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DASCard-1000 Series

USER'S GUIDE

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DASCard-1000 Series
User's Guide

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Preface

The *DASCard-1000 Series User's Guide* provides the information needed to install and use DASCard-1001, DASCard-1002, and DASCard-1003 cards.

The manual is intended for data acquisition system designers, engineers, technicians, scientists, and other users responsible for installing, starting up, and wiring signals to DASCard-1001, DASCard-1002, and DASCard-1003 cards. It is assumed that users are familiar with data acquisition principles, with their computer, and with their particular application.

Throughout the manual, references to DASCard-1000 Series cards apply to DASCard-1001, DASCard-1002, and DASCard-1003 cards. When a feature applies to a particular card, that card's name is used.

The *DASCard-1000 Series User's Guide* is organized as follows:

- Chapter 1 provides an overview of the features of DASCard-1000 Series cards, including a description of supported software and accessories.
- Chapter 2 provides a detailed description of the features of DASCard-1000 Series cards.
- Chapter 3 describes how to unpack, install, and start up DASCard-1000 Series cards.
- Chapter 4 describes how to attach accessories and how to wire signals to DASCard-1000 Series cards.
- Chapter 5 describes how to use the Control Panel to test the functions of DASCard-1000 Series cards.
- Chapter 6 describes how to calibrate DASCard-1000 Series cards.
- Chapter 7 provides troubleshooting information.

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- Appendix A lists the specifications for DASCard-1000 Series cards.
- Appendix B lists the screw terminal assignments for DASCard-1000 Series accessories.
- Appendix C describes the Keithley Memory Manager. The Keithley Memory Manager allows you to allocate memory when running under Windows™.

An index completes this manual.

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1

Overview

DASCard-1000 Series cards are analog input and digital I/O PC cards that you can use with any notebook or desktop computer that contains a Type II, PCMCIA (Personal Computer Memory Card International Association) socket. This chapter describes the features of the DASCard-1000 Series cards, the software that supports them, and available accessories.

Features

The major features of DASCard-1000 Series cards are as follows:

- The cards are software-selectable for 16 single-ended or eight differential analog input channels. A remote ground sense is provided for single-ended analog input channels.
- The DASCard-1001 and DASCard-1002 support eight software-selectable unipolar and bipolar analog input ranges; the DASCard-1003 supports a fixed unipolar analog input range (0 to 5 V) and a fixed bipolar analog input range (±5 V).
- The DASCard-1003 supports a maximum throughput rate of 140,000 samples/second with 12-bit resolution. When using a single channel, the DASCard-1001 and DASCard-1002 also support a maximum throughput rate of 140,000 samples/second with 12-bit resolution.
- A 512-word first-in, first-out memory location (FIFO) on the card stores analog-to-digital (A/D) conversion data; this allows continuous conversions at higher sampling rates.
- An oncard internal pacer clock is supported; you select the conversion rate through software.

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- An external pacer clock is supported.
- An external digital trigger is supported.
- Calibration factors are stored in nonvolatile, oncard memory; potentiometers are not used.
- Four digital input lines are provided.
- Eight digital output lines are provided.

Supporting Software

The following software is available for operating DASCard-1000 Series cards:

- **DASCard-1000 Series standard software package** - This package, which comes with the card, is provided on 3.5-inch high-density disks. The package includes function libraries for writing application programs under DOS using Microsoft® QuickBasic™ or Microsoft Professional Basic. The package also includes support files, utility programs, and language-specific example programs. Refer to the *DASCard-1000 Series Function Call Driver User's Guide* for more information.
- **ASO-1000 software package** - The optional Advanced Software Option for DASCard-1000 Series cards is provided on 3.5-inch high-density disks. The package includes function libraries for writing application programs under Windows or DOS using Microsoft C/C++, Borland® C/C++, Microsoft Visual C++™, or Microsoft Visual Basic® for Windows. The package also includes support files, utility programs, and language-specific example programs. Refer to the *DASCard-1000 Series Function Call Driver User's Guide* for more information.

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- **Utility programs** - The following utility programs are provided as part of both the DASCard-1000 Series standard software package and the ASO-1000 software package:
  - *Keithley MetraByte Enabler* - The Enabler (KMENABLE.EXE) runs under DOS and requests system resources for your DASCard-1000 Series card. Refer to page 3-8 for more information.
  - *Keithley MetraByte diagnostics utility* - The diagnostics utility allows you to check the status of your DASCard-1000 Series card when installed in the PCMCIA socket. Two versions of the diagnostics utility are available: KMINFO.EXE runs under DOS and KMINFOW.EXE runs under Windows. Refer to page 3-14 for more information.
  - *DASCard-1000 Series configuration utility* - The configuration utility (CFG1000.EXE) runs under Windows and allows you to create or modify a configuration file. The configuration file provides information about the card; this information is used by the DASCard-1000 Series Function Call Driver and other software packages to perform the card's operations. Refer to page 3-5 for more information.
  - *DASCard-1000 Series Control Panel* - The Control Panel (CTL1000.EXE) runs under Windows and allows you to perform operations on DASCard-1000 Series cards without programming. It provides a quick way to test your card and monitor your operation. Refer to Chapter 5 for more information.
  - *DASCard-1000 Series calibration utility* - The calibration utility (CAL1000.EXE) runs under Windows and allows you to calibrate the analog input circuitry of DASCard-1000 Series cards. Refer to Chapter 6 for more information.
- **Visual Test Extensions™ (VTX™)** - The optional Visual Basic custom control software package helps you write application programs for DASCard-1000 Series cards in Visual Basic for Windows. Refer to the *Visual Test Extensions™ User's Guide* and the VTX online help for more information.

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Accessories

The following accessories are available for use with the DASCard-1000 Series cards:

- **STP-37 screw terminal panel** - Provides screw terminals that allow you to access the functions of a card; provides cold junction compensation (CJC) for thermocouples; available with a plastic bottom cover (STP-37/C) that you can mount in a standard DIN rail.
- **EXP-1600 expansion accessory** - 16-channel expansion and thermocouple measurement accessory; provides switch-selectable gains of 0.5, 1, 5, 10, 50, 100, 250, and 500, mounting holes for current-sensing resistors, and connectors for attaching an FWA-EXP or FWA-37U field wiring accessory.
- **FWA-EXP field wiring accessory** - Connects directly to the EXP-1600 expansion accessory; provides 48 screw terminals that allow you to access 16 differential analog input channels; provides CJC for thermocouples. You connect one FWA-EXP to each EXP-1600 expansion accessory you are using.
- **FWA-37U field wiring accessory** - Connects directly to the EXP-1600 expansion accessory; provides 40 screw terminals that allow you to access the functions of the DASCard-1000 Series card. You connect a FWA-37U to the first EXP-1600 expansion accessory only.
- **CAB-1000 cable** - Shielded, 18-inch cable with a 32-pin connector on one end and a 37-pin, female D-type connector on the other end; allows you to connect a DASCard-1000 Series card directly to an STP-37 screw terminal panel or indirectly to an EXP-1600 expansion accessory through the CAB-3740/F interface cable. The CAB-1000 is shipped with the DASCard-1000 Series card.
- **CAB-3740/F cable** - Unshielded, 4-inch ribbon cable with a 37-pin connector on one end and a 40-pin connector on the other end; allows you to connect the 37-pin connector of the CAB-1000 cable to an EXP-1600 expansion accessory.
- **CAB-40 cable** - Unshielded, 4-inch ribbon cable with a 40-pin connector on each end; allows you to daisy chain multiple EXP-1600 expansion accessories; convenient when stacking multiple EXP-1600 expansion accessories in a rack.

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- **CAB-40/1 cable** - Unshielded, 18-inch ribbon cable with a 40-pin connector on each end; allows you to daisy chain multiple EXP-1600 expansion accessories; convenient when mounting multiple EXP-1600 expansion accessories on standoffs.
- **PWR-5V power supply and cable** - Converts 115 VAC to 5 VDC; used to power EXP-1600 expansion accessories.
- **PWR-5V/E power supply and cable** - Converts 220 VAC to 5 VDC; used to power EXP-1600 expansion accessories.
- **CAB-PWR cable** - 4-inch power cable; allows you to connect multiple EXP-1600 expansion accessories to the same PWR-5V or PWR-5V/E power supply.
- **CAB-PWR/1 cable** - 18-inch power cable; allows you to connect multiple EXP-1600 expansion accessories to the same PWR-5V or PWR-5V/E power supply.

Refer to the Keithley MetraByte catalog or contact your local sales office for information on obtaining these accessories.

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2

Functional Description

This chapter describes the following features of DASCard-1000 Series cards:

- Analog input features
- Digital I/O features
- Power

A functional block diagram of a DASCard-1000 Series card is shown in Figure 2-1.

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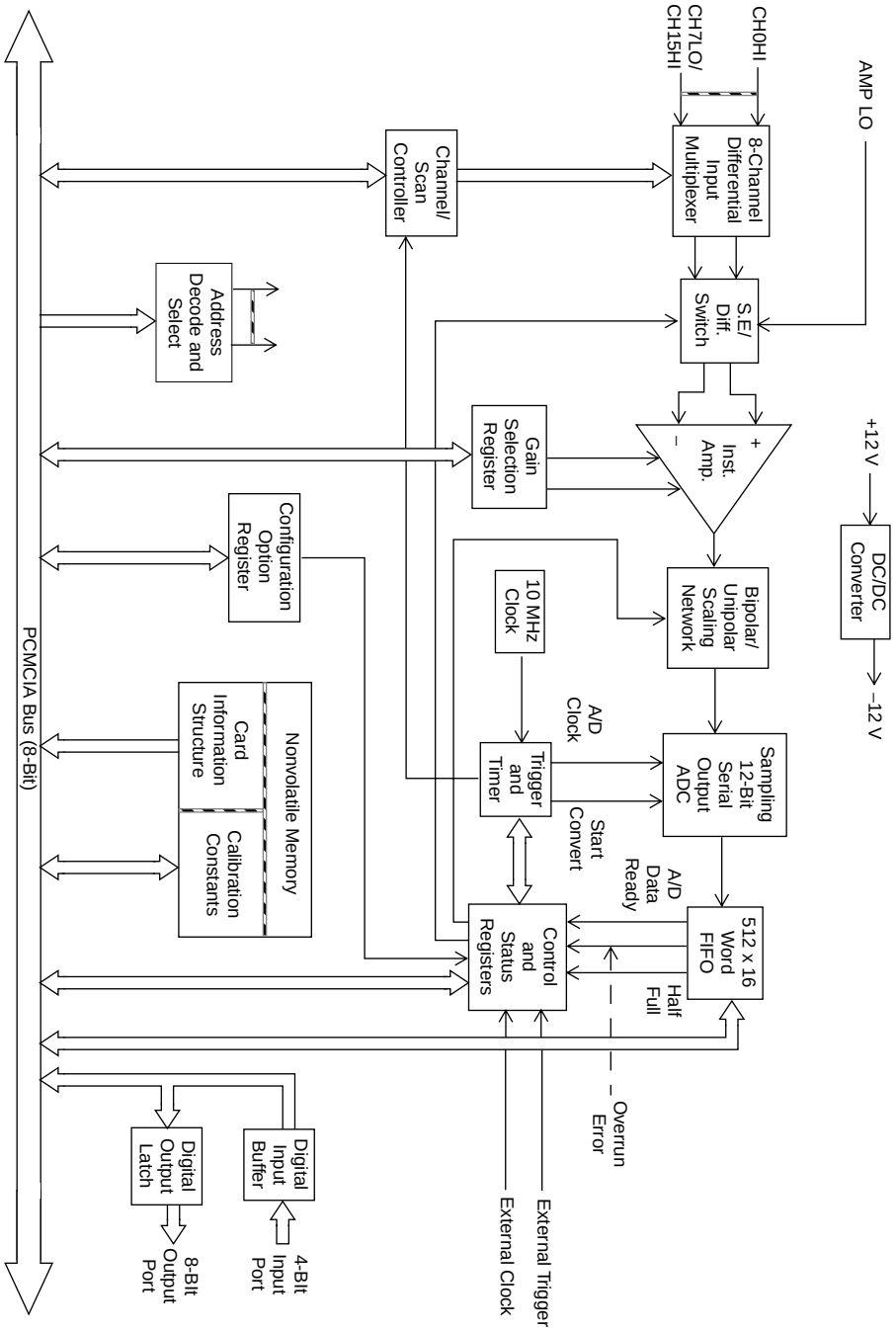


