TEMPpoint

Temperature Measuring Instruments

Ultra-Accuracy . . . by Design

TEMPpoint is a series of easy-to-use temperature instruments. Every facet of the instrument has been designed to give the highest accuracy. All aspects of each measurement are handled automatically within the instrument. Each box is a 48-channel stand-alone instrument for connection to a PC via USB or Ethernet. Each sensor input, either a thermocouple or RTD, is plugged directly into a connector receptacle at the front panel.

Accuracy is embodied through design features that are unmatched in any other instrument. These are:

- ***Dedicated A/D for each thermocouple or RTD input . . .*** *each 24-bit Delta-Sigma A/D converter provides a dedicated conversion channel at the highest resolution (1 part in 16 million). Resolution is not compromised by sharing the A/D among other input channels*
- ***Dedicated Cold Junction Compensation for each thermocouple input . . .*** *no sharing or space-distant compromise can interfere with this ultra-high ± 0.1°C reading on each channel*
- ***"Anytime" calibration for guaranteed accuracy . . .*** *auto-cal on power up or by separate command*
- ***Complete isolation for each channel . . .*** *1000V galvanic isolation provides protection for each channel and for the PC*
- ***Automatic linearization of measurements . . .*** *standard thermocouples (B, E, J, K, N, R, S, and T) are directly supported*

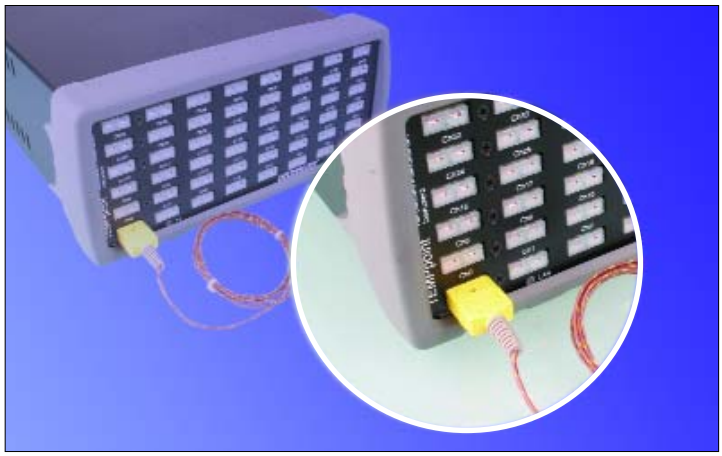


Figure 2. All 48 thermocouple or RTD inputs include easy access jacks for quick wiring.

Figure 1. TEMPpoint provides highly accurate, 24-bit resolution temperature measurements on 48 channels. It also provides the ultimate in galvanic isolation (1000V channel-to-channel) to protect signal integrity in harsh environments.

Available Models

	Sensor Type	Bus/Network
DT9871	Thermocouple	USB
DT9872	RTD	USB
DT8871	Thermocouple	Ethernet
DT8872	RTD	Ethernet

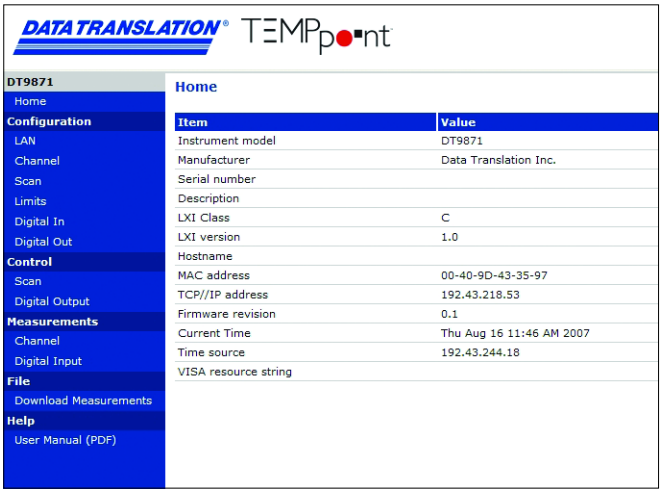


Figure 3. The main web page above shows information about your TEMPpoint instrument (Ethernet version) on the network. Using our web-based application, you can configure, measure, and control your TEMPpoint instrument either locally or remotely.

