

DT9805 Series

USB Thermocouple Measurement Modules

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USB Thermocouple Measurement

Key Features:

- Easy plug-and-play thermocouple measurements outside of the PC using USB 2.0 or 1.1.
- Up to 7 differential thermocouple channels and one CJC channel per module*.
- Scalable design for adding more channels (up to 889 thermocouples). Simply add more modules to your system using a single USB port and one or more USB hubs.
- Software support for multiple thermocouple types (B, E, J, K, N, R, S, T). Mix and match thermocouple types by configuring each channel separately.
- Free DT Thermocouple Measurement application for immediate temperature measurements with no programming. Just connect to the PC, connect your thermocouple inputs, and run! Linearized temperature measurements, based on the thermocouple types you specify, are returned in degrees C, F, or K.
- Thermocouple break detection.
- Programmable gains of 1, 10, 100, and 500 per channel for input ranges of ± 10 V, ± 1 V, ± 0.10 V, and ± 0.020 V. Autoranging is also available (for single-value operations) to automatically select the gain based on your input range.
- Two 16-bit analog output channels (DT9806 only).
- 8 Digital input lines. The digital lines can also be clocked synchronously at the analog input rate for time-stamping analog data and digital events.
- 9 Digital output lines, including one dynamic digital output line that can be updated synchronously at the analog input rate for synchronizing external devices.
- Two 16-bit counter/timer channels for event counting, frequency measurement, continuous pulse output, one-shot, and repetitive one-shot operations.
- 500 Volt galvanic isolation maximizes analog signal integrity and protects your computer.
- Flexible acquisition modes (single-value, continuous, and triggered scan).
- High resolution 16-bit A/D converter with throughputs as high as 50 kSamples/second (gains of 1 or 10).
- Selectable trigger and clock sources (software and digital) for acquiring analog data.
- Combines with Measure Foundry, Data Translation's powerful software for creating test and measurement, control, and analysis applications.
- Ships with the Data Acquisition Omni CD, which includes Ready-to-Measure™ applications, DT-Open Layers for .NET Class Library, an evaluation version of Measure Foundry, and more.

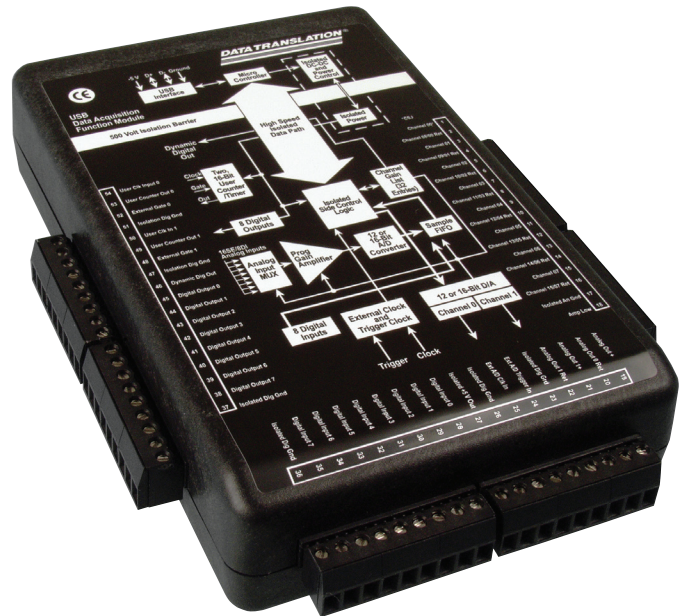


Figure 1. The DT9805 Series modules are ideally suited for plug-and-play thermocouple measurements. Pluggable screw terminal blocks allow you to connect thermocouples and other sensor types directly to the module.

