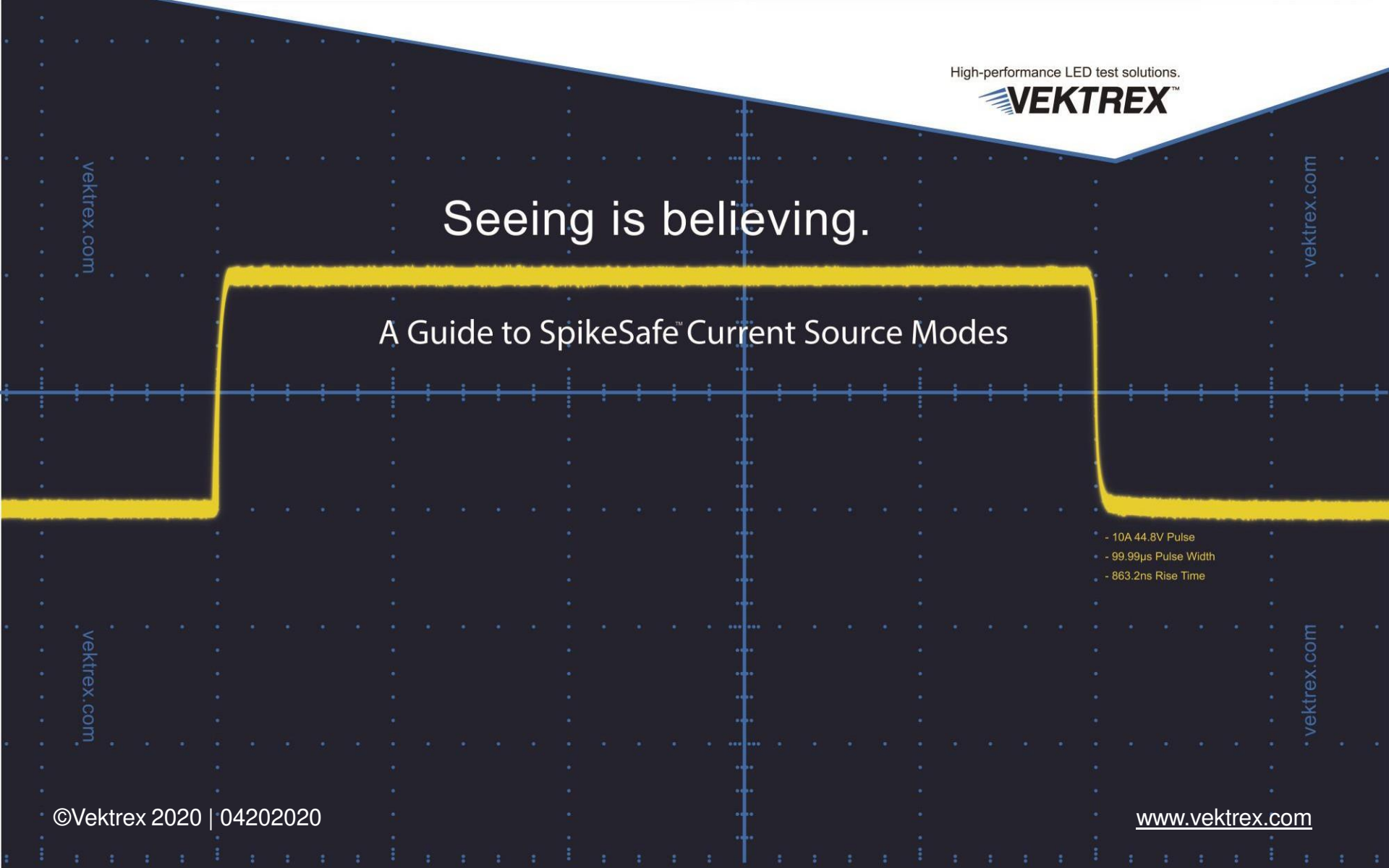
High-performance LED test solutions.

VEKTREX™

Seeing is believing.

