APPLICATION NOTE

How to Create Power Supply Output Sequences

5 steps to set up data logging

KEYSIGHT

Introduction

Turning on all the outputs is often risky when using a triple-output power supply. Many devices require powering up in a specific order, or you could damage them. Numerous devices require multiple bias or rail voltages to resolve this issue. Devices such as field programmable gate arrays require the voltages to turn on and off in a set sequence.

If you are working with devices with specific timing requirements, you will want to use a power supply with power sequencing. Power supply sequencing enables you to automatically set voltage outputs and delays according to a prescripted pattern you can choose. By implementing power supply sequencing, you can eliminate the need for manual channel activation and voltage adjustments, reducing the risk of accidental equipment damage.

This application note explains how to create power supply output sequences with data logging using the Keysight E36313A power supply.

The Importance of Sequencing

Devices such as microprocessors, field programmable gate arrays, and complex circuits require the voltages to turn on and off sequentially. Power-up sequencing is important, and power-down sequencing can help ensure proper shutdown of your device under test (DUT).

Sequencing test setups can be challenging when synchronizing individual independent multiple power outputs. The Keysight E36312A and E36313A triple-output bench power supply with built-in voltage sequencing capabilities offer the user precise control over power-up and power-down sequences. The bench power supply enables you to create a single DC output sequence with up to three DC outputs on one channel or group of channels.

Power-Up and Power-Down Sequencing Setup

Figure 1 is an example of a power-on and power-off sequence using a complex circuit board and the Keysight E36313A.

Figure 1. The E36313A triple-output bench power supply connects to power up a circuit board

Overview

The first step to generate all three E36313A DC outputs is to set up each output for the correct voltage and current limit. Each of the E36313A power supply's three outputs is independent and isolated, so it is easy to set the voltages and not worry about having a common ground. First, set Channel 1 to 5 V, Channel 2 to 15 V, and Channel 3 to 20 V.

Next, set the delays. You can configure On Delay and Off Delay for each channel. The On Delay function represents how long the unit waits to turn on after you start the sequence. The Off Delay represents how long the unit waits once you initiate the end of the sequence. For the power-up sequence, you program Channel 1 for a one-second delay, Channel 2 for a three-second delay, and Channel 3 for a five-second delay.

For the power-down sequence, you reverse the order and set Channel 3 to 0 V, Channel 2 to 0 V, and Channel 1 to 0 V. Channel 3 gets a one-second delay, Channel 2 has a two-second delay, and Channel 1 gets a three-second delay.

Now you can start the sequence and data logger by pressing the All On / Off key. Wait about 10 seconds, initiate the power-down sequence using the All On / Off key, and wait for the data logger to finish recording.

Capturing Voltage and Current Measurements Using Data Logging

Another helpful built-in capability in the E36312A / E36313A is the data logger. The data logger enables you to record voltage and current pairs over time. You eliminate the need to add a second instrument to the test setup specifically for data logging when integrating the data logger capability into the power supply.

How to Set Up Data Logging in 5 Easy Steps

Step 1: Determine the number of channels, voltage sequence, and delay times for each output channel.

Turn-on sequence:

- Channel 1: Wait 1 second, then go to 5 V.
- Channel 2: Wait 3 seconds, then go to 15 V.
- Channel 3: Wait 5 seconds, then go to 20 V.

Turn-off sequence:

- Channel 3: Wait 1 second, then go to 0 V.
- Channel 2: Wait 2 seconds, then go to 0 V.
- Channel 1: Wait 3 seconds, then go to 0 V.

Step 2: Set up each channel voltage and the current limit settings.

Program the following:

- Channel 1 for 5 V
- Channel 2 for 15 V
- Channel 3 for 20 V

Figure 2 is an example of the default current limit settings.

Figure 2. Channel voltage and current limit setting

Step 3: Configure the channel turn-on and turn-off delays, then join the outputs together.

- Use the On / Off coupling button to set all three channels to On.

In Figure 3, all three channels appear coupled in the sequence and respond to the trigger command using the front panel with all On / Off keys.

