



## MICRO-THERMOCOUPLES

- ❖ Bifilar construction
- ❖ Color coded insulation for polarity identification
- ❖ Moisture seal (encapsulated only)
- ❖ Individual packaging on spools

### Description

Our Micro-Thermocouples (MTC) are flexible fine gage thermocouples used whenever fast, accurate temperature measurements are required. The thermocouple consists of two dissimilar metals, joined together at one end. A small voltage is produced by the two metals, which can be measured and interpreted by a control system. The dissimilar metals are individually insulated, and an overcoat is present to maintain intimate bifilar configuration. The bifilar wire construction provides for easy handling in long lengths typically in medical catheter applications.

### Features

- Thermocouple Types: Type T
- Joint Encapsulation: Polymer Encapsulated, Bare
- Thermocouple Gauges: 44 AWG, 40 AWG
- Wire Insulation: Polyetherimide
- Limits of Error/Tolerance:  $\pm 1^{\circ}\text{C}$ ,  $\pm 0.5^{\circ}\text{C}$ ,  $\pm 0.2^{\circ}\text{C}$ (custom)
- Max. Service Temperature: Encapsulated  $+135^{\circ}\text{C}$ , Bare  $+180^{\circ}\text{C}$

### Applications

- Medical Catheters
- General purpose sensing in tight spaces or small volumes



**Sensor Specifications**

<b>Parameters</b>	<b>Specifications</b>	
<b>Joint Encapsulation</b>	Bare	Encapsulated
<b>Temperature Range</b>	Max. 180°C	Max +135°C
<b>Limits of Error/Tolerance</b>	From 0°C to 350°C: Standard $\pm 1^\circ\text{C}$ or $\pm 0.75\%$ , Special $\pm 0.5^\circ\text{C}$ or $\pm 0.40\%$ <sup>(a)</sup>	
<b>Wire Gauge</b>	AWG40, AWG44	
<b>Conductor Material</b>	Type T: Positive Copper/ Negative Constantan <sup>(b)</sup>	
<b>Wire Insulation Color</b>	Positive: Green/Black/Blue/Gold/Pink, Negative: Red	
<b>Insulation Resistance</b>	-	TYP: >10M $\Omega$ , 50VDC

**Notes:**

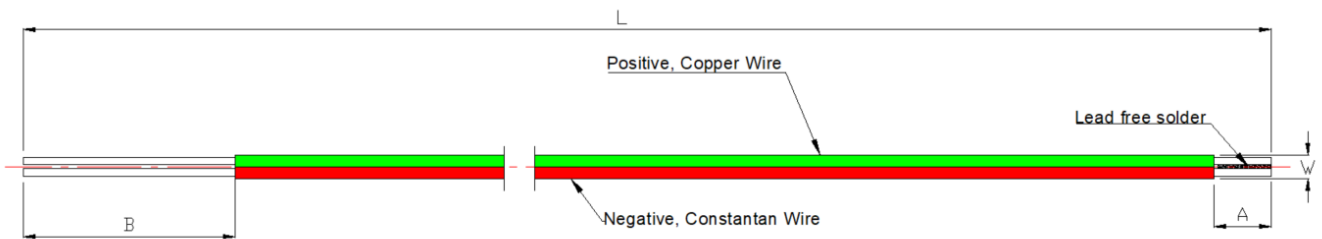
- a) Limits of Error follow ANSI MC96.1 as supplied by the manufacturer from the standard EMF-temperature tables, reference junction 0°C.
- b) Use same type extended wire to avoid generate second junction.

**Recommended Operating Conditions**

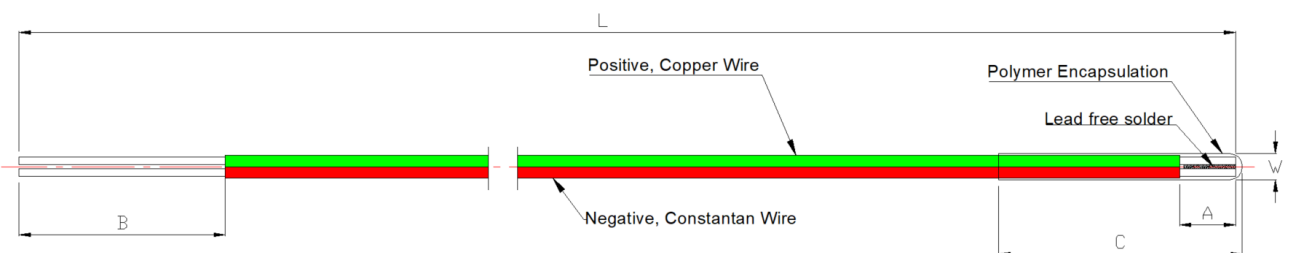
The micro-thermocouple wire used in assembly is very fragile. Handle wire with extreme care at all times to avoid pinching, scrapping, knotting, kinking, and contamination. Do not clamp wire with tweezers or clips unless specifically assembly requested.

