Keysight Technologies

Pulse Pattern and Function Arbitrary Generators and Arbitrary Waveform Generators

For Digital and Analog Testing

Leading versatile and precise stimulus through ideal and real-world signals

Revision 1.2

Signal Sources for Design and Manufacturing

KEYSIGHT
TECHNOLOGIES

Unlocking Measurement Insights

Sources for Analog and Digital Signals

Keysight offers a comprehensive portfolio
of pulse, pattern and function arbitrary waveform.

Whether your application calls for:

– Demanding digital pulses
– High-speed clock signals
– Square waves
– Flexible serial or parallel bit patterns and data streams
– Sine waves or arbitrary waveforms
– Modulation to shape the signal your DUT needs
– Jitter and noise generation to test your device to its limits
– High-resolution waveforms for radar and satellite

Keysight Technologies, Inc. provides the stimulus solution you are looking for.

Choose the performance you need from the portfolio of reliable
pulse generators, the data generator platform with up to 132 par-
allel channels or the multi-purpose pulse function arbitrary noise
generator instruments.

Keysight's family of stimulus instruments comprises:

– Pulse generators
– Pattern generators
– Data generators
– PRBS generators
– Jitter generators
– Noise generators
– Controllable jitter injection
– Timing generators
– Function arbitrary generators
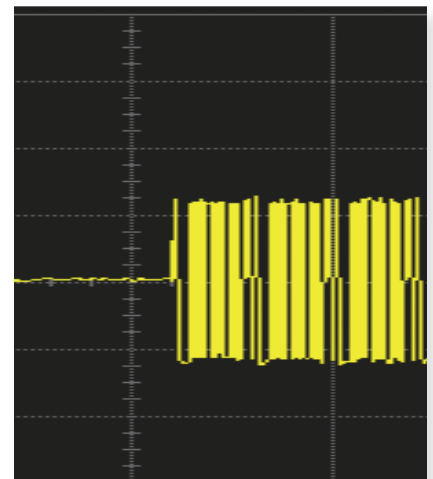– Arbitrary waveform generators

Keysight provides the perfect signal generation instrument for
your application.

Whether you:

– Require powerful pulses for the latest generation of laser diodes,
– Need to characterize a high-speed serial bus device at the physical layer, or
– Need to get a detailed insight into your system's signal integrity,

Keysight's pulse pattern generators and pulse function arbitrary noise generators deliver
the reliable and accurate results you require.

HARDWARE + SOFTWARE + PEOPLE = INSIGHT

Signal Sources

Pulse pattern generator	Function arbitrary generator	Arbitrary waveform generator
Pulse Perfomance	**Sine Wave Performance**	**Modulation Bandwidth**
16.2 Gb/s 13.5 Gb/s 12.5 Gb/s	M8020A/41A-C16/G16 81250A N4903B G13 — to 20 GHz	M8195A
7 Gb/s	M8020A/41A-C08/G08 81250A N4903B G07	
5 GHz	to 5 GHz	M8190A
3.35 GHz	81134A 81133A — to 1.5 GHz	81180B
660 MHz	81130A 81132A	
400 MHz	81130A 81131A — to 500 MHz	M933xA N824xA
330 MHz	81160A 81110A/81112A	
165 MHz	81110A/81111A	
120 MHz	81150A to 240 MHz	33621A 33622A — to 120 MHz
80 MHz		33250A 33611A 33612A
20 MHz	U2761A	33220A
10 MHz		33210A

Product Specifications at a Glance

Product Number	Frequency range	Maximum sample rate	Number of channels	Optional 2nd channel retrofittable	Amplitude range	Differnetial outputs	LVDS levels	Triggerable	Gate mode	Remotely programmable	Sine waves	Pulse generation	Pattern & data generation	PRBS generation
U2761A	1 µHz - 20 MHz	50 MSa/s	1		40 mV$_{pp}$ - 5.0 V$_{pp}$[1]			●		●	●	●		
332x0A/ 33522A	1 µHz - 80 MHz	50/200/ 250 MSa/s	1		10 mV$_{pp}$ - 10 V$_{pp}$[1]			●		●	●	●		
3361xA/3362xA	1 µHz -120 MHz	660 MSa/s	1/ 2		1 mV$_{pp}$ - 10 V$_{pp}$[1]			●		●	●	●		●
81150A	1 µHz - 240 MHz	2 GSa/s	1 or 2		100 mV$_{pp}$ - 10 V$_{p}$[1]	●	●	●	●	●	●	●	●	●
81160A	1 µHz - 500 MHz	2.5 GSa/s	1 or 2		50 mV$_{pp}$ - 5.0 V$_{pp}$[1]	●	●	●	●	●	●	●	●	●
81110A + 81111A	1 mHz - 165 MHz	N/A	1 or 2	●	100 mV$_{pp}$ - 20.0 V$_{pp}$[2]			●	●	●		●	●	●
81110A + 81112A	1 mHz - 330 MHz	N/A	1 or 2	●	100 mV$_{pp}$ - 3.8 V$_{pp}$[2]	●		●	●	●		●	●	●
81130A + 81131A	1 kHz - 400 MHz	N/A	1 or 2	●	100 mV$_{pp}$ - 3.8 V$_{pp}$[1]	●			●	●		●	●	●
81130A + 81132A	1 kHz - 660 MHz	N/A	1 or 2	●	100 mV$_{pp}$ - 2.5 V$_{pp}$[1]	●			●	●		●	●	●
81133A/ 81134A	15 MHz - 3.35 GHz	N/A	1		50 mV$_{pp}$ - 2.0 V$_{pp}$[3]	●	●			●		●	●	●
N4903B-G07/- G13	150 Mb/s -12.5 Gb/s [4] - 14. 2Gb/s with option D14	N/A	1 or 2	●	50 mV$_{pp}$ - 1.8 V$_{pp}$[3]	●	●			●			●	●
M8020A + M8041A/51A	256 Mb/s - 16.2 Gb/s [4]	N/A	1 - 4	●	50 mV$_{pp}$ - 1.2 V$_{pp}$[3]	●	●			●			●	●
M8020A + M8061A	1 Gb/s - 32.0 Gb/s [4]	N/A	1 or 2	●	50 mV$_{pp}$ - 1.2 V$_{pp}$[3]	●	●			●			●	●
81250A	20.8 Mb/s - 13.5 Gb/s [4]	N/A	2 - 132	●	100 mV$_{pp}$ - 1.8 V$_{pp}$[3]	●	●			●			●	●
N824xA/ M933xA	1 Hz - 500 MHz	1.25 GSa/s or 625 Sa/s	2		0.5 V$_{pp}$ - 1.0 V$_{pp}$[1]	●			●	●	●	●		
81180B	10 kHz - 1.5 GHz	4.6 GSa/s	1 or 2		100 mV$_{pp}$ - 3.0 V$_{pp}$[3]	●	●	●	●	●	●	●		
M8190A	1Hz - 5 GHz	12 GSa/s	1 or 2		350 mV$_{pp}$ -2.0 V$_{pp}$[3]	●	●	●	●	●	●	●	●	
M8195A	4 Hz - 20 GHz	65 GSa/s	1, 2 or 4	●	250 mV$_{pp}$ - 1.0 V$_{pp}$[3]	●		●	●	●	●	●	●	

1. 50 Ω into 50 Ω
2. 1 kΩ into 50 Ω
3. single ended
4. For BERT pattern generators only bit rates can be specified

Product Specifications at a Glance (2)

Product Number	Bursts	Data Bursts	Memory per channel	PRBS variations (2n - 1)	Segment looping	Controlled jitter injection	Variable width	Variable delay	Glitch-free timing changes (patented)	Analog channel add	Digital channel add	Multi-level signals	Modulation	Noise with adjustable crest factor	Uncopuple	Couple
U2761A							●	●				●	●			
332x0A/ 33522A	●		64 kSa				●	●				●	●			
3361xA/3362xA	●		4 MSa (64 MSa with option MEM)	n = 3, 4... 32			●	●	●	●		●	●		●	●
81150A	●	●	512kSa (16 Mbit pattern memory)	n = 7, 9, 11, 15, 23, 31	with pattern option PAT	●	●	●	●		●	●	●	●	●	●
81160A	●	●	256 kSa (4 Mbit pattern memory)	n = 7, 9, 11, 15, 23, 31	with pattern option 330 or 660	●	●	●	●		●	●	●	●	●	●
81110A + 81111A	●	●	16 kbit	n = 7,8,... 14			●	●	●	●						
81110A + 81112A	●	●	16 kbit	n = 7,8,... 14			●	●	●	●						
81130A + 81131A	●	●	64 kbit	n = 7,8,... 15	4 segments, 1 looping level		●	●			●					
81130A + 81132A	●	●	64 kbit	n = 7,8,... 15	4 segments, 1 looping level		●	●			●					
81133A/ 81134A	●	●	12 kbit	n = 5,6... 32		●	●	●	●[1]							
N4903B-G07/-G13	●	●	32 Mbit	n = 7, 10, 11, 15, 23, 31	120 segments, 1 looping level	●			●		●					
M8020A + M8041A/ 51A	●	●	2 Gbit	n = 7, 10, 11, 15, 23, 31	500 segments, 3 looping levels	●		●	●		●					●
M8020A + M8061A	●	●	2 Gbit	n = 7, 10, 11, 15, 23, 31	500 segments, 3 looping levels	●		●	●		●					●
81250A	●	●	8 kbit	n = 7, 10, 11, 15, 23, 31 (also PRWS)	30-60 segments, 4 looping levels	●		●	●		●				●	●
N824xA/ M933xA			8MSa (16 MSa with option 016)		with option 300 32,000 segments		●	●				●	●			
81180B			16 or 64 MSa		16,000 segments		●	●			●	●	●		●	●
M8190A			2 GSa		with option SEQ 219 = 524,288 segments		●	●				●	●		●	●
M8195A			16 GSa per AXIe module		with option SEQ		●	●				●	●		●	●