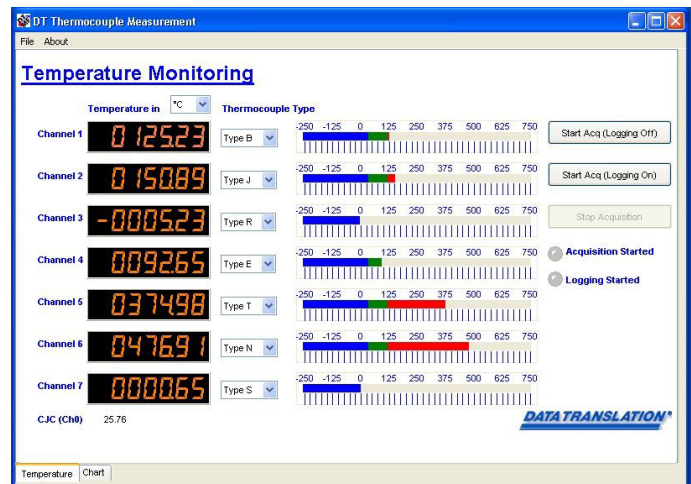


Figure 2. Use a DT9805 Series module with the free Thermocouple Measurement application for immediate linearized temperature measurements without programming. Simply connect the module to the PC using the supplied USB cable, connect your thermocouple inputs, and run the application. This view shows the temperature measurements of all 7 thermocouple inputs and the CJC channel in a digital display.

Overview

The DT9805 Series brings true plug-and-play temperature measurements to PCs with USB 2.0 or 1.1 ports. Simply attach the DT9805 Series module to the PC using the supplied USB cable, directly connect up to 7 thermocouples to the screw terminals on the module, and run the free DT Thermocouple Measurement application. Linearized temperature data is returned in degrees C, F, or K. You don't have to open your computer or do any programming. It's that simple. All power is provided from the USB cable to the PC.

The DT9805 Series consists of the DT9805 and DT9806 modules. Both modules feature a Cold Junction Compensation (CJC) channel, 7 differential analog input channels, 8 digital input lines, 9 digital output lines, and 2 counter/timer channels. In addition, the DT9806 provides 2 analog output channels for high-resolution, single-value output operations. To add more channels (up to 889 thermocouples), simply add more modules to your system using one or more USB hubs.

Specialized Analog Input Design

The DT9805 Series provides a CJC channel on analog input channel 0 that provides $10 \text{ mV}/^\circ \text{C}$ with an accuracy of 1° (from 5° to 45°C). Seven differential analog input channels are available for connecting B, E, J, K, N, R, S, or T thermocouple inputs. (If you want to measure other low-level analog input signals, such as pressure and flow sensors, you can use these channels to connect up to 16 single-ended/pseudo-differential or 8 differential analog inputs.) Thermocouple break detection is also provided to set the value to full-scale if an open circuit is detected at the input.

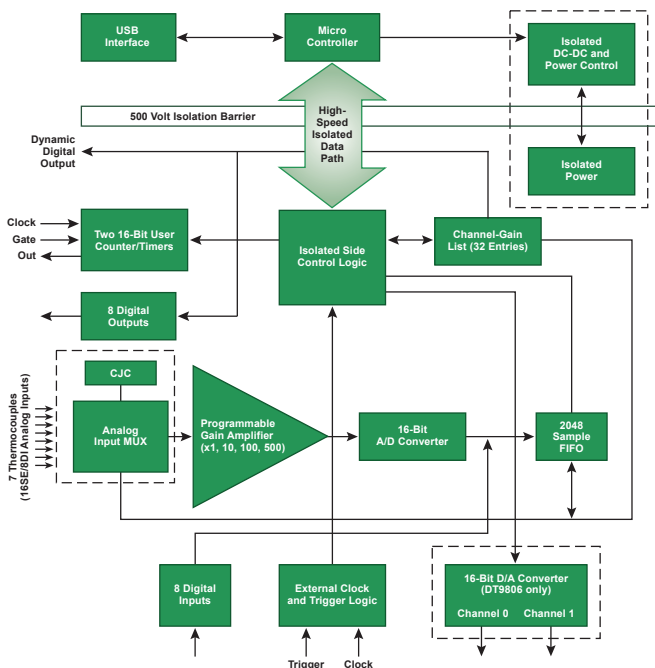


Figure 3. This block diagram shows all the subsystems and user-accessible signals of the DT9805 Series modules.

All analog inputs are multiplexed to a single 16-bit analog-to-digital (A/D) converter.

