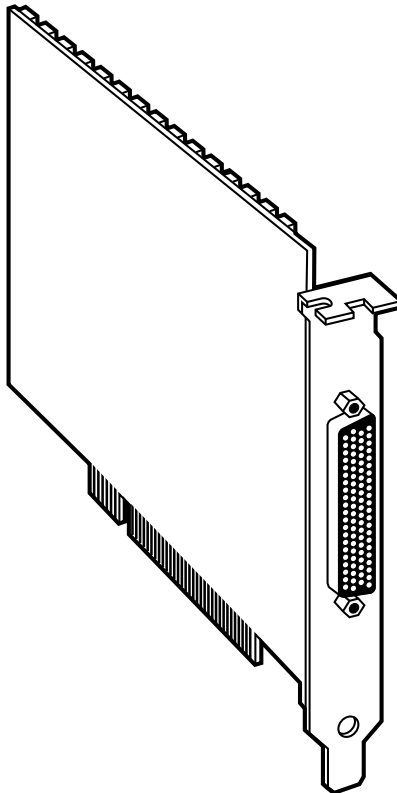




Relay Output Card PCI— 32 Outputs 32 Outputs/Kit



**CUSTOMER
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Order toll-free in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
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**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.

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1. Specifications

Channels: (32) output

Input Isolation: 400-V optical

Output Relay: 200 million operations, 10-VA resistive load

Relay Contact Current (Maximum): 10 W

Relay Contact Power Ratings (Maximum): 10 W

Relay Contact Resistance: Initial: 0.15 ohms

Relay Contact Speed: Operate: 0.5 ms; Release: 0.5 ms; Bounce: 0.5 ms

Relay Contact Voltage (Maximum): 100-V AC/DC

Relay Rated Life: Low load: 200,000,000 closures; Maximum load: 100,000,000 closures

Signal: TTL compatible address, data, and control

Throughput (Maximum): 600 Hz

MTBF: >150,000 hours (calculated)

Connectors: (1) DB37 male, (1) DB37 female

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

Size: 4.2"H x 6.3"W (10.7 x 16 cm)

Shipping Weight: 0.3 lb. (0.1 kg)

2. Introduction

2.1 Overview

The Relay Output Card PCI provides 32 reed relays that can switch power, data, and other electronic signals for control applications. The card is PCI 2.1 bus compliant.

2.2 What the Package Includes

The Relay Output Card PCI (part number IC907C) is shipped with the following items.

- Relay Output Card PCI
- (1) software CD
- This users' manual

The Relay Output Card PCI Kit (part number IC908C) is shipped with the following items:

- Relay Output Card PCI
- (1) software CD
- (2) 37-pin male/female terminal blocks
- This users' manual

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

3. Installation

3.1 Card Setup

The Relay Output Card PCI is a fully compliant PCI plug-and-play adapter. The I/O address is auto-assigned by either your system BIOS or your plug-and-play operating system.

3.2 Software Installation

FOR WINDOWS USERS

Choose **Install Software** at the beginning of the CD, select the **Digital I/O** software drivers, and install **SeaI/O**.

3.3 System Installation

The Relay Output 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 PCI slot and remove the blank metal slot cover.
4. Gently insert the Relay Output Card PCI into the slot. Make sure that the card is seated properly.
5. Replace the retaining screw.
6. Replace the cover.
7. Connect the power cord.

Installation is complete.

4. Technical Description

The Relay Output Card PCI provides four parallel reed relay output ports. The ports are organized as 1, 2, 3, and 4.

4.1 Features

- 32 SPST relays
- DB37 connectors
- Highly reliable 10-VA DIP reed relays used
- Multiple cards can reside in the same computer
- PCI 2.1 bus compliant

4.2 Reed Relays

Reed relays provide very-high-quality, long-life, low-power, dry-contact switch closures. Reed relays are not suited for high-current applications, and they can be destroyed by capacitive or inductive load switching. The relays are normally open, and they close when energized.

See **Chapter 1** for relay specifications.

4.3 Software

The Relay Output Card PCI comes with a suite of Windows® drivers. These 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. Windows 98/Me/XP, Windows NT®, and Windows 2000 drivers are included.

