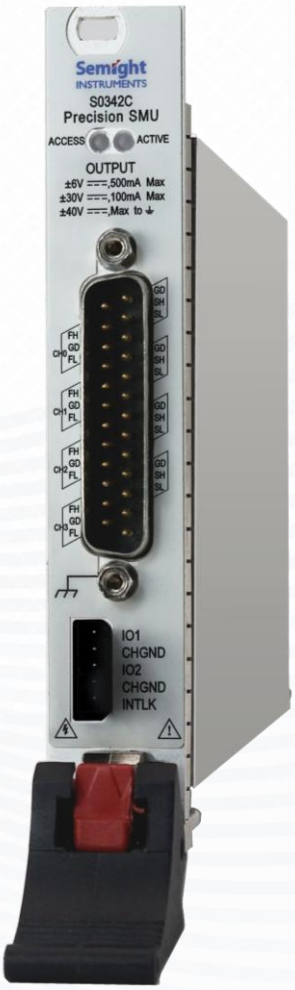
Semight INSTRUMENTS

Precision SMU

S0342C

Datasheet V2.2

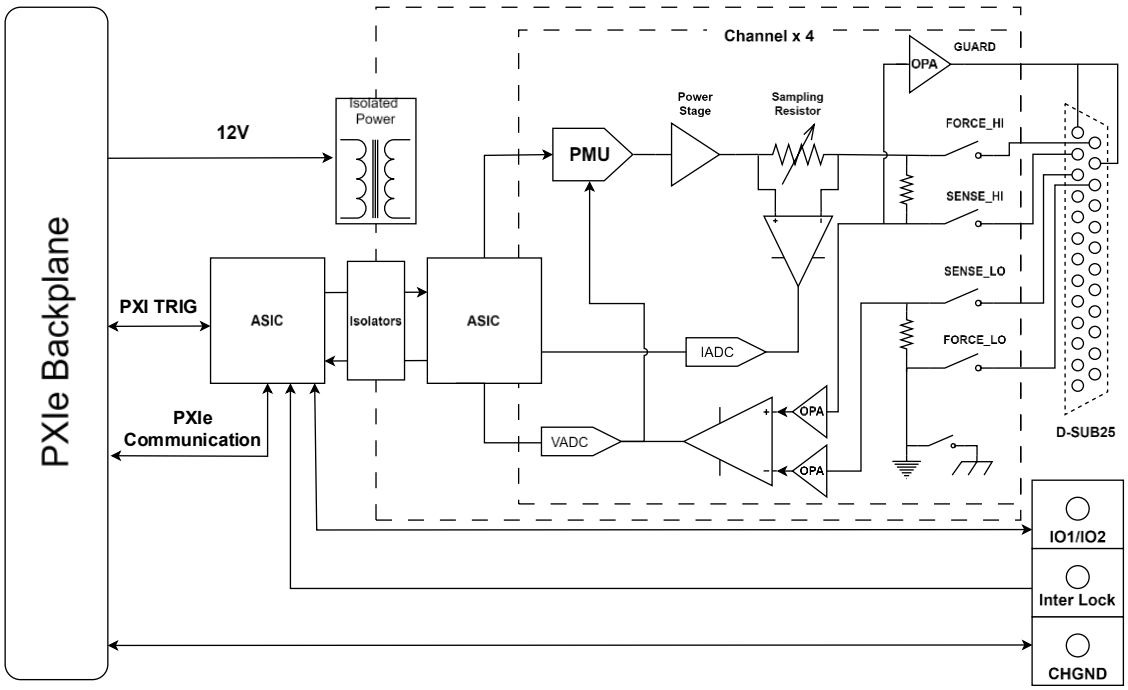
Based on analog control loop technology, this module can realize multi-channel voltage and current output. Compliant with the standard PXIe protocol, it is compatible with mainstream PXIe chassis, features high integration, and supports synchronous test. It provides users with ±30 V and ±500 mA (DC/pulsed) output for 4 identical simultaneous channels, with a maximum sampling rate of 500 Ksps and a minimum measurement resolution of 100 pA/60 μV.



