DaqBoard/2000™ Series

16-Bit, 200-kHz PCI & CompactPCI® Data Acquisition Boards

NEW

CE

Features

- **Six PCI (DaqBoard/2000) and six CompactPCI® (DaqBoard/2000c) versions available**
- **16-bit, 200-kHz A/D converter**
- **8 differential or 16 single-ended analog inputs (software selectable per channel)**
- **Expandable up to 256 analog input channels, while maintaining 200 kHz (5 µs per channel) scan rate**
- **Up to four boards can be installed into one PC for up to 1024 analog input channels**
- **100% digital calibration**
- **512 location channel/gain FIFO, capable of scanning all channels, including 256 analog expansion channels and digital/counter channels, at 5 µs per channel**
- **DMA bus mastering for synchronous analog I/O, digital I/O, and counter inputs**
- **Trigger modes include analog, digital, & software, with <5 µs latency**
- **Virtually infinite pre-trigger buffer***
- **Up to four 16-bit, 100-kHz analog outputs with infinite continuous waveform output capability***
- **40 digital I/O lines, can be scanned synchronously or asynchronously with analog inputs**
- **Digital I/O is expandable up to 272 lines, including optional isolation and relay closure**
- **Four counter/pulse input channels can be scanned synchronously or asynchronously with analog inputs**
- **Two timer/pulse output channels**

Signal Conditioning Options

- **Signal conditioning & expansion options for thermocouples, strain gages, accelerometers, isolation, RTDs, etc.— over 30 options in all (see p. 143)**

Software (see p. 125)

- **Included DaqX API library, drivers for Visual Basic®, C++, and Delphi™ for Windows® 95 and higher; C++ for Linux, DASYLab®, TestPoint®, & LabVIEW®**
- **Optional DaqView2000™ software package**
- **Optional DaqCOM™ ActiveX/COM-based applications program interface, including network capability**

Now with Linux Support!

The DaqBoard/2000 plug-in board provides cost-effective, high-speed data acquisition for up to 470 I/O channels

CompactPCI Versions Now Available!

The new DaqBoard/2000™ series sets the price/performance benchmark for high-speed, multi-function plug-and-play data acquisition for PCI bus computers. The DaqBoard/2000 series hardware design offers all of the features normally found on significantly more expensive boards, including 16-bit, 200-kHz A/D, 100% digital calibration, bus mastering, two or four 16-bit, 100-kHz D/A converters, 40 digital I/O lines, four counters and two timers.

DaqBoard/2000 series is supported by a growing family of over 30 signal conditioning and expansion options, offering signal conditioning for thermocouples, RTDs, accelerometers, isolation, high-voltage, strain gages, and much more. Up to 528 channels of analog and digital I/O can be accessed using one DaqBoard/2000, while maintaining the 5 µs per channel update rate. Up to four DaqBoard/2000s can be installed into one PC.

Software support is the most extensive of any board, including comprehensive drivers and new ActiveX/COM-based programming tools for nearly every programming environment under Windows® 95 and higher. Included in this list are Visual Basic®, C++, Delphi™, TestPoint®, LabVIEW®, and DASYLab®, and C++ for Linux. Also available is a suite of DaqView™ software options for *Out-of-the-Box*™ setup, acquisition, display, and analysis of acquired data—no programming required. DaqView2000™ combines DaqView, DaqViewXL™, and eZ-PostView™ in one software package for use with the DaqBoard/2000 series.

In total, the DaqBoard/2000 series sets the industry standard for plug-and-play PCI data acquisition. To view or download a comparison chart on a particular board, visit **www.iotech.com/DaqBoard2000**.

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* Limited only by available PC RAM and hard disk space

DaqBoard/2000™ Series
General Information

	Multi-Function I/O				Digital I/O	Analog Output
Feature	**/2001 & /2001c**	**/2000 & /2000c**	**/2005 & /2005c**	**/2004 & /2004c**	**/2002 & /2002c**	**/2003 & /2003c**
Analog inputs (16 bit/200 kHz)	16	16	16	—	—	—
Analog outputs (16 bit/100 kHz)	4	2	—	4	—	4
Digital I/O	40	40	40	40	40	—
Freq./pulse I/O	6	6	6	6	6	—

DaqBoard/2000™ Series Selection Chart

Synchronous I/O for High-Speed Applications

The DaqBoard/2000™ series sets a new standard with its ability to make analog measurements, read digital inputs, and read counter inputs, while synchronously generating up to four analog outputs and/or a 16-bit digital pattern output. Most other boards require CPU interaction to access I/O other than analog input, making it impossible to generate time-critical analog waveforms or digital patterns. With the new DaqBoard/2000 series, the true power of today's PCI-based PCs can be unleashed.

The same synchronous features of the DaqBoard extend to its family of DBK signal conditioning and expansion options. Up to 256 analog input channels and 272 (256, P2 only) digital I/O channels can also be accessed synchronously to one another, with precise and deterministic channel-to-channel timing. Up to four DaqBoards can be installed in one PC, quadrupling the channel capacity to over 1000 analog input channels, 1000 digital I/O channels and 16 high-speed analog output channels.

Signal I/O

One 100-pin connector on the DaqBoard/2000 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/2000 series accommodates all I/O using one cable, and utilizing a single PCI slot.

The 100-pin DaqBoard/2000 series I/O connector, **P4**, is logically divided into three sub-ports, P1, P2, and P3. **P1,** the analog input port, contains all of the analog input channels, as well as the sequencer control signals for accessing external analog input options. All analog expansion options attach to the P1 port. **P2,** the general purpose digital I/O port, can be used directly to control and monitor 24 digital I/O lines. P2 can also function as the digital I/O expansion port, whereby the 24 lines are exclusively used to control external digital DBK expansion options, for up to 256 lines of digital input or output. **P3** contains an additional 16-bit digital I/O port, as well as the counter inputs, timer outputs, and analog outputs. Several options are available to provide easy user access to all of the I/O signals on P4.
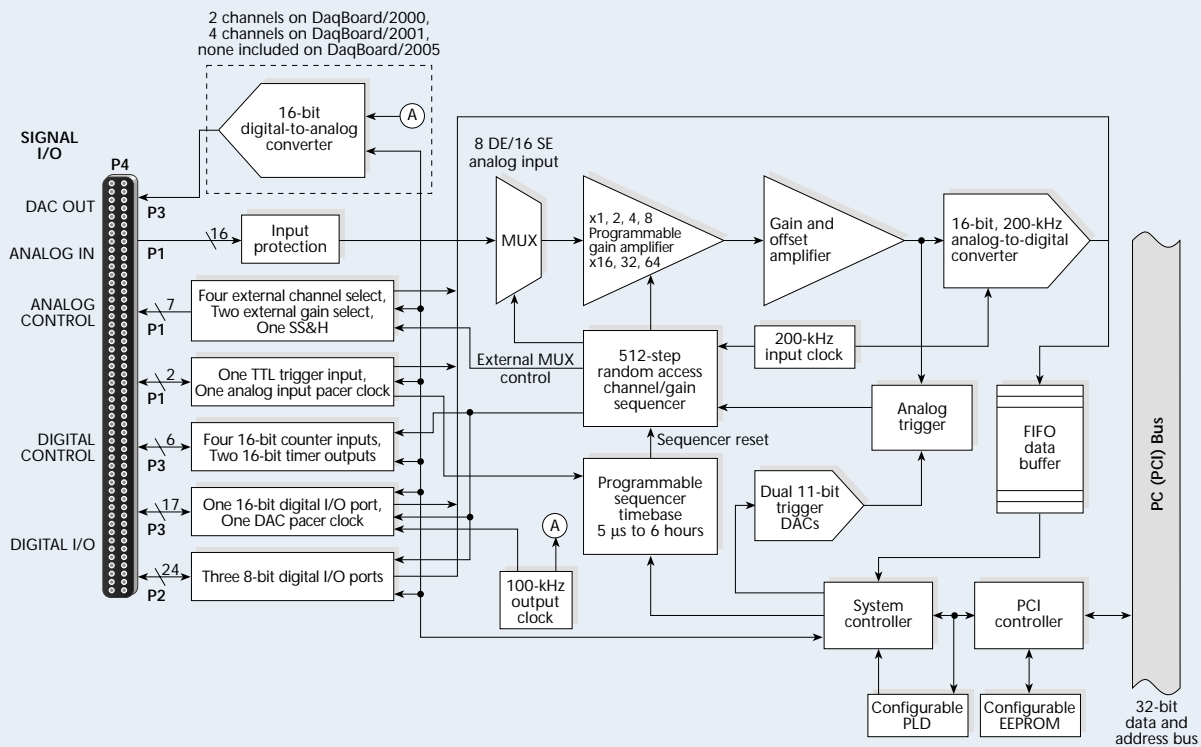
Analog Input (P1)

