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 µHz.

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 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
The included Agilent 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.agilent.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

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

**Arbitrary**
- 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

<table>
<thead>
<tr>
<th>Waveform</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine</td>
<td>100 µHz - 15 MHz</td>
</tr>
<tr>
<td>Square</td>
<td>100 µHz - 100 kHz</td>
</tr>
<tr>
<td>Triangle</td>
<td>100 µHz - 100 kHz</td>
</tr>
<tr>
<td>Ramp</td>
<td>10 MHz bandwidth</td>
</tr>
<tr>
<td>White noise</td>
<td>10 µHz or 10 digits</td>
</tr>
<tr>
<td>Accuracy</td>
<td>10 ppm in 90 days, 20 ppm in 1 year, 18°C - 28°C</td>
</tr>
<tr>
<td>Temp. Coeff</td>
<td>&lt; 2 ppm/°C</td>
</tr>
<tr>
<td>Aging</td>
<td>&lt; 10 ppm/yr</td>
</tr>
</tbody>
</table>

### Sinewave Spectral Purity

<table>
<thead>
<tr>
<th>Harmonic distortion</th>
<th>DC to 20 kHz</th>
<th>-70 dBc</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kHz to 100 kHz</td>
<td>-60 dBc</td>
<td></td>
</tr>
<tr>
<td>100 kHz to 1 MHz</td>
<td>-45 dBc</td>
<td></td>
</tr>
<tr>
<td>1 MHz to 15 MHz</td>
<td>-35 dBc</td>
<td></td>
</tr>
</tbody>
</table>

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

### Total harmonic distortion

<table>
<thead>
<tr>
<th>DC to 20 kHz</th>
<th>&lt;0.04%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase noise</td>
<td>&lt;55 dBc in a 30 kHz band</td>
</tr>
</tbody>
</table>

### Squarewave

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Rise/Fall time</th>
<th>Overshoot</th>
<th>Asymmetry</th>
<th>Duty cycle</th>
<th>Rise/Fall time</th>
<th>Linearity</th>
<th>Setting Time</th>
<th>Jitter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 20 ns</td>
<td>4%</td>
<td>1% + 5ns</td>
<td>20% to 80% (to 5 MHz)</td>
<td>40% to 60% (to 15 MHz)</td>
<td>&lt;0.1% of peak output</td>
<td>&lt;250 ns to 0.5% of final value</td>
<td>&lt;25ns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Triangle, Ramp, Arb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise/Fall time</td>
</tr>
<tr>
<td>Linearity</td>
</tr>
<tr>
<td>Setting Time</td>
</tr>
</tbody>
</table>

### Output Characteristics

**Amplitude (into 50Ω)**
- 50 mVpp - 10 Vpp

**Accuracy (at 1 kHz)**
- ± 1% of specified output

**Flatness (sinewave relative to 1 kHz)**
- < 100 kHz: ± 1% (0.1 dB)
- 100 kHz to 1 MHz: ± 1.5% (0.15 dB)
- 1 MHz to 15 MHz: ± 2% (0.2 dB)

**Output Impedance**
- 50Ω (fixed)
- + 5 Vpk ac + dc

**Resolution**
- 3 digits, amplitude and offset
- ± 2% of setting + 2 mV

**Units**
- Vpp, Vrms, dBm

**Isolation**
- 42 Vpk maximum to earth

**Protection**
- Short circuit protected + 15 Vpk overdrive < 1 minute

### Modulation

**AM**
- Carrier -3dB Freq.
- 10 MHz (typical)
- any internal waveform including Arb

**FM**
- Modulation
- 10 MHz - 10 kHz
- 10 MHz - 15 MHz
- Internal only

**FSK**
- Internal rate
- 10 MHz - 50 kHz
- 10 MHz - 15 MHz

**Burst**
- Carrier Freq.
- 5 MHz max.
- 1 to 50,000 cycles or infinite
- -360° to +360°
- 10 MHz - 50 kHz ± 1%

**Trigger**
- Single, External or Internal Rate

### Sweep

<table>
<thead>
<tr>
<th>Type</th>
<th>Linear or Logarithmic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direction</th>
<th>Up or Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start F/Stop F</td>
<td>10 MHz - 15 MHz</td>
</tr>
<tr>
<td>Speed</td>
<td>1 ms to 500 s ± 0.1%</td>
</tr>
</tbody>
</table>

### Rear Panel Inputs

<table>
<thead>
<tr>
<th>Ext. AM Modulation</th>
<th>± 5 Vpk = 100% modulation 5kΩ input resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Trigger/ FSK/Burst Gate</td>
<td>TTL low true</td>
</tr>
</tbody>
</table>

