

USB-TEMP and TC Series

USB-Based Temperature Measurement Devices



Features

- Temperature and voltage measurement USB devices
- Thermocouple, RTD, thermistor, or semiconductor sensor measurements
- Eight analog inputs
- Up to ± 10 V inputs*
- 24-bit resolution
- Eight digital I/O
- One counter input*

Software

Supported Operating Systems

- Windows 8/7/Vista/XP 32/64-bit
 - Universal library (UL), ULx for NI LabVIEW
- Android
 - UL for Android (USB-TEMP and USB-TC only)

Ready-to-Run Applications

- InstaCal (install, calibrate, and test)
- DAQami (acquire, view, and log)
- TracerDAQ (acquire, view, log, and generate)

Supported Programming Environments

- Visual Studio® and Visual Studio .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic .NET
- Java (Android only) including examples and demo apps
- LabVIEW (Windows only)
- DASyLab

Overview

All USB-TEMP and TC Series devices support thermocouple inputs. The USB-TEMP and TEMP-AI also supports RTD, thermistor, and semiconductor sensor measurements. In addition, voltage measurements are supported by the USB-TEMP-AI and USB-TC-AI.

Each device also includes eight digital I/O channels which can be user-configured for alarming or triggering.



The USB-TEMP Series provides temperature measurement flexibility as each channel can monitor any of the supported input types

USB-TEMP and USB-TC Series Selection Chart				
Model	Channels	Thermocouple Inputs	RTD, Thermistor, Semiconductor Sensor Inputs	Voltage Inputs
USB-TC	8	✓	—	—
USB-TEMP	8	✓	✓	—
USB-TC-AI	8	✓	—	✓
USB-TEMP-AI	8	✓	✓	✓

Analog Input

The USB-TEMP and USB-TC each include eight thermocouple inputs. The USB-TEMP also supports RTD, thermistor, and semiconductor sensor measurements.

The USB-TEMP-AI and USB-TC-AI feature four thermocouple inputs plus four voltage inputs with ranges up to ± 10 V. The USB-TEMP-AI also supports RTD, thermistor, and semiconductor sensor measurements. The USB-TEMP-AI and USB-TC-AI also offer four voltage input channels with ranges from ± 1.25 V to ± 10 V.

All devices also include open thermocouple detection to identify improperly working thermocouples.

Sample Rate

Each channel can be sampled at up to two samples per second for a total device throughput of 16 samples per second. USB-TEMP and TC Series devices also feature 24-bit Sigma-Delta analog-to-digital converters for maximum accuracy.

Digital I/O

Eight digital I/O lines are featured on each model. Each 5 V line can be independently configured for input or output.

Counter

One 32-bit counter is included on USB-TEMP-AI and USB-TC-AI devices. This TTL level input is capable of read/write rates of up to 1000 Hz with an input frequency of up to 1 MHz.

* USB-TEMP-AI and USB-TC-AI only

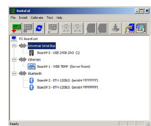

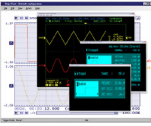
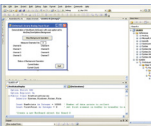

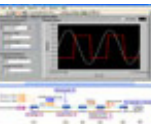

USB-TEMP and TC Series

General Information



Software Support

USB-TEMP and TC Series devices are supported by the software in the table below.

