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**ISOLATED DIGITAL
INPUT / RELAY OUTPUT
BOARD MODELS
USB-IIRO-16, USB-II-16,
USB-RO-16, USB-IIRO-8 and USB-IIRO-4**

USER MANUAL

File: MUSB-IIRO-16.B1j

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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.

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.

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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.

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Chapter 1: Introduction

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

Model Versions

- 16 isolated digital inputs and 16 relay outputs, enclosure, module and screw terminal board
- 16 isolated digital inputs only version
- 16 relay outputs only version
- 8 isolated digital inputs and 8 relay outputs version
- 4 isolated digital inputs and 4 relay outputs version

Each version is a different population on the same PCB. This manual primarily describes the 16 input / 16 output version. Wherever references occur to the number of inputs and number of outputs, substitute the number of inputs and outputs with the quantity specific to the model you are considering, or have purchased. All lesser quantity than the fully populated versions start their I/O counts from input 00, and from relay 00. So the IIRO-8 version would be populated with inputs IN00 through IN07 and outputs OUT00 through OUT07 (RELAY 00 through RELAY 07). The IIRO-4 version would be populated with inputs IN00 through IN03 and outputs OUT00 through OUT03 (RELAY 00 through RELAY 03). The corresponding removable screw terminal board would also be only populated with the terminals to access the I/O on the model you purchased.

Accessories:

Internal plug in screw termination board **(Green screw terminals = AWG 26-16)**
(Gray screw terminals = AWG 28-20)

External power supply components and AC/DC adapter

Options:

- OEM Board Only version (no enclosure or screw terminal board)
- E Economy model (no screw terminal board)
- DIN DIN rail mounting provision

Functional Description

FEATURES:

- High-Speed USB 2.0 device, USB 1.1 compatible
- 16 optically isolated inputs
- 16 Form C electromechanical 1A relays
- Internal, removable screw terminal board for easy wiring
- Small (4" x 4"x 1.25") rugged industrial enclosure
- Custom high-speed function driver
- PC/104 module size and mounting compatibility

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 (rms) or AC 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 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 must 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 jumper selected. Filters are switched into the circuit when jumpers are installed in position FLT0 to FLT15.

OUTPUTS

The board's outputs are comprised of sixteen FORM C SPDT electro mechanical relays. These relays are all de-energized at power-on. **Please note that once your hardware is properly installed in your system you will likely want to run one of our sample programs to exercise the I/O. When doing so, as soon as the sample program is run it will turn on all the relays and leave them in that state until you turn them all off within the sample.**

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 80 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.

USB CONNECTORS

The primary 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. Selection of power source is accomplished via a hardware jumper setting. A secondary USB connector (P4) is available to use instead of the Type B which is an embedded mini 5-pin connector that is in parallel with and next to the primary connector.

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.

