MODELS
USB-IDIO-16
USB-IDO-16
USB-IDIO-8

ISOLATED DIGITAL INPUT / FET OUTPUT BOARDS

USER MANUAL

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ADL Embedded Solutions GmbH, Eiserfelder Straße 316 D-57080 Siegen, Germany P. +49 (0) 271 250 810 0 F. +49 (0) 271 250 810 20
e-mail: sales@adl-europe.com; web: www.adl-europe.com

ADL Embedded Solutions Inc., 4411 Morena Blvd., Suite 101 San Diego, CA 92117-4345 P. +1 858 490-0597 F. +1 858 490-0599
e-mail: sales@adl-usa.com; web: www.adl-usa.com

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WARNING!!

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

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Chapter 1: Introduction

This 32 channel optically isolated digital I/O board is an ideal solution for adding portable, easy-to-install industrial grade I/O to any computer with a supported USB port. As a USB 2.0 high speed device it offers the fastest speed currently available with the USB bus, while being fully compatible with both USB 1.1 and USB 2.0 ports. The card is plug-and-play allowing for quick connect/disconnect whenever you need additional I/O on your computer.

Features

High Speed USB 2.0 device, USB 1.1 compatible
16 optically-isolated inputs
16 fully protected and isolated FET 2A outputs
Custom high-speed function driver
Internal, removable screw terminal board for easy wiring
Small (4" x 4" x 1.4") rugged industrial enclosure
PC/104 module size and mounting compatibility

Applications

These boards are especially useful in applications where high common-mode external voltages are present. Isolation is required to guard electronics from transient voltage spikes and offers greater common-mode noise rejection in electronically noisy surroundings containing industrial machinery and inductive loads. These applications include factory automation, energy management, industrial ON/OFF control, security systems, manufacturing test, and process monitoring. In addition to protecting industrial applications from accidental contact with high external voltages, the isolation provided eliminates troublesome ground loops.

Inputs

The board provides sixteen optically-isolated inputs. These inputs can accept either AC or DC signals and are not polarity sensitive. Input signals are rectified by photocoupler diodes while unused power gets dissipated through a 1.8k-ohm resistor in series. The inputs may be driven by either DC sources of 3 to 31 volts or AC (RMS) sources at frequencies of 40 Hz to 10 kHz. Standard 12/24 AC control transformer outputs can be accepted as well. External resistors connected in series may be used to extend the input voltage range, however this will raise the input threshold range. Consult with factory for available modified input ranges.

Each input circuit contains a switchable filter that has a 4.7 millisecond time constant. (Without filtering, the response is less than 40 microseconds.) The filter <u>must</u> be selected for AC inputs in order to eliminate the on/off response to AC. The filter is also valuable for use with slow DC input signals in a noisy environment. The filter may be switched out for DC inputs in order to obtain faster response. Filters are individually selected by jumpers. The filters are switched into the circuit when the jumpers are installed in position FLT0 to FLT15.

Outputs

The solid state outputs are comprised of sixteen fully protected and isolated FET outputs. The FET's have built in current limiting and are protected against short-circuit, over- temperature, ESD and inductive load transients. The current limitation is activated until the thermal protection acts. The FET's are all off at power-on.

Screw Terminal Accessory Board

A Screw Terminal Accessory board is included with the unit, except for the Economy (E) and OEM versions. The board provides access to all I/O signals via removable screw terminals. Each removable screw terminal carries 8 I/O signals, signal names are clearly marked on the accessory board's silk screen. The screw terminal board plugs directly onto the I/O board while fitting inside the rugged industrial enclosure.

NOTE: Screw termination board is also designed for the USB-isolated input/relay output board. For USB-isolated input/FET output board, please use "FET OUTPUTS" silk screen for correct pin designations.

USB Connector

The USB connector is a Type B connector and mates with the cable provided. The USB port provides communication signals along with +5 VDC power. The board can be powered from the USB port or, if needed for higher current applications, 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. When the LED flashes continuously, this signifies that there is data being transmitted over the USB bus.

