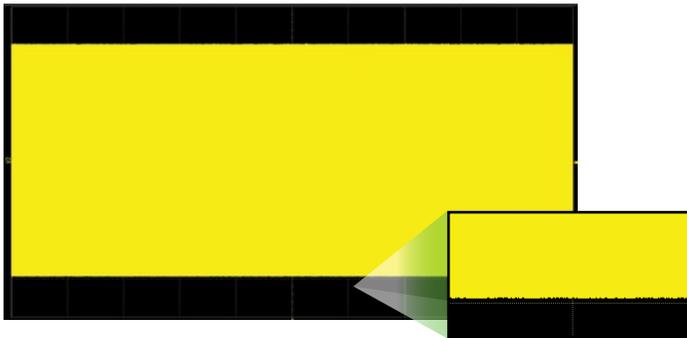
The trace style can be set to a series of separate sample **Points** or a continuous vector **Line**.

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

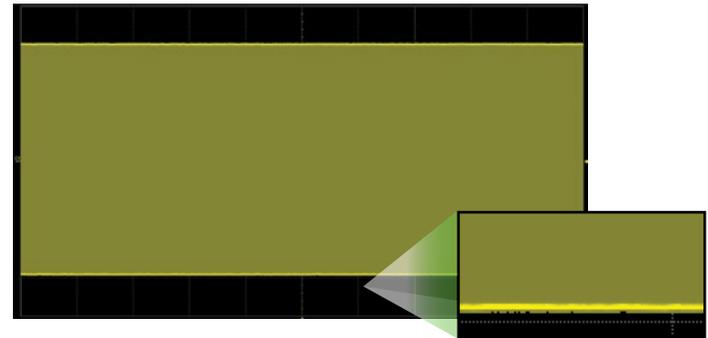
When more data is available than can actually be displayed, **Trace Intensity** helps to visualize significant events by applying an algorithm that dims less frequently occurring samples.



The front panel **Intensity button** sets the Adjust knob to control the trace intensity setting.



With Intensity 100%



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 on -MS models) 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	
	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. But 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.

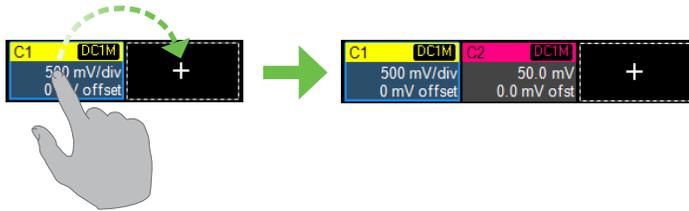
MAUI with OneTouch

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 (\emptyset) under your finger tip or cursor.

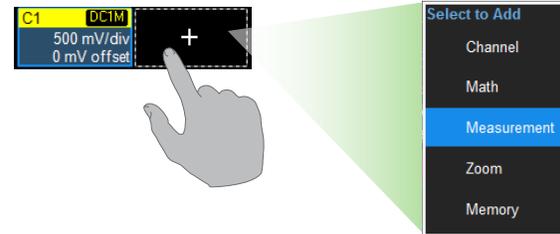
Turn On

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.



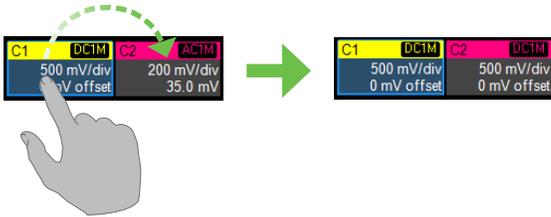
If there is no descriptor box of the desired type on the screen to drag, touch the Add New box and choose the trace type from the pop-up menu.

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



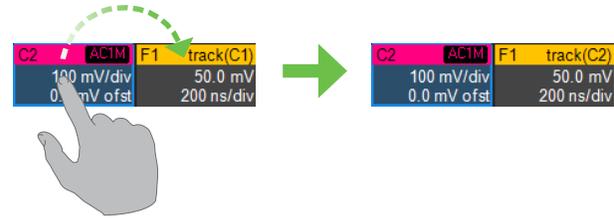
Copy Setup

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.

