



shown for each degree of temperature. resulting tabulations are called "Thermocouple Reference Tables" and the thermocouple output millivoltage is determined the output millivoltage of all type thermocouples, at all temperatures, within their range. The N.I.S.T. (National Institute of Standards and Technology) is the U.S. standards setting agency. They have

Thermocouple Reference Tables

Output Millivoltage of a Thermocouple

How to Determine Temperature by Measuring the

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④ December 7, 2015 ② S Bharadwaj Reddy ② 2 Comments

millivoltage Temperature by measuring the output How to calculate Thermocouple

Temperature Measurement

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Reference Junction Temperature = 22°C (71.6°F)

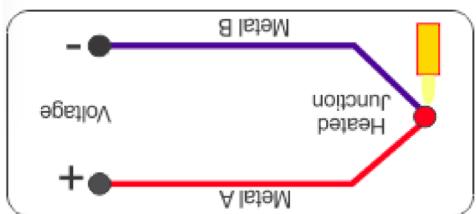
Measured "V_D" = 3.41 mV

Example #1 Type "T" Thermocouple

measuring junction.

5. Find that millivoltage total in the reference table. The corresponding temperature is the temperature of the measuring junction.
4. Add that millivoltage to the millivoltage measured as "V_D" to get a total.
3. Go to the table for the thermocouple being used and look up the millivoltage produced at that temperature.
2. Measure the actual temperature of the reference junction with a thermometer.
1. Measure the "V_D" millivoltage as shown above.

HOW TO DETERMINE THE MEASURING JUNCTION TEMPERATURE



One is the measuring junction and the other is the reference junction. V_D is the millivoltage resulting from the difference between the millivolts generated by the two opposing junctions. V_D is the millivoltage read when a meter is connected across the thermocouple as shown below.

The junction of each type thermocouple produces a specific millivoltage across it at a specific temperature. A thermocouple consists of two junctions connected in opposition.

Type B Thermocouple	Download
Type R Thermocouple	Download
Type S Thermocouple	Download
Type T Thermocouple	Download
Type K Thermocouple	Download
Type C Thermocouple	Download

* P=Positive Leg N = Negative Leg

ANSI LETTER	LEG*	METALLIC COMPOSITION	MELTING POINT	USABLE TEMPERATURE RANGE	TOLERANCES (THE GREATER OF BASE OR % OF READING)		
						°F	°C
E	P	CHROMEL®, CONSTANTAN	2230	1220	-300 TO 850° F -200 TO +450° C ± 1.7° C	± 0.5%	± 0.4%
J	P	IRON	2230	1220	30 TO 700° F 0 TO 400° C ± 2.2° C	± 0.75%	± 1.1° C or 0.4%
K	P	CHROMEL, ALUMEL,	2550	1400	-300 TO 1800° F -200 TO 1000° C ± 2.2° C	± 0.75%	± 1.1° C or 0.4%
N	P	NICROSIL.....	2440	1340	30 TO 1800° F 0 TO 1000° C ± 2.2° C	± 0.75%	± 1.1° C
R	P	PLATINUM 13% RHODIUM	3215	1170	400 TO 2700° F 200 TO 1500° C ± 1.5° C	± 0.25%	± 0.6° C or ± 0.1%
S	P	PURE PLATINUM	3215	1170	400 TO 2700° F 200 TO 1500° C ± 1.0° C	± 0.25%	± 0.5° C or ± 0.1%
T	P	COPPER CONSTANTAN	1980	1080	-450 TO 660° F -270 TO 350° C ± 1.0° C	± 0.75%	± 0.5° C or ± 0.4%

$$\text{Metric/English Scale Conversion } ^\circ\text{C} = ^\circ\text{F} - 32 \div 1.8 = 1.8^\circ\text{C} + 32$$

the measuring junction

- From the table, $5^\circ\text{C} = -0.193 \text{ mV}$
- Adding -0.193 mV to $+4.47 \text{ mV} = +4.28 \text{ mV}$
- Finding 4.28 mV in the table, the corresponding temperature is 100°C (212°F) and is the temperature of

Reference Junction Temperature = -5°C (23°F) (lower than the table reference of 0°C)

$$\text{Measured } "V_D" = 4.47 \text{ mV}$$

Example #2 Type "T" thermocouple

of the measuring junction.

