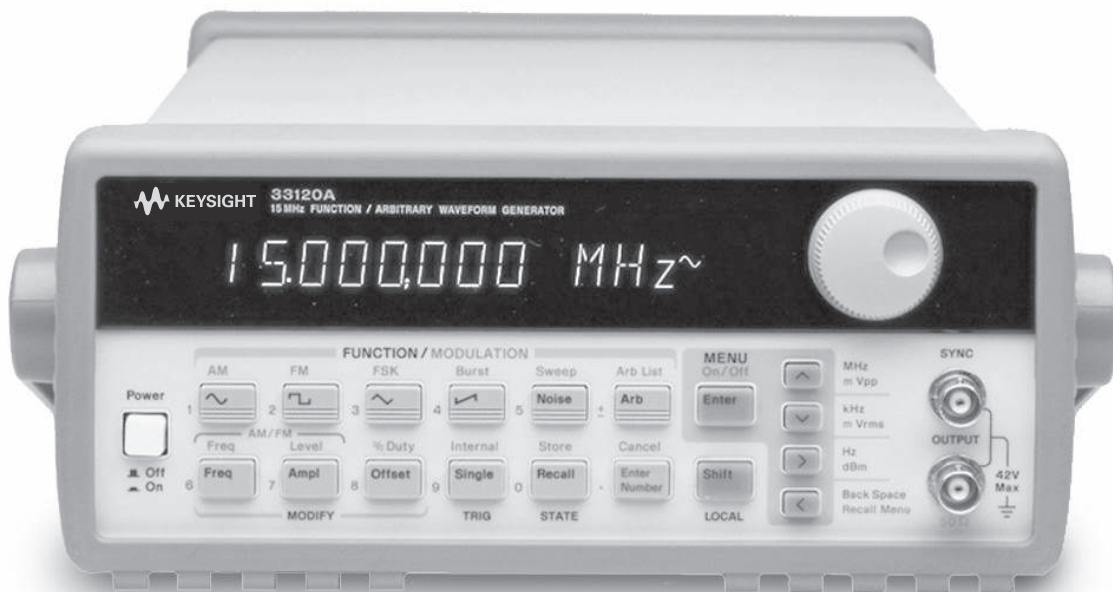


# Keysight Technologies 33120A Function/Arbitrary Waveform Generator

Data Sheet



- 15 MHz sine and square wave outputs
- Sine, triangle, square, ramp, noise and more
- 12-bit, 40MSa/s, 16,000-point deep arbitrary waveforms
- Direct digital synthesis for excellent stability

## Uncompromising performance for standard waveforms

The Keysight Technologies, Inc. 33120A Function/Arbitrary Waveform Generator uses direct digital-synthesis techniques to create a stable, accurate output signal for clean, low distortion sine waves. It also gives you fast rise- and fall-time square wave, and linear ramp waveforms down to 100  $\mu$ Hz.

## Custom waveform generation

Use the 33120A to generate complex custom waveforms such as a heartbeat or the output of a mechanical transducer. With 12-bit resolution, and a sampling rate of 40 MSa/s, the 33120A gives you the flexibility to create any waveform you need. It also lets you store up to four 16,000-deep waveforms in nonvolatile memory.

## Easy-to-use functionality

Front-panel operation of the 33120A is straightforward and intuitive. You can access any of ten major functions with a single key press or two, then use a simple knob to adjust frequency, amplitude and offset. To save time, you can enter voltage values directly in Vp-p, Vrms or dBm. Internal AM, FM, FSK and burst modulation make it easy to modulate waveforms without the need for a separate modulation source. Linear and log sweeps are also built in, with sweep rates selectable from 1ms to 500 s. GPIB and RS-232 interfaces are both standard, plus you get full programmability using SCPI commands.

## Optional phase-lock capability

The Option 001 phase lock/TCXO timebase gives you the ability to generate synchronized phase-offset signals. An external clock input/output lets you synchronize with up to three other 33120As or with an external 10-MHz clock.

Option 001 also gives you a TCXO timebase for increased frequency stability. With accuracy of 4 ppm/yr, the TCXO timebase make a 33120A ideal for frequency calibrations and other demanding applications.

With Option 001, new commands let you perform phase changes on the fly, via the front panel or from a computer, allowing precise phase calibration and adjustment.

## Link the Keysight 33120A to your PC

The included Keysight IntuiLink software allows you to easily create, edit, and download complex waveforms using the IntuiLink Arbitrary Waveform Editor. Or you can capture a waveform using IntuiLink Oscilloscope or DMM and send it to the 33120A for output. For programmers, ActiveX components can be used to control the instrument using SCPI commands. IntuiLink provides the tools to easily create, download, and manage waveforms for your 33120A. To find out more about IntuiLink, visit [www.keysight.com/find/intuilink](http://www.keysight.com/find/intuilink).

The 33120A can also be used in conjunction with the 34811A BenchLink Arb software. This Windows-based program lets you create and edit waveforms on your PC and download them to the 33120A.