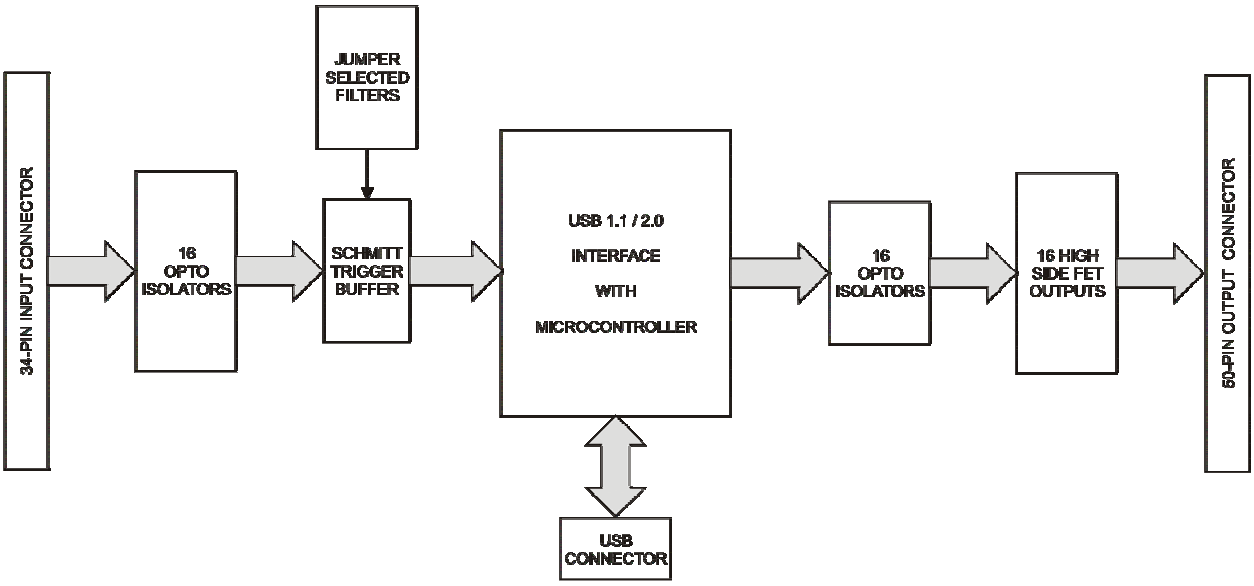


Figure 1-1: Block Diagram

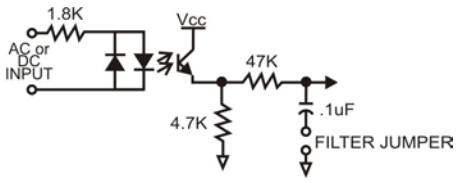


Figure 1-2: Example of One Input Circuit

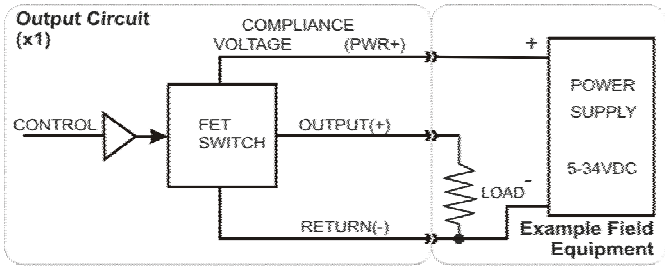


Figure 1-3: Example of One Output Circuit

Ordering Guide

USB-IDIO-16	Enclosure, module and screw terminal board
USB-IDO-16	16 isolated FET solid state outputs only version
USB-IDIO–8	8 isolated digital inputs and 8 isolated FET solid state outputs version (uses ports 0-7 for inputs and outputs).

Model Options

-OEM	Board only version (no enclosure and screw terminal board)
-E	Economy model (no screw terminal board)
-DIN	DIN rail mounting provision
-P	External power and AC/DC adapter

Accessories

USB-STB-84	Internal plug in screw termination board

Included with your board

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

1. USB-Isolated Input/FET Output Board (unit installed in labeled enclosure)
2. 6’ USB cable
3. Software Master CD (PDF user manual installed with product package)
4. Printed USB I/O Quick-Start Guide

Chapter 2: Installation

Software CD Installation

These paragraphs are intended to detail the software installation steps.

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 operating system. Substitute the appropriate drive letter for your drive where you see d: in the examples below.

WIN98/Me/2000/XP/2003

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

Hardware Installation

The board can be installed in any USB 2.0 or USB 1.1 port. Please refer to the USB I/O Quick Start Guide which can be found on the CD, for specific, quick steps to complete the hardware and software installation.

Chapter 3: Option Selection

Refer to the setup programs on the CD provided with the board. Also, refer to the Block Diagram and the Option Selection Map when reading this section of the manual.

