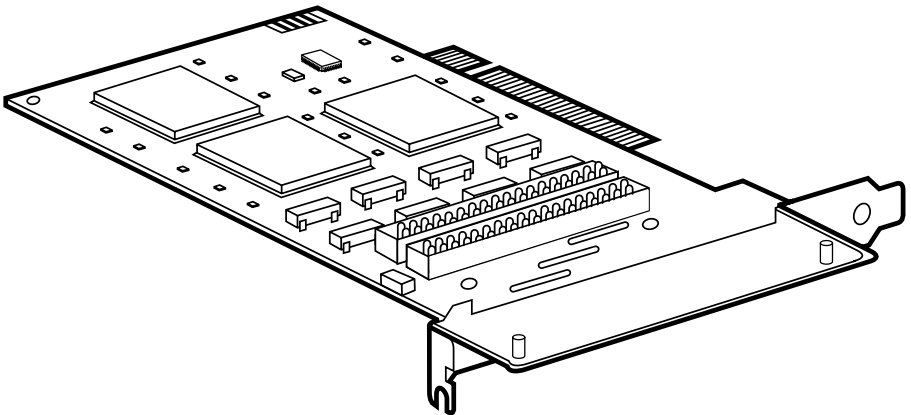




## Relay/Digital I/O Card PCI— 48 Inputs or Outputs



---

**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](http://www.blackbox.com) • E-mail: [info@blackbox.com](mailto: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 la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

**EUROPEAN UNION DECLARATION OF CONFORMITY**

This equipment complies with the requirements of the European EMC Directive 89/336/EEC.



**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 conectado 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 física 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 líneas de energía.
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 objetos líquidos 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: Objetos 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

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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

**Channels:** (48) input or output

**Current (Maximum):** 24 mA DC

**Signal:** TTL compatible address, data, and control

**Throughput (Maximum):** 600 Hz

**MTBF:** >150,000 hours (calculated)

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

**Relative Humidity:** Operating and Storage: 10 to 90% noncondensing;

**Connectors:** (2) 50-pin IDC

**Power:** From the bus; Consumption: Supply line: +5 VDC; Rating: 270 mA

**Size:** 3.3"H x 4.7"W (8.4 x 11.9 cm)

**Shipping Weight:** 0.3 lb. (0.1 kg)

## 2. Introduction

### 2.1 Overview

The Relay/Digital I/O Card PCI—48 Inputs or Outputs has two 8255 mode 0 compatible ports that provide four 8-bit ports and four 4-bit ports. Each can be individually configured as inputs or outputs. When configured as outputs, each bit of the 4-bit ports may be set or reset individually.

### 2.2 What the Package Includes

Your package should contain the following items:

- Relay/Digital I/O Card PCI—48 Inputs or Outputs
- (1) CD-ROM containing SeaI/O software
- This users' manual

If anything is missing or damaged, please contact Black Box at 724-746-5500.

### 2.3 Additional Items You Will Need

You'll also need the following cables. They are mentioned in the system installation procedure described in **Section 3.3**.

- 50-Pin Ribbon-to-Edge Cable (IC909C-CABL)
- 50-Pin Ribbon-to-IDC Cable (IC909C-IDC)



## 3. Installation

### 3.1 Overview

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

### 3.2 Software Installation

#### 3.2.1 WINDOWS USERS

Choose **Install Software** at the beginning of the CD and select the **Digital I/O** software drivers and install **SeaI/O**. Software drivers for Windows® 98/Me/XP, Windows NT®, and Windows 2000 are included.

#### 3.2.2 LINUX USERS

Refer to the installation instructions at the beginning of the CD for details on installing the digital I/O cards in Linux®.

### 3.3 System Installation

The Relay/Digital I/O Card PCI can be installed in any of the PCI expansion slots.

1. Turn off the PC's power. Disconnect the power cord.
2. Remove the PC's case cover.
3. Locate an available PC slot and remove the blank metal slot cover.
4. Remove the clamping portion of the bracket from the card.
5. Gently insert the card into the slot. Make sure that the card is seated properly.
6. Feed the two 50-pin ribbon cables (IC909C-CABL and IC909C-IDC) through the cutout bracket and connect them to the card.
7. Replace the bracket retaining screw.
8. Install the clamping portion of the bracket.
9. Replace the computer cover.