Contents

1 Product Description

The Semight S0342C is a compact and cost-effective single-slot 4-channel PXIe Source/Measure Unit (SMU) with the capability to source and measure both voltage and current. It delivers a maximum output of ±30 V and ±500 mA (DC/pulsed), and supports conventional SMU SCPI commands for easy test code migration. Compatible with mainstream existing PXIe chassis, high integration, convenient multi-channel expansion and multi-module synchronization, these features improve efficiency and lower the cost of ownership when integrating the SMUs into systems for production test.



S0342C Block Diagram

2 Features and Benefits

Maximum Range

Supports a maximum output of ±30 V and ±500 mA (DC/pulsed), enabling easy LIV sweep with a single module.

Minimum Measurement Resolution

The minimum current measurement resolution is as low as 100 pA, and the voltage measurement resolution is as low as 60 μV. Multi-channel measurements can be performed using low-cost PXIe SMUs, whereas in the past multiple modules are required.

High-speed Measurement

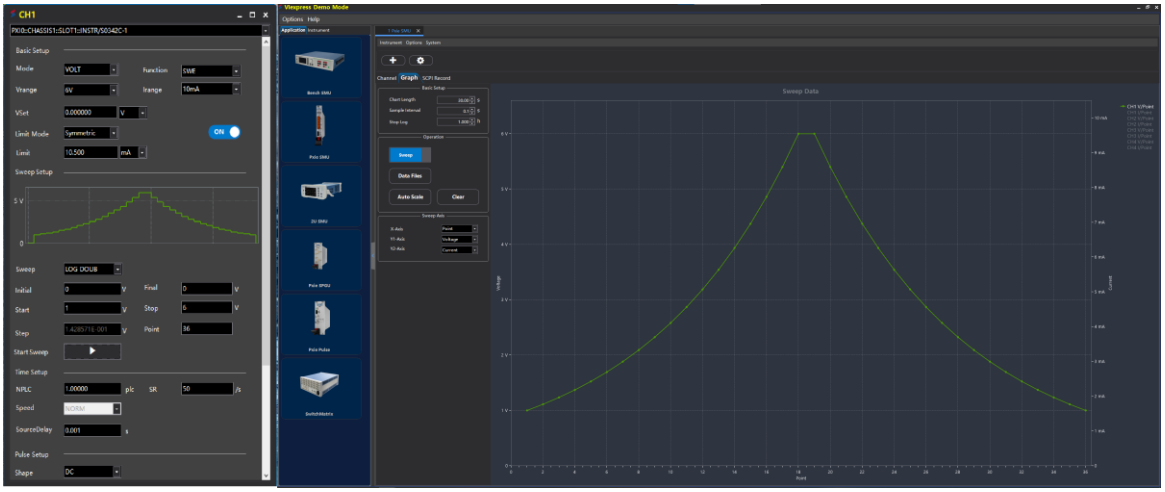
Supports an ADC sampling rate of up to 500 Ksps, with selectable NPLC and sampling rate.

Sensing Mode

Supports 2-wire or 4-wire (remote sense) connections; maximum sense lead resistance: 1 kΩ (rated accuracy); maximum voltage between remote sense output and sense terminals: 2 V.

