

ECONseries

Economy USB

Mini-Instruments



The GO! Application allows instant out-of-the-box measurements with standard instrument-like displays



A variety of ECONseries modules provide economical yet flexible solutions

Figure 1. The ECONseries features the powerful GO! application to provide economical, multifunction data acquisition instruments for the USB bus. Simply install the software, connect your module to any USB port, and GO!

Flexible Yet Economical

- A variety of low-cost ECONseries modules are available to provide flexible yet economical solutions.
- Choose the number of analog I/O and digital I/O channels, the resolution you need, and the signal range of your application.

Easy Plug-and-Play Measurements

- Connect the module to the USB 2.0 or 1.1 port of your PC.
- Attach signals directly to screw terminals on the module.
- Run multiple subsystem operations simultaneously.
- No power supply needed.

Oscilloscope Function

- Stream, plot, and analyze data from up to eight analog input channels.
- Zoom in or out of live signals.
- Print your data or save it to an Excel file.

Chart Recorder Function

- Record up to 32,000 data points from up to eight analog input channels and log data to Excel.

Digital Voltmeter Function

- Measure data from up to eight analog input channels and view it in a 5-digit digital display.
- Display the maximum or true root mean square (RMS) value.

File Viewer Function

- Load a previously saved Excel file.
- Scroll, zoom, or print your data.

Waveform Generation

- Generate DC, sine, rectangle, or triangle waveforms from up to two analog output channels.
- Select the frequency, amplitude, offset, and duty cycle of your signal.

Digital I/O Control

- Monitor and control up to 28 digital I/O lines.

External Event Counting

- Count pulses from the counter/timer for 1, 2, or 5 seconds or for an unlimited time.

Rate Generation

- Control the frequency of a continuous pulse output signal from the counter/timer.

ECONseries Modules

	Series Description	Subsystem (AI = Analog Input, SAI = Simultaneous AI, AO = Analog Output)	Resolution (bits) @ Throughput (kS/S)	Independent Subsystem Operation at Full Throughput	Analog Input FSR	Waveform Analog Output FSR	Clocks & Triggers External/Internal	Power Fully Loaded
Simultaneous	DT9816	6 SAI, 0 AO, 16 DIO, 1 C/T	16-bits @ 50 kS/s Per Channel*	Yes to 50 kS/s	±10 V, ±5 V	—	Yes/Yes	USB <200 mA
	DT9816-A	6 SAI, 0 AO, 16 DIO, 1 C/T	16-bits @ 150 kS/s Per Channel*	Yes to 150 kS/s	±10 V, ±5 V	—	Yes/Yes	USB <200 mA
General Purpose	DT9812-10V	8 AI, 2 AO, 16 DIO, 1 C/T	12-bits @ 50 kS/s Aggregate	Yes to 50 kS/s	±10 V, ±5 V, ±2.5 V, ±1.25 V	±10 V	Yes/Yes	USB <175 mA
	DT9813-10V	16 AI, 2 AO, 8 DIO, 1 C/T						
	DT9814-10V	24 AI, 2 AO, 1 C/T						
	DT9812-2.5V	8 AI, 2 AO, 16 DIO, 1 C/T	12-bits @ 50 kS/s Aggregate	Yes to 50 kS/s	0 to 2.44 V, 1.22 V, 0.61 V, 0.305 V, 0.1525 V	0 to 2.44 V	Yes/Yes	USB <100 mA
Digital I/O	DT9810	8 AI, 0 AO, 20 DIO, 1 C/T	10-bits @ 25 kS/s Aggregate	Yes to 25 kS/s	0 to 2.44 V	—	No/Yes	USB <100 mA
	DT9817	28 DIO, 1 C/T Sink = 10 mA, Source = 4.5 mA	—	Yes	—	—	—	USB <150 mA
	DT9817-H	28 DIO, 1 C/T Sink = 64 mA, Source = 15 mA	—	Yes	—	—	—	USB <500 mA
	DT9817-R Fully Isolated	16 DIO, 1 C/T Switches up to ±30V@400 mA	—	Yes	—	—	—	USB <500 mA

All ECONseries modules are:

- ESD protected up to 4 kV contact and 8 kV arc
- Single-ended analog input
- Non-isolated, utilizing the same ground as the USB port
- Powered from USB source, no power supply needed



Figure 2. Connect to a host computer using the standard USB 1.1 or 2.0 plug-in connector on the ECONseries module. The USB connector provides power to the module, eliminating the need for an external power supply, while providing complete enumeration for all data flow.

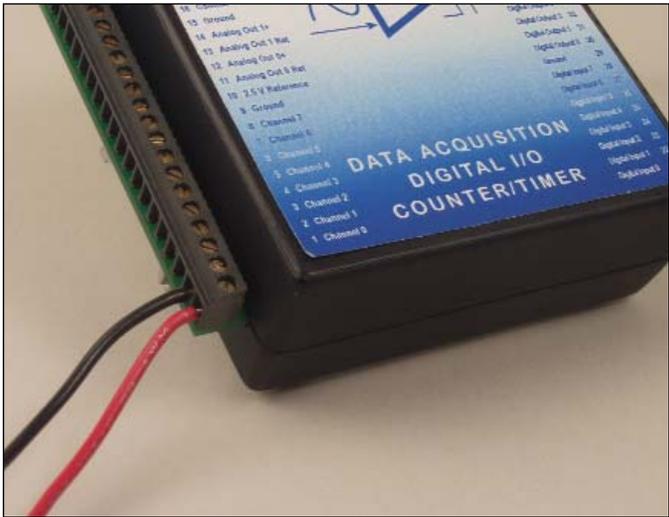


Figure 3. Connect sensors directly to the screw terminal of the module. Screw terminals can accept AWG 26 to AWG 16 size wire.

