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# MODEL PCI-IIRO-16

# USER MANUAL

FILE: MPCI-IIRO-16.B1e

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# Chapter 1: Introduction

The card is a half size card that provides isolated input and output interface for PCI-Bus computers. The card has sixteen optically-isolated inputs and sixteen electro-mechanical relay outputs for monitoring and controlling DC or AC signals. An interrupt can be generated when any of the inputs change state to free up computer resources by eliminating the need for polling. Fully sealed, low-resistance signal relays ideal for use in telecommunications, security and computer peripheral equipment are used. The card occupies eight consecutive 8-bit registers in I/O address space.

## Inputs

**ISOLATED INPUTS:** The sixteen pairs of 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 the input of an opto-isolator. A 470Ω resistor in series provides current limiting. Standard 12/24 VAC transformer outputs can be accepted as well as DC voltages. The input voltage range is 5 to 24 volts (rms). External resistors connected in series may be used to extend the input voltage range. The on/off state of the inputs is determined by a software read.

**FILTERS:** Each input circuit contains a software controlled filter that has a 5 millisecond time constant. For AC inputs the filter must be selected in order to maintain a DC level at the input register. The filter is also valuable for use with slow DC input signals in a noisy environment. All filters are turned off at power on, and are then enabled or disabled by software. The on/off status of the filters can also be read by software.

**INTERRUPTS:** When enabled by software the card asserts an interrupt on the PCI-Bus when any of the sixteen isolated inputs change state from either high to low, or low to high in DC mode and from signal to no signal in AC mode. This interrupt capability is disabled at power on. Software commands are used to enable, disable, clear and get status of the interrupt circuit.

## Outputs

The sixteen electro-mechanical relay outputs are comprised of ten Form C SPDT type and six Form A SPST (normally open) type. The relay contacts are rated at 0.5A at 125VAC, and 1A at 24VDC. All the relays are turned off at power-on, and are then controlled by data bits written by software and latched. The on/off status of the relays can be read back by software.



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# Specification

## Isolated Inputs

- Number of inputs: Sixteen
- Type: Non-polarized, optically isolated from each other and from the computer
- Input voltage range: 5 to 24V DC or AC rms (50 to 10000 Hz)
- Isolation*: 500V
- Input Resistance: 470 ohms in series with two diodes and an LED
- Response Time: 5 mSec w/filter
- Interrupts: PCI-INTA

## Relay Outputs

- Number of outputs: Sixteen in two groups of eight. In each group 5 relays are SPDT and 3 relays are SPST
- Contact Type: Single crossbar, Ag with Au clad. (Bifurcated contacts optional)
- Contact Rating: 1A max at 24VDC, 60VDC max, 0.5A at 125VAC max
- Contact Resistance: 100 milliohm max
- Contact Life: 5,000,000 min. (mech'l)
- Operate time: 5 mSec max
- Release Time: 5 mSec max
- Isolation*: 1000V
- Vibration: 10 to 55 Hz, 3.3 mm dbl amp; mech. dur. 1,000 $m/s^2$ (approx 100G)

* Notes on Isolation: Opto-Isolators, connector and relays 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 lines do not connect the hot side of the line to an input.

## Power Required

- +5VDC 250mA min, 750mA max (all relays ON)



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## Environmental

- Ambient Temperature: Operating: 0 °C. to +50 °C
  Storage: -40 °C. to +85 °C
- Humidity: 0 to 90% (non-condensing)
- Weight: Approx. 8 oz
- Size: 6.80" long (173 mm)

