DaqBoard/1000™ Series

16-Bit, 200-kHz PCI Data Acquisition Boards

Features
• 16-bit, 200-kHz A/D converter
• 8 differential or 16 single-ended analog inputs (software selectable per channel)
• Up to four boards can be installed into one PC
• 100% digital calibration
• 512 location channel/gain FIFO
• DMA bus mastering for synchronous analog I/O, digital I/O, and counter inputs
• Trigger modes include digital and software, with <5 µs latency
• Virtually infinite pre-trigger buffer
• Two 16-bit, 100-kHz analog outputs with infinite continuous waveform output capability (model /1000 only)
• 24 digital I/O lines, can be scanned synchronously or asynchronously with analog and digital inputs
• Four counter/pulse input channels can be scanned synchronously or asynchronously with analog and digital inputs
• Two timer/pulse output channels

Software
• Includes DaqView™ Out-of-the-Box™ software application for effortless data logging and analysis
• Support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET; Linux support also available
• Comprehensive drivers for DASYLab®, LabVIEW®, and MATLAB®
• DaqCal™ software application for easy user calibration

The DaqBoard/1000 series offers all the functionality of higher priced PCI boards along with features not found in other manufacturers’ low-cost offerings including flexible analog inputs with 7 analog gain ranges, inputs configurable as differential or single ended, 24 digital I/O lines, synchronous analog, digital and frequency I/O, and included Linux drivers.

Software support for the DaqBoard/1000 series includes support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET, plus comprehensive drivers for DASYLab®, LabVIEW®, and MATLAB®. Also included is DaqView Out-of-the-Box™ software for quick and easy set up and collection of data without programming, along with DaqCal™ software application for easy user calibration. Linux support is also available.

Signal I/O
One 68-pin connector on the DaqBoard/1000 series provides access to all of the input and output signals. Unlike other multifunction boards that require multiple PC slots in order to access all of the I/O, careful design of the DaqBoard/1000 series accommodates all I/O using one slot, and utilizing a single PCI slot. The latching 68-pin I/O connector contains all analog input channels plus digital I/O lines, counter inputs, timer outputs and analog outputs.

Analog Input
The DaqBoard/1000 series has a 16-bit, 200-kHz A/D coupled with 16 single-ended, or 8 differential analog inputs. Seven software-programmable ranges provide inputs from ±10V to ±156 mV full scale. Each channel can be software-configured for a different range, as well as for single-ended or differential bipolar input.
Scanning

The DaqBoard/1000 series has an on-board scan sequencer that permits the user to select any combination of up to 512 channel/range combinations. The sequencer scans all channels contained in the sequence at the fastest rate of 5 µs/channel, thereby minimizing the time-skew from channel-to-channel. The user can also set the time between scan groups, from 0 to 6 hours. In addition to scanning analog inputs, the sequencer can scan digital inputs and counter inputs.

Bus Mastering DMA

The DaqBoard/1000 series supports Bus Mastering DMA, which allows analog and digital/counter input data, as well as analog and digital output data to flow between the PC and the DaqBoard/1000 series without consuming valuable CPU time. The driver supplied with the DaqBoard/1000, as well as all other third-party software support such as LabVIEW®, automatically utilize Bus Mastering DMA to efficiently conduct I/O from the PC to the DaqBoard.

Triggering

Triggering can be the most critical aspect of a data acquisition application. The DaqBoard/1000 series supports a full complement of trigger modes to accommodate any measurement situation.

Digital and Pattern Triggering. A separate digital trigger input line is provided, allowing TTL-level triggering, again with latencies guaranteed to be less than 5 µs*. Both the logic levels (1 or 0), as well as the edge (rising or falling), can be programmed for the discrete digital trigger input.

Software-Based Channel Level Triggering. Software-based Channel Level triggering differs from the mode described above because the readings, analog, digital, or counter, are interrogated by the PC to detect the trigger event, not in the hardware as described above.

Triggering can also be programmed to occur when one of the counters reaches, exceeds, or is within a programmed level. Any of the built-in counter/totalizer channels can be programmed as a trigger source. Triggers can be detected on scanned digital input channel patterns as well.

