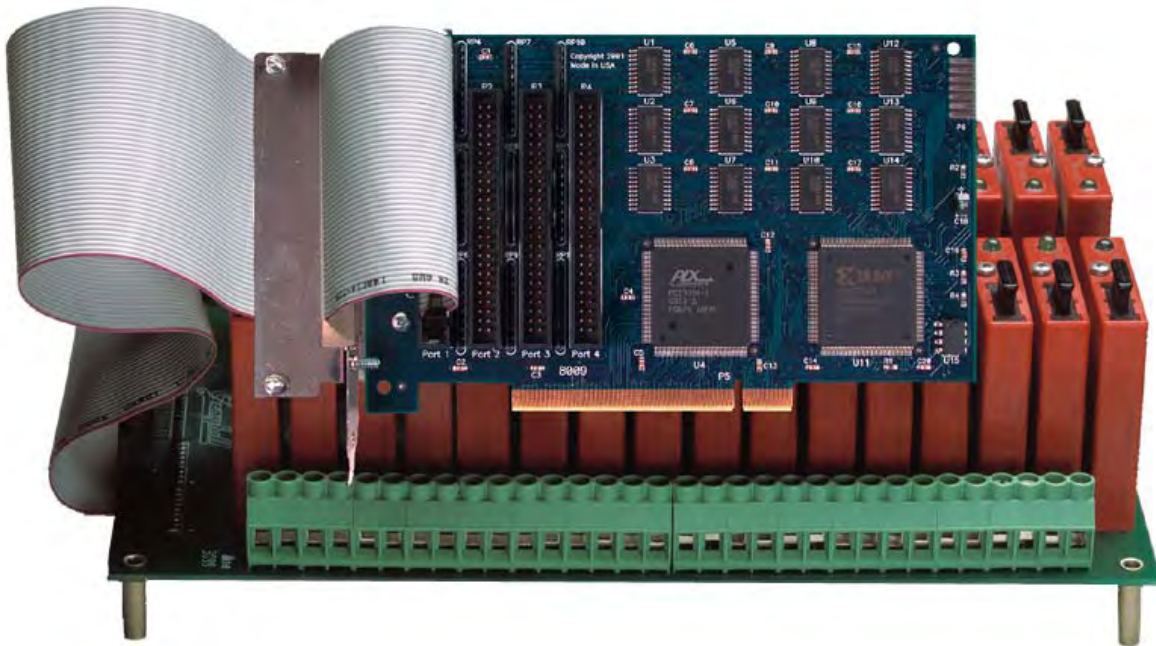


PIO-96.PCI User Manual



Part Number 8009



Table of Contents

INTRODUCTION.....	1
OTHER SEALEVEL PCI DIGITAL I/O PRODUCTS	1
BEFORE YOU GET STARTED.....	2
WHAT’S INCLUDED	2
OPTIONAL ITEMS.....	2
SOFTWARE INSTALLATION	4
PHYSICAL INSTALLATION	6
DIGITAL I/O INTERFACE.....	7
50-PIN HEADER CONNECTORS	7
PROGRAMMING THE PIO-96.PCI	8
PROGRAMMING FOR WINDOWS.....	8
PROGRAMMING FOR LINUX	8
DIRECT HARDWARE CONTROL	8
READING THE INPUTS.....	8
READING THE OUTPUTS	8
PRESETTING AN OUTPUT PORT	9
WRITING THE OUTPUTS	9
REGISTER DESCRIPTION.....	9
I/O CONTROL WORD.....	10
ELECTRICAL CHARACTERISTICS	11
SPECIFICATIONS	11
EXAMPLE CIRCUITS.....	12
APPENDIX A - TROUBLESHOOTING	13
APPENDIX B - HOW TO GET ASSISTANCE	14
APPENDIX C – SILK SCREEN – 8009 PCB	15
APPENDIX D - COMPLIANCE NOTICES.....	16
FEDERAL COMMUNICATIONS COMMISSION STATEMENT	16
WARRANTY.....	17

Introduction

The PIO-96.PCI part number 8009 digital I/O interface provides 96 channels of buffered drive digital I/O emulating 8255 mode zero. The PIO-96.PCI can be utilized for a variety of control and automation applications including control and monitoring of TTL devices (e.g. LEDs, small solenoids, small relays) and interfacing to solid-state relay racks (SSRs) for high-power AC or DC loads.

