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MODEL PCI-IDIO-16

USER MANUAL

FILE: MPCI-IDIO-16.C1k

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Chapter 1: Introduction

The card is a half-size card that provides isolated digital input and output interface for PCI-Bus computers. The card has 16 optically-isolated digital inputs for AC or DC control signals and 16 solid state switch outputs. An interrupt can be generated when any of the inputs change state to free up computer resources by eliminating the need for constantly polling the card. This card occupies eight consecutive 8-bit registers in I/O space.

Inputs

The isolated inputs can be driven by either AC or DC signals and are not polarity sensitive. Input signals are rectified by a diode bridge and applied to a transistor circuit that provides constant current drive to the opto-isolator independent of the amplitude on the input. Input voltages of 2.5-50VDC or AC voltages of 2V- 36Vrms can be accepted. Inputs have a 0.2V hysteresis. Each input circuit contains a switchable slow/fast filter that has a 5 millisecond time constant. The filter must be selected for AC inputs in order to eliminate response to zero crossings. The filters can also be useful with slow DC input signals in a noisy environment. The filters are under software control. All filters may be turned on by a read at base address +3. All filters may be disabled by a write to base address +3. The filters for the first eight inputs can be turned on and off individually by a write at base address +7; a value of one in the bit corresponding to the input will turn that input's filter on, while a value of zero will turn it off. The status of the first eight input filters can be read back at the same address.

Interrupts

When enabled by a software read to base address +2, the card asserts an interrupt whenever any of the inputs change state. Once an interrupt has been generated and serviced, it must be cleared. A software write to base address +1 will clear an interrupt. This interrupt capability may be disabled by a software write to base address +2.

Outputs

The digital outputs are comprised of fully protected high-side FET switches. The FETs 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 switches are in the off-state upon power-on or reset. Data to the output is latched by a Write to the base address and to base address+4. The On/Off status of the switches can be read back by a Read command from the base address and base address+4.

Specification

Digital Inputs

- Number of inputs: Sixteen
- Type: Non-polarized, optically isolated from each other and from the computer
- Input voltage range: 2.5 to 50V DC or 2-36Vrms AC (50 to 10000 Hz) with 0.2V hysteresis
- Isolation*: 500V
- Input Resistance: The opto-isolator diode current is constant at 2 mA regardless of input voltage. Total input current is 4 mA maximum at 50V
- Interrupts: When enabled by software, interrupts are generated when digital inputs change state
- Response Time: 5 mSec w/ filter, 50 µSec w/o filter

Protected FET Outputs

- Number of outputs: Sixteen in two groups of 8 channels each. In each group 4 channels are totally isolated and 4 channels have a common ground
- Output Type: High Side Power MOSFET Switch. Protected against short circuit, over temperature, ESD, capable of driving inductive loads
- Compliance Voltage: 5-34VDC (customer supplied) 40VDC absolute max
- Current: 2A maximum (source only)
- Turn-on time: 90µsec (typical)
- Turn-off time 110µsec. (typical)

* Notes on Isolation: Opto-Isolators, connector and FET's 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 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.

Power Required

- +5VDC @ 0.250A

Environmental

- Ambient Temperature: Operating: 0 °C. to +70 °C.
  Storage: -40 °C. to +85 °C.
- Humidity: 5 to 95% (non-condensing).
- Weight: Approx. 8 oz.
- Size: 6.80" long (173 mm).

