ArbStudio
Arbitrary Waveform Generators

Powerful, Versatile Waveform Creation

Key Features

- **125 MHz bandwidth**

- **1 GS/s maximum sample rate**

- **Long memory – 2 Mpts/Ch**

- **16-bit resolution**

- **2 and 4 channel models**

- **Arbitrary and Direct Digital Synthesis (DDS) modes**

- **Digital pattern generator**

- **PWM mode**

- **Sweep and burst modes**

- **Modulation – AM, FM, PM, ASK, SK, PSK**

A Powerful Combination of Performance, Capabilities and Features

A waveform generator must provide flexibility to cover a wide range of applications, high-performance to meet demanding signal requirements and be easy to use. ArbStudio Arbitrary Waveform Generators meet the needs of today's engineers and technicians with uncompromised performance, a wide variety of signal types, modulation schemes and generation modes all controlled through an intuitive, easy to use software interface.

Unmatched Performance

ArbStudio combines 125 MHz bandwidth with long 2 Mpts/Ch memory, fast 1 GS/s sample rate and high 16-bit resolution to provide performance unmatched by other generators. Other instruments make trade-offs between these specifications, only ArbStudio provides leading specification in every category. Along with this unmatched performance is the variety of models providing both 2 and 4 channel configurations as well as a digital pattern generator of up to 36 channels.

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Intuitive User Interface

The ArbStudio software provides an intuitive interface for creating, editing and sequencing waveforms. All channels, settings and controls can be accessed from the main screen. As waveforms are created they can be previewed in the graph display.
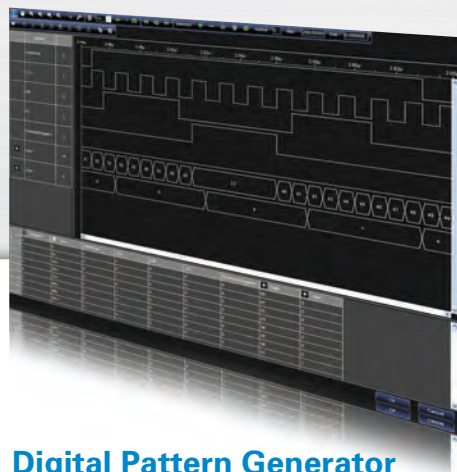
Digital Pattern Generator

Many systems have a variety of analog and digital signals yet most waveform generators provide only analog outputs. The ArbStudio 1102D and 1104D models provide analog and digital pattern generation with 18 or 36 channels respectively.

Modulation

Built-in modulation capabilities include AM, PM, FM, ASK, PSK and FSK. The modulation editor provides easy-to-use tools to configure the modulation scheme for any application.

Pulse-Width Modulation

Creating PWM signals has never been easier thanks to a dedicated control panel designed just for PWM waveforms. Easily set modulation shape, duty cycle and all other aspects of the PWM plus configure different settings for each channel.

Function Generator

All basic Sine, Square and Triangle waveforms can be created from a simple screen with controls that replicate a traditional bench top generator.
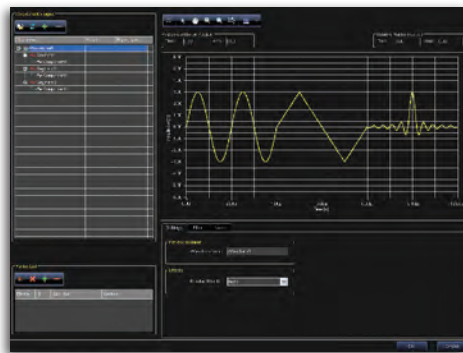
Flexibility

With both Arbitrary and Direct Digital Synthesis (DDS) ArbStudio offers extremely flexible generation capabilities. Math and noise functions are built-in and can be combined with waveforms. Up to 8 total 4 channel models can be synchronized with the AS-SYNC cable.

ArbStudio has an intuitive software interface that brings all the important controls to the main screen providing easy access to all channels, output controls, trigger controls and waveform creation screens.

1. Channel Controls

Access to all controls, waveforms and modulation capabilities of all channels.

2. Channel Status

Set or update the status and configuration of each channel or digital pod.

