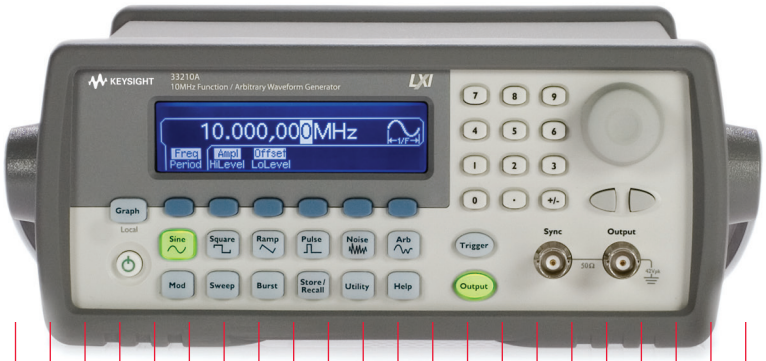
Keysight 33210A
10 MHz Function/Arbitrary Waveform Generator

Data Sheet



- 10 MHz Sine and Square waveforms
- Pulse, Ramp, Triangle, Noise, and DC waveforms
- Optional 14-bit, 50 MSa/s, 8K point Arbitrary Waveform Generator
- AM, FM, and PWM modulation types
- Linear & logarithmic sweeps and burst operation
- 10 mVpp to 10 Vpp amplitude range
- Graph mode for visual verification of signal settings
- Connect via USB, GPIB and LAN
- Fully compliant to LXI Class C specification

LXI

KEYSIGHT TECHNOLOGIES

Uncompromising performance at an affordable price

The Keysight Technologies, Inc. 33210A function/arbitrary waveform generator is the latest addition to the 332XX family. Waveforms are generated using direct digital synthesis (DDS) technology which creates stable, accurate low distortion sine waves as well as square waves with fast rise and fall times up to 10 MHz and linear ramp waves up to 100 kHz. For user defined waveforms, Option 002 provides 14-bit, 50 MSa/s 8K point arbitrary waveform generation.

Pulse generation

The 33210A can generate variable-edge-time pulses up to 5 MHz. With variable period, pulse width, and amplitude the 33210A is ideally suited to a wide variety of applications requiring a flexible pulse signal.

Custom waveform generation (Option 002)

The optional 8K point arbitrary waveform generator (Option 002) can be used in the 33210A to generate complex custom waveforms. With 14-bit resolution, and a sampling rate of 50 MSa/s, the 33210A gives you the flexibility to create the waveforms you need. It also lets you store up to four waveforms in nonvolatile memory. The Keysight IntuiLink arbitrary waveform software allows you to easily create, edit, and download complex waveforms using the waveform editor. Or you can capture a waveform using IntuiLink for Oscilloscopes and send it to the 33210A for output. To find out more about IntuiLink, visit www.keysight.com/find/intuilink

Easy-to-use functionality

Front-panel operation of the 33210A is straight-forward and user friendly. You can access all major functions with a single key or two. The knob or numeric keypad can be used to adjust frequency, amplitude, offset, and other parameters. You can even enter voltage values directly in Vpp, Vrms, dBm, or as high and low levels. Timing parameters can be entered in Hertz (Hz) or seconds.

Internal AM, FM, and PWM modulation make it easy to modulate waveforms without the need for a separate modulation source. Linear and logarithmic sweeps are also built in, with sweep rates selectable from 1 ms to 500 s. Burst mode operation allows for a user-selected number of cycles per trigger. GPIB, LAN, and USB interfaces are all standard, plus you get full programmability using SCPI commands.

External frequency reference (Option 001)

The 33210A external frequency reference lets you synchronize to an external 10 MHz clock, to another 33210A, or to a Keysight 33220A or Keysight 33250A. Phase adjustments can be made from the front panel or via a computer interface, allowing precise phase calibration and adjustment.

