

WaveSurfer 10 Oscilloscopes Getting Started Guide





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WaveSurfer 10 Oscilloscopes

Getting Started Guide

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Welcome

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

WaveSurfer 10 Oscilloscopes

About the WaveSurfer 10 Oscilloscopes

The WaveSurfer 10 combines the MAUI advanced user interface with high performance 10 GS/s hardware, powerful waveform processing, and advanced math, measurement and debug tools to quickly analyze and find the root cause of problems. The large touch screen display and compact form factor make accessing powerful analysis capabilities fast and easy.

MAUI - A New Wave of Thinking

MAUI is the most advanced oscilloscope user interface. MAUI is designed for touch; all important oscilloscope controls are accessed through the intuitive touch screen. MAUI is made for simplicity; time saving shortcuts and intuitive dialogs simplify setup. MAUI is built to solve; deep set of debug and analysis tools help identify problems and find solutions quickly.

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.

LabNotebook

The LabNotebook feature of WaveSurfer 10 provides a report generation tool to save and document all your work. Saving all displayed waveforms, relevant settings, and screen images is all done through LabNotebook, eliminating the need to navigate multiple menus to save all these files independently.

Specifications

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

Key Specifications	
Bandwidth	1 GHz
Channels	4
Sample Rate (per channel/interleaved)	5 GS/s / 10 GS/s
Memory (per channel/interleaved)	10 Mpts / 20 Mpts
Display	10.4" Touch
User Interface	MAUI

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 (one for each channel)
- 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

Advanced Debug Toolkit Option

With the addition of the Advanced Debug Toolkit, the WaveSurfer 10 becomes an unparalleled debug and analysis machine. The high sample rate of 10 GS/s on all 4 channels, 20 Mpts of memory, sequence mode segmented memory, history mode, 13 additional math functions, and 2 math traces, all included in this powerful debug package, enable the WaveSurfer 10 to perform advanced analysis on long captures with 10x oversampling.

Sequence Mode Acquisition

In Sequence Mode, the complete waveform consists of a user-defined number of fixed-size segments. Sequence Mode is ideal when capturing many fast pulses in quick succession or when capturing few events separated by long time periods. The instrument can capture complicated sequences of events over large time intervals in fine detail, while ignoring the uninteresting periods between the events. You can also make time measurements between events on selected segments using the full precision of the acquisition timebase.

Enhanced Sample Rate and Memory

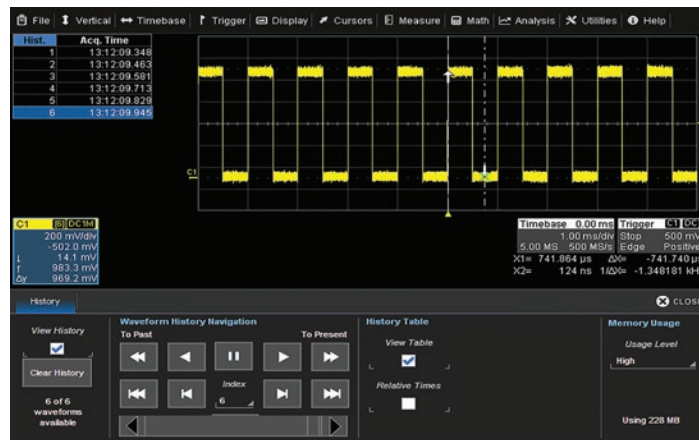
10 GS/s on all 4 channels
16 Mpts/ch interleaving to 32 Mpts

Enhanced Math and Measurements

Two single or dual operator math functions (instead of only one) can be applied to any source waveform(s). Thirteen math operators are available in addition to the standard selection. Functions can be configured to graph a Trend plot of any measurement parameter. Histicons allow the statistical distribution of measurements to be observed.

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 details and 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.



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 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.** 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 80% for temperatures up to 31° C decreasing linearly to 50% relative humidity at 40° C

Altitudes: up to 3,000 m (at < 25° C)

Power and Ground Connections

The instrument operates from a single-phase, 100-240 Vrms ($\pm 10\%$) AC power source at 50/60 Hz ($\pm 5\%$) or a 100-120 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 leadsets) is 340 W (340 VA). Power consumption in standby mode is 10 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

Online Help is available by selecting Support > Help from the oscilloscope display menu bar.

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 *WaveSurfer 10 Oscilloscopes Operator's Manual* can be downloaded from teledynelecroy.com/support/techlib. 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.