The PIO-96.PCI's 96 digital I/O channels are accessed via four 50-pin header connectors with industry-standard pin out. Each header provides 24 bits of digital I/O divided into three eight-bit groups. Each eight-bit group may be individually configured via software command as input or output to best match your particular application requirements.

The PIO-96.PCI is designed to be used with a variety of Operating Systems including Windows 98/NT/ME/2000/XP, Linux and DOS. The Seal/O API (Application Programmer Interface) included on CD with the PIO-96.PCI provides a variety of useful high-level function calls implemented as a Windows dynamic link library (DLL) and as a Linux kernel module and library. In addition to the API, Seal/O includes sample code and utilities to simplify software development.

Other Sealevel PCI Digital I/O Products

PIO-24.PCI	(P/N 8008)	- 24 TTL Inputs/Outputs
PIO-32.PCI	(P/N 8010)	- 32 TTL Inputs/Outputs
PIO-48.PCI	(P/N 8005)	- 48 TTL Inputs/Outputs
DIO-16.PCI	(P/N 8002)	- 8 Reed Relay Outputs/8 Opto-isolated Inputs
REL-16.PCI	(P/N 8003)	- 16 Reed Relay Outputs
DIO-32.PCI	(P/N 8004)	- 16 Reed Relay Outputs/16 Opto-isolated Inputs
ISO-16.PCI	(P/N 8006)	- 16 Opto-isolated Inputs
REL-32.PCI	(P/N 8007)	- 32 Reed Relay Outputs
PLC-16.PCI	(P/N 8011)	- 8 Form C Relay Outputs/ 8 Opto-isolated Inputs

Before You Get Started

What's Included

The PIO-96.PCI is shipped with the following items. If any of these items is missing or damaged please contact Sealevel for replacement.

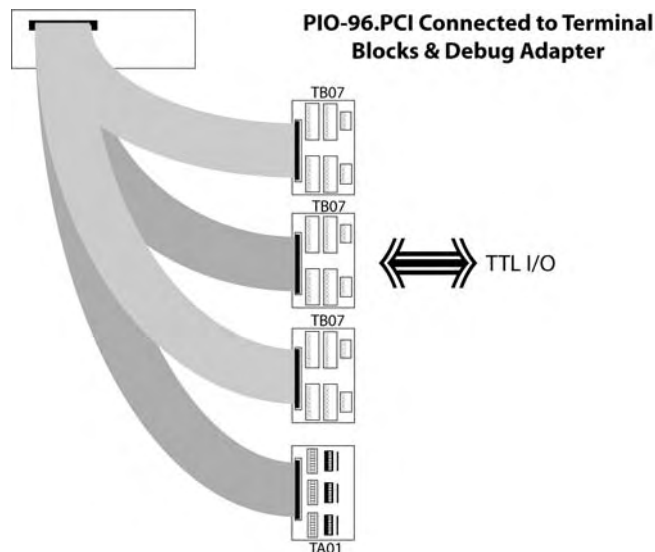
- **PIO-96.PCI Adapter**
- **Sealevel SeaI/O Software CD**

Optional Items

Depending upon your application, you are likely to find one or more of the following items useful for interfacing the PIO-96.PCI to real-world signals. All items can be purchased from our website (<http://www.sealevel.com>) or by calling (864) 843-4343.

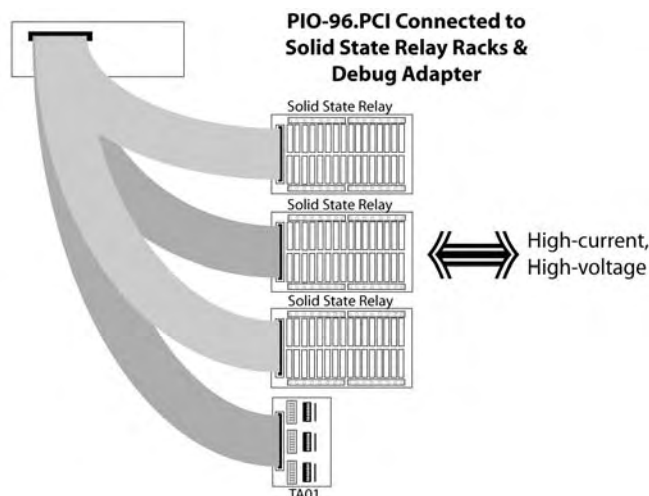
For TTL applications:

