Product Discontinuance Notice

The 33220A function generator and all associated options will be discontinued December 1, 2016. The last date this product can be ordered is November 30, 2016.

- For new product purchases, Keysight recommends the 33500B Trueform Series waveform generators.
- For more information, as well as to access to detailed migration guides, please visit www.keysight.com/find/nextgenFGs
- To contact a product selection expert, visit www.keysight.com/find/contactus
Uncompromising performance for functions and waveforms

The Keysight Technologies 33220A function/arbitrary waveform generator uses direct digital synthesis (DDS) techniques to create a stable, accurate output signal for clean, low distortion sine waves. It also gives you square waves with fast rise and fall times up to 20 MHz and linear ramp waves up to 200 kHz.

Key Features

- Fully compliant to LXI Class C specification
- 20 MHz Sine and Square waveforms
- Pulse, Ramp, Triangle, Noise, and DC waveforms
- 14-bit, 50 MSa/s, 64 k-point arbitrary waveforms
- AM, FM, PM, FSK, 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

Pulse generation

The 33220A can generate variable-edge-time pulses up to 5 MHz. With variable period, pulse width, and amplitude the 33220A is ideally suited to a wide variety of applications requiring a flexible pulse signal.

Custom waveform generation

Use the 33220A to generate complex custom waveforms. With 14-bit resolution, and a sampling rate of 50 MSa/s, the 33220A 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 Oscilloscope and send it to the 33220A for output. To find out more about IntuiLink, visit www.keysight.com/find/intuilink.

Easy-to-use functionality

Front-panel operation of the 33220A 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 $V_{pp}$, $V_{rms}$, dBm, or as high and low levels. Timing parameters can be entered in Hertz (Hz) or seconds.

Internal AM, FM, PM, FSK, 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 period of time. GPIB, LAN, and USB interfaces are all standard, plus you get full programmability using SCPI commands.

External frequency reference (Option 001)

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

### Waveforms

<table>
<thead>
<tr>
<th>Standard</th>
<th>Sine, Square, Ramp, Triangle, Pulse, Noise, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-in arbitrary</td>
<td>Exponential rise, Exponential fall, Negative ramp, Sin(x)/x, Cardiac</td>
</tr>
</tbody>
</table>

### Waveforms Characteristics

- **Sine**
  - Frequency Range: 1 µHz to 20 MHz
  - Amplitude Flatness\[1],\[2] (relative to 1 kHz):<br>
    - < 100 kHz: 0.1 dB<br>
    - 100 kHz to 5 MHz: 0.15 dB<br>
    - 5 MHz to 20 MHz: 0.3 dB
  - Harmonic distortion\[2],\[3]:
    - DC to 20 kHz: < 1 V<sub>PP</sub>
    - 20 kHz to 100 kHz: -65 dBc
    - 100 kHz to 1 MHz: -50 dBc
    - 1 MHz to 20 MHz: -40 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 20 MHz: -70 dBc + 6 dB/octave
  - Phase noise (10 kHz offset): -115 dBc / Hz, typical

- **Square**
  - Frequency range: 1 µHz to 20 MHz
  - Rise/Fall time: < 13 ns
  - Overshoot: < 2%
  - Variable duty cycle: 20% to 80% (to 10 MHz), 40% to 60% (to 20 MHz)
  - Asymmetry (@ 50% duty): 1% of period + 5 ns
  - Jitter (RMS): 1 ns + 100 ppm of period

- **Ramp, Triangle**
  - Frequency range: 1 µHz to 200 kHz
  - Linearity: < 0.1% of peak output
  - Variable Symmetry: 0.0% to 100.0%

- **Pulse**
  - Frequency range: 500 µHz to 5 MHz
  - Pulsewidth (period ≤ 10s): 10 ns resolution
  - Variable edge time: < 13 ns to 100 ns
  - Overshoot: < 2%
  - Jitter (RMS): 300 ps + 0.1 ppm of period

### Noise

- **Bandwidth**: 9 MHz typical
- **Arbitrary**
  - Frequency range: 1 µHz to 6 MHz
  - Waveform length: 2 to 64 k points
  - Amplitude resolution: 14 bits (including sign)
  - Sample rate: 50 MSa/s
  - Min. Rise/Fall Time: 35 ns typical
  - Linearity: < 0.1% of peak output
  - Setting Time: < 250 ns to 0.5% of final value
  - Jitter (RMS): 6 ns + 30 ppm

### Common Characteristics

- **Frequency**
  - Accuracy\[5]:
    - ± (10 ppm + 3 pHz) in 90 days
    - ± (20 ppm + 3 pHz) in 1 year
  - Resolution: 1 µHz

### AM

- **Carrier waveforms** Sine, Square, Ramp, Arb
- **Source** Internal/External
- **Internal modulation** Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
- **Depth**: 0.0% to 120.0%

### FM

- **Carrier waveforms** Sine, Square, Ramp, Arb
- **Source** Internal/External
- **Internal modulation** Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
- **Deviation**: DC to 10 MHz

### PM

- **Carrier waveforms** Sine, Square, Ramp, Arb
- **Source** Internal/External
- **Internal modulation** Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
- **Deviation**: 0.0 to 360.0 degrees

### PWM

- **Carrier waveform** Pulse
- **Source** Internal/External
- **Internal modulation** Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
- **Deviation**: 0% to 100% of pulse width

### FSK

- **Carrier waveforms** Sine, Square, Ramp, Arb
- **Source** Internal/External
- **Internal modulation** 50% duty cycle square (2 mHz to 100 kHz)

### External Frequency Reference (Option 001)

<table>
<thead>
<tr>
<th>Rear Panel Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Range</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>Impedance</td>
</tr>
<tr>
<td>Lock Time</td>
</tr>
</tbody>
</table>

### External Modulation Input\[6]

<table>
<thead>
<tr>
<th>(for AM, FM, PM, PWM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
</tr>
<tr>
<td>Input impedance</td>
</tr>
<tr>
<td>Bandwidth</td>
</tr>
</tbody>
</table>
### Sweep

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

### Burst

- **Waveforms**: Sine, Square, Ramp, Triangle, Pulse, Noise, Arb
- **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 (ms)**: 6 ms (3.5 ms 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 33220As

### Measurement Characteristics (Continued)

- **Ordering Information**
  - Keysight 33220A: 20 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. AB0: Taiwan: Chinese manual
- Opt. AB1: Korea: Korean manual
- Opt. ABA: English: English manual
- Opt. AB0: Germany: German manual
- Opt. ABJ: Japan: Japanese manual

### 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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### Footnotes

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. FSK uses trigger input (1 MHz maximum)
7. Sine and square waveforms above 6 MHz are allowed only with an “infinite” burst count
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