USB-2001-TC

Single-Channel Thermocouple Measurement Device

The USB-2001-TC provides reliable temperature measurement at an affordable price

Features
- **One thermocouple input**
- **20-bit resolution**
- **4 S/s sample rate**
- **Integrated cold junction compensation (CJC) sensor**
- **Open-thermocouple detection (OTD) feature**
- **Supports J, K, R, S, T, N, E, and B type thermocouples**
- **Accepts standard mini-plug**
- **Small form-factor**
- **Bus powered**

Supported Operating Systems
- **Windows® 11/10/8/7/Vista®/ XP, 32/64-bit**
- **Linux®**

Overview

The USB-2001-TC is a single-channel, 20-bit, thermocouple input DAQ device that measures temperatures in the ranges defined by NIST J, K, R, S, T, N, E, and B thermocouple types. It features a 4 S/s sample rate, integrated cold junction compensation, and open thermocouple detection.

The USB-2001-TC has a small form-factor, and is designed with a captive USB cable attached to one end, and a socket on the other end for receiving industry-standard thermocouple miniature connectors. The USB-2001-TC gets power from the host PC via the USB cable, and requires no external supply.

The USB-2001-TC provides an ideal solution for embedded applications that require reliable temperature measurements at an affordable price point.

Thermocouple Connectors

Users can quickly connect a thermocouple to the USB-2001-TC with a standard miniature connector.

Thermocouple miniconnectors are available for purchase from Measurement Computing.

Thermocouple Input

The USB-2001-TC is a USB device that takes measurements from type J, K, R, S, T, N, E, and B thermocouples.

The thermocouple type is software programmable and stored on the device. A 20-bit ADC processes the data conversions.

Thermocouple input ranges are ±73.125 mV (calibrated) and ±146.25 mV, (not calibrated). The ±146.25 mV range is used for open thermocouple detection.

The device has an integrated cold junction compensation sensor.
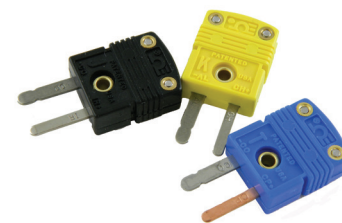
Open-Thermocouple Detection

The USB-2001-TC is equipped with open-thermocouple detection.

With OTD, any open-circuit condition at the thermocouple sensor is detected by the software. An open channel is detected by driving the input voltage to a positive value outside the range of the thermocouple output. The software recognizes this as an invalid reading and returns the value "OTD".

Thermocouple miniconnectors

Thermocouple leads with miniconnector

USB-2001-TC

Software

Software Support

The USB-2001-TC is supported by the software in the table below.
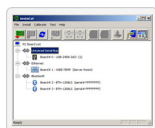
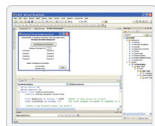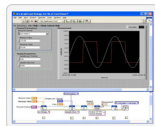| Ready-to-Run Applications	
DAQami™	Data acquisition companion software with drag-and-drop interface that is used to acquire, view, and log data, and generate signals. DAQami can be configured to log analog, digital, and counter channels, and to view that data in real-time or post-acquisition on user-configurable displays. Logged data can be exported for use in Excel® or MATLAB®. Windows OS DAQami is included with the free MCC DAQ Software bundle.
InstaCal™	An interactive installation, configuration, and test utility for MCC hardware. Windows OS InstaCal is included with the free MCC DAQ Software bundle.
TracerDAQ™ and TracerDAQ Pro	Virtual strip chart, oscilloscope, function generator, and rate generator applications used to generate, acquire, analyze, display, and export data. Supported features may vary by hardware. The Pro version provides enhanced features. Windows OS TracerDAQ is included with the free MCC DAQ Software bundle. TracerDAQ Pro is available as a purchased software download.
General-Purpose Programming Support	
Universal Library™ (UL) for Windows	Library for developing applications in C, C++, VB, C# .Net, VB .Net, and Python on Windows. The UL for Windows is included with the free MCC DAQ Software bundle. The UL Python API for Windows is available on GitHub (github.com/mccdaq/mcculw).
UL for Linux®	Library for developing applications in C, C++, and Python on Linux. UL for Linux is available on GitHub (github.com/mccdaq/uldaq). Open-source, third-party Linux drivers are also available for supported MCC devices.
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 for NI LabVIEW is included with the free MCC DAQ Software bundle.
DASYLab®	Icon-based data acquisition, graphics, control, and analysis software that allows users to create complex applications in minimal time without text-based programming. Windows OS DASYLab is available as a purchased software download. An evaluation version is available for 28 days.