Normally software-based triggering results in long latencies from the time that a trigger condition is detected, until the actual capturing of data commences. However, the DaqBoard/1000 series circumvents this undesirable phenomenon by use of pre-trigger data. Specifically, when software-based triggering is employed, and the PC detects that a trigger condition has occurred, (which may be thousands of readings later than the actual occurrence of the signal), the DaqBoard driver automatically looks back to the location in memory where the actual trigger-causing measurement occurred. The acquired data that is presented to the user actually begins at the point where the trigger-causing measurement occurred. The latency in this mode is equal to one scan cycle.

Stop Trigger. Any of the software trigger modes described above can also be used to stop an acquisition. Thus an acquisition can be programmed to begin on one event, such as a voltage level, and then can stop on another event, such as a digital pattern.

* TTL pattern triggering is one scan period
Pre- and Post-Triggering Modes. Six modes of pre- and post-triggering are supported, providing a wide variety of options to accommodate any measurement requirement. When using pre-trigger, the user must use software-based triggering to initiate an acquisition.

No pre-trigger, post-trigger stop event. This, the simplest of modes, acquires data upon receipt of the trigger, and stops acquiring upon receipt of the stop-trigger event.

Fixed pre-trigger with post-trigger stop event. In this mode, the user specifies the number of pre-trigger readings to be acquired, after which the system continues to acquire data until the program issues a command to halt acquisition.

No pre-trigger, infinite post-trigger. No pre-trigger data is acquired in this mode. Instead, data is acquired beginning with the trigger event, and is terminated when the operator issues a command to halt the acquisition.

Fixed pre-trigger with infinite post-trigger. The user specifies the amount of pre-trigger data to acquire, after which the system continues to acquire data until the program issues a command to halt acquisition.

Variable pre-trigger with post-trigger stop event*. Unlike the previous pre-trigger modes, this mode does not have to satisfy the pre-trigger number of readings before recognizing the trigger event. Thus the number of pre-trigger readings acquired is variable and dependent on the time of the trigger event relative to the start. In this mode, data continues to be acquired until the stop trigger event is detected.

Variable pre-trigger with infinite post-trigger*. This is similar to the mode described above, except that the acquisition is terminated upon receipt of a command from the program to halt the acquisition.

Calibration

Every range on the DaqBoard/1000 series is calibrated from the factory using a digital calibration method. This method works by storing a correction factor for each range on the DaqBoard/1000 series at the time of calibration. Whenever a particular range is selected, the appropriate calibration constant is automatically applied to a compensating DAC, thereby calibrating the specific range. The result is that readings generated by the A/D are already calibrated, and do not require additional processing.

This is significantly better than other boards, that merely adjust the readings in software after they are transferred to the PC. That method has the disadvantage of reducing the dynamic range of the A/D, and can adversely affect the speed at which the PC can obtain a calibrated reading.

* Driver support only
The DaqBoard/1000 series also has a user-cal mode, whereby the user can adjust the calibration of the board in their system, without destroying the factory calibration supplied with the board. This is accomplished by having 2 distinct calibration tables in the DaqBoard/1000 series on-board EPROM, one which contains the factory cal and the other which is available for user calibration.

**Analog Output**

Two 16-bit, 100-kHz analog output channels are built into the DaqBoard/1000, with an output from –10V to +10V. Through the use of Bus Mastering DMA, each D/A output can continuously output a waveform, which can be read from PC RAM or a file on the hard disk. In addition, a program can asynchronously output a value to either of the D/A for non-waveform applications, presuming that the D/A is not already being used in the waveform output mode.

When used to generate waveforms, the D/A can be clocked in several different modes. Each D/A can be separately selected to be clocked from one of the sources described below.

- **Asynchronous Internal Clock.** The on-board programmable clock can generate updates ranging from 1.5 Hz to 100 kHz, independent of any acquisition rate.
- **Synchronous Internal Clock.** The rate of analog output update can be synchronized to the acquisition rate derived from 100 kHz to once every 5.96 hours.

- **Digital Inputs and Outputs**
  
  Twenty-four TTL-level digital I/O lines are included in the DaqBoard/1000 series. They are divided into three 8-bit ports. Ports can be programmed in 8-bit groups as either input or output. Ports programmed as inputs can be part of the scan group and scanned along with other analog and digital input channels, or can be asynchronously accessed via the PC at any time, including when a scanned acquisition is occurring.