The DaqBoard/2000 series has a 16-bit, 200-kHz A/D coupled with 16 single-ended, or 8 differential analog inputs. Thirteen 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, and unipolar or bipolar input. Beyond the 16 built-in analog inputs, the user can expand the DaqBoard/2000 series up to 256 analog inputs using external DBK signal conditioning and expansion options (see p. 143). As with the on-board channels, expansion channels are scanned at the same 5 µs/channel rate (200 kHz), and most are software-programmable for range. There is *no* speed penalty for scanning expansion channels versus built-in channels. The DBK expansion options offer a wide variety of signal measurements, including thermocouples, RTDs, strain gages, accelerometers, high voltage, isolation, current, and much more.
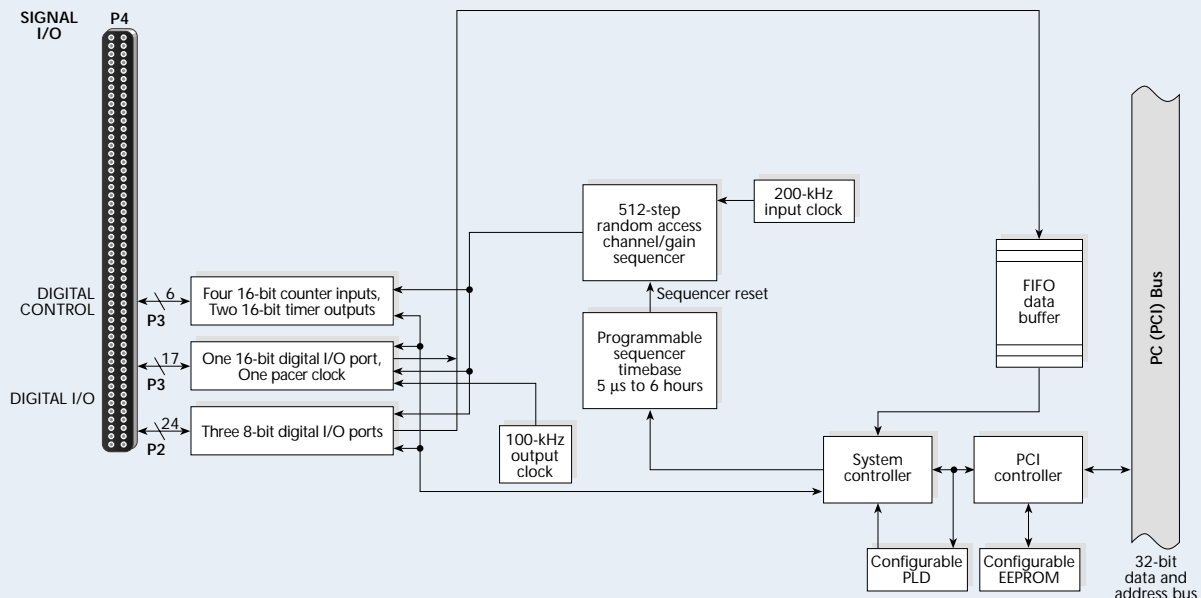
PC Data Acquisition Hardware

DaqBoard/2000, /2001, and /2005 Block Diagram

2 channels on DaqBoard/2000,
4 channels on DaqBoard/2001,
none included on DaqBoard/2005

16-bit digital-to-analog converter — (A)

SIGNAL I/O

P4

DAC OUT — P3

ANALOG IN — P1 — 16 — Input protection

8 DE/16 SE analog input — MUX — x1, 2, 4, 8 Programmable gain amplifier x16, 32, 64 — Gain and offset amplifier — 16-bit, 200-kHz analog-to-digital converter

ANALOG CONTROL — 7 — P1 — Four external channel select, Two external gain select, One SS&H

External MUX control

512-step random access channel/gain sequencer

200-kHz input clock

DIGITAL CONTROL — 2 — P1 — One TTL trigger input, One analog input pacer clock

Sequencer reset

Analog trigger

FIFO data buffer

6 — P3 — Four 16-bit counter inputs, Two 16-bit timer outputs

Programmable sequencer timebase 5 µs to 6 hours — Dual 11-bit trigger DACs

17 — P3 — One 16-bit digital I/O port, One DAC pacer clock — (A)

DIGITAL I/O

24 — P2 — Three 8-bit digital I/O ports

100-kHz output clock

System controller — PCI controller

PC (PCI) Bus

Configurable PLD — Configurable EEPROM — 32-bit data and address bus

DaqBoard/2002 Block Diagram

SIGNAL I/O

P4

512-step random access channel/gain sequencer — 200-kHz input clock

DIGITAL CONTROL — 6 — P3 — Four 16-bit counter inputs, Two 16-bit timer outputs

Sequencer reset

FIFO data buffer

17 — P3 — One 16-bit digital I/O port, One pacer clock

Programmable sequencer timebase 5 µs to 6 hours

DIGITAL I/O

24 — P2 — Three 8-bit digital I/O ports

100-kHz output clock

System controller — PCI controller

PC (PCI) Bus

Configurable PLD — Configurable EEPROM — 32-bit data and address bus

PC Data Acquisition Hardware

DaqBoard/2003 Block Diagram

Terminations

TB1-1	AGND
TB1-2	DAC0
TB1-3	AGND
TB1-4	DAC1
TB1-5	AGND
TB1-6	DAC2
TB1-7	AGND
TB1-8	DAC3
TB1-9	AGND
TB1-10	XTTL
TB1-11	CLK
TB1-12	DGND

DBK205 screw-terminal connector panel;
included with DaqBoard/2003

SIGNAL I/O
P4
DAC OUT
P3

Four 16-bit digital-to-analog converter

100-kHz output clock

System controller

PCI controller

Configurable PLD

Configurable EEPROM

PC (PCI) Bus

32-bit data and address bus

DaqBoard/2004 Block Diagram

SIGNAL I/O
P4
DAC OUT
P3

ANALOG CONTROL
7
P1

2
P1

DIGITAL CONTROL
6
P3

17
P3

DIGITAL I/O
24
P2

Four 16-bit digital-to-analog converter
A

Four external channel select, Two external gain select, One SS&H

One TTL trigger input, One analog input pacer clock

Four 16-bit counter inputs, Two 16-bit timer outputs

One 16-bit digital I/O port, One DAC pacer clock

Three 8-bit digital I/O ports

External MUX control

100-kHz output clock
A

512-step random access channel/gain sequencer

Sequencer reset

Programmable sequencer timebase 5 µs to 6 hours

200-kHz input clock

Analog trigger

Dual 11-bit trigger DACs

FIFO data buffer

System controller

PCI controller

Configurable PLD

Configurable EEPROM

PC (PCI) Bus

32-bit data and address bus

PC Data Acquisition Hardware

DaqBoard/2000™ Series
General Information

Scanning

The DaqBoard/2000 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 (see p. 120).

