

LeCroy WaveStation LW410B/LW420B Arbitrary Waveform Generator

MAIN FEATURES

- *100 ps Feature Placement and Single Point Resolution*
- *1 and 2 Channels Versions*
- *Generate Complex, Phase Synchronized Signals on Two Channels.*
- *Continuously Variable Sample Clock From 6 MHz to 400 MHz with 1 Hz Resolution*
- *Live Control of Edge Timing and Pulse Amplitude While Viewing Output Wave*
- *Stand Alone Design, no PC Required*
- *8 Bits of Vertical Resolution*
- *Up to 1 Mbyte of Playback Waveform Memory per Channel*
- *FastSwitch Group Sequence Test Mode Provides Random Access to Sequences With an Access Time of Under 11 ms*
- *Internal Disk Drives for Project, Sequence, and Waveform Storage*
- *Digital Output Option Provides 8-Bit TTL and ECL Digital Outputs Corresponding to the Wave on the Analog Output. Special Digital Editing Mode Useful in Creating Data Patterns.*
- *CE, UL and cUL Certified*



FEATURES & BENEFITS

LeCroy's LW420B WaveStation™ is a dual-channel, 400 MS/s arbitrary waveform generator (AWG) that brings together high performance with the flexibility and capability needed to quickly generate long, complex waveforms. WaveStation offers more than just great technical specifications. It provides a high level of functionality and ease of use while eliminating many of the traditional obstacles of AWGs.

Building on over 11 years of experience in the design and manufacture of high-performance digital storage oscilloscopes and signal sources, LeCroy's WaveStation combines innovative signal processing, high-performance design, and human factors engineering to provide a truly intuitive and highly interactive arbitrary waveform generator.

THE CHOICE IS YOURS: SPECIFY THE WAVEFORM, AND LET THE LW420B HANDLE THE DETAILS OR TAKE CONTROL YOURSELF

With the WaveStation, you need no awareness of the sample clock period or the particular reconstruction filter being used. All the LW420B needs is your waveform's time and voltage relationships. No matter which of the many available tools you use to specify the waveform, the LW420B will generate the output using the optimum combination of sample clock rate and filter bandwidth. The filters automatically selected will assure that aliasing does not take place and that all the timing relationships within the waveform will be precisely maintained. Full control of the clock and bandwidth filters is there for those who need it.

LW410A/420A AWGS



http://www.lecroy.com/signal_sources



REAL-TIME WAVEFORM MANIPULATION LETS YOU QUICKLY CONTROL THE WAVESHAPE—EASILY AND INTERACTIVELY— WHILE VIEWING ON THE INTERNAL CRT DISPLAY

Select a section of the waveform using the time cursors, then select one of a set of waveform manipulation operations (e.g. move feature, delay, amplitude) and turn the knob! That is how easy it is to continuously modify all or part of a waveform. Time shifts, as small as 100 ps, amplitude variations on a peak, or changes in signal duration are instantly reflected in the output signal. Margin testing or characterization, with the most complex waveforms, has never been so easy.

WAVEFORM CREATION HAS NEVER BEEN EASIER

Waveforms can be selected from libraries of traditional functions or application specific waveforms. They can also be created using equations or imported from external sources such as oscilloscopes, or from computer programs and simulator output files. Once waveforms are created or captured, they can be further modified using internal waveform (array) math processing. The waveform math functions include basic arithmetic operations, smoothing, integration, differentiation, and convolution.

The highly developed waveform editing capability uses advanced signal processing to provide bandlimited cut, paste, insert and offset operations with minimal editing artifacts. Single sample resolution, further simplifying waveform creation, is allowed since waveforms are not constrained to 8 sample multiples as with most other AWGs.

To simulate real-world signals, the internal, asynchronous, wide-band noise generator is easily used to add controlled amounts of noise to your signals—simply dial in the noise level as a percentage of your signal's amplitude. A real timesaver is that if you

vary the signal's amplitude, the signal-to-noise ratio is maintained.

FLEXIBLE WAVEFORM IMPORT AND TRANSFER

Pull waveforms directly from most digital scopes; Connect a GPIB cable between the LW420B and your digital oscilloscope. Select your scope from a list of commonly available models and begin importing waveforms.

Waveforms of up to 1 Mpoints in ASCII or from programs such as MathCad, MATLAB, PSPICE, IQSIM, TOPSIM and others can be imported from the floppy drive. You can also use a shareware program from LeCroy to convert your files to DIF format and transfer directly over the GPIB to the LW420B.

When importing or transferring files, you have the choice of over sampling or importing the points exactly as they are. Once in the WaveStation, all the modification, editing and math tools can be used to put the waveform in the shape you need for your task.

FAST SWITCH GROUP SEQUENCE INCREASES TEST FLEXIBILITY AND MINIMIZES TEST TIME

LeCroy's Fast Switch Group Sequence capability enables you to switch between many different pre-loaded waveforms in less than 11 ms. Waveforms will continually play until a sequence advance is received from the front panel or a remote command. Choose to auto advance from sequence to sequence or choose to jump to the nth sequence in the group. Generate a continuous output of a sequence selected from the group, or use the external trigger input to initiate a burst or single shot of the selected sequence.