A Guide to SpikeSafe™ Current Source Modes



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DC Mode

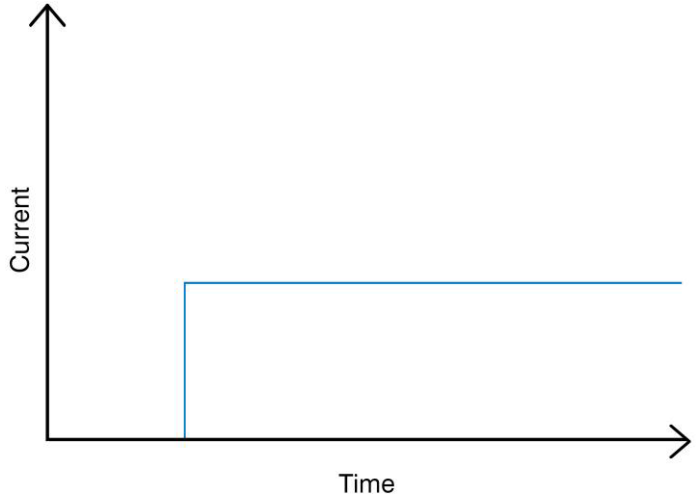
DC is an abbreviation for Direct Current. Also known as Constant Current, or 100% duty cycle. Since DC-biased lasers produce a continuous output waveform, DC drive is called CW (continuous waveform).

Some test methods turn DC sources on and off to produce slow pulses (pseudo pulses) in the millisecond or second range. Vektrex recommends using pulsed mode.

DC Mode is typically used for reliability, burn-in, LM-80 and HASS (highly accelerated stress system) testing.

DC Mode is applicable for light measurement applications where device heating is desired. LM-85, the measurement repeatability standard, describes using DC Mode with a fast turn on and a temperature control system to set device junction temperature.

To use DC Mode, the maximum compliance voltage and current are set. When off, the current is 0. When on, accurate stable current is output after a controlled ramp-up (not shown).



With continuous power conversion, Vektrex current source models support DC Mode with voltages up to 400V, maximum currents to 60A and total output power up to 6.4kW.

Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
✓	✓	✓	✓	✓

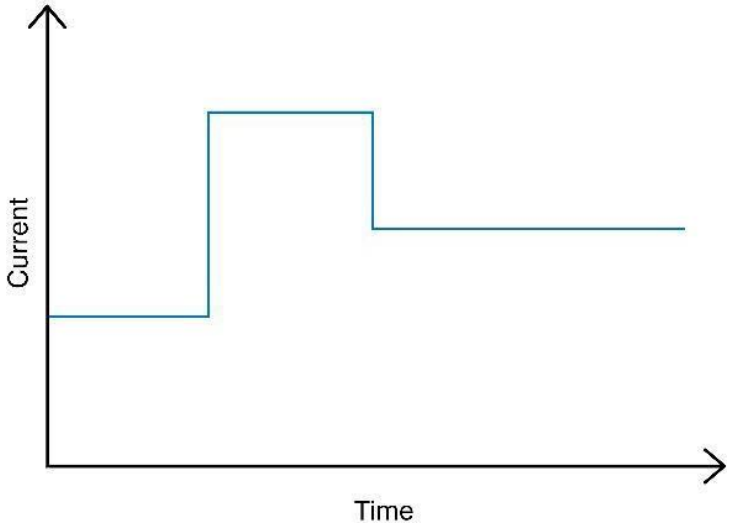
DC Dynamic Mode

DC Dynamic Mode is similar to DC Mode, with two primary differences:

1) The current is not ramped up linearly, the output transitions to full current in one step.
2) The current may be changed while the output is enabled.

DC Dynamic mode may be used with an external software program that sweeps the current in steps. This method can support an arbitrary number of steps, but timing accuracy depends on software delays that are not always predictable.

DC Dynamic mode is also appropriate for software-controlled sweeps, TEC control, low speed >10s pulsing, and arbitrary, programmed ramps. Software commands control the transition.



Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

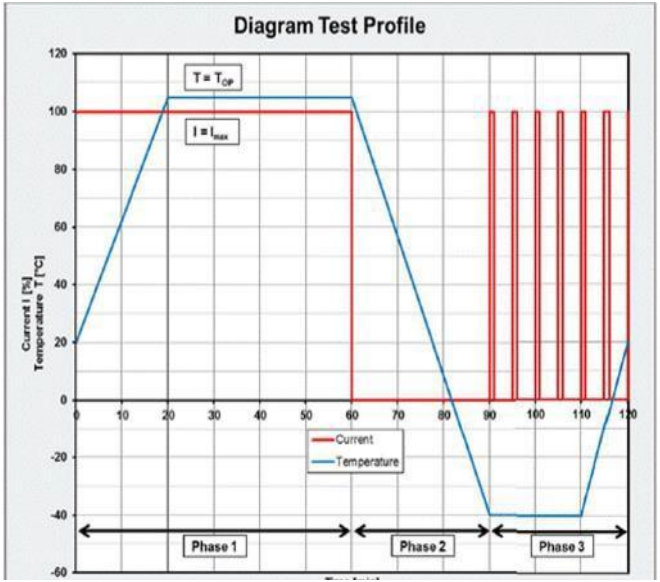
Modulated Current (MODI) Mode

Modulated Current Mode, also known as Modulated DC mode, produces an arbitrary waveform. A waveform is described as a sequence of DC current steps and downloaded into the current source for execution once, multiple times or infinitely. Modulated Current may also be known as Modulated DC. Step resolution is 1ms.

Applications for Modulated Current include cell phone flash emulation and rectifier ripple emulation. A sequence may be developed to produce a staircase sweep or mimic the red eye flash test. Other specific sequences may be developed to support the automotive electronic tests.

This mode can have high internal power dissipation.

Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
	Option	Option	Option	Option



Shown above is an automotive electrical test (IEC test) that may be implemented and executed from a modulated current sequence file.

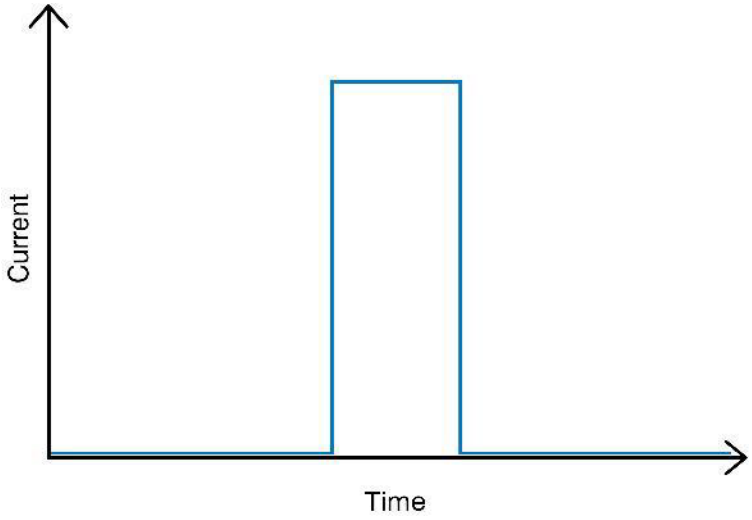
Single Pulse Mode

Single Pulse Mode produces a waveform that consists of one (1) single pulse. Also known as Mono Pulse and DC on/off mode (pseudo pulse mode).

Single Pulse Mode is typically used in light measurement applications for characterization, R&D and production.

Single Pulse Mode differs from the commonly used pseudo pulse mode (DC on/off) in the following ways:

- LM-85 standard for measurment repeatability includes single pulse mode
- Pulse Width is used to describe the ON time
- Pulse on timing is accurate.
- Pulse rise and fall is controlled.



