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MODEL PCI-IIRO-8

USER MANUAL

FILE: PCI-IIRO-8.B1f

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Chapter 1: Introduction

This is a half-size card that provides isolated digital input and output interface for PCI-Bus computers. The card has eight optically-isolated digital inputs for AC or DC control signals and eight electromechanical relay outputs. This card occupies four 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 the input of an opto-isolator. A 470Ω resistor in series provides current limiting. Standard 12/24 AC control 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.

Each input circuit contains a switchable slow/fast filter that has a 10 millisecond time constant. (Without filtering, the response is 20 uSec.) The filter must be selected for AC inputs in order to eliminate response to zero crossings. 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 switch S2; IP0 is controlled by F0, IP1 by F1, IP2 by F2, etc. The filters are switched into the circuit when the switch is moved to the ON position. The filters may also be controlled globally under software control. All filters may be turned on by a read at base address +3. Filters that have been activated by software may be disabled by a write to base address +3.

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 electromechanical relay outputs are comprised of five Form C SPDT outputs and three Form A SPST (normally open) type. The relays are all de-energized at power-on. Data to the relays is latched by a write to the base address. On/off status of the relays can be read back by a read at the base address.

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Specification

Digital Inputs

- Type: Non-polarized, optically isolated (not TTL compatible)
- Voltage Range: 5 to 24V DC or AC (50 to 1000 Hz)
- Isolation: 500V channel-to-ground or channel-to channel
- Input Resistance: 470 ohms in series with two diodes and an LED
- Response Time: 10 mSec w/filter, 20 µSec w/o filter

Relay Outputs

- Contact Rating: 2A carry current, single button, silver
- Max switching current: 1A
- Max switching Voltage: 60VDC @ 30W, 120VAC, 60VA
- Contact Arrangement: Channels 0-4 are SPDT Form C and channels 5-7 are SPST Form A
- Contact Resistance: Initial 100 milliohms maximum
- Contact Life: mech'l: 5 million operations minimum
- Contact Life: elect'l: 0.5 million operations minimum at full load
- Operating Time: 2 milliseconds maximum
- Release Time: 1 milliseconds maximum

General

- Interrupts: When enabled by software, interrupts are generated when digital inputs change state

Environmental

- Ambient Temperature: Operating: 0°C to +50°C
  Storage: -20°C to +70°C
- Humidity: 0 to 90% (non-condensing)
- Weight: Approx. 8 oz
- Size: 6.15" long (156 mm)
- Power Required: +5VDC @ 0.675A (all relays ON)
- Max Switching Power AC: 60 VA
  DC: 30 W

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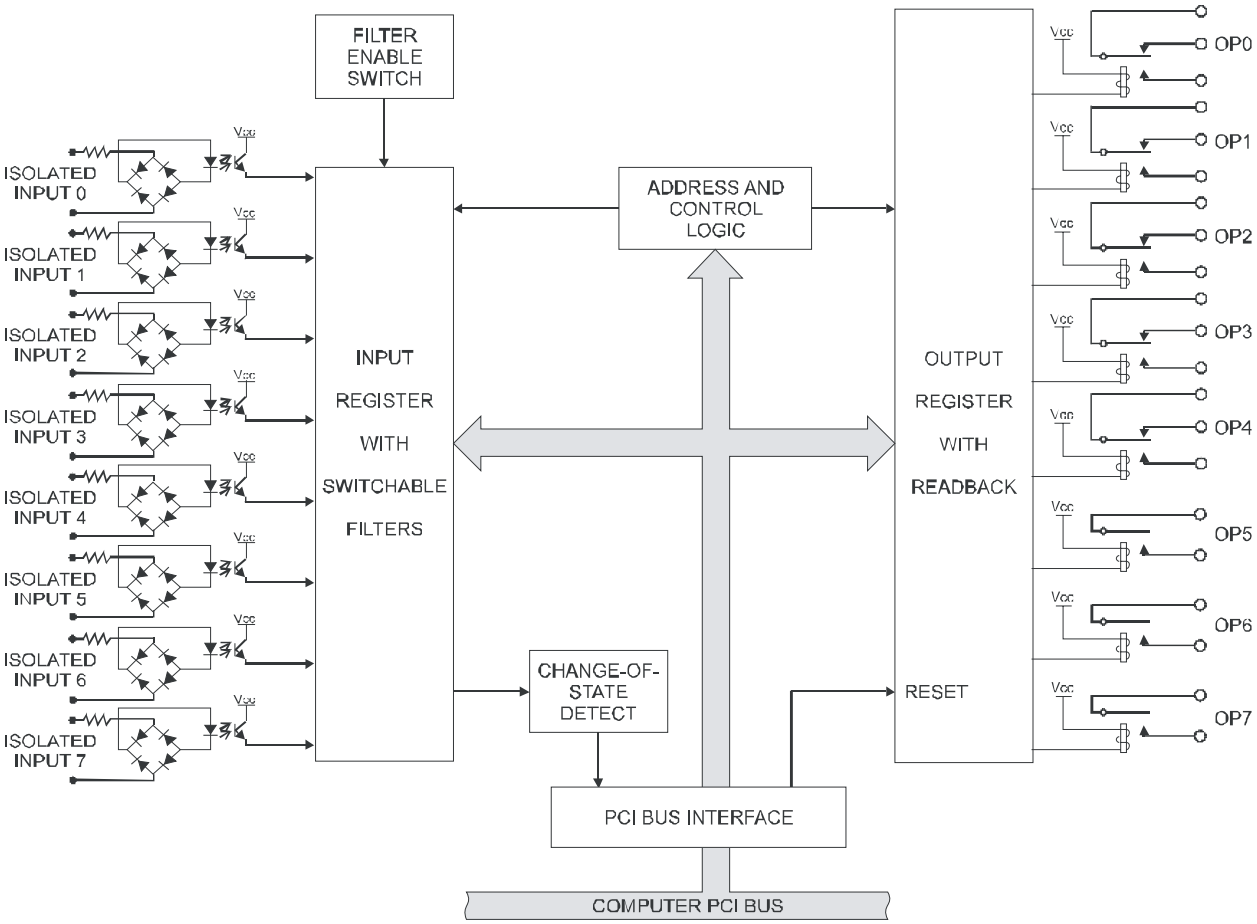