Figure 2-1. DASCard-1000 Series Functional Block Diagram

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Analog Input Features

The analog input features of DASCard-1000 Series cards are described in the following sections.

Channels

This section describes the following:

- Input configurations supported.
- Channel expansion.
- Gains and input ranges supported.
- Specifying a channel or channels for an analog input operation.

Input Configuration

Through software, you configure DASCard-1000 Series cards for either 16 single-ended or eight differential oncard analog input channels. The differences between a single-ended and a differential input configuration are described as follows:

- **Single-ended** - A single-ended input configuration is appropriate if you are measuring relatively high-level signals (greater than 1 V), if the source of the input signal is close to the card (less than two feet), and if all input signals are referred to a common ground.

  In a single-ended configuration, DASCard-1000 Series cards do not provide common-mode noise rejection for individual channels, but they do provide a remote ground sense.

- **Differential** - A differential input configuration is appropriate if you are measuring low-level signals (less than 1 V), if high source resistances (greater than 100 Ω) exist, or if common-mode voltages exist between the voltage source and the computer's chassis ground.

  In a differential configuration, DASCard-1000 Series cards provide a separate positive and negative terminal for each channel. Any common-mode noise that is picked up equally on both inputs is rejected.

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Channel Expansion

If you require additional analog input channels or signal conditioning for transducer inputs, you can use up to 16 16-channel EXP-1600 expansion accessories to increase the number of available channels to 256. Refer to page 4-3 and page 4-4 for more information on using EXP-1600 expansion accessories.

Notes: If you use EXP-1600 expansion accessories, channels on the DASCard-1000 Series card must be configured as single-ended.

The throughput of your card is reduced when using EXP-1600 expansion accessories.

Gains and Ranges

Each channel on a DASCard-1001 or DASCard-1002 card can measure analog input signals in one of eight unipolar and bipolar ranges; each channel on a DASCard-1003 card can measure analog input signals in one unipolar range and one bipolar range. Through software, you specify the input range type (unipolar or bipolar) of the card and the gain of each channel on the card.

Table 2-1 lists the gains supported by DASCard-1000 Series cards and the analog input voltage range for each gain.

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Table 2-1. Supported Gains

Card	Gain	Range	
		Bipolar	Unipolar
DASCard-1001	1	±5 V	0 to 5 V
	10	±500 mV	0 to 500 mV
	100	±50 mV	0 to 50 mV
	1000	±5 mV	0 to 5 mV
DASCard-1002	1	±5 V	0 to 5 V
	2	±2.5 V	0 to 2.5 V
	4	±1.25 V	0 to 1.25 V
	8	±625 mV	0 to 625 mV
DASCard-1003	1	±5 V	0 to 5 V

Channel Selection

DASCard-1000 Series cards can acquire data from a single analog input channel or from a range of consecutive analog input channels using automatic channel scanning. These two methods of channel selection are described as follows:

- **Single channel** - You use software to specify a single channel and initiate a conversion.
- **Automatic channel scanning** - You use software to specify the first and last channels in a range of consecutive channels. The channels are sampled in order from first to last; the hardware automatically increments the analog input multiplexer address shortly after the start of each conversion. When the last address is reached, the multiplexer returns to the start address and the channels are sampled again. For example, assume that the start channel is 4, the stop channel is 7, and you want to acquire five samples. Your program reads data first from channel 4, then from channels 5, 6, and 7, and finally from channel 4 again.

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The start channel can be higher than the stop channel. For example, assume that you are not using any expansion accessories, the card uses a differential configuration, the start channel is 7, the stop channel is 2, and you want to acquire five samples. Your program reads data first from channel 7, then from channels 0, 1, and 2, and finally from channel 7 again.

When using automatic channel scanning, all consecutive channels have the same gain (analog input range).

Note: If your application requires nonconsecutive channels or different gains for each channel, you can create a channel-gain queue through software. The DASCard-1000 Series Function Call Driver provides functions for creating a channel-gain queue; refer to the *DASCard-1000 Series Function Call Driver User's Guide* for more information.

Pacer Clocks

Through software, you select either an internal or an external pacer clock to determine when each A/D conversion is initiated. These pacer clocks are described in the following sections.

Internal Pacer Clock

The internal pacer clock uses the oncard 16-bit counter and either a 1 MHz or 10 MHz time base. The counter is normally in an idle state. When you start an analog input operation, the counter is loaded with its initial count value and begins counting down. When the counter counts down to 0, the first conversion is initiated. After the first conversion is initiated, the counter is loaded again and the process repeats.

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If the 10 MHz time base is selected, each count represents 0.1 µs; if the 1 MHz time base is selected, each count represents 1.0 µs. For example, if the 1 MHz time base is selected and you load a count of 50, the time between conversions is 50 µs; if the 10 MHz time base is selected and you load a count of 65,536, the time between conversions is 6.55 ms. The time between conversions can range from 0.1 µs to 65.536 ms.

Note: If you are using the DASCard-1000 Series Function Call Driver, you cannot select a time base; the DASCard-1000 Series Function Call Driver assumes the 10 MHz time base (each count represents 0.1 µs). Refer to the *DASCard-1000 Series Function Call Driver User's Guide* for more information.

External Pacer Clock

An external pacer clock is useful if you want to sample at rates not available with the oncard counter/timer circuitry, if you want to sample at uneven intervals, or if you want to sample on the basis of an external event.

The external pacer clock is an externally applied TTL-compatible signal, which you attach to the XCLK/PI0 line of the DASCard-1000 Series card. (The XCLK/PI0 line is assigned to screw terminal 25 on all the supported accessories.)

When you start an analog input operation, conversions are armed. At the next falling edge of the external pacer clock (and at every subsequent falling edge of the external pacer clock), a conversion is initiated.

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Using the Pacer Clocks

Figure 2-2 illustrates how conversions are initiated when using an internal and an external pacer clock. (Note that Figure 2-2 assumes that you are not using a hardware trigger; refer to Figure 2-3 on page 2-10 for an illustration of conversions when using a hardware trigger.)

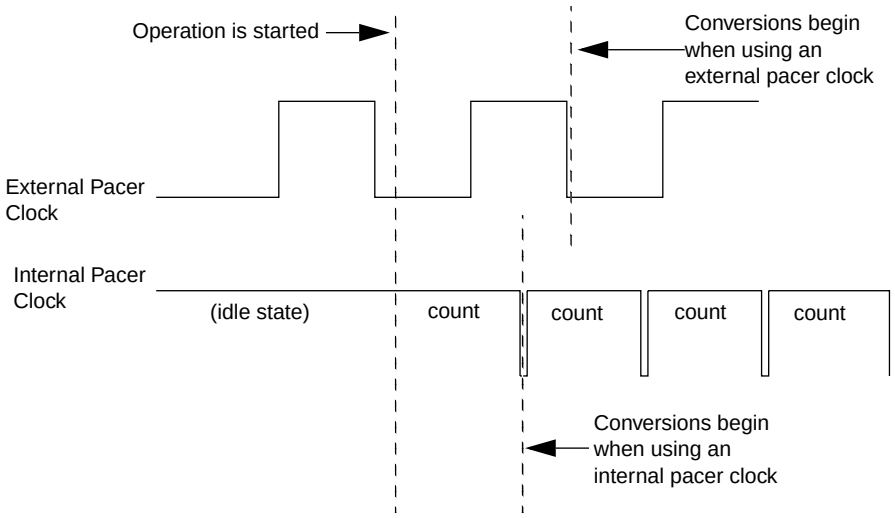


Figure 2-2. Using the Pacer Clock

Note: The maximum throughput rate for DASCard-1000 Series boards is 140 ksamples/second. However, the rate at which the computer can reliably read data from the DASCard-1000 Series card depends on a number of factors, including your computer, the operating system/environment, whether you are acquiring samples from multiple channels, the gains of the channels, whether you are using expansion accessories, and software issues. Make sure that the pacer clock does not initiate conversions too fast.

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Triggers

A trigger is an event that determines when a DASCard-1000 Series card can respond to either an internal or an external pacer clock. Through software, you can select a software or a hardware trigger source. These trigger sources are described in the following sections.

Software Trigger

A software trigger event occurs when you start the analog input operation. The point at which conversions begin depends on the pacer clock; refer to page 2-6 for more information.

Hardware Trigger

A hardware trigger event occurs when the DASCard-1000 Series card detects a negative edge on its XTRIG/PI1 line. The point at which conversions begin depends on the pacer clock; refer to page 2-6 for more information.

Figure 2-3 illustrates how conversions are initiated when using a hardware trigger.