Bus Mastering DMA

The DaqBoard/2000 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/2000 series without consuming valuable CPU time. The driver supplied with the DaqBoard/2000, as well as all other third-party software support such as TestPoint®, LabVIEW®, and DASYLab®, 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/2000 series supports a full complement of trigger modes to accommodate any measurement situation.

Hardware Analog Triggering. Many data acquisition boards claim analog triggering, but rely on the PC to take readings and make a decision, which leads to uncertain and potentially long latencies. The DaqBoard/2000 series uses true analog triggering, whereby the trigger level programmed by the user sets an analog DAC, which is then compared in hardware to the analog input level on the selected channel. The result is analog trigger latency which is guaranteed to be less than 5 µs, significantly shorter than most data acquisition boards. Any analog channel can be selected as the trigger channel, including built-in or expansion channels. The user can program both the trigger level, as well as the edge (rising or falling).

Channel-Scanning Flexibility

The DaqBoard/2000 series offers a 512-location scan sequencer that allows you to select each channel and associated input amplifier gain at random. The sequencer circuitry circumvents a major limitation encountered with many plug-in data acquisition boards — a drastic reduction in the scan rate for external expansion channels. All DaqBoard/2000 series channels, including the 528 potential expansion channels, are scanned at 200 kHz (5 µs/channel). In addition, the digital and frequency inputs can be scanned using the same scan sequence employed for analog inputs, enabling the time correlation of acquired digital data to acquired analog data. The DaqBoard/2000 series permits each scan group, which can contain up to 512 channel/gain combinations, to be repeated immediately or at programmable intervals of up to 6 hours. Within each scan group, consecutive channels are measured at a fixed 5 µs/channel rate.

DaqBoard/2000 Series Scanning Example
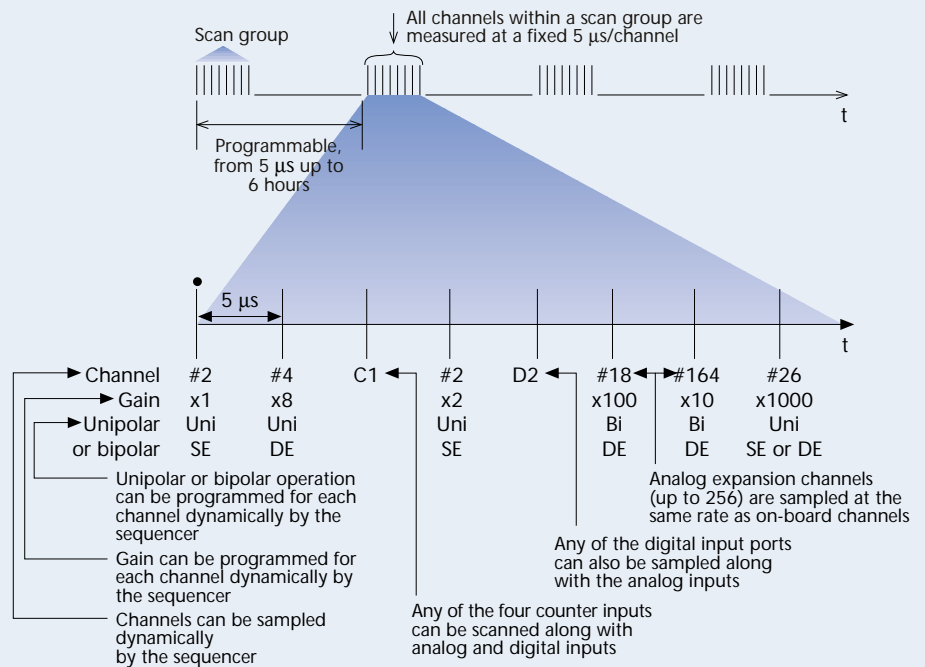
Digital and Pattern Triggering (P1). A separate digital trigger input line is provided, allowing TTL-level triggering, again with latencies guaranteed to be less than 5 µs. Both the logic levels (1 or 0), as well as the edge (rising or falling), can be programmed for the discrete digital trigger input.

Software-Based Triggering. Software-based triggering differs from the modes 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. The advantage of this mode is to permit triggering based on more complex situations, such as on a specific temperature, which was derived from the acquisition of at least two analog measurements, plus the calculation of the measured temperature using linearization algorithms.

The DaqBoard/2000 series also supports digital pattern triggering, whereby the user can designate any of the digital input ports as the trigger port. The programmed digital pattern,

including the ability to mask or ignore specific bits, is then compared to the actual input until a match is detected, after which the sequencer begins the scan sequence.

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.

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/2000 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 occurs. 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 temperature level, and then can stop on another event, such as a digital pattern.

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, acquisition continues until a stop-trigger event occurs.

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/2000 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/2000 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 by which the PC can obtain a calibrated reading.

The DaqBoard/2000 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/2000 series on-board EPROM, one which contains the factory cal, and the other which is available for user calibration.

Analog Output (P3)
DaqBoard/2000, /2001, /2003, & /2004 Only
Two or four 16-bit, 100-kHz analog output channels are built into the DaqBoard/2000 series, with an output from –10V to +10V. These outputs are entirely separate from the D/As which are used to determine analog trigger level (some data acquisition board suppliers confusingly refer to trigger D/As as if they are available to the user). 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/As for non-waveform applications, presuming that the D/A is not already being used in the waveform output mode. Additional low-speed D/A channels can be added to the DaqBoard through the use of the DBK2 analog output option card (see p. 149).

When used to generate waveforms, the D/As 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.

Asynchronous external clock. A user-supplied external input clock can be used to pace the D/A, entirely independent of analog inputs.

Synchronous external clock. A user-supplied external input clock can pace both the D/A and the analog input.

* Driver support only

DaqBoard/2000™ Series
General Information

Digital Pattern Generation (P3)

The DaqBoard/2000 series supports digital pattern generation via Bus Mastering DMA on the 16-bit high-speed digital I/O port. In the same manner as Analog Output, the digital pattern can be read from PC RAM or a file on the hard disk. Digital pattern generation is clocked in the same four modes as described above with analog output*.

Digital Inputs and Outputs (P2, P3)

Forty TTL-level digital I/O lines are included in the DaqBoard/2000 series. They are divided into three 8-bit ports (P2) and one 16-bit port (P3). The P2 ports can be programmed in 8-bit groups as either input or output. The 16-bit P3 port can be programmed as all inputs or all outputs. 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.

In addition, the P2 ports can be expanded up to 256 digital I/O lines using external DBK digital options (p. 143). These options are available as TTL-level I/O, relay output, or optically isolated input and output. Whenever expansion digital I/O is attached to the DaqBoard/2000 series, the P2 I/O lines are no longer user-programmable, and are instead used to communicate with the digital expansion options.

Counter Inputs (P3)

Four 16-bit counters are built into the DaqBoard/2000, 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 counters can also be cascaded, allowing over four billion counts to be accumulated. As with all other inputs to the DaqBoard/2000 series, the counter inputs can be read asynchronously under program control, or synchronously as part of an analog and digital scan group.

