

Arbitrary Waveform Generation Using Keysight Trueform Waveform Generators

Introduction

Arbitrary waveform design has long been a rigid, inflexible process. If you needed to modify a signal, you would typically need to redesign and regenerate the entire waveform from scratch. This was a tedious and inefficient way to work, especially for complex signals.

Trueform waveform generators have changed this by introducing a new level of flexibility. With powerful features like arbitrary waveform sequencing and frequency lists, you no longer need to start over every time you want to make a change. This makes your workflow faster and easier, allowing you to focus on your test instead of wrestling with your waveform.

Dive into the test challenges below and discover how Trueform waveform generators can help you do more with your arbitrary waveforms.

#1 Changing one segment without a complete redesign

You have designed a custom arbitrary waveform that works perfectly for testing your Device Under Test (DUT). However, during testing, you discover unexpected defects and need to modify your signal to introduce glitches in specific areas to test how your DUT handles transients. With traditional methods, this would mean starting the entire signal design process over again from scratch. This is a time-consuming and inefficient task.

How Keysight Trueform waveform generators overcome this

Keysight Trueform waveform generators' arb sequencing feature gives you the flexibility to easily add new characteristics to your existing signal without a complete redesign. You can simply insert the new glitches into the signal, saving you valuable time. You can be confident that those crucial glitch characteristics will be reliably reproduced in your output signal. This feature is available on both the 33500B and 33600A Series.

#2 Triggering a new signal after a continuous playback

In your test setup, you often need a different signal to start playing the moment an external event occurs. For example, you might need to switch from one DC level to another, or from a transmission packet to a receive packet. In the past, this was a difficult and often imprecise task. You likely had to rely on a controller to send commands, which introduced timing delays and added complexity to your setup.

How Keysight Trueform waveform generators overcome this

Trueform waveform generators solve this problem with their advanced waveform sequencing capability. This feature allows the generator to respond directly to a trigger, seamlessly switching from one signal to another with precise timing. You no longer need a separate controller, which simplifies your setup and improves accuracy.

With the 33500B and 33600A Series, you can simulate more realistic and complex scenarios by triggering multiple signals on multiple events.

#3 Reusing and reordering your proven signal designs

As an experienced engineer, you know that it is time-consuming to reorder existing signal segments to test different characteristics of your DUT. This can feel like a tedious, inefficient use of your development time.

How Keysight Trueform waveform generators overcome this

With the arb sequencing feature, you can build a library of your proven, custom arbitrary waveforms and combine them into new sequences. This allows you to create entire new waveforms by simply reordering your existing signal segments without having to redesign them from scratch.

Furthermore, the deep waveform memory on the 33500B and 33600A Series lets you store a large number of these segments directly on the instrument. This ensures you can change and re-sequence your arbitrary waveforms quickly and efficiently, saving you valuable time and effort in your workflow.

#4 Sweeping a single waveform through multiple frequencies

When you design a custom signal and upload it to a generator, you often need to run it at a set of different frequencies while keeping the same shape. A common example is testing for different resonant frequencies in a mechanical structure. With most DDS instruments, this becomes a tedious process. You have to manually change the frequency for each individual test, which is both time-consuming and inefficient.

How Keysight Trueform waveform generators overcome this

Trueform waveform generators eliminate this manual work by using the frequency lists feature. You can program a list of frequencies and their corresponding dwell times directly into the instrument. This allows your arbitrary waveform to automatically sweep through the entire set of frequencies, enabling you to test across your full range without manual intervention. You get to save time while ensuring your signal retains its intended shape and characteristics at every frequency.

Design Arbitrary Waveforms More Efficiently

As an engineer, you know the value of reusing proven designs, whether it's a block of code or a circuit layout. An efficient workflow is built on leveraging past work. Why should your arbitrary waveform design be any different? If you need to make a small change to a complex signal, you shouldn't be forced to recreate the entire waveform from scratch.

Trueform waveform generators provide a more intelligent solution. They give you the flexibility to reuse, re-sort, and change parameters on your existing waveform segments to build a completely new signal. This approach not only saves you significant time in the design process but also increases your confidence in the new signal, as you are building it from parts of a waveform you have already verified.

Streamline your workflow with waveform sequencing

For engineers seeking to streamline their workflow for generating arbitrary signals, waveform sequencing may be the ideal solution. This powerful feature allows you to develop a library of arbitrary waveform segments and then effortlessly reorganize them into a sequence to build a new, complex signal. A sequence is simply an ordered list of arbitrary waveforms that run one after another at a specified sample rate. This approach allows you to reuse proven designs and easily modify your signals without having to start from scratch.

With Keysight's Trueform waveform generators, your arbitrary signals are stored as *.arb*, *.csv*, or *.dat* files, while the sequence itself is stored as a *.seq* file. Each sequence can contain up to 512 steps, giving you extensive flexibility. For maximum performance, you can pre-load a total of 32 sequences with up to 1,024 segments into the generator's volatile memory, significantly improving your test throughput.

