TELEDYNE LECROY
Everywhere**you**look™

HDO4000
High Definition Oscilloscopes
Getting Started Guide

HD 4096

TELEDYNE LECROY
Everywhere**you**look™

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HDO4000
High Definition 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.

Contents

INTRODUCTION

HD 4096

HDO4000 High Definition Oscilloscopes

About the HDO4000 Oscillosocopes

Combining Teledyne LeCroy's HD4096 high-definition technology with long memory, a compact form factor, 12.1" touch screen display and powerful debug tools, the HDO4000 Oscillosocopes are ideal for precise measurements and quick debug. Tools such as WaveScan® Search and Find, LabNotebook Report Generator and History Mode help identify, isolate, and document problems for faster troubleshooting.

HD4096

HD4096 high-definition technology consists of high sample rate 12-bit ADCs, high signal-to-noise input amplifiers, and a low-noise system architecture. This technology enables HDO™ oscilloscopes to capture and display signals up to 1 GHz with a high sample rate and 16 times more resolution than other oscilloscopes.

Waveforms captured and displayed on the HDO4000 with HD4096 technology are cleaner and crisper. Signal details often lost in the noise are clearly visible and easy to distinguish, and measurements can be performed with unmatched precision for improved debug and analysis.

Specifications

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

Key Specifications	
Bandwidth	200 MHz – 1 GHz
Channels	2 or 4
Sample Rate (all channels)	2.5 GS/s
Memory (per channel)	12.5 Mpts/ch
Maximum Memory	50 Mpts

WaveScan Search and Find

WaveScan® Search and Find allows you to search a single acquisition using more than 20 different criteria. Or, set up a scan condition and scan for an event over hours or even days.

History Mode

Never miss a waveform. History mode lets you scroll back in time to view previous waveforms and isolate anomalies. Use cursors and measurement parameters to quickly find the source of problems. History mode is always available with a single button press, no need to enable this mode.

LabNotebook Report Generator

Save and document all your waveforms, settings and screen images through the LabNotebook report generation tool. With LabNotebook, there's no need to navigate multiple menus to save all these files independently. Returning your oscilloscope to a past state is only one button press away thanks to LabNotebook's flashback feature.

Materials List

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

- One (1) oscilloscope
- Two (2) or four (4) passive probes (one for each channel)
- One (1) AC line (power) cord
- One (1) protective front cover
- One (1) Getting Started Guide
- One (1) Oscilloscope Security Certificate
- One (1) Oscilloscope Registration Card
- One (1) Calibration Document

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.

Safety (protective) ground connection.

Alternating Current.

On/Standby power.

CAT Installation (Overvoltage) Category rating (I or II) per EN 61010-2:030:2010 safety standard. See Certifications for details.

Precautions

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

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

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

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

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

- **Use indoors only.**

- **Keep product surfaces clean and dry.**

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

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

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

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 Ground Connections

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

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

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

Maximum power consumption with all accessories installed (e.g., active probes, USB peripherals) is 320 W (320 VA) for four-channel models and 275 W (275 VA) for two-channel models. Power consumption in standby mode is 4 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.

Support

Online Documentation

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 *HDO4000 Oscillosocopes Operator's Manual* can be downloaded from **teledynelecroy.com/hdo4000**. This .PDF document contains more extensive procedures for operating your oscilloscope than are found here. You can also download Oscilloscope System Recovery Tools and Procedures, which contains instructions for using Acronis® True Image® Home included with the oscilloscope.

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

HDO4000 High Definition Oscilloscopes

The Front of Your Oscilloscope

A Touch Screen Display

B Front Panel

C Built-in Stylus Holder

D USB Ports

E Ground and Calibration Output Terminals

F Channel Inputs

G Power Button

H Rotating / Tilting Feet

921445-00 Rev A

The **touch screen display** is the principal viewing and control center of the oscilloscope. See "Touch Screen Display" for an overview of its components.

The **front panel** houses buttons and knobs that control different oscilloscope settings. For the most part, you can operate the instrument using front panel hard controls, display soft controls, or a mix of both that is convenient for you.

All front panel knobs have multiple modes of operation: pressing them invokes one action and turning them another. The labels below the knob tell you what happens when you "Push" instead of turn.

The **built-in stylus holder** stores a stylus that can be used with the touch screen display.

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

Ground and calibration output terminals are used to compensate passive probes.

Channel inputs 1–4 (or 1–2 depending on model) are signal inputs to the oscilloscope; Ext is for connecting an external trigger device.

The **Power button** turns on/off the oscilloscope. See "Powering On/Off" for more information.

The **rotating, tilting feet** enable four different viewing positions.