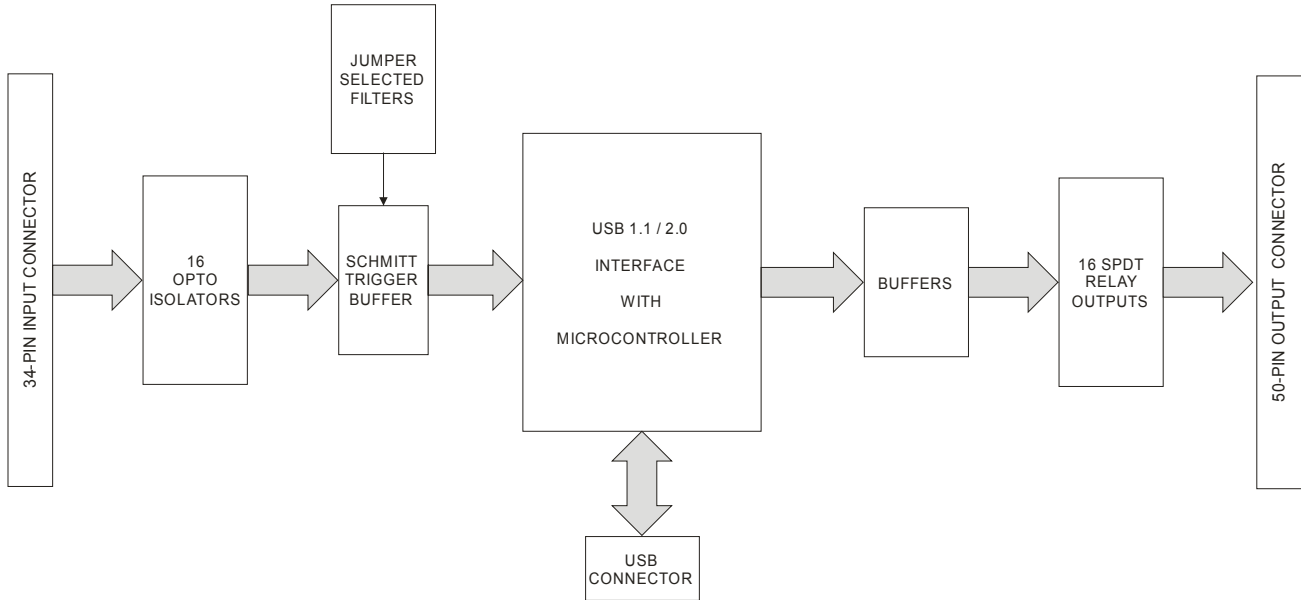


Figure 1-1: Block Diagram

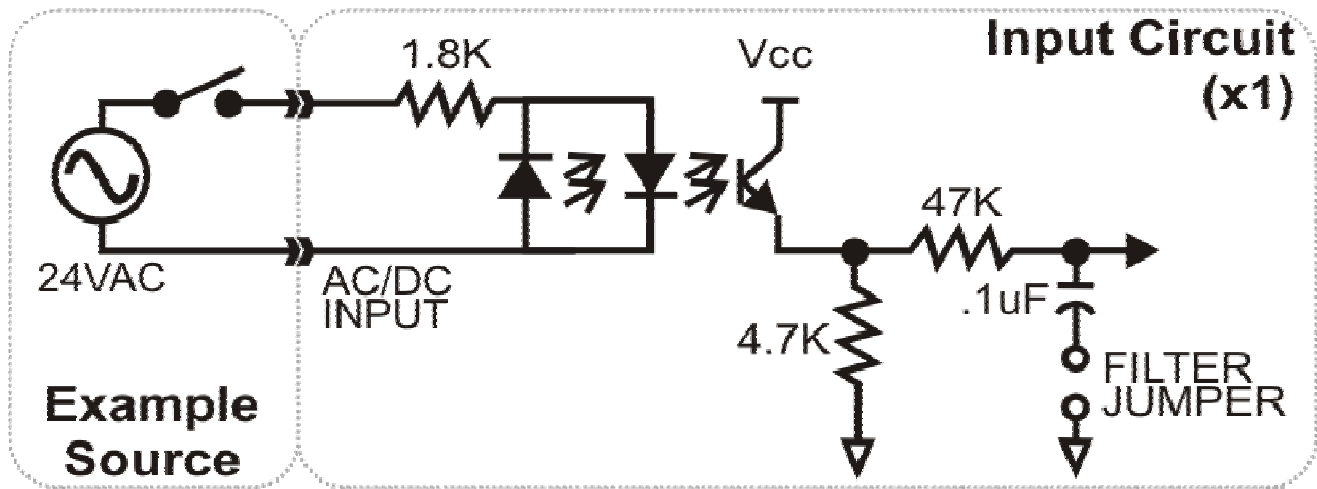


Figure 1-2: Example of one Input Circuit

Chapter 2: Installation

Software CD Installation

These paragraphs are intended to detail the software installation steps as well as describe what is being installed.

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 run, 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 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.

Input 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 Switch

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.