Ready-to-Run Applications		
InstaCal™		An interactive utility that configures MCC hardware, and for supported devices, performs calibration tasks. Windows® OS InstaCal is included with the free MCC DAQ Software bundle (CD/download).
DAQami		Drag-and-drop software interface used to acquire, view, and log data. DAQami can be configured to log analog channels and to view that data in real-time or post-acquisition on user-configurable displays. Windows OS DAQami pre-release is available as a free software download.
TracerDAQ® and TracerDAQ Pro		A virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. The Pro version provides enhanced features. Windows OS TracerDAQ is included with the free MCC DAQ Software bundle (CD/download). TracerDAQ Pro is available as a purchased software download.
General-Purpose Programming Support		
Universal Library (UL)		Programming library of function calls for C, C++, VB, C# .Net, and VB .Net using Visual Studio and other IDEs. Windows OS The UL is included with the free MCC DAQ Software bundle (CD/download).
UL for Android™		Programming library of function calls for Java programmers who develop apps for Android-based tablets and phones. UL for Android communicates with select MCC DAQ devices. Supports Android project development on Windows, Linux, Mac OS X UL for Android is included with the free MCC DAQ Software bundle (CD/download). UL for Android is supported by the USB-TEMP and USB-TC only.
Application-Specific Programming Support		
ULx for NI LabVIEW™		A comprehensive library of VIs and example programs for NI LabVIEW that is used to develop custom applications that interact with most MCC devices. Windows OS ULx is included with the free MCC DAQ Software bundle (CD/download).
DASYLab® Driver		Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming. DASYLab is available as a purchased software download. Windows OS

USB-TEMP and TC Series

USB-TEMP-AI and USB-TC-AI Specifications



Specifications

USB-TEMP-AI/USB-TC-AI

All specifications are subject to change without notice.
Typical for 25 °C unless otherwise specified.
All specifications apply to all temperature and voltage input channels unless otherwise specified.

Analog Input

A/D Converter Type: T0x-T3x, V0x-V3x, AD42_321, dual 24-bit Sigma-Delta

Number of Channels

Voltage Input: 4 differential, V0x-V3x,
4 single-ended

Temperature Input: 4 differential, T0x-T3x

Input Isolation: 500 VDC min between field wiring and USB interface

Channel Configuration

T0x-T3x: Temperature input, software programmable to match sensor type

V0x-V3x: Voltage input

Analog Input Modes

Power Up and Reset State: Factory default configuration is Disabled mode; once configured, each channel reverts to the mode previously set by the user

Single-Ended: Vx_H inputs are connected directly to their screw terminal pins; Vx_L inputs are disconnected from their screw terminal pins and internally connected to GND

Differential: Vx_H and Vx_L inputs are connected directly to their screw terminal pins; Tx_H and Tx_L inputs are connected directly to their screw terminal pins

Input Ranges

Thermocouple: T0x-T3x, ± 0.080 V

RTD[†]: T0x-T3x, 0 to 0.5 V

Thermistor[†]: T0x-T3x, 0 to 2 V

Semiconductor Sensor[†]: T0x-T3x, 0 to 2.5 V

Voltage: V0x-V3x, ± 10 V, ± 5 V, ± 2.5 V, ± 1.25 V,
software selectable

Absolute Maximum Input Voltage

T0x-T3x Relative to GND: ± 25 V max (power on), ± 40 V max (power off),
(pins 9, 19, 22, 27, 30, 33, 36, 39, 49)

V0x-V3x Relative to GND: ± 25 V max (power on), ± 15 V max (power off),
(pins 9, 19, 22, 27, 30, 33, 36, 39, 49)

Input Impedance

T0x-T3x: 5 G Ω (power on),
1 M Ω (power off)

V0x-V3x: 10 G Ω (power on),
2.49 k Ω (power off)

Input Leakage Current

T0x-T3x: With open thermocouple detect disabled, 30 nA max
T0x-T3x: With open thermocouple detect enabled, 105 nA max

V0x-V3x: ± 1.5 nA typ, ± 25 nA max

Input Bandwidth (-3 dB)

T0x-T3x: 50 Hz

V0x-V3x: 3 kHz

Maximum Working Voltage (signal + common mode)

