LeCroy

waveRunner®

# WaveRunner 6000 Series

## 6030
## 6050/6051
## 6100
## 6200

### LEADING FEATURES

- *350 MHz, 500 MHz, 1 GHz and 2 GHz Bandwidths*
- *5 GS/s on All Channels (10 GS/s on 2 Ch for 6100 and 6200)*
- *1 Mpts on All Channels, Expandable to 12/24 Mpts*
- *Compact and Lightweight*
- *Easy User Interface*
- *New 2.5 mm Passive Probe*
- *Touch Screen Interface*
- *Vertical Controls for Each Channel*
- *USB 2.0 and 802.3xx LAN Ports*
- *Open Windows 2000*

## Excellent Performance, Great Price, Easy to Use

LeCroy's WaveRunner® 6000 Series is built to be the world's best everyday bench oscilloscope. It offers the best acquisition specifications, a user interface that makes it easy to perform the most common oscilloscope functions, industry-leading long term support and a "feel" that makes the oscilloscope a pleasure to drive.

For the first time, LeCroy has combined the type of high performance front amplifier, ADC, memory and triggering used in more expensive oscilloscopes and designed it all into a very affordable package. The WaveRunner 6000 Series also introduces a user interface that makes viewing and measuring signals simple and fast.

With the WaveRunner 6000 Series, all viewing controls and basic oscilloscope functions are easily at hand using front panel knobs. You get fast views and can zoom in to see details on the bright touch panel color screen. Or use the simple and intuitive controls to call up exactly the measurements you need.

The WaveRunner 6000 Series includes an industry-leading signal acquisition path, which provides a 5 GS/s ADC on every channel and 1 Mbyte of standard memory. No need to worry about the undersampling or aliasing caused by slower ADCs or shorter memories on other oscilloscopes.

The WaveRunner 6000 Series comes standard with the new PP007 500 MHz passive probe (one per channel). This 2.5 mm high impedance probe offers excellent characteristics for probing everyday signals. LeCroy also offers a wide range of optional single-ended and differential active probes, current probes, optical to electrical (O/E) converters and differential amplifiers.

Lastly, we decided to architect the oscilloscope so that users could add just the functionality they want. There are options for testing power devices, serial data mask testing, jitter and timing analysis, and for a wide variety of probes, O/E converters and other application specific devices.

Altogether, the WaveRunner 6000 Series sets a new industry standard for high performance at low price in everyday bench oscilloscopes.

# Specifications

| Vertical System | WaveRunner 6030 | WaveRunner 6050 | WaveRunner 6051 | WaveRunner 6100 | WaveRunner 6200 |
|---|---|---|---|---|---|
| Analog Bandwidth @ 50 Ω, 10 mV–1 V/div, (-3 dB) | 350 MHz | 500 MHz | 500 MHz | 1 GHz | 2 GHz |
| Rise Time (Typical) | 1 ns | 750 ps | 750 ps | 400 ps | 225 ps |
| Input Channels | 4 | 4 | 2 | 4 | 4 |
| Bandwidth Limiters | 20 MHz; 200 MHz | | | | |
| Input Impedance | 1MΩ \|\| < 20 pF (10 MΩ \|\| 9.5 pF using PP007 probe) | | | | |
| Input Coupling | 50 Ω: DC, 1MΩ: AC, DC, GND | | | | |
| Maximum Input Voltage | 50 Ω: 5 Vrms, 1 MΩ: 250 Vmax (Peak AC: ≤ 5 kHz + DC) | | | | |
| Channel to Channel Isolation | > 40 dB @ < 100MHz (> 30 dB @ full bandwidth) | | | | |
| Vertical Resolution | 8 bits; up to 11 with enhanced resolution (ERES) | | | | |
| Sensitivity | 50 Ω: 2 mV/div—1 V/div fully variable; 1 MΩ: 2 mV—10 V/div fully variable | | | | |
| DC Gain Accuracy | ±1.0% of full scale (typical), ±1.5% of full scale with V/Div ≥ 10 mV (warranted) | | | | |
| Offset Range | 50 Ω: ±400 mV @ 2–4.95 mV/div<br>±1 V @ 5–100 mV/div<br>±10 V @ 102 mV/div – 1V/div | | | | |
| | 1 MΩ: ±400 mV @ 2–4.95 mV/div<br>±1 V @ 5–100 mV/div<br>±10 V @ 102 mV/div – 1V/div<br>±100 V @ 1.02V/div – 10V/div | | | | |
| Offset Accuracy | ±(1.5% + 0.5% of offset value +1 mV) | | | | |
| Probing System | BNC or Probus® | | | | |