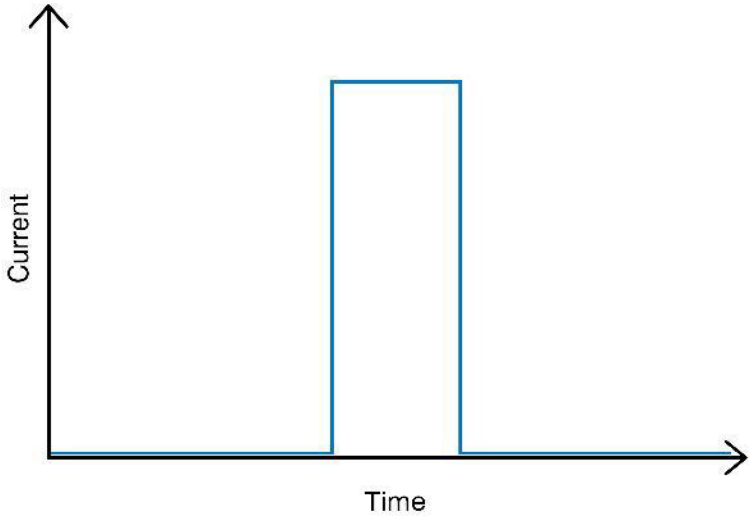
Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

Mono Pulse Mode

Mono Pulse Mode produces a waveform that consists of one(1) single pulse. Mono Pulse Mode is commonly used in light measurement applications for characterization, R&D and production.

Mono Pulse differs from Single Pulse in the way the pulse is aligned with the integration time for another instrument such as a Spectrometer. Single Pulse mode refers to timing where the integration time is completely within the pulse. Mono pulse mode refers to timing where the pulse is completely within the integration time; the pulse starts and ends during integration.

Light measurement in both Single Pulse and Mono Pulse methods is taken during the integration time. Both Single Pulse and Mono Pulse methods are appropriate for measurement repeatability..



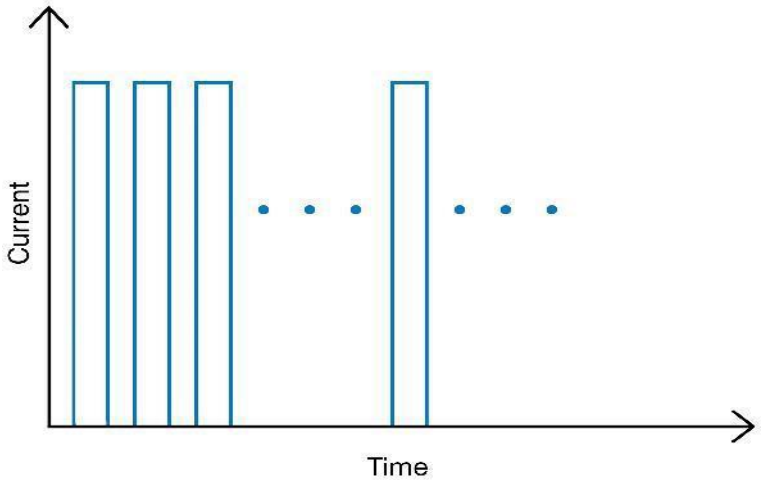
Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

Continuous Pulse Mode

In Continuous Pulse Mode, a Continuous Pulse train that transitions from off (0) to on, defined by maximum compliance voltage, the output is current and configured pulse parameters.

Continuous Pulse Mode is useful for a number of applications and commonly used in reliability, burn-in and LM-80 test systems.

Continuous Pulse Mode reduces junction temperature resulting in the highest measurement repeatability.



Continuous Pulse Mode for measurement repeatability is described in the LM-85 standard.

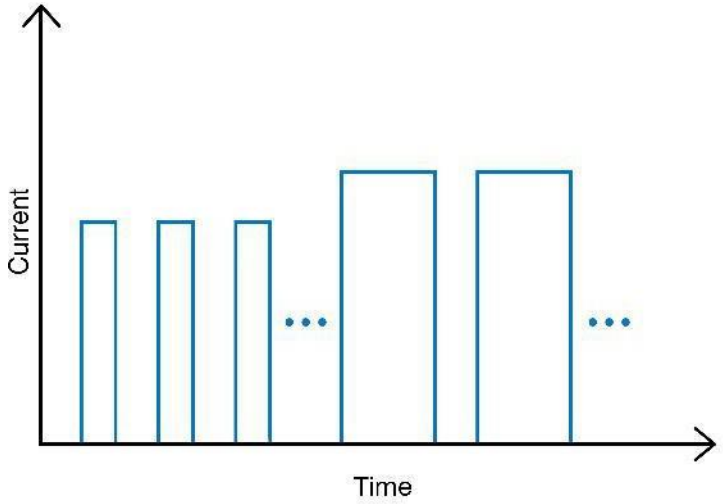
Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
	✓	✓	✓	✓