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* When digital pattern generation is used, one of the analog output channels is limited to asynchronous output mode

DaqBoard/2000 Series Signal Conditioning & Expansion Options

Product	Description	Capacity	Page
DBK1	16-connector BNC interface module	16 connectors	148
DBK2	D/A voltage-output card	4 channels	149
DBK4	dynamic signal-input card	2 channels	150
DBK5	current output card	4 channels	152
DBK7	frequency-to-voltage input card	4 channels	154
DBK8	high-voltage input card	8 channels	156
DBK9	RTD measurement card	8 channels	157
DBK10	expansion-card enclosure module	3 cards	158
DBK11A	screw-terminal card	40 terminals	159
DBK15	universal current/voltage input card	16 channels	160
DBK16	strain gage measurement card	2 channels	162
DBK17	simultaneous sample and hold card	4 channels	164
DBK18	low-pass filter card	4 channels	166
DBK20	digital I/O card (screw-terminal connectors)	48 channels	168
DBK21	digital I/O card (male DB37 connectors)	48 channels	168
DBK23	optically isolated digital-input module	24 channels	169
DBK24	optically isolated digital-output module	24 channels	171
DBK25	relay output card	8 channels	173
DBK30A	rechargeable battery/excitation module	14.4 or 28.8 VDC	174
DBK32A	auxiliary power supply card	±15 VDC @ 500 mA	175
DBK33	triple-output auxiliary power supply card	±15 VDC @ 250 mA & ±5 VDC @ 1000 mA	175
DBK40	BNC interface module	18 connectors	177
DBK41	analog expansion enclosure module	10 cards	178
DBK42	5B isolated signal-conditioning module	16 channels	180
DBK43A	strain gage module	8 channels	182
DBK44	5B isolated signal conditioning card	2 channels	184
DBK45	SS&H card with low-pass filter	4 channels	186
DBK46	internal analog output card	4 channels	108
DBK50	isolated high-voltage input module	8 channels	188
DBK51	isolated low-voltage input module	8 channels	188
DBK60	3-slot expansion module w/customizable panels	3 cards	190
DBK70	vehicle network interface module	16 channels	192
DBK80	differential voltage input card with excitation output	16 channels	197
DBK81	TC/mV card with screw-terminal connections	7 channels	198
DBK82	TC/mV card with screw-terminal connections	14 channels	198
DBK83	TC/mV card with external screw-terminal Pod and 3 ft. cable	14 channels	198
DBK84	TC/mV module with mini TC connector jacks	14 channels	198
DBK200	adapter board for analog inputs	P1	121
DBK201	panel-mount adapter board with three (DBK) expansion ports	P1, P2, P3	121
DBK202	screw-terminal adapter board, solder locations for user-supplied resistors and R/C networks, with three expansion ports	120 terminals, P1, P2, P3	121
DBK203	same as DBK202 adapter board with a rugged metal enclosure	120 terminals, P1, P2, P3	121
DBK206	adapter board with removable screw-terminals with three expansion ports	120 terminals, P1, P2, P3	122
DBK207	5B-isolated analog input signal conditioning board with two expansion ports	P1 (2)	201
DBK207/CJC	same as DBK207 plus on-board, cold-junction compensation; two expansion ports	P1 (2)	201
DBK208	Opto-22® signal conditioning board for isolated (solid-state-relay) digital I/O, with two P2 digital I/O expansion ports	P2 (2)	203
DBK209	same as DBK201 but rack and DIN-rail mountable with optional kits	P1, P2, P3	121

Timer Outputs (P3)

Two 16-bit timer outputs are built into the DaqBoard/2000, 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/2000 can be replicated with up to four DaqBoard/2000s (PCI and cPCI) installed in the same PC. The serial number on each DaqBoard/2000 is used to differentiate one from another, and a user-selected name can be assigned to each board for easy program documentation. Thus, with four boards installed along with DBK expansion options, over 1,000 analog input channels and over 1,000 digital I/O channels could be accessed from one PC. When multiple boards are installed, all boards can be operated synchronously.

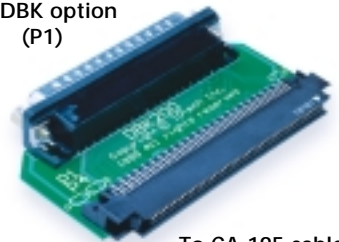# DaqBoard/2000™ Series
Connectivity Options

The DaqBoard/2000 series provides all I/O signals on one 100-pin connector. The following adapter options make it easy for the user to attach signals and expansion options to the DaqBoard/2000 series.

To DBK option (P1)

To CA-195 cable and DaqBoard/2000 series boards

Note: The following boards are not depicted with respect to scale.

DBK200™ Adapter Board
Suitable exclusively for analog-signal expansion, the DBK200 adapter board contains one 100-pin connector which connects to the DaqBoard/2000 series via the CA-195 cable, and one female DB37 connector that mates directly with the P1 port of any of the DBK analog signal conditioning and expansion options. This is the most convenient way to add analog expansion options if access to the DaqBoard/2000 series digital I/O or frequency signals is not required. Access to P1 analog signals is also possible via included female-mating solder-lug connectors or optional CA-37-x* or CA-37-xT* expansion cables.

DBK201

To analog DBK (P1)

To digital DBK (P2)

To pulse/frequency DBK (P3)

To CA-195 cable (P4)

DBK209

P1

P3

P2

To CA-195 cable (P4)

DBK201™ & DBK209™ Adapter Boards
For both analog and digital expansion, the DBK201 adapter board mates with the DaqBoard/2000 series via a 3-ft. CA-195 cable. The DBK209 provides three male DB37 connectors, divided into P1 analog input, P2 digital I/O, and P3 analog output and counter/timer I/O. Each port on the DBK201 connects to DBK expansion options via an optional CA-37-x* or CA-37-xT* expansion cable. Alternatively, users can solder wires to the included DB37 female-mating solder-lug connectors, or custom make their own cables that are terminated with a female DB37. An optional 6-ft. cable is available that contains a mating female DB37 connector at one end, and is unterminated at the other end (CA-113). The DBK209 is identical in function to the DBK201 but is snap-track (DIN-rail), and rack-mountable with optional mounting kits.
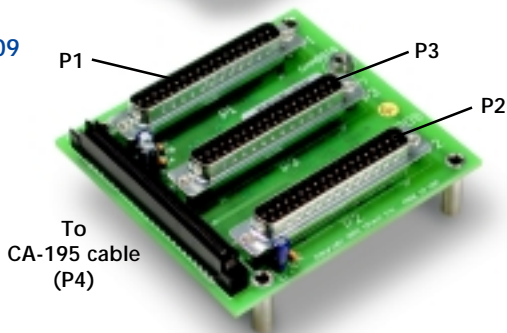
The CA-195 100-pin conductor cable connects the DaqBoard/2000 series boards with the DBK200 series adapters

DBK202

DBK202™ Screw-Terminal Adapter Board
The DBK202 screw-terminal board provides convenient screw-terminal access to all signals from the DaqBoard/2000 series. Divided into three ports (P1, P2, and P3), the DBK202 also provides another way to access signals. There are male DB37 connectors on P1 and P2, and an adapter cable (CA-60) can be used to connect to the P3 header for connection to DBK signal conditioning and expansion options. Mounting holes in the DBK202 permit it to be easily screw-mounted into a user-provided enclosure.

DBK203™ Screw-Terminal Adapter Module
The DBK203 is identical to the DBK202, except that it is housed in a shielded metal enclosure, which easily mounts to other DBK signal conditioning and expansion modules. Optional fastener panels are available for attaching other DBK modules.