Easy hook-up, all connections identified

Shielded, rugged enclosure provides noise immunity

Standard USB Connector

LED Indicator provides USB status

Built-in signal I/O screw terminal connectors

Figure 4. ECONseries modules provide easy signal and USB connections in a shielded, rugged enclosure.

The ECONseries design provides the following major advantages:

Prevents Measurement Errors

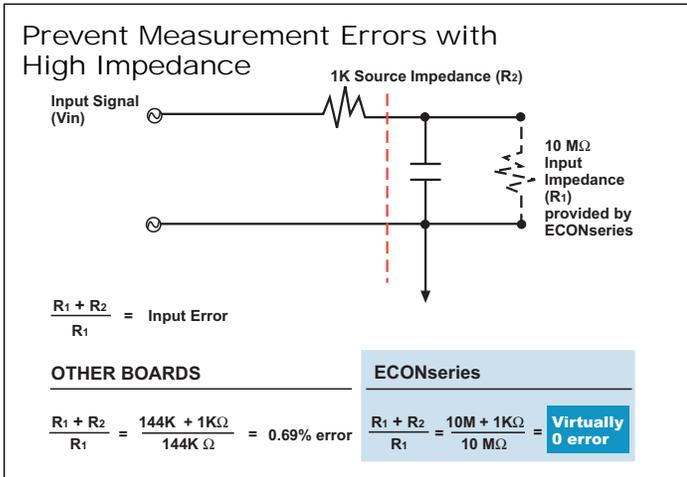


Figure 5. The ECONseries provides 10 MOhms of input impedance for virtually error-free analog input measurements.

Operates Reliably

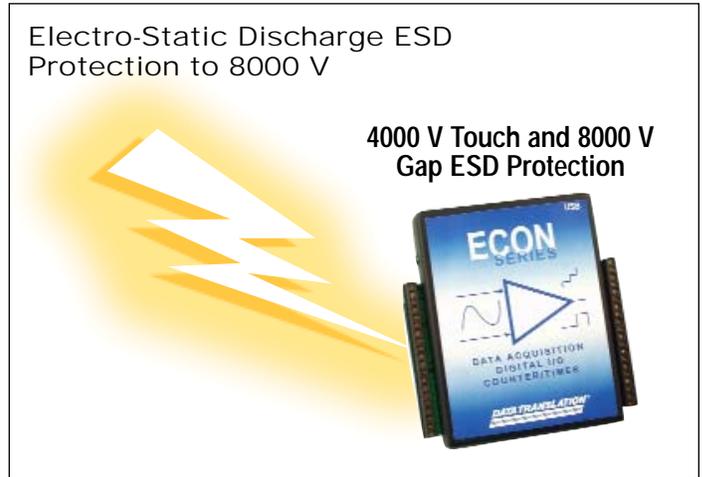


Figure 6. The ECONseries provides 4000 V touch and 8000 V gap ESD protection circuitry for superior noise immunity.

Performs Simultaneous Operations

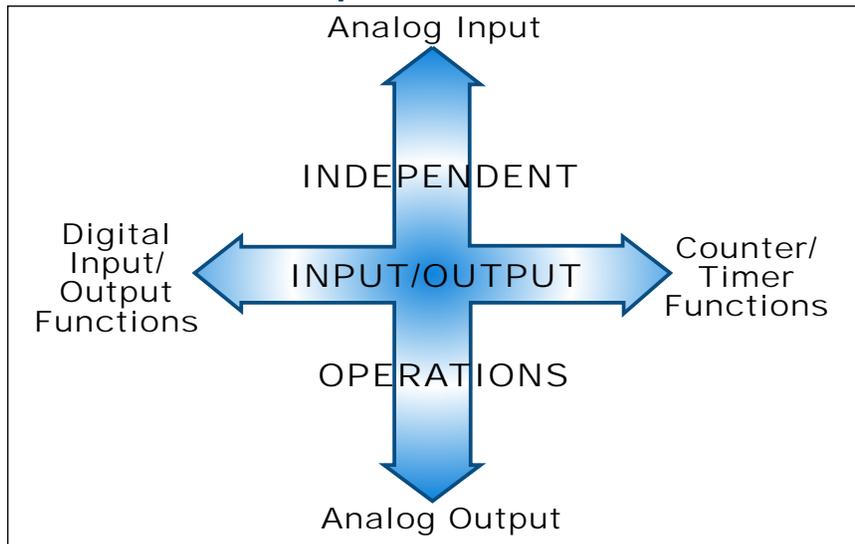


Figure 7. The ECONseries supports independent subsystem operations - great for measurement and control applications.