The Side of Your Oscilloscope

A **Video Output** VGA, DVI, and HDMI ports for connecting external monitors

B **Ethernet Ports** (2) for connecting to networks

C **USB Ports** (4) for connecting external USB devices

D **Audio Input/Output** Speaker, Mic, and Line-In for connecting external audio devices

E **Feet rotated back**

F **Feet rotated front and tilted**

The Back of Your Oscilloscope

A   **Aux Out** connector to send device trigger enabled, trigger out, or pass/fail output to another device

B   **Ref In/Out** connector to input an external Reference Clock, or to output a Reference Clock to another instrument

C   **USBTMC Port** for remote control

D   **AC Power Inlet** for the AC line cord

E   **Built-in Carrying Handle**

Carrying

The oscilloscope's case contains a **built-in carrying handle**. Lift the handle away from the oscilloscope body, grasp firmly and lift the instrument.

Always unplug the instrument from the power source before lifting and carrying it.

Connecting

Make the desired cable connections. All except for the power connection are optional.

After start up, configure the connection on the oscilloscope using the menu options listed below. See the *HDO4000 Oscilloscopes Operator's Manual* for more detailed instructions.

Power
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 Ground Connections in "General Safety Information").

LAN
Connect a cable from either Ethernet port on the side panel to a network access device. On the oscilloscope, use the standard Windows Network dialog to configure the network connection. Go to **Utilities > Preference Setup > Email** to configure email settings.

USB Peripherals
Connect the device to a USB port on the front or side of the instrument. Go to **Utilities > Utilities Setup > Hardcopy** to configure printer settings.

External Monitor
Connect the monitor cable to a video output on the side of the instrument (VGA, DVI, and HDMI are all supported). Go to **Display > Display Setup > Open Monitor Control Panel** to configure the display settings.

External Controller
Connect a USB-A/B cable from the USBTMC port on the back of the instrument to the controller. Go to **Utilities > Preference Setup > Remote** to configure remote control.

Other Oscilloscope (for Reference Clock)
Connect a BNC cable from Ref In/Out on the back of the instrument to the other instrument. Go to **Timebase > Horizontal Setup > Reference Clock** to configure the clock.

Other Auxiliary Device
Connect a BNC cable from Aux Out on the back of the instrument to the other device. Go to **Utilities > Utilities Setup > Aux Output** to configure the connection.

Powering On/Off

The **Power button** controls the operational state of the oscilloscope. Press the button to switch on the instrument; press it again to switch "off" (i.e., Standby power).

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

Always use the Power button or the **File > Shutdown** menu option to execute a proper shut down process and preserve settings. Pressing and holding the button will execute a "hard" shutdown, the same as on a computer, but we do not recommend doing this because it does not allow the Windows operating system to shut down properly.

The Power button does 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 to use the Power button or the File > Shutdown command, then 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 disconnect from power.

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

Probes

HDO4000 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 **teledynelecroy.com/hdo4000**.

Software Activation

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

Software 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. Follow the instructions on the website to download and install the software.

Activating Demonstration Software

The oscilloscope is delivered with a 30-day-trial license of the available software option packages. To activate a package:

1. Go to Utililties > Utilities Setup > Options.

2. Select a key from the Installed Option Keys list.

3. Touch the Activate Demo Key button at the right of the screen.

This reminder will appear whenever you reboot the oscilloscope without activating demo keys.
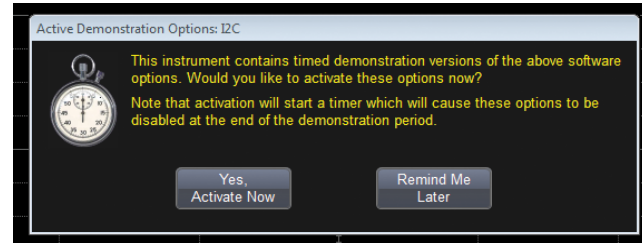
Purchasing Software Options

If after your trial has ended you decide to purchase an option, you'll receive another license key from Teledyne LeCroy. Refer to "Software Options" for more information.

USER INTERFACE

HDO4000 High Definition Oscilloscopes

Touch Screen Display

The entire display is a touch screen. Use your finger or the stylus to touch, double-touch, touch-and-drag, touch-and-hold (right click) and draw a selection box. Many controls that display information also work as "buttons" to access other functions. If you have a mouse installed, you can click anywhere you can touch to activate a control; in fact, you can alternate between clicking and touching, whichever is convenient for you.

A Menu Bar

B Grid Area

C Trigger Level Indicator

D Cursor

E Channel Descriptor Box

F Trigger Position Indicator

G Timebase and Trigger Descriptor Boxes

H Dialog Tabs

A **menu bar** of drop-down menus 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. You can adjust the brightness of the grid lines to make other objects more visible.

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

Cursors show where measurement points have been set. Touch-and-drag cursor indicators to quickly reposition the measurement point.