1. Glitch-free frequency changes only in 'direct' clock mode with external clock source

Key Applications at a Glance

	Clock generation	System trigger source	Diodes –LEDs	Radar test	Mixed signal devices	Flash chip test	PRBS generation	Data generation	Data looping	Serial bus test < 1 Gbit/ s	Hig speed serial bus test > 1 Gbit/ s	Signal integrity test	Jitter (stress) test	Noise immunity test
U2761A														
332x0A/33522A	●	●		●	●			●				●	●	●
3361xA/ 3362xA							●							
81150A	●	●		●	●		●					●	●	●
81160A	●	●		●	●		●					●	●	●
81110A + 81111A	●	●	●	●	●	●	●	●		●				
81110A + 81112A	●	●		●	●		●	●		●				
81130A + 81131A	●	●					●	●	●	●	●			
81130A + 81132A	●	●					●	●	●	●	●			
81133A/ 81134A	●	●					●	●				●	●	●
N4903B-G07/ G13	●	●								●	●	●	●	●
M8020A + M8041A/ 51A	●	●									●	●	●	●
M8020A + M8061A	●	●									●	●	●	●
81250A	●	●								●	●	●	●	
N824xA/ M933xA				●	●							●	●	●
81180B				●	●							●	●	●
M8190A				●	●						●	●	●	●
M8195A				●	●						●	●	●	●

Pulse Generation

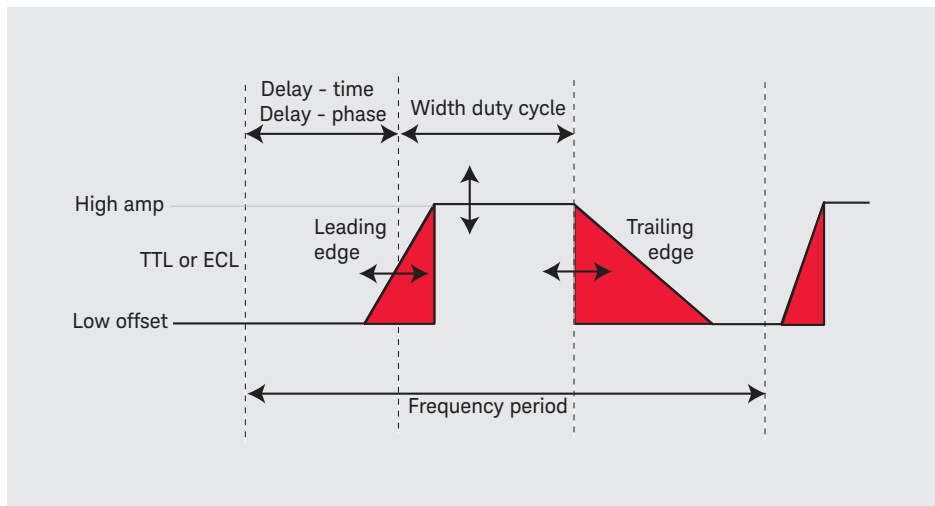## Pulse generation and signal parameters

A pulse generator provides full control over all pulse parameters like timing, levels and edges as shown in the diagram below.

It is used to set up continuous or triggered pulse streams and offers flexibility to address the most challenging applications.

All parameters can be adjusted to meet the needs of the specific application. Pulse generation capability is provided by all models. The pulse function arbitrary noise generator provides all flexibility to generate ideal and worst-case signals. The Keysight instruments cover a frequency range from 1 µHz to 5 GHz and an output amplitude range from 50 mV up to 100 V.

Glitch-free timing changes

The Keysight 81150A, 81160A, 81133A, 81134A, 81110A and N4903B uniquely allow timing parameter changes, such as changing the frequency, without dropouts or glitches. This industry-leading feature enables continuous operation without rebooting or resetting the device under test, when measuring a PLL pull-in and hold range for instance, or to characterize a device over a sweeping clock frequency.

Pulse parameters
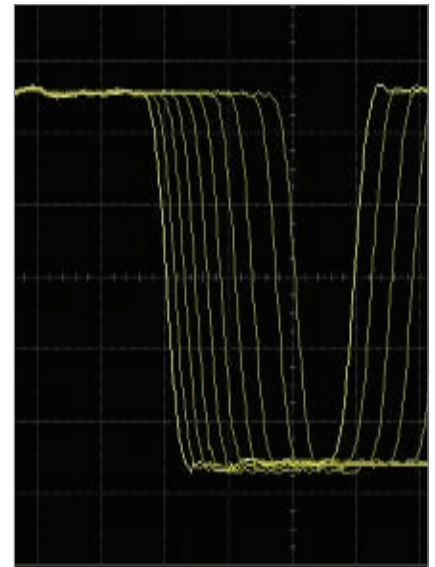
From Pulse to Pattern, Data and PRBS

Pulse pattern generators not only generate single impulses, bursts or continuous pulse streams as mentioned before.

Their pattern capability also allows the generation of data signals. This versatility is key to digital device test applications, for example for compliance tests.

In pattern mode, the same full control over the signal output is available as in the traditional pulse generation mode. This allows the generation of uncounted forms of data signals, including standard non-return-to-zero (NRZ) signals, or data bursts with programmable pulse width with additional delay to the clock signal.

Apart from user defined data signals, standardized pseudo random binary sequences (PRBS) can also be generated.

The ability to create user-defined bit patterns, standard compliant data and PRBS make the Keysight pulse pattern generators the ideal source for:

- Stimulated eye diagram measurements
- Cross-talk measurements
- Compliance tests
- Jitter tests
- Signal integrity measurements
- Stress tests for receivers

With the 81250A data generator and analyzer platform, modular and parallel pulse and data applications can be addressed with up to 132 parallel channels. The 81130A's data looping capabilities or the 12 MBit deep memory and the PC based pattern management tool of the 81133A and 81134A enable you to generate 'real-life' data sequences for today's latest technology, like serial high-speed busses.

Pulse pattern generators provide all the tools to generate the data packets needed for digital bus device tests: integrated pattern editors, PC-based graphically enhanced data and pattern management software, segment looping features as well as hardware-generated PRBS. This enables engineers to quickly gain detailed insight into their digital bus device - including devices for:

- USB 2.0
- Serial ATA
- PCI Express®
- Firewire and more

These tools allow the easy carrying out of all measurements from physical layer characterization, signal integrity, and jitter measurements, to complete standard compliance test.
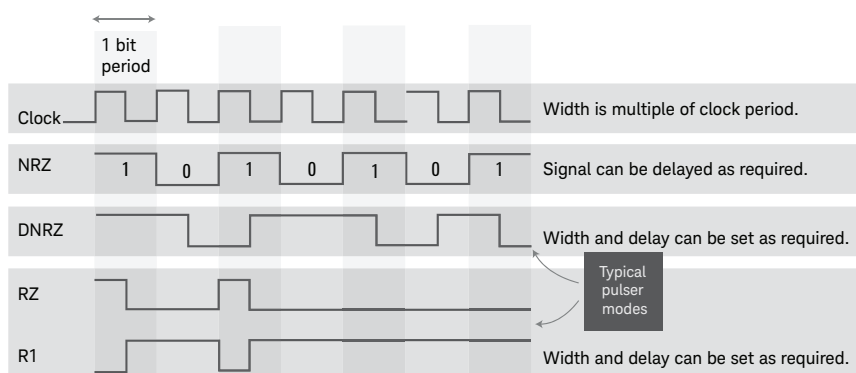
From Digital to Analog

The Keysight family of function arbitrary and arbitrary waveform generators with a wide range of possibilities to generate the signals you need. Whether you require a clean, low distortion sine wave, a variable-edge-time pulse or a complex custom waveform Keysight provides the right choice.

The commonly used direct digital synthesis (DDS) technology that provides the precision of digitally controlled logic to increase the stability of the output signal and reduce the complexity of the generator.

Using a Keysight proprietary point-by-point technology, the Keysight 33520 Series combines the low cost of DDS with the precision found in higher cost arbitrary waveform generators. With true point-by-point, the 33520 Series reproduces each point in memory with μHz frequency resolution, full bandwidth, and < 40 ps jitter.

