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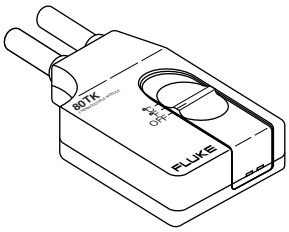
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FLUKE®

80TK Thermocouple Module

Instruction Sheet

Introduction

The Fluke 80TK is a thermocouple converter for use with any K-type thermocouple and a digital multimeter. The 80TK accepts the output of any K-type thermocouple and converts it to 1 mV per degree (Celsius or Fahrenheit).

A three-position switch acts as a power switch as well as selecting Fahrenheit or Celsius scaling for the output. In addition, the OFF position of the power switch allows you to read the battery condition via the external multimeter. The thermocouple input accepts wire leads or standard mini-thermocouple connectors.

Temperature is measured by exposing or attaching the thermocouple to the surface to be measured. The multimeter displays the temperature directly in degrees Fahrenheit or Celsius.

Specifications

Electrical

Measurement Range: -50 to 1000 degrees Celsius
-58 to 1832 degrees Fahrenheit

Resolution:

2000 count display:	0.1 °C/F in 200 mV range
	1.0 °C/F in 2 V range
3200 count display:	0.1 °C/F in 300 mV range
	1.0 °C/F in 3V range
4000 count display:	0.1 °C/F in 400 mV range
	1.0 °C/F in 4 V range

Note: Ignore decimal point on 2 V, 3 V, or 4 V range.

Maximum Voltage at Thermocouple Input: 60 V dc, 24V ac

RF Field: Exposure to an rf field interferes significantly with this module's capacity to accurately measure temperature with thermocouples. The interference is temporary and the module suffers no harm when exposed to an rf field of 3 V/m. Accurate temperature measurement capability is completely restored when the module is removed from the rf field.

Common sources of rf fields are handheld 2-way radios and cellular telephones. If such a source is suspected of interfering with this module, either turn off the transmitter or increase the separation between the transmitter and the module.

Environmental

Ambient Operating Range: 0 to 50 °C

Storage Temperature: -40 to 60 °C
-40 to 140 °F

Humidity: 0 % to 90 % (0 to 35 °C)
0 % to 70 % (35 to 50 °C)

Basic Accuracy: (@ 23 ±5 °C Calibration)*

(Applies for one year after purchase or recalibration)

RANGE	ACCURACY ± (% of reading + degrees), 1 year
-20 to 350 °C -4 to 662 °F	0.5 % ± 2 °C 0.5 % ± 3.6 °F
351 to 500 °C† 664 to 932 °F†*	1.75 % ± 2 °C 1.75 % ± 3.6 °F
501 to 1000 °C 933 to 1832 °F	2.0 % ± 2 °C 2.0 % ± 3.6 °F
-50 to -21 °C -58 to -5.8 °F	2.5 % ± 2 °C typical 2.5 % ± 3.6 °F typical

Temperature Coefficient:

* 0 °C to 18 °C and 28 °C to 50 °C ambient, multiply the basic accuracy specification by 0.1 for each degree above 28 or below 18.

† For accuracy enhancement between 351 °C to 500 °C, subtract 3 degrees from the reading. The accuracy is now 0.75 % ± 2 °C.

†* For accuracy enhancement between 663 °F and 932 °F, subtract 5.4 degrees from the reading. The accuracy is now 0.75 % ± 3.6 °F.

Note

The basic accuracy specification does not include the error of the probe or the DMM. Please refer to the probe accuracy specification for additional details.

General

Weight: 4.5 oz, 126 g

Overall length: 4 5/8 in, 11.75 mm

Battery: Standard 9 V Battery (NEDA #1604, 6F22, 006P)

Battery Life: 1600+ hours, 6.5 V minimum

Output: 3/4 in spaced banana plugs, 10 MΩ minimum load resistance

Accessories

80PK-1 (included): Bead Probe 4 ft K-type thermocouple bead probe, with Teflon tape insulation. Maximum insulation temperature: 260 °C. Accuracy: ± 2.2 °C or ± 0.75 % (whichever is greater) from 0 to 800 °C.