Generates Waveforms

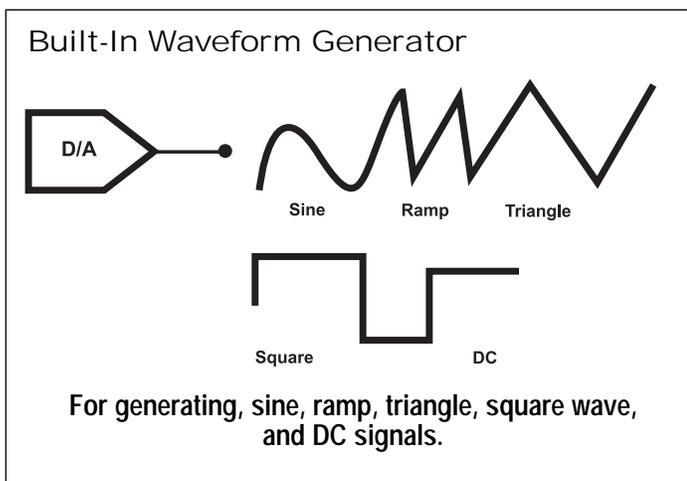


Figure 8. The DT9812-2.5 V, DT9812-10V, DT9813-10V, and the DT9814-10V modules provide 2 waveform DACs for generating sine, ramp, triangle, square wave, and DC signals.

Detects Edges for Pulse Width, Frequency, & Period Measurements

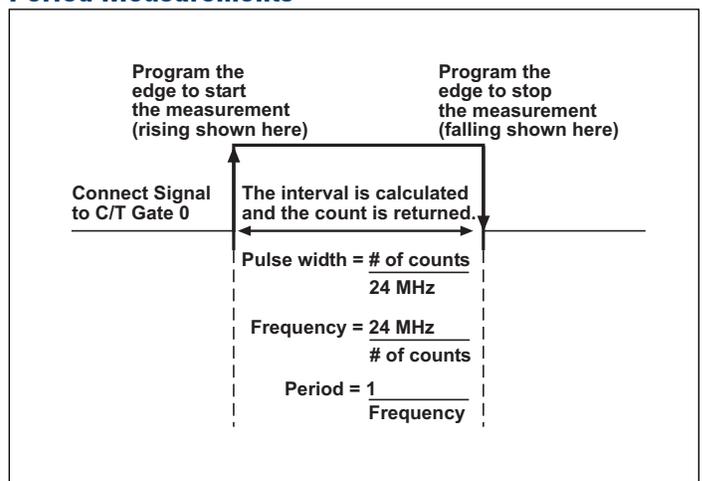


Figure 9. Programmable edges allow you to use the counter/timer of an ECONseries module to measure the pulse width, frequency, and period of a signal.

The DT9816 design provides the following additional advantages:

Six Simultaneously Sampled Analog Inputs

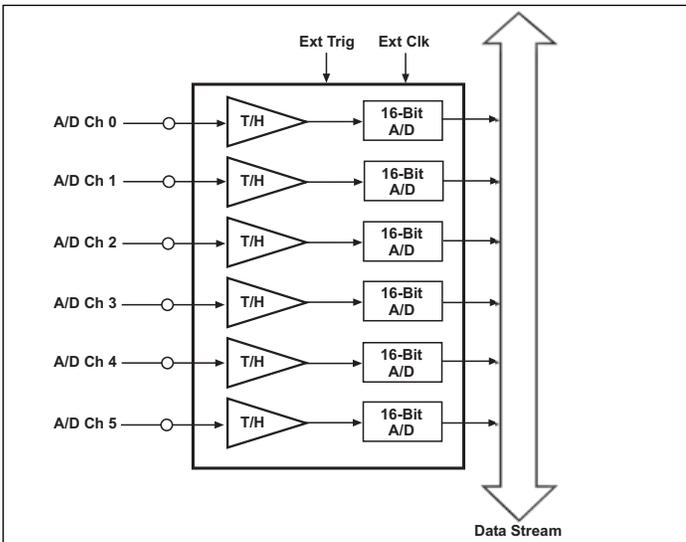


Figure 10. The DT9816 and DT9816-A feature six, independent, successive-approximation A/D converters with track-and-hold circuitry. Each converter uses a common clock and trigger for simultaneous sampling of all six analog input signals at up to 50 kHz per channel for the DT9816 at 150 kHz per channel for the DT9816-A.

Accurate Measurements Designed In

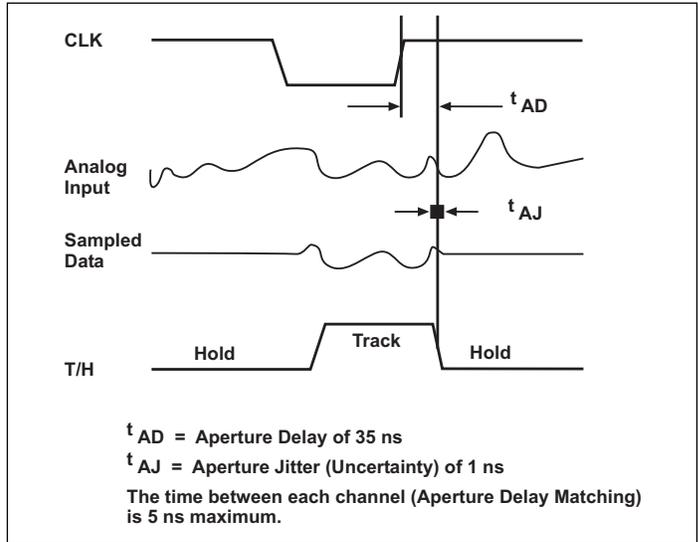


Figure 11. The A/D design of the DT9816 and DT9816-A features built-in accuracy. A maximum aperture delay of 35 ns (the time that it takes the A/D to switch from track to hold mode) is well matched at 5 ns across all six track-and-hold circuits, virtually eliminating the channel-to-channel skew that is associated with multiplexed inputs. A maximum aperture uncertainty of 1 ns (the jitter or variance in aperture delay), virtually eliminates phase noise in your data.

