SpikeSafe™ SMU Specifications

High Current
Performance Series
Precision Pulsed Current
Source Measure Unit

Operating Mode	Description	Typical Application	Model Configurations			
			Pulsed SMU	+BIAS	+MODI	+BIAS +MODI
DC	Constant current.	Any constant current application. LM-85, light measurement, characterization, R&D, production.	✓	✓	✓	✓
Single Pulse (Mono Pulse)	Single pulse output (one transition on and off) according to configured pulse parameters.	Any single pulse application. LM-85, light measurement, characterization, R&D, production.	✓	✓	✓	✓
Continuous Pulse (Pulse Train)	Continuous current pulse train that transitions on and off according to configured pulse parameters.	Continuous pulse light measurements to reduce junction heating. Any other continuous pulse application.	✓	✓	✓	✓
Modulated Current (MODI)	A programmable sequence of DC current steps that define a waveform. Sequences may be finite or run indefinitely.	Cell phone flash emulation, rectifier ripple emulation. Requires purchase of optional Modulated Current function.			✓	✓
Pulsed Sweep QCW Sweep	A series of N current pulses that increase or decrease in amplitude. Step number reported upon error.	I-V plots for LEDs, lasers, and other semiconductors. L-I plots for optoelectronics, overcurrent protection circuit tests, pulse withstand testing.	✓	✓	✓	✓
Bias	Constant DC bias current - generally used for K-factor determination.	Thermal resistance and Tj measurements.		✓		✓
Multiple Pulse	Similar to Single Pulse mode, but allows a programmable number of pulses to be output.	Fixed pulse count device testing. Also recommended for Single Pulse use (1 pulse).	✓	✓	✓	✓
DC Dynamic	Constant current - current changes may occur while the source channel is enabled.	Low speed > 10s pulsing. Software controlled pulsing. Useful for TEC control.	✓	✓	✓	✓
Continuous Dynamic	Continuous pulse train - current changes may occur while the source channel is enabled.	PWM, production binning, closed-loop power control.	✓	✓	✓	✓
Continuous Pulse with Bias Current	A continuous current pulse train that drops to bias level during off times.	Thermal resistance and Tj measurements using Continuous Pulse mode.		✓		✓
Continuous Dynamic with Bias Current	A continuous current pulse train (identical to Continuous Dynamic mode), but the bias current source is always enabled and drawing the bias current through the load.	Thermal resistance and Tj measurements using Continuous Dynamic mode.		✓		✓
Single Pulse with Bias Current	Identical to Single Pulse mode, but the bias current source is always enabled and drawing the bias current through the load.	Thermal resistance and Tj measurements using Single Pulse mode.		✓		✓
Pulsed Sweep with Bias Current	Like Pulsed Sweep, but with programmable bias current summed in with pulsed sweep.	Determine Tj rise during I-V or L-I-V plots for LEDs, lasers and other semiconductors. Allows Pulsed Sweep to be optimized to minimize time and junction heating.		✓		✓

SpikeSafe SMU Specifications	Model (Max Current)			
	10	20	40	60
Overall				
Min Output Voltage	0V			
Max Compliance Voltage	180V		100V	
Source Channels	1			
Max DC Output Power [15]	1.6kW	3.2kW	6.4kW	3kW
Max Pulsed Output Power[4]				
Conversion Mode	Buck/Boost			Buck
Pulsing				
Pulse Width Range[10, 14, 15]	Model dependent; minimum (1µs, 10µs or 50µs) to 15000s		Model dependent; minimum (10µs or 50µs) to 15000s	
Pulse Width Resolution (w/Pulse Width Offset)[12]	1µs (11ns)			
Pulse Width Accuracy (w/Pulse Width Offset)[12, 2]	1µs (50ns)	1.3µs (50ns)		
Pulse Rise/Fall Time[3]	200ns-3µs	350ns-4.5µs		3µs-5µs
Typical Pulse Width Jitter	30ns			
Timebase Accuracy	50ppm			
Pulse Period Range	30µs-30000s, depending on settings			
Duty Cycle Range	0-100%			
Pulse Count	0-12000000 (Multiple Pulse and Pulsed Sweep modes)			
Sweep Steps	3-10000 (Pulsed Sweep mode)			
Low Range Current				
Max Current	400mA	800mA	1.6A	3.2A
Setpoint Resolution	10µA	20µA	40µA	80µA
Output Current Accuracy	0.04%+350µA	0.04%+700µA	0.04%+1.4mA	0.2%+8mA
Min Recommended Current	350µA	700µA	1.4mA	8mA
High Range Current				
Max Current	10A	20A	40A	60A
Setpoint Resolution	200µA	400µA	800µA	1.6mA
Output Current Accuracy	0.08%+2mA	0.08%+4mA	0.08%+8mA	0.3%+24mA