The U2761A is a 20 MHz USB modular function generator with arbitrary waveform capabilities. The 332x0 Series contains three instruments for 10 MHz, 20 MHz, and 80 MHz sine waves. The 30 MHz, 16-bit 33520 Series 1 and 2 channel function/ arbitrary waveform generators use true point-by-point technology.

The 81150A and the 81160A combine different instruments to increase test efficiency while reducing test time.

Mixed signal devices require analog and digital signals in addition to modulation capabilities.

Combining different instruments like a pulse generator, function arbitrary generator, and noise generator allows you to generate the signal you need, whether it is an ideal pulse or a real-world signal.

The 81150A and the 81160A provide:

81160A pulse function arbitrary noise generator

– A pulse generator with precise signals for performance verification and characterization
– A function arbitrary generator for versatile signal generation to optimize testing and for modulation to shape the signal to the DUT needs
– A noise generator to distort signals and build worst-case scenarios
– An optional pattern generator to emulate digital devices with real-world conditions.

Signal imperfections such as rise time, ringing, glitches, noise and random timing variations can be easily simulated in a controlled manner. Physics, chemistry, biomedicine, electronics, mechanics, and other fields can benefit from the versatility of an arbitrary waveform generator. Wherever things vibrate, pump, pulse, bubble, burst, or change with time, there are applications available – limited only by your ability to specify the waveform data.

The noise generators are needed to distort the signal in a controlled and repeatable manner. Your device under test might require an arbitrary or a Gaussian distribution. A long repetition rate of 20 days (or even 26 days for the 81150A) guarantees an almost random signal with exact signal repetition. The selectable crest factor guarantees to test even serial bus standards.

Function arbitrary and arbitrary waveform generators

Specifications	Basic waveforms	Advanced waveforms	Amplitude	Connectivity
U2761A 20 MHz, modular	Sine and square (1 µHz to 20 MHz), pulse with variable edge time (1 µHz to 5 MHz), ramp, triangle	Arbitrary: 1 µHz to 200 kHz, 64 kSa, 14 bit, 50 MSa/s AM, FM, PM, FSK, PSK, ASK, sweep, exponential rise/fall	40 mVpp to 5 Vpp (into 50 Ω) 80 mVpp to 10 Vpp (into open-circuit)	USB
33210A 10 MHz	Sine, square, pulse, triangle, ramp, noise	Optional arbitrary: 1 mHz to 3 MHz, 2 to 8 kSamples, 14 bits, 50 MSa/s AM, FM, PWM, burst, sweep, exponential rise/fall, negative ramp, sin(x)/x, cardiac	10 mVpp to 10 Vpp (into 50 Ω) 20 mVpp to 20 Vpp (into open-circuit)	GPIB, LAN, LXI Class C and USB
33220A 20 MHz	Sine and square (1 µHz to 20 MHz), pulse, ramp, triangle, noise, and DC	Arbitrary: 1 µHz to 6 MHz, 2 to 64 kSamples, 14-bit, 50 MSa/ s AM, FM, PM, FSK, PWM, burst, sweep, exponential rise/fall, negative ramp, sin(x)/x, cardiac	10 mVpp to 10 Vpp (into 50 Ω) 20 mVpp to 20 Vpp (into open circuit)	GPIB, LAN, LXI Class C and USB
33250A 80 MHz	Sine and square (1 µHz to 80 MHz), pulse with variable edge times (1 µHz to 5 MHz), ramp, DC	Arbitrary: 64 kSamples, 12 bits, 200 MSa/s AM, FM, FSK, burst, sweep, noise, exponential rise/fall	10 mVpp to 10 Vpp (into 50 Ω) 20 mVpp to 20 Vpp (into open-circuit)	RS-232
336xxA 120 MHz	Sine (1 µHz to 120 MHz), square and pulse (1 µHz to 100 MHz)	Arbitrary: 64 MSamples, 12 bits, 200 MSa/s, PRBS, with slectable PN type, bit rate and edge time	1Vpp to 10 Vpp (into 50 Ω) 2 mVpp to 20 Vpp (into open-circuit)	GPIB, LAN, LXI Class C and USB (optional)
81150A 240 MHz	120 MHz pulse, 240 MHz sine, square, triangle, sin(x)/x, ramp	Arbitrary: 512 kSamples , 14 bit, 2 GSa/s FM, AM, PM, PWM, FSK, noise with selectable crest factor Pattern: user-defined and PRBS, 16 Mbit memory	100 mVpp to 10 Vpp (into 50 Ω) 200 mVpp to 20 Vpp (into open-circuit)	GPIB, LAN, LXI Class C and USB
81160A 500 MHz	330 MHz pulse, 500 MHz sine, square, triangle, sin(x)/x, ramp	Arbitrary (user defined): option 001 up to 256 kSamples, option 002 up to 128 kSamples per channel,14 bit, 2.5 GSa/ s FM, AM, PM, PWM, FSK, noise with selectable crest factor Pattern: user-defined and PRBS, option 001 memory 4 Mbit, option 002 2 Mbit per channel, arbitrary bit shaping, three level signals, sequencing	50 mVpp to 5 Vpp (into 50 Ω) 100 mVpp to 10 Vpp (into open-circuit)	GPIB, LAN LXI Class C and USB
M933xA/N824xA 1.25 GSa/s	Sine, square, pulse, doublet and ramp (1 Hz resolution)	Arbitrary: 16 Msamples, 15- or 10-bit, 1.25 GS/s with advanced sequencing, DC-500 MHz (1 GHz IQ modulation) bandwidth. AM, FM, FSK, burst, sweep	1 to 800 mVpp (function generator), up to 1 Vpp (arbitrary waveform generator)	CompactPCI®, PXI, PXIe (hybrid slot) and LXI
81180B 4.6 GSa/s	Standard sine and square waveforms at frequencies up to 250 MHz	Arbitrary waveform generator, 12-bit, 10 MSa/s - 4.6 Gs/s, any arbitrary waveform, 2 GHz IQ modulation bandwidth	100 mVpp to 3 Vpp single ended, 200 mVpp to 6 Vpp differential	GPIB, LAN, USB
M8190A 12 GSa/s	Standard sine and square waveforms at frequencies up to 5 GHz	Arbitrary waveforms with 2 DAC settings: 12 bit with 12 GSa/s and 14 bit with 8 GSa/s, Variable sample rate from 125 MSa/s to 8 / 12 GSa/s, 7 GHz IQ modulation bandwidth, up to 2 GSa memory per channel	3 selectable output amplifers: Direct DAC: −350 mVpp ... 700 mVpp DC amplifier: 500 mVpp ... 1.0Vpp AC amplifer: 200 mVpp ... 2.0 Vpp	GPIB, LAN and USB
M8195A 12 GSa/s	Standard sine and square waveforms at frequencies up to 20 GHz	Arbitrary waveforms 8 bit with up to 65 GSa/s, 2 independent I/Q baseband signals (dual polarization = 4 channels) at up to 32 GBaud and beyond, multi-level signals: NRZ, PAM4, PAM 8, DMT etc.	250 mVpp to 1 Vpp single ended, 500 mVpp to 2 Vpp differential	GPIB, LAN and USB

Put a Bench in Your Bag: U2761A

U2761A USB modular one-channel function generator

The Keysight U2761A 20 MHz USB modular function generator with one channel offers the flexibility of standalone and modular operation.

It offers eleven standard signals as well as arbitrary waveforms. It relies on direct digital synthesis (DDS) to create stable, accurate output of low-distortion sine waves. The U2761A also provides square waves with fast rise and fall times up to 20 MHz and linear ramps up to 200 kHz. For simulation of real-world signals, use the waveform editor to create arbitrary waveforms with 14-bit resolution up to 200 kHz.

Internal modulation eliminates the need for a separate modulation source. Linear and logarithmic sweeps are also built in, with sweep rates from 1 ms to 500s. With the included IVI-COM drivers, this instrument is compatible with popular development environments. Hi-Speed USB 2.0 compatibility makes connection to a PC quick an easy.

www.keysight.com/find/u2761a

Key features U2761A

– 20 MHz sine and square wave-forms
– 40 mV$_{PP}$ to 5 V$_{PP}$ amplitude range
– Pulse generation with variable period, pulse width and ampli-tude
– Sine, square, ramp, triangle, pulse, noise and DC wave-forms
– AM, FM, PM, ASK, FSK, PSK signals
– 14-bit, 64 k points, 50 MSa/s arbitrary

Complementary products

– U2781A USB modular
– Product chassis

The Basics: 33200 and 33500 Series

The Keysight 33200 and 33500 function/ arbitrary waveform gen-
erators are economical instruments used to create signals up to 80
MHz. With their ability to produce functions (sine, square, pulse,
etc.) as well as user-defined arbitrary waveforms, these instruments
are versatile additions to any electronics bench or test system.