DT9816 and DT9816-A Key Features:

- High-Speed Simultaneous Acquisition**
 Acquire all six analog input channels simultaneously at up to 50 kHz per channel (DT9816) or 150 kHz per channel (DT9816-A).
- High-Resolution Data**
 The DT9816 and DT9816-A feature 16-bit resolution for precision measurements.
- Two Bipolar Input Ranges**
 The DT9816 and DT9816-A feature +/- 10 V and +/- 5 V signal input ranges for maximum flexibility.
- Digital I/O Functions**
 The DT9816 and DT9816-A have 8 fixed digital inputs and 8 fixed digital outputs for controlling external equipment.
- Multifunction Counter/Timer**
 The DT9816 and DT9816-A have one 16-bit counter/timer for event counting, frequency measurement, and continuous pulse output operations.

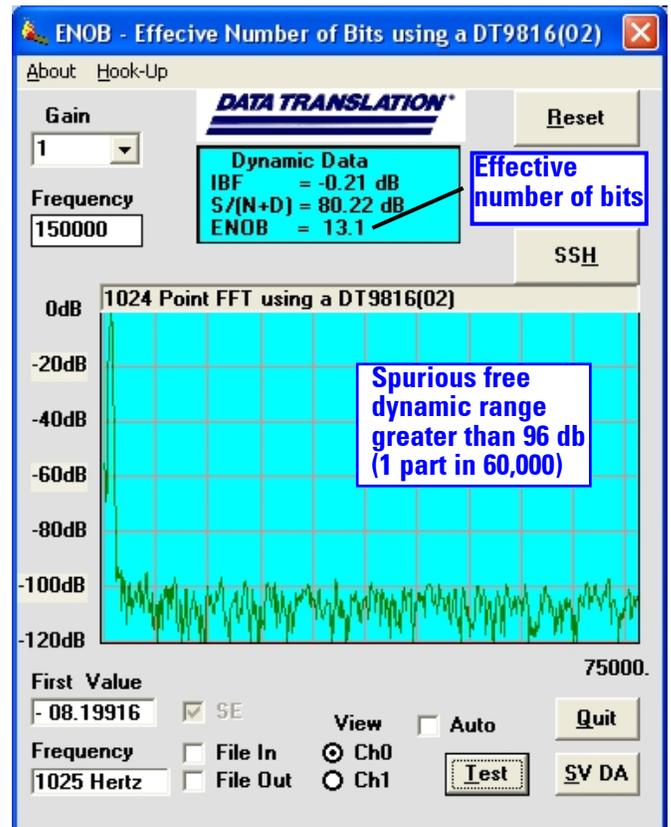


Figure 12. This graph shows the outstanding quality of the DT9816-A for all error sources ... effective number of bits greater than 13.1 from all sources. Note the absence of harmonic content and digital switching noise across the full spectrum.

Overview

The ECONseries features the powerful GO! application to provide economical, multifunction instruments for the USB bus. Simply install the software, connect your module to any USB port, and GO!

ECONseries modules are available in a number of configurations to offer the maximum flexibility - select the number of analog and digital I/O channels, the resolution you need, and the signal range required by your application.



GO! Application

For measurements right out of the box, use the GO! application. The GO! application automatically detects and configures the module you are using, and provides the following standard instrument-like displays for data acquisition, control, and display:

- Oscilloscope - Stream, plot, and analyze data from up to eight analog input channels. The software automatically adjusts for resolution and input signal range. You can scroll, pan, zoom, or freeze live signals; select the trigger type, level, and channel; and print or save your data to an Excel file.

- Chart Recorder - View and record up to 32,000 data points from eight analog input channels. Data is logged to an Excel file.
- Voltmeter - Measure and view data from up to eight analog input channels with a 5-digit digital display. You can choose to display the maximum or true root mean square (RMS) value.
- File Viewer - Load a previously saved Excel file. You can scroll, zoom, pan, or print your data.
- Waveform Generation - Generate DC, sine, rectangle, triangle waveforms from up to two analog output channels. You can select the duty cycle, frequency, amplitude, and offset of the signal.
- Digital Input - Monitor the status of up to 28 digital inputs using LEDs.
- Digital Output - Control the state of up to 28 digital output lines using switches.
- Counter - Count pulses from the counter/timer for 1, 2, or 5 seconds or for an unlimited time and view the count in a 9-digit digital display.
- Rate Generator - Control the frequency and duty cycle of a continuous pulse output signal from the counter/timer.

Throughput

Before selecting a module, consider whether you need analog inputs, and if so, what kind of throughput you need.