The Front of Your Oscilloscope



- A** Touch Screen Display
- B** Front Panel
- C** Built-in Stylus Holder
- D** USB Port
- E** Power Button
- F** BNC Inputs for C1-C4 and External Trigger
- G** Ground and Calibration Output Terminals
- H** Tilting Feet

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. Operate the instrument using front panel hard controls, display soft controls, or a mix of both that is convenient for you.



Many 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 port** can be used for transferring data or connecting peripherals such as a mouse or keyboard.

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

Channel inputs 1–4 are signal inputs to the oscilloscope; Ext is for connecting an external trigger device.

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

The **tilting feet** enable easier bench top viewing.

The Side of Your Oscilloscope



- A Audio In/Out:** Speaker, Mic, and Line-In for external audio devices
- B Ethernet Port** for LAN connection
- C Host USB Ports (4)**
- D L-BUS connector**
- E VGA connector** for external monitor

The Back of Your Oscilloscope

(not shown)

- F Built-in Carrying Handle**
- G Aux Out** connector to send pass/fail, device trigger enabled or trigger out signal to another device
- H AC Power Inlet** for the AC line cord
- I Kensington Lock**

Carrying

The oscilloscope's case contains a built-in carrying handle. Always unplug the instrument from the power source before lifting and carrying it.

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 Ground Connections in "General Safety Information").

The **Power button** on the front controls the operational state of the oscilloscope. Press the button to switch on the instrument; press the button again or use the **File > Shutdown** menu option to switch "off" (Standby).



CAUTION. Do not change the instrument's Windows® Power Options from the default. System Standby or System Hibernate modes should never be used.



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

Pressing and holding the Power button executes a "hard" shutdown, same as on a PC, but we do not recommend doing this as 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 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.

Connecting

After start up, configure the oscilloscope connections using the menu options listed below. See the *WaveSurfer 10 Oscilloscopes Operator's Manual* for more detailed instructions.

USB Peripherals

Connect the device to a USB port on the front or side of the instrument.

Printer

WaveSurfer 10 supports USB or network printers. Connect the printer to any host USB port or place it on the same network as the oscilloscope. Go to **Utilities > Utilities Setup > Hardcopy** to configure printer settings.

External Controller

Connect an Ethernet cable from a LAN port on the side of the instrument to the controller. Go to **Utilities > Preference Setup > Remote** to configure remote control using TCPIP or LXI.

External Monitor

WaveSurfer 10 supports external VGA monitors. Attach the monitor cable to the VGA connector on the side of the instrument. Go to **Display > Display Setup > Open Monitor Control Panel** to configure display settings using the standard Windows control panel dialogs. If the second monitor is capable of being used as a touch screen, you can configure it to duplicate the controls seen on the oscilloscope screen.

Note: External monitors with Fujitsu drivers cannot be used as touch screens, only as displays.

LAN

WaveSurfer 10 accepts DHCP network addressing. Connect a cable from the Ethernet port on the side panel to a network access device. Go to **Utilities > Utilities Setup > Remote** and select TCP/IP 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.

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.

Signal Inputs

Mixed Signal Options

WaveSurfer 10 oscilloscopes are compatible with the Teledyne LeCroy MS-250 and MS-500 mixed signal hardware options. Both offer 18 integrated digital channels and a set of tools designed to view, measure, and analyze analog and digital signals, enabling fast debugging of mixed signal designs. Flexible analog and digital cross-pattern triggering across all 22 channels provides the ability to quickly identify and isolate problems in an embedded system.

Probes

WaveSurfer 10 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/probes.

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.

Software Activation

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

Demonstration Software

The oscilloscope is delivered with a 30-day trial license of the available option packages.

To try an option, go to Utilities > Utilities Setup > Options, choose the option from the list, and touch Activate Demo Key.

Purchasing Software 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.

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 > Exit) or a remote PC, launch the browser and visit the software download page at the URL above.
2. Click the link to Oscilloscope Downloads > Firmware Upgrades.
3. Enter the required model information and account login. If you don't yet have an account, create one now.
4. Follow the instructions to download the installer and save it to a location accessible to the oscilloscope (USB storage device, Network location, etc.).
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.



