BOURNS®

Features

- Formerly a Riedon™ product
- Nominal current: 100 A to 1000 A
- AC or DC circuits
- 1500 VDC reinforced isolation
- Tolerance of ±0.2 %
- Amplified differential output: ±2.5 V peak
- RoHS compliant*

Applications

- Battery systems
- Renewable energy
- Motor drives
- EV charging stations

Riedon™ SSA-2 Series Shunt Sensors – Analog by Bourns

Specifications

Characteristic	SSA-2-100A	SSA-2-250A	SSA-2-500A	SSA-2-1000A
Nominal Current (A)	100	250	500	1000
Differential Analog Output ±2.6 volts maximum unclipped	±12.5 mV/A	±5 mV/A	±2.5 mV/A	±1.25 mV/A
Power Dissipation Rated current at primary terminations	4 W	9 W	17 W	35 W
Maximum Current (unclipped output)	200 A	500 A	1000 A	2000 A
Over Current (1 s, clipped)	600 A	1500 A	3000 A	6000 A
Power Supply (3.0 to 5.5 VDC) with high impedance load	@ 3.0 V, 20 mA typical		@ 5.5 V, 40 mA typical	
DC Offset @ 25 °C	≤ ±0.4 mV (10 Hz LP filter)			
Initial Accuracy @ 25 °C	±0.2 % (Offset is zeroed prior to calibrating using DC current)			
TCR (25 °C - 95 °C)	±30 PPM/°C			
Bandwidth (electronics)	300 kHz			
Reaction Time (typical)	1.6 µs (input step function, 50 % rise on input to 50 % rise on output)			
Common Mode Rejection Ratio	CMRR: -100 dB @ DC, -98 dB @ 10 kHz			
Common Mode Transient Immunity	CMTI: 80 kV/µS typical, 55 kV/µS minimum			
Signal to Noise Ratio (SNR)	VIN = 100 mVPP, fIN = 1 kHz, BW = 10 kHz 80 dB min., 84 dB typical VIN = 100 mVPP, fIN = 10 kHz, BW = 100 kHz 70 dB typical			
Long-Term Stability	< ±0.2 % 1000 hours 45 °C terminal temperature < ±0.5 % 1000 hours 100 °C terminal temperature			
Reinforced Isolation	1500 VDC 1000 VAC RMS (maximum continuous working voltage)			
Dielectric Strength	3500 VAC RMS 1 minute			
Operating Temperature	-40 °C to +115 °C ambient -40 °C to +125 °C primary conductor (see derating curve on page 4)			
Storage Temperature	-55 °C to +125 °C			

How to Order

SSA-2 - 100A

Model (SSA-2)

Nominal Current (100A)
- 100A = 100 A
- 250A = 250 A
- 500A = 500 A
- 1000A = 1000 A

Materials (RoHS Compliant)

Resistance Element............... Manganin™
Terminal Block .... Nickel-plated copper
Electronics Housing........ UL 94-V0 rated
Potting Material............... UL 94-V0 rated

Additional Information

Click these links for more information:

PRODUCT | TECHNICAL LIBRARY | INVENTORY | SAMPLES | CONTACT

Product Safety Notice

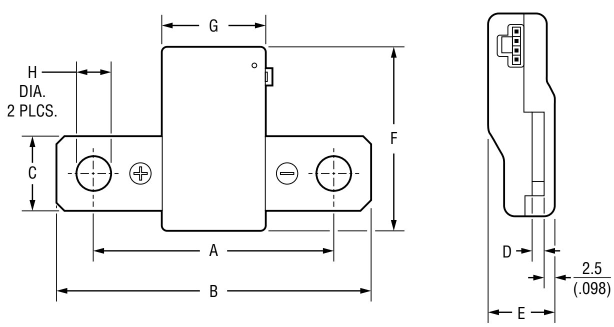
The Model SSA-2 Shunt Sensor must be used in a manner specified by this data sheet, otherwise the protection provided by the equipment may be impaired. The Model SSA-2 Series should not be treated as a structural part of the installation and must be properly supported on both ends.

