Installation Instructions for:

30-2204
4 Channel Thermocouple Amplifier

The Advanced Engine Management (AEM) 4 channel thermocouple amplifier revolutionizes temperature measurements by providing laboratory grade accuracy for your temperature measurements. The accuracy is guaranteed to be better than 1% full scale, even at the extremes of the temperature range. It is designed either for integration into vehicles already fitted with aftermarket ECU's or other devices that can accept an analog signal for either analysis or logging. Alternately, an RS-232 output is available to allow other programmable devices to use or display the thermocouple temperature data.

AEM achieves it's accuracy by starting with a 100% surface mount PCB. The four differential temperature inputs are fed into an A/D converter then fitted using a 3 stage, 8th order polynomial curve fit. This value is then compensated using our on board cold junction temperature measurement. The temperature values are output on four seperate 0-5v analog outputs and a 232 serial datastream.

The thermocouple amplifier can be mounted in the engine compartment or under the dashboard. It is very light and can easily be mounted with Velcro or via the mounting holes.

CONNECTION

When routing the thermocouple wires to the amplifier, make sure to only use K-type thermocouple wire and only use K-type thermocouple connectors. DO NOT use any other type of connector or material in the wiring between the thermocouples and the amplifier or massive errors will result! The required connectors to plug into the thermocouple amplifier are the "mini blade type".

The 9 wires should be hooked up as follows:

Color	**Marking**	**Connection**
Red	BATT POS	Switched +12v In
Green	TEMP 1	Temp #1 0-5v Output
Pink	TEMP 2	Temp #2 0-5v Output
Brown	TEMP 3	Temp #3 0-5v Output
Orange	TEMP 4	Temp #4 0-5v Output
Yellow	RS-232 TXD	RS232 Transmit
Blue	RS-232 GND	RS232 Ground
Grey	SIGNAL GND	Signal Gnd (used if a differential input is required)
Black	BATT NEG	Battery Ground

THERMOCOUPLE

A thermocouple is a device that contains 2 differing types of metal joined at the end. The junction between two differing metals generates a voltage which is a function of the temperature at the junction point. While most any two metals can be used, specific materials have become the standards because of the characteristic temperature sensitivities they possess.

The K-Type Thermocouple (Chromel/Alumel) is a general purpose thermocouple that is low cost and available in almost every type of configuration. This is the most common type of thermocouple in use today.

While the output voltages of different thermocouple types are known and tables are available to show the output voltages generated at any given temperature, you can not simply monitor the

voltage given by a thermocouple with a multi-meter. This is because the thermocouple acts as a differential device between the junctions and the connection of a multi-meter creates a junction at that point as well. The voltage supplied is for the difference of the temperature at the two different ends of the thermocouple so the output voltage will be for the temperature difference between the two points, not the absolute temperature at the measurement tip. This makes knowing the temperature at the connector critical to getting an accurate measurement. The connection temperature is known as the cold junction temperature and a compensation must be included for it's effect. This is very important as the error in the measurement of cold junction temperature will be directly reflected as an error in the measured temperature from the thermocouple. The AEM Thermocouple Amplifier has an internal Cold Junction Temperature sensor to ensure the accuracy of the output.

EXAMPLE: If the tip of a thermocouple is at 750C and the connection device, or cold junction is at 100C then the output for the thermocouple will reflect 650C. The cold junction temperature compensation must be added to the measured value to get the proper answer, 750C. The AEM Thermocouple amplifier performs all necessary compensations for the cold junction temperature so you don't have to worry about it.