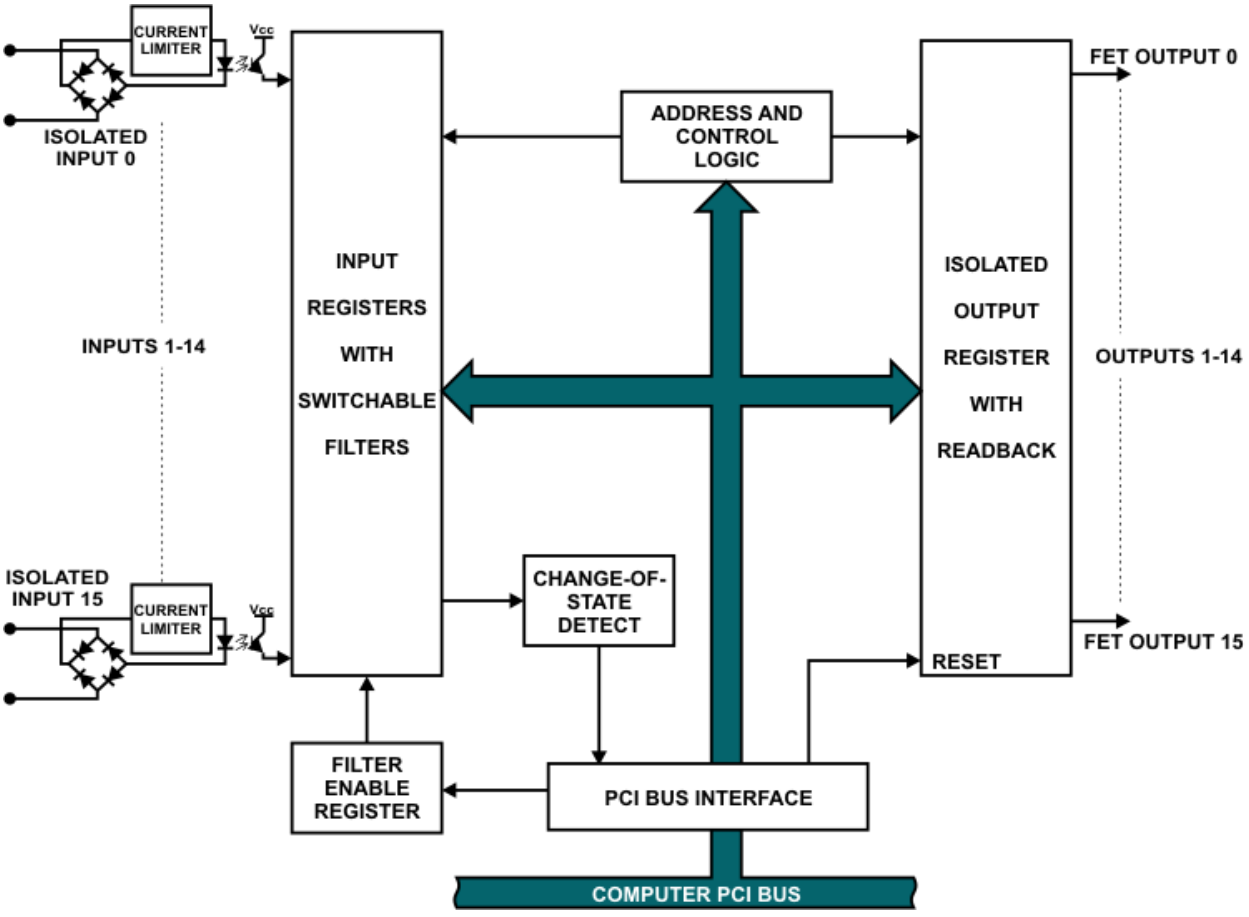


Figure 1-1: Block Diagram

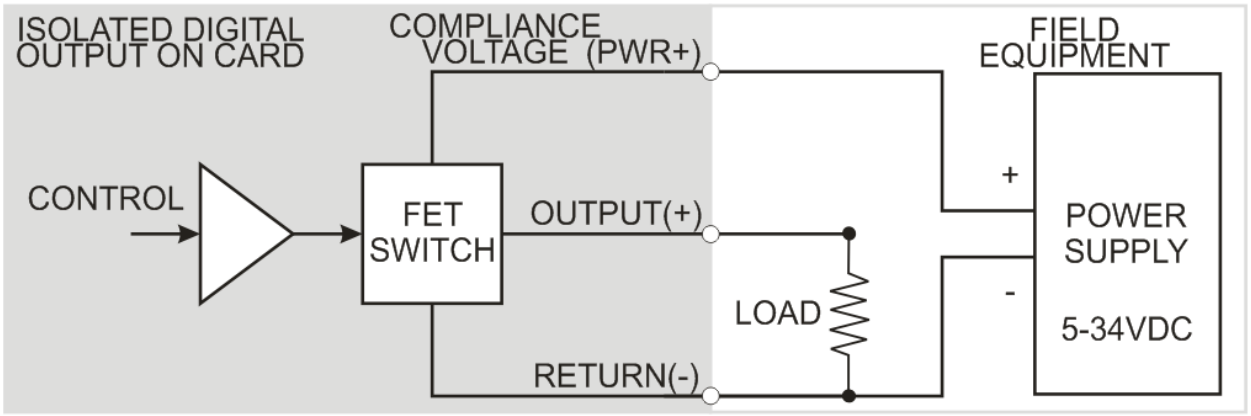


Figure 1-2: Simplified Output Connection Diagram

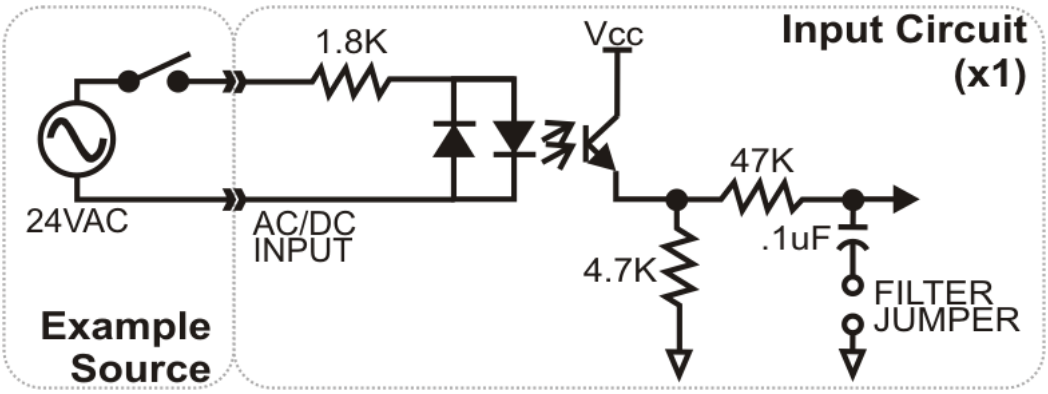


Figure 1-3: Simplified Input Connection Diagram

Chapter 2: Installation

A printed Quick-Start Guide (QSG) is packed with the card for your convenience. If you've already performed the steps from the QSG, you may find this chapter to be redundant and may skip forward to begin developing your application.

The software provided with this card is on 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.

Configure Card Options via Jumper Selection

Before installing the card into your computer, carefully read Chapter 3: Option Selection of this manual, then configure the card according to your requirements. Our Windows based setup program can be used in conjunction with Chapter 3 to assist in configuring jumpers on the card, as well as provide additional descriptions for usage of the various card options.

CD Software Installation

The following instructions assume the CD-ROM drive is drive "D". Please substitute the appropriate drive letter for your system as necessary.

DOS

1. Place the CD into your CD-ROM drive.
2. Type D : Enter to change the active drive to the CD-ROM drive.
3. Type I N S T A L L Enter to run the install program.
4. Follow the on-screen prompts to install the software for this board.

WINDOWS

1. Place the CD into your CD-ROM drive.
2. The system should automatically run the install program. If the install program does not run promptly, click START | RUN and type D : I N S T A L L, click OK or press Enter.
3. Follow the on-screen prompts to install the software for this board.