External Power

This is an option for applications that use more current than what your computer can provide on the USB port (typically 500 mA). The DC jack has a 2.00mm post on board and is designed to be used with the 9 VDC AC/DC external power supply that ships with this option. The voltage regulator on board regulates the 9 VDC and provides 5 VDC to the onboard circuitry. 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.

Filter Response Jumpers

Jumpers are used to select input filtering on a channel-by-channel basis. When jumper FLT0 is installed, additional filtering is introduced for input bit 0, FLT1 for bit 1, etc.

JUMPER SELECTION	Bit Filtered
FLT-0	IN00
FLT-1	IN01
FLT-2	IN02
FLT-3	IN03
FLT-4	IN04
FLT-5	IN05
FLT-6	IN06
FLT-7	IN07

JUMPER SELECTION	Bit Filtered
FLT-8	IN08
FLT-9	IN09
FLT-10	IN10
FLT-11	IN11
FLT-12	IN12
FLT-13	IN13
FLT-14	IN14
FLT-15	IN15

This additional filtering provides a slower response for DC signals as described previously and must be used when AC inputs are applied.

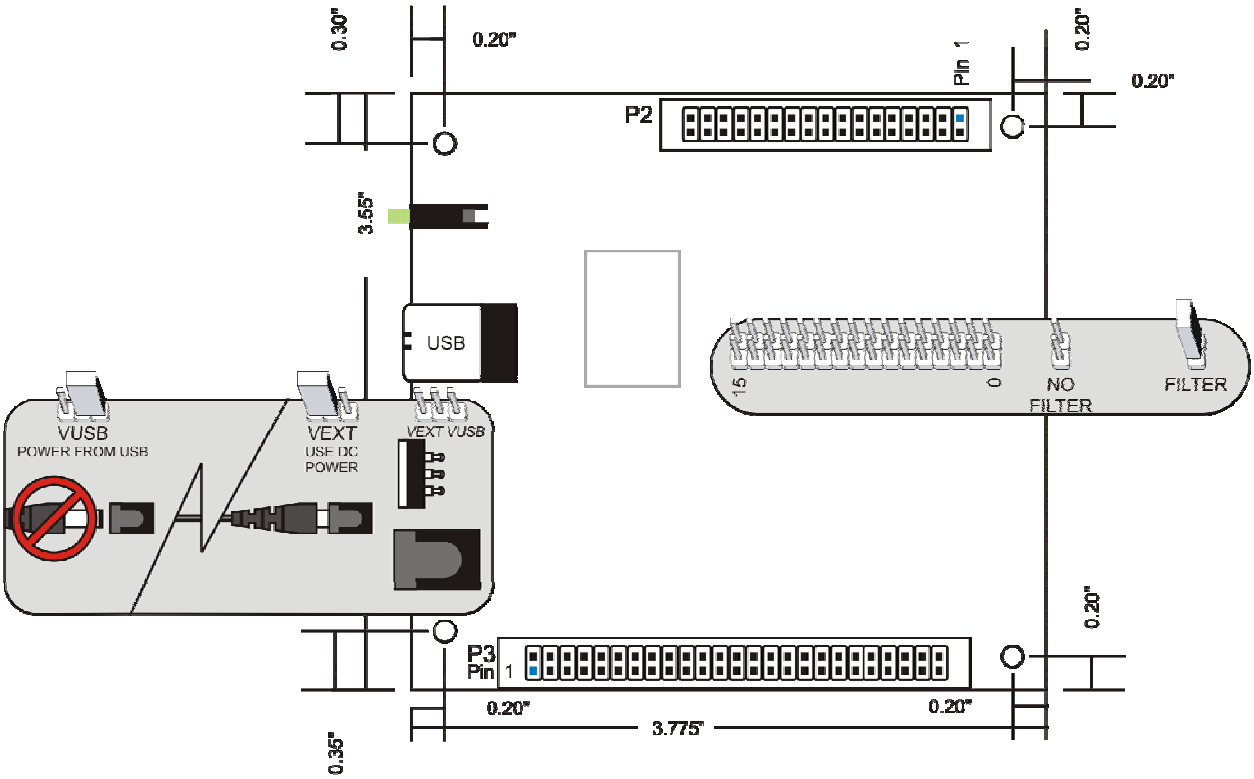


Figure 3-1: Option Selection Map

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 "0x8018".

