



PART ONE

GETTING STARTED

This part of the manual covers the main Waverunner features and explains, step by step, how to use them. You'll get to know your scope and start working with it quickly and effectively. Capture and view waveforms. Zoom and scroll. Learn the art of display. Use math and measurement tools. Document your work.

CHAPTER ONE: *Catch a New Wave*

In this chapter, see how

To select the input signal channel

To use menus and controls for basic operations

To find your way around the display

To adjust the timebase, gain and position of the signal

To zoom — manually and automatically

To set up the timebase

To set signal coupling


To calibrate and use the passive probe


To set up the CAL and BNC outputs

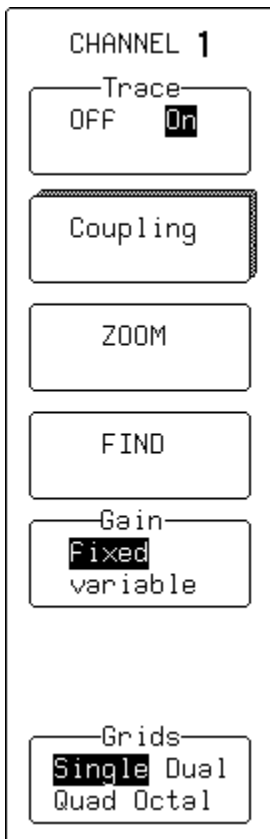
View Your Waveform

Take these steps to capture and view your signal; set time and volts per division; zoom and auto-scroll:

1. Connect your signal to the Waverunner (Channel 1 input for this example).

2. Press the blue  button to automatically set the (Edge) trigger level, timebase, and vertical settings for display of the input signal. Press it again to confirm the action.

3. Press  to select CHANNEL 1 and display the basic Waverunner menus.



4. Use these menus in the steps on the following pages to adjust the signal's trace on the screen.



To turn Channel 1 on or off.

TIP: Press  twice to turn the channel on or off.



To access the CHANNEL Coupling menus. See page 24.



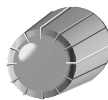
To automatically make a zoomed trace of the signal. Use the vertical POSITION knob to move the trace so that it is clearly visible. Use the vertical ZOOM knob to adjust its expansion vertically. See page 22.



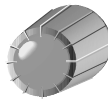
To automatically set gain and offset, and “find” the signal.



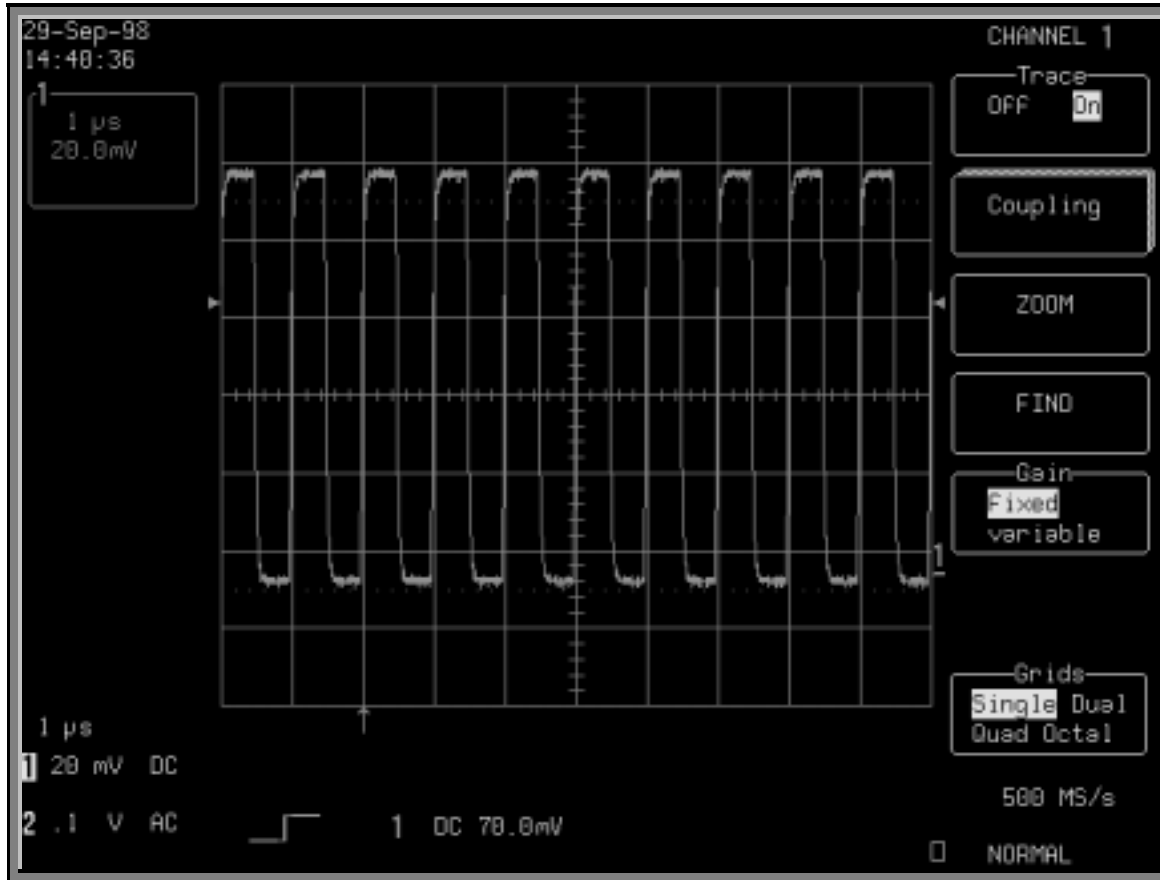
To select fixed or variable gain. Select “variable” to control the channel's gain continuously. See page 20.



