

# Agilent 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 Agilent Technologies 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 heart-beat 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

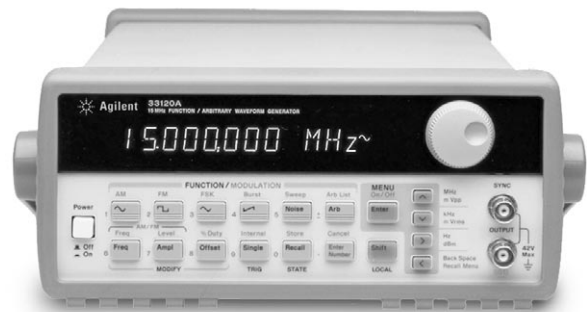
separate modulation source. Linear and log sweeps are also built in, with sweep rates selectable from 1 ms to 500 s. GPIB and RS-232 interfaces are both standard, plus you get full programmability using SCPI commands.

#### 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 Agilent 33120A to your PC

To further increase your productivity, use the 33120A in conjunction with Agilent 34811A BenchLink Arb software. The Windows®-based program lets you create and edit waveforms on your PC and download them to your 33120A with the click of a mouse. Create complex waveforms in a math or statistics program—or use the freehand drawing tool—then pass them into the instrument. Used in conjunction with an Agilent BenchLink Scope, the software also lets you capture a waveform with your Agilent oscilloscope or DMM and send it to your 33120A for output.

#### 3-year warranty

With your 33120A, you get operating and service manuals, a quick reference guide, test date, and a full 3-year warranty, all for one low price.



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## Waveforms

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

<b>Phase noise</b>	<-55 dBc in a 30 kHz band
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## 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	Up or Down
Start F/Stop F	10 MHz - 15 MHz
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 Parameter Change:	<350 ms

## 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

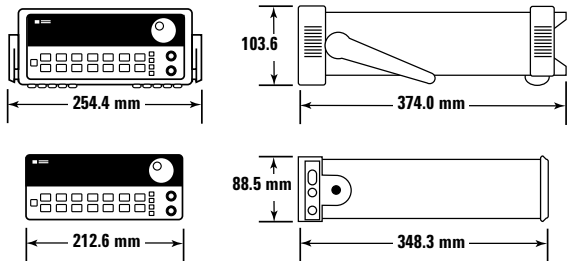
Timebase Accuracy	
Setability	< 0.01 ppm
Stability	$\pm 1$ ppm $0^\circ - 50^\circ$
Aging	< 2ppm in first 30 days (continuous operation) 0.1 ppm/month (after first 30 days)
External Reference Input	
Lock Range	10 MHz $\pm$ 50 Hz
Level	-10 dBm to + 15 dBm +25 dBm or 10 Vpp max input
Impedance	50 $\Omega$ $\pm$ 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

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

### General

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 aveage)
Operating Environment	0 $^\circ$ C to 55 $^\circ$ C
Storage Environment	-40 $^\circ$ C to 70 $^\circ$ C
State Storage Memory	Power Off state automati- cally saved, 3 User Configurable Stored States
Interface	IEEE-488 and RS-232 standard
Language	SCPI - 1993, IEEE-488.2
Dimensions (W x H x D)	
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	30 dBa
Warm-up Time	1 hour
Warranty	3 years standard



## Ordering Information

33120A Function/Arbitrary Waveform Generator

### Accessories included

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

### Options

- Opt. 001** Phase lock/TCXO timebase
- Opt. 106** BenchLink Arb software (34811A)
- Opt. 1CM** Rack Mount Kit (34190A)\*
- Opt. W50** Additional 2-year warranty (5-year total)
- 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

- Agilent 34161A** Accessory pouch
- Agilent 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)

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