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 driver software provided with the board uses a 32-bit .dll front end compatible with any Windows programming language. Samples provided in Borland C++Builder, Borland Delphi, Microsoft Visual Basic, and Microsoft Visual C++ demonstrate the use of the driver.

The following functions are provided by the driver in Windows.

These functions will allow you to read or write individual bits, bytes, or the entire board worth of data. In addition, counter-timer functionality and board-level functions complete the driver package.

For detailed information on each function refer to the .html Driver Manual located in the Win32 directory for this board.

```
unsigned long GetDevices(void )
unsigned long QueryDeviceInfo(DeviceIndex, pPID, pName, pDIOBytes, pCounters)
unsigned long DIO_Configure(DeviceIndex, bTristate, pOutMask, pData)
unsigned long DIO_Write1(DeviceIndex, BitIndex, bData)
unsigned long DIO_Write8(DeviceIndex, ByteIndex, Data)
unsigned long DIO_WriteAll(DeviceIndex,pData)
unsigned long DIO_Read8(DeviceIndex, ByteIndex,pBuffer)
unsigned long DIO_ReadAll(DeviceIndex,Buffer)
```

Chapter 6: Connector Pin Assignments

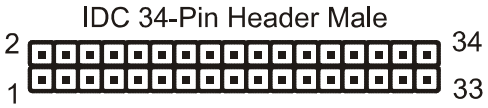
FET outputs are connected to the board via a 50-pin HEADER type connector named P3. The mating connector is an IDC type with 0.1 inch centers or equivalent. Normally, a screw terminal accessory (USB-STB-84) is included and installed directly on to the board headers. Pin assignments follow.

IDC 50-Pin Header Male

PIN	NAME	FUNCTION
1	OUT15+	Bit 15 Switched (Supply Voltage) Output
2	OUT15VBB	Bit 15 FET Supply Voltage
3	OUT15-	Bit 15 Power Supply Return (or Ground)
4	OUT14+	Bit 14 Switched (Supply Voltage) Output
5	OUT14VBB	Bit FET Supply Voltage
6	OUT14-	Bit 14 Power Supply Return (or Ground)
7	OUT13+	Bit 13 Switched (Supply Voltage) Output
8	OUT13VBB	Bit 13 FET Supply Voltage
9	OUT13-	Bit 13 Power Supply Return (or Ground)
10	OUT12+	Bit 12 Switched (Supply Voltage) Output
11	OUT12VBB	Bit 12 FET Supply Voltage
12	OUT12-	Bit 12 Power Supply Return (or Ground)
13	OUT11+	Bit 11 Switched (Supply Voltage) Output
14	OUT11VBB	Bit 11 FET Supply Voltage
15	OUT11-	Bit 11 Power Supply Return (or Ground)
16	OUT10+	Bit 10 Switched (Supply Voltage) Output
17	OUT10VBB	Bit 10 FET Supply Voltage
18	OUT10-	Bit 10 Power Supply Return (or Ground)
19	OUT09+	Bit 09 Switched (Supply Voltage) Output
20	OUT09VBB	Bit 09 FET Supply Voltage
21	OUT09-	Bit 09 Power Supply Return (or Ground)
22	OUT08+	Bit 08 Switched (Supply Voltage) Output
23	OUT08VBB	Bit 08 FET Supply Voltage
24	OUT08-	Bit 08 Power Supply Return (or Ground)
25		
26		
27	OUT07-	Bit 07 Power Supply Return (or Ground)
28	OUT07VBB	Bit 07 FET Supply Voltage
29	OUT07+	Bit 07 Switched (Supply Voltage) Output
30	OUT06-	Bit 06 Power Supply Return (or Ground)
31	OUT06VBB	Bit 06 FET Supply Voltage
32	OUT06+	Bit 06 Switched (Supply Voltage) Output
33	OUT05-	Bit 05 Power Supply Return (or Ground)
34	OUT05VBB	Bit 05 FET Supply Voltage
35	OUT05+	Bit 05 Switched (Supply Voltage) Output
36	OUT04-	Bit 04 Power Supply Return (or Ground)
37	OUT04VBB	Bit 04 FET Supply Voltage
38	OUT04+	Bit 04 Switched (Supply Voltage) Output
39	OUT03-	Bit 03 Power Supply Return (or Ground)
40	OUT03VBB	Bit 03 FET Supply Voltage
41	OUT03+	Bit 03 Switched (Supply Voltage) Output
42	OUT02-	Bit 02 Power Supply Return (or Ground)
43	OUT02VBB	Bit 02 FET Supply Voltage
44	OUT02+	Bit 02 Switched (Supply Voltage) Output
45	OUT01-	Bit 01 Power Supply Return (or Ground)
46	OUT01VBB	Bit 01 FET Supply Voltage
47	OUT01+	Bit 01 Switched (Supply Voltage) Output
48	OUT00-	Bit 00 Power Supply Return (or Ground)
49	OUT00VBB	Bit 00 FET Supply Voltage
50	OUT00+	Bit 00 Switched (Supply Voltage) Output