Sweep Mode

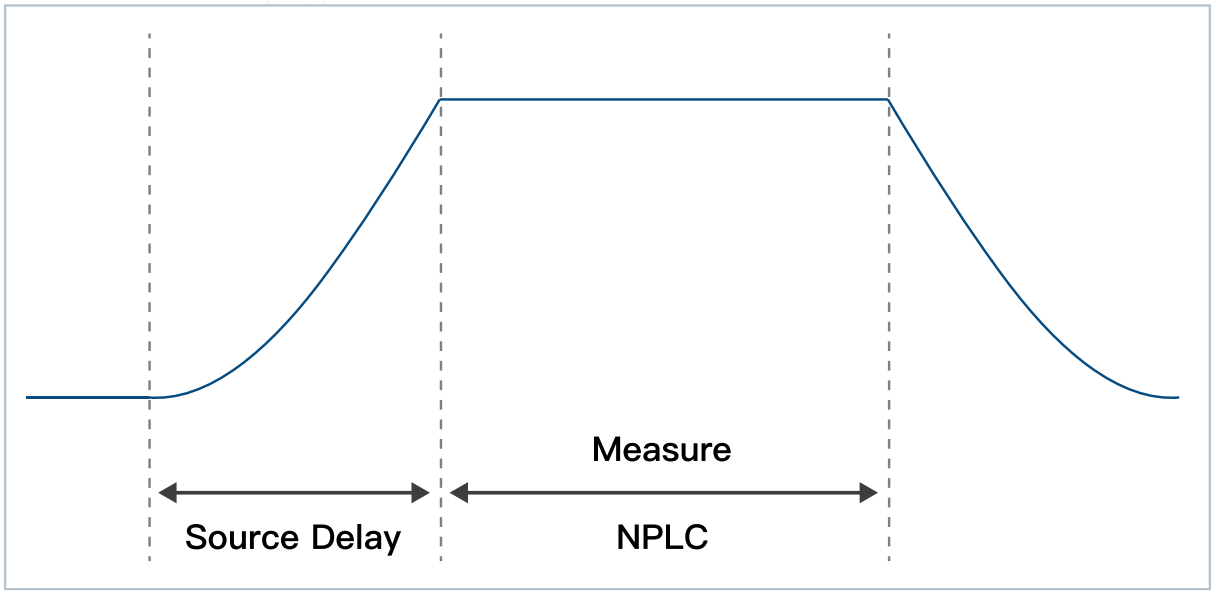
Supports single-sided and double-sided linear, logarithmic, and list sweep. The interval is configurable from 40 μs to 16 s, with a maximum of 10^6 points per sweep.



Dual-Sided Logarithmic Sweep

Source Delay

Supports Source Delay measurement. Users are recommended to set an appropriate Source Delay to obtain more accurate measurement results. The Source Delay must be longer than the source settling time, especially in low current ranges. If the sampled values are inaccurate, check whether the Source Delay setting is reasonable.



Source Delay and NPLC Setting Diagram

Protection

- Supports over-temperature protection; the system power will be shut down when an excessively high internal temperature is detected;
- If the module indicator does not light up, the hardware may be damaged.

Synchronous Trigger

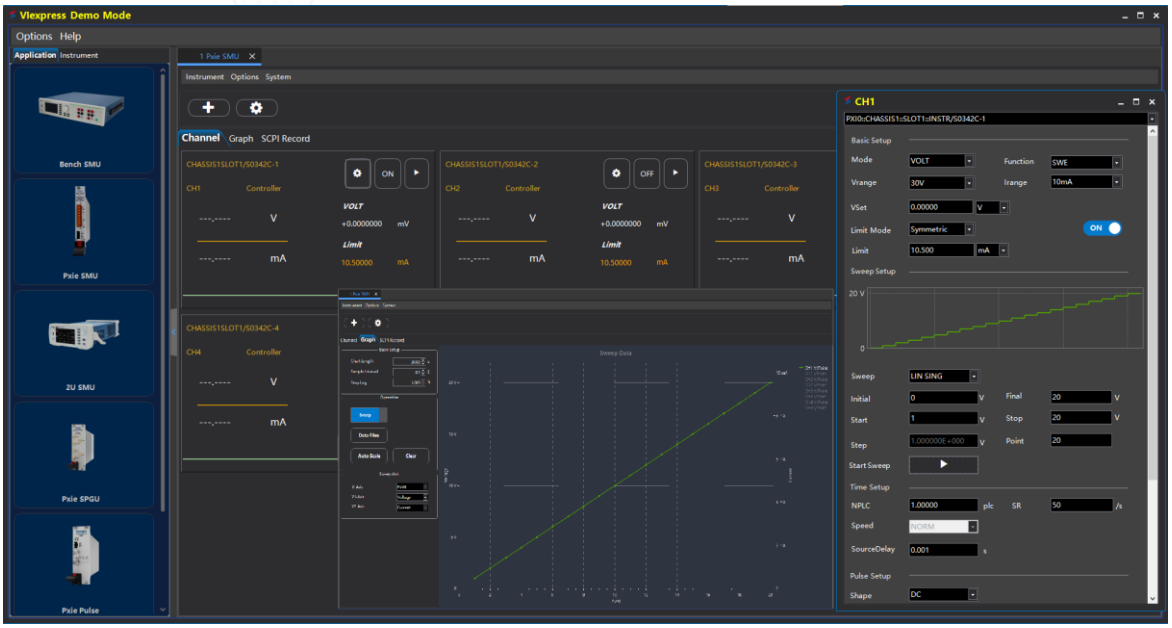
- Supports multi-module synchronous triggering (TRIG BUS) via internal and external signals: 8 internal Trig Bus lines (0 to 7) and 2 external DIO lines (1 to 2); Configure the internal Trig IO to ensure multiple modules reside on the same routing segment within the chassis. If they are located on different routing segments, the internal Trig IO can be routed to the corresponding IO ports via the chassis GUI;

