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Find the *Measurement Computing / IOtech DaqBook/2001* at our website: ***Click HERE***

DaqBook/2000 Series and DaqOEM/2000 Series

16-Bit, 200 kHz Multifunction Data Acquisition Systems



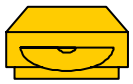




DaqBook/2001
DaqBook/2005
DaqBook/2020

DaqOEM/2001
DaqOEM/2005

Requires one of the following Operating Systems:



Windows XP
Windows Vista

DaqBook/2000 Series &
DaqOEM/2000 Series

1121-0901 rev 3.0



372335A-01

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This warning symbol is used in this manual or on the equipment to warn of possible injury or death from electrical shock under noted conditions.



This ESD caution symbol urges proper handling of equipment or components sensitive to damage from electrostatic discharge. Proper handling guidelines include the use of grounded anti-static mats and wrist straps, ESD-protective bags and cartons, and related procedures.



This symbol indicates the message is important, but is not of a Warning or Caution category. These notes can be of great benefit to the user, and should be read.



In this manual, the book symbol always precedes the words "Reference Note." This type of note identifies the location of additional information that may prove helpful. References may be made to other chapters or other documentation.



Tips provide advice that may save time during a procedure, or help to clarify an issue. Tips may include additional reference.

Specifications and Calibration

Specifications are subject to change without notice. Significant changes will be addressed in an addendum or revision to the manual. As applicable, the hardware is calibrated to published specifications. Periodic hardware calibration is not covered under the warranty and must be performed by qualified personnel as specified in this manual. Improper calibration procedures may void the warranty.

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Your order was carefully inspected prior to shipment. When you receive your system, carefully unpack all items from the shipping carton and check for physical signs of damage that may have occurred during shipment. Promptly report any damage to the shipping agent and your sales representative. Retain all shipping materials in case the unit needs returned to the factory.

CAUTION



Using this equipment in ways other than described in this manual can cause personal injury or equipment damage. Before setting up and using your equipment, you should read *all* documentation that covers your system. Pay special attention to Warnings and Cautions.

Note: During software installation, Adobe® PDF versions of user manuals will automatically install onto your hard drive as a part of product support. The default location is in the **Programs** group, which can be accessed from the *Windows Desktop*. Initial navigation is as follows:

Start [Desktop "Start" pull-down menu]
⇒ **Programs**
⇒ **IOtech DaqX Software**

You can also access the PDF documents directly from the data acquisition CD by using the <**View PDFs**> button located on the opening screen.

Refer to the PDF documentation for details regarding both hardware and software.

A copy of the Adobe Acrobat Reader® is included on your CD. The Reader provides a means of reading and printing the PDF documents. Note that hardcopy versions of the manuals can be ordered from the factory.



PDF
1121-0901

DaqBook2000_DaqOEM2000.pdf

Contains hardware-related and software-related material for DaqBook/2000, DaqBook/2001, DaqBook/2005, DaqBook/2020, DaqOEM/2001, and DaqOEM/2005. This pdf file plus the following constitute a complete set of documentation for these devices.



PDF
457-0909

DaqView.pdf

Discusses how to install and use this "out-of-the-box" data acquisition program.



PDF
1086-0926
1086-0922

PostAcquisition Analysis.pdf

This pdf consists of two documents. The first discusses *eZ-PostView*, a post data acquisition analysis program. The application is included free as a part of product support. The second includes information regarding *eZ-FrequencyView* and *eZ-TimeView*. These two applications have more features than does *eZ-PostView* and are available for purchase. They can; however, be used freely during a 30-day trial period.

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PDF
457-0905

DBK Options.pdf

The *DBK Option Cards and Modules User's Manual* discusses each DBK product. In addition, the document includes chapters on signal management, system connections, pinouts, DBK set up in software, and troubleshooting.



PDF
1008-0901

ProgrammersManual.pdf

The Programmer's Manual pertains to developing custom programs using Applications Program Interface (API) commands.

Programmers should check the **readme.file** on the install CD-ROM for the location of program examples included on the CD.

Manual Layout

Chapter 1 – Daq Systems

Chapter 2 – DaqBook/2000 Series and DaqOEM/2000 Series Device Overviews

Chapter 3 – Block Diagrams

Chapter 4 – Connectors, Indicators, Cables, & Pinouts

Chapter 5 – A Brief Look at Software

Chapter 6 – Configuring the System for Operation

Chapter 7 – CE Compliance and Noise Considerations

Chapter 8 – Taking Measurements

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Reference Note:
Reference to additional documents of importance begins on page iv.

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11 - Specifications

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DaqBook & DaqOEM 2000 Series Quick Start

Ethernet-Based Portable Data Acquisition





Before you get started

Verify that you have the following items.

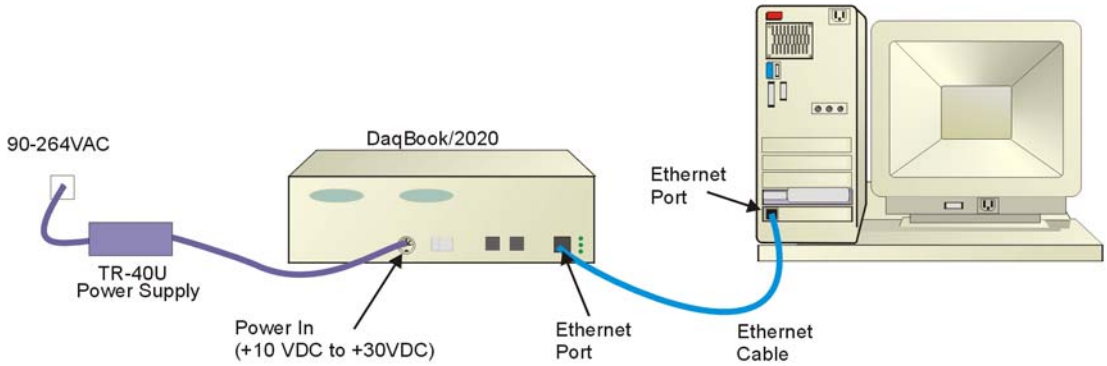
- DaqBook, or DaqOEM [*2000 Series*]
- TR-40U Power Supply
- Ethernet Patch Cable
- Ethernet jack [on PC or on a hub connected to the Ethernet]
- Data Acquisition CD
- Monitor: SVGA, 1024 x 768 screen resolution
- Windows 2000 and Windows XP users:
  PC with Intel™ Pentium, 1 GHz or equivalent;
  512 MB memory; 10 GB disk space
- Windows Vista users:
  PC must be *Windows Vista Premium Ready*

Step 1 - Install Software

1. Close all running applications on the host PC.
2. Insert the Data Acquisition CD into your CD-ROM drive and wait for the CD to auto-run. An *Opening Screen* will appear. As an alternative, you can download software from: www.mccdaq.com/software.
3. Click the <**ENTER SETUP**> button.
   Note: If you are downloading software from our website, follow instructions provided there.
4. From the hardware selection screen [which follows a licensing agreement], select the device from the drop-down list and follow the on-screen instructions.

Step 2 - Connect the 2000 Series Device to the Ethernet

Though the following figure represents connecting a DaqBook/2020 to a PC and to power, note that the Ethernet ports and Power In connectors are in the same relative locations for all devices in this 2000 Series.



In the figure, the DaqBook/2020 is connected directly to an Ethernet port on a host computer. Please consult your user's manual (located in PDF format on the CD) should you need information regarding network types other than this simple direct connection.

1. Connect the Ethernet cable to the Ethernet jack on the 2000 Series device rear panel.
2. Connect the other end of the Ethernet cable to the Ethernet jack on the host computer or network hub.

Step 3 - Connect the 2000 Series Device to Power

1. With the 2000 Series power switch "OFF," connect the power supply cable from the TR-40U to the unit's Power-In DIN5 connector (located on the rear panel).
2. Connect the TR-40U plug to a standard AC outlet; then turn the 2000 Series device Power switch to "ON."

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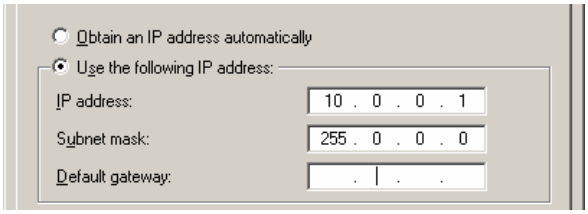
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Step 4 - Configure Computer Network Settings

Note: We recommend that you discuss this procedure with your Network Administrator before proceeding.



1. Open the Control Panel by navigating from the Windows Desktop as follows:
   Start Menu ⇒ Settings ⇒ Control Panel.
2. Double-click the "Network Connections" icon.
3. Double-click the icon for the network that the 2000 Series device is connected to.
4. In the "Local Area Connection Status" box, click on the <**Properties**> button. The "Local Area Connection Properties" box will appear.
5. Double-click the "Internet Protocol (TCP/IP)" component. The "Internet Protocol (TCP/IP) Properties" box will appear.
6. Select the "Use the following IP Address" radio button. (See figure at left).
7. Set the IP address field to 10.0.0.x where x is some number from 1 to 254. **Make sure that each computer and each device on the dedicated network has a unique IP address.**
8. Set the Subnet mask to 255.0.0.0. Note that the remaining fields can be left as is. Click <**OK**>.
9. Click <**OK**> on follow-up screens to exit.



Internet Protocol (TCP/IP) Properties
(Partial View)

Step 5 - Configure & Test the System



Daq Configuration

1. Open the Daq Configuration Applet.

a. Navigate from the Windows' Desktop: **Start Menu ⇒ Settings ⇒ Control Panel**
b. From the Control Panel, double-click the ***Daq Configuration*** icon.

2. Add the 2000 Series Device to the list of installed devices.

a. Select the Computer image in the Device Inventory configuration tree.
b. Click the <**Add Device**> button. The "Select Device Type" box will appear.
c. Select the 2000 Series device from the list of devices.

Note: For DaqOEM/2001 and DaqOEM/2005, select DaqBook/2001 and DaqBook/2005, respectively.

d. Click the <**OK**> button. The "Properties" box will appear for the selected device.
e. Enter the **Serial Number** of the device. The number is on the MAC label (rear panel, upper left). The serial number is located just below a barcode.
f. Select the "**Auto IP Setting**" radio button. The IP Address of the device will automatically be calculated and displayed in the IP Address field
g. Click the <**OK**> button.

3. Test the system connections.

a. Make sure the device has been properly installed and is powered-on.
b. Make sure all cables are properly and securely connected.
c. Click the "**Test Hardware**" tab.
d. Click the <**TCP/IP Test**> button. This tests the Transmission Control Protocol / Internet Protocol.
e. Upon completion of the TCP/IP test, click the <**Resource Test**> button.
When testing, if the unit does not respond within 30 seconds perform the following steps: 1) reboot the system, 2) upon power-up, re-open the Daq Configuration applet, 3)select another configuration setting, 4) reinitiate the test.

Step 6 - Connect Data Acquisition Signal Lines

Prior to making signal connections review the *Specifications* chapter of your user's manual to ensure that your intended signal inputs do not exceed the specified limits. The manual is included in PDF format on your CD.

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Daq Systems 1

Daq Systems, the Modular Concept …… 1-1

DaqBooks, DaqBoards, and Daq PC-Cards ….. 1-2

Using DBK Cards and Modules for Signal Conditioning …… 1-4

Daq Software …… 1-5

This chapter provides a brief overview of Daq devices.

Users interested in jumping straight to specific DaqBook/2000 Series or DaqOEM/2000 Series information can skip directly to chapter 2.

Daq Systems, the Modular Concept

Daq equipment and software form a modular, interrelated family of products that provide great flexibility in data acquisition system design. This flexibility allows for the development of custom systems that are unique to the user, and which can be optimized for his or her specific application needs. With the Daq product line, system expansion or redesign can typically be accomplished with relative ease.

- ***Primary Acquisition Device***. This is the main data acquisition device, e.g., a DaqBook, DaqBoard, or Daq PC-Card. These devices provide a vital data conversion and communications link between the data source of transducers and signal conditioners and the data processor of the host computer.

- ***DBK Option Cards and Modules***. Over 35 DBK cards and modules (the number is constantly growing) provide various types of signal conditioning and system expansion. Note that certain DBK modules exist for the purpose of supplying power to other members of the acquisition system. The DBK options are discussed in the *DBK Option Cards and User's Manual* (p/n 457-0905).

  Note: Only *passive* DBKs, such as the DBK1 BNC module, the DBK11A screw terminal card, and the DBK40 BNC analog interface, can be used with a Daq PC-Cards.

  Reference Note:
  DBK options are discussed in the *DBK Option Cards and Modules User's Manual* (p/n 457-0905). As a part of product support, this manual is automatically loaded onto your hard drive during software installation. The default location is the Programs directory, which can be accessed through the Windows Desktop.

- ***Software***. DaqView *out-of-the-box* software provides a graphical user interface with easy to read spreadsheet formats for viewing channel data, as well as a choice of analog, digital, and bar-graph meters. Waveform analysis can be performed, when applicable. A product support option, included on the data acquisition CD, provides a means of performing post data analysis. More information is included in the software-specific PDF documents that are installed on your hard-drive as a part of product support.

  In addition to the included out-of-the-box software, Daq products can be controlled via user-written custom programs through Applications Program Interface (API). Several languages are supported, e.g., C/C++, and VisualBASIC.

  Note that third party icon-driven software, such as DASYLab and LabView, can be used with the Daq devices.

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DaqView and DASYLab can only be used with one DaqBook/2000 Series, DaqOEM Series, or DaqBoard/2000 Series device at a time.

LabView can be used with multiple /2000 Series devices.

For multiple device applications (via custom programming) refer to the *Using Multiple Devices* section of the *Programmer's Manual*. During software installation from the data acquisition CD (p/n 1022-0601), a PDF version of the Programmer's Manual is automatically loaded onto your hard drive as a part of product support. The default location is the Programs directory.



Reference Note:
Programming topics are covered in the *Programmer's User Manual* (p/n 1008-0901). As a part of product support, this manual is automatically loaded onto your hard drive during software installation. The default location is the Programs directory, which can be accessed through the Windows Desktop.

DaqBooks, DaqBoards and Daq PC-Cards

Daq products connect to one or more DBKs on their signal input side and a computer on their output side. Each type of Daq device connects to the computer in a different way:

- A **DaqBook/2000 Series** product is a primary data acquisition device which resides external to a PC. These devices connect directly to computer's Ethernet port, or to an Ethernet network via a hub. Note that early DaqBook models connected to a computer's enhanced parallel port (EPP) interface or connected to the PC by use of a PC-Card and cable.
- **DaqOEM/2000** Series devices are DaqBook/2000 Series devices, minus the chassis.
- The **DaqBoard** [**ISA type**] board is an internal card that plugs into an ISA-bus slot within a computer.
- **DaqBoard/2000 Series boards** plug into a PCI-bus slot, within a host PC. A variation of these boards, the **DaqBoard/2000c Series boards**, plug into a compact-PCI-bus slot, within a compact type host PC.
- The **Daq PC-Card** slides into the PCMCIA slot of a host computer, typically a notebook PC.

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Daq Data Acquisition Devices		
Category	**Device**	**Description**
Primary Acquisition Device	**DaqBook/2000 Series**	**Portable Data Acquisition** **16-bit, 200 kHz** devices with Ethernet connectivity. The series consists of DaqBook/2001, DaqBook/2005, and DaqBook/2020.
	DaqOEM/2000 Series	**Portable Data Acquisition** **16-bit, 200 kHz boards** with Ethernet connectivity. The series consists of DaqOEM/2001 and DaqOEM/2005. These boards reside external to the host PC.
	DaqBook/100 Series DaqBook/200 Series	**Portable Data Acquisition** 12-bit: DaqBook/100, /112, /120 16-bit: DaqBook/200, /216, /260
	DaqBoard/2000 Series	**Plug-In Boards for PCI Bus-Slots** 16-bit , 200 kHz. Six boards identified as /2000 through /2005
	DaqBoard/2000c Series	**Plug-In Boards for Compact-PCI Bus-Slots** 16-bit , 200 kHz. Six boards identified as /2000c through /2005c
	DaqBoard (ISA types)*	**Plug-In Boards for ISA Bus-Slots** 12-bit: DaqBoard/100A, /112A 16-bit: DaqBoard/200A, /216A, /2000
	Daq PC-Card*	**Plug-In PCMCI Card** 12-bit: Daq/112B 16-bit: Daq/216B
DBK Option Cards and Modules*	Analog Signal Conditioning	**Cards and DBK modules used to condition Analog Signals** DBK/ 4, 7, 8, 9, 12, 13, 15, 17, 18, 19, 42, 43A, 44, 45, 50, 51, 52, 53, 54, 55, 65, 80, 81, 82, 83, 84, 85, 90, 100, 207, 207/CJC
	Analog Output	**Cards used to modify Analog Output Signals** DBK/ 2, 5
	Digital I/O and Control	**Cards and DBK modules used to condition Digital I/O** DBK/ 20, 21, 23, 24, 25, 208, 210
	Expansion Connections	**Cards and DBK modules used to expand the acquisition system.** DBK/ 1, 10, 11A, 35, 40, 41, 60, 200, 201, 202, 203, 204, 205, 206, 209
	Power Supply	DBKs: 30A, 32A, 33, 34
Software	Included Software	DaqView, Post Data Acquisition Analysis Program (actual application not specified), Visual Basic extensions, Application Programming Interface (API)
	Optional Software	DaqViewXL, DASYLab

* The list of DBK cards and modules continues to grow. For information regarding new and upcoming products consult out website, your sales representative, or contact the factory directly.

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Using DBK Cards and Modules for Signal Conditioning

The DBK signal-conditioning cards and modules are designed for use with DaqBooks, LogBooks, and various types of data acquisition boards, i.e., ISA, PCI, and compact-PCI types. The DBKs perform best when used with an acquisition device that can dynamically select channel, gain, and range. DBK cards and modules with dynamic channel and gain/range selection allow for high channel-to-channel scan rates with a variety of transducers.

Note: Only *passive* DBKs, such as the DBK1 BNC module, the DBK11A screw terminal card, and the DBK40 BNC analog interface, can be used with Daq PC-Cards.

DBK output signals can be bipolar, e.g., -5 to +5 V, or unipolar, e.g., 0 to 10 V. The user can select a range of relevant values to correspond to the lowest signal (e.g., -5 or 0 V) and the highest signal (e.g., 5 or 10 V) signal. This type of range selection guarantees the highest resolution in 12-bit or 16-bit conversion.

DBK modules share the same footprint as the DaqBook and a typical notebook PCs; allowing for convenient stacking. The majority of these modules have their own power supply; however, several options exist for packaging and powering the DBKs.



Reference Note:
DBK options are detailed in the *DBK Option Cards and Modules User's Manual* (p/n 457-0905). As a part of product support, this manual is automatically loaded onto your hard drive during software installation. The default location is the Programs directory, which can be accessed through the Windows Desktop.

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Daq Software

The Daq devices have software options capable of handling most applications. Three types of software are available:

- ready-to-use graphical programs, e.g., DaqView, DaqViewXL, and post acquisition data analysis programs such as eZ-PostView
- drivers for third-party, icon-driven software such as DASYLab and LabView
- various language drivers to aid custom programming using API

Ready-to-use programs are convenient for fill-in-the-blank applications that do not require programming for basic data acquisition and display:

- DaqView is a Windows-based program for basic set-up and data acquisition. DaqView lets you select desired channels, gains, transducer types (including thermocouples), and a host of other parameters with a click of a PC's mouse. DaqView lets you stream data to disk and display data in numerical or graphical formats. PostView is a post-acquisition waveform-display program within DaqView.
- DaqViewXL allows you to interface directly with Microsoft Excel to enhance data handling and display. Within Excel you have a full-featured Daq control panel and all the data display capabilities of Excel.
- A post acquisition data analysis programs, e.g., eZ-PostView, typically allows you to view and edit post-acquisition data.
- The Daq Configuration control panel allows for interface configuration, testing, and troubleshooting.

Each Daq system comes with an Application Programming Interface (API) via a subroutine library (DAQ) or an ActiveX/COM based library (DaqCOM). API-language drivers include: C/C++, and Visual Basic. The latest software is a 32-bit version API.



Reference Notes:

- The software document modules, *DaqView*, *DaqViewXL*, and *Post Acquisition Data Analysis User's Guide*, are not included as part of the hardcopy manual, but are available in PDF version. See the PDF Note, below.
- Programming topics are covered in the *Programmer's User Manual* (1008-0901). As a part of product support, this manual is automatically loaded onto your hard drive during software installation. The default location is the Programs directory, which can be accessed through the Windows Desktop.

PDF Note: During software installation, Adobe® PDF versions of user manuals will automatically install onto your hard drive as a part of product support. The default location is in the **Programs** directory, which can be accessed from the *Windows Desktop*. Refer to the PDF documentation for details regarding both hardware and software.

A copy of the Adobe Acrobat Reader® is included on your CD. The Reader provides a means of reading and printing the PDF documents. Note that hardcopy versions of the manuals can be ordered from the factory.

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Device Overviews

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I/O Comparison Matrix
for DaqBook/2000 Series and DaqOEM/2000 Series Devices

Device	Analog Input Channels Analog Input signals enter through P1 , go to MUX, to PGA, to Gain & Offset Amplifier, then to Analog-to-Digital Converter (ADC)	Analog Output Channels Digital Signals go through Digital-to-Analog Converters, then through "DAC Out."	Digital I/O Channels* Digital signals pass through one 16-bit Digital I/O Port (on P3) and three 8-bit Digital I/O Ports (on P2).	Counter/ Timers Four 16-bit Counter Input signals and Two 16-bit Timer Output signals.
DaqBook/2001 and DaqOEM/2001	**16 Analog Input via P1**	**4 Analog Output via P3**	**40 Digital I/O via P2 & P3**	**4 Counter In 2 Timer Out via P3**
DaqBook/2005 and DaqOEM/2005	**16 Analog Input via P1**	**No DAC Channels**	**40 Digital I/O via P2 & P3**	**4 Counter In 2 Timer Out via P3**
DaqBook/2020	**14 Analog Input via P1** **16 Differential Voltage Inputs via BNC Connectors** **14 Thermocouple Inputs via Mini-TC Connectors**	**4 Analog Output via BNC Connectors**	**24 Digital I/O via P2**	**4 Counter In 2 Timer Out via BNC Connectors**
		Note: DaqBook/2020's Digital I/O is via the three 8-bit ports on P2. The device has no P3 connector. For this reason it has 24 Digital I/O channels available, not 40 as do the other devices.		