10. Connect the power cord.

Installation is complete.

## 4. Technical Description

The Relay/Digital I/O Card PCI provides 48 channels of digital I/O configurable as inputs or outputs. Use the channels for PC-based control and automation including sensors, switches, satellite antenna control systems, video and audio studio automation, security control systems, and other industrial automation systems.

### 4.1 Pull-Ups

Nine or ten pin bussed resistor packs are installed to provide pull-ups to input ports. These are installed on all ports. The pull-up resistor packs are rated 10 k ohms. See Table 4-1.

**Table 4-1. Input port pull-ups.**

| <b>Bussed Resistor</b> | <b>Corresponding Port</b> | <b>Bussed Resistor</b> | <b>Corresponding Port</b> |
|------------------------|---------------------------|------------------------|---------------------------|
| RP4                    | Port A1                   | RP1                    | Port A2                   |
| RP5                    | Port B1                   | RP2                    | Port B2                   |
| RP6                    | Port C1                   | RP3                    | Port C2                   |

### 4.2 Software

The Relay/Digital I/O Card PCI comes with Windows 98, Me, 2000, and Windows NT® drivers. The drivers provide a consistent and straightforward applications program interface (API), allowing the developer to concentrate on the details of the application as opposed to 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, further simplifying installation.

### 4.3 Linux Users

The Relay/Digital I/O Card PCI ships with software for Linux, including a kernel-mode driver, API, and the SeaIOTst diagnostic tool. The kernel-mode driver is provided as a module, so future driver upgrades may be performed with minimal (usually zero) downtime. The Linux API is identical to the Windows counterpart, facilitating quick and easy ports of existing SeaI/O-aware applications to the Linux operating system. All source code for the Linux software suite is provided under the GNU Public License (GPL v2.0).

## 4.4 Register Description

Table 4-2 lists the available port addresses.

**Table 4-2. Address registers.**

| Address     |                                   | Mode  | D7    | D6    | D5    | D4     | D3    | D2     | D1     | D0     |
|-------------|-----------------------------------|-------|-------|-------|-------|--------|-------|--------|--------|--------|
| Base+0      | Port A1                           | RD/WR | PA1D7 | PA1D6 | PA1D5 | PA1D4  | PA1D3 | PA1D2  | PA1D1  | PA1D0  |
| Base+1      | Port B1                           | RD/WR | PB1D7 | PB1D6 | PB1D5 | PB1D4  | PB1D3 | PB1D2  | PB1D1  | PB1D0  |
| Base+2      | Port C1                           | RD/WR | PC1D7 | PC1D6 | PC1D5 | PC1D4  | PC1D3 | PC1D2  | PC1D1  | PC1D0  |
| Base+3      | Control Word Port 1               | WR    | CW1D7 | 0     | 0     | CW1D4  | CW1D3 | CW1D2  | CW1D1  | CW1D0  |
| Base+4      | Interrupt configuration Port 1    | RD/WR | 0     | 0     | 0     | 0      | 0     | IRQEN1 | IRQC11 | IRQC10 |
| Base+5      | Interrupt status for Port 1 and 2 | RD    | 0     | 0     | 0     | IRQST2 | 0     | 0      | 0      | IRQST1 |
| Base+8      | Port A2                           | RD/WR | PA2D7 | PA2D6 | PA2D5 | PA2D4  | PA2D3 | PA2D2  | PA2D1  | PA2D0  |
| Base+9      | Port B2                           | RD/WR | PB2D7 | PB2D6 | PB2D5 | PB2D4  | PB2D3 | PB2D2  | PB2D1  | PB2D0  |
| Base+A (10) | Port C2                           | RD/WR | PC2D7 | PC2D6 | PC2D6 | PC2D4  | PC2D3 | PC2D2  | PC2D1  | PC2D0  |
| Base+B (11) | Control Word Port 2               | WR    | CW2D7 | 0     | 0     | CW2D4  | CW2D3 | CW2D2  | CW2D1  | CW2D0  |
| Base+C (12) | Interrupt configuration Port 2    | RD/WR | 0     | 0     | 0     | 0      | 0     | IRQEN2 | IRQC21 | IRQC20 |

## 4.5 Control Words

n = control word for port 1 or 2

### 4.5.1 I/O CONFIGURATION

Table 4-3 helps you configure the control words.

