USB-2001-TC

Specifications

Revision 1.1, January, 2010

Specifications

All specifications are subject to change without notice.
Typical for 25 °C unless otherwise specified.

Caution! Electromagnetic interference can adversely affect the measurement accuracy of this product. The input terminals of this device are not protected for electromagnetic interference. As a result, this device may experience reduced measurement accuracy or other temporary performance degradation when connected cables are routed in an environment with radiated or conducted radio frequency electromagnetic interference. To limit radiated emissions and to ensure that this device functions within specifications in its operational electromagnetic environment, take precautions when designing, selecting, and installing measurement probes and cables.

Analog input

Table 1. Input characteristics

Parameter	Conditions	Specification
Number of channels		One
ADC resolution		20 bits
Input ranges		±73.125 mV, calibrated ±146.25 mV, not calibrated. Used for open thermocouple detection.
Common-mode range	Channel-to-USB ground	±30 V
Common-mode rejection ratio (0 to 60 Hz)	Channel-to-USB ground	>145 dB
Noise rejection	50/60 Hz	>80 dB
Temperature measurement ranges		Works over temperature ranges defined by NIST (J, K, R, S, T, N, E, and B thermocouple types.) The E type has a maximum limit of 900 ºC.
Conversion time		250 ms
Input bandwidth	–3 dB	1 Hz
Differential input impedance		20 MΩ between isolated 3.3 V and ground
Input noise		2 µVpp
Open thermocouple bias voltage		3.3 V
Cold-junction compensation sensor accuracy	0 to 65 ºC	1.25 °C maximum, 0.6 °C typical
Cold-junction compensation sensor resolution		0.0625 °C typical
Overvoltage protection		30 V max between TC+ and TC–

Channel configurations

Table 2. Channel configuration specifications

Sensor category	Conditions	Specification
Thermocouple (Note 2)	J, K, S, R, B, E, T, or N	One differential channel

Note 1: Channel configuration information is stored in internal FLASH Program Memory on the microcontroller by the firmware whenever any item is modified. Modification is performed by commands issued over USB from an external application, and the configuration is non-volatile.

Note 2: The factory default configuration is *undefined '#'*.

Compatible thermocouples

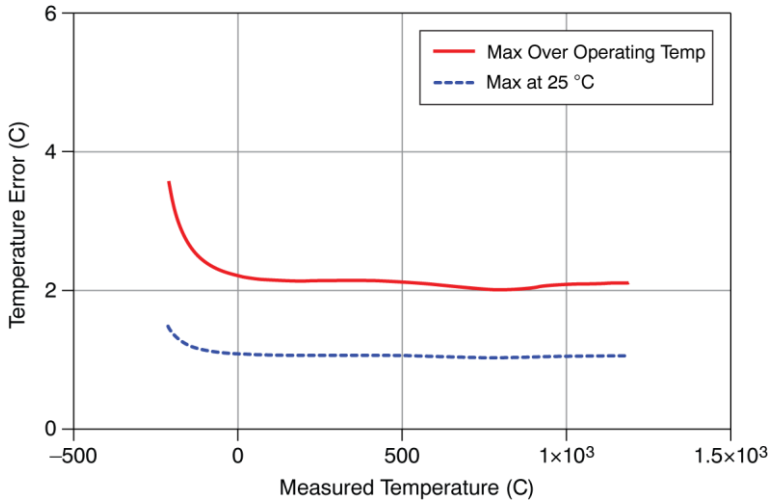
Table 3. Compatible sensor type specifications

Parameter	Specification	
Thermocouple type	J:	–210 °C to 1200 °C
	K:	–270 °C to 1372 °C
	R:	–50 °C to 1768 °C
	S:	–50 °C to 1768 °C
	T:	–270 °C to 400 °C
	N:	–270 °C to 1300 °C
	E:	–270 °C to 900 °C
	B:	0 °C to 1820 °C

