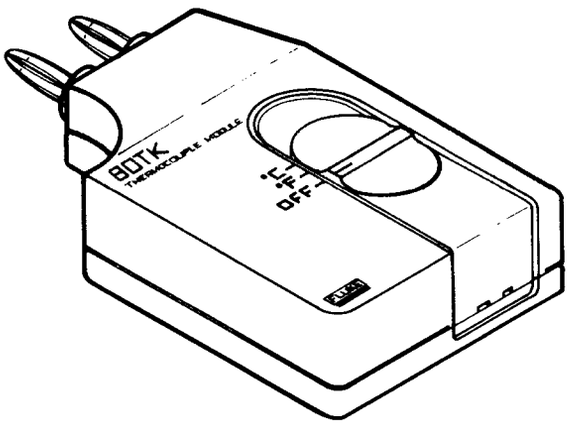


Instruction Sheet

80TK
Thermocouple Module

INTRODUCTION

The Fluke 80TK is a thermocouple converter for use with any K-type thermocouple and a digital multimeter (DMM). The 80TK accepts the output of any K-type thermocouple and converts it to 1 millivolt 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 2V range
3200 count display	0.1° C/F in 300 mV range 1.0° C/F in 3V range

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

Maximum Voltage at Thermocouple Input: 60V DC, 24V AC

RF Field Derating: Strong RF fields can adversely affect measurement accuracy.

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) *

Range	**Accuracy** (% of reading + degrees)
-20 to 350°C	0.5% ± 2°C
-4 to 662°F	0.5% ± 3.6°F
351 to 500°C**	1.75% ± 2°C
663 to 932°F***	1.75% ± 3.6°F
501 to 1000°C	2.0% ± 2°C
933 to 1832°F	2.0% ± 3.6°F
-50 to -21°C	2.5% ± 2°C
-58 to -5.8°F	2.5% ± 3.6°F

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 ounces, 126 grams

Overall length: 4 5/8 inches, 11.75 mm

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

Battery Life: 1600+ hours, 6.5V minimum

Output: 3/4 inch spaced banana plugs,10 megohm minimum load resistance

ACCESSORIES

80PK-1 (included): Bead Probe 4 foot 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

P/N 735985 February 1985

80PK-2: Immersion Probe (6 inch metal sheath)

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

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 24V AC OR 60V 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 dc volts input of the Multimeter. Observe polarity.
2. Set the multimeter to the 200 or 300 millivolt range.
3. Use the 2V or 3V range for higher temperatures. Ignore the decimal point.
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 DMM will read a steady, constant voltage. The voltage readings are:

Range	Reading
C	$\geqslant$ 1.1V
F	$\geqslant$ 2.3V

Battery Condition Test

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

Battery Replacement

WARNING

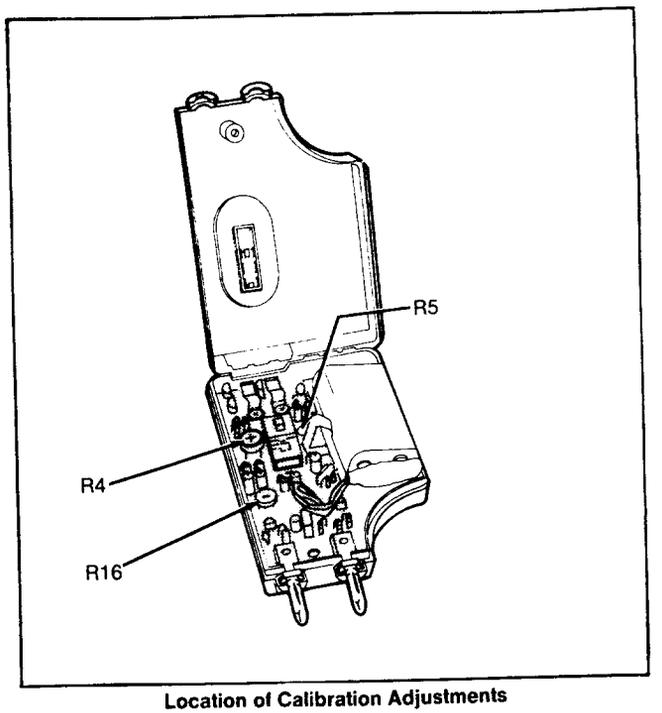
TO AVOID ELECTRICAL SHOCK, REMOVE THE THERMOCOUPLE FROM THE MEASUREMENT SURFACE, OR DISCONNECT THE THERMOCOUPLE FROM THE INSTRUMENT BEFORE OPENING THE CASE. TOTALLY REASSEMBLE THE INSTRUMENT BEFORE ATTEMPTING TO USE IT.