DBK203

* The "x" in the cable part numbers should be replaced by the number of expansion products to be connected
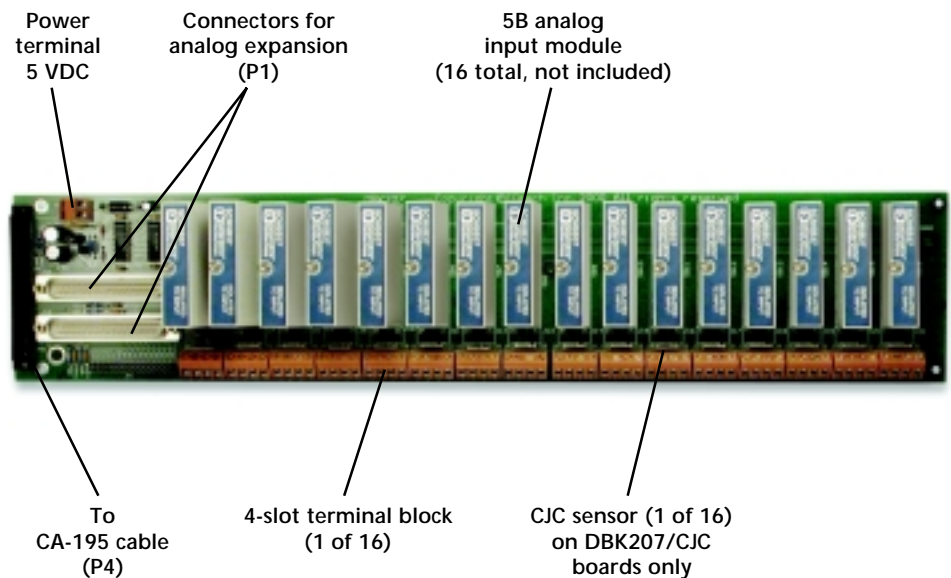
DBK206 Screw-Terminal Adapter Board

Similar in function to the DBK202, but designed for mounting in 19-inch enclosures, the DBK206 features three vertically mounted straight male DB37 connectors for analog and digital channel expansion (P1 analog I/O, P2 digital I/O, and P3 digital and counter-timer, and analog output). Two rows of removable screw terminals provide convenient access to all DaqBoard/2000 series I/O signals (10-22 AWG wire). It mates with the DaqBoard/2000 series via a 3ft. CA-195 cable, and each port (P1, P2, and P3) connects to DBK signal conditioning and expansion options via optional CA-37-x cable(s). The standard DBK206 can be panel mounted, but it also is DIN-rail mountable with option DIN2 and is rack-mountable with option Rack3 (see p. 123).

Analog I/O (P1)

Digital and counter-timer I/O (P3)

To CA-195 cable (P4)

Digital I/O (P2)

Removable screw terminals
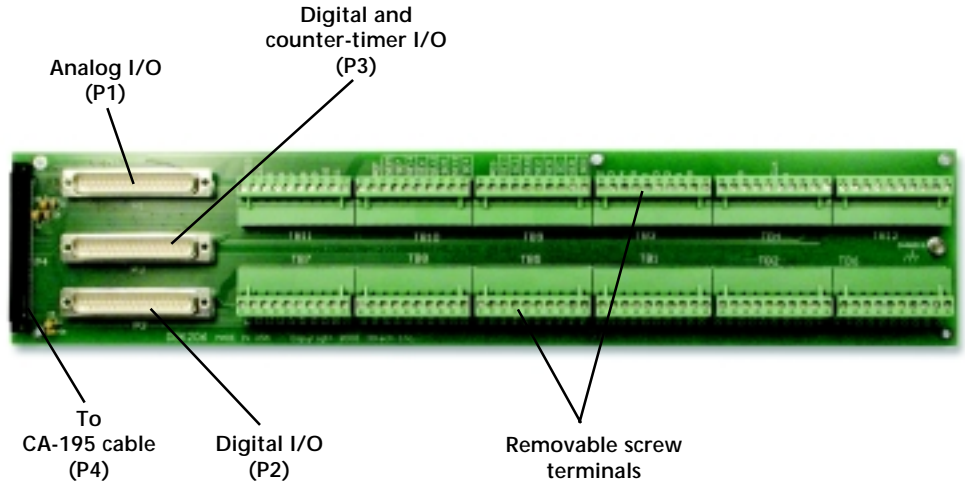
DBK207 & DBK207/CJC™ Multiplexing Isolated Analog Input Board

The DBK207 provides sockets for 16 channels of isolated analog input when populated with industry standard 5B-style or compatible signal conditioning modules (sold separately, see p. 205). Each channel features screw-terminals and sockets for current conversion resistors (supplied with 5B current input modules). The DBK207/CJC features added cold-junction compensation per channel for thermocouple-based measurements.

Multiplexing is built-in allowing up to 16 DBK207 boards to be directly connected to one DaqBoard/2000 series board for a total signal capacity of 256 isolated analog inputs. The 100-pin P4 connector on the DBK207 attaches directly to the DaqBoard (via CA-195 cable). Two DB37 connectors permit daisy chaining to other DBK207 boards, and to any of the other DBK analog signal conditioning boards and modules. The DBK207/CJC and the DBK207 can be rack or snap-track mounted with optional mounting kits. See p. 123 for complete information on the DBK207 and DBK207/CJC.

Power terminal 5 VDC

Connectors for analog expansion (P1)

5B analog input module (16 total, not included)

To CA-195 cable (P4)

4-slot terminal block (1 of 16)

CJC sensor (1 of 16) on DBK207/CJC boards only
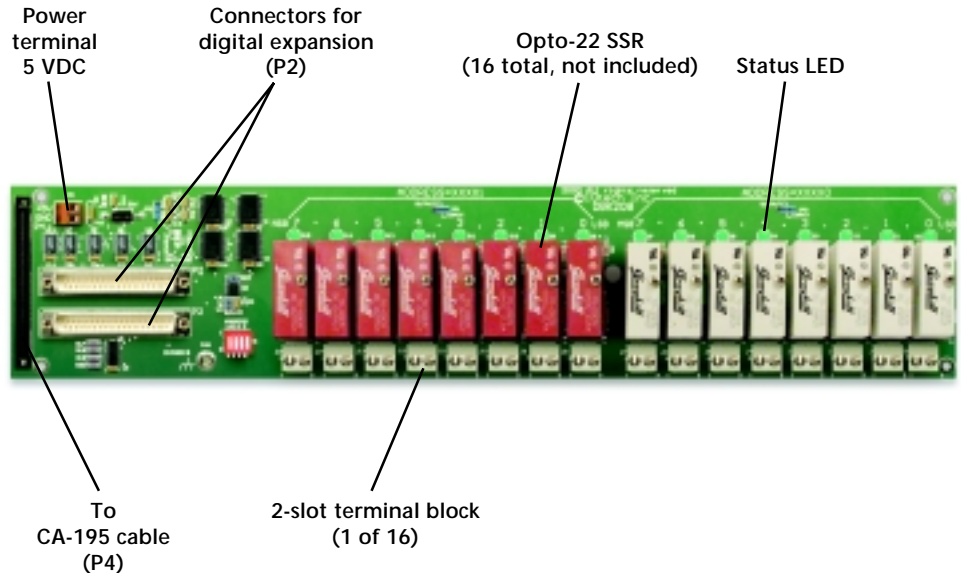
DBK208™ Multiplexing Isolated Digital I/O Board

The DBK208™ provides sockets for 16 channels of isolated digital I/O when populated with industry standard Opto-22®-style or compatible solid-state-relay modules (sold separately, see p. 207). Each socket also features screw-terminals and an LED to indicate logic status. The 16 digital I/O can be jumper configured as either inputs or outputs in 8-channel groups.

Multiplexing is built-in allowing up to 16 DBK208 boards to be connected to one DaqBoard/2000 series board, for a total signal capacity of 256 isolated digital I/O channels. On-board logic insures that outputs are disabled during power-up and by a computer (CPU) reset. Also included is the ability to choose whether outputs are "off", or in the "last known state" when loss of external power occurs.

The 100-pin P4 connector on the DBK208 attaches directly to a DaqBoard/2000 series board (via CA-195 cable) while two DB37 connectors permit daisy chaining to other DBK208 boards, and to any of the other DBK digital boards and modules. See p. 203 for complete information on the DBK208.

Power terminal 5 VDC

Connectors for digital expansion (P2)

Opto-22 SSR (16 total, not included)

Status LED

To CA-195 cable (P4)

2-slot terminal block (1 of 16)

Rack3™ Rack-Mount Kit

Rack-mount kit for the DBK206, DBK207, DBK207/CJC, DBK208, and DBK209 signal termination and expansion boards.

DIN1™ & DIN2™ DIN-Rail Kit

Snap-track (DIN-rail) mounting kit for the DBK206, DBK207, DBK207/CJC, and DBK208 signal termination and expansion boards. Specify DIN2 for DBK209 only.