DIGITAL OUTPUT OPTION

The Digital Output option provides 8-bit TTL and ECL digital outputs corresponding to the current value of the Channel-1 analog output. The latched digital data is held for the duration of the sample clock. The digital data,

including the sample clock and its complement, are available via rear-panel connectors. The special digital editing mode is useful for creating and editing byte wide data patterns or selected bits and the standard "cut and paste" tools available for analog waveforms can also be used.

400 MS/s MAXIMUM CLOCK RATE, 1 MPOINT WAVEFORMS, AND SYNTHESIZER TIMEBASE WITH TWO PHASE- SYNCHRONIZED CHANNELS

A maximum sample rate of 400 MS/s, up to 1 Mbyte of waveform memory, a precise timebase, and single point resolution gives you the power you need to generate the most demanding, complex stimuli. The timebase combining 3 ppm accuracy and 1 ppm/year stability assures that the waveforms you test your systems with next year will be the same as the ones you use today. Low single sideband phase noise and a 1 Hz frequency resolution over a continuous 6 kHz-400 MHz range provide the flexibility and capability needed to generate even the most complex and demanding waveforms.

FULLY INTEGRATED AWG INCLUDES HIGH PERFORMANCE PROCESSOR, INTERNAL HARD DISK DRIVE, AND BUILT-IN 9 INCH CRT

WaveStation provides all the power needed to work with long and complex waveforms. A built-in hard disk drive, a 486 processor, up to 24 Mbytes of RAM, and a large internal monochrome VGA display make the LW420A a fast, responsive instrument ideally suited for the interactive graphical operations required in a high-performance AWG.

GENERATOR MODE

Standard Function Waveforms

Sine, 1 Hz–100 MHz
 Square, 1 Hz–50 MHz
 Triangle, 1 Hz–25 MHz
 Ramp, 1 Hz–25 MHz
 Pulse, (period) 20 ns - max. memory
 DC
 Frequency Sweep, Linear / Log
 Multitone, 1–10 tones,
 1 Hz–100 MHz

Special Waveform Generation Mode

IMD - Intermodulation distortion test waveform: Select center frequency, 1-15 tone pairs, tone spacing, resolution, offset from center frequency.

ARBITRARY FUNCTIONS

Waveform Creation

Interactive Graphical editor on internal 9" diagonal CRT—8.5" viewable.

Standard Functions

Sine, Square, Triangle, Ramp, Pulse, DC

Equation Editor

Waveform (array) Math
 Waveform Import From
 Digital Oscilloscope
 Floppy Disk

Feature Time Resolution:

100 ps @ 400 MHz

Available memory:

256 k/ch standard
 1 Mpoint optional

SEGMENTED WAVEFORMS

Minimum segment length: 64 points

Maximum segment length:

Up to available memory (1 Mpoint with memory option installed).

Segment length resolution: 1 point

Number of links:

512 for 256k memory
 2048 for 1M memory

WAVEFORM OUTPUT CHARACTERISTICS

Output channels:

LW410A – 1 Channel
 LW420A – 2 Channel

Output Impedance: 50 Ω , $\pm 5\%$

DC Accuracy:

2% ± 40 mV > 500 mV
 2% ± 15 mV < 500 mV

Vertical resolution: 8 bits

Minimum output voltage:

10 mV p-p into 50 Ω

Maximum output voltage:

10 V p-p into 50 Ω

Offset voltage range: ± 5 V into 50 Ω .

The output voltage (signal + offset) must be in the range ± 5 V into 50 Ω .

Offset voltage resolution: 0.05% of full scale

Output bandwidth: 100 MHz (-3dB) (widest bandwidth)

Total harmonic distortion:

For sinusoidal output of <5 V p-p;

< -45 dBc (-50 dBc typical) for frequencies: <1MHz

< -35dbc (< -45 dBc typical) for frequencies: 1 MHz–20 MHz

< -25 dBc (< -40 dBc typical) for frequencies: >20MHz–50 MHz, predominantly 2nd harmonic

Spurious & non-harmonic distortion:

< -60 dBc for frequencies <1 MHz

Signal-to-noise ratio: >40 dB (-45 typical) for output amplitudes >100 mV @ 0 offset

Transition times: 5.0 ns, 10%–90% at widest bandwidth.

Overshoot and ringing: <8% of step size max. 3% typical

Settling time: <50 ns to within 2% of step size at widest bandwidth.

Inter-channel crosstalk: <1%

Ch 1 to Ch 2 skew: <1 ns for identical waveforms in each channel (widest bandwidth).