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

4.4 Programming Examples

Below are several simple examples using 80x86 assembly code for energizing and checking the state of the reed relays on the Relay Output Card PCI. All examples assume a base address of 300 Hex.

Example #1: Programming example to set Relay #27 on, write a "1" in bit position D2, to port address Base+3, or 303 Hex.

```
MOV DX, 303H           ;Set DX to Port D
MOV AL, 00001000B     ;Set bit 3 to a '1'
OUT DX, AL
```

Example #2: Another method that takes into account the read-back capability of the output ports.

```
MOV DX, 303H           ;Set DX to Port D
IN AL, DX              ;Get old port setting
NOT AL                 ;Invert bits - see note below
OR AL, 00001000B      ;OR in bit 3
OUT DX, AL             ;Set Bit 3
```

NOTE

Reading back the ports results in the binary complement of the output.

4.5 Register Description

Table 4-1. Registers.

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	R/W	P1D7	P1D6	P1D5	P1D4	P1D3	P1D2	P1D1	P1D0
Base+1	R/W	P2D7	P2D6	P2D5	P2D4	P2D3	P2D2	P2D1	P2D0
Base+2	R/W	P3D7	P3D6	P3D5	P3D4	P3D3	P3D2	P3D1	P3D0
Base+3	R/W	P4D7	P4D6	P4D5	P4D4	P4D3	P4D2	P4D1	P4D0

R/W = Read/Write bits

NOTE

The reed relay ports have a non-destructive readback capability. Reading back the ports results in the binary complement of the output. This is particularly useful when writing software that queries the last value written to prevent inadvertently changing the state of the relays.

4.6 Connector and Jumper Pinout

Each relay has two sides, an A side and a B side. Each side is connected to two places: the cable and the jumpers on the top of the board. Tables 4-2 through 4-5 provide the pinouts for the two DB37 cable ends and the onboard jumpers.

For easy wiring, the card’s DB37 connector can be interfaced directly to the terminal block kit (if you ordered IC907C, you’ll need part number EDN37-SP). The kit, consisting of a 6-ft. (1.8-m) male/female cable and screw terminal block, provides a simple means to connect field wiring to the 37-pin cards. The terminal block provides both male and female DB37 connectors, eliminating the need for gender changers and other adapters while simplifying cable connections. If you ordered IC908C (the Relay Output Card PCI—32 Outputs/Kit), the terminal blocks are already included.

Table 4-2. DB37 labeled ports 1, 2.

Relay	Relay A Side Port 1-A	DB37 Pin	Relay B Side Port 1-B	DB37 Pin
K1	1	2	1	20
K2	2	3	2	21
K3	3	4	3	22
K4	4	5	4	23
K5	5	6	5	24
K6	6	7	6	25
K7	7	8	7	26
K8	8	9	8	27
Relay	Relay A Side Port 2-A	DB37 Pin	Relay B Side Port 2-B	DB37 Pin
K9	1	10	1	28
K10	2	11	2	29
K11	3	12	3	30
K12	4	13	4	31
K13	5	14	5	32
K14	6	15	6	33
K15	7	16	7	34
K16	8	17	8	35

Table 4-3. Power and ground pin assignments.

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

Table 4-4. DB37 labeled ports 3, 4.

Relay	Relay A Side Port 3-A	DB37 Pin	Relay B Side Port 3-B	DB37 Pin
K17	1	2	1	20
K18	2	3	2	21
K19	3	4	3	22
K20	4	5	4	23
K21	5	6	5	24
K22	6	7	6	25
K23	7	8	7	26
K24	8	9	8	27
Relay	Relay A Side Port 4-A	DB37 Pin	Relay B Side Port 4-B	DB37 Pin
K25	1	10	1	28
K26	2	11	2	29
K27	3	12	3	30
K28	4	13	4	31
K29	5	14	5	32
K30	6	15	6	33
K31	7	16	7	34
K32	8	17	8	35

Table 4-5. Power and ground pin assignments.

