The DT9841 and DT9842 provide a complete data acquisition system for real-time signal capture and processing. With a variety of I/O and programming options, the DT9841 and DT9842 provide an ideal platform for real-time applications.

- **DT9841 Noise and Vibration Applications**
  - Eight 24-bit inputs with built-in anti-aliasing filters for superior AC performance.

- **DT9841E Economical Vibration Applications**
  - Economical 2-channel version with built-in anti-aliasing filters. Available start-up kit is ideal for developers and OEMs.

- **DT9841-VIB IEPE for Accelerometers and Microphones**
  - Eight IEPE sensor connections. Ideal for noise, vibration, acoustics, sonar, and accelerometer measurements.

- **DT9842 Fast Control Loop Applications**
  - Eight high-speed inputs and 2 or 8 precision outputs.

In addition to the simultaneous input channels, all modules feature two or eight deglitched waveform analog outputs, 24 digital I/O lines (16 on the -VIB version), three 32-bit user counter/timers, and the Texas Instruments 300MHz TMS320C6713 DSP chip.

---

**Features Summary**

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<td>3</td>
<td>24</td>
<td>100dB</td>
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<td>SAR</td>
<td>2 or 8</td>
<td>3</td>
<td>24</td>
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</table>

**Figure 1.** DT9840 Series modules are available in two configurations: Sleek Box and board-level OEM version and offer a variety of analog input and output options, including IEPE sensor inputs. All modules are fully isolated to 500V.

**Figure 2.** The DT9840 Series is an intelligent data acquisition system optimized for the highest performance, real-time data acquisition and digital signal processing applications. A unique architecture tightly couples A/D and D/A converters to a DSP engine to allow simultaneous data collection and analysis, and host communications.
Figure 3. This figure shows the component layout and subsystem access of the board-level version of the DT9840 Series module.

Figure 4. This figure shows the component layout and subsystem access of the 2-Channel DT9841E module.
Figure 5. The DT9841E-DK is a startup kit for developers that allows easy signal connections. It consists of the DT9841E board, EP358E accessory panel, 2 EP344 cables, a standard USB cable, and a EP348 power supply.

Figure 6. Exploded view of the DT9841-VIB, IEPE compatible vibration measurement Sleek Box.
Four Different Models

- DT9841
- DT9841E
- DT9841-VIB
- DT9842/2 and DT9842/8

Each module contains an embedded DSP processor for real-time control and a high-speed USB 2.0 interface for communicating to a host PC. The DT9841, DT9841E, and DT9841-VIB modules feature 24-bit Sigma-Delta converters - great for noise and vibration testing. The DT9842/2 and DT9842/8 modules feature 16-bit successive-approximation converters - great for fast control loop operations.

Modules provide simultaneous acquisition and control of up to 8 analog input channels (2 on the DT9841E), 2 analog output channels (8 on the DT9842/8), 16 or 24 digital I/O lines, and 3 32-bit counter/timer channels at up to 100 kHz. Additionally, the DT9841-VIB accepts signals from IEPE sensors. And, if you need more I/O, simply connect up to four DT9840 Series modules together! Two packaging configurations are available for most models to suit your application needs.

Software Flexibility

To get up and running quickly, use the DT Dynamic Signal Analyzer application to stream real-time data between the PC and your DT9840 Series module right out of the box - without programming! You can modify this application as you wish or configure a complete real-time system using the property pages of Measure Foundry. Or, if you need more flexibility, develop your own low-level DSP application using TI Code Composer Studio.

Simultaneous Analog Inputs

The DT9841 and DT9841-VIB modules offer 8, 24-bit analog input channels. The DT9841E offers 2, 24-bit analog input channels. These modules have built-in anti-aliasing filters for superior AC performance in noise and vibration testing applications. The analog input channels are configured for differential mode on the DT9841 and the DT9841E and single-ended mode on the DT9841-VIB, and support an input range of +/-10 V.

The DT9842/2 and DT9842/8 modules offer 8, 16-bit analog input channels (without filtering) for fast control-loop applications, such as predictive maintenance and servo loop applications. All analog input channels are configured for single-ended mode and support an input range of +/-10 V. When clocked by either the internal or external clock, all analog input channels, digital input lines, and counter/timer channels are simultaneously sampled at up to 100 kSamples/s (800 kHz aggregate). Using software, you can scan all the analog inputs either a specified number of times or continuously. You can also read a single value from a single input channel, if desired.