**Dimensions**

**Bare: Non-Insulated Junction**



**Encapsulated: Insulated Junction**



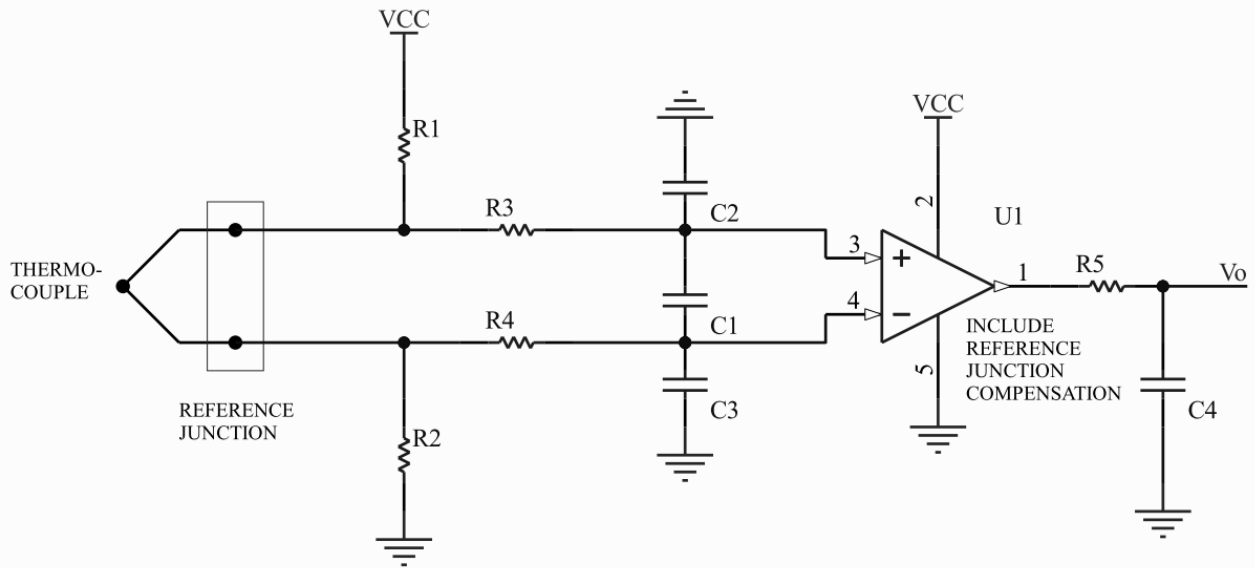
- **Solder Joint Length (A):** Normally 1.27mm max.
- **Wire Strip Length (B):** Normally 13 $\pm$ 6mm.
- **Encapsulation Length (C):** Normally 6.35mm max.
- **Maximum Profile (W):** 0.33mm max. for 40 AWG encapsulation, 0.211mm max. for 40 AWG bare, 0.241mm max. for 44 AWG encapsulation.
- **Wire length tolerance (L):** Customized length per customer assembly request.
- **Packaging:** Sensors wrapped on white plastic spools.

# MICRO-THERMOCOUPLES

## Customize Parameter

Customize Item	Parameter
L	Example: 1800mm, 1600mm, 1450mm
Encapsulation	Polymer Encapsulated, Bare
AWG	40, 44
Type	T
Wire Insulation Color	Green/Red, Black/Red, Blue/Red, Gold/Red, Pink/Red

## Circuit Suggestion



Note:

1. Since U1 includes reference junction compensation, U1 should be placed near to reference junction.

## Temperature-EMF Tables (Reference Junction= 0°C, Type T)

Temperature (°C)	Voltage (mV)	Temperature (°C)	Voltage (mV)
0	0	110	4.750
10	0.391	120	5.228
20	0.790	130	5.714
30	1.196	140	6.206
40	1.612	150	6.704
50	2.036	160	7.209
60	2.468	170	7.720
70	2.909	180	8.327
80	3.358		
90	3.814		
100	4.279		

