

2510 TEC SourceMeter

The Model 2510 Thermoelectric Cooler Controller is designed to:

- control the power to the TEC to maintain a constant temperature, current, voltage, or thermistor resistance
- measure the resistance of the TEC
- software PID loop

CONTROL SYSTEM SPECIFICATIONS

SET: Constant Peltier Temperature
Constant Peltier Voltage
Constant Peltier Current
Constant Thermistor Resistance

CONTROL METHOD:

Programmable software PID loop.
Proportional, Integral, and Derivative gains independently programmable.

SETPOINT SHORT TERM STABILITY: $\pm 0.005^\circ\text{C rms}$.^{2,3}

SETPOINT LONG TERM STABILITY: $\pm 0.01^\circ\text{C}$.^{2,4}

SETPOINT RANGE: -50°C to 225°C .

OVER TEMPERATURE LIMIT: 250°C max .

UNDER TEMPERATURE LIMIT: -50°C max .

SETPOINT RESOLUTION: 0.001°C , 1mV , $100\mu\text{A}$, 0.01% of nominal (25°C) thermistor resistance.

HARDWARE CURRENT LIMIT: 1.0A to $5.25\text{A} \pm 5\%$.

SOFTWARE VOLTAGE LIMIT: ± 0.5 to $10.5\text{V} \pm 5\%$.

THERMAL FEEDBACK ELEMENT SPECIFICATIONS (1 Year, $23^\circ\text{C} \pm 5^\circ\text{C}$)

Sensor Type	RTD		Thermistor				Solid State	
	100 Ω	1 k Ω	100 Ω	1 k Ω	10 k Ω	100 k Ω	Current Output (I_{SS})	Voltage Output (V_{SS})
Excitation ⁹	2.50 mA	833 μA	2.5 mA	833 μA	100 μA	33 μA	+13.5V	2.5 mA
Compliance						833 $\mu\text{A max}$	833 μA	15.75 V max
Nominal Resistance Range	0–250 Ω	0–2.50 k Ω	0–1 k Ω	0–10 k Ω	0–80 k Ω	0–200 k Ω		
Excitation Accuracy	$\pm 2.9\%$	$\pm 2.9\%$	$\pm 2.9\%$	$\pm 2.9\%$	$\pm 2.9\%$	$\pm 2.9\%$	$\pm 12\%$	$\pm 2.9\%$
Nominal Sensor Temperature Range	-50° to $+250^\circ\text{C}$	-50° to $+250^\circ\text{C}$	-50° to $+250^\circ\text{C}$	-50° to $+250^\circ\text{C}$	-50° to $+250^\circ\text{C}$	-50° to $+250^\circ\text{C}$	-40° to $+100^\circ\text{C}$	-40° to $+100^\circ\text{C}$
Sensor Coefficients	α, β, δ	α, β, δ	A, B, C	A, B, C	A, B, C	A, B, C	Slope & offset	Slope & offset
Measurement Accuracy ($\pm\%$ rdg + offset)	$0.04 + 0.07 \Omega$	$0.04 + 0.4 \Omega$	$0.04 + 0.07 \Omega^1$	$0.04 + 0.4 \Omega^1$	$0.02 + 3 \Omega^1$	$0.04 + 21 \Omega$	$0.03 + 100 \text{ nA}$	$0.03 + 500 \mu\text{V}$

THERMISTOR MEASUREMENT ACCURACY¹⁴

Nominal Thermistor Resistance	Accuracy vs. Temperature			
	0 $^\circ\text{C}$	25 $^\circ\text{C}$	50 $^\circ\text{C}$	100 $^\circ\text{C}$
100 Ω	0.021 $^\circ\text{C}$	0.035 $^\circ\text{C}$	0.070 $^\circ\text{C}$	0.27 $^\circ\text{C}$
1 k Ω	0.015 $^\circ\text{C}$	0.023 $^\circ\text{C}$	0.045 $^\circ\text{C}$	0.18 $^\circ\text{C}$
10 k Ω	0.006 $^\circ\text{C}$	0.012 $^\circ\text{C}$	0.026 $^\circ\text{C}$	0.15 $^\circ\text{C}$
100 k Ω	0.009 $^\circ\text{C}$	0.014 $^\circ\text{C}$	0.026 $^\circ\text{C}$	0.13 $^\circ\text{C}$

GENERAL

NOISE REJECTION:

SPEED	NPLC	CMRR ¹²
Normal	1.00	90 dB

SOURCE OUTPUT MODES: Fixed DC level.

PROGRAMMABILITY: IEEE-488 (SCPI-1995.0), RS-232, 3 user-definable power-up states plus factory default and *RST.

