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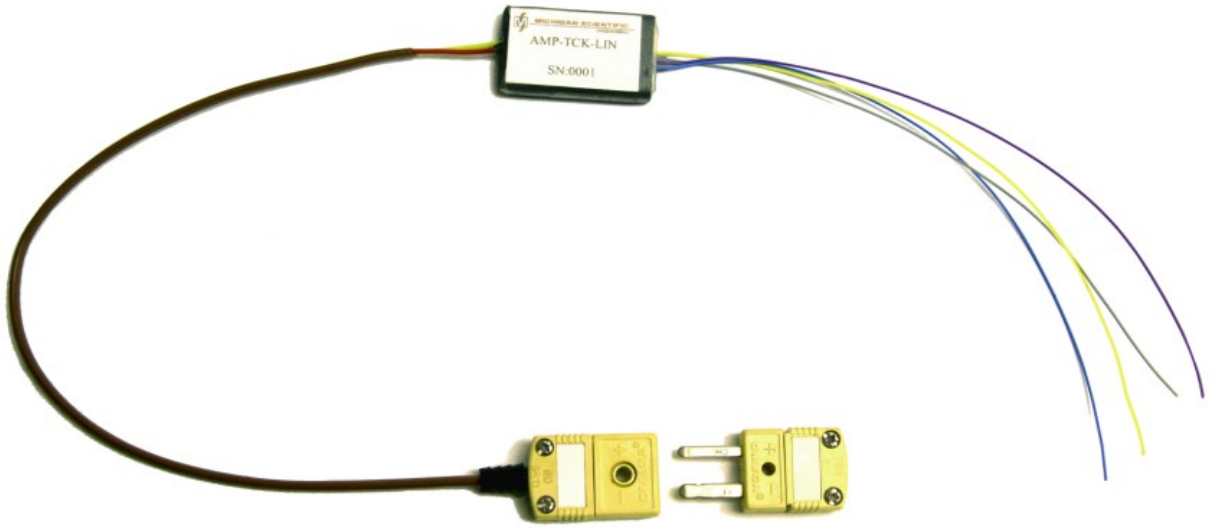
AMP-TC*-LIN

LINEARIZING THERMOCOUPLE AMPLIFIER OPERATOR'S MANUAL



OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

* Indicates type of thermocouple (K, J)

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Introduction

The *Linearizing Thermocouple Amplifier* is designed to provide cold junction compensation, amplification and linearization of thermocouple sensors. These amplifiers may be used in conjunction with Michigan Scientific slip rings. Although all Michigan Scientific slip ring assemblies are manufactured with instrumentation quality rings and brushes, superior data accuracy is achieved by locating the thermocouple amplifier on the rotating side of the slip ring. This configuration greatly improves signal quality because the amplifier is located closer to the sensor, which reduces errors due to temperature gradients across dissimilar metals in the slip ring and magnetic interference.

Amplifiers are available for K-type thermocouples (J-type coming soon). For more channels, more than one amplifier may be used with a single control unit. The amplifiers can be adhered, potted or strapped to many different types of parts. Some Michigan Scientific slip rings are available with the amplifiers built into the rotor.

Features

- Nonlinear thermocouple input signal is converted to linear output voltage (i.e. 0°C = 0V, 200°C = 2V, etc.)
- Input signal is amplified to 10 mV per degree Celsius over entire input range
- Cold junction compensation
- Units available in K-type (J-type coming soon)
- Signal bandwidth, 10 Hz
- Input signals can be grounded or isolated

Operation

General Operation

The AMP-TC*-LIN must be powered with ± 15 Volts and a common. See electrical installation for instructions on how to connect these supplies to the proper wires. The AMP-TC*-LIN signals should be measured with respect to the common gray wire.

Current flows in the ground line, so there will be a voltage drop along the length of the conductor. This will create an offset if the signals are measured with respect to the common at the Remote Amplifier Control Unit. Michigan Scientific recommends that the signals be measured with respect to the common wire at the amplifier. This can be accomplished by adding a second common line from the amplifier to the recording device.

The thermocouple sensor should be attached using the provided mating connector (Omega® HMPW-*-M). If a thermocouple input is left unused or if the thermocouple opens, the output of the amplifier will drop to 0 V. The amplifier will not be damaged if a thermocouple is left unattached.

Operation with PS Series Amplifier Control Units

Any Michigan Scientific Remote Amplifier Control Unit will provide the ±15 Volts and common. These control units have switches that control bridge excitation and shunt calibration. Both switches are used with Michigan Scientific's strain gage amplifiers, and have no impact on the operation of the thermocouple amplifier.

The Remote Amplifier Control Units reverse the polarity of the ±15 V terminals when the bridge excitation switch is off. The thermocouple amplifier will continue to work under this condition.

