

# Keysight Technologies

## Accelerate Vehicle Charging System Simulation with the N6705A DC Power Analyzer

### Application Note



This application brief describes how the Keysight N6705A DC Power Analyzer can simulate vehicle charging system power waveforms for R&D electrical component testing.

## Description

When R&D engineers test electrical components for use in a vehicle, it is necessary to simulate various power conditions. This ensures that the electrical components in the vehicle continue to work properly during different power conditions from the charging system. For example, abrupt loading of the vehicle power system such as during starter crank causes voltage dips powering the electrical components. Figure 1 describes an example of such a voltage dip waveform. Electrical components found in vehicle telematics (vehicle tracking, satellite navigation, mobile communications, television, etc.) and mechatronics (anti-lock braking systems, spin-assist, airbag deployment, etc.) are thoroughly tested through a variety of charging scenarios similar to the voltage dip that replicate cranking profiles, power disturbances or decay reflected on the vehicle's power system.

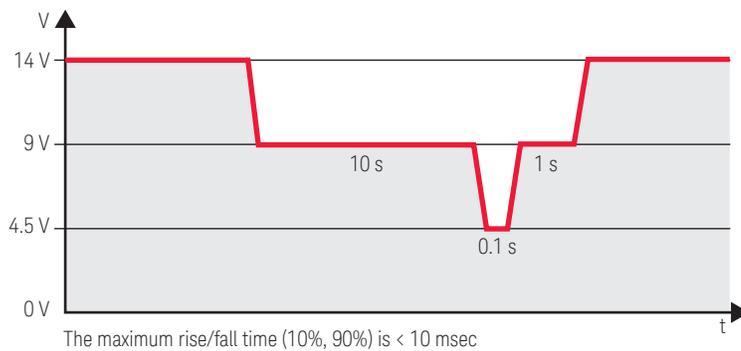


Figure 1. An example of a voltage dip waveform

## Problem

Simulating these power waveforms demands a system capable of producing several different voltage waveforms. Some automotive R&D engineers create custom test stations containing specialized equipment made for recreating these power waveforms. This solution is expensive, inflexible and requires a lot of time. Often times, these systems are ordered from outside vendors and contain an internal power supply with fast protection, a high-speed function generator and an industrial computer interface. Also, it does not easily allow for much flexibility for changing test settings because this system is custom-made for specific tests. Finally, testing the electrical components would require a trip to a local test station because the number of these customized systems is low.

## Solution: The Keysight N6705A DC Power Analyzer

The Keysight Technologies, Inc. N6705A DC Power Analyzer has the arbitrary waveform capability, slew rate control and configurability to recreate low-frequency power waveforms to power the electrical components in a vehicle. It packs the power of up to four power supplies, a function generator, an oscilloscope, a voltmeter, an ammeter and a datalogger in a 7 inch high, bench top package.

The DC Power Analyzer provides an easy way for an R&D or design validation engineer to recreate some of the automotive power waveforms such as slow decreasing/increasing of operating voltage, quick charges, cranking profiles and voltage dips all from the front panel. While the design has been optimized for use on the bench, the N6705A DC Power Analyzer is also an LXI Class C instrument with LAN, GPIB and USB interfaces.

The N6705A is a modular power system that houses up to four power supply outputs. Each output can either work independently of the others or be synchronized with other outputs. There are over twenty different power modules ranging in performance (basic, high-performance and precision) and power (50 W, 100 W and 300 W). Mix and match up to four power modules in the N6705A to test multiple DUTs.

## Simulating transients using the front panel

There are arbitrary waveform controls built into the N6705A that allow users to create nine different waveforms: sine, step, pulse, ramp, trapezoid, staircase, exponential, user defined voltage and user defined current waveforms. These waveforms are all configurable from the front panel without having to write a single line of code!

Replicate the signal in Figure 1 by creating a four step user-defined voltage waveform. The voltage waveform begins at 14 V, drops to 9 V for 10 s, dips down to 4.5 V for a brief 100 ms, rises to 9 V for 1 s and returns to 14 V after the dip. Figure 2a shows the user defined voltage waveform setup screen on the N6705A reflecting the steps previously described. Figure 2b shows the waveform in scope view. Notice how the N6705A is capable of measuring and displaying voltage and current data at the device under test (DUT) in an oscilloscope-like display.