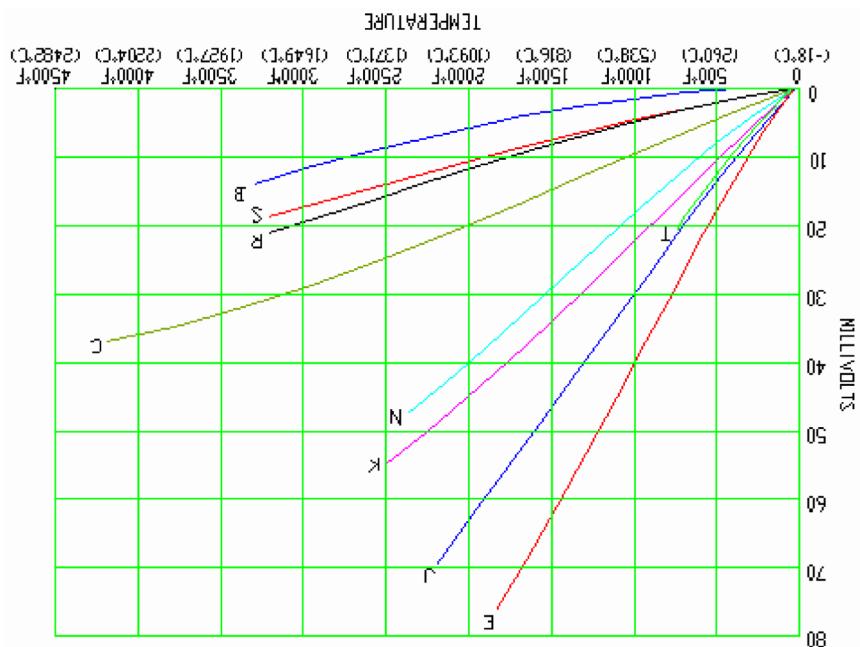
- Finding 4.28 mV in the table, the corresponding temperature is 100°C (212°F) and is the temperature of
- Adding 0.87 mV to $3.41 \text{ mV} = 4.28 \text{ mV}$.
- From the table, $22^\circ\text{C} = 0.87 \text{ mV}$.



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Thermocouple chart



NOTE: Individual T/C units may be calibrated by measuring their output at several known temperatures and preparing an error correction chart. This chart is used to eliminate any deviation from the "standard" output millivoltages versus temperature readings inherent in this particular thermocouple. The result is known as an "NIST" traceable thermocouple.

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CHARACTERISTICS grade DEWEY GAIT characteristics of thermocouples are determined by their purity and composition of the materials used in their construction. The purity and composition of the materials used in their construction determine the characteristics of the thermocouple.



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Officer - Instrumentation, GSPC - Oil & Gas, Kakinada, India.

S Bharamwaj Reddy



Author

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4 months ago

Hi sir

Ramesh Ketha



Reply

A little remark. Besides the American standard and tables, there are also German standards in use. Do not mix them since the values are different. Make sure which type of TC one is dealing with.

A more accurate but more complex way, is to use a real cold junction TC that is inserted in water of 0°C. This is water with melting ice in it. This gives a MV reading that equals the hot junction temperature.

11 months ago

Eddy Studyck



2 comments

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I am katha ramesh i asking about LBD, card voltage 8 V, but when switch active 4.5V showing, when switch normal voltage 7.5 V how generate 4.5V and 7.5V in LBD
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ASwini mohanty
Good morning Thank you for your help ,we find important thin...
MORSLI

DCS stands for Distributed control system
where as ESD stands...
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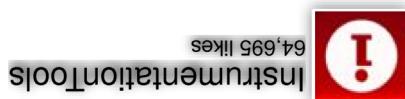
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