WARNING Cancer and Reproductive Harm
www.P65Warnings.ca.gov

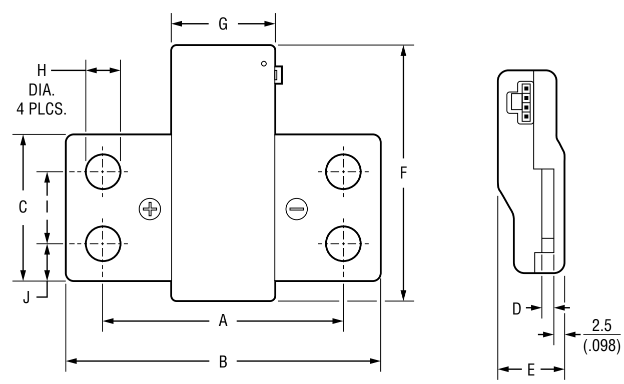
*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

Product Dimensions

SSA-2-100A to SSA-2-500A



SSA-2-1000A



Product Dimensions

Model	SSA-2-100A	SSA-2-250A	SSA-2-500A	SSA-2-1000A
A	63.5 ± 0.5 (2.50 ± .020)			
B	84 ± 0.5 (3.307 ± .020)			
C	20 ± 0.5 (.787 ± .020)			40 ± 0.5 (1.575 ± .020)
D	3 ± 0.5 (.118 ± .020)		4 ± 0.5 (.157 ± .020)	
E	16.4 ± 0.5 (.646 ± .020)		17.4 ± 0.5 (.685 ± .020)	
F	48.7 ± 0.5 (1.917 ± .020)			68.7 ± 0.5 (2.705 ± .020)

Model	SSA-2-100A	SSA-2-250A	SSA-2-500A	SSA-2-1000A
G	28 ± 0.5 (1.102 ± .020)			
H	8.7 ± 0.5 (.343 ± .020)			
I	–	–	–	19 ± 0.5 (.748 ± .020)
J	–	–	–	10.5 ± 0.5 (.413 ± .020)
Mass (g)	67	69	84	145

DIMENSIONS: MM / (INCHES)

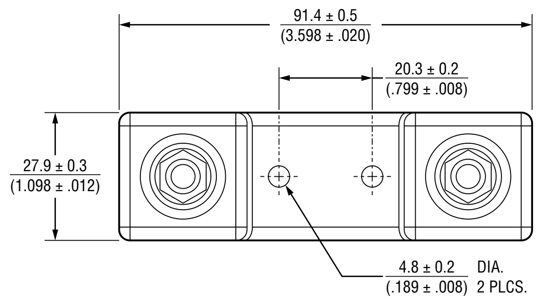
Connectors

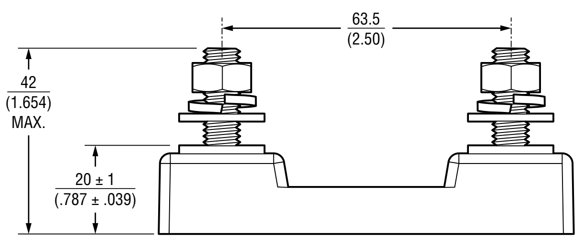
Mating Connector	Molex Part Number
4-Pin Female	1053071204
20-22 AWG Female Crimp Terminals	1053002200*
4-Pin TPA (Optional)	1053251004

* Use Gold (Au) plated contacts for 115 °C temperature rating.

Optional Base Mounting Fixtures

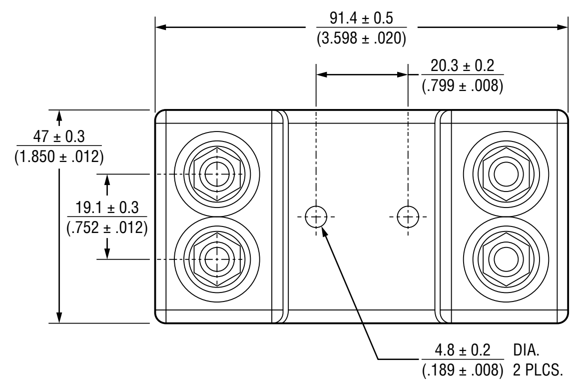
SSA-BASE (Model SSA-2-100A ~ SSA-2-500A)

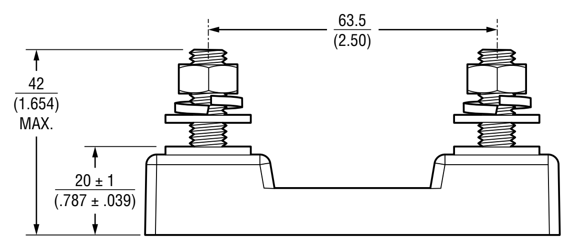




DIMENSIONS: MM / (INCHES)