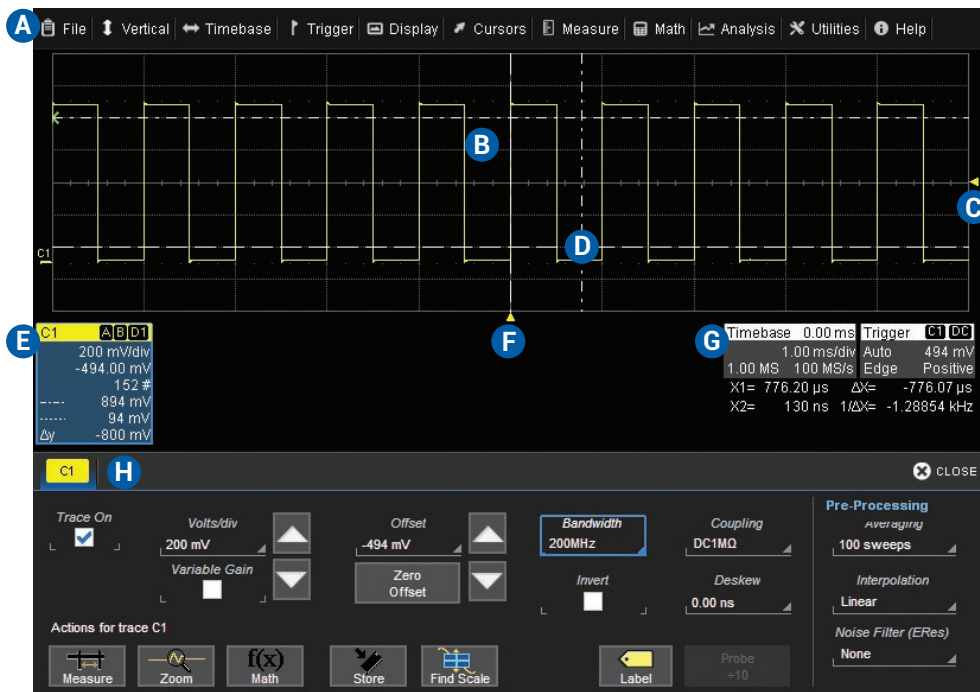
CAUTION. The installation may take several minutes, depending on the length of time since your last upgrade. Do not power down the oscilloscope at any point during the installation process.

USER INTERFACE

WaveSurfer 10 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 Indicator
- 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 many grid settings on the Display Setup dialog.

Trigger level and **trigger position** 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, Memory (M1-M4), and Digital (Digital1-Digital2, with mixed signal options) **descriptor boxes** appear along the bottom of the grid area and summarize current settings for each open trace. Touch the descriptor box to open the set up dialog.

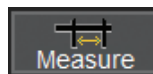
Timebase and Trigger descriptor boxes appear at the right of the display. Timebase and Trigger settings only apply to channel traces. Touch the descriptor box to open the corresponding set up dialog.

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.



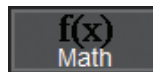
A **toolbar** along the bottom of the Channel, Math, and Memory dialogs applies common actions so that you don't have to leave the underlying dialog. They always apply to the active (highlighted) trace.



Apply up to six measurement parameters.



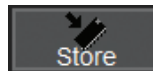
Display a zoom of the trace.



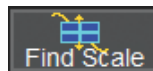
Apply a math function to the trace.



Open the Serial Decode dialog (when serial decoders are installed).



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



Scale the waveform to fit the grid.



Apply a custom label to the trace.

Changing the Display

To modify the grid style, choose **Display > Display Setup** from the menu bar and make your selections from the Display dialog.

By default, the oscilloscope has **Auto Grid** enabled. Auto Grid adds a grid for each new trace type (channels/memories, math, and zooms) as they open and removes the grid when no longer needed. There are options to display all traces on a single grid, an XY trace, or a single grid with an XY trace.

You can also choose to place the **Grid on Top** of traces so it remains visible, or apply **Axis Labels** to show the value currently represented by the extreme Vertical and Horizontal margins of the grid. **Grid Intensity** makes the grid lines dimmer or brighter relative to the trace.

Working With Traces

The easiest way to turn on a trace is to use the front panel **C1-C4**, **Math**, and **Zoom** buttons. A waveform appears on the grid, a new descriptor box opens at the bottom of the grid area, and the corresponding setup dialog opens. This is now the “active” trace.

To turn off a trace, press the front panel button again.

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. This is true for all traces, regardless of the type. Although several traces may be open and appear on the display, only one at a time is active.

Also, the front panel buttons will light to indicate the active trace.



Active. Controls will work for this trace.



Inactive. Controls will not work for this trace.

Line and Intensity

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

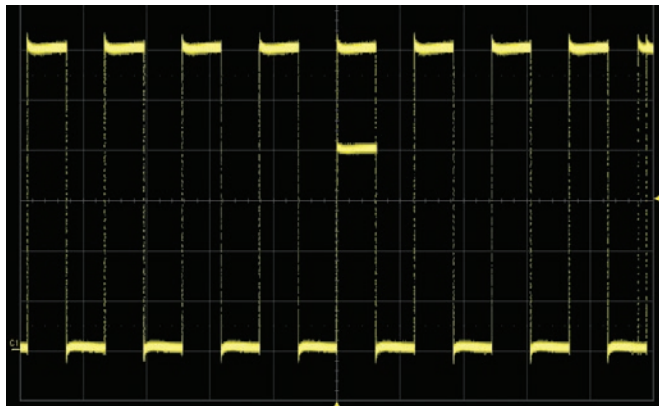


When more data is available than can actually be displayed, **Trace Intensity** helps to visualize significant events by applying an algorithm that dims less frequently occurring samples. Turn the front panel **Intensity knob** to control the Trace Intensity.