Function
Arbitrary

The 33200 Series offers three bandwidths: 10 MHz, 20 MHz, and 80 MHz for the 33210A,
33220A, and 33250A, respectively. They all use the direct digital synthesis (DDS) tech-
nology explained earlier to produce both the functions as well as the arbitrary wave-
forms. By using DDS, these instruments can produce signals with very high frequency
resolution while having low distortion. All instruments in the 33200 Series provide stan-
dard functions, arbitrary waveforms, modulation, sweep, burst, and triggered outputs.
Also, they can be synchronized to another Function/Arbitrary Waveform generator or to
a user-supplied 10 MHz clock.

The one and two channel 33500 Series sets a new standard in the 30 MHz function/arbi-
trary waveform generator class of products. Based on a proprietary Keysight technology,
these instruments offer true point-by-point waveform generation. The 33500 Series
provides standard functions, arbitrary waveforms, modulation, sweep, burst, triggered
outputs, synchronization to an external reference, and 2-channel operation (33522A).

www.keysight.com/find/33210a
www.keysight.com/find/33220a
www.keysight.com/find/33250a
www.keysight.com/find/33522a

Key features 33200 Series

– Low distortion functions and
  arbitrary waveforms
– Choice of bandwidths –
  10 MHz, 20 MHz, and 80 MHz
– Textual and graphical display in
  a 2U x ½ rack package
– Standard connectivity – GPIB,
  USB and LAN (33210A/20A),
  and RS-232 (33250A)
– Free waveform editing software

Key features 33500 Series

– True point-by-point technology
  for the highest signal fidelity in
  its class
– 30 MHz, 16-bit, 250 MSa/s
  waveform generation
– Large display with built-in
  waveform editor in a 2U x ½
  rack package
– Standard connectivity – USB,
  LAN, and optional GPIB
– Free waveform editing software
  plus optional Waveform Builder
  Pro software

Complementary products

– Infiniivision 7000 oscilloscopes
– Infiniivision 2000 X and 3000 X
  oscilloscopes
– 34410A and 34411A digital
  multimeters
– 53200 Series universal/RF
  counters

The Basics: 33600 Series

33600 Series waveform generators with exclusive Trueform signal generation technology offer more capability, fidelity and flexibility than previous generation Direct Digital Synthesis (DDS) generators. Use them to accelerate your development process from start to finish.

Function
Arbitrary

The one and two channel 33600 Series offers two bandwidths: 80 MHz for the 33611A and 33612A and 120 MHz for the 33621A and 33622A Trueform wavefrom generators. Keysight Technologies, Inc. Trueform technolgy offers an alternative that blends the best of DDS and point-per-clock architectures giving you the benefits of both without the limitations of eitehr. All instruments in the 33600 Series provide the full range of signals such as arbitrary waveforms, modulation, sweep, burst, and triggered outputs.

They can generate high-bandwidth pulses up to 100 MHz, PRBS patterns, Trueform arbitary waveforms.

Built-in LAN, USB and optional GPIB interfaces allow yout to easily control your instruments or transfer wavefroms to you instrument. Test your device with confidence that the waveform generator is outputting the signals you expect.

www.keysight.com/find/33600a

Key features 33600 Series

- 1 GSa/s sampling rate
- up to 80 MHz and 120 MHz
- 14-bit resolution with 1 mVpp to 10 Vpp amplitude for greater amplitude accuracy
- arbitrary waveform generation with sequencing and up to 64 MSa memory
- 1 ps jitter, 200 x better than DDS generators
- 5 x lower harmonic distortion than DDS

Complementary products

- 33503A BenchLink Waveform Builder Pro software
- 34840B BenchVue software
- Infiniivision 7000 oscilloscopes
- Infiniivision 2000 X and 3000 X oscilloscopes
- 34410A and 34411A digital multimeters
- 53200 Series universal/RF counters

81150A Pulse Function Arbitrary Noise Generator

The Keysight 81150A pulse function arbitrary noise generator enables reliable and repeatable measurements. It is the instrument of choice for pulse and clock generation.

Pulse Function Arbitrary Noise

It offers flexible pulse, clock and trigger generation with highest signal quality and with a frequency range up to 120 MHz. It is therefore a perfect fit for all system clock or trigger applications.

It combines the benefits of a pulse generator, a noise generator and a function arbitrary generator. The pattern generator is optional and allows sending ideal and real-world pattern. The arbitrary bit shaping lets you emulate overshoot, asymmetric delay and duty cycle distortion up to 120 Mbit/s.

Test your DUT with high quality pulses but without any effects generated by the source. Achieve complete control over timing parameters including trigger ability with fixed latency and glitch-free change of timing. The different modulation capabilities up to 10 MHz, combined with the precision digital noise functionality, allow you to build real-world signals, simply and quickly. Use real-life signals for worst case scenarios e.g., reproducible noise.

The selectable crest factor (voltage peak/RMS[1]) combined with the long repetition period of 26 days helps you to stress your device to its limits but keeping the test results repeatable. The enhanced trigger capabilities are there to measure exactly when needed.

www.keysight.com/find/81150

Key features 81150A

– 1 or 2 channels
– 1 µHz – 120 MHz pulse with variable rise/fall time
– 1 µHz – 240 MHz sine wave-form outputs
– Precise digital noise: crest factor (peak/RMS) selectable: 3.1, 4.8, 6.0, 7.0
– Noise repetition: 26 days
– Pulse, sine, square, ramp, noise, and arbitrary waveforms
– Triggerable
– FM, AM, PM, FSK, PWM modulation capability
– Full control of all pulse parameters (rise/fall/width, etc.)
– Differential outputs
– Ideal and arbitrary bit shaped pattern up to 120 Mbit/s
– Three level signals
– PRBS 2^{31}
– 16 Mbit pattern
– Integration in Matlab, Keysight 33503A BenchLink Waveform Builder Pro

Complementary products

– InfiniiVision 7000 Series oscilloscope

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1. RMS = root mean square

81160A Pulse Function Arbitrary Noise Generator

The Keysight 81160A pulse function arbitrary noise generator tackles a new speed class up to 500 MHz, offering at the same time the well-proven flexibility and quality in signal generation of the 81150A pulse function arbitrary noise generator.

Pulse
Function
Arbitrary
Noise

Like the 81150A, the 81160A allows high-precision pulse, clock and trigger generation and addresses the same vast spectrum of applications: digital and mixed signal device test, capture and reproduce live signals, radar distance test, sensor simulation and disc drive tests – to name only a few.

Functionality like glitch-free change of timing parameters allows frequency changes without drop-outs or glitches so that tests can be performed without interruptions or time-consuming repetitions.

Plug and play solutions with minimal cabling, low space overhead also maximize test efficiency.

The optional pattern generator is available with a data rate up to 330 Mbit/ s (Option 330) and up to 660 Mbit/s (Option 660).

www.keysight.com/find/81160

Key features 81160A

– 1 or 2 channels
– 1 µHz – 330 MHz pulse with variable rise/fall time
– 1 µHz – 500 MHz sine waveform outputs
– Precise digital noise: crest factor (peak/RMS) selectable: 3.1, 4.8, 6.0, 7.0
– Noise repetition: 20 days
– Pulse, sine, square, ramp, noise, and arbitrary waveforms
– Triggerable
– FM, AM, PM, FSK, PWM modulation capability
– Full control of all rise parameters (rise/ fall/ width, etc.)
– Differential outputs
– Ideal and arbitrary bit shaped pattern up to 330 Mbit/ s (Opt 001) and 660 Mbit/ s (Opt 002)
– Three level signals
– PRBS 2^{31}
– 4 Mbit pattern for Opt 001, 2 Mbit pattern per channel for Opt 002

Complementary products

– DSO/ MSO 9104A
– InfiniiVision 7000 Series oscilloscope
– DSO/ MSO 9064A

Test & Measurement World

BEST
IN
TEST

2012 FINALIST

The Lab Standard: 81110A
81110A 165/330 MHz pulse generator

The Keysight 81110A pulse pattern generator is the industry-standard for pulse, pattern, data and PRBS generation up to 165/330 MHz.
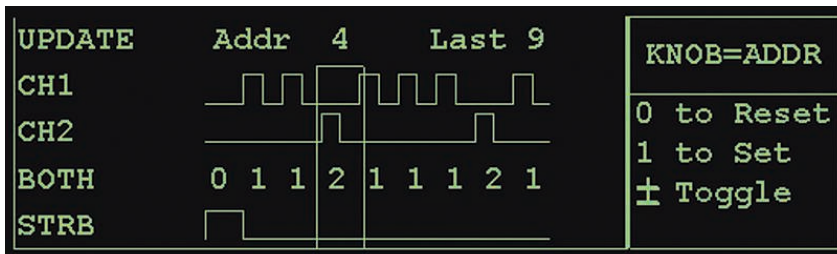

Pulse
Pattern
Data
PRBS

It provides high quality signals and leading flexibility that meets virtually all application needs. This instrument is a must for all labs.

The 81110A with one or two 81111A 165 MHz output channels provides pulse, pattern, data and PRBS generation up to 165 MHz with an amplitude of up to 20 Vpp and an output impedance of 1kΩ into 50 Ω. With the same user interface and programming commands, it is the natural upgrade from the 81101A and 81104A.