SSA-BASE-1K (Model SSA-2-1000A)





DIMENSIONS: MM / (INCHES)

Features:

- Robust design
- 5/16-18 Stainless Steel Hardware
- Torque Nuts:
  11-13 ft-lb (15-17.6 N-m)
- Accessories made from UL 94-V0 rated materials

Optional SS-CABLE Power / Serial Connection

SS-CABLE-1M

Serial Output		
White	Analog (–)	Pin 1
Yellow	Analog (+)	Pin 2
Black	Ground	Pin 3
Red	+3.0 to 5.5 V	Pin 4

- For all SSA-2 models
- Color-coded 22 ga wire
- Two twisted pairs
- 1 meter standard length

Frequently Asked Questions

Q: How does the Model SSA-2 Series compare with Hall Effect technology?

A: When compared to Hall Effect technology, the Model SSA-2 Series Shunt Sensor - Analog will offer:

- Immunity to stray magnetic fields
- Unlike closed loop hall sensors, the Model SSA-2 Series has a unipolar power supply requirement
- No hysteresis
- Low-noise resolution and offset performance allows accurate low-current measurements
- Superior offset, gain and linearity performance over entire temperature range
- Low noise
- Higher bandwidth (300 kHz vs 50 kHz)
- Lighter weight
- Superior stability
- No sensitivity to conductor positioning
- No periodic calibration

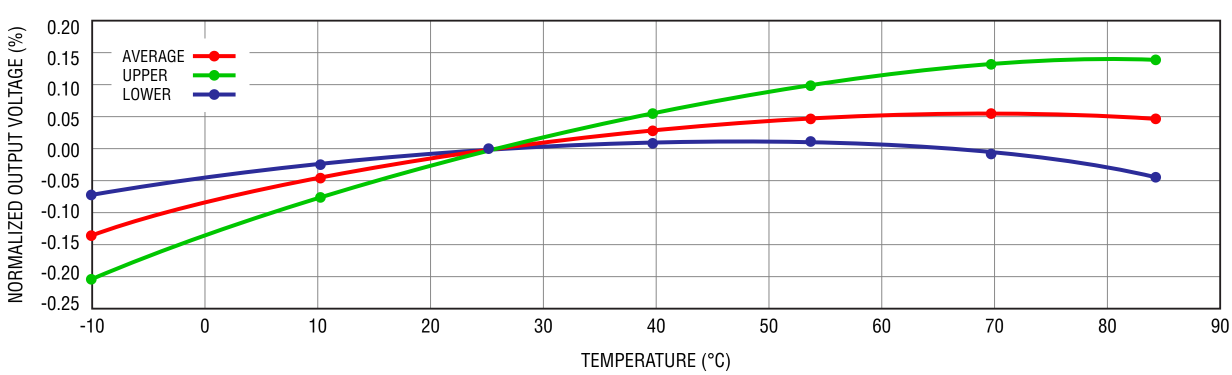
Q: Is the Model SSA-2 Series suitable for AC measurements?

A: The wide bandwidth of the SSA makes it appropriate for measuring AC as well as DC currents.

Q: How does the output vary with temperature?

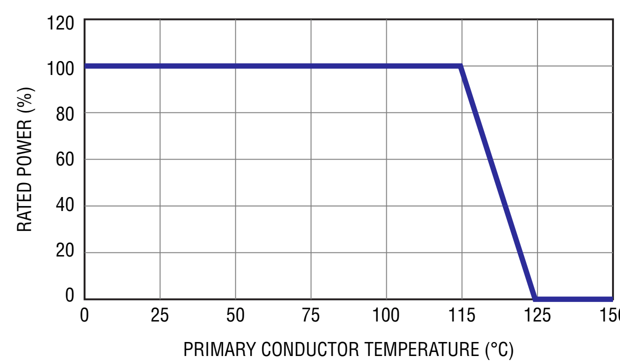
A:

Typical Output vs Temperature



Q: Is there a derating for temperature?