Continuous Dynamic Mode

Continuous Dynamic Mode is similar to Continuous Mode, with three primary differences:

1) The current is not ramped up linearly, the output transitions to full current at the first pulse
2) Pulse parameters may be changed while the output is enabled.
3) The amplifier headroom is not tuned for efficiency.
4) Continuous Dynamic is the best mode for production binning, closed-loop power control or precision photometric measurements.

Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓



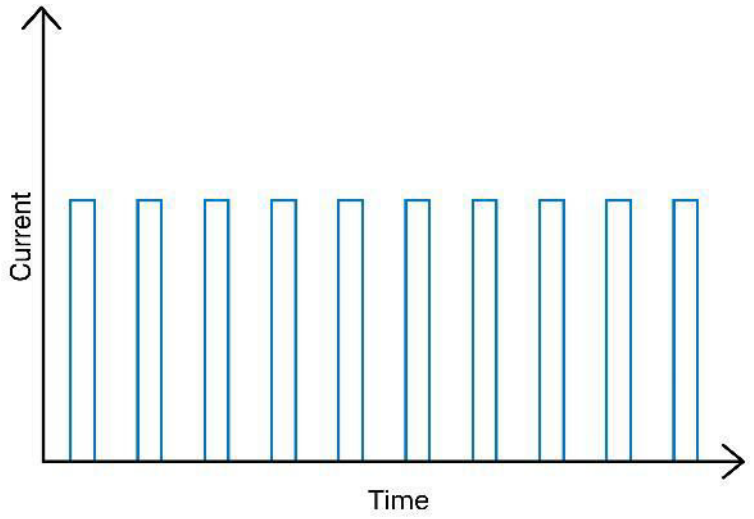
Pulse rise and fall times can be shortened and overshoot can be reduced by increasing the Maximum Compliance voltage setting in Continuous Dynamic Mode. This gives the amplifier additional operating range to overcome circuit inductance.

Multiple Pulse Mode

Multiple Pulse Mode outputs a defined number of identical pulses. This mode involves a two-part sequence: 1) the channel is enabled to pulse, and 2) pulses are produced upon receipt of a hardware or software trigger. After the pulses are complete the channel remains enabled and it can be re-triggered.

Multiple Pulse Mode is designed for high speed testing. It executes much faster than Single Pulse Mode and so it should be used instead of Single Pulse Mode when speed is critical.

Multiple Pulse Mode may be used to execute the Simulated Lightning Strikes Test (10,000 pulses). Multiple Pulse Mode may also be used for other applications where stopping the pulse train at a set pulse count is important.



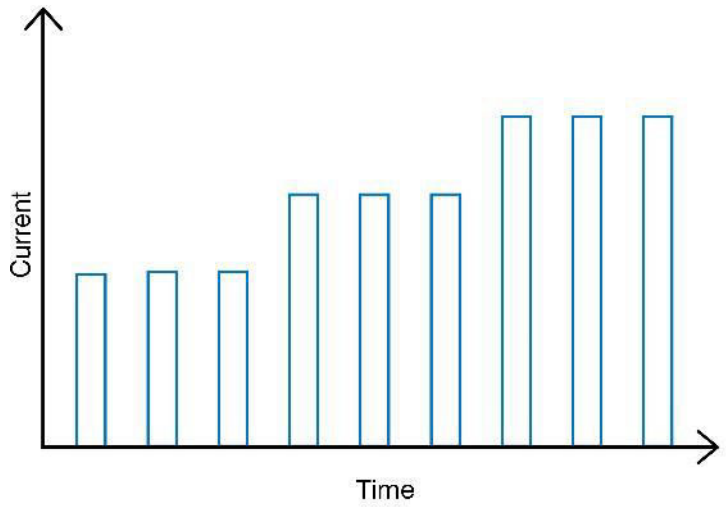
Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

Multiple Pulsed Sweep With Pulse Count > 1

Pulsed Sweep Mode normally produces only one pulse for each current step. By setting the Pulse Count parameter >1, a sweep with multiple pulses is generated at each current step.

