ACCES I/O PRODUCTS, INC.

MODEL USB-DA12-8A

Eight Channel Digital to Analog Converter with ARB (Arbitrary Waveform Generator)

USER MANUAL

FILE: MUSB-DA12-8A.C5c

Notice

WARNING!!

ALWAYS CONNECT AND DISCONNECT YOUR FIELD CABLING WITH THE COMPUTER POWER OFF. ALWAYS TURN COMPUTER POWER OFF BEFORE INSTALLING A CARD. CONNECTING AND DISCONNECTING CABLES, OR INSTALLING CARDS INTO A SYSTEM WITH THE COMPUTER OR FIELD POWER ON MAY CAUSE DAMAGE TO THE I/O CARD AND WILL VOID ALL WARRANTIES, IMPLIED OR EXPRESSED.

Warranty

Prior to shipment, ACCES equipment is thoroughly inspected and tested to applicable specifications. However, should equipment failure occur, ACCES assures its customers that prompt service and support will be available. All equipment originally manufactured by ACCES which is found to be defective will be repaired or replaced subject to the following considerations.

Terms and Conditions

If a unit is suspected of failure, contact ACCES' Customer Service department. Be prepared to give the unit model number, serial number, and a description of the failure symptom(s). We may suggest some simple tests to confirm the failure. We will assign a Return Material Authorization (RMA) number which must appear on the outer label of the return package. All units/components should be properly packed for handling and returned with freight prepaid to the ACCES designated Service Center, and will be returned to the customer's/user's site freight prepaid and invoiced.

Coverage

First Three Years: Returned unit/part will be repaired and/or replaced at ACCES option with no charge for labor or parts not excluded by warranty. Warranty commences with equipment shipment.

Following Years: Throughout your equipment's lifetime, ACCES stands ready to provide on-site or in-plant service at reasonable rates similar to those of other manufacturers in the industry.

Equipment Not Manufactured by ACCES

Equipment provided but not manufactured by ACCES is warranted and will be repaired according to the terms and conditions of the respective equipment manufacturer's warranty.

General

Under this Warranty, liability of ACCES is limited to replacing, repairing or issuing credit (at ACCES discretion) for any products which are proved to be defective during the warranty period. In no case is ACCES liable for consequential or special damage arriving from use or misuse of our product. The customer is responsible for all charges caused by modifications or additions to ACCES equipment not approved in writing by ACCES or, if in ACCES opinion the equipment has been subjected to abnormal use. "Abnormal use" for purposes of this warranty is defined as any use to which the equipment is exposed other than that use specified or intended as evidenced by purchase or sales representation. Other than the above, no other warranty, expressed or implied, shall apply to any and all such equipment furnished or sold by ACCES.

Chapter 1: Introduction

Features
- High-speed USB 2.0 device
- Small, portable 8-channel, 12-bit Digital-to-Analog Converter (DAC) outputs
- Analog output ranges of 0-2.5V, 0-5V, 0-10V, ±2.5V, ±5V, ±10V
- Single-ended and differential outputs (separate connectors)
- Simultaneous update of DAC outputs
- Up to 125k conversions per DAC per second
- Streaming USB waveform data at over 400,000 DAC outputs per second
- ILDA (International Laser Display Association) compatible outputs
- 256k byte Waveform Storage Memory
- Waveform Streaming
- Stored waveforms at up to 1 million DAC conversions per second
- PC/104 module size and mounting compatibility
- Small (4" x 4" x 1.75") rugged industrial enclosure
- DB25M and DB25F enclosure mounted I/O connectors

Applications
- Portable / Laptop
- Education / Laboratory
- Industrial Automation
- Embedded OEM
- ILDA Laser Projector Driver

Functional Description

This USB product is an ideal solution for adding portable, easy-to-install analog outputs to any computer with a USB port. The unit is a high speed USB 2.0 device, offering the highest speed available with the USB bus. The board is plug-and-play allowing quick connection on a USB port. The product 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.

This product features 8, 12-bit Digital-to-Analog Converters with both single-ended and differential outputs on separate connectors. Each individual DAC has unipolar and bipolar ranges (jumper settable) giving the user a variety of output options.

DAC (Analog) Outputs

The eight DAC outputs are accessible by two connectors: single-ended outputs are accessed via J1 (a 16-pin header) and corresponding differential outputs are accessed via J3 (a 26-pin header). Six output ranges, three unipolar and three bipolar, are jumper

selectable for each individual DAC output. The unipolar ranges are 0-2.5V, 0-5V, and 0-10V. The bipolar ranges are ±2.5V, ±5V, and ±10V.

An automatic circuit limits the DAC outputs to zero volts when the board is initially plugged in. Consequently, this circuit causes a small lead-in time of about 500 microseconds before the DAC outputs ramp up to the correct voltage. This must be accounted for in Manual, Stream, and Loop modes. One way to accomplish this is to manually write one value to the DACs to cause them to output a known voltage.