Channel (C1-C4), Zoom (Z1-Z4), Math (F1-F2), or Memory (M1-M4) **descriptor boxes** appear immediately below the grid and summarize current settings for each open trace. Touch the descriptor box to open the corresponding set up dialog.

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.

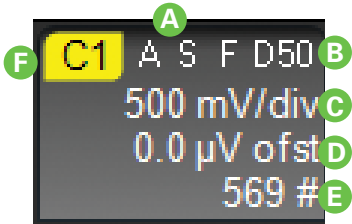For convenience, related dialogs appear as a series of tabs behind the main dialog. Touch the tab to open the dialog.
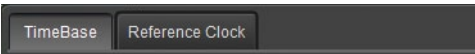
Timebase Descriptor Box

A Trigger Delay (Position)
B Time/div
C Sample Rate
D # Samples
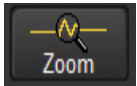E Sampling Mode
(blank when in real-time mode)

Channel Descriptor Box

A Pre-Processing Summary Listing (summarizes changes from default states)
B Coupling
C Gain Setting
D Offset Setting
E Averaging Sweeps Count
F Channel Abbreviation
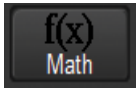
Toolbar Shortcuts

Toolbar shortcuts on the main Channel, Math, and Memory dialogs offer shortcuts to useful functions so that you don't have to leave the underlying dialog. They always apply to the active (highlighted) trace.
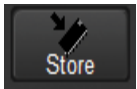
Measure	Apply up-to-eight measurement parameters.
Zoom	Display a zoom of the trace.
f(x) Math	Apply up-to-two dual operator math functions.
Store	Copy the active trace to an internal memory (e.g., C2 to M2).
Find Scale	Scale the waveform to fit the grid.
Label	Apply a custom label to a waveform.
Decode	Open decode software if an option is installed.
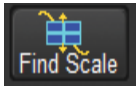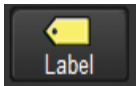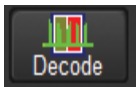
Language Selection

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

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

1. Choose File > Minimize to hide the oscilloscope display 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. The available languages are: German, Spanish, French, Italian, and Japanese. Follow the installer prompts.

   NOTE: Other language packs are available from Microsoft's website.

7. After exiting the Control Panel, click the oscilloscope icon in the lower-right corner of the desktop to maximize the oscilloscope display.
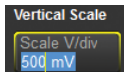
Entering/Selecting Data

Touch & Type

Touching once activates a control. In some cases, you'll immediately see a pop-up menu of options. Touch one to select it.

In other cases, data entry fields appear highlighted on the display.

When a data entry field is highlighted (as shown above), it is active and can be modified by using the front panel Adjust knob.

If you have a keyboard installed, you can type your entry in the active field. Or, you can touch again, then select your entry from the pop-up menu or keypad.

When there are long lists of values, the pop-up may contain scroll bars or Up/Down arrow keys. Use these to navigate to the desired value. It may also help to use the stylus to make the selection when values lie close together on the display.

You'll see a pop-up keypad when you double-touch a numerical data entry field. Touch the soft keys to use it exactly as you would a calculator. When you touch OK, the calculated value is entered in the field.
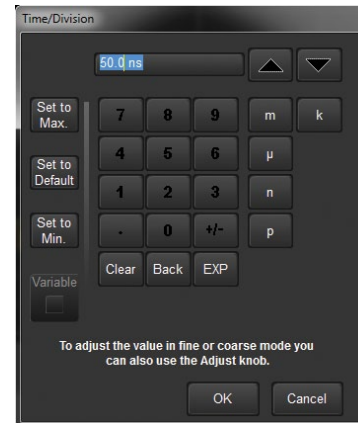
Touch & Drag

Touch-and-drag waveforms, cursors, and trigger indicators to reposition them on the grid; this is the same as setting the values on the dialog. Quickly zoom areas of the grid by touching and dragging to draw a selection box around a portion of the trace.

Stylus

Use the stylus anytime you want a more precise selection tool than your finger. It is especially helpful for selecting exact areas of the grid.
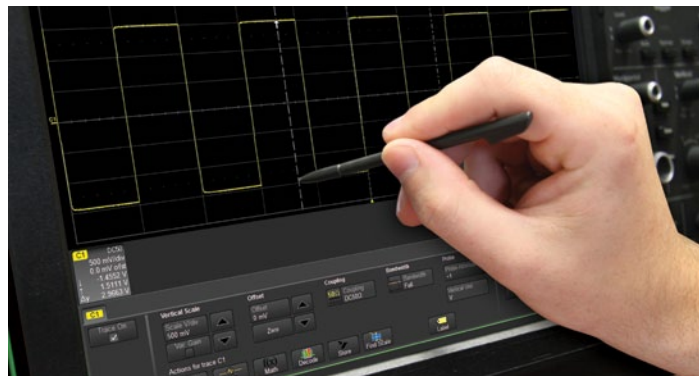
Front Panel

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 *HDO4000 Oscilloscopes Operator's Manual*. Below are a few useful front panel controls.