- **Counter Inputs**
  
  Four 16-bit counters are built into the DaqBoard/1000, each capable of counting up to 65,536 TTL-level transitions. Each of the four counters will accept frequency inputs up to 10 MHz. The four 16-bit counters can also be cascaded into two 32-bit counters, allowing over four-billion counts to be accumulated. As with all other inputs to the DaqBoard/1000 series, the counter inputs can be read asynchronously under program control, or synchronously as part of an analog and digital scan group. Counter inputs can be configured for pulse count or totalize mode.

- **Timer Outputs**

  Two 16-bit timer outputs are built into the DaqBoard/1000, each capable of generating different square waves with a programmable frequency range from 16 Hz to 1 MHz.

- **Multiple DaqBoards per PC**

  All of the features described for the DaqBoard/1000 can be replicated with up to four DaqBoard/1000s installed in the same PC. The serial number on each DaqBoard/1000 is used to differentiate one from another, and a user-selected name can be assigned to each board for easy program documentation. When multiple boards are installed, all boards can be operated synchronously.

The DaqBoard/1000 series provides all I/O signals on one 68-pin connector. The TB-100™ adapter option (shown below) makes it easy for the user to attach signals to the DaqBoard/1000 series boards.
**Specifications**

**General (all boards)**
- Power Consumption (per board): 3.5W
- Operating Temperature: 0° to +60°C
- PCI Bus: PCI2.2 compliant, universal 3.3V/5V signaling support, compatible with PCI-X
- Vibration: MIL STD 810E
- Signal I/O Connector: 68-pin SCSI type III carries all analog and digital I/O signals
- Dimensions: 165 mm W x 15 mm D x 108 mm H (6.5" x 0.6" x 4.2")

**Analog Inputs**
- Channels: 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential bipolar
- Bandwidth: 500 kHz
- Settling Time: 5 µs to 1 LSB for full-scale step
- Maximum Input Voltage: ±11V relative to analog common
- Over-Voltage Protection: ±35V
- Ranges: Software or sequencer selectable on a per-channel basis

**A/D Specifications**

<table>
<thead>
<tr>
<th>Voltage Range*</th>
<th>Absolute Error $\pm$% reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 to +10V</td>
<td>0.015 $\pm$ 0.005</td>
</tr>
<tr>
<td>-5 to +5V</td>
<td>0.015 $\pm$ 0.005</td>
</tr>
<tr>
<td>-2.5 to +2.5V</td>
<td>0.015 $\pm$ 0.005</td>
</tr>
<tr>
<td>-1.25 to +1.25V</td>
<td>0.015 $\pm$ 0.005</td>
</tr>
<tr>
<td>-0.625 to +0.625V</td>
<td>0.015 $\pm$ 0.008</td>
</tr>
<tr>
<td>-0.3125 to +0.3125V</td>
<td>0.015 $\pm$ 0.008</td>
</tr>
<tr>
<td>-0.156 to +0.156V</td>
<td>0.02 $\pm$ 0.008</td>
</tr>
</tbody>
</table>

* Specifications assume differential input single channel scan, 200-kHz scan rate, unfiltered

**Accuracy**

- **One Year, 0-35°C**
- **(± reading+% range)**

**Input Sequencer**
- Analog, digital, and counter inputs can be scanned synchronously, based on either an internal programmable timer, or an external clock source. Analog and digital outputs can be synchronized to either of these clocks.

**Scan Clock Sources:**
1. Internal, programmable from 5 µs to 5.96 hours in 1 µs steps
2. External, TTL level input up to 200 kHz max

**Programmable Parameters per Scan:** Channel (random order), gain

**External Acquisition Scan Clock Input**
- **Maximum Rate:** 200 kHz
- **Clock Signal Range:** 0V to +5V
- **Minimum Pulse Width:** 50 ns high, 50 ns low