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

4.7 Jumper Setup Options

The common on each port may be tied to ground, 5, or 12 volts. Either side of each relay then may be tied to the common. Figure 4-1 shows an example setup.

- Port 4: The common is tied to ground (GND). The A side of port-4 relay 3 (K27) is tied to the common. The B side of port-4 relay 6 (K30) is tied to the common.
- Port 3: The common is tied to ground (GND). The A side of port-3 relay 2 (K18) is tied to the common. The B side of port-3 relay 5 (K21) is tied to the common.
- Port 2: The common is tied to 5 volts. The B side of port-2 relay 4 (K12) is tied to the common.
- Port 1: The common is tied to 12 volts. The A side of port-1 relay 1 (K1) is tied to the common. The A side of port-1 relay 8 (K8) is tied to the common.

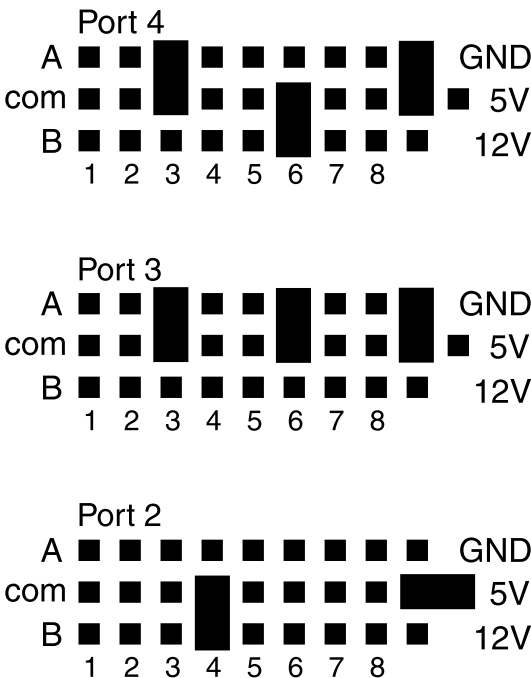


Figure 4-1. Example setup.

RELAY OUTPUT CARD PCI

Table 4-6. Cable with two female ends (side A, side B).

DB37 Labeled Side A	Function	Jumper Pin	DB37 Labeled Side B	Jumper Pin	Common
1	Ground	N/A	1	Ground	N/A
2	Relay 2A	PORT 1-A2	2	Relay 2B	PORT 1-B2
3	Relay 4A	PORT 1-A4	3	Relay 4B	PORT 1-B4
4	Relay 6A	PORT 1-A6	4	Relay 6B	PORT 1-B6
5	Relay 8A	PORT 1-A8	5	Relay 8B	PORT 1-B8
6	Relay 10A	PORT 2-A2	6	Relay 10B	PORT 2-B2
7	Relay 12A	PORT 2-A4	7	Relay 12B	PORT 2-B4
8	Relay 14A	PORT 2-A6	8	Relay 14B	PORT 2-B6
9	Relay 16A	PORT 2-A8	9	Relay 16B	PORT 2-B8
10	Relay 18A	PORT 3-A2	10	Relay 18B	PORT 3-B2
11	Relay 20A	PORT 3-A4	11	Relay 20B	PORT 3-B4
12	Relay 22A	PORT 3-A6	12	Relay 22B	PORT 3-B6
13	Relay 24A	PORT 3-A8	13	Relay 24B	PORT 3-B8
14	Relay 26A	PORT 4-A2	14	Relay 26B	PORT 4-B2
15	Relay 28A	PORT 4-A4	15	Relay 28B	PORT 4-B4
16	Relay 30A	PORT 4-A6	16	Relay 30B	PORT 4-B6
17	Relay 32A	PORT 4-A8	17	Relay 32B	PORT 4-B8
18	12 V	N/A	18	12 V	N/A
19	5 V	N/A	19	5 V	N/A
20	Relay 1A	PORT 1-A1	20	Relay 1B	PORT 1-B1
21	Relay 3A	PORT 1-A3	21	Relay 3B	PORT 1-B3
22	Relay 5A	PORT 1-A5	22	Relay 5B	PORT 1-B5
23	Relay 7A	PORT 1-A7	23	Relay 7B	PORT 1-B7
24	Relay 9A	PORT 2-A1	24	Relay 9B	PORT 2-B1
25	Relay 11A	PORT 2-A3	25	Relay 11B	PORT 2-B3
26	Relay 13A	PORT 2-A5	26	Relay 13B	PORT 2-B5
27	Relay 15A	PORT 2-A7	27	Relay 15B	PORT 2-B7
28	Relay 17A	PORT 3-A1	28	Relay 17B	PORT 3-B1
29	Relay 19A	PORT 3-A3	29	Relay 19B	PORT 3-B3
30	Relay 21A	PORT 3-A5	30	Relay 21B	PORT 3-B5
31	Relay 23A	PORT 3-A7	31	Relay 23B	PORT 3-B7
32	Relay 25A	PORT 4-A1	32	Relay 25B	PORT 4-B1

