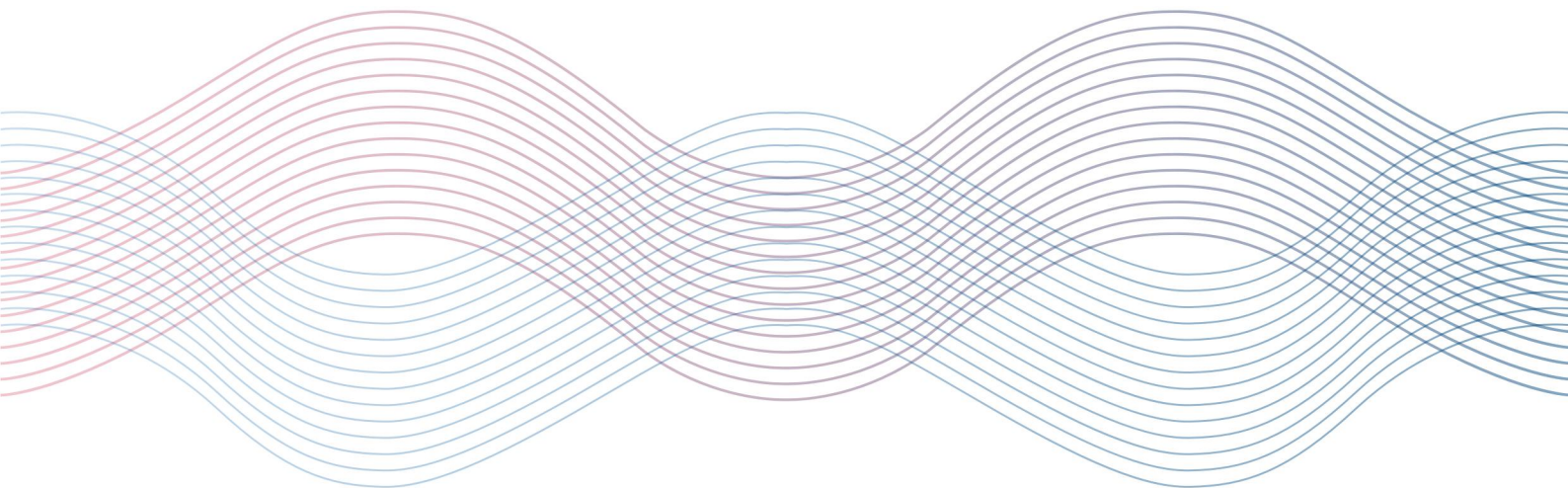
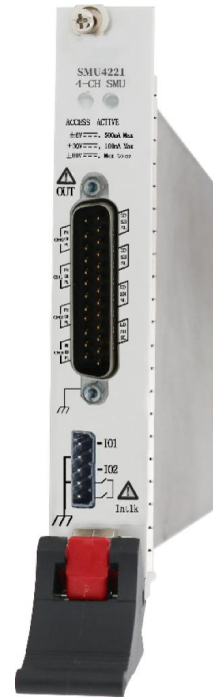


# SMU4221

4-Channel PXIe Precision Source Meter

Version 1.9



## Product Description

The SMU4221 Precision source meter is compact and cost-effective 4-Channel PXIe Source/Measure Units (SMUs) with the capability to source and measure both voltage and current. They have Maximum  $\pm 30$  V,  $\pm 500$  mA DC/Pulsed 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
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: $\pm 30$ V, $\pm 500$ mA (DC/Pulsed)	Easily LIV sweep test with single Card
Source and measurement resolution down to 100 pA and 100 $\mu$ V	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 500K 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
Supports both conventional and default SCPI commands	Conventional SCPI commands provide some compatibility with older SMU code (such as Keithley 2400 series) to minimize code conversion work
Built-in DIO	Easy to realize the synchronization of SMU4221 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

Calibration period:1 Year

Measurement speed: 1PLC (power line cycle)

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

## Voltage Source specifications

Voltage Programming accuracy	Range	Programming resolution	Accuracy (1 Year) $\pm$ (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10Hz
	$\pm 30$ V	1mV	0.03%+4 mV	1000 $\mu$ V
	$\pm 6$ V	200 $\mu$ V	0.03%+1 mV	100 $\mu$ V
Temperature coefficient	$\pm(0.15 \times \text{accuracy})/^{\circ}\text{C}(0^{\circ}\text{C}-18^{\circ}\text{C}, 28^{\circ}\text{C}-50^{\circ}\text{C})$			
Channel <sup>1</sup>	CH0 to CH3			

Output power	3 W per channel and 6 W total
Settling time	<200 $\mu$ s (typical)
Overshoot	< $\pm$ 0.1% (Typical. Normal. Step is 10 % to 90 % range, full range, resistive load)
Noise 10Hz-20MHz	6 V voltage source, 0.5 A resistive load, <3 mVrms

1, Channels are isolated from earth ground but share a common LO.