A:



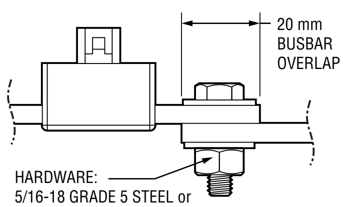
Q: What are the overload capabilities of the Model SSA-2 Series?

A: The output reading will saturate with an input current that exceeds the corresponding maximum unclipped voltage output of 2.62 volts. Ultimately, the overload capabilities are thermally limited per the derating curve.

Frequently Asked Questions (Continued)

Q: What is the best way to connect to the Model SSA-2 Series terminals?

A: Make sure connections are clean and well prepared. Bolts must be torqued to the hardware manufacturer's recommendations. There should be sufficient clamping force to ensure proper connection. Overlap shown below should be taken as a minimum. Suitable for copper, copper-clad aluminum or aluminum conductors.



Q: How much heat does the Model SSA-2 Series Shunt Sensor create?

A: A majority of the heat generated by the Model SSA-2 Series is dissipated through the primary conductors. Care should be taken to ensure that the primary conductors are sized appropriately given expected amperage and conductor length. We recommend a 70 °C maximum conductor temperature. If there are thermal concerns, oversizing the conductors will help minimize the operating temperature of the shunt sensor.

Q: Is it necessary to install the Model SSA-2 Series on the low side of the circuit?

A: The Model SSA-2 Series Shunt Sensors are completely isolated, so it may be installed in either the low or high side of the circuit.

Q: What size wire is suitable for the Model SSA-2 Series?

A:

Copper Conductor Ampacity Ratings (continuous)					
mm^2	AWG	Amps (75 °C)	mm^2	AWG	Amps (75 °C)
13.3	6	65	107	0000 (4/0)	230
21.2	4	85	127	250 MCM	255
33.6	2	115	152	300 MCM	285
42.4	1	130	203	400 MCM	335
54	0 (1/0)	150	253	500 MCM	380
67	00 (2/0)	175	380	750 MCM	475
85	000 (3/0)	200	887	1500 MCM	625

Q: Thermal EMF?

A: Thermal EMF happens when the two sensing terminals of the shunt sensor experience different temperatures. This phenomenon is essentially eliminated with the differential output of the device. It is still possible that the two current carrying terminals could experience a temperature differential, however. This offset would be 0.5 mV/°C.

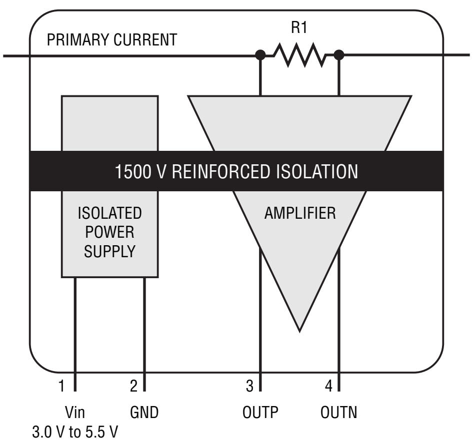
Q: Is there a version with digital outputs?

A: Bourns plans to develop digital output versions in the very near future.

Frequently Asked Questions (Continued)

Q: Is there a functional diagram of the general layout?

A:

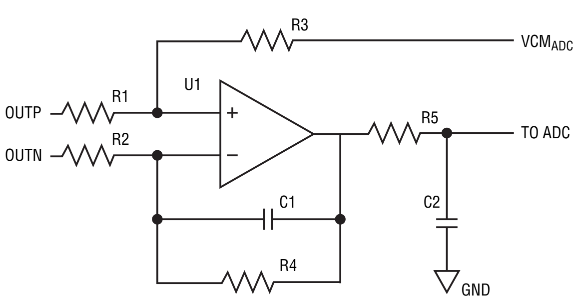


Q: How do I improve the signal to noise ratio (SNR) of the shunt sensor?

A: Oversampling and averaging are two ways to increase SNR and resolution.

Q: Is there a way to convert the differential output to a single-ended output?

A: VCM will be the new zero current point and the output will be offset by this amount. R3, R4, RS set the gain.



Q: Is there another way to read the differential output with single ended ADCs?

A: The Model SSA-2 Series outputs have a common mode voltage of about +1.44 VDC referenced to ground. The difference between OUTP and OUTN is the differential voltage. You can use two single-ended ADC channels to measure the OUTP and OUTN voltages referenced to ground and then just subtract the two in software to find the differential voltage. Ideally, you would do a simultaneous measurement, if possible.

