dB4

High Performance USB Module for Sound & Vibration Analysis

DB4 Features

- **4 simultaneous, 24-bit Delta-Sigma A/D channels** for high resolution measurements.
- **Support for four IEPE inputs,** including 4mA current source.
- **Portable operation.** No external power supply needed. Runs on USB power.
- **Tachometer input support** in the A/D data stream for synchronizing measurements.
- **Sampling rate of over 52kHz** to meet your application need.
- **Low frequency measurements** supported with a wide pass band of 0.5Hz to 25.8kHz (0.49 x sampling frequency).
- **Analog input ranges of +/-10V and +/-1V** with software-selectable gains of 1 and 10.
- **One 24-bit Delta-Sigma D/A converter** with single-value or ultra-smooth waveform capability.
- **Programmable triggers for analog input operations** for maximum flexibility. Choose a software trigger, TTL trigger, or analog threshold trigger.

Figure 1. The dB4 has 4 simultaneous IEPE sensor inputs plus a synchronous tachometer input and is ideal for portable noise and vibration measurement applications.

- **Software selectable** AC or DC coupling.

Overview

The dB4 is a highly accurate five channel data acquisition module that is ideal for portable noise and vibration measurements. Four 24-bit IEPE (ICP®) sensor inputs are synchronized with a tachometer input to provide data streams that are matched in time for field or laboratory use.

The 38 segment clock-time conversion of the Delta-Sigma A/Ds is offset in software to provide this time correlated

data. The rugged small module is self-powered via the USB connection to a PC laptop. BNC connections are provided

for all I/O signals for secure and easy-to-use operation.

Summary of Features

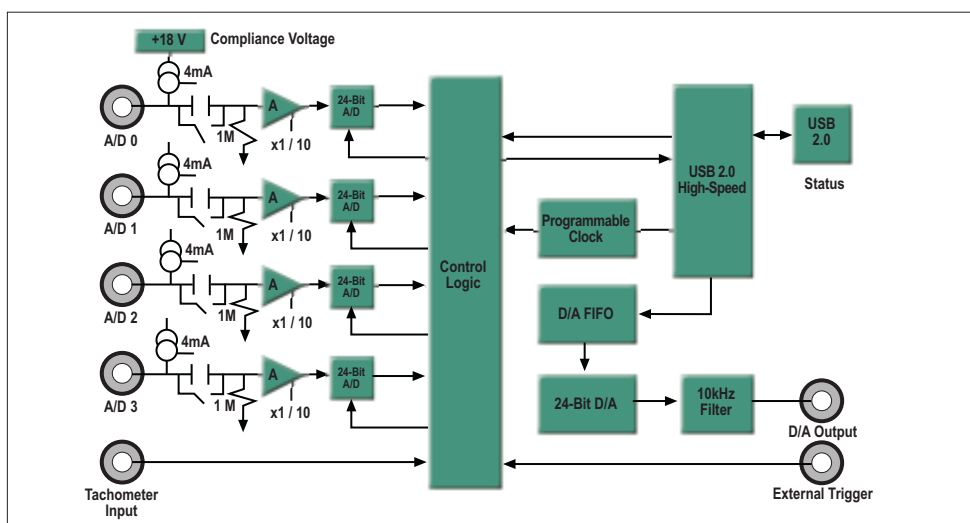|	A/D Throughput Per Channel	D/A Channels	Tachometer Input	Simultaneous Subsystem Operation	Applications
dB4	52.734kHz 4 IEPE Inputs Simultaneous	1 waveform or Single Value	1 Synchronou to Analog Data Stream	Yes	Vibration, Acoustics, Sonar

Figure 2. The dB4 is a high performance, multifunction data acquisition module for USB that provides A/Ds with IEPE capability, one waveform D/A, a tachometer input, and simultaneous operation of all subsystems.

Analog Inputs

The dB4 module supports four analog input channels and a tachometer input. Gains of 1 and 10 are supported for effective input ranges of +/- 10V and + /- 1V. The module uses 24-bit Delta-Sigma analog-to-digital converters (ADCs) that provide anti-aliasing filters based on the clock rate. These filters eliminate aliasing, which is a condition where high frequency input components erroneously appear as lower frequencies after sampling.

You can read data from one or more analog input channels using an analog input channel list. You can enter up to 5 entries in the channel list, including four analog input channels and the tachometer input.

Analog Inputs with IEPE Functions

Applications requiring accelerometers, vibration, noise, and sonar measurements often use IEPE sensors. The dB4 module supports the following software programmable IEPE functions for each of its four analog inputs:
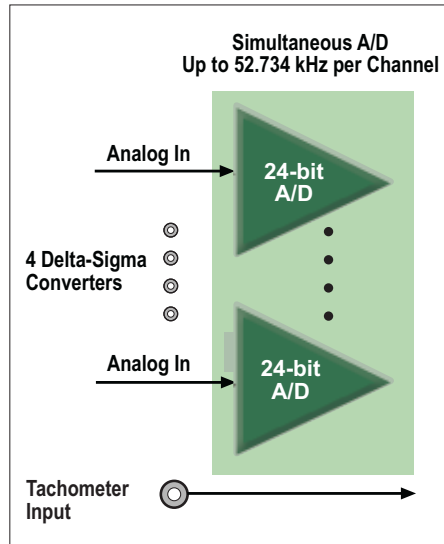
- Current source - Enable or disable the use of a 4mA current source to drive the IEPE sensors.
- AC/DC coupling - Select whether AC coupling or DC coupling is used.