POWER SUPPLY: Nominal 100 to 240VAC rms, 50–60Hz, 90VA.

WARRANTY: 1 year.

EMC: Conforms to European Union Directive 89/336/EEC, EN 61326-1.

SAFETY: Conforms to European Union Directive 73/23/EEC, EN 61010-1.

VIBRATION: MIL-PRF-28800F Class 3 Random Vibration.

WARM-UP: 1 hour to rated accuracies.

DIMENSIONS, WEIGHT: 89mm high \times 213 mm wide \times 370mm deep (3½ in \times 8½ in \times 14½ in).
Bench configuration (with handle & feet): 104mm high \times 238mm wide \times 370mm deep (4½ in \times 9½ in \times 14½ in). **Net Weight:** 3.8kg (8.38 lbs).

ENVIRONMENT: Operating: 0°–50°C, 70% R.H. up to 35°C. Derate 3% R.H./°C, 35°–50°C.
Storage: –25° to 65°C

TEC OUTPUT SPECIFICATIONS

OUTPUT RANGE: $\pm 10\text{VDC}$ at up to $\pm 5\text{ADC}$.

OUTPUT RIPPLE: $< 5\text{mV rms}$.⁵

AC RESISTANCE EXCITATION: $\pm(9.6\text{mA} + 190\mu\text{A})$.^{10,11}

TEC MEASUREMENT SPECIFICATIONS

FUNCTION	1 Year, $23^\circ\text{C} \pm 5^\circ\text{C}$
Operating Resistance ^{1,6,7,8}	$\pm(2.0\%$ of rdg + 0.1Ω)
Operating Voltage ^{1,6}	$\pm(0.1\%$ of rdg + 4mV)
Operating Current ⁶	$\pm(0.4\%$ of rdg + 8mA)
AC Resistance ^{1,13}	$\pm(0.10\%$ of rdg + 0.02Ω)

OPEN SHORTED THERMOELECTRIC DETECTION

LOAD IMPEDANCE: Stable into $1\mu\text{F}$ typical.

COMMON MODE VOLTAGE: 30VDC maximum.

COMMON MODE ISOLATION: $> 10^9\Omega$, $< 1500\text{pF}$.

MAX. SENSE LEAD RESISTANCE: 1Ω for rated accuracy.

MAX. FORCE LEAD RESISTANCE: 0.1Ω .

OPEN/SHORTED ELEMENT DETECTION

SOFTWARE LINEARIZATION FOR THERMISTOR AND RTD

COMMON MODE VOLTAGE: 30VDC .

COMMON MODE ISOLATION: $> 10^9\Omega$, $< 1000\text{pF}$.

MAX. VOLTAGE DROP IN INPUT FORCE LEADS: 1 volt.

MAX. SENSE LEAD RESISTANCE: 100Ω for rated accuracy.

SENSE INPUT IMPEDANCE: $> 1 \cdot 10^8\Omega$.

NOTES

- 1 With remote voltage sense.
- 2 With $10\text{k}\Omega$ thermistor as sensor.
- 3 Short term stability is defined as 24 hours with Peltier and Model 2510 at $25^\circ\text{C} \pm 0.5^\circ\text{C}$.
- 4 Long term stability is defined as 30 days with Peltier and Model 2510 at $25^\circ\text{C} \pm 0.5^\circ\text{C}$.
- 5 10Hz to 10MHz measured at 5A output into a 2Ω load.
- 6 Common mode voltage = 0V (meter connect enabled, connects Peltier low output to thermistor measure circuit ground). $\pm(0.1\%$ of rdg + 0.1Ω) with meter connect disabled.
- 7 Resistance range 0Ω to 20Ω for rated accuracy.
- 8 Current through Peltier $> 0.2\text{A}$.
- 9 Default values shown, selectable values of $3\mu\text{A}$, $10\mu\text{A}$, $33\mu\text{A}$, $100\mu\text{A}$, $833\mu\text{A}$, 2.5mA . Note that temperature control performance will degrade at lower currents.
- 10 AC Ohms is a dual pulsed measurement using current reversals available over bus only.
- 11 @ $23^\circ\text{C} \pm 5^\circ\text{C}$.
- 12 For $1\text{k}\Omega$ unbalance in LO lead. Minimum amplifier specification.
- 13 Resistance range 0Ω to 100Ω for rated accuracy.
- 14 Accuracy figures represent the uncertainty that the Model 2510 may add to the temperature measurement, not including thermistor uncertainty. These accuracy figures are for thermistors with typical A, B, C constants.