APEX WAVES

COMPREHENSIVE SERVICES

We offer competitive repair and calibration services, as well as easily accessible documentation and free downloadable resources.

SELL YOUR SURPLUS

We buy new, used, decommissioned, and surplus parts from every NI series. We work out the best solution to suit your individual needs.

〜〜 Sell For Cash   〜〜 Get Credit   〜〜 Receive a Trade-In Deal

OBSOLETE NI HARDWARE IN STOCK & READY TO SHIP

We stock **New, New Surplus, Refurbished,** and **Reconditioned** NI Hardware.

Bridging the gap between the manufacturer and your legacy test system.

📞 1-800-915-6216
🌐 www.apexwaves.com
✉ sales@apexwaves.com

Request a Quote

✉ CLICK HERE

USB-TC01

NI USB-TC01

Single-Channel Thermocouple Input Module

Français	Deutsch	日本語	한국어	简体中文
ni.com/manuals				

The National Instruments USB-TC01 data acquisition (DAQ) device provides a Full-Speed USB interface for a single thermocouple channel. This user guide describes how to use the device.

For specifications, refer to the *NI USB-TC01 Device Specifications* document available at *ni.com/manuals.*

Figure 1. NI USB-TC01 Device
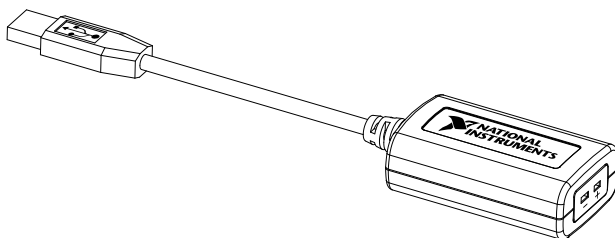
Safety Guidelines

The following section contains important safety information that you must follow when installing and using the NI USB-TC01.

⚠ **Caution** Operate the NI USB-TC01 only as described in these operating instructions. Misuse of the device can result in a hazard. You can compromise the

safety protection built into the device if the device is damaged in any way. If the device is damaged, contact National Instruments for repair.

⚠ **Caution** Do not substitute parts or modify the device except as described in this user guide. Use the device only with the accessories specified in the installation instructions.

⚠ **Caution** Do not operate the device in an explosive atmosphere or where there may be flammable gases or fumes. If you must operate the device in such an environment, it must be in a suitably rated enclosure.

If you need to clean the device, use a dry cloth. Make sure that the device is completely dry and free from contaminants before returning it to service.

Operate the device only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

You must insulate signal connections for the maximum voltage for which the device is rated. Do not exceed the maximum ratings for the device. Do not install wiring while the device is live with electrical signals.

Operate the device at or below the Measurement Category I[1]. Measurement circuits are subjected to working voltages[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Measurement categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of measurement categories:

- Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS[3] voltage. This category is for measurements of voltages from specially protected secondary circuits.

---

[1] Measurement Category is defined in electrical safety standard IEC 61010-1. Measurement Category is also referred to as Installation Category.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

[3] MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

- Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 V for U.S. or 230 V for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar E Series devices.
- Measurement Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Measurement Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

Installing the NI USB-TC01

Software support for Windows 7/Vista/XP is provided by the device. No separate driver installation is required for operation.

Figure 2. NI USB-TC01 Components
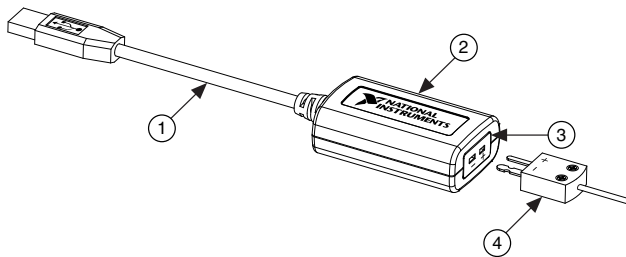
1. USB Cable	3. Thermocouple Input
2. NI USB-TC01 Device	4. Mini Thermocouple Connector

Complete the following steps to set up the NI USB-TC01:

1. Plug the thermocouple into the thermocouple input on the NI USB-TC01 device. Refer to the *Thermocouple Input* section for more information.
2. Connect the NI USB-TC01 USB cable into an available USB port on the computer. On first connection to the computer, it may take a few seconds for the operating system to detect and configure the NI USB-TC01 device.