V0x-V3x: ± 10.25 V max

Common Mode Rejection Ratio

T0x-T3x: f_{IN} = 60 Hz, 100 dB

V0x-V3x: f_{IN} = 60 Hz, all input ranges, 83 dB

ADC Resolution: 24 bits

ADC No Missing Codes: 24 bits

Input Coupling: DC

Warm-Up Time: 30 minutes min

Open Thermocouple Detect

T0x-T3x: Automatically enabled when the channel pair is configured for thermocouple sensor; the maximum open detection time is 3 seconds

CJC Sensor Accuracy

T0x-T3x: 15 °C to 35 °C, ± 0.25 °C typ, ± 0.5 °C
max

T0x-T3x: 0 °C to 70 °C, -1.0 °C to 0.75 °C max

Channel Configurations

T0x-T3x: Disabled, all temperature input channels are disconnected from screw terminals and internally connected to GND

T0x-T3x: Thermocouple, 4 differential channels

T0x-T3x[†]: Semiconductor sensor, 4 differential channels

T0x-T3x[†]

RTD and Thermistor

2-wire input configuration with a single sensor per channel pair, 2 differential channels

2-wire input configuration with two sensors per channel pair, 4 differential channels

3-wire configuration with a single sensor per channel pair, 2 differential channels

4-wire input configuration with a single sensor per channel pair, 2 differential channels

4-wire input configuration with two sensors per channel pair, 4 differential channels

V0x-V3x: Disabled, all voltage input channels are disconnected from screw terminals and internally connected to GND

V0x-V3x: Differential, 4 differential channels

V0x-V3x: Single-ended, 4 single-ended channels

Compatible Sensors – T0x-T3x

Thermocouple:

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: -570 °C to 400 °C

N: -570 °C to 1300 °C

E: -570 °C to 1000 °C

B: 0 °C to 1820 °C

RTD[†]

100 Ω PT (DIN 43760: 0.00385 ohms/ohm/°C)

100 Ω PT (SAMA: 0.003911 ohms/ohm/°C)

100 Ω PT (ITS-90/IEC751:0.0038505
ohms/ohm/°C)

Thermistor[†]: Standard 2,252 Ω through 30,000 Ω

Semiconductor/IC[†]: TMP36 or equivalent

[†] USB-TEMP-AI only

USB-TEMP and TC Series

USB-TEMP-AI and USB-TC-AI Specifications



USB-TEMP-AI/TC-AI Specifications (continued)

Accuracy

Thermocouple Measurement Accuracy — T0x-T3x				
Sensor Type	Sensor Temperature Range	Accuracy Error Maximum (°C)	Accuracy Error Typical (°C)	Tempco (°C/°C)
J	-210 °C	2.028	0.707	0.031
	0 °C	0.835	0.278	
	1200 °C	0.783	0.288	
K	-210 °C	2.137	0.762	0.035
	0 °C	0.842	0.280	
	1372 °C	0.931	0.389	
S	-50 °C	1.225	0.435	0.021
	250 °C	0.554	0.195	
	1768 °C	0.480	0.157	
R	-50 °C	1.301	0.458	0.019
	250 °C	0.549	0.190	
	1768 °C	0.400	0.134	
B	250 °C	2.193	2.185	0.001
	700 °C	0.822	0.819	
	1820 °C	0.469	0.468	
E	-200 °C	1.976	0.684	0.030
	0 °C	0.954	0.321	
	1000 °C	0.653	0.240	
T	-200 °C	2.082	0.744	0.035
	0 °C	0.870	0.290	
	400 °C	0.568	0.208	
N	-200 °C	2.197	0.760	0.028
	0 °C	0.848	0.283	
	1300 °C	0.653	0.245	

Includes CJC measurement error. All specifications are (±).