The 81110A with 81111A output channels is used in countless applications, flash chip test, communication equipment, aerospace defence and automotive test as well as many other high-end applications.

Alternatively, the Keysight 81110A pulse pattern generator with one or two Keysight 81112A 330 MHz output modules is also the right choice for a broad range of test applications. Instead of variable transitions, 800 ps or 1.6 ns edges are selectable. The output impedance is 50 Ω and provides up to 3.8 Vpp into 50 Ω. Internal channel addition is not available.

81111A and 81112A output channels can not be combined in one and the same 81110A.

The Lab Standard: 81110A (2)

81110A pulse pattern generator with 81112A 330 MHz
output channel(s)

81110A pulse pattern generator with 81111A 165 MHz or with
81112A 330 MHz output channel(s)

Key features 81110A with 81111A

– 1 or 2 channels
– Up to 20 Vpp (1 kΩ into 50 Ω)
– Variable transition times between 3 ns and 200 ms
– Internal and external clocking
– 1 mHz to 165 MHz repetition rate
– Glitch-free timing changes
– Triggerable or internal PLL
– Single ended outputs
– Analog channel addition
– Data patterns
– Pseudo random binary sequence (PRBS) generation

Key features 81110A with 81112A

– 1 or 2 channels
– Up to 3.8 Vpp (50 Ω into 50 Ω)
– Selectable transition times 800 ps or 1.6 ns
– Internal and external clocking
– 1 mHz to 330 MHz repetition rate
– Glitch-free timing changes
– Triggerable or internal PLL
– Differential outputs
– Data patterns
– Pseudo random binary sequence (PRBS) generation

Complementary products

– Infinii Vision 6000 Series D/MSO
– Infinii Vision 7000 Series D/MSO
– Infiniium 9000 Series D/MSO

Clean and Precise: 81130A

81130A pulse pattern generator with 81131A 400 MHz output channel(s)

The Keysight 81130A 400 MHz pulse pattern generator with one or two 81131A output channels is the instrument of choice for advanced applications that require even higher precision signals and timing accuracy.

Precision
Timing
PRBS
Data
Pattern
Pulse

It offers a wide channel delay range and of course, full control of the pulse width. On top of which, enhanced data generation and pattern segment looping features allow you to generate complex data patterns.

Key features 81130A with 81131A

– 1 or 2 channels
– Up to 3.8 Vpp (50 Ω into 50 Ω)
– Selectable transition times 800 ps or 1.6 ns
– Internal and external clocking
– 1 kHz to 400 MHz repetition rate
– Precision timing
– Differential outputs
– EXOR channel addition
– Complex data patterns and pattern segment looping
– Pseudo random binary sequence (PRBS) generation

Complementary products

– Infinii Vision 6000 Series D/MSO
– Infinii Vision 7000 Series D/MSO
– Infiniium 9000 Series D/MSO

Clean and Precise: 81130A (2)

81130A pulse pattern generator with 81132A 660 MHz output channel(s)

The Keysight 81130A pulse pattern generator with one or two 81132A 660 MHz output channels offers enhanced performance compared to the 81130A with 81131A output channels.
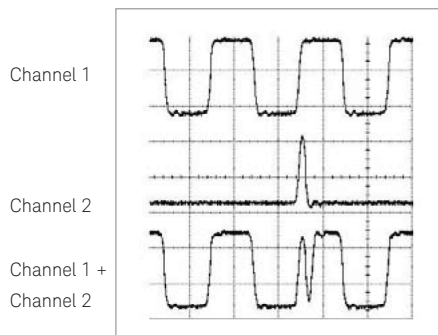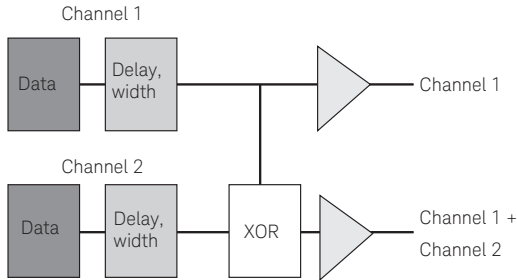

It is Keysight's recommended data generator for USB compliance tests. Data rates up to 1.32 Gbit/s can be achieved by the digital channel add feature, offering stimulus signals for Gigabit Ethernet test, for example.

90000 Series oscilloscope

Key features 81130A with 81132A

– 1 or 2 channels
– Up to 2.5 Vpp (50 Ω into 50 Ω)
– Fixed transition times: 500 ps typical
– Internal and external clocking
– 1 kHz to 660 MHz repetition rate
– Precision timing
– Differential outputs
– EXOR channel addition
– Up to 1.32 Gbit/s data generation
– Complex data patterns and pattern segment looping e.g. for USB pre-compliance testing
– Pseudo random binary sequence (PRBS) generation

Complementary products

– Infinii Vision 6000 Series D/MSO
– Infinii Vision 7000 Series D/MSO
– Infiniium 9000 Series D/MSO
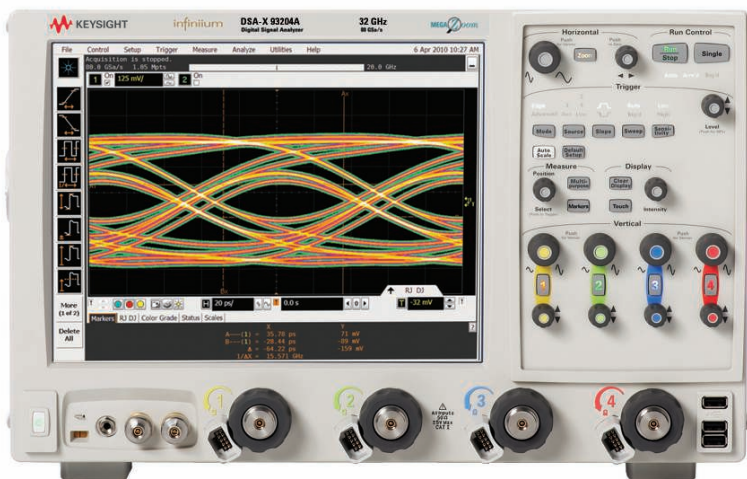
High Speed, High Fidelity: 81133A/81134A

The Keysight 81133A and 81134A 3.35 GHz pulse pattern genera-tors provide the ultimate timing accuracy and signal performance.

Precision timing
PRBS
Data
Pattern
Pulse
Jitter

81134A pulse pattern generator

With their unrivaled performance, they are the perfect clock, pulse, data, pattern and PRBS sources for all applications up to 3.35 GHz. In addition, the instruments allow you to control the signal quality at speeds from 15 MHz up to 3.35 GHz. Sample applications comprise crossover point adjustments and jitter insertion using the delay control input. Their high quality signals and low intrinsic jitter enable you to perform quick and reliable measurements with accurate and repeatable results. With the 12 Mbit pattern memory per channel, the 81133A and 81134A enable you to generate the long data patterns required to test today's high speed interfaces, like PCI Express or Serial ATA and many more. The PC-based pattern management software is a very convenient tool to edit and save data patterns on any computer. It also allows you to load patterns easily into the generator. The jitter-insertion capabilities enable jitter tolerance tests. Target applica-tions of the 81133A and 81134A include physical layer characterization, signal integrity and jitter tests. In addition the 81134A is Keysight's recommended solution for PCI Express and Serial ATA compliance tests.
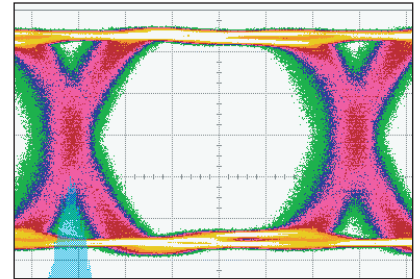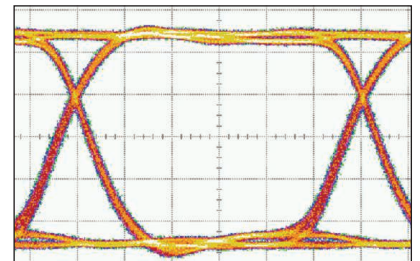