## Current Source specifications

Current Programming accuracy	Range	Programming resolution	Accuracy (1 Year) $\pm$ (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10 Hz
	$\pm$ 500 mA <sup>1</sup>	20 $\mu$ A	0.05% + 100 $\mu$ A + Vo*25 $\mu$ A	10 $\mu$ A
	$\pm$ 100 mA	4 $\mu$ A	0.05% + 10 $\mu$ A+ Vo*5 $\mu$ A	1 $\mu$ A
	$\pm$ 10 mA	400 nA	0.05% + 5 $\mu$ A + Vo*500 nA	100 nA
	$\pm$ 1 mA	40 nA	0.05% + 500 nA + Vo*50 nA	10 nA
	$\pm$ 100 $\mu$ A	4 nA	0.05% + 50 nA + Vo*5 nA	1 nA
	$\pm$ 10 $\mu$ A	400 pA	0.05% + 20 nA + Vo*500 pA	150 pA
Temperature coefficient	$\pm(0.15 \times \text{accuracy})/^{\circ}\text{C}(0^{\circ}\text{C}-18^{\circ}\text{C}, 28^{\circ}\text{C}-50^{\circ}\text{C})$			
Channel <sup>2</sup>	CH0 to CH3			
Output power	3 W per channel and 6 W total			
Settling time	<300 $\mu$ s (typical)			
Overshoot	< $\pm$ 0.1% (Typical. Normal. Step is 10 % to 90 % range, full range, resistive load)			

1,500mA range is available only for 6V voltage range

2, Channels are isolated from earth ground but share a common LO.

## Voltage Measurement specifications

Voltage Measurement accuracy	Range	Measurement resolution	Accuracy (1 Year) $\pm$ (% reading+ offset)
	$\pm$ 30 V	300 $\mu$ V	0.03%+4 mV
	$\pm$ 6 V	60 $\mu$ V	0.03%+1 mV
Temperature coefficient	$\pm(0.15 \times \text{accuracy})/^{\circ}\text{C} (0^{\circ}\text{C}-18^{\circ}\text{C}, 28^{\circ}\text{C}-50^{\circ}\text{C})$		

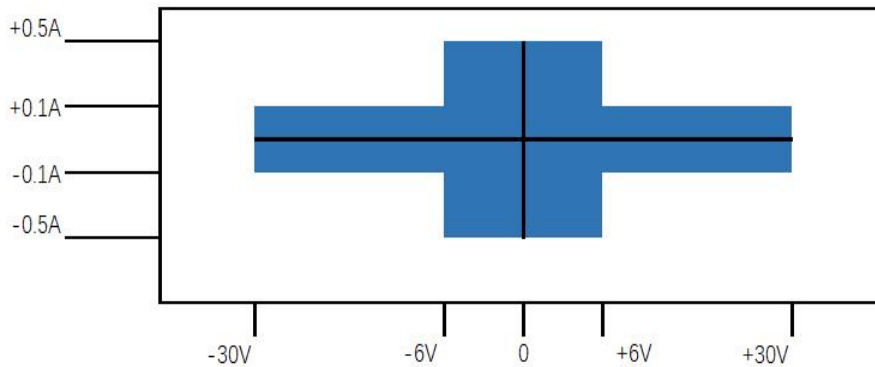
## Current Measurement specifications

Current Measurement accuracy	Range	Measurement resolution	Accuracy (1 Year) $\pm$ (% reading+ offset)
	$\pm$ 500 mA <sup>1</sup>	10 $\mu$ A	0.05% + 100 $\mu$ A + Vo*25 $\mu$ A
	$\pm$ 100 mA	1 $\mu$ A	0.05% + 10 $\mu$ A+ Vo*5 $\mu$ A
	$\pm$ 10 mA	100 nA	0.05% + 5 $\mu$ A + Vo*500 nA
	$\pm$ 1 mA	10 nA	0.05% + 500 nA + Vo*50 nA
$\pm$ 100 $\mu$ A	1 nA	0.05% + 50 nA + Vo*5 nA	

	±10 µA	100 pA	0.05% + 20 nA + Vo*500 pA
Temperature coefficient	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)		

1,500mA range is available only for 6V voltage range

## I-V Out capability



## Typical output settling time

Source	Range	Output settling time			Condition
		Fast <sup>1,2</sup>	Normal <sup>1</sup>	Slow <sup>1</sup>	
Voltage	30 V	<400 µs	<1.5 ms	<2.8 ms	Time required to reach within 0.1 % of final value at open load condition. Step is 10 % to 90 % range
	6 V	<250 µs	<780 µs	<2.8 ms	
Current	±500 mA	<50 µs	<330 µs	<2.5 ms	Time required to reach within 0.1 % of final value at short condition. Step is 10 % to 90 % range
	±100 mA	<50 µs	<270 µs	<2.5 ms	
	±10 mA	<50 µs	<270 µs	<2.5 ms	
	±1 mA	<100 µs	<290 µs	<2.5 ms	
	±100 µA	<150 µs	<5 ms	<2.5 ms	
	±10 µA	<250 µs	<3 ms	<2.5 ms	

1, Output transition speed: Fast, Normal, Slow.

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	0.0001 PLC ~ 10 PLC
Sampling Rate	5 sps ~ 500 Ksps

## Derating accuracy with PLC setting < 1 PLC

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

PLC	Range			
	6 V 、 30 V	10 $\mu$ A	100 $\mu$ A to 100 mA	500 mA
0.1	0.01%	0.03%	0.01%	0.02%
0.01	0.03%	0.06%	0.02%	0.04%
0.001	0.3%	0.4%	0.3%	0.4%

### 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

### 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 0.43Kg
Power	Full Load 12V/2.5A;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	
SMU4221	4-Channel PXIe Precision Source Meter