Note: In addition to the BNC connectors indicated above, the DaqBook/2020 includes a BNC for External TTL Trigger input and one for External Clock input.

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Overview

DaqBook/2020, /2001, /2005, DaqOEM/2001, and DaqOEM/2005 are high-speed, multi-function, data acquisition devices for use with Ethernet PCs and Ethernet networks. Each unit connects directly to a PC's Ethernet port or network hub, and each features a 16-bit, 200-kHz A/D converter and digital calibration.

DaqOEM/2001 and DaqOEM/2005 devices have no chassis, but are otherwise identical to the DaqBook/2001 and DaqBook/2005, respectively.

Note that block diagrams are presented in chapter 3 and connectors and pinouts are discussed chapter 4.

Product Features

I/O Connections

For DaqBook/2020, all input and output signals are accessed via: 37-pin DSUB connectors [P1 and P2], BNC Connectors, and mini-TC connectors. Chapter 4 includes connector descriptions and pinouts.

For DaqBook/2001, /2005 and DaqOEM/2001, and DaqOEM/2005 all input and output signals are accessed via the three 37-pin DSUB connectors [P1, P2, and P3]. Chapter 4 includes connector descriptions and pinouts.

General Features

- **TTL-level digital I/O lines**. For DaqBook/2020 there are 24 TTL-level digital I/O lines divided into three 8-bit ports on P2. For the other /2000 Series devices there are 40 digital I/O lines. They are divided into three 8-bit ports on P2 and one 16-bit port on P3.
- **Four 16-bit counters**. Each can accept frequency inputs up to 10 MHz. The counters can be cascaded into two 32-bit counters.
- **Two 16-bit timer outputs**. Each can generate square waves from 16 Hz to 1 MHz.
- **Configuration through software only**. Device settings are made via software. There are no hardware settings to be made, for example, there are no device DIP switches to be set or jumpers to be positioned. However, note that DBK expansion options may require s small degree of manual set up. Refer to the *DBK Option Cards and Modules User's Manual* (457-0905) for details. A PDF version of the document is included on the installation CD.
- **Scan Sequencing.** Each DaqBook/2020, /2001, /2005, DaqOEM/2001, and DaqOEM/2005 has a scan sequencer lets you select up to 16384 channel/range combinations. Scan rates are programmable on a per channel basis to 5 µs/channel, 10 µs/channel, or 1000 µs/channel.

  Note: Inputs to these devices can be measured at the 5 µs/channel rate. However, some DBK expansion options require more settling time and can be measured at the slower rate of 10 µs/channel or 1000 µs/channel. All types of measurements can be mixed within the scan group.
- **Synchronization**. Each device includes two SYNC ports. Up to four units can be synchronized, with respect to each other. Synchronization is accomplished by connecting one DaqBook device SYNC port to the SYNC port of a second DaqBook device. A unit can be *scan-synchronized* and *triggered* from any other DaqBook that is connected to it via a SYNC cable. Either one of a unit's two sync ports, or both, can be used. Note that the total combined length of the Sync cables is not to exceed 15 feet (4.57 m). Chapter 8 includes a block diagram regarding synchronizing multiple units.

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Triggering

DaqBook/2020, /2001, /2005, DaqOEM/2001, and DaqOEM/2005 each support a full complement of trigger modes including:

- **Hardware analog triggering** – A user-programmed trigger level sets an analog DAC, which is compared in hardware to the analog input level on the selected channel. Trigger latency is < 5 µs.
- **Digital and pattern triggering** – TTL-level triggering and latencies less than 5 µs. The trigger can be programmed for logic level or edge triggering. In pattern triggering, any of the digital input ports acts as the trigger port. You can program the digital pattern.
- **Software-based triggering** – The PC detects the trigger event from analog, digital, or counter readings. Six pre- and post-triggering modes are supported. Trigger latency is one scan period.



Multi-unit synchronization via the SYNC ports does not support pre-trigger data. Only post-trigger data can be collected and time correlated between the units.

Synchronous Input Operations

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow for synchronous scanning and acquisition of Analog Input, Digital Input and Counter Input Data at up to 200 kHz aggregate scanning rates. The Analog Input data can be either main unit or expansion modules from P1 compatible analog input modules. The Digital Input data can be main unit 8-bit P2 (8255) digital inputs, 16-bit P3* digital inputs or P2 compatible DBK digital input expansion modules.

*The 16-bit P3 digital inputs do not apply to DaqBook/2020, which has no P3 connector.

Analog Input Channels

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow analog input for the device and for P1 compatible DBK analog input expansion modules.

Channel Selection and Mode Settings

The DaqBook/2000 Series and DaqOEM/2000 Series devices each accept up to 16 single ended or up to 8 differential-ended inputs and can be programmed for single-ended or differential-ended on a per channel basis. Just one analog channel is sacrificed when a DBK expansion module is enabled. See DBK documentation in the *DBK Option Cards & Modules User's Manual* (p/n 457-0905) for further information.

The DaqBook/2020 accepts up to 14 single ended inputs.

Channel Range and Polarity

Each device channel can be programmed for either unipolar or bipolar mode with gain settings of 1, 2, 4, 8, 16, 32, and 64. Note that the DaqBook/2020's front panel analog inputs are bipolar only.

Channel Sampling Interval

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow for programmable sampling intervals of 5us, 10us, or 1000µs on a per channel basis. This mode allows some channels which change slowly but a higher degree of accuracy is desirable to be sampled at a longer interval while channels that change more rapidly to be sampled using a shorter interval. Each 5us or 10us interval reduces the maximum aggregate acquisition rate for the entire scan by that amount.

Note: DBK90 and DBK100 TC measurement modules sample at 1000µs/channel.

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Digital Input Channels

The devices allow for either synchronous scanning of digital input channels or asynchronous I/O operations for all configured digital channels.

Counter Input Channels

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow for synchronous scanning of the 4 16-bit counter input channels. The four 16-bit counter channels can also be cascaded into two 32-bit counter channels. For either cascaded or non-cascaded counter channels each channel can be configured for:

- ***Pulse Counting Mode*** – specifies that each counter should be cleared upon being read and placed into the input scan.
- ***Totalize Counting Mode*** – specifies that each counter is to free-run and not be cleared during the input acquisition.

Synchronous Input Acquisition Clocking

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow clocking of the synchronized inputs either by an internal, programmable pacer clock or by external clocking. These products use a sequencer to implement a multiplexing approach to gathering the input data. This means that with either internal or external clocking the entire channel scan (including the sampling time for each channel) may not exceed the maximum aggregate rate of 200 kHz.

Synchronous Output Operations

The DaqBook/2001, DaqBook/2020, and DaqOEM/2001 allow for synchronous output of D/A channels at up to 100 kHz for each channel. All D/A channels can output waveform data from an on-board 256 k sample buffer.

Output Channel Configuration

Analog Output Channels

For DaqBook/2001, DaqBook/2020, and DaqOEM/200, each D/A channel can be configured for waveform output individually. If the D/A channel is *not configured for waveform output* it then is available for asynchronous output operations.

Digital Output Channel

May only be used for asynchronous digital I/O operations.

Synchronous Output Clocking

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow clocking of the synchronized output by the acquisition clock source, an internal, programmable pacer clock or by an external clock source. When the clock source generates a new clock signal all outputs are updated concurrently. Regardless of the clock source, the clock may not exceed the maximum update rate of 100 kHz.

Synchronous Output Data Source for DACs

For DaqBook/2001, DaqBook/2020, and DaqOEM/2001, the data source for synchronized output operations can be that of the on-board 256k sample buffer.

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Asynchronous I/O Operations

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow asynchronous input of any counter or digital channel that is not currently configured for synchronous acquisition. The devices also allow for asynchronous output to any D/A channels not currently configured for waveform output. Likewise, the 16-bit P3 digital port, if available, can be used for both asynchronous input and output operations. In addition, the timer outputs can be programmed at any time regardless of the current state of synchronous or asynchronous operations on other channels.

Digital I/O Channels

Local 8255 Channels

The DaqBook/2000 Series and DaqOEM/2000 Series devices have an implemented Intel 8255 core in the digital I/O logic on the P2 port of the product. With the Intel 8255 there are three 8-bit wide ports available for I/O and one 8-bit wide port for configuration purposes. The configuration port is used to configure the other three 8-bit ports for either input or output operations.

Local 16-bit P3 Port

The 16-bit P3 Digital Port can be used as either an input, or an output port. With this port, no configuration is required, the port simply outputs when written to and inputs when read. The 16-bit P3 port does not apply to DaqBook/2020.

Expansion Digital I/O

The DaqBook/2000 Series and DaqOEM/2000 Series devices have the ability to expand digital I/O through the P2 port via digital I/O expansion modules. These modules are discussed in the *DBK Option Cards & Modules User's Manual*. When using the digital I/O expansion modules the local P2 Intel 8255 digital I/O becomes inaccessible in lieu of the expansion modules. These expansion modules provide additionally Intel 8255 ports as well as input isolation for applications that require the expanded capabilities.

Pulse Stream Output Using Timers

The DaqBook/2000 Series and DaqOEM/2000 Series devices allow the generation of output pulses based upon a programmable setting. These output timers can be set at any time regardless of the state of any synchronous or asynchronous operations which are currently taking place on other channels.

Analog Output Channels

The DaqBook/2001, DaqOEM/2001, and DaqBook/2020 have the ability to output analog data to any of the available (up to four) D/A channels. Each D/A channel may be asynchronously updated by an application if the D/A channel is not currently being used for waveform output operations. DaqBook/2005 and DaqOEM/2005 do not have analog output capability.

Counter Input Channels

The DaqBook/2000 Series and DaqOEM/2000 Series devices have counter input capabilities and have the ability to read counter input [if the counter channel is not configured for synchronous acquisition]. As in the case of synchronous operations the 4 16-bit counter input channels can be used individually or cascaded into two 32-bit counter channels. For either cascaded or non-cascaded counter channels each channel can be configured for:

- ***Clear on Read Mode*** - specifies that each counter should be cleared (reset to 0) upon being read.
- ***Continuous Totalize Mode*** – specifies that each counter is to *free-run* and not be cleared during the read operation.

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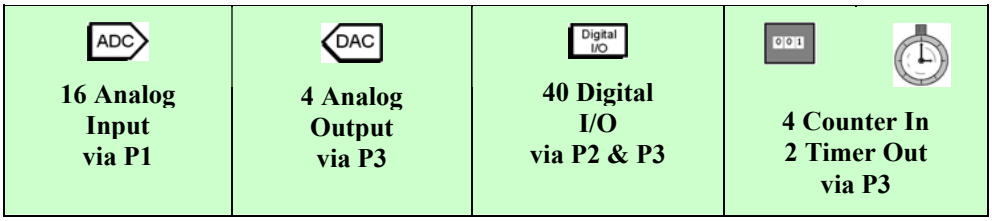
Synchronous Operation Matrix

The following table applies to DaqBook/2000 Series and the DaqOEM/2000 Series devices. Note that this table is closely related to the comparison table on page 2-1.

Operation	DaqBook/2020	DaqBook/2001 DaqOEM/2001	DaqBook/2005 DaqOEM/2005
Synchronous Input			
Analog Main Unit Inputs	Yes	Yes	Yes
Analog Expansion Input	Yes	Yes	Yes
Counter Inputs	Yes	Yes	Yes
Digital Main Unit Inputs	Yes	Yes	Yes
Digital Expansion Inputs	Yes	Yes	Yes
Synchronous Output			
Analog D/A Waveform Output	Yes	Yes	No
Asynchronous IO			
Main Unit Digital I/O	Yes	Yes	Yes
Expansion Digital I/O	Yes	Yes	Yes
Timer Output (Pulse Generation)	Yes	Yes	Yes
Analog Output	Yes	Yes	No

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DaqBook/2001 & DaqOEM/2001



Summary of DaqBook/2001 and DaqOEM/2001 Channels

DaqBook/2001 is a high-speed, multi-function, data acquisition module. DaqOEM/2001 is a board with the same functionality, but no chassis. Both devices feature a 16-bit, 200-kHz A/D converter, digital calibration, four 16-bit, 100-kHz D/A converters, 40 digital I/O lines, four counters, and two timers. Both connect to a PC or Ethernet network via a 10/100BaseT Ethernet port.

Up to 470 channels of analog and digital I/O can be accessed with one DaqBook/2001 or one DaqOEM/2001 board. Up to 896 thermocouple channels can be accessed with the use of DBK90 and DBK100 expansion modules.

P1, P2, and P3 37-pin connectors provide access to all I/O signals. Port descriptions follow:

- **P1 –** Analog input port for16 single-ended or 8 differential analog inputs with 13 software programmable ranges (±10 V to ±156 mV full scale).
- **P2 –** General purpose digital I/O port with 24 lines, or digital I/O expansion port controlling up to 192 external lines.
- **P3 –** 16-bit digital I/O port, counter inputs, timer outputs, and analog outputs.

The on-board scan sequencer lets you select up to 16384 channel/range combinations. The sequencer scans all channels of the scan at 5µs/channel, 10µs/channel, or 1000µs/channel.

100M-bit Ethernet allows analog and digital/counter input data, as well as analog and digital output data, to flow between the PC and the DaqBook/2001, or to the DaqOEM/2001.

DaqBook/2001 and DaqOEM/2001 each support a full complement of trigger modes including:

- **Hardware analog triggering** – A user-programmed trigger level sets an analog DAC, which is compared in hardware to the analog input level on the selected channel. Trigger latency is < 5 µs.
- **Digital and pattern triggering** – Each device has a separate digital trigger input line, allowing TTL-level triggering and latencies less than 5 µs. The trigger can be programmed for logic level or edge triggering. In pattern triggering, any of the digital input ports acts as the trigger port. You can program the digital pattern.
- **Software-based triggering** – The PC detects the trigger event from analog, digital, or counter readings. Six pre- and post-triggering modes are supported. Trigger latency is one scan period.

The four 16-bit, 100-kHz analog output channels have an output from -10 V to +10 V.

Other features of the DaqBook/2001 and DaqOEM/2001 include:

- **40 TTL-level digital I/O lines**. They are divided into three 8-bit ports and one 16-bit port.
- **Four 16-bit counters**. Each can accept frequency inputs up to 10 MHz. The counters can be cascaded into two 32-bit counters.
- **Two 16-bit timer outputs**. Each can generate square waves from 16 Hz to 1 MHz.
- **Configuration through software**. There are no switches or jumpers on the DaqBook/2001 or on the DaqOEM/2001.

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DaqBook/2005 & DaqOEM/2005

16 Analog Input via P1	**No DAC Channels**	**40 Digital I/O via P2 & P3**	**4 Counter In 2 Timer Out via P3**

Summary of DaqBook/2005 and DaqOEM/2005 Channels

DaqBook/2005 is a high-speed, multi-function, data acquisition module. DaqOEM/2005 is a board with the same functionality, but no chassis. Both devices feature a 16-bit, 200-kHz A/D converter, digital calibra-tion, 40 digital I/O lines, four counters, and two timers. Both connect to a PC or Ethernet network via a 10/100BaseT Ethernet port.

DaqBook/2005 and DaqOEM/2005 are identical to the DaqBook/2001 and DaqOEM/2001 previously described, with one exception: the /2005 devices have no analog output capability.

DaqBook/2020

14 Analog Input via P1	**4 Analog Output via BNC Connectors**	**24 Digital I/O via P2**	**4 Counter In 2 Timer Out via BNC Connectors**
16 Differential Voltage Inputs via BNC Connectors	Note: DaqBook/2020's Digital I/O is via the three 8-bit ports on P2. The device has no P3 connector. For this reason it has 24 Digital I/O channels available, not 40 as do the other devices.		
14 Thermocouple Inputs via Mini-TC Connectors			

Note: In addition to the BNC connectors indicated above, the DaqBook/2020 includes a BNC for External TTL Trigger input and one for External Clock input.

Summary of DaqBook/2020 Channels

DaqBook/2020 is a high-speed, multi-function, data acquisition module. It features a 16-bit, 200-kHz A/D converter, digital calibration, four 16-bit, 100-kHz D/A converters, 24 digital I/O lines, four counters, and two timers. It connects to a PC or Ethernet network via a 10/100BaseT Ethernet port.

Up to 470 channels of analog and digital I/O can be accessed with one DaqBook/2020. Up to 896 thermocouple channels can be accessed with the use of DBK90 and DBK100 expansion modules.

P1, P2, and BNC connectors provide access to all I/O signals. Port descriptions follow:

- **P1 –** Analog input port for14 single-ended analog inputs with 13 software programmable ranges (±10 V to ±156 mV full scale).
- **P2 –** General purpose digital I/O port with 24 lines, or digital I/O expansion port controlling up to 256 external lines.
- **BNCs –** DaqBook/2020 provides connection for 16 differential voltage inputs via BNC connectors. In addition, BNC connectors are present for: 4 Counter Inputs, two Timer Outputs, one External TTL Trigger Input, and one External Clock Input.
- **Mini-TC Connectors –** DaqBook/2020 provides connection for 14 thermocouple inputs via mini-TC connectors.

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DaqBook/2020's on-board scan sequencer lets you select up to 16384 channel/range combinations. The sequencer scans all channels of the scan at 5µs/channel, 10µs/channel, or 1000µs/channel.

100M-bit Ethernet allows analog and digital/counter input data, as well as analog and digital output data, to flow between the PC and the DaqBook/2020.

DaqBook/2020 supports a full complement of trigger modes including:

- **Hardware analog triggering** – A user-programmed trigger level sets an analog DAC, which is compared in hardware to the analog input level on the selected channel. Trigger latency is < 5 µs.
- **Digital and pattern triggering** – DaqBook/2020 includes a digital trigger input line, which allows TTL-level triggering and latencies less than 5 µs. The trigger can be programmed for logic level or edge triggering. In pattern triggering, any of the digital input ports acts as the trigger port. You can program the digital pattern.
- **Software-based triggering** – The PC detects the trigger event from analog, digital, or counter readings. Six pre- and post-triggering modes are supported.

The four 16-bit, 100-kHz analog output channels have an output from -10 V to +10 V.

Other features of the DaqBook/2020 include:

- **24 TTL-level digital I/O lines**. They are divided into three 8-bit digital I/O ports (on P2).
- **Four 16-bit counters**. Each can accept frequency inputs up to 10 MHz. The counters can be cascaded into two 32-bit counters.
- **Two 16-bit timer outputs**. Each can generate square waves from 16 Hz to 1 MHz.
- **Configuration through software**. There are no switches or jumpers on the DaqBook/2020.
- **16 differential voltage inputs** via BNC connectors.
- **14 thermocouple inputs** via mini-TC connectors.

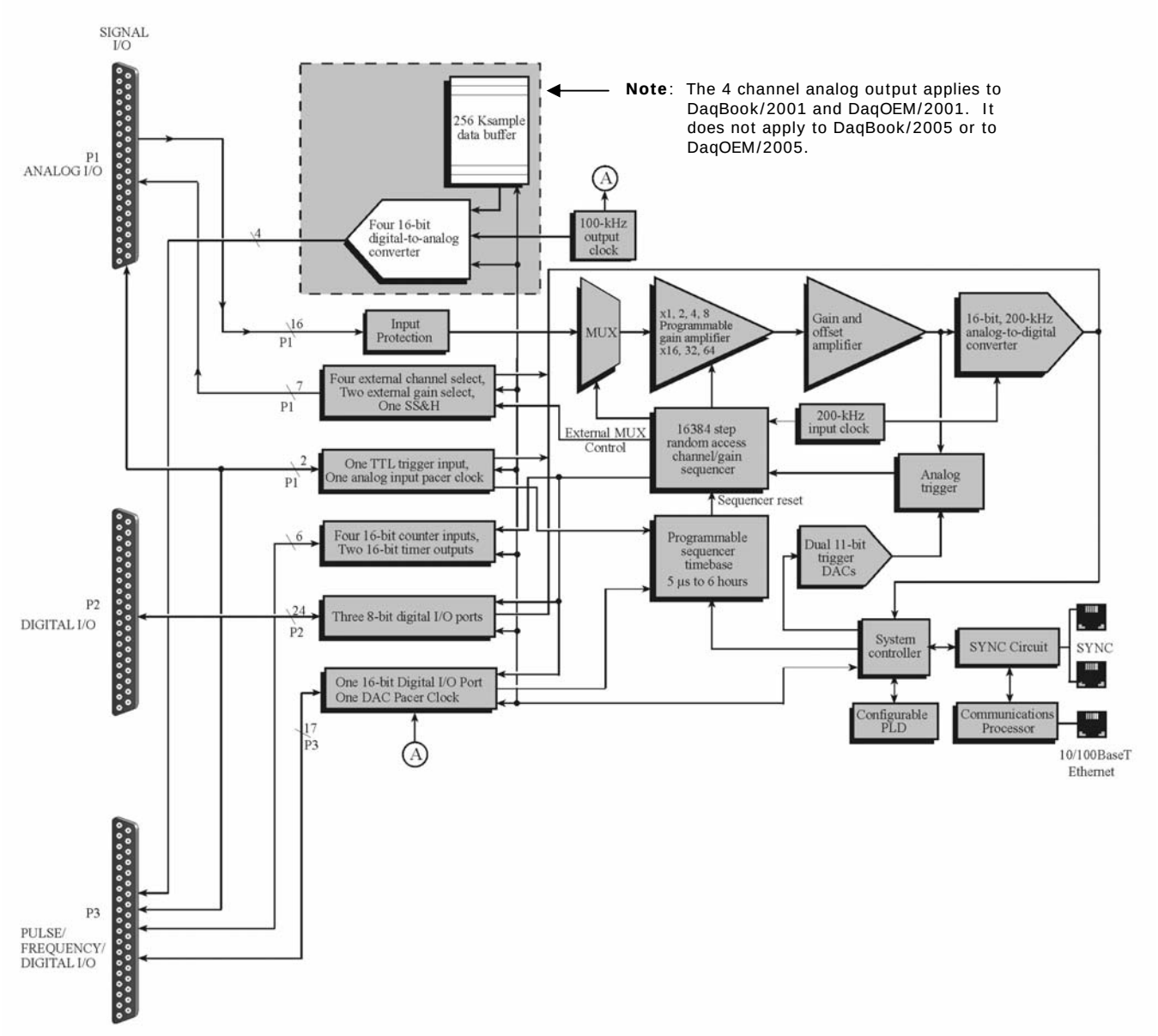
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DaqBook/2001, DaqOEM/2001, DaqBook/2005, & DaqOEM/2005 …… 3-1
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Detail "TC" (Thermocouple Input Circuitry) for DaqBook/2020 …… 3-3
Detail "V" (Differential Voltage Input Circuitry) for DaqBook/2020 …… 3-3