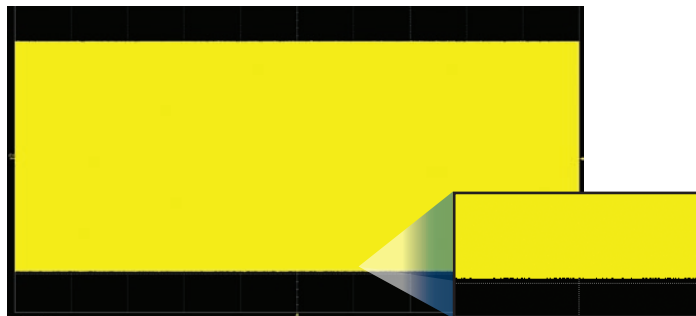
Using WaveStream

WaveStream provides a vibrant, intensity graded display with a fast update rate to closely simulate the look and feel of an analog oscilloscope. WaveStream is most helpful in viewing signals that have signal jitter or signal anomalies, or for applying a visual check before creating an advanced trigger or WaveScan setup to locate an unusual event.

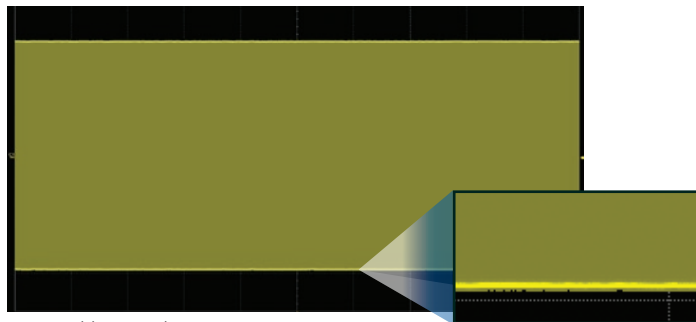
To apply WaveStream, push the front panel **Intensity** knob. The WaveStream indicator will light to show it is on. Push the knob again to exit WaveStream.



Trace in WaveStream Display Mode



Trace with Intensity 100%



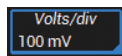
Trace with Intensity 40%.

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.

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.

To quickly zoom areas of the grid, touch & drag to draw a selection box around a portion of the trace.



Use the stylus when you want a more precise selection tool than your finger. It is especially helpful for zooming exact areas of the grid or selecting values that lie close together on pop-up menus.

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 *WaveSurfer 10 Oscilloscopes Operator's Manual*. Below are a few useful front panel controls.

- A Auto Setup** turns on and configures all channels with a signal attached. An edge trigger is set to the signal mean level.
- B Clear Sweeps** resets math and measurement counters.
- C** The **Print** button captures the entire screen and handles it according to your Hardcopy setting (print to file on USB drive, create LabNotebook entry, etc.).
- D** The **Intensity** knob controls the Trace Intensity. Pushing the knob toggles between WaveStream display mode and regular intensity. In WaveStream mode, the knob controls trace color saturation.
- E** 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.
- F** The **Touch Screen** button enables or disables touch screen functionality.

Most 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, while the bottom label describes its "push" action.

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



Sharing Data

Print/Screen Capture

WaveSurfer 10 oscilloscopes offer several ways to preserve and share data, any of which can be associated with the front panel **Print button**.



Pressing Print captures an image of the display, which will then be handled according to your chosen Print method (sent to a printer, saved to a file, etc.). Go to Utilities > Utilities Setup > Hardcopy to configure how the oscilloscope handles the Print command.

Note: To make Print create a new Notebook Entry, go to File > LabNotebook > Preferences and select Create Entry when Hardcopy Pressed.

Sending Data

If the oscilloscope is networked, LabNotebook reports, waveform files, setups, and other user data can be emailed directly from the instrument.

Files can also be transferred to a USB drive through any of the host USB ports. Exit to the desktop (File > Exit) and use the Windows Explorer to transfer files from oscilloscope folders to USB drives. Stored user data files are located on the D: drive.

BASICS

WaveSurfer 10 Oscilloscopes

Vertical

These controls adjust the channel trace along the Y axis.