Four programmable gains (1, 10, 100, and 500) are provided to support input signal ranges of $\pm 10 \text{ V}$, $\pm 1 \text{ V}$, $\pm 0.10 \text{ V}$, and $\pm 0.020 \text{ V}$. For thermocouple inputs, which are typically in the range of 20 mV, DT9805 Series modules provide a dynamic range of 100,000:1 (100 db) to ensure that the input signals are amplified to the full $\pm 10 \text{ V}$ range of the A/D converter and digitized to 16 bits for maximum accuracy. Each channel is configurable, allowing you to mix and match input signals according to your needs. In addition, DT9805 Series modules support autoranging, where the software can determine the appropriate gain based on the input range you specify (in single-value mode).

The maximum sampling rate depends on the gain that is used: 50 kSamples/s when the gain is 1 or 10, 10 kSamples/s when the gain is 100, and 2 kSamples/s when the gain is 500. The minimum sampling rate is 0.75 Hz.

Flexible Acquisition Modes

Using the DT9805 Series, you can acquire a single sample from a single analog input channel or multiple samples from multiple analog input channels. A 32-location channel-gain list gives you the flexibility to sample non-sequential analog input channels, analog input channels with different gains, and digital inputs with the analog input channels you want at the A/D sample rate.

The DT9805 Series provides two ways to cycle through the channel-gain list:

- **Continuous scan mode** – Choose this mode if you want to accurately control the period between conversions of individual channels in a channel-gain list.
- **Triggered scan mode** – Choose this mode if you want to accurately control both the period between conversions of individual channels in a channel-gain list and the period between each scan, or cycle, through the channel-gain list. This mode is useful when synchronizing or controlling external equipment or when acquiring a buffer of data on each trigger or retrigger.

High-Resolution Analog Outputs

The DT9806 module provide two DC-level analog output channels for single-value operations. A 16-bit digital-to-analog converter provides high-resolution output values with an output range of $\pm 10 \text{ V}$.

Flexible Digital I/O Lines

DT9805 Series modules feature 8 digital input lines for single-value operations. You can also read all the digital input lines simultaneously with the analog input channels at the A/D clocked rate. The digital input lines can be clock separately as the only channel in the channel-gain list at up to 50 kSamples/second.

Nine digital outputs are provided. Eight of these digital outputs are provided for single-value operations. A dynamic digital output line is also provided for synchronizing external devices. You can program the value of this line to change state as an analog input channel is read.

User Connections			
Pin	Signal Description	Pin	Signal Description
1	Analog Input 00/CJC Circuit	28	Digital Input 0
2	Analog Input 08/00 Return	29	Digital Input 1
3	Analog Input 01	30	Digital Input 2
4	Analog Input 09/01 Return	31	Digital Input 3
5	Analog Input 02	32	Digital Input 4
6	Analog Input 10/02 Return	33	Digital Input 5
7	Analog Input 03	34	Digital Input 6
8	Analog Input 11/03 Return	35	Digital Input 7
9	Analog Input 04	36	Isolated Digital Ground
10	Analog Input 12/04 Return	37	Isolated Digital Ground
11	Analog Input 05	38	Digital Output 7
12	Analog Input 13/05 Return	39	Digital Output 6
13	Analog Input 06	40	Digital Output 5
14	Analog Input 14/06 Return	41	Digital Output 4
15	Analog Input 07	42	Digital Output 3
16	Analog Input 15/07 Return	43	Digital Output 2
17	Isolated Analog Ground	44	Digital Output 1
18	Amp Low	45	Digital Output 0
19	Analog Output 0+	46	Dynamic Digital Output
20	Analog Output 0 Return	47	Isolated Digital Ground
21	Analog Output 1+	48	External Gate 1
22	Analog Output 1 Return	49	User Counter Output 1
23	Isolated Digital Ground	50	User Clock Input 1
24	External A/D Trigger	51	Isolated Digital Ground
25	External A/D Sample Clock In	52	External Gate 0
26	Isolated Digital Ground	53	User Counter Output 0
27	Isolated +5V Out	54	User Clock Input 0

Programmable Clocks and Triggers

For starting analog input measurements, you can select either an internal or external trigger source. Select the internal trigger to start the operation based on a software command. Select an external trigger to start the acquisition based on an external event. To use the external trigger, connect a TTL-level signal to the screw terminal of the module labeled External A/D Trigger. The trigger occurs on the rising edge of this signal.

