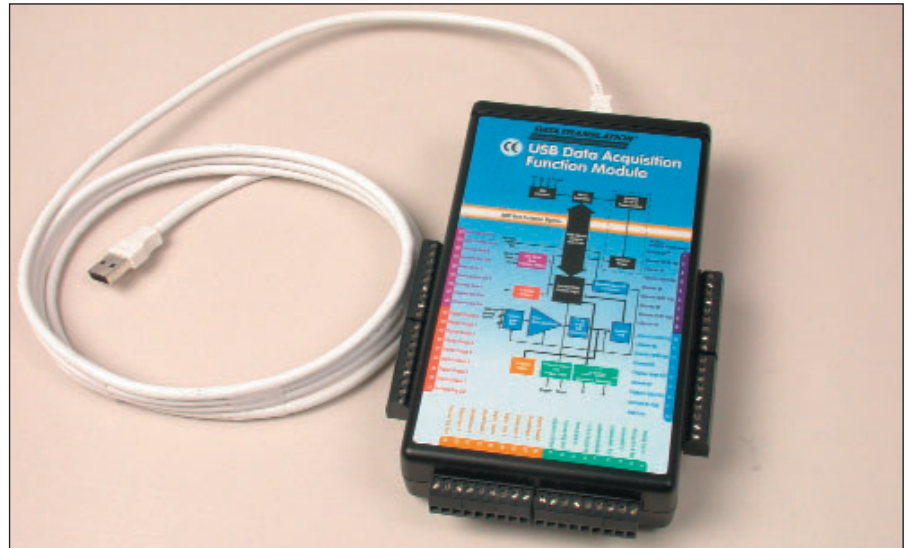


DT9800 Series

USB Function Module for Data Acquisition

- True plug-and-play:
 - One cable supplies both power and all connections to the USB module.
 - All connections are external so you do not need to open the chassis for installation.
 - Hot-swapping capability lets you plug and unplug while your computer is on; no rebooting is required.
- Compact measurement system includes isolated shielded box and direct I/O connections from sensors, useful for portable applications and noisy environments.
- Four different board configurations provide a range of flexible, cost-effective options for all general-purpose data acquisition.
- 500 V isolation provides low-noise measurements, prevents ground loops, and protects your computer.
- Fully compatible with USB 2.0 and 1.1.
- Four different board configurations provide a range of flexible, cost-effective options for all general-purpose data acquisition.
- Supported by DT Measure Foundry, test and measurement application builder software that lets you easily create complex measurement applications.
- Ships with WDM drivers, Ready-To-Measure™ applications and evaluation version of DT Measure Foundry, and more.



The DT9800 Series is a family of USB function modules for data acquisition.

Overview

The DT9800 Series brings true plug-and-play data acquisition to computers that contain Universal Serial Bus (USB) ports. No more opening up your computer chassis to install boards—just plug in the module, then run the included quickDAQ software. It's easy and efficient.

DT9800 Series modules offer 16SE/8DI inputs with 12- or 16-bit resolution, up to 100 kS/s throughput, 16 digital I/O lines and 2 user counter/timers, and optional 12- or 16-bit analog outputs.

Analog Inputs

All DT9800 Series modules feature 16 single-ended or 8 differential inputs.

In addition, an Amp Low connection allows single-ended inputs to be referenced to a common point other than ground to provide 16 pseudo-differential inputs. Software-selectable gain settings of 1, 2, 4 or 8 provide input ranges of

± 1.25 V, ± 2.5 V, ± 5 V, and ± 10 V. On the DT9801 and DT9802, input ranges of 0-1.25, 2.5, 5, and 10 V are also available.

For added flexibility, a 32-location channel-gain list allows you to sample non-sequential channels and channels with different gains. The A/D resolution sampling rate vary depending on the board type, as listed below:

Board	Resolution	Sampling Rate
DT9801/9802:	12 bits	100 kS/s
DT9803/9804:	16 bits	100 kS/s

By offering board types with different features, the DT9800 Series provides the right cost-effective solution for your data acquisition needs. The analog input subsystem can be completely software calibrated for hands-off operation.