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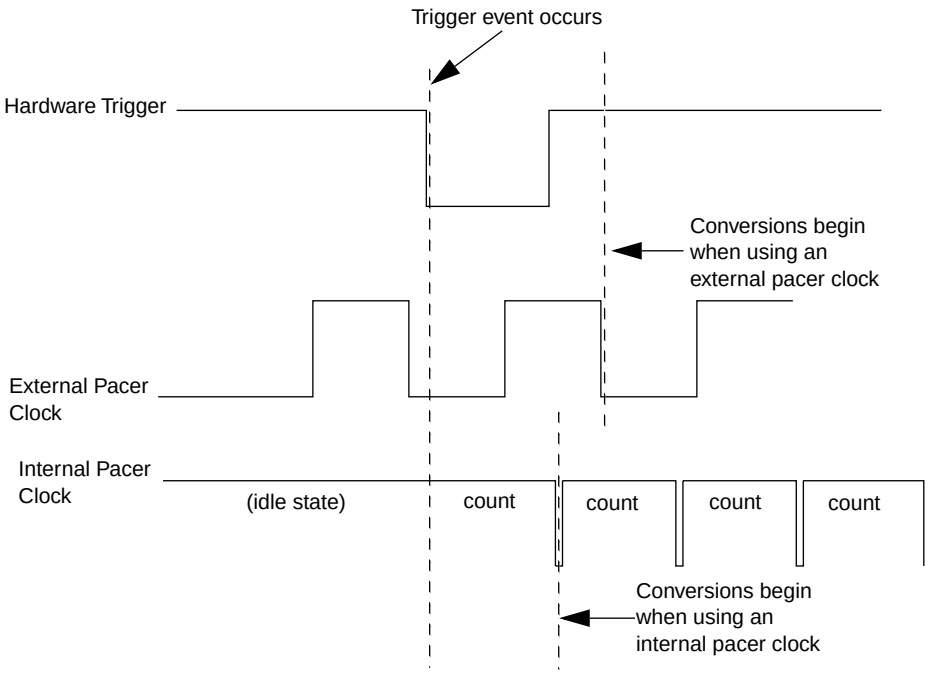


Figure 2-3. Initiating Conversions with a Hardware Trigger

Note: Although DASCard-1000 Series cards do not provide a hardware-based analog trigger, you can program an analog trigger through software, using one of the analog input channels as the trigger channel. The DASCard-1000 Series Function Call Driver provides functions for an analog trigger; refer to the *DASCard-1000 Series Function Call Driver User's Guide* for more information.

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Data Transfer

DASCard-1000 Series cards contain a 512-word FIFO. When you initiate conversions using an internal or an external pacer clock, the result of each A/D conversion is automatically stored in the FIFO.

The FIFO increases the maximum attainable conversion rate by allowing you to store up to 512 samples on the DASCard-1000 Series card without using the computer's resources. The DASCard-1000 Series card can generate an interrupt when any data is available in the FIFO and/or when the FIFO is half full. An interrupt service routine can then transfer data to the computer's memory while the FIFO continues to fill. Refer to the next section for more information about interrupts.

If the conversion rate is too fast or if the time required to service the interrupt is too long, the card can generate an error to indicate that the FIFO became full and subsequent samples were lost.

Interrupts

DASCard-1000 Series cards can generate an interrupt when one or more of the following events occurs:

- **A/D Data Ready** - Data is available in the A/D FIFO.
- **A/D FIFO Half Full** - The A/D FIFO contains at least 256 samples.
- **A/D Clock Error** - A pacer clock pulse (internal or external) occurs while an A/D conversion is still in progress.
- **A/D FIFO Overrun** - The A/D FIFO becomes full before acquired samples can be transferred to computer memory.

At power-up, interrupts are disabled.

Note: If you are using the DASCard-1000 Series Function Call Driver, the use of interrupts is handled automatically by the driver; no action on your part is required.

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Digital I/O Features

DASCard-1000 Series cards contain four digital input lines (XCLK/PI0, XTRIG/PI1, PI2, and PI3) and eight digital output lines (PO0 through PO7). Logic 1 on a line indicates that the input/output is high; logic 0 on a line indicates that the input/output is low.

The digital input lines are compatible with TTL-level signals. If no signal is connected to a digital input line, the input appears high (logic 1).

You can use the digital input and output lines for any general-purpose task, with the following exceptions:

- If you are using an EXP-1600 expansion accessory for an analog input operation, the PO0, PO1, PO2, and PO3 digital output lines determine the expansion accessory channel that is acquiring data; in this case, you cannot use these digital output lines for general-purpose digital output operations.
- If you are using an external pacer clock, you cannot use the XCLK/PI0 digital input line for general-purpose digital input operations.
- If you are using an external digital trigger, you cannot use the XTRIG/PI1 digital input line for general-purpose digital input operations.

Power

The analog circuitry on a DASCard-1000 Series card is powered by the +12 V of the computer. The computer also provides power to the STP-37 screw terminal panel to power the CJC circuitry.

The computer cannot provide power to EXP-1600 expansion accessories. When using EXP-1600 expansion accessories, you must provide external +5 V power. Refer to the *EXP-800/1600 User's Guide* for more information.

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3

Setup and Installation

This chapter contains the information you need to install and use your DASCard-1000 Series card.

System Requirements

To use a DASCard-1000 Series card, your system must consist of the following:

- Notebook or desktop computer with an available Type II, PCMCIA socket (80386 or higher).
- Windows, Version 3.1 or higher, running in Enhanced mode.
- DOS, Version 5.0 or higher.
- Available 8 bytes of I/O space.
- Available 4K bytes between 640K bytes and 1M bytes of high memory for storing the calibration factors and other card information.
- Available interrupt level.

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- CardSoft™, CardWare™, CardTalk™, Phoenix®CARD Manager Plus, or any other PCMCIA Card and Socket Services (PCMCIA standard 2.10 or higher).

  PCMCIA Card and Socket Services allow any DASCard-1000 Series card to work in your computer. Typically, PCMCIA Card and Socket Services are DOS-based, terminate-and-stay-resident (TSR) programs that are loaded from your CONFIG.SYS file.

  Note: Note that many notebook computers are shipped with PCMCIA Card and Socket Services already installed; in these cases, you may be unaware of the name of the Card and Socket Services or how they are used in your computer.

- Keithley MetraByte Enabler (KMENABLE.EXE) and Keithley MetraByte diagnostics utility (KMINFO.EXE).

Unpacking the Card

To prevent any damage to your DASCard-1000 Series card, perform the following steps when unpacking the card:

1. Remove the wrapped DASCard-1000 Series card from its outer shipping carton.
2. Carefully remove the card from its plastic case. (Keep the plastic case for future storage needs.)
3. Inspect the card for signs of damage. If any damage is apparent, arrange to return the card to the factory; refer to page 7-6 for more information.
4. Check the remaining contents of your package against the packing list to ensure that your order is complete. Report any missing items immediately.
5. Once you have determined that the card is acceptable, you can install the software and set up the card. Refer to the following sections for information.

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Installation and Startup

To install and start up a DASCard-1000 Series card, you must perform the following tasks:

1. From Windows, install the appropriate software package (DASCard-1000 Series standard software package or ASO-1000 software package). Refer to “Installing the Software” on page 3-4 for information.
2. Determine whether the default configuration of the DASCard-1000 Series card is appropriate for your application, and if it is not, specify the appropriate configuration options in a configuration file. Refer to “Creating a Configuration File” on page 3-5 for information.
3. Return to DOS.
4. From DOS, load the Enabler. Refer to “Loading the Enabler” on page 3-8 for information.
5. Install the DASCard-1000 Series cards. Refer to “Installing the Card” on page 3-13 for information.
6. Check that the DASCard-1000 Series cards are installed correctly by using the Keithley MetraByte diagnostics utility. Refer to “Using the Diagnostics Utility” on page 3-14 for information.
7. Test the functions of the DASCard-1000 Series cards using the Control Panel from Windows. Refer to Chapter 5 for information about the Control Panel.
8. Write your application program. If you are using the DASCard-1000 Series Function Call Driver, refer to the *DASCard-1000 Series Function Call Driver User’s Guide* for information. If you are using VTX, refer to the *Visual Test Extensions™ User’s Guide* and the VTX online help for information.
9. Run your application program.

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Installing the Software

This section describes how to install the DASCard-1000 Series standard software package and the ASO-1000 software package. To install other software packages, refer to the documentation supplied with the software package.

To install the DASCard-1000 Series standard software package or the ASO-1000 software package, perform the following steps:

1. Make a back-up copy of the supplied disks. Use the copies as your working disks and store the originals as backup disks.
2. Insert disk #1 into the disk drive.
3. Start Windows, if necessary.
4. From the Program Manager menu, choose File and then choose Run.
5. Assuming that you are using disk drive A, type the following at the command line in the Run dialog box, and then select OK:

   ```
   A:SETUP
   ```

   The installation program prompts you for your installation preferences, including whether you are programming under DOS or Windows or both, which languages you will be using, and the drive and directory you want to copy the software to. It also prompts you to insert additional disks, as necessary.
6. Continue to insert disks and respond to prompts, as appropriate.

   When the installation program prompts you for a drive designation, enter a designation of your choosing or accept the default drive C. When the installation program prompts you for a directory name, enter a name of your choosing or accept the default name.

   The installation program creates a directory on the specified drive and copies all files, expanding any compressed files.

   The installation program also creates a DASCard-1000 family group; this group includes icons for the Keithley MetraByte utilities, example Windows programs, and help files.

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7. When the installation program notifies you that the installation is complete, review the following files:
   - FILES.TXT lists and describes all the files copied to the hard disk by the installation program.
   - README.TXT contains information that was not available when this manual was printed.

Creating a Configuration File

A default configuration file (DAS1000.CFG) is provided in both the DASCard-1000 Series standard software package and the AS0-1000 software package. DAS1000.CFG contains a set of default configuration options that take effect whenever you install or power-up a DASCard-1000 Series card. These default configuration options are listed in Table 3-1.

Table 3-1. Default Configuration

Attribute	Default Configuration
Card name	DASCard-1002
Input range type	Bipolar
Input configuration	Single-ended
Number of expansion accessories[1]	0
Number of single-ended channels[2]	16

Notes

[1] If you are using EXP-1600 expansion accessories, the configuration file also contains the gains of the EXP-1600 channels.

[2] This is required by some software packages, such as Keithley MetraByte's VTX.

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If the default options are appropriate for your application, you can skip the rest of this section. If the default options are not appropriate for your application, you must specify the appropriate options in a configuration file, using the CFG1000.EXE configuration utility.

Note: The default configuration assumes that you are not using any EXP-1600 expansion accessories. If you are using one or more EXP-1600, you must modify the default configuration file or create a new configuration file to indicate the number of EXP-1600s you are using and the gains of the EXP-1600 channels.

To create a new configuration file or modify an existing configuration file, perform the following steps:

1. Either click on the configuration utility icon or choose Run from the Program Manager File menu, enter the following in the box, and select OK:

   ```
   CFG1000
   ```

   Make sure that you enter the correct path to CFG1000.EXE, or use the Browse button to find this file.

   The utility displays the DASCard-1000 Configuration panel with the default configuration options shown.

2. To modify an existing configuration file, choose the Open option from the File menu and select the appropriate configuration file; go to step 3.

   To create a new configuration file, go directly to step 3.

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3. Modify the configuration options for card 0. The card number is displayed in the Card Number text box.

Note: If you are using one DASCard-1000 Series card, it is always configured as card 0; this is true whether the card is installed in socket 0 or in socket 1 and whether or not another PCMCIA card is installed in the other socket.

If you are using two DASCard-1000 Series cards, decide in advance which card you will install in each socket; the card in socket 0 is configured as card 0 and the card in socket 1 is configured as card 1.

Refer to page 3-13 for more information about installing cards.