Figure 1-1: Block Diagram

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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.

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.

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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.

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Chapter 3: Option Selection

Filter Response Switch

DIP switch S2 is used to select input filtering on a channel-by-channel basis. When S2-1 is ON, additional filtering is introduced for input bit 0, S2-2 for bit 1, etc.

Switch Section	Bit Filtered
S2-1	IP0
-2	IP1
-3	IP2
-4	IP3
-5	IP4
-6	IP5
-7	IP6
-8	IP7

This additional filtering provides a slower response as described previously and must be used when AC inputs are applied. Note also, as previously described, that the filters can be globally activated (or de-activated) under software control at base address +3.

Interrupts

An interrupt is asserted by the card when an input data bit changes state if enabled by software as previously described.

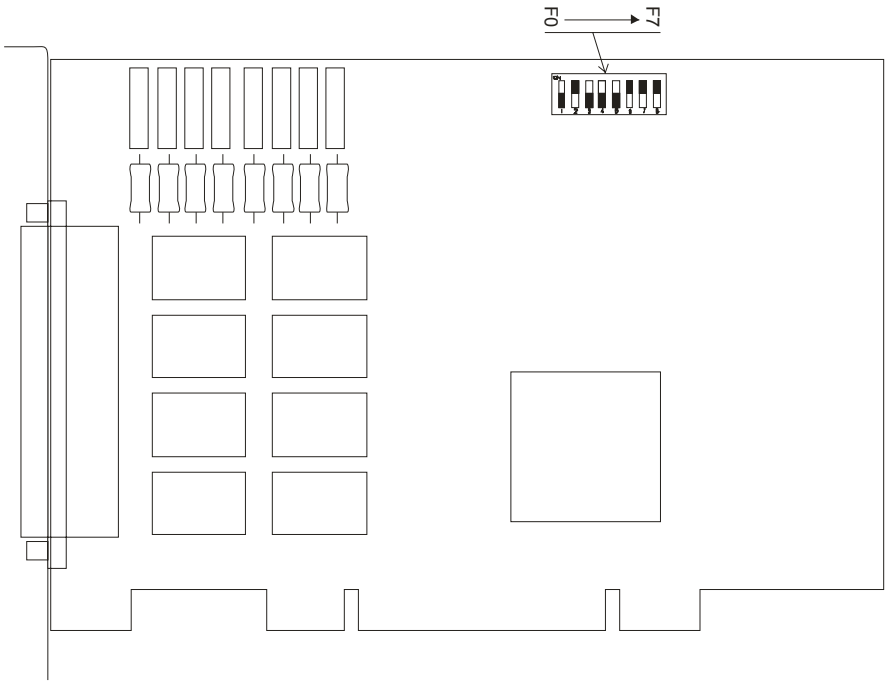


Figure 3-1: Option Selection Map

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Chapter 4: Address Selection

The card occupies four consecutive registers in I/O space.The PCI architecture is inherently plug-and-play in nature. This means that the BIOS or Operating System determines the resources assigned to PCI cards rather than you selecting those resources with switches or jumpers. As a result, you cannot set or change the card's base address. You can only determine what the system has assigned.

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

Alternatively, some operating 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 address space, so your card's addresses may be located anywhere in the 0000 to FFFF hex range. PCIFind uses the Vendor ID and the Device ID to search for your card, then reads the base address and IRQ assigned. If you want to determine the base address and IRQ assigned, use the following information:

The Vendor ID code is 494F (ASCII for "I/O")
The device ID code is 0F00

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Chapter 5: Programming

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

I/O Address	Read	Write
Base +0	Read Relay Output	Write Relay Output
Base +1	Read Isolated Inputs	Clear Interrupt
Base +2	Enable IRQ	Disable IRQ
Base +3	Activate Filter	Deactivate Filter

Digital Inputs

Digital input states are read as a single byte from the port at Base Address +1. Each of the eight bits within the 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
Digital Input	IP7	IP6	IP5	IP4	IP3	IP2	IP1	IP0

The card's response to inputs is rated at 20 uSec or faster. Sometimes it is necessary to slow down that response to accommodate AC inputs or in noisy environments. The 10 mSec filter can be enabled for all inputs in software by reading at base address +3 or disabled by writing at base address +3.

