

DAS-4000 Series

64MHz to 1GHz ISA-Bus
Analog Input Boards

FEATURES

- Family of three data acquisition boards:
DAS-4100 - 64MHz sampling rate
DAS-4300 - 1GHz sampling rate
- Up to 2MB of onboard memory for continuous, gap-free, high-speed acquisition
- 8-bit resolution
- Equivalent Time Sampling for high sampling rates with repetitive waveforms
- High performance acquisition on 1 or 2 channels
- Pre-, post-, and about-triggering
- Programmable trigger delay functions
- Clock controls for slaving boards to an external clock or for synchronizing multiple boards
- Single-slot AT-board plug-in solutions
- Windows-based oscilloscope program available
- DOS and Windows 3.X/95/98 drivers available

APPLICATIONS

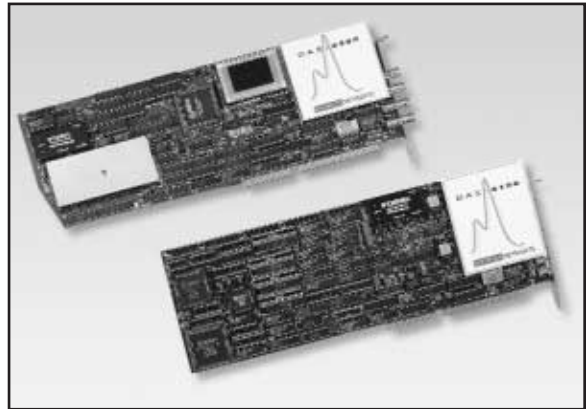
- Real-time signal processing
- Spectrum analysis
- Ultrasonic inspection systems
- Radar guidance systems
- Pattern recognition
- Optical and laser signal analysis
- Non-destructive test systems

Functional Description

The DAS-4000 Series is a family of very high speed ISA-bus data acquisition boards for the IBM PC and compatible computers. All members of the family share a common architecture and core features making each DAS-4000 Series product ideal for high speed applications. The two versions of the DAS-4000 Series feature high speed 8-bit flash converters allowing transient waveform capturing at maximum rates of 64 MSamples/s to 1 GSample/s. Onboard memory ensures continuous, high speed, gap-free data acquisition under Windows or DOS. The DAS-4000 Series provides flexible triggering options with pre-, post-, and about-trigger modes and hardware digital and analog trigger inputs. All boards are designed to quickly and efficiently transfer data to the PC. Once the waveform data has been captured, the PC can transfer data off the board at extremely high rates using simple memory block move instructions, so the board can be rearmed quickly to begin acquiring more data.

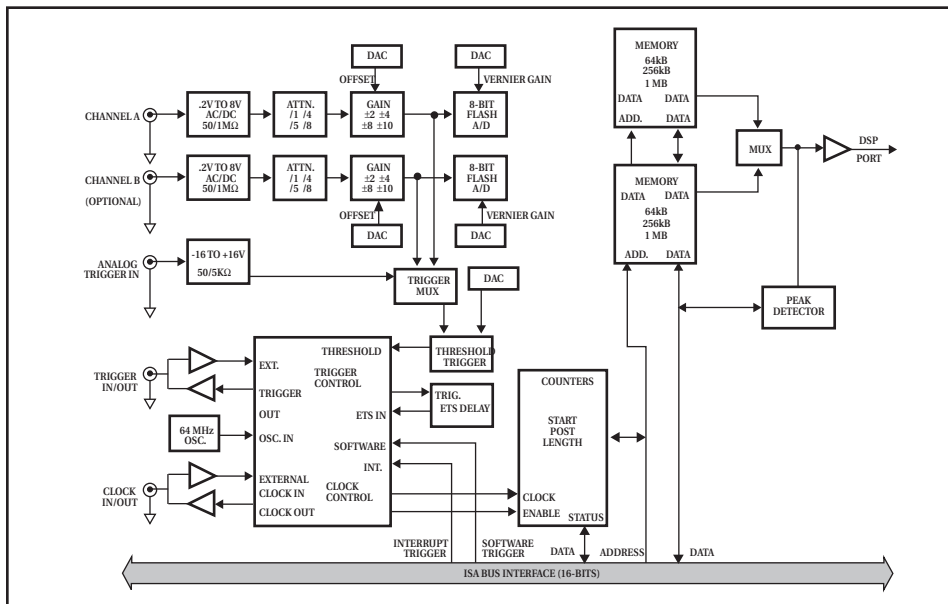
DAS-4100

The DAS-4100 is an 8-bit waveform digitizer that provides transient sampling rates of 64 MSamples/s, and optional equivalent time sampling of repetitive waveforms at up to 2 GSamples/s. You can order the DAS-4100 with one or two true channels and a variety of memory options. The two-channel models include two A/D converters and two separate memory banks so data can be acquired simultaneously on both channels. A 1 MByte per channel onboard memory buffer provides