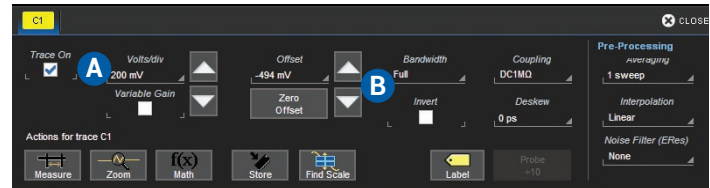
From the Front Panel



- A** Press to turn on/activate analog trace.
- B** Turn to raise or lower Vertical Offset. Push to return to zero.
- C** Turn to raise or lower Vertical Scale (V/div). Push to make fine adjustments.

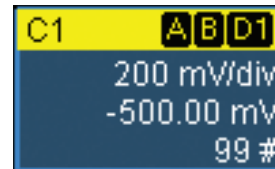
From the Display

Touch Channel descriptor box 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.

Channel Descriptor Box



Pre-Processing Summary List
(changes from default state)

Coupling

Gain Setting

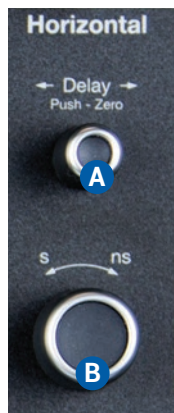
Offset Setting

Averaging Sweeps Count

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.

Timebase Descriptor Box

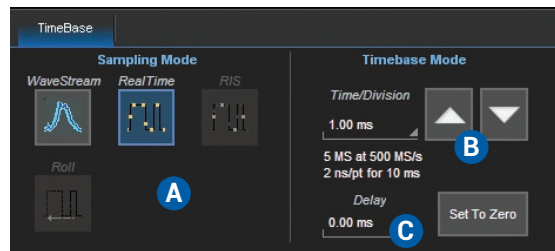
Sampling Mode
(blank in real-time) —
Samples —

Timebase	0.0 ms
WStream	20.0 ms
1.00 MS	5.0 MS/s

— Trigger Delay
(Position)
— Time/div
— Sample Rate

From the Display

Touch the Timebase descriptor box to open the Timebase dialog.



- A** Touch button to select a Sampling Mode.
- B** Use the Up/Down buttons to change Time/Division.
- C** Enter a Delay time or use the button to Set To Zero.

Triggers

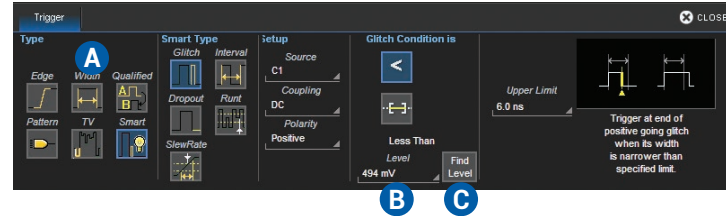
Triggers tell the oscilloscope when to perform an acquisition. Available trigger types are described at more length in the *WaveSurfer 10 Oscilloscopes Operator's Manual*.

From the Front Panel



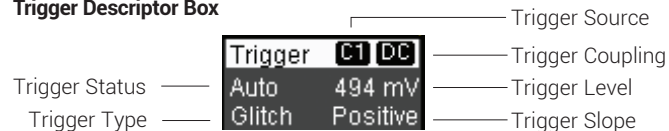
- A** Opens the Trigger dialog.
- B** Stops the oscilloscope from acquiring data.
- C** Triggers once (single-shot acquisition) when all conditions are met.
- D** Triggers repeatedly whenever all conditions are met.
- E** Same as Normal when there is a valid trigger; triggers after a preset period when 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



- A** Touch to choose trigger Type.
- B** Touch to set Trigger Level (V).
- C** Touch to let the software automatically set trigger level based on the input signal.

Trigger Descriptor Box



Trigger Indicators



Level
Indicator



Position
Indicator

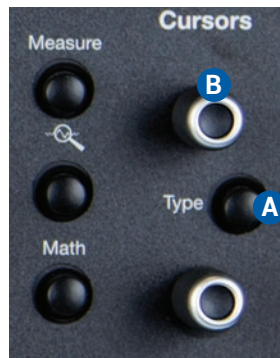


Pre/Post-Trigger Indicator appears at the corner of the grid when a trigger point is no-longer visible.