Figure 6-1: FET Output Pin Assignments (P3)

Isolated Inputs are connected to the board via a 34-pin HEADER type connector named P2. The mating connector is an IDC type with 0.1 inch centers or equivalent.



PIN	NAME	FUNCTION
1	IN00 A	Isolated Input 00 A
2	IN00 B	Isolated Input 00 B
3	IN01 A	Isolated Input 01 A
4	IN01 B	Isolated Input 01 B
5	IN02 A	Isolated Input 02 A
6	IN02 B	Isolated Input 02 B
7	IN03 A	Isolated Input 03 A
8	IN03 B	Isolated Input 03 B
9	IN04 A	Isolated Input 04 A
10	IN04 B	Isolated Input 04 B
11	IN05 A	Isolated Input 05 A
12	IN05 B	Isolated Input 05 B
13	IN06 A	Isolated Input 06 A
14	IN06 B	Isolated Input 06 B
15	IN07 A	Isolated Input 07 A
16	IN07 B	Isolated Input 07 B
17		
18		
19	IN08 A	Isolated Input 08 A
20	IN08 B	Isolated Input 08 B
21	IN09 A	Isolated Input 09 A
22	IN09 B	Isolated Input 09 B
23	IN10 A	Isolated Input 10 A
24	IN10 B	Isolated Input 10 B
25	IN11 A	Isolated Input 11 A
26	IN11 B	Isolated Input 11 B
27	IN12 A	Isolated Input 12 A
28	IN12 B	Isolated Input 12 B
29	IN13 A	Isolated Input 13 A
30	IN13 B	Isolated Input 13 B
31	IN14 A	Isolated Input 14 A
32	IN14 B	Isolated Input 14 B
33	IN15 A	Isolated Input 15 A
34	IN15 B	Isolated Input 15 B

Figure 6-2: Isolated Input Pin Assignments (P2)