For more information about the meaning of the configuration options, use the online help or refer to Chapter 2.

4. If you are using two cards, when the configuration options for card 0 are correct, use the spin-dial to the right of the card number to select card 1, and then modify the configuration options for card 1.
5. After you modify the configuration options for both cards, save the new settings, as follows:
   - To save the new settings in an existing configuration file, choose the Save option from the File menu.
   - To save the new settings in a new configuration file, choose the SaveAs option from the File menu. The software prompts you for the name of the new configuration file.
6. To exit the configuration utility, choose the Exit option from the File Menu or the Exit button from the DASCard-1000 Configuration panel.

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Note: The example programs, provided with both the DASCard-1000 Series standard software package and the ASO-1000 software package, use the default configuration file DAS1000.CFG. If you intend to use the example programs, make sure that you do not inadvertently rename or delete DAS1000.CFG. If you want to use a different configuration file with the example programs, you must modify the example programs appropriately.

Loading the Enabler

The Enabler (KMENABLE.EXE) is a TSR utility that requests a base address, interrupt level, and memory segment address for a DASCard-1000 Series card from PCMCIA Card Services and provides information about the assigned resources to your application program.

Note: The DASCard-1000 Series Function Call Driver requires that the Keithley MetraByte Enabler (KMENABLE.EXE) provide your application program with the base addresses, interrupt levels, and memory segment addresses assigned to your cards.

To ensure that PCMCIA Card Services assign a base address, interrupt level, and memory segment address that will not cause a conflict with another device in your system and to ensure that the Keithley MetraByte Enabler provides the information about the assigned resources to your application program, perform the following steps to load the Enabler:

1. If your PCMCIA Card Services allow you to exclude resources from resource allocation, make sure that you exclude any base addresses, interrupt levels, and memory segment addresses that you know are being used by other devices in your system.
2. If your PCMCIA Card Services allow you to reserve system resources, make sure that you reserve a base address, interrupt level, and memory segment address that you know are not being used by other devices in your system.

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3. Check the default base addresses, interrupt levels, and memory segment addresses listed in Table 3-2 to see if they are being used by other devices in your system.

Table 3-2. Default Resource Assignments

Resource	Default Assignment	
	Card 0	Card 1
Base address	300h	308h
Interrupt level	5	7
Memory address[1]	Automatic	Automatic

Notes

[1] By default, PCMCIA Card Services automatically select an available segment address in computer memory for the calibration factors and other card information.

4. If the default resource assignments are available, go to step 5.

   If the any of the default resource assignments are not available, go to step 6.

5. Load the Enabler by entering the following at the DOS prompt:

   ```
   KMENABLE
   ```

   To continue, go to step 7.

6. Load the Enabler using one or more of the command-line options listed in Table 3-3.

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Table 3-3. Enabler Options

Option	Description
/BA0:*baseaddress*	Uses the base address *baseaddress* when allocating memory for the I/O map for card 0. Make sure that &H precedes hexadecimal numbers.
/BA1:*baseaddress*	Uses the base address *baseaddress* when allocating memory for the I/O map for card 1. Make sure that &H precedes hexadecimal numbers.
/I0:*intlevel*	Uses the interrupt level *intlevel* when allocating an interrupt level for card 0.
/I1:*intlevel*	Uses the interrupt level *intlevel* when allocating an interrupt level for card 1.
/MEM0:*memaddress*	Uses the segment address *memaddress* when allocating memory for the calibration factors and other card information for card 0. Make sure that &H precedes hexadecimal numbers and that the segment address is less than FFFFh.
/MEM1:*memaddress*	Uses the segment address *memaddress* when allocating memory for the calibration factors and other card information for card 1. Make sure that &H precedes hexadecimal numbers and that the segment address is less than FFFFh.
/NORETRY[1]	The Enabler returns an error if the base address, interrupt level, or memory segment address that you specify is being used by another PC card; this helps you control the resources that PCMCIA Card Services allocate. If you do not use this option and specify a resource that is assigned to another PC card, PCMCIA Card Services automatically select an available resource.
/U	Unloads the Enabler from computer memory.

Notes

[1] PCMCIA Card Services can check the base address, interrupt level, and memory segment address of PC cards only. Whether or not you use the /NORETRY option, if you specify a base address, interrupt level, or memory segment address that is assigned to a non-PCMCIA device, PCMCIA Card Services may allocate the resource again and a conflict may occur.

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For example, if the default assignments for card 0 are appropriate but you want to change the assignments for card 1, enter a line similar to the following at the DOS prompt:

```
KMENABLE /BA1:&H310 /MEM1:&HC800 /I1:11
```

As another example, if you want to change a base address, memory segment address, and/or interrupt level without restarting your computer, you can remove the Enabler by entering the following at the DOS prompt:

```
KMENABLE /U
```

Then, you can reload the Enabler using the appropriate command-line options to specify the new base address, memory segment address, and/or interrupt level.

7. Install the DASCard-1000 Series cards; refer to page 3-13.
8. To ensure that the Enabler recognizes the DASCard-1000 Series cards and to ensure that appropriate resources were allocated, run the diagnostics utility by entering the following at the DOS prompt:

   ```
   KMINFO
   ```

   The diagnostics utility displays information about the cards. If any of the fields in the display is missing or if an error is displayed, the cards were not configured properly. Refer to Chapter 7 for troubleshooting information.

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Notes: You can either load the Enabler manually from DOS each time you restart the computer or you can include the appropriate line of code in either your AUTOEXEC.BAT file, your CONFIG.SYS file, or a user-defined batch file.

You cannot load the Enabler from the MS-DOS Prompt in Windows. You must exit the Windows environment.

Make sure that you restart the computer after you add the Enabler to your AUTOEXEC.BAT or CONFIG.SYS file.

Although it is recommended that you load the Enabler before you install your cards, for some hardware, your cards can already be installed when you load the Enabler.

If you used the PCMCIA software to reserve system resources and then use a command-line option to specify a base address, interrupt level, or memory segment address that was not reserved, the value you specify is ignored.

To conserve real-mode memory, you can load the Enabler into high memory (between 640K bytes and 1M bytes). Refer to your memory manager documentation for more information.

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Installing the Card

Note: On most notebook computers, you can hot-swap DASCard-1000 Series cards; it is not necessary to turn computer power OFF when installing or removing a card.

To install a DASCard-1000 Series card, perform the following steps:

1. Select the appropriate Type II, PCMCIA socket and remove the cover from the socket, if necessary.
2. Insert the 68-pin PCMCIA bus connector end of the card into the socket until it makes contact. The card is keyed so that you can insert it in only one way.

   Depending on your computer, the card may rest completely inside the computer, partially inside the computer, or outside the computer. On some computers, a beep indicates that the card is installed correctly.

   If you are using two DASCard-1000 Series cards, install the card configured as card 0 in socket 0 and the card configured as card 1 in socket 1. You can install the cards in either order.
3. Replace the socket cover, if appropriate.
4. If your hardware does not support hot-swapping, you may have to reapply power to your DASCard-1000 Series cards using the appropriate PCMCIA Card Services function.
5. To ensure that the DASCard-1000 Series cards are installed properly, run the diagnostics utility by entering the following at the DOS prompt:

   ```
   KMINFO
   ```

   The diagnostics utility displays information about the cards. If any of the fields in the display is missing or if an error is displayed, the cards were not configured properly. Refer to Chapter 7 for troubleshooting information.

When the DASCard-1000 Series cards are installed properly, you can attach accessories and wire the appropriate signals to the card; refer to Chapter 4 for information. Refer to the documentation provided with your computer for more information on installing PC cards.

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Using the Diagnostics Utility

The diagnostics utility (KMINFO.EXE for DOS, KMINFOW.EXE for Windows) allows you to check the status of your DASCard-1000 Series card during installation and startup and during operation.

During installation and startup, use KMINFO.EXE to check that your DASCard-1000 Series card is installed correctly. Enter the following at the DOS prompt:

```
KMINFO
```

If you are having problems while running an application program, use KMINFOW.EXE to check your DASCard-1000 Series card. Either click on the diagnostics utility icon or choose Run from the Program Manager File menu, enter the following in the box, and choose OK:

```
KMINFOW
```

Make sure that you enter the correct path to KMINFOW.EXE, or use the Browse button to find this file.

The diagnostics utility displays the following information:

- The PCMCIA Card and Socket Services that are installed.
- Whether or not the Enabler is installed.
- The manufacturer and card name of all other PC cards installed.
- Whether or not the DASCard-1000 Series card is enabled.
- If the DASCard-1000 Series card is enabled, the base address, interrupt level, memory segment address, and any errors that occurred when allocating system resources.

A sample display is shown in Figure 3-1.

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```
PCMCIA Card Information utility, Ver 1.00
(c) Copyright Keithley Instruments, Inc., 1995

PCMCIA Status & information:
----------------------------
Card Services loaded in memory (C) Copyright 1993 by Databook, Inc.
Keithley MetraByte enabler IS loaded in memory

Socket 0:
---------
Keithley MetraByte
DASCard-1002
Card Enabled:
   I/O Base Address = 0x300
   IRQ = 5
   Memory Window = 0xC800