## Waveforms

<b>Standard</b>	Sine, square, triangle, ramp, noise, sin(x)/x, exponential rise exponential fall, cardiac, dc volts.
-----------------	------------------------------------------------------------------------------------------------------

<b>Arbitrary</b>	
Waveform length	8 to 16,000 points
Amplitude resolution	12 bits (including sign)
Sample rate	40 MSa/s
Non-volatile memory	Four (4) 16,000 waveforms

## Frequency Characteristics

Sine	100 $\mu$ Hz - 15 MHz
Square	100 $\mu$ Hz - 15 MHz
Triangle	100 $\mu$ Hz - 100 kHz
Ramp	100 $\mu$ Hz - 100 kHz
White noise	10 MHz bandwidth
Resolution	10 $\mu$ Hz or 10 digits
Accuracy	10 ppm in 90 days, 20 ppm in 1 year, 18°C - 28°C
Temp. Coeff	< 2 ppm/°C
Aging	< 10 ppm/yr

## Sinewave Spectral Purity

<b>Harmonic distortion</b>	
dc to 20 kHz	-70 dBc
20 kHz to 100 kHz	-60 dBc
100 kHz to 1 MHz	-45 dBc
1 MHz to 15 MHz	-35 dBc

<b>Spurious (non-harmonic)</b>	
DC to 1 MHz	< -65 dBc
1 MHz to 15 MHz	< -65 dBc + 6 dB/octave

<b>Total harmonic distortion</b>	
DC to 20 kHz	< 0.04%
Phase noise	< -55 dBc in a 30 kHz band

## Signal Characteristics

<b>Squarewave</b>	
Rise/Fall time	< 20 ns
Overshoot	4%
Asymmetry	1% + 5ns
Duty cycle	20% to 80% (to 5 MHz) 40% to 60% (to 15 MHz)

<b>Triangle, Ramp, Arb</b>	
Rise/Fall time	40 ns (typical)
Linearity	< 0.1% of peak output
Setting Time	< 250 ns to 0.5% of final value
Jitter	< 25ns

## Output Characteristics

<b>Amplitude</b>	
(into 50 $\Omega$ )	50 mVpp - 10 Vpp <sup>1</sup>
Accuracy (at 1 kHz)	$\pm$ 1% of specified output
Flatness ( <i>sinewave relative to 1 kHz</i> )	
< 100 kHz	$\pm$ 1% (0.1 dB)
100 kHz to 1 MHz	$\pm$ 1.5% (0.15 dB)
1 Mz to 15 MHz	$\pm$ 2% (0.2 dB) Ampl $\geq$ 3Vrms $\pm$ 3.5% (0.3 dB) Ampl < 3Vrms
Output Impedance	50 $\Omega$ (fixed)
Offset (into 50 $\Omega$ ) <sup>2</sup>	+ 5 Vpk ac + dc
Accuracy	$\pm$ 2% of setting + 2 mV
Resolution	3 digits, amplitude and offset
Units	Vpp, Vrms, dBm
Isolation	42 Vpk maximum to earth
Protection	Short circuit protected $\pm$ 15 Vpk overdrive < 1 minute

<b>Modulation</b>	
<b>AM</b>	
Carrier -3dB Freq.	10 MHz (typical)
Modulation	any internal waveform including Arb
Frequency	10 mHz - 20 kHz
Depth	0% - 120%
Source	Internal/External

<b>FM</b>	
Modulation	any internal waveform including Arb
Frequency	10 mHz - 10 kHz
Deviation	10 mHz - 15 MHz
Source	Internal only

<b>FSK</b>	
Internal rate	10 mHz - 50 kHz
Frequency Range	10 mHz - 15 MHz
Source	Internal/External (1 MHz max.)

<b>Burst</b>	
Carrier Freq.	5 MHz max.
Count	1 to 50,000 cycles or infinite
Start Phase	-360° to +360°
Internal Rate	10 mHz - 50 kHz $\pm$ 1%
Gate Source	Internal/External Gate
Trigger	Single, External or Internal Rate

<b>Sweep</b>	
Type	Linear or Logarithmic
Direction	Direction
Start F/Stop F	Start F/Stop F
Speed	1 ms to 500 s $\pm$ 0.1%
Trigger	Single, External, or Internal

<b>Rear Panel Inputs</b>	
Ext. AM Modulation	$\pm$ 5 Vpk = 100% modulation 5k $\Omega$ input resistance
External Trigger/FSK/Burst Gate	TTL low true

## System Characteristics<sup>3</sup>

<b>Configuration Times<sup>4</sup></b>	
Function Change: <sup>5</sup>	80 ms
Frequency Change: <sup>5</sup>	30 ms
Amplitude Change:	30 ms
Offset Change:	10 ms
Select User Arb:	100 ms
Modulation	< 350 ms
Parameter Change:	

## Arb Download Times over GPIB

Arb Length	Binary	ASCII Integer	ASCII Real <sup>6</sup>
16,000 points	8 sec	81 sec	100 sec
8,192 points	4 sec	42 sec	51 sec
4,096 points	2.5 sec	21 sec	26 sec
2,048 points	1.5 sec	11 sec	13 sec

## Arb Download Times over RS-232 at 9600 Baud<sup>7</sup>

Arb Length	Binary	ASCII Integer	ASCII Real <sup>8</sup>
16,000 points	35 sec	101 sec	134 sec
8,192 points	18 sec	52 sec	69 sec
4,096 points	10 sec	27 sec	35 sec
2,048 points	6 sec	14 sec	18 sec

[1] 100 mVpp - 20 Vpp into open circuit

[2] Offset  $\leq$  2x pk - pk amplitude

[3] Times are typical. May vary based on controller performance

[4] Time to change parameter and output the new signal.