PC Data Acquisition Hardware
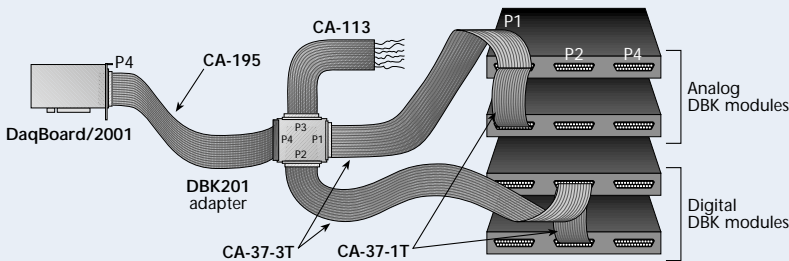
DaqBoard/2000™ Series
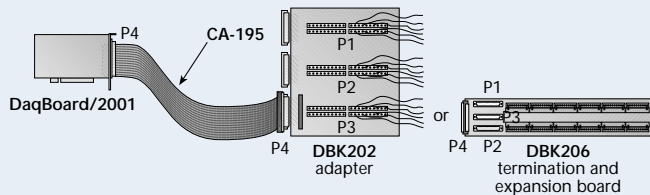## Connectivity Options

System Configuration Examples
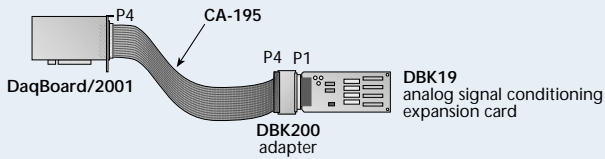
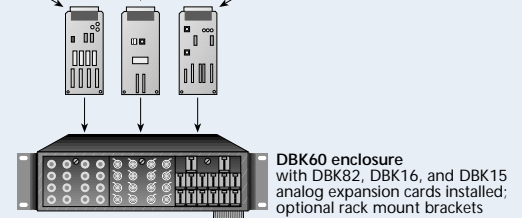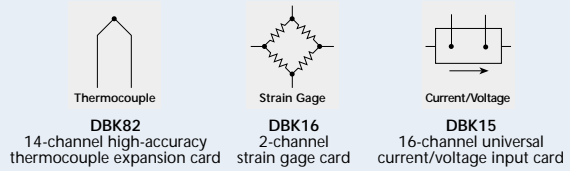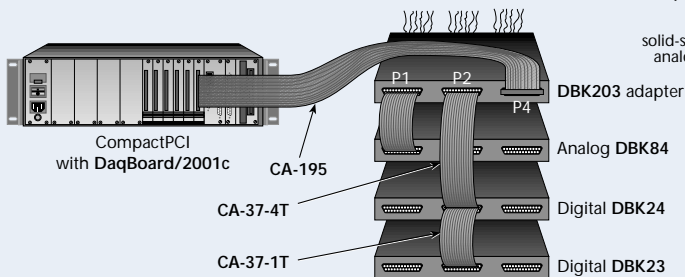*The DBK200 adapter mates directly with analog DBK signal conditioning options*
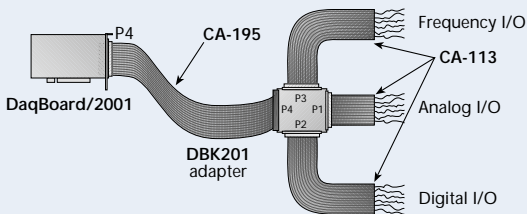
*The DBK201 adapter with analog and digital DBK signal conditioning and expansion modules*

The DBK202 or DBK206 (P1, P2, P3) adapter with screw-terminal connectors
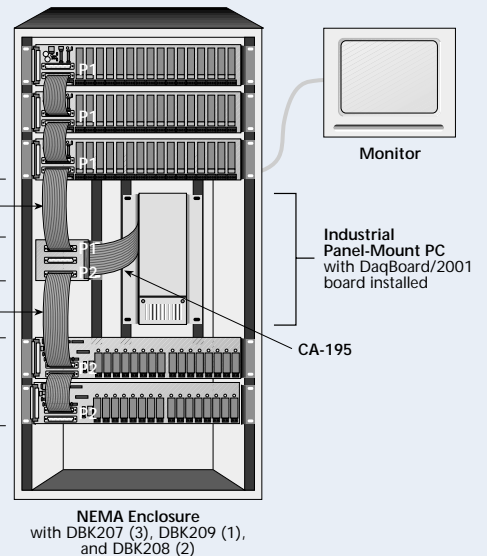

The DBK203 adapter with screw-terminal connectors

DBK82
14-channel high-accuracy thermocouple expansion card

DBK16
2-channel strain gage card

DBK15
16-channel universal current/voltage input card

DBK60 enclosure
with DBK82, DBK16, and DBK15 analog expansion cards installed; optional rack mount brackets

DBK602, DBK604, DBK605 termination panels installed

Industrial Rack-Mount PC
with DaqBoard/2001 board installed

The DBK60 ruggedized rack-mount enclosure with optional signal conditioning and termination panels
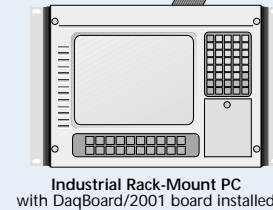
DBK207
(3) signal conditioning and expansion board for 5B-compatible I/O modules; analog and digital expansion; mounted using Rack3

DBK209 adapter board

DBK208
(2) signal conditioning and expansion board for Opto-22®-compatible solid-state-relay (SSR) modules; analog and digital expansion; mounted using Rack3

Monitor

Industrial Panel-Mount PC
with DaqBoard/2001 board installed

NEMA Enclosure
with DBK207 (3), DBK209 (1), and DBK208 (2)

The DBK209 adapter with DBK207 and DBK208 isolated analog input and digital I/O signal conditioning and expansion boards (16 max), with Rack3 mounting option

Software Support
## Included Software for DaqBoard/2000™ Series

The DaqBoard/2000™ series is supported by several levels of software support, allowing you to select the software environment that best fits your application and skill set. On this page is a description of the software that is included with every DaqBoard/2000. The next page is an overview of optional software available for the DaqBoard/2000.

DaqX Subroutine API Libraries

DaqBoard/2000 series is supplied with free DaqX Subroutine API Libraries providing complete support for all of the functionality available on each data acquisition device in Visual Basic®, C/C++, and Delphi™. Further, DaqX is supported under all versions of Windows®. Included with DaqX Subroutine API Libraries are over 100 example programs, and comprehensive API documentation is provided through an online programmers manual.

LabVIEW® Support
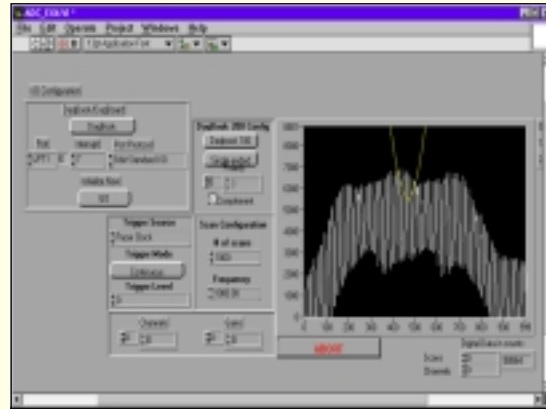
IOtech offers extensive LabVIEW® support for the DaqBoard/2000 series, including expansion and signal conditioning modules. IOtech data acquisition VIs for LabVIEW are more than just simple hardware access VIs, they are full blown examples complete with engineering data conversion, data display and logging capabilities.