- **Terminal Block Kit - (Part Number KT107)**
 - Kit includes the TB07 screw terminal block and CA167 ribbon cable for connecting one of the PIO-96.PCI's 50-pin header connectors to your I/O. 6" Snap track and DIN rail clips are included for DIN rail mounting.
- **IDC 50 to IDC 50 Pin 40" Ribbon Cable (Part Number CA167)**
 - Interfaces each of the PIO-96.PCI's 50-pin header connectors to your I/O.
- **Simulation/debug module (Part Number TA01)**
 - Module allows monitoring status of output pins and controlling state of input pins. An LED corresponding to each port bit illuminates to indicate state. Eight position DIP-switches are used to generate input status changes.



For high-current, high-voltage applications:

- **IDC 50 to IDC 50 Pin Ribbon Cable (Part Number CA167)**
 - 40” cable connects the PIO-96.PCI to solid-state relay racks equipped with 50-pin header interface.
- **IDC 50 to IDC 50 Pin Ribbon Cable (Part Number CA135)**
 - 40” cable connects the PIO-96.PCI to solid-state relay racks equipped with 50-pin edge connector.
- **Solid-State Relay Racks:**
 - **Quad six position relay rack (Part Number PB24HQ)**
 - Relay rack can accept up to six QSSRs for a total of 24 channels. Features a 50-pin header connector for easy interface via 50-conductor ribbon cables.
 - **Quad four position relay rack (Part Number PB16HQ)**
 - Relay rack can accept up to four QSSRs for a total of 16 channels. Features a 50-pin header connector for easy interface via 50-conductor ribbon cables.
- **Quad Solid-State Relay Modules:**
 - **AC Input (Part Number IA5Q)** - Provides 4 channels of discrete I/O interface to monitor AC inputs up to 140V @ 10mA.
 - **DC Input (Part Number IB5Q)** - Provides 4 channels of discrete I/O interface to monitor DC inputs from 3.3V to 32V.
 - **AC Output (Part Number OA5Q)** - Provides 4 channels of discrete I/O interface to control AC outputs up to 140V @ 3A.
 - **DC Output (Part Number OB5Q)** - Provides 4 channels of discrete I/O interface to control DC outputs up to 60V @ 3A.
- **Simulation/debug module (Part Number TA01)**
 - Module simulates the operation and load characteristics of a standard 24-channel relay rack. An LED corresponding to each port bit illuminates to indicate state. Eight position DIP-switches are used to generate input status changes.



Software Installation

Windows 98/ME/2000/XP Installation

1. Start Windows.
2. Insert the Sealevel Systems CD in to your CD drive.
3. If 'Auto-Start' is enabled for this drive the software will automatically launch. Otherwise, point your browser to the 'Index.htm' on the root directory of the CD
4. Select 'Install Software'.
5. Select the Part Number for your adapter from the listing.
6. Select 'Windows 98/ME/2000/XP'. The setup file will automatically detect the operating environment and install the proper components. Next (depending on your browser) select the 'Run this program from its current location' or 'Open' option. Follow the information presented on the screens that follow.
7. A screen may appear with the declaration: "The publisher cannot be determined due to the problems below: Authenticode signature not found." Please select the 'Yes' button and proceed with the installation. This declaration simply means that the Operating System is not aware of the driver being loaded. It will not cause any harm to your system.
8. During setup the user may specify installation directories and other preferred configurations. This program also adds entries to the system registry that are necessary for specifying the operating parameters for each driver. An uninstall option is also included to remove all registry/INI file entries from the system.

Windows NT Card Installation: After accomplishing the above steps, bring up the Control Panel and double-click on the SeaIO Devices icon. To install a new card, click "Add Port". Repeat this procedure for as many SeaIO cards as you wish to install.

Linux Installation

Note: You MUST have "root" privileges to install the software and drivers.

