S3012H

Single Channel Precision Source Meter



Datasheet V1.2

S3012H Single Channel Precision Source Meter

The S3012H precision source meter is compact and cost-effective bench-top Source/Measure Units (SMUs) with the capability to source and measure both voltage and current. These capabilities make the S3012H ideal for a wide variety of IV (current versus voltage) measurement tasks that require both high resolution and accuracy. The S3012H provides best-in-class performance for

a modest price. They have broad voltage (\pm 200 V) and current (\pm 3 A DC and \pm 10 A pulsed) sourcing capability, excellent precision (minimum 100 fA/100 nV sourcing and measuring resolution) and possess a superior color LCD graphical user interface (GUI). In addition, several task-based viewing modes dramatically improve productivity for test, debug, and characterization. The S3012H offers unmatched measurement throughput and supports conventional SMU SCPI commands for easy test code migration. These features improve efficiency and lower the cost of ownership when integrating the SMUs into systems for production test.

Feature

Feature	Benefit
Integrated 4-quadrant sourcing and	Easily and accurately measure current and voltage using a
measuring capabilities	single instrument without the need to manually change any
	connections
Measurement range: ±200 V, ±3 A	A single SMU product covers both high voltage and high
(DC), ±10 A (pulsed)	current measurement needs, allowing for more
	standardization and simplifying inventory and support
	concerns
Source and measurement resolution	Can make low-level measurements using a low-cost bench-top
down to 100 fA and 100 nV	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
User-friendly front panel GUI with 5.0	Can quickly and easily perform measurements and display
inch capacitive touchscreen supports	data on the front panel, thereby greatly speeding up
both graphical and numerical view	interactive test, characterization and debug operations
modes	
Free quick V/I control software	Can make measurements remotely from a PC without the
	need to program
Supports both conventional and	Conventional SCPI commands provide some compatibility with
default SCPI commands	older SMU code (such as Keithley 2400 series) to minimize
	code conversion work
Synchronization	Highspeed/ low - delay multi-channel synchronization with
	hardware technology
Digital I/O	Flexibly configured High-speed Digital I/O, support threshold
	value triggering, so as to realize efficient interaction between
	output measured values and user system

Application

The S3012H has a broad application range that spans uses from R&D and education to industrial development, production test and automated manufacturing. Moreover, they work equally well as either standalone or system components.

Testing semiconductors, discrete and passive components

- Diodes, laser diodes, LEDs
- Photodetectors, sensors
- Field effect transistors (FETs), bipolar junction transistors (BJTs)
- ICs (analog ICs, RFICs, MMICs, etc)
- Resistor, varistor, thermistors, switches

Research and education

- New material investigations
- Nano devices characterization (e.g. CNT)
- Giant magnetic resistance (GMR)

Testing precision electronics and green energy devices

- Photovoltaic cells
- Power transistors, power devices
 - Battery
- Automotive
- Medical instruments
- Power and DC bias source for circuit test
- Organic devices
- Any precise voltage/current source and measurement

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 source specifications

Voltage programming	Range	Programming	Accuracy (1 Year)	Typical Noise (RMS)
accuracy	resolution ± (% reading+ offset)		0.1 Hz-10Hz	
	±200 V	1mV	0.02%+40 mV	600 µV
	±20 V	100 µV	0.02%+5 mV	100 µV
	±6 V	10 µV	0.02%+500 μV	$4\mu V$

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	±200 mV	1 uV	0.02%+200 μV	2 µV		
Temperature	±(0.15 × accu	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)				
coefficient						
Maximum output	30W: ±20V@1.5A, ±200V@0.1A;18W: ±6 V@3A					
power						
Settling time	<800us (typic	cal)				
Overshoot	<±0.1% (Typi	cal.Normal.Step i	is 10 % to 90 % range, full	range,resistive load)		
Noise 10Hz-20MHz	6V voltage source, 3A resistive load, <3mV RMS					