SpikeSafe SMU Specifications	Model (Max Current)			
	10	20	40	60
Misc.				
Nominal Current Ripple[1]	<1A: 0.03%+300µA >1A: 0.012%+2mA	<5A: 0.05%+250µA >5A: 0.02%+1.8mA	<5A: 0.05%+20µA >5A: 0.02%+4mA	<10A: 0.05%+200µA >10A: 0.02%+3mA
DC Ramp Rate: Low Speed Setting	10V/s, 100mA/s	10V/s, 200mA/s	10V/s, 400mA/s	
DC Ramp Rate: Default Setting	10V/s, 1A/s	10V/s, 2A/s	10V/s, 4A/s	
DC Ramp Rate: High Speed Setting	1000V/s, 50A/s	1000V/s, 200A/s	1000V/s, 400A/s	
Current Stability[9]	70ppm			
SpikeSafe Monitoring				
Voltage Monitor Accuracy (2 wire)[11]	3%+1V (See Digitizer section for voltage measure specifications)			
Current Monitor Accuracy, Low Range[11]	0.1%+2mA	0.1%+4mA	0.1%+8mA	0.5%+4mA
Current Monitor Accuracy, High Range[11]	0.4%+10mA	0.4%+20mA	0.4%+40mA	0.5%+40mA
Bias Current[5]				
Max Current	66mA	132mA	264mA	
Setpoint Resolution	2µA	4µA	8µA	
Bias Current Accuracy	0.35%+60µA	0.35%+120µA	0.35%+240µA	0.35%+480µA
Fall Time to Bias Current	200ns-3µs			
5% Settling Time After Falling Edge[7]	10-70µs			
0.1% Settling Time After Falling Edge[8]	70-130µs			
Modulated Current[6]				
Sequence Step Amplitude Range	0-100%			
Min Step Width	1ms			
Max Step Width	10s			
Step Width Accuracy	10µs			
Max Number of Steps	20			
Max Number of Step Sequences (Loops)	3			
Loop Count	1 to 32767 or Infinite			
Current Rise/Fall Time Each Step[3]	5-8µs			

SpikeSafe SMU Specifications

Current Out	
Output Current Drive Type	Floating, both + and - terminal driven, max 100V common mode to chassis ground
Output Cabling	Single or multi-conductor twisted pair
Recommended Max Output Cable Length	6m
Trigger In	
Signal Type	3.3V logic (5V tolerant)
Polarity	Programmable
Modes Supported	Multiple Pulse, Pulsed Sweep, Modulated Current
Programmable Delay	Programmable delay, 10μs to 30s
Delay Programming Resolution	1μs
Delay Jitter	Multiple Pulse Mode: 3.4μs, Pulsed Sweep Mode: 107μs
Trigger Out	
Signal Type	5V logic, 50Ω pull-up and open drain outputs
Polarity	Programmable
Modes Supported	All pulsed modes, Software trigger in DC mode
Trigger Jitter	<10ns typical
Programmable Delay	Programmable delay, 10μs to 30s
Other External Interfaces	
Remote Pause	Optoisolated input, pauses output, selectable polarity
Remote Disable	Optoisolated input, halts output, selectable polarity
General	
Physical	Rack mount / bench top chassis 89mmH x 483mmW x 635mmD (including handles)
Input Power	AC Power: Selectable; single and three phase available; 50-60Hz
Remote Control	100-base T Ethernet, TCP/IP with SCPI syntax
Monitoring System	Built-in acquisition system monitors & reports voltage, current, and fault conditions
Device Protection	3rd generation SpikeSafe™ protection including high-speed over current shutdown, slow start up, leakage detection and other protection algorithms
Calibration Interval	1 year: on-site or return to Vektrex
Operating Conditions	For indoor use only, 10 to 35C, 70%R.H., <2000m altitude
Cooling	Air cooled
Particulate Level	Clean lab conditions
Other	CE, ROHS

Digitizer Specifications

Measure Method	4 wire
Ranges	3 Ranges, 10V, 100V and 400V
Input Impedance	1MΩ -1.4MΩ
Coupling	DC Coupled, All Ranges
Maximum Common Mode	Sense+ or Sense- must be <420VDC from Chassis Ground or Force+ or Force-
ADC Sample Rate	500,000 samples/second, continuous sampling
Digitizer Type	True Differential
Resolution	18 Bits
Programmable Measurement Aperture	2μs to 400ms, 500kHz samples boxcar averaged to form measurement points
Measurement Trigger	Software or hardware
Hardware Trigger Edge Polarity	Programmable
Trigger Delay	Programmable 0 to 400ms, 2μs resolution
Measurement Points Per Acquisition	1 to 525
Autozero Function	Reduces measurement offset