80PK-22: Immersion Probe (8.4 in or 21.3 cm from tip to probe handle)

80PK-3A: Surface Probe (for flat or curved surfaces)

80PK-24: Air Probe (protected by stainless steel baffle)

80PK-25: Piercing Probe (suitable for food use, liquids and gels)

80PK-26: Exposed Junction Probe (exposed bead attached to 8.5 in probe)

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80PK-27: Industrial Surface Probe

80PK-8: Pipe Clamp Probe (For pipe diameter 1/4 in to 1 7/8 in)

80PK-9: HVAC Probe for piercing pipe insulation for pipe temperature measurement

80PK-11: K-type Velcro Temperature Probe

80CK-M: Male Mini-Connector (for attachment of K-type thermocouple wire)

Use and Operation

Thermocouples rely upon the difference in temperature between the measuring junction and a reference junction. Traditionally the reference junction is another thermocouple placed in an ice bath, however, the 80TK uses an electronic reference junction. The converter (80TK) must be operated in a thermal environment consistent with its specifications.

Measuring Technique

Making accurate temperature readings using a thermocouple is a matter of identifying and minimizing the causes of error. The largest contributor to errors is the thermal interface between the measurement surface and the thermocouple. The next largest contributor is the temperature difference between the thermocouple probe and its environment.

Here are some suggestions for improving the accuracy of your temperature measurements. Ensure that there is a good connection between the probe and the surface you are measuring. You can do this in many ways:

1. Increase the mounting pressure.
2. Use an interface agent (such as silicone grease) between the thermocouple probe and the surface you are measuring.
3. Use a thermal epoxy to attach the thermocouple.

When measuring temperatures higher than ambient, adjust the connection of the probe to the surface until you get the highest temperature reading. Use any of the suggestions given above to do so.

When measuring temperatures lower than ambient, adjust the connection of the probe to the surface until you get the lowest temperature reading. Use any of the suggestions given above to do so.

When measuring temperatures near ambient, make the reading when the multimeter display is most stable.

⚠⚠Warning

To avoid electrical shock, do not use this instrument when voltages exceeding 30 V rms, 42.4 peak, or 60 V dc are present. The probe tip is electrically connected to the output terminals.

Temperature Measurement

Follow this procedure to correctly use the 80TK.

1. Plug the 80TK into the multimeter. Ensure that the red banana plug is plugged into the voltage input and the black banana plug is plugged into the COM input.
2. Set the multimeter to the 200, 300, or 400 millivolt range. This setting will read temperatures equal to the number of millivolts the range has (i.e., 320 °C or F if the millivolt range reads 320 mV).
3. Use the dc volt setting and ignore the decimal for higher temperatures than can be accommodated by the millivolt range. Less resolution is available when using the volt range.

⚠⚠Warning

To avoid electrical shock, if connecting wires to the input screws, make sure the thermocouple is removed from the measurement surface. Completely reassemble the instrument before use.

4. Plug the thermocouple into the 80TK thermocouple input connector. If the thermocouple does not have a plug attached, connect the thermocouple wires to the thermocouple input screws inside the 80TK. The yellow coded wire (chromel) connects to the screw marked ”+”.
5. Turn on the 80TK and the multimeter.
6. Adjust the thermal connection between the measurement surface and the thermocouple as described previously.
7. Read the temperature on the multimeter.

Open Thermocouple Reading

If the thermocouple probe has open circuited (i.e. is broken), the multimeter will read a steady, constant voltage. The voltage readings are:

Range	Reading
C	≥ 1.0V
F	≥ 2.2V

Battery Condition Test

1. Set the power switch to the OFF position.
2. Connect the 80TK to the multimeter.
3. Set the multimeter to the 200, 300, or 400 millivolt dc range.
4. Read the battery test voltage on the multimeter. A minimum reading of 75 mV is acceptable and indicates that approximately 100 hours of battery life remain.

Battery Replacement

⚠⚠Warning

To avoid electrical shock, remove the thermocouple from the measurement surface, or disconnect the thermocouple from the instrument before opening the case. Totally reassemble the instrument before attempting to use it.