gap-free data acquisition. All board functions are under software control including input impedance selection, AC/DC coupling, input voltage range, sampling rates, A/D output coding, trigger selection, clock control, threshold phase and level, board selection, and interrupt enabling. Industry standard SMB connectors are used to provide easy setup while maintaining maximum signal integrity. The DAS-4100 onboard high speed memory buffer is mapped directly into PC memory space. The PC can transfer captured waveforms off the board very quickly. As the processing speed and power of the PC's microprocessor increases, the DAS-4100 will continue to provide bus and memory access speed compatibility.

Block Diagram DAS-4100



DAS-4300

The DAS-4300 is the fastest 8-bit data acquisition board available. With AC/DC coupling, programmable gain and offset, analog bandwidth of up to 350MHz combined with a 1GHz transient digitizer, the DAS-4300 offers a very flexible front end. The board can take advantage of two types of equivalent time sampling to increase the effective sampling rate up to 20GHz. Pre-trigger, post-trigger, and post-trigger delay combined with 8 kByte onboard memory allows viewing of any desired event. Software and external analog or digital triggers are among the many trigger options available. Data can be transferred off the board very quickly, taking advantage of zero wait state operations. Finally, all registers and voltages on the board can be read back for automatic testing and diagnostics.

DAS-4000 Series

Segmented Memory Mode. The memory buffer on the DAS-4100 can be used to capture many successive waveforms without writing the waveform data to PC memory between applications. This is accomplished by “segmenting” the available memory.

Collecting data in this fashion reduces the “dead” time between acquisitions to a minimum re-arming sequence. Nominally, re-arming the board takes only 10 to 20µs, allowing for the capture of waveforms that may occur in rapid succession. When data acquisition is completed, a block memory-to-memory transfer can be used to empty the data buffer.

Moving data in large blocks is usually much more efficient than moving data in many small blocks. Consequently, this method provides maximum data throughput.

Programmable Gain. The analog input stage of the DAS-4000 Series features broadband amplifiers capable of accepting a dynamic input range without clipping. The gain is controllable in both coarse and fine steps in order to take maximum advantage of the available input range. See the following table for the input range and gain steps for each DAS-4000 Series board.

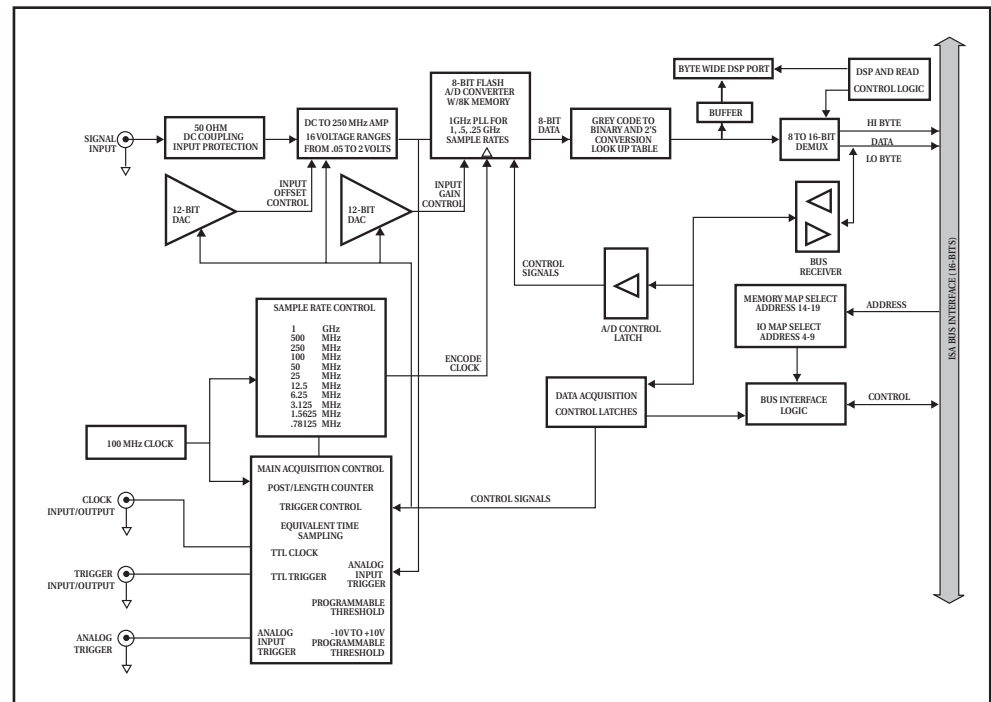
In addition to the programmable gain and offset, the input impedance can be 50Ω or 1MΩ, selectable through software in the DAS-4100 or via jumpers in the DAS-4300.

