



## FEATURES

- High-speed USB 2.0 device, sampling rate to 500kHz
- All functions fully software configurable
- 16-bit resolution A/D converter
- 16 single-ended or 8 differential inputs
- Eight input ranges, unipolar or bipolar
- Real-time hardware autocalibration and oversampling for accurate data
- Unique channel-by-channel programmable gains
- Data buffer for A/D
- Synchronous, asynchronous, timed trigger modes
- 16 high-current digital I/O lines
- 16-bit programmable counter/timer
- Alternate embedded USB connector
- USB/104 form-factor for embedded OEM's
- Small (4" x 4" x 1.25") rugged industrial enclosure
- All required power drawn from USB port

## FACTORY OPTIONS

- External power for high current capabilities
- DIN rail mounting provision
- OEM (board only) version with mounting holes for added flexibility in embedded applications
- Current ranges (4-20mA, 10-50mA) S.E. or Diff
- Extended Temperature Operation -40 to +85°C



## FUNCTIONAL DESCRIPTION

The USB-AI16-16A is an ideal solution for adding portable, easy-to-install high-speed analog and digital I/O capabilities to any computer with a USB port. The unit is a USB 2.0 high-speed device, offering the highest speed currently available with the USB bus. The USB-AI16-16A is a 16-bit resolution A/D board capable of speeds up to 500kHz for its 16 single-ended or 8 differential analog inputs. Each channel can be independently software configured to accept 8 different input ranges. Additionally, each channel includes its own analog ground pin on the I/O connector which is helpful in reducing noise. A unique, real-time internal calibration system allows the card to continually compensate for offset/gain errors giving a more accurate reading. The unit is plug-and-play allowing a quick connection whenever you need additional I/O on the convenience of a USB port.

This small, compact, multifunction I/O board provides the user with everything needed to start acquiring, measuring, analyzing and monitoring in a variety of applications. The USB-AI16-16A data acquisition board can be used in many current real-world applications such as embedded equipment monitoring, precision PC-based and portable environmental measurements, and mobile data acquisition. Additional features include 16 digital I/O lines and a programmable 16-bit counter. The counter can be configured in a variety of modes and has the ability to use external signals to trigger and control the scanning of its inputs.

The USB-AI16-16A is designed to be used in rugged industrial environments but is small enough to fit nicely onto any desk or testing station. The board is PC/104 sized (3.550 by 3.775 inches) and ships inside a steel powder-coated enclosure with an anti-skid bottom.

## OEM USB/104 FORM FACTOR

The OEM (board only) version is perfect for a variety of embedded applications. What makes the OEM option unique is that its PCB size and mounting holes match the PC/104 form factor (without the bus connections). This allows our rugged analog input board to be added to any PCI-104 or PC/104 stack by connecting it to a USB port usually included on-board with embedded CPU form factors such as EBX, EPIC, and PC/104. This is especially important since many newer CPU chipsets do not support ISA and have plenty of USB ports. The USB-AI16-16A OEM board can also be installed using standoffs inside other enclosures or systems.

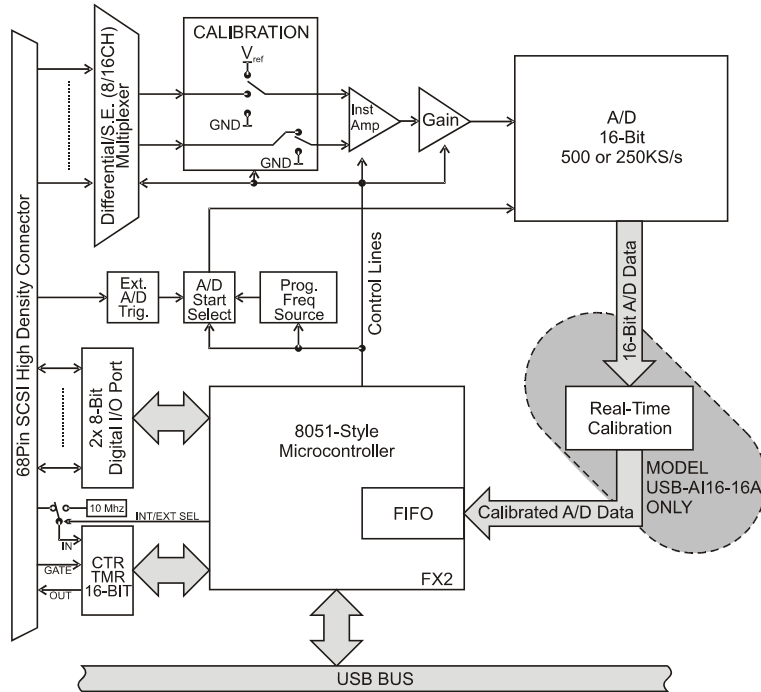
## ACCESSORIES

The USB-AI16-16A is available with optional cable assemblies and screw terminal boards for easy-to-use, out of the box connectivity.

