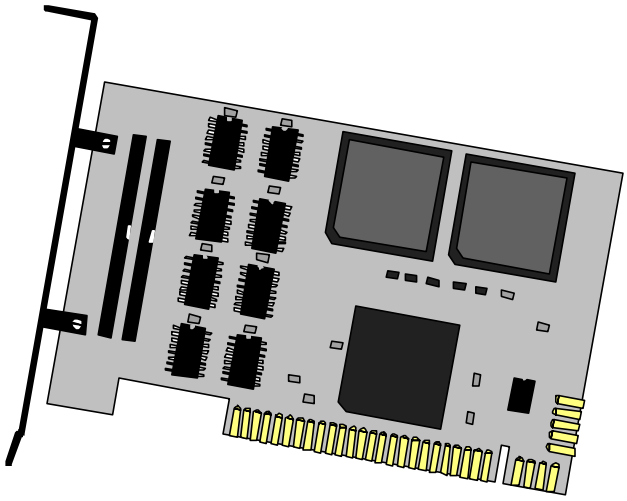
SEALEVEL®
SYSTEMS INCORPORATED

PIO-48.PCI ™
USER MANUAL



Part # 8005

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Introduction

Overview

The Sealevel Systems **PIO-48.PCI** provides two 8255 mode 0 compatible ports providing four eight-bit ports and four four-bit ports. Each can be individually configured as inputs or outputs. When configured as outputs each bit of the four bit ports may be set or reset individually.

What's Included

The **PIO-48.PCI** is shipped with the following items. If any of these items is missing or damaged, contact the supplier.

- **PIO-48.PCI** Adapter
- Sealevel Software
- Industry Standard Relay Rack Cables are Available:
  Part number CA135 for Edge Connection
  Part number CA167 for IDC Connection

Installation

Card Setup

The **PIO-48.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.

Linux Users

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

System Installation

The **PIO-48.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. Remove the clamping portion of the bracket from the card.
5. Gently insert the **PIO-48.PCI** into the slot. Make sure that the adapter is seated properly.
6. Feed the two 50-pin ribbon cables 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.

Technical Description

The **PIO-48.PCI** provides 48 channels of digital I/O configurable as inputs or outputs, which can be utilized 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.

Software

The **PIO-48.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, including Visual C++, Visual Basic, and Delphi, are supported for application development. SeaI/O includes 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.

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

Figure 1-Electrical Characteristics

Pull Ups

Ten pin bussed resistor packs are installed to provide pull-ups to the input ports. These are installed on all ports. The pull-up resistor packs are rated at 10K ohms. Figure 2 below provides the bussed resistor and corresponding port. The resistors insure that no line is floating which is not connected. This provides consistent biasing on all un-terminated lines.

Bussed Resistor	Corresponding Port	Bussed Resistor	Corresponding Port
RP4	Port A1	RP1	Port A2
RP5	Port B1	RP2	Port B2
RP6	Port C1	RP3	Port C2

Figure 2-Pull Up Resistors

50 Pin Ribbon Pin Out

Figure 3-50 Pin Ribbon Cable Pin Out

Description	Pin #
Port A	
A0	47
A1	45
A2	43
A3	41
A4	39
A5	37
A6	35
A7	33
Port B	
B0	31
B1	29
B2	27
B3	25
B4	23
B5	21
B6	19
B7	17
Port C	
C0	15
C1	13
C2	11
C3	9
C4	7
C5	5
C6	3
C7	1
GND	All Even pins
+5V	49

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 8005 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). If an input is not driven it will read as a zero (0) due to the 10K ohm pull up resistors on each port.

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. See **Relative Addressing vs. 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 A1 bit zero is the interrupt source (pin 47)**. Refer to the API section in the SeaI/O help file for more detailed information.

Port C

Port C of each bank has the ability to be configured as two four bit ports. If both lower and upper nibbles are configured the same then no special considerations need to be made. But if they are configured differently, one nibble as input, and one as output then the user will have to keep this in mind.

Port C absolute addressing (when port C is split)

When reading, the input nibble will be returned on the corresponding upper or lower nibble while the outputs will be returned on their corresponding upper or lower nibble. When writing, the corresponding nibble will be written to the output nibble, while the input nibble will have its output register written to. The output register can be written to without affecting the inputs. These will be eight bit operations and it will up to the programmer to keep track of the two four bit nibbles.

Port C relative addressing (when port C is split)

The input and output nibbles will each be treated as individual four bit ports.

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, two control word is used. Refer to the following table.

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.