Modules with multiplexed inputs, such as the DT9810, DT9812-2.5V, DT9812-10V, DT9813-10V, and DT9814-10V provide only one A/D converter that is shared by the inputs (see Figure 23). A multiplexer selects or switches the channel to acquire, which introduces a settling time and phase shift between channels. In a multiplexed architecture, the total or aggregate throughput is the maximum rate of the sampling clock. The DT9810 provides an aggregate throughput of up to 25 kHz, while the DT9812-2.5V, DT9812-10V, DT9813-10V, and DT9814-10V provide an aggregate throughput of up to 50 kHz. The per channel rate is determined by dividing the maximum sampling rate by the number of inputs sampled. For example, if you are acquiring 8 inputs on a DT9812-10V, the per channel rate is 6.25 kS/s.

In contrast, modules that provide separate A/D converters per channel (see Figure 24), such as the DT9816 and DT9816-A, eliminate the phase shift between signals, allowing you to correlate simultaneous measurements of multiple inputs. The per channel sampling rate, in this case, is the maximum rate of the sampling clock (50 kS/s for the DT9816 and 150 kS/s for the DT9816-A).

Analog Inputs

The DT9810, DT9812 2.5V, and DT9812-10V modules provide 8

Oscilloscope

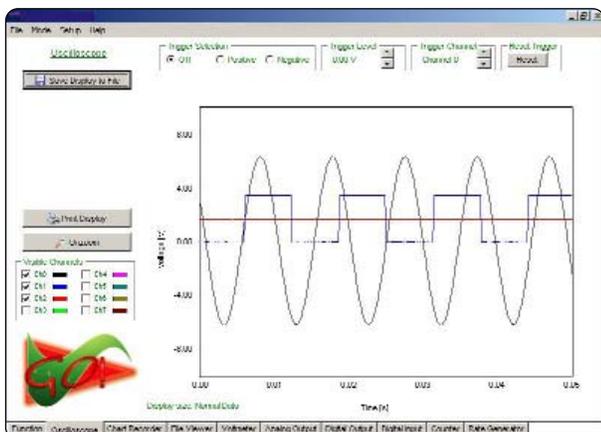


Figure 13 Use the Oscilloscope tab of the GO! application to stream, plot, and analyze data from up to eight single-ended analog input channels. The software automatically adjusts for resolution and input signal range. You can scroll, pan, zoom, or freeze live signals; select the trigger type, level, and channel; and print or save your data to an Excel file.

Chart Recorder

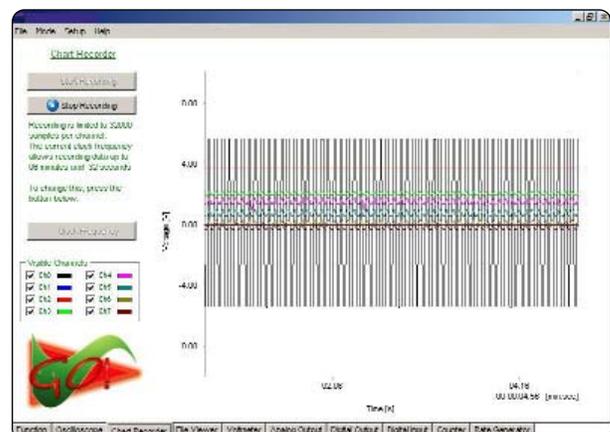


Figure 14. Use the Chart Recorder tab of the GO! application to view and record up to 32,000 data points from up to eight single-ended analog input channels. Data is logged to an Excel file.

Voltmeter

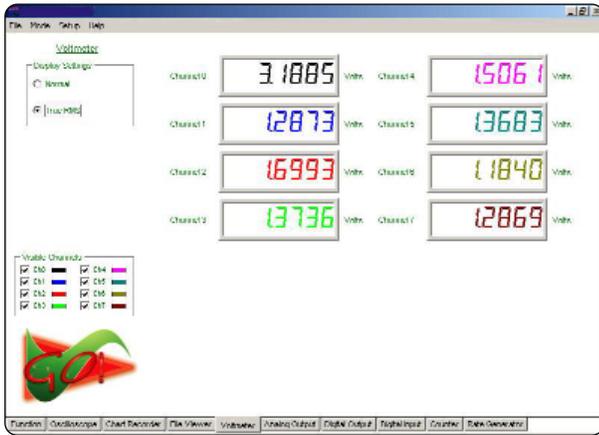


Figure 15. Use the Voltmeter tab of the GO! application to measure and view data from up to eight analog input channels in a 5-digit digital display. You can choose to display the maximum or RMS value.

multiplexed single-ended analog input channels, the DT9813-10V provides 16 channels, and the DT9814-10V provides 24 channels. The DT9816 and DT9816-A modules provide 6 separate 16-bit analog converters for simultaneous acquisition of up to 6 single-ended analog inputs.

The DT9810 provides 10-bit resolution, while the DT9812-2.5V, DT9812-10V, DT9813-10V, and the DT9814-10V provide 12-bit resolution. For maximum resolution, the DT9816 and DT9816-A provide 16-bit resolution.