Semiconductor Sensor Measurement [‡] – T0x-T3x		
Sensor Type	Temperature Range	Accuracy Error Maximum
TMP36 or equivalent	-40 °C to 150 °C	±0.50 °C

RTD Measurement Accuracy [‡] – T0x-T3x				
RTD	Sensor Temperature Range	Accuracy Error Maximum (°C)	Accuracy Error Typical (°C)	Tempco (°C/°C)
PT100, DIN US or ITS-90	-200 °C	2.913	2.784	0.001
	-150 °C	1.201	1.070	0.001
	-100 °C	0.482	0.349	0.001
	0 °C	0.261	0.124	0.001
	100 °C	0.269	0.127	0.001
	300 °C	0.287	0.136	0.001
	600 °C	0.318	0.150	0.001

I_{x+} = 210 μA. All specifications are (±).

Thermistor Measurement Accuracy [‡] – T0x-T3x				
Thermistor	Sensor Temperature Range	Accuracy Error Maximum (°C)	Accuracy Error Typical (°C)	Tempco (°C/°C)
2252	-40 °C	0.001	0.0007	0.001
	0 °C	0.021	0.008	0.001
	50 °C	0.263	0.130	0.001
	120 °C	3.473	1.750	0.001
5000	-35 °C	0.001	0.0006	0.001
	0 °C	0.009	0.004	0.001
	50 °C	0.115	0.049	0.001
	120 °C	1.535	0.658	0.001
10000	-25 °C	0.001	0.0005	0.001
	0 °C	0.005	0.002	0.001
	50 °C	0.060	0.028	0.001
	120 °C	0.771	0.328	0.001
30000	-10 °C	0.001	0.0005	0.001
	0 °C	0.002	0.001	0.001
	50 °C	0.019	0.009	0.001
	120 °C	0.267	0.128	0.001

I_{x+} = 10 μA. All specifications are (±).

Typical Thermistor Resistance Measurement Range [‡]					
Temp	2252 Ω Thermistor	3000 Ω Thermistor	5 kΩ Thermistor	10 kΩ Thermistor	30 kΩ Thermistor
-40 °C	76 kΩ	101 kΩ	168 kΩ	240 kΩ ¹	885 kΩ ¹
-35 °C	55 kΩ	73 kΩ	121 kΩ	179 kΩ	649 kΩ ¹
-30 °C	40 kΩ	53 kΩ	88 kΩ	135 kΩ	481 kΩ ¹
-25 °C	29 kΩ	39 kΩ	65 kΩ	103 kΩ	360 kΩ ¹
-20 °C	22 kΩ	29 kΩ	49 kΩ	79 kΩ	271 kΩ ¹
-15 °C	16 kΩ	22 kΩ	36 kΩ	61 kΩ	206 kΩ ¹
-10 °C	12 kΩ	17 kΩ	28 kΩ	48 kΩ	158 kΩ
-5 °C	9.5 kΩ	13 kΩ	21 kΩ	37 kΩ	122 kΩ
0 °C	7.4 kΩ	9.8 kΩ	16 kΩ	29 kΩ	95 kΩ

¹ Resistance values greater than 180 kΩ cannot be measured by the USB-TEMP-AI in the thermistor mode.

Absolute Accuracy – V0x-V3x	
Range	Absolute Accuracy (mV)
±10 V	±2.779
±5 V	±1.398
±2.5 V	±0.707
±1.25 V	±0.362

Accuracy Components					
Range	Gain Error (% of Reading)	Offset Error (μV)	INL Error (% of Range)	Gain Temperature Coefficient (ppm/°C)	Offset Temperature Coefficient (μV/°C)
±10 V	0.0246	16.75	0.0015	3.68	0.42
±5 V	0.0246	16.75	0.0015	3.68	0.42
±2.5 V	0.0246	16.75	0.0015	3.68	0.42
±1.25 V	0.0246	16.75	0.0015	3.68	0.42

All values are (±).