The following is an example that uses Keysight BenchLink Waveform Builder Pro to build a new signal from a library of arbs.



Figure 1. BenchLink Waveform Builder Pro sequencing menu.

When creating a waveform sequence, you have precise control over each segment. For every arbitrary waveform you add to your sequence, you can configure four key parameters:

- **Play control:** Defines the repetition and how the segment is triggered.
- **Repeat count:** Sets the specific number of times the waveform will play.
- **Marker mode:** Controls the behavior of the Sync signal.
- **Marker point:** Specifies the exact point in the waveform where the Sync signal's behavior changes.

As shown in the table in Figure 1, this configuration demonstrates the flexibility of sequencing. The sequence begins by playing a "MyArb1" waveform and will continue to play until it receives an external trigger. Once triggered, it will move to the next step, playing "MyArb4" for a precise 200 repetitions. The sequence then concludes by playing "MyArb2" indefinitely. Throughout this entire process, the Sync signal maintains its current level, as defined by the marker mode setting.

Measurement tips:

- When creating complex signals, memory can be a concern. The 33600A Series, with its optional 64 MSa memory, offers ample space. With waveform sequencing, you can save even more memory by simply replaying shorter waveforms as needed throughout your signal, rather than storing a single, long waveform.
- For advanced sequencing needs, you can use the Keysight BenchLink Waveform Builder Pro software, which allows you to easily construct intricate sequences on your PC.

Precise frequency sweeping with frequency lists

While most generators offer basic linear or logarithmic frequency sweeps, Trueform waveform generators provide a more precise and flexible solution: frequency lists. This feature lets you define a specific list of frequencies, up to 128 of them, and set the exact dwell time for each. The generator then sequentially moves through the list, staying at each frequency for the specified duration. This gives you granular control over your test and applies to all waveform types, including sine waves and custom arbitrary waveforms.

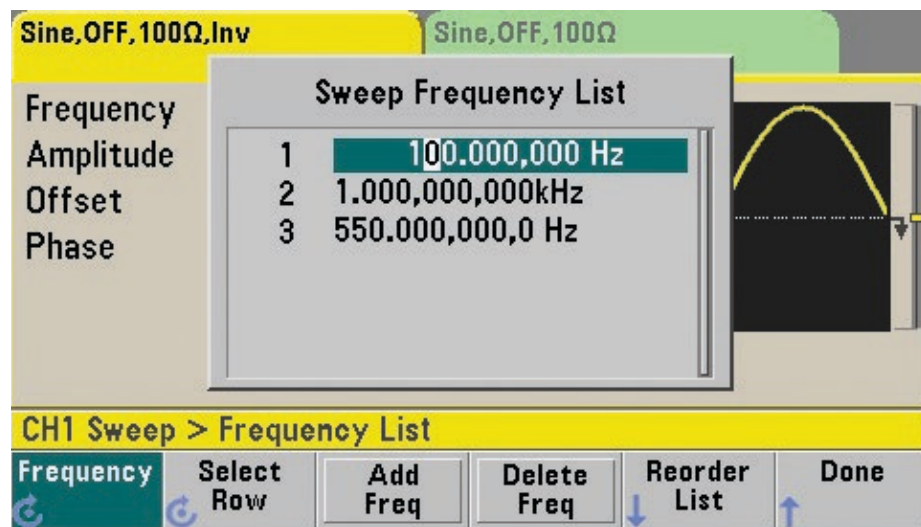


Figure 2. Trueform waveform generator frequency list menu.

Conclusion

Keysight's *Trueform* waveform generators represent a fundamental shift in signal generation technology. While traditional DDS generators force you to compromise on signal integrity for the sake of price, *Trueform* delivers a new standard of performance and flexibility. You no longer have to settle for distorted signals, unpredictable jitters, or a waveform that looks different from cycle to cycle. *Trueform*'s patented technology ensures that every point of your signal is reproduced exactly as you designed it, giving you a level of accuracy and confidence that was previously unattainable in this class of instrument. But the benefits extend beyond signal quality. *Trueform*'s advanced sequencing, triggering, and frequency list capabilities empower you to streamline your entire workflow. You can now easily reuse proven signal segments, automate complex test scenarios, and save valuable development time. With *Trueform*, you gain the signal integrity and efficiency required for modern R&D and manufacturing.

How can you benefit from Trueform technology

Trueform waveform generators offer the performance you need for efficient signal simulation with:

- Arbitrary waveform sequencing
- Arbitrary waveform triggering model
- 1 GSa/s
- Change amplitude, sample rate, and filter settings with arb metadata
- Deep waveform memory
- Easy drag and drop file system

To learn more about Keysight *Trueform* generators, go to [Trueform Series Waveform and Function Generators](#)



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