- Internal and external triggering shall comply with the following principles: One channel can be configured with multiple IOs as trigger outputs, but only one IO can be configured as trigger input at the same time; One IO can be configured as trigger input by multiple channels, but one IO can only be configured as trigger output by one channel at the same time;
- Pulse Width: configurable from 100 ns to 1 ms; active high;
- External DIO trigger level:

DIO Interface Specifications	Max. Ratings
Absolute Max. Input Voltage	5.25 V
Absolute Min. Input Voltage	-0.25 V
Min. Logic High Level	2.1 V
Max. Logic Low Level	0.7 V
Max. Logic Output Current	2 mA
Max. Sink Current	-50 mA

Free PC-based GUI Control Software

Can make measurements and control remotely from a PC without the need to program.



GUI interface

PC System Configuration

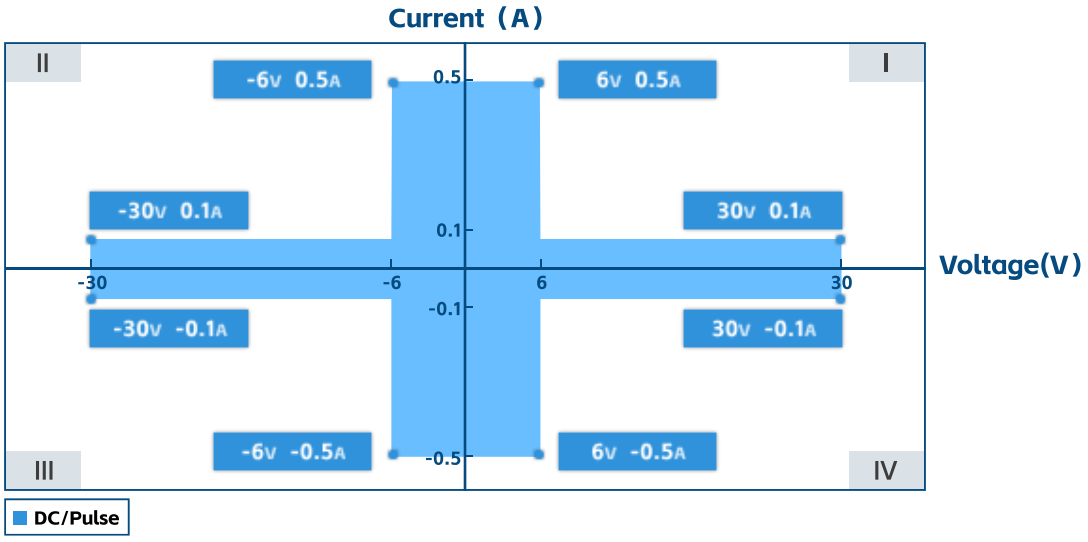
- Intel Core i7 or higher;
- 8 GB RAM (to be increased based on actual application requirements);
- Windows 11 /Windows 10 (64-bit) /Windows 7 (64-bit; patches required for driver installation);
- Semight driver must be installed to operate the modules.