## SOFTWARE

The module utilizes a high-speed custom function driver optimized for a maximum data throughput of 1MBps that is 50-100 times faster than the USB human interface device (HID) driver used by many competing products. This approach maximizes the full functionality of the hardware along with capitalizing the advantage of high-speed USB 2.0. The USB-AI16-16A is supported for use in most USB supported operating systems and includes a free Linux (including Mac OS X) and Windows 98se/Me/2000/XP/2003 compatible software package. This package contains sample programs and source code in Visual Basic, Delphi, C++ Builder, and Visual C++ for Windows. Also incorporated is a graphical setup program in Windows. Third party support includes a Windows standard DLL interface usable from the most popular application programs, and includes example LabVIEW VIs. Embedded OS support include Windows XPe.

## BLOCK DIAGRAM



## SPECIFICATIONS

### Analog Inputs

ADC Type	Successive approximation
Sampling rate	
USB-AI16-16A	500Ksamples/sec (maximum aggregate)
USB-AI16-16E	250Ksamples/sec (maximum aggregate)
Resolution	16-bit
Number of channels	16 single-ended or 8 differential (software selectable)
Bipolar ranges	$\pm 1V$ , $\pm 2V$ , $\pm 5V$ , $\pm 10V$ (software selectable)
Unipolar ranges	0-1V, 0-2V, 0-5V, 0-10V (software selectable) 4-20mA or 10-50mA Factory installed (optional)
Board Calibration	VREF LOW: AGND VREF HIGH: 9.90V $\pm$ 0.0299V
System Calibration	Program provided to calibrate entire system
Calibration Hardware	
USB-AI16-16A	Calibrated real-time output for offset/gain errors
USB-AI16-16E	NONE
Input impedance	1M
A/D Start Sources	Software Start, Timer Start, and External Start Trigger (rising or falling edge; software selectable)
A/D Start Enable	Externally supplied (pulled-up; active-high)
A/D Start Types	Single Channel or Scan (software selectable)
Channel Oversamp.	0-255 consecutive samples/channel
Over volt protection	-40 to +55V
Crosstalk	No crosstalk present below 400KHz -60dB @ 500KHz

### Digital I/O

Lines	16 inputs or outputs in groups of 8 (pulled-up)
Input voltage	Logic low: 0V(min) to 0.8V(max) Logic high: 2V(min) to 5V(max)
Input current	$\pm 20\mu A$ (max)
Output voltage	Logic low: 0V(min) to 0.55V(max) Logic high: 2V(min) to 5V(max)
Output current	Logic low: 64mA(max) sink Logic high: 32mA(max) source

### Counter/Timer

Available Counters	Counter 0
Type:	82C54 programmable interval counter
Input Frequency	10MHz (max)
Counter size	16-bit
Clock	Internal 10MHz or Externally supplied (software selectable; pulled-up)
Clock Period	100ns (min)
Clock Pulse Width High	30ns (min)
Clock Pulse Width Low	40ns (min)
Gate	Externally supplied (pulled-up; active-high)

Output	External (pulled-up)
Input/Output	
Voltage/Current	Same as Digital I/O

### Environmental

Operating Temperature	0° to +70°C, optional -40° to +85°C
Storage Temperature	-40° to +105°C
Humidity	5% to 90% RH, without condensation
Board Dimensions	PC/104 format, 3.550" by 3.775" and mounting holes
Power requirement	+5V at 330mA typical

### The following items are included with your shipment

- Board installed in labeled enclosure
- 6' USB cable
- Software Master CD (PDF user manual installed with product package)
- Printed USB I/O Quick-Start Guide

### Ordering Guide

USB-AI16-16A Advanced version, 16-Bit, 500kHz, with autocalibration  
 USB-AI16-16E Economy version, 16-Bit, 250kHz, with software calibration

### Model Options

- -P External AC/DC adapter (power jack/regulator installed)
- -OEM Board only (no enclosure)
- -DIN DIN rail mounting provision
- -T Extended Temperature Operation (-40° to +85°C)
- -S0x "x" = special number designator  
4-20mA or 10-50mA inputs  
16 current inputs when factory configured as single-ended  
8 current inputs when factory configured as differential  
DIO lines can be configured with pull down resistors

### Accessories

STB-68	Screw terminal board
C68PS18L	68-Pin SCSI 18" shielded cable
MP104-DIN	DIN rail mounting provision
CUSB-OTG-6	6' USB Cable with Type A to mini type OTG connector for embedded applications