DT9810 and DT9812-2.5V modules feature a full-scale input signal range of 0 to 2.44 V. If you need a full-scale input signal range of ± 10 V, the DT9812-10V, DT9813-10V, DT9814-10V, DT9816 and DT9816-A are available. The DT9816 and DT9816-A

modules also feature a full-scale input signal range of ± 5 V.

The DT9812-2.5V provides gains of 1, 2, 4, 8, and 16; the DT9812-10V, DT9813-10V, and DT9814-10V provides programmable gains of 1, 2, 4, and 8; and the DT9816 and DT9816-A provide gains of 1 and 2.

The GO! application provides the Oscilloscope (Figure 13), Chart Recorder (Figure 14), Voltmeter (Figure 15), and File Viewer (Figure 16) instrument-like displays to acquire, view, print, and save data from all eight of the analog input channels on the ECONseries modules.

Waveform Generation

The DT9812-2.5V module provides 2, 12-bit waveform analog output channels with an output

File Viewer

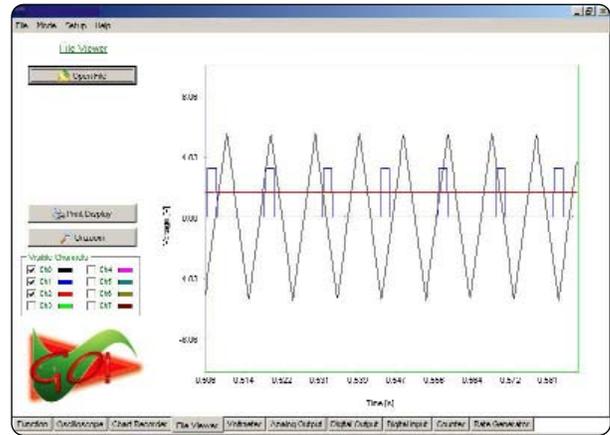


Figure 16. Use the File Viewer tab of the GO! application to load a previously saved Excel file. You can scroll, zoom, pan, or print your data.

Effective Input Ranges

Gain	DT9812-2.5V	DT9812-10V, DT9813-10V, DT9814-10V	DT9816
1	0 to 2.44 V	± 10 V	± 10 V
2	0 to 1.22 V	± 5 V	± 5 V
4	0 to 0.61 V	± 2.5 V	—
8	0 to 0.305 V	± 1.25 V	—
16	0 to 0.1525 V	—	—

Note: The GO! Application uses a gain of 1. Gains of 2, 4, 8, and 16 (DT9812-2.5V only) are supported at the driver level.

signal range of 0 to 2.5 V. The DT9812-10V, DT9813-10V, and DT9814-10V modules provide 2, 12-bit analog output channels with an output signal range of ± 10 V. These modules support an update rate of up to 50 kS/s.

Waveform Generator

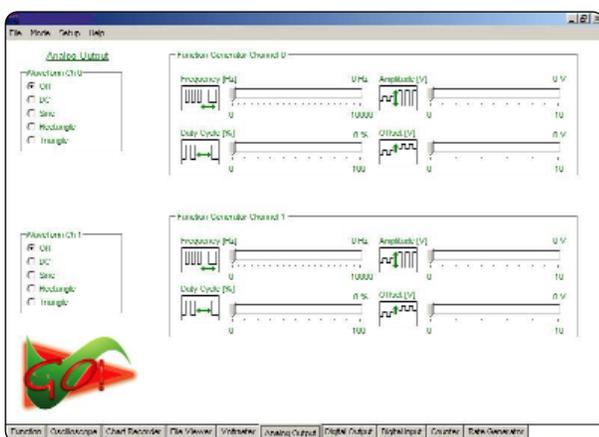


Figure 17. Use the Waveform Generator tab of the GO! application to generate DC, sine, rectangle, triangle waveforms from one or both analog output channels. You can select the duty cycle, frequency, amplitude, and offset of the signal.

Digital Input

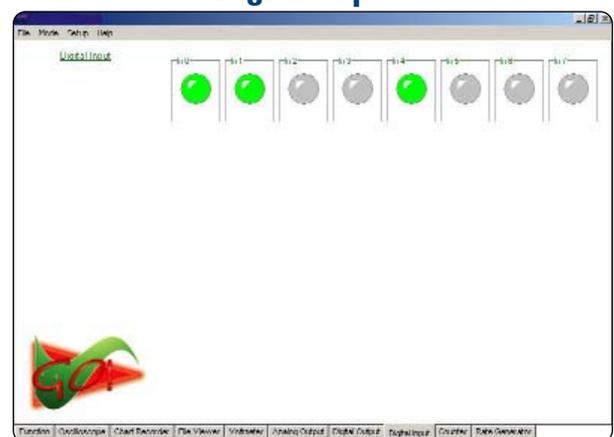


Figure 18. Use the Digital Input tab of the GO! application to monitor the status of the digital inputs using LEDs. The GO! application supports up to 16 digital inputs.