LINUX

1. Please refer to linux.htm on the CD-ROM for information on installing under linux.

Caution! * ESD A single static discharge can damage your card and cause premature failure! Please follow all reasonable precautions to prevent a static discharge such as grounding yourself by touching any grounded surface prior to touching the card.

Hardware Installation

1. Make sure to set switches and jumpers from either the Option Selection section of this manual or from the suggestions of SETUP.EXE.
2. Do not install card into the computer until the software has been fully installed.
3. Turn OFF computer power AND unplug AC power from the system.
4. Remove the computer cover.
5. Carefully install the card in an available 5V or 3.3V PCI expansion slot (you may need to remove a backplate first).
6. Inspect for proper fit of the card and tighten screws. Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.
7. Install an I/O cable onto the card's bracket mounted connector.
8. Replace the computer cover and turn ON the computer which should auto-detect the card (depending on the operating system) and automatically finish installing the drivers.
9. Run PCIfind.exe to complete installing the card into the registry (for Windows only) and to determine the assigned resources.
10. Run one of the provided sample programs that was copied to the newly created card directory (from the CD) to test and validate your installation.

The base address assigned by BIOS or the operating system can change each time new hardware is installed into or removed from the computer. Please recheck PCIFind or Device Manager if the hardware configuration is changed. Software you write can automatically determine the base address of the card using a variety of methods depending on the operating system. In DOS, the PCI\SOURCE directory shows the BIOS calls used to determine the address and IRQ assigned to installed PCI devices. In Windows, the Windows sample programs demonstrate querying the registry entries (created by PCIFind and NTIOPCI.SYS during boot-up) to determine this same information.

Chapter 3: Address Selection

This card uses I/O addresses offset from the base address assigned by the PCI bus. The address spaces are defined in the programming section of this manual.

PCI architecture is Plug-and-Play. This means that the BIOS or Operating System determines the resources assigned to PCI cards rather than the user selecting those resources with switches or jumpers. As a result, you cannot set or change the card's base address or IRQ level. You can only determine what the system has assigned.

To determine the base address that has been assigned, run the PCIFind utility program. This utility will display a list of all the cards detected on the PCI bus, the addresses assigned to each function on each of the cards, and the respective IRQs.

Alternatively, Windows systems can be queried to determine which resources were assigned. In these operating systems, you can use either PCIFind, or the Device Manager utility from the System Properties Applet of the control panel. The card is installed in the Data Acquisition class of the Device Manager list. Selecting the card, clicking Properties, and then selecting the Resources Tab will display a list of the resources allocated to the card.

The PCI bus supports 64K of I/O address space, so your card's addresses may be located anywhere in the 0000h to FFFFh range. The card occupies eight consecutive 8 bit registers in I/O address space.

PCIFind uses the Vendor ID and Device ID to search for your card, then reads the base address and IRQ. If you want to determine the base address and IRQ without using PCIFind, use the following information:

The Vendor ID code is 494F (ASCII for "I/O")
The Device ID code for the card is 0x0DC8

An example of how to locate PCI card resources is provided with in the PCI\SOURCE directory, under your installation directory. This code runs in DOS, and uses the PCI defined interrupt BIOS calls to query the PCI bus for card specific information. You will need the Device ID and Vendor ID listed above to use this code.

Chapter 4: Programming

The base or starting address is assigned by the computer system during installation and will fall on an eight byte boundary. The card's read and write functions are as follows:

I/O Address	Read	Write
Base +0	FET Drive Outputs 0-7	FET Drive Outputs 0-7
Base +1	Isolated Inputs 0-7	Clear Interrupt
Base +2	Enable IRQ	Disable IRQ
Base+3	Activate Input Filters 0-15	Deactivate Input Filters 0-15
Base+4	FET Drive Outputs 8-15	FET Drive Outputs 8-15
Base+5	Isolated Inputs 8-15	Unused
Base+6	Interrupt Status	Unused
Base +7	Input Filter Status 0-7	Control Input Filters 0-7

Digital Inputs

Digital input states are read as a pair of bytes from the ports at Base Address +1 and +5. Each of the eight bits within each byte corresponds to a particular digital input. A "1" signifies that the input is energized and a "0" signifies that the input is de-energized.