In the DAS-4000 Series, calibration values for gain and offset for each channel is stored in onboard EEPROM. When changing from one range to another, these values are used to set the vernier gain and offset for each range.

	DAS-4100	DAS-4300
Input Range	±0.1V to ±4V, 0 to 0.2V to 0 to 8V	±25mV to ±1V, 0 to 50mV to 0 to 2V
Coarse steps	12	12
Fine steps	4096	4096

Equivalent Time Sampling (ETS). Although the DAS-4000 Series boards have maximum transient sampling rates of 64 MSample/s or 1 GSample/s, higher effective sampling rates can be achieved if the signal of interest is repetitive in nature. ETS is a technique by which a repetitive signal is resampled, successively moving the digitization starting point a fixed interval of time. The interval is precisely controlled so that the new sample points fall between the previously sampled points.

Block Diagram DAS-4300



The DAS-4100 can achieve rates of up to 2 GSamples/s using the ETS technique, and the DAS-4300 can provide rates up to 20 GSamples/s. This technique requires that the board provide the synchronizing trigger. Once data is collected, the data points must be interleaved to form a continuous waveform at the higher effective sampling rate.

Multiple Board Applications. A board select function is provided for multiple board/channel applications. Boards can be selected and de-selected through software in order to access the desired channel of data.

Clocking and Triggering. The DAS-4000 Series features flexible clocking, triggering, and gating modes. You can configure the DAS-4000 Series boards to accept an external clock input or to provide a clock output for synchronizing multiple boards.

Flexible trigger modes allow you to acquire data in relationship to a specific event. An event that starts or stops acquisition can be internal or an external digital trigger. You can configure the DAS-4000 Series for several triggering modes, including the following: post-trigger, pre-trigger, and about-trigger. Post-trigger is the standard acquisition mode; acquisition begins after an internal or external trigger event and continues until an end condition occurs or the specified number of samples are collected. Pre-trigger mode allows acquisition to occur until an external trigger occurs. About-trigger mode acquires data both before and after the trigger event.

DAS-4000 Series

DAS-4000 Series Selection Guide

	DAS-4100	DAS-4300
Number of Channels	1 or 2, true	2, muxed*
Resolution	8-bits	8-bits
Max. Sampling Rate	64MHz	1GHz
Equivalent Time Sampling	2.048GHz	20GHz
Input Range	±0.1V to ±4V, 0 to 0.2V to 0 to 8V	±25mV to ±1V, 0 to 50mV to 0 to 2V
Input Bandwidth	100MHz	100 to 350MHz
Max Onboard Memory	2 MByte	8 kByte
Analog Trigger	Yes	Yes
Pre- and Post-trigger	Yes	Yes

* Muxed channels cannot be switched at speed

Software

Several software options are available for the DAS-4000 Series. These options include:

- DAS-4000 Standard Software Package
- Advanced Software Option (ASO-4100/4300)
- VisualSCOPE Interface
- TestPoint

See the Software section beginning on page 295 for more information on any of these software packages.

TestPoint

TestPoint software lets you create applications without programming. It provides a graphical, drag-and-drop interface for acquisition from IEEE-488 instruments, data acquisition boards, and RS-232/485 instruments and devices. This integrated tool is a self-contained environment and incorporates many commonly used math, analysis, report generation, and graphics functions. TestPoint includes features from controlling external devices, responding to events, processing data, creating report files, and exchanging information with other Windows programs.

DAS-4000 Standard Software Package

The DAS-4000 standard software package which is supplied with the board includes everything needed to install, configure, test, and calibrate a DAS-4000 Series board. The standard software includes the following:

- DOS-based oscilloscope application for controlling and calibrating the board without programming

Oscilloscope Utility. The DAS-4000 Series oscilloscope utility is a DOS-based application that allows you to exercise the DAS-4000 Series boards without programming. You can test the features of the DAS-4000 Series board, re-calibrate the analog input section of the board, and perform basic oscilloscope functions such as saving and recalling waveforms from disk. The oscilloscope utility provides a quick way to test the board and your application together. You can then use a spreadsheet or an analysis package to post-process or graph the data.