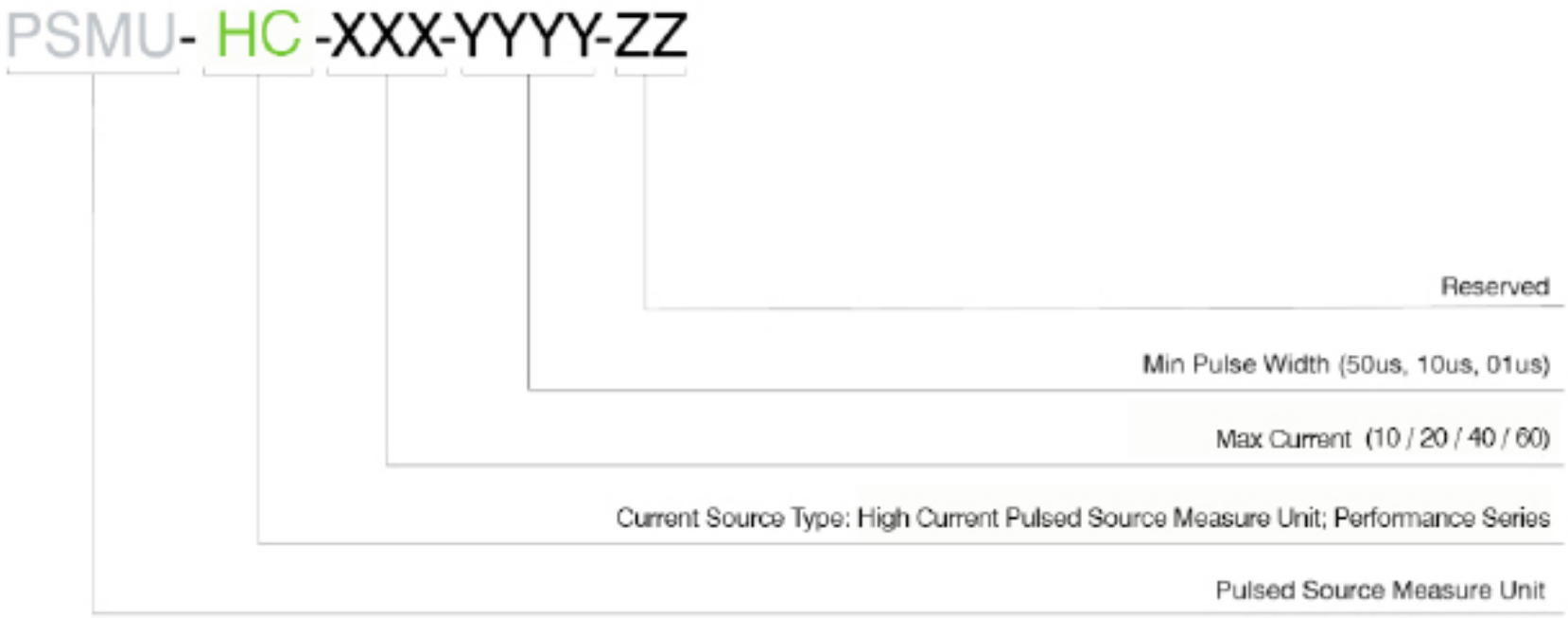
Digitizer Range Specifications

Ranges	**10V**	**100V**	**400V**
Maximum Voltage	10.4V	112.2V	420.6V
Typical Noise, RMS, 10ms Measurement Aperture	100μV	200μV	500μV
Analog Bandwidth (-3dB)	570kHz	290kHz	570kHz
Accuracy +/- (% of Settings + Volts)	0.09% + 500μV	0.09% + 2mV	0.09% + 10mV

Force Sense Selector Switch Specifications[13]

A/B Function	Routes external auxiliary device to output connector. SpikeSafe SMU and auxiliary device will share load wiring.
Connect/Disconnect Function	Routes source output and digitizer to output connector.
Control	Programmable

Model Number Guide



When ordering, specify separately integrated functions:
+BIAS
+MODI
+Force Sense Selector Switch
+400V MCV

When ordering, consider accessories including rackmount kit, cable kit, and trigger kit.

Notes

All source specifications at 23C+/-5C, pulsing specifications: outside cable <3m.

All digitizer specifications at 23C+/-5C, 5% to 80% relative humidity, noncondensing after autozero and a 90 minute warmup period.

[1] RMS, 20MHz BW, primary frequency 100kHz or 200kHz

[2] Typical performance with automatic adjustments enabled, compensation settings tuned for best shape, I > 10% Imax, Pulse Width <10s

[3] Typical performance with compensation settings tuned for fastest rise and best pulse shape, I > 10% Imax

[4] Typical energy per pulse available: 1.5J

[5] Requires BIAS option

[6] Requires MODI option

[7] Typical time to recover to 95% of bias value, typical cable compensation, Ibias>50% Max bias

[8] Typical time to recover to 99.9% of bias value, typical cable compensation, Ibias>50% Max bias

[9] Typical p-p current variation over 1 hour, after warm up at 23C

[10] Max Pulse Width is 10sec for: Pulsed Sweep, Bias Pulsed Sweep, and Multiple Pulse modes

[11] 2-wire measurement designed for load monitoring. I > Imin. Ton > 10μs.

[12] Pulse Width Offset is a correction factor that is automatically added to the pulse width setting. By setting this factor, nominal pulse width errors can be reduced. The setting range for Pulse Width Offset is +/- 50μs

[13] Requires Force Sense Selector Switch option

[14] Max compliance voltage, load inductance and forward voltage can impact pulse widths below 50μs

[15] With suitable auxiliary power supply: Compliance Voltage/2

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