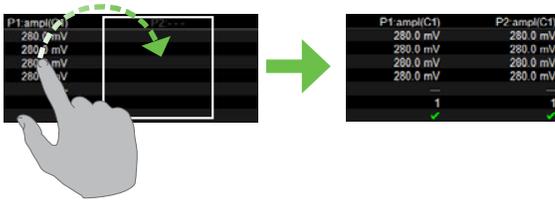


Change Source

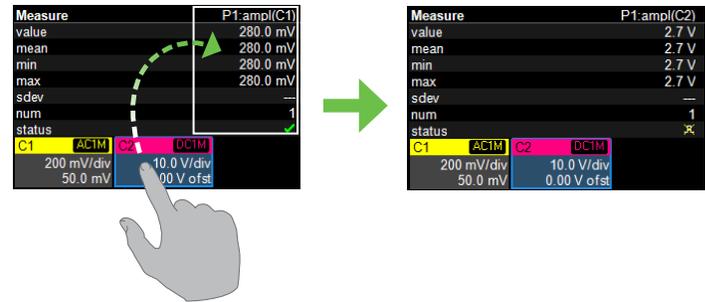
To change the source of a trace, drag-and-drop the descriptor box of the desired source onto the target descriptor box. You can also drop it on the Source field of the target setup dialog.



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

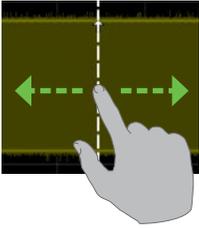


To change the source of a measurement, drag-and-drop the descriptor box of the desired source onto the parameter (Px) column of the Measure table. You can do the same to a qualifier (Qx) on the Pass/Fail readout table.

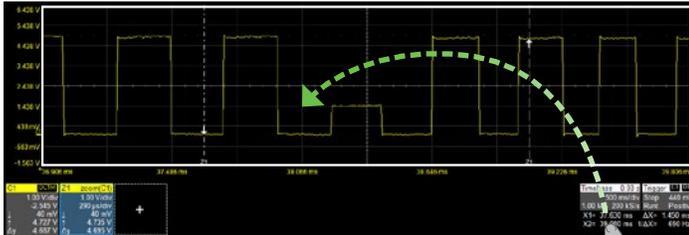


Position Cursors

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

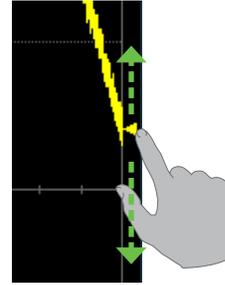


To place horizontal cursors on zooms or other calculated traces where the Horizontal Scale has forced cursors off the grid, drag the cursor readout from below the Timebase descriptor to the grid where you wish to place the cursors. The cursors are set at either the 5 (center) or 2.5 and 7.5 divisions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

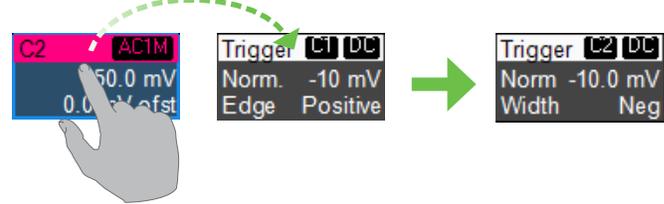


Change Trigger

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.

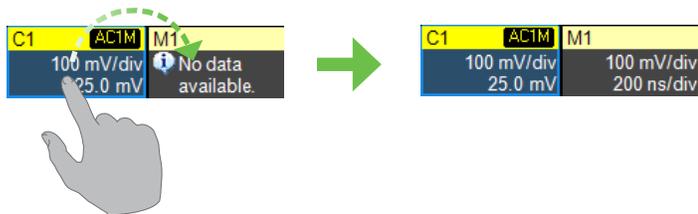


To change the trigger source channel, drag-and-drop the desired channel (Cx) descriptor box onto the Trigger descriptor box. The trigger will revert to the last trigger set on that channel.