Waveforms	
Standard	Sine, Square, Ramp, Triangle, Pulse, Noise, DC
Built-in arbitrary waveforms (available only with Option 002 ARB)	Exponential rise, Exponential fall, Negative ramp, Sin(x)/x, Cardiac

Waveform characteristics		
Sine		
Frequency range	1 mHz to 10 MHz	
Amplitude Flatness [1, 2]	(relative to 1 kHz) < 100 kHz 0.1 dB 100 kHz to 5 MHz 0.2 dB 5 MHz to 10 MHz 0.3 dB	
Harmonic distortion [2, 3]		
	< 1 Vpp	≥ 1 Vpp
DC to 20 kHz	–70 dBc	–70 dBc
20 kHz to 100 kHz	–65 dBc	–60 dBc
100 kHz to 1 MHz	–50 dBc	–45 dBc
1 MHz to 10 MHz	–40 dBc	–30 dBc
Total harmonic distortion [2, 3]		
DC to 20 kHz	0.04%	
Spurious (non-harmonic) [2, 4]		
DC to 1 MHz	–70 dBc	
1 MHz to 10 MHz	–70 dBc + 6 dB/octave	
Phase noise (10 kHz offset)	–115 dBc / Hz, typical	
Square		
Frequency range	1 mHz to 10 MHz	
Rise/fall time	20 ns	
Overshoot	< 2%	
Variable duty cycle	20% to 80% (to 5 MHz) 40% to 60% (to 10 MHz)	
Asymmetry (@ 50% duty)	1% of period + 5 ns	
Jitter (RMS)	1 ns + 100 ppm of period	
Ramp, triangle		
Frequency range	1 mHz to 100 kHz	
Linearity	< 0.1% of peak output	
Variable symmetry	0.0% to 100.0%	
Pulse		
Frequency range	1 mHz to 5 MHz	
Pulse width (period ≤ 10 s)	40 ns minimum 10 ns resolution	
Variable edge time	20 ns to 100 ns	
Overshoot	< 2%	
Jitter (RMS)	300 ps + 0.1 ppm of period	
Noise		
Bandwidth	7 MHz typical	
8K-point arbitrary waveform generator (Option 002)		
Frequency range	1 mHz to 3 MHz	
Waveform length	2 to 8 k points	
Amplitude resolution	14 bits (including sign)	
Sample rate	50 MSa/s	
Min. rise/fall time	70 ns typical	
Linearity	< 0.1% of peak output	

Measurement Characteristics (continued)

Settling time	< 500 ns to 0.5% of final value
Jitter (RMS)	6 ns + 30 ppm
Non-volatile memory	4 waveforms

Common characteristics	
Frequency	
Accuracy [5]	± (10 ppm + 3 pHz) in 90 days ± (20 ppm + 3 pHz) in 1 year
Resolution	1 µHz (internal) 1 mHz (user)
Amplitude	
Range	10 mVpp to 10 Vpp into 50 Ω 20 mVpp to 20 Vpp into open circuit
Accuracy [1, 2] (at 1 kHz)	± 2% of setting ± 1 mVpp
Units	Vpp, Vrms, dBm
Resolution	3 digits
DC offset	
Range (peak AC + DC)	± 5 V into 50 Ω ± 10 V into open circuit
Accuracy [1, 2]	± 2% of offset setting ± 0.5% of amplitude ± 2 mV
Resolution	3 digits
Main output	
Impedance	50 Ω typical
Isolation	42 Vpk maximum to earth
Protection	Short-circuit protected, overload automatically disables main output

External frequency reference (Option 001)	
Rear panel input	
Lock range	10 MHz ± 500 Hz
Level	100 mVpp to 5 Vpp
Impedance	1 kΩ, typical
Lock time	< 2 seconds
Rear panel output	
Frequency	10 MHz
Level	632 mVpp (0 dBm), typical
Impedance	50 Ω, typical AC coupled
Phase offset	
Range	+360° to –360°
Resolution	0.001°
Accuracy	20 ns
Modulation	
AM	
Carrier waveforms	Sine, Square
Source	Internal/External
Internal modulation	Sine, Square, Ramp, Triangle, Noise, Arb [7] (2 mHz to 20 kHz)
Depth	0.0% to 120.0%
FM	
Carrier waveforms	Sine, Square
Source	Internal/External
Internal modulation	Sine, Square, Ramp, Triangle, Noise, Arb [7] (2 mHz to 20 kHz)
Deviation	DC to 5 MHz
PWM	
Carrier waveforms	Pulse
Source	Internal/External
Internal modulation	Sine, Square, Ramp, Triangle, Noise, Arb [7] (2 mHz to 20 kHz)
Deviation	0% to 100% of pulse width

External modulation input (for AM, FM, PWM)	
Voltage range	± 5 V full scale
Input impedance	5 kΩ typical
Bandwidth	DC to 20 kHz