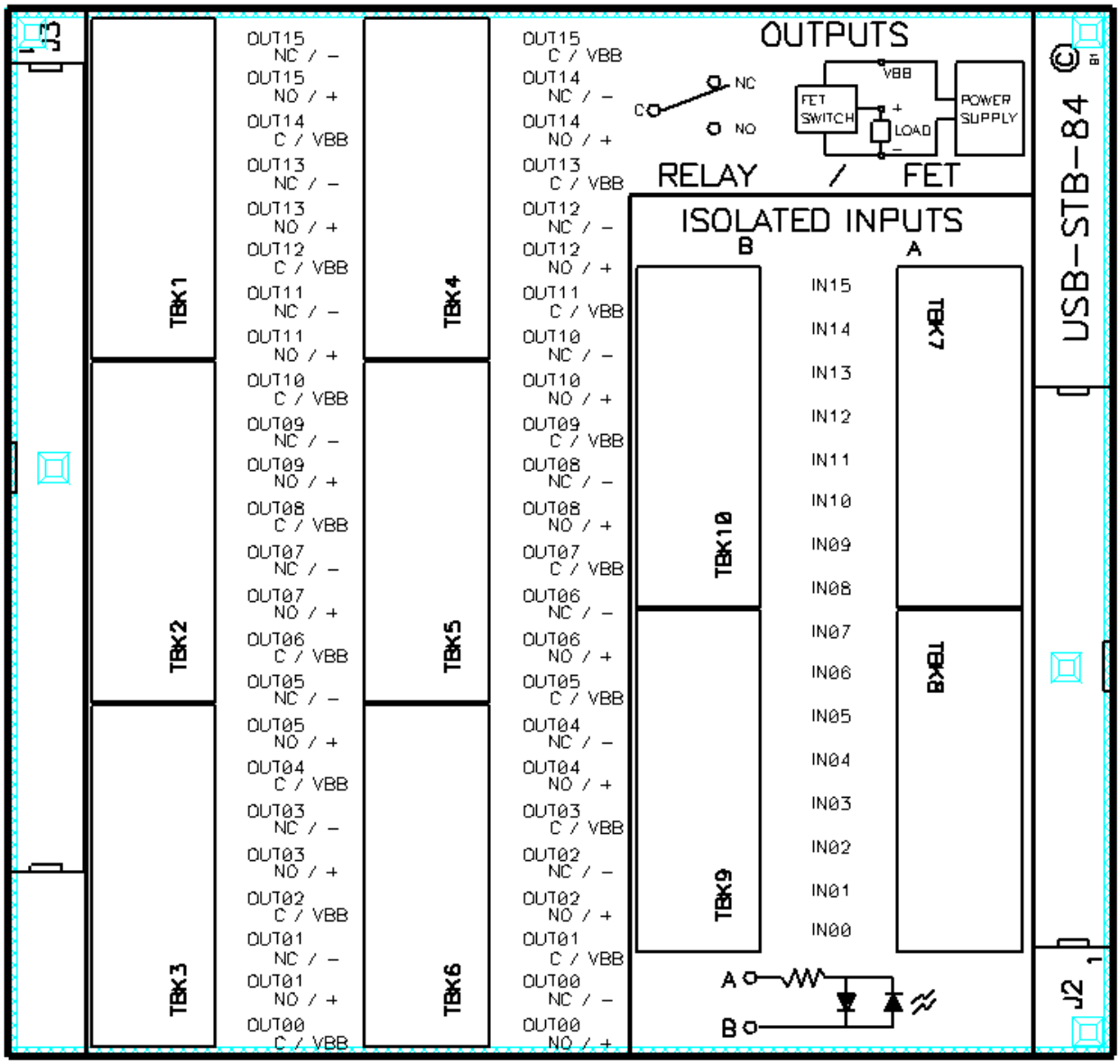


Figure 6-3: USB-STB-84 Screw Terminal Board

Chapter 7: Specification

Isolated Inputs

Number of inputs:	Sixteen
Type:	Non-polarized, optically isolated from each other and from the computer
Voltage Range:	3 to 31 DC or AC RMS (40 Hz to 10 kHz) (CMOS compatible)
Isolation:	500V*(see note) channel-to-ground or channel-to channel
Input Resistance:	1.8K ohms in series with opto coupler
Filter Response:	Rise Time = 4.7 mS / Fall Time = 4.7 mS
Non-Filter Response:	Rise Time = 10 uS / Fall Time = 30 uS

Isolated FET Outputs

Number of outputs:	Sixteen Solid State FET's (off @ power up)
Output Type:	High Side Power MOSFET Switch. Protected against short circuit, over-temperature, ESD, can drive inductive loads.
Voltage Range:	5-34VDC recommended (customer supplied) for continuous use, 40VDC absolute maximum
Current Rating:	2A maximum
Turn-on time:	90 uS (typical)
Turn-off time:	110 uS (typical)

Power Required

5V @ 35mA typical (all FETs off, add 5mA per FET)

5V @ 115mA typical (all FETs on)

5VDC provided via USB cable up to 500mA**

**optional external power supply can be ordered if desired if current use of the board is expected to be greater than what can be supplied by the USB cable.

Environmental

Operating Temp: 0 - 70 ^{o}C (Non-icing)

*Notes on Isolation: Opto-Isolators and connectors are rated for at least 500V, but isolation voltage breakdowns will vary and is affected by factors like cabling, spacing of pins, spacing between traces on the PCB, humidity, dust and other environmental factors. This is a safety issue so a careful approach is required. For CE certification on the front end of the circuitry, isolation was specified at 40V AC and 60V DC. The design intention was to eliminate the influence of common mode. Use proper wiring techniques to minimize voltage between channels and to ground. For example, when working with AC voltages do not connect the hot side of the line to an input. Tolerance of higher isolation voltage can be obtained on request by applying a conformal coating to the board.

Customer Comments

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

ADL Embedded Solutions GmbH, Eiserfelder Straße 316 D-57080 Siegen, Germany P. +49 (0) 271 250 810 0 F. +49 (0) 271 250 810 20
e-mail: sales@adl-europe.com; web: www.adl-europe.com

ADL Embedded Solutions Inc., 4411 Morena Blvd., Suite 101 San Diego, CA 92117-4345 P. +1 858 490-0597 F. +1 858 490-0599
e-mail: sales@adl-usa.com; web: www.adl-usa.com