Current source specifications

Current programming	Range	inge Programming Accuracy (1 Year) <i>Typical Noise (RMS)</i>			
accuracy		resolution	± (% reading+ offset)	0.1 Hz-10Hz	
	±10 A ¹	50 µA	0.4% + 40 mA	NA	
	±3 A	20 µA	0.05% + 5 mA	10 µA	
	±1.5A	5 μΑ	0.02% + 500 <i>µ</i> A	3 µA	
	±150 mA	500 nA	0.02% + 25 μA	800 nA	
	±15 mA	50 nA	0.02% + 2.5 μA	100 nA	
	±1.5 mA	5 nA	0.02% + 150 nA	20 nA	
	±150 μΑ	500 pA	0.02% + 25 nA	200 рА	
	±15 μΑ	50 pA	0.02% + 3 nA	75 pA	
	±1.5 μΑ	5 pA	0.03% + 600 pA	50 pA	
	±150 nA	500 fA	0.05% + 300 pA	10 pA	
Temperature		±(0.15 × a	ccuracy)/°C (0°C-18°C,28°C-	50°C)	
coefficient					
Maximum output	30W: ±20V@1.5A, ±200V@0.1A;18W: ±6 V@3A				
power					
Settling time	<500us (typical)				
Overshoot	<±0.1% (T	ypical.Normal.Ste	ep is 10 % to 90 % range, ful	l range, resistive load)	

1, 10 A range is available only for pulse mode, accuracy specifications for 10 A range are typical.

Voltage measurement specifications

Voltage measurement	Range	Measurement	Accuracy (1 Year)	
accuracy		resolution	± (% reading+ offset)	
	±200 V	100 μV	0.02% + 40 mV	
	±20 V	10 uV	0.02% + 5 mV	
	±6 V	1 uV	0.02% + 500 uV	
	±200mV	100 nV	0.02% + 200 μV	
Temperature	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)			
coefficient				

Current measurement	Range	Measurement	Accuracy (1 Year)	
accuracy		resolution	± (% reading+ offset)	
	±10 A ¹	10 µA	0.4% + 25 mA	
	±3 A	10 µA	0.05% + 5 mA	
	±1.5A	1 µA	0.02% + 500 μA	
	±150 mA	100 nA	0.02% + 25 μA	
	±15 mA	10 nA	0.02% +2 μA	
	±1.5 mA	1 nA	0.02% + 150 nA	
	±150 μA	100 pA	0.02% + 20 nA	
	±15 μΑ	10 pA	0.02% +3 nA	
	±1.5 μA²	1 pA	0.03% + 600 pA	
	±150 nA ²	100fA	0.05% + 300 pA	
Temperature	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)			
coefficient				

Current measurement specifications

1, 10 A range is available only for pulse mode, accuracy specifications for 10 A range are typical.

2, Low Current Measurements, Triaxial Cable is recommended to connect: Force Hi connect to core cable, Guard connects to inner shield, outer shield connects to protective ground, Force 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.

Resistance measurement specifications (4W)

Resistance	Range	Measurement	Test current	Accuracy (1 Year)
measurement accuracy	resolution ± (% readir		± (% reading+ offset)	
	1 Ω	1 uΩ	1 A	0.09% + 0.5 mΩ
	10 Ω	10 uΩ	100 mA	0.065% + 5 mΩ
	100 Ω	100 uΩ	10 mA	0.065% + 50 mΩ
	1 KΩ	1 mΩ	1 mA	0.055% + 500 mΩ
	10 KΩ	10 mΩ	100 uA	0.065% + 5 Ω
	100 KΩ 100 mΩ 10 uA <i>O</i> .		0.07% + 50 Ω	
	1 MΩ	1 Ω	1 uA	0.05% + 500 Ω
	10 MΩ	10 Ω	0.1 uA	0.65% + 5KΩ
	100 MΩ	100 Ω	0.05 uA	1.27% + 10 KΩ
Temperature	±(0.15 × accuracy)/°C (0°C-18°C,28°C-50°C)			
coefficient				
Source I mode, manual	Total error = \	/meas/lsrc = R read	ding x (gain error %	6 of V range + gain error %
Ohm measurement	of I range + offset error of I source range/Isrc value %) + (offset error of V			
(4-wire)	measure range/Isrc value)			
	Example: I source value=1A at 1A range V measure range=1V range			
	Total error(% reading + offset) = (0.02%+0.02%+500uA/1A) +(500uV/1A)			
	=0.09%+0.5mΩ			

Pulse source specifications (4W)

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



Item	Maximums	Maximum pulse width	Maximum duty cycle
1	0.15A/200V	DC,no limit	100%
2	1.5A/20V	DC,no limit	100%
3	3A/6V	DC,no limit	100%
4	3A/20V	1mS	10%
5	10A/6V	1mS	10%

Typical Pulse Performance (4W)

Source	range	Typical rise time 1,3Typical Settling Time2,3Test load		Test load
Voltage	200 V	600 µS	1.5 mS	No load
	20 V	200 µS	360 µS	No load
	6 V	160 μS	300 µS	No load
Current	10 A	140 μS	320 µS	Full load
3 A		120 µS	280 µS	Full load
	1.5 A	120 µS	280 µS	Full load
	150 mA		280 µS	Full load
	15 mA	120 µS	280 µS	Full load
	1.5 mA	120 µS	280 µS	Full load