Output protection: ± 20 V

Output filtering: Gaussian filters with the following cutoff frequencies can be selected; 100 MHz, 10 MHz, 1 MHz, 100 kHz, 10 kHz

SAMPLE CLOCK CHARACTERISTICS

(with internal 10 MHz reference)

Sample Clock: 6 kHz–400 MHz

Resolution: 1 Hz

Accuracy: <3 ppm over operating temperature range.

Stability: aging <1 ppm/year

SSB Phase Noise: < -90 dBc/Hz @ 10 KHz offset for a 10 MHz sine wave at the output

TRIGGERING CHARACTERISTICS

Trigger slope: Positive or Negative

Trigger input impedance: 50 $\Omega \pm 5\%$

Threshold range: ± 2.5 V

Threshold resolution: 20 mV

Threshold accuracy: 100 mV

Threshold sensitivity: 50 mV p-p

Minimum pulse width: 5 ns

Protection: ± 5 V

TRIGGER MODES

Continuous: Runs continuously

Single: Outputs 1 repetition of the waveform for each trigger received. Triggers received while the waveform is still running are ignored.

Burst: Outputs the selected waveform a programmable number of times in response to a trigger. The maximum number of repetitions for a burst is 4,095. Triggers received while the burst is running are ignored.

Gated: The waveform starts on the



leading edge of the gate signal and stops on completion of the waveform cycle occurring at the trailing edge of the gate signal.

TRIGGER DELAY

Minimum delay time: 35 ns \pm 3.5 ns +5 sample clocks (fixed)

Maximum delay time: 10 s at highest clock rate to 100k s at lowest clock rate.

Delay resolution: 1 sample clock. Delay is in units of seconds. When operating from the front panel, the resolution is set in increments of the sample clock period.

Delay accuracy: Same as sample clock + minimum delay time.

Delay jitter: 1 sample clock.

TRIGGER SOURCES

Manual: Front panel push-button.

External: Front panel BNC connector.

GPIB: A trigger command may be issued over the GPIB bus.

MASS STORAGE

3.5" 1.44 MB DOS format floppy drive
400 MB internal hard disk drive.

AUXILIARY INPUTS

External 10 MHz reference: Rear panel BNC connector for input of an external reference clock. 400 mV p-p to 5 V p-p into 50 Ω .

AUXILIARY OUTPUTS

10 MHz reference: \pm 3 ppm accuracy
Amplitude (high): 1.6 V into 50 Ω .
Amplitude (low): 0.2 V into 50 Ω .

Markers: Select Edge or Clock

Edge: 1 bit memory—set up to 128 edge transitions—ECL or TTL levels

Clock: Frequency up to one half the sample clock rate.

Protection: Outputs protected to \pm 5 V.

Channel 1 Digital Output Optional:

8 bits and clock with TTL and ECL logic levels available simultaneously.

Noise In: From rear panel BNC connectors.

HARD COPY OUTPUTS

Supported Printers include:

Epson MX/FX
Epson LQ
HP LaserJet II
HP ThinkJet

PROGRAMMABILITY

GPIB IEEE 488.2 compatible. Compliant with SCPI programming language. Capable of initiating and controlling waveform transfer from digital oscilloscopes by simply connecting a GPIB cable (no computer required).

MECHANICAL

Dimensions:

14.92"W x 7.67"H x 19.58"D
(37.9 cm x 19.5 cm x 49.7 cm)

Weight: 27.6 lbs (12.5 kilograms)

ENVIRONMENTAL

Temperature: 5° to 35° full specifications; 0° to 40°C operating; -20° to 70°C non-operating.

Humidity: 10% to 90% relative, non-condensing

POWER:

Autosensing
90-132/180-250 V AC
47-63 Hz

4 amps @ 115 V AC
(20 amps cold start surge)

2 amps @ 230 V AC
(40 amps cold start surge)

Warranty: One Year

LW400 SERIES - ORDERING INFORMATION

WAVEFORM GENERATORS:

Single Channel 400 MS/s Arbitrary Waveform Generator
1 Megasample memory - 1 channel
Dual Channel 400 MS/s Arbitrary Waveform Generator
1 Megasample memory - 2 channels
Rackmount Adapter for LW410/420
Transit Case for LW410/420
Soft Carrying Case for LW410/420
Operators Manual for LW410/420 - Included with LW410/420
Remote Programming Manual for LW410/420 - Incl. with LW410/420
Service Manual for LW410/420
Digital Output - Channel 1 Only
5 NIST Calibrations on any LW400 Series AWG
NIST Calibration on LW400 Series
MIL-STD Calibration on LW400 Series
5 Year Warranty and NIST Calibration on LW400 Series
5 Year Warranty on LW400 Series AWG
5 Year Warranty and MIL-STD 45662A Calibration on LW400 Series

PRODUCT CODE

LW410B
LW410-ME2
LW420B
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LS-RM
LS-TRANS
LS-SOFT
LW400-OM
LW400-RPG
LW400-SM
LW400-09A
LW4XX-C5
LW4XX-CC
LW400-CCMIL
LW4XX-T5
LW4XX-W5
LW4XX-R5/MIL