For pacing analog input measurements, you can select either the internal clock source provided by the module or an external clock source. An external clock is useful when you want to pace acquisitions at rates not available with the internal clock or when you want to pace at uneven intervals. To use an external clock, connect a TTL-level signal to the screw terminal of the module labeled External A/D Sample Clock In. Conversions start on the rising edge of this signal.

Multifunction Counter/Timers

DT9805 Series modules feature two 32-bit user counter/timers that you can use for event counting, frequency generation (continuous pulse output), one-shot, and repetitive one-shot operations. You can connect or cascade counters together either in software or by external connections to the screw terminals of the module. Programmable gates, clocks, and output signals are also supported.

500 V Galvanic Isolation Protects Your Data

Computers are susceptible to ground-spikes through any external port. These spikes can cause system crashes and may even cause permanent damage to your computer. DT9805 Series modules feature 500 Volts of galvanic isolation to protect your computer from ground-spikes and to ensure a reliable stream of data.

User Connections

DT9805 Series modules provide pluggable screw terminal blocks for connecting all signals. You can remove these screw terminal blocks for easy wiring. Pin assignments are clearly marked on the module for quick setup.

USB 2.0 Compatibility

DT9805 Series modules are fully compatible with USB 2.0 and USB 1.1. USB 2.0 is both forward and backward compatible with USB 1.1, resulting in a seamless transition process for users. A USB cable is shipped with the DT9805 Series for connecting the module to the USB 2.0 or USB 1.1 port of your computer.

Power

All power is provided through the USB cable to the module. No external power supply or battery is required.

DT Thermocouple Measurement Application

For real-time measurement and display of linearized thermocouple data without programming, use the free DT Thermocouple Measurement application, available for download at www.datatranslation.com.

The DT Thermocouple Measurement application provides the following features:

- Plug and play operation with the DT9805 Series.
- Automatically detects the module and configures the device driver.
- Supports 2-wire thermocouple inputs.
- Allows you to specify the thermocouple type (B, E, J, K, N, R, S, and T) for each channel.
- Provides a digital view of live signals showing the temperature of each thermocouple input as well as the CJC channel, shown in Figure 2.
- Provides a graphical view of live signals in a chart recorder display, shown in Figure 4, for analysis. You can set up the chart to display each thermocouple signal in its own band or all thermocouple signals in one band. In addition, you can set up the chart display to automatically scale the y-axis based on your input signal (autoscale) or scale the y-axis to the first input signal in your buffer (capture-scale). Other options are provided for showing or hiding the reference cursors, holding the display from updating, printing the display, and saving the results to disk. Scrolling, panning, and zooming functions allow you to see the entire signal in one display.
- Logs data directly to disk for post-analysis in Excel or other programs.
- Loads saved signal files into the chart recorder display for analysis.

Any combination of thermocouple types can be connected to one module – for example, use three J-types, two T-types, and two K-types – all at the same time.