| Timebase System | |
|---|---|
| Timebases | Internal timebase common to all input channels; an external clock may be applied at the auxiliary input |
| Time/Division Range | Real time: 200 ps/div—10 s/div, RIS mode: to 20 ps/div, Roll mode: up to 1,000 s/div |
| Clock Accuracy | ≤ 5 ppm @ 25 °C (≤ 10 ppm @ 5–40 °C) |
| Time Interval Accuracy | Clock Accuracy + Jitter Noise Floor |
| Sample Rate and Delay Time Accuracy | Equal to Clock Accuracy |
| Trigger and Interpolator Jitter | ≤ 3 ps rms |
| Channel to Channel Deskew Range | ±9 X time/div setting, 100 ms max, each channel. |
| External Sample Clock | DC to 1 GHz; 50 Ω or 1M Ω BNC input. Limited to 2 channel operation, (CH2 only in 6051).<br>Minimum rise time and amplitude requirements apply at low frequencies. |
| Roll Mode | User selectable. Available at lower time/div settings. |

| Acquisition System | WaveRunner 6030 | WaveRunner 6050 | WaveRunner 6051 | WaveRunner 6100 | WaveRunner 6200 |
|---|---|---|---|---|---|
| Single-Shot Sample Rate/Ch | 2.5 GS/s | 5 GS/s | 5 GS/s | 5 GS/s | 5 GS/s |
| Interleaved Sample Rate (2 Ch) | N/A | N/A | N/A | 10 GS/s | 10 GS/s |
| Max. Random Interleaved Sampling (RIS) Rate | 200 GS/s | | | | |
| Max. Trigger Rate | 125,000 waveforms/second | | | | |
| Sequence Time Stamp Resolution | 1 ns | | | | |
| Minimum Time between Sequential Segments | 8 µs | | | | |

| ACQUISITION MEMORY | Max. Acquisition Points (4 Ch / 2 Ch; 2 Ch / 1 Ch in 6051) | Segments (Sequence Mode) |
|---|---|---|
| Standard | 1M / 2M | 500 |
| Option S | 2M / 4M | 500 |
| Option M | 4M / 8M | 1,000 |
| Option L | 8M / 16M | 5,000 |
| Option VL | 12M / 24M | 10,000 |

| Acquisition Processing | 6030 | 6050 | 6051 | 6100 | 6200 |
|---|---|---|---|---|---|
| Time Resolution (min. Single-shot) | 200 ps (5 GS/s) | | | 100 ps (10 GS/s) | |
| Averaged | Summed and continuous averaging to 1 million sweeps | | | | |
| ERES | From 8.5 to 11 bits vertical resolution | | | | |
| Envelope (Extrema) | Envelope, Floor, or Roof for up to 1 million sweeps | | | | |
| Interpolation | Linear or SinX/X | | | | |

| Trigger System | |
|---|---|
| Trigger Modes | Normal, Auto, Single, Stop |
| Sources | Any input channel, External, Ext/10, or Line; slope and level unique to each source |
| Trigger Coupling | DC |
| Pre-trigger Delay | 0–100% of memory size (adjustable in 1% increments, or 100 ns) |
| Post-trigger Delay | 10,000 divisions in real time mode, limited at slower time/div settings in roll mode. |
| Hold-off | 2 ns to 20 s or 1 to 1,000,000,000 events |
| Internal Trigger Level Range | ±4.1 div from center (typical) |