An Interlock feature can cause the DAC outputs to be zero volts when an external event is detected.
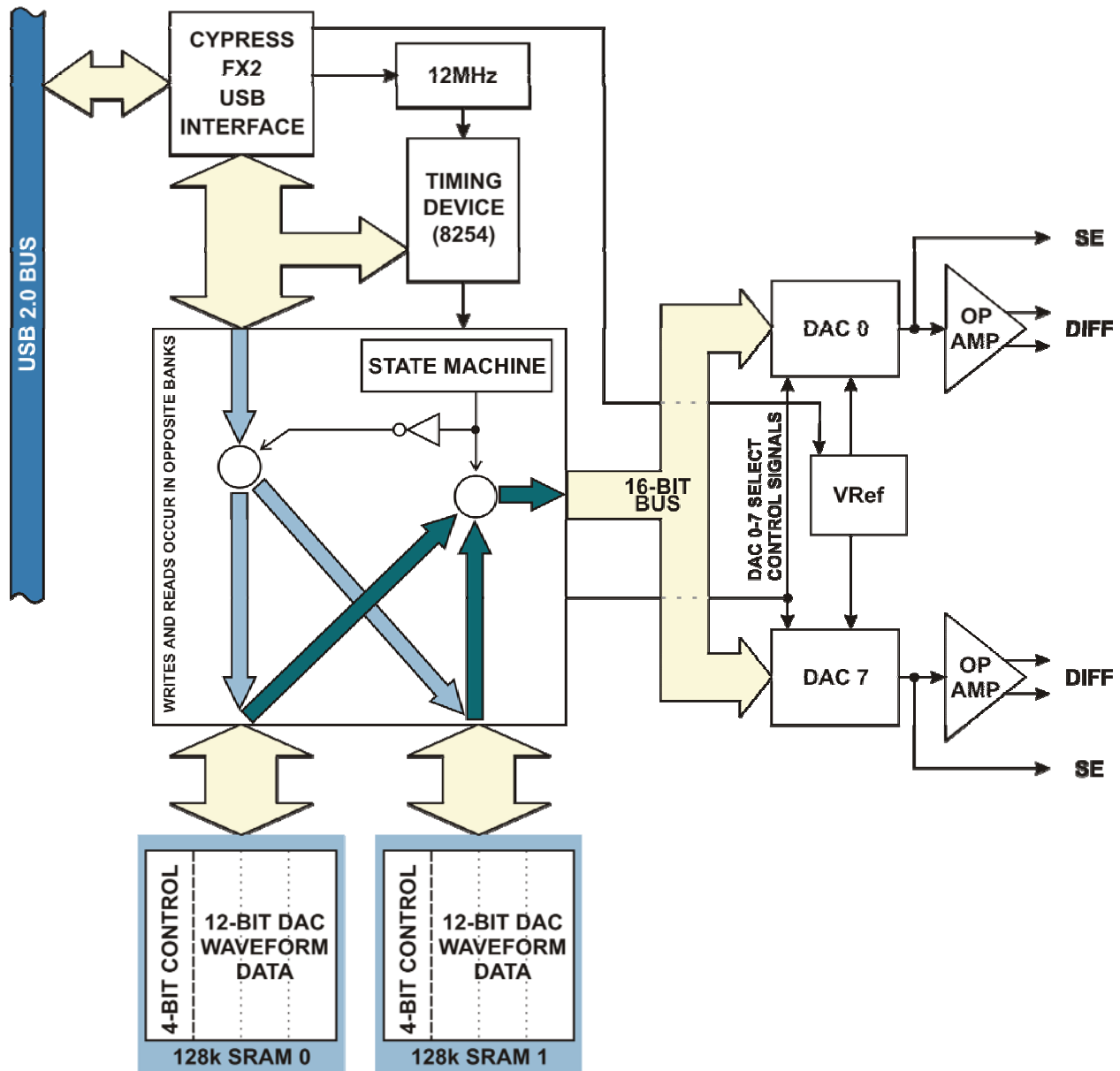
Figure 1-1: Block Diagram

Manual USB-DA12-8A

DAC Modes Description

The DACs have three modes of operation: Manual Mode, Stream Mode, and Loop Mode. In Manual Mode, software writes to update the DACs individually or simultaneously. In Stream Mode, software periodically writes to the Waveform Storage Memory. The memory is then read out into the DACs at the programmed frequency of the counter/timer and produces an arbitrary waveform. In Loop Mode, software writes up to 128k words into the Waveform Storage Memory. Once playback is started, the memory is read out into the DACs at the programmed frequency of the counter/timer producing an arbitrary waveform. When the last written value is reached, playback is "looped" back to the beginning of the waveform and the waveform is repeated. This continues until playback is paused or stopped.

Manual Mode

In Manual Mode, software writes to the DACs directly. The DACs can be updated individually or simultaneously. Individually means when a DAC is written to, it updates immediately. Simultaneously means all DACs are written to and then the outputs are updated.

Waveform Storage Memory

This board contains two SRAMs, each 64k words long, giving a total of 128k words of waveform storage. DAC Data is written into the SRAMs by software. The DAC Data is read out of the SRAMs and into the DACs at the frequency of the counter/timer output.

Waveform Playback

There are two ways to begin playback of the waveform stored in the Waveform Storage Memory. The first is a command issued by software. The second is a falling edge of the External Trigger signal (pulled-up) on J4 pin 5.

Playback is paused when the Pause signal (pulled-up) on J4 pin 6 is driven low.