Delta-Sigma A/D Converters

These modules have built-in anti-aliasing filters for superior AC performance in noise and vibration testing applications.

Internally, the dB4 module uses a Delta-Sigma converter for each analog input. Delta-Sigma 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.

Figure 4. Simultaneous Delta-Sigma A/D converters and the tachometer input are synchronized through software to accommodate for the group delay of the A/D converters.

- Eliminate errors that result from aliasing and high frequency noise.
- 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.

Group Delay and Data Synchronization

Because of the inherent filtering algorithms, Delta-Sigma converters have an initial delay of 38 clock pulses after the sample clock is first started and before the first conversion is completed, due to the group delay of converters.

The tachometer data (which does not have the 38 sample group delay) is synchronized with the analog data stream. This is done through the firmware and device driver by caching the tachometer data and aligning it in time with the analog data in the user's data buffers.

Tachometer Input

The dB4 includes support for a tachometer input in the analog input data stream for synchronous measurements. The measurement edge for the tachometer input is rising. The module accepts one ±30V, 31-bit tachometer input signal with a maximum frequency of 380kHz and a minimum pulse width of 1.3 microseconds. The threshold voltage is fixed at ±2V with 0.5V of hysteresis. Measurements are based on two consecutive rising edges of the tachometer input signals.
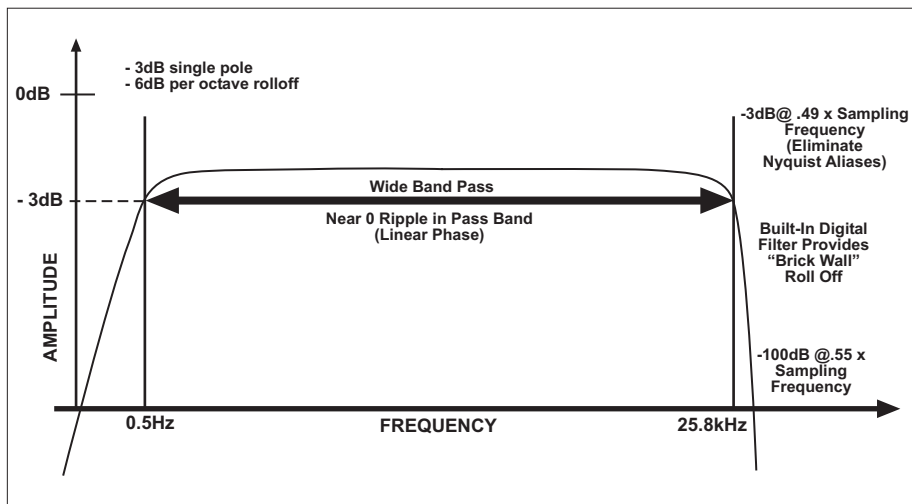
The tachometer input is treated like any other channel in the analog input channel list; therefore, all the clocking, triggering, and conversion modes supported for analog input channels are supported for the tachometer input.

Waveform Quality Analog Output

The dB4 supports one 24-bit D/A converter with an output range of +/- 10V. You can output a single value from the analog output channel, or you can use a software trigger to start a waveform operation. A two-pole, 10kHz Butterworth filter is applied to remove clocking noise and smooth signal output.

A standard waveform such as a sine, triangle, or square wave is easily produced by loading the onboard FIFO with 8,192 samples. The specific waveform is output at a fixed rate of 46.875 kHz. Great care has been used in design to minimize the glitch energy for any major or minor carry. This results in extremely smooth waveforms.

You can update the analog output channel as you are acquiring analog input data for gap-free simultaneous stimulus and response. Note that since the module uses a Delta-Sigma D/A converter, 34 clock pulses are required before the first D/A conversion is complete.

Figure 5. dB4 provides software selectable AC and DC coupling. When AC coupling is selected, the dB4 provides zero ripple in the wide pass band and excellent "brick wall" anti-alias filter eliminates unwanted high frequency interference.

USB 2.0 Compatibility

The dB4 module uses a high-speed USB 2.0 interface, which provides transfer rates between the module and the host at up to 480 Mbits/s. This means that all acquired signals stream to and from the host at full acquisition speeds. The dB4 can also be used with USB 1.1 ports, but at USB 1.1 performance (12 Mbits/s).

Easy Signal Connections

The dB4 provides BNCs for the analog input, tachometer input, analog output, and external trigger signals.

EMI and ESD Design Criteria

The dB4 has been designed to perform with the lowest noise characteristics. Damping resistors in series with every I/O line minimize ringing and EMI and provide current limits that protect against transient signals.