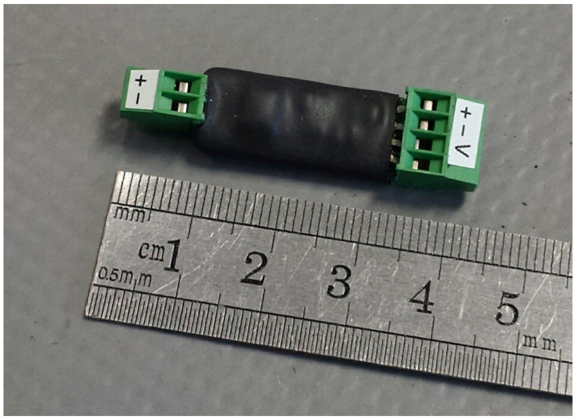


Precision Instrumentation Amplifier Datasheet

General Description

SMT's Precision Instrumentation Amplifier is used to interface sensitive bipolar sensors to data acquisition equipment.

This amplifier is to be used with sensors that produce a differential voltage output in microvolt to millivolt ranges. The amplification circuit provides 1000 times voltage gain, as well as both low and high frequency AC filtering.

This datasheet covers performance and usage information for this amplifier as well as an application note of its usage with an Omega HFS-4 series heat flux sensor.

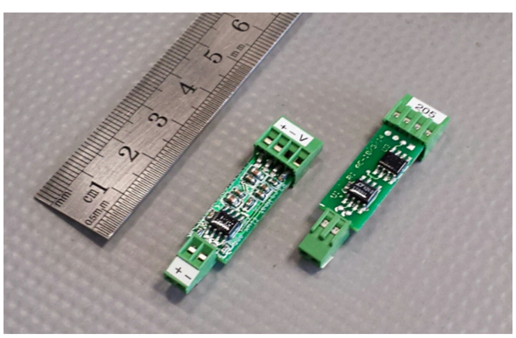
Applications

- Heat Flux Measurements
- High Precision Load Cells
- Piezoelectric Sensor Measurements

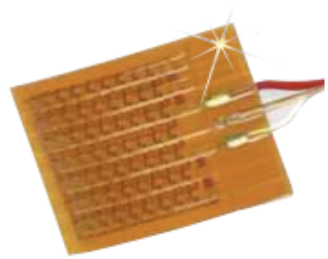
Features

- Differential Inputs converted to ground referenced output.
- 1000 times differential voltage gain.
- Can measure differentially in both directions due to 2.5v offset on output.
- Optional voltage supply to interface with sensors requiring external power.
- AC filtering on output including 50/60Hz rejection.
- Requires no external power if used inline with SMT's data acquisition devices.
- Compatible with SMT A2, A3 and WiDAQ dataloggers.
- Compact design, can be placed inline between sensor and datalogger.

Gain Amp



Heat Flux Sensor



Performance/Functional Specifications

Electrical Performance	
Voltage Supply	5 V – 18V DC
Current Draw	Typical 1mA– MAX 20mA
Shorted Output Voltage	2.500V +/- 10mV
Voltage Gain	1000x (other gains available)
Error	+/- 1%
Max Output Swing	0V – 3.000V
Start up Time	5 ms

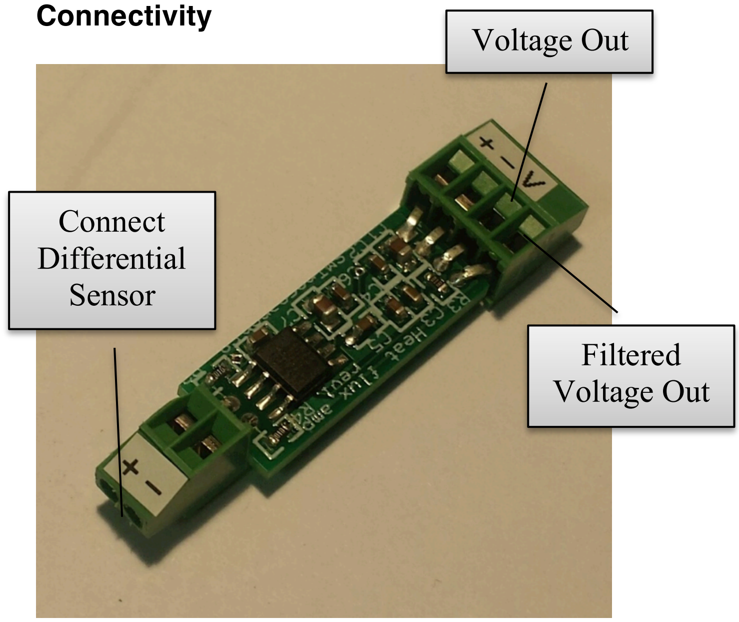
Environmental	
Operating Temperature	0° to 70°C°
Storage Temperature	-25° to 70°C
Humidity	5% to 90% RH non-condensing
Electrostatic Discharge (ESD)	8kVdc air, 4 kVDC contact (exposed inputs)