Linux for the DaqBoard/2000™ Series
Features
- **Support for all DaqBoard/2000 PCI Series products including the CompactPCI product lines**
- **Support for all DBK digital and analog expansion cards and modules**
- **Over 50 example programs in C using the features of the DaqBoard/2000 series as well as most DBK expansion modules.**
- **Source is available for user modification and customization**
- **Support for multiple DaqBoard/2000 series devices**

Linux drivers for the DaqBoard/2000 series products provide an effective and robust alternative for non-Windows based data acquisition applications. IOtech's Linux drivers for the DaqBoard/2000 series products include support for all DBK series expansion as well as extensive example programs for most DBKs and features provided by the DaqBoard/2000 series products.

- Synchronous scanning of Analog, Digital Input and Counter input channels up to 200 kHz
- Asynchronous I/O operations for Digital I/O, Counter Input and Analog output channels
- Synchronous streamed Analog Waveform and Digital Pattern output up to 100 kHz
- Analog, Digital and Counter channel Start Trigger and Stop Trigger events
- DBK expansion support for expansion and signal conditioning options, including temperature (TC and RTD), high voltage, frequency input, strain gage, digital I/O, and 5B options
- Sophisticated buffering features allow the application to collect acquired data in a variety of ways
- Over 50 example programs written in C using all the features of the DaqBoard/2000 Series along with examples for most DBK expansion and signal conditioning cards and modules
- Tunable input update rate allows the application to optimize throughput and I/O turn-around times

PC Data Acquisition Hardware

Software Support
Optional Software for DaqBoard/2000™ Series

### DaqView2000™ & eZ-PostView™

DaqView2000™ graphical data acquisition and display software is available for all DaqBoard/2000 series systems. Using DaqView software's spreadsheet-style interface, you can easily set up your application and begin taking data within minutes of connecting your hardware, with no programming required (see p. 138). Included with DaqView2000 is eZ-PostView which makes it simple to visually inspect acquired waveforms from multiple channels within seconds of acquiring the data. See p. 228 for complete information.

### eZ-TimeView™ & eZ-FrequencyView™
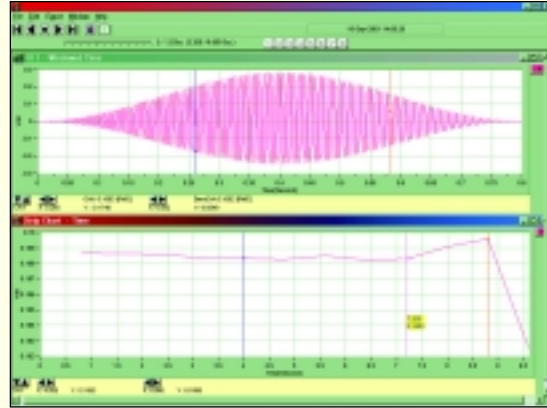
eZ-TimeView™ and eZ-FrequencyView™ are post-acquisition analysis packages for data acquired from the DaqBoard/2000 series. eZ-TimeView is targeted at time-domain analysis, including min/max, peak-peak, mean, RMS, plus a wide variety of plotting and waveform viewing capabilities. eZ-FrequencyView is targeted at post-acquisition frequency-domain analysis, including FFT's, octave analysis, plus dozens of other analysis features. See p. 229-230 for complete information.

DASYLab®
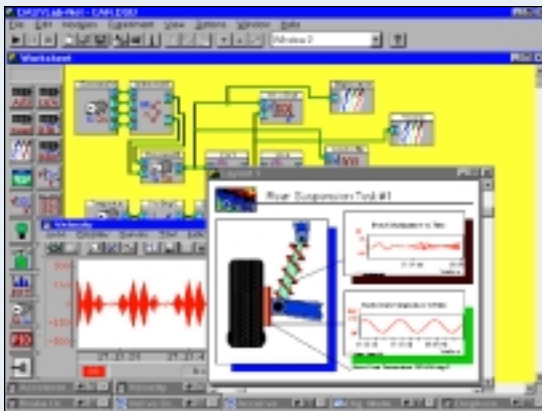
If your application requirements go beyond the scope of DaqView™, DASYLab® software offers a greater degree of flexibility and customization. You can learn DASYLab in a matter of days, without the weeks of training required for some other icon-based application-development software. See p. 223 for complete information.

DaqCOM™ ActiveX/COM Support
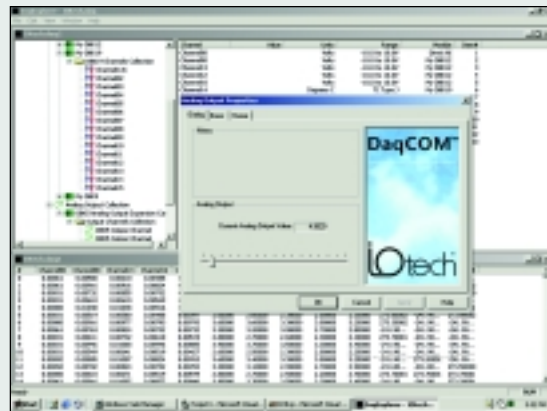
The DaqCOM™ suite of programming allows applications developers to rapidly develop and deploy custom systems by leveraging COM (Component Object Model) technology. DaqCOM does this by providing a powerful easy-to-use interface to most programming languages including, Visual Basic®, VBA, C++, Delphi™ and J++. In addition, DaqCOM supports the new Windows.NET architecture and includes examples for VisualBasic.NET and C. See p. 221 for complete information.

DaqBoard/2000™ Series
Specifications

Specifications

General (all boards)

Power Consumption (per board): 3.5W (up to 10W with external accessories)

Power Available for External Signal Conditioning and Expansion Options: 5V at 1A (all boards); ±15V at 75 mA each (except for /2002)

Operating Temperature: 0˚ to +60˚C

Vibration: MIL STD 810E

Signal I/O Connector: 100-pin high-density edge-type 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 (/2000, /2001, & /2005)

Channels: 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential and unipolar or bipolar

Expansion: Up to 256 channels per board (4 boards per PC), without degradation in maximum channel-to-channel scan rate (5 µs/channel)

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

Voltage Range*	Accuracy** One Year, 0-35°C (% reading+% range)	
	Absolute	Transfer†
0 to +10V	0.015 + 0.005	0.004 + 0.002
0 to +5V	0.015 + 0.005	0.004 + 0.002
0 to +2.5V	0.015 + 0.005	0.004 + 0.002
0 to +1.25V	0.015 + 0.008	0.004 + 0.002
0 to +0.625V	0.015 + 0.008	0.004 + 0.002
0 to +0.3125V	0.015 + 0.008	0.004 + 0.003
-10 to +10V	0.015 + 0.005	0.004 + 0.001
-5 to +5V	0.015 + 0.005	0.004 + 0.001
-2.5 to +2.5V	0.015 + 0.005	0.004 + 0.001
-1.25 to +1.25V	0.015 + 0.005	0.004 + 0.001
-0.625 to +0.625V	0.015 + 0.008	0.004 + 0.001
-0.3125 to +0.3125V	0.015 + 0.008	0.004 + 0.0015
-0.156 to +0.156V	0.02 + 0.008	0.004 + 0.0015

* Specifications assume differential input single channel scan, 200-kHz scan rate, unfiltered
** Accuracy specification is exclusive of noise
† Transfer accuracy assumes calibration inside computer; applicable for measurements made 5°C from ambient temperature at calibration

A/D Specifications (/2000, /2001, & /2005)

Type: Successive approximation

Resolution: 16 bit

Conversion Time: 5 µs

Maximum Sample Rate: 200 kHz

Nonlinearity (Integral): ±1 LSB

Nonlinearity (Differential): No missing codes

Input Sequencer (/2000, /2001, /2002, /2004, & /2005)

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

Programmable Parameters per Scan: Channel (random order), gain, unipolar/bipolar

Depth: 512 location

On-Board Channel-to-Channel Scan Rate: 5 or 10 µs per channel, programmable

Expansion Channel Scan Rate: 5 or 10 µs per channel, programmable

External Acquisition Scan Clock Input (/2000, /2001, & /2005)

Maximum Rate: 200 kHz

Clock Signal Range: 0V to +5V

Minimum Pulse Width: 50 ns high, 50 ns low

Triggering

Trigger Sources: 6, 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 2, 4, 5, or 6. Pre-trigger is supported with fixed or variable pre-trigger periods.
  1. Single-Channel Analog Hardware Trigger
     Latency: 5 µs max (/2000, /2001, & /2005)
  2. Single-Channel Analog Software Trigger
     Latency: One scan period max (/2000, /2001, & /2005)
  3. Single-Channel Digital Trigger
     Latency: 5 µs max (/2000, /2001, /2002, /2004, & /2005)
  4. Digital Pattern Triggering
     Latency: One scan period max (/2000, /2001, /2002, /2004, & /2005)
  5. Counter/Totalizer Triggering (/2000, /2001, /2002, /2004, & /2005)
     Latency: One scan period, max (all boards)
  6. Software Triggering (all boards)
     Trigger can be initiated under program control.

