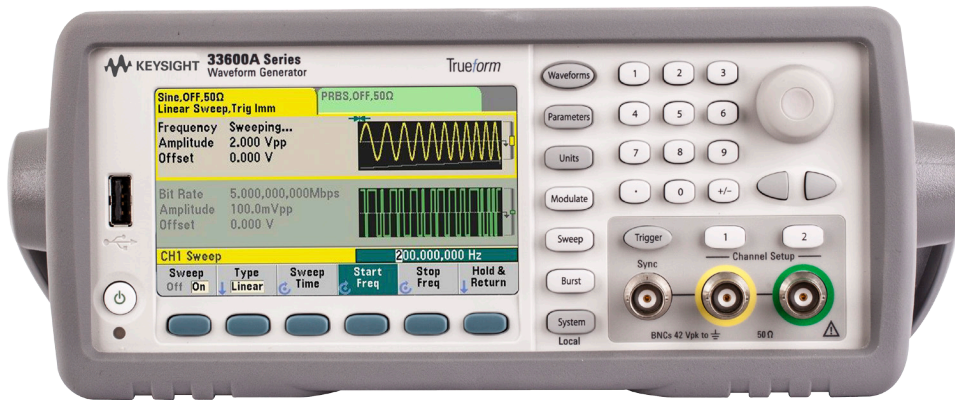


# Keysight Technologies

## Comparison: 33220A/33250A to 33500B/33600A Trueform Series Waveform Generators

### Migration Guide



## Introduction

The Keysight Technologies, Inc. 20-MHz 33220A and 80-MHz 33250A are function/arbitrary waveform generators that have established themselves as two of the premiere such instruments on the market today. Their replacements, Keysight's new 33500B and 33600A Trueform Series waveform generators are designed to offer users more capability, signal fidelity, and updated interfaces. This document summarizes and compares the key advances and capabilities of the 33500B/33600A Trueform Series waveform generators to the 33220A/33250A function generators. Key differences between the instruments will also be highlighted.

If you use these models:	Now order these models:
33220A function/arbitrary waveform generator, 20 MHz	33511B Trueform waveform generator, 20 MHz, 1 channel, arb
Opt 001 external time base reference	N/A – Built-in external time base reference
33250A function/arbitrary waveform generator, 80 MHz	33611A Trueform waveform generator, 80 MHz, 1 channel

Note that higher bandwidth options are available for the Trueform Series waveform generators: a 30-MHz option for the 33500B model and a 120-MHz for the 33600A model. Also, an optional second channel can be ordered with these units.

## Compatibility

When looking to replace reliable instruments like the 33220A/33250A, there are a number of factors to consider; not the least of which is compatibility. A comparison of key specifications is shown in Tables 1 and 2. Some of the areas where the Trueform Series waveform generators are equivalent to the 33220A/33250A function generators are:

- Signal type and modulation: The Trueform Series is a superset of the 33220A/33250A capability. All differences are cited in the next section.
- Signal fidelity and resolution: The Trueform Series specifications are as accurate as or better than that of the 33220A/33250A with few exceptions. Edges are faster, they have less jitter and are generally better. See Application Note 5991-0852EN for more details on Keysight's Trueform technology versus the older DDS-based signal generation.
- SCPI compatibility: The programming code utilizes the same syntax and can be used on the newer 33500B and 33600A Series models. However, users must add programming to make use of the new functionality.
- Some commands are not documented in the Trueform programming manual but are still available for backwards compatibility. For new systems, do not use the older commands
- Commands that are in the SOUR:DATA subsystem are not documented but supported:
  - APPLY:TRIngle
  - APPLY:USER
  - SOUR:PULSE subsystem
- Mechanical size: The height and width dimensions of the Trueform Series function generators are the same as the 33220A/33250A models.
- Accessories: Rack mount kits and probe accessories are compatible with all products.
- Manufacturing: All Keysight waveform generators are produced to the same rigorous quality standards and manufacturing process controls.
- Service and support: Keysight's international team is available to help users calibrate their function generator or answer any questions about any instrument.
- Warranty: Both the 33220A/33250A and Trueform Series generators offer the same standard 3-year standard warranty.

Table 1. 20-MHz waveform generator specification comparison.

Specification for Comparison	33220A	33500B Trueform Series
Sample rate	50 MSa/s	250 MSa/s
Bandwidth	20 MHz sine and square	20 MHz up to 30 MHz with bandwidth options
Amplitude resolution	14 bit	16 bit
Arb memory	64-K points	1-M points, (16-M points optional)
Jitter	1 ns + 100 ppm (square wave)	< 40 ps
Phase noise	-115 dBc/Hz (10 kHz offset)	-115 dBc/Hz (10 kHz offset)
Total Harmonic distortion (THD)	0.04%	< 0.04%
Graphical display	256x64 monochrome	WQVGA color TFT LCD
IO connectivity	USB, LAN GPIB	USB, LAN GPIB

Table 2. 80-MHz waveform generator specification comparison.

