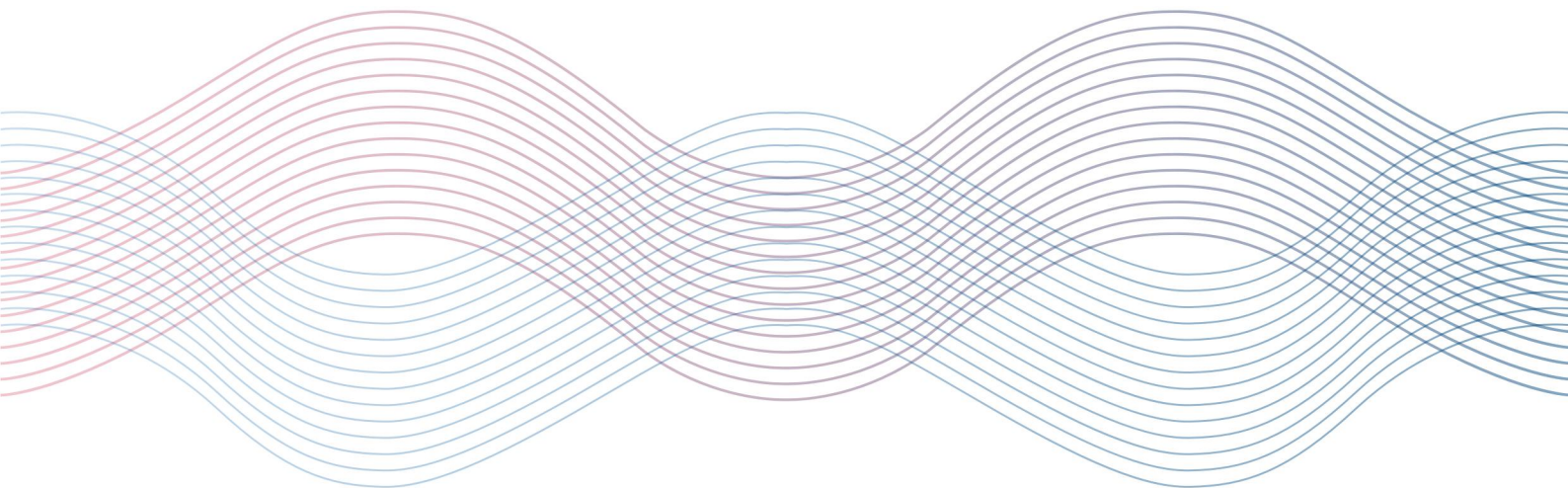


# SMU4213

Single-Channel PXIe Precision Source Meter

Version 1.5



## Product Description

The SMU4213 Precision source meter is compact and cost-effective PXIe Source/Measure Unit (SMU) with the capability to source and measure both voltage and current. SMU4213 have Maximum  $\pm 200$  V,  $\pm 1$  A DC,  $\pm 3$  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: $\pm 200$ V, $\pm 1$ A (DC), $\pm 3$ A (pulsed)	Easily LIV sweep test with dual Cards
Source and measurement resolution down to 100 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 SMU4213 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 °C  $\pm$  5 °C

Humidity :30% to 70% RH

After 60 minutes warm-up, ambient temperature changes less than  $\pm 3$  °C

Calibration period:1 Year

Measurement speed: 1PLC (power line cycle)

## Voltage Programming and Measurement specifications

Voltage accuracy	Range	Programming resolution	Accuracy (1 Year) $\pm$ (% reading+ offset)	Typical Noise (RMS)
	$\pm 200$ V	100 $\mu$ V	0.03%+10 mV	0.4 mV

	±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 10 Hz-20 MHz	20 V voltage source, 1 A resistive load, <5 mVrms			

## Current Programming and Measurement specifications

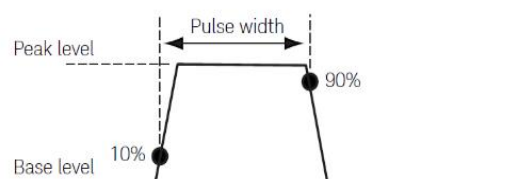
	Range	Programming resolution	Accuracy (1 Year) ± (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10 Hz
Current accuracy	±3 A <sup>1</sup>	1 µA	0.03% + 2 mA	20 µA
	±1 A	100 nA	0.03% + 90 µA	4 µA
	±100 mA	10 nA	0.03% + 9 µA	600 nA
	±10 mA	1 nA	0.03% + 900 nA	60 nA
	±1 mA	100 pA	0.03% + 90 nA	6 nA
	±100 µA	10 pA	0.03% + 9 nA	700 pA
	±10 µA	1 pA	0.03% + 1 nA	80 pA
	±1 µA <sup>2</sup>	100 fA	0.03% + 200 pA	20 pA
	Temperature coefficient	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)		
Settling time	<100µs (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, Low Current Measurements, Triaxial Cable is recommended to connect: HI connect to core cable, Guard connects to inner shield, outer shield connects to protective ground, LO connect to core cable, inner shield not connect, and outer shield connect to protective ground. Triaxial Cable rated insulation voltage is not less than 250V.