Noise Performance Specifications			
Range	Peak-to-Peak Noise (μV)	RMS Noise (μVrms)	Noise-Free Resolution (Bits)
±10 V	41.13	6.23	19.09
±5 V	30.85	4.67	18.51
±2.5 V	17.14	2.60	18.36
±1.25 V	11.14	1.69	17.98

Setting Time – V0x-V3x	
Range	Absolute Accuracy ±0.0004% (seconds)
±10 V	15.0
±5 V	0.40
±2.5 V	0.40
±1.25 V	0.40

‡ USB-TEMP-AI only

USB-TEMP and TC Series

USB-TEMP-AI and USB-TC-AI Specifications



USB-TEMP-AI/TC-AI Specifications (continued)

Analog Input Calibration

Recommended Warm-Up Time: 30 minutes min
Calibration: Firmware calibration
Calibration Interval: 1 year
Calibration Reference: 10.000 V, ± 5 mV max; actual measured values stored in EEPROM
Tempco: 5 ppm/ $^{\circ}$ C max
Long Term Stability: 30 ppm/1000 h

Throughput Rate

Maximum Throughput: 2 Samples/second per channel

Digital Input/Output

Digital Type: 5 V CMOS
Number of I/O: 8 (DIO0 through DIO7)
Configuration: Independently configured for input or output; power on reset is input mode
Pull-Up/Pull-Down Configuration: All pins pulled up to 5 V through 47 k resistors (default); contact MCC factory for pull down to ground (GND) capability
Digital I/O Transfer Rate (Software Paced)
Digital Input: 50 port reads or single bit reads per second typical.
Digital Output: 100 port writes or single bit writes per second typical.
Input High Voltage: 2.0 V min, 5.5 V absolute max
Input Low Voltage: 0.8 V max, -0.5 V absolute min
Output Low Voltage (IOL = 2.5 mA max): 0.7 V max
Output High Voltage (IOH = -2.5 mA max): 3.8 V min

Counter

Pin Name: CTR
Number of Channels: 1
Resolution: 32-bits
Counter Type: Event counter
Input Type: TTL, rising edge triggered
Input Source: CTR screw terminal
Counter Read/Writes Rates (Software Paced)
Counter Read: System dependent, 33 to 1000 reads per second
Counter Write: System dependent, 33 to 1000 reads per second
Schmidt Trigger Hysteresis: 20 mV to 100 mV
Input Leakage Current: ± 1.0 μ A typ
Input Frequency: 1 MHz max
High Pulse Width: 500 ns min
Low Pulse Width: 500 ns min
Input High Voltage: 4.0 V min, 5.5 V absolute max
Input Low Voltage: 1.0 V max, -0.5 V absolute min

Memory

EEPROM: 1,024 bytes isolated micro reserved for sensor configuration; 256 bytes USB micro for external application use

Microcontroller

Type: Two high-performance 8-bit RISC microcontrollers

USB 5 V Voltage

Input Voltage Range: 4.75 V min to 5.25 V max

Power

Supply Current: USB enumeration, <100 mA
Supply Current: Quiescent mode with all inputs configured for Disabled mode, 270 mA typ
User 5 V Output Voltage Range: 4.9 V min to 5.1 V max
User 5 V Output Current: Bus-powered and connected to a self-powered hub, 5 mA max
Isolation: Measurement system to PC, 500 VDC min

USB Specifications

USB Device Type: USB 2.0 (full-speed)
Device Compatibility: USB 1.1, USB 2.0
Device Power Capability: Self-powered
USB Cable Type: A-B cable, UL type AWM 2527 or equivalent. (min 24 AWG VBUS/GND, min 28 AWG D+/D-)
USB Cable Length: 3 meters max

Current Excitation Outputs ($\pm 1x$, T0x-T3x)**

Configuration: 2 dedicated pairs
Current Excitation Output Ranges
Thermistor: 10 μ A
RTD: 210 μ A
Tolerance: $\pm 5.0\%$
Drift: 200 ppm/ $^{\circ}$ C
Line Regulation: 2.1 ppm/V max
Load Regulation: 0.3 ppm/V
Output Compliance Voltage: 3.90 V max, -0.03 V min, (relative to GND pins 9, 19, 22, 27, 30, 33, 36, 39)

