# USB-AIO16-64MA

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
- 64 single-ended or 32 differential analog inputs
- 8 input ranges, 4 unipolar and 4 bipolar; per 4 channel programmable
- Autocalibration and oversampling for real-time accurate data
- A/D starts via software, timer, or external trigger
- 2 x 16-bit analog outputs; 4kHz update rate
- 16 high-current digital I/O lines
- 16-bit programmable counter/timer
- I/O via two D-sub 37-pin female and one D-sub 25-pin female connectors
- Alternate embedded USB connector
- USB/104 form-factor for embedded OEM's
- Power drawn from USB port in most applications

### FACTORY OPTIONS

- High gain version
- Reference junction sensor w/two 37-pin terminal blocks
- Extended Temperature Operation -40 to +85 C
- External power for high current capabilities
- Rugged steel powder coated enclosure

## FUNCTIONAL DESCRIPTION

The USB-AIO16-64MA 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 system is plug-and-play allowing a quick connection whenever you need additional I/O on the convenience of a USB port. The unit is a high-speed USB 2.0 device, offering the highest speed available on the USB 2.0 bus.

The USB-AIO16-64MA is a 16-bit resolution A/D system capable of sampling speeds up to 500kHz for it's 64 single-ended or 32 differential analog inputs. Groups of 4 channels can be software configured to accept 8 different input ranges. A unique, real-time internal calibration system allows the card to continually compensate for offset/gain errors giving a more accurate reading. Additional features include 2 x 16-bit analog outputs, 16 digital I/O lines, and a programmable 16-bit counter.

This small, compact, multifunction I/O system provides the user with everything needed to start acquiring, measuring, analyzing and monitoring in a variety of applications. The USB-AIO16-64MA data acquisition system 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. The system is PC/104 sized and designed to be used in rugged industrial environments but is small enough to fit nicely onto any desk or testing station.

### OEM USB/104 FORM FACTOR

This OEM (boards 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/output 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-AIO16-64MA OEM board can also be installed using standoffs inside other enclosures or systems.

### ACCESSORIES

The USB-AIO16-64MA 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-AIO16-64MA is supported for use in most USB supported operating systems and includes a free Linux (including Mac OS X) and Windows compatible software package. This package contains sample programs and source code in Visual Basic, Delphi 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.

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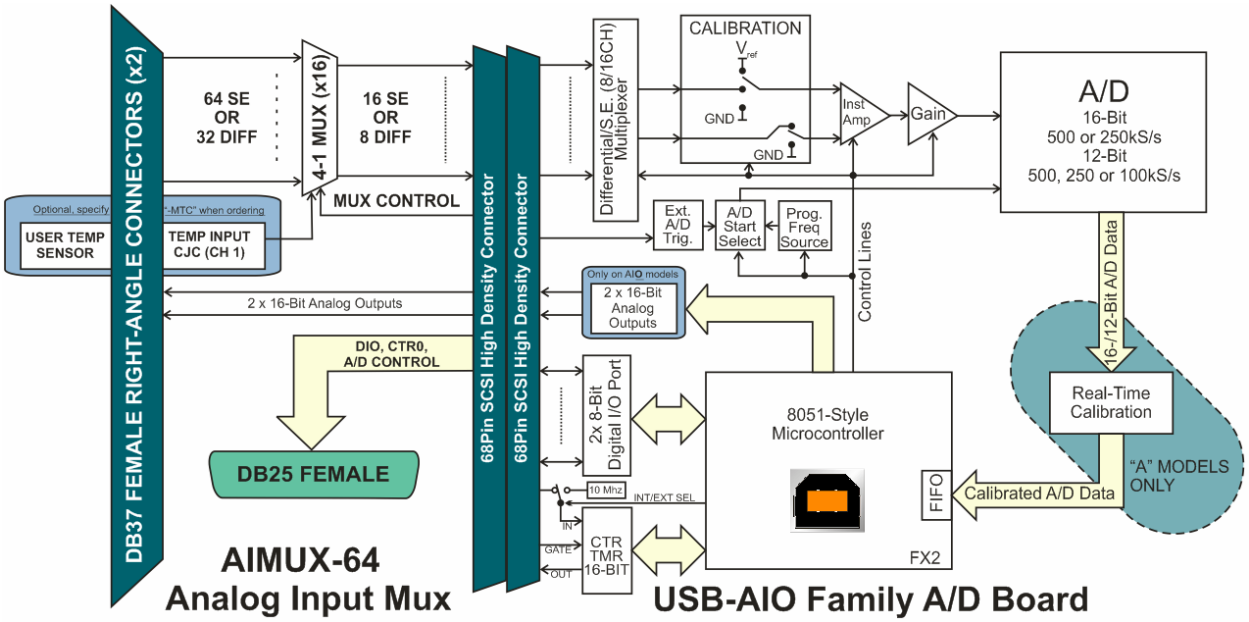