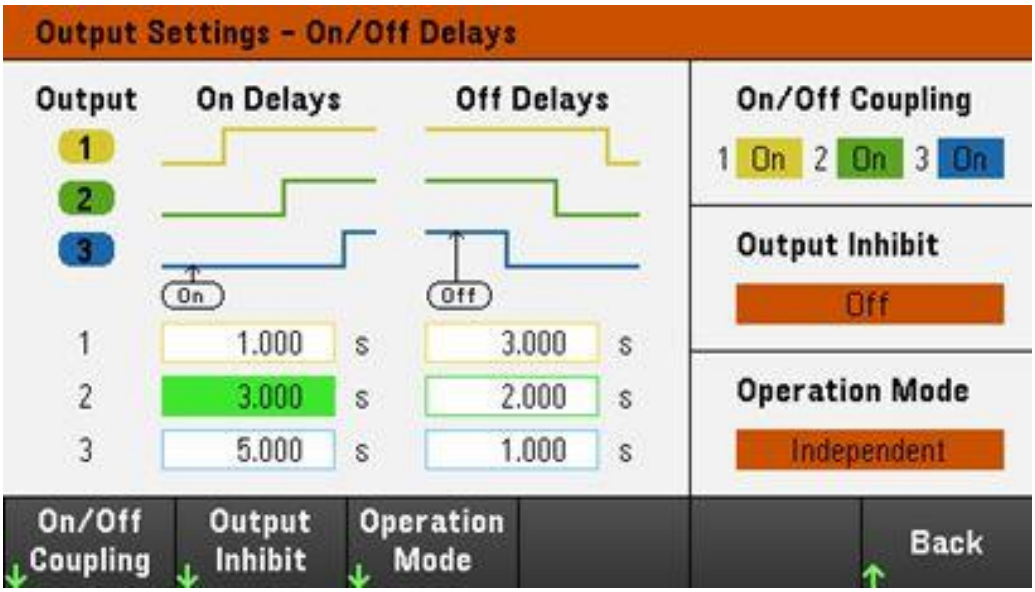

Figure 3. The channel turn-on and turn-off delay setting

Step 4: Set up the data logger properties and waveform settings.

We selected V1, V2, and V3 output settings in our example.

- Select the channels you want to view.
- Program the following that appears in Figure 4:
  - Data logger selections.
  - Duration for the data capture.
  - Sample period.
  - Trigger source.

The data file size automatically calculates based on the settings. When performing a data log, connect a USB drive to the front-panel USB port to store the data log.

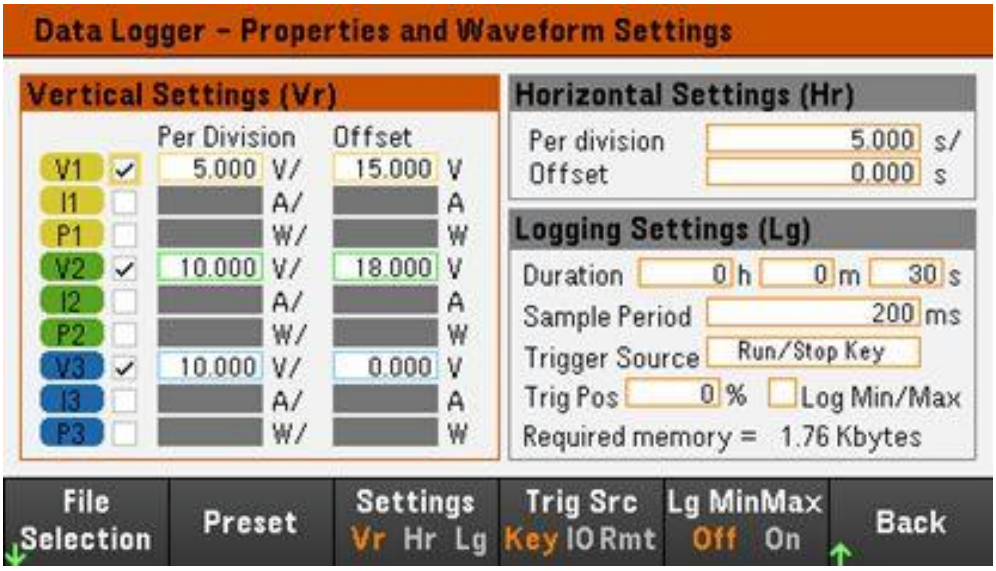

Figure 4. Data logger and waveform set

Step 4A: Set voltages.

