

MicroTC User Manual



Copyright © 2023 Michigan Scientific Corporation

Details and specifications provided in this document are purely for informational purposes and are subject to alterations. No liability is accepted for errors or omissions.

Michigan Scientific Corporation
8500 Ance Road
Charlevoix, MI 49720

Revision Date: 5/01/2023 11:30 a.m. twnachazel

Contents

Introduction	1
Installation	3
Operations	5
Troubleshooting Guide	8

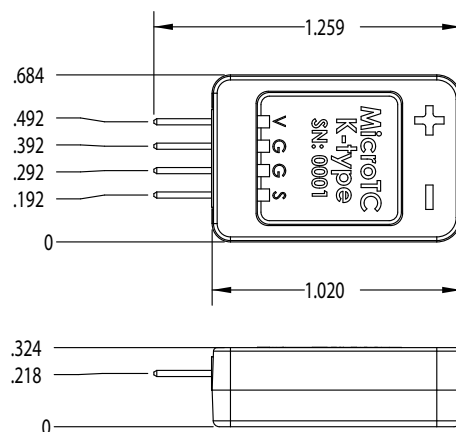
The background features a faint, light blue schematic of a printed circuit board (PCB) with various traces, pads, and components. A large, stylized white cross is positioned in the upper left corner. The title text is centered and rendered in a bold, dark grey sans-serif font.

The MicroTC Linear Thermocouple Amplifier...

- Provides cold junction compensation, amplification and linearization of K-type thermocouple signals
- Input signal is amplified to 5 mV per degree Celsius over a wide input range
- Signal bandwidth, 2.35 kHz (other bandwidths available)
- May be used in conjunction with Michigan Scientific Slip Ring Assemblies
- Reduces errors due to temperature gradients across dissimilar metals in the slip ring and magnetic interference
- Input signals can be grounded or isolated
- More than one amplifier may be used with a single control unit

Specifications

Input	
Range (5 mV/C Linear Output)	-25 °C to 400 °C
Range (with polynomial equation)	-200 °C to 970 °C
Output	
Range	Min = -0.77 V; Max = 4.92 V
Measurement Error	±2 °C Typical; ±3 °C Max
Noise	
0.01 Hz - 10 Hz	0.8 µV p-p
Dynamic Response	
Frequency Response -3db	2.35 kHz
Settling Time 0.1%	36 µs
Power Requirements	
Voltage (V)	+7 Vdc to + 16 Vdc
Quiescent Current	3.25 mA max
Environment	
Specification	0 °C to +50 °C (+32 °F to +122 °F)
Operation	-40 °C to +100 °C (-40 °F to +212 °F)
Mechanical	
Weight	3.9 g (0.14 oz)
Overall Length	32.0 mm (1.259 in)
Overall Height	8.2 mm (0.324 in)
Overall Width	17.4 mm (0.684 in)



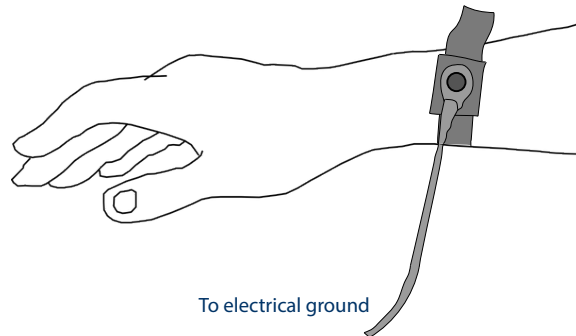
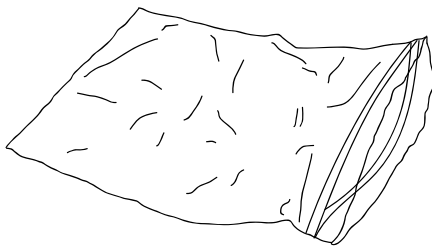
Installation



Electrostatic Sensitivity

The MicroTC is an electrostatic sensitive device. The terminals should not be touched except during soldering. Soldering should be performed at electrostatic discharge protected workstations. Wires attached to the MicroTC should not be touched either.

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



Electrical Installation

Wires soldered to the signal terminals should be covered with heat shrink tubing. This will both protect the terminals from electrical shorting as well as provide strain relief for the wires.