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, Pulse current source base 6V voltage range and 105% range limit

I-V Out capability



Typical output settling time

Source	Range	Output sett	Output settling time		Condition
		Fast ^{1,2}	Normal ¹	Slow ¹	
Voltage	200V	<1.3mS	<1.5mS	<2.5ms	Time required to reach within
20V 6V	<300µS	<360µS	<1ms	0.1 % of final value at open	
	<150µS	<250µS	<1ms	load condition. Step is 10 %	
	200mV	<200µS	<250µS	<1ms	to 90 % range
Current	3A	<200µS	<280µS	<1.2ms	Time required to reach within
	1.5A	<200µS	<280µS	<1.2ms	0.1 % (0.3 % for 3 A range) of
	150mA	<200µS	<280µS	<1.2ms	final value at short condition.
15mA	<200µS	<280µS	<1.2ms	Step is 10 % to 90 %	
	1.5mA	<200µS	<280µS	280µS <1.2ms range , Pulse current source	range , Pulse current source
	150µA	<250uS	<300uS	<1.2ms	base 6V voltage range and
15µA	<250uS	<1.2mS	<2ms	105% range limit	
	1.5uA	<600uS	<1.2mS	<5mS	
	150nA	<600uS	<5mS	<12mS	

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	0.00005PLC ~ 10PLC
Sampling Rate	5sps ~ 1Msps

Derating accuracy with PLC setting < 1 PLC

PLC	Range						
	200mV	6V	20V	150nA to	15uA	150uA to	1.5A to
			to200V	1.5uA		150mA	3A
0.1	0.02%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01
0.01	0.3%	0.03%	0.02%	0.2%	0.04%	0.02%	0.02%
0.001	3.2%	0.4%	0.1%	2.5%	0.4%	0.03%	0.03%

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

Supplemental characteristics

Sensing Modes	2-wire or 4-wire (Remote-sensing) connections		
Maximum sense lead resistance:	1 k Ω for rated accuracy		
2W internal voltage drop	<60mV/A		
Max voltage between High Force	2V		
and High Sense			
Maximum output voltage in	>range 105% (200V range>202V)		
output connector			
DC floating voltage	Max ±250 V DC between low force and chassis ground		
Sweep	Sweep step time: from 20uS to 16S, Max:64K 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		
Over voltage protection	Turn off output when output voltage great than OVP setting value,		
	recover operation after power reset,		
	Accuracy: ±(1%Setting+500mV)		
Other abnormal protection	Power reset, recover operation or hardware damage		

Communication port

LAN		100BASE-T / 10BASE-T		
USB		USB 2.0 HOST (front)		
		USB 2.0 DEVICE (back)		
Digital I/O DB9	Pin5	GND		
MAX input voltage: 5.25V	Pin6	IO1,Digital I/O, Synchronous signal input		
Min input voltage: -0.25V	Pin7	IO2,Digital I/O, Synchronous signal output		
Min logic H input voltage: 2.1V				
Max logic L input voltage: 0.7V,				
Max source current: 2mA				

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Max sink current: -50mA		
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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
Altitude	Operating: 0 m to 2000 m, Storage: 0 m to 4600 m
Power supply	90 V to 264 V, 47 Hz to 63 Hz, 250 VA maximum
Warm-up	1 hour
Dimensions	450 × 212 × 105mm (with foot pad/handle/ rotary Knob)
Weight	Net weight 5.2 kg

Front Panel

Display	5.0" TFT color display (800x480), Capacitive touchscreen
Hardkeys	Trigger,Home,Cancel, power on, output on/off, rotary Knob
Softkeys	LCD Mapping function keys
Connectivity	USB Host, output, ground

Rear panel

Connectivity	LAN, DB9, USB device,AC socket, Ground

Ordering information and accessories

Power cable, USB cable, quick reference, U disk (including PDF manuals, quick I/V Measurement Software and drivers)

Model number	
S3012H	Single Channel Precision Source Meter, pulser

About Us

We are leading supplier in Test and Measurement Instruments and equipment in China, we founded in 2017 and located at No. 1508, Xiangjiang Road, Suzhou High Tech Park. We also provide integrated and customized turnkey solutions through Test and Measurement Instruments, Automatic Test Systems.

Our focal points are tests and measurements on high-speed optical communication, such as laser chip testing, laser chip burning, silicon chip testing, TO component burning and optical transceiver testing. More importantly, we also drive ourselves toward Semiconductor IC test and measurement by providing turnkey test solutions in KGD, WLR and WAT tester and other under-development projects.