Once the device has been detected, the NI USB-TC01 launch screen will open, as shown in Figure 3, or a Windows Autoplay dialog will appear allowing you to select **TC01Launcher.exe** to run the software.

> **Note** You must connect the NI USB-TC01 to the computer for the launch screen to open. If the NI USB-TC01 is connected to the computer and the launch screen does not appear, refer to the NI USB-TC01 support page. The support page is accessible by going to `ni.com/info` and entering Info Code `USBTC01`, or by clicking the **Device Support** link on the NI USB-TC01 launch screen.

> **Note** If Autoplay does not start, you can manually run the software by locating the NI USB-TC01 under My Computer and double-clicking **TC01Launcher.exe**.

Figure 3. NI USB-TC01 Launch Screen
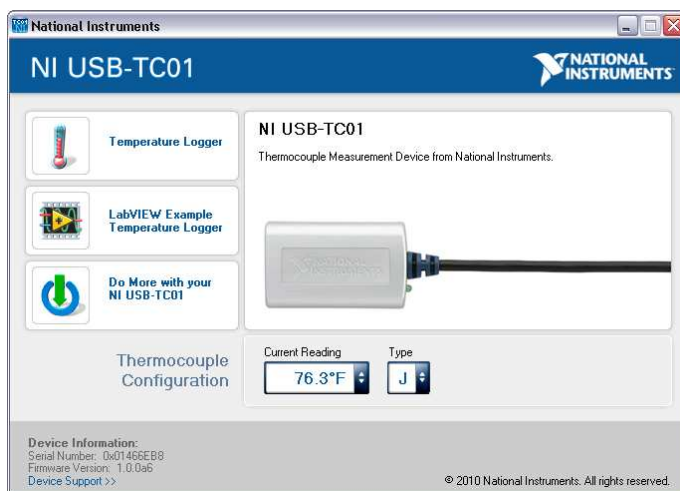
Through the NI USB-TC01 launch screen, you can graph and log data with the Temperature Logger, customize the Temperature Logger source code in LabVIEW, and explore other ways to do more with your NI USB-TC01.

> **Note** When the Temperature Logger or another application accesses the device, the **Current Reading** on the NI USB-TC01 launch screen is blocked and does not update.

LED Indicator

The green LED on the NI USB-TC01 indicates the device status. When the LED is illuminated, the device is powered and ready for operation. If the LED is not illuminated, the device is not powered or did not initialize.

Taking Measurements with Software

Logging Temperature

To log temperature data, complete the following steps:

1. From the NI USB-TC01 launch screen, click **Temperature Logger**.
2. In the NI USB-TC01 Temperature Logger window that opens, select the **Thermocouple Type** and **Temperature Units**.
3. To capture (log) the temperature readings, select **Log Data**.
4. Click **Start**. The NI USB-TC01 acquires and graphs the temperature until you click **Stop**.
5. Click **View Log** to open the log file.

Downloading Additional Applications

Additional ready-to-run applications that provide added functionality for your NI USB-TC01 are available as free downloads. You can access these applications by selecting **Do More with your NI USB-TC01** from the NI USB-TC01 launch screen.

Creating Custom Software

In addition to taking measurements with the NI USB-TC01 launch screen, you can also build custom software for your NI USB-TC01 with LabVIEW and NI-DAQmx driver software. LabVIEW uses graphical icons and wires that resemble a flowchart, so you can graphically wire together function blocks to create your own applications for logging data, alarming, triggering, reporting, and performing real-time data analysis. To learn more, select **Do More with your NI USB-TC01** from the NI USB-TC01 launch screen.

Connecting Input Signals

The NI USB-TC01 provides connection for a single thermocouple. Supported thermocouple types are J, K, R, S, T, N, E, and B.

The NI USB-TC01 has a two-prong uncompensated thermocouple input that accepts a standard two-prong male mini thermocouple connector.

Figure 4. NI USB-TC01 Terminal Assignments
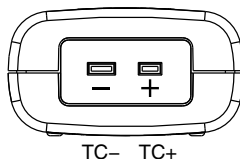
Connect the positive lead of the thermocouple connector to the TC+ terminal, and the negative lead of the thermocouple connector to the TC- terminal.

If you are unsure which thermocouple lead is positive and which is negative, refer to the thermocouple documentation or the thermocouple wire spool.

