

# S2012C

Single-Channel PXIe Precision Source Meter

Version 1.6



## Product Description

The S2012C Precision source meter is compact and cost-effective PXIe Source/Measure Unit (SMU) with the capability to source and measure both voltage and current. S2012C 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 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 S2012C and external instrument without additional Synchronous control card |
| Standard PXIe Module,<br>Applicable to PXIe chassis | Easily expand to multi-channel and integration into rack and stack systems  |

## Technical Specification

Specification conditions

Temperature :23 °C ± 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 ± 3 °C

## Voltage Programming and Measurement specifications

| Voltage accuracy        | Range  | Programming resolution | Accuracy (1 Year)<br>$\pm$ (% reading+ offset) | Typical Noise (RMS)<br>0.1 Hz-10 Hz |
|-------------------------|--|------------------------|--|-------------------------------------|
|                         | $\pm 200$ V  | 100 $\mu$ V            | 0.03%+10 mV                                    | 0.4 mV                              |
|                         | $\pm 20$ V   | 10 $\mu$ V             | 0.03%+1 mV                                     | 50 $\mu$ V                          |
|                         | $\pm 6$ V  | 1 $\mu$ V              | 0.03%+0.4 mV                                   | 9 $\mu$ V                           |
|                         | $\pm 0.6$ V  | 100 nV                 | 0.03%+100 $\mu$ V                              | 2 $\mu$ V                           |
| Temperature coefficient | $\pm(0.15 \times \text{accuracy})/^{\circ}\text{C}$ (0 $^{\circ}$ C-18 $^{\circ}$ C,28 $^{\circ}$ C-50 $^{\circ}$ C) |                        |  |                                     |
| Settling time           | <50 $\mu$ s (typical)  |                        |  |                                     |
| Overshoot               | < $\pm 0.1\%$ (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)<br>$\pm$ (% reading+ offset) | Typical Noise (RMS)<br>0.1 Hz-10 Hz |
|------------------|------------------------|------------------------|--|-------------------------------------|
|                  | $\pm 3$ A <sup>1</sup> | 1 $\mu$ A              | 0.03% + 2 mA                                   | 20 $\mu$ A                          |
|                  | $\pm 1$ A              | 100 nA                 | 0.03% + 90 $\mu$ A                             | 4 $\mu$ A                           |

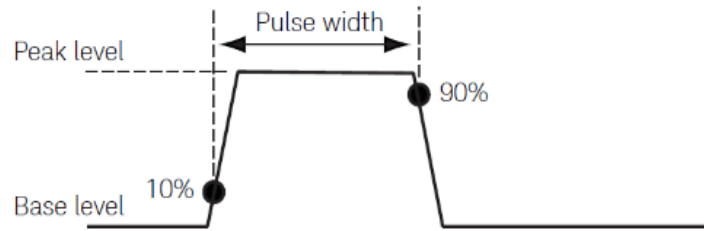
|                         |  |        |                   |        |
|-------------------------|--|--------|-------------------|--------|
|                         | $\pm 100$ mA   | 10 nA  | 0.03% + 9 $\mu$ A | 600 nA |
|                         | $\pm 10$ mA  | 1 nA   | 0.03% + 900 nA    | 60 nA  |
|                         | $\pm 1$ mA   | 100 pA | 0.03% + 90 nA     | 6 nA   |
|                         | $\pm 100$ $\mu$ A  | 10 pA  | 0.03% + 9 nA      | 700 pA |
|                         | $\pm 10$ $\mu$ A   | 1 pA   | 0.03% + 1 nA      | 80 pA  |
|                         | $\pm 1$ $\mu$ A  | 100 fA | 0.03% + 200 pA    | 20 pA  |
|                         | $\pm 100$ nA <sup>2</sup>  | 100 fA | 0.06% + 30 pA     | 3 pA   |
|                         | $\pm 10$ nA <sup>2</sup>   | 10 fA  | 0.06% + 9 pA      | 600 fA |
| Temperature coefficient | $\pm(0.15 \times \text{accuracy})/^{\circ}\text{C}$ (0 $^{\circ}$ C-18 $^{\circ}$ C,28 $^{\circ}$ C-50 $^{\circ}$ C) |        |                   |        |
| Settling time           | <100 $\mu$ s (typical)   |        |                   |        |
| Overshoot               | < $\pm 0.1\%$ (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 $\mu$ s   |
| Pulse width programming resolution | 1 $\mu$ s   |
| Pulse width programming accuracy   | $\pm 10$ $\mu$ s  |
| Pulse width jitter                 | 2 $\mu$ s   |
| 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   | 400µs               | 2%                 |