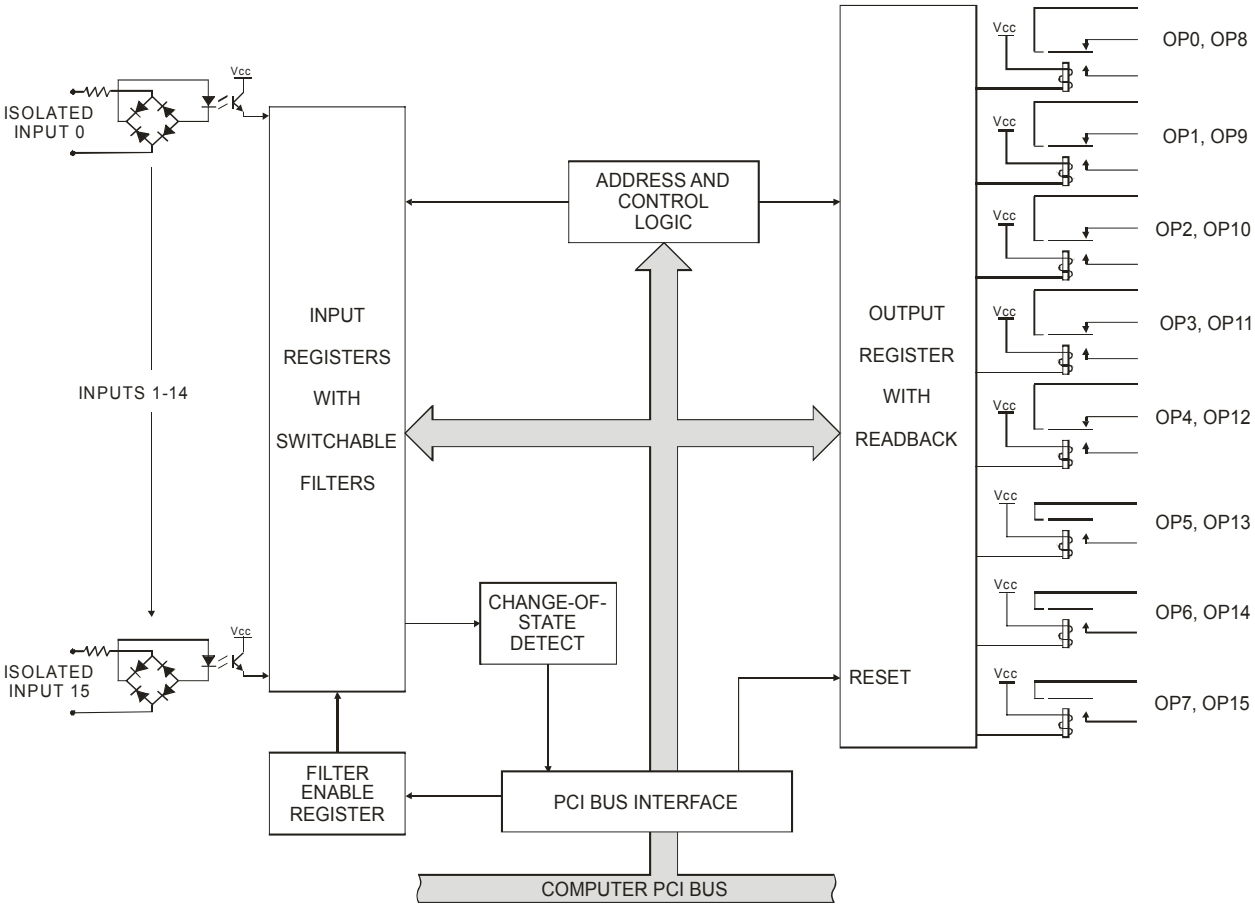



**Figure 1-1:** Block Diagram



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# 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.

## 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.***



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## Hardware Installation

1. Do not install card into the computer until the software has been fully installed.
2. Turn OFF computer power AND unplug AC power from the system.
3. Remove the computer cover.
4. Carefully install the card in an available 5V or 3.3V PCI expansion slot (you may need to remove a backplate first).
5. 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.
6. Install an I/O cable onto the card's bracket mounted connector.
7. 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.
8. Run PCIfind.exe to complete installing the card into the registry (for Windows only) and to determine the assigned resources.
9. 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.



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# 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 0F08

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.



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# Chapter 4: Programming

The base or starting address is assigned by the computers plug-and-play operating system during installation and will fall on a eight byte boundary (see chapter 3).

The card's read and write functions are as follows:

| I/O Address | Read | Write |
|---|---|---|
| Base +0 | Outputs 0 – 7 | Outputs 0 – 7 |
| Base +1 | Inputs 0 – 7 | Interrupt Clear |
| Base +2 | Interrupt Enable | Interrupt Disable |
| Base +3 | Filter Enable | Filter Disable |
| Base +4 | Outputs 8 – 15 | Outputs 8 – 15 |
| Base +5 | Inputs 8 – 15 | Unused |
| Base +6 | Interrupt Status | Unused |
| Base +7 | Filter Status | Unused |

## Relay Outputs

At power-up, all relays are de-energized (normally-closed contacts). The relay outputs are controlled by writing to the base address +0 and +4. Each bit within the bytes controls a specific relay. A "1" energizes the corresponding relay and a "0" de-energizes it. The status of the relays can be determined at any time by a read from base address +0 and +4.

| Bit Position | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|
| Relay Low Byte | OP7 | OP6 | OP5 | OP4 | OP3 | OP2 | OP1 | OP0 |
| Relay High Byte | OP15 | OP14 | OP13 | OP12 | OP11 | OP10 | OP9 | OP8 |

For example, if bit D5 is set to a 1 by writing 20 hex to the base address +0 the relay that controls OP5 is energized, closing the associated normally-open contacts. All other relays would be de-energized and their normally-closed contacts would be closed.



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## Isolated Inputs

Input states can be read from Base Address +1and +5. Each of the bits within the bytes corresponds to a particular isolated 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 by a software read from base address +3 or disabled by a write of any value to base address +3. The status of the filters can be read back from base address +7. A value of FF hex indicates the filters are active and a value of 00 hex indicates they are disabled.

**INTERRUPTS:** The card supports interrupts. The interrupt level is assigned by the 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.