USB-2001-TC
Specifications

USB-2001-TC Block Diagram
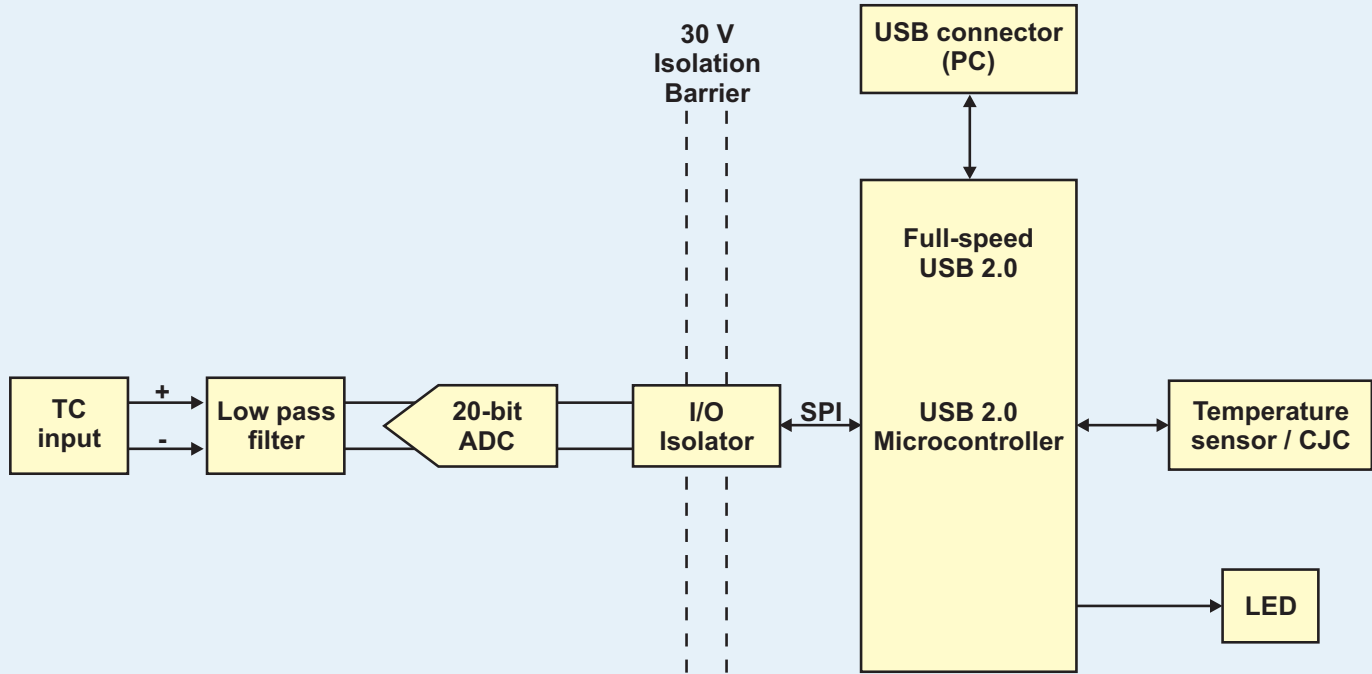
Specifications

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

Analog input

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: Proper function over the temperature ranges defined by NIST (type J, K, R, S, T, N, E, and B). Type E maximum is 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 ºC to 65 ºC: 1.25 °C max, 0.6 °C typ
Cold-junction compensation sensor resolution: 0.0625 °C typ
Overvoltage protection: 30 V max between TC+ and TC–

Channel configurations

Thermocouple type:
    J, K, S, R, B, E, T, or N; one differential channel.
    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.
    The factory default configuration is undefined '#'.

Compatible thermocouples

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 900 °C
    B: 0 °C to 1820 °C

Temperature accuracy

Refer to the USB-2001-TC User's Guide for an accuracy error chart for each thermocouple type.

LED indicator

LED status:
    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

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.
Isolation
    Channel-to-earth ground: +30 V maximum
    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.

USB-2001-TC

Ordering

Bus interface
USB specification: USB 2.0 Full-Speed
Device compatibility: USB 1.1, USB 2.0

Mechanical
Dimensions (L × W × H): 62.56 × 38.10 × 20.32 mm
2.46 in. (L) × 1.50 in. (W) × 0.80 in. (H)
Cable Length: 2 meters (6.5 feet)
Weight: Approximately 116 g (4.1 oz)

Environment
Operating temperature range: 0 °C to 55 °C
Storage temperature range: –40 °C to 85 °C
Operating humidity: 10 to 90% non-condensing
Storage humidity: 5 to 95% RH, noncondensing
Maximum altitude: 2,000 m (6,561.68 feet) (at 25 °C ambient temperature)
Pollution degree: 2
The USB-2001-TC is intended for indoor use only.

Order Information

Hardware

Part No.	Description
USB-2001-TC	USB-based single-channel thermocouple measurement device.

Accessories

Part No.	Description
ACC-TC-J-001	Type J Thermocouple, 36 in. leads with STD miniconnector
CN-144-JM	Type J male thermocouple connector
CN-144-KM	Type K male thermocouple connector
CN-144-TM	Type T male thermocouple connector
745690-J001	J-type thermocouples wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F), 1 m
745690-J002	J-type thermocouples wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F), 2 m
745690-K001	K-type thermocouples wire, fiberglass (0 °C to 482 °C , 32 °F to 900 °F), 1 m
745690-K002	K-type thermocouples wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F), 2 m
745690-T001	T-type thermocouples wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F), 1 m
745690-T002	T-type thermocouples wire, fiberglass (0 °C to 482 °C, 32 °F to 900 °F), 2 m

Software also Available from MCC

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

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

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