The signal terminals on the MicroTC are color coded and labeled to help determine which supply or output signal corresponds to which terminal. The signals and terminal colors are shown in the table below:

Terminal Signals

Signal	Label	Color
Supply Voltage	V	Blue
Ground	G	Gray
Ground	G	Gray
Signal Output	S	Yellow

Linearization Formulas

The output of the MicroTC is a linear 5 mV/°C over an input range of -25 °C to 400 °C. Outside of this range, linearizing formulas can be used to determine temperature within the specified error. The following formulas use the voltage from the amplifier as the independent variable and generate temperature in °C.

T = Temperature in °C

V = Voltage from amplifier

Range: -60 °C to 970 °C

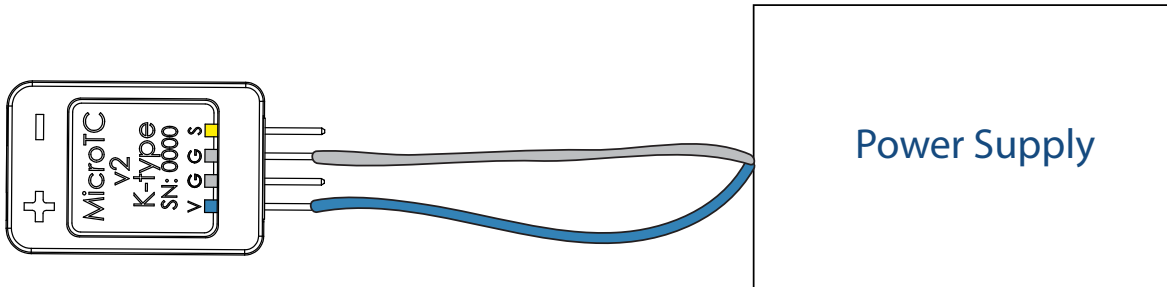
$$T = 0.1744 \times V^4 - 0.8386 \times V^3 - 1.4378 \times V^2 + 204.33 \times V - 1.6323$$

Range: -200 °C to 100 °C

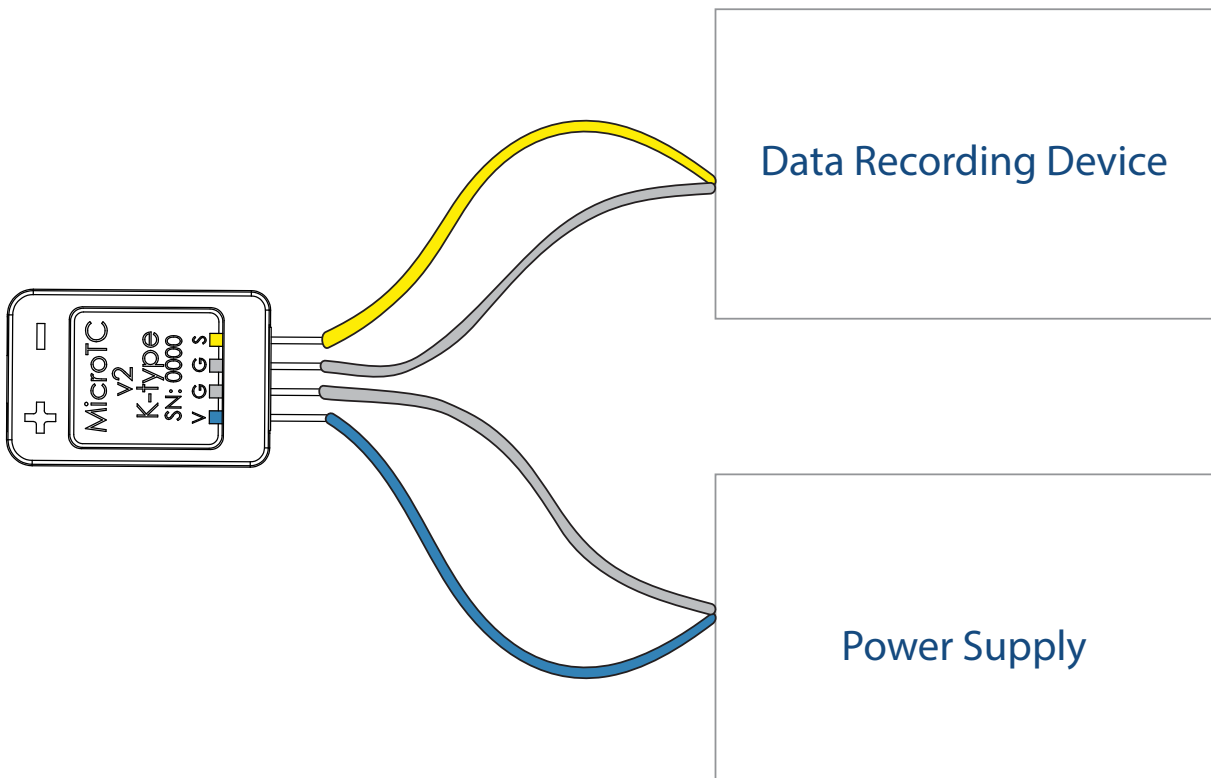
$$T = -137.02 \times V^4 + 35.24 \times V^3 - 0.3931 \times V^2 + 207.1 \times V - 1.1512$$

