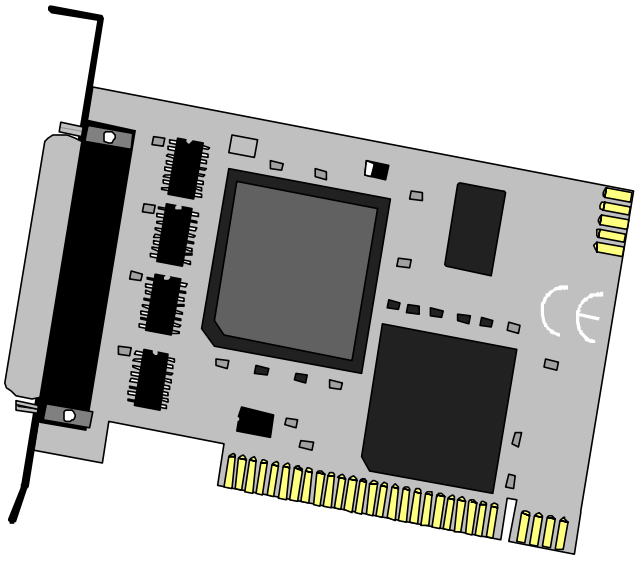
SEALEVEL®
SYSTEMS INCORPORATED

PIO-32.PCI™
USER MANUAL



Part # 8001

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Introduction

Overview

The Sealevel Systems **PIO-32.PCI** provides the PC with four 8-bit ports that can be defined independently as input or output.

What's Included

The **PIO-32.PCI** is shipped with the following items. If any of these items is missing or damaged, contact the supplier.

- **PIO-32.PCI** Adapter
- DIO Software CD

Installation

Card Setup

The **PIO-32.PCI** is a fully compliant PCI 'Plug and Play' adapter. All card resources (i.e. I/O address, IRQ selection) are auto-assigned by either your system BIOS or your 'Plug and Play' operating system.

Software Installation

For proper operation install software first. To install the software place the CD in your CD-ROM tray and the auto-run program will start. If auto-run is not available browse the CD and choose "index.htm". Choose **Install Software** at the beginning of the CD. Select the **Digital I/O** software drivers and install **SeaIO** prior to installing hardware.

System Installation

The **PIO-32.PCI** can be installed in any of the PCI expansion slots.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover.
3. Locate an available PCI slot and remove the blank metal slot cover.
4. Gently insert the **PIO-32.PCI** into the slot. Make sure that the adapter is seated properly.
5. Replace the screw.
6. Replace the cover.
7. Connect the power cord. Installation is complete.

Technical Description

The **PIO-32.PCI** provides 32 channels of digital I/O configurable as inputs or outputs, which can be utilized for PC based control and automation of equipment. Uses include sensors, switches, satellite antenna control systems, video and audio studio automation, security control systems, and other industrial automation systems.

The **PIO-32.PCI's** 32 channels consist of 4 ports of I/O, each port configurable as either input or output, to suit the task at hand. The status of each of the 4 ports is user selectable as input or output by simply writing a control word to the port register. This gives the user the ability to customize the combination of inputs and outputs as needed.

For development purposes, the card's DB-37 connector can be interfaced directly to Sealevel's terminal block kit, Part# **KT-101**. The **KT-101** kit, consisting of a 6 ft. M/F cable and positive tension screw terminal block provides a simple means to connect field wiring the **PIO-32.PCI**.

Features

- 32 Channels of Digital I/O configurable as inputs or outputs
- Implemented as 4 ports of 8 channels each of I/O providing flexible operation
- Terminal Block and cable kit available to simplify field wiring requirements
- Supports all PCI interrupts

Software

The PIO-32.PCI Software

The **PIO-32.PCI** ships with Sealevel Systems' SeaI/O suite of Windows 98/NT/ME/2000 drivers. SeaI/O provides the user with a consistent and straightforward API, allowing the developer to concentrate on the details of the application as opposed to low level driver development. Popular development environments are supported for application development. SeaI/O includes sample applications and a utility for configuring the driver parameters under Windows, further simplifying installation.

Linux Users

The PIO-48.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 its 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), to assist in "roll-your-own"-type applications.

3rd Party Software Support

Third party software support for many HMI/MMI and other process control software is included on the product installation CD. For the most up to date information on third party software support, please visit http://www.sealevel.com/3rdpartysw.htm.

