

Precision Thermocouple Amplifier (Thermocouple to Digital Converter with Linearization- SPI Interface)

This precision thermocouple sensor module performs cold-junction compensation and digitizes the signal from any type of thermocouple. The output data is formatted in degrees Celsius. The converter resolves temperatures to 0.0078125°C, allows readings as high as +1800°C and as low as -210°C (depending on thermocouple type), and exhibits thermocouple voltage measurement accuracy of $\pm 0.15\%$. The thermocouple inputs are protected against overvoltage conditions up to $\pm 45\text{V}$. A lookup table (LUT) stores linearity correction data for several types of thermocouples (K, J, N, R, S, T, E, and B). Line frequency filtering of 50Hz and 60Hz is included, as well as thermocouple fault detection. An SPI-compatible interface allows the selection of thermocouple type and setup of the conversion and fault detection processes. The operating supply of the project is 5V and it consumes a very low current. The module communicates over the SPI interface.

Testing this module with Arduino is very easy. The pin configuration information is available below. Adafruit library and example code are available at the Adafruit website below and on downloads under the article.

<https://learn.adafruit.com/adafruit-max31856-thermocouple-amplifier/wiring-and-test>

Arduino Pin Configuration, Connector Cn1

CN1 Pin 1 >>5V

CN1 Pin 2>>>DY DIGITAL PIN D5

CN1 Pin 3>>>CS DIGITAL PIN D10

CN1 Pin 4>>>SK DIGITAL PIN D13

CN1 Pin 5>>>SO DIGITAL PIN D12

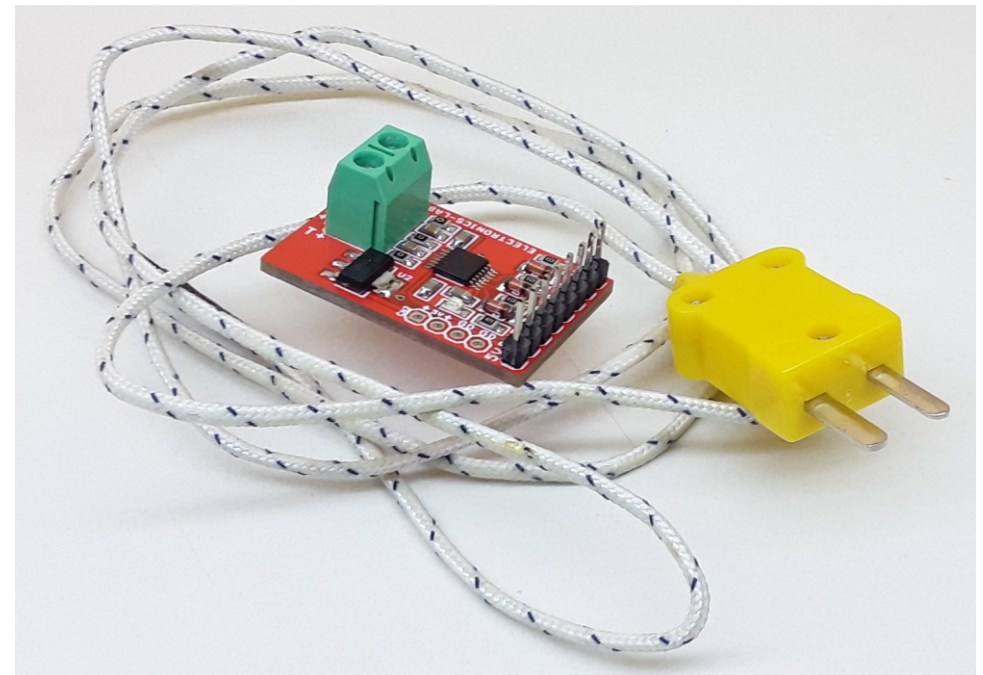
CN1 Pin 6>>>SI DIGITAL PIN D11

CN1 Pin 7>>>FUALT NO CONNECTION

CN1 Pin 8>>>GND

Features

- Supply 5V DC @ 10mA
- Supports K, J, N, R, S, T, E and B Type Thermocouples
- Easy SPI Interface
- Screw Terminal for Easy Sensor Connections
- Male Header Connector for Micro-Controller Connections
- On Board Power LED
- Detects Open Thermocouples
- Over- and Under temperature Fault Detection
- Provides High-Accuracy Thermocouple Temperature Readings
- Includes Automatic Linearization Correction for 8 Thermocouple Types
- $\pm 0.15\%$ (max, -20°C to +85°C) Thermocouple Full- Scale and Linearity Error
- 19-Bit, 0.0078125°C Thermocouple Temperature Resolution
- Internal Cold-Junction Compensation Minimizes System Components
- $\pm 0.7^\circ\text{C}$ (max, -20°C to +85°C) Cold-Junction Accuracy
- $\pm 45\text{V}$ Input Protection Provides Robust System Performance
- Simplifies System Fault Management and Troubleshooting
- 50Hz/60Hz Noise Rejection Filtering Improves System Performance
- PCB dimensions: 21.59 x 33.81 mm



BOM						
NO.	QNTY.	REF.	DESC.	MANUFACTURER	SUPPLIER	SUPPLIER PART NO
1	1	CN1	8 PIN MALE HEADER PITCH 2.54MM	WURTH	DIGIKEY	732-5321-ND
2	1	CN2	4 PIN MALE HEADER PITCH 2.54MM	DNP		DNP
3	1	CN3	2 PIN SCREW TERMINAL PITCH 5.08MM	PHOENIX	DIGIKEY	277-1247-ND
4	3	C1,C4,C5	0.1uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
5	2	C2,C3	0.01uF/50V SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
6	1	D1	LED SMD SIZE 0805	OSRAM	DIGIKEY	475-1278-1-ND
7	3	D2,D3,D4	1N4148 SMD	MICROCHIP	DIGIKEY	1N4148UR-1-ND
8	2	L1,L2	FERRITE BEAD OR 100E 5% RESISTOR SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
9	1	R1	470E 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
10	3	R2,R3,R4	10K 5% SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
11	1	R5	0E SMD SIZE 0805	MURATA/YAGEO	DIGIKEY	
12	1	U1	MAX31856	MAXIM	DIGIKEY	MAX31856MUD+-ND
13	1	U2	LM117-3.3V	TI	DIGIKEY	LM1117MP-3.3/NOPBCT-ND