Environmental

Operating Temperature Range: 0 $^{\circ}$ C to 55 $^{\circ}$ C max
Storage Temperature Range: -40 $^{\circ}$ C to 85 $^{\circ}$ C max
Humidity: 0 to 90% non-condensing max

Mechanical

Dimensions: 127 mm (L) x 88.9 mm (W) x 35.56 (H)
User Connection Length: 3 meters max

Screw Terminal Connector

Connector Type: Screw terminal
Wire Gauge Range: 16 AWG to 30 AWG

** USB-TEMP-AI only

USB-TEMP and TC Series

USB-TEMP and USB-TC Specifications



Specifications

USB-TEMP/TC

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

Analog input

A/D Converters: Four dual 24-bit, Sigma-Delta type
Number of Channels: 8 differential
Input Isolation: 500 VDC min between field wiring and USB interface
Channel Configuration: Software programmable to match sensor type
Differential Input Voltage Range for Various Sensor Categories
Thermocouple: ±0.080 V
RTD^{††}: 0 to 0.5 V
Thermistor^{††}: 0 to 2 V
Semiconductor Sensor^{††}: 0 to 2.5 V
Absolute Maximum Input Voltage: ±C0x through ±C7x relative to GND (pins 9, 19, 28, 38), ±25 V power on, ±40 V power off
Input Impedance: 5 GΩ, min
Input Leakage Current
 Open thermocouple detect disabled, 30 nA max
 Open thermocouple detect enabled, 105 nA max
Normal Mode Rejection Ratio: f_{IN} = 60 Hz, 90 dB min
Common Mode Rejection Ratio: f_{IN} = 50 Hz/60 Hz, 100 dB min
Resolution: 24 bits
No Missing Codes: 24 bits
Input Coupling: DC
Warm-Up Time: 30 minutes min
Open Thermocouple Detect: Automatically enabled when the channel pair is configured for thermocouple sensor; maximum open detection time is 3 seconds
CJC Sensor Accuracy: 15 °C to 35 °C, ±0.25 °C typ., ±0.5 °C max
 0 °C to 70 °C, -1.0 to 0.5 °C max

Channel Configurations

Thermocouple: 8 differential channels
Semiconductor Sensor^{††}: 8 differential channels
RTD and Thermistor^{††}
 2-wire input configuration with a single sensor per channel pair,
 4 differential channels
 2-wire input configuration with two sensors per channel pair,
 8 differential channels
 3-wire configuration with a single sensor per channel pair,
 4 differential channels
 4-wire input configuration with a single sensor per channel pair,
 4 differential channels
 4-wire input configuration with two sensors per channel pair,
 8 differential channels

Compatible Sensors

Thermocouple

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 1000 °C
 B: 0 °C to 1820 °C

RTD^{††}

100 Ω PT (DIN 43760: 0.00385 ohms/ohm/°C)
 100 Ω PT (SAMA: 0.003911 ohms/ohm/°C)
 100 Ω PT (ITS-90/IEC751:0.0038505 ohms/ohm/°C)