Stream Mode

In Stream Mode, software writes between 64k and 128k words of DAC Data into the Waveform Storage Memory and then issues a play command. The DAC Data is then read out of the SRAMs and into the DACs at the frequency of the counter/timer output. Software can then resume writing new DAC Data to the SRAMs. This mode allows a continuous waveform to be output on the DACs at a desired frequency.

Loop Mode

In Loop Mode, software writes up to 128k words into the Waveform Storage Memory. The last DAC value written contains DAC Data with the Loop bit set. A playback command is issued and the DAC data is read out of the SRAMs and into the DACs at the frequency of the counter/timer output. When the DAC value with the Loop bit set is reached, playback is "looped" back to the beginning of the waveform and the waveform is repeated. This continues until playback is paused or stopped. The external Loop Enable signal from J4 pin 8 is pulled-up enabling Loop Mode. To disable Loop Mode, drive Loop Enable low.

Interlock

The interlock function forces the DAC outputs to zero volts when the Interlock signal (pulled-up) on J4 pin 7 is a level high. Interlock is enabled/disabled in software. If enabled, the Interlock pin must be driven low to allow the DACs to output any voltages.

DAC Data

DAC Data words written to the Waveform Storage Memory must be in the following word format:

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value 0-4095 (0x000-0xFFF)

Table 1-1: DAC Data Word Format

Control Bit Descriptions

EOM (End of Movie) Set this bit to cause the DAC waveform to halt. If you do not set EOM in the last DAC Data word in your waveform, the DACs will continue to output data from the SRAMs and repeat forever.

EOF (End of Frame) Set this bit to control the EOF signal output on J4 pin 1.

EOD (End of DACs) The data is read out of the Waveform Storage Memory sequentially into DAC 0 through DAC 7. If you want to start over at DAC 0, set this bit. Examples of this function are detailed in **Table 1-3** through **Table 1-8**. EOD is also an output on pin 2 of J4.

LOOP Set this bit to cause playback to be "looped" back to the beginning of the waveform. This allows a waveform to be replayed continuously. Driving the Loop Enable input signal (pulled-up) on pin 8 of J4 low disables the LOOP function.

Blank This status bit is set when EOM, EOD, and LOOP are set and EOF is not set. Blank is only readable at pin 4 of J4.

DAC Data bits D15 (EO**M**), D14 (EO**F**), D13 (EO**D**) and D12 (**L**OOP) combine to result in the following commands.

MFDL	Command
0000	<no command>
0001	LOOP
0010	EOD
0011	EOD & LOOP
0100	EOF
0101	EOF & LOOP
0110	EOF & EOD
0111	EOF & EOD & LOOP
1000	EOM
1001	Blank Off
1010	EOM & EOD
1011	Blank On
1100	EOM & EOF
1101	Factory Reserved
1110	EOM & EOF & EOD
1111	Factory Reserved

Table 1-2: Control Bits High Nybble Commands

Below are some examples of how to use the DAC Data Control Bits.

This DAC Data would cause the card to initialize the eight DAC values then stop, effectively creating a DC output on all DACs (Note: You could have cleared EOM and set LOOP for the same effect, but you would then waste cycles repeating the same DC data):

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value 0-4095 (0x000-0xFFF)
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	0	0	DAC 2 value
0	0	0	0	DAC 3 value
0	0	0	0	DAC 4 value
0	0	0	0	DAC 5 value
0	0	0	0	DAC 6 value
1	0	0	0	DAC 7 value

Table 1-3: EOM Example-Initialize DACs for DC Outputs

If you wanted to output a square wave on all DACs you could double the waveform and loop:

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	0	0	DAC 2 value
0	0	0	0	DAC 3 value
0	0	0	0	DAC 4 value
0	0	0	0	DAC 5 value
0	0	0	0	DAC 6 value
0	0	0	0	DAC 7 value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	0	0	DAC 2 value
0	0	0	0	DAC 3 value
0	0	0	0	DAC 4 value
0	0	0	0	DAC 5 value
0	0	0	0	DAC 6 value
0	0	0	1	DAC 7 value

Table 1-4: LOOP Example-Square Wave on All DACs

If you don't want to use all eight DACs, you can set EOD on the last DAC you do want to use. If you were using three DACs your data might look like this:

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	1	0	DAC 2 value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	1	1	DAC 2 value

Table 1-5: EOD Example-Waveform on Three DACs

This EOD functionality allows complex relationships between rates of output. If DAC 1 is going to output at one-third the rate of DAC 0:

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value
0	0	1	0	DAC 0 value
0	0	1	0	DAC 0 value
0	0	0	0	DAC 0 value
0	0	1	0	DAC 1 value
0	0	1	0	DAC 0 value
0	0	1	0	DAC 0 value
0	0	0	0	DAC 0 value
0	0	1	1	DAC 1 value

Table 1-6: EOD Example-DAC 1 at 1/3rd Frequency of DAC 0

Careful understanding of this EOD functionality is critical to correctly creating a waveform. Here's a more complex example:

D15	D14	D13	D12	D11 through D0
EOM	EOF	EOD	LOOP	DAC Value
0	0	1	0	DAC 0 value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	1	0	DAC 2 value
0	0	1	0	DAC 0 value
0	0	0	0	DAC 0 value
0	0	0	0	DAC 1 value
0	0	0	0	DAC 2 value
0	0	0	0	DAC 3 value
0	0	0	0	DAC 4 value
0	0	1	0	DAC 5 value
0	0	0	0	DAC 0 value
0	0	1	0	DAC 1 value
0	0	0	1	DAC 0 value

Table 1-7: More Complex EOD Example

External Signals (Control/Status)

J4 (a 10-pin header) has four inputs for control and four outputs for status.