- Set V1 to 5 V / Division and Offset to 15 V.
- Set V2 to 10 V / Division and Offset to 18 V.
- Set V3 to 10 V / Division and Offset to 0 V.

Use offset adjustments to position each channel on the waveform display. This process enables you to view all three output channels simultaneously.

Step 4B: Set Horizontal values to 5 seconds per division.

Step 4C: Set Logging parameters.

- Duration 30 seconds.
- Sample Period 200 ms.
- Trigger Source Run / Stop Key.

The data file size automatically calculates for you based on the settings. In our example, the required memory equals 1.76 Kbytes. You need to connect a USB drive in the front panel USB port to retrieve the stored data log results when performing a data log.

In Step 5, we will start the data logger, initiate the power-up sequence trigger, wait a few seconds, initiate the power-down sequence, and wait until the data logger finishes recording.

Step 5: Start the data logger by pressing the Run / Stop key, then press the Back key.

- Press the All On / Off front panel key and wait about 10 seconds to start the power-up sequence.
- Press the front panel All On / Off key again to initiate the power-off sequence.

Figure 5 displays the data logger that captures all three DC outputs and then displays the power-up and power-down voltage sequence.

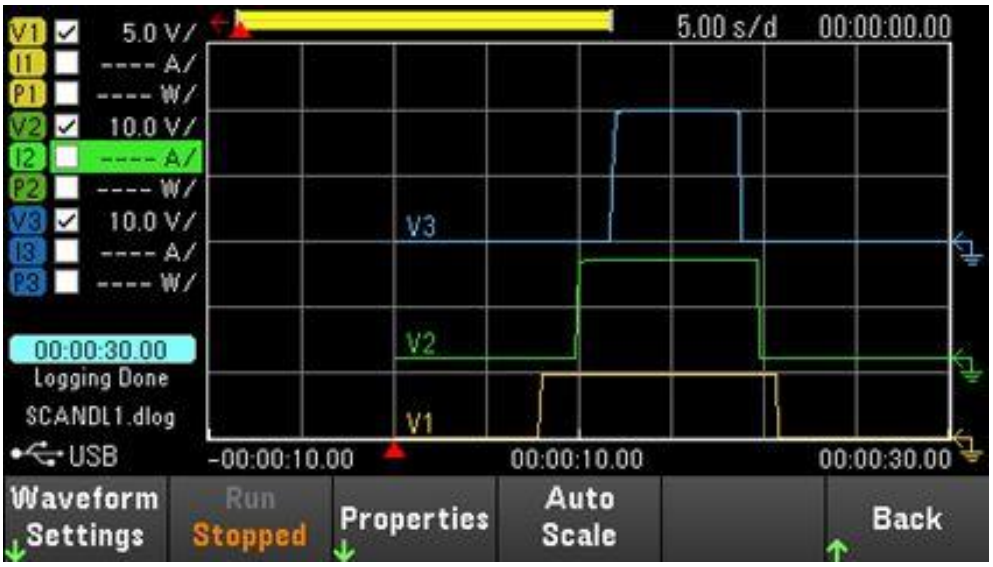

Figure 5. Three DC outputs and displays of the power-up and power-down voltage sequence

Conclusion

Bench power supplies have a built-in output sequencing function that enables programmability. You can program voltage values, current limit values, and time per step using the test sequence feature. Using the bench power supply with the test sequences feature enables precise control over power-up and power-down sequences and reduces test setup complexity.

For more information on the Keysight E36000 Series, please visit E36300 Series Triple-Output Power Supply.