3. Digital Pattern Output

The 1102D and 1104D models offer simultaneously analog and digital pattern generation of 18 or 36 channels.
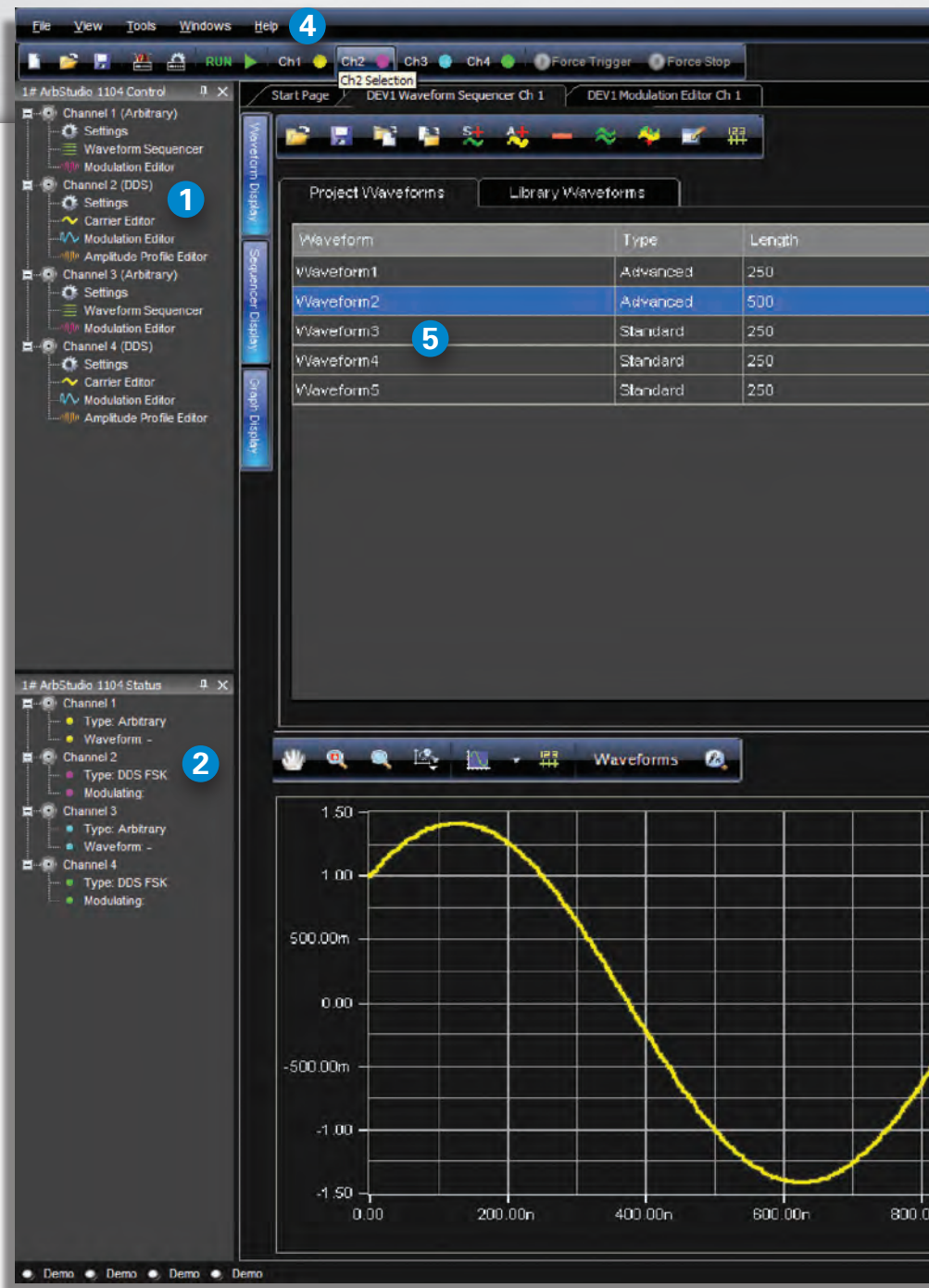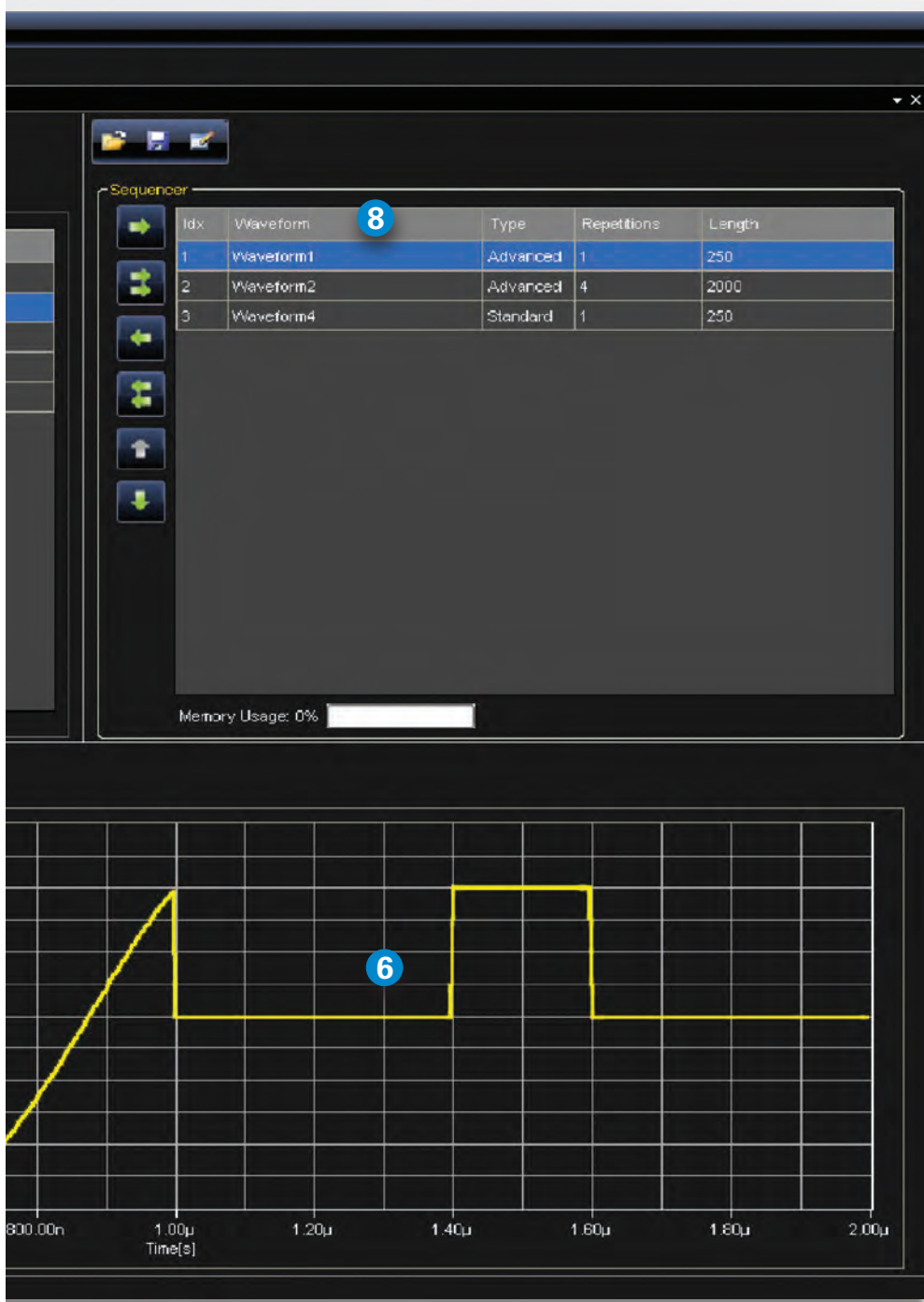

