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SPECIFICATIONS

USB-TC01

1-Channel Temperature Input Device

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* specifications describe the performance met by a majority of models.
- *Nominal* specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

Conditions

Specifications are valid at 25 °C unless otherwise noted.

Warm-Up Time

Recommended warm-up time	15 minutes

Input Characteristics

Number of channels	1
ADC resolution	20 bits
Input range	±73.125 mV
Common-mode range, Channel-to-USB ground	±30 V
Common-mode rejection ratio (0 to 60 Hz), Common-to-USB ground	>145 dB
Noise rejection (50/60 Hz)	>80 dB

NATIONAL INSTRUMENTS

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 °C.)
Conversion time	250 ms
Sample rate	4 S/s, maximum, software-timed
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 °C to 65 °C	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-

Note 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.

Temperature Measurement Accuracy

The following figures show the errors for each thermocouple type when connected to the USB-TC01. The figures display the maximum errors at 25 °C and over the full operating temperature range, and account for cold-junction compensation errors. The figures were generated using thermocouples connected to subminiature connectors of the same type.

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

Figure 1. Temperature Error of Type J Thermocouple

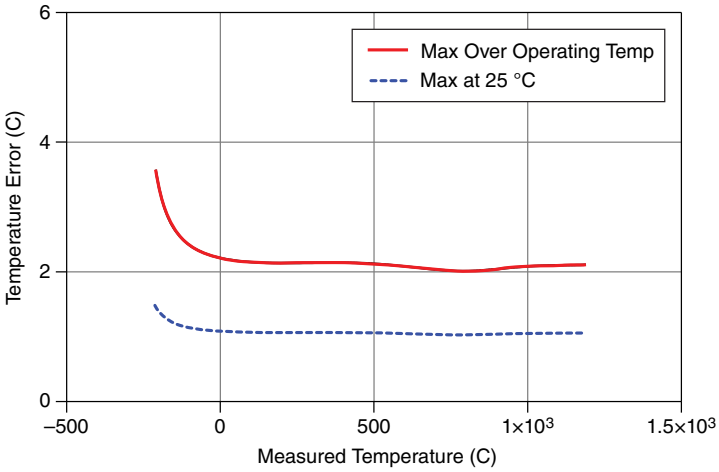


Figure 2. Temperature Error of Type K Thermocouple

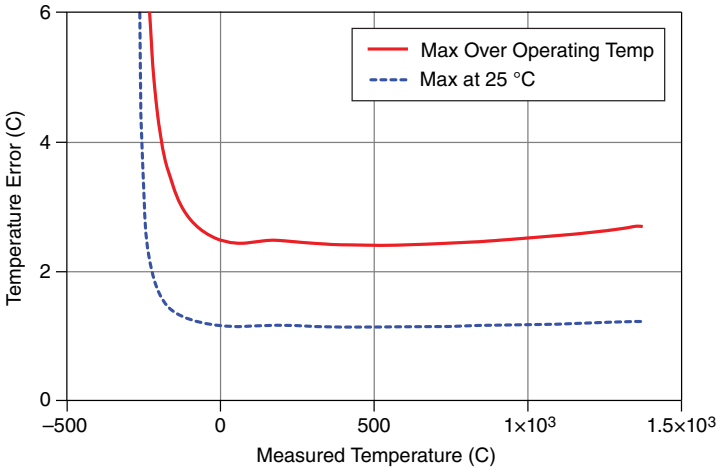


Figure 3. Temperature Error of Type R Thermocouple

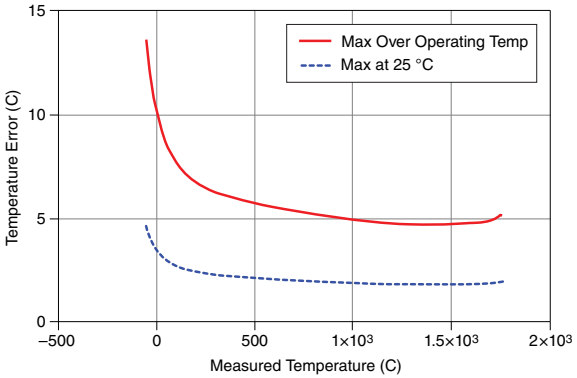


Figure 4. Temperature Error of Type S Thermocouple

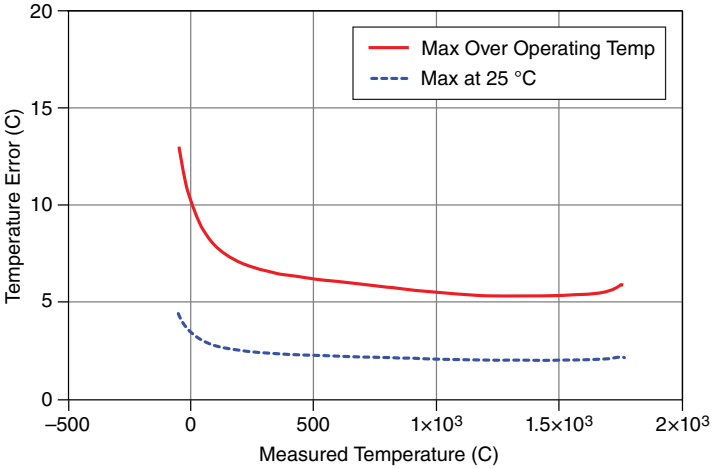


Figure 5. Temperature Error of Type N Thermocouple

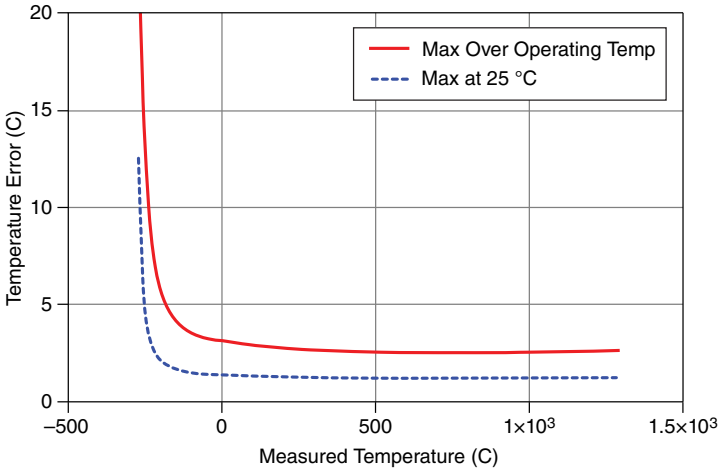