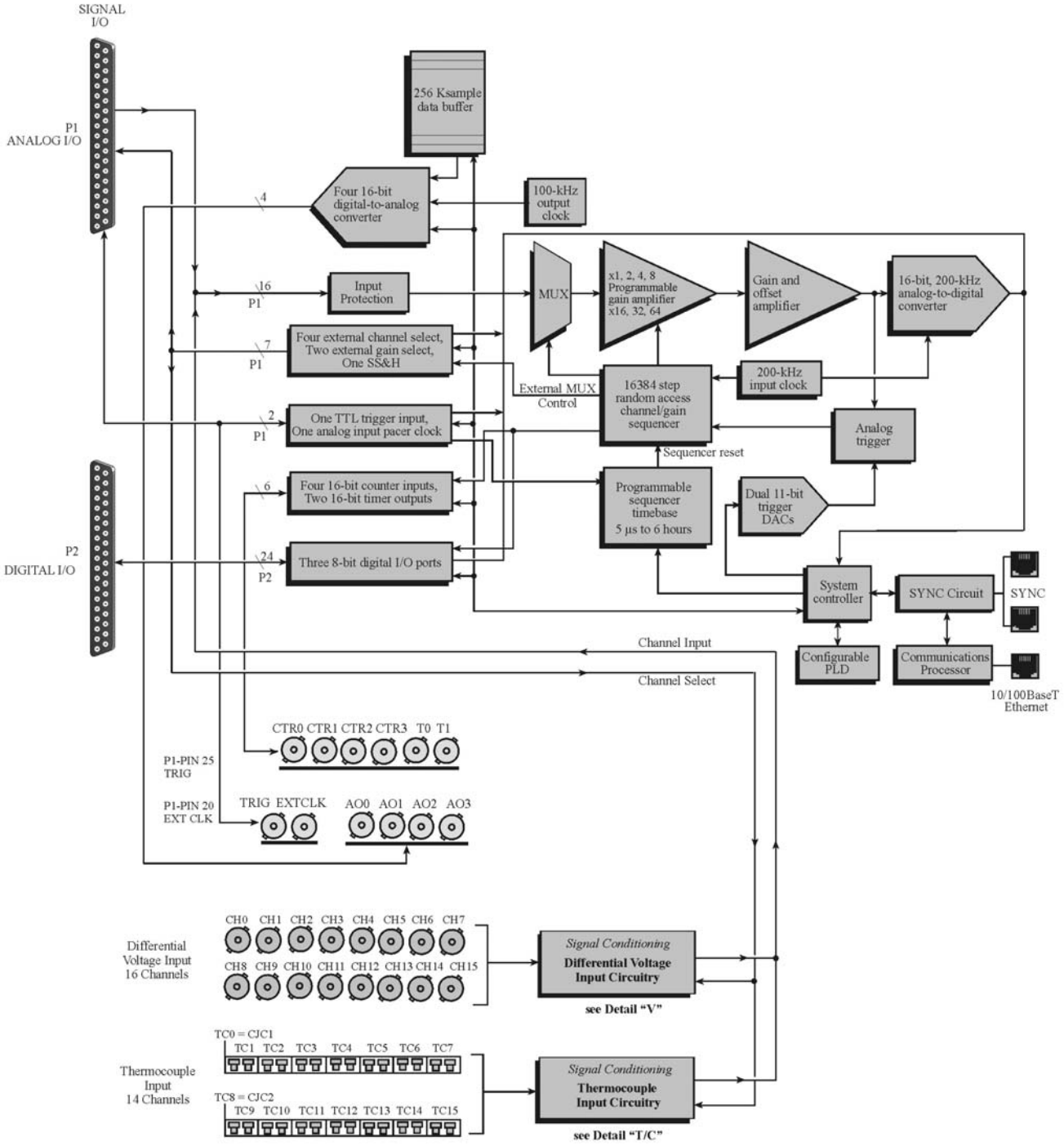
DaqBook/2001, DaqOEM/2001, DaqBook/2005, & DaqOEM/2005



Block Diagram for use with
DaqBook/2001, DaqOEM/2001, DaqBook/2005, & DaqOEM/2005

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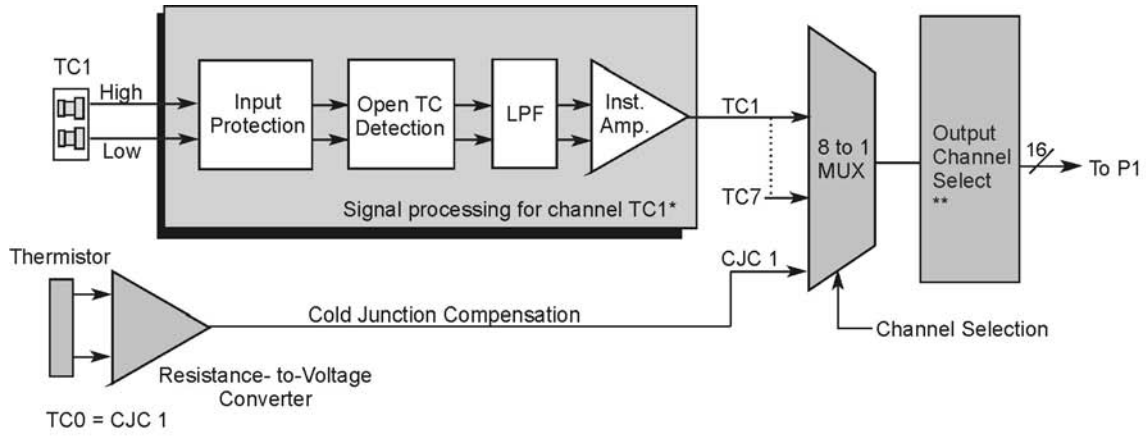
DaqBook/2020 Block Diagram



DaqBook/2020 Block Diagram

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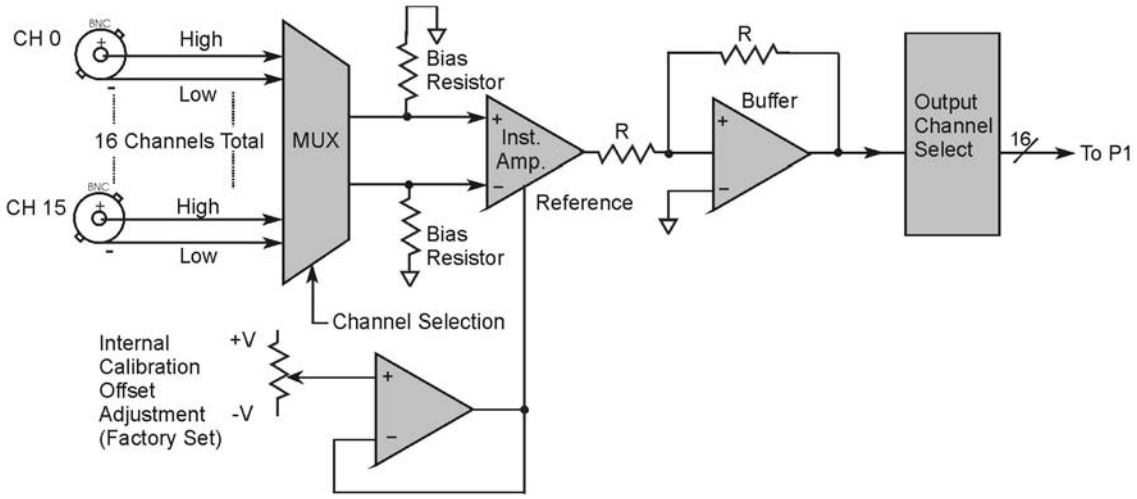
Detail “TC” (Thermocouple Input Circuitry) for DaqBook/2020



* The 14 thermocouple circuitry channels TC1 through TC7 and TC9 through TC15 each have their own signal processing block, which consists of Input Protection, Open Thermocouple Detection, a Low Pass Filter, and an Instrument Amplifier. Channels TC0 and TC8 are used for Cold Junction Compensation (CJC).

** A second “8 to 1 MUX” for channels TC9 through TC15 and CJC2 (TC8) connects to the Output Channel Select.

Detail “V” (Differential Voltage Input Circuitry) for DaqBook/2020



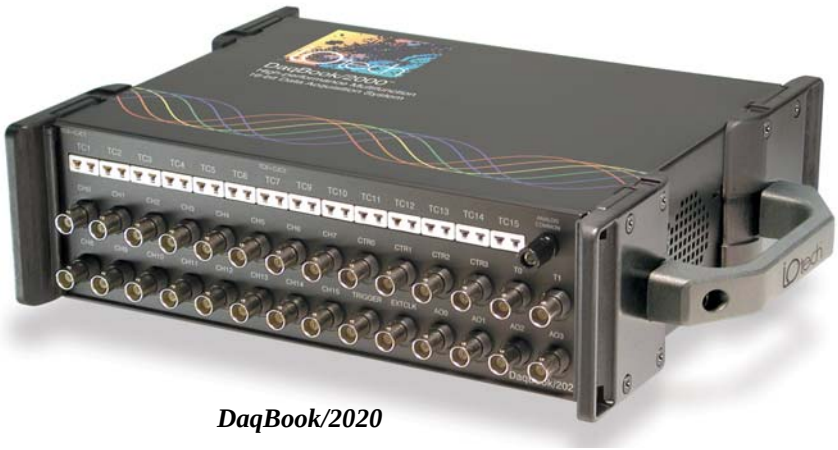
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DaqBook/2020 …… 4-1
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DaqBook/2020



DaqBook/2020

DaqBook/2020 provides for up to 256 channels of analog input expansion, 192 channels of digital expansion I/O, and 896 channels of thermocouple measurement via expansion with DBK90 and DBK100 modules.

Front Panel

The front panel is populated with an upper row of mini-TC connectors and two rows of BNC connectors. All connectors are clearly labeled on the device.

- **Thermocouple Inputs –** Mini TC connectors TC1 through TC7 and TC9 through TC15 provide a means of connecting up to 14 thermocouples in total. Note that TC0 and TC8 are for cold junction compensation.
- **Analog Common –** Ground jack used as a reference for differential measurements.
- **Differential Voltage Inputs** – 16 BNC connectors.
- **Analog Output** - 4 BNC connectors (AO0, AO1, AO2, and AO3).
- **Counters** – Four BNC connectors (CTR0, CTR1, CTR2, and CTR3) for 16-bit counter input signals.
- **Timers** – Two 16-bit Timer Output signals via BNC connectors (T0 and T1).
- **Trigger** – BNC for TTL triggering of an acquisition.
- **External Clock** – BNC for clocking each scan of an acquisition via an external clock.

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Rear Panel

The DaqBook/2020 rear panel contains P1 and P2 DB37 connectors, a MAC Address Label, DIN5 power connector, power switch, 2 Synchronization Ports, Ethernet Port, and 5 LEDs [2 of which are on the Ethernet connector].



DaqBook/2020, Rear Panel View

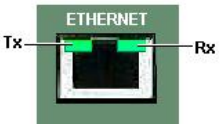
P1 - DB37 Connector: Analog input port for 14 single-ended analog inputs with 13 software programmable ranges (±10 V to ±156 mV full scale). The Analog Input signals enter through P1 go through a multiplexer (MUX) to PGA, to Gain & Offset Amplifier, then to Analog-to-Digital Converter (ADC).

P2 - DB37 Connector: General purpose digital I/O port with 24 lines, or digital I/O expansion port controlling up to 192 external lines.

MAC Address Label: The Media Access Control (MAC) label is located near the Ethernet connector. The label shows the device serial number in three formats: (1) Barcode, (2) base 10, and (3) hexadecimal. If prompted to enter a serial number in software, use the base 10 number. Conversion to a hexadecimal number for use in addressing will be automatic.

ETHERNET: The 10/100BaseT Ethernet port can connect to the Ethernet port of the host PC, or to an Ethernet network. Either of two Ethernet patch cables may be used to make the connection. CA-242 is a 1.5 foot cable. CA-242-7 is a 7-foot cable. Note that the Ethernet connector has two built in LEDs that indicate traffic flow. These are discussed with the three other Ethernet-related LEDs. Note that the Ethernet cable length must be <10m in order for the system to be CE Compliant.

LEDs: There are 5 ETHERNET Status LEDS. Two rectangular LEDs, Tx and Rx are built right into the frame of the Ethernet jack. The other three, located just to the right of the jack, are round and are labeled L, T, and D.



Tx and Rx LEDs

Tx – "ON" indicates traffic is being transmitted (see figure at right).
Rx – "ON" indicates that the port is receiving traffic.
L (Link) "ON" indicates a link exists. "OFF" indicates no link.
T (Transmit) "ON" indicates 100 M-Bits, "OFF" indicates 10 M-Bits.
D (Duplex) "ON" indicates full duplex, which allows simultaneous two-way data traffic. "OFF" indicates half-duplex, which only allows one-way data traffic at any given time.

SYNC (Qty of 2) – Two "synchronization ports" provide a means of synchronizing up to four DaqBook/2000 Series units in regard to post-trigger scanning. The ports accept CA-74-1 and CA-74-5 RJ-11, 6-conductor type cables. Total combined cable length is not to exceed 15 feet (4.57 m).

POWER Switch: A rocker-type switch with a "0" label for Power Off, and a "1" for Power On.

POWER IN: +10 to +30 VDC, through a socket type DIN5 connector on the chassis. Power is typically supplied from a TR40U power adapter.

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DaqBook/2001 and DaqBook/2005

DaqBook/2001 and /2005 provide for up to 256 channels of analog input expansion. They have 40 built-in digital I/O channels, but can be expanded up to 272 channels.



DaqBook/2001
The lower unit is showing the rear panel.

The DaqBook/2001 and /2005 rear panels are identical. Each contains a P1, P2, and P3 DB37 connector, a MAC Address Label, DIN5 power connector, power switch, 2 Synchronization Ports, Ethernet Port, and 5 LEDs [2 of which are on the Ethernet connector].

P1 - DB37 Connector: Analog input port for 16 single-ended analog inputs or 8 differential, programmable on a per-channel basis as single-ended or differential and as uni-polar or bipolar. The 13 programmable ranges are from ±10 V to ±156 mV full scale.

P2 - DB37 Connector: General purpose digital I/O port with 24 (3 x 8-bit) lines on P2, or digital I/O expansion port controlling up to 272 external lines. Programmable as input or output.

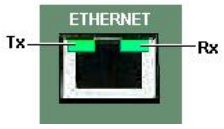
P3 - DB37 Connector: 16-bit digital I/O port with 4 counter inputs and 2 timer outputs. In addition, DaqBook/2001 has P3 connection to 4 analog outputs (DAC0, DA1, DAC2, and DAC3)..

MAC Address Label: The Media Access Control (MAC) label is located near the Ethernet connector. The label shows the device serial number in three formats: (1) Barcode, (2) base 10, and (3) hexadecimal. If prompted to enter a serial number in software, use the base 10 number. Conversion to a hexadecimal number for use in addressing will be automatic.

ETHERNET: The 10/100BaseT Ethernet port can connect to the Ethernet port of the host PC, or to an Ethernet network. Either of two Ethernet patch cables may be used to make the connection. CA-242 is a 1.5 foot cable. CA-242-7 is a 7-foot cable. Note that the Ethernet connector has two built in LEDs that indicate traffic flow. These are discussed with the three other Ethernet-related LEDs. Note that the Ethernet cable length must be <10m in order for the system to be CE Compliant.

LEDs: There are 5 ETHERNET Status LEDS. Two rectangular LEDs, Tx and Rx are built right into the frame of the Ethernet jack. The other three, located just to the right of the jack, are round and are labeled L, T, and D.

Tx – "ON" indicates traffic is being transmitted (see figure at right).
Rx – "ON" indicates that the port is receiving traffic.
L (Link) "ON" indicates a link exists. "OFF" indicates no link.
T (Transmit) "ON" indicates 100 M-Bits, "OFF" indicates 10 M-Bits.
D (Duplex) "ON" indicates full duplex, which allows simultaneous two-way data traffic. "OFF" indicates half-duplex, which only allows one-way data traffic at any given time.



Tx and Rx LEDs

SYNC (Qty of 2) – Two "synchronization ports" provide a means of synchronizing up to four DaqBook/2000 Series units in regard to post-trigger scanning. The ports accept CA-74-1 and CA-74-5 RJ-11, 6-conductor type cables. Total combined cable length is not to exceed 15 feet (4.57 m).

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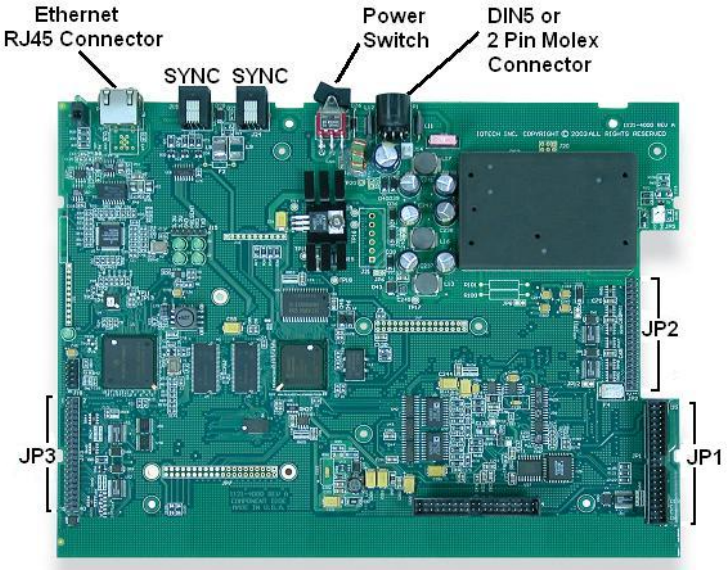
POWER Switch: A rocker-type switch with a "0" label for Power Off, and a "1" for Power On.

POWER IN: +10 to +30 VDC, through a socket type DIN5 connector on the chassis. Power is typically supplied from a TR40U power adapter.

DaqOEM/2001 and DaqOEM/2005

The DaqOEM/2000 Series boards include all the analog, digital, and frequency I/O functionality that is found in their DaqBook/2000 Series counterparts.

The DaqOEM/2000 Series boards are each powered by user-supplied +10 to +30 VDC input at 15W via a DIN5 or 2-pin Molex connector. An optional AC/DC converter (TR-40U) can be used to supply the proper DC voltage from a standard 110 to 250 VAC source.



DaqOEM/2000 Series Board

All input and output signals for the DaqOEM/2000 Series boards are accessed via three 40-pin headers designated JP1, JP2, and JP3. Optional cables (p/n CA-248) are available for converting the 40-pin headers to male DB37 connectors.

- **JP1 – 40 pin header**. Analog input port for16 single-ended or 8 differential analog inputs with 13 software programmable ranges (±10 V to ±156 mV full scale).
- **JP2 – 40 pin header**. General purpose digital I/O port with 24 lines, or digital I/O expansion port controlling up to 192 external lines.
- **JP3 – 40 pin header**. 16-bit digital I/O port, 4 counter inputs, and 2 timer outputs.

  In addition, for DaqOEM/2001 JP3 connects to 4 on-board analog outputs (DAC0, DAC1, DAC2, and DAC3). DaqOEM/2005 has no on-board DACs.
- **TC Expansion –** each device is expandable up to 896 TC inputs via use of DBK90 or DBK100 options.
- **Analog Expansion –** each device is expandable up to 256 analog input channels while maintaining a 200 kHz scan rate.

In regard to specifications, for DaqOEM/2001 refer to DaqBook/2001 specifications. For DaqOEM/2005 refer to DaqBook/2005 specifications.

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Cables

Should you need help in regard to cables or have any other product inquiries please contact the factory.

Cables for use with DaqBook/2000 Series Devices		
	Description	**Part No.**
1.	Molded expansion cable. Connects a DBK module to a DaqBook, 2 in.	CA-255-2T
2.	Molded expansion cable. Connects a DBK module to a DaqBook, 4 in.	CA-255-4T
3.	DBK expansion cable. Connects a DBK module to a DaqBook, 2.5 in.	CA-37-1T
4.	DBK expansion cable. Connects a DBK module to a DaqBook, 4.5 in.	CA-37-3T
5.	Expansion-card cable. Connects DBK series expansion card options. The "x" in the part no. indicates the number of cards that can be connected via the cable.	CA-37-x
6.	SYNC cable, RJ-11, 6 conductor, 1 ft.	CA-74-1
7.	SYNC cable, RJ-11, 6 conductor, 5 ft.	CA-74-5
8.	Ethernet patch cable, shielded, 18 in.	CA-242
9.	Ethernet patch cable, shielded, 7 ft.	CA-242-7
10.	Power Cable, 5-pin male DIN to 5-pin male DIN; provides convenient connection between DaqBook power input connectors and battery packs. 6 in.	CA-115
11.	Power Cable, 5-pin male DIN to vehicle cigarette lighter, 8 ft.	CA-116

Cables for use with DaqOEM/2000 Series Boards		
	Description	**Part No.**
1.	SYNC cable, RJ-11, 6 conductor, 1 ft.	CA-74-1
2.	SYNC cable, RJ-11, 6 conductor, 5 ft.	CA-74-5
3.	Power Cable, 5-pin DIN to vehicle cigarette lighter, 8 ft.	CA-116
4.	Ethernet patch cable, shielded, 18 in.	CA-242
5.	Ethernet patch cable, shielded, 7 ft.	CA-242-7
6.	Ribbon cable, 40-pin header to 37-pin DSUB [DB37 connector], 9 in.	CA-248



The total combined length of the SYNC cables is not to exceed 15 feet (4.57 m).

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Pinouts

P1 and JP1 – Analog I/O …… 4-8
P2 and JP2 – Digital I/O …… 4-9
P3 and JP3 – Pulse/Frequency/Digital I/O (Does not apply to DaqBook/2020E)…… 4-10

CAUTION



Turn off power to all devices connected to the system before connecting cables or setting configuration jumpers and switches. Electrical shock or damage to equipment can result even under low-voltage conditions.

