



## USB-AIO16-16A

High-Speed, Multifunction,  
16-Bit Analog I/O Module



### FEATURES

- High-speed USB 2.0 Multifunction DAQ
- Sustained sampling rates up to 500kHz
- 16-bit or 12-bit resolution A/D converter
- Flexible, software configured functionality
- 16 single-ended or 8 differential analog inputs
- 8 input ranges, 4 unipolar and 4 bipolar, channel-by-channel programmable
- Autocalibration and oversampling for real-time accurate data
- A/D starts via software, timer, or external trigger
- Up to 2 16-bit analog outputs; 4kHz update rate
- 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 for typical applications



### 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 inputs (4-20mA, 10-50mA)
- Extended Temperature Operation -40 to +85°C

### FUNCTIONAL DESCRIPTION

The USB-AIO16-16A 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-AIO16-16A 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-AIO16-16A 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-AIO16-16A 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

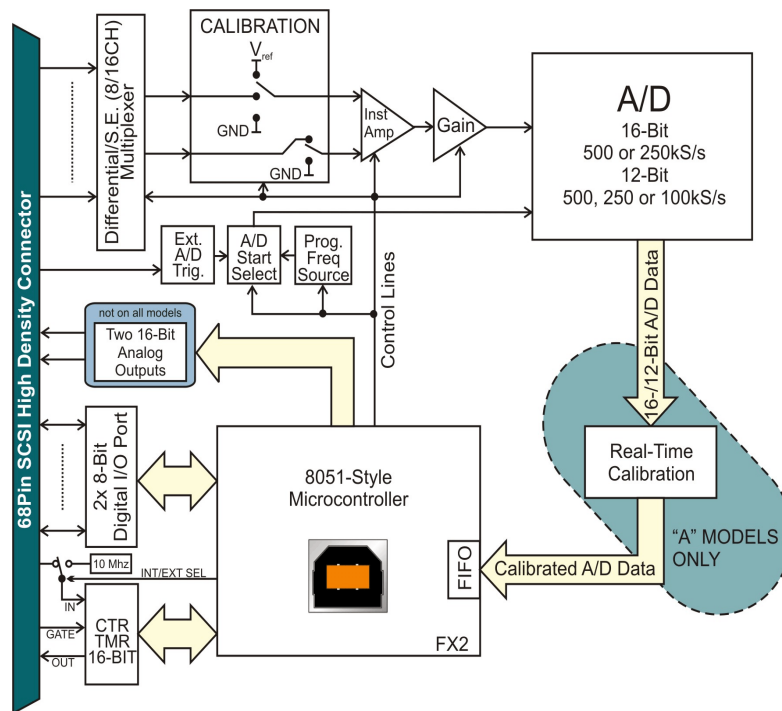
The OEM (board only) version is perfect for a variety of embedded applications. What makes the OEM option unique is that its PCB size and mounting holes match the PC/104 form factor (without the bus connections). This allows our rugged analog input board to be added to any PCI-104 or PC/104 stack by 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-AIO16-16A OEM board can also be installed using standoffs inside other enclosures or systems.

### ACCESSORIES

The USB-AIO16-16A 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-AIO16-16A 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 XP.



**BLOCK DIAGRAM**

## SPECIFICATIONS

### Analog Inputs

ADC Type	Successive approximation
Resolution	16-bit, 12-bit
Sampling rate	
"16-16A" version	500k samples/sec (maximum aggregate)
"16-16E" version	250k samples/sec (maximum aggregate)
"12-16A" version	500k samples/sec (maximum aggregate)
"12-16" version	250k samples/sec (maximum aggregate)
"12-16E" version	100k samples/sec (maximum aggregate)
Number of channels	16 single-ended or 8 differential (software selectable)
Unipolar ranges	0-1V, 0-2V, 0-5V, 0-10V (software selectable)
Bipolar ranges	±1V, ±2V, ±5V, ±10V (software selectable)
Factory installed (optional)	4-20mA or 10-50mA
Calibration Hardware	
"16-16A" version	Two on-board references + calibrated real-time output
"16-16E" version	Two on-board references
"12-16A" version	Two on-board references + calibrated real-time output
"12-16" version	Two on-board references
"12-16E" version	None
System Calibration	Program provided to calibrate entire system
Accuracy	Uncalibrated 0.094% Full-Scale (FS) Calibrated <sup>(1)</sup> 0.0015% FS
Int Nonlinearity Error	0.0046% FS
No Missing Codes	15 bits
Input impedance	1MΩ
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	-60dB @ 500kHz