**Customer Questions & Answers**

Question	Answer
<ul style="list-style-type: none"> <li>How does a thermocouple work?</li> </ul>	<p>A thermocouple wire is a sensor used for determining temperature. It consists of diverse metals joined at the ends in a single connecting point. When the temperature of one end differs from the other, the connecting points generate electricity.</p>
<ul style="list-style-type: none"> <li>How does a thermocouple take temperature measurement?</li> </ul>	<p>Thermocouples utilize the Seebeck effect. Two different electrical conductors (legs) are connected to a circuit. If the junctions of the two different conductors have two different temperatures levels, a thermoelectric voltage is generated. The voltage can be converted for temperature measurement purposes.</p>
<ul style="list-style-type: none"> <li>What is type T thermocouple?</li> </ul>	<p>Common thermocouple wire Type T composed of copper and constantan, these wires are individually insulated and made as parallel bonded.</p>
<ul style="list-style-type: none"> <li>What is the initial calibration tolerances for thermocouples and how to refer the limits of error?</li> </ul>	<p>The tolerance of initial calibration following ANSI MC96.1, is defined as the allowable deviation of the thermocouple and extension wire in its initial condition, once the thermocouple is in use its calibration will change. The magnitude and direction of the change are dependent on temperature, time and environmental conditions affecting the thermocouple and may not be accurately predicted. These tolerances do not include installation or system errors.</p>
<ul style="list-style-type: none"> <li>How to use the Temperature-EMF tables correctly?</li> </ul>	<p>If the reference junction is maintained at 0°C, the appropriate temperature or EMF data may be read directly from the tables. When it is not practical to maintain the reference junction temperature at 0°C, these tables may still be used by applying an appropriate correction. The value of the correction may be obtained from these tables. The observed EMF output of the thermocouple must first be corrected to compensate for the difference between the reference junction temperature actually used and 0°C.</p>
<ul style="list-style-type: none"> <li>Micro-thermocouple wire assembly tips.</li> </ul>	<p>The fabrication of thermocouples requires special techniques. If the equipment and skill required to fabricate thermocouples properly are not available, the user should purchase fabricated thermocouples, since improper techniques can result in significant errors in temperature measurements.</p> <p>It must be borne in mind that zero error is unattainable. In addition to the instrument error, the thermocouple and the extension wire will introduce errors. The installed components may deteriorate with use, to avoid the continued use of thermocouples with excessive deviations from the original characteristic due to exposure or contamination, it is good practice to check the thermocouples at regular intervals.</p>
<ul style="list-style-type: none"> <li>What is micro-thermocouple best application?</li> </ul>	<p>Micro-thermocouples are commonly used in treatment of tachycardia and atrial fibrillation, measuring the tissue temperature during radiofrequency ablation of cardiac arrhythmias.</p>

## Ordering Information

TE PN	Local PN	AWG	Encapsulation	Insulation Resistance	L(mm)	Insulation Color	Max Temp	TY PE	Limits of Error
10210962-00	PF5040138-1	40	Bare	-	1800	Green/Red	180°C	T	±1
10216823-00	PF5040138-2	40	Bare	-	1600	Green/Red	180°C	T	±1
PF5040139-1	PF5040139-1	40	Encapsulated	>10MΩ/50VDC	1800	Green/Red	135°C	T	±1
PF5040139-2	PF5040139-2	40	Encapsulated	>10MΩ/50VDC	2000	Green/Red	135°C	T	±1
10213932-00	PF5040139-3	40	Encapsulated	>10MΩ/50VDC	600	Green/Red	135°C	T	±1
10214448-00	PF5040139-4	40	Encapsulated	>10MΩ/50VDC	1600	Green/Red	135°C	T	±1
20010076-00	-	40	Encapsulated	>10MΩ/50VDC	1450	Green/Red	135°C	T	±1
20010076-02	-	40	Encapsulated	>10MΩ/50VDC	1450	Green/Red	100°C	T	±0.5 (±0.2 <sup>(a)</sup> )
20023518-00	-	44	Encapsulated	>10MΩ/200VDC	1970	Green/Red	120°C	T	±1
20010076-01*	-	40	Encapsulated	>5MΩ/500VDC	1450	Green/Red	135°C	T	±1
20022707-00*	-	40	Bare	-	1800	Pink/Red	180°C	T	±1
20022708-00*	-	40	Bare	-	1800	Black/Red	180°C	T	±1
20022709-00*	-	40	Bare	-	1800	Gold/Red	180°C	T	±1
20022710-00*	-	40	Bare	-	1800	Blue/Red	180°C	T	±1

### Notes:

\*: Under development, engineering sample available.

a) Limits of error: 0°C~+100°C:±0.5°C,+ 30°C~+50°C:±0.2°C.

## Change History

Date	Version	Change Description
2018-11-17	A	Initial version
2022-05-09	B	Updated product information
2022-08-18	B1	Add 20010076-02

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