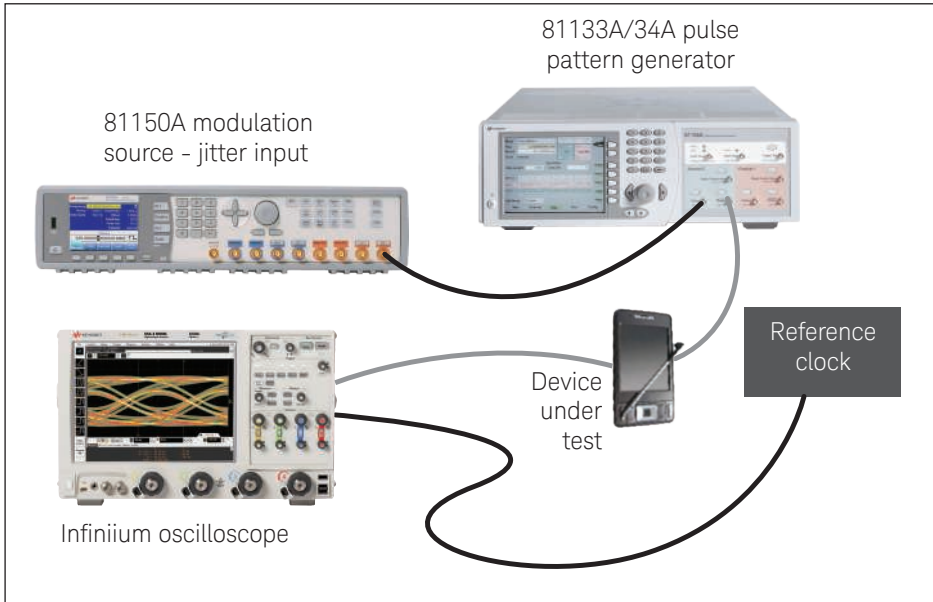Jitter modulated with noise
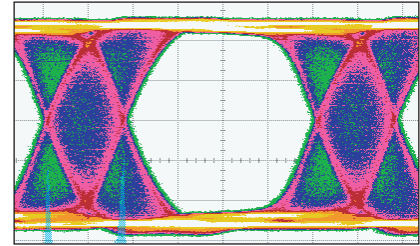
Jitter modulated with sine-wave
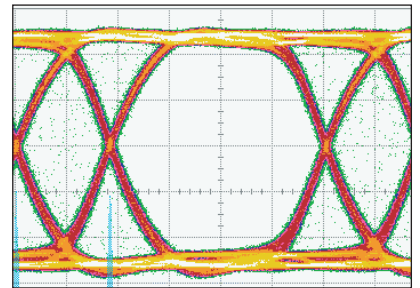
Jitter modulated with rectangle-wave

Variable cross over point at 70%

High Speed, High Fidelity: 81133A/81134A (2)

81150A modulation source - jitter input

81133A/34A pulse pattern generator

Device under test

Reference clock

Infiniium oscilloscope

Perform stress tests by modifying the amount and shape of jitter by using the delay control input and an external modulation source.

www.keysight.com/find/81133a
www.keysight.com/find/81134a

## Key features 81133A with 81134A

– 1 channel (81133A) or 2 channels (81134A)
– 50 mV$_{pp}$ up to 2 Vpp amplitude (50 Ω into 50 Ω)
– Programmable termination voltage
– Adjustable transition times between 60 ps and 120 ps
– 15 MHz to 3.35 GHz repetition rate
– Total jitter typically less than 2 ps
– 12 Mbit pattern memory per channel
– PC-based pattern management software
– 1.5 ps typical RMS jitter
– Differential outputs
– Complex data patterns e.g. for PCI Express, SATA
– Pseudo random binary sequence (PRBS) generation
– Delay modulation: –250 ps to 250 ps, –25 ps to 25 ps selectable (up to 500, 50 ps ps total jitter)
– Modulation frequency: 0 - 200 MHz
– Additional variable crossover between 30% – 70% typical
– NRZ/RZ/R1 signal formats over the full frequency range

Complementary products

– DSO, DSA 90000 Series

J–BERT M8020A High-performance BERT Pattern Generators up to 8.5, 16 and 32 Gb/s

The J–BERT M8020A offers pattern generator options for data rates up to 8.5 Gb/s, 16 Gb/s and 32 Gb/s. It's a high-performance pattern generator with integrated jitter, de-emphasis, and level interference for characterizing single and multiple lanes of high-speed digital devices, sub-systems and boards in the computer, consumer and communication industry.

Jitter
De-emphasis
4 Channels
Pattern
Coding
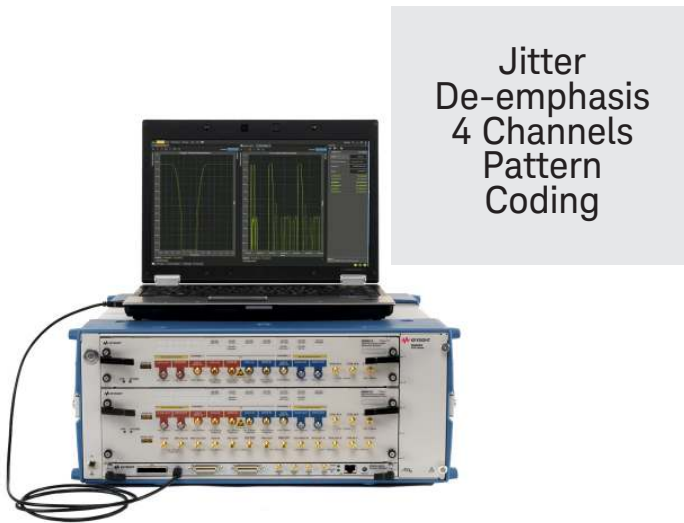
The high-performance Keysight J–BERT M8020A enables fast, accurate receiver characterization of single- and multi-lane devices running up to 16 or 32 Gb/s.

With today's highest level of integration, the M8020A streamlines your test setup. In addition, automated in situ calibration of signal conditions ensures accurate and repeatable measurements.

Target applications

R&D and test engineers who characterize, verify compliance of chips, devices, boards and systems with serial I/O ports up to 16 Gb/s and 32 Gb/s. The M8020A can be used to test popular serial bus standards, such as: PCI Express, USB, MIPI™ M-PHY®, SATA/SAS, DisplayPort, SD UHS-II, Fibre Channel, front-side and memory buses, backplanes, repeaters, active optical cables, Thunderbolt, 10 GbE, 100GbE (optical and electrical), SFP+, CFP2/4 transceivers, CEI.

www.keysight.com/find/m8020a

Key features M8020A

- Data rates up to 8.5/ 16 Gb/s for pattern generator. Extension to 32 Gb/s possible with M8061A multiplexer 2:1
- 1-4 16 Gb/s channels in a 5-slot AXIe chassis. One 32 Gb/s channel in a 5-slot AXI chassis.
- Fast transition times of 12 ps typical
- Differential outputs on data and clock with variable amplitude between 50 mV and 1.2 V_{pp} single ended.
- Patterns in NRZ format, 2 Gbit/ch user definable, PRBS, coding, pattern blocks and loops
- Integrated and calibrated jitter injections: RJ, high-frequency PJ1, PJ2,low-frequency PJ, BUJ, Clk/2, SSC, sinusoidal interference, and ISI
- Low intrinsic jitter 8 ps pp typical for accurate measurements
- 8- tap de-emphasis (positive and negative) up to 20 dB
- Modules and options are upgradeable

Complementary products

- M8061A 32Gb/s multiplexer
- M8048A ISI channels
- DCA-X 86100D Infiniium wide-bandwidth oscilloscope
- DSA Z-Series Infiniium oscilloscopes

J–BERT N4903B Pattern Generator 7 Gb/s and 12.5 Gb/s

The Keysight N4903B J-BERT pattern generator options for data rates up to 7 Gb/s and 12.5 Gb/s provide an accurate and flexible stimulus for stimulating high-speed digital devices.

Jitter
PRBS
Pattern
Clock
Sequences

The N4903B generates user-definable NRZ-patterns or PRBS with variable data rate and output amplitude. It offers built-in and calibrated jitter injection to stress receiver ports of high-speed digital devices and boards. Design and test engineers can quickly and accurately stimulate serial high-speed ports, as used in DisplayPort, PCI Express, SATA, fully-buffered DIMM, Fibre Channel, CEI, 10 Gigabit Ethernet, XFP/XFI, SFP/SFP+ designs. The J-BERT pattern generator can be used in combination with the de-emphasis signal converter to compensate for channel degradations. For signal analysis, it is complemented by oscilloscopes, built-in error detectors and other analyzers. The N4903B pattern generator can be upgraded to a full bit error ratio tester when test needs change.

www.keysight.com/find/n4903

Key features N4903B G07, G13

– Data rates between 150 Mb/s and 7 Gb/s or 12.5 Gb/s provide sufficient margin
– Fastest transition times < 20 ps
– Low jitter < 9 ps pp for accurate measurements
– Differential outputs on data and clock with variable amplitude between 50 mV and 1.8 V
– Pattern with NRZ format, 32 Mbit user pattern, PRBS, block and loop sequencer
– Built-in and calibrated jitter injection: SJ, PJ, RJ, BUJ (Option J10) to generate eye closures of > 0.5 UI
– External jitter injection via delay control input up to 1 GHz
– Interference channel with switchable ISI traces and sinusoidal interference (Option J11) to emulate channel degradations
– SSC clocking (Option J11) for computer bus clocks
– Sub-rate clock output to generate reference clocks
– Upgrade path to add second channel, jitter, SSC, and analysis functionality

Complementary products

– 86100C DCA-J Infiniium wide-bandwidth oscilloscope
– N4916B de-emphasis signal converter with option clock doubler
– DSO, DSA 90000 Series
– DSO 90000 X Series

For a Parallel World: 81250

The Keysight 81250 data generator/analyzer platform is the right choice for functional and parametric test applications on digital subsystems, ICs and boards, during development or manufacturing.