The four inputs are External Trigger, Pause, Interlock, and Loop Enable. External Trigger starts the playback of the waveform(s) stored in Waveform Storage Memory.

Pause causes the playback of the waveform to be paused. Interlock sets the DAC outputs to zero volts. Loop Enable allows the LOOP bit within the DAC Data to function.

The four outputs are EOF, EOD, Status, and Blank. Both EOF and EOD are set when their respective control bits are set within the DAC Data. Once set, they remain valid until Channel 0 DAC Data is read (determined by the programmed counter/timer frequency). Status is a custom user controlled output. Contact the factory for details. Blank is set and reset by combinations of DAC Data Control Bits.

Ordering Guide

- USB-DA12-8A   Module installed in an enclosure with one DB25F, one DB25M and one (1) screw terminal accessory (ADAP25)

Model Options
- -E   Economy version excludes screw terminal (ADAP25)
- -OEM   Board only version (no enclosure) with I/O headers and no screw terminal
- -PR   115VAC to 5VDC Regulated Power Supply wall adaptor

Special Order

Resistors in series with differential connector for impedance matching, latching I/O connectors and conformal coating are some examples of special configurations. Contact factory with your requirement.

Included with your board

The following components are included with your shipment, depending on options ordered. Please take time now to ensure that no items are damaged or missing.

- Standard USB Module
- ADAP25, Screw Terminal Adaptor with a Female DB25 connector, qty 1
- 6' USB cable
- Software Master CD
- Printed USB I/O Quick-Start Guide

Optional Accessories

- MP104-DIN   DIN Rail Mounting Provision
- ADAP25M   Screw Terminal Adaptor with a Male DB25 connector (may be needed if you intend on using both the Single-Ended and the Differential Analog Outputs at the same time).

Chapter 2: Installation

USB I/O Quick-Start Guide

Provides quick and straight-forward steps to complete the software and hardware installation of this product in your system.

Software CD Installation

The software provided with this board is contained on one CD and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your software format and operating system. Substitute the appropriate drive letter for your CD-ROM or disk drive where you see d: in the examples below.

WIN95/98/Me/NT/2000/XP/2003

a.   Place the CD into your CD-ROM drive.
b.   The installation program should automatically run. If it does not click START | RUN and type d:install, click OK or press ENTER.
c.   Follow the on-screen prompts to install the software for this board.

Hardware Installation

The board can ONLY be installed in a USB 2.0 port. Please refer to the printed USB I/O Quick Start Guide (which can also be found on the CD), for specific, quick steps to complete the hardware and software installation.

Chapter 3: Hardware Details

Refer to the setup program installed from the CD for the board along with this Option Selection Map when configuring jumper settings.
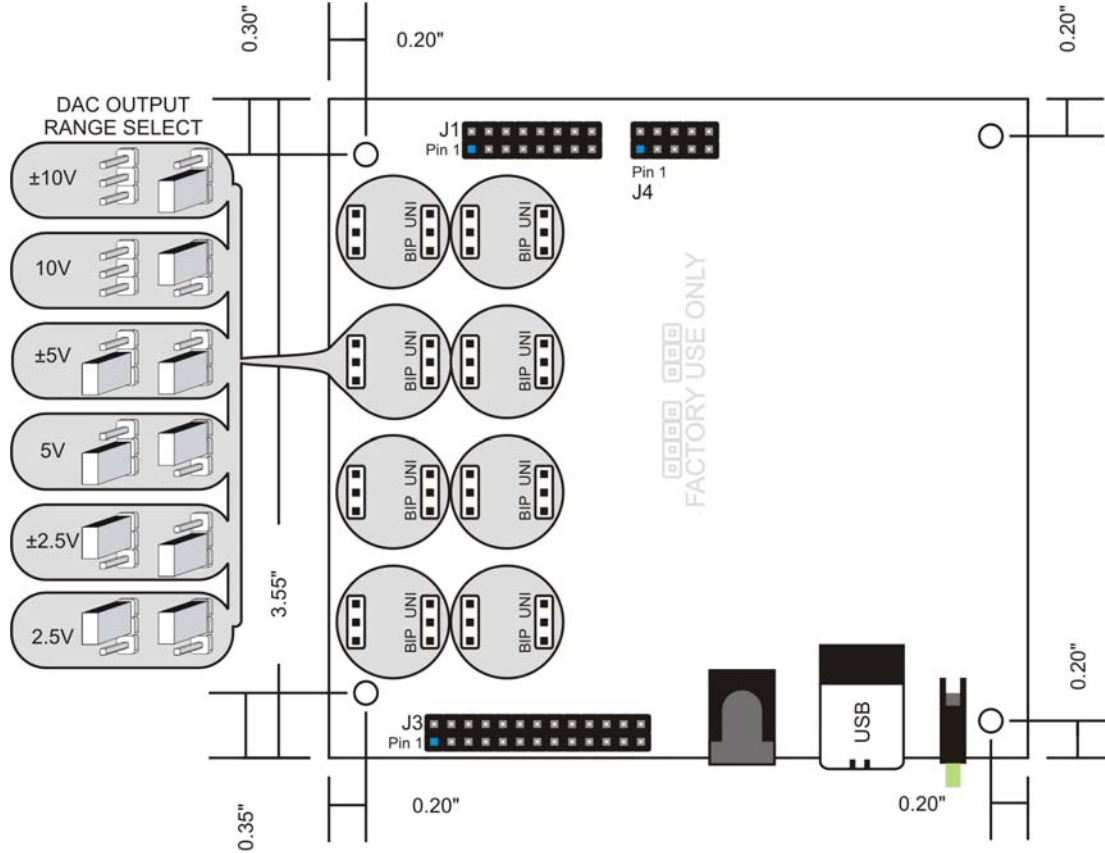