Socket 1:
---------
Empty...
```

Figure 3-1. Sample Diagnostics Utility Display

Note: The socket number specified by the diagnostics utility does not necessarily correspond to the card number assigned to the card in the configuration file. For example, the diagnostics utility indicates that a PC memory card is installed in socket 0 and a DASCard-1001 card is installed in socket 1. Since you are using only one DASCard-1000 Series card, in your configuration file (and in any software that uses a configuration file), the DASCard-1001 card is referred to as card 0.

If any of the fields in the diagnostics utility display is missing or if an error is displayed, the DASCard-1000 Series card was not configured properly. Refer to Chapter 7 for troubleshooting information.

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4

Cabling and Wiring

This chapter describes how to attach accessories to a DASCard-1000 Series card and provides information to keep in mind when connecting signals to a DASCard-1000 Series card.

Note: Before you make any connections to a DASCard-1000 Series card, make sure that power to your computer and any accessories attached to the DASCard-1000 Series card are OFF.

Attaching Accessories

You can use an STP-37 screw terminal panel or an EXP-1600 expansion accessory with a DASCard-1000 Series card. The following sections describe how to attach these accessories.

Attaching an STP-37 Screw Terminal Panel

The screw terminals on the STP-37 screw terminal panel allow you to connect field wiring to a DASCard-1000 Series card. In addition, the STP-37 contains CJC circuitry for measuring thermocouple input.

Note: Only DASCard-1001 cards support thermocouple input. If you are measuring thermocouple input on a DASCard-1001, refer to page 4-10 for information on wiring your application.

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The STP-37 contains 41 screw terminals. The screw terminals labeled 1 to 37 are used to access the functions of DASCard-1000 Series card; refer to Appendix B for a list of the screw terminals assigned to each function. (Note that screw terminal 38 is not used.) The three screw terminals in the screw terminal block labeled P2 are used to access the CJC sensor on the panel.

To attach an STP-37 to a DASCard-1000 Series card, attach the 32-pin (smaller) end of the CAB-1000 cable to the 32-pin connector on the DASCard-1000 Series card and attach the 37-pin (larger) end of the CAB-1000 cable to the J1 connector on the STP-37. Note that the cables are keyed so that you can connect them in only one way.

Figure 4-1 illustrates the connection of an STP-37 to a DASCard-1001 card.

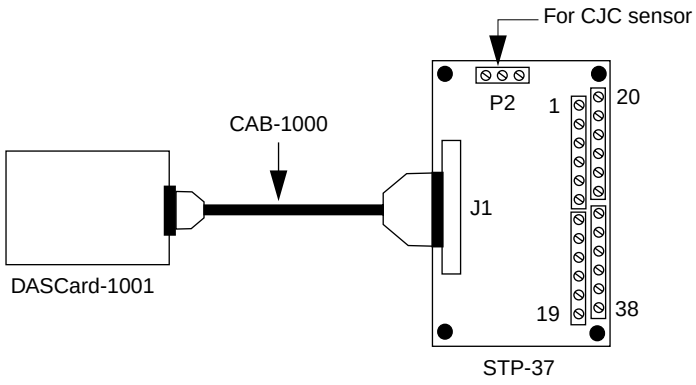


Figure 4-1. Attaching an STP-37 Screw Terminal Panel

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Attaching an EXP-1600 Expansion Accessory

Each EXP-1600 expansion accessory provides up to 16 differential analog input channels (0 to 15). Screw terminals are provided on the following removable field wiring accessories:

- **FWA-EXP** - You attach the FWA-EXP directly to the J1 connector on the EXP-1600; it provides 48 screw terminals, two screw terminals for each channel (CH*xx* HI and CH*xx* LO, where *xx* is the number of the analog input channel) and 16 screw terminals for miscellaneous functions. You connect one FWA-EXP to each EXP-1600 you are using.
- **FWA-37U** - You attach the FWA-37U directly to the P4 connector on the EXP-1600; it provides 40 screw terminals that allow you to access the other functions of the DASCard-1000 Series card. You connect an FWA-37U to the first EXP-1600 only.

To connect an EXP-1600 to a DASCard-1000 Series card, perform the following steps:

1. Attach the 32-pin (smaller) end of the CAB-1000 cable to the 32-pin connector on the DASCard-1000 Series card.
2. Attach the 37-pin (larger) end of the CAB-1000 cable to the 37-pin end of the CAB-3740/F cable.
3. Attach the 40-pin end of the CAB-3740/F cable to the P2 connector on the EXP-1600.
4. Attach an external +5 V power supply (such as the PWR-5V or PWR-5V/E) to one of the external power connectors on the EXP-1600.

Note that the cables are keyed so that you can connect them in only one way.

Figure 4-2 illustrates the connection of an EXP-1600 to a DASCard-1001 card.

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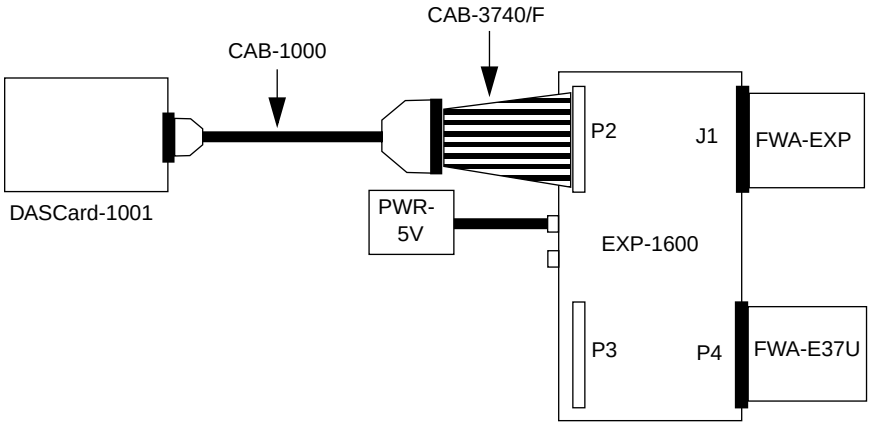


Figure 4-2. Attaching an EXP-1600 Expansion Accessory

Refer to the *EXP-800/1600 User's Guide* for more information.

Attaching Multiple EXP-1600 Expansion Accessories

You can attach up to 16 EXP-1600 expansion accessories to provide up to 256 analog input channels. You attach the expansion accessories in a daisy-chain configuration using a CAB-40 or CAB-40/1 cable.

The first expansion accessory in the daisy chain is associated with oncard channel 0, the next expansion accessory is associated with oncard channel 1, and so on. You specify the associated oncard channel by setting a jumper on each expansion accessory, using a unique jumper setting for each expansion accessory.

You can access any unused oncard channels by attaching an FWA-37U field wiring accessory to the first EXP-1600 expansion accessory in the daisy-chain configuration.

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You connect the first EXP-1600 to the DASCard-1000 Series card as described in the previous section. To connect additional EXP-1600 expansion accessories, attach one end of the CAB-40 or CAB-40/1 cable to either the P2 or P3 connector on the previous expansion accessory and attach the other end of the cable to either the P2 or P3 connector on the next expansion accessory in the chain. (Note that P2 and P3 are identical connectors.)

You must attach +5 V power to all the EXP-1600 expansion accessories. If desired, you can connect multiple EXP-1600s to a single PWR-5V or PWR-5V/E power supply using CAB-PWR or CAB-PWR/1 cables; attach one end of a CAB-PWR or CAB-PWR/1 cable to the unused power connector on the first expansion accessory and the other end of the cable to either of the power connectors on the next expansion accessory in the chain. (Note that the two power connectors are identical.)

Figure 4-3 illustrates how to connect three EXP-1600 expansion accessories to a DASCard-1001 card.

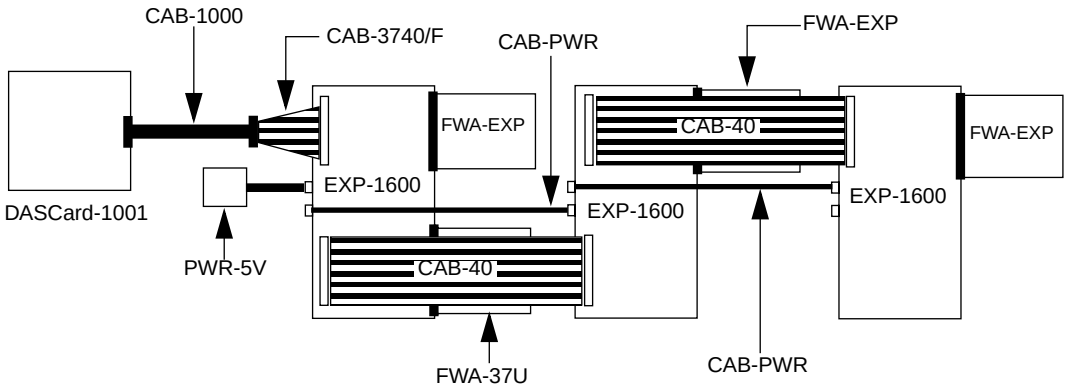


Figure 4-3. Attaching Multiple EXP-1600 Expansion Accessories

Refer to the *EXP-800/1600 User's Guide* for more information about the EXP-1600 expansion accessory.

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Connecting Signals

Keep the following in mind when wiring signals to a DASCard-1000 Series card:

- You wire your signal to a screw terminal on an accessory. Appendix B lists the screw terminals associated with the functions of DASCard-1000 Series cards.
- DASCard-1000 Series cards contain both a digital common (DGND) and an analog common (AGND). Use the digital common for all digital signal returns and power supply returns; use the analog common for all analog signal returns.
- When wiring analog input signals, it is recommended that you terminate all unused input channels to analog ground; this prevents the internal amplifier circuitry from saturating if you select an unconnected input and ensures the accuracy of your data.
- When using a DASCard-1001 card at a gain of 1000 or 100, take the following precautions to avoid analog noise and performance degradation:
  - Operate DASCard-1001 cards in 8-channel differential mode. Using the card in 16-channel single-ended mode at a gain of 1000 introduces enough ground-loop noise to produce large fluctuations in readings.
  - Minimize noise from crosstalk and induced-voltage pickup in the flat cables and screw terminal accessories by using shielded cable. Connect the shield to AGND and the inner conductors to CH LO and CH HI. CH LO and AGND should have a DC return (or connection) at some point; this return should be as close to the signal source as possible. Induced noise from RF and magnetic fields can easily exceed tens of microvolts, even on 1-foot or 2-foot cables; shielded cable eliminates this problem.

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  - Avoid bi-metallic junctions in the input circuitry. For example, the kovar leads, used on reed relays, typically have a thermal emf to copper of 40 µV/˚C. Thermals can introduce strange random variations caused by air currents and so on.
  - Provide filtering using either hardware (resistors, capacitors, and so on) or software. To provide software filtering, instead of reading the channel once, read it 10 or more times in quick succession and average the readings. If the noise is random and gaussian, it will be reduced by the square-root of the number of readings.

- Do not mix your analog input signals with the AC line. An inadvertent short between data and power lines can cause extensive and costly damage to your computer for which the manufacturer may not accept liability. To prevent this problem, use the following precautions:
  - Avoid direct connections to the AC line.
  - Make sure all connections are tight and sound so that signal wires are not likely to come loose and short to high voltages.
  - Use isolation amplifiers and transformers where necessary.

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Connecting an Analog Input Signal to a Single-Ended Input

Figure 4-4 illustrates how to connect an analog input signal to single-ended analog input channel 0 on a DASCard-1001 card.

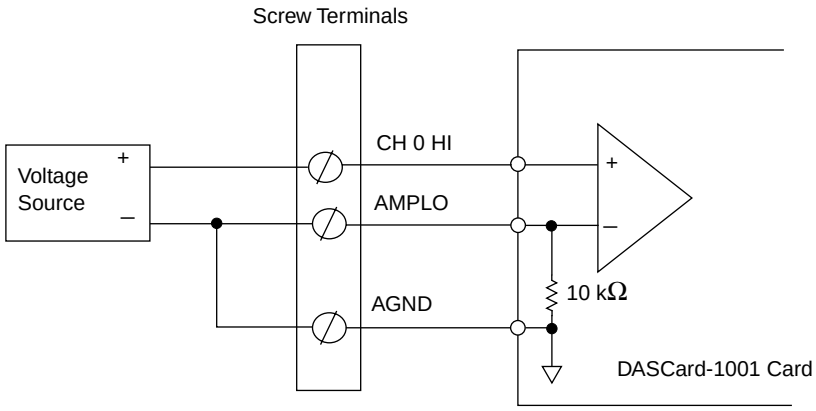


Figure 4-4. Single-Ended Input

Note: It is recommended that you use the remote ground sense (AMPLO) as shown in Figure 4-4. However, if you do not connect AMPLO, the 10 kΩ resistor provides a ground reference on the board.

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Connecting an Analog Input Signal to a Differential Input

For differential input configurations, you must provide a bias current return path to the analog common. Figure 4-5 illustrates how to connect an analog input signal to differential analog input channel 0 on a DASCard-1001 card for output resistances both less than and greater than 100 Ω.

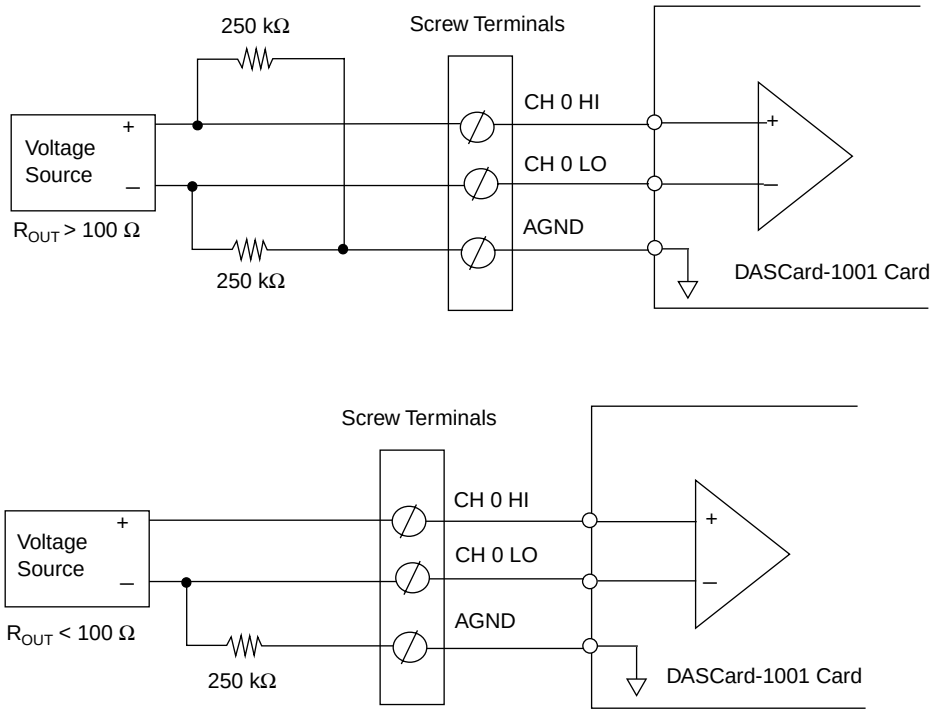


Figure 4-5. Differential Input

Note: For output resistances greater than 100 Ω, it is recommended that the sum of the resistors used be at least 5,000 times greater than the source output resistor.