1. Set the power switch to the OFF position.
2. Disconnect the 80TK from the multimeter.
3. Unplug or disconnect the thermocouple.
4. Turn the 80TK so the power switch is facing down. Remove the single screw located between the banana plugs.
5. Grasp one case half in each hand. Pull the two halves apart, beginning at the end with the banana plugs.
6. Remove and replace the battery.
7. Reassemble the 80TK.
8. To reassemble, mate the two case halves at the end with the thermocouple connector, then "hinge" the two halves together.

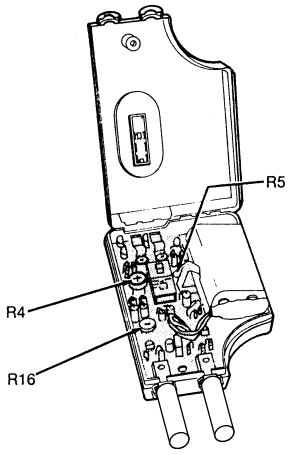
80TK Self Test

The following test is an easy way to verify proper operation of the 80TK:

1. Follow the Battery Replacement Procedure to open the case.
2. Using a short piece of bare wire, short the input thermocouple terminals together.
3. Plug the 80TK into the multimeter.
4. Turn the multimeter and the 80TK on. Set the multimeter to 200, 300, or 400 mV range.
5. The multimeter should read the ambient room temperature.

80TK Calibration Procedure

A calibration cycle of 1 year is recommended to maintain the 80TK within specifications. The required equipment is listed below. Use Calibration Procedure 1 to calibrate the 80TK for use with any K-type thermocouple. Use Calibration Procedure 2 if the 80TK will be used exclusively with one K-type thermocouple. Always calibrate the Celsius function before calibrating the Fahrenheit function.



Location of Calibration Adjustments

Calibration Procedure 1.

Use this procedure to calibrate the 80TK:

1. Verify the condition of the battery as described above and replace the battery if necessary. Follow the Battery Replacement procedure to disassemble the 80TK, but do not remove the battery or reassemble the 80TK.
2. Allow 80TK and the room-temperature water bath to stabilize at room temperature, away from drafts, for at least 30 minutes before proceeding with calibration. Place the reference thermometer into the room temperature water bath. Allow the reading to stabilize.
3. Use the shorting bar to short the 80TK thermocouple input terminals.
4. Plug the 80TK into the dc volts input of the multimeter. Set the multimeter to the 300 mV or equivalent range.
5. Set the switch on the 80TK to CELSIUS position. Adjust R4 to half rotation, then adjust R5 until the reading on the multimeter matches the reading on the mercury reference thermometer ± 5.0 °C. Now adjust R4 until the two readings are within ± 0.1 °C.

   Note

   If the mercury reference thermometer displays °F, use the following conversion to get °C: [5/9 (temp in °F)-32] = (temp in °C)
6. Set the switch on the 80TK to the FAHRENHEIT (center) position.
7. Adjust R16 until the reading on the multimeter matches the reading on the mercury reference thermometer ± 0.2°F.

   Note

   If the mercury reference thermometer displays °C, use the following conversion to get °F:[9/5(temp in °C) + 32] = (temp in °F)
8. Set 80TK switch to the OFF position. Remove 80TK from multimeter and remove any connections to the 80TK thermocouple input terminals.
9. Reassemble the 80TK.
10. The 80TK is now calibrated.

Calibration Procedure 2.

Use this procedure if the 80TK will be used exclusively with one K-type thermocouple:

Perform Calibration Procedure 1. Substitute the following for step 3 in Calibration Procedure 1:

3. Connect the thermocouple to the 80TK thermocouple input, and place the thermocouple into the room temperature bath along with the mercury reference thermometer.

Required Equipment

Refer to Table 1 for equipment required to calibrate the 80TK.