## Programming Examples

No driver software is provided with 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 relays

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

Example: Read the digital inputs

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



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# 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 | IP7 | Isolated Input | 40 | IP15 |
| 2 | IP6 | | 41 | IP14 |
| 3 | IP5 | | 42 | IP13 |
| 4 | IP4 | | 43 | IP12 |
| 5 | IP3 | | 44 | IP11 |
| 6 | IP2 | | 45 | IP10 |
| 7 | IP1 | | 46 | IP9 |
| 8 | IP0 | | 47 | IP8 |
| 9 | OP7(C) | Relay Contact | 48 | OP15(C) |
| 10 | OP6(C) | | 49 | OP14(C) |
| 11 | OP5(C) | | 50 | OP13(C) |
| 12 | OP4(NC) | | 51 | OP12(NC) |
| 13 | OP4(NO) | | 52 | OP12(NO) |
| 14 | OP3(C) | | 53 | OP11(C) |
| 15 | OP2(NC) | | 54 | OP10(NC) |
| 16 | OP2(NO) | | 55 | OP10(NO) |
| 17 | OP1(C) | | 56 | OP9(C) |
| 18 | OP0(NC) | | 57 | OP8(NC) |
| 19 | OP0(NO) | | 58 | OP8(NO) |
| 20 | | Not Used | 59 | |
| 21 | IP7 | Isolated Input | 60 | IP15 |
| 22 | IP6 | | 61 | IP14 |
| 23 | IP5 | | 62 | IP13 |
| 24 | IP4 | | 63 | IP12 |
| 25 | IP3 | | 64 | IP11 |
| 26 | IP2 | | 65 | IP10 |
| 27 | IP1 | | 66 | IP9 |
| 28 | IP0 | | 67 | IP8 |
| 29 | OP7(NO) | Relay Contact | 68 | OP15(NO) |
| 30 | OP6(NO) | | 69 | OP14(NO) |
| 31 | OP5(NO) | | 70 | OP13(NO) |
| 32 | OP4(C) | | 71 | OP12(C) |
| 33 | OP3(NC) | | 72 | OP11(NC) |
| 34 | OP3(NO) | | 73 | OP11(NO) |
| 35 | OP2(C) | | 74 | OP10(C) |
| 36 | OP1(NC) | | 75 | OP9(NC) |
| 37 | OP1(NO) | | 76 | OP9(NO) |
| 38 | OP0(C) | | 77 | OP8(C) |
| 39 | | Not Used | 78 | |

**Table 6-1:** Connector Pin Assignments



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## 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 pinout of each leg when plugged into an STB-37 is identical to that of the eight channel ISA and PCI Isolated Input/Relay Output Cards. The “Y” cable is six (6) feet long on each leg.

| “1-39" Cable | | | “40-78" Cable | | |
|---|---|---|---|---|---|
| **PIN** | **NAME** | **FUNCTION** | **PIN** | **NAME** | **FUNCTION** |
| 1 | IP7 | Isolated Input | 1 | IP15 | Isolated Input |
| 2 | IP6 | | 2 | IP14 | |
| 3 | IP5 | | 3 | IP13 | |
| 4 | IP4 | | 4 | IP12 | |
| 5 | IP3 | | 5 | IP11 | |
| 6 | IP2 | | 6 | IP10 | |
| 7 | IP1 | | 7 | IP9 | |
| 8 | IP0 | | 8 | IP8 | |
| 9 | OP7(C) | Relay Contact | 9 | OP15(C) | Relay Contact |
| 10 | OP6(C) | | 10 | OP14(C) | |
| 11 | OP5(C) | | 11 | OP13(C) | |
| 12 | OP4(NC) | | 12 | OP12(NC) | |
| 13 | OP4(NO) | | 13 | OP12(NO) | |
| 14 | OP3(C) | | 14 | OP11(C) | |
| 15 | OP2(NC) | | 15 | OP10(NC) | |
| 16 | OP2(NO) | | 16 | OP10(NO) | |
| 17 | OP1(C) | | 17 | OP9(C) | |
| 18 | OP0(NC) | | 18 | OP8(NC) | |
| 19 | OP0(NO) | | 19 | OP8(NO) | |
| 20 | IP7 | Isolated Input | 20 | IP15 | Isolated Input |
| 21 | IP6 | | 21 | IP14 | |
| 22 | IP5 | | 22 | IP13 | |
| 23 | IP4 | | 23 | IP12 | |
| 24 | IP3 | | 24 | IP11 | |
| 25 | IP2 | | 25 | IP10 | |
| 26 | IP1 | | 26 | IP9 | |
| 27 | IP0 | | 27 | IP8 | |
| 28 | OP7(NO) | Relay Contact | 28 | OP15(NO) | Relay Contact |
| 29 | OP6(NO) | | 29 | OP14(NO) | |
| 30 | OP5(NO) | | 30 | OP13(NO) | |
| 31 | OP4(C) | | 31 | OP12(C) | |
| 32 | OP3(NC) | | 32 | OP11(NC) | |
| 33 | OP3(NO) | | 33 | OP11(NO) | |
| 34 | OP2(C) | | 34 | OP10(C) | |
| 35 | OP1(NC) | | 35 | OP9(NC) | |
| 36 | OP1(NO) | | 36 | OP9(NO) | |
| 37 | OP0(C) | | 37 | OP8(C) | |

**Table 6-2:** Breakout Cable Pin Assignments



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# 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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