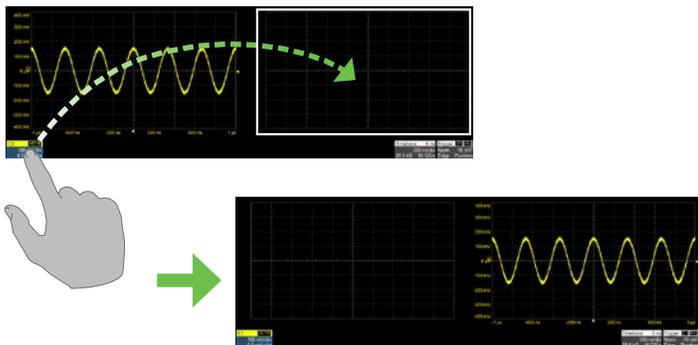
Store to Memory

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



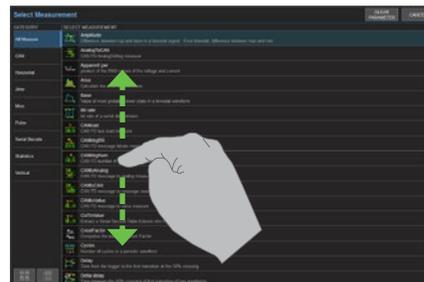
Move Trace

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



Scroll

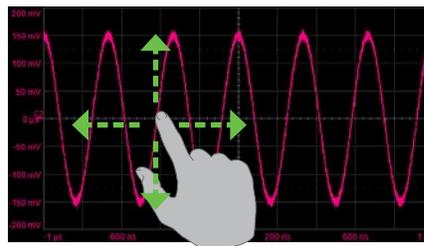
To scroll long lists of values or readout tables, swipe the selection dialog or table in an up or down direction.



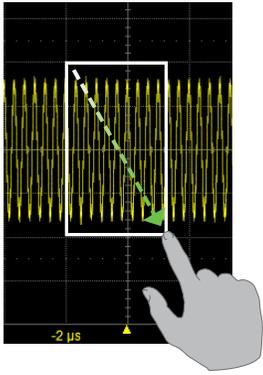
Pan

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

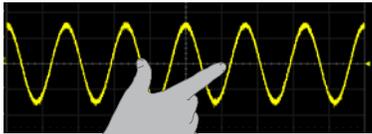
To pan at an accelerated rate, swipe the trace right/left or up/down.



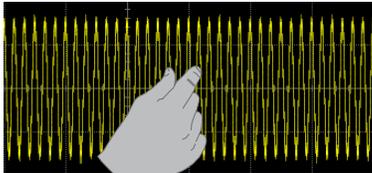
Zoom



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 Zx descriptor box to open the zoom factor controls and adjust the zoom exactly.



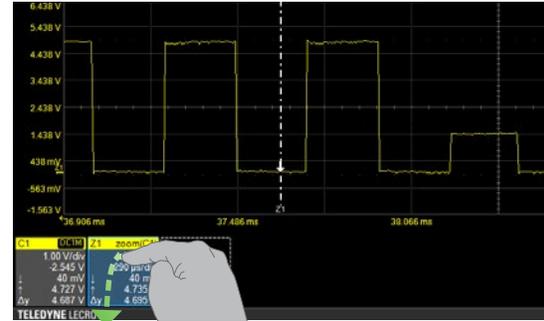
To "zoom in" on any trace, unpinch two fingers over the trace horizontally.



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

Turn Off

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



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

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

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 *HDO9000 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**, on the other hand, 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 Hardcopy 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 **HD** button enables/disables HD1024 operation.
- G** The front panel **Adjust** knob changes the value in a highlighted data entry field when turned. Pushing the Adjust knob toggles between coarse (large increment) or fine (small increment) 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.



BASICS



**HD09000 High Definition
Oscilloscopes**

Vertical

These controls adjust the channel trace along the Y axis.

From the Front Panel



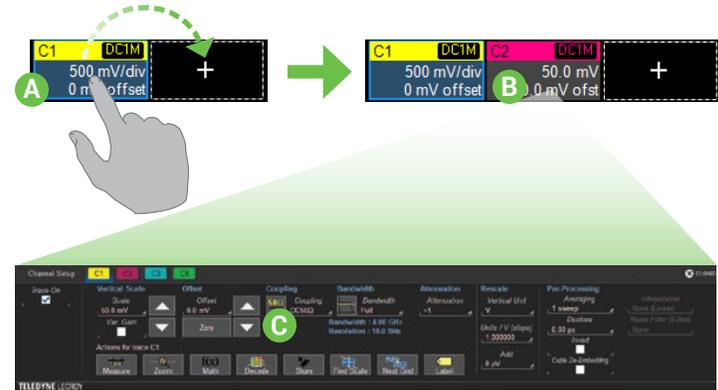
- A** Press to turn on/activate analog trace.
- B** Press to turn on/activate digital trace (-MS models only).
- C** Turn to raise or lower Offset (analog) or Vertical Position (digital). Push to return to zero.
- D** Turn to raise or lower Vertical Scale (analog) or Group Height (digital). Push to adjust with more precision.