TEMPpoint Front Panel: Model DT9871

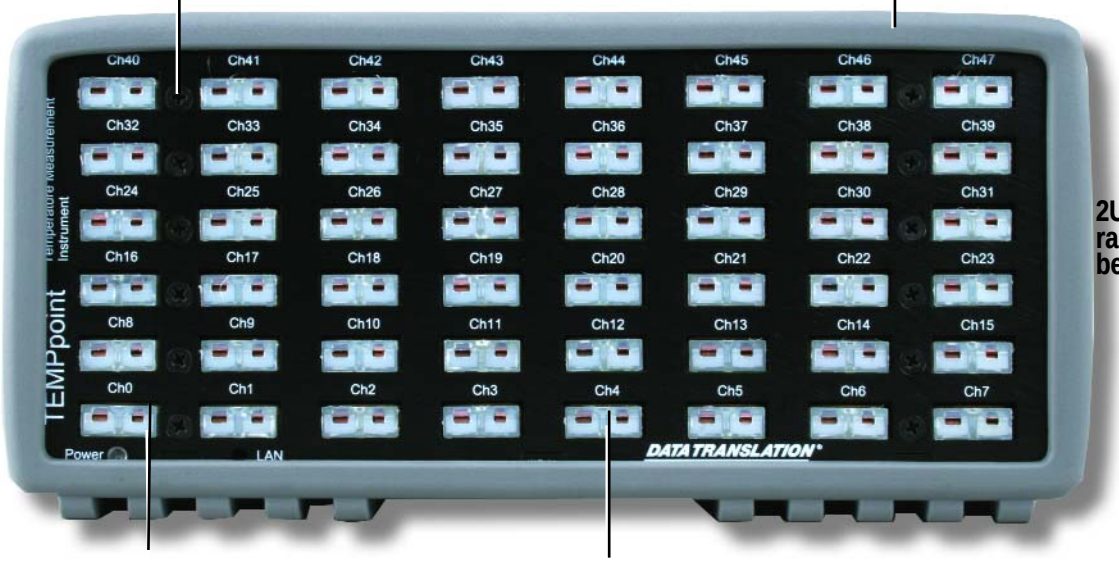


Figure 4. All 48 channels provide direct thermocouple or RTD connections as shown above.

TEMPpoint Back Panel

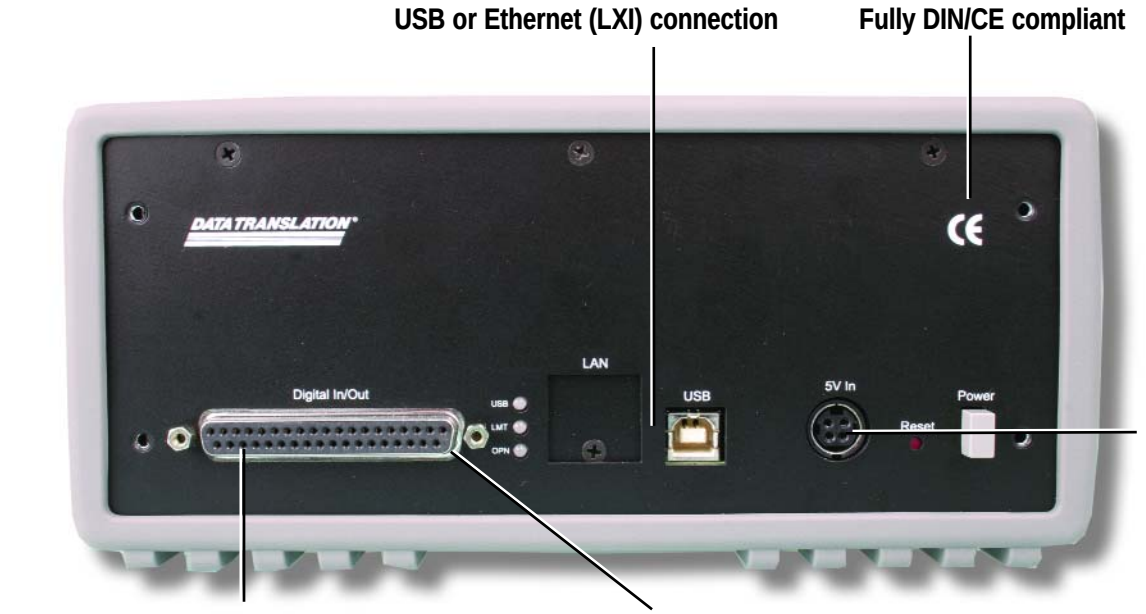


Figure 5. Digital I/O, power, and USB or Ethernet connections are provided on the back panel.

TEMPpoint Software

Capability That Fits Each Application Need

The TEMPpoint application is an executable program built with Measure Foundry. The benefit for the user is that the application can be modified or expanded to meet a particular need. For example, the user might want to apply a unique algorithm or formula to data that is derived from a thermocouple. Use of Measure Foundry's "Melting Pot" component allows the modification straightforwardly. Other extensions to the TEMPpoint application can also be achieved with Measure Foundry. These can then be distributed to run locally or remotely.

TEMPpoint Application

Your TEMPpoint instrument comes with a ready-to-measure application for measuring temperature data. Developed using Measure Foundry, the TEMPpoint application allows you to acquire temperature measurements from up to 48 thermocouple or RTD channels, display the data on the screen, and log data to disk for analysis.