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

The **Print button** captures the entire screen and sends it to a printer, saves it to a file, or creates a Notebook Entry in LabNotebook.

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

Other shortcut buttons arranged across the bottom open special applications.

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

Front panel buttons light up to indicate which functions are active.

The **Adjust knob** changes the value in any 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.

The **Intensity button** sets the Adjust knob to control the trace intensity. When more data is available than can actually be displayed, the Intensity button helps to visualize significant events by applying an algorithm that dims less frequently occurring samples. This feature can also be accessed from the **Display > Display Setup** dialog.
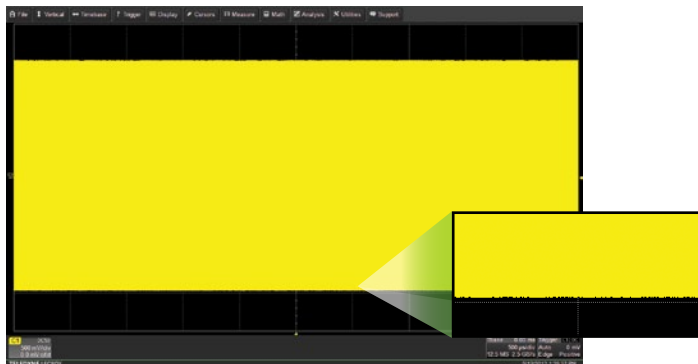
With Intensity 100%
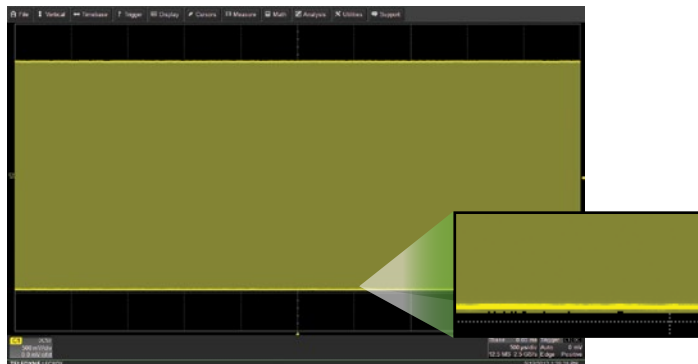
With Intensity 40%

BASICS

HDO4000 High Definition
Oscilloscopes

HD
4096

Turning On/Off Traces

From the Front Panel

Press the corresponding **Channel button (1–4)** to turn on the trace and make it active. To turn off an active trace, press the button again.

A trace (waveform pattern) appears on the grid with a color-coded Channel descriptor box below it. This box always displays the current settings for the trace and is labeled C1–C4.

From the Display

Choose **Vertical > Channel <#> Setup** to turn on the trace and make it active. To turn off the trace, touch the descriptor box and deselect Trace On.
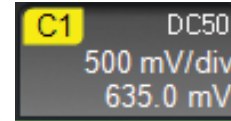
Zoom, Math, and Memory Traces

Besides the channel traces, you can view a zoom (close-up) of a portion of the channel trace (Z1-Z4), a channel trace previously stored to the oscilloscope's memory (M1-M4), or a trace that displays the result of a math function applied to one or more channel traces (F1-F2). The quickest way to turn on these traces is to use the front panel **Zoom**, **Math**, and **Memory buttons**, which open the setup dialogs. If multiple channel traces are open and you press Zoom, zoom traces are created for each channel. Adjust a trace individually by touching its descriptor box and changing dialog settings.

Active vs. Inactive Trace

A highlighted descriptor box indicates the "active" trace, and all display and front panel actions will apply to that trace until another is selected. The same is true for all math, zoom, and memory traces. Although several traces may be open and appear on the grid, only one at a time is active.
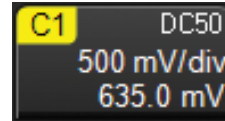
C1 DC50 500 mV/div 635.0 mV	C1 DC50 500 mV/div 635.0 mV
Inactive Controls will not work for this trace.	**Active** Controls will work for this trace.

Also, the front panel Channel buttons (1-4) and the Mem, Zoom, and Math buttons will light up to indicate the active trace.

Viewing Multiple Traces

By default, the oscilloscope has **Auto Grid** enabled. This divides the screen into a maximum of three grids, one each for channels/memories, math functions, and zooms. All traces of the same type appear on the same grid.

To display all types of traces on a single grid, choose **Display > Single Grid** from the menu bar

Two special grid layouts are available: **XY Grid**, which puts the oscilloscope in XY mode, and **XY Single Grid**, which creates one XY grid and one single grid for the rest of your traces.

Vertical

These controls adjust the channel trace along the Y axis.

From the Front Panel

A Press to activate trace.