Channel Descriptor Box

C1	AVG	AC1M	Pre-Processing Summary List (changes from default state)
	100 mV/div		Coupling
	25.00 mV		Gain Setting
	592 #		Offset Setting
----	175 mV		Averaging # Sweeps
-----	-225 mV		Vertical Cursor Positions
Δy	-400 mV		

Analog Traces From the Display

- A** Drag another channel descriptor to the Add New box, or touch the Add New box and choose Channel.

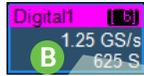


- B** Touch the new descriptor box to open the Cx setup dialog.
- C** Change Vertical settings.

OR

Drag and drop any other channel descriptor onto the new descriptor to copy the setup.

Digital Traces From the Display

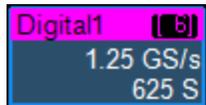


- A** Choose Vertical > Digital # Setup.
- B** Touch Digital descriptor to open the Digital dialog.

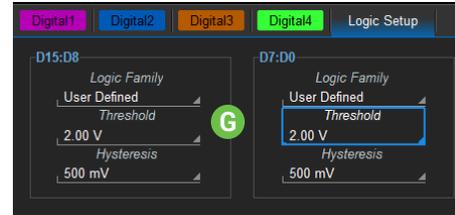


- C** Open tab to configure each active group (1-4).
- D** Touch checkboxes to select the lines in the group. Use arrows to switch between banks.
- E** Choose to display individual digital lines, bus trace or both.
- F** Modify display by setting Vertical Position (top of lowest bit relative to center) and Group Height (vertical space occupied by group) in divisions.

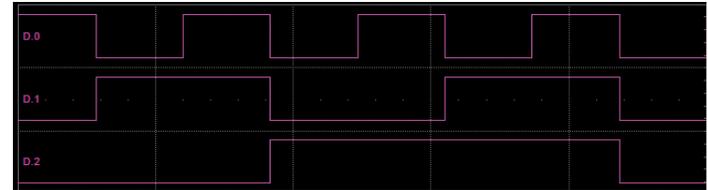
Digital Descriptor Box



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



- G** Choose a standard Logic Family, or enter custom values for Threshold and Hysteresis. Separate controls allow you to set different values for each bank.



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



Bus trace collapses lines into hex values.

Line Activity Indicators



High



Low



Transitioning

Horizontal (Timebase)

These controls adjust the trace along the X axis.

From the Front Panel



- A** Turn to increase or decrease trigger Delay. Push to return Delay to zero.
- B** Turn to raise or lower Horizontal Scale (Time/div). Push to adjust scale with more precision on math, memory, or zoom traces.

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 Display



- B** Turn HD1024 On/Off (it is "on" by default).
- C** Touch button to select a Sampling Mode.
- D** Enter Time/Division.
- E** Enter optional Delay time, or use the button to Set To Zero.
- F** Select number of Active Channels to increase/decrease available number of sample points and resolution.
- G** Use Clock Source dialog to change reference/sampling clock.

HD Mode

The HDO9000 with HD1024 high definition technology offers more quantization levels and greater precision when digitizing waveforms. HD1024 allows for dynamic ADC configuration based on the number of active channels and applies bandwidth filtering when the sample rate is reduced below 10 GS/s to prevent aliasing and increase resolution. When HD1024 is off, the oscilloscope operates in continuous 8-bit resolution.

A HD 10 Bits 20 kS

Timebase Mode: Time/Division 50.0 ns, 20 kS at 40 GS/s, 25 ps/pt for 500 ns, Delay 0 ns, Set To Zero

Real Time Sampling Rate: Sampling Rate 40.0 GS/s, Set Maximum Memory, Fixed Sample Rate

Active Channels: 4 9 Bits, 2 10 Bits (highlighted), Auto Maximize

C HD Summary

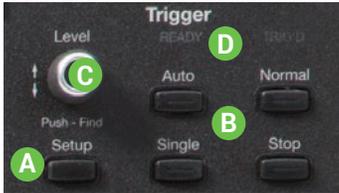
	Bandwidth	ADC configuration	Optimized Filtering	Resolution
C1	1.00 GHz	10 Bits	1.0 Bits	11.0 Bits
C2	4.00 GHz	10 Bits	-	10.0 Bits
C3	500 MHz	10 Bits	1.5 Bits	11.5 Bits
C4	4.00 GHz	10 Bits	-	10.0 Bits