## BLOCK DIAGRAM

## SPECIFICATIONS

**Analog Inputs**

| | |
|---|---|
| ADC Type | Successive approximation |
| Resolution | 16-bit or 12-bit |
| Sampling rate | (maximum aggregates) |
| "16-64MA" version | 500k samples/sec |
| "16-64ME" version | 250k samples/sec |
| "12-64MA" version | 500k samples/sec |
| "12-64M" version | 250k samples/sec |
| "12-64ME" version | 100k samples/sec |
| Number of channels | 64 single-ended or 32 differential (software selectable) |
| Unipolar ranges | 0-1V, 0-2V, 0-5V, 0-10V (software selectable) |
| Bipolar ranges | ±1V, ±2V, ±5V, ±10V (software selectable) |
| Calibration Hardware | |
| "16-64MA" version | Two on-board references + calibrated real-time output |
| "16-64ME" version | Two on-board references |
| "12-64MA" version | Two on-board references + calibrated real-time output |
| "12-64M" version | Two on-board references |
| "12-64ME" version | None |
| System Calibration | Program provided to calibrate entire system |
| Accuracy | |
| Uncalibrated | 0.094% Full-Scale (FS) |
| Calibrated[1] | 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 |
| A/D Start Enable | Externally supplied (pulled-up; active-high) |
| A/D Start Types | Single Channel or Scan (software selectable) |
| Channel Oversampling | 0-255 consecutive samples/channel (software selectable) |
| Overvoltage protection | -40 to +55V |
| Crosstalk | -60dB @ 500kHz |

[1] For best accuracy, one must calibrate to their own standard.

**Analog Outputs**

| | |
|---|---|
| Number of Outputs | 2 |
| Type of Outputs | 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 inputs or outputs in groups of 8 (pulled-up) |
| Input voltage | Logic low: 0V(min) to 0.8V(max)<br>Logic high: 2V(min) to 5V(max) |
| Input current | ±20µA (max) |
| Output voltage | Logic low: 0V(min) to 0.55V(max)<br>Logic high: 2V(min) to 5V(max) |
| Output current | Logic low 64mA(max) sink<br>Logic high 32mA(max) source |

**Counter/Timer**

| | |
|---|---|
| Type | 82C54 programmable interval counter |
| Available Counters | CTR0 (CTR1, CTR2 dedicated to A/D conv. starts) |
| Input Frequency | 10MHz (max) |
| Counter size | 16-bit |
| Clock | Internal 10MHz or Externally supplied |
| 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 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" and mounting holes |
| Power Required | +5V at 320mA typical |

## ORDERING GUIDE

(all models have two DB37F and one DB25F I/O connectors)

| | |
|---|---|
| USB-AIO16-64MA | 16-Bit, 500kHz, with Advanced Cal HW, 2 analog outputs |
| USB-AI16-64MA | as above but with no analog outputs |
| USB-AIO16-64ME | 16-Bit, 250kHz, with Standard Cal HW, 2 analog outputs |
| USB-AI16-64ME | as above but with no analog outputs |
| USB-AIO12-64MA | 12-Bit, 500kHz, with Advanced Cal HW, 2 analog outputs |
| USB-AI12-64MA | as above but with no analog outputs |
| USB-AIO12-64M | 12-Bit, 250kHz, with Standard Cal HW, 2 analog outputs |
| USB-AI12-64M | as above but with no analog outputs |
| USB-AIO12-64ME | 12-Bit, 100kHz, with 2 analog outputs |
| USB-AI12-64ME | as above but with no analog outputs |

**Model Options**

| | |
|---|---|
| • -HG | High Gain (required for thermocouple measurement) |
| • -MTC | Thermocouple reference sensor with two 37-pin terminal |
| • -PR | External AC/DC adapter |
| • -T | Extended Temperature Operation (-40° to +85°C) |

**Optional Accessories**

| | |
|---|---|
| ADAP37 | Screw terminal board (no ribbon cable needed) |
| STB-37 | Screw terminal board (requires ribbon cable) |
| CAB37M-18 | 18" ribbon cable assembly |
| MP104-DIN | DIN rail mounting provision |
| CUSB-EMB-1 | 1 foot USB Cable (Type A to micro header) |
| CUSB-EMB-6 | As above but with a 6' cable |

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