# Waveform Sequencing with PathWave BenchVue Waveform Builder Pro

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# Introduction

Arbitrary waveform design and use have had limited flexibility until recently. If you wanted to change a waveform, you had to generate a new signal. While you might have been able to change one or two points by hand, changing large parts of the waveform required a redesign. Keysight PathWave BenchVue Waveform Builder Pro gives you access to advanced signal-creation and editing capabilities, without spending hours programming. The result is quicker and easier custom waveform creation combined with deeper analytical insight into your signals.

Waveform sequencing lets you create multiple configured waveforms with several common segments. Sequencing lets you build long, complex waveforms using minimal instrument memory. With waveform sequencing, you can save memory by replaying different shorter waveforms at various locations in your signal as needed.

Engineers looking to optimize their workflow can use waveform sequencing to generate arbitrary signals. They can organize the signals into a sequence to make new signals.

This application note covers how to implement waveform sequencing using the 33503A PathWave BenchVue Waveform Builder Pro, supported by the Keysight 33500B and 33600A Trueform Series waveform generators.

# PathWave BenchVue Waveform Builder Pro — Waveform Sequencing

PathWave BenchVue Waveform Builder Pro is full-featured waveform-creation software for waveform generators. The software enables engineers to take full advantage of signal-generation capabilities and makes custom waveform creation fast and simple. It is ideal for research and development engineers who need to characterize new designs and for test system engineers who must validate production units.

PathWave BenchVue Waveform Builder Pro is a PC application that provides easy-to-use creation tools, such as an equation editor and waveform math and drawing tools, that you can use to create custom signals. It features a standard function library waveform sequencer, as well as filters and windowing functions that allow you to modify and refine your waveform easily. A library of built-in signals supports the fast creation of more complex waveforms, such as multitone, serial data, trapezoid, and Gaussian.

However, some applications require complex waveforms of more than 16 million points. Some also require the repetition of relatively small arbitrary waveforms over a large number of cycles. Still other applications require the arbitrary waveform to interact with the device under test (DUT) via the instrument's sync output. In these situations, you need sequences of arbitrary waveforms.

A sequence is an ordered list of arbitrary waveforms that run one after another at a specified sample rate. You can create a sequence in SCPI with the DATA:SEQuence command, but for more complex sequences, it is usually easier to use PathWave BenchVue Waveform Builder Pro software.

## Use PathWave BenchVue Waveform Builder Pro to do the following:

- create a series of waveforms for troubleshooting
- streamline a list of waveforms to play back for automated testing
- choreograph multiple waveform outputs to control devices such as LEDs, motors, and actuator sequencingDC coupled: < −45 dBc @ 10 MHz and 5 dBm < −65 dBc @ 2 GHz and 5 dBm

# The benefits of creating waveform sequencing

One key feature of building arbitrary waveforms in PathWave BenchVue Waveform Builder Pro is that it allows you to sequence multiple waveforms together (Figure 1).

Waveform sequencing lets the engineer harness the full power of a function generator. With PathWave BenchVue Waveform Builder Pro, you can do the following:

- create a customized series of waveforms for troubleshooting
- sequence a list of waveforms to play back for automated testing
- choreograph multiple waveform outputs to control devices such as LEDs, motors, and actuators
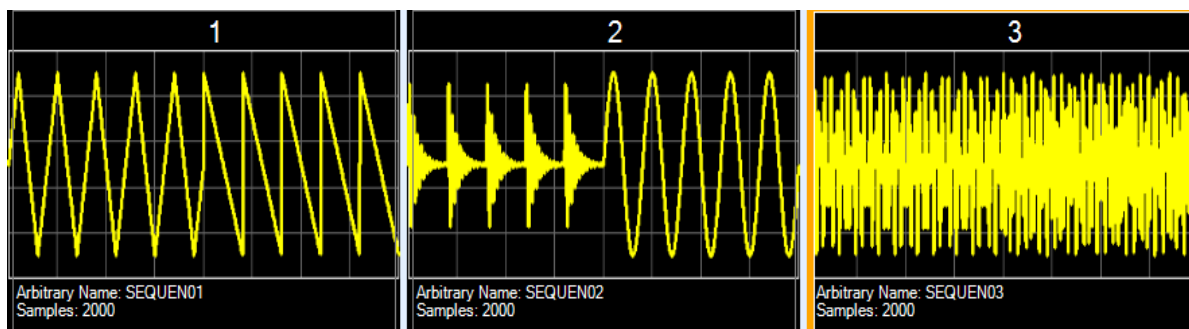