- A** HD descriptor box shows bits of resolution due to the ADC configuration. It is hidden when HD Mode is Off.
- B** When HD Mode is On, Active Channels shows the ADC configuration options: 9-bit, 10-bit, or Maximize based on actual active channels. (When HD Mode is Off, it shows maximum sample rate per channel.)
- C** HD Summary dialog shows per channel:
 - Bandwidth due to combined manual bandwidth filters, anti-aliasing filters, and coupling setting
 - Bits resolution for which the ADC Configuration is optimized due to the Active Channels selection
 - Bits resolution gained due to all the Optimized Filtering of bandwidth
 - Total Resolution (the sum of ADC Configuration and Optimized Filtering)

Triggers

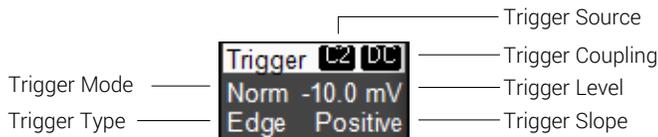
Triggers tell the oscilloscope when to perform an acquisition. Available trigger types are described at more length in the *HDO9000 Oscilloscopes Operator's Manual*.

From the Front Panel

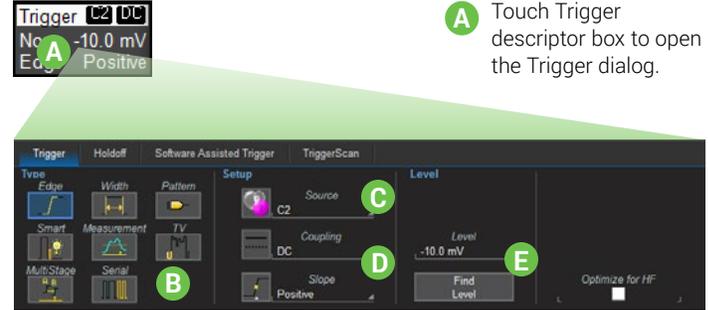


- A** Press to open the Trigger setup dialog.
- B** Press to control acquisition processing:
 Auto – trigger after a preset period if there is no valid trigger.
 Normal – trigger repeatedly whenever all conditions are met.
 Single – trigger once when all conditions are met.
 Stop – stop acquisition.
- C** Turn to raise or lower trigger voltage Level. Push to find a level.
- D** READY lights when trigger armed; TRIG'D lights when trigger fired.

Trigger Descriptor Box



From the Display



A Touch Trigger descriptor box to open the Trigger dialog.

- B** Touch to choose trigger Type.
- C** Touch to choose Source channel, or drag the channel descriptor box onto the Source field.
- D** Make any other settings required by the trigger type, such as Coupling and Slope.
- E** Touch to set Trigger Level (V) or let software automatically Find Level.

Trigger Indicators



Cursors

Cursors set measurement points on a trace. There are five preset cursor types, each with a unique appearance on the display: Horizontal (Time), Horizontal + Vertical, Vertical (Amplitude), Horizontal (Frequency), and Horizontal (Event). These are described in more detail in the *HDO9000 Oscilloscopes Operator's Manual*.

From the Front Panel



- A** Press to apply cursor. Continue pressing to cycle through all cursor types.
- B** Turn to adjust cursor position. Push to select different cursor markers to adjust.

From the Display



- A** Choose Cursor > Cursor Setup to open the Cursor dialog.
- B** Touch to choose Cursor Type.
- C** Touch-and-drag cursor markers to reposition cursor.
- D** Vertical Cursor readout appears on descriptor boxes.
- E** Horizontal Cursor readout appears below Timebase. Drag horizontal readout to zoom traces to place cursors on zoomed area.

Measurements & Statistics

Measurements are waveform parameters that can be expressed as numerical values, such as amplitude or frequency. You can set up to eight simultaneous measurements on one or more traces and view the active readout in a table. Statistical measurements 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.



- Touch the Add New box and choose Measure to turn on the Measure table.
- Readout of parameter values. Touch any cell to open Px setup dialog. Drag any Px cell to target Px cell to copy the parameter setup.
- Use Measure dialog to turn on/off measurements, statistics, histograms, and help markers.
- Use Px dialog to create/change custom measurement.
- Use Gate subdialog to set measurement gates, or drag gate markers from edge of grid.
- Touch Action buttons to plot Histogram, Trend, or Track of measurement.
- Drag trace descriptor to Px cell to change measurement source.