Control Word 0: Bank 1 (A1, B1, C1)
Control Word 1: Bank 2 (A2, B2, C2)

Control Words
I/O Configuration

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			

Figure 4-Control Words

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.

Tables : 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)
A1	0 (R/W)
B1	1 (R/W)
C1	2 (R/W)
A2	8 (R/W)
B2	9 (R/W)
C2	10 (R/W)

Figure 5-Absolute byte Address (any configuration)

Port	API Port # Relative Address (function)	Port Type
A1	0 (R)	Input
B1	1 (R)	Input
C1	2 (R)	Input
A2	0 (W)	Output
B2	1 (W)	Output
C2 Lower	2 (W)	Output
C2 Upper	3 (R)	Input

Figure 6-Relative byte Address Given:

Inputs A1, B1, C1, C2Upper

Outputs A2, B2, C2 Lower

Absolute Address

Port 1		Port 2	
Absolute bit Address	Port-Bit	Absolute bit Address	Port-Bit
0	A1-0	64	A2-0
1	A1-1	65	A2-1
2	A1-2	66	A2-2
3	A1-3	67	A2-3
4	A1-4	68	A2-4
5	A1-5	69	A2-5
6	A1-6	70	A2-6
7	A1-7	71	A2-7
8	B1-0	72	B2-0
9	B1-1	73	B2-1
10	B1-2	74	B2-2
11	B1-3	75	B2-3
12	B1-4	76	B2-4
13	B1-5	77	B2-5
14	B1-6	78	B2-6
15	B1-7	79	B2-7
16	C1-0	80	C2-0
17	C1-1	81	C2-1
18	C1-2	82	C2-2
19	C1-3	83	C2-3
20	C1-4	84	C2-4
21	C1-5	85	C2-5
22	C1-6	86	C2-6
23	C1-7	87	C2-7

Figure 7-Absolute bit Address (any configuration)

The following tables are provided for the user in the event that he/she wishes to record their particular relative addressing setup, provided its constant. Print this page and fill in the tables starting in the top left corner of each and work from top to bottom, left to right. Start with zero on the first input and increment by one on each additional input. Next move to outputs and again start with zero and increment by one on each additional output.

Bank 1 – P2		Bank 2 – P3	
Address	Port	Address	Port
	A1		A2
	B1		B2
	C1		C2

Figure 8-Relative Byte Address

Bank 1 – P2		Bank 2 – P3	
Address	Port-Bit	Address	Port-Bit
	A1-0		A2-0
	A1-1		A2-1
	A1-2		A2-2
	A1-3		A2-3
	A1-4		A2-4
	A1-5		A2-5
	A1-6		A2-6
	A1-7		A2-7
	B1-0		B2-0
	B1-1		B2-1
	B1-2		B2-2
	B1-3		B2-3
	B1-4		B2-4
	B1-5		B2-5
	B1-6		B2-6
	B1-7		B2-7
	C1-0		C2-0
	C1-1		C2-1
	C1-2		C2-2
	C1-3		C2-3
	C1-4		C2-4
	C1-5		C2-5
	C1-6		C2-6
	C1-7		C2-7

Figure 9-(Print and fill in for your configuration)

Direct Hardware Control

In systems where the users program has direct access to the hardware (DOS) the tables below gives the mapping and functions that the 8005 provide. The address of each eight-bit port is calculated as shown in the table on the following page, the cards 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). If an input is not driven it will read as a one due to the 10K ohm pull up resistors on each port.

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.

Bit Set/Reset

Port C supports bit set/reset as shown in the tables below.

Port Configuration:

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

Interrupts

Interrupts can be set up as shown in the tables below.

Port C

Port C is written and read to as a single eight bit port, but it has the ability to be configured as two four bit ports. If both lower and upper nibbles are configure the same then no special considerations need to be made. But if they are configured differently, one nibble as input, and one as output then the user will have to keep this in mind. When reading, the input will be returned on the corresponding upper or lower nibble while the current outputs will be returned on their corresponding upper or lower nibble. When writing, the corresponding nibble will be written to the output nibble, while the input nibble will have its output register written to. The output register can be written to without affecting the inputs.

Register Description (for direct hardware control)

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
Port 2										
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	PC2D5	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

Figure 10-Register Description

Control Words

n = control word for port1 or 2

I/O Configuration

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

Figure 11-Control Words

Bit Set or Reset Port C

n = port number

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

Control Word (X = 0)								Hex Value	Port C
7	**6**	**5**	**4**	**3**	**2**	**1**	**0**		Bit
Reset									
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
Set									
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

Interrupt control

When enabled interrupts are generated on A10 and A20 (Pin 47 on each 50 pin header), for this reason to use interrupts on a Port its A byte must be set as an input.