1. Set the power switch to the OFF position.
2. Disconnect the 80TK from the DMM.
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 thermocouple input terminals together.
3. Plug the 80TK into the DMM.
4. Turn the DMM and the 80TK on. Set the DMM to its 200 or 300 mV range.
5. The DMM should read the ambient room temperature.



Location of Calibration Adjustments

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.

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 DMM. Set the DMM to the 300mV 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 DMM 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 DMM 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 postion. Remove 80TK from DMM 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:

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

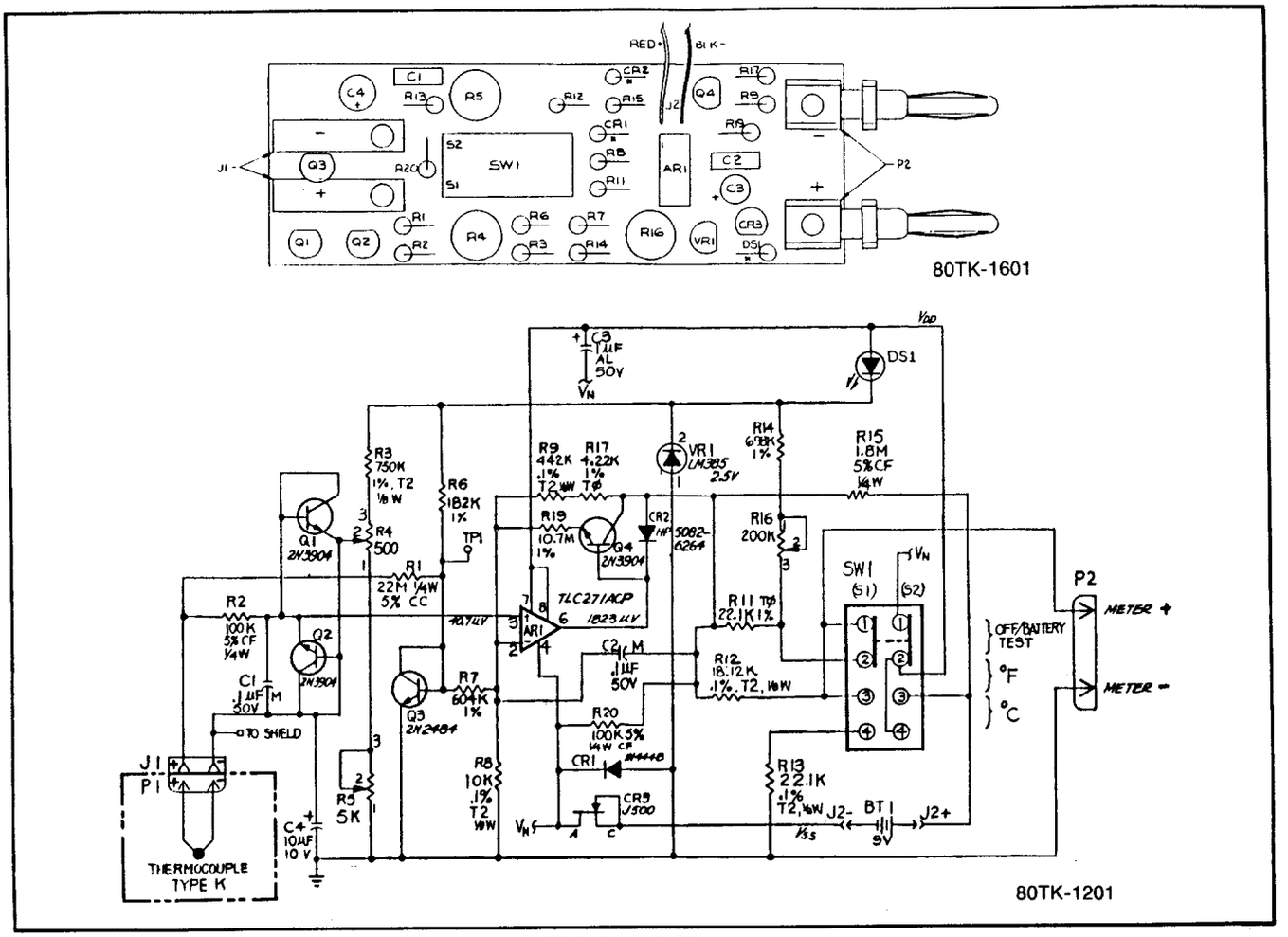
   3. Connect the thermocouple to the 80TK thermocouple input, and place the thermocouple into the room temperature bath along with the mercury reference thermometer.