Table 4-6 (continued). Cable with two female ends (side A, side B).

DB37 Labeled Side A	Function	Jumper Pin	DB37 Labeled Side B	Jumper Pin	Common
33	Relay 27A	PORT 4-A3	33	Relay 27B	PORT 4-B3
34	Relay 29A	PORT 4-A5	34	Relay 29B	PORT 4-B5
35	Relay 31A	PORT 4-A7	35	Relay 31B	PORT 4-B7
36	Ground	N/A	36	Ground	N/A
37	Ground	N/A	37	Ground	N/A

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 adapters currently installed in your system. This includes your onboard serial ports, controller cards, sound cards, etc. The I/O addresses used by these adapters, 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 that the systems card is securely installed in a motherboard slot.

A.2 Calling Black Box

If you determine that your Relay Output Card PCI 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 Output Card PCI:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the Relay Output 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

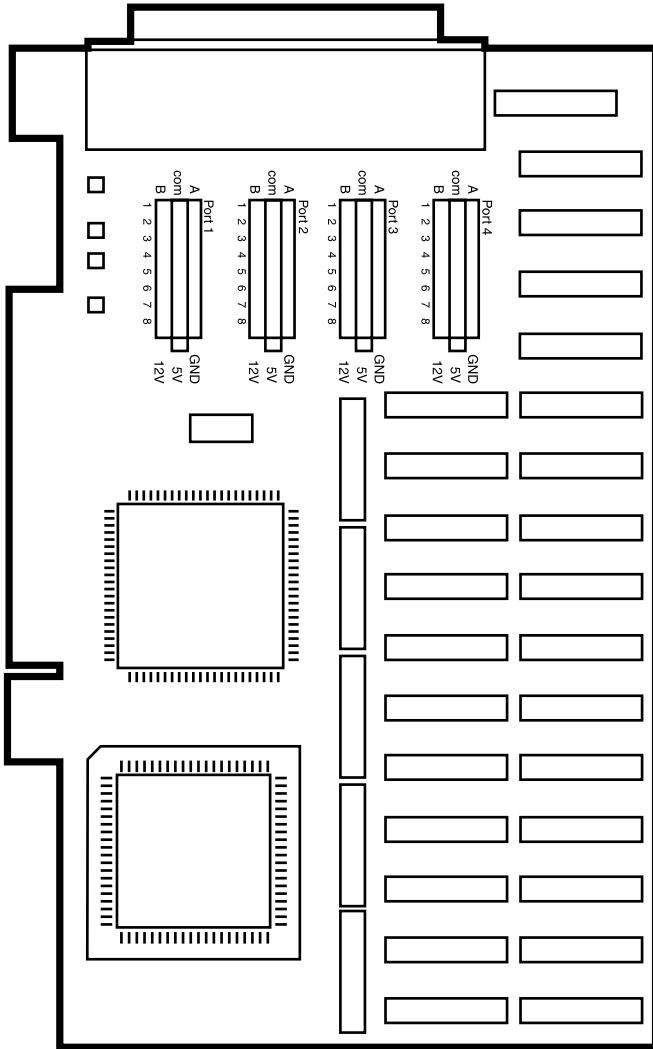


Figure B-1. Board layout.



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