B Turn to raise or lower Offset.
Push to return Offset to zero.

C Turn to raise or lower Vertical
Scale (V/div).
Push to adjust scale with
more precision.

From the Display

Touch to activate the trace and
again to open the Channel dialog.

A Touch any control to change the value.

B Use the Up/Down buttons to change Vertical Scale or Offset.

Horizontal (Timebase)

These controls adjust the trace along the X axis.

From the Front Panel
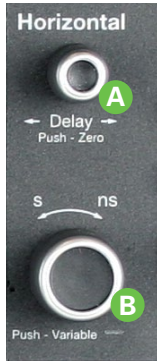
A Turn to raise or lower trigger Delay. Push to return Delay to zero.

B Turn to raise or lower Horizontal Scale (Time/div). Push to adjust scale with more precision on math, memory, or zoom traces.

From the Display

Touch to open the Timebase dialog.
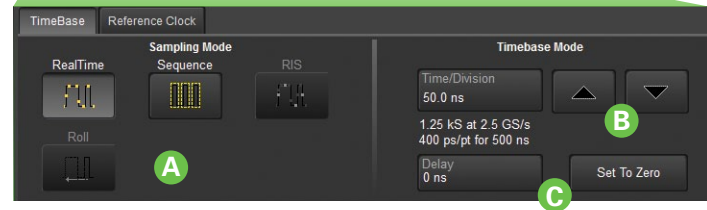
A Touch to select a Sampling Mode.

B Use the Up/Down buttons to change Time/Division.

C Enter a Delay or use the button to Set To Zero.

Zoom

Zoom traces display a close-up portion of a channel trace.

From the Front Panel

Press the Zoom button.

Zoom trace opens for every channel trace. The zoomed portion of the original trace is highlighted.
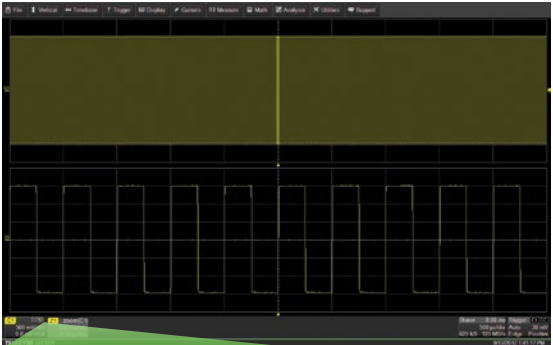
C1	DC50	Z1	zoom(C1)
	500 mV/div		500 mV/div
	0.0 mV ofst		2.00 µs/div

Use Vertical knobs to adjust V/div.

Use Horizontal knobs to adjust Time/div.

From the Display
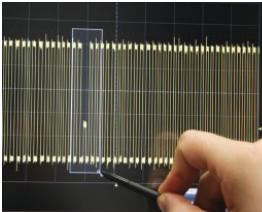
Draw a zoom box on a portion of a Channel trace.

Repeat on another section to open a new zoom trace.

OR
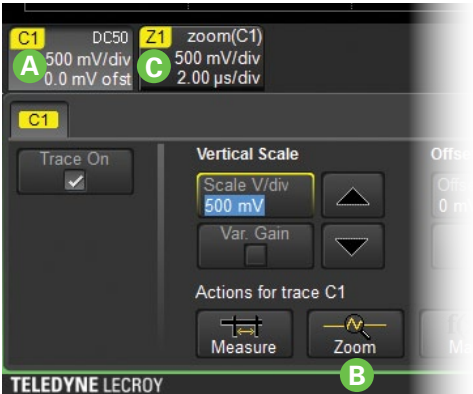
Ⓐ Touch Channel descriptor box to activate the trace.

Ⓑ Touch the Zoom shortcut button.

Ⓒ Touch Zoom descriptor to open the Zoom dialog and adjust values.

Math

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

A Choose Math > Math Setup or press front panel Math button to open Math dialog.

B Math trace (F1-F2) opens in separate grid.

C Touch F<#> tab and select Trace On. (Deselect Trace On to close trace).

D Choose Source channel and math Operator (function).

E Math descriptor box shows math scaling. Touch to re-open function tab and adjust trace.

Triggers

Triggers tell the oscilloscope when to perform an acquisition. Available trigger types are described at more length in the *HDO4000 Oscilloscopes Operator's Manual.*

From the Front Panel

A Opens the Trigger dialog.

B Stops the oscilloscope from acquiring data.

C Triggers once (single-shot acquisition) when all conditions are met.

D Triggers repeatedly whenever all conditions are met.

E Same as Normal when there is a valid trigger; triggers after a preset period when there is no valid trigger.

F Turn to raise or lower Trigger Level (V). Push to automatically find the level.

G Lights up when a trigger is armed.

H Lights up when a trigger has fired.