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Connecting a Thermocouple Input Signal

When used with an STP-37 screw terminal accessory, a DASCard-1001 card can measure thermocouple input. You use the CJC sensor to apply a correction factor (in software) to the thermocouple reading. To access the CJC sensor, wire the CJC sensor to an unused channel on the DASCard-1001 card.

Figure 4-6 illustrates how to connect a thermocouple input signal to an STP-37 screw terminal panel, using analog input channel 0 on a DASCard-1001 card to read the thermocouple input and analog input channel 15 on the DASCard-1001 card to access the CJC reading.

You connect the following:

- CH0HI on the DASCard-1001 card (screw terminal 37) to analog ground (screw terminal 29).
- The CJC output (screw terminal VOUT) to CH15HI on the DASCard-1001 card (screw terminal 11).
- The +5 V power from the host computer (screw terminal 1) to the CJC power input (screw terminal VS).
- CJC ground (screw terminal GND) to analog ground (screw terminal 29).

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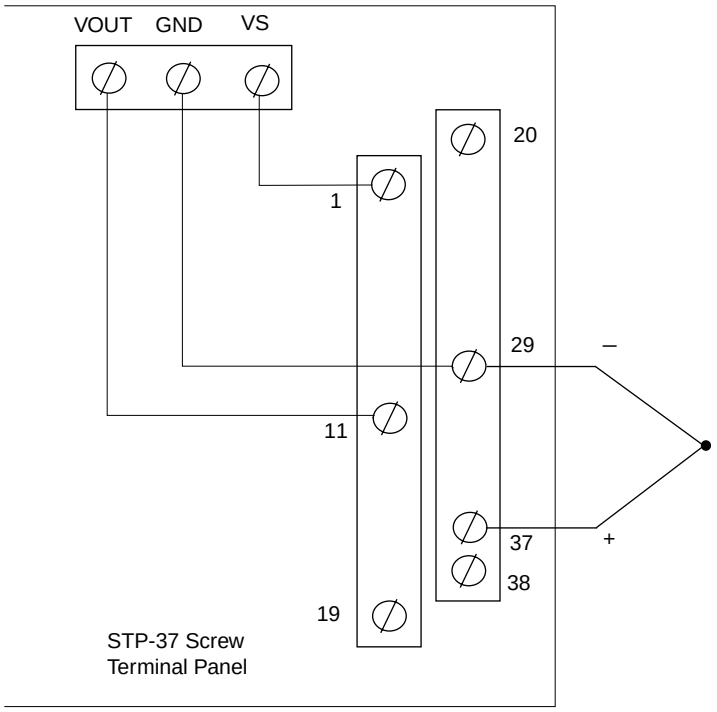


Figure 4-6. Thermocouple Input

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Connecting Digital Signals

You can connect the following digital signals to a DASCard-1000 Series card:

- **Digital input signal** - Connect a digital input signal to the XCLK/PI0, XTRIG/PI1, PI2, or PI3 line of the DASCard-1000 Series card.
- **Digital output signal** - Connect a digital output signal to the PO0, PO1, PO2, PO3, PO4, PO5, PO6, or PO7 line of the DASCard-1000 Series card.
- **External pacer clock** - Connect an external pacer clock to the XCLK/PI0 line of the DASCard-1000 Series card.
- **Hardware trigger** - Connect an external digital trigger to the XTRIG/PI1 line of the DASCard-1000 Series card.

Make sure that all digital signals are TTL-level compatible. Use the DGND line as the return for all digital signals.

Caution: To prevent damage to DASCard-1000 Series cards, do not apply voltages exceeding TTL maximum levels (–0.5 V to +5.5 V) to digital input pins.

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5

The Control Panel

The Control Panel (CTL1000.EXE) is a utility program that allows you to test the functions of your DASCard-1000 Series card under Windows. The Control Panel is shipped with both the DASCard-1000 Series standard software package and the ASO-1000 software package.

Note: Before using the Control Panel, it is recommended that you install the Keithley Memory Manager (VDMAD.386) to ensure the allocation of a memory buffer large enough for Control Panel needs. Refer to Appendix C for information about the Keithley Memory Manager.

To use the Control Panel, perform the following steps:

1. Either click on the Control Panel icon or choose Run from the Program Manager File menu, enter the following in the box, and choose OK:

   ```
   CTL1000
   ```

   Make sure that you enter the correct path to CTL1000.EXE, or use the Browse button to find this file.

   The software displays the Open Configuration File panel, asking you to specify the configuration file you want to use.

2. Select the configuration file in one of the following ways:

   – To use the default configuration file DAS1000.CFG, choose OK. Refer to Table 3-1 on page 3-5 for a list of the default configuration options.

   – Highlight or enter the name of another configuration file in the File Name box and choose OK. The software uses the configuration options from the selected configuration file.

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After you specify the appropriate configuration options, the software displays the DASCard-100*x* Test & Control panel, where DASCard-100*x* indicates the model of the first card (card 0) listed in the configuration file. The DASCard-100*x* Test & Control panel allows you to acquire, display, and transfer analog input data and to set up and display the analog input parameters.

3. Select the appropriate buttons to perform an analog input operation. For information about the meaning of the analog input parameters, use the online help provided with the Control Panel or refer to Chapter 2.

4. To perform a digital I/O operation, choose Digital I/O from the Panels menu. The software displays the DASCard-100*x* Digital I/O panel. This panel controls the output and input of digital signals.

5. Select the appropriate buttons to perform a digital I/O operation. For information about the meaning of the digital I/O parameters, use the online help provided with the Control Panel or refer to Chapter 2.

6. When you have finished the digital I/O operation, choose Close to return to the DASCard-100*x* Test & Control panel.

7. If desired, you can use Dynamic Data Exchange (DDE) to transfer data to another Windows program by choosing DDE from the Panels menu.

   When you have finished using the Control Panel, choose Exit from the File menu to terminate the program.

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6

Calibration

DASCard-1000 Series cards and EXP-1600 expansion accessories are calibrated in the factory and should not require calibration when shipped. It is recommended that you check and, if necessary, readjust the calibration of your DASCard-1000 Series cards and EXP-1600 expansion accessories every six months to a year.

Note: DASCard-1000 Series cards do not contain adjustable potentiometers. Instead, full scale and offset calibration factors are stored in nonvolatile memory on the card; this ensures that the calibration factors are not lost when the computer is powered down.

Equipment Required

You need the following equipment to calibrate a DASCard-1000 Series card or EXP-1600 expansion accessory:

- A digital voltmeter accurate to a minimum of 5 1/2 digits
- An adjustable precision ±5 V voltage source

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Calibration Procedure

To calibrate DASCard-1000 Series cards and EXP-1600 expansion accessories, use the calibration utility (CAL1000.EXE). CAL1000.EXE runs under Windows and is shipped with both the DASCard-1000 Series standard software package and the ASO-1000 software package.

To calibrate a DASCard-1000 Series card or EXP-1600 expansion accessory, perform the following steps:

1. Either click on the calibration utility icon or choose Run from the Program Manager File menu, enter the following in the box, and choose OK:

   ```
   CAL1000
   ```

   Make sure that you enter the correct path to CAL1000.EXE, or use the Browse button to find this file.

   The software displays the DASCard-100*x* panel, where DASCard-100*x* indicates the model of the card you are calibrating; this is usually the card in physical socket 0.

   Note: The calibration utility can calibrate one DASCard-1000 Series card. If the utility finds a DASCard-1000 Series card in socket 0, it calibrates that card. If the utility does not find a card in socket 0 or if it finds a non-DASCard-1000 Series card in socket 0, it calibrates the DASCard-1000 Series card in socket 1. If you are using two DASCard-1000 Series cards, you must swap the cards to make sure that the card you are calibrating is in physical socket 0.

   ---

2. Follow the prompts as they appear on the screen; the program guides you through the calibration process. For more information, choose Help to access the online help.
3. When you have finished calibrating the board, choose Close to terminate the program.

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7

Troubleshooting

If your DASCard-1000 Series card is not operating properly, use the information in this chapter to isolate the problem. If the problem appears serious enough to warrant technical support, refer to page 7-6 for information on how to contact an applications engineer.

Identifying Symptoms and Possible Causes

Table 7-1 lists general symptoms and possible solutions for problems with DASCard-1000 Series cards.

Table 7-1. Troubleshooting Information

Symptom	Possible Cause	Possible Solution
Diagnostics utility indicates that the card is not installed correctly	PCMCIA Card and Socket Services are not installed.	Refer to the documentation supplied with your computer for information on installing PCMCIA Card and Socket Services. If Card and Socket Services were not supplied with your computer, contact your local Keithley MetraByte sales office for information on obtaining them.
	PCMCIA Card and Socket Services are not compliant with PCMCIA standard 2.10 or higher.	Contact your computer manufacturer for information on upgrading to PCMCIA standard 2.10. If PCMCIA Card and Socket Services were not supplied with your computer, contact your local Keithley MetraByte sales office for information on obtaining them.

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Table 7-1. Troubleshooting Information (cont.)

Symptom	Possible Cause	Possible Solution
Diagnostics utility indicates that the card is not installed correctly (cont.)	The Enabler is not installed.	Exit Windows and try loading the Enabler (KMENABLE.EXE) again from DOS. (You cannot load the Enabler from the MS-DOS Prompt in Windows.) Refer to page 3-8.
	A memory segment address is not assigned.	Make sure that 4K bytes of high memory between 640K bytes and 1M bytes are available. Use the DOS command MEM or the DOS utility Microsoft Diagnostics (MSD) to check the available high memory in your system. If your PCMCIA Card Services allow you to reserve system resources when you install the PCMCIA software, make sure that you reserve 4K bytes for the DASCard-1000 Series card. Refer to the documentation supplied with your PCMCIA Card and Socket Services for information.
	You loaded the Enabler with a DASCard-1000 Series card already installed and the Enabler does not recognize the card.	Remove the DASCard-1000 Series card and turn power OFF. Turn power back ON, load the Keithley MetraByte Enabler (KMENABLE.EXE), and then reinstall the card. If your hardware does not support hot-swapping, you may have to manually reapply power to the card using the appropriate PCMCIA Card Services function.