**Table 4-3. Control words settings.**

| CWnD0              |   | Port C1 lower nibble (bits 0–3) |   |   |   |   |   | 1=input 0=output 1 on power up |            |     |         |         |
|--------------------|---|---------------------------------|---|---|---|---|---|--------------------------------|------------|-----|---------|---------|
| CWnD1              |   | Port B1                         |   |   |   |   |   | 1=input 0=output 1 on power up |            |     |         |         |
| CWnD2              |   |                                 |   |   |   |   |   | 0 or 1 (no effect)             |            |     |         |         |
| CWnD3              |   | Port C1 upper nibble (bits 4–7) |   |   |   |   |   | 1=input 0=output 1 on power up |            |     |         |         |
| CWnD4              |   | Port A1                         |   |   |   |   |   | 1=input 0=output 1 on power up |            |     |         |         |
| CWnD5              |   |                                 |   |   |   |   |   | 0 or 1 (no effect)             |            |     |         |         |
| CWnD6              |   |                                 |   |   |   |   |   | 0 or 1 (no effect)             |            |     |         |         |
| CWnD7              |   |                                 |   |   |   |   |   | Always a 1                     |            |     |         |         |
| Control Word (X=0) |   |                                 |   |   |   |   |   | Hex Value                      | Port Setup |     |         |         |
| 7                  | 6 | 5                               | 4 | 3 | 2 | 1 | 0 |                                | A          | B   | C Upper | C Lower |
| 1                  | X | X                               | 0 | 0 | X | 0 | 0 | 80                             | Out        | Out | Out     | Out     |
| 1                  | X | X                               | 0 | 0 | X | 0 | 1 | 81                             | Out        | Out | Out     | In      |
| 1                  | X | X                               | 0 | 0 | X | 1 | 0 | 82                             | Out        | In  | Out     | Out     |
| 1                  | X | X                               | 0 | 0 | X | 1 | 1 | 83                             | Out        | In  | Out     | In      |
| 1                  | X | X                               | 0 | 1 | X | 0 | 0 | 88                             | Out        | Out | In      | Out     |
| 1                  | X | X                               | 0 | 1 | X | 0 | 1 | 89                             | Out        | Out | In      | In      |
| 1                  | X | X                               | 0 | 1 | X | 1 | 0 | 8A                             | Out        | In  | In      | Out     |
| 1                  | X | X                               | 0 | 1 | X | 1 | 1 | 8B                             | Out        | In  | In      | In      |
| 1                  | X | X                               | 1 | 0 | X | 0 | 0 | 90                             | In         | Out | Out     | Out     |
| 1                  | X | X                               | 1 | 0 | X | 0 | 1 | 91                             | In         | Out | Out     | In      |
| 1                  | X | X                               | 1 | 0 | X | 1 | 0 | 92                             | In         | In  | Out     | Out     |
| 1                  | X | X                               | 1 | 0 | X | 1 | 1 | 93                             | In         | In  | Out     | In      |
| 1                  | X | X                               | 1 | 1 | X | 0 | 0 | 98                             | In         | Out | In      | Out     |
| 1                  | X | X                               | 1 | 1 | X | 0 | 1 | 99                             | In         | Out | In      | In      |
| 1                  | X | X                               | 1 | 1 | X | 1 | 0 | 9A                             | In         | In  | In      | Out     |
| 1                  | X | X                               | 1 | 1 | X | 1 | 1 | 9B                             | In         | In  | In      | In      |

**4.5.2 BIT SET OR RESET PORT C**

n = port number

Table 4-4 lists the bit parameters.

**Table 4-4. Bit set options.**

|       |  |
|-------|--|
| CWnD0 | 1 = set to +5V                      0 = Reset to GND |
| CWnD4 | 0 or 1 (no effect)                                   |
| CWnD5 | 0 or 1 (no effect)                                   |
| CWnD6 | 0 or 1 (no effect)                                   |
| CWnD7 | Always a zero when using Bit set/reset               |

|       |       | Bit Select |        |
|-------|-------|------------|--------|
| CWnD3 | CWnD2 | CWnD1      | C1 Bit |
| 0     | 0     | 0          | = 0    |
| 0     | 0     | 1          | = 1    |
| 0     | 1     | 0          | = 2    |
| 0     | 1     | 1          | = 3    |
| 1     | 0     | 0          | = 4    |
| 1     | 0     | 1          | = 5    |
| 1     | 1     | 0          | = 6    |
| 1     | 1     | 1          | = 7    |

# RELAY/DIGITAL I/O CARD PCI—48 INPUTS OR OUTPUTS

Table 4-5 describes the control word choices.