This mode is useful to test lasers in QCW (Quasi Continuous Wave) mode. It may also be used to do LM-85 Continuous Pulse Mode testing of LEDs. The Pulse Count parameter is programmed for enough pulses to allow the spectrometer or other instrument to make the required measurement.

The resulting measurements are more accurate and less noisy than single pulse/step measurements.



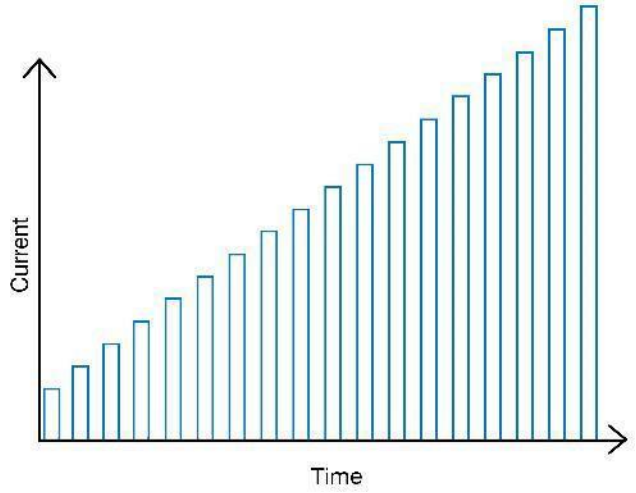
Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

Pulsed Sweep Mode

Pulsed Sweep Mode produces a series of current pulses that increase or decrease in amplitude.

Pulsed Sweep Mode is typically used to generate IV (current vs voltage), LI (light vs current) or LIV (light vs current vs voltage) plots for LEDs, VCSEL, laser diodes and other semiconductor devices.

If the sweep results in a device failure such as an open circuit, the SpikeSafe reports the sweep step that failed. This feature makes Pulsed Sweep Mode very useful for pulsed withstand testing, overcurrent protection tests, and other similar applications.



Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		✓	✓	✓

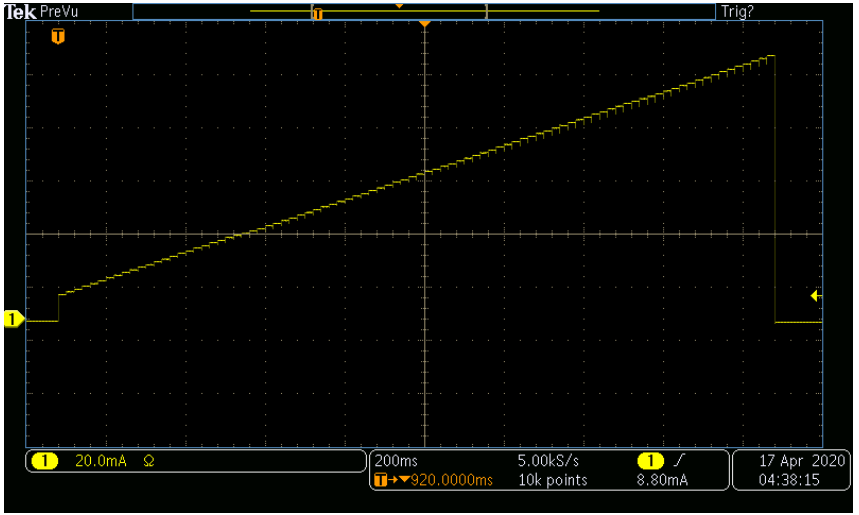
Staircase Sweep Mode

Staircase Sweeps are a traditional method for generating an I-V plot. During a staircase sweep, the current level is increased in steps with measurements taken at each step.

Early source meters were incapable of pulsed sweeps and so labs had to use staircase sweeps. Now that better equipment is available, Vektrex recommends using a pulsed sweep with short on time for best accuracy, especially when doing I-V or L-I sweeps.