TIP: With AUTO SETUP you can automatically set up signals in the 5 mV to 40 V range with a frequency of ≥ 50 Hz and a duty cycle as small as 0.1%.



To select the grid style and number. Next page: Single grid. See also Chapter 3, “Display Your Signal.”



TO FIND YOUR WAY AROUND THE WAVERUNNER DISPLAY

29-Sep-98
14:40:36

Real-Time Clock field: powered by a battery-backed real-time clock, it displays the current date and time.

1
1 μs
20.0mV

Displayed Trace Label indicates each channel or channel displayed, the time/div and volts/div settings, and cursor readings where appropriate.

1 μs
1 20 mV DC
2 .1 V AC

Acquisition Summary field: timebase, volts/div, probe attenuation, and coupling for each channel, with the selected channel highlighted.





Trigger Level arrows on both sides of the grid that mark the trigger voltage level relative to ground level.



Trigger Delay is an arrow indicating the trigger time relative to the trace.



Trigger Status field shows sample rate and trigger re-arming status (AUTO, NORMAL, SINGLE, STOPPED). The small square icon flashes to indicate that an acquisition has been made.



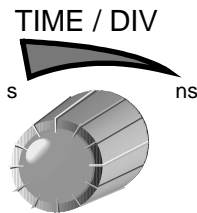
Trigger Configuration field contains an icon indicating the type of trigger, and information on the trigger's source, slope, level and coupling, and other information when appropriate.

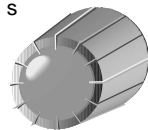


Trace and Ground Level shows the trace number and ground level marker.

Other display areas include the **Time and Frequency field**, located below the grid and stating time and frequency relative to cursors, and a **Message field** placed above the grid and reserved for special messages. For more about the display, see Chapter 3, "Display Your Signal."

USE TIME / DIV TO ADJUST THE TIMEBASE

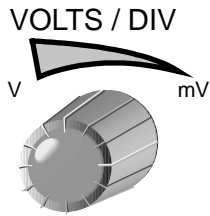


- 5. Turn  to adjust the timebase as desired.

NOTE: AUTO SETUP operates only on channels that are turned on, unless no channels are turned on. Then all channels will be affected. When more than one channel is turned on, the first channel in numerical order with a signal applied to it will be automatically set up for edge triggering

The time per division is set in a 1–2–5 sequence. Waverunner automatically adapts itself to use the maximum sampling rate whenever the timebase is changed. The selected time/div setting is shown in the trace label at the top left portion of the screen, and the sampling rate in the trigger status field at the bottom right-hand corner.