CAUTION



The discharge of static electricity can damage some electronic components. Semiconductor devices are especially susceptible to ESD damage. You should always handle components carefully, and you should never touch connector pins or circuit components unless you are following ESD guidelines in an appropriate ESD controlled area. Such guidelines include the use of properly grounded mats and wrist straps, ESD bags and cartons, and related procedures.

DaqBook/2001 and DaqBook/2005 each have three 37-pin connectors designated as P1, P2 and P3.

DaqOEM/2001 and DaqOEM/2005 have no DB37 connectors. Instead, these boards make use of three 40-pin headers designated as JP1, JP2, and JP3. A CA-248 ribbon cable can be used to obtain a DB37 connector for a 40-pin header. The cables are 9 inches long.

Signal assignment to connectors is as follows.

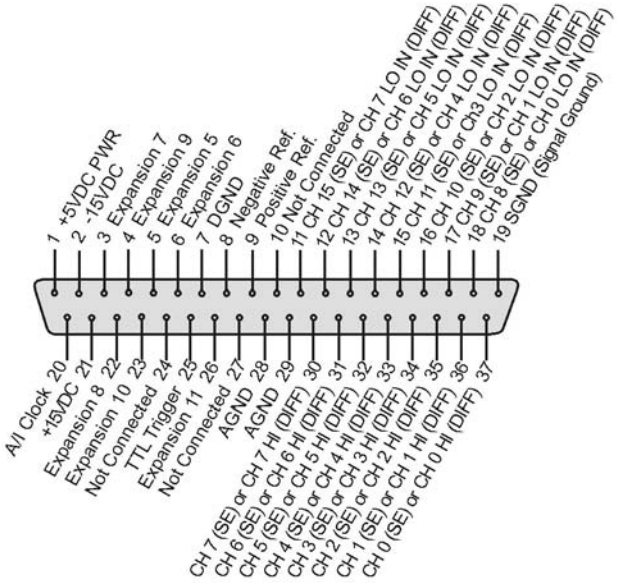
- P1 and JP1 are used for Analog I/O
- P2 and JP2 are used for Digital I/O
- P3 and JP3 are used for Pulse/Frequency and Digital I/O

DaqBook/2020 has a P1 and P2 connector, but no P3. It does, however, have BNC connectors that are directly related to certain P3 signals. The upcoming P3 pinout indicates when a signal applies to a BNC connector on the DaqBook/2020.

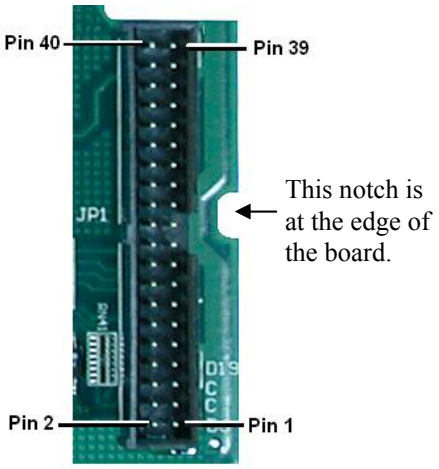
To connect a DBK option to a DaqBook connect a CA-37-x cable to the appropriate DB37 connector [P1, P2, or P3] on the DaqBook and connect the free end of the cable to the DBK card or module. If you are not familiar with DBK options, or need refreshed, review the *DBK Basics* section of the *DBK Options User's Manual* (p/n 457-0905); then review information regarding specific DBKs, as applicable. A PDF version of the DBK manual is included on your data acquisition CD.

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P1, DB37 Connector for DaqBook/2000 Series Devices



JP1, 40-pin header for DaqOEM/2000 Series Boards

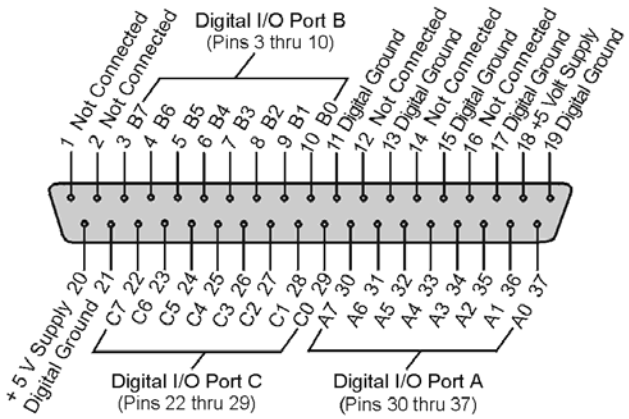


P1 Pin	Signal Name	Description	JP1 Pins
1	+5 Volts	Expansion +5 V power	1
2	-15 Volts	Expansion -15 VDC power	3
3	Expansion 7	Digital OUT, external ADDRESS select bit 3	5
4	Expansion 9	Digital OUT, external ADDRESS select bit 1	7
5	Expansion 5	Digital OUT, external GAIN select bit 1	9
6	Expansion 6	Digital OUT, external GAIN select bit 0	11
7	DGND	Digital Ground	13
8	Negative Reference	Analog, -5 V reference	15
9	Positive Reference	Analog +5V reference	17
10	Not Connected	N/A	19
11	CH 15 (SE), or CH 7 LO DIFF	Ch 15 HI IN (single-ended mode) / Ch 7 LO IN (differential mode)	21
12	CH 14 (SE), or CH 6 LO DIFF	Ch 14 HI IN (single-ended mode) / Ch 6 LO IN (differential mode)	23
13	CH 13 (SE), or CH 5 LO DIFF	Ch 13 HI IN (single-ended mode) / Ch 5 LO IN (differential mode)	25
14	CH 12 (SE), or CH 4 LO DIFF	Ch 12 HI IN (single-ended mode) / Ch 4 LO IN (differential mode)	27
15	CH 11 (SE), or CH 3 LO DIFF	Ch 11 HI IN (single-ended mode) / Ch 3 LO IN (differential mode)	29
16	CH 10 (SE), or CH 2 LO DIFF	Ch 10 HI IN (single-ended mode) / Ch 2 LO IN (differential mode)	31
17	CH 9 (SE), or CH 1 LO DIFF	Ch 9 HI IN (single-ended mode) / Ch 1 LO IN (differential mode)	33
18	CH 8 (SE), or CH 0 LO DIFF	Ch 8 HI IN (single-ended mode) / Ch 0 LO IN (differential mode)	35
19	Signal Ground (SGND)	Sense Common (SGND)	37
20	A/I Clock**	External ADC Pacer Clock Input / Internal ADC Pacer Clock Output	2
21	+15 Volts	Expansion +15 V power	4
22	Expansion 8	Digital OUT, external ADDRESS select bit 2	6
23	Expansion 10	Digital OUT, external ADDRESS select bit 0	8
24	Not Connected	N/A	10
25	TTL Trigger**	Digital IN, External TTL Trigger Input	12
26	Expansion 11	Digital OUT, Simultaneous sample and hold (SSH)	14
27	Not Connected	N/A	16
28	AGND	Analog Ground	18
29	AGND	Analog Ground	20
30	CH 7 (SE), or CH 7 HI DIFF	Ch 7 IN (single-ended mode) / Ch 7 HI IN (differential mode)	22
31	CH 6 (SE), or CH 6 HI DIFF	Ch 6 IN (single-ended mode) / Ch 6 HI IN (differential mode)	24
32	CH 5 (SE), or CH 5 HI DIFF	Ch 5 IN (single-ended mode) / Ch 5 HI IN (differential mode)	26
33	CH 4 (SE), or CH 4 HI DIFF	Ch 4 IN (single-ended mode) / Ch 4 HI IN (differential mode)	28
34	CH 3 (SE), or CH 3 HI DIFF	Ch 3 IN (single-ended mode) / Ch 3 HI IN (differential mode)	30
35	CH 2 (SE), or CH 2 HI DIFF	Ch 2 IN (single-ended mode) / Ch 2 HI IN (differential mode)	32
36	CH 1 (SE), or CH 1 HI DIFF	Ch 1 IN (single-ended mode) / Ch 1 HI IN (differential mode)	34
37	CH 0 (SE), or CH 0 HI DIFF	Ch 0 IN (single-ended mode) / Ch 0 HI IN (differential mode)	36
--	AGND	Analog Ground	38
--	AGND	Analog Ground	39
--	AGND	Analog Ground	40

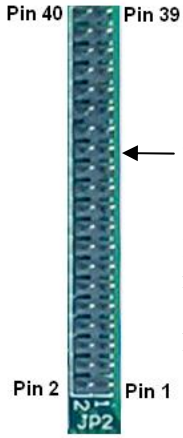
** In addition to P1 pin 20 and pin 25, DaqBook/2020 has an “EXTCLOCK” BNC and a “TRIGGER” BNC.

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P2, DB37 Connector for DaqBook/2000 Series Devices



JP2, 40-pin header for DaqOEM/2000 Series boards.



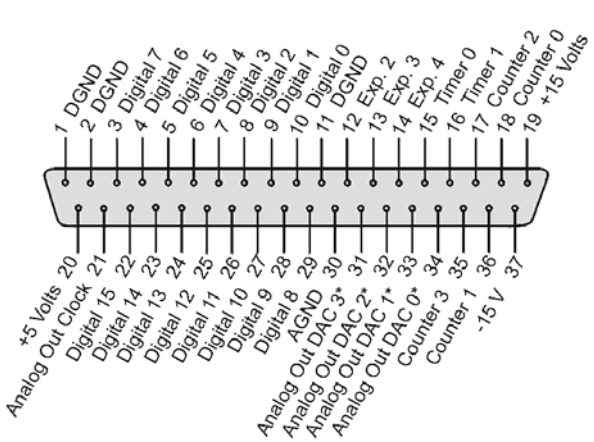
This side is the outer edge of the board.

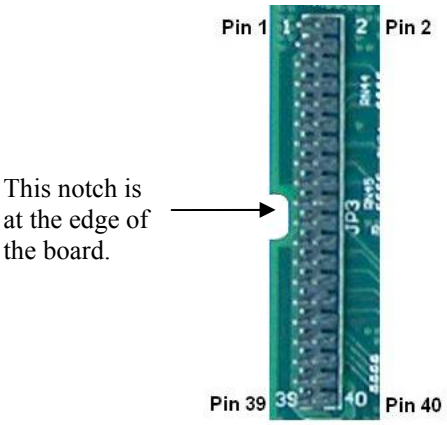
In regard to orientation, note that JP1 would appear just below this JP2 header.

P2 Pin	Signal Name	Description	JP2 Pin
1	Not Connected	N/A	1
2	Not Connected	N/A	3
3	Port B - B7	Digital I/O: P2 Digital Port B, Bit 7; or, P2 Expansion Address Bit 0 Out	5
4	Port B - B6	Digital I/O: P2 Digital Port B, Bit 6; or, P2 Expansion Address Bit 1 Out	7
5	Port B - B5	Digital I/O: P2 Digital Port B, Bit 5; or, P2 Expansion Address Bit 2 Out	9
6	Port B - B4	Digital I/O: P2 Digital Port B, Bit 4; or, P2 Expansion Address Bit 3 Out	11
7	Port B - B3	Digital I/O: P2 Digital Port B, Bit 3; or, P2 Expansion Address Bit 4 Out	13
8	Port B - B2	Digital I/O: P2 Digital Port B, Bit 2; or, P2 Expansion RESET Output	15
9	Port B - B1	Digital I/O: P2 Digital Port B, Bit 1; or, P2 Expansion WRITE Output	17
10	Port B - B0	Digital I/O: P2 Digital Port B, Bit 0; or, P2 Expansion READ Output	19
11	DGND	Digital Ground	21
12	Not Connected	N/A	23
13	DGND	Digital Ground	25
14	Not Connected	N/A	27
15	DGND	Digital Ground	29
16	Not Connected	N/A	31
17	DGND	Digital Ground	33
18	+ 5 Volt Supply	Expansion +5 Volt Power	35
19	DGND	Digital Ground	37
20	+ 5 Volt Supply	Expansion +5 Volt Power	2
21	DGND	Digital Ground	4
22	Port C - C7	Digital I/O: P2 Digital Port C, Bit 7; or, P2 Expansion Data Bit 7	6
23	Port C - C6	Digital I/O: P2 Digital Port C, Bit 6; or, P2 Expansion Data Bit 6	8
24	Port C - C5	Digital I/O: P2 Digital Port C, Bit 5; or, P2 Expansion Data Bit 5	10
25	Port C - C4	Digital I/O: P2 Digital Port C, Bit 4; or, P2 Expansion Data Bit 4	12
26	Port C - C3	Digital I/O: P2 Digital Port C, Bit 3; or, P2 Expansion Data Bit 3	14
27	Port C - C2	Digital I/O: P2 Digital Port C, Bit 2; or, P2 Expansion Data Bit 2	16
28	Port C - C1	Digital I/O: P2 Digital Port C, Bit 1; or, P2 Expansion Data Bit 1	18
29	Port C - C0	Digital I/O: P2 Digital Port C, Bit 0; or, P2 Expansion Data Bit 0	20
30	Port A - A7	Digital I/O: P2 Digital Port A, Bit 7	22
31	Port A - A6	Digital I/O: P2 Digital Port A, Bit 6	24
32	Port A - A5	Digital I/O: P2 Digital Port A, Bit 5	26
33	Port A - A4	Digital I/O: P2 Digital Port A, Bit 4	28
34	Port A - A3	Digital I/O: P2 Digital Port A, Bit 3	30
35	Port A - A2	Digital I/O: P2 Digital Port A, Bit 2	32
36	Port A - A1	Digital I/O: P2 Digital Port A, Bit 1	34
37	Port A - A0	Digital I/O: P2 Digital Port A, Bit 0	36
---	DGND	Digital Ground	38
---	DGND	Digital Ground	39
---	DGND	Digital Ground	40

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JP3, 40-pin header for DaqOEM/2000 Series boards.





P3 Pin	Signal Name	Description	JP3 Pin	BNC /2020 Correlation
1	DGND	Digital Ground	1	--
2	DGND	Digital Ground	3	--
3	Digital 7	P3 Digital Port Bit 7	5	--
4	Digital 6	P3 Digital Port Bit 6	7	--
5	Digital 5	P3 Digital Port Bit 5	9	--
6	Digital 4	P3 Digital Port Bit 4	11	--
7	Digital 3	P3 Digital Port Bit 3	13	--
8	Digital 2	P3 Digital Port Bit 2	15	--
9	Digital 1	P3 Digital Port Bit 1	17	--
10	Digital 0	P3 Digital Port Bit 0	19	--
11	DGND	Digital Ground	21	--
12	Expansion 2	Reserved for XC/D-	23	--
13	Expansion 3	Reserved for XWR-	25	--
14	Expansion 4	Reserved for XRD-	27	--
15	Timer 0	P3 Timer 0 Output	29	BNC on 2020
16	Timer 1	P3 Timer 1 Output	31	BNC on 2020
17	Counter 2	P3 Counter 2 Input	33	BNC on 2020
18	Counter 0	P3 Counter 0 Input	35	BNC on 2020
19	+ 15 Volts	Expansion, +15 VDC	37	--
20	+ 5 Volt Supply	Expansion, +5 Volt Power	2	--
21	Analog Out Clock	External DAC Pacer Clock Input/Internal DAC Pacer Clock Output	4	--
22	Digital 15	Digital I/O; P3 Digital Port Bit 15	6	--
23	Digital 14	Digital I/O; P3 Digital Port Bit 14	8	--
24	Digital 13	P3 Digital Port Bit 13	10	--
25	Digital 12	P3 Digital Port Bit 12	12	--
26	Digital 11	P3 Digital Port Bit 11	14	--
27	Digital 10	P3 Digital Port Bit 10	16	--
28	Digital 9	P3 Digital Port Bit 9	18	--
29	Digital 8	P3 Digital Port Bit 8	20	--
30	AGND	Analog Ground	22	--
31	Analog Out DAC 3	Analog DAC 3 Output See note 1.	24	BNC on 2020
32	Analog Out DAC 2	Analog DAC 2 Output See note 1.	26	BNC on 2020
33	Analog Out DAC 1	Analog DAC 1 Output See note 1.	28	BNC on 2020
34	Analog Out DAC 0	Analog DAC 0 Output See note 1.	30	BNC on 2020
35	Counter 3	P3 Counter 3 Input	32	BNC on 2020
36	Counter 1	P3 Counter 1 Input	34	BNC on 2020
37	- 15 Volts	Expansion, - 15 VDC Power	36	--
---	DGND	Digital Ground	38	--
---	Reserved	Reserved for future use.	39	--
---	Reserved	Reserved for future use.	40	--

Note 1: Pins 31, 32, 33, and 34 connect to DAC0, DAC1, DAC2, and DAC3 for DaqBook/2001 and DaqOEM/2001. DaqBook/2020 connects to the four DACs via BNC connectors. DaqBook/2005 and DaqOEM/2005 have no DACs.

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Software 5

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Out-of-the-Box™ Software …… 5-1
Drivers for Third-party, Icon-driven Software …… 5-2
Language Drivers …… 5-2

Overview

The Daq devices have software options capable of handling most applications. Three types of software are available:

- *Out-of the-box* graphical programs, e.g., DaqView, DaqViewXL, and post acquisition data analysis programs such as eZ-PostView, eZ-TimeView, and eZ-FrequencyView.
- drivers for third-party, icon-driven software such as DASYLab and LabVIEW.
- various language drivers to aid custom programming using API; includes DaqCOM™ ActiveX/COM support.

Out-of-theBox™ Software

Out-of-the-Box programs are convenient for fill-in-the-blank applications that do not require programming for basic data acquisition and display:

- **DaqView** is a Windows-based program for basic set-up and data acquisition. DaqView lets you select desired channels, gains, transducer types (including thermocouples), and a host of other parameters with a click of a PC's mouse. DaqView lets you stream data to disk and display data in numerical or graphical formats.
- **DaqViewXL** allows you to interface directly with Microsoft Excel to enhance data handling and display. Within Excel you have a full-featured Daq control panel and all the data display capabilities of Excel.
- **eZ-PostView** provides a simple method of graphically viewing acquired waveforms from the DaqBook Device. Up to 8 windows can be displayed on one screen, with up to 16 channels overlaid on each window. eZ-PostView makes it simple to visually inspect acquired waveforms from multiple channels within seconds of acquiring the data. Documentation, in Adobe PDF format, is provided on the CD. Refer to the *PostAcquisition Analysis.PDF*.
- **eZ-TimeView & eZ-FrequencyView**
  eZ-TimeView and eZ-FrequencyView are optional post-acquisition analysis packages, which are related to eZ-PostView, but include more features. 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. Documentation, in Adobe PDF format, is provided on the CD. Refer to the *PostAcquisition Analysis.PDF*.
- The **Daq Configuration control panel** allows for interface configuration, testing, and troubleshooting.

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Reference Notes:

- The software document modules, *DaqView*, *DaqViewXL*, and *Post Acquisition Data Analysis User's Guide*, are not included as part of the hardcopy manual, but are available in PDF version. See the PDF Note, below.
- Programming topics are covered in the *Programmer's User Manual* (1008-0901). As a part of product support, this manual is automatically loaded onto your hard drive during software installation. The default location is the Programs directory, which can be accessed through the Windows Desktop.

PDF Note: During software installation, Adobe® PDF versions of user manuals will automatically install onto your hard drive as a part of product support. The default location is in the **Programs** group, which can be accessed from the *Windows Desktop*. Refer to the PDF documentation for details regarding both hardware and software.

Note that the PDF documents can be read directly from the CD by using the <**View PDFs**> button located on the opening install screen.

A copy of the Adobe Acrobat Reader® is included on your CD. The Reader provides a means of reading and printing the PDF documents. Note that hardcopy versions of the manuals can be ordered from the factory.

Drivers for Third-party, Icon-driven Software

LabVIEW® Support
We provide LabVIEW® support for expansion and signal conditioning modules. Our data acquisition VIs for LabVIEW are more than just simple hardware access VIs, they are complete with engineering data conversion, data display and logging capabilities.

DASYLab®
If your application requirements go beyond the scope of DaqView, you may want to consider DASYLab software, as the latter offers a greater degree of flexibility and customizing.

Language Drivers

Each Daq system comes with an Application Programming Interface (API). API-language drivers include: C/C++, and Visual Basic. The latest software is a 32-bit version API.

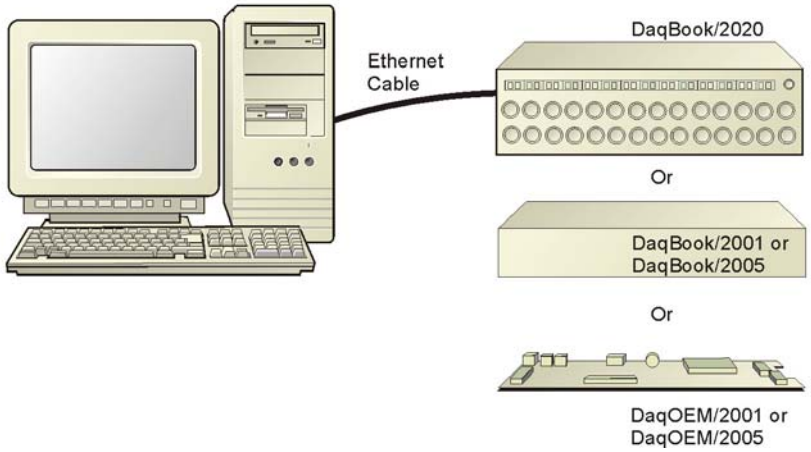
DaqBook/2000 Series devices are supplied with DaqX Subroutine API Libraries. These provide complete support for all of the functionality available on each data acquisition device in Visual Basic®, and C/C++. In addition, DaqX is supported under all versions of Windows®. Over 100 program examples are included with DaqX Subroutine API Libraries. API documentation is provided in a *Programmer's Manual* (p/n 1008-0901), which is included on the installation CD.

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++, and J++. In addition, DaqCOM supports the new Windows.NET architecture and includes examples for VisualBasic.NET and C++. Support for VisualStudio.NET is accomplished via the COMInterop feature within VisualStudio.NET.