Digital Output

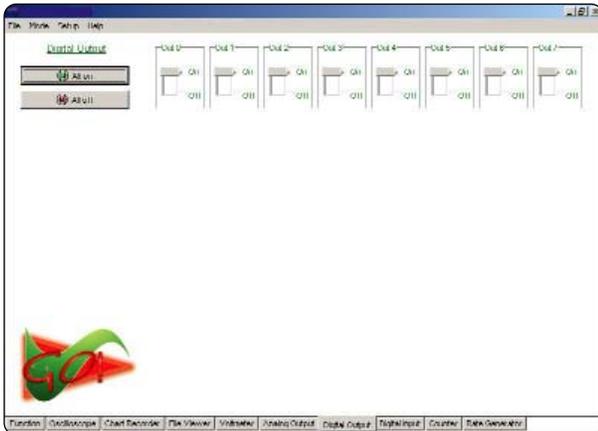


Figure 19. Use the Digital Output tab of the GO! application to control the state of the digital output lines using switches. The GO! application supports up to 12 digital outputs.

Counter

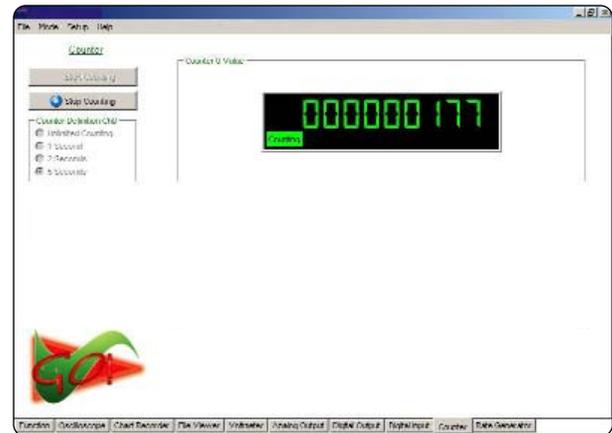


Figure 20. Use the Counter tab of the GO! application to count pulses from the counter/timer for 1, 2, or 5 seconds or for an unlimited time and view the count in a 9-digit display.

Rate Generator

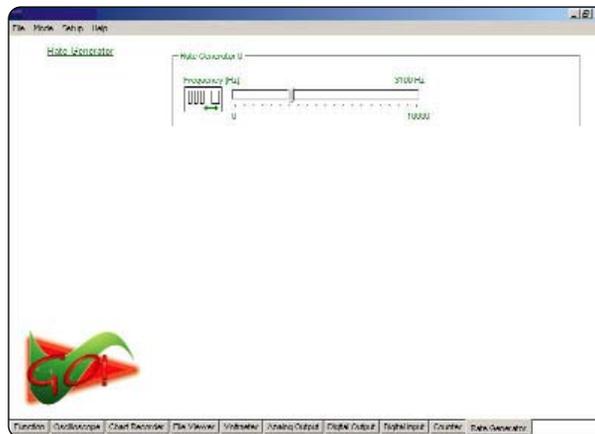


Figure 21. Use the Rate Generator tab of the GO! application to control the frequency of a continuous pulse output signal from the counter/timer.

Use the Waveform Generator display of the GO! application (Figure 17) to generate sine, rectangle, triangle, or DC waveforms from one or both analog output channels. You can select the frequency, amplitude, duty, and offset cycle of the signal.

Simultaneous analog input and analog output operations are supported at the driver level.

Digital I/O Lines

The DT9812-2.5V, DT9812-10V, DT9816, and DT9816-A modules feature 8 digital input lines and 8 digital output lines. The DT9813-10V provides 4 digital input lines, and 4 digital output lines. The DT9810 module provides 20 programmable digital I/O lines. If you need more digital I/O lines and do not need analog I/O functionality, select the DT9817 or DT9817-H module, which provide 28 programmable digital I/O lines. The

DT9817-H provides high drive capability with 15 mA source and 64 mA sink.

Finally, the DT9817-R is a robust, isolated version with 16 digital I/O lines (8 in/8 out) that can switch up to $\pm 30V@400\text{ mA}$. The DT9817-H and DT9817-R are ideal for solid state or mechanical relays.

Use the Digital Input or Digital Output display of the GO! application (Figure 18 & 19) to monitor and control the digital I/O lines.

Multifunction Counter/Timers

The DT9816 and DT9816-A support one 16-bit counter/timer channel. All other modules feature one 32-bit user counter/timer channel. You can perform event counting, frequency measurement, and continuous pulse output operations using this counter/timer.

Use the Counter display of the GO! application (Figure 20) to count pulses from the counter/timer or the Rate Generator display (Figure 21) to generate a pulse output signal.

Programmable gates, clocks, and output signals are also supported at the driver level for maximum flexibility. In addition, programmable edges allow you to measure the time between two edges of a signal to determine the pulse width, frequency, or period of a signal.

Flexible Clocks and Triggers

The DT9810, DT9812-2.5V, DT9812-10V, DT9813-10V, DT9814-10V, DT9816, and

DT9816-A modules support an internal trigger and internal clock. In addition, the DT9812-2.5V, DT9812-10V, DT9813-10V, DT9814-10V, DT9816, and DT9816-A modules support an external trigger and clock.

Use the internal trigger to start an analog input operation based on a software command, or use the external trigger to start an analog input operation based on an external event.

Use the external clock signal to pace an analog input operation at a rate not available with the internal clock or when you want to pace at uneven intervals.

Synchronizing Multiple Modules

You can synchronize the analog input operations of multiple DT9812-2.5V, DT9812-10V, DT9813-10V, DT9814-10V, DT9816, or DT9816-A modules by connecting the output of the counter/timer from one module to the clock input of the next module as shown in Figure 22.