The card supports interrupts on change of state of digital inputs. Thus, it is not necessary to continuously poll inputs (by reading at base address +1) to detect any state change. To enable this interrupt capability, read at base address +2. To disable interrupts, write at base address +2. To clear an IRQ, write at base address +1.

Relay Outputs

At power-up, all relays are de-energized. The current state of the relays can be determined at any time by a read operation at the base address. The relay outputs are controlled by writing to the base address. Data are written to all eight relays as a single byte. Each bit within the byte controls a specific relay. A "1" energizes the corresponding relay and a "0" turns it off.

Bit Position	D7	D6	D5	D4	D3	D2	D1	D0
Relay	OP7	OP6	OP5	OP4	OP3	OP2	OP1	OP0

For example, if bit D5 is turned on by writing hex 20 to the base address 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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Programming Examples

No API driver software is provided with the card because programming is very simple and can be accomplished most efficiently using direct I/O instructions in DOS. Use the standard ACCES32 API driver for windows. 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 6: Software

Utility software provided with the card is the base address locator, an illustrated setup program, and a sample program. The sample program sequentially turns on each relay until all are on and then sequentially turns them off. After each relay is turned on, the relay states are read back, the opto-isolated inputs are read, and the data are displayed.

The programs are as follows:

SETUP.EXE: Setup Program

DOS

CSAMPLES:	These three directories contain DOS samples in Borland C,
BSAMPLES:	Microsoft QuickBASIC 4.5,
PSAMPLES:	and Turbo Pascal 7.0

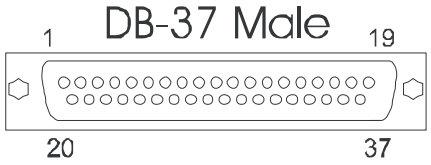
WIN32

DELPHI:	These four directories contain samples in Borland Delphi 4.0,
CBUILDER:	Borland C++Builder 3.0,
VBASIC:	Microsoft VisualBASIC 5.0,
VISUALC	and Microsoft VisualC++ 5.0: These samples will run in Windows95, Windows98, or WindowsNT 4.0. Before running these Win32 samples, make sure you have properly installed the ACCES32 driver (installed as part of the TOOLS package.)

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Chapter 7: Connector Pin Assignments

Analog and digital I/O signals are connected to the card via a 37-pin D type connector that extends through the back of the computer case. The mating connector is an AMP 747304-1 or equivalent. The wiring may be directly from the signal sources or may be on ribbon cable from screw terminal accessory boards.



Pin	Name	Function
1	IP7	Digital Input Bit 7
2	IP6	Digital Input Bit 6
3	IP5	Digital Input Bit 5
4	IP4	Digital Input Bit 4
5	IP3	Digital Input Bit 3
6	IP2	Digital Input Bit 2
7	IP1	Digital Input Bit 1
8	IP0	Digital Input Bit 0
9	OP7(C)	Bit 7 Relay Common
10	OP6(C)	Bit 6 Relay Common
11	OP5(C)	Bit 5 Relay Common
12	OP4(NC)	Bit 4 Relay, Normally-Closed Contact
13	OP4(NO)	Bit 4 Relay, Normally-Open Contact
14	OP3(C)	Bit 3 Relay Common
15	OP2(NC)	Bit 2 Relay, Normally-Closed Contact
16	OP2(NO)	Bit 2 Relay, Normally-Open Contact
17	OP1(C)	Bit 1 Relay Common
18	OP0(NC)	Bit 0 Relay, Normally-Closed Contact
19	OP0(NO)	Bit 0 Relay, Normally-Open Contact
20	IP7	Digital Input Bit 7
21	IP6	Digital Input Bit 6
22	IP5	Digital Input Bit 5
23	IP4	Digital Input Bit 4
24	IP3	Digital Input Bit 3
25	IP2	Digital Input Bit 2
26	IP1	Digital Input Bit 1
27	IP0	Digital Input Bit 0
28	OP7(NO)	Bit 7 Relay, Normally-Open Contact
29	OP6(NO)	Bit 6 Relay, Normally-Open Contact
30	OP5(NO)	Bit 5 Relay, Normally-Open Contact
31	OP4(C)	Bit 4 Relay Common
32	OP3(NC)	Bit 3 Relay, Normally-Closed Contact
33	OP3(NO)	Bit 3 Relay, Normally-Open Contact
34	OP2(C)	Bit 2 Relay, Common
35	OP1(NC)	Bit 1 Relay, Normally-Closed Contact
36	OP1(NO)	Bit 1 Relay, Normally-Open Contact
37	OP0(C)	Bit 0 Relay, Common

Table 7-1: Connector Pin Assignments

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