4. Output Controls

Enable the waveform output and control ArbStudio triggering.

5. Waveform List

Displays all waveforms that have been created during the current session or any waveform saved in the library.

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Sequencer

Idx	Waveform	Type	Repetitions	Length
1	Waveform1	Advanced	1	250
2	Waveform2	Advanced	4	2000
3	Waveform4	Standard	1	250

Memory Usage: 0%

6. Waveform Display
See the waveforms as they are created or view the waveforms loaded in the sequencer.

7. Synchronization Ports
Up to eight of the 4 channel models can be connected and synchronized to provide anywhere from 4 to 32 channels of simultaneous waveforms.
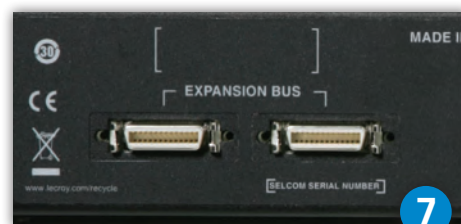
8. Waveform Sequencer
Configure the waveform sequence with only a few mouse clicks and view the output below.

9. BNC Outputs
ArbStudio is available in 2 and 4 channel configurations with a maximum output of 12 V_{p-p}.

10. Clock and Trigger Input/Output
Trigger in and trigger out connections for working with other equipment are provided as well as an external clock input.

SPECIFICATIONS

	ArbStudio 1102	ArbStudio 1102D	ArbStudio 1104	ArbStudio 1104D
Number of Channels	2		4	
Digital Pattern Generator	N/A	18 Channels	N/A	36 Channels
Waveforms	Sine, Cosine, Triangle, Rectangle, Sawtooth, Ramp, Pulse, Sinc, Exponential, Sweep, DC, Noise, From File, Arbitrary			
Waveform Characteristics				
Sine Waves				
Frequency Range (Arbitrary)	2 µHz to 125 MHz			
Frequency Range @ Max Sample Rate (DDS)	3.7 mHz to 110 MHz			
Amplitude Flatness (1 V_{p-p}, Typical)				
DC to 110 MHz (DDS)	< ±0.1 dB			
DC to 125 MHz (Arbitrary)	< ±0.1 dB			
Harmonics Distortion (1 V_{p-p}, Typical)				
≤ 1 MHz	< -66 dBc			
1 MHz to 5 MHz	< -63 dBc			
5 MHz to 10 MHz	< -59 dBc			
10 MHz to 25 MHz	< -53 dBc			
25 MHz to 75 MHz	< -38 dBc			
75 MHz to 110 MHz (DDS)	< -31 dBc			
75 MHz to 125 MHz (Arbitrary)	< -28 dBc			
Non Harmonic Distortion (1 V_{p-p}, Typical)				
≤ 1 MHz	< -71 dBc			
1 MHz to 5 MHz	< -71 dBc			
5 MHz to 10 MHz	< -71 dBc			
10 MHz to 25 MHz	< -66 dBc			
25 MHz to 75 MHz	< -53 dBc			
75 MHz to 125 MHz (Arbitrary)	< -47 dBc			
75 MHz to 100 MHz (DDS)	< -61 dBc			
100 MHz to 110 MHz (DDS)	< -30 dBc			
THD (100 kHz, 1 V_{p-p}, Typical)	< 0.15%			
Phase Noise (20 MHz, 1 V_{p-p}, Typical)				
10 kHz Offset	-106 dBc / Hz			
100 kHz Offset	-113 dBc / Hz			
1 MHz Offset	-128 dBc / Hz			
Analog Bandwidth				
Arbitrary/DDS	125 MHz / 110 MHz			
Square Wave, Pulse (1 V_{p-p})				
Frequency Range	2 µHz to 62.5 MHz			
Duty Cycle Range	1% to 99%			
Rise/Fall Time, Typical	< 3.5 ns			
Overshoot, Typical	< 5.5%			
Random Jitter (rms, Typical)	< 20 ps			
Triangle				
Frequency Range	2 µHz to 31.25 MHz			
Start Phase Range	0 to 360°			
Ramp				
Frequency Range	2 µHz to 31.25 MHz			
Sinc (Sin(x)/x)				
Frequency Range	2 µHz to 15.5 MHz			
Minimum Lobe Width	8 ns			
Waveform Sequencing				
Waveforms	All, From File, Arbitrary			
Waveform Repetitions	1 to (2^33 – 1)			
Start Source	Software, Internal, External			
No. of Waveforms	1 to 511			
Common Characteristics				
Arbitrary				
Sample Rate Real Time	4 S/s to 250 MS/s			
Vertical Resolution	16-bit			
Waveform Memory	2 Mpts / Ch			
Minimum Waveform Length	8 points			
Waveform Resolution	2 points			
Noise Bandwidth (-3 dB Gaussian Noise), Typical	100 MHz			
Run Modes	Single, Continuous, Stepped, Burst			
Direct Digital Synthesis (DDS)				
Sample Rate Real Time	125 MS/s to 250 MS/s			
Run Modes	Single, Continuous, Burst			
Carrier Waveform Memory	2048 Samples / Ch			
Amplitude, 50 Ω Load (1 kHz)	0 V to +12 V_{p-p}			
Amplitude, Open Circuit	0 V to +24 V_{p-p}			
Amplitude Resolution	< 1 mV			
DC Accuracy, Open Circuit (±12 V Range)	± 0.25% of amplitude range (within ±10 °C of calibration temperature T=25 °C, Humidity ≤ 80%) ± 0.3% of amplitude range (0 to 50 °C)			
DC Accuracy, 50 Ω Load (±6 V Range)	± 0.25% of amplitude range (within ±10 °C of calibration temperature T=25 °C, Humidity ≤ 80%) ± 0.3% of amplitude range (0 to 50 °C)			