500 V Isolation Protects Your Data

Because they reside outside the computer, USB modules are susceptible to groundspikes. These spikes can cause system crashes and may even cause permanent damage to your computer. The DT9800 Series features 500 V galvanic isolation that protects your computer from groundspikes and ensures a reliable stream of data.

Analog Input Acquisition Modes

DT9800 Series modules can acquire a single value from any channel or a number of samples from multiple channels. To acquire data from multiple channels, DT9800 Series modules provide two scan modes: continuously paced and triggered scan mode. Using continuously paced mode, the module scans the channel-gain list continuously and acquires data until you stop the operation or until a specific number of samples is acquired. Using triggered scan mode, the module scans the channel-gain list at high speeds with a programmed interval between scans, emulating a simultaneous sample-and-hold operation.

You can pace either scan mode using an internal or external clock.

Analog Trigger Modes

Internal Triggers:

- Software Trigger
- Triggered Scan Counter

External Trigger:

- External TTL Trigger Input

The external A/D sample clock and the digital trigger input signals are accessible through the user connector.

Analog Outputs

The DT9802 module features two analog output channels. These outputs have a 12-bit resolution and an output range of ± 5 V, 0-5 V, ± 10 V, and 0-10 V.

The DT9804 module features two 16-bit analog outputs with a range of ± 10 V.

Digital I/O

All DT9800 Series modules feature 16 digital I/O lines. These lines are divided into the following 8-bit ports:

- Port A, input
- Port B, output

You can also read the status of Port A at rates as high as the maximum speed

of the A/D by including the digital input lines of Port A as a channel in the analog channel-gain list. This dynamic digital input feature allows you to “time stamp” the digital inputs in relation to the analog inputs. In this mode, all 8 digital input lines of Port A are read as one word.

The digital outputs have sufficient current capability to drive external solid-state relay modules (sink 12 mA and source 1 mA). If you apply +5 V to the +5 V outputs, the digital outputs maintain their previous state if the computer goes down or if the USB cable is unplugged. On enumeration, the module senses +5 V and does not reset the digital outputs.

User Counter/Timers

Two dedicated counter/timers are available for counting events, creating a one-shot or frequency output, or measuring a frequency input. You can cascade two counters internally through software or cascade more than two counters externally on the user connections. You can also set the duty cycle, frequency, and output polarity of the output pulse from the user counter/timers.

Features Summary

Board	Channels	Analog Inputs			Throughput	
		Resolution	Input Ranges			
DT9801	16SE/8DI	12 bits	$\pm 1.25, 2.5, 5, 10$ V 0-1.25, 2.5, 5, 10 V	100 kS/s		
DT9802	16SE/8DI	12 bits	$\pm 1.25, 2.5, 5, 10$ V 0-1.25, 2.5, 5, 10 V	100 kS/s		
DT9803	16SE/8DI	16 bits	$\pm 1.25, 2.5, 5, 10$ V	100 kS/s		
DT9804	16SE/8DI	16 bits	$\pm 1.25, 2.5, 5, 10$ V	100 kS/s		
Board	Channels	Analog Outputs			Digital I/O	
		Resolution	Output Ranges	Output Speed	I/O Lines	Counter/Timer
DT9801	0	NA	NA		16	2
DT9802	2	12 bits	$\pm 5, 10, 0-5, 0-10$ V	50Hz	16	2
DT9803	0	NA	NA		16	2
DT9804	2	16 bits	± 10 V	50Hz	16	2

Cross-Series Compatibility Saves Programming Time, Protects Your Investment

Virtually all Data Translation data acquisition boards, including the DT9800 Series, are compatible with the DT-Open Layers for .NET Class Library 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. For example, if you are currently using a Data

Translation DT300 data acquisition board, upgrading to a DT9800 Series module is simple—just load the new drivers and you're done.