3 Specifications

Operating Conditions:

- Temperature: 23 °C ± 5 °C;
- Humidity: 30% to 60% (RH);
- Measure after 60 minutes warm-up; Ambient temperature changes less than ±3 °C during measurement;
- Calibration Period: 1 year;
- Measurement Speed: 1 PLC;
- If the PXI Express chassis has multiple fan speed settings, set the fans to the highest setting.

SMU Output Capability



DC/Pulsed I-V Output Capability

Voltage Source Specifications

	Range	Resolution	Accuracy (1 Year) ± (% reading + offset)[1]	*Typical Noise (RMS)* *0.1 Hz to 10 Hz*
Voltage Accuracy	±30 V 错误! 未找到引用源。	1 mV	0.03% + 4 mV	*1 mV*
	±6 V	200 µV	0.03% + 1 mV	*100 µV*
Temperature Coefficient	± (0.15 x accuracy) /°C (0 °C to 18 °C, 28 °C to 50 °C)			
Channel[2]	CH0 to CH3			
Output Power	Max. 3 W per channel, total max. power of 6 W for four channels.			
Overshoot	< ±0.1% (typical, Normal mode, step is 10% to 90% range, full scale point, resistive load test)			
Noise 10 Hz to 20 MHz	< 3 mVrms (6 V voltage source, 0.5 A resistive load)			

[1] Accuracy calculation example: To test the accuracy of a 6 V range with a 1 V output, the tolerance is:

$$\pm\left(\underbrace{1000}_{reading} \times 0.03\% + \underbrace{1}_{offset}\right) mV = \pm 1.3\ mV$$

[2] All channel outputs are bank-isolated from earth ground, but also share a common LO between channels.

[3] This instrument has potentially dangerous high-voltage outputs (±31.5 V) to the HI/Sense HI/Guard terminals. To prevent electric shock, appropriate safety precautions must be taken before power-on. Do not connect the Guard terminal to any output, including shorting it to chassis ground or output LO, as this may damage the instrument.

Current Source Specifications

	Range	Resolution	Accuracy (1 Year) ± (% reading + offset)	*Typical Noise (RMS)* *0.1 Hz to 10 Hz*
Current Accuracy	±500 mA [错误!未找到引用源。]	20 µA	0.05% + 100 µA + Vo x 25 µA	*10 µA*
	±100 mA	4 µA	0.05% + 10 µA + Vo x 5 µA	*1 µA*
	±10 mA	400 nA	0.05% + 5 µA + Vo x 500 nA	*100 nA*
	±1 mA	40 nA	0.05% + 500 nA + Vo x 50 nA	*10 nA*
	±100 µA	4 nA	0.05% + 50 nA + Vo x 5 nA	*1 nA*
	±10 µA	400 pA	0.05% + 20 nA + Vo x 500 pA	*150 pA*
Temperature Coefficient	± (0.15 x accuracy) /°C (0 °C to 18 °C, 28 °C to 50 °C)			
Channel	CH0 to CH3			
Output Power	Max. 3 W per channel, total max. power of 6 W for four channels.			
Overshoot	< ±0.1% (typical, Normal mode, step is 10% to 90% range, full scale point, resistive load test)			

[4] The 500 mA range is available only for the 6 V voltage range.