IRQENX	interrupt enable	1 = enabled	0 = disabled (0 on power up)
IRQCX0	Interrupt mode select see table		
IRQCX1	Interrupt mode select see table		

Figure 12-Interrupt Control

Interrupt mode select table

IRQCX1	IRQCX0	INT Type
0	0	Low level
0	1	High level
1	0	Falling edge
1	1	Rising edge

Figure 13-Interrupt Mode

Interrupt Read

reading this port clears the interrupt

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

Figure 14-Interrupt Read

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	794 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board Length	6.100 inches	(15.494 cm.)
Board Height including Goldfingers	4.100 inches	(10.414 cm.)
Board Height excluding Goldfingers	4.525 inches	(11.494 cm.)

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.

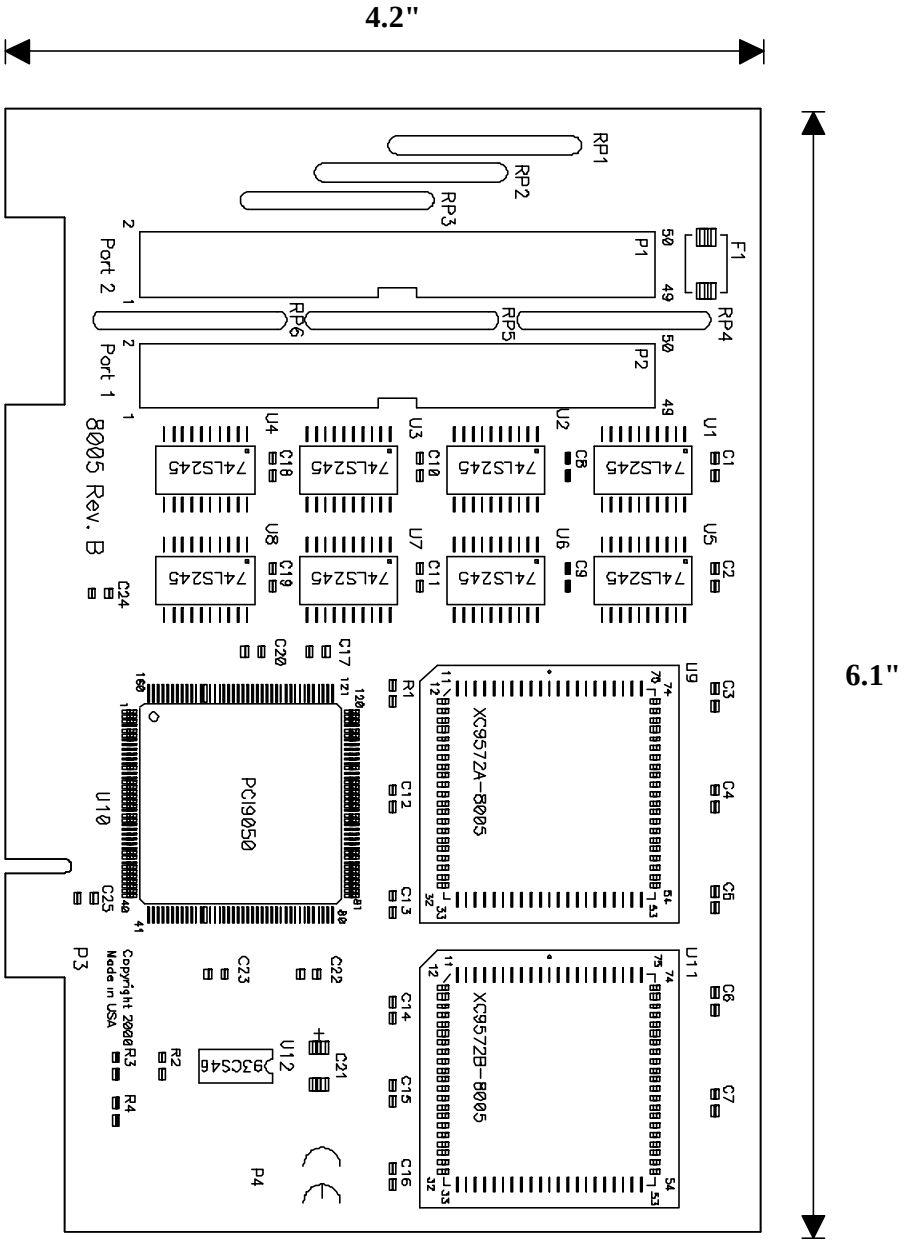
Appendix B - How To Get Assistance

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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www.sealevel.com
email: support@sealevel.com

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

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