<sup>(1)</sup> To achieve best accuracy, one must calibrate to their own standard.

### Analog Outputs

Number / Type:	2 / single-ended
Resolution:	16-bit
Unipolar Ranges:	0-5V, 0-10V (factory installed)
Bipolar Ranges:	±5V, ±10V (factory installed)
Conversion Rate:	4kHz per channel
Settling Time	4us typ, 7us max; 1/4 to 3/4 scale to ±2LSBs
Output Current	±25mA per channel

### Digital I/O

Lines	16, prog. as in/out in groups of 8 (pulled-up)
Input voltage/current	Logic low: 0V(min) to 0.8V(max) @±20μA(max)

Output volts/current	Logic high: 2V(min) to 5V(max) @±20μA(max) Logic low: 0V(min) to 0.55V(max) @64mA(max) sink Logic high: 2V(min) to 5V(max) @32mA(max) source
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### Counter/Timer

Type / size:	82C54 programmable interval counter / 16-bit
Available Counters	CTR0 (CTR1/CTR2 dedicated to A/D starts)
Frequency	10MHz (max) Int. or ext. supplied (sw select; pulled-up)
Clock Period	100ns (min)
Pulse Width Hi/Lo	30ns (min) / 40ns (min)
Gate	Externally supplied (pulled-up; active-high)
Output	External (pulled-up)
In/Out Volt/Current	Same as Digital I/O

### Environmental

Operating Temp.	0° to +70°C, optional -40° to +85°C
Storage Temp.	-40° to +105°C
Humidity	5% to 90% RH, without condensation
Board Dimensions	PC/104 format, 3.550" by 3.775" w / mounting holes
Power required	+5V at 315mA typical

### Included with your shipment

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

### Ordering Guide

USB-AIO16-16A	16-Bit, 500kHz, with autocalibration and 2 analog outputs
USB-AIO16-16A	Same as above but with no analog outputs
USB-AIO16-16E	16-Bit, 250kHz, with software calibration and 2 analog outs
USB-AIO16-16E	Same as above but with no analog outputs
USB-AIO12-16A	12-Bit, 500kHz, with autocalibration and 2 analog outputs
USB-AIO12-16A	Same as above but with no analog outputs
USB-AIO12-16	12-Bit, 250kHz, with software calibration, 2 analog outputs
USB-AIO12-16	Same as above but with no analog outputs
USB-AIO12-16E	12-Bit, 100kHz, with 2 analog outputs
USB-AIO12-16E	Same as above but with no analog outputs

### 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



## Assured Systems

Assured Systems is a leading technology company with over 1,500 regular clients in 80 countries, deploying over 85,000 systems to a diverse customer base in 12 years of business. We offer high-quality and innovative rugged computing, display, networking and data collection solutions to the embedded, industrial, and digital-out-of-home market sectors.

### US

[sales@assured-systems.com](mailto:sales@assured-systems.com)

Sales: +1 347 719 4508

Support: +1 347 719 4508

1309 Coffeen Ave  
Ste 1200  
Sheridan  
WY 82801  
USA

### EMEA

[sales@assured-systems.com](mailto:sales@assured-systems.com)

Sales: +44 (0)1785 879 050

Support: +44 (0)1785 879 050

Unit A5 Douglas Park  
Stone Business Park  
Stone  
ST15 0YJ  
United Kingdom

VAT Number: 120 9546 28

Business Registration Number: 07699660