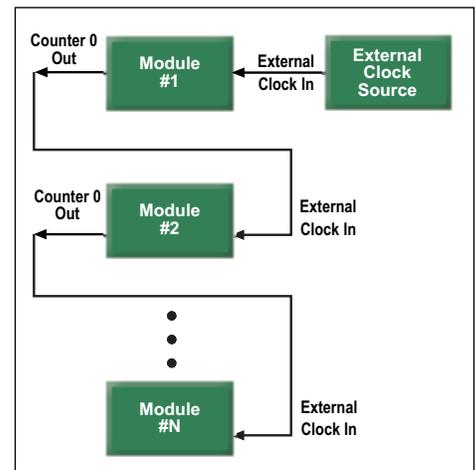


Figure 22. You can synchronize the analog I/O operations of multiple modules by connecting them together.

Easy Signal Connections

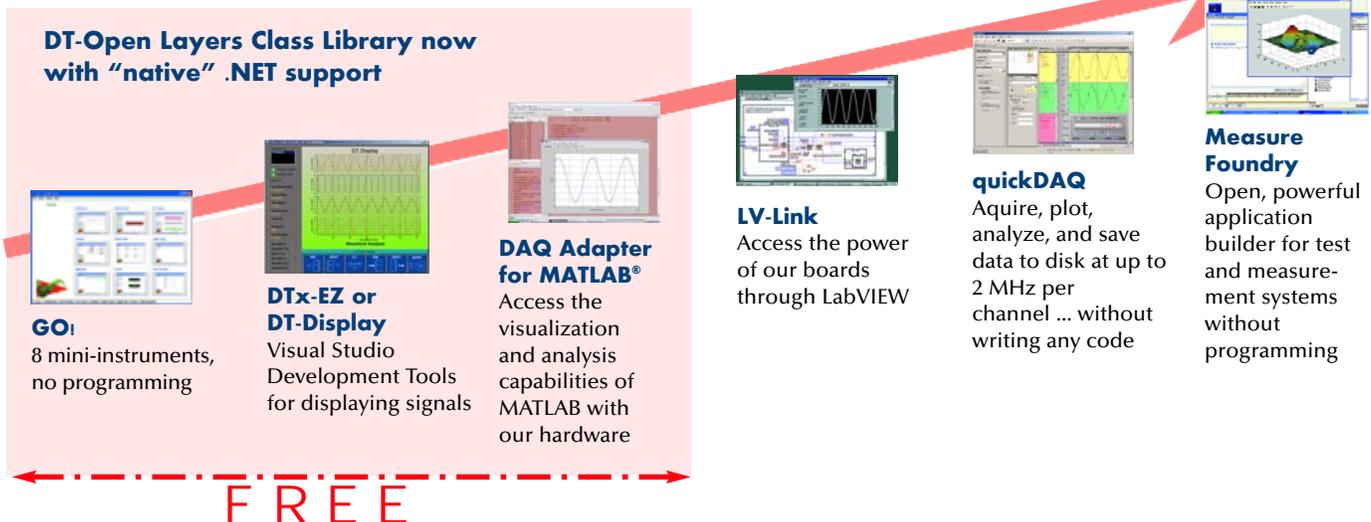
Screw terminals on the module allow easy and direct signal connections. No extra accessories are required! Simply wire your signals to the module and you're all set.

And, because of the module's high impedance, measurement errors are prevented.

Creating Custom Applications

The **GO! application** provides an easy-to-use solution for measuring signals right out of the box! If, you'd rather create your own application, the ECONseries is fully DT-Open Layers for .NET-compliant, allowing users of all levels - from programmers to application users - the ability to create a program for the ECONseries. The following software choices are available:

Options for Solution Development



All ECON Series 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.

■ Drivers:

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

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

■ **Measure Foundry** is an open, powerful application builder for test and measurement systems. No programming is required!

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

■ **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 without writing any code. quickDAQ supports applications from temperature measurement to high-speed testing and analysis.

The following software is available as a free download from our website:

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

■ **GO! Application** allows you to measure signals right out of the box.

Cross-Series Compatibility Saves Programming Time, Protects Your Investment

Virtually all Data Translation data acquisition boards, including the ECONseries, are compatible with the DT-Open Layers for .NET Class Library. 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. Little or no programming is needed.

ECONseries User Manuals

Each ECONseries module includes a getting started and user's manual. Manuals are provided in electronic (PDF) format on the ECON CD that is shipped with the module. You can also purchase hard copies, if desired.

- [Click here for full specifications.](#)
- [Click here for pin assignments and block diagrams.](#)

Technical Support

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 contact Technical Support through email at tsupport@datx.com with any questions.

Ordering Summary

ECONseries Modules

- DT9810
- DT9812-2.5V
- DT9812-10V
- DT9813-10V
- DT9814-10V
- DT9816
- DT9816-A
- DT9817
- DT9817-H
- DT9817-R

System Requirements

- Windows 2000/XP Professional Edition operating system.
- USB Ports - one or more (version 2.0 or 1.1).
- CD-ROM drives - one or more.

Software

All software is provided on the Omni CD that ships with the module.

Accessories

- DIN Mount Kit.

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