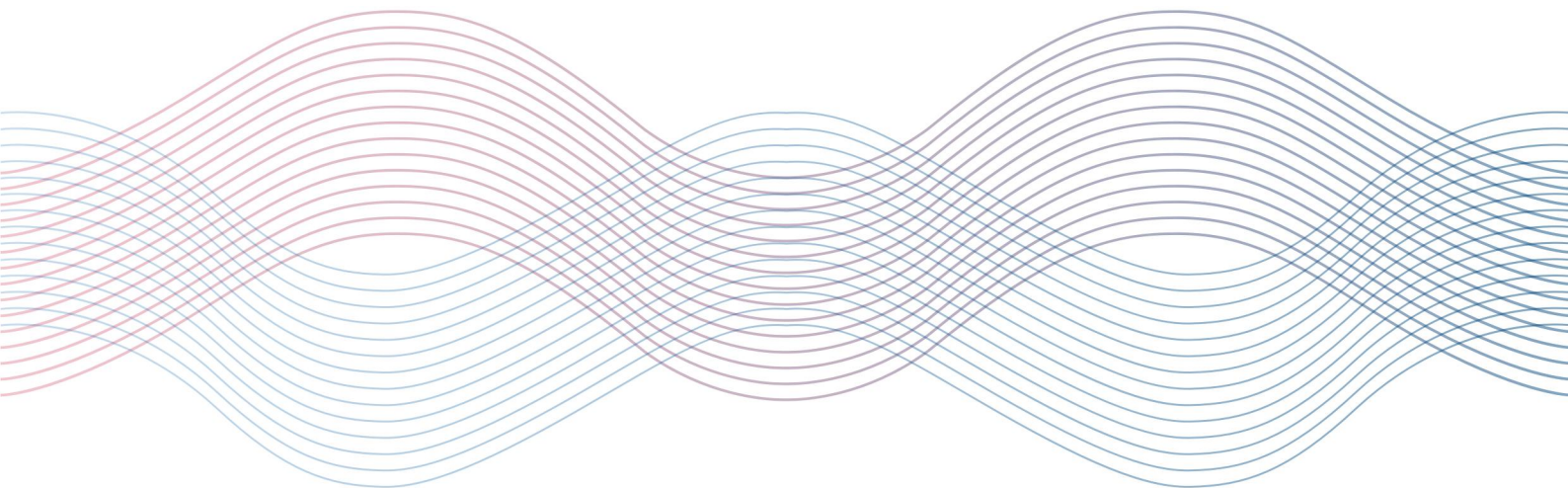


SMU4212

Single-Channel PXIe Precision Source Meter

Version 1.6



Product Description

The SMU4212 Precision source meter is compact and cost-effective PXIe Source/Measure Unit (SMU) with the capability to source and measure both voltage and current. SMU4212 have Maximum ± 200 V, ± 1 A DC, ± 3 A pulsed and constant 20W power sourcing capability, supports conventional SMU SCPI commands for easy test code migration. Support Most of standards PXIe chassis, support multi-card synchronization, these features improve efficiency and lower the cost of ownership when integrating the SMUs into systems for production test.

Key Features

Feature	Benefit
Precision-fast Control (Adaptive PFC) system	Users can adjust the related parameters based on the load characteristics to obtain precision, and fast output characteristics
Integrated 4-quadrant sourcing and measuring capabilities	Easily and accurately measure current and voltage using a single Card without the need to manually change any connections
Measurement range: ± 200 V, ± 1 A (DC), ± 3 A (pulsed)	Easily LIV sweep test with dual Cards
Source and measurement resolution down to 10 fA and 100 nV	Can make low-level measurements using a low-cost High-density PXIe SMU that were previously only possible using a more expensive semiconductor device analyzer
Fast measurement	Up to 1M ADC sampling rate, NPLC and sampling rate optional setting
Free quick V/I control software	Can make measurements remotely from a PC without the need to program
Built-in DIO	Easy to realize the synchronization of SMU4212 and external instrument without additional Synchronous control card
Standard PXIe Module, Applicable to PXIe chassis	Easily expand to multi-channel and integration into rack and stack systems

Technical Specification

Specification conditions

Temperature : $23 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$

Humidity : 30% to 70% RH

Calibration period: 1 Year

Measurement speed: 1PLC (power line cycle)

After 60 minutes warm-up, ambient temperature changes less than $\pm 3 \text{ }^{\circ}\text{C}$

Voltage Programming and Measurement specifications

Voltage accuracy	Range	Programming resolution	Accuracy (1 Year) ± (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10 Hz
	±200 V	100 µV	0.03%+10 mV	400 µV
	±20 V	10 µV	0.03%+1 mV	50 µV
	±6 V	1 µV	0.03%+0.4 mV	9 µV
	±0.6 V	100 nV	0.03%+100 µV	2 µV
Temperature coefficient	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)			
Settling time	<50µs (typical)			
Overshoot	<±0.1% (Typical. Normal mode. Step is 10 % to 90 % range, full range, resistive load)			
Noise 10Hz-20MHz	20 V voltage source, 1 A resistive load, <5 mVrms			