### System Characteristics

#### Configuration Times

<table>
<thead>
<tr>
<th>Function Change</th>
<th>80 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Change</td>
<td>30 ms</td>
</tr>
<tr>
<td>Amplitude Change</td>
<td>30 ms</td>
</tr>
<tr>
<td>Offset Change</td>
<td>10 ms</td>
</tr>
</tbody>
</table>

### Arb Download Times over GPIB

<table>
<thead>
<tr>
<th>Arb Length</th>
<th>Binary</th>
<th>ASCII Integer</th>
<th>ASCII Real</th>
</tr>
</thead>
<tbody>
<tr>
<td>16,000 points</td>
<td>8 sec</td>
<td>81 sec</td>
<td>100 sec</td>
</tr>
<tr>
<td>8,192 points</td>
<td>4 sec</td>
<td>42 sec</td>
<td>51 sec</td>
</tr>
<tr>
<td>4,096 points</td>
<td>2.5 sec</td>
<td>26 sec</td>
<td>21 sec</td>
</tr>
<tr>
<td>2,048 points</td>
<td>1.5 sec</td>
<td>13 sec</td>
<td>11 sec</td>
</tr>
</tbody>
</table>

### Arb Download Times over RS-232 at 9600 Baud

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

### Notes

1. 100 mVpp - 20 Vpp into open circuit
2. Offset ≤ 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.

---

[1] 100 mVpp - 20 Vpp into open circuit
[2] Offset ≤ 2x pk - pk amplitude
[3] Times are typical. May vary based on controller performance
[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**: $< 0.01 \text{ ppm}$
- **Stability**: $\pm 1 \text{ ppm 0° - 50°}$
- **Aging**: $< 2 \text{ppm in first 30 days (continuous operation)}$
  - $0.1 \text{ ppm/month (after first 30 days)}$

#### External Reference Input
- **Lock Range**: $10 \text{ MHz } \pm 50 \text{ Hz}$
- **Level**: $-10 \text{ dBm to } +15 \text{ dBm}$
  - $+25 \text{ dBm or 10 Vpp max input}$
- **Impedance**: $50 \Omega \pm 2\%$, 42 Vpk isolation to earth
- **Lock Time**: $< 2 \text{ seconds}$

#### Internal Reference Output
- **Frequency**: $10 \text{ MHz}$
- **Level**: $> 1 \text{ Vpp into } 50 \Omega$

#### Phase Offset
- **Range**: $+360° \text{ to } -360°$
- **Resolution**: $0.001°$
- **Accuracy**: $25 \text{ ns}$

#### Trigger Output
- **Level**: $5\text{V zero-going pulse}$
- **Pulse Width**: $> 2\mu\text{s typical}$
- **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**: $45 \text{ Hz to } 66 \text{ Hz and } 360 \text{ Hz to } 440 \text{ Hz}$
- **Power Consumption**: $50\text{VA peak (28 W average)}$
- **Operating Environment**: $0°C \text{ to } 55°C$
- **Storage Environment**: $-40°C \text{ to } 70°C$
- **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
- **Dimensions (W x H x D)**
  - Bench top: $254.4\text{mm x 103.6mm x 374mm}$
  - Rack mount: $212.6\text{mm x 88.5mm x 348.3mm}$
- **Weight**: $4 \text{ kg (8.8 lbs)}$
- **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**: $30 \text{ dBA}$
- **Warm-up Time**: $1 \text{ hour}$
- **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

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opt. 001</td>
<td>Phase lock/TCXO timebase</td>
</tr>
<tr>
<td>Opt. 106</td>
<td>BenchLink Arb software (34811A)</td>
</tr>
<tr>
<td>Opt. 1CM</td>
<td>Rack Mount Kit (34190A)*</td>
</tr>
<tr>
<td>Opt. 910</td>
<td>Extra manual set</td>
</tr>
</tbody>
</table>

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)

Agilent Technologies’ Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent’s overall support policy: “Our Promise” and “Your Advantage.”

Our Promise

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

Agilent Email Updates

www.agilent.com/find/emailupdates

Get the latest information on the products and applications you select.

By internet, phone, or fax, get assistance with all your test & measurement needs

Phone or Fax

United States:
(tel) 800 829 4444

Canada:
(tel) 877 894 4414
(fax) 905 282 6495

China:
(tel) 800 810 0189
(fax) 800 829 2816

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82 2) 2004 5004
(fax) (82 2) 2004 5115

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Taiwan:
(tel) 0800 047 866
(fax) 0800 286 331

Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6836 0252
Email: tm_asia@agilent.com

Online Assistance:

www.agilent.com/find/assist

Product specifications and descriptions in this document subject to change without notice.

Windows® is a U.S. registered trademark of Microsoft Corporation.

© Agilent Technologies, Inc. 2001, 2004
Printed in USA, May 1, 2004
5968-0125EN