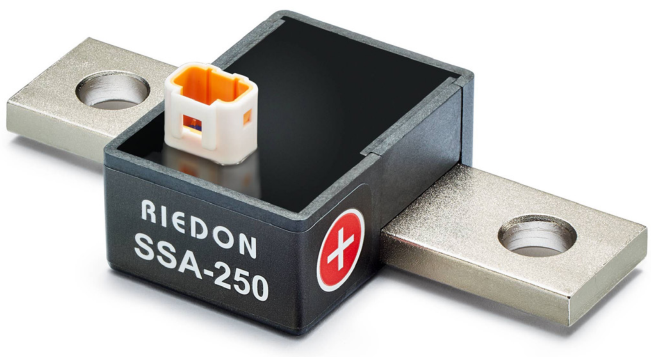
SSA - Smart Current Sensor

Amplified Analog Output and Reinforced Isolation



- **100A to 1000A**
- **1500VDC Reinforced Isolation**
- **Amplified Output**
- **0.1% Tolerance**
- **Compared to Hall Effect Technology**
  - » ***Superior Overall Current Measurement Accuracy***
  - » ***Unipolar Power Supply***
  - » ***Lower Temperature Drift***
  - » ***No Periodic Calibration***
  - » ***Higher operating temperature range***
- **Typical Applications:**
  - » ***Battery Systems***
  - » ***UPS systems***
  - » ***Motor Drives***
  - » ***Frequency Inverters***
  - » ***Fuel Cells***

SPECIFICATIONS		
Nominal Current	100A, 250A, 500A, 1000A - others on request	
Maximum Current	2 times nominal	
Power Supply (3.0 to 5.5vdc)	3.0V, 20mA typical high impedance load	5.5V, 40mA typical high impedance load
Differential Analog Output 2.62 volts maximum unclipped	100A =12mV/amp 250A = 5mV/amp	500A = 2.5mV/amp 1000A = 1.25mV/amp
Offset (maximum)	≤ ± 0.3mV	
Initial Accuracy	± 0.1% (offset is zeroed prior to calibration)	
Linearity over Current Range	± 0.1% of range	
Bandwidth (unfiltered)	300kHz	
Reaction Time (typical)	1.6μS (input step function, 50% rise on input to 50% rise on output)	
Thermal EMF (maximum)	0.05mV/°C	
Long term stability	< ±0.2% 1000 hours 45°C terminal temperature < ±0.5% 1000 hours 100°C terminal temperature	
Reinforced Isolation	$1500V_{DC}$ $1000V_{AC}$ RMS (maximum working voltage)	
Operating Temperature	- 40°C to +85°C ambient - 40°C to +125°C primary conductor (see derating curve on page 4)	
Storage Temperature	- 55°C to +125°C	
Materials	Resistance Element: Manganin Terminal Block: Nickel Plated Copper Suitable for Copper, Copper-Clad Aluminum or Aluminum conductors Electronics Housing: 94-V0 Potting Material: 94-V0 rated	
Secondary Mating Connector	JST type J04R-JWPF-VSLE-S (housing), SWPR-001T-P025 (contact)	
Optional Accessories	SSA-CABLE-length (pre-terminated mating cable, 1 meter standard) SSA-BASE (Insulated panel mounting fixture (94-V0))	