Figure 3-1: Option Selection Map

USB Connector (P1)

The USB connector available via the outside of the enclosure is a Type B and mates with the six foot cable provided. The USB port provides communication signals along with +5 VDC power. The board can be powered from the USB port or an external power supply can be used.

LED

The LED on the front of the enclosure is used to indicate power and data transmissions. When the LED is in an illuminated steady green state, this signifies that the board is successfully connected to the computer and has been detected and configured by the operating system. Continuous flashing of the LED signifies that there is data being transmitted over the USB bus.

DC Power Jack (Optional)

Please note, not all boards will contain this option. Use this option when more current is needed than what your USB port can supply (typically 500 mA). The DC jack has a 2.00mm post on board and is designed to be used with the 5VDC regulated AC/DC external power supply that ships with this option. When using external power, switch the jumper located near the USB connector to VEXT, otherwise when the jumper is in the VUSB position current is drawn from the USB port (please consult the option selection map for a visual reference).

Single Ended Outputs (J1) 16-pin header
Single Ended DAC outputs.

Differential Outputs (J3) 26-pin header
Differential DAC outputs. This connector follows the ILDA specification when used with a DB25F (included in standard product version).

Status and Control (J4) 10-pin header
Monitor and control various card functions.
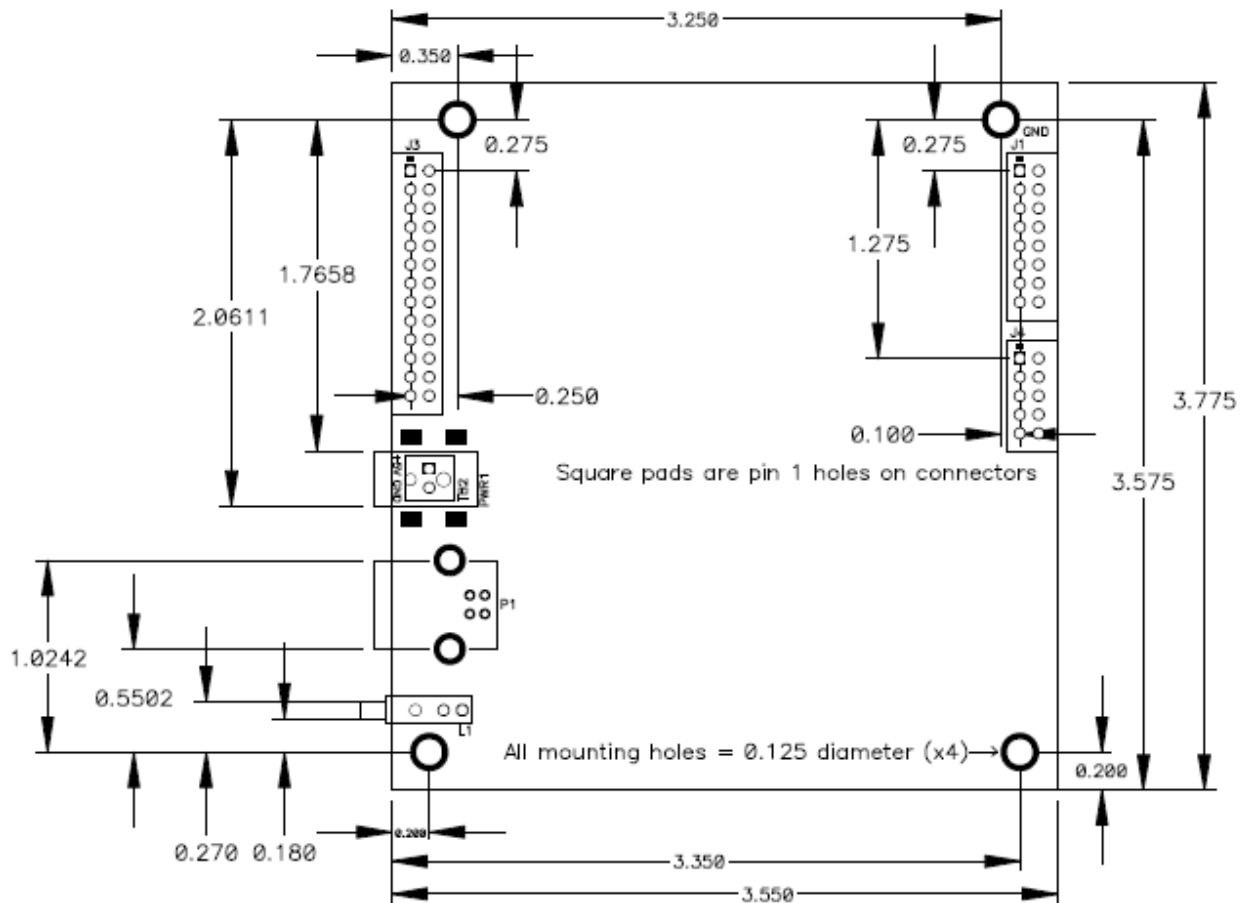
Figure 3-2: USB-DA12-8A Board Dimensional Drawing