I/O connector Pin-Out DB-37 Male

Table 1-I/O Connector Pin Out

Pin #	Description
1	+5VDC
2	PA1
3	PA3
4	PA5
5	PA7
6	PB1
7	PB3
8	PB5
9	PB7
10	PC1
11	PC3
12	PC5
13	PC7
14	PD1
15	PD3
16	PD5
17	PD7
18	GND
19	GND
20	PA0
21	PA2
22	PA4
23	PA6
24	PB0
25	PB2
26	PB4
27	PB6
28	PC0
29	PC2
30	PC4
31	PC6
32	PD0
33	PD2
34	PD4
35	PD6
36	GND
37	GND

Electrical Characteristics

The table below provides the electrical characteristics of each Input/Output. Each port is buffered with a 74LS245 octal bi-directional transceiver. Each input is capable of sinking up to 24 mA, while each output can source up to 15 mA.

Recommended Operating Conditions		
	Min	Max
Input	0 V	5.25 V
Source		15 mA
Sink		24 mA

Electrical Characteristics	
High Level Input Voltage	Min 2 V
Low Level Input Voltage	Max 0.8 V
High Level Output Voltage	Min 2 V at 15 mA
	Typically 3.4 V at 3 mA
Low Level Output Voltage	Max 0.55 V at 24 mA

Table 2-Electrical Characteristics

Programming

Application Programmers Interface (API)

Most modern operating systems do not allow direct hardware access. The SeaIO driver and API have been included to provide control over the hardware in Windows and Linux environments.

The purpose of this section of the manual is to help the customer with the mapping of the API to the actual inputs for the 8001 specifically. Complete documentation of the API can be found in its accompanying help file.

Reading the Inputs:

The API presents the inputs as active low. If an input is driven high (2V to 5.25 V) it will read as a logical zero (0), if driven low (0V to 0.8V) it will read as a logical one (1).

Reading the Outputs:

The API returns the complement of value that is currently being used to drive the outputs. The outputs cannot be read with relative addressing, absolute addressing must be used. Refer to **Relative Addressing vs. Absolute Addressing** for more information.

Presetting an Output Port:

Each port has an output register associated with it. This register may be written and retains its value whether the port is configured as an input or an output. To preset the value of an output port the program should write to the port when it is configured as an input then configure it as an output. Inputs cannot be written to with relative addressing, absolute addressing must be used. Refer to **Relative and Absolute Addressing** below.

Writing the Outputs:

The outputs are active high. Writing a one (1) corresponds to 5V while writing a zero (0) corresponds to 0V, at the output.

Interrupts:

Interrupt sampling can be set up in the API. **Port A bit zero is the interrupt source(pin 20)**. Refer to the API section in the SeaI/O help file for more detailed information.

Port Configuration:

Each eight-bit port can be configured as inputs or outputs. The API provides a set adapter state call to access the control words. For this device, one control word is used.

Control Word	0 = input	1 = output
Port A – Bit 0		
Port B – Bit 1		
Port C – Bit 2		
Port D – Bit 3		

Note: The control panel also allows you to configure the device. Your program can over ride the control panel configuration when executed, but the control panel configuration will be the default on power up. The default settings are based on the settings in the control panel application when last changed and saved after re-booting.

Relative Addressing vs. Absolute Addressing

The SeaIO API makes a distinction between "absolute" and "relative" addressing modes. In absolute addressing mode, the Port argument to the API function acts as a simple byte offset from the base I/O address of the device. For instance, Port #0 refers to the I/O address base + 0; Port #1 refers to the I/O address base + 1.

Relative addressing mode, on the other hand, refers to input and output ports in a logical fashion. With a Port argument of 0 and an API function meant to output data, the first (0^{th}) output port on the device will be utilized. Likewise, with a Port argument of 0 and an API function designed to input data, the first (0^{th}) input port of the device will be utilized.

In all addressing modes, port numbers are zero-indexed; that is, the first port is port #0, the second port is #1, the third #2, and so on.

Given Port A and Port D are inputs and Port B, Port C are outputs, the Tables below show Absolute address, and the relative address. The absolute address will be the same for any configuration, while the relative address will depend on the particular configuration.

Absolute and Relative Addressing

Table:3 shows the API Port/bit reference numbers for Absolute and Relative Addressing

R = Read
W = Write
R/W = Read or Write

Port	API Port # Absolute Address (function)	API Port # Relative Address (function)	Port Type
A	0 (R/W)	0 (R)	Input Port
B	1 (R/W)	0 (W)	Output Port
C	2 (R/W)	1 (W)	Output Port
D	3 (R/W)	1 (R)	Input Port

Table 3-API Port/Bit Reference Numbers

Continuing with Table 4, the API Port/bit reference numbers for Absolute and Relative Addressing