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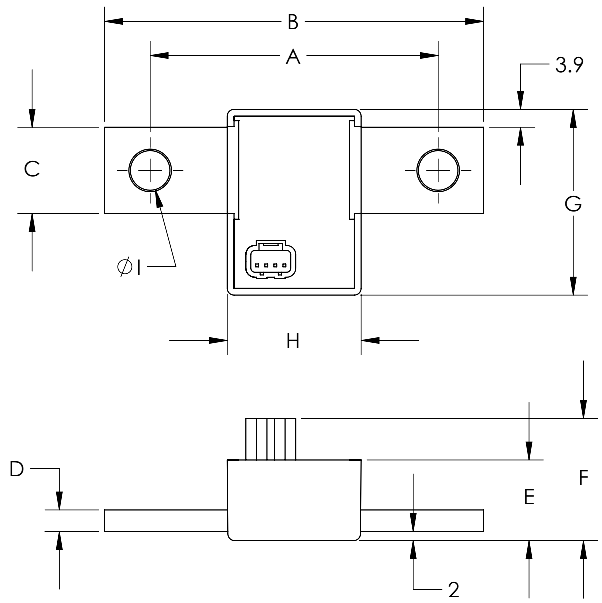
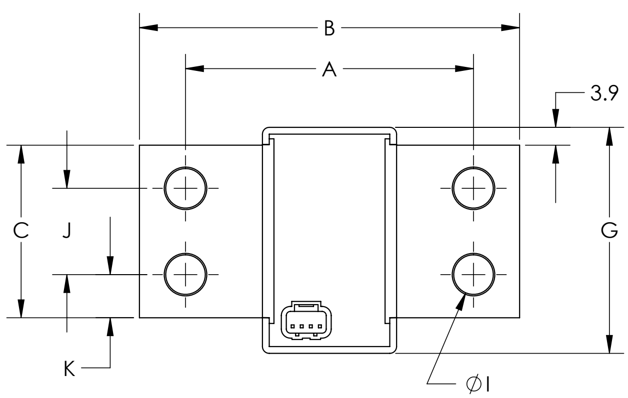
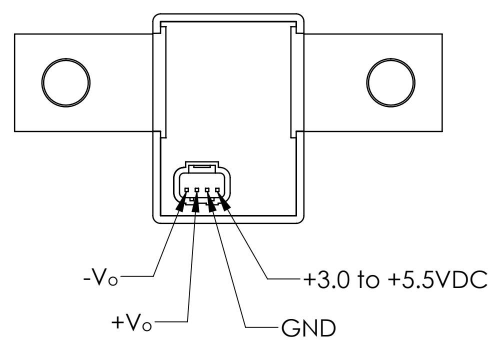
Standard Configuration



		Dimensions (mm)			
		SSA-100	SSA-250	SSA-500	SSA-1000
A	(±0.5)	63.5	63.5	63.5	63.5
B	(±0.5)	83.8	83.8	83.8	83.8
C	(±0.3)	19.1	19.1	19.1	38.1
D	(±0.3)	4.9	4.9	8	8
E	(±0.3)	17.8	17.8	21.3	21.3
F	(MAX)	29	29	33	33
G	(±0.5)	41	41	41	50
H	(±0.5)	29.8	29.8	29.8	29.8
I	(±0.2)	8.7	8.7	8.7	8.7
J	(±0.3)	-	-	-	19.05
K	(±0.3)	-	-	-	9.5
Mass		80g	90g	121g	215g





Product Safety notice: The SSA current sensor must be used in a manner specified by this datasheet, otherwise the protection provided by the equipment may be impaired

Please note that the SSA series should not be treated as a structural part of the installation and must be properly supported on both ends.

Ordering Information

Example: SSA-250

Size
100
250
500
1000

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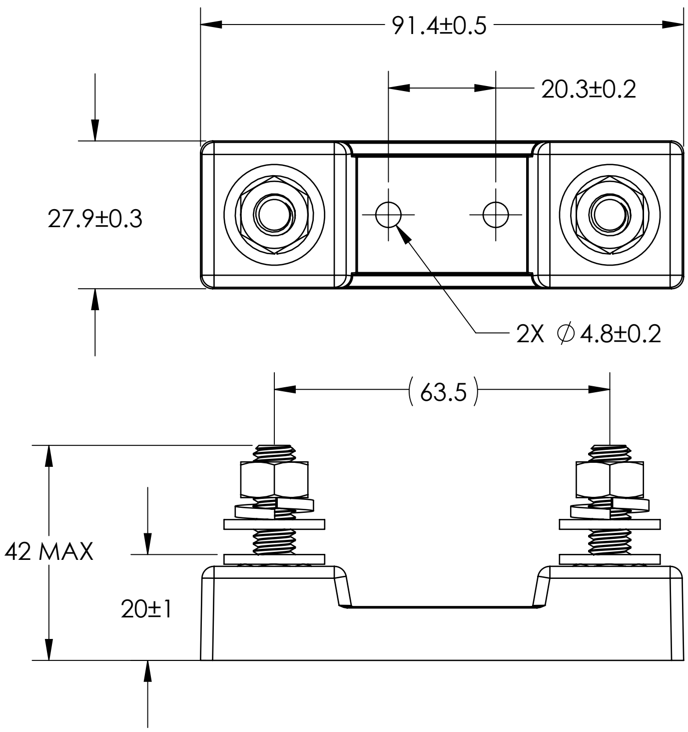
SSA-BASE Mounting Fixture (Optional)