ANALOG OUTPUTS

All four temperature channels have high accuracy, 0-5V analog outputs. The calibration is:

Temperature (C) = Volts * 200
Temperature (F) = (Volts * 360) + 32

Example: If 1.45 volts were output: The temperature in Degrees C would be 1.45 * 200 = 290C
The temperature in Degrees F would be (1.45 * 360) + 32 = 554F

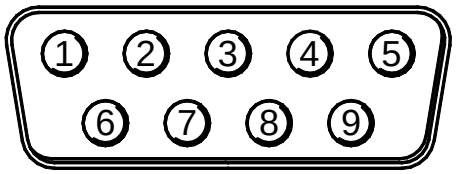
Volts	Deg C	Deg F	Volts	Deg C	Deg F	Volts	Deg C	Deg F
0.00	0	32	1.70	340	644	3.40	680	1256
0.10	20	68	1.80	360	680	3.50	700	1292
0.20	40	104	1.90	380	716	3.60	720	1328
0.30	60	140	2.00	400	752	3.70	740	1364
0.40	80	176	2.10	420	788	3.80	760	1400
0.50	100	212	2.20	440	824	3.90	780	1436
0.60	120	248	2.30	460	860	4.00	800	1472
0.70	140	284	2.40	480	896	4.10	820	1508
0.80	160	320	2.50	500	932	4.20	840	1544
0.90	180	356	2.60	520	968	4.30	860	1580
1.00	200	392	2.70	540	1004	4.40	880	1616
1.10	220	428	2.80	560	1040	4.50	900	1652
1.20	240	464	2.90	580	1076	4.60	920	1688
1.30	260	500	3.00	600	1112	4.70	940	1724
1.40	280	536	3.10	620	1148	4.80	960	1760
1.50	300	572	3.20	640	1184	4.90	980	1796
1.60	320	608	3.30	660	1220	5.00	1000	1832

STATUS LEDS

Each thermocouple input has a status LED. It will be lit whenever an open condition is detected. If a thermocouple is plugged in but the LED is still on then the thermocouple has an open short somewhere in it and must be replaced.

SERIAL OUTPUT

The serial output can be used for data logging when an EFI system is not accessible. To run the data stream, a RS-232 (DB-9) Female Receptacle must be purchased.



Wire View of RS-232 (DB-9) Male Plug

Two wires need to be connected to a RS-232 serial port. The YELLOW wire from the AEM thermocouple amplifier shall be connected to Pin #2 (RX) on the serial port for receiving data. Pin # 5 (GND) on the serial port is the ground and should be connected to the Blue wire. If a standard 9-pin serial cable is to be cut instead, the (RX) wire is typically RED and the (GND) wire is typically GREEN. However, this should be confirmed with a continuity tester before attempting.

Use HyperTerminal for testing the data stream. This software is found on most PCs. To find HyperTerminal go to: Start | All Programs | Accessories | Communications | HyperTerminal. Name the New Connection and click OK. Set the COM port to the one being used and click OK.

Bits Per Second = 19,200
Data Bits = 8
Parity = None
Stop Bits = 1
Flow Control = Hardware

Verify the settings above and click OK. When power is supplied to the AEM Thermocouple amplifier, temperature data will be displayed, as shown below.

Junction Temp, Temp1, Temp2, Temp3, Temp4 (in degrees C)

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AEM Inc. 2005
Thermocouple Amplifier
Version 1

23.1, 122, 255, 700, 390
23.1, 122, 255, 700, 390
23.1, 122, 255, 700, 390
23.1, 122, 255, 700, 390
23.1, 122, 255, 700, 390
23.1, 122, 255, 700, 390
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Data logging with HyperTerminal

SPECIFICATIONS
Laboratory Grade Accuracy, 4 Channel K-Type Thermocouple Amplifier

- Works with any K Type Thermocouple
- Uses commonly available miniature thermocouple connectors
- On board cold junction temperature compensation
- 0 to 1,000C (32 to 1,832 F) measurement range
- Can measure up to 20C degrees below cold junction temperature
- 0-5v analog output (x4)
- RS-232 serial output also included
- Fault LED's tell the user when a thermocouple is faulty
- High quality Deutsch connector
- Includes mating harness

Four Channel Thermocouple Amplifier

Supply Voltage:	9 to 18 Volts
Supply Current (nominal):	0.25 amps
K-Type Thermocouple Inputs:	4
0-5v Analog Outputs:	4
RS-232 Serial Outputs:	1
Minimum Measuring Temp:	20C Below Cold Junction Temperature
Maximum Measuring Temp:	1,000C
Harness & Connector Temp Limit:	120 C