API Bit # Absolute Address (function)	API Bit # Relative Address (function)	Port Bit
0 (R/w)	0 (R)	A0 - Input
1 (R/w)	1 (R)	A1 - Input
2 (R/w)	2 (R)	A2 - Input
3 (R/w)	3 (R)	A3 - Input
4 (R/w)	4 (R)	A4 - Input
5 (R/w)	5 (R)	A5 - Input
6 (R/w)	6 (R)	A6 - Input
7 (R/w)	7 (R)	A7 - Input
8 (R/w)	0 (W)	B0 - Output
9 (R/w)	1 (W)	B1 - Output
10 (R/w)	2 (W)	B2 - Output
11 (R/w)	3 (W)	B3 - Output
12 (R/w)	4 (W)	B4 - Output
13 (R/w)	5 (W)	B5 - Output
14 (R/w)	6 (W)	B6 - Output
15 (R/w)	7 (W)	B7 - Output
16 (R/W)	8 (W)	C0 - Output
17 (R/W)	9 (W)	C1 - Output
18 (R/W)	10(W)	C2 - Output
19 (R/W)	11(W)	C3 - Output
20 (R/W)	12(W)	C4 - Output
21 (R/W)	13(W)	C5 - Output
22 (R/W)	14(W)	C6 - Output
23 (R/W)	15(W)	C7 - Output
24 (R/W)	8 (R)	D0 - Input
25 (R/W)	9 (R)	D1 - Input
26 (R/W)	10 (R)	D2 - Input
27 (R/W)	11 (R)	D3 - Input
28 (R/W)	12 (R)	D4 - Input
29 (R/W)	13 (R)	D5 - Input
30 (R/W)	14 (R)	D6 - Input
31 (R/W)	15 (R)	D7 - Input

Table 4- API Port/Bit Reference Numbers

Direct Hardware Control

In systems where the user's program has direct access to the hardware (DOS) the table below gives the mapping and functions that the 8001 provide. The address of each eight-bit port is calculated as shown in the table on the following page, the card's base address plus an offset.

Reading the Inputs:

The inputs are active high. If an input is driven high (2V to 5.25 V) it will read as a logical one (1), if driven low (0V to 0.8V) it will read as a logical zero (0).

Reading the Outputs:

The value that is currently being used to drive the outputs will be returned.

Presetting an Output Port:

Each port has an output register associated with it. This register may be written and retains its value whether the port is configured as an input or an output. To preset the value of an output port the program should write to the port when it is configured as an input then configure it as an output.

Writing the Outputs:

The outputs are active high. Writing a one (1) corresponds to 5V while writing a zero (0) corresponds to 0V, at the output.

Port Configuration:

Each port can be configured as an input or an output by writing to its direction control bit, refer to the table below.

Interrupts

Interrupts can be set up as shown on the following page. **Port A1 bit zero is the interrupt source(pin 20)**.

Register Description (for direct hardware control)

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	R/W	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	R/W	PBD7	PBD6	PBD5	PBD4	PBD3	PBD2	PBD1	PBD0
Base+2	R/W	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	R/W	PDD7	PDD6	PDD 5	PDD 4	PDD 3	PDD 2	PDD 1	PDD 0
Base+4	R/W	{0}	{0}	{0}	{0}	DIRD	DIRC	DIRB	DIRA
Base+5	R/W	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	R Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	R Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Table 5-Register Description

Note: All ports are set to input after reset or power up.
Interrupt source is Base+0 bit D0. When selecting the Interrupt Mode, always disable interrupts prior to changing or setting states. This will help prevent inadvertent or un-expected interrupts from occurring. When using the high and low level interrupts, a change in state of the input must occur before the interrupt can be cleared. The device providing the input to Base +0, bit D0 must do this.

PAD0-7 = Port A (Base+0)
PBD0-7 = Port B (Base+1)
PCD0-7 = Port C (Base+2)
PDD0-7 = Port D (Base+3)
DIRA-D = Port A-D direction control (Base+4)
0 = input
1 = output
IRC0-1= Interrupt Mode select (Base+5)

IRC1	IRC0	
0	0	Low level
0	1	high level
1	0	falling edge
1	1	rising edge

IRQEN = enable interrupts (Base+5)
0 = disabled
1 = enabled (disabled after reset or power up).
IRQST = interrupt status (Base+5)

1 = interrupt pending (reading the bit clears interrupt).

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 50º C (32º to 122º F)	-20º to 70º C (-4º to 158º F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Power Consumption

Supply line	+5 VDC
Rating	500 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board Length	4.721 inches	(12.00 cm.)
Board Height including Goldfingers	3.300 inches	(8.39 cm.)
Board Height excluding Goldfingers	2.975 inches	(7.56 cm.)
Board Weight	3.2 ounces	(90.71g)

Appendix A - Troubleshooting

Following these simple steps can eliminate most common problems.

Install software **first**. After installing the software then proceed to adding the hardware. This places the required installation files in the correct locations.