- **For SSA-100 thru SSA-500**
- **Robust design**
- **5/16-18 Stainless Steel Hardware**
- **Torque Nuts:**
  11-13 ft-lb (15-17.6 N-m)
- **UL 94-V0 rated materials**

Ordering Info: SSA-BASE

SSA-CABLE Power/Output Connection (Optional)

Differential Output	
White	Analog (-)
Yellow	Analog (+)
Black	Ground
Red	+3.0v to 5.5v

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

SSA shown with optional accessories

Ordering Info: SSA-CABLE-length

Example: SSA-CABLE-1M

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RIEDON

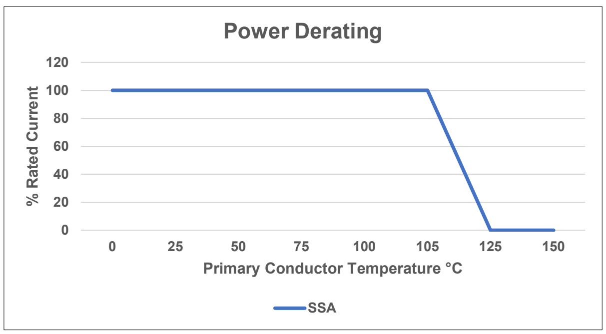
Frequently Asked Questions

Q: How does the Riedon SSA compare with hall effect technology?
A: When compared to hall effect technology, the SSA smart current sensor will offer:

- Immunity to stray magnetic fields
- Unlike closed loop hall sensors, the SSA 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 (300KHz vs 50KHz)
- Lighter weight
- Superior stability
- No sensitivity to conductor positioning
- No periodic calibration

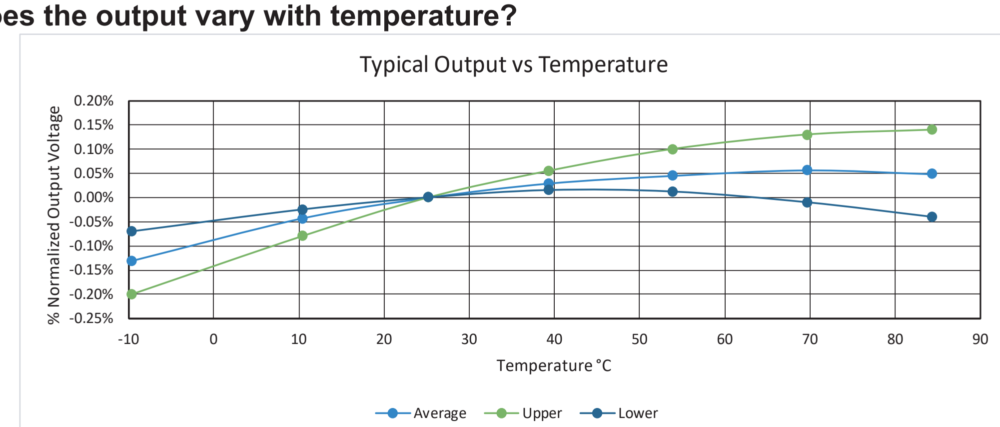
Here is a document published by Texas Instruments that discusses some of the technical aspects:
http://www.ti.com/lit/sbaa293

Q: Is there a derating for temperature?
A:



Q: How much heat does the SSA smart current sensor create?
A: A majority of the heat generated by the SSA 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 smart current sensor.