You can be productive right out of the box using this software… without writing code! You can even export the data to other applications, like Measure Foundry, Microsoft Excel, and MATLAB for more advance analysis. And, since source code is also provided, you can customize the application to suit your needs using Measure Foundry.

- **Acquire temperature data** from TEMPpoint on up to 48 channels simultaneously at up to 15Hz per channel
- **Configure the channel type and scan rate** to suit your application
- **Add alarms** and min/max points for process control
- **Display live signals** for real-time visual analysis
- **Log data to disk** for analysis
- **No coding necessary,** just load and start measuring right out-of-the-box
- **Export data** into other applications for advanced post-processing and analysis
- **Customize the application,** if desired, using the provided source code and Measure Foundry

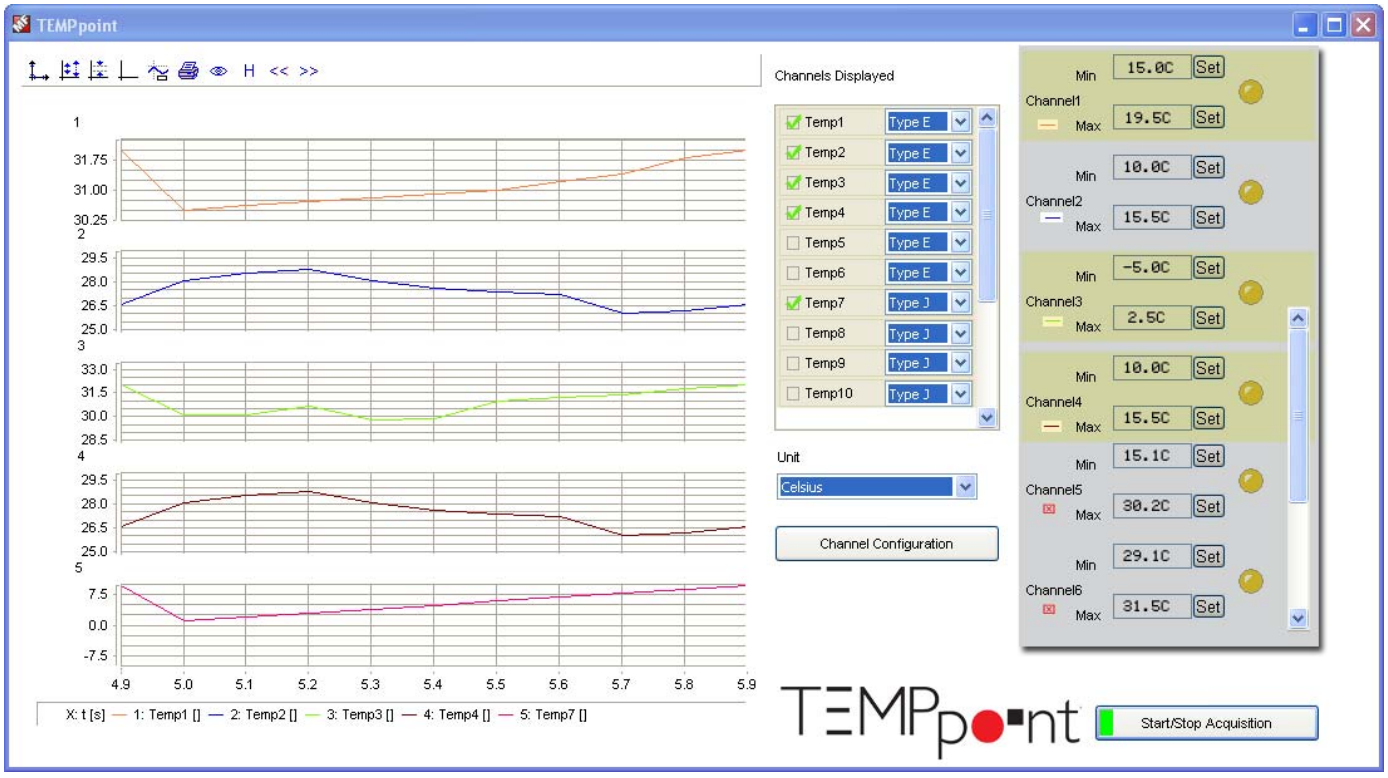


Figure 6. The TEMPpoint application is a ready-to-run executable that can be easily modified and extended using Measure Foundry. Thermocouple types and channels can be selected for display to analyze visually in real-time with status shown.