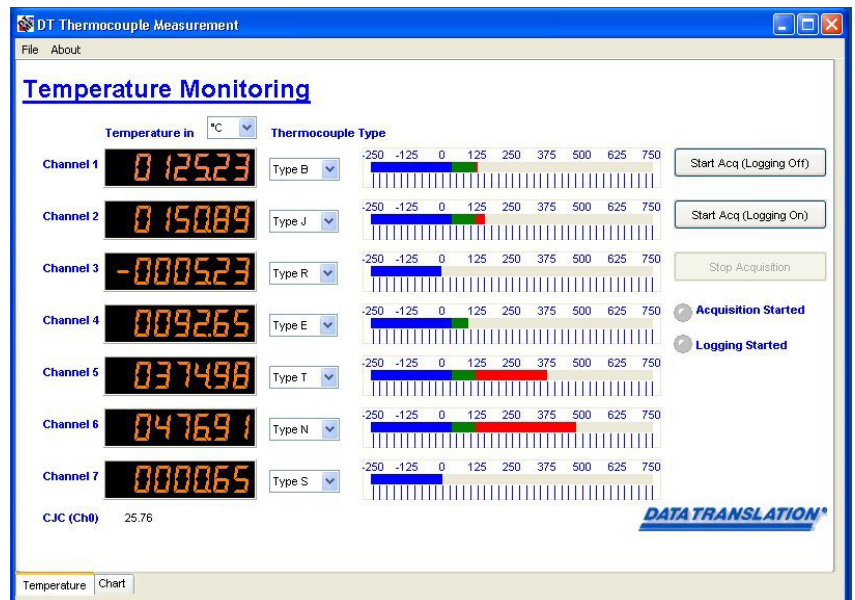


Figure 4. The Chart view allows you to log thermocouple data to a chart recorder display and to a file for further analysis in Excel or other programs. In this example, the temperature of a T-type thermocouple and the CJC channel are displayed.

Customize Applications Using Measure Foundry

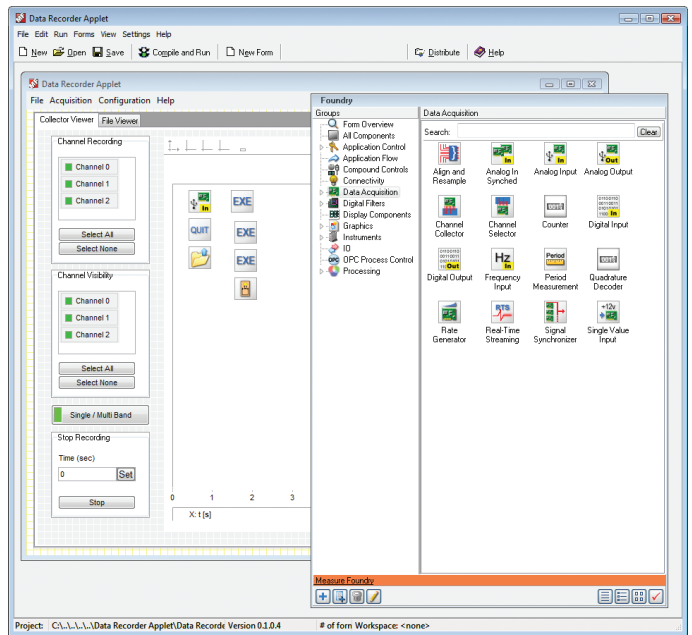
If you need more flexibility than the DT Thermocouple Measurement application provides, use Measure Foundry to modify the application or to create your own application. Measure Foundry is a powerful software package that allows non-programmers to create test and measurement, control, and analysis applications. It includes a thermocouple Linearization panel specifically for dealing with thermocouples. This panel automatically adjusts for the CJC channel, linearizes raw analog input data based on the thermocouple types you specify, and returns the data in degrees C, F, or K.

Software Options

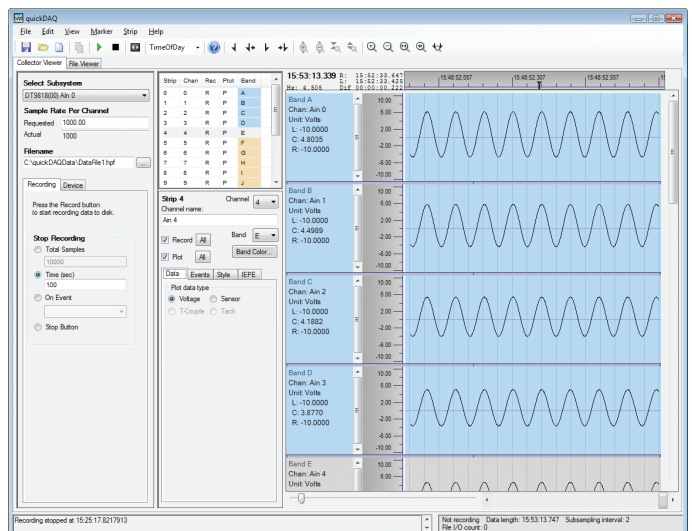
Many software choices are available for application development, from ready-to-measure applications to programming environments.