Math

Math traces display the result of applying a mathematical function (e.g., Average, FFT, Histogram) to one or more traces. One important distinction between math functions and measurement parameters is that the result of math is always another waveform trace, whereas the result of measurement is a number.



- A** To turn on the next math trace in the series, touch the Add New box and choose Math or just drag another math descriptor box to the Add New box.
- B** Math descriptor box shows math function and scaling. Touch it to open Function (Fx) setup dialog.
- C** Use Fx dialog to change function.
- D** Use Zoom subdialog to rescale math trace, or just pinch/unpinch directly over the trace.

Memories (Reference Waveforms)

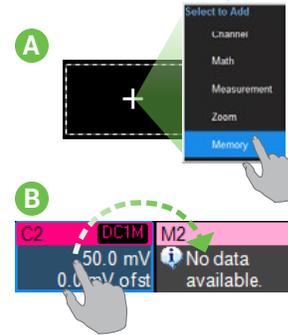
Memories are waveform traces stored for reference. They can be recalled to the display for comparison with other traces, or they can be zoomed and measured for better analysis of historical data. You can store up to four internal memories (M1-M4). After that, new memories will overwrite previously stored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

Internal memories only persist until the oscilloscope is rebooted. To store memories indefinitely, save them to an external file by choosing File > Save Waveform. The file can then be recalled into one of the four internal memories for viewing by choosing File > Recall Waveform. Only memory files saved with the extension .trc can be recalled.

- A** To recall a stored memory, press the front panel Mem(ory) button to open the Memories dialog, then check On next to M1-M4.



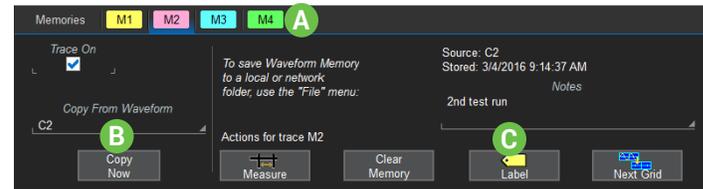
To store a new memory, either:



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

- B** Drag the descriptor box of the trace you want stored onto the Mx descriptor box.

OR



- A** Open the M1-M4 tab behind the Memories dialog.
- B** Select the trace you want stored in Copy From Waveform and touch Copy Now.
- C** Optionally add notes or labels to the stored waveform.

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.



- A** Choose scan Mode (event to find) and Source waveform to search.
- B** Refine scan settings.
- C** Select different views of the results: event table with/without time stamps, scan overlay, zoom trace, or all.
- D** Take action when an event is found, such as sending a pulse or sounding an alarm.
- E** Result table lists found events. Touch an event to zoom it on the grid.
- F** Color overlays mark the events on the source trace.

History Mode

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



- A** Choose to display Table with/without Relative Time stamps.
- B** Use the Auto Play buttons and the slider bar at the bottom of the dialog to "replay" the history. This is a useful way to find events of interest.
- C** When you find something of interest, Pause to freeze the display and select the Index row of the table to see the details.

Software Options

These are just some of the options available to enhance the performance of a HDO9000.

Q-Scape Multi-Tabbed Display (HDO9K-QSCAPE) architecture speeds your understanding of your design with 4x the display area. Configure each tab with the grid style you want. Quickly move waveforms to different tabs through drag-and-drop.

Advanced Customization Package (HDO9K-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 (HDO9K-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 (HDO9K-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 (HDO9K-EMC) offers specialized measurements to test a design's susceptibility to EM discharge.

Electric-Telecom Pulse Mask Test (HDO9K-ETPMT) performs automated compliance mask tests on a wide range of electrical telecom standards.

JITKIT (HDO9K-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 (HDO9K-EYEDRII) provides the channel emulation and de-embedding tools for the next generation of serial data standards. It seamlessly integrates into Teledyne LeCroy's SDA II and SDA III software for eye diagram and jitter analysis.

SDA II (HDO9K-SDAII) delivers integrated jitter and timing analysis for clock and data signals to help you characterize your design, prove compliance, and determine why a device or host fails compliance.