TEMPpoint Web-Based Application & Set-Up

Web Access

Using our web-based application, you can configure, measure, and control the DT8871 and DT8872 instruments either locally or remotely. In addition, this application provides a special email notification feature that allows you to leave your application unattended without worry - you will be notified via email once your measurements exceed any specified alarm limits.
The main web page shows information about your TEMPpoint instrument on the network:

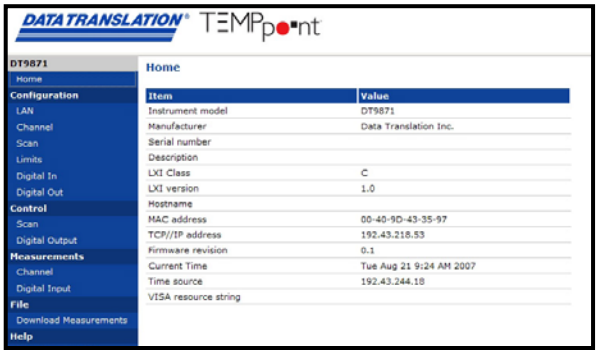


Figure 7. The main web page shows information about your TEMPpoint instrument on the network.

Configuration Web Pages

Web pages are provided for configuring the following aspects of your TEMPpoint instrument: Local Area Network (LAN), input channels that you want to measure, scan parameters (such as the scan rate), alarm limits, and digital I/O lines.

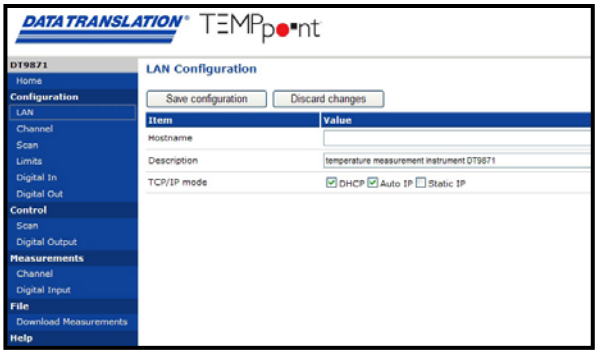


Figure 8. Use the LAN configuration page to configure the Local Area Network (LAN) for accessing the TEMPpoint instrument.

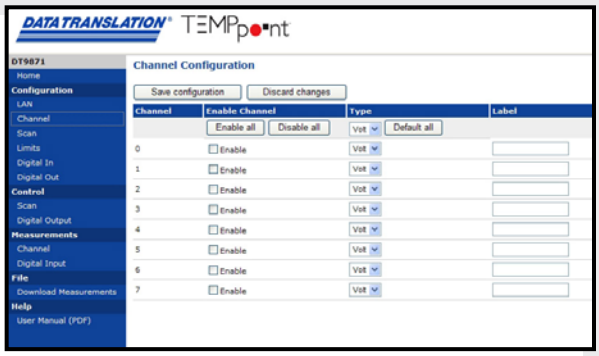


Figure 9. Use the Channel configuration page to enable the channels you want to measure, specify the thermocouple or RTD type to use for each channel, and add a label to describe each channel.

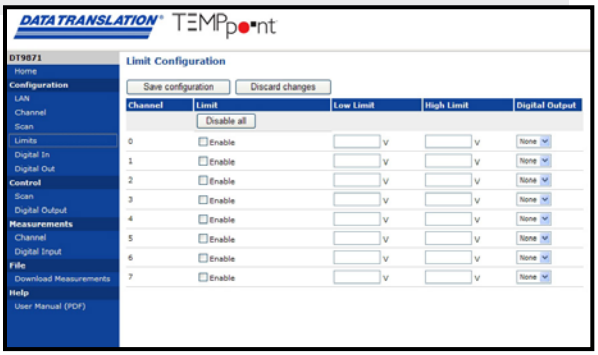


Figure 10. Use the Limits configuration page to define alarm conditions for specific (enabled) channels that you want to measure. If the alarm condition occurs, the specified digital output line is turned on.

Measurements Web Pages

You can use the Measurements web pages to view your temperature results (in either a Meter, Bar Graph, or Strip Chart display) as well as the value of the digital input port.

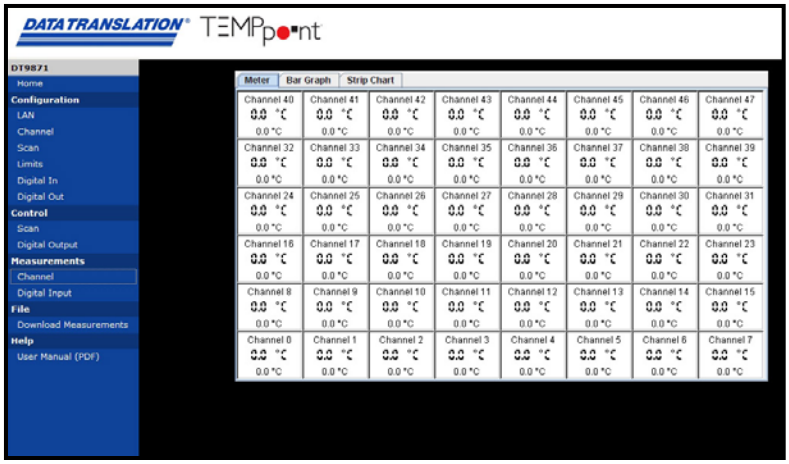


Figure 11. Use the Channel measurements page to display the measurement from each enabled channel. You can view the results using a Meter, Bar Graph, or Strip Chart display.