User Connections

A single USB cable, shipped with each DT9800 Series module, provides both power and connections from your PC or Mac. No external power or battery is required. Signal connections are made directly to the module, and pluggable terminal blocks are removable for easy connections. Pin assignments are clearly

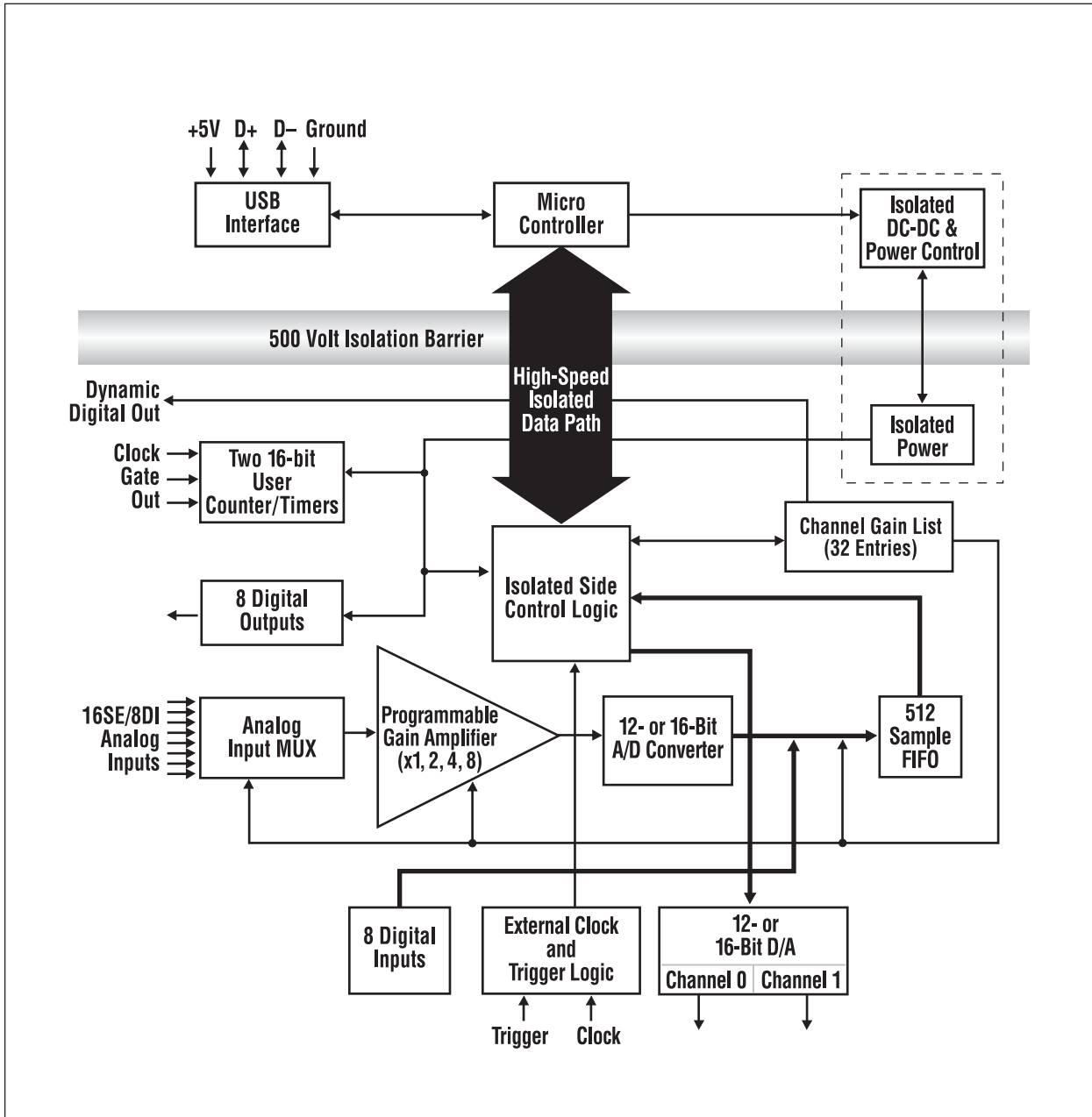
marked on the module label for quick setup.

USB 2.0 Compatibility

The DT9800 Series is 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 the user. In fact, USB 2.0 uses the same cables and connectors as USB 1.1.