Advanced Software Option (ASO-4100/4300)

The ASO-4100/4300 extends the DAS-4000 Series language support to C and Visual Basic under DOS and all Windows programming languages. The Advanced Software Option includes the following:

- Function Call Driver compatible with C under DOS
- Function Call Driver packaged as a Dynamic Link Library (DLL) for use with Windows 3.X/95/NT languages

Function Call Driver for C. The Function Call Driver provides high-level functions for use in the C programming environment. These functions handle all data acquisition functions, memory and buffer allocation, and multiple board management. The function calls have intuitive names that describe the functions they perform. The Function Call Driver is compatible with the following languages and versions:

- Microsoft C/C++ version 4.0 and higher
- Borland C/C++ version 1.0 and higher

Windows DLL. A Microsoft Windows DLL allows you to program the board using the Function Call Driver with Windows-based languages. Supported languages include:

- Microsoft Visual Basic for Windows version 3.0
- Microsoft C/C++ version 7.0 and higher
- Microsoft Visual C/C++ version 1.0 to 1.52
- Borland C/C++ version 4.0 and higher

By using the Function Call Driver in Windows, your DAS-4000 Series application programs can take advantage of all the features of Windows. These features include running multiple applications, using extended memory, and the consistent graphical user interface. Windows 3.X also allows you to transfer data from one application to another using Dynamic Data Exchange (DDE). Using DDE, your data acquisition program can transfer data automatically to a spreadsheet for analysis or plotting.

VisualScope Software

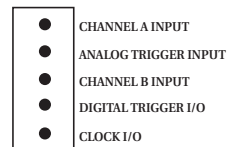
The VisualSCOPE software consists of a Windows application that provides the look and feel of a stand-alone oscilloscope on your PC. You can display one or two channels at once. Previously saved or calculated waveforms can be displayed for comparison to live inputs. Using cursors, you can directly measure time, amplitude, and frequency values of signals. Dual timebase windowing allows you to zoom in on a particular segment of a waveform. Captured waveforms can be easily stored to disk or exported to other applications by cut/copy/paste operations or DDE. VisualSCOPE also supports 14 automatic, real-time waveform measurements (including Vrms, Vmax, Vmin, Vpp, Vavr, period, freq, width, rise/fall time, and duty cycle) as well as statistics on the measurements. The built-in Signal Calculator allows you to take interactive waveform measurements, perform vector and scalar arithmetic, or perform user-defined functions—all without programming.

DAS-4000 Series

Connector Diagrams

DAS-4100

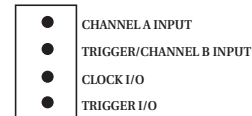
All connections are made using SMB connectors. SMB to BNC cables are included with the board.



Rear view

DAS-4300

All connections are made using BNC connectors.



Rear view

SPECIFICATIONS

DAS-4100

NUMBER OF CHANNELS: 1 or 2, SMB connectors

CHANNEL TO CHANNEL ISOLATION, DC TO 50MHZ:

50dB with channels at same sensitivity;

46dB with 4V signal on Ch A and Ch B set to 200mV sensitivity

INPUT COUPLING: AC or DC, software-selectable

INPUT IMPEDANCE: 50Ω or 1MΩ, software-selectable, shunted by approximately 20pF. Input impedance and range may be changed via two plug-in resistors per channel.

INPUT RANGE: ±100mV to ±4V and 0 to 200mV to 0 to 8V

MAXIMUM SAFE INPUT VOLTAGE AT 50Ω: 5V rms continuous, ±250V transients lasting less than 100μs.

ANALOG-TO-DIGITAL CONVERTER

TYPE: Flash.

RESOLUTION: 8-bits.

CODING: Binary.

INTEGRAL LINEARITY: ±0.6 LSB.

DIFFERENTIAL LINEARITY: ±0.6 LSB.

LARGE SIGNAL BANDWIDTH: 160MHz @ V_{in} = full scale.

APERTURE JITTER: 15ps rms.

INPUT SLEW RATE: 440V/μs.

GAIN ACCURACY: ±5% of full scale using calibration file provided.

DC OFFSET ACCURACY: ±5% of offset using calibration file provided.

NUMBER OF SAMPLES PER TRIGGER (LENGTH)

MINIMUM: 2.

MAXIMUM: 2,097,152.

POST-TRIGGER DELAY:

MINIMUM: 0.

MAXIMUM: 16,777,216.

PRE-TRIGGER DATA:

MINIMUM: 2.