Internally, the DT9841, DT9841E, and DT9841-VIB modules use a Sigma-Delta converter for each analog input, while the DT9842/2 and DT9842/8 modules use a successive-approximation converter for each analog input.

Sigma-Delta converters offer the following advantages for analog input operations, making them ideal for noise and vibration testing applications:

- Reduce noise and improve accuracy by oversampling each input up to 64 times.
- Eliminate errors that result from aliasing and high frequency noise by using a built-in decimation filter when sampling between 200 Hz and 5 kHz.
- Provide excellent low-level signal-to-noise performance, which improves dynamic accuracy on low-level signals.
- Provide excellent differential linearity, which ensures consistently accurate data conversion across the full input range.

Because of their inherent filtering algorithms, though, Sigma-Delta converters also have an initial delay of 37 clock pulses (370 µs at 100 kHz) after the sample clock is first started and before the first conversion is completed. Thereafter, the data is converted without delay (at 100 kHz, sampling occurs every 10 µs).

In fast control-loop applications, this initial delay is unacceptable. For these applications, successive-approximation converters are the best choice.

Successive-approximation converters always run as fast as possible because no filtering is performed (at 100 kHz, sampling occurs every 10 µs). In addition, they have extremely low aperture uncertainty (5 ns jitter) for minimal phase error and very accurate comparison/correlation of high-speed analog signals.

www.haopute.com email:info@haopute.com phone:028-84625157
Analog Inputs with IEPE Functions

Applications that require accelerometer, vibration, noise, or sonar measurements often use IEPE sensors. The DT9841-VIB module supports the following software programmable IEPE functions for each of it’s eight analog inputs.

- Current source — Enable or disable the use of a 4 mA current source to drive the accelerometer.
- AC/DC coupling — Select whether AC coupling or DC coupling is used.
- Filtering — Enable or disable the use of the 2-pole, 10kHz, Butterworth filter.

Waveform Quality Analog Outputs

The DT9841, DT9841E, and DT9841-VIB modules support two, 24-bit waveform analog outputs with an output range of ±10 V or ±2.5 V. A software-selectable filter of 5 kHz or 20 kHz is available for each channel for smoothing the output value.

The DT9842/2 module supports two, 16-bit waveform analog outputs and the DT9842/8 module supports eight, 16-bit waveform analog outputs. Each analog output channel provides an output range of ±10 V. Each analog output is deglitched to less than 10 nV second spike for all the major and minor bit carries.

When clocked by either the internal or external clock, all the analog outputs and digital outputs are simultaneously updated at up to 100 kSamples/s (200 kHz or 800 kHz aggregate).

Using software, you can update all the analog outputs either a specified number of times or continuously. You can also generate a waveform for each analog output channel or write a single value to a single output channel, if you wish.

When powered up or reset, no digital data is output from the modules. All the outputs include diode protection to the isolated ground and the isolated +5 V.

Up/Down Counter/Timers

All DT9840 Series modules provide three 32-bit counter/timer channels with programmable C/T clocks, gates, edges, and pulse output parameters. You can use these counter/timers to perform standard counting operations, such as event counting and rate generation, as well as up/down counting, one-shot, and repetitive one-shot operations. Additionally, you can measure the period or frequency of a signal between programmable clock or gate edges.
You can also read the value of all the counter/timer channels at the same time as the analog input channels and digital input lines at up to 100 kHz.

**Easy Channel Expansion**

For high-channel count applications, use the Scalable Bus connectors on the module and the shielded EP342 cable to connect up to four modules together for up to 32 analog I/O channels, 96 digital I/O lines, and 12 counter/timer channels. (Expansion capability is available on the DT9841, DT9841-VIB, and DT9842).

If you wish, you can synchronize the operation of all modules using the Scalable Bus master clock. In this configuration, one module is the master and the other modules are slaves. You can use either an internal or external clock source to pace the master module. The Scalable Bus master clock resets the slave modules and paces them at the same rate as the master module. The first and last modules in the chain must be terminated with software-selectable 100 Ohm termination resistors.

**Programmable Triggers**

The DT9840 Series supports an internal and external trigger for starting all the I/O operations on the module.

Using the internal trigger, I/O operations start based on a software command. Using an external trigger, I/O operations start when the module detects a low-to-high transition on the Ext Trig input of the module. Connect a TTL-level signal to the Ext Trig connector on the module.

