DaqLab/2000™ Series

Ethernet-Based Laboratory Data Acquisition Instruments

Features

- **Ideal for bench-top data acquisition applications**
- **16-bit, 200-kHz A/D converter**
- **Built-in capability measures voltage, frequency, and digital I/O**
- **Easily expand to measure temperature, strain, vibration and much more via internal expansion slots**
- **Includes *Out-of-the-Box*™ DaqView™ software for data logging applications, plus support for all popular programming environments**
- **High-speed Ethernet interface insures continuous real-time data transfers to the PC**

The DaqLab/2000™ series provides bench-top data acquisition capability for a wide variety of laboratory applications. Compared to traditional digital multimeters, the DaqLab is 1,000 times faster and is capable of measuring a wider variety of signals.

Included with the DaqLab is DaqView™ software, an *Out-of-the-Box*™ application that is ideal for data logging, real-time display and storage to disk, along with DaqCal™ software application for easy user calibration. No programming is required to begin using the DaqLab, and users can be up-and-running within minutes. Also included is support for Visual Studio® and Visual Studio® .NET, with examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET, plus comprehensive drivers for DASYLab®, LabVIEW®, and MATLAB®.

Built into the DaqLab is a 16-bit/200-kHz A/D converter. Signal I/O is on the front panel via removable screw terminal connectors, and additional I/O is via rear panel DB37 connector. Front-panel I/O includes 8 voltage inputs, 4 frequency inputs, 2 timer outputs, and 6 digital I/O. The DaqLab/2001 also has 4 analog outputs on the front panel screw terminals. Expansion channels can be added to the DaqLab via DBK™ boards that install into the two built-in slots. Signals attach to the DBK cards via on-board screw terminals or BNC connectors, which are accessed from the front of the DaqLab.

For rack-mount systems applications, see the DaqScan/2000™ series. For portable and battery-powered applications, see the DaqBook/2000™ series

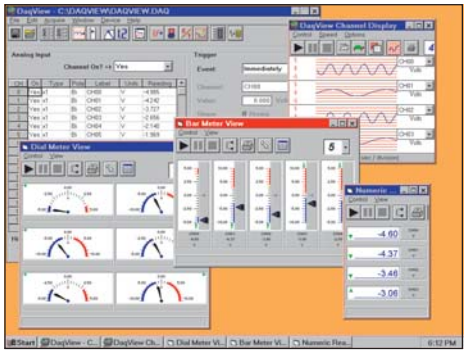
DaqLab is ideal for benchtop data acquisition

DaqLab/2000 Series Selection Chart		
Feature	**DaqLab/2001**	**DaqLab/2005**
PC Interface	10/100BaseT Ethernet	10/100BaseT Ethernet
A/D Converter	16 bit/200 kHz	16 bit/200 kHz
Front-panel voltage inputs	8	8
Built-in expansion slots	2	2
Maximum analog channel capacity*	128	128
Analog outputs	4 channel, 16 bit/100 kHz	—
Frequency inputs	4 channel, 16 bit/10 MHz	4 channel, 16 bit/10 MHz
Timer outputs	2 channel, 16 bit/1 MHz	2 channel, 16 bit/1 MHz
Digital I/O	30	30
Included data logging application	DaqView	DaqView
Included software support	Visual Basic, C/C++, ActiveX/COM, LabVIEW, MATLAB, DASYLab	Visual Basic, C/C++, ActiveX/COM, LabVIEW, MATLAB, DASYLab

* Up to 448 TC channels can be measured with one DaqLab using DBK90 TC options. Measurement speed with DBK90 is 1msec/channel.

If additional I/O is required, then any of the DBK options can be attached to the rear-panel P1 and P2 connectors, allowing expansion up to 100s of analog and digital I/O channels.

The high-speed Ethernet interface built into the DaqLab insures that all acquired data flows into the PC in real time, eliminating the need for local data storage or expensive memory options.



DaqView™ graphical data acquisition and display software is included with all DaqLab systems

† CE pending

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DaqLab/2000™ Series

General Information

Scanning

The DaqLab™ has an on-board scan sequencer that permits the user to select any combination of up to 16,384 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 (when DBK90 option channels are scanned, their scan time is 1 msec/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.

Triggering

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

Hardware Analog Triggering. The DaqLab supports 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 devices. 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).