**Table 4-5. Control word options.**

| Control Word (X=0) |   |   |   |   |   |   |   | Hex Value | Port C Bit |
|--------------------|---|---|---|---|---|---|---|-----------|------------|
| 7                  | 6 | 5 | 4 | 3 | 2 | 1 | 0 |           |            |
| <b>Reset</b>       |   |   |   |   |   |   |   |           |            |
| 0                  | X | X | X | 0 | 0 | 0 | 0 | 00        | 0          |
| 0                  | X | X | X | 0 | 0 | 1 | 0 | 02        | 1          |
| 0                  | X | X | X | 0 | 1 | 0 | 0 | 04        | 2          |
| 0                  | X | X | X | 0 | 1 | 1 | 0 | 06        | 3          |
| 0                  | X | X | X | 1 | 0 | 0 | 0 | 08        | 4          |
| 0                  | X | X | X | 1 | 0 | 1 | 0 | 0A        | 5          |
| 0                  | X | X | X | 1 | 1 | 0 | 0 | 0C        | 6          |
| 0                  | X | X | X | 1 | 1 | 1 | 0 | 0E        | 7          |
| <b>Set</b>         |   |   |   |   |   |   |   |           |            |
| 0                  | X | X | X | 0 | 0 | 0 | 1 | 01        | 0          |
| 0                  | X | X | X | 0 | 0 | 1 | 1 | 03        | 1          |
| 0                  | X | X | X | 0 | 1 | 0 | 1 | 05        | 2          |
| 0                  | X | X | X | 0 | 1 | 1 | 1 | 07        | 3          |
| 0                  | X | X | X | 1 | 0 | 0 | 1 | 09        | 4          |
| 0                  | X | X | X | 1 | 0 | 1 | 1 | 0B        | 5          |
| 0                  | X | X | X | 1 | 1 | 0 | 1 | 0D        | 6          |
| 0                  | X | X | X | 1 | 1 | 1 | 1 | 0F        | 7          |

### 4.5.3 INTERRUPT CONTROL

Table 4-6 lists interrupt enable and disable parameters.

**Table 4-6. Interrupt control options.**

|        |  |           |                 |
|--------|--|-----------|-----------------|
| IRQENX | interrupt enable   | 1=enabled | 2=disabled      |
|        |  |           | (0 on power up) |
| IRQCX0 | Interrupt mode select (see table in <b>Section 4.5.4</b> ) |           |                 |
| IRQCX1 | Interrupt mode select (see table in <b>Section 4.5.4</b> ) |           |                 |

**4.5.4 INTERRUPT MODE SELECT TABLE**

Table 4-7 lists the interrupt mode selections.

**Table 4-7. Interrupt mode options.**

| <b>IRQCX1</b> | <b>IRQCX0</b> | <b>INT Type</b> |
|---------------|---------------|-----------------|
| 0             | 0             | Low level       |
| 0             | 1             | High level      |
| 1             | 0             | Falling edge    |
| 1             | 1             | Rising edge     |

**4.5.5 INTERRUPT READ**

Reading this port clears the interrupt. Table 4-8 lists the status.

**Table 4-8. Interrupt status options.**

|        |                       |                                 |
|--------|-----------------------|---------------------------------|
| IRQST1 | (D0) Interrupt status | 1 = interrupt pending, 0 = none |
| IRQST2 | (D4) Interrupt status | 1 = interrupt pending, 0 = none |

**4.6 50-Pin Ribbon Cable Pinout**

Table 4-9 lists the cable's pin signals.

