Keysight Technologies
Be More Efficient Designing Your Arbitrary Waveforms

Application Brief

KEYSIGHT
TECHNOLOGIES

Be More Efficient Designing Your Arbitrary Waveforms

Test challenge examples:	How True*form* technology can help:
– Changing one segment of an arb without redesigning the whole signal – Reusing your proven signal designs but put them together in a different order – Having a signal continuously playing until an event starts another signal – Needing to sweep your arb through a set of different frequencies	– 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

Historically, arbitrary waveform design and use had limited flexibility. You simply design a waveform and then use it in your generator. But, if you wanted to change the waveform, you had to regenerate a whole new signal. While you might have been able to change one or two points by hand, changing large parts of the waveform required a complete redesign. Trueform waveform generators now make arb signal generation much more flexible, and your workflow easier, thanks to capabilities like arb sequencing and frequency lists.

See our test challenges below to learn how Trueform waveform generators can help your arb waveforms do more.

Changing one segment of an arb without redesigning the whole signal

You've finally designed your custom arb signal, a stimulus for your Device-Under-Test (DUT), and it works exactly as desired. Using the signal you found defects in your DUT that you didn't expect. Now you'd like to reuse the signal, but add in a few glitches in key areas to ensure that your DUT can handle the transients. With the Trueform waveform generators (both the 33500B and 33600A Series), you don't need to start the signal design process from scratch. That's because an arb sequencing feature gives you the flexibility to easily add in signal characteristics without having to redesign the whole waveform. Furthermore, those glitch characteristics will actually show up in your signal—something not always guaranteed with DDS generators.

Having a signal continuously playing until an event starts another signal

When sending signals to your DUT, you often need to send a different signal when an event occurs. This could be as simple as going from one DC level to another. Perhaps you need to go from a transmission packet to a receive packet. In the past, it was difficult to easily accomplish this task with your function generator. You probably had to send commands to the generator when you wanted a new signal. Did you know that you can accomplish the same thing without a controller and with better timing using Trueform waveform generators (both the 33500B and 33600A Series)? Their waveform sequencing capability enables advanced triggering that allows you to trigger a different signal on a trigger or multiple signals on multiple triggers. Consequently, with a Trueform waveform generator, you are now able to simulate more situations.

Reusing your proven signal designs but put them together in a different order

You've designed arbitrary waveform signals for a while now and are experienced with the tools. However, the signals you need tend to be very similar and it sometimes seems like all you do is shuffle their order to test out different characteristics of your DUT. If you're like most engineers, you're always looking for ways to become more efficient. Why not save development time with your arbitrary waveforms? Trueform waveform generators (both the 33500B and 33600A Series) allow you to build a library of arbs and combine them into sequences to create whole new waveforms. You can then easily re-sequence the arbs into any order you like. And, with the deep waveform memory available on the Trueform waveform generators, you can store numerous arb signals on your instrument so that you can change your arbs faster.

Want your arb to sweep through a set of different frequencies

You've designed your signal using a PC and uploaded it to a signal generator. You realize, however, that you want the signal to have different sample rates or frequencies while still retaining its same shape. An example of this would be testing different resonant frequencies in mechanical structure testing where you want to automatically test a set of varying frequencies. With most DDS instruments, you would need to manually change the frequency each time you performed a different test. Trueform waveform generators allow you to more efficiently perform this task using frequency lists. Now, you can save time going from frequency to frequency by setting a list of frequencies and the dwell time right in the instrument.

Design arbitrary waveforms more efficiently

As an engineer, you'd like to reuse as much of your work as possible. Whether it's programming or a circuit design, you know that it's an efficient and good practice to reuse your proven designs. Why should building an arbitrary waveform be any different? If you've already designed a signal and now need to redesign a single part of it, you shouldn't have to recreate the whole thing. With Trueform waveform generators you don't have to. You can reuse, re-sort and change parameters on your arbs to build a whole new signal. This approach not only saves you time, but also increases your confidence in the new signal since you are simply reusing parts of a waveform you used in the past.