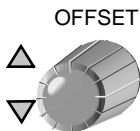
ADJUST SENSITIVITY AND POSITION



6. Turn the knob to reduce the vertical gain sensitivity. The volts/div setting is shown in the Channel 1 trace label.

The next two steps can be taken (if not already) when you wish to fine tune the vertical gain and get a better vertical resolution:

7. Fine tune the vertical gain by selecting "variable" from the Gain menu (see page 17).
8. Now turn the VOLTS / DIV knob through several complete rotations, so that the entire signal reaches from top to bottom of the grid. Filling the grid in this way, you can use the full range of available digitizing levels.



9. Use the knob to center the waveform on the grid.

ZOOM AND SCROLL AUTOMATICALLY

Use ZOOM to see more detail on your signal. The display will show the original signal and its zoomed copy.

10. Press the **A** button to display the TRACE A menus (to display Trace B, C, or D, press its button).
11. Press the **A** button again or the top button to display the trace and its label. (Do the same to turn off a trace.)

12. Press the button for:
- MULTI ZOOM &
AUTO SCROLL

The menus shown on the next page will be displayed.

UTILITIES

TIP: Press the **UTILITY** button to select *Special Modes*. Then select the *Channels* menu to choose

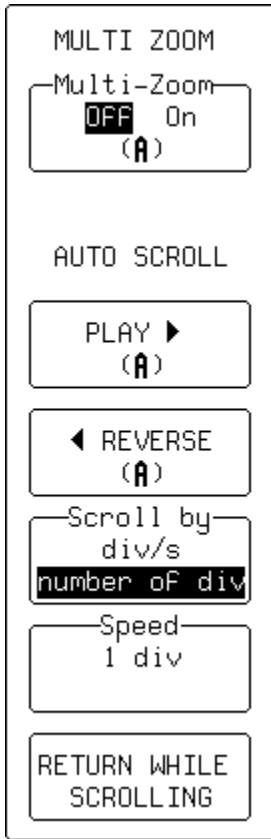
In: to set the offset of a gain (*VOLTS/DIV*) change in volts or vertical divisions (this is in volts, by default).

Automatic Recalibration: to turn this feature on or off (default is "On"). "Off" may speed capture, but time calibration is not certain during the capture period.

Global BWL: to control the global bandwidth limit. When On, the chosen bandwidth (see page 24) applies to all channels. When Off, a bandwidth limit can be set individually for each channel.

TIP: To go back to the default power-up settings, simultaneously press the second and fifth menu buttons from the top, and the **1** CHANNEL SELECT 1 button.

13. Use these menus to scroll back and forth through the full length of one or all of your zoom copies.



MULTI-ZOOM unifies the control of all zoom traces, while AUTO-SCROLL walks the zoom trace or traces across the referenced trace.



When **Off**, only the active zoom trace is controlled. When **On**, all displayed zoom traces (A, B, C, D) are simultaneously controlled (automatically) with Auto Scroll and (manually) with the horizontal ZOOM and POSITION knobs. See the next page for more on Multi-Zoom.



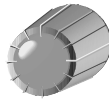
To scroll the zoom trace from right to left of screen. When playing the menu is labeled "STOP (PLAYING)": Press to stop.



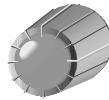
To scroll the zoom trace from left to right of screen. When playing the menu is labeled "STOP (REVERSING)": Press to stop.



To scroll by divisions per second or number of divisions. Use **div/s** to scroll continuously for viewing. Use **number of div** for waveform processing, especially Pass/Fail testing. When processing is complete, the display will be updated by the number of divisions set.



To set scroll speed, using the knob. When scrolling by divisions, 10 div will step the zoom trace "grid-page" by "grid-page" across the length of the referenced trace.



To return to the TRACE A menus, while continuing to scroll, by pressing the menu button.

RETURN



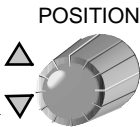
To stop scrolling and return to the previous menu displayed.

TIP: Consider zoom as an extra timebase that offers alternative sweep speeds. You can display as many as four zooms at once.