Bit Position	D7	D6	D5	D4	D3	D2	D1	D0
Input Low Byte	IP7	IP6	IP5	IP4	IP3	IP2	IP1	IP0
Input High Byte	IP15	IP14	IP13	IP12	IP11	IP10	IP9	IP8

FILTERS: Sometimes it is necessary to slow down the card's response to eliminate noise spikes on DC inputs in industrial environments or to convert sinusoidal AC inputs. The 5 mSec filter can be enabled for all inputs 0-15 by a software read from base address +3 or disabled by a write of any value to base address +3. The filters for inputs 0-7 can be programmed individually by a write to base address +7 when the previous global enable command has not been given; a value of one in the corresponding bit location activates the filter and a value of zero disables that filter. The status of filters 0-7 can be read back from base address +7.

INTERRUPTS: The card supports interrupts. The interrupt level is assigned by the BIOS or plug-and-play operating system. The assigned interrupt level can be viewed when PCIFind.EXE is run (see chapter 3). The card's interrupt capability makes it is unnecessary to continuously poll inputs (by reading at base address +1 and +5) to detect when an input state has changed. To enable interrupts read from base address +2. To disable interrupts, write any value to base address +2. To clear an interrupt write any value to base address +1. The user must include the clear instruction in the interrupt service routine software. For shared interrupt applications the card has an IRQ status byte that can be read from base address +6. Bits 0 and 1 set indicate interrupts are enabled, bit 2 set indicates an IRQ has been generated, bits 3 thru 7 will always read 0.

FET Switch Outputs

At power-up, all FET switches are in the OFF-state. The current state of the FET switches can be determined at any time by a read operation from Base Address +0 and +4. The FET switch outputs are controlled by writing to Base Address +0 and +4. Data is written to each group of eight switches as a single byte. Each bit within the byte controls a specific switch. A "1" turns on the corresponding switch and a "0" turns it off.

Bit Position	D7	D6	D5	D4	D3	D2	D1	D0
FET Contr'd	OP7	OP6	OP5	OP4	OP3	OP2	OP1	OP0
FET Contr'd	OP15	OP14	OP13	OP12	OP11	OP10	OP9	OP8

For example, if bit D5 is turned on by writing hex 20 to the base address the relay that controls OP5 is energized. All other low-byte FETs would be de-energized.

Programming Examples

No driver software is provided with the card because programming is very simple and can be accomplished most efficiently using direct I/O instructions. The following examples are in C but are readily translated into other languages:

Example: Turn on OP0 and OP7

```
Base=0xF300;          //Base I/O address
outportb(Base, 0x81);
```

Example: Read back the state of the switches

```
X=inportb(Base);      //switch register data to X
printf("%02x");       //display results
```

Example: Read the digital inputs

```
Y=inportb(Base+1);    //digital input register to Y
```

Chapter 5: Connector Pin Assignments

Digital I/O signals are connected to the card via a 78-pin D type connector that extends through the back of the computer case. The mating connector is an AMP 748368-1 or equivalent. We optionally provide a breakout cable that divides the 78-pin I/O connector down to two 37-pin D type connectors. See the following page for information about termination solutions.