**Programmable Clocks**

All DT9840 Series modules support an internal and external clock for pacing I/O operations. These clocks are shared by all I/O subsystems.

On the DT9841, DT9841E, and DT9841-VIB modules, the internal clock has a 36 MHz time base and supports sampling frequencies between 200 Hz and 100 kHz. On the DT9842/2 and DT9842/8, the internal clock has an 18 MHz time base and supports sampling frequencies between 0 Hz and 100 kHz. Use software to specify the sampling frequency you want.

If you want to use an external clock to pace I/O operations, connect a TTL-level signal to the Ext Clk connector on the module. For the DT9841, DT9841E, and DT9841-VIB ensure that the frequency of the external clock signal that you connect to the module has a 50% duty cycle, is 256 times the actual clock frequency you want, and has a resulting clock frequency between 200 Hz and 100 kHz. For example, if you need a sampling frequency of 100 kHz, use an external clock source with a frequency of 25.6 MHz. For the DT9842/2 and DT9842/8, the frequency of the signal that you connect to the Ext Clk input is the clock frequency that is used.
High-Speed USB 2.0 Host Interface

All DT9840 Series modules use a high-speed USB 2.0 interface, which provides transfer rates between the module and the host at up to 480 Mbits/s. The DT9840 Series can also be used with USB 1.1 ports, but at USB 1.1 performance (12 Mbits/s).

500 V Galvanic Isolation

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. DT9840 Series modules feature 500 Volts of galvanic isolation to protect your computer from ground-spikes and to ensure a reliable stream of data.

Flexible Memory Configurations

All DT9840 Series modules provide 128 MB of SDRAM memory and 2 MB of flash memory.

You can download a DSP program from the PC directly to the SDRAM memory on the module and run it. The program resides in memory as long as the module stays powered on. The module does not need host intervention (eliminating any Windows latencies) and can run on its own, monitoring and controlling data. If the PC becomes disconnected accidentally, data is preserved, ensuring the security of mission-critical applications.

Once you have run and debugged your program, you can store it in flash memory. This allows the DSP program to run automatically, independent of the PC, each time the module is powered on.

Memory is shared by the I/O subsystems, onboard DSP processor, and Scalable Bus. Each subsystem has its own high-speed pathway in and out of memory, and each pathway has its own independent DMA controller. This allows I/O subsystems to operate without processor intervention.

Multiple Packaging Configurations

DT9840 Series modules are available in two packaging configurations:

- Sleek Box version (-SB).
- Board-level version.

The Sleek Box for the DT9841, DT9841-VIB, and DT9842 packages the board-level version of the DT9840 Series module in a CE-compliant box with standard signal connectors, USB cable, power supply (EP348), and fan. This configuration is great for easy signal connections. A removable side panel allows direct access to the JTAG connector for debugging purposes. The Sleek Box is not available for the DT9841E. However, a developer’s kit is available for the DT9841E. The DT9841-VIB has a special interface board designed specifically for IEPE sensor inputs.

The board-level version is available for OEM embedded applications, and ships with a USB cable. A +5 V AC to DC power supply is required for operation, and is available separately as EP348.

Many Software Choices

A number of software choices are provided to allow users of all levels - from programmers to application users – the ability to access the DT9840 Series:

- Measure Foundry is an open powerful application builder for test and measurement systems. Using property pages, you can easily configure real-time tasks like data collection, data display, signal processing, and streaming to disk. Programming blocks support custom algorithm development. Measure Foundry is also MATLAB® and Excel® compatible. Measure Foundry automatically downloads the required COFF files to the module in the background.

- The DT Dynamic Signal Analyzer helps you to get up and running quickly. You can stream real-time data between the PC and your DT9840 Series module right out of the box! The DT Dynamic Signal Analyzer is a Ready-to-MeasureTM application that automatically configures the DT9840 Series hardware, performs oscilloscope, spectrum analyzer, digital voltmeter, and function generator operations, and streams data to and from the host PC - all without programming! You can modify this application as you wish or configure a complete real-time system using Measure Foundry.