From the Display

Touch to open Trigger dialog.
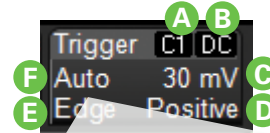
A Trigger Source

B Trigger Coupling

C Trigger Level

D Trigger Slope

E Trigger Type

F Trigger Status

G Touch to choose trigger Type.

H Touch to set Trigger Level (V).

I Touch to let the software automatically set trigger level based on the input signal.

Trigger Indicators

Level Indicator

Position Indicator

Pre/Post-Trigger Indicator Appears at edge of the grid when a trigger point no-longer visible.

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 *HDO4000 Oscilloscopes Operator's Manual*.

From the Front Panel
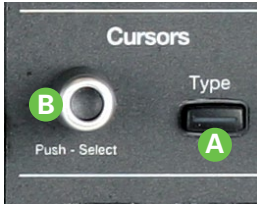
A Press to apply cursor. Continue pressing to cycle through all cursor types.

B Turn to adjust cursor position. Push to select different cursor lines 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 line to reposition cursor.

D Vertical Cursor readout appears on descriptor boxes.

E Horizontal Cursor readout appears below Timebase.

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 channel traces and view the active readout in a table. Statistical measurements can be added to the table of parameter values. You can also view measurements as a histicon, a miniature histogram, or open a second grid showing the trend, a plot of the values showing how the measurement has changed over time. Levels can be set for certain parameters that required them. Measurements gates can be used to only perform measurements on a specific portion of the waveform.

A   Choose Measure > Measure Setup to open the Measure dialog.

B   Touch to re-open Measure dialog.

C   Statistics can be added to the readout.

D   Readout of parameter values.

E   Touch to show table of parameter values.

F   Touch to choose parameter.

G   Touch to choose source channel.

H   Touch to display trend.

I   Touch to set a level(s) used for @level parameters.

J   Touch to set measurement gates.

K   Select to display histicons.

L   Select to display statistics.

Memories (Reference Waveforms)

Memories are traces stored for reference. They can be recalled to the display for comparison with other traces. A memory can be zoomed or measured for better analysis of historical data. You can store up-to-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.

Press the front panel Mem(ory) button to open the Memory dialog.

A To turn on stored memory, check On next to M1-M4.

B To store new memory, touch M1-M4 button or tab.
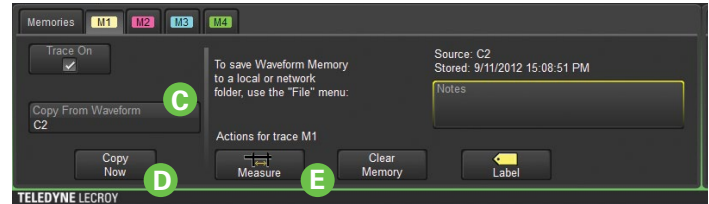
C Select source trace in Copy From Waveform.

D Touch to copy to internal memory.

E Make any other adjustments to stored waveform.

Documenting

HDO4000 Oscilloscopes offer several ways to preserve and share data—such as print, save to file, email, or save as Notebook Entry— any of which can be associated with the front panel Print button.

Go to Utilities > Utilities Preferences > Hardcopy Setup to configure how the oscilloscope handles the Print command. To make Print create a new Notebook Entry, go to File > LabNotebook > Preferences and select Create Entry when Hardcopy Pressed. Pressing Print captures an image of the display, which will then be handled according to your chosen Print method.

Sending Data

If you have email set up on the oscilloscope, LabNotebook reports and other saved files can be sent directly from the instrument. They can also be transferred to a USB drive through any of the host USB ports on the instrument. Use the Windows Explorer to transfer files from your save folder.

LabNotebook

The integrated LabNotebook tool lets you build reports containing waveform images and custom annotations right on the oscilloscope. You create individual Notebook Entries as you work, which are saved to a resident database. When you choose File > LabNotebook, the LabNotebook dialog opens showing all your Notebook entries. Choose which entries to export, the report file format and the output location. You can also use the LabNotebook Flashback feature to put the oscilloscope back to the exact state it was in when the Notebook Entry was saved. See the *HDO4000 Oscilloscopes Operator's Manual* for more information on using LabNotebook.
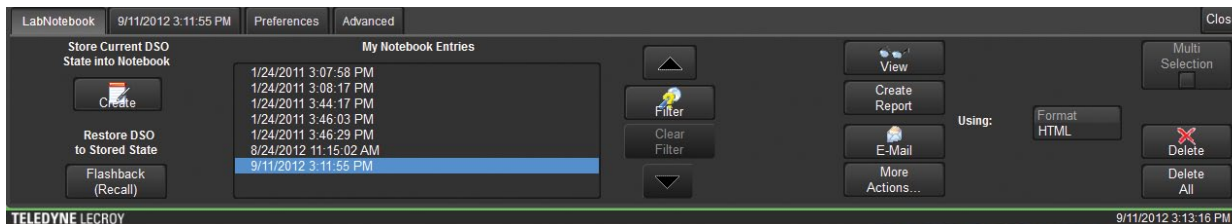
Temperature Dependent Calibration

The HDO4000 is calibrated at the factory prior to being shipped. This calibration is run at 23° C (± 2° C) and is valid for temperatures ± 5° C of the original calibration temperature. Within this temperature range the HDO4000 will meet all of the specifications. When the oscilloscope is used outside of this temperature range a temperature dependent calibration is recommended. There are two options for this calibration: Calibrate All or Calibrate Current Setting.