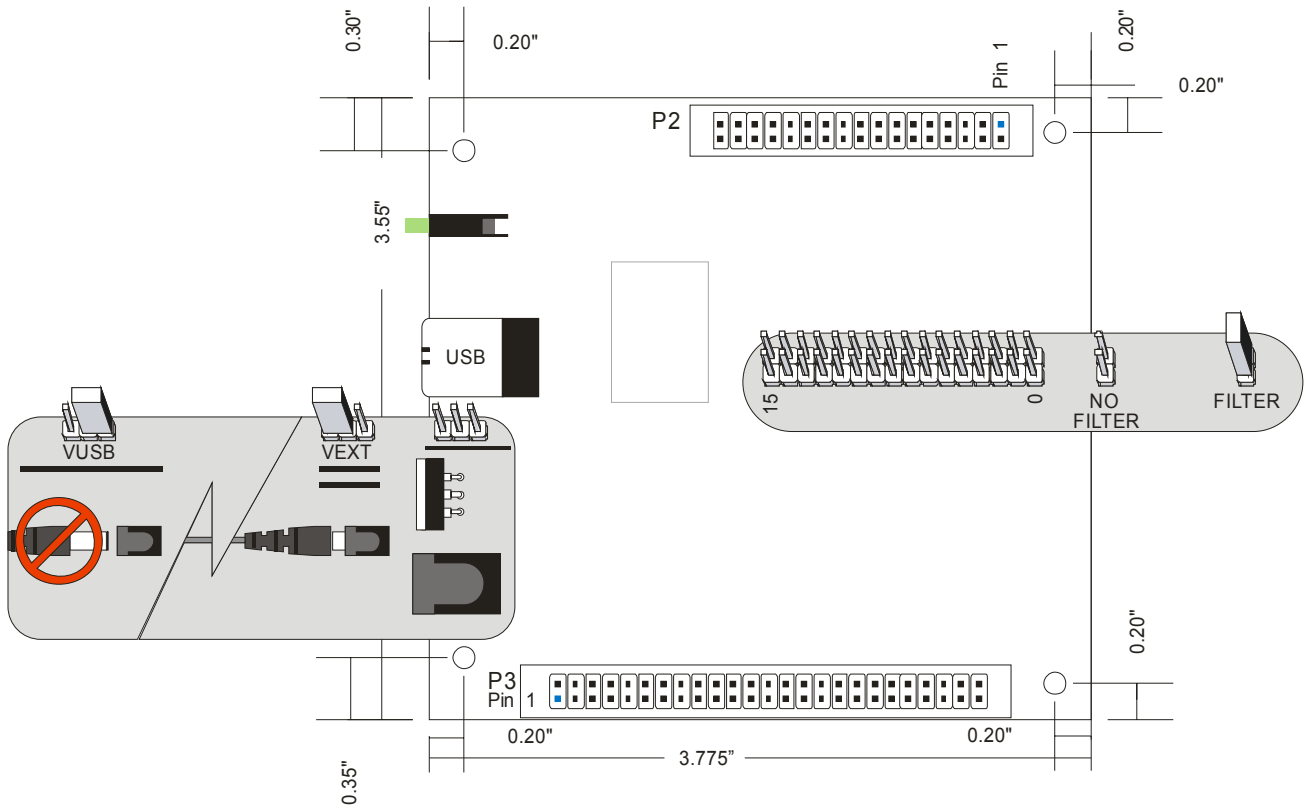


Figure 3-1: Option Selection Map

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". See the table for PID to model descriptions.

Model Description	PID
16 Inputs / 16 Relays	0x8010
16 Inputs	0x8011
16 Relays	0x8012
8 Inputs / 8 Relays	0x8014
4 Inputs / 4 Relays	0x8016

Table 4-1: Model Description to PID

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.

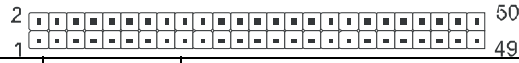
For detailed information on each function refer to the .html Driver Manual located in the Win32 directory for this board.

```
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)
unsigned long CTR_8254Mode(DeviceIndex, BlockIndex, CounterIndex, Mode)
unsigned long CTR_8254ModeLoad(DeviceIndex, BlockIndex, CounterIndex,Mode, LoadValue)
unsigned long CTR_8254ReadModeLoad(DeviceIndex, BlockIndex, CounterIndex, Mode, LoadValue,
    pReadValue)
unsigned long CTR_8254Read(DeviceIndex, BlockIndex, CounterIndex, pReadValue)
unsigned long CTR_StartOutputFreq(DeviceIndex, CounterIndex, pHz)
```

Chapter 6: Connector Pin Assignments

Relay 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. The wiring may be directly from the signal sources or may be on ribbon cable from screw terminal accessory boards such as the STA-50.