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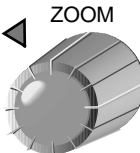
USE THE POSITION AND ZOOM CONTROLS

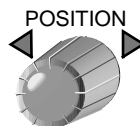
14. Turn  to place Trace A vertically on the grid.

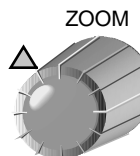
TIP: *The smaller Waverunner knobs are rate sensitive: the faster you rotate them, the greater the change that results per increment.*



When using more than one grid, turn  to move traces from one grid to another.

15. Turn  to adjust the expansion factor and increase the amount of zoom.

16. Turn  to move the zoomed region of the trace.

17. Turn  to vertically expand, or reduce, the zoom trace.

TO ZOOM AND MULTI-ZOOM

You can zoom several traces from a single waveform to obtain precise timing measurements and improve the time resolution on your displayed waveform. For instance, on a waveform composed of two pulses separated by a long delay, you could make Trace A a zoom of the first pulse, and Trace B a zoom of the second.



Multi-Zoom allows you to move the zoomed region of the waveform along two or more different traces, or two or more regions of the same trace, simultaneously. When you activate multi-zoom, the horizontal zoom and position controls apply to all displayed traces — A, B, C, and D — allowing you to view similar sections of different traces at the same time. The vertical sensitivity controls still act individually on the traces.

When trace labels have dotted top and bottom edges, like the one at right, this indicates that their traces are multi-zoomed.



SET UP THE TIMEBASE

SETUP
TIMEBASE

18. Press  and access the TIMEBASE menus.

TIMEBASE

T/div 50 μ s

250000

samples at

500 MS/s

(2 ns/pt)

For 500 μ s

Sampling

Single Shot

Sample Clock

Internal

ECL 0V TTL

Sequence

OFF On

Record up to

250k

samples

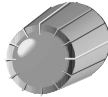
19. Use these menus to set up the timebase in single-shot mode. See Chapter 7, “A Question of Timebase,” for more on the sampling modes.



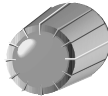
Single-Shot sampling displays data collected during successive single-shot acquisitions from the input channels — capture nonrecurring, or very low repetition-rate events, simultaneously on all input channels.



To select **Internal** or external — **ECL, 0V, TTL** — clock modes. Select internal unless using an external clock signal. See Chapter 7, “A Question of Timebase,” for external clock. The LT364 series has a “Channel Use” menu below “Sample Clock” (see “Pairing Channels” in Chapter 8).



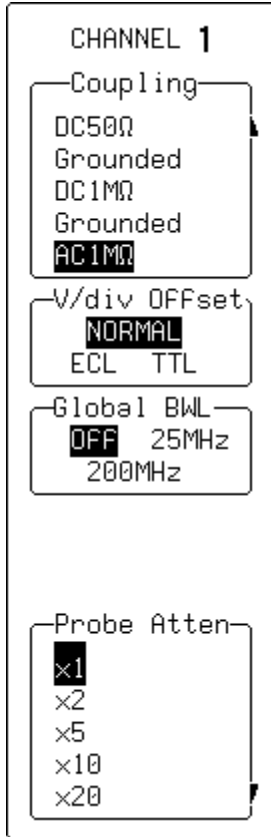
To switch sequence mode **On** or **Off**. Use the knob to choose the number of segments. See Chapter 7, “A Question of Timebase,” for sequence sampling



To select the maximum number of samples to be acquired, using the menu knob; and, to set the default 50k, using the menu button.

SET THE COUPLING

20. Press and then the button for to display the coupling menus.



21. Use these menus to set input signal coupling and grounding, the channel bandwidth limit, and the probe attenuation.



Selects the signal coupling



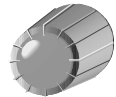
Moves your selection down the list. When at the bottom, as here, the down arrow disappears and this button becomes inactive.



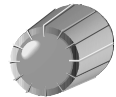
Press **NORMAL** to set offset, volts/div, and input coupling to display ECL signals. Press again; settings for TTL signals are given. Press a third time; settings will return to those of the last manual setup.



Press to turn the bandwidth limit **Off** or reduce the bandwidth to 200 MHz or 25 MHz. Reduces signal and system noise and prevents high-frequency aliasing. Global BWL means that the limit set will apply to all channels. BWL means that a limit can be set individually for each channel. See the TIP on page 20 for how to set these, using SPECIAL MODES.