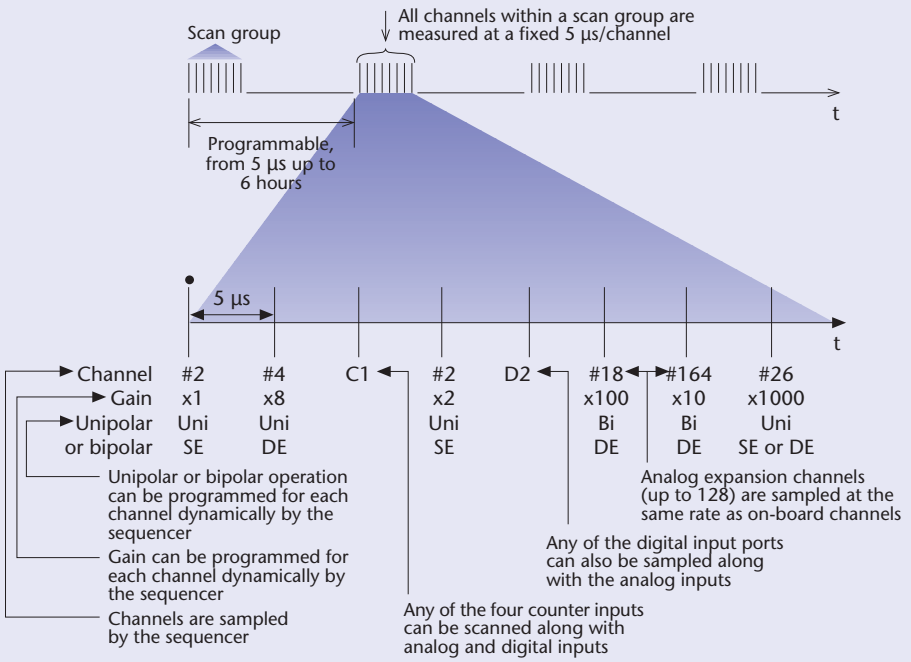
Digital Triggering. A separate digital trigger input line is provided, allowing TTL-level triggering, again with latencies guaranteed to be less than 5 µs. Both the logic levels (1 or 0), as well as the edge (rising or falling), can be programmed for the discrete digital trigger input.

Digital Pattern Triggering. The DaqLab also supports digital pattern triggering, whereby the user can designate the digital input 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.

Channel-Scanning Flexibility

The DaqLab offers a 16,384 location scan sequencer that allows you to select each channel and associated input amplifier gain at random. All built-in and expansion channels, are scanned up to 200 kHz (5 µs/channel)*. In addition, the digital and frequency inputs can be scanned using the same scan sequencer employed for analog inputs, enabling the time correlation of acquired digital data to acquired analog data. The DaqLab permits each scan group, 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.

DaqLab Scanning Example



Counter Triggering. 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.

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.

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 DaqLab 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 been met, (which may be thousands of readings later than the actual occurrence of the signal), the DaqLab driver automatically looks back to the location in memory where

* DBK90 channels are scanned 1 msec/channel

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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.

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.

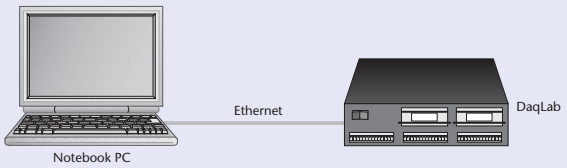
Variable pre-trigger with post-trigger stop event. Unlike the previous pre-trigger modes, this mode does not have to satisfy the pre-trigger number of readings before recognizing the trigger event. Thus the number of pre-trigger readings acquired is variable and dependent on the time of the trigger event 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.

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.

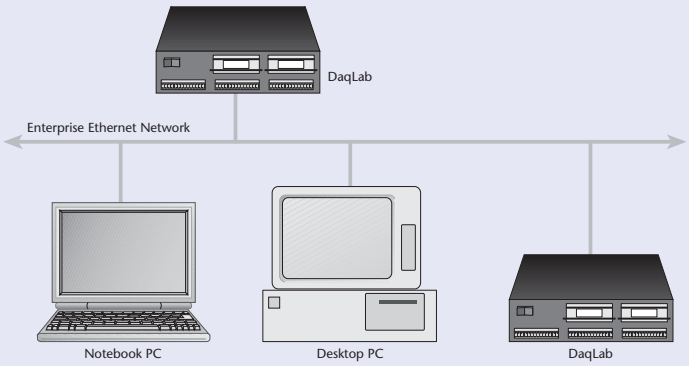
Ethernet Connection

The most common configuration for a DaqLab is when directly attached to a PC via a point-to-point Ethernet link. In this mode, data transfers will occur at the full 200 Kreadings per second rate of the DaqLab, insuring that no data is lost during transfer.



Point-to-point Ethernet connection

The DaqLab can also be attached to an enterprise-wide network, where it is one of many devices on the network. In this application, the data transfer rate is highly dependent on other data traffic on the network.