Data
PRBS
Pattern
Pulse

Key features 81250

– Up to 132 channels (RZ, NRZ) within one clock group, depending on the configuration
– PRBS and PRWS (pseudo random word sequence) up to $2^{31}-1$
– 20.8 Mbit/s to 13.5 Gbit/s data rate
– Sequencing with 4 looping levels
– Branching on internal and external events
– Variable delays and levels can be independently set for each channel
– EXOR channel edition

The 81250 is a flexible and scalable platform which, depending on the configuration, offers up to 66 synchronous input and output channels. The frequency covers 333 kHz to 13.5 GHz. The 81250 data generator and analyzer is freely configurable to fit application needs either as a stand alone data generator or a platform with any number of generator and analyzer channels. In addition, the Keysight 81250 can be combined with other standard VXI modules or systems. With up to 64 Mbit memory depth per channel and full control of the pulse parameters for each individual channel, maximum stress can be applied to a DUT. The 81250 data generator/analyzer platform is the ideal tool throughout the design verification process – from first turn-on through operational check and characterization of design margins, to detailed analysis of critical design parts.

www.keysight.com/find/81250

N824xA and M933xA Arbitrary Waveform Generators

The Keysight M9330A and M9331A with their high resolution and high sampling rate deliver unprecedented performance in arbitrary waveform creation. The equivalent to these PXI-modules are the benchtop instruments N8241A and N8242A.

Arbitrary

The M9330A and the N8241A provide the most realistic waveforms for radar, satellite and frequency agile communication systems, thanks to their 15-bit vertical resolution and 1.25 GSa/ s sampling rate. At the same speed, with 10 bit vertical resolution, the M9331A is ideal for compliance testing of digital radios targeted for use with communication standards such as MB-OFDM ultra wide-band, 802.11n, MIMO and proprietary wideband formats.

www.keysight.com/find/modular
www.keysight.com/find/m9330a
www.keysight.com/find/m9331a

Key features
M933xA and N824xA

- 1 or 2 channels
- Amplitude range of 1 or 2 mVpp to 800 mVpp, 1 Vpp
- Triggerable
- Gate mode
- Remotely programmable
- Pulse generation
- Memory of 8 or 9 and 16 MSa/channel
- Modulation
- Radar test
- Mixed signal devices
- Signal integrity test
- Jitter (stress) test
- Noise immunity test

Complementary products

- E8267D PSG vector signal generator
- M9392A PXI vector signal analyzer
- M9202A PXIe IF digitizer: 12-bit, 2 GSa/s, 1 GHz
- M9018A 18-slot PXIe chassis
- M9021A PXIe system interface
- N7509A waveform generation toolbox for wideband signal simulation
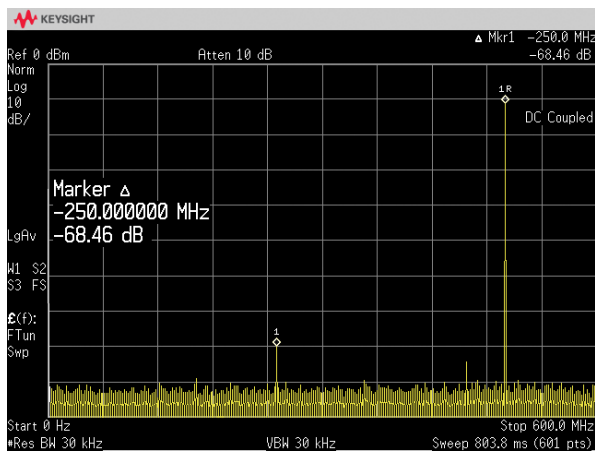
Complex Real-World Signals: 81180B

Test with confidence. 4.6 GSa/s arbitrary waveform generation and 12 bit vertical resolution

Arbitrary

The Keysight 81180B arbitrary waveform generator provides 4.6 GSa/s, 2 GHz I/Q modulation bandwidth and 12 bit vertical resolution for applications where waveform resolution is an issue. With 2 GHz I/Q modulation bandwidth it's a perfect complement to the E8267D PSG vector signal generator. The upconversion to higher carrier frequencies requires a reliable and precise modulation source. Any signal distortion gets multiplied by each of the test instruments making it difficult to pinpoint a DUT failure. The more precise the foundation is the more you test your device and not your source.

www.keysight.com/find/81180
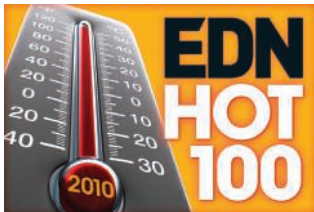
Key features 81180B

- 1 or 2 channels, coupled or uncoupled
- Two 2-channel systems can be synchronized to form a 4 channel system
- Three software-selectable amplifiers optimized for
  - I/Q applications with 1 GHz per channel, differential, DC coupled output
  - Maximum bandwidth and flatness for direct RF applications with AC output bandwidth to 1.5 GHz
  - Time domain applications with low overshoot and jitter
- 16 M points or 64 M points per channel combined with advanced sequencing to make best usage of memory
- Integration in Matlab, NI La VIEW, Keysight Signal Studio[1] and Keysight 33503A Bench-Link Waveform Builder Pro

Complementary products

- In conjunction with PSG or other upconverter: Keysight 90000 X Series, DSO and DSA 9000 Series
- For direct RF carrier frequency: Keysight DSO and DSA 90000 Series
- Keysight M9099 Waveform Creator Application Software

1. Integration in Signal Studio pulse builder and multi tone is planned

Enhance your Reality: M8190A

Push your design to the limit and bring new insight to your analysis. 8 GSa/s arbitrary waveform generation with 14 bit vertical resolution

Arbitrary

From low-observables radar to high-density communications, testing is more realistic with precision arbitrary waveform generation. Take reality to the extreme: A Keysight AWG is the source of greater fidelity and delivers high resolution and wide bandwidth – simultaneously. This unique combination lets you create signal scenarios that push your designs to the limit and bring new insights to your analysis. Get bits and bandwidth – and enhance your reality.

High-quality signal generation is the foundation of reliable and repeatable measurements. The Keysight M8190A ensures accuracy and repeatability with 14-bit resolution up to 8 GSa/s sampling rage and excellent vertical resolution gives you confidence that you are testing your device not the signal source.

Capability such as easy switching between 14-bit output at 8 GSa/s and 12-bit output at 12 GSa/s help you handle multiple applications and measurement requirements.

Because every application calls for different signal characteristics, The Keysight M8190A contains three amplifiers that are optimized for I/Q signals, IF/RF or time domain signals.

Highly realistic testing often requires long play times and long single scenarios. 2 GSa of memory per channel combined with advanced sequencer capabilities allow you to use the memory efficiently and effectively.

www.keysight.com/find/m8190a

Key features M8190A

- Precision AWG with two DAC settings
  - 14 bit 8 Gsa/s
  - 12 bit with 12 Gsa/s
- Variable sample rate from 125 MSA/s to 8/12 Gsa/s
- Up to 2 GSa memory per channel with advanced sequencing
- Three amplifiers for different applications
- IQ signals:
  - Differential output
  - Spurious free dynamic range up to 80 dBc typical
  - Harmonic distortion up to 72 dBc typical
- Time domain applications
  - Transition time (20/80) 50 ps
  - Differential output
  - Amplitude 600 mV … 1.0 Vpp in an output window -1.0 V … +3.3 V
- IF /RF
  - 50 MHz to 5 GHz bandwidth
- Single ended, AC coupled output
- Output power
  - 10 dBm …+10 dBm
- 2 U AXIe module

Complementary products

- In conjunction with PSG or other up converter Keysight 90000 X Series, DSO and DSA 9000 Series
- For direct RF carrier frequency DSO and DSA 90000 or 9000 Series
- M9099 Waveform Creator Application Software

Explore your Possibilities: M8195A

Go where you never have been able to test before: in speed, in bandwidth and in channel density.

As devices and interfaces become faster and more complex, the M8195A AWG gives you the versatility to create the signals you need for digital applications, optical and electrical communication, advanced research, wideband radar and satcom.

In optical applications, for driving dual-polarization systems, the M8195A scores with four independent, precisely synchronized output channels in a single AXIe module. Since all four channels are generated by the same instrument without any external circuitry, precise synchronization down to the femto-second-range is guaranteed.

The M8195A supports multi-level signaling techniques like pulse-amplitude modulation 4 (PAM4) and PAM 8 or technologies in the mobile application space such as MIPI C-PHY.

Physics, chemistry and electronics research working at the edge of technology, call for precise and configurable pulses down to 100 ps or less for extremely short, yet wideband RF pulses and chirps.
Any arbitrary waveform which can be described mathematically can be generated e.g., in Matlab and downloaded to the M8195A.