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Configuring the System for Operation 6

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Connecting a DaqBook/2000 Series Device to the Ethernet

The DaqBook/2000 and DaqOEM/2000 Series devices connect directly to an Ethernet port on a PC or network hub via a built-in 10/100BaseT Ethernet interface. An Ethernet patch cable CA-242 (1.5 foot) or CA-242-7 (7 foot) cable is used to make the connection.



Contact the factory or your service representative in regard to Ethernet connectivity if your operating system is other than Windows NT, Windows 2000, or Windows XP.

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CAUTION



Turn off power to the system devices and externally connected equipment before connecting cables. Electric shock or damage to equipment can result even under low-voltage conditions.



Take ESD precautions (packaging, proper handling, grounded wrist strap, etc.)



Reference Note: Adobe PDF versions of user manuals will automatically install onto your hard drive as a part of product support. The default location is in the **Programs** group, which can be accessed from the *Windows Desktop*. You can also access documents directly from the data acquisition CD via the <View PDFs> button located on the CD's opening screen.

Minimum System Requirements

PC system with Pentium® Processor

Windows Operating System
RAM as follows

32 Mbytes of RAM for Windows NT
64 Mbytes of RAM for Windows 2000
64 Mbytes of RAM for Windows XP

STEP 1 – Install the Software

1. Remove previous version Daq drivers, if present. You can do this through Microsoft's *Add/Remove Programs* feature.
2. Place the Data Acquisition CD into the CD-ROM drive. Wait for PC to auto-run the CD. This may take a few moments, depending on your PC. If the CD does not auto-run, use the Desktop's *Start/Run/Browse* feature to locate and run **Setup.exe** [from the applicable CD-ROM drive].
3. After the intro-screen appears, follow the screen prompts.

STEP 2 – Determine the type of Network Connection

To properly connect and configure the device you must determine the type of network it will become part of. This is because the type of network used has a direct bearing on the IP address of the device.

Briefly, the four network types are as follows:

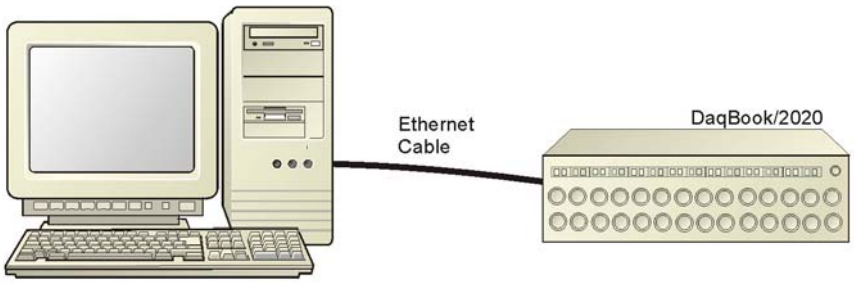
- **Dedicated Network - with a direct cable connection from the PC to the device**
- **Dedicated Network - making use of a network hub or switch**
- **LAN with a DHCP server**
  (Local Area Network with a Dynamic Host Configuration Protocol)
- **LAN without a DHCP server**
  (Local Area Network with no Dynamic Host Configuration Protocol)

Brief descriptions and illustrations follow.

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Dedicated Network - with a direct cable connection from the PC to the device

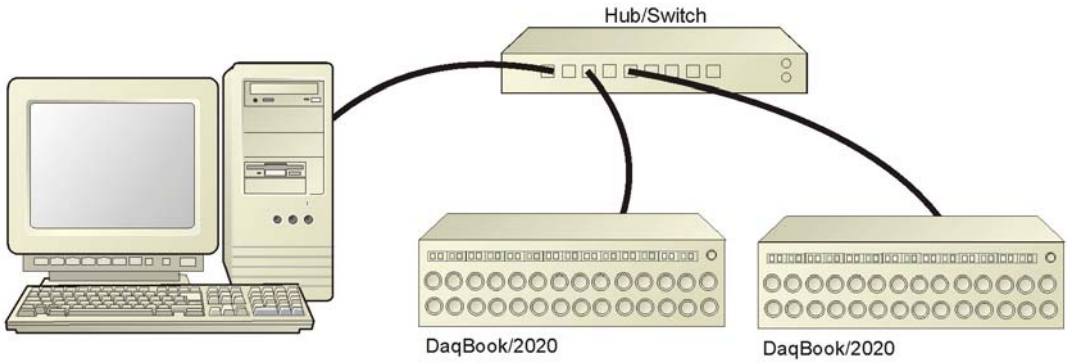
In this scenario a DaqBook/2020 is connected directly to an Ethernet jack on a host computer. The following figure could just as easily portray a DaqBook/2001, DaqBook/2005, DaqOEM/2001, or DaqOEM/2005 connected to the host PC via Ethernet cable.



Dedicated Network using a Direct Cable Connection

Dedicated Network - making use of a network hub or switch

In the following figure a DaqBook/2020 is connected to the Ethernet through a network hub/switch. At least one computer is also connected to the hub. The other DaqBook/2000 Series and DaqOEM/2000 Series devices can be connected directly to the hub/switch in the same manner.



Dedicated Network using a Hub/Switch

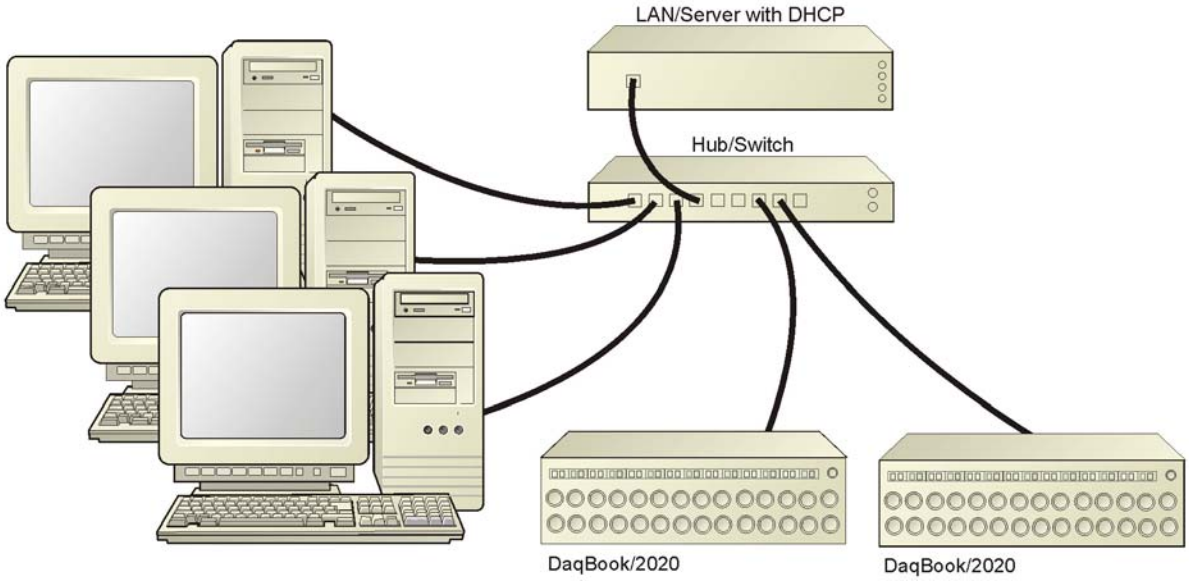


Some network devices such as a *wireless access point* may act as a DHCP server. If this is the case, follow the instructions for the LAN with a DHCP server. For detailed information consult the documentation that is specific to your network device.

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LAN with a DHCP Server (Local Area Network with a Dynamic Host Configuration Protocol server)

Many corporations use the LAN/Server with DHCP arrangement for their networks. In this type of setup several computers are typically connected to a network that makes use of a DHCP server. In addition, the primary data acquisition device, e.g., DaqBook/2020, is connected to the network hub/switch.



LAN with a DHCP Server

Notes:

- Using a DaqBook/2020, DaqBook/2001, DaqBook/2005, DaqOEM/2001, or DaqOEM/2005 on a typical LAN may affect the speed of the network and internet data transfer. Because of this we recommend adding a network card to the computer and using one of the two dedicated network configurations.
- Contact your network administrator before connecting a DaqBook/2020, DaqBook/2001, DaqBook/2005, DaqOEM/2001, or DaqOEM/2005 to a corporate network.

LAN with no DHCP Server

(Local Area Network with no Dynamic Host Configuration Protocol server)

This scenario looks the same as that shown in the previous illustration, except there is no Dynamic Host Configuration Protocol (DHCP). In this type of setup, one or more computers are connected to a network; and each computer has a static IP address.

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STEP 3 – Connect the System Components



Reference Note:
For information regarding connections, refer to Chapter 4, *Connectors, Indicators, Cables, & Pinouts*.

What you will need to connect a DaqBook/2000 or DaqOEM/2000 Series device to the Ethernet:

- An available connection to the Ethernet. The connection can be either
  - an Ethernet jack on a computer or
  - an Ethernet jack on a hub that is connected to the Ethernet.
- An Ethernet patch cable, e.g., a CA-242 (1.5 foot cable) or a CA-242-7 (7-foot cable).

1. Connect the Ethernet cable to the Ethernet jack on the DaqBook/2000 or DaqOEM/2000 Series device, as applicable.
2. Connect the other end of the Ethernet cable to the Ethernet jack on the host computer or network hub.

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STEP 4 – Power-up the System

What you will need:

A power supply with a range of +10 VDC to +30 VDC.
The power supply needs to have a male DIN5 connector.

Note: The switching-mode power supply that is commonly used with these systems has an input range of 100 VAC to 240 VAC at 50 Hz to 60 Hz. The power supply's output [to the device] is typically 15 VDC @ 2.7 amps via a DIN5 connector.

Note: Various AC adapter models support power grids of USA, Europe, Japan, and Asia.



Reference Note: It is possible to use a VDC power source other than the commonly used switching-mode power supply, often referred to as an adapter. However, be sure to consult the power-related sections of *DBK Basics* before doing so. The *DBK Basics* segment immediately follows chapter 1 of this user's manual.



Reference Note:
Refer to the power-related sections of *DBK Basics* before powering up a system. The *DBK Basics* section is located near the end of this user's manual.

How to make the connection:

In the following steps we use the term "Daq Device" to mean a DaqBook/2020, DaqBook/2001, DaqBook/2005, DaqOEM/2001, or a DaqOEM/2005, as applicable to your system.

1. Using the unit's power switch, turn the Daq device "OFF." The switch will be in the "0" position and the power LED will be unlit.
2. Connect the DIN5 end of the adapter's cable to the power in connector on the Daq device.
3. Connect the adapter's plug to a standard AC outlet.
4. If your adapter has a power switch, position it to "ON."
5. Turn ON the Daq device by placing the power switch to the "1" position. The power led will light up.

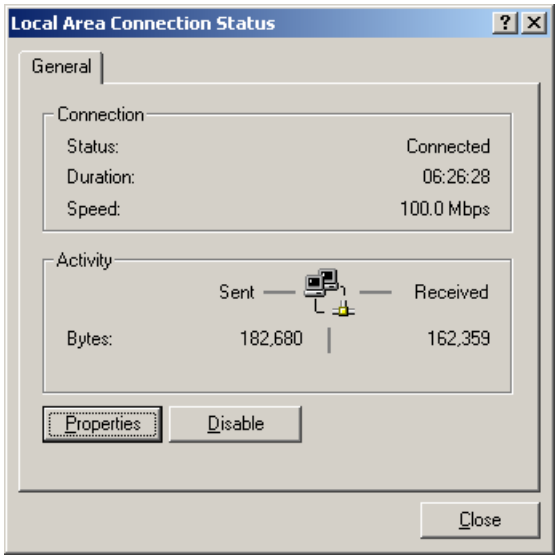
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STEP 5 – Configure the Computer's Network Settings [Applies to "dedicated networks" only]

If using a LAN (Local Area Network), <u>which has a DHCP server</u>, skip this section and continue with *STEP 7 - Configure and Test the System using the Daq*Configuration Applet* (page 6-11).

If using a LAN (Local Area Network), <u>which has no DHCP server</u>, skip this section and continue with *STEP 6 - Configure Device Network Settings using DaqIPConfig* (page 6-10).

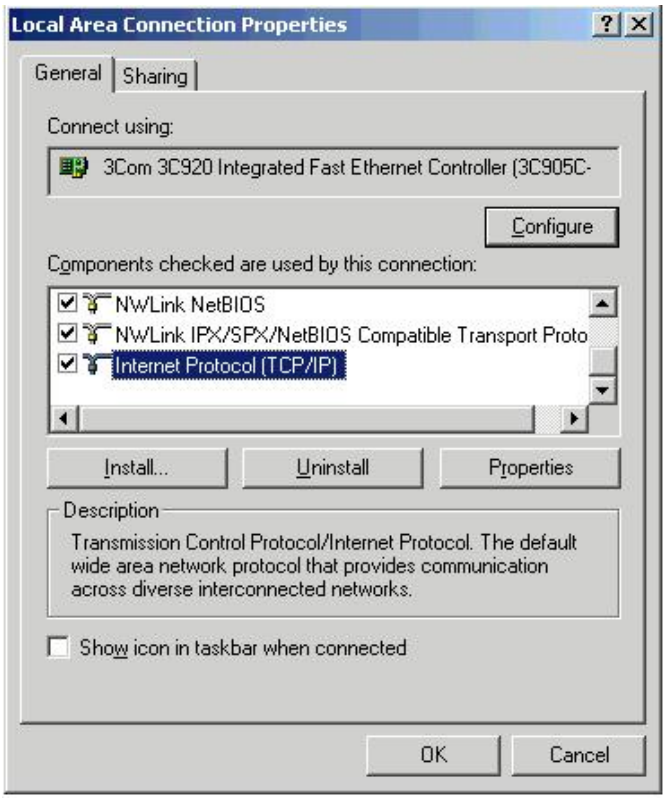
1. Open the Control Panel by navigating from the Windows Desktop as follows:
   Start Menu ⇒ Settings ⇒ Control Panel.
2. Double-click the "Network and Dial-up Connections" icon.
3. Double-click the "Network Connection" icon for the network that the DaqBook device is connected to.



Local Area Connection Status

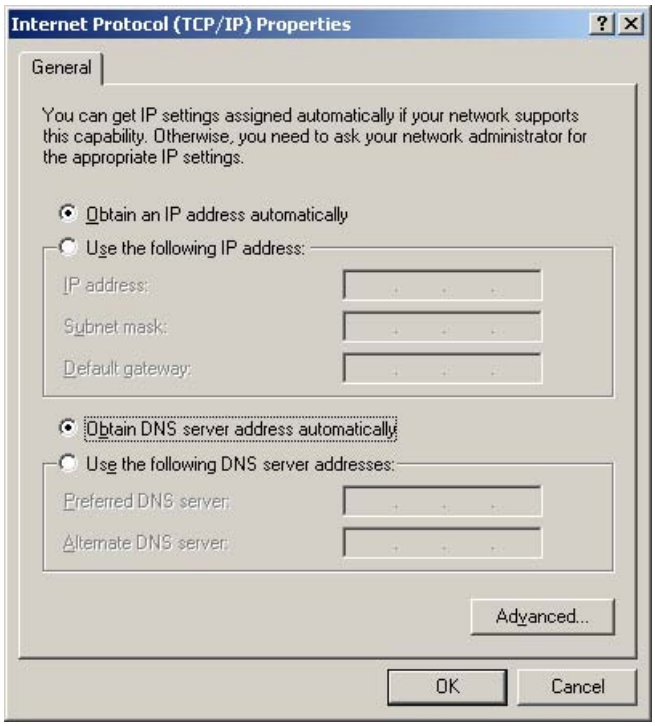
4. In the "Local Area Connection Status" box (previous figure), click on the <**Properties**> button. The "Local Area Connection Properties" box will appear (following figure).

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Local Area Connection Properties

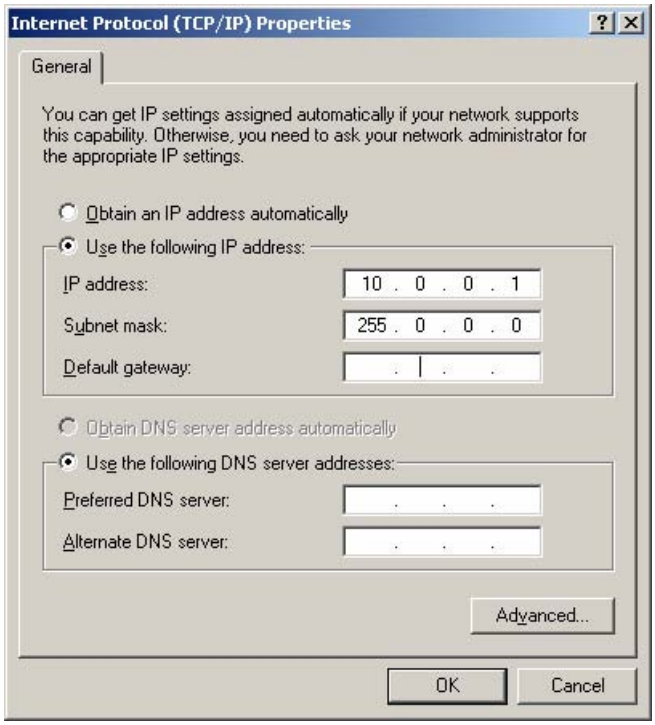
5. Double-click the “Internet Protocol (TCP/IP)” component (previous figure). The “Internet Protocol (TCP/IP) Properties” box will appear (following figure).



Internet Protocol (TCP/IP) Properties

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Configure the Computer's TCP/IP settings as follows.



Internet Protocol (TCP/IP) Properties

6. Select the "Use the following IP Address" radio button.
7. Set the IP address field to 10.0.0.x where x is some number from 1 to 255.



Make sure that each computer on the dedicated network has a unique IP address.

8. Set the Subnet mask to 255.0.0.0. Note that the remaining fields can be left unchanged.

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STEP 6 – Configure Device Network Settings using DaqIPConfig

Applies only to a LAN (Local Area Network), which has a no DHCP server.

If using a LAN (Local Area Network), which has a DHCP server, skip this section and continue with *STEP 7 - Configure and Test the System using the Daq*Configuration Applet* (page 6-11).

The *DaqIPConfig* applet, designed for 32-bit Windows NT/2000/XP systems. *DaqIPConfig* allows you to change the IP address of a device to match the address of a host computer. The applet is located in the program group for the associated device and can be accessed from the Windows Desktop via the start menu.

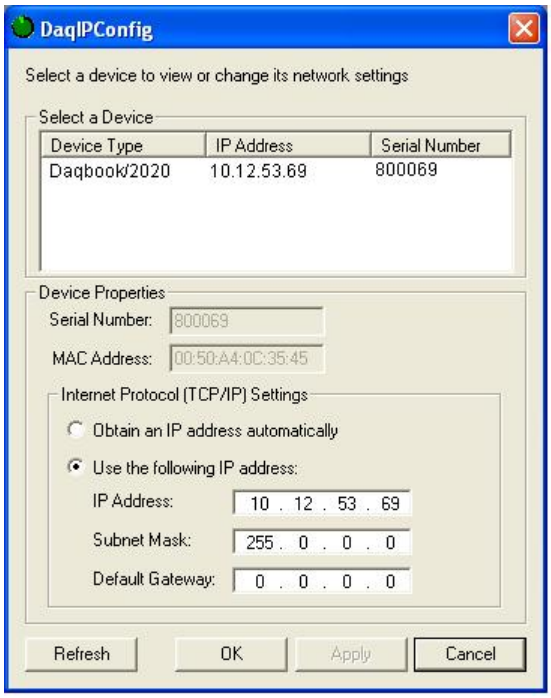
1. Locate the DaqIPConfig Applet.

Locate the DaqIPConfig applet by navigating from the Windows' Desktop as follows:

Start Menu ⇒ Programs ⇒ IOtech DaqX Software ⇒ DaqIPConfig

2. Open the DaqIPConfig Applet.

Click on the DaqIPConfig selection to open the applet.



DaqIPConfig

3. Select the device that is to have the address change.

Note: In the above figure there is only one device to select, i.e., DaqBook/2020.

4. Set the internet protocol (TCP/IP) settings to be compatible with host computer.

(a) Select the radio button labeled "Use the following IP address."

(b) Enter the new internet protocol settings. If needed, consult your network administrator for acceptable numbers.

(c) Click the <OK> button.

5. Reboot the device.

The new IP address will not take affect until the device has been powered-off, then powered back on.

6. Repeat steps 3, 4, and 5 for other devices in the system.

After configuring the network settings for all devices, proceed to Step 7.

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STEP 7 – Configure and test the System using the Daq* Configuration Applet

The *Daq* Configuration* applet, designed for 32-bit Windows NT/2000/XP systems, is located in the Windows *Control Panel*. It allows you to add or remove a device and change configuration settings. The included test utility provides feedback on the validity of current configuration settings, as well as performance summaries.

1. Open the Daq* Configuration Applet.

a. Open the Control Panel by navigating from the Windows' Desktop as follows:
Start Menu ⇒ Settings ⇒ Control Panel

b. From the Control Panel, double-click the ***Daq* Configuration*** icon.

2. Add the first-level device to the list of installed devices.

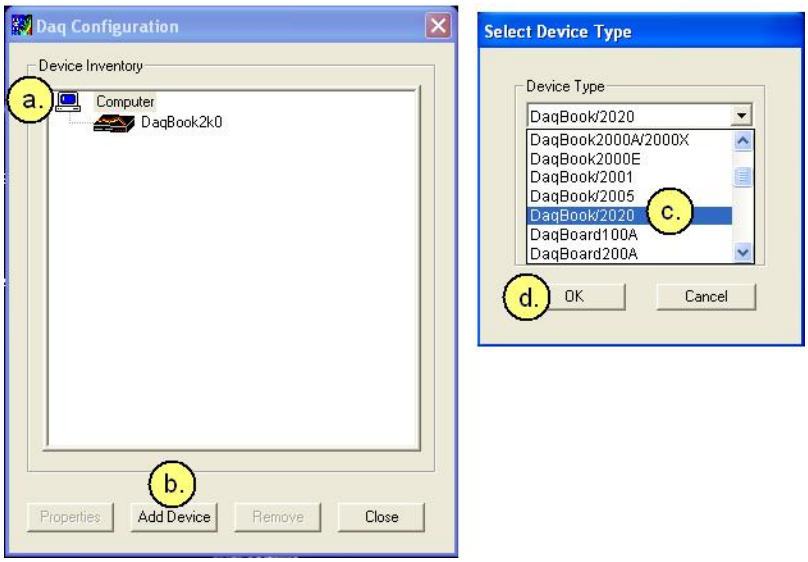
The first-level device is the device that will be connected directly to the Ethernet, via a host computer's Ethernet jack or a jack on a network hub. The DaqBook/2020 is an example of a first-level device.

a. Select the Computer image in the Device Inventory configuration tree (following figure).

b. Click the <**Add Device**> button. The "Select Device Type" box will appear.

c. Select the DaqBook/2020 from the list of devices.

d. Click the <**OK**> button. The "Properties" box will appear for the selected device.