Figure 6. Temperature Error of Type B Thermocouple

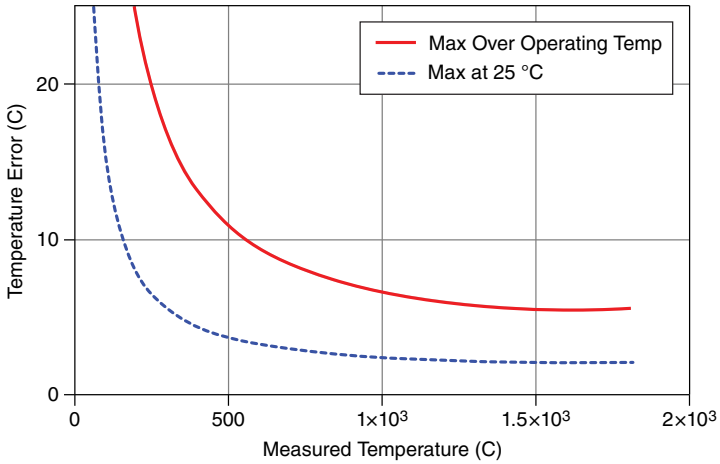


Figure 7. Temperature Error of Type T Thermocouple

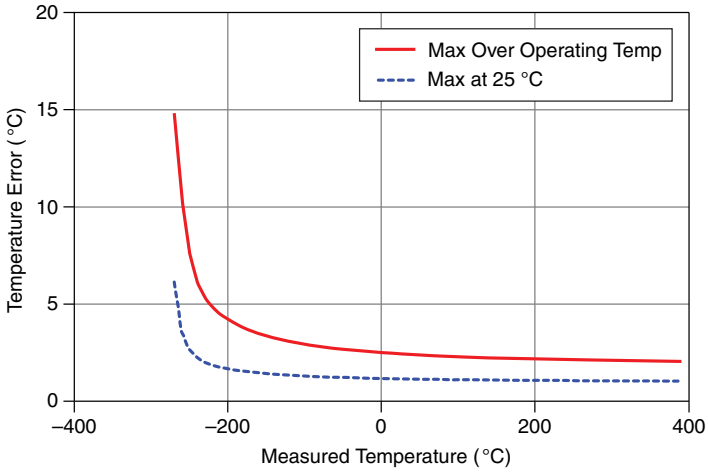
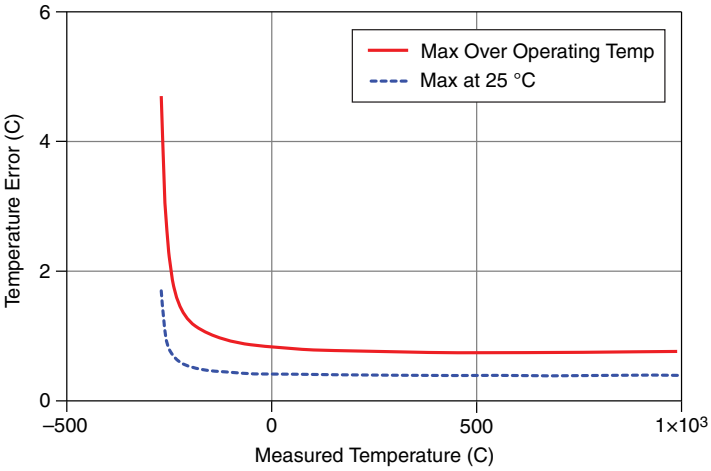


Figure 8. Temperature Error of Type E Thermocouple



Power Requirements

Current consumption from USB	150 mA maximum, 100 mA typical
Current consumption from USB in suspend mode	2.5 mA maximum

Bus Interface

USB specification	USB 2.0 full speed

Physical Characteristics

Dimensions	62.56 x 38.10 x 20.32 mm (2.463 x 1.5 x 0.8 in.) with a 2 m USB cable
Weight	116 g (4.1 oz), approximate
USB cable length	2 m (6.5 ft)

Safety Voltages

Connect only voltages that are within these limits.

Isolation, channel-to-earth ground, continuous	±30 V max, Measurement Category I

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

Caution Do not use this module for connection to signals or for measurements within Measurement Categories II, III, or IV

Note Measurement Categories CAT I and CAT O (Other) are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Hazardous Locations

This device is not certified for use in hazardous locations.

Environmental

Operating temperature (IEC 60068-2-1 and IEC 60068-2-2)	0 °C to 55 °C
Storage temperature (IEC 60068-2-1 and IEC 60068-2-2)	-40 °C to 85 °C
Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5% to 95% RH, noncondensing
Maximum altitude	2,000 m (at 25 °C ambient temperature)
Pollution Degree (IEC 60664)	2

Indoor use only.

Safety

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations and certifications, and additional information, refer to the *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit *ni.com/certification*, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at *ni.com/environment*. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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