64K MEMORY MAX: 65,534.

256K MEMORY MAX: 262,142.

1M MEMORY MAX: 1,048,574.

2M MEMORY MAX: 2,097,150.

EQUIVALENT TIME SAMPLING:

SAMPLING RATE	SAMPLING PERIOD	REPETITIVE WAVEFORMS
2048 MHz	0.488 ns	32
1024 MHz	0.98 ns	16
512 MHz	1.95 ns	8
256 MHz	3.91 ns	4
128 MHz	7.81 ns	2

DAS-4300

NUMBER OF CHANNELS: 1 with 2 multiplexed BNC.

CHANNEL-TO-CHANNEL SWITCHING TIME: 1ms with both channels set for DC coupling and identical level; 15ms with both channels set at opposite extremes for worst case switching.

INPUT COUPLING: AC or DC, jumper-selectable.

INPUT IMPEDANCE: 50Ω or 100kΩ, jumper-selectable.

INPUT RANGE: ±25mV to ±1V, 0 to 50mV to 0 to 2V.

ANALOG-TO-DIGITAL CONVERTER:

TYPE: Flash.

RESOLUTION: 8-bits.

CODING: Binary, Two's Complement, Absolute.

Sampling Rate	Sampling Period
1000 MHz	1 ns
500 MHz	2 ns
250 MHz	4 ns
100 MHz	10 ns
50 MHz	20 ns
25 MHz	40 ns
12.5 MHz	80 ns
6.25 MHz	160 ns
3.125 MHz	320 ns
1.5625 MHz	640 ns
0.78125 MHz	1280 ns

Equivalent time sampling	Sampling period
2000 MHz	500 ps
4000 MHz	250 ps
5000 MHz	200 ps
10000 MHz	100 ps
20000 MHz	50 ps

NUMBER OF SAMPLES PER TRIGGER (LENGTH):

MINIMUM: 1 @ 100MHz and below.
10 @ 250MHz and above.

MAXIMUM: 8192.

POST-TRIGGER DELAY:

MINIMUM: 0.

MAXIMUM: 65,536 @ 100MHz and below.
655,360 @ 250MHz and above.

PRE-TRIGGER DATA:

MINIMUM: 1.

MAXIMUM: 8,192.

TRIGGER:

SOFTWARE TRIGGER MODE: ±

COMMON TRIGGER MODE: ±

PARALLEL TRIGGER MODE: ±

EXTERNAL DIGITAL TRIGGER MODE: ±

EXTERNAL ANALOG TRIGGER MODE: ±

ANALOG TRIGGER MODE: ±

INTERRUPT MODE: ±

DAS-4000 Series

DAS-4100 POWER REQUIREMENTS

+5V: 2.8A typ, 3.2A max.
 +12V: 130mA typ, 160mA max.
 -12V: 100mA typ, 200mA max.

DAS-4300 POWER REQUIREMENTS

+5V: 2.3A.
 +12V: 75mA.
 -12V: 185mA.

ENVIRONMENTAL (ALL DAS-4000 SERIES)

OPERATING TEMPERATURE: 0°C to +50°C.
STORAGE TEMPERATURE: -20°C to +70°C.
HUMIDITY: 0 to 90% (non-condensing).
EMC: Conforms to European Union Directive 89/336/EEC.
SAFETY: Meets EN61010-1/IEC 1010.
DIMENSIONS: 13.375in L × 4.7in H × 0.6in D
 (33.9cm × 11.9cm × 1.5cm).

ORDER	DESCRIPTION
DAS-4101/64K	64MHz, single channel, 64kByte memory analog input board
DAS-4101/256K	64MHz, single channel, 256kByte memory analog input board
DAS-4101/1M	64MHz, single channel, 1MByte memory analog input board
DAS-4101/2M	64MHz, single channel, 2MByte memory analog input board
DAS-4102/64K	64MHz, dual channel, 64kByte memory analog input board
DAS-4102/256K	64MHz, dual channel, 256kByte memory analog input board
DAS-4102/1M	64MHz, dual channel, 1MByte memory analog input board
DAS-4301/8K	1GHz, single channel, 8kByte memory analog input board
OPTIONS	
ASO-4100	Advanced Software Option for the DAS-4100 Series (can be obtained free from our website)
ASO-4300	Advanced Software Option for the DAS-4300 Series (can be obtained free from our website)
TESTPOINT	TestPoint Software Package

QUESTIONS?

1-800-552-1115 (U.S. only)

Call toll free for technical assistance, product support or ordering information, or visit our website at www.keithley.com.