**Figure 1.** A simple and clean waveform sequence with three waveform segments

# Creating Waveform Sequences

To create a waveform sequence in PathWave BenchVue Waveform Builder Pro, select New > Sequence from the main menu, as shown in Figure 2.
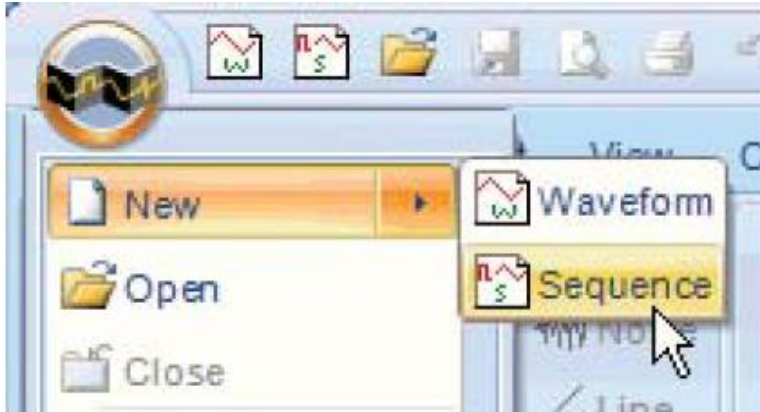


**Figure 2.** Creating a new sequence with PathWave BenchVue Waveform Builder Pro

The software opens a dialog box that allows you to specify the sequence's target instrument and sampling rate, as shown in Figure 3.
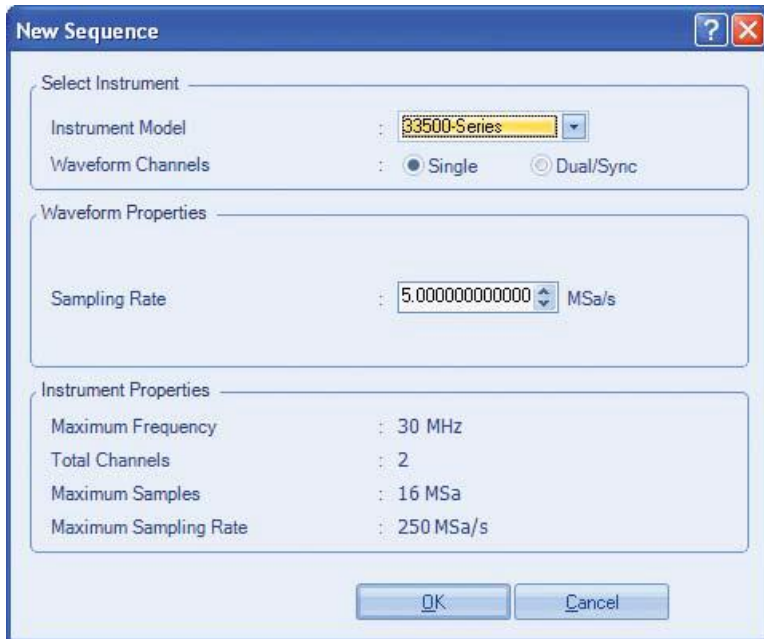


**Figure 3.** Dialog box for setting the parameters for a new sequence

After you enter the parameters and press **OK**, use a table to list each waveform in the sequence, as shown in Figure 4. For each waveform, you can specify the following attributes:

