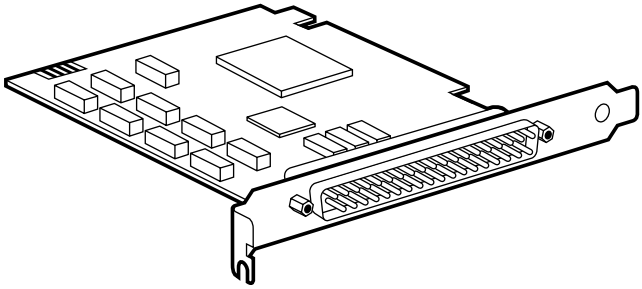
BLACK BOX
NETWORK SERVICES

JANUARY 2005
IC904C

Relay/Digital I/O PCI Card
8 Inputs/8 Outputs



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

EMC Directive Statement

CE

Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

- EN55022 Class A — "Limits and methods of measurement of radio interference characteristics of information technology equipment"
- EN50082-1 — "Electromagnetic compatibility - Generic immunity standard" Part 1: Residential, commercial, and light industry
- EN60950 (IEC950) — "Safety of information technology equipment, including electrical business equipment"

WARNING

This is a Class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high-quality shielded cabling to maintain compliance with FCC/EMC directives.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

Windows and Windows NT are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

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1. Specifications

1.1 General Specifications

MTBF: Greater than 150,000 hours (calculated)

Connectors: (1) DB37 male

Temperature Tolerance: *Operating*: 32 to 122°F (0 to 50°C); *Storage*: -4 to +158°F (-20 to +70°C)

Humidity: 10 to 90%, noncondensing

Power: 10 to 29 mA (19 mA factory default), +5 VDC; Maximum input current: 60 mA

Size: 3.9"H x 5"L (9.9 x 12.7 cm) including goldfingers; 3.6"H x 5"L (9.1 x 12.7 cm) without goldfingers

Weight: 3.2 oz. (90.7 g)

1.2 Relay Specifications

Contact Power Rating: 10 watts maximum

Contact Voltage Maximum: 100 volts DC or AC maximum

Contact Current Maximum: 0.5 amps DC or AC RMS

Initial Contact Resistance: 0.15 ohms

Rated Life: *Low Load:* 200 million closures;
Maximum Load: 100 million closures

Contact Speed: 0.5 msec each for operate, bounce, and release

Maximum Operating Speed: 600 Hz

Input Impedance: Each isolated input: 500 ohms (factory default)

2. Introduction

2.1 Overview

The Relay/Digital I/O PCI Card, 8 Inputs/8 Outputs provides 8 highly reliable 10-VA DIP reed relays that can latch power, data, and other electronic signals for control applications. The card also has eight optically isolated inputs to allow monitoring of off-board switch closures or relays, or for any other general-purpose monitoring needs. The reed relays and inputs are pins on the DB37 connector. The card conforms to the PCI 2.1 specification. Multiple cards can reside in the same computer.

2.2 What's Included

The Relay/Digital I/O PCI Card, 8 Inputs/8 Outputs comes with the following items. If anything is missing or damaged, please contact Black Box at 724-746-5500.

- (1) Relay/Digital I/O PCI Card, 8 Inputs/ 8 Outputs
- (1) CD-ROM containing DIO software
- This users' manual

2.3 Software

The Relay/Digital I/O PCI Card, 8 Inputs/8 Outputs includes an I/O suite of Windows® 98/Me/XP, Windows NT®, and Windows 2000 drivers. The software provides a consistent and straightforward application program interface (API), so the developer can concentrate on the details of the application instead of low-level driver development. Popular development environments, including Visual C++, Visual Basic, and Delphi, are supported for application development. The software includes a utility for configuring the driver parameters under Windows NT. Configuration is automatic with Windows 98/Me/XP and Windows 2000.

For DOS and other operating systems, please refer to the software included with your card.

2.4 Input Port

Port A is an 8-bit input port (8 pins on the DB37 connector) attached to optically isolated input sensors. Each sensor can be used to interface a voltage input and then sense whether the voltage is on or off. Each sensor is isolated (with respect to a common ground) from every other sensor, and it's also isolated with respect to

the host PC ground. This means that signals such as low-voltage AC, motor-servo voltage, and control-relay signals can be "sensed," (or read) by the PC without risking damage caused by ground loops or ground faults.

Each sensor input pair has a current-limiting resistor that is used to limit the input current to the opto-isolator. The opto-isolator has two internal "back-to-back" diodes. This allows AC or DC signals to be sensed, regardless of polarity. When the applied voltage is high enough to cause the LED in the opto-isolator to power-on, the output of the opto-isolator goes low (0 volts) and the signal is read as a low logic level (binary 0) by the PC. When the input signal is too low to turn on the opto-isolator, the output goes high and the port bit is read by the PC as a high logic level (binary 1).

The input impedance of each isolated input is approximately 560 ohms (factory default). The opto-isolator requires approximately 3 mA to turn on. The maximum input current is 60 mA.

When selecting the input resistor, consider:

1. Power-on voltage for the circuit to sense.

2. The maximum input voltage. Maximum input voltage must not overload the input resistor, *and* it must not overdrive the opto-isolator input-current specification. The following formulas apply:

   - Power-on current: 3 mA
   - Isolator diode drop: 1.1 V
   - Resistor power max: 0.25 W

Power-on voltage = diode drop + power-on current x resistance

Or:

1.1 + (.003 A) x R

Maximum voltage = square root of (0.25 [resistor value])

Table 2-1 on the next page shows four common input resistors and the ranges associated with each.