**Triggering**
- **Trigger Sources:** 5 individually selectable for starting and stopping an acquisition. Stop acquisition can occur on a different trigger source other than start acquisition, and can be triggered via modes 1, 3, 4, or 5. Pre-trigger is supported with fixed or variable pre-trigger periods.
  1. Single-Channel Analog Software Trigger
  2. Single-Channel Digital Trigger
  3. Digital Pattern Triggering
  4. Counter/Totalizer Triggering
  5. Software Triggering

**Analog Outputs (/1000 only)**

- The two analog output channels are updated synchronously relative to scanned inputs, and clocked from either an internal onboard clock, or an external clock source. Analog outputs can be updated asynchronously, independent of any other scanning in the system. Bus Mastering DMA provides CPU and system-independent data transfers, ensuring accurate outputs independent of other system activities. Streaming from disk or memory is supported, allowing continuous waveform outputs (limited only by available PC system resources).

- **Channels:** 2
- **Output Voltage Range:** ±10V
- **Offset Error:** ±0.0045V max
- **Gain Error:** ±0.01%
- **Digital Feedthru:** 50 mV when updated with analog and digital scanned inputs, based either on internal programmable timer, or an external clock source. Counter can also be read asynchronously.

**Counter**

**Input Characteristics:** 100 Ohms series, 20 pF to common

**I/O Levels:** TTL

**Frequency/Update Rate:** 200 kHz max

**Input Characteristics:** Output 12 mA per pin, 200 mA total continuous (per bank of 24 outputs)

**Digital I/O**

- **Channels:** 24
- **Input Scanning Modes:** 2, programmable
  1. Asynchronous, under program control at any time
  2. Synchronous with input scanning
- **Ports:** 3 x 8-bit (82C55 emulation). Each port is software programmable as input or output
- **Input Characteristics:** 100 Ohms series, 20 pF to common
- **I/O Levels:** TTL
- **Sampling/Update Rate:** 200 kHz max

**Frequency/Pulse Generators**

- **Channels:** 2 x 16-bit
- **Output:** 1-MHz base rate divided by 1 to 65,535 (programmable)
## Specifications & Ordering Information

### Ordering Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-bit, 200-kHz data acquisition board for PCI-bus PCs with 16 analog inputs, two 16-bit, 100-kHz analog outputs, 24 digital I/O, four 16-bit counter-timers, and two 16-bit frequency/pulse generators; includes DaqView and DaqCal software; support for Visual Studio® and Visual Studio® .NET, plus comprehensive drivers for DASYLab®, LabVIEW®, and MATLAB®; Linux support also available</td>
<td>DaqBoard/1000</td>
</tr>
<tr>
<td>Same as DaqBoard/1000 but with no analog outputs</td>
<td>DaqBoard/1005</td>
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</tbody>
</table>

### Software

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>DaqView add-on for seamless execution with Microsoft Excel's tool palette</td>
<td>DaqViewXL/Plus</td>
</tr>
<tr>
<td>DaqView add-on includes all of the features of DaqViewXL/Plus, plus frequency-domain analysis</td>
<td>DaqView/Pro</td>
</tr>
<tr>
<td>Icon-based data acquisition, graphics, control, and analysis software</td>
<td>DASYLab</td>
</tr>
</tbody>
</table>

### Accessories & Cables

<table>
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<tr>
<th>Description</th>
<th>Part No.</th>
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<tbody>
<tr>
<td>BNC termination module with 16 BNC connectors and internal screw-terminal connections; connects via a CA-G55, CA-G56, or CA-G56-6 cable</td>
<td>DBK215</td>
</tr>
<tr>
<td>Termination board with screw terminals for access to all DaqBoard/1000 series I/O; connects via CA-G56 cable</td>
<td>TB-100</td>
</tr>
<tr>
<td>Rack-mount kit for TB-100</td>
<td>Rack3</td>
</tr>
<tr>
<td>68-conductor ribbon expansion cable, mates with the DaqBoard/1000 series boards and the TB-100, 3 ft.</td>
<td>CA-G55</td>
</tr>
<tr>
<td>68-conductor shielded expansion cable, mates with the DaqBoard/1000 series boards and the TB-100, 3 ft.</td>
<td>CA-G56</td>
</tr>
</tbody>
</table>

**BUY NOW!**

For complete product specifications, pricing, and accessory information, call 1-888-714-3272 (U.S. only) or visit iotech.com.