| | 6030 | 6050 | 6051 | 6100 | 6200 |
|---|---|---|---|---|---|
| Trigger Sensitivity w/ Edge Trigger (CH1-4+ external) | 2 div @ < 350 MHz;<br>1 div @ < 250 MHz | 2 div @ < 500 MHz;<br>1 div @ < 350 MHz | 2 div @ < 500 MHz;<br>1 div @ < 350 MHz | 2 div @ < 1 GHz<br>1 div @ < 750 MHz | 2 div @ < 2 GHz;<br>1 div @ < 1.8 GHz |
| Max. Trigger Frequency w/ SMART Trigger® (CH1-4+ external) | 350 MHz Max.<br>@ ≥ 10 mV | 500 MHz Max.<br>@ ≥ 10 mV | 500 MHz Max.<br>@ ≥ 10 mV | 750 MHz Max.<br>@ ≥ 10 mV | 750 MHz Max.<br>@ ≥ 10 mV |
| Trigger Level DC Accuracy | ±4% full scale ±2 mV (typical) | | | | |
| External Trigger Range | EXT/10 ±4V; EXT ±400mV | | | | |

| Basic Triggers | |
|---|---|
| Edge/Slope/Line | Triggers when signal meets slope (positive or negative) and level condition |

| SMART Triggers® | |
|---|---|
| State or Edge Qualified | Triggers on any input source only if a defined state or edge occurred on another input source.<br>Delay between sources is selectable by time or events. |
| Dropout | Triggers if signal drops out for longer than selected time between 2 ns and 20 s. |
| Pattern | Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input — 2 Ch+EXT on 6051). Each source can be high, low, or don't care. The high and low level can be selected independently. Triggers at start or end of the pattern. |