Pin	Name	Function	Pin	Name
1	IN7A	Non-Polarized Isolated Inputs "A" Sides	40	IN15A
2	IN6A		41	IN14A
3	IN5A		42	IN13A
4	IN4A		43	IN12A
5	IN3A		44	IN11A
6	IN2A		45	IN10A
7	IN1A		46	IN9A
8	IN0A		47	IN8A
9	VBB7+	Compliance Volt	48	VBB15+
10	VBB6+		49	VBB14+
11	VBB5+		50	VBB13+
12	OUT4- to 7-	Comm Return	51	OUT12- to 15-
13	OUT4+	Output	52	OUT12+
14	VBB3+	Compliance Volt	53	VBB11+
15	OUT2-	Return	54	OUT10-
16	OUT2+	Output	55	OUT10+
17	VBB1+	Compliance Volt	56	VBB9+
18	OUT0-	Return	57	OUT8-
19	OUT0+	Output	58	OUT8+
20		Not Used	59	
21	IN7B	Non-Polarized Isolated Inputs "B" Sides	60	IN15B
22	IN6B		61	IN14B
23	IN5B		62	IN13B
24	IN4B		63	IN12B
25	IN3B		64	IN11B
26	IN2B		65	IN10B
27	IN1B		66	IN9B
28	IN0B		67	IN8B
29	OUT7+	Output	68	OUT15+
30	OUT6+		69	OUT14+
31	OUT5+		70	OUT13+
32	VBB4+	Compliance Volt	71	VBB12+
33	OUT3-	Return	72	OUT11-
34	OUT3+	Output	73	OUT11+
35	VBB2+	Compliance Volt	74	VBB10+
36	OUT1-	Return	75	OUT9-
37	OUT1+	Output	76	OUT9+
38	VBB0+	Compliance Volt	77	VBB8+
39		Not Used	78	

Table 5-1: Connector Pin Assignments

Termination Solutions

The breakout solution for the card involves a “Y” cable that terminates into two identically pinned out 37DBF connectors. As part of a kit, these connectors plug into the STB-37 screw terminal cards, which easily mount into a length of SNAPTRACK. The “Y” cable is six (6) feet long on each leg. See the simplified output connection diagram in Figure 1-2 for help in wiring your application.

“1-39" Cable				“40-78" Cable		
PIN	**NAME**	**FUNCTION**		**PIN**	**NAME**	**FUNCTION**
1	IN7A	Isolated Input “A” Sides		1	IN15A	Isolated Input “A” Sides
2	IN6A			2	IN14A	
3	IN5A			3	IN13A	
4	IN4A			4	IN12A	
5	IN3A			5	IN11A	
6	IN2A			6	IN10A	
7	IN1A			7	IN9A	
8	IN0A			8	IN8A	
9	VBB7+	Compl. Volt		9	VBB15+	Compl. Volt
10	VBB6+			10	VBB14+	
11	VBB5+			11	VBB13+	
12	OUT4- to 7-	Comm Return		12	OUT12- to 15-	Comm Return
13	OUT4+	Output		13	OUT12+	Output
14	VBB3+	Compl. Volt		14	VBB11+	Compl. Volt
15	OUT2-	Return		15	OUT10-	Return
16	OUT2+	Output		16	OUT10+	Output
17	VBB1+	Compl. Volt		17	VBB9+	Compl. Volt
18	OUT0-	Return		18	OUT8-	Return
19	OUT0+	Output		19	OUT8+	Output
20	IN7B	Isolated Input ”B” Sides		20	IN15B	Isolated Input ”B” Sides
21	IN6B			21	IN14B	
22	IN5B			22	IN13B	
23	IN4B			23	IN12B	
24	IN3B			24	IN11B	
25	IN2B			25	IN10B	
26	IN1B			26	IN9B	
27	IN0B			27	IN8B	
28	OUT7+	Output		28	OUT15+	Output
29	OUT6+			29	OUT14+	
30	OUT5+			30	OUT13+	
31	VBB4+	Compl. Volt		31	VBB12+	Compl. Volt
32	OUT3-	Return		32	OUT11-	Return
33	OUT3+	Output		33	OUT11+	Output
34	VBB2+	Compl. Volt		34	VBB10+	Compl. Volt
35	OUT1-	Return		35	OUT9-	Return
36	OUT1+	Output		36	OUT9+	Output
37	VBB0+	Compl. Volt		37	VBB8+	Compl. Volt

Table 5-2: Breakout Cable Pin Assignments

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.

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