Table 1. Required Equipment

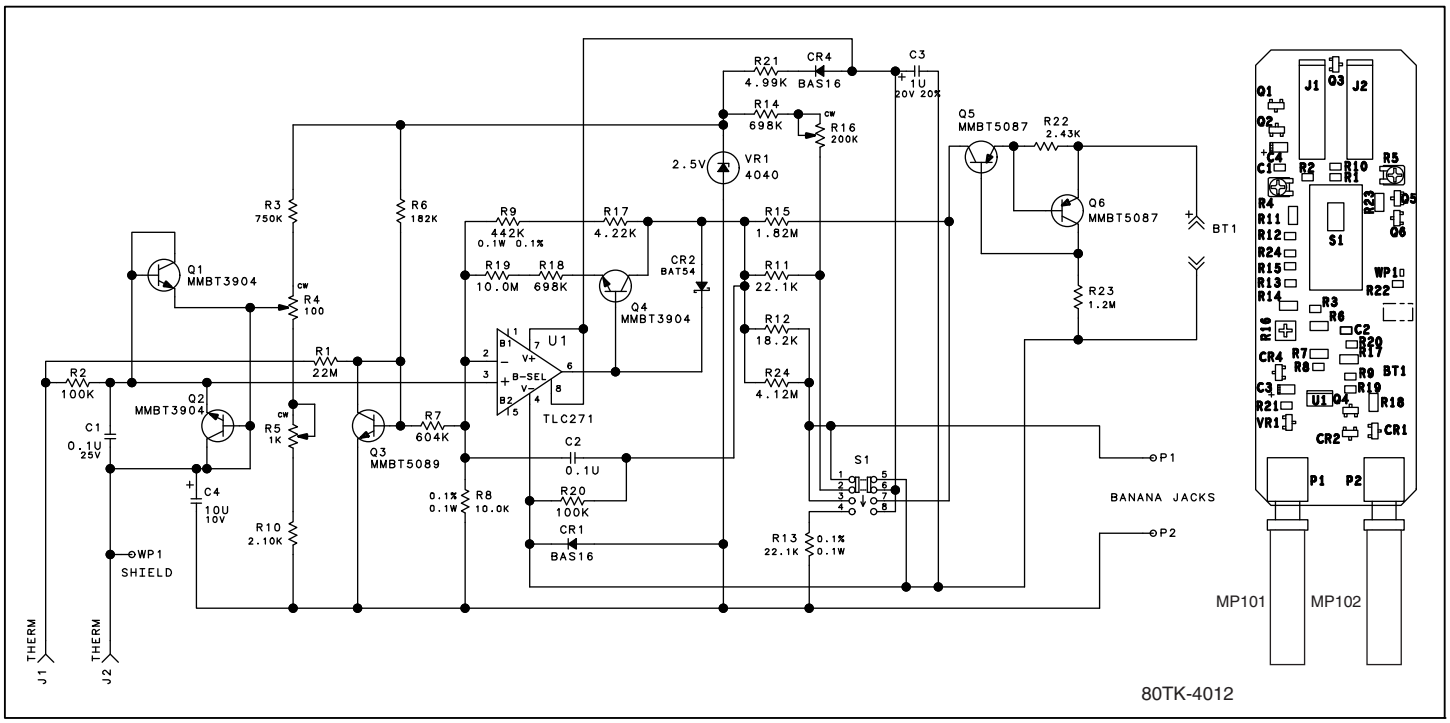
Instrument	Minimum Specification	Recommended Model
Mercury Reference Thermometer	0.1 °C resolution	Princo Model SAMA-CP45
Dewar Flask and Cap(water bath)	2 pint capacity, filled with water	Thermos bottle
Digital Voltmeter	300 mV range, 100 µV resolution	Fluke Model 87 Series V or equivalent
Shorting bar OR K-type thermocouple	<1 Ω meets NBS standards(with subminiature K plug)	Wire Fluke 80PK-1

To contact Fluke or for service, call one of the following telephone numbers:

USA: 1-888-44-FLUKE (1-888-443-5853)
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Or, visit Fluke's Web site at www.fluke.com.

