Power Supply Simulator PSS

Introduction

The Flexstar Power Supply Simulator (PSS) is a unique tool which can simulate an infinite number of D.C. power quality conditions. The purpose of the PSS is to test device functionality with a poorly behaved power supply or battery power source.

The Flexstar PSS is the marriage of a precision programmable power supply, arbitrary waveform generator, sine wave ripple and noise generation, and high speed current and voltage sampling engine. Additionally the user can inject external signals to accurately replicate sawtooth, triangle, square waves, white noise, etc.
Also included in the feature list is the ability to simulate sudden open-circuit or short-circuit conditions. Another feature present is the precise control of slew rates.

These features make this product an indispensable tool for design and quality verification for a wide variety of devices such as storage devices, automotive electronics, semiconductor test, medical equipment, aerospace, etc. Virtually anything powered by D.C. power supplies or batteries can be tested using the PSS.

The PSS consists of a motherboard with up to four power channel cards. The motherboard contains a microcontroller with an embedded USB interface, an FPGA which implements the high speed sampling and digital control for the power channels, and a large array of SRAM memory used to store arbitrary waveform data and voltage and current samples. Also present is a high speed A/D converter used for voltage and current sampling.
Each power channel contains a precision voltage regulator, a digital sine wave synthesizer, and voltage and current measurement circuits.

The PSS is available in two basic configurations:

- Integrated PSS: Product integrated with Flexstar storage device test system.
- Desktop PSS: Product supplied as a stand alone system with enclosure and power supply.

The PSS requires a host computer for control and analysis of power samples.

Power Supply Simulator PSS

Feature Summary

- Up to 4 voltage outputs programmable from 0 to 15V in 0.25 mv steps with excellent accuracy
- Up to 35W output power per channel.
- Arbitrary waveform generation with up to 100K points rendered at up to 10K points/sec.
- Hardware ripple/noise injection DC to 20 MHz and programmable up to 1V P-P.
- Signal injection from an external source (DC coupled).
- High speed voltage and current measurement and sampling.
- Open circuit or short circuit simulation.
- High speed USB 2.0 interface.
- Voltage slew rate control from 10 us up to 1 second in 10 us increments.

Precision Programmable Power Supply

The PSS can have up to four programmable outputs each of which can range from 0 to 15 volts in steps of 0.25 millivolts. Each channel can provide up to 35 watts of continuous power. Accuracy for each channel is typically better than 0.5% of the desired output. Sense feedback maintains the accuracy at the load.

- Number of output channels: 1, 2, or 4.
- Input voltage: 18V +5% -0% @ 8A maximum.
- Output voltage range: 0 to 15V.
- Voltage resolution: 0.25 millivolts.
- Accuracy: < +/- 0.5% of set point.
- Current capacity: Up to 5A continuous.
- Absolute current limit: 6.5A.
- Power limit: 35W.
- Quiescent regulator noise & ripple: < 50 mv P-P at 2A.
- Settling time: < 40us.
- Load regulation: < 1% for a 1A change.
- Negative voltage excursions: Not to exceed -0.3V below ground.
- Operating range: 0 to 50 C, 10% to 80% RH.

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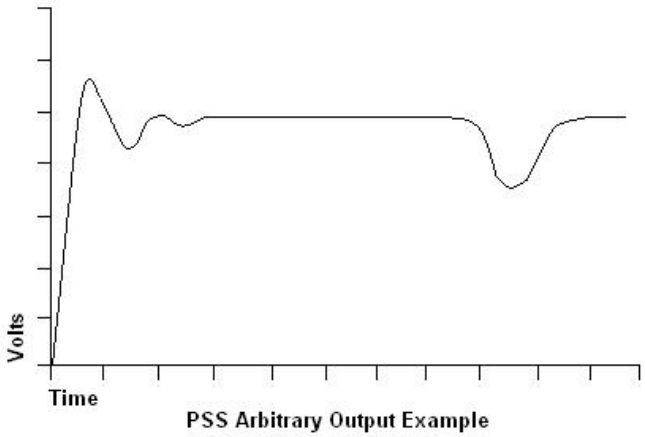
Arbitrary Waveform Generation

Each voltage channel can store up to 100,000 voltage points. The voltage points are then rendered at up to 10K points per second to create various arbitrary waveforms. As can be seen in the example below, this is a very useful feature that allows simulation of an infinite number of power supply behaviors. Each channel has its own arbitrary waveform generation capability and may be executed once or repeated continuously.



PSS Arbitrary Output Example

- Number of points per channel: 100,000 maximum.
- Rendering rate: 10K points per second (100 us period) maximum.
- Rendering clock resolution: 100 microseconds.
- Voltage point resolution: 0.25 millivolts.

Sine Wave Ripple & Noise Generator

Each PSS power channel has a digital sine wave synthesizer which can provide a sine wave component which is added to the static D.C. output. This is used to simulate low frequency ripple or high frequency noise to the device under test. The sine wave amplitude can be programmed in 1% increments up 1V P-P. In addition, the user can supply a signal from an external source such as a function generator to allow different wave shapes to be summed with the D.C. output. Note that the external signal is D.C. coupled to the output.

- Usable frequency range: D.C. to 20 MHz.
- Programming resolution: 0.06 Hz.
- Amplitude control: 0 to 1V P-P in 1% (10 millivolt) increments.
- Amplitude accuracy: +/- 5% of set value.

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Voltage and Current Sampling

The PSS has a built-in high speed Analog to Digital Converter used to measure voltage and current from each power channel. All sampling and storage in memory is handled in hardware using a powerful FPGA. This means that power sampling can be done independently from all other functions and is continuous.
Samples are stored in the large on-board SRAM memory. The samples are then uploaded to the host computer for viewing and analysis.

- Sample rate: Up to 100K samples per second (all channels).
- Sample rate clock resolution: 1 microsecond.
- Voltage measurement accuracy: +/- 0.5% of actual load value.
- Voltage measurement resolution: 0.25 millivolts.
- Current measurement accuracy (averaged): +/- 2 milliamps.
- Current measurement resolution: 0.125 milliamps.
- Sample buffer size (per channel): 1,000,000 for voltage and 1,000,000 for current.

Open & Short Circuit Feature

The PSS can simulate a power source that has suddenly gone open circuit (high impedance) to test the ability of the device under test to deal with this condition. Similarly the voltage channel output can be shorted simulating a failed power supply. The short circuit feature uses a break before make such that the output of the PSS is not damaged.

- Open circuit impedance: >= 100K ohms.
- Short circuit impedance: < 200 milliohms.
- Short circuit break before make time: < 20 microseconds.

Slew Rate Control

Slew rates (transition time for changes in the output voltage) can be programmed in discreet steps. The technique used is similar to the arbitrary waveform generation except that the goal is to create a linear ramp of pre-determined length. The PSS generates slew rates by dividing the voltage difference by the slew rate time and creating a ramp consisting of discreet micro-steps.

- Slew rate micro-step period: 10 microseconds to 1000 microseconds.
- Slew rate micro-step resolution: 10 microseconds.
- Slew rate voltage resolution: 0.25 millivolts.