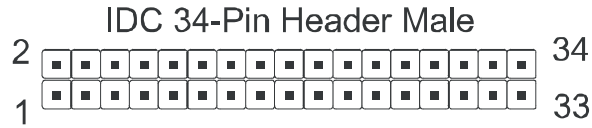
IDC 50 Pin Header Male



PIN	NAME	FUNCTION
1	OUT15-NO	Relay 15, Normally-Open Contact
2	OUT15-C	Relay 15, Common Contact
3	OUT15-NC	Relay 15, Normally-Closed Contact
4	OUT14-NO	Relay 14, Normally-Open Contact
5	OUT14-C	Relay 14, Common Contact
6	OUT14-NC	Relay 14, Normally-Closed Contact
7	OUT13-NO	Relay 13, Normally-Open Contact
8	OUT13-C	Relay 13, Common Contact
9	OUT13-NC	Relay 13, Normally-Closed Contact
10	OUT12-NO	Relay 12, Normally-Open Contact
11	OUT12-C	Relay 12, Common Contact
12	OUT12-NC	Relay 12, Normally-Closed Contact
13	OUT11-NO	Relay 11, Normally-Open Contact
14	OUT11-C	Relay 11, Common Contact
15	OUT11-NC	Relay 11, Normally-Closed Contact
16	OUT10-NO	Relay 10, Normally-Open Contact
17	OUT10-C	Relay 10, Common Contact
18	OUT10-NC	Relay 10, Normally-Closed Contact
19	OUT09-NO	Relay 09, Normally-Open Contact
20	OUT09-C	Relay 09, Common Contact
21	OUT09-NC	Relay 09, Normally-Closed Contact
22	OUT08-NO	Relay 08, Normally-Open Contact
23	OUT08-C	Relay 08, Common Contact
24	OUT08-NC	Relay 08, Normally-Closed Contact
25		
26		
27	OUT07-NC	Relay 07, Normally-Closed Contact
28	OUT07-C	Relay 07, Common Contact
29	OUT07-NO	Relay 07, Normally-Open Contact
30	OUT06-NC	Relay 06, Normally-Closed Contact
31	OUT06-C	Relay 06, Common Contact
32	OUT06-NO	Relay 06, Normally-Open Contact
33	OUT05-NC	Relay 05, Normally-Closed Contact
34	OUT05-C	Relay 05, Common Contact
35	OUT05-NO	Relay 05, Normally-Open Contact
36	OUT04-NC	Relay 04, Normally-Closed Contact
37	OUT04-C	Relay 04, Common Contact
38	OUT04-NO	Relay 04, Normally-Open Contact
39	OUT03-NC	Relay 03, Normally-Closed Contact
40	OUT03-C	Relay 03, Common Contact
41	OUT03-NO	Relay 03, Normally-Open Contact
42	OUT02-NC	Relay 02, Normally-Closed Contact
43	OUT02-C	Relay 02, Common Contact
44	OUT02-NO	Relay 02, Normally-Open Contact
45	OUT01-NC	Relay 01, Normally-Closed Contact
46	OUT01-C	Relay 01, Common Contact
47	OUT01-NO	Relay 01, Normally-Open Contact
48	OUT00-NC	Relay 00, Normally-Closed Contact
49	OUT00-C	Relay 00, Common Contact
50	OUT00-NO	Relay 00, Normally-Open Contact

Table 6-1: Relay Output Connector Pin Assignments

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

Table 6-2: Isolated Inputs Connector Pin Assignments

Chapter 7: Specifications

ISOLATED INPUTS

Number of inputs:	Sixteen
Type:	Non-polarized, optically isolated from each other and from the computer (CMOS compatible)
Voltage Range:	3 to 31 DC or AC Rms (40 to 10000 Hz)
Isolation:	500V*(see note) channel-to-ground or channel-to channel
Input Resistance:	1.8K ohms in series with opto coupler
Filter Response Times:	Rise Time = 4.7 mS / Fall Time = 4.7 mS
Non-Filter Response Times:	Rise Time = 10 uS / Fall Time = 30 uS

RELAY OUTPUTS

Number of outputs:	Sixteen SPDT form C
Contact Type:	Single crossbar; Ag with Au clad
Rated Load AC:	0.5 A at 125 VAC (62.5 VA max.)
Rated Load DC:	1A at 24 VDC (30 W max.)
Max. Switching Voltage:	125 VAC, 60 VDC
Max. Switching Current:	1 A
Contact Resistance:	100 mΩ max.
Contact Life: mech'l:	5 million operations min.
Operating Time:	5 milliseconds max.
Release Time:	5 milliseconds max.

POWER REQUIRED

5V@ 30mA typical (all relays off, add 30mA per relay)

5V@ 510mA typical (all relays ON)

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

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

ENVIRONMENTAL

Operating Temp: 0 - 70 °C (Non-icing)
Weight: 14.5 oz

***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, 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: ***manuals@acesio.com***. Please detail any errors you find and include your mailing address so that we can send you any manual updates.



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