Chapter 4: USB Address Information

Use the provided driver to access the USB board. This driver will allow you to determine how many supported USB devices are currently installed, and each device's type. This information is returned as a Vendor ID (VID), Product ID (PID) and Device Index.

The board's VID is "0x1605", and its PID is "0x4002".

The Device Index is determined by how many of the device you have in your system, and provides a unique identifier allowing you to access a specific board at will.

Chapter 5: Programming

The installation program on the CD will install four PDF manuals to your hard drive. These are the USB I/O Quick-Start Guide, this User Manual, Software Reference Manual, and super-software-tech manual; Vendor Requests.

Software Reference Manual

Details our various drivers and sample programs in a number of programming languages as well as providing insight into the most optimum combination of language, environment/OS and hardware selection available. Following are two very useful calls associated with this product. Refer to the Software Reference Manual for additional calls and information.

unsigned long **DACMultiDirect**(
unsigned long DeviceIndex - number from 0-31 indicating on which device you wish to set a DAC value
unsigned short *pDACData - a pointer to the first of an array of WORDs, consisting of channel/value pairs; channels are from 0-7, values are from 000h-FFFh, as for DACDirect()
unsigned long DACDataCount - number indicating how many channel/value **pairs** are in the array referenced by pDACData
)

unsigned long **DACOutputFrame**(- This function writes a group of points(a "frame") into the DAC stream. All points in a frame control the same number of DACs; if, for example, you wish to output one point with all 8 DACs, followed by 99 points with only 2 DACs, set the DAC count to 8, output a frame of just the first point, then set the DAC count to 2, and output a frame of the next 99 points. If the driver's internal buffer is full, the function will return "ERROR_NOT_READY" (equal to 21 decimal); try again in a moment, as the driver's buffer should drain some as soon as there's room in the larger hardware buffer and available time on the USB bus.
unsigned long DeviceIndex - number from 0-31 indicating on which device you wish to stream a frame of DAC points
unsigned long FramePoints - the number of points in the frame
unsigned short * FrameData - a pointer to the first of an array of WORDs; each DAC value is stored in a WORD, so it should contain (DACs in a point) $\times$ (points in the frame) WORDs
)

Vendor Requests
This file provides information on a RAW USB INTERFACE for very low-level programming, generally for use in Operating Systems other than Windows.

Chapter 6: Connector Pin Assignments

The standard product ships with the board installed in a steel powder-coated enclosure with one male DB25 connector and one female DB25 connector for accessing the I/O signals. These connectors are cabled to the header connectors inside the enclosure.

The OEM (board only) version of the product uses three vertical header connectors to provide a means to interface with the onboard signals. There is a 26 pin header for differential analog outputs, a 16 pin header for single-ended analog outputs and a 10 pin header for control and status of the board's functions.

The interlock signal on J4 pin 7 of the OEM (board only) version will need to be grounded to allow the DACs to output any voltages (if this function is enabled by software). On the standard product version this connection is brought to the DB25 Male connector pin 12.

There is an additional separate interlock pass-through connection on J3 between pins 7 and 8. This follows the ILDA specification (refer to table 6-6). On the standard product version this connection is brought to DB25 Female connector pins 4 and 17.

IDC 10 Pin

CONTROL & STATUS CONNECTOR

IDC10-Pin Header Male
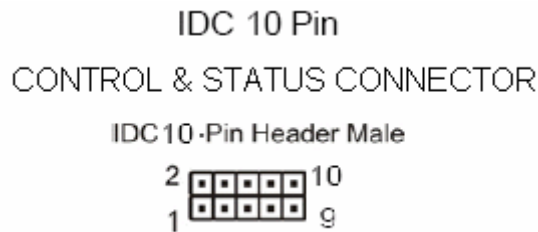
Pin	Signal Name	Direction	Description
1	EOF	Output	Set when EOF occurs in DAC Data; active-high
2	EOD	Output	Set when EOD occurs in DAC Data; active-high
3	Status	Output	Custom user-defined output
4	Blank	Output	Set and reset using combination of DAC Control bits; active-high
5	External Trigger	Input	Begins playback of stored DAC waveform(s); pulled-up; active-low
6	Pause	Input	Pauses waveform playback; pulled-up; active-low
7	Interlock	Input	Sets the DAC outputs to zero volts; pulled-up; active-high
8	Loop Enable	Input	Enable LOOP function; pulled-up; active-high
9	GND	-	Ground
10	N/C	-	-