Cursors

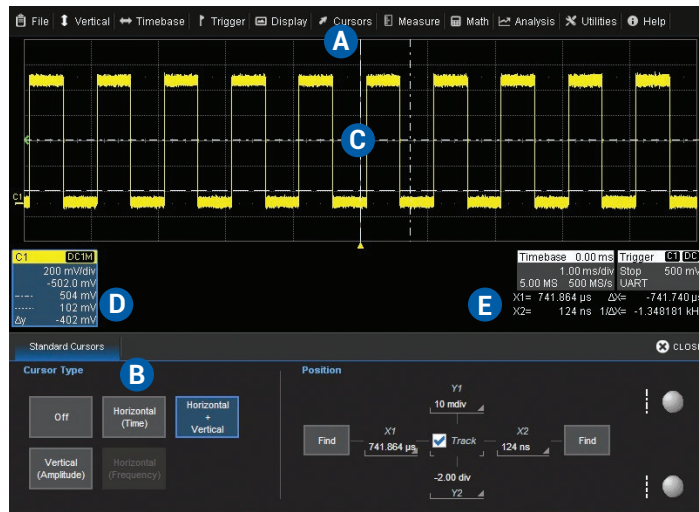
Cursors set measurement points on a trace. There are five preset cursor types, each with a unique appearance on the display: Horizontal (Time), Horizontal + Vertical, Vertical (Amplitude), Horizontal (Frequency), and Horizontal (Event). These are described in more detail in the *WaveSurfer 10 Oscilloscopes 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 reset the cursor to the default position. When both Horizontal and Vertical cursors are displayed, push the knob to switch the cursor that is being controlled.

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 six simultaneous measurements on one or more traces and view the active readout in a table. You can also gate measurements to limit them to a specific portion of the trace, or add statistical measurements to the readout.



- A** Press front panel Measure button or choose Measure > Measure Setup to open the Measure dialog.
- B** Readout of parameter values. Touch any cell to re-open Measure dialog if closed.
- C** Check Show Table to show/hide measurement readout.
- D** Touch Px fields to select parameter and source trace.
- E** Set measurement gates on dialog, or drag gate markers from edge of grid.
- F** Add statistics to the measurement readout.

Math

Math traces display the result of applying a mathematical function (e.g., FFT) 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** Press front panel Math button or choose Math > Math Setup or to open Math dialog.
- B** Choose Single or Dual math operators.
- C** Choose source waveform and function(s).
- D** Math trace opens in separate grid.
- E** Math descriptor box shows math scaling.
- F** Touch Zoom tab to adjust scale of Math trace.

Zoom

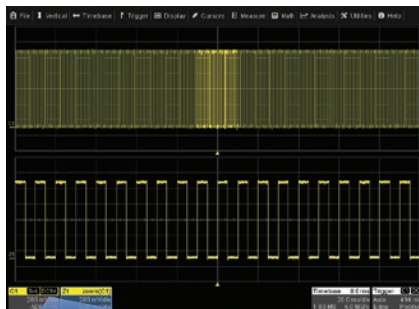
Zooms display a magnification of another trace. You can create up to four zooms (Z1-Z4) from any other type of trace.

From the Front Panel



Press the Zoom button.

Zoom trace opens for every open channel trace. The zoomed portion of the original trace is highlighted.

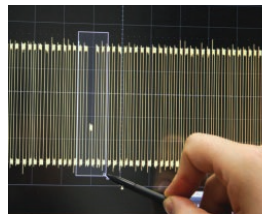


C1	BwL	DC1M	Z1	zoom(C1)
200 mV/div			200 mV/div	
-500.0 mV			2.00 ms/div	

Use Vertical knobs to adjust V/div.

Use Horizontal knobs to adjust Time/div.

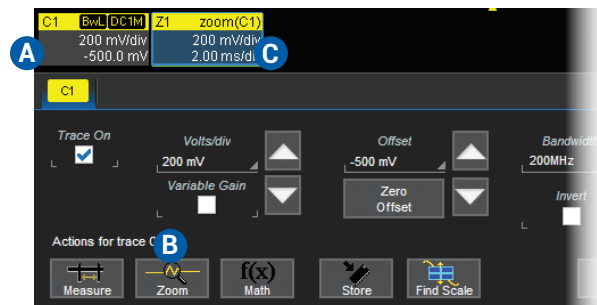
From the Display



Draw a zoom box on a portion of a trace.

Repeat on another section to reposition the zoom trace.

OR



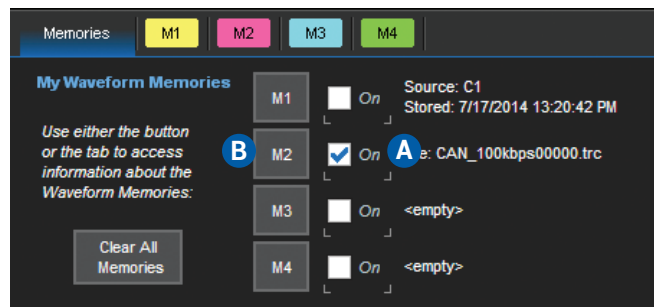
- A** Touch Channel descriptor box to activate the trace.
- B** Touch the Zoom shortcut button.
- C** Touch Zoom descriptor to open the Zoom dialog and rescale the zoom.