Analog Outputs (/2000, /2001, /2003, & /2004)

The two or four 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, nearly-infinite length, waveform outputs (limited only by available PC system resources).

Channels: 2 (/2000); 4 (/2001, /2003, & /2004)

Resolution: 16 bits

Output Voltage Range: ±10V

Clock Sources: 4, programmable
  1. Onboard D/A clock, independent of scanning input clock
  2. Onboard scanning input clock (/2000, /2001, & /2004 only)
  3. External D/A input clock, independent of external scanning input clock
  4. External scanning input clock (/2000, /2001, & /2004 only)

Digital I/O (/2000, /2001, /2002, /2004, & /2005)

Channels: 40, expandable up to 208 with DBK options

Input Scanning Modes: 2, programmable
  1. Asynchronous, under program control at anytime
  2. Synchronous with input scanning

Ports: 3 x 8-bit (82C55 emulation), and 1 x 16-bit. Each port is software programmable as input or output

Input Characteristics: 100 Ohm series, 20 pF to common

I/O Levels: TTL

Sampling/Update Rate: 200 kHz max

Output Characteristics: Output 12 mA per pin, 200 mA total continuous (per bank of 40 outputs)

Pattern Generation Output (/2000, /2001, /2002, /2004, & /2005)

The P3 16-bit digital I/O port can be configured for 16-bit pattern generation. The pattern can be updated synchronously with an acquisition.

Counter (/2000, /2001, /2002, /2004, & /2005)

Counter inputs can be scanned synchronously along with analog and digital scanned inputs, based either on internal programmable timer, or an external clock source. Counter can also be read asynchronously.

Channels: 4 x 16-bit; cascadable as 2 x 32-bit

Frequency Measurement Rate: 10 MHz max

Trigger Level: TTL

Frequency/Pulse Generators (/2000, /2001, /2002, /2004, & /2005)

Channels: 2 x 16-bit

Output: 1-MHz base rate divided by 1 to 65,535 (programmable)

DaqBoard/2000™ Series
Ordering Information

Ordering Information

Description   **Part No.**

16-bit, 200-kHz data acquisition board for PCI-bus PCs with 16 analog inputs, two 16-bit, 100 kHz analog outputs, 40 digital I/O, four 16-bit counter-timers, and two 16-bit frequency/pulse generators; includes DaqX API library, drivers for Visual Basic®, C++, and Delphi™ for Windows® 95 and higher; C++ for Linux, DASYLab®, TestPoint®, & LabVIEW®   DaqBoard/2000

CompactPCI version   DaqBoard/2000c

Same as DaqBoard/2000 but with four 16-bit, 100-kHz analog outputs   DaqBoard/2001

CompactPCI version   DaqBoard/2001c

Same as DaqBoard/2001 but with no analog I/O   DaqBoard/2002

CompactPCI version   DaqBoard/2002c

Data acquisition board for PCI-bus PCs with four 16-bit, 100-kHz analog outputs   DaqBoard/2003

CompactPCI version   DaqBoard/2003c

Same as DaqBoard/2001 but with no analog inputs   DaqBoard/2004

CompactPCI version   DaqBoard/2004c

Same as DaqBoard/2001 but with no analog outputs   DaqBoard/2005

CompactPCI version   DaqBoard/2005c

DaqBoard/2000, DaqView2000 software, DBK202, and CA-195   DAQ2000/STR-KIT

Accessories

Adapter board, directly connects DBK signal conditioning and expansion options (P1, analog only) to a CA-195 or CA-209 expansion cable   DBK200

Adapter board, connects all DBK signal conditioning and expansion options to a CA-195 or CA-209 expansion cable   DBK201

Adapter board with screw terminals, also connects DBK signal conditioning and expansion options to a CA-195 or CA-209 expansion cable   DBK202

Same as DBK202 but housed in a shielded metal enclosure   DBK203

Termination and expansion board with removable screw terminals for access to all DaqBoard/2000 series I/O with direct connection for DBK signal conditioning and expansion options (P1, P2 and P3 for analog and digital I/O) via CA-37-1 cable(s); connects to DaqBoard/2000 series P4 connector via a CA-195 or CA-209 cable   DBK206

Termination and (P1) expansion board with fixed screw terminals and sockets for up to 16 multiplexed 5B-compatible isolated analog input modules; connects to DaqBoard/2000 series (P4) connector via a CA-195 or CA-209 cable and to LogBook or DaqBook series devices (P1) connector via CA-37-1   DBK207

Description   **Part No.**

Same as DBK207 but with on board, cold-junction compensation and two (P1) expansion ports   DBK207/CJC

Termination and expansion board with fixed screw terminals (12 to 26 AWG wire), sockets for up to sixteen Opto-22®-compatible isolated solid-state-relay (SSR) digital I/O modules, and status LEDs per channel; connects to DaqBoard/2000 series P4 connector via a CA-195 or CA-209 cable   DBK208

Same as DBK201 but rack and DIN-rail mountable with optional kits   DBK209

Rack-mount kit for DBK206, DBK207, DBK207/CJC, DBK208, and DBK209 signal termination and expansion boards   Rack3

DIN-rail adapter kit for DBK206, DBK207, DBK207/CJC, and DBK208 signal termination and expansion boards   DIN1

DIN-rail adapter kit for DBK209 signal termination and expansion board   DIN2

Optional hardcopy manual set (3); includes programmer's manual, DaqBoard/2000 & DaqBoard/2000c series user's manual, and DBK option cards & modules user's manual   1033-0900

Cables

Expansion-card cable for connecting DBK series expansion options; specify number of option cards (x) to be connected   CA-37-x

Ribbon cable with female DB37 connector, provides convenient wiring to P1, P2, and P3 ports without requiring soldering to DB37 connectors, 6 ft.   CA-113

100-conductor expansion cable, mates with the DaqBoard/2000 series boards and the DBK200, DBK201, DBK202, DBK203, DBK206, DBK207, DBK207/CJC, DBK208, and DBK209;
   3 ft. expansion cable   CA-195
   6 ft. expansion cable   CA-195-6

Same as CA-195 with CE compliance; 3 ft.   CA-209

Software

DaqView™ for setup, data acquisition, display, and analysis; DaqViewXL™ for seamless execution within Microsoft® Excel's tool palette, and eZ-PostView™ for post-acquisition viewing and analysis   DaqView2000

Icon-based data acquisition, graphics, control, and analysis software   DASYLab

ActiveX/COM-based applications program interface   DaqCOM

DaqCOM™ with network support   DaqCOM/NET

Data acquisition grid control for Visual Basic   DaqCOM/OCX

Post-acquisition time-domain analysis software for data acquired from the DaqBoard/2000   eZ-TimeView

Post-acquisition fequency-domain analysis software for data acquired from the DaqBoard/2000   eZ-FrequencyView

Related Products

Expansion Hardware

PC Data Acquisition Hardware