The N6705A also allows users to save user-defined waveform setups and scope data to the 64 MB of internal memory or to an external USB memory device.

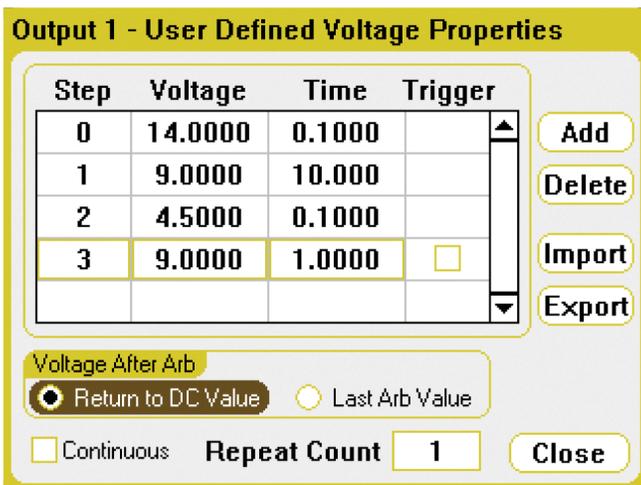


Figure 2a. N6705A screenshot of the user defined arbitrary voltage waveform setup screen

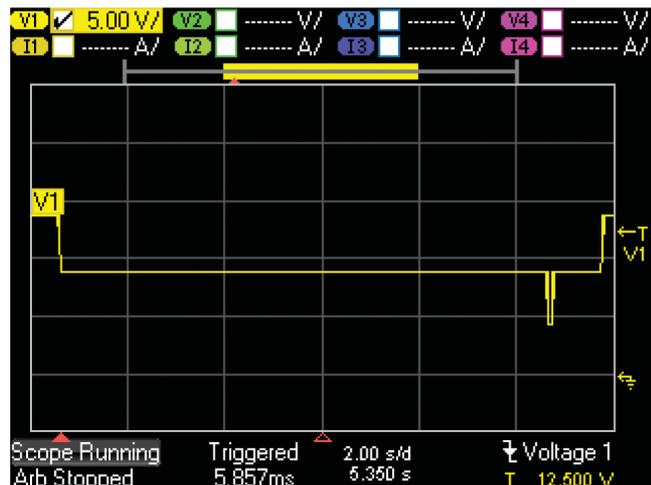


Figure 2b. N6705A screenshot of the very brief voltage dip waveform in scope view

## Configurable slew rate

The power waveform in the Figure 1 example has a maximum rise/fall time of less than 10 ms. This example requires a slew rate of 450 V/s. All power modules available for the N6705A have programmable slew rates. Slew rates can be as low as 4.76 V/s and are configurable from the Output Source Settings screen on the front panel. Note that the maximum slew rate is limited by the output rise time specification of the module.

## Summary

The Keysight Technologies N6705A DC Power Analyzer has the capability to simulate basic automotive power waveforms for vehicle electrical systems with its arbitrary waveform control, slew rate control and flexibility. The N6705A is an intuitive system designed for the R&D or design validation engineer to incorporate multiple instruments in a bench top package.

## Related applications

- Voltage drop out detection
- Sleep current margin test
- Stress and abuse test

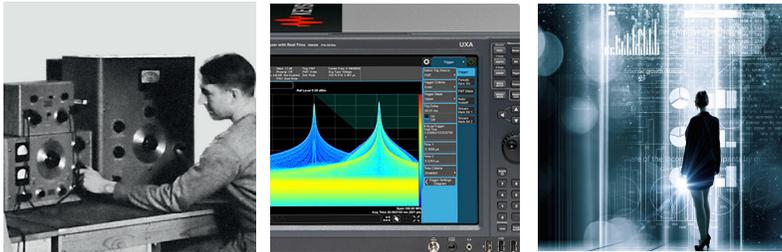
## Related products

- N6700 Low-Profile Modular Power System

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