When the pulse off time is short compared with the on time, the device heating is similar to the heating during a staircase sweep. For example at 20ms on, 9us off, step heating is within 0.05% of the heating of an equivalent staircase sweep.

DC Dynamic and Modulated Current Modes are also applicable for generating Staircase sweeps.



Start Current =0.01A; Stop Current= 0.1A;
Pulse Width=0.01s (or any other, e.g. 0.001s);
Pulse Period= 0.02s

Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
			✓	✓

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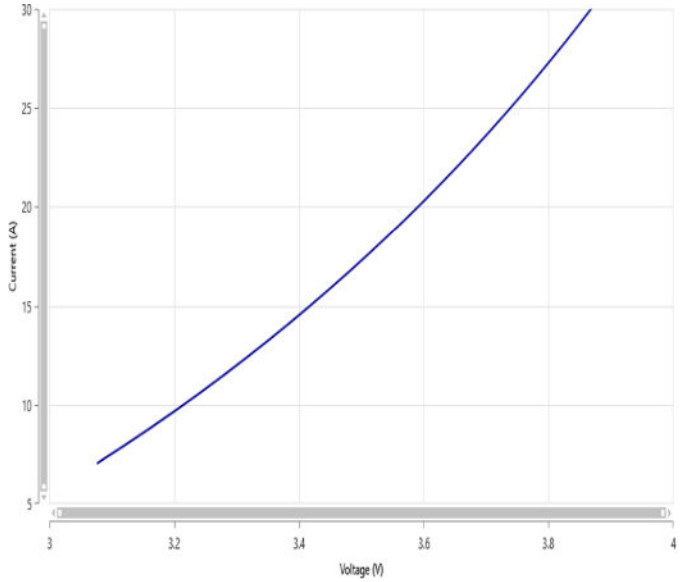
Pulsed Sweep Mode - IV Plot

The industry standard IV plot graphs device current over voltage.

Using the Pulsed Sweep Mode, Vektrex's Control Panel Software application can automatically generate IV plots.

By programming long on times and short off times, IV plots generated using the SpikeSafe Pulsed Sweep Mode can duplicate plots generated with Keithley current sources.

The real power is in performing pulsed sweeps with short pulses that reduce heating. Compared to other current sources, the resulting plots more accurately represent voltage vs current at a constant junction temperature.