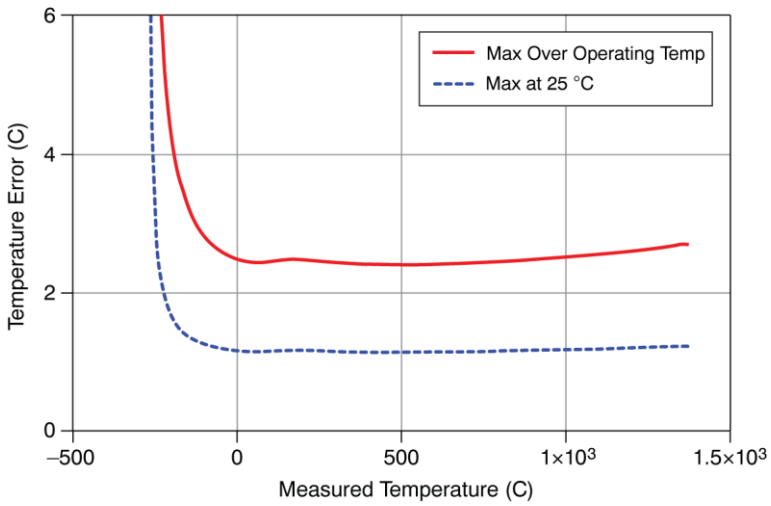
Temperature accuracy

The following graphs show the errors for each thermocouple type when connected to the USB-2001-TC. The graphs display the maximum errors at 25 °C and over the full operating temperature range, and account for cold-junction compensation errors. The graphs were generated using thermocouples connected to subminiature connectors of the same type.

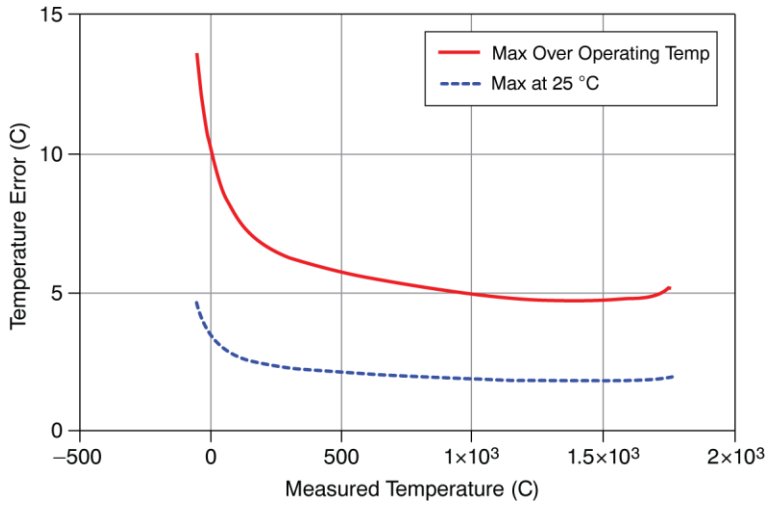
The CJC sensor resolution is 0.0625 °C. This is the minimum value of the CJC step width. As such, the reading may result in a saw tooth curve rather than a square curve as the temperature inside the board changes. This is the expected behavior.



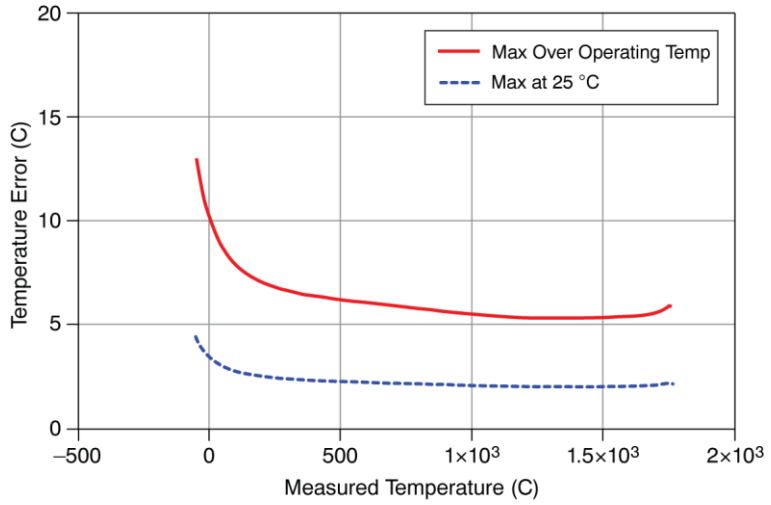
Temperature error of J type thermocouple