Current Programming and Measurement specifications

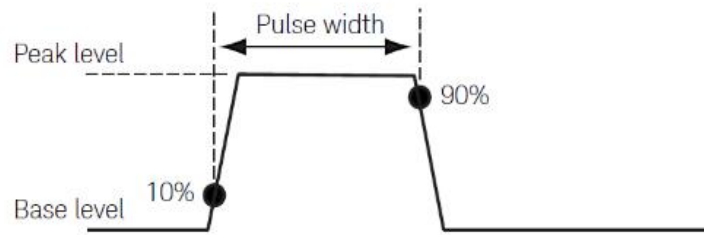
Current accuracy	Range	Programming resolution	Accuracy (1 Year) ± (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10 Hz
	±3 A ¹	1 µA	0.03% + 2 mA	20 µA
	±1 A	100 nA	0.03% + 90 µA	3 µA
	±100 mA	10 nA	0.03% + 9 µA	200 nA
	±10 mA	1 nA	0.03% + 900 nA	20 nA
	±1 mA	100 pA	0.03% + 90 nA	2 nA
	±100 µA	10 pA	0.03% + 9 nA	200 pA
	±10 µA	1 pA	0.03% + 1 nA	30 pA
	±1 µA	100 fA	0.03% + 200 pA	10 pA
	±100 nA ²	100 fA	0.06% + 30 pA	5 pA
	±10 nA ²	10 fA	0.06% + 9 pA	1 pA
Temperature coefficient	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)			
Settling time	<100 µs (typical)			
Overshoot	<±0.1% (Typical. Normal mode. Step is 10 % to 90 % range, full range, resistive load)			

1, 3 A range is available only for pulse mode, accuracy specifications for 3 A range are typical.

2, Additional specification conditions: 10 PLC setting

Pulse source specifications (4W)

Minimum programmable pulse width	100 µs
Pulse width programming resolution	1 µs
Pulse width programming accuracy	±10 µs
Pulse width jitter	2 µs
Pulse width definition	The time from 10 % leading to 90 % trailing edge as follows



Item	Maximums	Maximum pulse width	Maximum duty cycle
1	0.1A/200V	DC, no limit	100%
2	1A/20V	DC, no limit	100%
3	3A/66.6V	1 ms	5%
4	3A/160V	400 μ s	2%

Typical Pulse Performance(4W)

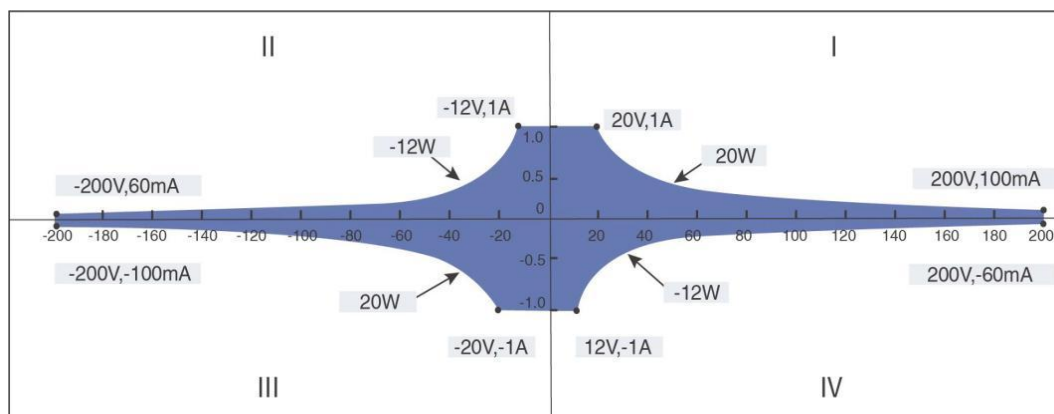
Source	Maximum output	Typical rise time ¹	Typical Settling Time ²	Test load
Voltage	160 V	800 μ s	1.2 ms	NO load
	5 V	40 μ s	100 μ s	NO load
Current	3A~100 μ A	90 μ s	250 μ s	Full load ³
	10 μ A	120 μ s	300 μ s	Full load ³
	1 μ A	800 μ s	1.2 ms	Full load ³
	100 nA	800 μ s	1.2 ms	Full load ³
	10 nA	1.2 ms	2.4 ms	Full load ³