Table 2-1. Input resistor ranges.

Input Resistor (Ohms)	Value Power-On (Volts)	Max. Input Range (Volts)	Max. Current (mA)
220	1.76 to 7.4	2 to 6	29
560*	2.8 to 11.8	3 to 12	19
1K	4.1 to 15	4 to 16	15
2.2K	7.7 to 23.4	8 to 24	10

*Factory default

Increasing the input resistor can increase the maximum input voltage. Because the PCI card uses socketed DIP resistor networks, they can easily be replaced (at the factory) with a different value. The input circuits are not intended for monitoring 120-volt AC circuits.

2.5 Output Port (Reed Relay)

Reed relays provide very-high-quality, long-life, low-current (0.5 amps max.), dry-contact switch closures. Reed relays are not suited for high-current applications and can be destroyed by inductive load switching (where a spark occurs across the contacts internally). The relays are normally open; they close when energized. Writing a "1" to the proper port bit can individually energize each relay.

3. Installation

3.1 Card Setup

The Relay/Digital I/O PCI Card is a fully compliant PCI "plug-and-play" adapter. All card resources (such as I/O address and IRQ selection) are auto-assigned by either your system BIOS or your plug-and-play operating system.

3.2 Operating System Installation

Install the proper software for your adapter before installing the hardware. Refer to the supplied software for the correct operating system installation procedure.

3.3 System Installation

You can install the Relay/Digital I/O PCI Card in any of the PCI expansion slots. To install the card:

1. Turn off the PC's power. Disconnect the power cord.

2. Remove the PC case cover.

3. Locate an available PCI slot and remove the screw that secures the blank metal slot cover. Remove the cover.

4. Gently insert the PCI card into the slot. Make sure that the card is seated properly.

5. Replace the screw.

6. Replace the cover.

7. Connect the power cord. Installation is complete.

Once you install the card, refer to Tables 4-1–4-3 and Table 5-1. Table 5-1 describes where in memory each port is located. Use it along with Table 4-1, 4-2, or 4-3 to define base addresses for the input/output ports.

4. Pin Assignments

4.1 Sensor Input Port Pin Assignments (P3 DB37 Male)

Table 4-1. Input port values.

Port A Bit	P1
0	2,20
1	3,21
2	4,22
3	5,23
4	6,24
5	7,25
6	8,26
7	9,27

4.2 Output Port (Reed Relay) Pin Assignments (P3 DB37 Male)

Table 4-2. Output port values.

Port C Bit	Relay	P2 Pin
0	K1	10,28
1	K2	11,29
2	K3	12,30
3	K4	13,31
4	K5	14,32
5	K6	15,33
6	K7	16,34
7	K8	17,35

4.3 Power and Ground Pin Assignments (P3 DB37 Male)

Table 4-3. Power and ground values.

Ground	18,36,37
+ 5 volts	19
+ 12 volts	1

5. Address Register

Table 5-1. Address register values.

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	RD/WR	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+2	RD/WR	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+4	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+5	RD/WR	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRS0
Base+6	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Appendix A. Troubleshooting

A.1 Read This First

Following these simple steps can eliminate most common problems without calling Technical Support.

1. Install the software first. After installing the software, add the hardware. This places the required installation files in the correct locations.

2. Identify all I/O adapters currently installed in your system. This includes your onboard serial ports, controller cards, sound cards, etc. Identify the I/O addresses used by these adapters, as well as the IRQs (if any).

3. Make sure that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address and may not be allowed to share IRQs.

4. Make sure the PCI card is securely installed in a motherboard slot.

A.2 Calling Black Box

If you determine that your Relay/Digital I/O PCI Card is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

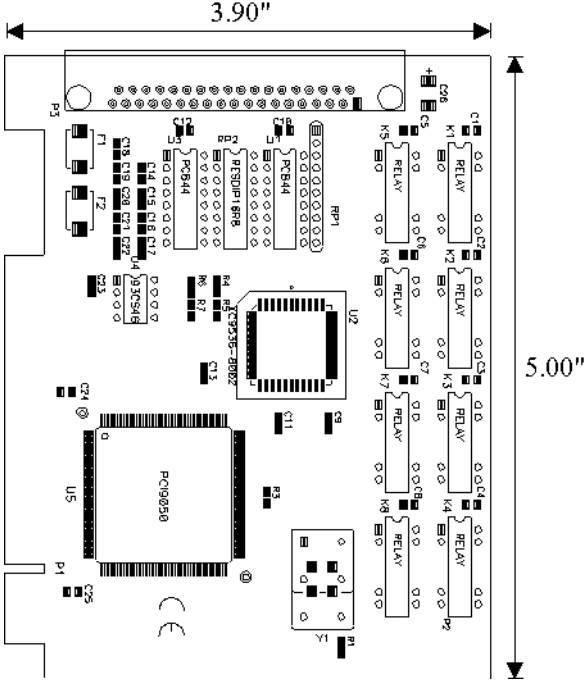
- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

A.3 Shipping and Packaging

If you need to transport or ship your Relay/Digital I/O PCI Card:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the Relay/Digital I/O PCI Card for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

Appendix B. Block Diagram



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