	PCMCIA Card Services recognizes a DASCard-1000 Series card as another type of device and allocates resources without providing the Keithley MetraByte Enabler with information about the allocated resources.	Remove the DASCard-1000 Series card and turn power OFF. Turn power back ON, load the Keithley MetraByte Enabler (KMENABLE.EXE), and then reinstall the card. If your hardware does not support hot-swapping, you may have to manually reapply power to the card using the appropriate PCMCIA Card Services function.

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Table 7-1. Troubleshooting Information (cont.)

Symptom	Possible Cause	Possible Solution
Card does not respond	PCMCIA Card Services cannot check the interrupt level and base address assigned to non-PCMCIA devices and may have selected an interrupt level or base address that is being used by another device, such as a network card, a mouse, or a sound card.	Use the diagnostics utility to determine the system resources selected by PCMCIA Card Services; refer to page 3-14. If the interrupt level or base address is being used by another device, load the Enabler again using command-line options to select another interrupt level or base address; refer to page 3-8. If your PCMCIA Card Services allow you to reserve system resources when you install the PCMCIA software, make sure that you reserve an unused interrupt level or base address. Refer to the documentation supplied with your PCMCIA Card and Socket Services for information. Assign another interrupt level or base address to the other device. Available interrupt levels depend on the computer you are using. Typically, base addresses 300h to 377h are available.
	Computer memory is not available for the calibration factors and other card information.	Make sure that at least 4K bytes is available between 640K bytes and 1M bytes of high memory. If you used the /MEM0 or /MEM1 option when loading the Enabler, make sure that the address you specified is less than FFFFh. Remove some of your TSR programs from computer memory.

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Table 7-1. Troubleshooting Information (cont.)

Symptom	Possible Cause	Possible Solution
Card does not respond (cont.)	The card is not inserted correctly in the PCMCIA socket.	Check installation. Make sure that you have inserted the card in a Type II PCMCIA socket. Remove the card and insert again. If your hardware does not support hot-swapping, you may have to manually reapply power to the card using the appropriate PCMCIA Card Services function.
	The card is damaged.	Contact the Keithley MetraByte Applications Engineering Department; refer to page 7-6.
An application program written using the DASCard-1000 Series Function Call Driver does not run properly	The Keithley MetraByte Enabler (KMENABLE.EXE) did not provide the DASCard-1000 Series Function Call Driver with the base address, interrupt level, and memory segment address assigned to your card.	Remove the DASCard-1000 Series card and turn power OFF. Turn power back ON, load the Keithley MetraByte Enabler (KMENABLE.EXE), and then reinstall the card. If your hardware does not support hot-swapping, you may have to manually reapply power to the card using the appropriate PCMCIA Card Services function.
Mouse does not work properly or interferes with other card operations	PCMCIA Card Services may have selected an interrupt level or base address that is being used by the mouse.	Use the diagnostics utility (KMINFO.EXE or KMINFOW.EXE) to determine the system resources used; refer to page 3-14. Assign a different system resource to the mouse. Reserve unused system resources when you install the PCMCIA software, if possible.
Intermittent operation	Vibrations or loose connections exist.	Cushion source of vibration and tighten connections.
	The card is overheating.	Check environmental and ambient temperature. See the documentation for your computer.
	Electrical noise exists.	Provide better shielding or reroute wiring.

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Table 7-1. Troubleshooting Information (cont.)

Symptom	Possible Cause	Possible Solution
Data appears to be invalid	An open connection exists.	Check wiring to screw terminals.
	The card is out of calibration.	Recalibrate the card; refer to Chapter 6.
	Multiple devices in your system are using the same interrupt level, base address, or memory segment address.	Use the diagnostics utility to determine the system resources used; refer to page 3-14. Assign a different system resource to the other device.
Card does not work properly	You used **Ctrl Alt Del** to restart your computer. (On some computers, **Ctrl Alt Del** does not reset the socket controller.)	Restart your computer by using the reset button or by turning power OFF and then back ON. Refer to your computer documentation.
System lockup	A timing error occurred.	Press **Ctrl Break**.

If you cannot identify the problem using the information in Table 7-1, refer to the next section to determine whether the problem is in the computer or in the DASCard-1000 Series card.

Testing the Card and the Computer

To determine whether the problem is in the computer or in the DASCard-1000 Series card, perform the following steps:

1. Remove power connections to the computer.
2. Unplug the accessory cable from the DASCard-1000 Series card, keeping the connections intact on the accessory.
3. Remove the DASCard-1000 Series card from the computer and visually check for damage. If a card is obviously damaged, refer to page 7-6 for information on returning the card.
4. With the DASCard-1000 Series card removed from the computer, check the computer for proper operation. Power up the computer and perform any necessary diagnostics.

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If you have another DASCard-1000 Series card that you know is functional, refer to the next section to determine whether the problem is in the PCMCIA socket or in the I/O connections. If you do not have another card, refer to page 7-6 for information on how to contact an applications engineer.

Testing the PCMCIA Socket and I/O Connections

To determine whether the problem is in the PCMCIA socket or in the I/O connections, perform the following steps:

1. When you are sure that the computer is operating properly, install a DASCard-1000 Series card that you know is functional. Do not make any I/O connections.
2. Apply computer power and check operation with the functional DASCard-1000 Series card in place. This test checks the PCMCIA socket. If you are using two DASCard-1000 Series cards, check the other socket you are using.
3. If the PCMCIA sockets are functional, check the I/O connections. Connect the accessories, one at a time, and check operation.
4. If operation is normal, the problem is in the DASCard-1000 Series card originally in the computer.
5. If you cannot isolate the problem, refer to the next section for instructions on getting technical support.

Technical Support

Before returning any equipment for repair, call the Keithley MetraByte Applications Engineering Department at:

(508) 880-3000
Monday - Friday, 8:00 A.M. - 6:00 P.M., Eastern Time

An applications engineer will help you diagnose and resolve your problem over the telephone.

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Please make sure that you have the following information available before you call:

DASCard-1000 Series card	Model	DASCard-1001 DASCard-1002 DASCard-1003
	Serial #	_____
	Revision code	_____
Computer	Manufacturer	_____
	CPU type	286 386 486 Pentium
	Clock speed (MHz)	20 25 33 66 100 ____
	Math coprocessor	Yes No
	Amount of RAM	_____
	Video system	EGA VGA SVGA
	BIOS type	_____
	PCMCIA controller	_____
	Memory manager	_____
Operating system	DOS version	_____
	Windows version	3.0 3.1 _____
	Windows mode	Standard Enhanced
PCMCIA Card and Socket Services	Type	_____
	Version	_____
Software package	Name	_____
	Serial #	_____
	Version	_____
	Invoice/order #	_____
Compiler (if applicable)	Language	_____
	Manufacturer	_____
	Version	_____
Accessories	Type/number	_____
	Type/number	_____
	Type/number	_____

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If a telephone resolution is not possible, the applications engineer will issue you a Return Material Authorization (RMA) number and ask you to return the equipment. Include the RMA number with any documentation regarding the equipment.

When returning equipment for repair, include the following information:

- Your name, address, and telephone number.
- The invoice or order number and date of equipment purchase.
- A description of the problem or its symptoms.
- The RMA number on the outside of the package.

Repackage the equipment, using the original anti-static wrapping, if possible, and handling it with ground protection. Ship the equipment to:

ATTN: RMA #_____
Repair Department
Keithley MetraByte
440 Myles Standish Boulevard
Taunton, Massachusetts 02780

Telephone (508) 880-3000
Telex 503989
FAX 508/880-0179

Note: If you are submitting your equipment for repair under warranty, you must include the invoice number and date of purchase.

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A

Specifications

Table A-1 lists the specifications for the DASCard-1000 Series cards.

Table A-1. DASCard-1000 Series Specifications

Feature	Attribute	Specifications
Analog Input	Number of channels	16 single-ended (with remote ground sense) 8 differential
	Range	Unipolar: 0 to 5 V Bipolar: ±5 V
	Gain	DASCard-1001: 1, 10, 100, 1000 DASCard-1002: 1, 2, 4, 8 DASCard-1003: 1 only
	Resolution	12 bits (1 part in 4096 or 244 ppm) over a 2% reduced digital range for software calibration
	Absolute accuracy at 25°C	–(0.5 to 3.5)% of full scale range (before software calibration) ±0.01% of full scale range ±1 LSB, maximum (after software calibration)
	Nonlinearity	Integral: ±1.5 LSB, maximum Differential: ±1 LSB, maximum Monotonicity: guaranteed over temperature range
	Data format	12 bits, twos complement

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Table A-1. DASCard-1000 Series Specifications (cont.)

Feature	Attribute	Specifications
Analog Input (cont.)	Temperature coefficient of accuracy	Unipolar offset (referred to input), maximum: DASCard-1001: ±0.25 µV/°C ±(63 µV/°C ÷ gain) DASCard-1002: ±1 µV/°C ±(63 µV/°C ÷ gain) DASCard-1003: ±128 µV/°C Bipolar offset (referred to input), maximum: DASCard-1001: ±0.25 µV/°C ±(23 µV/°C ÷ gain) DASCard-1002: ±1 µV/°C ±(24 µV/°C ÷ gain) DASCard-1003: ±112 µV/°C Full scale, maximum: DASCard-1001: ±34 ppm/°C DASCard-1002: ±34 ppm/°C DASCard-1003: ±34 ppm/°C