User Connections

Pin Number	Signal Description	Pin Number	Signal Description
1	Analog Input 00	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 +5 V Out (10 mA)	54	User Clock Input 0



DT9800 Series Block Diagram

Digital I/O		
	Port A	Port B
Number of lines	8 input	8 output
Inputs		
High-level input voltage:	2.0 V minimum	
Low-level input voltage:	0.8 V maximum	
High-level input current:	3 μ A	
Low-level input current:	-3 μ A	
Maximum internal pacer clock rate: (single digital channel)	Maximum A/D rate	
Outputs		
Output driver high voltage:		74 HCT 244 (TTL) 2.4 V minimum (IOH = 1 mA);
Output driver low voltage:		0.5 (maximum) (IOL = 12 mA)

Analog Inputs

	DT9801/DT9802	DT9803/DT9804
Number of analog input channels		
Single-ended/pseudo-differential:	16	16
Differential:	8	8
Resolution	12 bits	16 bits
Channel-gain list	32 locations	32 locations
Input FIFO size	512 samples	512 samples
Input gains	1, 2, 4, 8	1, 2, 4, 8
Input range		
Bipolar:	±1.25, 2.5, 5, 10 V	±1.25, 2.5, 5, 10 V
Unipolar:	0-1.25, 2.5, 5, 10	
Drift		
Zero:	±30 (20 $\mu\text{V} \times \text{Gain}$)/°C	±25 (10 $\mu\text{V} \times \text{Gain}$)/°C
Gain:	±30 ppm/°C	±20 ppm/°C
Input impedance	100 M Ω , 10 pF, Off 100 M Ω , 100 pF, On	100 M Ω , 10 pF, Off 100 M Ω , 100 pF, On
Input bias current	±20 nA	±20 nA
Common mode voltage	±11 V maximum (operational)	±11 V maximum (operational)
Maximum input voltage	±40 V maximum (protection)	±40 V maximum (protection)
Channel acquisition time	3 μs	5 μs
A/D conversion time	6.6 μs	8 μs
Common mode rejection	>74 db	>74 db
DC Accuracy		
Nonlinearity (integral)	±1.0 LSB	±4 LSB
Differential nonlinearity	±0.5 LSB (no missing codes)	±1.0 LSB (no missing codes)
A/D converter noise	0.3 LSB rms	0.4 LSB rms
Channel-to-channel offset	±40.0 μV	±40.0 μV
AC Accuracy		
Effective number of bits (ENOB)	11.5 bits	13.5 bits
Total harmonic distortion (THD)	-80 dB typical	-90 dB typical
Channel crosstalk	-80 dB @ 1 kHz	-80 dB @ 1 kHz
Clocking and trigger input		
Maximum A/D pacer clock		
Single analog input throughput	100 kS/s @ 0.03% accuracy	100 kS/s @ 0.01% accuracy
Multiple analog input throughput	100 kS/s @ 0.03% accuracy	100 kS/s @ 0.01% accuracy
Single digital input channel	Maximum A/D rate	Maximum A/D rate
Minimum A/D pacer clock throughput	0.75 S/s	0.75 S/s
External A/D sample clock		
Minimum pulse width:	600 ns (high); 600 ns (low)	600 ns (high); 600 ns (low)
Maximum frequency (analog inputs):	100 kHz	100 kHz
Maximum frequency (digital inputs only):	Maximum A/D rate	Maximum A/D rate
External digital (TTL) trigger		
High-level input voltage:	2.4 V minimum	2.4 V minimum
Low-level input voltage:	0.8 V maximum	0.8 V maximum
Minimum pulse width:	600 ns (high); 600 ns (low)	600 ns (high); 600 ns (low)