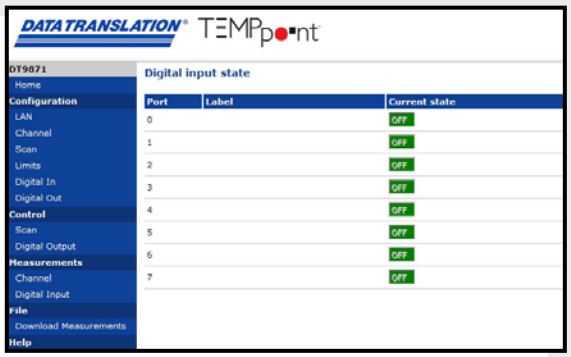


Figure 12. Use the Digital Input Measurement page to view the current value of the digital input port.

Control Web Pages

You can use the Control web pages start or stop a scan or to update the value of the digital output port.

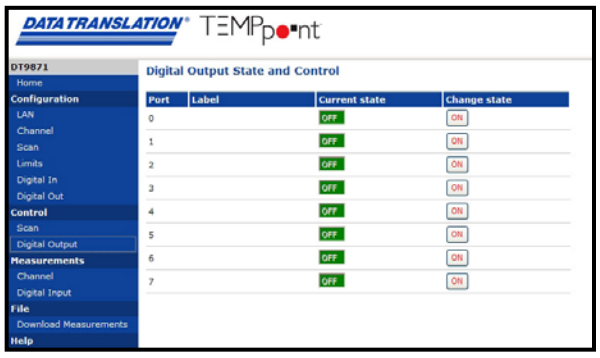


Figure 13. Use the digital output control web page to update the value of the digital output port.

File Web Pages

You can use the Download Measurements web page to download your temperature measurement results to disk. You can choose to include the timestamp of every scan as well as the limits detected in each scan.

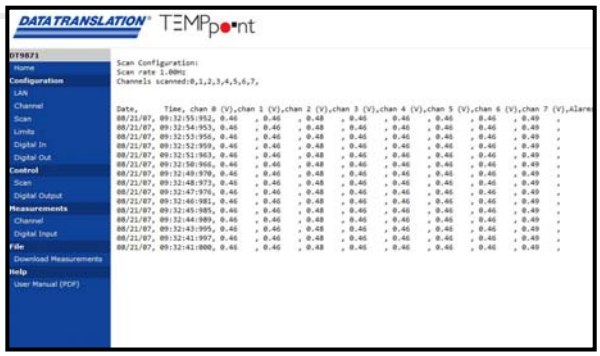


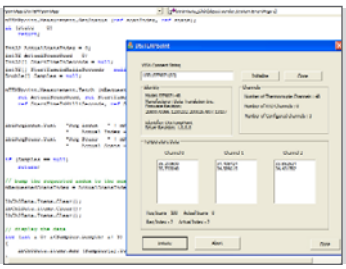
Figure 14. The resulting measurement data is saved to disk

Other TEMPpoint Software

For USB and LXI Versions:

IVI-COM Driver

This driver is provided to write application programs for TEMPpoint using an IVI-COM instrument interface. It can be used with programs written in Visual C# or Visual Basic for .NET under Visual Studio 2003 or Visual Studio 2005.
You can also use the IVI-COM driver with LabVIEW from National Instruments to program TEMPpoint instruments.



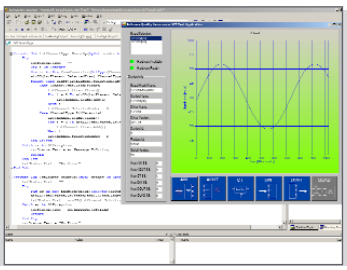
For USB Versions Only:

quickDAQ for TEMPpoint

This ready-to-run application allows you to acquire, plot, analyze, and save temperature data from up to 48 channels simultaneously and add markers, min/max points, and alarms. You can even export the data to other applications like Measure Foundry, Microsoft Excel®, and MATLAB® for advanced analysis.

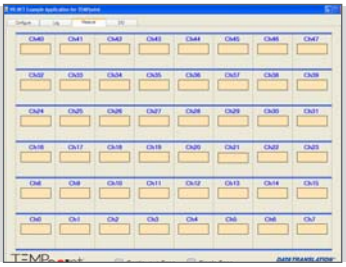
DT-Open Layers for .NET Class Library

The DT-Open Layers for .NET Class Library is a collection of classes, methods, properties, and events that provides a programming interface for DT-Open Layers-compatible hardware devices. It can be used from any language that conforms to the Common Language Specification (CLS), including Visual Basic.NET, Visual C#, Visual C++.NET with managed extensions, and Visual J#.NET.