Table 6-1: J4, Control/Status, 10-Pin IDC

IDC 16 Pin
SINGLE ENDED CONNECTOR
IDC 16-Pin Header Male

Pin	Signal Name	Direction	Description
1	DAC0	Output	DAC0 single-ended output
2	GND	-	Ground
3	DAC1	Output	DAC1 single-ended output
4	GND	-	Ground
5	DAC2	Output	DAC2 single-ended output
6	GND	-	Ground
7	DAC3	Output	DAC3 single-ended output
8	GND	-	Ground
9	DAC4	Output	DAC4 single-ended output
10	GND	-	Ground
11	DAC5	Output	DAC5 single-ended output
12	GND	-	Ground
13	DAC6	Output	DAC6 single-ended output
14	GND	-	Ground
15	DAC7	Output	DAC7 single-ended output
16	GND	-	Ground

Table 6-2: J1, S.E. Analog Outputs, 16-Pin IDC

Pin	Signal Name	Direction	Description
1	DAC0+	Output	DAC0 differential non-inverting output
2	DAC0-	Output	DAC0 differential inverting output
3	DAC1+	Output	DAC1 differential non-inverting output
4	DAC1-	Output	DAC1 differential inverting output
5	DAC2+	Output	DAC2 differential non-inverting output
6	DAC2-	Output	DAC2 differential inverting output
7	Interlock	Input	Interlock pass-through to pin 8
8	Interlock	Input	Interlock pass-through to pin 7
9	DAC3+	Output	DAC3 differential non-inverting output
10	DAC3-	Output	DAC3 differential inverting output
11	DAC4+	Output	DAC4 differential non-inverting output
12	DAC4-	Output	DAC4 differential inverting output
13	DAC5+	Output	DAC5 differential non-inverting output
14	DAC5-	Output	DAC5 differential inverting output
15	DAC6+	Output	DAC6 differential non-inverting output
16	DAC6-	Output	DAC6 differential inverting output
17	DAC7+	Output	DAC7 differential non-inverting output
18	DAC7-	Output	DAC7 differential inverting output
19	N/C	-	
20	N/C	-	
21	N/C	-	
22	N/C	-	
23	N/C	-	
24	N/C	-	
25	GND	-	Ground
26	GND	-	Ground

IDC 26 Pin CONNECTOR

IDC 26-Pin Header Male

2 □ 26
1 □ 25

Table 6-3: J3, Differential Analog Outputs, 26-Pin IDC

Pin	Signal Name	Direction	Description
1	DAC0	Output	DAC0 single-ended output
2	DAC1	Output	DAC1 single-ended output
3	DAC2	Output	DAC2 single-ended output
4	DAC3	Output	DAC3 single-ended output
5	DAC4	Output	DAC4 single-ended output
6	DAC5	Output	DAC5 single-ended output
7	DAC6	Output	DAC6 single-ended output
8	DAC7	Output	DAC7 single-ended output
9	EOF	Output	Set when EOF occurs in DAC Data; active-high
10	Status	Output	Custom user-defined output
11	External Trigger	Input	Begins playback of stored DAC waveform(s); pulled-up; active-low
12	Interlock	Input	Sets the DAC outputs to zero volts; pulled-up; active-high
13	GND	-	Ground
14	GND	-	Ground
15	GND	-	Ground
16	GND	-	Ground
17	GND	-	Ground
18	GND	-	Ground
19	GND	-	Ground
20	GND	-	Ground
21	GND	-	Ground
22	EOD	Output	Set when EOD occurs in DAC Data; active-high
23	Blank	Output	Set and reset using combination of DAC Control bits; active-high
24	Pause	Input	Pauses waveform playback; pulled-up; active-low
25	Loop Enable	Input	Enables LOOP function; pulled-up; active-high

Table 6-4: DB25 Male, S.E. Analog Outputs (J1) & Control/Status (J4)

Pin	Signal Name	Direction	Description
1	DAC0+	Output	DAC0 differential non-inverting output
2	DAC1+	Output	DAC1 differential non-inverting output
3	DAC2+	Output	DAC2 differential non-inverting output
4	Interlock	Input	Interlock pass-through to DB25F-17
5	DAC3+	Output	DAC3 differential non-inverting output
6	DAC4+	Output	DAC4 differential non-inverting output
7	DAC5+	Output	DAC5 differential non-inverting output
8	DAC6+	Output	DAC6 differential non-inverting output
9	DAC7+	Output	DAC7 differential non-inverting output
10	N/C	-	
11	N/C	-	
12	N/C	-	
13	GND	-	Ground
14	DAC0-	Output	DAC0 differential inverting output
15	DAC1-	Output	DAC1 differential inverting output
16	DAC2-	Output	DAC2 differential inverting output
17	Interlock	Input	Interlock pass-through to DB25F-4
18	DAC3-	Output	DAC3 differential inverting output
19	DAC4-	Output	DAC4 differential inverting output
20	DAC5-	Output	DAC5 differential inverting output
21	DAC6-	Output	DAC6 differential inverting output
22	DAC7-	Output	DAC7 differential inverting output
23	N/C	-	
24	N/C	-	
25	N/C	-	

Table 6-5: DB25 Female, Differential Analog Outputs (J3)