Voltage Measurement Specifications

	Range	Resolution	Accuracy (1 Year) ± (% reading + offset)
Voltage Measurement Accuracy	±30 V	300 µV	0.03% + 4 mV
	±6 V	60 µV	0.03% + 1 mV
Temperature Coefficient	± (0.15 x accuracy) /°C (0 °C to 18 °C, 28 °C to 50 °C)		

Current Measurement Specifications

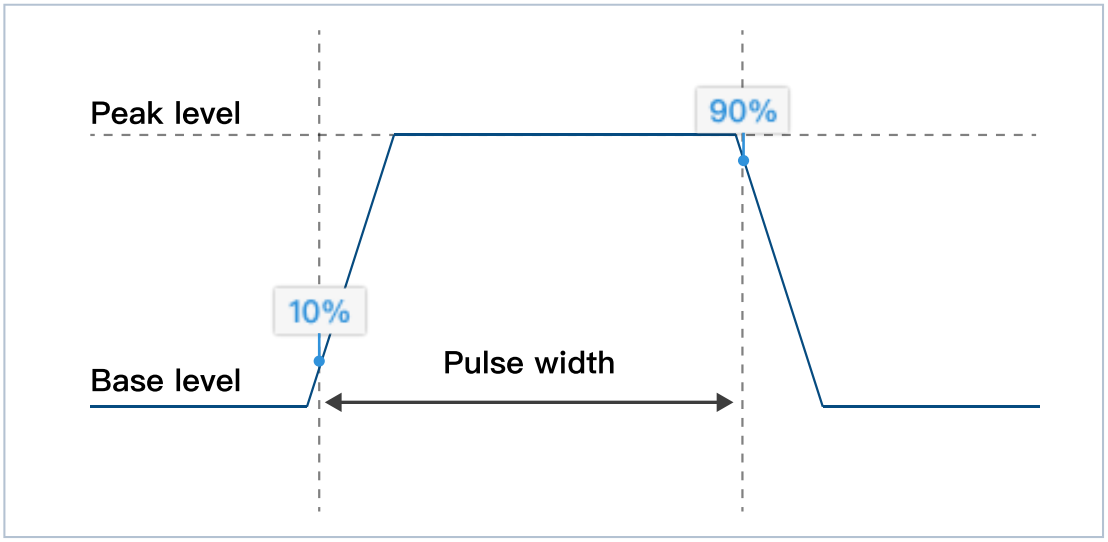
	Range	Resolution	Accuracy (1 Year) ± (% reading + offset)
Current Measurement Accuracy	±500 mA	10 µA	0.05% + 100 µA + Vo x 25 µA
	±100 mA	1 µA	0.05% + 10 µA + Vo x 5 µA
	±10 mA	100 nA	0.05% + 5 µA + Vo x 500 nA
	±1 mA	10 nA	0.05% + 500 nA + Vo x 50 nA
	±100 µA	1 nA	0.05% + 50 nA + Vo x 5 nA
	±10 µA	100 pA	0.05% + 20 nA + Vo x 500 pA
Temperature Coefficient	± (0.15 x accuracy) /°C (0 °C to 18 °C, 28 °C to 50 °C)		

Resistance Measurement Resolution/Accuracy (4-Wire)

	Range	Resolution	Default Test Current	Accuracy (1 Year) ± (% reading + offset)
Resistance Measurement Accuracy	10 Ω	2 mΩ	100 mA	0.09% + Vo x 0.005% + 10 mΩ
	100 Ω	20 mΩ	10 mA	0.13% + Vo x 0.005% + 100 mΩ
	1 KΩ	200 mΩ	1 mA	0.13% + Vo x 0.005% + 1 Ω
	10 KΩ	2 Ω	100 µA	0.13% + Vo x 0.005% + 10 Ω
	100 KΩ	20 Ω	10 µA	0.28% + Vo x 0.005% + 100 Ω
Temperature Coefficient	± (0.15 x accuracy) /°C (0 °C to 18 °C, 28 °C to 50 °C)			
Manual Current Source Resistance Measurement (4-Wire)	Total Error = Measured Voltage / Current Source Set Current = Resistance Reading × (Voltage Source Range Gain Error Percentage + Current Measurement Range Gain Error Percentage + Current Source Range Offset Error / Set Current) + (Voltage Source Range Offset Error / Set Current Value) Example: Current Source Set Current = 100 mA, Voltage Measurement Range = 6 V Total Error = [0.03% + 0.05% + (10 µA + Vo x 5 µA) / 100 mA] + (1 mV / 100 mA) ≈ 0.09% + Vo x 0.005% + 10 mΩ			

Pulse Source Specifications (4-Wire)

Item	Specification
Min. 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.