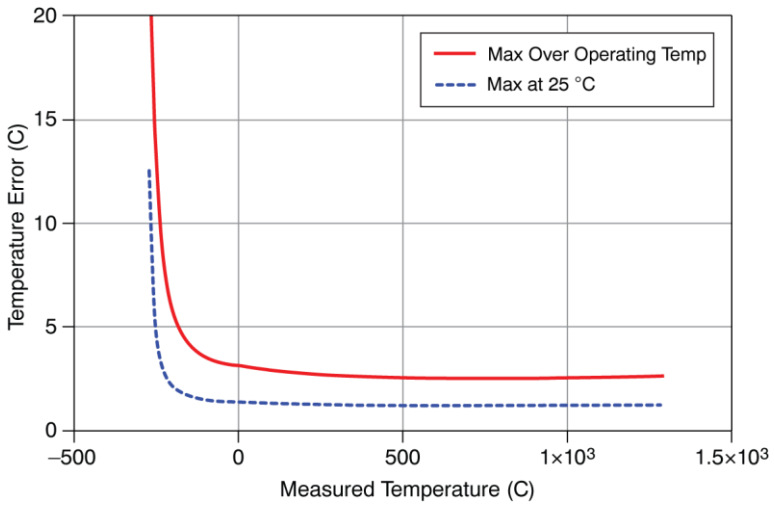
Temperature error of K type thermocouple



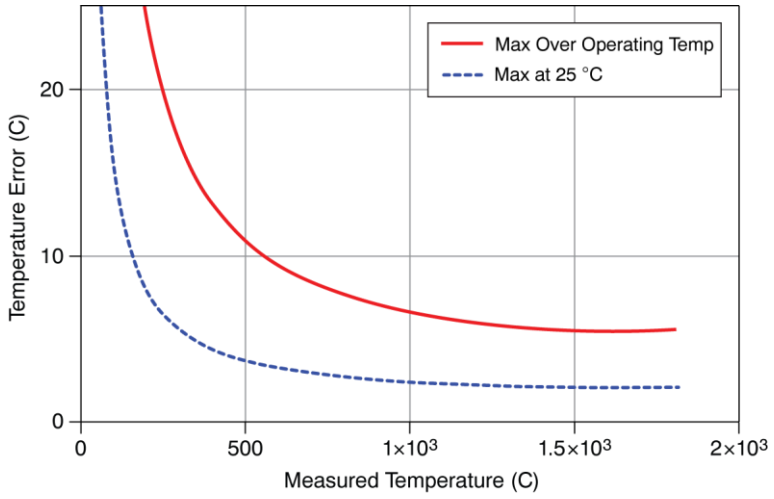
Temperature error of R type thermocouple