Calibrate All - All possible combinations of vertical and horizontal settings are calibrated at the current temperature. This calibration is valid for the current temperature ± 5° C. This calibration takes about 50 minutes.

Calibrate Current Setting - The oscilloscope is calibrated at the current vertical and horizontal setting. This calibration is valid for this setting for the current temperature ± 5° C. This calibration takes under 30 seconds.

It is recommended that the HDO4000 be calibrated when the temperature range is outside of the ± 5° C of the original calibration temperature or when it has been more than 1 month since the previous calibration.

It is recommended that the HDO4000 be warmed up for at least 20 minutes prior to use. During the HDO4000 warm-up period, the oscilloscope will automatically initiate calibrations to ensure that the HDO4000 is always calibrated.

It is required that all inputs be removed from the oscilloscope prior to performing calibration.

Software Options

You may purchase these optional software packages to enhance the operation of an HDO4000 Oscilloscope.

Available Software Options

Spectrum Analyzer Option (HDO4K-SPECTRUM) - Simplifies setup and use of the oscilloscope for analyzing frequency-dependent effects. It allows users who are familiar with RF spectrum analyzers to start using the FFT with little or no concern about the details of setting up an FFT.

Power Analysis Option (HDO4K-PWR) - Provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits. The Power Analysis option is used with Teledyne LeCroy oscilloscopes to make critical power switching device measurements, perform control loop modulation analysis, and measure line power harmonics.

Serial Trigger/Decode and Other Options (see table at right) - There are many serial trigger and decode options available that provide added insight when debugging particular serial data standards. For the most up to date list, go to **teledynelecroy.com/serialdata.**

How to Purchase and Install Options

To purchase an option, contact your Teledyne LeCroy sales representative at the number listed in this guide. You will receive a license key via email that activates the optional features on the oscilloscope. To install the 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 software.

Part Number	Description
HDO4K-ET-PMT	Electrical Telecom Mask Test Package
HDO4K-AUTO	CAN, LIN and FlexRay Trigger and Decode Package
HDO4K-CANbus TD	Can Trigger and Decode Option
HDO4K-LINbus TD	LIN Trigger and Decode Option
HDO4K-FlexRaybus TD	FlexRay Trigger and Decode Option
HDO4K-SENT D	SENT Decode Option
HDO4K-EMB	I^2C, SPI, UART and RS-232 Trigger and Decode Package
HDO4K-I2Cbus TD	I^2C Trigger and Decode Option
HDO4K-SPIbus TD	SPI Trigger and Decode Option
HDO4K-UART-RS232bus TD	UART and RS232 Trigger and Decode Option
HDO4K-Audiobus TD	Audiobus Trigger and Decode Option for I^2S, LJ, RJ and TDM
HDO4K-Audiobus TDG	Audiobus Trigger, Decode and Graph Option for I^2S, LJ, RJ, and TDM
HDO4K-DigRF3Gbus D	DigRF 3G Decode Option
HDO4K-DigRFv4bus D	DigRF v4 Decode Option
HDO4K-DPHYbus D	D-PHY Decode Option
HDO4K-ARINC429BUS Dsymbolic	ARINC 429 Symbolic Decode Option
HDO4K-1553 TD	MIL-STD-1553 Trigger and Decode Option
HDO4K-USB2bus D	USB 2.0 Decode Option
HDO4K-USB2-HSICbus D	USB-HSIC Decode Option

REFERENCE

HD **4096** **HDO4000 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.