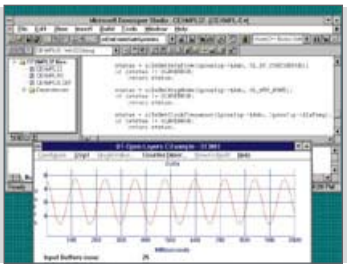
VB.NET Example Program

The VB.NET example application for TEMPpoint is a temperature measurement application written using Visual Basic.NET and the DT-Open Layers for .NET Class Library. Using this application, you can configure the TEMPpoint instrument, log data to disk for analysis, display the data on screen, and monitor and control the digital I/O lines.
Since the source code is provided you can customize this application as you wish



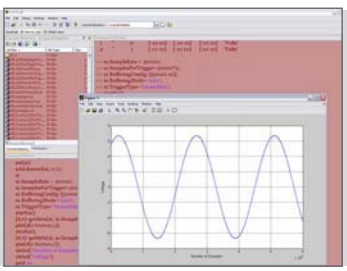
DataAcq SDK

This SDK consists of the necessary header files, libraries, example programs, and documentation to develop your own DT-Open Layers data acquisition and control applications. It is intended for use with non .NET languages, such as ANSI C, Visual C++ 6.0, and Visual Basic 6.0.



DAQ Adaptor for MATLAB

Data Translation's DAQ Adaptor provides an interface between the MATLAB Data Acquisition (DAQ) subsystem from The MathWorks and Data Translation's DT-Open Layers architecture.



Other Features

- ***Constant throughput across all channels — rates up to 15Hz per channel*** *over all 48 channels with an input range of ± 1.25V*
- ***+100 nA break-detection circuitry*** *to detect open thermocouple inputs*
- ***8 opto-isolated digital input lines*** *for monitoring valves or switches*
- ***Drive relays directly — 8 opto-isolated digital output lines*** *that operate from ± 30V@400mA (AC or DC)*
- ***Digital I/O lines*** *galvanically isolated to 250V*

Figure 15. Digital inputs and outputs are easily connected via the 37-pin D-sub connector on the back of the instrument using the STP-37 screw terminal panel and 37-pin EP333 cable.

Inputs, Outputs, Triggers

Thermocouple & RTD Inputs

TEMPpoint instruments support 48 inputs with 24-bit resolution per channel. On the DT9871 and DT8871, a voltage or thermocouple input can be attached to any channel in a mix or match fashion. This gives the user ultimate flexibility when setting up an application.

The DT9872 and DT8872 provide a 4-wire RTD input with Kelvin sensing for maximum accuracy. A true 750mA current source provides stimulus for common PT100 and PT1000 RTDs. Software calibration and linearization is provided for the 0.00385 Alpha from -200°C to +850°C.

TEMPpoint instruments provide an input range of ±1.25V and a gain of 1. Because TEMPpoint architecture uses an A/D per channel, sampling rates of up to 15Hz per channel over all 48 channels can be reached.

TEMPpoint instruments use Delta-Sigma analog-to-digital converters which provide an anti-aliasing filter. This type of converter is perfect for accurate thermocouple measurement as the filter rejects 50Hz and 60Hz power line frequency components. Additionally, having an A/D per channel allows the conversion to be done right at the CJC point to get more accurate readings.

Digital Input/Output Lines

TEMPpoint instruments feature eight, isolated, digital input lines. The digital input lines operate from +3 to +28V DC, with a switching time of 2ms maximum.

TEMPpoint instruments are perfect for driving relays directly, featuring eight, isolated, digital output lines. The outputs are solid-state relays that operate at ±30V and 400mA peak (AC or DC) with a switching time of 2ms maximum.

TEMPpoint instruments include channel-to-channel isolation of up to 250V between digital I/O lines. If the application requires greater channel-to-channel isolation, every other digital line may be used. This reduces the number of digital I/O lines, but provides channel-to-channel isolation of 500V (one channel can be +250V while the adjacent channel can be -250V).

Triggers

A trigger is an event that occurs based on a specified set of conditions. Acquisition starts when the instrument detects the initial trigger event and stops when either all the buffers that have been queued to the subsystem have been filled or you stop the operation. TEMPpoint instruments support a software trigger only.

Ultra-Accuracy . . . by Design

TEMPpoint instruments were designed for ultra-high accuracy...no shortcuts were taken. Detailed below are just a few of the steps taken to insure TEMPpoint as the highest precision temperature measuring instruments available on the market.