Operations

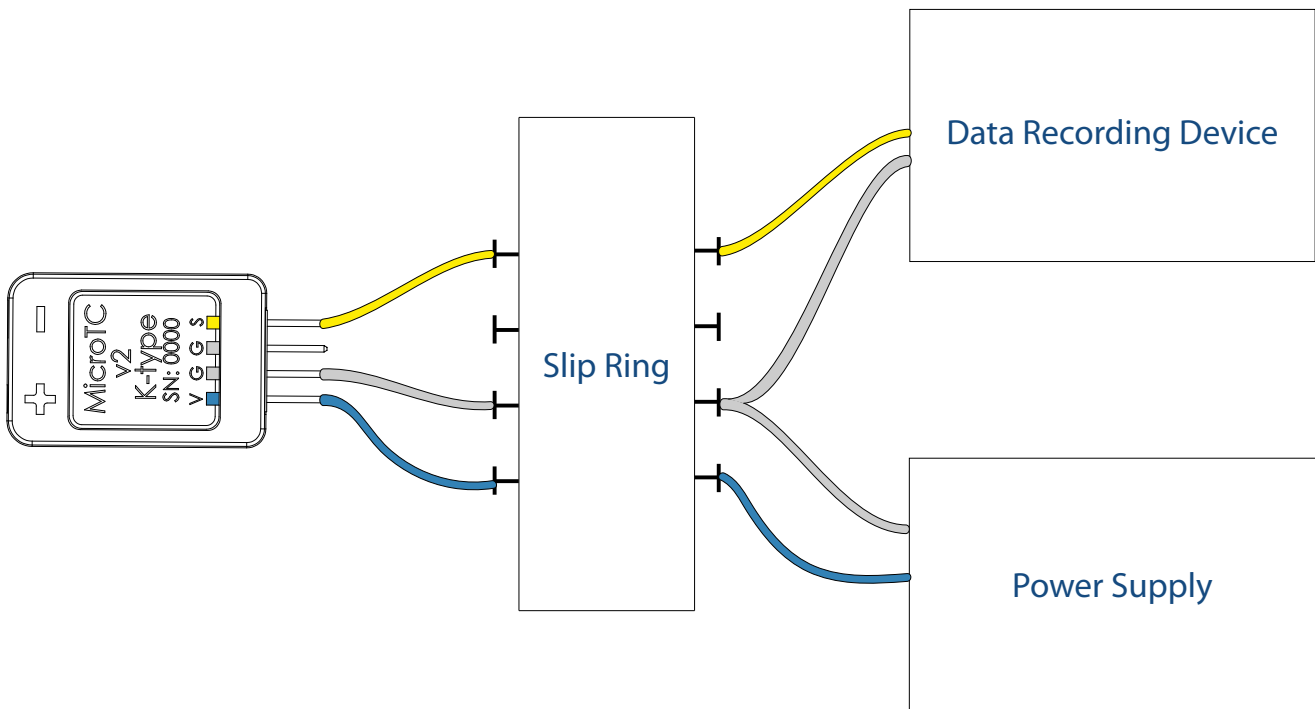
The MicroTC must be powered with +7 to +16 V and a common. See [Electrical Installation](#) section of this manual for instructions on how to connect these supplies to the proper terminals. The MicroTC signals should be measured with respect to the common terminal.