Specifications (K-Type)

PARAMETER	SPECIFICATION
INPUT	
Range	-80°C to 1000°C
OUTPUT	
Range	±10V
Sensitivity	10mV/°C
Capacitive load	10 nF
TEMPERATURE ERROR	
-40°C to +75°C Case Temperature	± 3°C Max
-40°C to +125°C Case Temperature	± 5°C Max
DYNAMIC RESPONSE	
Frequency Response -3dB	10Hz
Slew rate	0.00025 V/µs
Settling Time 1%	80 ms
POWER REQUIREMENTS	
Voltage	± 15 VDC
Quiescent Current	± 10mA
ENVIRONMENT	
Specification	-40°C to +75°C
Operation	-40°C to +125°C
MECHANICAL (without connectors)	**AMP-TC*-LIN**
Weight	9.2 g (0.324 oz)
Overall Length	30.99 mm (1.220 in)
Overall Height	5.46 mm (0.215 in)
Overall Width	19.23 mm (0.757 in)

Table 1

Installation

Electrostatic Sensitivity

The AMP-TC*-LIN is an electrostatic sensitive device. The conductors of the wires should not be touched except during soldering. Soldering should be performed at an electrostatic discharge protected workstation.

If an electrostatic discharge protected workstation is not available, use a grounded wrist-strap and ground the strain gage amplifier. Do not handle the device in areas where static charges are obviously present. Always store the AMP-TC*-LIN in an anti-static bag or container when not in use.

Mechanical Installation

The AMP-TC*-LIN could be adhered to a clean surface with Dow Corning 3145 RTV adhesive/sealant. Manufacturer's directions for curing should be followed.

Caution should be used to protect the hook-up wires from cutting or breakage.

Electrical Installation

The hook up wires on the AMP-TC*-LIN are color coded to help determine which supply or output signal corresponds to which wire. The signals and wire colors are shown in the table below.

SIGNAL	WIRES
OUTPUT CONNECTIONS:	
Positive 15V	Blue
Negative 15V	Violet
Common	Gray
Amplifier Output Channel 1	Yellow
THERMOCOUPLE CONNECTIONS:	
Thermocouple Positive*	Yellow
Thermocouple Negative	Red

* Yellow for K type, White for J type

Figure 1

The output high is measured relative to the ground wire. Michigan Scientific recommends that a separate wire for signal common be added to the common wire to reduce errors from voltage drops along the power common wire. This wire can be added to the stator of a slip ring to decrease the amount of rings needed, but care should be taken to physically place the amplifier as close as possible to the slip ring.

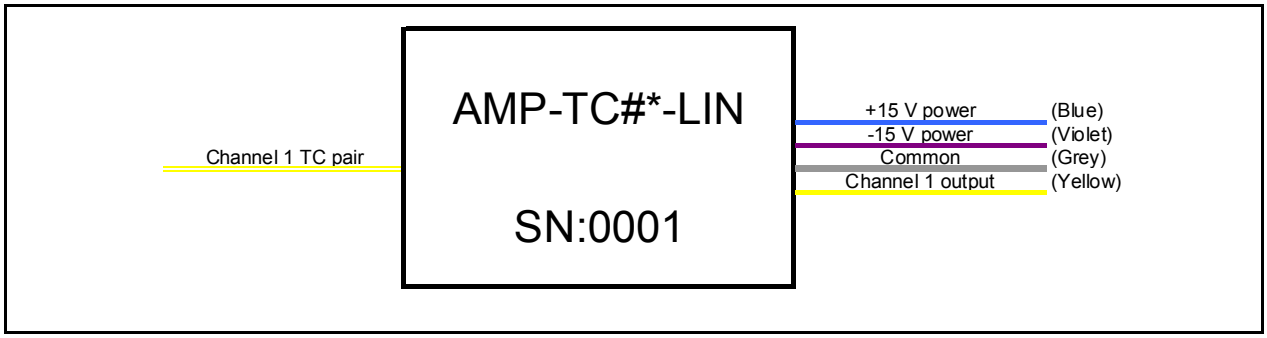

Figure 2

Troubleshooting

Symptom	Possible Cause	Test to Verify Problem	Solution
Output noisy with thermocouple spinning	Thermocouple could be opening momentarily; frequency response of data acquisition system may be to slow to show complete drop out of signal	Look at dynamic signal with an oscilloscope	Repair thermocouple junction Restrain thermocouple better
Output near 0 V regardless of thermocouple temperature	Amplifier Out High could be shorted to Common	With amplifier power off, measure resistance from Amplifier Out High to Common. The resistance should be between 100 and 200 Kohm	Remove short
	Amplifier Out High or Common conductor could be open	Measure resistance from one end of conductor to the other	Repair open wire
	Open thermocouple	Connect known good thermocouple to amplifier input. If voltage drop-out is a result of the open thermocouple; the output should now be near room temperature	Repair thermocouple junction
Output near 9.7 V when thermocouple is at room temperature	- 15 V supply is disconnected	Measure continuity from power supply to amp's violet terminal	Repair broken wire
Output near –3.3 V when thermocouple is at room temperature	15 V supply is disconnected	Measure continuity from power supply to amp's blue terminal	Repair broken wire
Output near –0.18 V when thermocouple is at room temperature	Common is disconnected	Measure continuity from power supply to amp's gray terminal	Repair broken wire

Table 2