Thermistor^{††}: Standard 2,252 Ω through 30,000 Ω

Semiconductor/IC^{††}: TMP36 or equivalent

Throughput Rate

Maximum Throughput: 2 S/s per channel

Accuracy

Thermocouple Measurement Accuracy			
Sensor Type	Maximum Error	Typical Error	Temperature Range
J	±1.499 °C	±0.507 °C	-210 °C to 0 °C
	±0.643 °C	±0.312 °C	0 °C to 1200 °C
K	±1.761 °C	±0.538 °C	-210 °C to 0 °C
	±0.691 °C	±0.345 °C	0 °C to 1372 °C
S	±2.491 °C	±0.648 °C	-50 °C to 250 °C
	±1.841 °C	±0.399 °C	250 °C to 1768.1 °C
R	±2.653 °C	±0.650 °C	-50 °C to 250 °C
	±1.070 °C	±0.358 °C	250 °C to 1768.1 °C
B	±1.779 °C	±0.581 °C	250 °C to 700 °C
	±0.912 °C	±0.369 °C	700 °C to 1820 °C
E	±1.471 °C	±0.462 °C	-200 °C to 0 °C
	±0.639 °C	±0.245 °C	0 °C to 1000 °C
T	±1.717 °C	±0.514 °C	-200 °C to 0 °C
	±0.713 °C	±0.256 °C	0 °C to 600 °C
N	±1.969 °C	±0.502 °C	-200 °C to 0 °C
	±0.769 °C	±0.272 °C	0 °C to 1300 °C

Includes CJC measurement error.

Semiconductor Sensor Measurement ^{††}		
Sensor Type	Temperature Range	Accuracy Error Maximum
TMP36 or equivalent	-40 °C to 150 °C	±0.50 °C

RTD Measurement Accuracy ^{††}			
RTD	Sensor Temperature	Maximum Accuracy Error (°C) I _{x+} = 210 μA	Typical accuracy Error (°C) I _{x+} = 210 μA
PT100, DIN, US or ITS-90	-200 °C to -150 °C	±2.85	±2.59
	-150 °C to -100 °C	±1.24	±0.97
	-100 °C to 0 °C	±0.58	±0.31
	0 °C to 100 °C	±0.38	±0.11
	100 °C to 300 °C	±0.39	±0.12
	300 °C to 600 °C	±0.40	±0.12

Thermistor Measurement Accuracy ^{††}		
Thermistor	Temperature Range	Maximum Accuracy Error (°C) I _{x+} = 10 μA
2252 Ω	-40 °C to 120 °C	±0.05
3000 Ω	-40 °C to 120 °C	±0.05
5000 Ω	-35 °C to 120 °C	±0.05
10000 Ω	-25 °C to 120 °C	±0.05
30000 Ω	-10 °C to 120 °C	±0.05

Typical Thermistor Resistance ^{††}					
Temp	2252 Ω Thermistor	3000 Ω Thermistor	5 kΩ Thermistor	10 kΩ Thermistor	30 kΩ Thermistor
-40 °C	76 kΩ	101 kΩ	168 kΩ	240 kΩ ¹	885 kΩ ¹
-35 °C	55 kΩ	73 kΩ	121 kΩ	179 kΩ	649 kΩ ¹
-30 °C	40 kΩ	53 kΩ	88 kΩ	135 kΩ	481 kΩ ¹
-25 °C	29 kΩ	39 kΩ	65 kΩ	103 kΩ	360 kΩ ¹
-20 °C	22 kΩ	29 kΩ	49 kΩ	79 kΩ	271 kΩ ¹
-15 °C	16 kΩ	22 kΩ	36 kΩ	61 kΩ	206 kΩ ¹
-10 °C	12 kΩ	17 kΩ	28 kΩ	48 kΩ	158 kΩ
-5 °C	9.5 kΩ	13 kΩ	21 kΩ	37 kΩ	122 kΩ
0 °C	7.4 kΩ	9.8 kΩ	16 kΩ	29 kΩ	95 kΩ

¹ Resistance values greater than 180 kΩ cannot be measured by the USB-TEMP in the thermistor mode.