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Fluke Europe B.V.
P.O. Box 1186
5602 B.D. Eindhoven
The Netherlands



80TK Schematic Diagram

Replaceable Parts

Ref Des	PN	Description
	2814488	CASE TOP
	2814495	CASE BOTTOM
	735860	COVER SWITCH
	735944	SHIELD, BOTTOM
	735910	SHIELD, TOP
	735928	SHIELD CONTACT
	747501	SCREW,SCREW,PH,PO,STL,4-40,.250
MP101	202470	CURRENT SHUNT SHROUD (RED)
MP102	202447	CURRENT SHUNT SHROUD (BLACK)
AR1	802691	IC,OP AMP,TLC271A,PROGRAMMABLE,LOW POWER,SO8
BT1	696534	BATTERY,PRIMARY ,BATTERY,9V,0-15MA
C1 C2	942529	CAPACITOR,SMR,CAP,CER,0.1UF,+-10%,25V,X7R,0805
C3	942552	CAPACITOR,SMR,CAP,TA,1UF,+-20%,20V,3216
C4	650223	CAPACITOR,SMR,CAP,TA,10UF,+-20%,10V,3216
CR1 CR4	830489	DIODE,BAS16,SMR,DIODE,SI,75V,250MA,SOT-23
CR2	876529	DIODE,BAT54,SMR,DIODE,SI,SCHOTTKY,30V,200MA,SOT-23
J1 J2	735993	80TK-8008,CONTACT, THERMOCOUPLE
MP1	1276793	80TK-3012,80TK - PCB SM_PIH
P1 P2	736033	80TK-8009,PLUG,BANANA
Q1 Q2 Q4	742676	NPN,MMBT3904,SMR,TRANSISTOR,SI,NPN,60V,350MW,SOT-23
Q3	820902	NPN,MMBT5089,SMR,TRANSISTOR,SI,NPN,30V,200MW,SOT-23
Q5 Q6	820910	PNP,MMBT5087,SMR,TRANSISTOR,SI,PNP,50V,225MW,SOT-23
R1	802725	RESISTOR,CERMET,22M,+-1%,0.1W,400PPM,0805,TAPE
R10	943006	RESISTOR,CERMET,2.1K,+-1%,0.1W,100PPM,0805,TAPE
R11	913731	RESISTOR,SMR,RES,CERM,22.1K,+-1%,100PPM,1206
R12	802675	RESISTOR,SMR,RES,MF,18.2K,+-0.1%,0.1W,25PPM,0805
R13	802683	RESISTOR,SMR,RES,MF,22.1K,+-0.1%,0.1W,25PPM,0805
R14 R18	867296	RESISTOR,SMR,RES,CERM,698K,+-1%,.125W,100PPM,1206
R15	802717	RESISTOR,CERMET,1.82M,+-1%,0.1W,400PPM,0805
R16	928085	RESISTOR,SMR,RES,VAR,CERM,200K,+-25%
R17	821447	RESISTOR,SMR,RES,CERM,4.22K,+-1%,.125W,100PPM,1206
R19	943659	RESISTOR,CERMET,10M,+-1%,0.1W,400PPM,0805,TAPE
R2 R20	928866	RESISTOR,SMR,RES,CERM,100K,+-1%,0.1W,100PPM,0805
R21	928767	RESISTOR,SMR,RES,CERM,4.99K,+-1%,0.1W,100PPM,0805
R22	928754	RESISTOR,SMR,RES,CERM,2.43K,+-1%,0.1W,100PPM,0805
R23	806240	RESISTOR,SMR,RES,CERM,1.2M,+-5%,.125W,200PPM,1206
R24	802709	RESISTOR,CERMET,4.12M,+-1%,0.1W,400PPM,0805
R3	802659	RESISTOR,SMR,RES,MF,750K,+-0.25%,0.1W,50PPM,0805
R4	106937	RESISTOR,SMR,RES,VAR,CERM,100,+-20%,0.25W
R5	802782	RESISTOR,SMR,RES,VAR,CERM,1K,+-20%,0.25W
R6	927426	RESISTOR,SMR,RES,CERM,182K,+-1%,.125W,100PPM,1206
R7	876441	RESISTOR,SMR,RES,CERM,604K,+-1%,.125W,100PPM,1206
R8	802444	RESISTOR,SMR,RES,MF,10K,+-0.1%,0.1W,50PPM,0805
R9	802667	RESISTOR,SMR,RES,MF,442K,+-0.1%,0.1W,25PPM,0805
S1	740225	SWITCH,SWITCH,SLIDE,DPTT
VR1	930065	BIPOLAR 4040,SMR,IC,V REF,SHUNT,2.5 V,1%,150 PPM,SOT23

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