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.

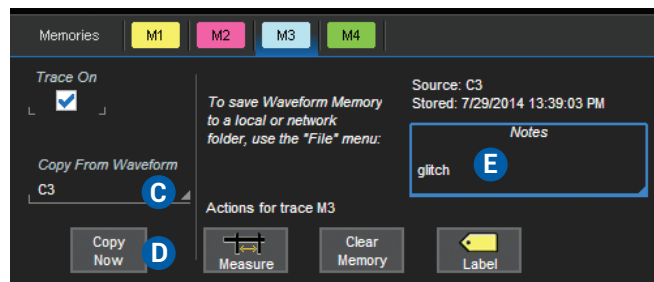
Internal memories only persist until the oscilloscope is rebooted. To store memories indefinitely, save them to an external file by choosing File > Save Waveform. The file can then be recalled into one of the four internal memories for viewing by choosing File > Recall Waveform. Only memory files saved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

Choose Math > Memory Setup to open the Memory dialog.



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

B To store a new memory, touch M1-M4 button or tab.



C Select source trace in Copy From Waveform.

D Touch to copy to internal memory.

E Add notes or labels to stored waveform.

LabNotebook

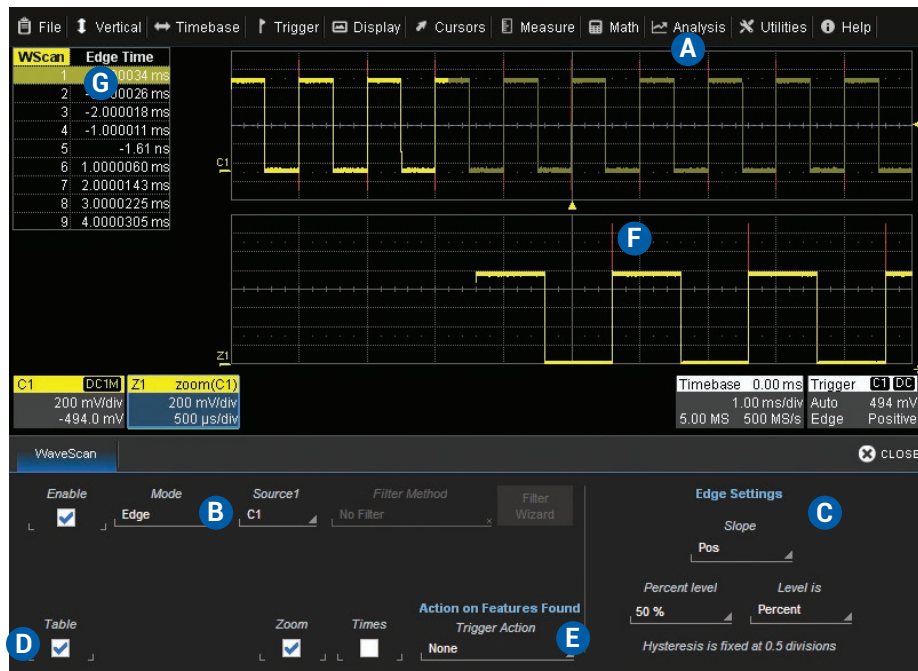
The integrated LabNotebook tool lets you build reports containing waveform images and custom annotations right on the oscilloscope. You create individual Notebook Entries as you work, which are saved in a resident database. When you choose File > LabNotebook, the LabNotebook dialog opens showing all your Notebook Entries, where they can be further annotated and exported into different report formats.



- A** Create Notebook Entry from dialog, menu bar, or Print button.
- B** Notebook Entries appear in list. Select from the list to edit or export.
- C** Open tab of same name to add description and annotations to an entry.
- D** View screen capture associated with selected entry.
- E** Export selected entries to a report.
- F** Use Flashback to restore all setups to same state as when selected entry was created.

WaveScan

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), easily customized, enable a quick search for events of interest. The results are time stamped, tabulated, and can be selected for individual viewing.



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

Software Options

The **Advanced Debug Toolkit** (WS10-ADT) enhances the acquisition, math and measurement capabilities of a WaveSurfer 10 oscilloscope. Additionally, the History Mode and Sequence Mode functions are also added.

Power Analysis Option (WS10-PWR) provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits. Measure critical device power switching, analyze control loop modulation, and measure line power harmonics.