Safety	
Safety Requirements	SELV Separated Extra Low Voltage

Mechanical	
Standard Enclosure	
Case Dimensions Weight	50mm (L) x 35mm (W) x 20mm (H) 15g
Connections	
Input	(+) – Positive Differential (-) – Negative Differential
Output (leaded version)	Red – Power / 5v Black – Ground White – Voltage Output Wire colour codes may differ depending on the type of cable used.

Measurement Performance	
Linearity	70 ppm over full range
Input Range	-500uV to 400uV
Output Resolution	1 mV
Accuracy	+/- 2mV
Operation temperature	typ. 5 ppm/°C – MAX 50 ppm/°C

Connectivity



Connect the datalogger to the positive, negative and voltage out terminals.

The voltage port is located to the right of power and ground. The right most output is a filtered voltage output. Use this output if your signal appears to have any jitter or noise. Response time from this port is slower due to the noise cancelling capacitors.

Connect the sensor to the +/- port.

Note: A 2.5V offset is applied. Before using determine the exact offset by shorting the +/- inputs and measure the voltage across Vout and Ground.

Output readings will then be:

2.500V– Reading = Amplified Reading

Application Note

Heat Flux Sensor with A3 DataLogger

This guide covers the installation of an OMEGA HFS-4 heat flux sensor used with the SMT Precision Instrumentation Amplifier and SMT's monitoring system.

Step 1 – Calibrating the Amplifier

a) Note the amplifier gain, typical gain amplifier to be used with the HFS-4 is 1000 times.

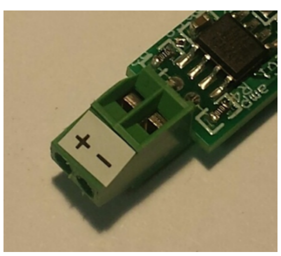
b) Connect the gain amp to the datalogger (WiDAQ, A2 or A3).

c) Change the dynamic range of the datalogger to 16x to give a range +/-312.5mV. For more accurate measurements 32x can also be used.

d) WiDAQ: Write 0x24 to Address 0x250

e) A2/A3: Write the following:
- Address: 18 Value: 4 Select Set
- Address: 255 Value: 1 Select Set

f) Offset should be near -156250. Perform a recalibrate/zero again after doing this.



g) Zero any error or drift in the datalogger circuit. Short the differential inputs with a small wire.

h) Take a few readings and make sure they are showing up in the BiG software, all samples taken should be within 100uV.

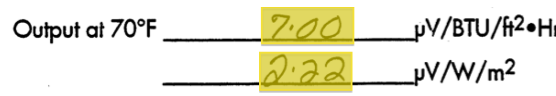
i) Select calibrate in BiG by right-clicking the sensor you wish to calibrate and pan/zoom the time graph to contain only the readings where the inputs were shorted and are consistent. Select calibrate.

j) The datalogger is now ready to read differential voltages centred at 0uV.

Step 2 – Calibrating the Heat Flux Sensor

a) Connect the heat flux sensor to the differential port. The RED wire is positive, the WHITE wire is negative.

b) Open the calibration report that came with your heat flux sensor and make note of the units highlighted below.



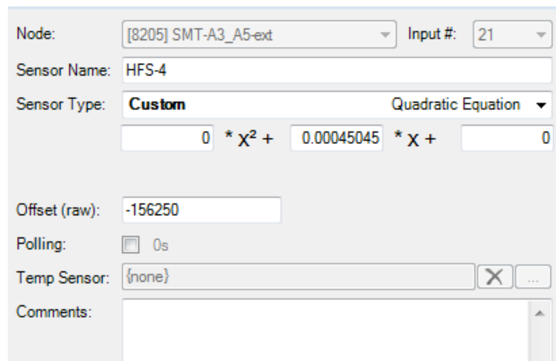
c) Right click the sensor in BiG and click configure. Choose *Custom – Quadratic Formula* as sensor type.

d) Calculate b multiplier:

   a. Multiply calibration value by 1000. Example: 1000 x 2.22

   b. Calculate inverse value. Example: 1/2220 = 0.00045

e) Enter value as b in quadratic formula $ax^2 + bx + c$



a) Calculated value is in W/m2

b) Note the temperature factor graph below. If your mean temperature is known, multiply this number into the transfer function above.

c) Your Heat flux sensor is now ready to be used for measurements.