1, Leading edge, the time from 10 % leading to 90 % leading

2, The time required from Pulse out 0 to reach within 1 % of final value

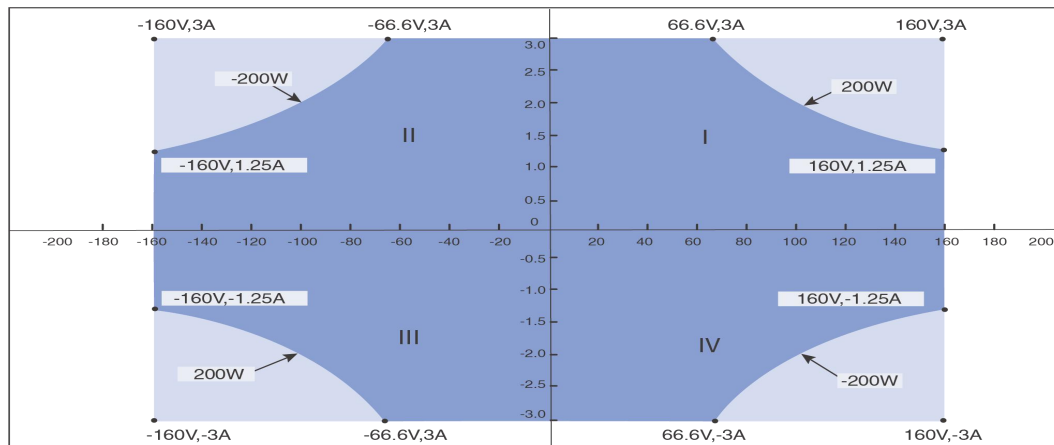
3, Test condition: Normal, resistive load 6V maximum output

DC I-V Out capability



■ Pulse or DC

Pulsed I-V Out capability



- Pulse only, maximum pulse on time 1ms, maximum duty cycle 5%
- Pulse only, maximum pulse on time 400 us, maximum duty cycle 2%

Typical output settling time

Source	Range	Output settling time ¹			Condition
		Fast ²	Normal	Slow	
Voltage	200 V	<500 μ s	<900 μ s	<2 ms	Time required to reach within 0.1 % of final value at open load condition. Step is 10 % to 90 % range
	20 V	<60 μ s	<100 μ s	<600 μ s	
	6 V	<60 μ s	<100 μ s	<300 μ s	
	0.6 V	<50 μ s	<50 μ s	<50 μ s	
Current	3 A~100 μ A	<50 μ s	<100 μ s	<0.8 ms	Time required to reach within 0.1 % (0.3 % for 3 A range) of final value at short condition. Step is 10 % to 90 % range
	10 μ A	<100 μ s	<150 μ s	<0.8 ms	
	1 μ A	<1 ms	<1 ms	<1 ms	
	100 nA	<600 μ s	<1.2 ms	<2 ms	
	10 nA	<1.2 ms	<2.4 ms	<5 ms	

1, Output transition speed: Fast, Normal, Slow. Users can adjust the APFC parameters based on the load

characteristics to obtain precision, and fast output characteristics

2, Slow mode is recommended for overshoot sensitive equipment, Fast mode may have overshoot on output in some condition

Sampling rate and NPLC setting

Setting	Range
NPLC	0.00005 PLC ~ 10 PLC
Sampling Rate	5sps ~ 1Msps

Derating accuracy with PLC setting < 1 PLC

Add % of range using the following table for measurement with PLC < 1

PLC	Range							
	600mV	6 V	20 V	200 V	10 nA to 1 μ A	10 μ A	100 μ A to 100 mA	1 A to 3 A
0.1	0.02%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%
0.01	0.3%	0.3%	0.03%	0.02%	0.2%	0.04%	0.02%	0.02%
0.001	3.2%	3.2%	0.04%	0.1%	2.5%	0.4%	0.03%	0.03%

Supplemental characteristics

Sensing Modes	2-wire or 4-wire (Remote-sensing) connections
Maximum sense lead resistance	1 k Ω for rated accuracy
Max voltage between Force and Sense	1V
Maximum output voltage in output connector	>range 105%
Sweep	Sweep step time: from 20 μ s to 16s, Max:8K point
Auto range	Support, turn off output is recommended for overshoot sensitive equipment before range change
Source delay	Support, It is recommended that users set appropriate source delay to obtain higher accuracy
Over temperature protection	The output will be turned off (also disable operation) when the SMU internal temperature is detected higher than 85 degrees. When the temperature returns to less than 65 degrees, operation recover
Other abnormal protection	Power reset, recover operation or hardware damage

WARNING: here are potentially hazardous voltages (± 210 V) present at the HI, Sense HI, and Guard terminals of this instrument. To prevent electrical shock, the safety precaution must be done before turn on the instrument. Never connect the Guard terminal to any output, including chassis ground, or output LO, doing so will damage the instrument.

Environmental specifications

Environment	For use in indoor facilities
Operating	0 $^{\circ}$ C to +50 $^{\circ}$ C, 30 % to 70 % non-condensing
Storage	-30 $^{\circ}$ C to 70 $^{\circ}$ C, 10 % to 90 % non-condensing
Dimensions (mm)	210*130*20
Weight	Net weight 0.46Kg
Power	Full Load 12V/3.5A;3.3V/0.5A;5V/0.01A
Altitude	Operating: 0 m to 2000 m, Storage: 0 m to 4600 m
Warm-up	1 hour

Ordering information

Output Low terminal connector, quick reference, U disk (including PDF manuals, quick I/V Measurement Software and drivers)

Model number	
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