Waveform sequencing

For those engineers looking to create a more efficient workflow to generate arbitrary signals, waveform sequencing may be just the answer you need to streamline your development. Using it, you can develop a library of arbitrary waveform signals and then reorganize the signals into a sequence to make a new signal. A sequence is simply an ordered list of arbitrary waveforms that run one after another at a specified sample rate.

In the Trueform waveform generators, arbitrary signals are stored as .arb, .csv or .dat files. The sequence is stored as a .seq file. A sequence can have up to 512 steps. A total of 32 sequences with up to 1,024 segments can be pre-loaded into the generators' volatile memory to improve throughput.

Measurement tip:

The 33600A Series can store up to 64 Msamples (optional) waveforms. With waveform sequencing, you can save memory by replaying different shorter waveforms at different locations in your signal as needed.

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

Arbitrary Name	Play Control		Repeat Count		Marker Mode		Marker Point
MyArb1	Repeat Until Trigger	∨	N/A		Maintain	∨	0
MyArb4	Repeat	∨	200		Maintain	∨	0
MyArb2	Repeat Infinite	∨	N/A		Maintain	∨	0

Figure 1. BenchLink Waveform Builder Pro sequencing menu.

As you create your sequence there are four parameters to configure for each arb:

– Play control (repetition and trigger configuration)
– Repeat count (number of times to play the waveform)
– Marker mode (behavior of Sync signal)
– Marker point (point in waveform at which Sync signal changes)

As the table in Figure 1 shows, this sequence will play "MyArb1" until a trigger is received. It will then play "MyArb4" 200 times, and will finish by playing "MyArb2" indefinitely. The Sync signal is maintained at its current level throughout the sequence.

Measurement tip:

For more complex sequences, you can use Keysight Bench-Link Waveform Builder Pro software (a program you can purchase to run on your PC) to construct a sequence.

Frequency lists

Most generators have a way to sweep through a range of frequencies. They enable you to output your signals at different frequencies linearly or logarithmically. Trueform waveform generators allow you to define a frequency list and set how long you want to dwell at that frequency. Now, you can set a list of up to 128 frequencies and set your dwell time. The generator then sequentially goes through the list of frequencies, staying at each frequency for the defined dwell time. This feature can be used for all waveform types including arbs.
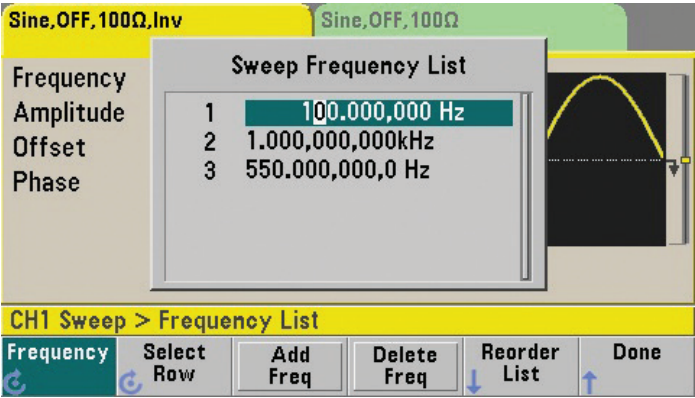

Figure 2. Trueform waveform generator frequency list menu.

Summary

The 33600A Series of Trueform waveform generators builds on the features of its predecessor, the 33500B Series waveform sequencing and frequency lists are just two of the new capabilities unique to the Trueform waveform generators.

See the True*form* waveform generator test challenge web site for additional topics such as:

– Generating a waveform with many points
– Simulating signals with the highest integrity
– Effortlessly couple or synchronize two signals on a waveform generator
– Using a waveform generator to generate a PRBS signal
– Creating a differential signal with a waveform generator

www.keysight.com/find/trueformTC

For 33600A Series Trueform waveform generator product information visit www.keysight.com/find/33600A

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.lxistandard.org
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

Three-Year Warranty
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.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

www.keysight.com/find/trueformTC
www.keysight.com/find/33600A

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

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-09-23-14)

KEYSIGHT
TECHNOLOGIES