- Use TI Code Composer Studio for maximum flexibility. Using Code Composer, you can develop your own low-level DSP applications to run in stand-alone mode or to communicate with your own Windows application written in Microsoft Visual Studio. Each DT9840 Series module comes with a device driver, a full set of I/O and communication API libraries for the DSP and host PC, example programs and utilities, and complete documentation.
DT Dynamic Signal Analyzer application example

**Oscilloscope Panel:**
- Stream and analyze signals on one or all 8 channels in real-time
- Zoom/pan, autoscale, or freeze live signals
- Print or save signals to disk
- Open and post-analyze saved signal from disk

**Spectrum Panel:**
- Stream data in and perform up to a 128K point FFT on one or all 8 channels
- Many FFT types: spectrum analyzer, autocorrelation, power spectrum
- Many windows functions, including Rectangle, Hann, Blackman
- Select linear, logarithmic, or dB view for Y-axis scale

**DVM Panel:**
- 24-bit resolution provides 6.5-digit Digital Volt Meter for all 8 channels
- Selectable upper- and lower-limit range
- Warning LED indicator for values in or out of limit range

**Configuration Panel:**
- Automatically configures DT9840 Series
- Selectable input sampling frequency from 10 kHz to 100 kHz
- Selectable input audio sampling frequencies from 11.025 kHz to 96 kHz

**Function Generator Panel:**
- Generate DC, Sine Wave, Square Wave, Ramp, Triangle, and Arbitrary Waveforms
- Set frequency, amplitude, offset, duty cycle, sweep rate, and sweep width
- Load and play standard waveform signals from file (supports all .WAV, .DCF, or ASCII files)

Figure 15. The DT Dynamic Signal Analyzer automatically configures DT9840 Series hardware for real-time streaming to/from a host PC without programming!

**Drag and drop instrument-like panels onto your worksheet ...**  **Configure real-time tasks using simple property pages ...**  **... and you are ready to run.**

Figure 16. Measure Foundry is a user configurable, real-time development package that makes developing applications simple and fast. Using property pages you can easily configure real-time tasks. The COFF file is automatically downloaded to the module in the background.

**Code-Based Program Development**

Develop host program with C++ or Visual Basic and Data Translation Host Communication library.

Develop DSP program with TI Code Composer Studio and Data Translation DSP libraries.

```
DT_BoardDownload( BRD_HANDLE hBoard, CHAR *pFilename, BOOL bVerifyFlag);
```

```
DT_ReadADC( ULONG nADCIndex, LONG *pADValue);
```

Figure 17. For maximum flexibility, you can develop your own low-level DSP applications using TI Code Composer Studio. You can develop DSP programs to run in stand-alone mode or to communicate with your own Windows application written in Microsoft Visual Studio.
Easy Signal Connections

The Sleek Box version of the module, shown in Figure 1, provides BNCs for all the analog I/O, external trigger, and external clock signals. You can also access the analog I/O and digital I/O signals through 37-pin D-sub connectors on the front panel. A 25-pin D-sub connector is provided on the front panel for accessing the counter/timer signals.

The board-level version of the module, shown in Figure 1, provides two 68-pin connectors for accessing all of the analog I/O, digital I/O, and counter/timer signals, and BNCs for attaching external trigger and clock signals.

The 8-channel versions of the module also provide Scalable Bus connectors for attaching up to 7 additional modules, a serial port connector and JTAG connector for easy debugging, a power input and output connector, and a USB 2.0 connector for attaching to a host computer.

The DT9841E offers a startup kit for developers to allow easy access to all signal connections. The DT9841E-DK consists of the DT9841E board, EP358E accessory panel, 2 EP344 cables, standard USB cable, and an EP348 power supply.

The DT9841-VIB provides BNC inputs on the front panel specifically designed to accept inputs from IEPE sensors. Additionally, a separate BNC is provided for x, y, z positioning.

ACCESSORIES

- **EP342** — 0.1m shielded 50-pin cable for connecting multiple DT9840 Series modules using the Scalable Bus.
- **EP348** — 5V optional power supply (with included power cable).
- **EP358E** — 2 channel in, 2 channel out accessory panel for DT9841E; includes 2 EP344 cables.

SUPPORTED SOFTWARE

- DT Dynamic Signal Analyzer application example
- Measure Foundry
- TI Code Composer 3.3
- Microsoft Visual Studio (6.0 or greater)

Ordering Information

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

**DT9841/DT9842**

Each DT9841, DT9841E, or DT9842 module is shipped with a USB cable, device drivers for Microsoft Windows® XP/Vista/7, DSP library, host communication library, and comprehensive manuals in PDF form. Manuals are available in hard-copy form for an additional charge. The Sleek Box version also ships with the EP348 power supply.

**Ordering Summary**

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<th>A/D Converter</th>
<th>Resolution</th>
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