Specification for Comparison	33250A	33600A Trueform Series
Sample rate	200 MSa/s	1 GSa/s
Bandwidth	80 MHz sine and square	Up to 120 MHz (Sine)/100 MHz (Square) with bandwidth options
Amplitude resolution	12 bit	14 bit
Arb memory	64-K points	4-M points (64-M points optional)
Jitter	< 2 MHz 0.01% + 525 ps > 2 MHz 0.1% + 75 ps	< 1 ps (typical) 10 Hz to 40 MHz
Phase noise	-65 dBc/Hz (At 10 MHz, 30 KHz offset)	-122 dBc/Hz (At 80 Mhz, 10 kHz offset) with standard oscillator
Total Harmonic distortion (THD)	0.2%	< 0.04%
Graphical display	256 x 64 Color	WQVGA Color TFT LCD
IO connectivity	RS-232, GPIB	USB, LAN GPIB (optional)

## Differences

The few differences between the 33220A/33250A and Trueform Series generators that might affect migration are listed below. Many of these differences improve the performance of the Trueform Series generators relative to that of the 33220A/33250A function generators.

### Physical differences

- GPIB connectivity is optional on the 33600A Series.
- RS-232 connectivity is not available on the 33500B/33600A Series.
- The 33250A is physically deeper than the Trueform generators.
- Connectors are in different positions.

## Key differences

- The *Trueform* generators use different signal generation technology than the older 33220A/33250A. The older generators use DDS-based technology, while the *Trueform* technology is unique to Keysight generators. *Trueform* offers greater waveform integrity than DDS architectures. For more information on these differences see: *Trueform Waveform Generation Technology Overview*, publication number 5991-0852EN.
- *Trueform* generators offer two channels of waveform output and phase synchronous two channel behavior (phase sync, 90 degrees phase offset, Combine, Sum and modulation by “other” channel, etc.)
- 33500B and 33600A generators offer *Trueform* arbitrary waveforms with higher signal fidelity, waveform sequencing, much larger memory and much lower jitter than DDS waveforms in 33220A/33250A.
- Time to power up is longer in *Trueform* generators than in their predecessors.
- For sinewave outputs the 33250A offers 10 Vpp up to 80 MHz, while the 33600A Series offers 10 Vpp to 60 MHz, 8 Vpp from 60 MHz to 80 MHz, and 4 Vpp up to 120 MHz.
- For square wave outputs the 33250A offers 10 Vpp up to 80 MHz, while the 33600A Series offers 10 Vpp to 50 MHz, and 4 Vpp up to 100 MHz.
- The 33220A, 33250A, and *Trueform* Series generators use different calibration procedures with different default passwords.
- Internal amplitude range changes are different for each set of generators. Most users will not notice a difference, but those that expect a certain range of voltages before internal generator relay state changes should take notice.
- Some specifications vary between the 33220A/33250A and *Trueform* Series generators. In general, the *Trueform* specifications equal or exceed those of the 33220A/33250A.
- The timing of responses is different, including power on, configuration and signal output changes.
- Save and recall instrument configurations are different.

## Key programming differences

- Response to the \*IDN? Command is unique and specific to each instrument. No IDN emulation mode is offered.
- The different waveform generators have different calibration procedures.
- Response times may be different on programming interfaces on identical SCPI commands.
- The 33220A/33250A uses MEMory commands to configure power-on state recall; whereas the *Trueform* generators uses MMEMory commands to configure from either the internal or USB file systems.
- LAN was available on the 33220A. The following LAN setup commands are no longer supported with the *Trueform* generators.
  - SYSTem:COMMunicate:LAN
  - :AUTOip[:STATe] {OFF|0|ON|1}
  - :AUTOip[:STATe]?
  - :LIPaddress?
  - :MEDiasense {OFF|0|ON|1}
  - :MEDiasense?
  - :NETBios {OFF|0|ON|1}
  - :NETBios?

## Conclusion

The next-generation of waveform generators—Keysight’s Trueform Series generators—are here. For those users migrating from older Keysight equipment to this next generation, the new Trueform Series generators offer signal fidelity that exceeds that of older generators and are virtual drop-in replacements for the 33220A/33250A function generators. For those looking for more bandwidth or signal flexibility, the Trueform Series generators offer higher bandwidth options and a second channel. With the Trueform Series generators, converting your existing systems to the newest models has never been easier.

For more information about the 33500B & 33600A Trueform waveform generators visit:

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



### 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.

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)

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