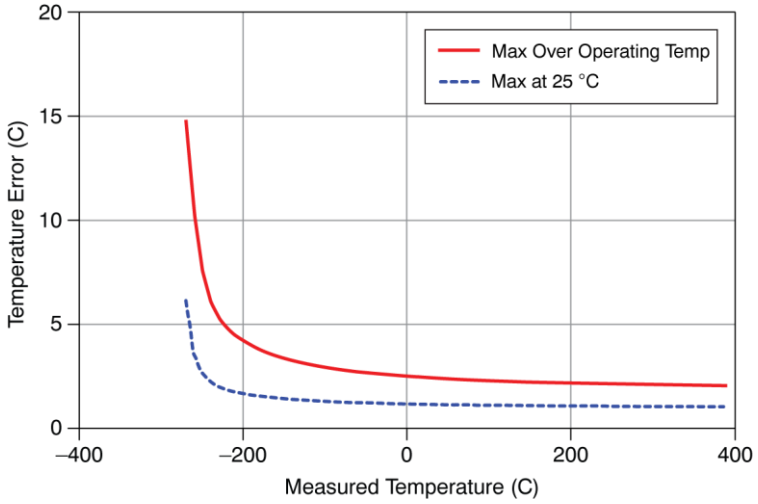
Temperature error of S type thermocouple



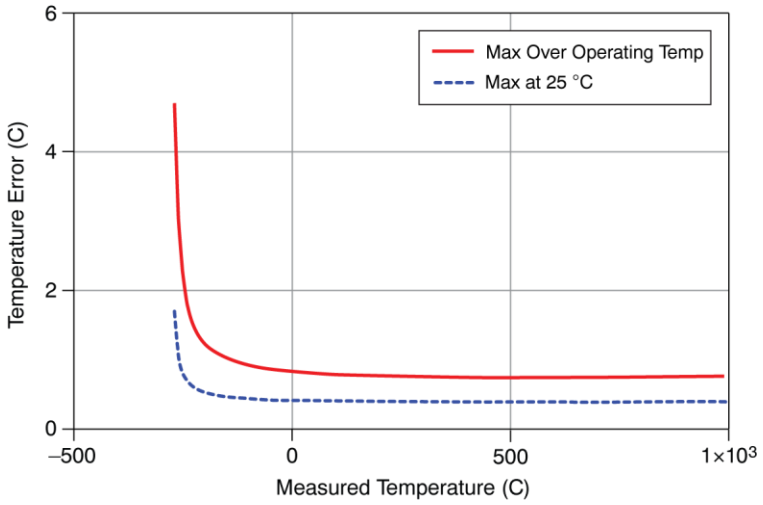
Temperature error of N type thermocouple



Temperature error of B type thermocouple



Temperature error of T type thermocouple



Temperature error of E type thermocouple

LED indicator

Table 4. LED behavior

Condition	Specification
Steady green	The device is powered and ready for operation.
Blinking green	The device is powered, but not yet enumerated by the USB.
Off	The device is not powered or is in USB suspend.

Power

Table 5. Power specifications

Parameter	Specification
Current consumption from USB	150 mA maximum, 100 mA typical
Suspend current	2.5 mA maximum
Recommended warm-up time	15 minutes

Safety voltages

Connect only voltages that are within these limits.

Table 6. Safety voltage specifications

Parameter	Conditions	Specification
Isolation	Channel-to-earth ground	+30 V maximum (Note 3)

Note 3: Measurement Category I is for measurements performed on circuits *not* directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Bus interface

Table 7. Bus specifications

Parameter	Specification
USB specification	USB 2.0 Full-Speed
Device compatibility	USB 1.1, USB 2.0

Mechanical

Table 8. Mechanical specifications

Parameter	Specification
Dimensions	62.56 mm (L) x 38.10 mm (W) x 20.32 mm (H) 2.46 in. (L) x 1.50 in. (W) x 0.80 in. (H)
Cable length	2 meters (6.5 feet)
Weight	Approximately 116 g (4.1 oz)

Environment

Table 9. Environmental specifications

Operating temperature range	0 to 55 ° C
Storage temperature range	–40 to 85 ° C
Operating humidity	10 to 90% non-condensing
Storage humidity	5 to 95% RH, noncondensing
Maximum altitude	2,000 m (at 25 ºC ambient temperature)
Pollution degree	2

Note 4: The USB-2001-TC is intended for indoor use only.

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