Analog Outputs

	DT9802	DT9804
Number of analog output channels	2 (voltage output)	2 (voltage output)
Resolution	12 bits	16 bits
Output range	0-5, 0-10, ±5, ±10 V	±10 V
Output speed	50 Hz	50 Hz
Error		
Gain:	±2 LSB + Reference	±6 LSB + Reference
Zero:	Software adjustable to 0	Software adjustable to 0
Current output	±5 mA minimum	±5 mA minimum
Output impedance	0.3 Ω typical	0.3 Ω typical
Capacitive drive capability	0.001 μF (no oscillators)	0.001 μF (no oscillators)
Nonlinearity (integral)	±1.0 LSB	±4 LSB
Differential linearity	±0.5 LSB (monotonic)	±0.1 LSB (monotonic)
Protection	Short circuit to Analog Common	Short circuit to Analog Common
Power-on voltage	0 V ±10 mV	0 V ±10 mV
Settling time to 0.01% of FSR	50 μs , 20 V step; 10.0 μs , 100 mV step	50 μs , 20 V step; 10.0 μs , 100 mV step
Slew rate	2 V/ μs	2 V/ μs

Options for Software Development

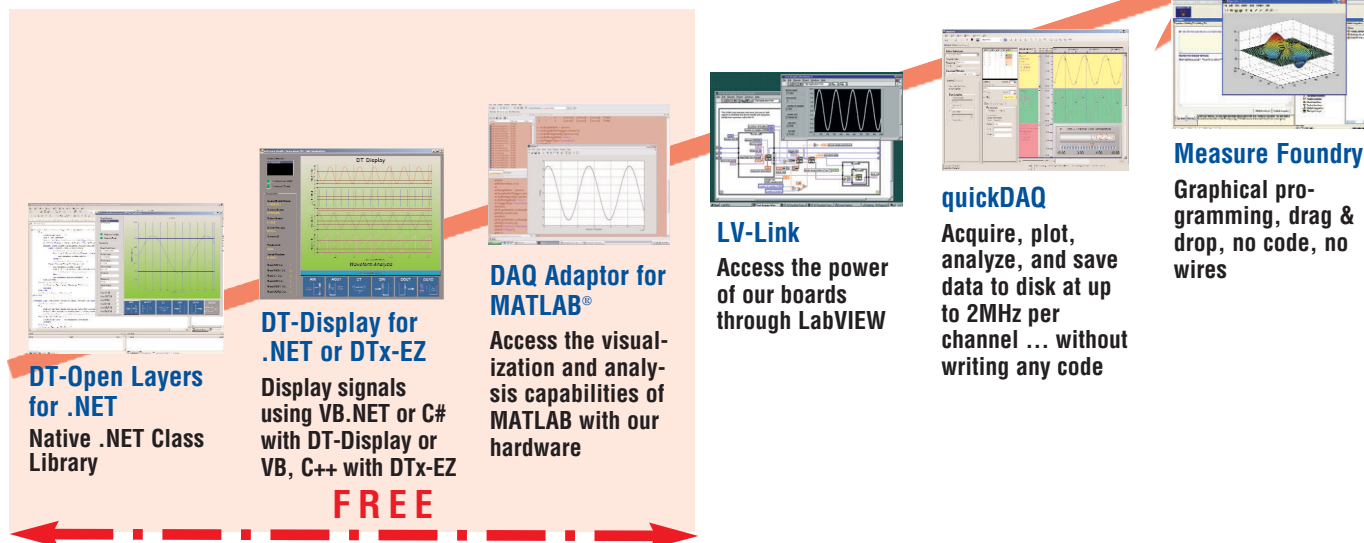


Figure 18. There are many software choices available for application development. Each option offers development capability at different levels. Choose from ready-to-measure applications to full graphical programming with Measure Foundry.

Software

All boards ship with the Omni CD that includes the following software:

■ DT-Open Layers for .NET with DT-Display:

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.

— **DT-Display for .NET** is a control for plotting data to a Windows form. It provides a powerful and user-friendly interface for rendering data.

■ DT-Open Layers for Win32:

DT-Open Layers for Win32 consists of the DataAcq SDK and DTx-EZ.

— The **DataAcq 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.

— **DTx-EZ** provides visual programming tools for Microsoft Visual Basic and Visual C++ that enable quick and easy development of test and measurement applications.

Note: If you have an existing application that was written using the DataAcq SDK, we recommend that you migrate your application to use the DT-Open Layers for .NET Class Library. This will guarantee compatibility with future Data Translation hardware and software.