# Specifications

| | |
|---|---|
| **SMART Triggers® with Exclusion Technology** | |
| Glitch and Pulse Width | Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults (subject to bandwidth limit of oscilloscope). |
| Signal or Pattern Interval | Triggers on intervals selectable between 2 ns and 20 s. |
| Timeout (State/Edge Qualified) | Triggers on any source if a given state (or transition edge) has occurred on another source. Delay between sources is 10 ns to 20 s, or 1 to 99,999,999 events. |
| Exclusion Triggering | Trigger on intermittent faults by specifying the normal width or period. |
| **Automatic Setup** | |
| Auto Setup | Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals |
| Vertical Find Scale | Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range. |
| **Probes** | |
| Probes | One PP007 per channel standard; Optional passive and active probes available |
| Probe System; Probus | Automatically detects and supports a variety of compatible probes |
| Scale Factors | Automatically or manually selected, depending on probe used |
| **Color Waveform Display** | |
| Type | Color 8.4" flat-panel TFT-LCD with high resolution touch screen |
| Resolution | SVGA; 800x600 pixels |
| Real Time Clock | Dates, hours, minutes, seconds displayed with waveform. Accurate to ±50 ppm. SNTP support to synchronize to precision internet clocks. |
| Number of Traces | Display a maximum of 8 traces. Simultaneously display channel, zoom, memory, and math traces. |
| Grid Styles | Auto, Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY |
| Waveform Styles | Sample dots joined or dots only |
| **Analog Persistence Display** | |
| Analog and Color-Graded Persistence | Variable saturation levels; stores each trace's persistence data in memory |
| Persistence Selections | Select analog, color, or three-dimensional |
| Trace Selection | Activate persistence on all or any combination of traces |
| Persistence | Aging Time Select from 500 ms to infinity |
| Sweeps Displayed | All accumulated, or all accumulated with last trace highlighted |
| **Zoom Expansion Traces** | |
| | Display up to 4 Zoom/Math traces. |
| **CPU** | |
| Processor | Intel Celeron 1.7 GHz or better |
| Processing Memory | 256 MB on Std, S & M option; 512 MB with L and VL option |
| Operating System | Microsoft Windows 2000 Professional |
| **Internal Waveform Memory** | |
| | M1, M2, M3, M4 Internal Waveform Memory (store full-length waveform with 16 bits/data point) or store to any number of files limited only by data storage media |
| **Setup Storage** | |
| Front Panel and Instrument Status | Store to the internal hard drive, over the network, or to a USB-connected peripheral device |
| **Interface** | |
| Remote Control | Via Windows Automation, or via LeCroy Remote Command Set |
| GPIB Port (Optional) | Supports IEEE – 488.2 |
| Ethernet Port | 10/100Base-T Ethernet interface (RJ-45 connector) |
| USB Ports | 5 USB 2.0 ports (one on front of instrument) supports Windows-compatible devices |
| External Monitor Port | Standard 15-pin D-Type SVGA-compatible DB-15; connect a second monitor to use dual-monitor display mode |
| Parallel Port | Standard DB-25 |
| Serial Port | DB-9 RS232 port (not for remote oscilloscope control) |
| **Auxiliary Input** | |
| Signal Types | Selected from External Trigger or External Clock input on front panel |
| Coupling | 50 Ω: DC, 1MΩ: AC, DC, GND |
| Maximum Input Voltage | 50 Ω: 5 Vrms, 1MΩ: 250 Vmax (Peak AC: ≤ 10 kHz + DC) |
| **General** | |
| Auto Calibration | Ensures specified DC and timing accuracy is maintained for 1-year minimum |
| Probe Calibrator | Output available on front panel provides a variety of DC and square wave signals for probe compensation adjustment |
| Power | 100–240 Vrms at 50/60 Hz; 115 Vrms (±10%) at 400 Hz Automatic AC Voltage Selection<br>Installation Category: 300V CAT II; Max. Power Consumption: 400 VA/400 W; 350 VA/350 W for WaveRunner 6051 |
| **Environmental** | |
| Temperature: Operating | +5 °C to 40 °C |
| Temperature: Nonoperating | –20 °C to +60 °C |
| Humidity: Operating | 5% to 80% RH (noncondensing) up to 30 °C; upper limit derates linearly to 45% RH (noncondensing) at 40 °C |
| Humidity: Nonoperating | 5% to 95% RH (noncondensing) as tested per MIL-PRF-28800F |
| Altitude: Operating | 3,048 m (10,000 ft.) max at ≤ 25 °C |
| Altitude: Nonoperating | 12,190m (40,000 ft.) |
| **Physical** | |
| Dimensions (HWD) | 211 mm x 355 mm x 363 mm (excluding handle and feet) 8.3" x 13.8" x 14.3" |
| Net Weight | 10 kg (22 lbs.), excluding printer |
| Shipping Weight | Less than 13.6 kg. (30 lbs.) |
| **Certifications** | |
| | CE Approved, UL and cUL listed; Conforms to EN 61326-1, EN 61010-1, UL 61010B-1, and CSA C22.2 No. 1010.1 |
| **Warranty and Service** | |
| | 3-year warranty; calibration recommended annually.<br>Optional service programs include extended warranty, upgrades, calibration, and customization services |

# WaveRunner® Ordering Information

## WaveRunner 2- and 4-Channel Digital Oscilloscopes

| | |
|---|---|
| 2 GHz, 5 GS/s, 1 Mpts/4 Ch; 10 GS/s, 2 Mpts/2 Ch, 4 Ch Color | WaveRunner 6200 |
| 1 GHz, 5 GS/s, 1 Mpts/4 Ch; 10 GS/s, 2 Mpts/2 Ch, 4 Ch Color | WaveRunner 6100 |
| 500 MHz, 5 GS/s, 1 Mpts/4 Ch; 5 GS/s, 2 Mpts/2 Ch, 4 Ch Color | WaveRunner 6050 |
| 500 MHz, 5 GS/s, 1 Mpts/2 Ch; 5 GS/s, 2 Mpts/1 Ch, 2 Ch Color | WaveRunner 6051 |
| 350 MHz, 5 GS/s, 1 Mpts/4 Ch; 5 GS/s, 2 Mpts/2 Ch, 4 Ch Color | WaveRunner 6030 |