Spectrum Analyzer Option (WS10-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.

Many **Serial Trigger and Decode** options are available (see table). Decoders apply software algorithms to extract encoded serial data information from physical layer waveforms measured on your oscilloscope. The extracted information is displayed over the actual physical layer waveforms, color-coded to provide fast, intuitive understanding of the relationship between message frames and time synchronous events. Serial triggers fire upon finding decoded data that match complex, user-defined filters.

Part Number	Description
WS10-1553 TD	MIL-STD-1553 Trigger and Decoder
WS10-ARINC429bus Dsymbolic	ARINC-429 Symbolic Decoder
WS10-Audiobus TD	Audiobus Trigger and Decoder for I ² S, LJ, RJ and TDM variants
WS10-CANbus TD	CAN Trigger and Decoder
WS10-CAN FD TD	CAN FD Trigger and Decoder
WS10-DigRF3Gbus D	MIPI DigRF 3G Decoder
WS10-DigRFv4bus D	MIPI DigRF v4 Decoder
WS10-DPHYbus D	MIPI D-PHY Decoder
WS10-EMB	I ² C, SPI, UART/RS-232 Trigger and Decoder
WS10-ENETbus D	10M and 100M ENET Decoder
WS10-FlexRaybus TD	FlexRay Trigger and Decoder
WS10-I2Cbus TD	I ² C Trigger and Decoder
WS10-LINbus TD	LIN Trigger and Decoder
WS10-Manchesterbus D	Manchester Decoder
WS10-NRZbus D	NRZ Decoder
WS10-SENTbus D	SENT Decoder
WS10-SPIbus TD	SPI Trigger and Decoder
WS10-UART-RS232bus TD	UART and RS232 Trigger and Decoder
WS10-USB2bus D	USB 2.0 Decoder
WS10-USB2-HSICbus D	USB-HSIC Decoder

REFERENCE

WaveSurfer 10 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

<p>United States and Canada World Wide Corporate Office</p> <p>Teledyne LeCroy 700 Chestnut Ridge Road Chestnut Ridge, NY, 10977-6499 Ph: 800-553-2769 / 845-425-2000 Fax: 845-578-5985 teledynelecroy.com</p> <p>Support: contact.corp@teledynelecroy.com</p> <p>Sales: customersupport@teledynelecroy.com</p>	<p>US Protocol Solutions Group</p> <p>Teledyne LeCroy 3385 Scott Boulevard Santa Clara, CA, 95054 teledynelecroy.com</p> <p>Sales and Service: Ph: 800-909-7211 / 408-727-6600 Fax: 408-727-0800 contact.corp@teledynelecroy.com</p> <p>Support: Ph: 800-909-7112/408-653-1260 psgsupport@teledynelecroy.com</p>	<p>Europe</p> <p>Teledyne LeCroy SA 4, Rue Moise 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</p> <p>Protocol Analyzers: Ph: +44 12 765 0397 1</p>	<p>China</p> <p>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</p> <p>Service: Rm. 2002 Ph: ++86 10 8280 0245</p>
<p>Taiwan</p> <p>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</p>	<p>Singapore</p> <p>Genetron Singapore Pte Ltd. 37 Kallang Pudding Road, #08-08 Tong Lee Building Block B Singapore 349315 Ph: ++ 65 9760-4682</p>	<p>Korea</p> <p>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</p>	<p>Japan</p> <p>Teledyne LeCroy Japan Hobunsha 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</p>

Certifications

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

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 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, high quality shielded interface cables should be used.

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

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

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

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

European Contact:

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

AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

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

EN 55011:2010 Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN61326-1:2013 and EN61326-2-1:2013.

Australia / New Zealand Contacts:

Vicom Australia Ltd.
1064 Centre Road
Oakleigh, South Victoria 3167
Australia

Vicom New Zealand Ltd.
60 Grafton Road
Auckland
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:

- Mains Supply Connector: CAT II, local distribution level, equipment connected to the mains supply (AC power source).
- Measuring Terminals: CAT O, signal level, equipment measuring terminals connected to source circuits where measures are taken to limit transient voltages to an appropriately low level.
- Unit: Pollution Degree 2, operating environment where normally only dry, non-conductive pollution occurs. Conductivity caused by temporary condensation should be expected.
- Unit: 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 and its accessories conform to the 2011/65/EU RoHS2 Directive, as it has been classified as Industrial Monitoring and Control Equipment (per Article 3, Paragraph 24) and is exempt from RoHS compliance until 22 July 2017 (per Article 4, Paragraph 3).

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 WaveSurfer 10 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 WaveSurfer 10 Oscilloscopes.