The M8195A is designed to address communications/satcom requirements, such as extremely wide instantaneous bandwidth from DC to the Ku-Band. It also allows fast frequency hopping across bands within hundreds of picoseconds.

www.keysight.com/find/m8195a

Key features M8195A

- Sample rate up to 65 GSa/s
- Analog bandwidth up to 20 GHz
- 8 bit vertical resolution
- Up to 16 GSa of waveform memory per AXI module[1]
- 1, 2 or 4 channels in one slot AXIe module (number of channels is SW upgradeable)
- Multi-module synchronization up to 16 channels per 5-slot AXIe chassis[1]
- Advanced 3-level sequencing with external dynamic control[1]
- Amplitude up to 1 $V_{PP(se)}$ (2 $V_{PP(diff)}$), voltage window -1.0...+3.3. V
- $t_{rise/fall\ 20\%/80\%}$ < 18ps (typ)
- Ultra low intrinsic jitter (RJ_{rms} < 200 fs @ 32 Gb/s PRBS 2^{11}- 1)
- Distortions generated by cables, amplifiers etc. can be compensated by embedding/ de-embedding the S-parameters of the respective circuits or by performing an in-situ calibration.

Complementary products

- In conjunction with PSG or other upconverter Keysight 90000 X Series, DSO and DSA 9000 Series
- For direct RF carrier frequency DSO and DSA 90000 or 9000 Series
- M9099 Waveform Creator Application Software

1. Available with M8195A Rev. 2

Transition/Time Converters

Models 15432B, 15433B, 1534B, 15435A, 15438A, and N4915A Option 001

These converters have been designed to convert the transition times of instruments with fast, fixed transition times, to slower, fixed transition/times

All transition times are measured between 10% and 90% of amplitude.

The design of these converters ensures very low signal reflection (far beyond the 3 dB point).

Reducing the signal transition times also increases the overall pulse-performance for overshoot/reflection sensitive applications.

The converters are fitted with two SMA connectors, one male, one female.

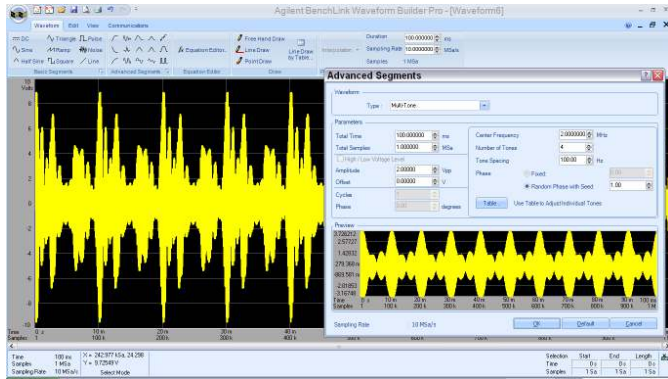www.keysight.com/find/time_converter

Key features

- – Output transition time 47 ps, 150 ps, 250 ps, 500 ps, 1000 ps, 2000 ps
- – 3 dB point 2.1 GHz, 1.3 GHz, 640 MHz, 370 MHz, 190 MHz
- – Input voltage < 10 V_{pp}
- – Insertion loss < 0.2 dB
- – Overshoot and ringing < 3 %
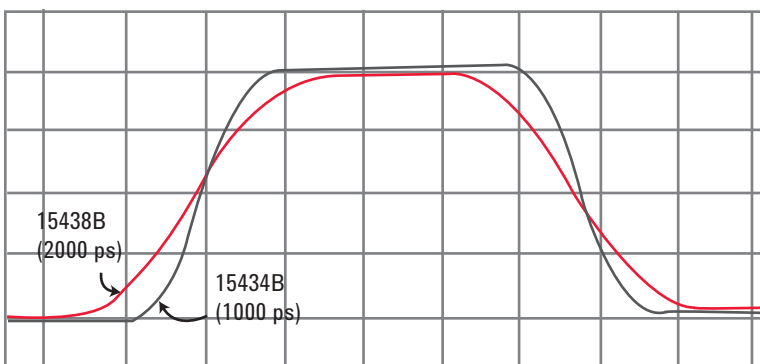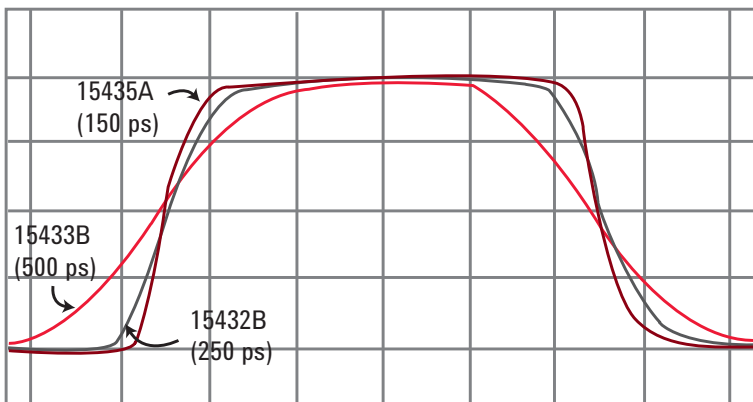
33503A BenchLink Waveform Builder Pro Software

Waveform Builder Pro Makes Custom Waveforms Quick and Easy

Keysight 33503A BenchLink Waveform Builder Pro Software is the first full-featured waveform creation software for pulse/function/arbitrary waveform generators. The software enables you to take full advantage of the signal generation capabilities of the Keysight 33200, 33500, 33600, 81100 Series waveform generators and makes custom waveform creation fast and simple.

This Microsoft Windows-based program provides easy-to-use creation tools such an equation editor, waveform math and drawing tools to create custom signals with a library of built-in waveforms to choose from. The software also provides a waveform sequencer, filters and windowing functions allowing you to easily modify and further define your waveform.

With the BenchLink Waveform Builder Pro you get advanced signal creation and editing capabilities without spending hours programming.

The software supports the following generators:

– 33600A Series Trueform waveform generators, 80 & 120 MHz
– 33210A, 33220A, 33250A function/arbitrary waveform generators
– 33522A function/arbitrary waveform generator
– 81150A and 81160A pulse/function/arbitrary noise generators
– 81180B, M8190A and M8195A arbitrary waveform generators

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Key features 33503A

– Waveform libraries provide quick and easy access to both common signals (sine, square, triangle, ramp, pulse, exponential) and complex signals
– Free-hand, point, and line-draw modes to create custom shapes
– Equation editor allows you to create waveforms with exact polynomials
– Sequencing editor allows you to build and arrange composite waveforms to optimize your design waveforms to optimize your design
– Filtering and windowing functions allow you to smooth transitions between waveforms
– Fast Fourier Transform (FFT) allows you to view the frequency characteristics of your signals
– Complimentary Cumulative Distribution Function (CCDF) curves allows you to view the power characteristics of your signals

Related Literature

Publication title	Pub number
U2761A USB Modular Function/ Arbitrary Waveform Generator Data Sheet	5991-0413EN
Keysight USB Modular Products Data Sheet	5989-9923EN
33210A 10 MHz Function/Arbitrary Waveform Generator Data Sheet	5989-8926EN
Transferring Arbitrary Waveform Data to the 33200A Family of Function/Arbitrary Waveform Generators	5989-9760EN
33500B Series Waveform Generators Data Sheet	5991-0692EN
33600A Series Trueform Waveform Generators Data Sheet	5991-3272EN
81150A and 81160A Pulse Function Arbitrary Noise Generator Data Sheet	5989-6433EN
Keysight 81150A and 81160A Pulse Function Arbitrary Noise Generators Applications	5989-7860EN
Keysight 81150A and 81160A Pulse Function Arbitrary Noise Generators Demo Guide	5989-7718EN
10 Hints for Getting More From Your Function Generator	5989-1456EN
Keysight Technologies 81100 Family Pulse Pattern Generators Data Sheet	5980-1215E
Keysight Technologies 81133A and 81134A 3.35 GHz Pulse Pattern Generators Data Sheet	5988-5549EN
J-BERT N4903B Data Sheet	5990-3217EN
J-BERT M8020A High-performance BERT Data Sheet	5991-3647EN
M8061A 32 Gb/s Multiplexer with De-Emphasis Data Sheet	5991-2506EN
M8048A ISI Channels Data Sheet	5991-3648EN
ParBERT 81250 Parallel Bit Error Ratio Tester Product Overview Data Sheet	5968-9188E
M9330A Arbitrary Waveform Generator 15-bit, 1.25 GS/s Data Sheet	5990-6426EN
M9331A Arbitrary Waveform Generator 10-bit, 1.25 GS/s Data Sheet	5990-6421EN
N8241A Arbitrary Waveform Generator Synthetic Instrument Module 1.25 GS/s or 625 MS/s Technical Overview Data Sheet	5989-2595EN
N8242A Arbitrary Waveform Generator Synthetic Instrument Module 10 Bit, 1.25 GS/s or 625 MS/s Technical Overview Data Sheet	5989-5010EN
81180B Arbitrary Waveform Generator Data Sheet	5991-0346EN
M8190A 12GSa/s Arbitrary Waveform Generator Data Sheet	5990-7516EN
M8195A 65GSa/s Arbitrary Waveform Generator Data Sheet	5992-0014EN

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