Eliminate Amplifiers

Many devices employ amplifiers in their analog circuitry to "boost" the small voltage levels associated with thermocouples. Typically, amplification is required when lower resolution, 16-bit A/D converters are used. Without this boost, accurate temperature measurement would not be possible.

For example, consider a +/- 10 volt 16-bit A/D with a gain of 1. The value of an lsb is:

$$\frac{20V}{2^{16}} = 300\mu V$$

Since thermocouples typically change 50 µV per degree Celsius, this system would only be "accurate" to approximately 6 degrees!

By using A/D converters with greater resolution, amplifiers become unnecessary as the A/D's themselves can discern much smaller changes in input voltage. For example, by using a +/- 2.5 volt, 24-bit A/D the resolution would become,

$$\frac{5V}{2^{24}} = .300\mu V$$

This is 1000 times smaller than the 16-bit converter. So even without amplification, much smaller voltages can be digitized without being subjected to drift errors. This design yields more stability and greater accuracy.

"Anytime" Calibration

Auto-zeroing is a feature of some A/D converters which virtually eliminates offset errors and increases long-term stability. TEMPpoint is equipped with state-of-the-art, auto-zeroing A/D's which automatically calibrate each time the instrument is turned on. When powering off/on is not an option, simply perform an "anytime" calibration while the instrument is running to achieve the same results. Total freedom for the customer.

A CJC Circuit on Every Channel

Thermocouples are "relative" not "absolute" temperature measuring devices that generate voltage as a function of the temperature difference between both ends. To measure absolute temperature, you need to know the temperature of one end of the thermocouple to find the temperature of the other end. This is where the CJC circuit comes in. The CJC measures the temperature of the end of thermocouple that plugs into the instrument. TEMPpoint incorporates an independent CJC circuit for every channel. This a more costly approach, but makes TEMPpoint more accurate and more immune to temperature variations both inside and outside the instrument.

1000V Galvanic Isolation

A vast majority of thermocouple applications reside in industrial environments. By their nature, such environments create a wide variety of problems for data acquisition systems, including temperature instrumentation. Noise and high voltage inherent in industrial machinery can adversely affect a temperature measuring instrument from a relatively benign discrepancy in an acquired value to the destruction of the entire instrument. High quality galvanic isolation helps both situations.

Galvanic isolation improves system accuracy by eliminating the unwanted effects of voltage transients and acts as an "insurance policy" against the damaging effects of high voltages.

Custom Designed DC-DC Converters

Our custom DC-DC converters circuits have a unique power distribution system that supplies power to only 2 of the 6 boards at any one time. Cycling non-adjacent boards in this manner creates less power surges, reduces noise, and improves the overall system performance.

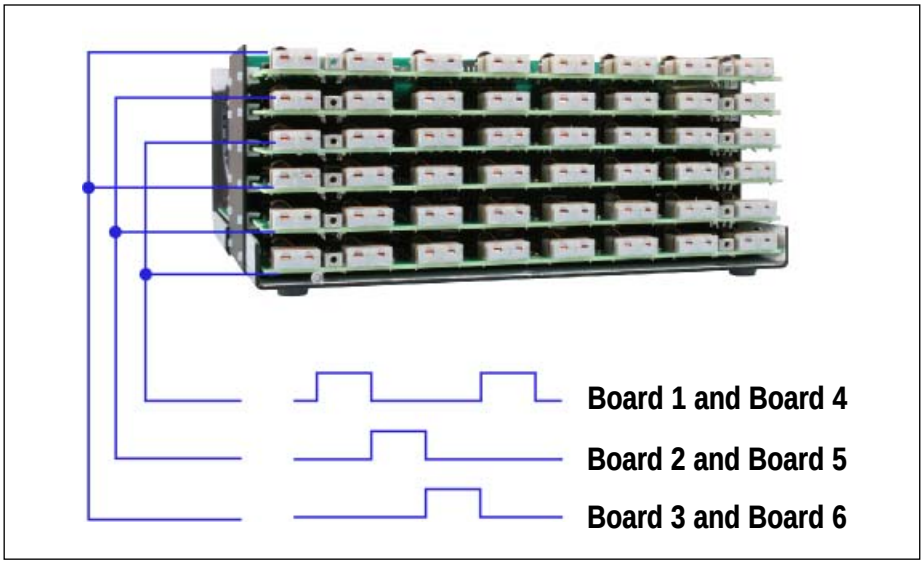


Figure 16. Custom designed DC-DC converters supply power to two non-adjacent boards at a time to reduce power surges and noise and improve system performance.

High-Stability, Low Drift Voltage References

Temperature measurement systems compare the voltages produced by a thermocouple with a known voltage before the data can be properly digitized and stored. This is where voltage references come in.

TEMPpoint uses high-precision, high-stability, low-drift voltage references rated at 4 PPM per degree and 100 PPM drift per year. This means TEMPpoint is accurate now and will remain that way over time.