^{††} USB-TEMP only

USB-TEMP and TC Series

Ordering Information



USB-TEMP/TC Specifications (continued)

Digital Input/Output

Digital Type: CMOS

Number of I/O: 8 (DIO0 through DIO7)

Configuration: Independently configured for input or output; power on reset is input mode

Pull-Up/Pull-Down Configuration: All pins pulled up to 5 V through 47 k resistors (default); pull-down to ground (GND) also available

Digital I/O Transfer Rate (Software Paced)

Digital Input: 50 port reads or single bit reads per second typ

Digital Output: 100 port writes or single bit writes per second typ

Input High Voltage: 2.0 V min, 5.5 V absolute max

Input Low Voltage: 0.8 V max, -0.5 V absolute min

Output Low Voltage (IOL = 2.5 mA): 0.7 V max

Output High Voltage (IOH = -2.5 mA): 3.8 V min

Memory

EEPROM: 1,024 bytes isolated micro reserved for sensor configuration; 256 bytes USB micro for external application use

Microcontroller

Type: Two high-performance 8-bit RISC microcontrollers

USB 5 V voltage

Input Voltage Range: 4.75 V min to 5.25 V max

Power

Supply Current

USB Enumeration: <100 mA

Continuous Mode: 140 mA typ

User 5 V Output Voltage Range: Connected to self-powered hub, 4.75 V min to 5.25 V max

User 5 V Output Current: Bus-powered and connected to a self-powered hub, 10 mA max

Isolation: Measurement system to PC, 500 VDC min

USB Specifications

USB Device Type: USB 2.0 (full-speed)

Device Compatibility: USB 1.1, USB 2.0, self-powered, 100 mA consumption max

USB Cable Type: A-B cable, UL type AWM 2527 or equivalent (min 24 AWG VBUS/GND, min 28 AWG D+/D-)

USB Cable Length: 3 meters max

Current Excitation Outputs (I_{x+}) - USB-TEMP Only

Configuration: 4 dedicated pairs

Current Excitation Output Ranges

Thermistor: 10 μ A typ

RTD: 210 μ A typ

Tolerance: \pm 5% typ

Drift: 200 ppm/ $^{\circ}$ C

Line Regulation: 2.1 ppm/V max

Load Regulation: 0.3 ppm/V typ

Output Compliance Voltage: 3.90 V max, -0.03 V min

Environmental

Operating Temperature Range: 0 $^{\circ}$ C to 70 $^{\circ}$ C

Storage Temperature Range: -40 $^{\circ}$ C to 85 $^{\circ}$ C

Humidity: 0 to 90% non-condensing

Mechanical

Dimensions: 127 mm (L) x 88.9 mm (W) x 35.56 (H)

User Connection Length: 3 meters max

Screw Terminal Connector

Connector Type: Screw terminal

Wire Gauge Range: 16 AWG to 30 AWG

Ordering Information

Part No.	Description
USB-TEMP	8-channel temperature measurement device; supports thermocouples, RTDs, thermistors, and semiconductor sensors. Includes USB cable and MCC DAQ software CD.
USB-TEMP-AI	8-channel temperature and voltage measurement device; supports thermocouples, RTDs, thermistors, and semiconductor sensors. Includes USB cable and MCC DAQ software CD.
USB-TC	8-channel thermocouple measurement device. Includes USB cable and MCC DAQ software CD.
USB-TC-AI	8-channel thermocouple and voltage measurement device. Includes USB cable and MCC DAQ software CD.

Accessories

Part No.	Description
745690-E001	E-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 1 m
745690-E002	E-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 2 m
745690-J001	-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 1 m
745690-J002	-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 2 m
745690-K001	K-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 1 m
745690-K002	K-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 2 m
745690-T001	T-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 1 m
745690-T002	T-type thermocouples wire, fiberglass (0 $^{\circ}$ C to 482 $^{\circ}$ C, 32 $^{\circ}$ F to 900 $^{\circ}$ F), 2 m
745691-01	3-wire, 100 ohm RTD, sealed with alumina tube, 1 m (USB-TEMP and USB-TEMP-AI only)
745691-02	3-wire, 100 ohm RTD, platinum (ready made), 2 m (USB-TEMP and USB-TEMP-AI only)

Software

Part No.	Description
TracerDAQ Pro	Out-of-the-box virtual instrument suite with strip chart, oscilloscope, function generator, and rate generator – professional version
DASYLab	Icon-based data acquisition, graphics, control, and analysis software