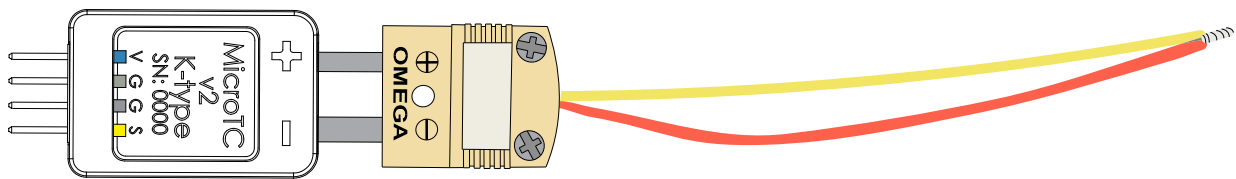
Current flows in the ground line, so there will be a voltage drop along the length of the conductor. This will create an offset if the signals are measured with respect to the common at the Remote Amplifier Control Unit. It is recommended that the signals are measured with respect to the common wire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



The output high is measured relative to the ground wire. It is recommended that a separate wire for signal common is added to the common terminal to reduce errors from voltage drops along the power common wire. When using the MicroTC with a slip ring assembly, a separate signal common can be added to the stator of a slip ring to decrease the amount of rings needed, but it is important to place the amplifier as close as possible to the slip ring.



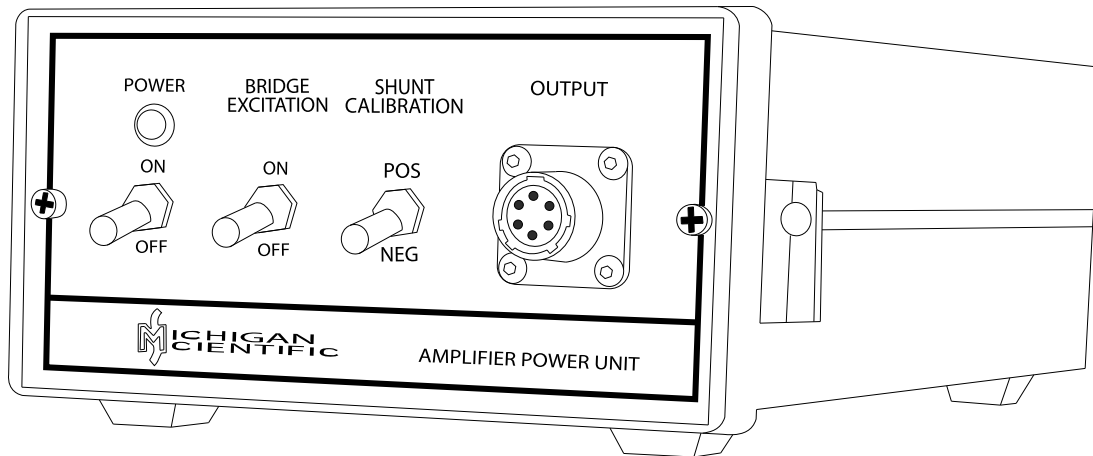
The thermocouple sensor should be attached using the provided mating connector (Omega± HMPW-*-M). If a thermocouple input is left unused or if the thermocouple opens, the output of the amplifier will rise to V+. The amplifier will not be damaged if a thermocouple is left unattached.



Operation with PS Series Amplifier Control Unit

Any Michigan Scientific Remote Amplifier Control Unit will provide ± 15 Volts and common. These control units have switches that control bridge excitation and shunt calibration. For use with MicroTC units, the Bridge Excitation switch should be turned on, and the Shunt Calibration switch is unused.

The Remote Amplifier Control Units reverse the polarity of the ± 15 V terminals when the bridge excitation switch is off. The MicroTC-S will power off in this condition.



Troubleshooting Guide

Problem	Potential Cause	Test to Verify Problem	Solution
Output noisy with thermocouple spinning	Thermocouple could be opening momentarily; frequency response of data acquisition system may be too 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 k Ω	Remove short
	One of the conductor wires may be open	Measure resistance from one end of conductor to the other	Repair open wire
Output near 4.92 V when thermocouple is at room temperature	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 around 10-20 mV regardless of thermocouple temperature	Connector may be reversed	Inspect connector for proper orientation	Ensure proper connection of signal, ground, and power wires