**Table 4-9. Cable pinout.**

| <b>Description</b> | <b>Pin #</b> |
|--------------------|--------------|
| <b>Port A</b>      |              |
| A0                 | 47           |
| A1                 | 45           |
| A2                 | 43           |
| A3                 | 41           |
| A4                 | 39           |
| A5                 | 37           |
| A6                 | 35           |
| A7                 | 33           |



Table 4-9 (continued). Cable pinout.

| <b>Description</b> | <b>Pin #</b>  |
|--------------------|---------------|
| <b>Port B</b>      |               |
| B0                 | 31            |
| B1                 | 29            |
| B2                 | 27            |
| B3                 | 25            |
| B4                 | 23            |
| B5                 | 21            |
| B6                 | 19            |
| B7                 | 17            |
| <b>Port C</b>      |               |
| C0                 | 15            |
| C1                 | 13            |
| C2                 | 11            |
| C3                 | 9             |
| C4                 | 7             |
| C5                 | 5             |
| C6                 | 3             |
| C7                 | 1             |
| GND                | All even pins |
| +5 V               | 49            |

# Appendix A. Troubleshooting

## A.1 Tips

Following these simple steps can eliminate most common problems.

1. Install software *first*. After installing the software, add the hardware. This places the required installation files in the correct locations.
2. Identify all I/O cards currently installed in your system. This includes your onboard serial ports, controller cards, sound cards, etc. The I/O addresses used by these cards, as well as the IRQ (if any), should be identified.
3. Make sure that there is no conflict with currently installed cards. No two cards can occupy the same I/O address and may not be allowed to share IRQs.
4. Make sure the system's card is securely installed in a motherboard slot.

## A.2 Calling Black Box

If you determine that your Relay/Digital I/O Card PCI—48 Inputs or Outputs 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:

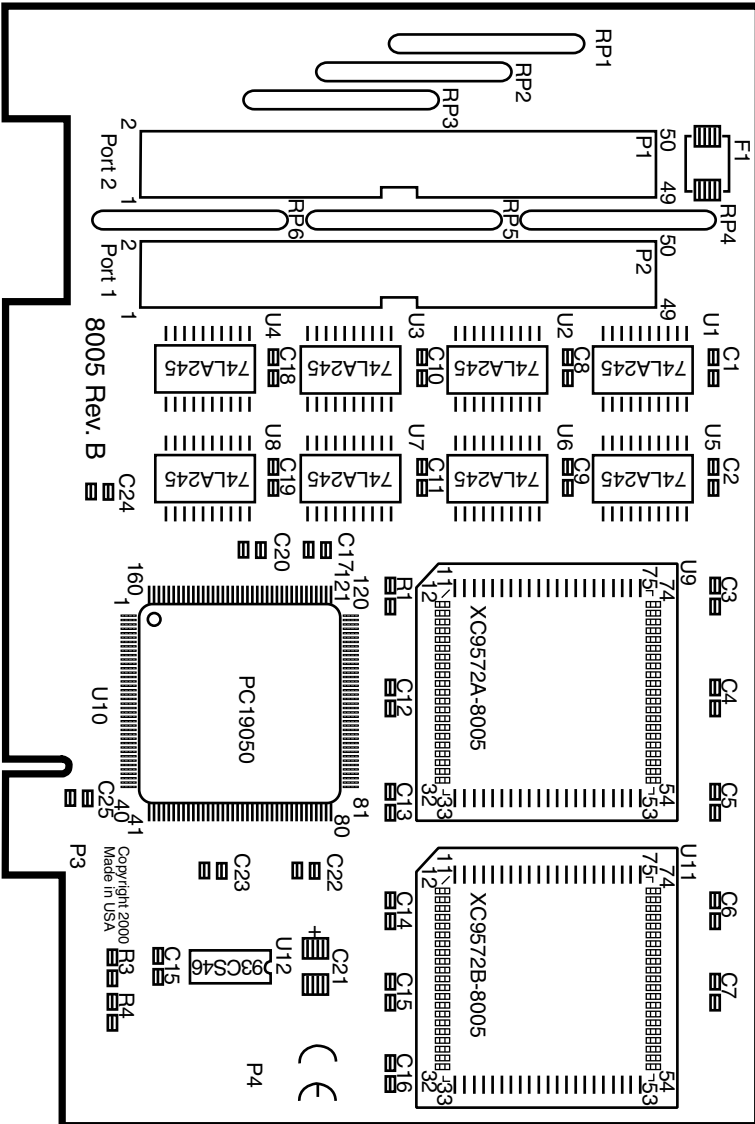
- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

### A.3 Shipping and Packaging

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

- Package it carefully. We recommend that you use the original container.
- If you are shipping the Relay/Digital I/O Card PCI 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. Board Layout





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