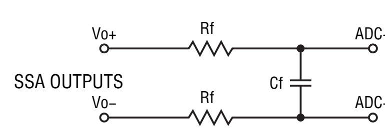
For example: If OUTP measures 1.85 V and OUTN measures 1.03 V the differential voltage is 1.85-1.03 = 0.82 V.

Q: I notice a high frequency noise on the output signal, why is this?

A: The Model SSA-2 Series Shunt Sensor has an output chopper circuit at 625 kHz. This is how we achieve the good DC-accuracy and low temperature drift of offset and gain. Chopping noise is the differential errors (mismatch, etc.) that have been modulated to high frequency to remove them from the baseband. The chopping noise is far above the Model SSA-2 Series bandwidth of 300 kHz. Use an analog filter to attenuate if necessary, see below.

Q: How do I improve the stability of precision DC current readings?

A: ***Analog Filtering:*** The Model SSA-2 Series has no internal filtering to maximize its 300 KHz bandwidth for high speed AC measurements. Most applications will operate at much lower frequencies and would benefit greatly from analog filtering, especially for DC signals. A low pass RC filter before the AID converter will improve the signal. Pick the lowest practical filter frequency. Typically one would prioritize lower resistance values and higher capacitances to reduce Johnson noise and output impedance.



$$f_{3dB} = \frac{1}{4\pi R_f C_f}$$

A: ***Digital Filtering:*** The filtering can be done digitally by the CPU. Averaging multiple readings will stabilize the readings at the cost of CPU cycles.

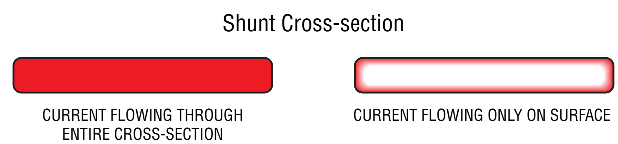
Frequently Asked Questions (Continued)

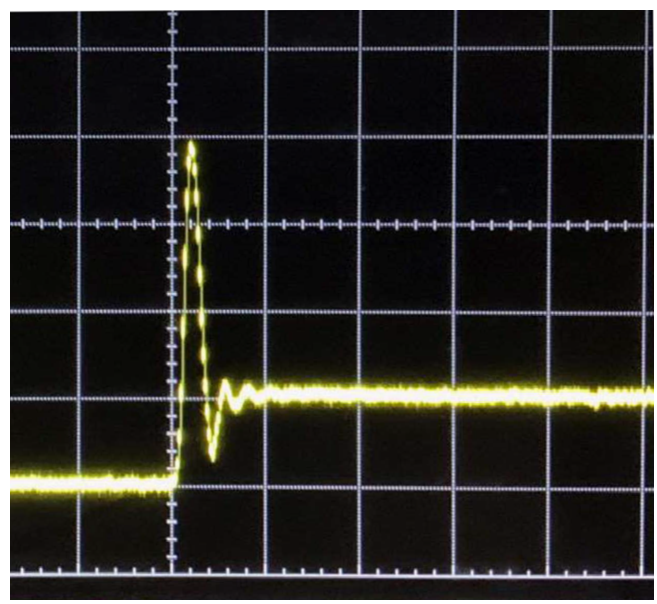
Q: I'm getting overshoot on fast rising currents. Why?

A: When using the Model SSA-2 Series in square wave or pulse applications without filtering, the output will have an excessive amplitude due to the skin effect of the shunt. This will be true with microsecond rise-time currents.

The output of the shunt is inversely proportional to its effective cross-sectional area. For the first couple of microseconds the current is flowing on the surface of the resistance material and not evenly across the whole cross-sectional area like with lower frequency currents. The higher the ΔI/Δt, the lower the effective cross-section which results in a higher resistance and a higher output voltage. In under 10 microseconds, the current is flowing through the whole cross-section and the output returns to normal.

The amplitude of the pulse is hard to quantify as it is highly dependent on the rest of the circuit's reactance. Filtering is the usual answer. This can either be placed on the output of the Model SSA-2 Series Shunt Sensor before the ADC or Bourns can add a filter internally on the sensing side of the electronics. Contact Bourns if this is required.





Step response from Fluke 5220A amplifier at 20A square-wave current (no load), 20 μs/div range

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