To set the probe attenuation factor for the input channel. The buttons scroll up or down, while the knobs scroll the selector up and down the list. LeCroy's ProBus® system automatically senses probes and sets their attenuation. This menu then changes to indicate the type of probe attached and its attenuation factor. See the following pages for more on probes and ProBus.



NOTE:

AC position: signals are coupled capacitively, the input signal's DC component is blocked, and signal frequencies below 10 Hz are limited.

DC position: signal frequency components are allowed to pass through, and an input impedance of either 1MΩ or 50Ω can be selected. The maximum dissipation into 50Ω is 0.5 W. Whenever this is attained, inputs will automatically be grounded. "Grounded" will be highlighted in the "Coupling" menu and an overload message will be displayed in the Acquisition Summary field. Reset by removing the signal from the input and reselecting "DC50Ω."

SETUP FOR CAL AND BNC SIGNALS

UTILITIES

1. Press  .

2. Press the button to select  and display the CAL BNC OUT menus.

CAL BNC OUT

REAR OUT

OFF

Pass/Fail

Trigger Out

Trigger Rdy

CAL OUT

SET TO 1 kHz

1 V SQUARE

Shape

Square

DC Level

Amplitude

1.00 V

into 1M Ω

Frequency

1 kHz

3. Use these menus to choose the type of signal put out at the front CAL and rear BNC signal outputs. Set the frequency, amplitude, and pulse shape of the calibration signal.



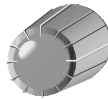
To set the type of signal from the rear BNC connector.



To reset the CAL output to its default state: a 1 kHz 1 V square wave. The Waverunner automatically sets the calibration signal to its default when switched on.



To select the form of the calibration signal.



To set the pulse level for the CAL output (range: -1.00 to 1.00 V), using the knob.



To set the desired frequency of a CAL signal in the range 500 Hz to 1 MHz, using the knob.

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TO CALIBRATE THE PASSIVE PROBE


Your Waverunner scope comes with a LeCroy passive probe for each channel.




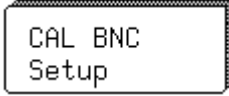
First. Turn on your Waverunner scope.


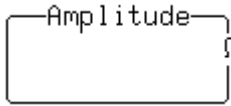
Second. Insert the probe lead in the Channel 1 input.

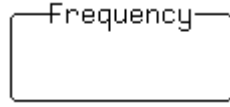
Third. Connect the probe tip to the CAL output (see front panel illustration in “First Things”).

Fourth. Attach the lead's alligator clip to the ground ring indicated by , located below CAL.

The CAL signal will be a 1 kHz square wave, 1 V p-p.

Fifth. Press  , then the button to select 

Sixth. Press  to select  and set the amplitude level.

Seventh. Now select  to set the frequency in the range 500 Hz to 1 MHz.

Eighth. Set channel coupling to DC 1 M Ω using “Coupling” (see previous page).

Ninth. Press  to turn on Channel 1.

Tenth. Press  twice.

If overshoot or undershoot of the displayed signal occurs, adjust the probe by inserting the small screwdriver, supplied with the probe package, into the potentiometer on the probe head and turning it clock wise or counterclock wise to achieve the optimal square wave contour.

HOW PROBUS HELPS YOU

LeCroy's ProBus probe system provides a complete measurement solution from probe tip to oscilloscope display.



ProBus allows you to control transparent gain and offset directly from your front panel — particularly useful for voltage, differential, and current active probes. It uploads gain and offset correction factors from the ProBus EPROMS, and automatically compensates to achieve fully calibrated measurements.

This intelligent interconnection between your Waverunner scope and a wide range of accessories offers important advantages over standard BNC and probe ring connections. ProBus ensures correct input coupling by auto-sensing the probe type, eliminating the guesswork and errors that occur when attenuation or amplification factors are set manually.

TIP: Use Waverunner's rear panel BNC signal output to provide a pulse:

For Pass/Fail testing

At the occurrence of each accepted trigger event (Trigger Out)

When the scope is ready to accept a trigger event (Trigger Rdy)