■ **quickDAQ** is a ready-to-run application that lets you acquire, plot, analyze, and save data without writing any code. quickDAQ supports applications from temperature measurement to high-speed testing and analysis.

■ Drivers:

The 32-bit WDM device drivers make your application cross-platform compatible. These drivers support Data Translation USB and PCI boards using Windows 2000/XP.

You can choose to install demonstrations of the following software from the CD:

■ **Measure Foundry** is a powerful visual software environment for creating test and measurement, control, and analysis applications. No programming or wiring is required!

■ **LV-Link** contains all necessary VIs, examples, and documentation to use Data Translation hardware in LabVIEW 8.0 and greater.

The following software is available as a free download from our web site.

■ **DAQ Adaptor for MATLAB** to access the visualization and analysis capabilities of MATLAB from The MathWorks™.

BUS: USB

Type: Multifunction

Counter/Timer

Number of counter/timer channels	2
Clock Inputs	
High-level input voltage:	2.4 V minimum
Low-level input voltage:	0.8 V maximum
Minimum pulse width:	600 ns (high); 600 ns (low)
Maximum frequency:	750.0 kHz
Gate Inputs	
High-level input voltage:	2.4 V minimum
Low-level input voltage:	0.8 V maximum
Minimum pulse width:	600 ns (high); 600 ns (low)
Counter Outputs	
Output driver high voltage:	3.0 V minimum (1 mA source)
Output driver low voltage:	0.4 V maximum (2 mA sink)

Power, Physical, and Environmental Specifications



Power	
+5 V standby	0.5 mA maximum
+5 V enumeration	100 mA maximum
+5 V power on	500 mA maximum
+5 V isolated power out (TB 27)	10 mA maximum
Physical	
Dimensions:	6.5 in. (length) by 4.5 in. (width) x 1.4 in. (height)
Weight:	9 oz.
I/O connector:	USB
Certification and compliance	
	FCC Part 15 Class B verified; will not compromise FCC compliance of host computer CE
Environmental	
Operating temperature range:	0°C to 55°C
Storage temperature range:	-25°C to 85°C
Relative humidity:	To 95%, noncondensing

DT9800 Series Manuals

The DT9800 Series Getting Started and User's Manual are provided in electronic (PDF) format on the CD-ROM provided with the board. You can also purchase a hard copy of these.

DIN-RAIL Mounting Kit for USB

This kit provides a simple, standard method for mounting equipment to walls, cabinets, or machinery. The kit contains everything you need to fit it directly on the back of the USB function module housing.

Technical Support

As you develop your application, technical support is available when you need it. Extensive information is available 24 hours a day on our web site at www.datatranslation.com, including drivers, example code, bug fixes, pinouts, a searchable KnowledgeBase, and much more.

Support is also available from your point of purchase. You can also request complimentary support via e-mail or fax at any time.

Ordering Summary

All Data Translation hardware products are covered by a 1-year warranty. For pricing information, see a current price list, visit our web site, or contact your local reseller.

DT9800 Series

Each DT9800 Series board is shipped with the Data Acquisition Omni CD, which includes DT-Open Layers-compliant drivers for Microsoft Windows 2000/XP, Ready-To-Measure software, and comprehensive user's manuals in PDF format. Manuals are available in hard-copy form for an additional charge.

- DT9801 USB function module with 12-bit, 100 kS/s analog inputs and no analog outputs
- DT9802 USB function module with 12-bit, 100 kS/s analog inputs and 2, 12-bit analog outputs
- DT9803 USB function module with 16-bit, 100 kS/s analog inputs and no analog outputs
- DT9804 USB function module with 16-bit, 100 kS/s analog inputs and 2, 16-bit analog outputs

Accessories

- DT9800 Series User's Manual and Getting Started Manual in hard-copy form
- DIN Mount Kit

Software

The following software can be purchased separately:

- quickDAQ is a 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

Data Translation now offers free downloads on the Web for:

- DT-LV Link to access the power of our boards through LabVIEW.
- DAQ Adaptor for MATLAB to access the analysis and visualization tools in MATLAB.

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