Teledyne LeCroy Service Centers

United States and Canada World Wide Corporate Office	**US Protocol Solutions Group**	**Europe**	**Singapore**
Teledyne LeCroy 700 Chestnut Ridge Road Chestnut Ridge, NY, 10977-6499 Ph: 800-553-2769/845-425-2000 Fax: 845-578-5985 teledynelecroy.com **Support:** contact.corp@teledynelecroy.com **Sales:** customersupport@teledynelecroy.com	Teledyne LeCroy 3385 Scott Boulevard Santa Clara, CA, 95054 teledynelecroy.com **Sales and Service:** Ph: 800-909-7211/408-727-6600 Fax: 408-727-0800 contact.corp@teledynelecroy.com **Support:** Ph: 800-909-7112/408-653-1260 psgsupport@teledynelecroy.com	Teledyne LeCroy SA 4, Rue Moïse Marcinhes Case postale 341 1217 Meyrin 1 Geneva, Switzerland Ph: +41 22 719 2228/2323/2277 Fax: +41 22 719 2233 contact.sales@teledynelecroy.com applications.indirect@teledynelecroy.com teledynelecroy.com/europe **Protocol Analyzers:** Ph: +44 12 765 0397 1	**Oscilloscopes:** Teledyne LeCroy Singapore Pte Ltd. Blk 750C Chai Chee Road #02-08 Singapore 469003 Ph: ++ 65 64424880 Fax: ++ 65 64427811 **Protocol Analyzers:** Genetron Singapore Pte Ltd. 37 Kallang Pudding Road, #08-08 Tong Lee Building Block B Singapore 349315 Ph: ++ 65 9760-4682
Taiwan	**China**	**Korea**	**Japan**
LeColn Technology Co Ltd. Far East Century Park, C3, 9F No. 2, Chien-8th Road Chung-Ho Dist., New Taipei City, Taiwan Ph: ++ 886 2 8226 1366 Fax: ++ 886 2 8226 1368 sales_twn@teledynelecroy.com	Teledyne LeCroy Beijing Rm. 2001 Unit A, Horizon Plaza No. 6 Zhichun Rd., Haidian Dist. Beijing 100088, China Ph: ++86 10 8280 0318/0319/0320 Fax: ++86 10 8280 0316 **Service:** Rm. 2002 Ph: ++86 10 8280 0245	Teledyne LeCroy Korea 10th fl. Ildong Bldg. 968-5 Daechi-dong, Gangnam-gu Seoul 135-280, Korea Ph: ++82 2 3452 0400 Fax: ++82 2 3452 0490	Teledyne LeCroy Japan Hobunsya Funchu Bldg, 3F 3-11-5, Midori-cho, Fuchu-Shi Tokyo, 183-0006 Japan Ph: ++ 81 4 2402 9400 Fax: ++ 81 4 2402 9586 teledynelecroy.com/japan

Certifications

This section contains the instrument's Electromagnetic Compatibility (EMC), Safety and Environmental certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC
The oscilloscope meets intent of EC Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1:2006, EN 61326-2-1:2006 EMC requirements for electrical equipment for measurement, control, and laboratory use. [1]

Electromagnetic Emissions:
CISPR 11:2003, Radiated and Conducted Emissions Group 1, Class A [2][3]

EN 61000-3-2:2006 Harmonic Current Emissions, Class A

EN 61000-3-3/A2:2005 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:
EN 61000-4-2:2001 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes [4]

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

EN 61000-4-4:2004 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines [4]

EN 61000-4-5:2006 Power line Surge, 1 kV AC Mains, L-N, L-PE, N-PE [4]

EN 61000-4-6:2007 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz [4]

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

[1] To ensure compliance with all applicable EMC standards, high quality shielded interface cables should be used.

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

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

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

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

European Contact:
Teledyne LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700

AUSTALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC
Oscilloscope complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

CISPR 11:2003 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2006 and EN61326-2-1:2006.

Australia / New Zealand Contacts:

Vicom Australia Ltd.	Vicom New Zealand Ltd.
1064 Centre Road	60 Grafton Road
Oakleigh, South Victoria 3167	Auckland
Australia	New Zealand

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The oscilloscope meets intent of EC Directive 2006/95/EC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

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

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

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

• Installation (Overvoltage) Categories:
  CAT II (Mains Supply Connector) local distribution level, applicable to equipment connected to the mains supply (AC power source).

  CAT I (Measuring Terminals) signal level, applicable to equipment measuring terminals connected to source circuits where measures are taken to limit transient voltages to an appropriately low level.

• Pollution Degree 2: operating environment where normally only dry, non-conductive pollution occurs. Conductivity caused by temporary condensation should be expected.

• Protection Class I: grounded equipment, in which protection against electric shock is achieved by Basic Insulation and a connection to the protective ground conductor in the building wiring.

U.S. NATIONALLY RECOGNIZED AGENCY CERTIFICATION

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

UL 61010-1 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 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 2002/96/EC and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

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

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

This instrument has been classified as Industrial Monitoring and Control Equipment, and is outside the scope of the 2011/65/EU RoHS Directive (Exempt until July 2017, per Article 4).

ISO Certification

Manufactured under an ISO 9000 Registered Quality Management System. Visit **teledynelecroy.com** to view the certificate.

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.

Windows License Agreement

The HDO4000 Series Oscilloscope software runs on the Windows operating system. Teledyne LeCroy's agreement with Microsoft prohibits users from running software that is not relevant to measuring, analyzing, or documenting waveforms on HDO4000 Oscilloscopes.