Required Equipment

The following equipment is required to calibrate the 80TK.

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, 10 megohm input impedance	Fluke Model 25
Shorting bar	<1 ohm	Wire
OR K-type thermocouple	meets NBS standards (with subminiature K plug)	Fluke 80PK-1



80TK Schematic Diagram

Replaceable Parts

REFERENCE DESIGNATOR	JF P/N	DESCRIPTION
	735845	CASE,TOP
	735852	CASE,BOTTOM
	735860	COVER,SWITCH
	735910	SHIELD,TOP
	735928	CONTACT, SHIELD
	735944	SHIELD,BOTTOM
	747501	SCREW,MACH,PHPO,4-40X1/4,TIN PLATE
AR1	753319	IC,OP AMP,PRGMMABLE LOW POWER,SELECTED
BT1	696534	BATTERY,9V,0-15MA
C1,C2	649913	CAP,POLYES,0.1UF,+-10%,50V
C3	733683	CAP,AL,1UF,+-20%,50V
C4	714766	CAP,TA,10 UF,+-20%,10V
CR1	659516	DIODE,SI,BV=75V,1N4448
CR2	753301	DIODE,SI,SCHOTTKY,SMALL SIG,HP5082-6264
CR3	741512	DIODE,SI,N-JFET,CURRENT REG,IF=0.24MA,J500
DS1	723486	DIODE,LED,RED
J1	735993	CONTACT, THERMOCOUPLE
J2	738179	CONNECTOR, BATTERY
P1	736033	PLUG,BANANA
Q1,Q2,Q4	698225	XSISTOR,SI,NPN,SMALL SIGNAL,2N3904
Q3	741363	XSISTOR,SI,NPN,SMALL SIGNAL
R11	655266	RES,MF,22.1K,+-1%,0.125W,100PPM
R12	734020	RES,MF,18.12K,+-0.1%,0.125W,50PPM
R13	733998	RES,MF,22.1K,+-0.1%,0.125W,50PPM
R14	757252	RES,MF,698K,+-1%,0.125W,100PPM
R15	747790	RES,CF,1.8M,+-5%,0.25W
R16	757245	RES,VAR,CERM,200K,+-20%,0.3W
R1	748186	RES,CC,22M,+-5%,0.25W
R17	746180	RES,MF,4.22K,+-1%,0.125W,100PPM
R19	756593	RES,MF,10.7M,+-1%,0.125W,100PPM
R20,R2	658963	RES,CF,100K,+-5%,0.25W
R3	746164	RES,MF,750K,+-1%,0.125W,50PPM
R4	733642	RES,VAR,CERM,500,+-20%,0.3W
R5	733659	RES,VAR,CERM,5K,+-20%,0.3W
R6	733592	RES,MF,182K,+-1%,0.125W,100PPM
R7	659078	RES,MF,604K,+-1%,0.125W,100PPM
R8	733972	RES,MF,10K,+-0.1%,0.125W,50PPM
R9	756585	RES,MF,442K,+-0.1%,0.125W,50PPM
SW1	740225	SWITCH,SLIDE,DPTT
VR1	748178	IC, 2.5V,100 PPM T.C.,BANDGAP REF

WARRANTY

ONE YEAR LIMITED WARRANTY

Fluke warrants your accessory to be free from defects in material and workmanship under normal use and service for 1 YEAR from date of purchase to the original purchaser. It does not apply to batteries or fuses or when the accessory has been misused, altered or damaged by accident or abnormal conditions of operation.

For warranty service, send the accessory, with a description of the difficulty, postage prepaid, to a Fluke Service Center. Fluke assumes no risk for damage in transit. Fluke will, at our option, repair or replace the defective accessory free of charge. However, if we determine that the failure was caused by misuse, alteration, accident, or abnormal condition of operation, you will be billed for the repair. The repaired accessory will be returned, transportation prepaid.

FLUKE MAKES NO WARRANTY OTHER THAN THE LIMITED WARRANTY STATED ABOVE. ALL WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, ARE LIMITED TO A PERIOD OF 1 YEAR FROM THE DATE OF PURCHASE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

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