**Figure 5.** Connecting a Thermocouple Input Signal to the NI USB-TC01
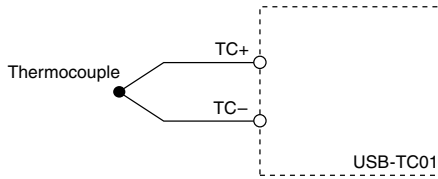
For best results, NI recommends using insulated or ungrounded thermocouples when possible. If you need to increase the length of your thermocouple, use the same type of thermocouple wires to minimize the error introduced by thermal EMFs.

Temperature measurement errors depend in part on the thermocouple type, the temperature being measured, the accuracy of the thermocouple, and the cold-junction temperature. Error graphs for each thermocouple type connected to the NI USB-TC01 are provided in the *NI USB-TC01 Device Specifications* document, available at *ni.com/manuals*.

NI USB-TC01 Circuitry

The NI USB-TC01 device's thermocouple channel passes through a differential filter and is sampled by a 20-bit analog-to-digital converter (ADC), as shown in the following figure.

**Figure 6.** NI USB-TC01 Input Circuitry
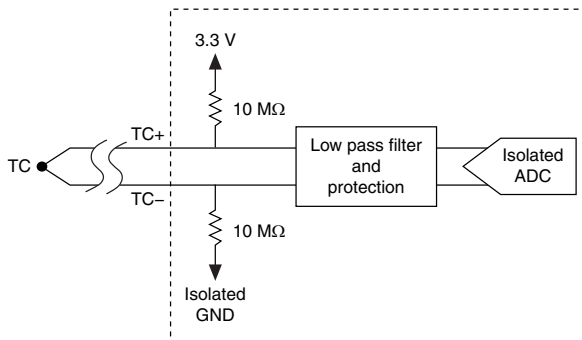
Thermocouple Measurement Accuracy

Temperature measurement errors depend in part on the thermocouple type, the temperature being measured, the accuracy of the thermocouple, and the cold-junction temperature sensing accuracy.

Thermocouple Input

The NI USB-TC01 supports the J, K, R, S, T, N, E, and B thermocouple types. The thermocouple input supports the standard mini thermocouple connector.

Figure 7. Mini Thermocouple Connector
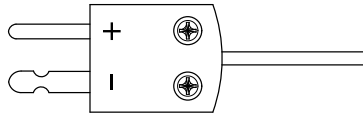
If your thermocouple has bare wire leads, you can purchase a screw terminal mini thermocouple connector to use with the NI USB-TC01. For the best accuracy, the mini thermocouple connector type and thermocouple type should match.

Open Thermocouple Detection (OTD)

The NI USB-TC01 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.

If an open thermocouple is detected, the NI USB-TC01 software displays a message and lists the internal CJC temperature, as shown in the following figure.

Figure 8. NI USB-TC01 Software Open Thermocouple Message

> **Note** During an open thermocouple condition, some invalid values may be returned before the open thermocouple is reported.

Cold-Junction Temperature Measurement Accuracy

Heat from other nearby heat sources can cause errors in thermocouple measurements by heating up the terminals so that they are at a different temperature than the cold-junction compensation (CJC) sensor used to measure the cold junction.

Minimizing Thermal Gradients

Thermocouple wire can be a significant source of thermal gradients if it conducts heat or cold directly to terminal junctions. To minimize these errors, use the following guidelines:

- Use small-gauge thermocouple wire. Smaller wire transfers less heat to or from the measuring junction.
- Avoid running thermocouple wires near hot or cold objects.
- If you connect any extension wires to thermocouple wires, use wires made of the same conductive material.

Where to Go from Here

Technical Support on the Web

The NI USB-TC01 online support page contains links to the most recent product documentation, drivers and updates, KnowledgeBase documents, tutorials, and example code. The NI USB-TC01 support page is accessible from the NI USB-TC01 launch screen by selecting the **Device Support** link or from `ni.com/info` by entering Info Code `USBTC01`.

Training Courses

If you need more help getting started developing an application with NI products, NI offers training courses. To enroll in a course or obtain a detailed course outline, refer to `ni.com/training`.

Worldwide Support and Services

The National Instruments website is your complete resource for technical support. At *ni.com/support*, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit *ni.com/register* to register your National Instruments product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting *ni.com/certification*. If your product supports calibration, you can obtain the calibration certificate for your product at *ni.com/calibration*.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.