### Typical Pulse Performance(4W)

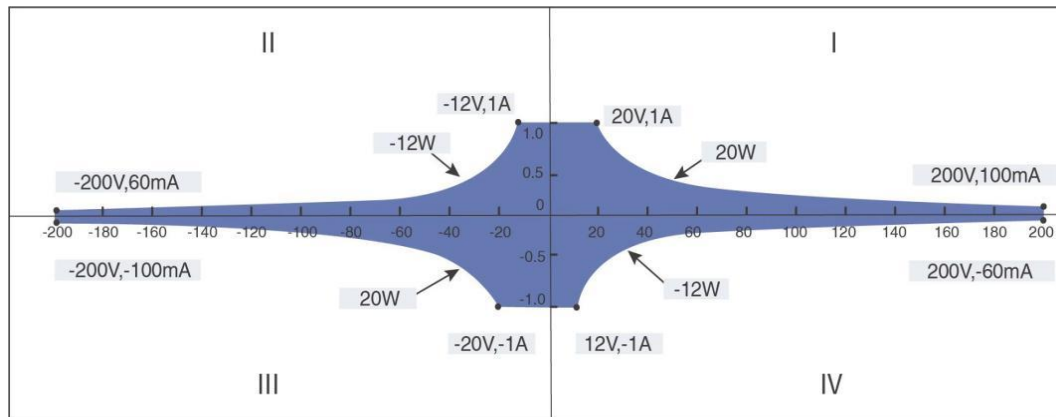
| Source  | Maximum output | Typical rise time <sup>1</sup> | Typical Time <sup>2</sup> | Settling | Test load              |
|---------|----------------|--------------------------------|---------------------------|----------|------------------------|
| Voltage | 160 V          | 800µs                          | 1.2 ms                    |          | NO load                |
|         | 5 V            | 40 µs                          | 100 µs                    |          | NO load                |
| Current | 3A~1 mA        | 90 µs                          | 250 µs                    |          | Full load <sup>3</sup> |
|         | 100 µA ~10 µA  | 120 µs                         | 400 µs                    |          | Full load <sup>3</sup> |
|         | 1 µA           | 800 µs                         | 1.2 ms                    |          | Full load <sup>3</sup> |
|         | 100 nA         | 2 ms                           | 5 ms                      |          | Full load <sup>3</sup> |
|         | 10 nA          | 5 ms                           | 20 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

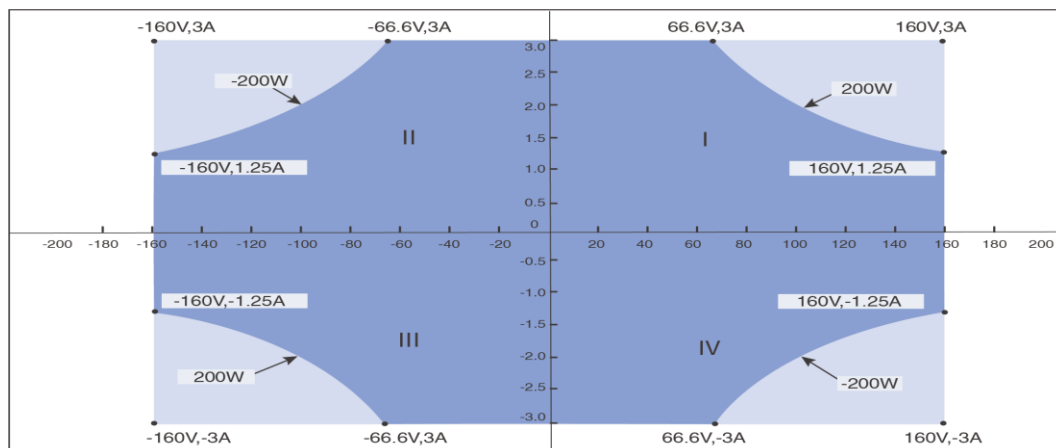
3, Test condition: Normal, resistive load 6V maximum output

### DC I-V Out capability



■ Pulse or DC

### 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 <sup>1</sup> |         |         | Condition  |
|---------|-------|-----------------------------------|---------|---------|--|
|         |       | Fast <sup>2</sup>                 | Normal  | Slow    |  |
| Voltage | 200 V | <500 μs                           | <1 ms   | <2 ms   | Time required to reach within 0.1 % of final value at open |
|         | 20 V  | <60 μs                            | <100 μs | <600 μs |  |

|         |                        |              |              |              |   |
|---------|------------------------|--------------|--------------|--------------|---|
|         | 6 V                    | <60 $\mu$ s  | <100 $\mu$ s | <300 $\mu$ s | load condition. Step is 10 % to 90 % range  |
|         | 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        |   |
|         | 100 nA                 | <3 ms        | <3 ms        | <3 ms        |   |
|         | 10 nA                  | <10 ms       | <10 ms       | <10 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 |       |       |       |                    |            |                       |            |
|------|-------|-------|-------|-------|--------------------|------------|-----------------------|------------|
|      |       | 6 V   | 20 V  | 200 V | 10 nA to 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        | 1V   |
| Maximum output voltage in output connector | >range 105%  |
| Sweep                                      | Sweep step time: from 20 $\mu$ 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 ( $\pm 210$  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 Low terminal connector, quick reference, U disk (including PDF manuals, quick I/V

Measurement Software and drivers)

|              |  |
|--------------|--|
| Model number |  |
| S2012C       | Single Channel PXIe Precision Source Meter |

## Contact us

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\*This information is subject to change without notice.