[5] Modulation or sweep off

[6] Times for 5-digit and 12-digit numbers

[7] For 4800 baud, multiply the download times by two; For 2400 baud, multiply the download times by four, etc.

[8] Time for 5-digit numbers; for 12-digit numbers, multiply the 5-digit numbers by two

## Option 001 Phaselock/ TCXO Timebase

### Timebase Accuracy

Setability	Setability
Stability	$\pm 1$ ppm $0^\circ - 50^\circ$
Aging	< 2ppm in first 30 days (continuous operation) 0.1 pm/month (after first 30 days)

### External Reference Input

Lock Range	10 MHz $\pm$ 50 Hz
Level	-10 dBm to + 15 dBm +25 dBm or 10 Vpp max input
Impedance	50 $\Omega$ $\pm$ 2%, 42 Vpk isolation to earth
Lock Time	< 2 seconds

### Internal Reference Output

Frequency	10 MHz
Level	> 1 Vpp into 50 $\Omega$

### Phase Offset

Range	+ 360 $^\circ$ to - 360 $^\circ$ .
Resolution	0.001 $^\circ$
Accuracy	25 ns

### Trigger Output

Level	5V zero-going pulse
Pulse Width	> 2 $\mu$ s typical
Fanout	Capable of driving up to three 33120As

### Ordering Information

Keysight 33120A Function/Arb Generator  
Opt. 001 Phase Lock/TCXO Timebase Option

## Genera

Power Supply	110V/120V/220V/240V $\pm$ 10%
Power Line Frequency	45 Hz to 66 Hz and 360 Hz to 440 Hz
Power Consumption	50VA peak (28 W average)
Operating Environment	0 $^\circ$ C to 55 $^\circ$ C
Storage Environment	-40 $^\circ$ C to 70 $^\circ$ C
State Storage Memory	Power Off state automatically saved, 3 User Configurable Stored States
Interface	IEEE-488 and RS-232 standard
Language	SCPI - 1993, IEEE-488.2
<b>Dimensions (W x H x D)</b>	
Bench top	254.4mm x 103.6mm x 374mm
Rack mount	212.6mm x 88.5mm x 348.3mm
Weight	4 kg (8.8 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	<b>30 dBa</b>
Warm-up Time	1 hour
Warranty	1 year

## Ordering Information

33120A Function/Arbitrary Waveform Generator

### Accessories included

Operating manual, service manual, quick reference guide, IntuiLink connectivity software, test data, and power cord

### Options

Opt. 001 Phase lock/TCXO timebase  
Opt. 106 BenchLink Arb software (34811A) > 1 Vpp into 50  $\Omega$   
Opt. 1CM Rack Mount Kit (34190A)\*  
Opt. 910 Extra manual set

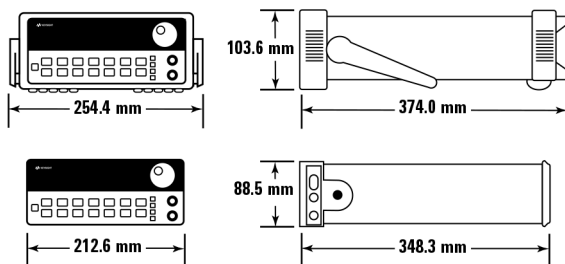
### Manual language options (please specify one)

ABA US English  
ABD German  
ABE Spanish  
ABF French  
ABJ Japanese  
ABZ Italian  
ABO Taiwan Chinese  
AB1 Korean

### Accessories

Keysight 34161A Accessory pouch  
Keysight 34811A BenchLink Arb software

\* For racking two side-by-side, order both items below  
Lock-link Kit (P/N 5061-9694)  
Flange Kit (P/N 5063-9212)



**myKeysight**

myKeysight

[www.keysight.com/find/mykeysight](http://www.keysight.com/find/mykeysight)

A personalized view into the information most relevant to you.



**Three-Year Warranty**

[www.keysight.com/find/ThreeYearWarranty](http://www.keysight.com/find/ThreeYearWarranty)

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



**Keysight Assurance Plans**

[www.keysight.com/find/AssurancePlans](http://www.keysight.com/find/AssurancePlans)

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

**Keysight Channel Partners**

[www.keysight.com/find/channelpartners](http://www.keysight.com/find/channelpartners)

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

**Americas**

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

**Asia Pacific**

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

**Europe & Middle East**

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:  
[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)  
 (BP-07-10-14)