Enterprise-wide Ethernet connection

Calibration

Every range on the DaqLab is calibrated from the factory using a digital calibration method. This method works by storing a correction factor for each range on the DaqLab 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.

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DaqLab/2000™ Series

General Information & Specifications

Analog Output

Four channels of 16-bit/100-kHz analog output are built into the DaqLab/2001. 256 Ksamples of memory are included, which can store waveforms loaded from the PC. Additional low-speed D/A channels can also be added to the DaqLab through the use of the DBK2 analog output option card.

When used to generate continuous outputs, 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 onboard 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.

Digital Inputs & Outputs

Six TTL-level digital I/O lines are provided on the DaqLab front panel. The 6-bit port can be programmed as all inputs or all outputs. Ports programmed as inputs can be part of the scan group and read along with other analog and digital input channels, or can be read asynchronously via the PC at any time, including when a scanned acquisition is occurring.

An additional 24 bits of digital I/O are provided via rear-panel DB25 connectors, programmable in 8-bit ports as input or output.

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

* Specifications assume differential input single channel scan, 200-kHz scan rate, unfiltered
** Accuracy specification is exclusive of noise

Counter Inputs

Four 16-bit counters are built into the DaqLab, each capable of counting up to 65,536 TTL-level transitions. Each of the four counters are accessible via front-panel removable screw terminals, and 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 DaqLab, the counter inputs can be read asynchronously under program control, or synchronously as part of an analog and digital scan group.

Timer Outputs

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

Specifications

General

Supply Voltage Range: 90 to 250 VAC
Power Required: 15W (assuming no DBK options)
Power Available for external signal conditioning and expansion options: 5V at 1A; ±15V at 500 mA, not to exceed 10W
Operating Temperature: 0˚ to 50˚C
Storage Temperature: -40˚ to +80˚C
Relative Humidity: 0 to 95%, non-condensing
Vibration: MIL STD 810E, category 1 and 10
Signal I/O Connector: Front-panel removable screw terminals and rear-panel DB37
Dimensions: 285 mm W x 220 mm D x 90 mm H (11" x 8.5" x 3.5")
Weight: 2.3 kg (5 lbs)

A/D Specifications

Type: Successive approximation
Resolution: 16 bit
Conversion Time: 5 µs
Maximum Sample Rate: 200 kHz
Nonlinearity (Integral): ±1 LSB
Nonlinearity (Differential): No missing codes

Analog Inputs

Channels: 8 single-ended inputs via front-panel screw terminals
Expansion: Up to 128 high-speed channels, or 448 TC channels
Bandwidth: 500 kHz
Settling Time: 5 µsec to 1 LSB for full-scale step
Temperature Coefficient: ±(10ppm +0.3 LSB)/˚C outside the range of 0˚ to 35˚C
Input Impedance: 10M Ohm (single-ended): 20M Ohm (differential)
Bias Current: <1nA (0˚ to 35˚C)
Common Mode Rejection: 86 dB, DC to 60 Hz for gains < =8; >100 dB for gains > =16
Maximum Input Voltage (without damage): ±11V relative to analog common
Over-Voltage Protection: ±35V
Ranges: Software or sequencer selectable on a per-channel basis
Crosstalk: -100 dB DC to 60 Hz; 86 dB @10 kHz

Input Sequencer

Analog, digital and frequency inputs can be scanned synchronously, based on either an internal programmable timer, or an external clock source.
Scan Clock Sources: 2
1. Internal, programmable from 5 µs to 5.96 hours in 1 µs steps
2. External, TTL-level input up to 200 kHz max, available on front-panel terminal block

Programmable Parameters per Scan: Channel (random order), gain, unipolar/bipolar
Depth: 16,384 locations
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 (1 msec with DBK90 and DBK100)

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: 6, individually selectable for starting and stopping an acquisition. Stop acquisition can occur on a different channel than start acquisition; stop acquisition can be triggered via modes 2, 4, 5, or 6 described below.

1. Single-Channel Analog Hardware Trigger

Any analog input channel can be software programmed as the analog trigger channel, including any of the analog expansion channels.
Input Signal Range: -10 to +10V max
Trigger Level: Programmable (11-bit resolution)
Hysteresis: Programmable (11-bit resolution)
Latency: 5 µs max

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DaqLab/2000™ Series

Specifications & Ordering Information

2. Single-Channel Analog Software Trigger

Any analog input channel, including any of the analog expansion channels, can be selected as the software trigger channel. If the trigger channel involves a calculation, such as temperature, then the driver automatically compensates for the delay required to obtain the reading, resulting in a maximum latency of one scan period.