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SPECIFICATIONS

	ArbStudio 1102	ArbStudio 1102D	ArbStudio 1104	ArbStudio 1104D
Common Characteristics (cont'd)				
AC Accuracy, Open Circuit (0 V$_{p-p}$ to +24 V$_{p-p}$ Range, 1 kHz Sine Wave)	± 0.25% of amplitude range (within ±10 °C of calibration temperature T=25 °C, Humidity ≤ 80%) ±0.3% of amplitude range (0 to 50 °C)			
AC Accuracy, 50 Ω Load (0 V$_{p-p}$ to +12 V$_{p-p}$ Range, 1 kHz Sine Wave)	± 0.25% of amplitude range (within ±10 °C of calibration temperature T=25 °C, Humidity ≤ 80%) ±0.3% of amplitude range (0 to 50 °C)			
Output Impedance	Selectable: 50 Ω, Low or High Impedance			
Short Circuit Protection	Signal outputs are robust against permanent shorts against floating ground			
Frequency Accuracy				
Stability	< ± 5 ppm			
Aging	< ± 2 ppm / year			
Max Interpolated Sample Rate	1 GS/s (4x interpolation)			
Interpolation Factors	1x, 2x, 4x			
Sampling Frequency Resolution	15 digits limited by 1 nHz			
Multi Channel Specifications				
Sampling Rate Tuning	Programmable per channel couple (Ch 1–2)		Programmable per channel couple (Ch 1–2, Ch 3–4)	
Skew Between Channels (at Common Sample Rate)				
Average (Typical)	< 300 ps			
Standard Deviation (Typical)	< 35 ps			
Math	Sum, Difference, Product of Two Channels in a Channel Pair			
Modulation				
Amplitude Modulation				
Modulation Type	Arbitrary AM, ASK			
Carrier Waveform	All, From File, Arbitrary			
Modulating Waveforms	All, From File, Arbitrary			
Modulating Source	Internal			
Modulating Waveform Sample Clock at Max. Sampling Rate	0.46 S/s to 125 MS/s			
Memory Size	2047 entries			
Phase/Frequency Modulation				
Modulation Type	Arbitrary FM/PM, FSK, PSK			
Carrier Waveform	All, From File, Arbitrary			
Modulating Waveforms	All, From File, Arbitrary			
Modulating Source	Internal			
Carrier Frequency at Max. Sample Rate				
Sine Wave	3.7 mHz to 110 MHz			
Square	3.7 mHz to 62.5 MHz			
Triangle	3.7 mHz to 31.25 MHz			
Ramp	3.7 mHz to 31.25 MHz			
Modulating Waveform Sample Clock at Max. Sample Rate	From 119.2 S/s to 125 MS/s (per sample programmable)			
Memory Size	511 entries			
Frequency Resolution at 125 MS/s Sample Rate	0.0019 Hz (FSK) 2.15E-5° (PSK)			
Frequency Resolution at 250 MS/s Sample Rate	0.0037 Hz (FSK) 4.30E-5° (PSK)			
Pulse Width Modulation				
Carrier Waveform	Pulse			
Carrier Frequency	100 mHz to 20 MHz			
Duty Cycle Modulating Waveform	Sine, Triangle, Ramp, Noise, Manual			
Duty Cycle Modulating Frequency	10 µHz to 6.67 MHz			
Source	Internal			
Duty Cycle Deviation	0% to 100% of pulse period			
Frequency Sweep				
Carrier Waveform	All, From File, Arbitrary			
Sweep Type	All waveforms			
Sweep Direction	Up or Down			
Sweep Range at Max. Sample Rate				
Sine Wave	3.7 mHz to 110 MHz			
Square	3.7 mHz to 62.5 MHz			
Triangle	3.7 mHz to 31.25 MHz			
Ramp	3.7 mHz to 31.25 MHz			
Sweep Time at Max. Sample Rate	100 ns to 4.2 s			
Pattern Generator Characteristics				
Number of Channels	N/A	18	N/A	18 / 36
Vector Memory Depth	N/A	1 Mpts / Ch (per Ch programmable direction)	N/A	1 Mpts / Ch (per Ch programmable direction)
Acquisition Memory Depth	N/A	2 Mpts / Ch	N/A	2 Mpts / Ch
Update Frequency	N/A	125 MS/s (per Ch programmable direction)	N/A	125 MS/s (per Ch programmable direction)
Sampling Frequency	N/A	250 MS/s	N/A	250 MS/s
Direction Control	N/A	Per Ch Programmable	N/A	Per Ch Programmable
Output Voltage Level	N/A	1.2 V to 3.6 V		1.2 V to 3.6 V
Trigger Levels	N/A	31	N/A	31
Operating Modes	N/A	18 Ch Digital or 2 Ch Analog	N/A	36 Ch Digital or 4 Ch Analog or 18 Ch Digital plus 2 Ch Analog