## Included with Standard Configuration

| | |
|---|---|
| 10:1 10 MΩ, 500 MHz BW Passive Probes – Qty 4 (2 with WaveRunner 6051) | PP007 |
| Printed Getting Started Manual | WR6-GS-E |
| CD-ROM containing Operators Manual, Remote Command Manual, Utility Software, and Recovery Software | |
| Optical 3-button Wheel Mouse – USB | |
| Standard Ports; 10/100Base-T Ethernet, USB (5), Parallel, RS-232, SVGA Video out, Audio in/out | |
| Internal Hard Drive | |
| Protective Front Cover | |
| Standard Commercial Calibration and Performance Certificate | |
| 3-Year Warranty | |

## Memory Options

| | 6200 | 6100 | 6050 | 6030 | 6051 | |
|---|---|---|---|---|---|---|
| 2 Mpts/Ch, 4 Mpts maximum using 2 Channel (1 Channel for 6051) | | S | | | S2 | |
| 4 Mpts/Ch, 8 Mpts maximum using 2 Channel (1 Channel for 6051) | | M | | | M2 | |
| 8 Mpts/Ch, 16 Mpts maximum using 2 Channel (1 Channel for 6051) | | L | | | L2 | |
| 12 Mpts/Ch, 24 Mpts maximum using 2 Channel (1 Channel for 6051) | | | | | VL | VL2 |

## Hardware Options

| | |
|---|---|
| Removable HDD | WR6-RHD |
| CD-RW Upgrade | WR6-CDRW |

## WaveShape Analysis Packages

| | |
|---|---|
| CAN Bus Tigger and Decode Test Package | CANbus TD |
| Jitter and Timing Analysis | WR6-JTA2 |
| PowerMeasure Analysis | WR6-PMA2 |
| Disk Drive Measurement Package | WR6-DDM2 |
| Digital Filter Package | WR6-DFP2 |
| Serial Data Mask Package | WR6-SDM |
| Ethernet Test Package (WaveRunner 6100 and 6200 only1) | WR6-ENET |
| USB 2.0 Compliance Software (WaveRunner 6200 only2) | WR6-USB2 |
| Advanced Math Package | WR6-XMATH |
| Intermediate Math Package | WR6-XWAV |
| Master Analysis Package (XMATH + XDEV + JTA2) | WR6-XMAP |
| Value Analysis Package (XWAV + JTA2) | WR6-XVAP |
| Developer's Customization Kit | WR6-XDEV |
| Norton Antivirus | WR6-AV |

## Selected Accessories

| | |
|---|---|
| Passive Probe, 500 MHz | PP007-1 |
| 2.5 GHz Active Voltage Probe | HFP2500 |
| 1.5 GHz Active Voltage Probe | HFP1500 |
| 1 GHz Active Voltage Probe | HFP1000 |
| 500 MHz Differential Probe | AP033 |
| 1 GHz Differential Probe | AP034 |
| 500A, 2 MHz Current Probe | CP500 |
| 150A, 10 MHz Current Probe | CP150 |
| 15A, 50 MHz Current Probe | CP015 |
| 30A, 50 MHz Current Probe | AP015 |
| 3 GHz Differential Probe and Adjustable Tips | D300 & D300AT |
| 100 MHz Differential Amp | DA1855A |
| Floppy Drive (External USB) | WR6-FLPY |
| Rackmount, 6U Height | WR6-RACK |
| Mini Keyboard | WR6-KBD |
| Soft Carrying Case | WR6-SOFT |
| Hard Transit Case | WR6-HARD |
| Accessory Pouch | WR6-POUCH |
| GPIB | WR6-GPIB |
| 256 MB USB Memory Key | MEM-USB |
| Scope Cart – Basic | OC1021 |
| Scope Cart – With extra shelf & drawer | OC1024 |
| Operator's Manual Printed Hardcopy | WR6-OM-E |
| 5-Year NIST Calibration and Warranty | WR6-T5 |

[1] Package may be used with lower BW oscilloscope models, however, some measurements will not operate with signals at all data rates.

[2] Can be used with lower bandwidth models, however only USB 1.1 test functions will be available. WaveRunner 6200 required for USB 2.0 capability.

LeCroy