## 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	0.1 A/200 V	DC, no limit	100%
2	1 A/20 V	DC, no limit	100%
3	3 A/66.6 V	1 ms	5%
4	3 A/160 V	400 $\mu$ s	2%

### Typical Pulse Performance(4W)

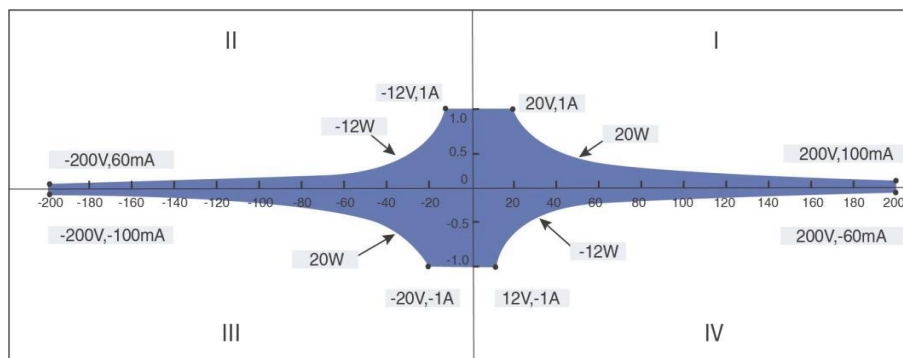
Source	Maximum output	Typical rise time <sup>1</sup>	Typical Settling Time <sup>2</sup>	Test load
Voltage	160 V	800 $\mu$ s	1.2 ms	NO load
	5 V	40 $\mu$ s	100 $\mu$ s	NO load
Current	3A~1 mA	90 $\mu$ s	250 $\mu$ s	Full load <sup>3</sup>
	100 $\mu$ A ~10 $\mu$ A	120 $\mu$ s	400 $\mu$ s	Full load <sup>3</sup>
	1 $\mu$ A	800 $\mu$ s	1.2 ms	Full load <sup>3</sup>

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

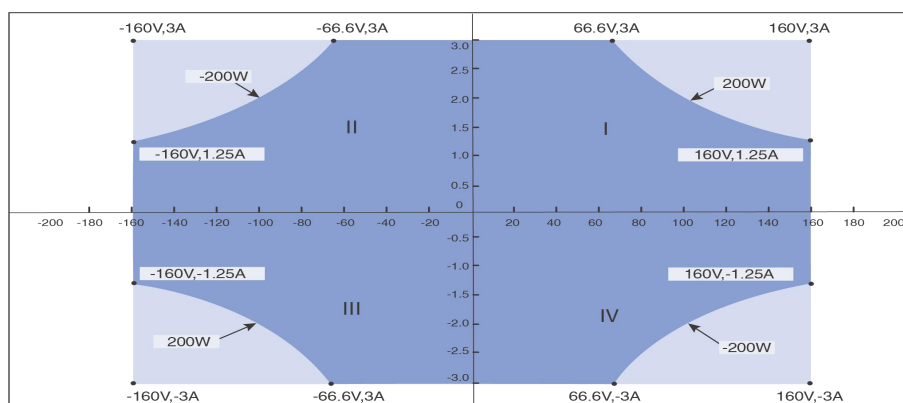
3, Test condition: Normal, resistive load 6V maximum output

### DC I-V Out capability



■ Pulse or DC

### Pulse I-V Out capability



■ Pulse only, maximum pulse on time 1ms, maximum duty cycle 5%  
 ■ Pulse only, maximum pulse on time 400  $\mu$ s, maximum duty cycle 2%

## Typical output settling time

Source	Range	Output settling time <sup>1</sup>			Condition
		Fast <sup>2</sup>	Normal	Slow	
Voltage	200 V	<500 $\mu$ s	<1 ms	<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 $\mu$ s	<100 $\mu$ s	<600 $\mu$ S	
	6 V	<60 $\mu$ s	<100 $\mu$ s	<300 $\mu$ s	
	0.6 V	<50 $\mu$ s	<50 $\mu$ s	<50 $\mu$ s	
Current	3 A~1 mA	<50 $\mu$ s	<100 $\mu$ 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
	100 $\mu$ A~10 $\mu$ A	<100 $\mu$ s	<150 $\mu$ s	<0.8 ms	
	1 $\mu$ A	<1 ms	<1 ms	<1 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	5 sps ~ 1 Msps

## Derating accuracy with PLC setting < 1 PLC

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

PLC	Range							
	600 mV	6 V	20 V	200 V	1 $\mu$ A	10 $\mu$ A	100 $\mu$ 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 $\Omega$ for rated accuracy
Max voltage between Force and Sense	2 V
Maximum output voltage in output connector	>range 105%
Sweep	Sweep step time: from 20 $\mu$ s to 16 s, 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 ( $\pm 210$  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 °C to +50 °C, 30 % to 70 % non-condensing
Storage	-30 °C to 70 °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 connector, quick reference, U disk (including PDF manuals, quick I/V Measurement Software and drivers)

Model number	
SMU4213	Single Channel PXIe Precision Source Meter