Using Daq* Configuration Device Inventory & Select Device Type to Add a Device

Note: Although the above figure indicates that a DaqBook/2020 was selected as the first level device, we could similarly have selected another device, i.e., a DaqBook/2001 or a DaqBook/2005.



If your device is a DaqOEM/2001 or a DaqOEM/2005 you will select DaqBook/2001 or DaqBook/2005, respectively. This is because the DaqOEM/2000 Series boards are electronically and functionally identical to their DaqBook/2000 Series counterparts.

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3. *Set the properties of the first-level device.*

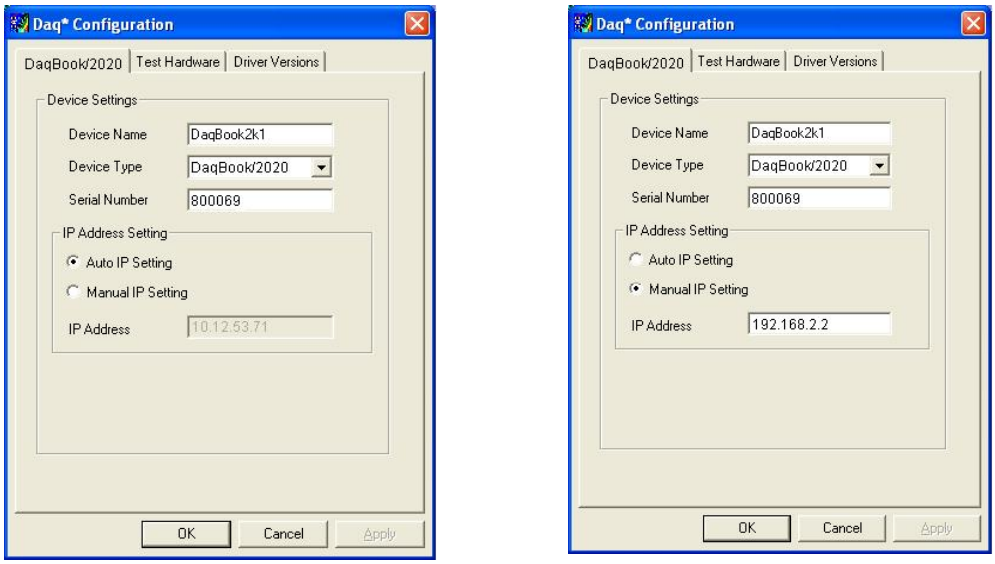
In this step you will set the device properties according to one of the following two methods, depending on whether you have a "Dedicated Network" or a "LAN with DHCP Server Network." Illustrations of the network types are provided on page 6-3.

Users of Dedicated Networks follow these 2 steps.

a. Enter the **Serial Number** of the first-level device, e.g., DaqBook/2020. In the following screen shots the Serial Number is 800069.

b. Select the "**Auto IP Setting**" radio button. Note that the IP Address of the DaqBook/2020 will automatically be calculated and displayed in the IP Address field as indicated in the following left-hand figure.

c. Click the <**OK**> button.



For DEDICATED Networks **For LAN with DHCP Server Networks**

Daq* Configuration, Properties Dialog Boxes

Note: The above images are based on DaqBook/2020. We could similarly have selected another device.

Users of LAN with DHCP Server Networks follow these 3 steps.

The *DaqIPConfig* applet provides the Serial Number and the IP Address of the device. Users of LAN with DHCP Server Networks will need to enter both numbers in the *Daq* Configuration, Properties* dialog boxes (previous right-hand figure). Page 6-10 includes instructions for accessing *DaqIPConfig*.

If needed, refer to the upper right-hand figure in regard to radio-button and data entry locations.

a. Enter the base 10 version of the **Serial Number** of the device, e.g., DaqBook/2020.

b. Select the "**Manual IP Setting**" radio button.

c. In the **IP Address** field, enter the IP address.

d. Click the <**OK**> button.



- **Provide your network administrator with the information located on the device's MAC label.**
- **Find out from the administrator if the IP Address will be changing. If so, see if you can obtain a permanent IP Address that will be dedicated specifically to your device.**

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4. Test the system connections.

a. Make sure the device has been properly installed and is powered-on.

b. Make sure all cables are properly and securely connected.

c. Click the "**Test Hardware**" tab.

d. Click the <**TCP/IP Test**> button. This tests the Transmission Control Protocol / Internet Protocol. The TCP/IP test has two components: *Pinging Device and TCP Connection*.

The **Pinging Device** test is an ICMP (Internet Control Message Protocol) ping test. In addition to indicating either "Passed" or "Failed," the test displays the round-trip time of the ping, for example, <10 ms; and Packet Loss expressed as a percent of data lost.

A long ping round trip time, for example, >50 ms and/or any packet loss indicates a slow network that is not optimized.

If the Pinging Device Test *fails* a <**Details**> button will appear just above the <**Resource Test**> button. If this is the case, click the <**Details**> button to obtain possible causes and possible solutions.

The result of the **TCP (Transmission Control Protocol)** test will be either *passed* or *failed*. If the TCP test *failed* a <**Details**> button will appear just above the <**Resource Test**> button. If this is the case, click the <**Details**> button to obtain possible causes and possible solutions.

e. Upon completion of the TCP/IP test, click the <**Resource Test**> button. The Resource Test consists of two components: *Resource Tests* and *Performance Tests*.

The **Resource Test** performs a quick communications check. If the host PC can communicate with the device a message that the test *passed* is displayed.

The **Performance Tests** obtain quantitative results using the current configuration of the acquisition device. The test results represent the maximum rates at which various operations can be performed, and will vary according to port hardware capabilities.

The ADC FIFO Input Speed part of the test results in a display of the maximum rate at which data can be transferred from the tested device's internal ADC FIFO to computer memory. Results are given in samples/second, where a sample (2 bytes in length) represents a single A/D value.



When testing a DaqBook/2000 or a DaqOEM/2000 Series device, if the unit does not respond within 30 seconds perform the following steps:

1) **reboot the system**
2) **upon power-up, re-open the *Daq* Configuration* applet**
3) **select another configuration setting**
4) **reinitiate the test**

This completes the procedure for connecting a DaqBook/2020, DaqBook/2001, DaqBook/2005, DaqOEM/2001, or DaqOEM/2005 to the Ethernet.

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Reference Notes:
Depending on your application and system setup, related information can be found in the following sources:

- The *DBK Options Manual* (p/n 457-0905).
- The *Programmer's Manual*, (p/n 1008-0901).

Note: You can access PDF documents directly from the opening screen of the data acquisition CD via the <**View PDFs**> button.

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CE Compliance & Noise Considerations 7

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CE Standards and Directives …… 7-1
Safety Conditions ……7-2
Emissions/Immunity Conditions ……7-2
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CE Compliance for System Expansion …… 7-3
Noise Considerations …… 7-4

Overview

CE-compliant products bear the "CE" mark and include a *Declaration of Conformity* stating the particular specifications and conditions that apply. The test records and supporting documentation that validate the compliance are kept on file at the factory.

The European Union established CE standards in 1985. The standards include specifications for safety, EMI emissions, and immunity from electromagnetic interference. Products that are intended for placement in the European Union must meet or exceed the standards and bear the "CE" mark.

Although not required in the USA, meeting or exceeding the CE standards is considered good engineering practice, since doing so enhances safety while reducing noise and ESD problems.

In contracted and in-house testing, most Daq products met the required specifications. In many cases, products that were not originally in compliance were redesigned accordingly. In noted instances, alternate product versions, shield plates, edge guards, special connectors, or add-on kits are required to meet CE compliance.

CE Standards and Directives

The electromagnetic compatibility (EMC) directives specify two basic requirements:

1. The device must not interfere with radio or telecommunications.
2. The device must be immune from electromagnetic interference from RF transmitters, etc.

The standards are published in the *Official Journal of European Union* under direction of CENELEC (European Committee for Electrotechnical Standardization). The specific standards relevant to Daq equipment are listed on the product's *Declaration of Conformity*.

The safety standard that applies to Daq products is EN 61010-1:1993 (*Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements*). Environmental conditions include the following:

- indoor use
- altitude up to 2000 m
- temperature 5°C to 40°C (41°F to 104°F)
- maximum relative humidity 80% for temperatures up to 31°C (87.8°F) decreasing linearly to 50% relative humidity at 40°C (104°F)
- mains supply voltage fluctuations not to exceed ±10% of the nominal voltage
- other supply voltage fluctuations as stated by the manufacturer
- transient overvoltage according to installation categories (overvoltage categories) I, II and III For mains supply, the minimum and normal category is II
- pollution degree I or II in accordance with IEC 664

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For clarification, terms used in some Declarations of Conformity include:

- **pollution degree**: any addition of foreign matter, solid, liquid or gaseous (ionized gases) that may produce a reduction of dielectric strength or surface resistivity. **Pollution Degree I** has no influence on safety and implies: the equipment is at operating temperature with non-condensing humidity conditions; no conductive particles are permitted in the atmosphere; warm-up time is sufficient to avert any condensation or frost; no hazardous voltages are applied until completion of the warm-up period. **Pollution Degree II** implies the expectation of occasional condensation.
- **overvoltage (installation) category**: classification with limits for transient overvoltage, dependent on the nominal line voltage to earth. **Category I** implies signals without high transient values. **Category II** applies to typical mains power lines with some transients.

Safety Conditions

Users must comply with all relevant safety conditions in the user's manual and the Declarations of Conformity. This manual and Daq hardware make use of the following Warning and Caution symbols: If you see either of these symbols on a product, carefully read the related information and be alert to the possibility of personal injury.



This warning symbol is used in this manual or on the equipment to warn of possible injury or death from electrical shock under noted conditions.



This warning/caution symbol is used to warn of possible personal injury or equipment damage under noted conditions.

Daq products contain no user-serviceable parts; refer all service to qualified personnel. The specific safety conditions for CE compliance vary by product; but general safety conditions include:

- The operator must observe all safety cautions and operating conditions specified in the documentation for all hardware used.
- The host computer and all connected equipment must be CE compliant.
- All power must be off to the device and externally connected equipment before internal access to the device is permitted.
- Isolation voltage ratings: do not exceed documented voltage limits for power and signal inputs. All wire insulation and terminal blocks in the system must be rated for the isolation voltage in use. Voltages above 30 Vrms or ±60 VDC must not be applied if any condensation has formed on the device.
- Current and power use must not exceed specifications. Do not defeat fuses or other over-current protection.

Emissions/Immunity Conditions

The specific immunity conditions for CE compliance vary by product; but general immunity conditions include:

- Cables must be shielded, braid-type with metal-shelled connectors. Input terminal connections are to be made with shielded wire. The shield should be connected to the chassis ground with the hardware provided.
- The host computer must be properly grounded.
- In low-level analog applications, some inaccuracy is to be expected when I/O leads are exposed to RF fields or transients over 3 or 10 V/m as noted on the Declaration of Conformity.

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CE Enhancements for DBKs

The following CE enhancements are detailed in the *DBK Cards and Modules User's Manual* (p/n 457-0905).

- DBK41/CE
- Edge Guard (for DBK5, DBK8, and DBK44)
- Applicable cables and connectors

CE Compliance for System Expansion

The DaqBook/2000 and DaqOEM/2000 Series devices are CE compliant at the time they leave the factory, and will remain in compliance providing that the conditions stated on their respective *Declaration of Conformity* cards continue to be met.

You may want to expand your data acquisition system while having it retain its "CE Compliant" status. If so, refer to the most recent *Declaration of Conformity* for each device, prior to making any efforts to expand the system.



Connecting a *non-CE Compliant* DBK module or card to your system will make the system non-compliant.

In order to remain CE Compliant, DaqBook/2020, DaqBook/2001, and DaqBook/2005 require the use of ferrite inductive collars and a ground line, which are included in an Ethernet CE Kit. Installation instructions for the kit follow this chapter.

General rules of thumb regarding expansion, while remaining CE Compliant, are:

- Review the most recent *Declaration of Conformity* for each device.
- Use short cables.
- When possible, use shielded cables.
- When assembling or disassembling components, take ESD precautions, including the use of grounded wrist straps.
- Ensure that the host computer is CE Compliant.
- Ensure that expansion devices are CE Compliant
- Ensure all system components are properly grounded.

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Noise Considerations

Controlling electrical noise is imperative because it can present problems even with the best measurement equipment. Most laboratory and industrial environments suffer from multiple sources of electrical noise. For example, AC power lines, heavy equipment (particularly if turned on and off frequently), local radio stations, and electronic equipment can create noise in a multitude of frequency ranges.

Local radio stations are a source of high frequency noise, while computers and other electronic equipment can create noise in all frequency ranges. Creating a completely noise-free environment for test and measurement is seldom practical. Fortunately, simple techniques such as using shielded/twisted pair wires, filtering, and differential voltage measurement are available for controlling the noise in our measurements. Some techniques prevent noise from entering the system; other techniques remove noise from the signal.

While many techniques for controlling noise in signals provide a means of removing the noise that is already present, the preferred solution is to prevent the occurrence of noise in the signal in the first place.

The following practices, some of which are required for CE compliance, should be employed to minimize noise.

- **Make a solid earth ground connection**. *Required for CE Compliance*. Ensure that the chassis of the primary data acquisition device, e.g., DaqBook/2020 is connected to earth ground. This practice: (a) keeps radiated emissions low by keeping the chassis electrically quiet, (b) keeps potential common-mode voltages low, (c) improves user safety, and (d) provides a safe path for Electrostatic Discharge energy back to earth ground.

- **Use short Ethernet cables**. The use of short Ethernet cables will reduce noise. The shorter the cable the better.

- **Use shielded cables**. Loose wires are effective antennae for radio frequency pickup and can form loops for inductive pickup. The use of properly connected shields will greatly reduce such noise.

- **Minimize ambient EMI**. The lower the ambient EMI, the better. Sources of electromagnetic interference include solenoids, motors, computer equipment, high power distribution wiring, etc.

- **Distance cables**. Power supply switch transients can vary in strength and frequency. Ethernet cables can radiate digital switching noise. For these reasons route the power supply and Ethernet cables such that they are as far as possible from all analog lines. The analog lines include those that connect to P1 on the front panel, as well as those that connect to the rear panel via an expansion port, or through the P4 connector.

- **Use ferrite inductive collars**. A clamp-on ferrite collar can be secured at each end of the Ethernet cable and at both ends of the power supply cable. The collars on the Ethernet cable will reduce digital switching noise. Note that the collars will not reduce the integrity of the Ethernet channel if the system is making use of shielded Ethernet cables, part number CA-242. Ferrite collars on the power cable will reduce the effects of power transients.



This partial view of the host PC shows the Ethernet cable with a ferrite collar. The PC's connection to the ground-line is also visible.



This partial view of a data acquisition device shows its connection to the ground-line. It also shows two ferrite collars, the foremost of which is clamped to the power cable. The background collar is clamped onto the Ethernet cable.

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Introduction

The Ethernet CE Kit includes three ferrite clamp-on inductive collars to reduce EMI. It also includes a ground-line for safety. The kit is simple to install and consists of the following components.

- **3 Ferrite Inductive Collars with Tie-wrap**, p/n L-8-1
- **1 Ground-Line**, p/n CA-250
- **4 Washers**, #8 External Tooth, p/n WA-5 – used to lock screws (2 washers per screw)
- **1 Screw, #8-32x1/4** Phillips Pan-head, p/n HA-154-4 – used to secure the ground-line to a threaded splice-plate hole on the data acquisition device
- **1 Screw, #6-32x5/16** Phillips Pan-head, p/n HA-2-5 – used to secure the ground-line to the PC

Connect the Ground Line

This ground line connection procedure is *only required* if you are <u>not</u> using a shielded Ethernet cable [e.g., MCC's CA-242] connected to an earth-grounded PC.

CAUTION

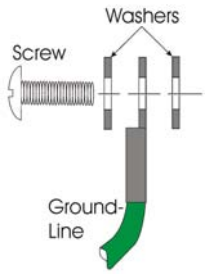
Use care when connecting the ground line to the acquisition device and the PC. The use of screws which are too long can cause damage to circuitry.

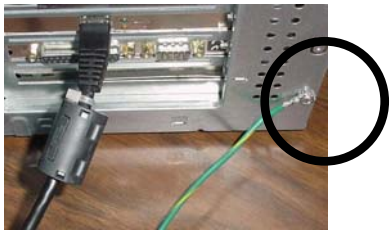
1. ***If using a desktop or tower PC***, (a) remove a screw that secures the computer casing to the chassis. The first photo shows a good connection point for the PC ground. (b) Use the #6-32x5/16 screw and two #8 tooth washers, orientated as illustrated, to secure one end of the ground line to the PC chassis.

   If using a notebook (laptop) PC, connect one end of the ground-line to a known earth ground. Depending on the ground chosen, you may need to use a screw other than the one supplied.

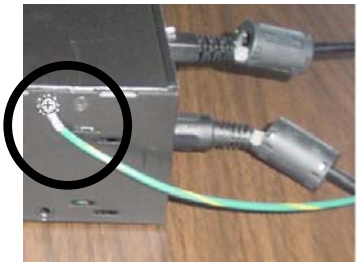
2. On the data acquisition device, remove one of the four protective bumpers (protective ears).

3. Using the #8-32x1/4 screw and two #8 tooth washers, orientated as illustrated to the right, secure the free end of the ground line to the chassis of the data acquisition device. Note that you will be making use of one of the threaded holes which was used to secure the bumper. The second photo below shows such a connection.





Ground Line on PC Chassis



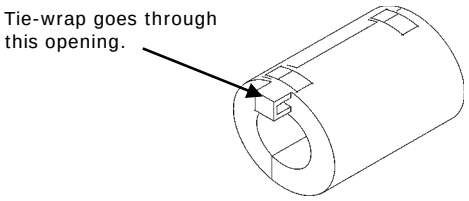
Ground Line on Acquisition Device
"Protective Bumper" shown removed.

4. Re-attach the protective bumper to the acquisition device.

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Install the Ferrite Inductive Collars

1. Place one ferrite collar at each end of the Ethernet cable. Snap the two collars shut. See photos.
2. Place the remaining ferrite collar next to the DIN5 connector on the power cable. Snap the collar shut.
3. Use a tie-wrap (one per ferrite collar) to secure each collar to its respective cable.



4. (Optional) Trim the excess tie-wrap material. While trimming use care to avoid cutting into the cables.

This completes the installation.



This partial view of the host PC shows the Ethernet cable with a ferrite collar. The PC's connection to the ground-line is also visible.



This partial view of the data acquisition device shows its connection to the ground-line. It also shows two ferrite collars, the foremost of which is clamped to the power cable. The background collar is clamped onto the Ethernet cable.

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Taking Measurements 8

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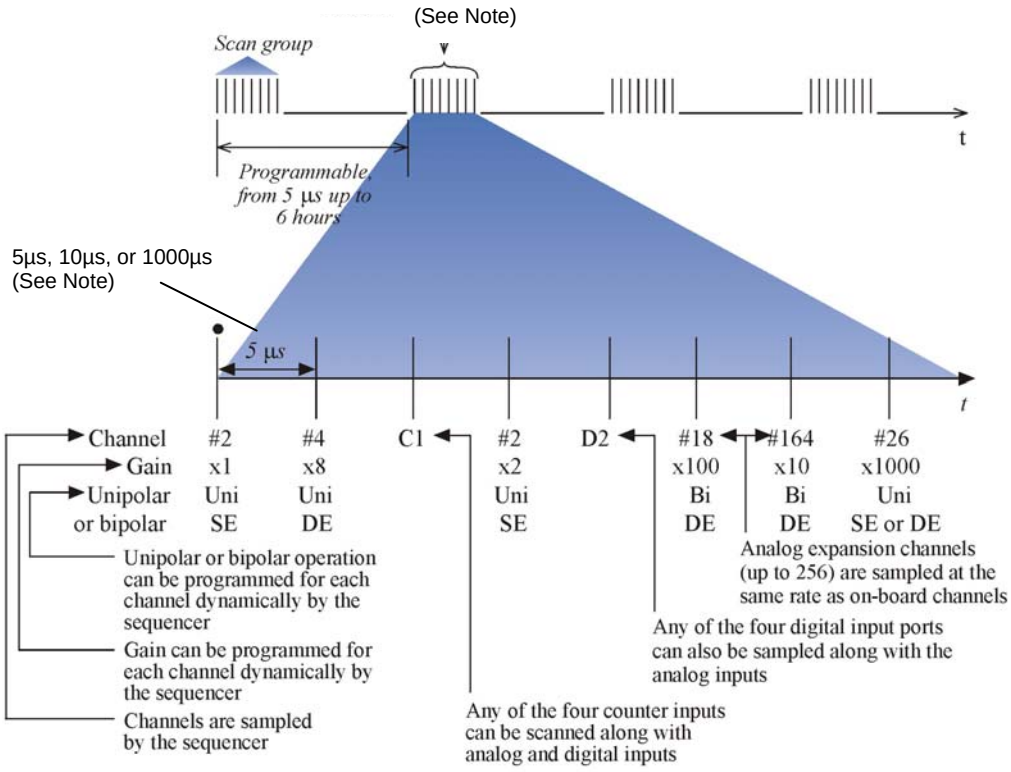
Introduction

With signal lines connected and a system up and running you can begin acquiring data. Specific connector details and pinouts are provided in chapter 4. You should refer to the software documentation applicable to your data acquisition system, for example, *DaqView*.

Scanning

DaqBook/2000 and DaqOEM/2000 Series devices each have an on-board scan sequencer that permits the user to select any combination of up to 16384 channel/range combinations. The sequencer scans all channels contained in the sequence at the rate of 5 µs/channel, 10 µs/channel, or 1000 µs/channel, depending on the speed of the DBK expansion options; 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.

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.