Q: How does the output vary with temperature?
A:



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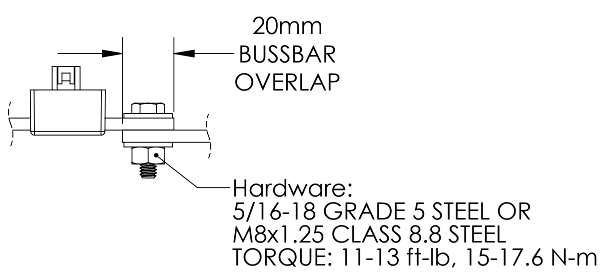
Frequently Asked Questions

Q: What are the overload capabilities of the SSA?

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

Q: What is the best way to connect to the SSA's terminals?

A: Make sure connections are clean and well prepared. Bolts to 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: Is it necessary to install the SSA on the low side of the circuit?

A: The SSA series of smart current sensors is completely isolated, so it may be installed in either the low or high side of the circuit.

Q: Thermal EMF?

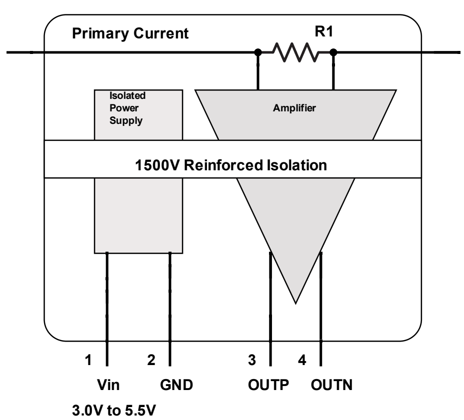
A: Thermal EMF happens when the two sensing terminals of the current sensor experience different temperatures. This phenomenon is essentially eliminated with the differential output of the SSA. It is still possible that the two current carrying terminals could experience a temperature differential, however.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

Q: Is there a version with digital outputs?

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

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

A:



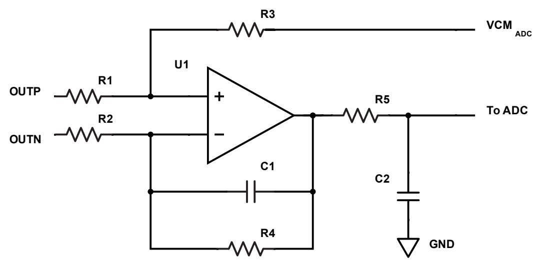
Frequently Asked Questions

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

A: Oversampling and averaging are two ways to increase SNR and resolution. See the following link for a full explanation: https://www.cypress.com/file/236481/download

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

A:



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

A: ***Analog Filtering***: The Riedon SSA smart current sensor has no internal filtering to maximize its 300KHz 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 A/D converter will improve the signal. Pick the lowest practical filter frequency.

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. Using an exponential digital filter can be very effective in that it gives an immediate usable reading that gets more accurate with each subsequent reading. The C code is like this:

```
filteredVadc += (newVadc - filteredVadc) * Weight;
```

Weight is the feedback percentage given to the newVadc reading. This is a number between 0 and 100% but is typically between 1% and 20%. Every new ADC reading will change the filtered value by a percentage of the difference between the two. Higher values respond more quickly, lower values more slowly.

Additional code can be added to improve the hysteresis of the filtered Vadc which “resets” the value if the difference between the filtered Vadc and the newVadc is larger than x%. This code resets the value if they are more than 1% different:

```
if ( ( abs(filteredVadc) < abs(0.99 * newVadc)) || ( abs(filteredVadc) > abs(1.01 * newVadc)) ) {
        filteredVadc = newVadc;
    }
else {
        filteredVadc += (newVadc - filteredVadc) * 0.15;      // 15% weighting on newVadc
    }
```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