Pulse Width Definition

Max. Current Limitation	Max. Pulse Width	Max. Duty Cycle
0.1 A/30 V	DC, unlimited	100%
0.5 A/6 V	DC, unlimited	100%

Pulse Source Rise Time

Output	Max. Output	Rise Time[5]	Settling Time[6]	Test Load
Voltage Source	30 V	1.2 ms	< 1.5 ms	No load
	6 V	400 µs	< 780 µs	
Current Source	500 mA	300 µs	< 400 µs	Full load[7]
	100 mA to 1 mA	240 µs	< 300 µs	
	100 µA	800 µs	< 1.5 ms	
	10 µA	1 ms	< 2 ms	

[5] Time required for the pulse leading edge to rise from 10% to 90%.

[6] Time required for the pulse to reach within 1% of the final value.

[7] Test Conditions: Normal mode, voltage rises to 6 V under pure resistive full load.

Output Settling Time

Output	Range	Output Settling Time[8]			Test Condition
		Fast[9]	Normal	Slow	
Voltage Source	30 V	< 500 µs	< 1.5 ms	< 3 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 Source	500 mA	< 150 µs	< 400 µs	< 2.5 ms	Under full load in Normal mode, the voltage output reaches 6 V. Time required to reach within 0.1% of final value. Step is 10% to 90% range
	100 mA to 1 mA	< 120 µs	< 300 µs	< 2.5 ms	
	100 µA	< 150 µs	< 1.5 ms	< 2.5 ms	
	10 µA	< 700 µs	< 2 ms	< 2.5 ms	

[8] Output Slew Rate: Fast, Normal, and Slow 3 modes. Users can adjust according to load characteristics to achieve appropriate settling time or stability. Switching of the output slew rate is only supported when OUTPUT is OFF.

[9] In Fast mode, the output may exhibit significant overshoot under different ranges or load conditions. For overshoot-sensitive devices, Normal or Slow mode is recommended.

Sampling Rate and NPLC Setting

Setting	Range
NPLC	0.0001 PLC to 10 PLC[10]
Sampling Rate	5 sps to 500 Ksps[11]

[10] A maximum of 2 channels can be configured simultaneously at 0.0001 PLC. If more than 2 channels are used, the minimum configurable NPLC is 0.0002 PLC.

[11] A maximum of 2 channels can be configured simultaneously at 500 Ksps. If more than 2 channels are used, the maximum sampling rate is 250 Ksps.

Measurement Accuracy Derating

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

PLC	Range			
	6 V, 30 V	10 µA	100 µA 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%

Environment Specifications

Item	Specification
Environment	For use in indoor facilities
Operating	0 °C to +50 °C, 30% to 60% RH, non-condensing
Storage	-30 °C to 70 °C, 10% to 90% RH, non-condensing
Dimensions (mm)	210 x 130 x 20
Weight	Net weight 0.43 kg
Power Supply	Full load: 12 V/2.5 A; 3.3 V/0.5 A; 5 V/0.01 A
Altitude	Operation: 0 m to 2000 m, Storage: 0 m to 4600 m
Pollution Degree	2
Warm-up	1 hour

4 Ordering Information

Standard Factory Accessories: Output Connector (cable not included), DIO Connector (cable not included), Software Installation USB Flash Driver (host PC software, product drivers, PDF datasheet and PDF manuals).

Model Number	
S0342C	Precision SMU
Optional Accessories	
TA-03007	Output extension cable, DB25 female-to-female (F/F), 1 m, PVC
Service	
R3C	Factory Extended Warranty Service Plan – 36 Months
R5C	Factory Extended Warranty Service Plan – 60 Months

5 Warranty

No.	Item	Content	Warranty Period
1	Main Unit	Free repair within warranty	12 months
2	Accessories	Consumables and accessories are not covered under warranty	3 months
3	Calibration Interval	Factory calibration or calibrated at the nearest Semight service center	12 months

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