Scanning Example

Note: All inputs can be measured at the 5 µs/channel rate. Some DBK expansion options require more settling time and can be measured at the slower rate of 10 µs/channel or 1000 µs/channel. All types of measurements can be mixed within the scan group.

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Triggering

Triggering can be the most critical aspect of acquiring data. DaqBook/2000 and DaqOEM/2000 Series devices support a full complement of trigger modes to accommodate a wide variety of applications.



Multi-unit synchronization via the SYNC ports does not support pre-trigger data. Only post-trigger data can be collected and time correlated between the units.

Hardware Analog Triggering. Many data acquisition products claim analog triggering, but rely on the PC to take readings and make a decision, which leads to uncertain and potentially long latencies. DaqBook/2000 and DaqOEM/2000 Series devices use 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 that 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. The user can program both the trigger level, as well as the edge (rising or falling).

Digital 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. The digital trigger input is labeled TTLTRG.

Digital Pattern Triggering (P2 and P3 [if available]**)**. The DaqBooks support 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.

Counter Triggering. Triggering can 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 DaqBook circuitry 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 DaqBook 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 that point. The latency in this mode is equal to one scan cycle.

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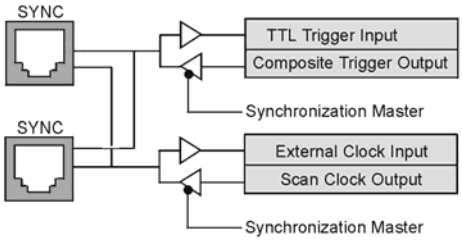
Pre- and Post-Triggering Modes. Six modes of pre- and post-triggering are supported, providing a wide variety of options to accommodate any measurement requirement. When using pre-trigger, the user must use software-based triggering to initiate an acquisition.

- ***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*** (driver support only). 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*** (driver support only). This is similar to the mode just described, except that the acquisition is terminated upon receipt of a command from the program.
- ***Stop Trigger***. Any of the software trigger modes described above can be used to stop an acquisition. Thus an acquisition can be programmed to begin on one event, such as a temperature level, and then stopped on another, such as a digital pattern event.

Synchronous I/O Operations

Synchronizing Multiple Units

DaqBook/2000 and DaqOEM/2000 Series devices can be synchronized to each other via their SYNC ports. Each unit has two identical SYNC ports. Either, or both, SYNC ports can be used to connect to the units via SYNC cables, CA-74-1 or CA-74-5 (1-foot or 5-foot cables, respectively). The units can be scan-synchronized and triggered from any other SYNC-connected unit.



Synchronization Concept Block Diagram

The preceding diagram shows how a DaqBook can input or output synchronization timing and trigger events on either SYNC connector. A more detailed block diagram follows shortly.

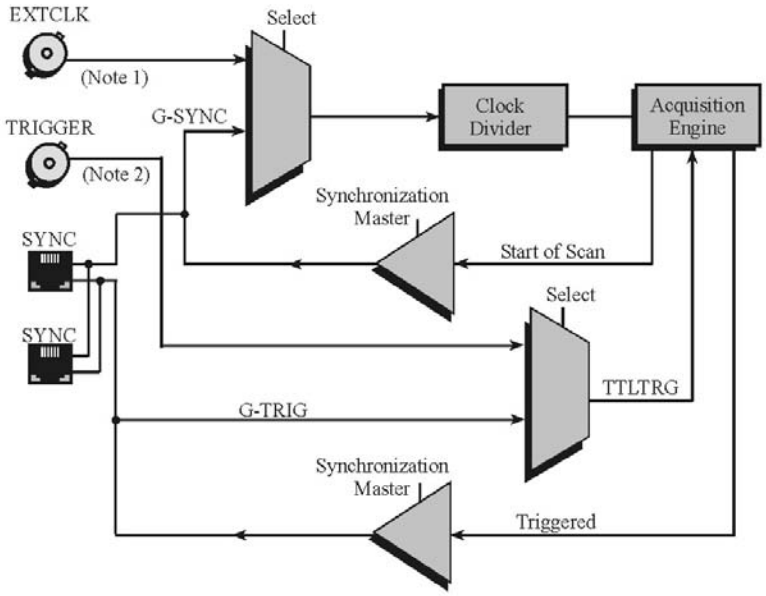
SYNC cables are not to exceed a total combined length of 15 feet (4.57 m).

Reference Note: The SYNC features are programmable via software. For detailed information see the *Using Multiple Devices* and the **`daqAdcSetClockSource`** sections of the *Programmer's Manual* (p/n 1008-0901).

PDF NOTE: During software installation, Adobe® PDF versions of user manuals automatically install onto your hard drive as a part of product support. The default location is in the **Programs** group, which can be accessed from the *Windows Desktop*. Refer to the PDF documentation for details regarding both hardware and software.

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DaqBook/2020 uses BNC connectors for EXTCLK and TRIGGER inputs. The other devices use pins as indicated in notes 1 and 2.



Synchronization Model for DaqBook/2000 and DaqOEM/2000 Series Devices,

Note 1: For DaqBook/2001 and DaqBook/2005, the clock signal is from P1, pin 20.
For DaqOEM/2000 Series devices, the clock signal is from JP1, pin 2.

Note 2: For DaqBook/2001 and DaqBook/2005 the trigger signal is from P1, pin 25.
For DaqOEM/2000 Series devices, the trigger signal is from JP1, pin 12.

In regard to synchronization, the following applies:

- One of three signals can be used to drive the DaqBook's acquisition scan rate. These are:
  - the internal acquisition pacer clock
  - an external acquisition pacer clock.
  - the global sync (G-SYNC) input from the SYNC ports
- Both the SYNC connector input and the external clock input can be divided down.
- When a DaqBook is in the Master Mode, both the trigger condition and the scan timing are output on the SYNC port. The global trigger (G-TRIG) is selected instead of the TTL Trigger Input.

Whether the DaqBook is using its **internal scan clock**, or **external clock input**, it can be programmed to output the clock on the SYNC connector. In either case, the unit is behaving like a ***synchronization master***. Other DaqBook units [that are connected to the *master*, via a SYNC port] should be programmed as ***synchronization slaves***.

When a DaqBook is programmed as a *synchronization slave*, it will derive its scan period from the SYNC port. If the *slave unit* must be triggered at the same time as the *master unit*, **then the slave unit should use TTL Trigger as its trigger source**.



Multi-unit synchronization via the SYNC ports does not support pre-trigger data. Only post-trigger data can be collected and time correlated between the units.

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SYNC Notes:

- **When a DaqBook is programmed as a *synchronization slave*, the TTL trigger source is automatically derived from the SYNC port.**
- **When a DaqBook is programmed as a *synchronization master*, it will output its trigger condition on the SYNC port.**
- **When synchronizing two or more DaqBooks, the slave units should have at least 0.1 µs of *dead time* in the scan period. By "dead time," we mean a duration in which no channels are sampled. This accommodates fundamental differences in the clocks [for each DaqBook].**
- **All DaqBooks that are connected via SYNC cables can be *scan-synchronized* to within 0.1 µs of each other.**
- **A maximum of 4 units can be synchronized; scan-synchronous (post trigger).**
- **SYNC cables are not to exceed a total combined length of 15 feet (4.57 m).**

Synchronous Input Operations

DaqBooks allow synchronous scanning and acquisition of Analog Input, Digital Input and Counter Input Data at up to 200 kHz aggregate scanning rates. The Analog Input data can be either main unit or expansion modules from P1 compatible analog input modules. The Digital Input data can be main unit 8-bit P2 (8255) digital input or P2 compatible DBK digital input expansion modules. For DaqBook/2001, DaqBook/2005 and the DaqOEM equivalents, 16-bit P3 digital inputs are applicable. DaqBook/2020 has no P3 connector, but uses of BNC connectors for the same functionality.

Analog Input Channels

P1 – Channels 0 through 15

DaqBooks allow analog input configuration of themselves, as well as for the P1 compatible DBK analog input expansion modules.

Channel Selection and Mode Settings

The DaqBook/2001, /2005 and DaqOEM/2001 and /2005 can accept up to 16 single ended or up to 8 differential-ended inputs and can be programmed for single-ended or differential-ended on a per channel basis. Just one analog channel is sacrificed when a DBK expansion module is enabled. See DBK documentation in the *DBK Option Cards & Modules User's Manual* (p/n 457-0905) for additional information.

DaqBook/2020 can accept up to 14 single-ended inputs. One analog channel is sacrificed when a DBK expansion module is enabled. See DBK documentation in the *DBK Option Cards & Modules User's Manual* (p/n 457-0905) for additional information.

Channel Range and Polarity

DaqBook channels can be programmed for either unipolar or bipolar mode with gain settings of 1, 2, 4, 8, 16, 32 and 64.

Channel Sampling Interval

DaqBooks allow for programmable sampling intervals of 5 us, 10 us, or 1000 us on a per channel basis. This mode allows some DBK expansion channels [which change slowly but offer a higher degree of accuracy] to be sampled at a longer interval, while channels that change more rapidly to be sampled using a shorter interval. Each 5 µs, 10 µs, or 1000 µs interval reduces the maximum aggregate acquisition rate for the entire scan by that amount.

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Digital I/O Channels

There are 24 Digital I/O channels available to DaqBook/2020; and 40 available to DaqBook/2001, /2005, and DaqOEM/2001 and /2005. The channels are grouped as follows:

8 Channels, A0 through **A7** from P2 [or JP2] Port A
8 Channels, B0 through **B7** from P2 [or JP2] Port B
8 Channels, C0 through **C7** from P2 [or JP2] Port C
16 Channels, Digital 0 through **Digital 15** from P3 [or JP3] **These 16 channels do not apply to DaqBook/2020.**

The DaqBooks allow for either synchronous scanning of digital input channels or asynchronous I/O operations for all configured digital channels.

Counter Input Channels

Counter 0, 1, 2, 3 (CTR0, CTR1, CTR2, CTR3)

The DaqBooks allow synchronous scanning of four16-bit counter input channels. The 4 channels can be cascaded into two 32-bit counter channels. For either cascaded or non-cascaded counter channels each channel can be configured for:

- ***Pulse Counting Mode*** – specifies that each counter should be cleared upon being read and placed into the input scan.
- ***Totalize Counting Mode*** – specifies that each counter is to free-run and not be cleared during the input acquisition.

Synchronous Input Acquisition Clocking

A /I Clock

The DaqBooks allow clocking of the synchronized inputs either by an internal, programmable pacer clock or by external clocking. These products use a sequencer to implement a multiplexing approach to gathering the input data. This means that with either internal or external clocking the entire channel scan (including the sampling time for each channel) may not exceed the maximum aggregate rate of 200 kHz.

Synchronous Output Operations for DaqBook/2020, DaqBook/2001, and DaqOEM/2001

DaqBook/2020, DaqBook/2001, and DaqOEM/2001 allow synchronous output of any D/A channels available at up to 100 kHz for each channel. All D/A channels may have output clocked out synchronously.

Output Channel Configuration

Analog Output Channels
DAC0, DAC1, DAC2, DAC3
(AO0, AO1, AO2, AO3)

Each D/A channel can be configured for waveform output individually. If the D/A channel is not configured for waveform output it then is available for asynchronous output operations.

Synchronous Output Clocking

A / O Clock

DaqBook/2020, DaqBook/2001, and DaqOEM/2001 allow clocking of the synchronized output by the acquisition clock source, an internal, programmable pacer clock or by an external clock source. When the clock source generates a new clock signal all outputs are updated concurrently. Regardless of the clock source, the clock may not exceed the maximum update rate of 100 kHz.

Synchronous Output Data Source

DaqBook/2020, DaqBook/2001, and DaqOEM/2001 allow the data source for synchronized DAC output operations to be that of an internal memory-based buffer. The output data, for all channels, is contained in the buffer.

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Asynchronous I/O Operations

Each DaqBook allows asynchronous input of any counter or digital channel that is not currently configured for synchronous acquisition. The circuitry allows for asynchronous output to any D/A channels that are not currently configured for waveform output. Likewise, for DaqBook/2001, /2005 and DaqOEM/2001 and /2005 the 16-bit P3 [or JP3] digital port can be used for both asynchronous input and output operations. In addition, the timer outputs can be programmed at any time regardless of the current state of synchronous or asynchronous operations on other channels.

Digital I/O Channels

Local 8255 Channels (P2 or JP2, Port A, Port B, Port C)
The DaqBooks have an implemented Intel 8255 core in the digital I/O logic on the P2 port. With the Intel 8255 there are three 8-bit wide ports available for I/O and one 8-bit wide port for configuration purposes. The configuration port is used to configure the other three 8-bit ports for either input or output operations.

Local 16-bit P3 Port (P3 or JP3, Digital 0 through Digital 15) **[Does not apply to DaqBook/2020]**
The 16-bit P3 Digital Port can be used as either an input or output port. With this port, no configuration is required. The port simply outputs when written to and inputs when read.

Expansion Digital I/O
The DaqBooks have the ability to expand their digital I/O capabilities via the P2 port and the connection of applicable digital I/O expansion modules. These modules are discussed in the *DBK Option Cards & Modules User's Manual* (p/n 457-0905). When using the digital I/O expansion modules the local P2 Intel 8255 digital I/O becomes inaccessible in lieu of the expansion modules. These expansion modules provide additional Intel 8255 ports as well as input isolation for applications that require the expanded capabilities.

Pulse Stream Output Using Timers (Timer0, Timer1)

Each DaqBook allows for the generation of output pulses based upon a programmable setting. These output timers can be set at any time regardless of the state of any synchronous or asynchronous operations which are currently taking place on other channels.

For DaqBook/2020, the outputs are through BNC connectors labeled T0 and T1.

For DaqBook/2001 and /2005, the timer outputs are through the P3 connector, pin 15 for Timer 0 and pin 16 for Timer 1.

For DaqOEM/2001 and /2005, the timer outputs are through the JP3 header, pin 29 for Timer 0 and pin 31 for Timer 1.

Analog Output Channels
DAC0, DAC1, DAC2, DAC3
(AO0, AO1, AO2, AO3)

DaqBook/2020, DaqBook/2001, and DaqOEM/2001 can output analog data to any of the four D/A channels. Each D/A channel may be asynchronously updated by an application if the D/A channel is not currently being used for waveform output operations.

For DaqBook/2020, the analog out channels make use of BNC connectors labeled:
AO0, AO1, AO2, and AO3.

For DaqBook/2001, the analog out channels use P3 as follows:
DAC0 – P3 pin 34, DAC1 – P3 pin 33, DAC2 – P3 pin 32, DAC 3 – P3 pin 31.

For DaqOEM/2001, the analog out channels use JP3 as follows: DAC0 – JP3 pin 30, DAC1 – JP3 pin 28, DAC2 – JP3 pin 26, DAC 3 – JP3 pin 24.

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Counter Input Channels (CTR0, CTR1, CTR2, CTR3)

DaqBooks and DaqOEMs have counter input capabilities and have the ability to read counter input providing that the counter channel is not configured for synchronous acquisition. As in the case of synchronous operations the four 16-bit counter input channels can be used individually or cascaded into two 32-bit counter channels. For either cascaded or non-cascaded counter channels each channel can be configured for:

- ***Clear on Read Mode*** - specifies that each counter should be cleared (reset to 0) upon being read.
- ***Continuous Totalize Mode*** – specifies that each counter is to *free-run* and not be cleared during the read operation.

Using DBK Cards and Modules for Signal Conditioning

The DBK signal-conditioning cards and module are designed for use with DaqBooks, LogBooks, and various types of data acquisition boards, i.e., ISA, PCI, and compact-PCI types. The DBKs perform best when used with an acquisition device [such as a DaqBook] that can dynamically select channel, gain, and range. DBK cards and modules with dynamic channel and gain/range selection allow for high channel-to-channel scan rates with a variety of transducers.

Note: Only *passive* DBKs, such as the DBK1 BNC module, the DBK11A screw terminal card, and the DBK40 BNC analog interface, can be used with Daq PC-Cards.

DBK output signals can be bipolar, e.g., -5 to +5 V, or unipolar, e.g., 0 to 10 V. The user can select a range of relevant values to correspond to the lowest signal (e.g., -5 or 0 V) and the highest signal (e.g., 5 or 10 V) signal. This type of range selection guarantees the highest resolution in 12-bit or 16-bit conversion.

DBK modules share the same footprint as DaqBooks and approximate the footprints of many notebook PCs. The footprint factor allows for convenient stacking. The majority of these modules have their own power supply; however, several options exist for packaging and powering the DBKs.



Reference Note:
DBK options are detailed in the *DBK Option Cards and Modules User's Manual* (p/n 457-0905). As a part of product support, the manual is automatically loaded onto your hard drive during software installation. The default location is the Programs group, which can be accessed through the Windows Desktop. A PDF version of the document can be read directly from the data acquisition CD via the introduction screen's <View PDFs> button.

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Calibration 9

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Using DaqCal.exe …… 9-1

Overview

The DaqBook/2000 and DaqOEM/2000 Series devices are digitally calibrated at the factory. The digital method involves storing a correction factor on the circuit board for each range 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 the calibration method in which readings are adjusted in software after they are transferred to the host PC. That method reduces the dynamic range of the A/D, and can adversely affect the speed at which the PC obtains a calibrated reading.

The DaqBook/2000 and DaqOEM/2000 Series devices include a user-cal mode, whereby the user can adjust the calibration of the unit's board, without destroying the supplied factory calibration. This is accomplished with two distinct calibration tables in the unit's on-board EPROM, one which contains the factory calibration factors, and the other which is available for user calibration.

Using DaqCal.exe

When calibration adjustments are needed they should be completed in the following order:

1. PGA Input and Output Offset
2. Sample/Hold Offset
3. A/D Offset and Gain
4. VDC Voltage Reference
5. DAC0 Full-Scale[1]
6. DAC1 Full-Scale[1]
7. DAC2 Full-Scale[1]
8. DAC3 Full-Scale[1]

[1]DAC Full-Scale only applies to DaqBook/2020, DaBook/2001, and DaqOEM/2001.

A Windows-based program, DaqCal.exe, is used to calibrate Daq systems, including analog expansion cards. DaqCal.exe is used in conjunction with:

- a 4.5 digit, digital multi-meter
- an adjustable voltage calibrator
- an ambient temperature meter

To use the calibration program:

1. Launch **DaqCal**.

   Note: DaqCal is installed automatically from your data acquisition CD as a part of product support. This takes place during software installation. DaqCal's default location is the **IOtech DaqX Software** folder, in the **Programs** group.

2. When DaqCal opens you will be prompted to select your device from a list. After doing so, simply follow the illustrated on-screen instructions.

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Troubleshooting and Customer Support 10

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Electrostatic Discharge (ESD), Handling Notice



The discharge of static electricity can damage some electronic components. Semiconductor devices are especially susceptible to ESD damage. You should always handle components carefully, and you should never touch connector pins or circuit components unless you are following ESD guidelines in an appropriate ESD-controlled area. Such guidelines include the use of properly grounded mats and wrist straps, ESD bags and cartons, and related procedures.

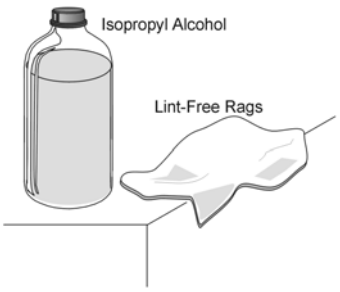
Product Care

Daq products and DBK options are essentially maintenance free and require a minimal amount of care. They should be treated much like any other high-tech equipment. In general:

- Keep them clear of harsh chemicals and abrasive elements.
- Avoid exposing the products to extreme heat, for example, avoid setting up a DaqBook system near a boiler or furnace.
- Avoid extreme shock and vibration.
- Avoid subjecting the units to liquids and extremely fine air particulate, such as silica dust.
- Never touch circuit boards without proper ESD (Electrostatic Discharge) measures in place.

A “common-sense” approach to handling your data acquisition equipment will go a long way in protecting it from inadvertent damage.

Note that you can use lint-free rags and Isopropyl Alcohol (Rubbing Alcohol) to clean the outer plate surfaces of DaqBooks and optional DBK modules.



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ReadMe Files and the Install CD-ROM

The Install CD-ROM includes ReadMe Files. These files often contain late-breaking information that may not appear in the user documentation. During installation you should review the ReadMe files when prompted to by the program.

The Install CD-ROM includes:

- DaqBook/2000 Series Windows NT/2000/XP driver
- **DaqX.DLL** (32-bit API) for DaqBook/2000 Series
- Microsoft C/C++ API support
- Microsoft VB API support
- Borland Delphi API support
- Daq* Configuration Control Panel Applet
- User documentation in Adobe® PDF format
- DaqView

Upon installation, the user needs to run the *Daq* Configuration* Control Panel applet. The applet is used to configure the DaqBook device for an appropriate Ethernet Port. This must be performed in order for the application to access the device through the Windows NT/2000/XP driver.

Driver Support

The daqX API can be used with WaveBook, DaqBook, DaqBoard, Daq PC Card and TempBook product lines. All daqX functions share the **daq** prefix.

The API support examples can be found in the installed directory:
<Install> ProgrammingLanguageSupport\DAQ

Refer to the *Programmer's Manual*, p/n 1008-0901.

DaqCOM Issues

DaqCOM support is contained within the Help file support, which is installed with DaqCOM. It is located within the DaqCOM program group.

DaqCOM support will not be available unless it has been specifically installed with the product. If the DaqCOM program group is not listed under programs (which can be accessed via the Windows desktop), then you will need to install it from the data acquisition CD, or download it from our website.

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Ethernet Problems

- Make sure the Ethernet network is not experiencing technical problems. Check with your Network Administrator.
- Ensure that your system is properly configured in the Daq*Configuration Applet [located in the Windows Control Panel]. If a device is not configured correctly it will not be accessible from an application.
- Verify that the correct MAC (Media Access Control) number is reflected by the software.
- If communications cannot be established with the DaqBook or, if trying to connect causes the system to hang or crash, try the following:
    - Verify that the device power switch is set to ON and that the POWER ON indicator is lit.
    - Ensure that all physical device interface connections are correct. This includes Ethernet connections from the DaqBook to the host PC's Ethernet jack, or Ethernet Network hub.
    - Run the *Daq Configuration* applet from the Windows Control Panel. Make sure the device is configured to the appropriate Ethernet port with the appropriate protocol. Run the device test and if it fails try other protocols for the device. Be sure to click on **<Apply>** to apply the settings, before re-running the test.
- If problems persist, notify your Network Administrator. If he or she can't solve the problem, contact the factory.