Input Signal Range: Anywhere within range of the selected trigger channel
Trigger Level: Programmable (16-bit resolution), including "window triggering"
Latency: One scan period max.

3. Single-Channel Digital Trigger

A separate digital input is provided for digital triggering.

Input Signal Range: -15V to +15V
Trigger Level: TTL
Minimum Pulse Width: 50 ns high, 50 ns low
Latency: 5 µs max

4. Digital Pattern Triggering

8- or 16-bit pattern triggering on any of the digital input ports. Programmable for trigger on equal, above, below, or within/outside of a window. Individual bits can be masked for "don't care" condition.

Latency: One scan period max

5. Counter/Totalizer Triggering

Counter/totalizer inputs can trigger an acquisition. User can select to trigger on a frequency or on total counts that are equal, above, below, or within/outside of a window.

Latency: One scan period, max.

6. Software Triggering

Trigger can be initiated under program control.

Analog Output (Model /2001)

The 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 also be updated asynchronously, independent of any other scanning in the system.

Channels: 4
Connector: Removable screw terminal
Resolution: 16 bits
Data Buffer: 256 Ksample
Output Voltage Range: ±10V
Output Current: ±10 mA
Offset Error: ±0.0045V max
Gain Error: ±0.01%
Digital Feedthru: 50 mV when updated
Update Rate: 100 kHz max, 1.5 Hz min (no minimum with external clock)
Settling Time: 10 µsec max to 1 LSB for full-scale step
Clock Sources: 4, programmable

1. Onboard D/A clock, independent of scanning input clock
2. Onboard scanning input clock
3. External D/A input clock, independent of external scanning input clock, available on front panel terminal block
4. External scanning input clock, available on front panel terminal block

Digital I/O

Channels: 30
Input Scanning Modes: 2

1. Asynchronous, under program control at any time relative to input scanning
2. Synchronous with input scanning

Ports: Three 8-bit ports; programmable as input or output, and one 6-bit port
Connector: 37-pin DSUB on rear panel (24 bits); removable terminal block on front panel (6 bits)
Input Protection: ±8KV ESD clamp diodes parallel
I/O Levels: TTL
Sampling Rate: 200 kHz max
Update Rate: Asynchronous under program control

Frequency/Pulse Counters

Counter inputs can be scanned synchronously along with analog and digital scanned inputs, based either on internal programmable timer, or an external clock source. Counters can be configured to clear when read, or to totalize and clear under program control.

Channels: 4 x 16-bit; cascadable as 2 x 32-bit
Frequency Measurement Rate: 10 MHz max
Connector: Removable screw terminal
Input Signal Range: -15V to +15V
Trigger Level: TTL
Minimum Pulse Width: 50 ns high, 50 ns low

Timer Outputs

Channels: 2 x 16-bit
Connector: Removable screw terminal
Output Waveform: Square wave
Output Rate: 1 MHz base rate divided by 1 to 65535 (programmable)
High-Level Output Voltage: 2.0V min @ -3.75 mA; 3.0V min @ -2.5 mA
Low-Level Output Voltage: 0.4V max @ 2.5 mA

Ordering Information

Description	Part No.
DaqLab includes documentation on CDROM, quick start guide, DaqView™ software; support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET; drivers for DASYLab®, LabVIEW®, and MATLAB®; and DaqCal™ software application	
Ethernet 16-bit, 200-kHz data acquisition system	DaqLab/2005
Same as above plus 4 channels of analog output	DaqLab/2001
Molded expansion cable for connecting DBK modules; 2 in.	CA-255-2T
Molded expansion cable from connecting DBK modules; 4 in.	CA-255-4T

Software

DaqView add-on for seamless execution with Microsoft Excel's tool palette	DaqViewXL/Plus
DaqView add-on includes all of the features of DaqViewXL/Plus, plus frequency-domain analysis	DaqView/Pro
Icon-based data acquisition, graphics, control, and analysis software	DASYLab
Post-acquisition time-domain analysis software for data acquired from the DaqLab	eZ-TimeView
Post-acquisition fequency-domain analysis software for data acquired from the DaqLab	eZ-FrequencyView

Related Products

Hardware
DBK1
DBK2
DBK4
DBK5
DBK7
DBK8
DBK9
DBK10
DBK11A
DBK15
DBK16
DBK17
DBK18
DBK20
DBK21
DBK23
DBK24
DBK25
DBK32A
DBK41
DBK42
DBK43A
DBK44
DBK45
DBK50
DBK51
DBK55
DBK60
DBK65
DBK70
DBK80
DBK81
DBK82
DBK83
DBK84
DBK85
DBK90
DBK207
DBK207/CJC
DBK208
DBK210

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DaqViewXL/Plus
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eZ-PostView
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