Technical Support

As you develop your application, application engineers are available during normal business hours to discuss your requirements. Extensive information, including drivers, example code, pinouts, a searchable Knowledgebase, and much more, is available 24 hours a day on our web site at www.datatranslation.com. You can also request complimentary support via email or fax at anytime.

Ordering Summary

Model Numbers

- **DT9871** — Thermocouple measurement instrument for USB.
- **DT9872** — RTD measurement instrument for USB.
- **DT8871** — Thermocouple measurement instrument for Ethernet (LXI).
- **DT8872** — RTD measurement instrument for Ethernet (LXI).

Accessories (Sold Separately)

- **EP333** — Cable with two 37-pin male DSUB connectors for Digital I/O.
- **STP37** — 37-pin screw terminal panel for connecting Digital I/O.

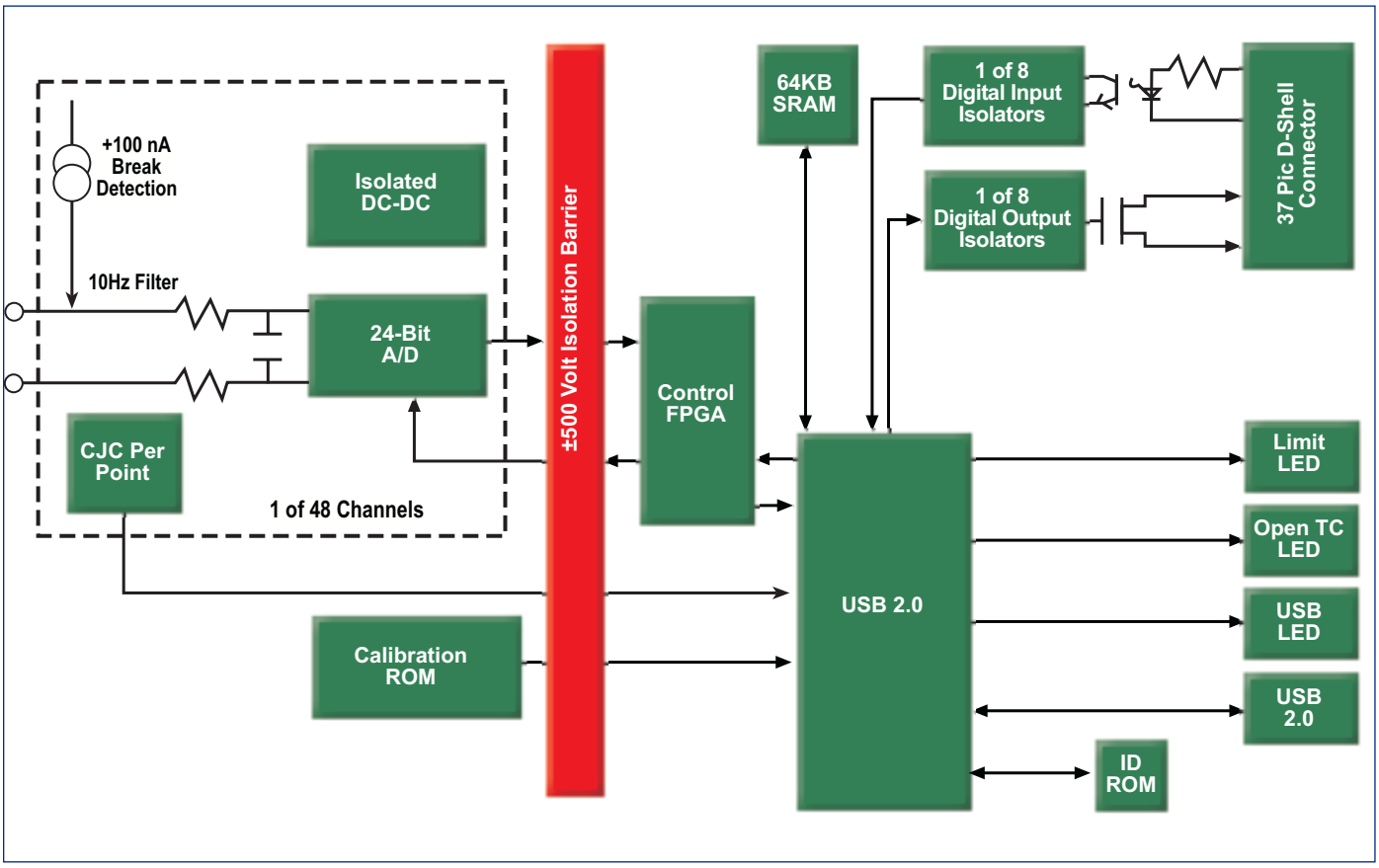


Figure 17. Block diagram of the DT9871 board inside the TEMPpoint instrument..