	Input bandwidth (–3 dB)	DASCard-1001: Gain of 1: 50 kHz, typical Gain of 10: 50 kHz, typical Gain of 100: 10 kHz, typical Gain of 1000: 1 kHz, typical DASCard-1002: 50 kHz, typical (all gains) DASCard-1003: 50 kHz, typical
	Throughput	Single channel (any gain) DASCard-1001: 140,000 samples/second DASCard-1002: 140,000 samples/second DASCard-1003: 140,000 samples/second Multiple channels at the same gain DASCard-1001: Gain of 1: 34,000 samples/second Gain of 10: 28,000 samples/second Gain of 100: 5,700 samples/second Gain of 1000: 615 samples/second DASCard-1002: Gain of 1: 34,000 samples/second Gain of 2: 34,000 samples/second Gain of 4: 32,000 samples/second Gain of 8: 28,000 samples/second DASCard-1003: 140,000 samples/second

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Table A-1. DASCard-1000 Series Specifications (cont.)

Feature	Attribute	Specifications
Analog Input (cont.)	Conversion time	5.6 µs, maximum (including acquisition time)
	Input bias current	200 nA, maximum
	Common-mode rejection ratio (at DC)	DASCard-1001: Gain of 1: 75 dB, minimum Gain of 10: 90 dB, minimum Gain of 100: 106 dB, minimum Gain of 1000: 106 dB, minimum DASCard-1002: Gain of 1: 75 dB, minimum Gain of 2: 80 dB, minimum Gain of 4: 85 dB, minimum Gain of 8: 89 dB, minimum DASCard-1003: 75 dB, minimum
	Input overvoltage	±32 V, continuous powered ±20 V, continuous unpowered
	Electrical noise[1]	Gain of 1: 1 count p-p, 0.1 counts rms Gain of 2: 1 count p-p, 0.1 counts rms Gain of 4: 1 count p-p, 0.1 counts rms Gain of 8: 1 count p-p, 0.1 counts rms Gain of 10: 1 count p-p, 0.1 counts rms Gain of 100: Bipolar input range: 1 count p-p, 0.1 counts rms Unipolar input range: 2 counts p-p, 0.2 counts rms Gain of 1000: Bipolar input range: 2 counts p-p, 0.2 counts rms Unipolar input range: 4 counts p-p, 0.5 counts rms
	Data transfer	8 bits
	A/D FIFO	512 words
	Interrupt events	A/D Data Ready (FIFO Not Empty) A/D FIFO Half Full A/D Clock Error A/D Buffer Overrun (FIFO Overrun)
Pacer Clock	Internal	16-bit counter from 10 MHz or 1 MHz
	External	Negative edge Minimum pulse width: 200 ns

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Table A-1. DASCard-1000 Series Specifications (cont.)

Feature	Attribute	Specifications
Trigger	External	Negative edge Minimum pulse width: 200 ns
Digital Input	Number of lines	4 (with 10 kΩ pull-up resistors)
	Low voltage	0.8 V maximum
	High voltage	2.0 V minimum
Digital Output	Number of lines	8
	Low voltage	0.5 V maximum at 10 mA 0.33 V maximum at 6 mA
	High voltage	2.4 V minimum at –10 mA 3.84 V minimum at –6 mA
Power Requirements	+5 VDC	DASCard-1001: 70 mA maximum DASCard-1002: 70 mA maximum DASCard-1003: 70 mA maximum
	+12 VDC	DASCard-1001: 44 mA maximum DASCard-1002: 44 mA maximum DASCard-1003: 37 mA maximum
General	Operating temperature	0°C to 70°C
	Storage temperature	–40°C to 85°C
	Humidity	0 to 90%, noncondensing
	Dimensions	Standard PCMCIA Type II (5.00 mm thick)

Notes

[1] Does not include the uncertainty inherent in the quantization process. The inherent quantization noise introduced by any ADC is due to uncertainty at code boundaries and adds a peak-to-peak value of 1 LSB to the electrical noise and makes the rms level 0.5 LSB.

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B

Screw Terminal Assignments

Table B-1 lists the functions of the screw terminals on the following accessories:

- STP-37 screw terminal panel
- FWA-37U field wiring accessory attached to an EXP-1600 expansion accessory

Table B-1. Screw Terminal Assignments for the STP-37 and FWA-37U

Screw Terminal	DASCard-1000 Series Line	Function
1	+5 V	+5 V power
2	PO4	Digital output line 4
3	PO3	Digital output line 3
4	PO1	Digital output line 1
5	PI3	Digital input line 3
6	XTRIG/PI1	External digital trigger/digital input line 1
7	DGND	Digital ground
8	Not used	None
9	PO7	Digital output line 7
10	Not used	None
11	CH7LO/CH15HI	Analog input channel 7 low/channel 15 high
12	CH6LO/CH14HI	Analog input channel 6 low/channel 14 high

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Table B-1. Screw Terminal Assignments for the STP-37 and FWA-37U (cont.)

Screw Terminal	DASCard-1000 Series Line	Function
13	CH5LO/CH13HI	Analog input channel 5 low/channel 13 high
14	CH4LO/CH12HI	Analog input channel 4 low/channel 12 high
15	CH3LO/CH11HI	Analog input channel 3 low/channel 11 high
16	CH2LO/CH10HI	Analog input channel 2 low/channel 10 high
17	CH1LO/CH9HI	Analog input channel 1 low/channel 9 high
18	CH0LO/CH8HI	Analog input channel 0 low/channel 8 high
19	AMPLO	Remote ground sense for single-ended input configuration
20	PO5	Digital output line 5
21	Not used	None
22	PO2	Digital output line 2
23	PO0	Digital output line 0
24	PI2	Digital input line 2
25	XCLK/PI0	External pacer clock/digital input line 0
26	Not used	None
27	PO6	Digital output line 6
28	Not used	None
29	AGND	Analog ground
30	CH7HI	Analog input channel 7 high
31	CH6HI	Analog input channel 6 high
32	CH5HI	Analog input channel 5 high
33	CH4HI	Analog input channel 4 high
34	CH3HI	Analog input channel 3 high
35	CH2HI	Analog input channel 2 high
36	CH1HI	Analog input channel 1 high
37	CH0HI	Analog input channel 0 high

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C

Keithley Memory Manager

The process that Windows uses to allocate memory can limit the amount of memory available to Keithley DAS products operating in Windows Enhanced mode. To reserve a memory heap that is adequate for the needs of your product, you can use the Keithley Memory Manager (KMM), included in the ASO software package.

The reserved memory heap is part of the total physical memory available in your system. When you start up Windows, the KMM reserves the memory heap. Then, whenever your application program requests memory, the memory buffer is allocated from the reserved memory heap instead of from the Windows global heap. The KMM is DAS product independent and can be used by multiple Keithley DAS Windows application programs simultaneously.

Note: The memory allocated with the KMM can be used by a DMA controller, if applicable.

The following are supplied with the KMM:

- **VDMAD.386 -** Customized version of Microsoft's Virtual DMA Driver. This file consists of a copy of Microsoft's Virtual DMA Driver and a group of functions that is added to perform the KMM functions. When you use the KMM to reserve a memory heap, Microsoft's Virtual DMA Driver is replaced by the VDMAD.386 file.

  Note: If you have multiple versions of VDMAD.386, it is recommended that you install the latest version; to determine which version is the latest version, refer to the time stamp of the file.

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- **KMMSETUP.EXE** - Windows program that helps you set up the VDMAD.386 parameters and then modifies your SYSTEM.INI file accordingly.

Installing and Setting Up the KMM

To install and set up the KMM whenever you start up Windows, you must modify the SYSTEM.INI file. You can modify the SYSTEM.INI file using either the KMMSETUP.EXE program or a text editor.

Using KMMSETUP.EXE

Using the KMMSETUP.EXE program, you can modify your Windows SYSTEM.INI file as follows:

1. Invoke KMMSETUP.EXE in one of the following ways:
   - From the Program Manager menu, choose File and then Run, and then type the complete path and program name for KMMSETUP.
   - Select the KMMSETUP icon, if installed.
2. In the New VDMAD.386 box, enter the path and name of the VDMAD.386 file, as follows:

   ```
   C:\WINDOWS\VDMAD.386
   ```

   The string you enter replaces `*vdmad` in the `device=*vdmad` line in your SYSTEM.INI file.

   Note: Normally, the VDMAD.386 file is stored in the WINDOWS directory. If it is stored elsewhere, enter the correct path and name or use the Browse button to find the file.

   ---

3. Notice the Current Setting box. The value specified reflects the current size of the reserved memory heap in KBytes.
4. In the Desired Setting box, enter the desired size of the reserved memory heap in KBytes.

   The value you enter replaces the `KEIDMAHEAPSIZE=` line in the [386Enh] section of your SYSTEM.INI file.

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Notes: The memory size you specify is no longer available to Windows. For example, if your computer has 8 MBytes of memory installed and you specify `KEIDMAHEAPSIZE=1000` (1 MByte), Windows can only see and use 7 MBytes.

If you specify a value less than 128, a 128 KByte minimum heap size is assumed. The maximum heap size is limited only by the physical memory installed in your system and by Windows itself.

5. Select the Update button to update the SYSTEM.INI file with the changes you have made.
6. Restart Windows to ensure that the system changes take effect.

Using a Text Editor

Using a text editor, you can modify your Windows SYSTEM.INI file in the [386Enh] section, as follows:

1. Replace the line `device=*vdmad` with the following:

   ```
   device=c:\windows\vdmad.386
   ```

   Note: Normally, the VDMAD.386 file is stored in the WINDOWS directory. If it is stored elsewhere, enter the correct path and name.

2. Add the following line:

   `KEIDMAHEAPSIZE=<`*size*`>`

   where *size* indicates the desired size of the reserved memory heap in KBytes.

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Notes: The memory size you specify is no longer available to Windows. For example, if your computer has 8 MBytes of memory installed and you specify `KEIDMAHEAPSIZE=1000` (1 MByte), Windows can only see and use 7 MBytes.

If you do not add the `KEIDMAHEAPSIZE` keyword or if the size you specify is less than 128, a 128 KByte minimum heap size is assumed. The maximum heap size is limited only by the physical memory installed in your system and by Windows itself.

3. Restart Windows to ensure that the system changes take effect.

Removing the KMM

If you make changes to the SYSTEM.INI file, you can always remove the updated information from the SYSTEM.INI file and return all previously reserved memory to Windows.

If you are using KMMSETUP.EXE, select the Remove button to remove the updated information. If you are using a text editor, modify and/or delete the appropriate lines in SYSTEM.INI. In both cases, make sure that you restart Windows to ensure that the system changes take effect.

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