Sweep	
Waveforms	Sine, Square, Ramp
Type	Linear or Logarithmic
Direction	Up or Down
Sweep time	1 ms to 500 s
Trigger source	Single, External or Internal
Marker	Falling edge of sync signal (programmable frequency)

Burst [6]	
Waveforms	Sine, Square, Ramp
Type	Counted (1 to 50,000 cycles), Infinite, Gated
Start/stop phase	+360° to –360°
Internal period	1 µs to 500 s
Gate source	External trigger
Trigger source	Single, External or Internal

Trigger characteristics	
Trigger input	
Input level	TTL compatible
Slope	Rising or Falling, selectable
Pulse width	> 100 ns
Input impedance	> 10 kΩ, DC coupled
Latency	< 500 ns
Jitter (rms)	6 ns (3.5 ns for pulse)
Trigger output	
Level	TTL compatible into ≥ 1 kΩ
Pulse width	> 400 ns
Output impedance	50 Ω typical
Maximum rate	1 MHz
Fanout	≤ 4 Keysight 33210As (or equivalent)

1. Add 1/10th of output amplitude and offset spec per °C for operation outside the range of 18 to 28 °C
2. Autorange enabled
3. DC offset set to 0 V
4. Spurious output at low amplitude is –75 dBm typical
5. Add 1 ppm/°C average for operation outside the range of 18 to 28 °C
6. Sine and square waveforms above 3 MHz are allowed only with an "infinite" burst count
7. Only available if Option 002 is installed

Measurement Characteristics (continued)

Programming times (typical)			
Configuration times	USB	LAN	GPIB
Function change	120 ms	120 ms	120 ms
Frequency change	2 ms	3 ms	2 ms
Amplitude change	30 ms	30 ms	30 ms
Select user arb	130 ms	130 ms	130 ms
Arb download times (Option 002)	Binary transfer		
	USB	LAN	GPIB
2 k points	5 ms	9 ms	10 ms
4 k points	8 ms	15 ms	20 ms
8 k points	14 ms	27 ms	40 ms

General	
Power supply	Cat II 100 to 240 V @ 50/60 Hz (–5%, +10%) 100 to 120 V @ 400 Hz (± 10%)
Power consumption	50 VA max
Operating environment	IEC 61010 Pollution Degree 2 Indoor Location
Operating temperature	0 to 55 °C
Operating humidity	5% to 80% RH, non-condensing
Operating altitude	Up to 3000 meters
Storage temperature	–30 to 70 °C
State storage memory	Power off state automatically saved, Four user-configurable stored states
Interface	LAN LXI-C Ethernet 10/100 USB 2.0, GPIB
Language	SCPI – 1993, IEEE-488.2
Dimensions (W x H x D)	
Bench top	261.1 mm x 103.8 mm x 303.2 mm
Rack mount	212.88 mm x 88.3 mm x 272.3 mm
Weight	3.4 kg (7.5 lbs)
Safety designed to	UL-1244, CSA 1010 EN61010
EMC tested to	MIL-461C, EN55011, EN50082-1
Vibration and shock	MIL-T-28800, Type III, Class 5
Acoustic noise	30 dBa
Warm-up time	1 hour

Ordering Information

Keysight 33210A

10 MHz function/arbitrary waveform generator

Accessories included

Operating manual, service manual, quick reference guide, IntuiLink waveform editor software, test data, USB cable, and power cord (see language option).

Options

Opt. 001 External timebase reference

Opt. 002 8K-point arbitrary waveform generator

Opt. A6J ANSI Z540 calibration

Opt. AB0 Taiwan: Chinese manual

Opt. AB1 Korea: Korean manual

Opt. AB2 China: Chinese manual

Opt. ABA English: English manual

Opt. ABD Germany: German manual

Opt. ABF France: French manual

Opt. ABJ Japan: Japanese manual

Opt. PLG Continental European power cord

Other Accessories

34131A Carrying case

34161A Accessory pouch

34190A Rackmount kit

34191A Dual flange kit, 2U

34194A Dual lock link kit

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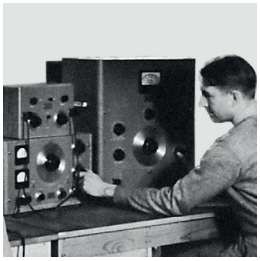

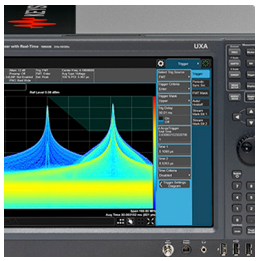

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