- play control (repetition and trigger configuration)
- repeat count (number of times to play the waveform)
- marker mode (behavior of Sync signal)
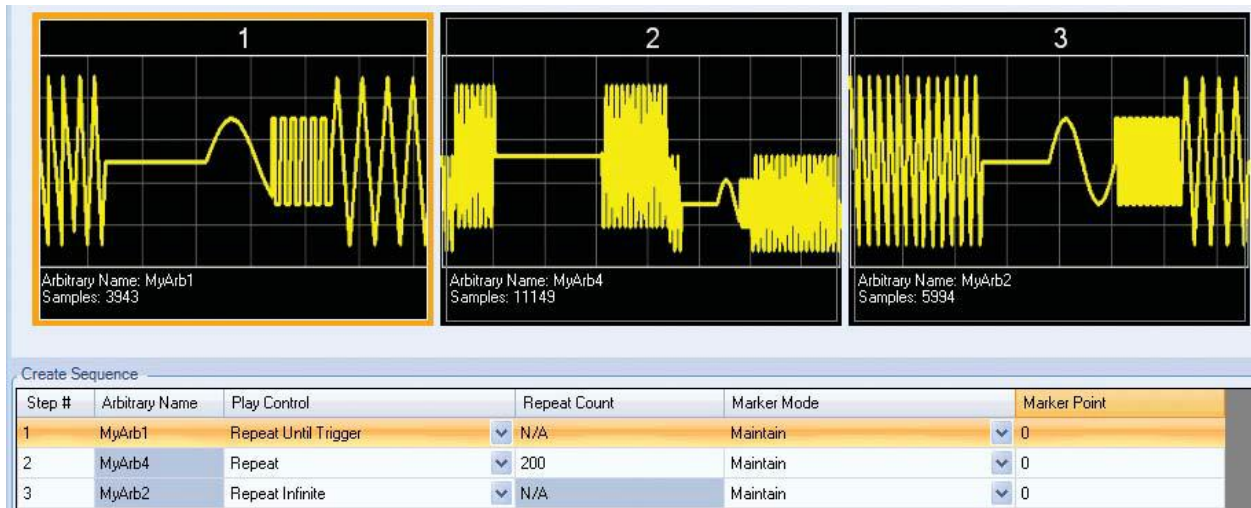- marker point (point in the waveform at which Sync signal changes)



**Figure 4.** Table for listing each waveform in sequence

As the table in Figure 4 shows, this sequence will play "MyArb1" until it receives a trigger. It will then play "MyArb4" 200 times, and it will finish by playing "MyArb2" indefinitely. The sync signal will be maintained at its current level throughout the sequence.

The arbitrary waveform sequence capabilities of the 33500B and 33600A Trueform Series allow you to combine arbitrary waveforms into a variety of powerful combinations quickly. They allow you to create long combinations of waveforms and to use the instrument's sync signal to interact with your DUT.

# Conclusion

PathWave BenchVue Waveform Builder Pro software is full-featured waveform-creation software for pulse, function, and arbitrary waveform generators. The software enables you to take full advantage of signal-generation capabilities and makes custom waveform creation fast and simple. The software also provides a waveform sequencer, filters, and windowing functions, allowing you to modify and define your waveform easily.

With PathWave BenchVue Waveform Builder Pro, you get advanced signal-creation and editing capabilities without spending hours programming. The software supports the following Keysight products:

- 33500B Trueform Series waveform generators, 20 and 30 MHz
- 33600A Trueform Series waveform generators, 80 and 120 MHz

For more information on the Keysight Trueform Series waveform generators, please visit
https://www.keysight.com/my/en/products/waveform-and-function-generators.html

For more information on Keysight PathWave BenchVue Waveform Builder Pro software, please visit
https://www.keysight.com/us/en/software/application-sw/benchvue-software.html

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