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Frequently Asked Questions

(1) Topic: Environmental Factors

Question: What environments are the products intended for?

Answer: Refer to the product specifications in regard to operating and storage temperature ranges, and relative humidity. Note that system components are not intended to be exposed to harsh environments and should always be protected from snow, rain, extreme dust, and harsh sun.

(2) Topic: DaqX

Question: What is DaqX software?

Answer: DaqX software is low-level software support for application development. DaqX is installed during the installation of the DaqView application. DaqX supports Visual C++ and Visual Basic programming environments.

Question: Where can I get the latest version of DaqX software?

Answer: You can download the latest versions from our website. This service is free.

(3) Topic: Calibration

Question: Should I calibrate my DaqBook when I receive it?

Answer: No, because each DaqBook-related product is factory-calibrated to its rated accuracy before it leaves the factory.

Question: When is calibration required?

Answer: Depending on your operating guidelines, your equipment will require periodic calibration to ensure the original accuracy is maintained. We recommend that you have your DaqBook system calibrated at least once a year.

(4) Topic: Computers for Data Acquisition

Question: What type of computer do you recommend for use with data acquisition devices such as a DaqBook/2020E, DaqBook/2010E, or DaqBook/2010/OEM?

Answer: The PC should have built in Ethernet capabilities and use an operating system of Windows NT, 2000, XP, or later.

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Customer Support

If you want to Expand or Enhance Your DaqBook System . . .

You can visit our internet site at www.mccdaq.com to find the latest accessories, expansion cards and modules. You can also call our sales department directly at (440) 439-4091.

If you need to Report Problems or Request Product Support

Note: **Please do not return any equipment to the factory unless it has an RMA number (Return Merchandise Authorization number). RMA numbers are issued by the factory.**

To report problems or request support, contact our applications department or your service representative. Contact information follows shortly. When you contact us, please have the following information available, as applicable:

- Hardware model numbers and software version numbers.
- Operating system, type of computer, and device information in the Windows control panel, such as interrupts and address settings for our hardware and others.
- Results of tests, such as the Daq* Configuration control panel.
- Hardware setup and software configuration.
- Information on input signals, including voltage ranges, signal impedance ranges, noise content, and common mode voltages.
- The name of a contact person from your company who can discuss the problems encountered.
- Instructions for return shipping.
- All troubleshooting notes and comments on tests performed, and all problem-related conditions.
- If your problem is Ethernet related, discuss the problem with your Network Administrator prior to contacting the factory. Please provide us with your administrator's comments, if applicable.

Note: Before calling for assistance, take a few minutes to read all parts of the manual that may be relevant to the problem. Also, please review the troubleshooting material.

You can reach Measurement Computing by one of the following means:

- Knowledgebase: kb.mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Mail: Measurement Computing Corp**. ● 10 Commerce Way, Suite 1008 ● Norton, MA 02766**

All equipment returned to the manufacturer must have an RMA (Return Material Authorization) number. You can obtain an RMA number by calling the Applications Department. When returning the equipment, use the original shipping container (or equivalent) to prevent damage. Put the RMA number on your shipping label to ensure that your shipment will be handled properly. After receiving your equipment, we will fax a confirmation form that summarizes the charges (if applicable) and expected return date.

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Specifications 11

DaqBook/2020, /2001, /2005, DaqOEM/2001, and DaqOEM/2005

General

Supply Voltage Range: 10 to 30 VDC

Power Required: 15W, assuming no DBK options

Power Available for External Signal Conditioning & Expansion Options: 5V at 1A, ±15V at 500 mA, each not to exceed 7W on DaqBook/2020; not to exceed 10W on DaqBook/2001, /2005, DaqOEM/2001, or DaqOEM/2005

Operating Temperature: -30°C to + 70°C

Storage Temperature: -40°C to +80°C (-40° to 158°F)

Relative Humidity: 0 to 95% non-condensing

Vibration: MIL STD 810E, Categories 1 and 10

Signal I/O Connectors

DaqBook/2001 and /2005: DB37 male connectors: P1, P2, and P3

DaqBook/2020: DB37 male connectors: P1 and P2, BNC connectors, mini-Thermocouple Connectors

DaqOEM/2001 and /2005: 40-pin headers designated as JP1, JP2, and JP3. AMP # 2-103328-0

Dimensions

DaqBook/2001 and /2005: 285 mm W x 220 mm D x 45 mm H (11" x 8.5" x 1.75")

DaqBook/2020: 285 mm W x 220 mm D x 90 mm H (11" x 8.5" x 3.5")

DaqOEM/2001 and /2005: 27.5 cm W x 20.5 cm D

Weight

DaqBook/2001 and /2005: 1.36 kg (3 lbs)

DaqBook/2020: 2.5 kg (5.5 lbs.)

DaqOEM/2001 and /2005: 0.48 kg (1.06 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): ± 2 LSB

Missing Codes: None, over full operating temperature range

Analog Inputs

Channels:

DaqBook/2001, 2005; via P1 (DB37): 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential and as unipolar or bipolar.

DaqOEM/2001, /2005; via JP1 (40-pin header): 16 single-ended or 8 differential, programmable on a per-channel basis as single-ended or differential and as unipolar or bipolar.

DaqBook/2020; via BNC connectors: 16 differential inputs. **via P1 (DB37):** 14 single-ended.

Expansion: Up to 256 channels, without degradation, in maximum channel-to-channel scan rate (5 or 10 µs per channel).

Total Harmonic Distortion: -84 dB (typ)

Signal to Noise and Distortion: 80 dB (typ)

Noise: 2 LSBRMS (typ)

Bandwidth: 500 kHz

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Settling Time: 5 µs maximum to 1 LSB for full-scale step

Temperature Coefficient: ±(10ppm +0.3 LSB)/°C outside the range of 0° to 30°C

Input Impedance: 10 MΩ for single-ended; 20 MΩ for differential

Bias Current: <1nA at 0° to 30°C

Common Mode Rejection: 86 dB, DC to 60 Hz for gains ≤ 8; >100 dB for gains ≥16

Maximum Input Voltage: +11V relative to analog common

Over-Voltage Protection:

DaqBook/2001, DaqBook/2005: ±35V
DaqOEM/2001, DaqOEM/2005: ±35V
DaqBook/2020: ±25V

Crosstalk: -100 dB DC to 60 Hz; 86 dB @ 10 kHz

Ranges: Software programmable via sequencer on a per-channel basis.

Voltage Range (Note 1)	Accuracy (Note 2) One Year, 0 to 35°C ±(% reading + % range)	Input Noise (Note 3) (LSB rms) 10 Hz to 200 kHz
	Absolute	Typical
0 to +10 V	0.015 + 0.005	1
0 to +5 V	0.015 + 0.005	1
0 to +2.5 V	0.015 + 0.005	1
0 to +1.25 V	0.015 + 0.008	2
0 to +0.625 V	0.015 + 0.008	2
0 to +0.3125 V	0.015 + 0.008	2
-10 to +10 V	0.015 + 0.005	1
-5 to +5 V	0.015 + 0.005	1
-2.5 to +2.5 V	0.015 + 0.005	1
-1.25 to +1.25 V	0.015 + 0.005	2
-0.625 to +0.625 V	0.015 + 0.008	2
-0.3125 to +0.3125 V	0.015 + 0.008	3
-0.156 to +0.156 V	0.020 + 0.008	3

Notes:

1) Specifications assume differential input single channel scan, 200 kHz scan rate, unfiltered.
2) Accuracy specification is exclusive of noise. Measurements were taken at P1.
3) Inputs shorted to Signal Ground (SGND). 8192 samples.

Analog Input Specifications for DaqBook/2020 front panel BNC Connectors

Inputs: 5 µs maximum to 1 LSB for full-scale step

Maximum Voltage Range: ±10V

Input Impedance: 20 MΩ

Accuracy:

For Gains 1, 2: ± [0.1% of reading + 0.005% of range]
For Gains 4, 8, 16, 32, 64: ± [0.1% of reading + 250uV]

Total Harmonic Distortion: -84 dB (typ)

Signal to Noise and Distortion: 80 dB (typ)

Noise: 2 LSBRMS (typ)

Maximum Input Voltage (without damage): ±25 V

3 dB Bandwidth: 2.6 MHz

Temperature Coefficient: 10 ppm for every °C outside the range of 0° to 50°C

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Thermocouple Input Specifications for DaqBook/2020 Mini-TC Connectors

TC/mV Connectors: 14 Mini-TC connectors, oriented in 2 rows of 7
Inputs: 14 differential TC/mV inputs, open TC detection per channel
TC Types: J, K, T, E, S, R, B, N28, N14; x100 voltage
Input Impedance: 40 MΩ (differential); 20 MΩ (single-ended)
Input Voltage Range: ± 100 mV
Input Bandwidth: 4 kHz
Input Bias Current: 10 nA (typ)
CMRR: -100 db (typ)
Maximum Working Voltage (Signal + Common Mode): ±10V
Over-Voltage Protection: ±40V
Voltage Accuracy: ±(0.2% of the reading + 50 µV)
Temperature Coefficient for Voltage Accuracy: 10ppm for every ˚C outside the range of 0° to 50°C
TC Accuracy: Valid for one year, 18° to 28°C, see the following table.
Temperature Coefficient for Type T: ±0.03°C per °C ambient outside the range of 18 to 28˚C
Minimum Resolution: 0.1˚C for all TC types

TC Accuracy at Measurement Temperature in °C (±°C)											
Type	**Min**	**Max**	**-100**	**0**	**100**	**300**	**500**	**700**	**900**	**1100**	**1400**
J	-200	760	0.8	0.7	0.7	0.8	0.9	0.9	—	—	—
K	-200	1200	0.9	0.8	0.8	0.9	1.1	1.1	1.2	1.3	—
T	-200	400	0.9	0.8	0.8	0.8	—	—	—	—	—
E	-270	650	0.8	0.7	0.7	0.7	0.8	—	—	—	—
S	-50	1768	—	3.1	2.4	2.0	2.0	1.9	2.0	2.1	2.1
R	-50	1768	—	3.1	2.1	2.0	1.9	1.9	1.7	1.9	2.0
B	50	1780	—	—	—	4.9	3.2	2.8	2.4	2.3	2.0
N28	-270	400	1.2	0.9	0.9	0.9	—	—	—	—	—
N14	0	1300	—	0.9	0.9	0.9	1.1	1.1	1.2	1.3	—

Accuracy conditions:

- Exclusive of thermocouple errors
- Exclusive of noise
- $V_{CM} = 0$

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Input Sequencer

Analog, digital and counter inputs can be scanned synchronously based either on 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 maximum in 1 µs steps
2. External, TTL level input up to 200 kHz maximum

Programmable parameters per scan: channel (random order), gain, unipolar or 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 ms with DBK90 or 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

External Sync Ports

Number of External Sync Ports: 2, on rear panel

Maximum Number of Units to be Synchronized: 4 units, scan-synchronous (post trigger)

Maximum Length of Sync Cables: 15 feet (4.57 m), total for all cables

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. Pre-trigger is supported with fixed or variable pre-trigger periods.

1. Single-Channel Analog Hardware Trigger.
Any analog input channel, including any of the analog expansion channels, can be software programmed as the analog trigger channel.

Input Signal Range: -10V to +10V max

Trigger Level: Programmable, 11-bit resolution

Hysteresis: Programmable, 11-bit resolution

Latency: 5 µs max

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 with temperature, then the driver automatically compensates for the delay required to calculate the reading, resulting in a maximum latency of one scan period.

Input Signal Range: Anywhere within the range of the selected trigger channel

Trigger Level: Programmable, 16-bit resolution, including “window triggering”

Hysteresis: Programmable, 16-bit resolution

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 max.

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 digital input. Programmable for trigger on equal, above, below, or within or outside of a window. Individual bits can be masked for “don’t care” condition.

Latency: One scan period maximum.

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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 maximum.

6. Software Triggering: Trigger can be initiated under program control.

Analog Outputs

Applies to DaqBook/2020, DaqBook/2001, and DaqOEM/2001
Does not apply to DaqBook/2005 or to DaqOEM/2005

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 DAC channels (DAC0, DAC1, DAC2, and DAC3)

Resolution: 16 bits

Data Buffer: 256Ksample

Output voltage range: ±10 V

Output current: ±10 mA

Offset error: ±0.0045 V maximum

Digital Feedthru: 50 mV when updated

Gain error: ±0.01%

Update rate: 100 kHz maximum, 1.5 Hz minimum (no minimum with external clock)

Settling Time: 10 µs maximum 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
4. External scanning input clock

Digital I/O

Channels:

DaqBook/2001, /2005: 40 built-in, expandable to 272 with external DBK options

DaqOEM/2001, /2005: 40 built-in, expandable to 272 with external DBK options

DaqBook/2020: 24 built-in, expandable to 256 with external DBK options

Input Scanning Modes: 2 programmable

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

Ports:

DaqBook/2001, /2005: 3 x 8-bit (82C55 emulation), and 1 x 16-bit, Programmable as input or output.

DaqOEM/2001, /2005: 3 x 8-bit (82C55 emulation), and 1 x 16-bit. Programmable as input or output.

DaqBook/2020: 3 x 8-bit (82C55 emulation). Each port is programmable as input or output.

Input Characteristics: 100 Ω series, 20 pF to common

Input protection: ±8 kV ESD clamp diodes parallel

I/O levels: TTL

Sampling Rate: 200 kHz max

Update Rate: Asynchronous under program control

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

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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. Bus mastering DMA provides CPU and system-independent data transfers, insuring data acquisition performance irrespective of other system activities. 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 maximum

Input Signal Range: -15 V to +15 V

Input Characteristics: 2.7 kΩ series in parallel with 20 pF to common and 10 kΩ to +5 V

Input protection: ±8 kV ESD clamp diodes parallel

Trigger Level: TTL

Minimum pulse width: 50 ns high, 50 ns low

Frequency/Pulse Generators

Channels: 2 x 16-bit

Output Waveform: Square wave

Output rate: 1 MHz base rate divided by 1 to 65535 (programmable)

High level output voltage: 2.0 V minimum @ -3.75 mA, 3.0 V minimum @ -2.5 mA

Low level output voltage: 0.4 V maximum @ 2.5 mA

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Accessories and Cables

Cables for use with DaqBook/2000 Series Devices		
	Description	**Part No.**
1.	Molded expansion cable. Connects a DBK module to a DaqBook, 2 in.	CA-255-2T
2.	Molded expansion cable. Connects a DBK module to a DaqBook, 4 in.	CA-255-4T
3.	DBK expansion cable. Connects a DBK module to a DaqBook, 2.5 in.	CA-37-1T
4.	DBK expansion cable. Connects a DBK module to a DaqBook, 4.5 in.	CA-37-3T
5.	Expansion-card cable. Connects DBK series expansion card options. The “x” in the part no. indicates the number of cards that can be connected via the cable.	CA-37-x
6.	SYNC cable, RJ-11, 6 conductor, 1 ft.	CA-74-1
7.	SYNC cable, RJ-11, 6 conductor, 5 ft.	CA-74-5
8.	Ethernet patch cable, shielded, 18 in.	CA-242
9.	Ethernet patch cable, shielded, 7 ft.	CA-242-7
10.	Power Cable, 5-pin male DIN to 5-pin male DIN; provides convenient connection between DaqBook power input connectors and battery packs. 6 in.	CA-115
11.	Power Cable, 5-pin male DIN to vehicle cigarette lighter, 8 ft.	CA-116

Cables for use with DaqOEM/2000 Series Boards		
	Description	**Part No.**
1.	SYNC cable, RJ-11, 6 conductor, 1 ft.	CA-74-1
2.	SYNC cable, RJ-11, 6 conductor, 5 ft.	CA-74-5
3.	Power Cable, 5-pin DIN to vehicle cigarette lighter, 8 ft.	CA-116
4.	Ethernet patch cable, shielded, 18 in.	CA-242
5.	Ethernet patch cable, shielded, 7 ft.	CA-242-7
6.	Ribbon cable, 40-pin header to 37-pin DSUB [DB37 connector], 9 in.	CA-248



The total combined length of the SYNC cables is not to exceed 15 feet (4.57 m).

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Manuals

Manual Set (Set #1121-0900). This is a hardcopy set of manuals that is available for purchase. The set includes the following three manuals:

DaqBook/2000 and DaqOEM/2000 Series User's Manual (p/n 1121-0901)

Programmer's Manual for developing custom programs using API commands. (p/n 1008-0901)

DBK Option Cards & Modules User's Manual. (p/n 457-0905)

Software

DaqViewXL for seamless execution of DaqView from within Microsoft Excel's tool palette.

DASYLab icon-based data acquisition graphics, control, and analysis software.

eZ-TimeView post-acquisition time-domain analysis software

eZ-FrequencyView post-acquisition frequency domain analysis software

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Glossary

Acquisition — A collection of scans acquired at a specified rate as controlled by the sequencer.

Analog — A signal of varying voltage or current that communicates data.

Analog-to-Digital Converter (ADC) — A circuit or device that converts analog values into digital values, such as binary bits, for use in digital computer processing.

API — Application Program Interface. The interface program within the Daq system's driver that includes function calls specific to Daq hardware and can be used with user-written programs (several languages supported).

Bipolar — A range of analog signals with positive and negative values (e.g., -5 to +5 V); see *unipolar*.

Buffer — *Buffer* refers to a circuit or device that allows a signal to pass through it, while providing isolation, or another function, without altering the signal. *Buffer* usually refers to:

(a) A device or circuit that allows for the temporary storage of data during data transfers. Such storage can compensate for differences in data flow rates. In a FIFO (First In - First Out) buffer, the data that is stored first is also the first data to leave the buffer.

(b) A follower stage used to drive a number of gates without overloading the preceding stage.

(c) An amplifier which accepts high source impedance input and results in low source impedance output (effectively, an impedance buffer).

Buffer Amplifier — An amplifier used primarily to match two different impedance points, and isolate one stage from a succeeding stage in order to prevent an undesirable interaction between the two stages. (Also see, *Buffer*).

Channel — In reference to Daq devices, *channel* simply refers to a single *input*, or *output* entity.

In a broader sense, an *input channel* is a signal path between the transducer at the point of measurement and the data acquisition system. A channel can go through various stages (buffers, multiplexers, or signal conditioning amplifiers and filters). Input channels are periodically sampled for readings.

An *output channel* from a device can be digital or analog. Outputs can vary in a programmed way in response to an input channel signal.

Common mode — Common mode pertains to signals that are identical in amplitude and duration; also can be used in reference to signal components.

Common mode voltage — Common mode voltage refers to a voltage magnitude (referenced to a common point) that is shared by two or more signals. *Example*: referenced to common, Signal 1 is +5 VDC and Signal 2 is +6 VDC. The common mode voltage for the two signals is +5.5 VDC [(5 + 6)/2].

Crosstalk — An undesired transfer of signals between systems or system components. Crosstalk causes signal interference, more commonly referred to as *noise*.

Digital — A digital signal is one of discrete value, in contrast to a varying signal. Combinations of binary digits (0s and 1s) represent digital data.

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Digital-to-Analog Converter (DAC) A circuit or device that converts digital values (binary bits), into analog signals.

DIP switch A DIP switch is a group of miniature switches in a small *Dual In-line Package* (DIP). Typically, users set these switches to configure their particular application.

Differential mode The differential mode measures a voltage between 2 signal lines for a single channel. (Also see *single-ended mode*).

Differential mode voltage Differential mode voltage refers to a voltage difference between two signals that are referenced to a common point. Example: Signal 1 is +5 VDC referenced to common. Signal 2 is +6 VDC referenced to common.

If the +5 VDC signal is used as the reference, the differential mode voltage is +1 VDC (+ 6 VDC - +5 VDC = +1 VDC).

If the +6 VDC signal is used as the reference, the differential mode voltage is -1 VDC (+ 5 VDC - +6 VDC = -1 VDC).

ESD Electrostatic discharge (ESD) is the transfer of an electrostatic charge between bodies having different electrostatic potentials. This transfer occurs during direct contact of the bodies, or when induced by an electrostatic field. ESD energy can damage an integrated circuit (IC).

Excitation Some transducers [e.g. strain gages, thermistors, and resistance temperature detectors (RTDs)] require a known voltage or current. Typically, the variation of this signal through the transducer corresponds to the condition measured.

Gain The degree to which an input signal is amplified (or attenuated) to allow greater accuracy and resolution; can be expressed as ×n or ±dB.

Isolation The arrangement or operation of a circuit so that signals from another circuit or device do not affect the *isolated* circuit.

In reference to Daq devices, *isolation* usually refers to a separation of the direct link between the signal source and the analog-to-digital converter (ADC). Isolation is necessary when measuring high common-mode voltage.

Linearization Some transducers produce a voltage in linear proportion to the condition measured. Other transducers (e.g., thermocouples) have a nonlinear response. To convert nonlinear signals into accurate readings requires software to calibrate several points in the range used and then interpolate values between these points.

Multiplexer (MUX) A device that collects signals from several inputs and outputs them on a single channel.

Sample (reading) The value of a signal on a channel at an instant in time. When triggered, the ADC reads the channel and converts the sampled value into a 12- or 16-bit value.

Scan A series of measurements across a pre-selected sequence of channels.

Sequencer A programmable device that manages channels and channel-specific settings.

Simultaneous Sample-and-Hold An operation that gathers samples from multiple channels at the same instant and holds these values until all are sequentially converted to digital values.

Single-ended mode The single-ended mode measures a voltage between a signal line and a common reference that may be shared with other channels. (Also see *differential mode*).

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Trigger An event to start a scan or mark an instant during an acquisition. The event can be defined in various ways; e.g., a TTL signal, a specified voltage level in a monitored channel, a button manually or mechanically engaged, a software command, etc. Some applications may use pre- and post-triggers to gather data around an instant or based on signal counts.

TTL Transistor-Transistor Logic (TTL) is a circuit in which a multiple-emitter transistor has replaced the multiple diode cluster (of the diode-transistor logic circuit); typically used to communicate logic signals at 5 V.

Unipolar A range of analog signals that is always zero or positive (e.g., 0 to 10 V). Evaluating a signal in the right range (unipolar or bipolar) allows greater resolution by using the full-range of the corresponding digital value. See *bipolar*.

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