The following software is available for use with USB modules and is provided on the Data Acquisition Omni CD:

- Measure Foundry®** – An evaluation version of this software is included on the Data Acquisition Omni CD. Measure Foundry® is a drag-and-drop test and measurement application builder designed to give top performance with ease-of-use development.
- Measurement Applets** – Included in the Measure Foundry evaluation version. These small applications, developed with Measure Foundry, can be modified or combined to provide a specific solution. Order the full development version of Measure Foundry to develop applications using real hardware.
- quickDAQ application** – An evaluation version of this .NET application is included on the Data Acquisition Omni CD. quickDAQ acquires analog data from all devices supported by DT-Open Layers for .NET software at high speed, plots it during acquisition, analyzes it, and/or saves it to disk for later analysis. Note: quickDAQ supports analog input functions only. DT9817 and DT9835 modules are DIO only and are not supported.
- Quick DataAcq application** – The Quick DataAcq application provides a quick way to get up and running using your USB module. Using this application, verify key features of the module, display data on the screen, and save data to disk.
- DT-Open Layers® for .NET Class Library** – Use this class library if you want to use Visual C#® or Visual Basic® for .NET to develop application software for your USB module using Visual Studio® 2003/2005/2008; the class library complies with the DT-Open Layers standard.
- DataAcq SDK** – Use the Data Acq SDK to use Visual Studio 6.0 and Microsoft® C or C++ to develop application software for your USB module using Windows®; the DataAcq SDK complies with the DT-Open Layers standard.
- DTx-EZ** – DTx-EZ provides ActiveX® controls, which allows access to the capabilities of your USB module using Microsoft Visual Basic or Visual C++®; DTx-EZ complies with the DT-Open Layers standard.
- DAQ Adaptor for MATLAB** – Data Translation's DAQ Adaptor provides an interface between the MATLAB® Data Acquisition (DAQ) toolbox from The MathWorks™ and Data Translation's DT-Open Layers architecture.
- LV-Link** – An evaluation version of this software is included on the Data Acquisition Omni CD. Use LV-Link to use the LabVIEW™ graphical programming language to access the capabilities of your USB module.



The data recorder applet is developed with Measure Foundry and allows you to acquire data, plot it, and save it to disk.



quickDAQ acquires analog data from all devices supported by DT-Open Layers for .NET software at high speed, plots it during acquisition, analyzes it, and/or saves it to disk for later analysis.

Cross-Series Compatibility

Virtually all Data Translation data acquisition boards, including the DT9805 Series, are compatible with the DT-Open Layers software standard. This means that if your application was developed with one of Data Translation's software products, you can easily upgrade to a new Data Translation board, now or in the future. Little or no reprogramming is needed.

User Manual

Each DT9805 Series module includes a user's manual that provides getting started and reference information about using the DT9805 Series. The manual is provided in electronic (PDF) format on the Data Acquisition Omni CD provided with the module.

Technical Support

Application engineers are available by phone and email during normal business hours to discuss your application requirements. Extensive product information, including drivers, example code, pinouts, a searchable Knowledge Base, and much more, is available 24 hours a day on our web site at www.datatranslation.com.

For more information about the DT9805 Series, including specifications, please visit: <http://www.datatranslation.com/info/DT9805/>

Ordering Summary

All Data Translation hardware products are covered by a 1-year warranty. For pricing information, please visit our website or contact your local reseller.

Each DT9805 Series module is shipped with the Data Acquisition Omni CD, which includes DT-Open Layers compliant drivers for Windows® XP, Windows Vista, and Windows 7, ready-to-run software, and a comprehensive user's manual in PDF format. Manuals are available in hard-copy form for an additional charge.

- DT9805 USB function module with 16-bit, 50 kS/s analog inputs
- DT9806 USB function module with 16-bit, 50 kS/s analog inputs and two 16-bit analog outputs

Software

The following software is available for purchase separately:

- **Measure Foundry** – Test and measurement application builder for Windows® XP, Windows Vista, and Windows 7. SP1300-CD.
- **quickDAQ** – High-performance, ready-to-run application that lets you acquire, plot, analyze, and save data to disk at up to 2 MHz per channel. SP8501-CD
- **LV-Link** – Access the power of Data Translation boards through LabVIEW®.

Free Software Downloads

The following software is available for free download from our website:

- **DAQ Adaptor for MATLAB** – Access the analysis and visualization tools of MATLAB using Data Translation boards.