1. Read this manual thoroughly before attempting to install the adapter in your system.
2. Use Device Manager under Windows to verify proper installation.
3. Use the SeaIO control panel applet for card identification and configuration.
4. If these steps do not solve your problem, please call Sealevel Systems' Technical Support, (864) 843-4343. Our technical support is free and available from 8:00AM-5PM Eastern Time Monday through Friday.

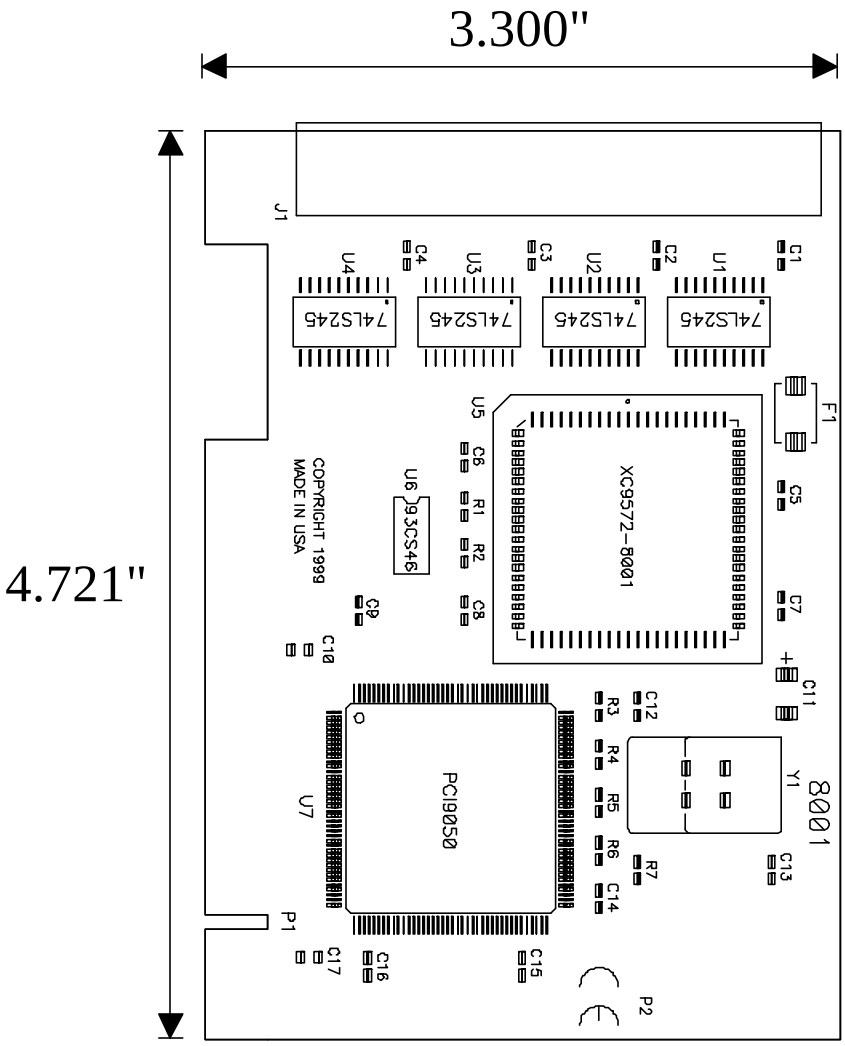
Appendix B - How To Get Assistance

Please refer to Troubleshooting Guide prior to calling Technical Support.

1. Begin by reading through the Trouble Shooting Guide in Appendix A. If assistance is still needed please see below.
2. When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the adapter installed in a computer ready to run diagnostics.
3. Sealevel Systems provides an FAQ section on its web site. Please refer to this to answer many common questions. This section can be found at http://www.sealevel.com/faq.htm .
4. Sealevel Systems maintains a Home page on the Internet. Our home page address is www.sealevel.com. The latest software updates, and newest manuals are available via our FTP site that can be accessed from our home page.
5. Technical support is available Monday to Friday from 8:00 a.m. to 5:00 p.m. eastern time. Technical support can be reached at (864) 843-4343.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

Appendix C - Silk-Screen



Appendix D - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. In such case the user will be required to correct the interference at his own expense.

EMC Directive Statement

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"
- **EN55024**-'Information technology equipment Immunity characteristics Limits and methods of measurement.
- **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.

Warranty

Sealevel Systems, Inc. provides a limited lifetime warranty. Should this product fail to be in good working order at any time, Sealevel Systems will, at it's option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster.

Sealevel Systems assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Sealevel Systems will not be liable for any claim made by any other related party.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

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Technical Support is available from 8 a.m. to 5 p.m. Eastern time.
Monday - Friday

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