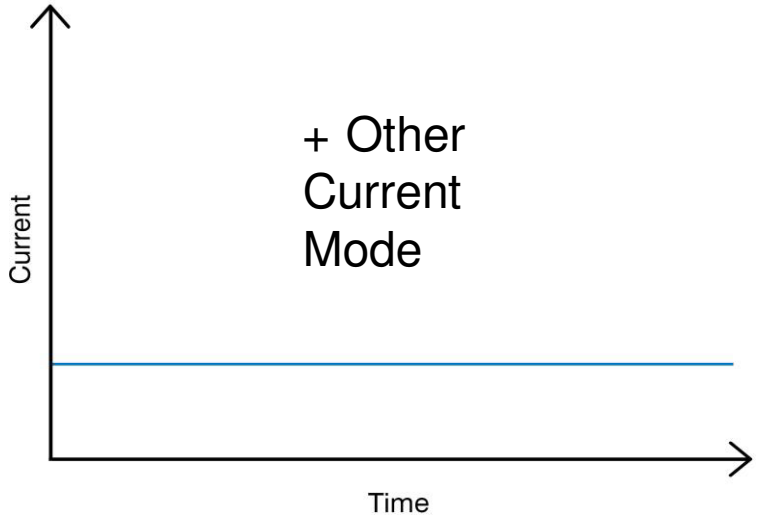


Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
			✓	✓

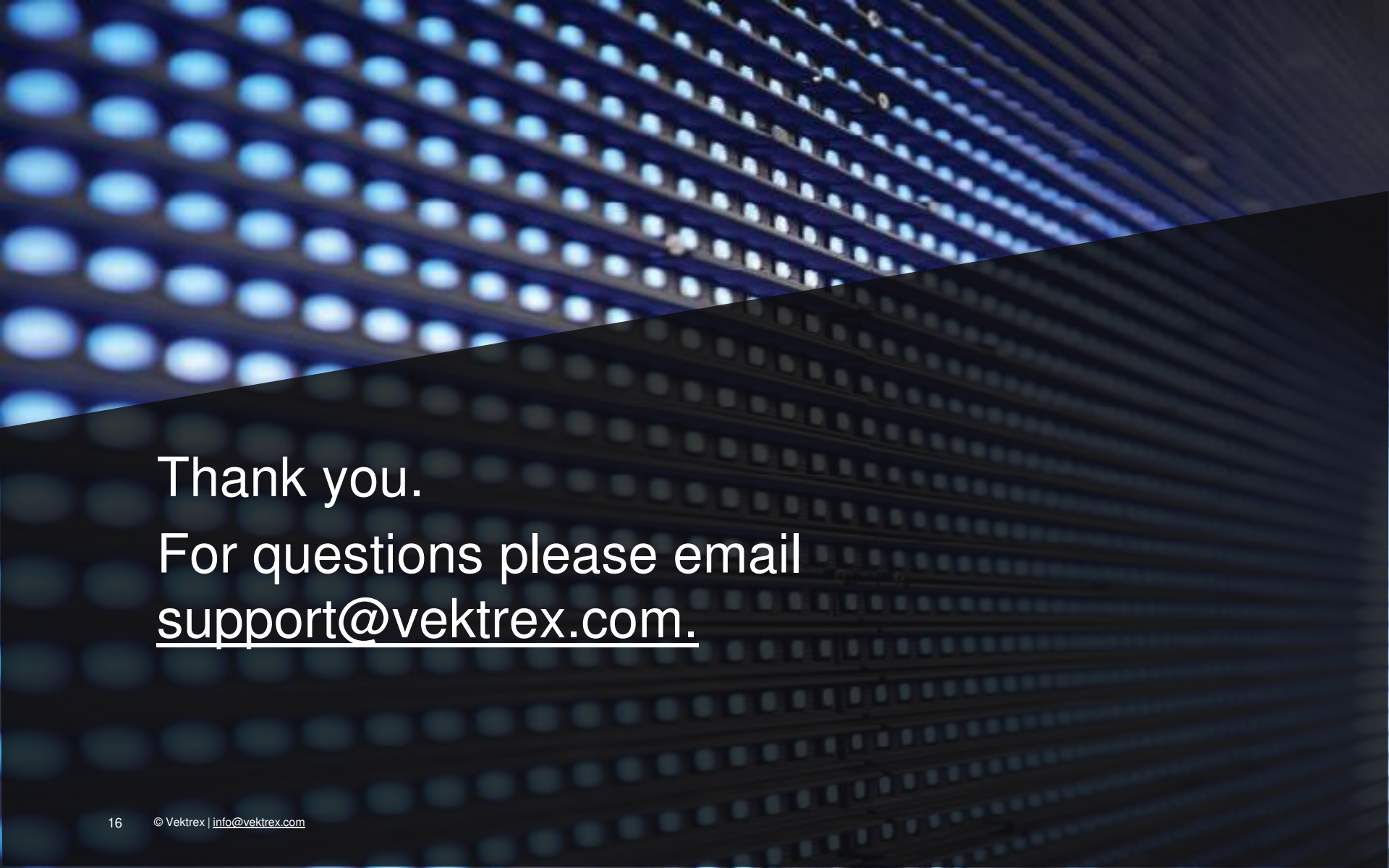
Bias Modes

The optional SpikeSafe Bias current modes add a second low-current current source to the output channel to support thermal measurements including Junction Temperature (T) and Thermal Resistance (RΘ). The Bias Modes are:

- **Bias Only**
- **Single Pulse + Bias**
- **Continuous Pulse + Bias**
- **Continuous Dynamic + Bias**
- **Pulsed Sweep + Bias**



Available in SpikeSafe Models				
DC	DCP	PRF	SMU	High Current
		Option	Option	Option



Thank you.

For questions please email support@vektrex.com.