DDR Debug Toolkit (HDO9K-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, and DDR4 signal analysis.

Spectrum Analyzer (HDO9K-SPECTRUM) creates an RF Spectrum Analyzer-like environment for analyzing frequency-dependent effects. Use the FFT on the oscilloscope with little or no concern about the details of setting up an FFT.

Power Analysis Software (HDO9K-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 (HDO9K-SDM) adds eye pattern mask testing capability to the instrument.

Many **Serial Trigger & Decoder Options** provide added insight when debugging serial data. Options are offered as trigger and decode (D/TD); plus serial data measure/graph and eye diagram tests (DME/TDME); plus Symbolic decoding (DME/TDME Symbolic). Physical layer test packages (TDMP) are also available for some protocols. For the most up to date list, go to teledynelecroy.com/serialdata.

REFERENCE



**HD09000 High Definition
Oscilloscopes**

Service

Contact your local Teledyne LeCroy service center for calibration or other service.

Returning a Product

If the product cannot be serviced on location, the service center will give you a **Return Material Authorization (RMA)** code and instruct you 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 device. Do not include the manual.
2. Pack the product in its case, surrounded by the original packing material (or equivalent).
3. Label the case with a tag containing:
 - The RMA
 - Name and address of the owner
 - Product model and serial number
 - Description of failure or requisite service
4. Pack the product case in a cardboard shipping box with adequate padding to avoid damage in transit.
5. Mark the outside of the box with the shipping address given to you by Teledyne LeCroy; be sure to add the following:
 - ATTN: <RMA code assigned by Teledyne LeCroy>
 - FRAGILE

6. If returning a product to a different country:

- Mark the shipment as a **Return of US manufactured goods for warranty repair/recalibration.**
- If there is a cost for the service, list the cost in the Value column and the original purchase price **For insurance purposes** only.
- Be very specific about the reason for shipment. Duties may have to be paid on the value of the service.

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

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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

Certifications

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

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

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

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

Electromagnetic Emissions:

EN 55011:2010, Radiated and Conducted Emissions Group 1, Class A^{2 3}

EN 61000-3-2/A2:2009 Harmonic Current Emissions, Class A

EN 61000-3-3:2008 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

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

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

EN 61000-4-4/A1:2010 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines⁴

EN 61000-4-5:2006 Power Line Surge, 1 kV AC Mains, L-N, L-PE, N-PE⁴

EN 61000-4-6:2009 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz

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

- ¹ To ensure compliance with all applicable EMC standards, use high-quality shielded interface cables.
- ² Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.
- ³ This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.
- ⁴ Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.
- ⁵ Performance Criteria "C" applied for 70%/25 cycle voltage dips and for 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:*

Teledyne LeCroy Europe GmbH
Im Breitspiel 11c
D-69126 Heidelberg
Germany
Tel: + 49 6221 82700

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

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

AS/NZS CISPR 11:2011 Radiated and Conducted Emissions, Group 1, Class A.

Australia / New Zealand Contacts:*

RS Components Pty Ltd.	RS Components Ltd.
Suite 326 The Parade West	Units 30 & 31 Warehouse World
Kent Town, South Australia 5067	761 Great South Road
	Penrose, Auckland, New Zealand

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

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

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

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

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

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

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

U.S. NATIONALLY RECOGNIZED AGENCY CERTIFICATION

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

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

CANADIAN CERTIFICATION

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

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

Environmental Compliance

END-OF-LIFE HANDLING



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

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

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

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

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System.

Warranty

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

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

Teledyne LeCroy shall not be responsible for any defect, damage, or failure caused by any of the following: a) attempted repairs or installations by personnel other than Teledyne LeCroy representatives or b) improper connection to incompatible equipment, or c) for any damage or malfunction caused by the use of non-Teledyne LeCroy supplies. Furthermore, Teledyne LeCroy shall not be obligated to service a product that has been modified or integrated where the modification or integration

increases the task duration or difficulty of servicing the oscilloscope. Spare and replacement parts, and repairs, all have a 90-day warranty.

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

Intellectual Property

All patents pertaining to the HDO9000 can be found on our website at: teledynelecroy.com/patents/

Windows License Agreement

The HDO9000 Series oscilloscope software runs on the Windows operating system. Teledyne LeCroy's agreement with Microsoft prohibits users from installing third-party software on HDO9000 oscilloscopes that is not relevant to measuring, analyzing, or documenting waveforms.