SPECIFICATIONS AND ORDERING INFORMATION

	ArbStudio 1102	ArbStudio 1102D	ArbStudio 1104	ArbStudio 1104D
Multi-instrument Synchronization				
Max Number of Instruments		Up to 8 units with AS-SYNC cable		
Synchronization Accuracy		< 300 ps		
Auxiliary Inputs/Outputs				
External Trigger Output				
Output Level		TTL compatible into > 1 KΩ		
Output Impedance		50 Ω nominal		
External Trigger Input				
Frequency Range		DC to 125 MHz		
Threshold Level		VIL_{max} = 0.8 V, VIH_{min} = 2 V		
Voltage Range		-0.5 V to 4 V		
Damage Level		VIN_{max} < 6 V, VIN_{min} > -2 V		
Slope		Rising Edge or Falling		
External Clock				
Frequency Range		0 MHz to 125 MHz		
Min. Input Voltage Swing		$\triangle VIN_{min}$ > 2 V		
Damage Level		VIN_{max} < 5 V, VIN_{min} > -5 V		
General Characteristics				
Power Supply Voltage Range		100 ±10% to 240 ±10% VAC		
Power Consumption		35 W max.		
Power Frequency Range		50/60 Hz ±5%		
PC Interface		USB 2.0		
Physical Characteristics				
External Dimensions (HWD)		2.4" x 12.8" x 7.2" (62 x 326 x 182 mm)		
Weight		2.8 lbs (1.3 kg)		
Environmental Characteristics				
Temperature (Operating)		Main equipment: 0 to 50 °C Power adapter: 0 to 40 °C		
Temperature (Non-Operating)		Main equipment: -40 to 71 °C Power adapter: -25 to 71 °C		
Humidity (Operating)		5% to 80% RH (non-condensing) at ≤ 30 °C, 50% max. RH (non-condensing) at 40 °C		
Humidity (Non-Operating)		5% to 95% max. RH (non-condensing)		
Altitude (Operating)		Up to 3,048 m (10,000 ft) at ≤ 30 °C		
Altitude (Non-Operating)		Up to 12,192 m (40,000 ft)		
Minimum PC Requirements				
Operative System		Microsoft Windows® 2000/XP SP2/Vista/7 32-bit Editions		
Processor		Intel® Pentium® III processor, or better		
Memory		512 MB RAM		
Hard Disk		150 MB available free space		
Display Resolution		800 x 600 or better		
Connectivity		USB 2.0 or 1.1		

Ordering Information

Product Description	Product Code
2 Ch 16-bit 1 GS/s Arbitrary Waveform Generator	ArbStudio 1102
4 Ch 16-bit 1 GS/s Arbitrary Waveform Generator	ArbStudio 1102D
2 Ch 16-bit 1 GS/s Arbitrary Waveform and Digital Pattern Generator	ArbStudio 1104
4 Ch 16-bit 1 GS/s Arbitrary Waveform and Digital Pattern Generator	ArbStudio 1104D
ArbStudio Sync Cable for ArbStudio 1104 and 1104D	AS-SYNC

Customer Service

LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year.

This warranty includes:
- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge

LeCroy

1-800-5-LeCroy
www.lecroy.com

Local sales offices are located throughout the world. Visit our website to find the most convenient location.

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