ILDA DB-25 Pinout and Signal Description Standard Excerpts

Pins	Signal Names	Signal Description
1, 14	X+, X-	Controls the horizontal beam position. This is a bipolar analog signal whose voltage range is 10V peak-to-peak differential. A differential voltage level of -10V shall deflect the laser beam to the left side of the projection area. A differential voltage level of +10V shall deflect the signal to the right side. A differential voltage of +10V occurs if the normal signal line has a voltage level of +10V with respect to the voltage level of the inverted signal line. When compared to the ground level of the differential driver, the voltage level of the normal signal line shall be +5V and the level of the inverted signal shall be -5V.
2, 15	Y+, Y-	Controls the vertical beam position. This is a bipolar analog signal whose voltage range is 10V peak-to-peak differential. A differential voltage level of -10V shall deflect the laser beam to the bottom of the screen. A differential voltage level of +10V shall deflect the signal to the top of the screen. A differential voltage level of 0V shall place the beam in the center of the screen vertically. A differential voltage of +10V occurs if the normal signal line has a voltage level of +10V with respect to the voltage level of the inverted signal line. When compared to the ground level of the differential driver, the voltage level of the normal signal line shall be +5V and the voltage level of the inverted signal shall be -5V.
3, 16	Intensity + Intensity -	
4, 17	Interlock A Interlock B	These are intended to keep the projector from outputting light if inadvertently connected to nonlaser signal sources such as SCSI, Parallel or serial connectors. These signals are also a fail-safe should other control measures fail. These signals are tied together at the signal source. If this loop is broken, it is required that projectors close a shutter or turn off the laser or take other actions that prevent light from being emitted from the projector. It is important to note that this portion of the ISPDB25 is a projector interlock which may be separate from the remote interlock connector on a laser used with the projector.
5, 18	R+, R-	Controls the red intensity. This is a unipolar analog signal whose voltage range is 5V peak-to-peak differential. A differential voltage level of 0V shall produce no red output. A differential voltage level of +5V shall produce maximum red output. A differential voltage of +5V occurs if the normal signal line has a voltage level of +5V with respect to the voltage level of the inverted signal line. When compared to the ground level of the differential driver, the voltage level of the normal signal line shall be +2.5V and the voltage level of the inverted signal shall be -2.5V.
6, 19	G+, G-	Controls the green intensity. This is a unipolar analog signal whose voltage range is 5V peak-to-peak differential. A differential voltage level of 0V shall produce no green output. A differential voltage level of +5V shall produce maximum green output. A differential voltage of +5V occurs if the normal signal line has a voltage level of +5V with respect to the voltage level of the inverted signal line. When compared to the ground level of the differential driver, the voltage level of the normal signal line shall be +2.5V and the voltage level of the inverted signal shall be -2.5V.
7, 20	B+, B-	Controls the blue intensity. This is a unipolar analog signal whose voltage range is 5V peak-to-peak differential. A differential voltage level of 0V shall produce no blue output. A differential voltage level of +5V shall produce maximum blue output. A differential voltage of +5V occurs if the normal signal line has a voltage level of +5V with respect to the voltage level of the inverted signal line. When compared to the ground level of the differential driver, the voltage level of the normal signal line shall be +2.5V and the voltage level of the inverted signal shall be -2.5V.
8, 21	User-defined	signal 1+, 1-
9, 22	User-defined	signal 2+, 2-
10,23	User-defined	signal 3+, 3-
11,24	User-defined	signal 4+, 4-
12	Projector	Return signal
13	Shutter	Optical shutter intended to extinguish all light from the graphics scanners. This is a unipolar analog signal whose voltage range is 5 volts peak. The shutter signal is referenced to the Ground pin. A voltage level of 0 volts shall close the shutter so that no light is emitted from the graphics scanners. A voltage level of +5 volts shall fully open the shutter.
25	Ground	0 voltage potential reference and signal shield.

Table 6-6: ILDA Signal Naming Standard, DB25F Signal Descriptions
References: International Laser Display Association http://www.laserist.org/index.htm

Chapter 7: Specifications

Analog Outputs

Number of Outputs:	8 channels
Type of Outputs:	Single-ended and differential
Resolution:	12-bit resolution
Unipolar Ranges:	0-2.5V, 0-5V, 0-10V
Bipolar Ranges:	±2.5V, ±5V, ±10V
Conversion Rate:	125kHz, all channels simultaneous
Relative Accuracy:	±2 LSB typical
Differential Non-linearity:	±0.2 LSB typical
Settling Time:	8us typical, 10us max
Output Current:	6mA per channel
Bus Type	USB 2.0 High-speed

Environmental

Operating Temperature:	0° to 70°C
Storage Temperature:	-40° to $+85^{O}$C
Humidity:	5% to 95% non-condensing
Board Dimension:	3.550 x 3.775 inches
Box Dimension:	4 x 4 x 1.75 inches tall

Power   +5VDC @ ~200mA typical, no-load on DAC outputs**

Max load of 8mA per differential output increases the load on +5V by ~40mA. Max load of 8mA per single-ended output increases the load on +5V by ~15mA.

** Regulated AC/DC adapter should be ordered ("-PR" option) together with the board if the total current draw is expected to exceed that which the USB port can provide by default (typically 500mA).

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: ***manuals@accesio.com***. Please detail any errors you find and include your mailing address so that we can send you any manual updates.

ACCES I/O PRODUCTS, INC.

10623 Roselle Street, San Diego, CA 92121
Tel. (858) 550-9559 FAX (858) 550-7322
www.accesio.com