1. Login as "root".
2. Mount the CDROM by typing:

```
mount -t iso4860 /dev/hdc /cdrom
```

Note: Your cdrom may not be /dev/hdc it could be /dev/hda, /dev/hdb, /dev/hdd, or if you have a SCSI drive /dev/sda, /dev/sdb, /dev/sdc, etc. You may mount the CDROM to any location, the /cdrom is just a common example.

3. Next change to the directory where you mounted the CDROM:

```
Ex. cd /cdrom/software/SeaIO/Other/linux
```

Note: The syntax is case sensitive.

4. Copy seaio .tar.gz to your home directory by typing:

```
cp seaio .tar.gz ~
```

5. Change to your home directory by typing:

```
cd
```

6. Unmount the drive and then Unzip and Untar the drivers and software by typing:

```
umount /cdrom
```

```
tar -xvzf seaio .tar.gz
```

7. Change to the SeaIO directory by typing:

```
cd SeaIO
```

8. Now compile and prepare the drivers for use:

```
make install
```

9. With the system off and unplugged, install your SeaIO PCI card.

10. Plug system back in and boot Linux.

```
Login as "root".
```

11. Load the driver by typing:

```
SeaIO -load
```

The driver has enabled the card and is ready to use, and you now have the option to run a test utility on it. Skip to section "Using the test software" if you wish to do so at this time.

To set up Linux to automatically load the driver; refer to a Linux manual concerning your specific distribution for help.

Physical Installation

The adapter can be installed in any 5V PCI expansion slot.

Do not install the Adapter in the machine until the software has been fully installed.

1. **Turn off PC power. Disconnect the power cord.**
2. Remove the PC case cover.
3. Locate an available 5V PCI slot and remove the blank metal slot cover.
4. Gently insert the PCI adapter into the slot. Make sure that the adapter is seated properly.
5. After the adapter has been installed, the cables should be routed thru the opening in the bracket. This bracket also features a strain relief function that should be used to prevent un-expected cable removal.
6. Replace the screw you removed for the blank and use it to secure the adapter into the slot. (This is required to ensure FCC Part 15 compliance.)
7. Replace the cover.
8. Connect the power cord

The PIO-96.PCI is now ready for use.

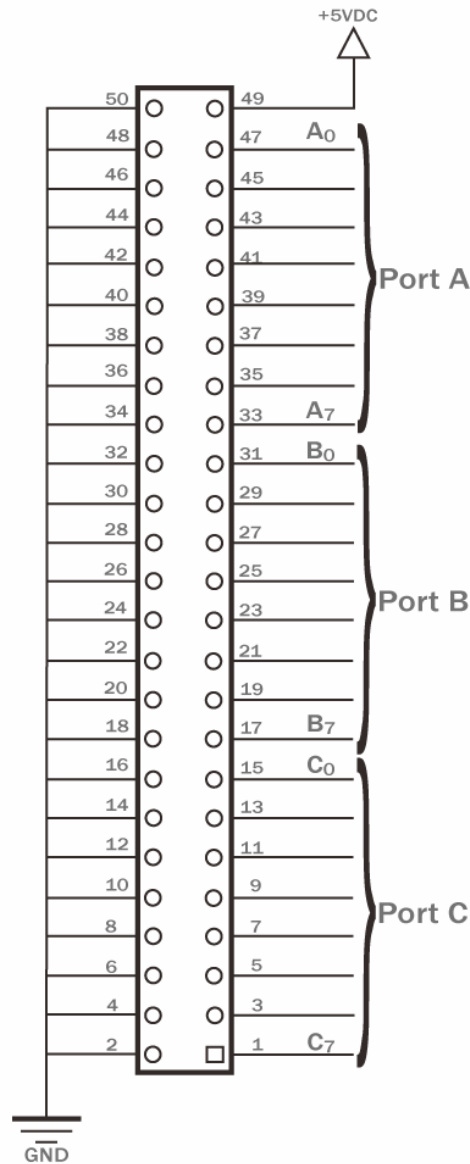
Digital I/O Interface

The PIO-96.PCI's 96 digital I/O channels are accessed via four industry-standard 50-pin header connectors. Each header provides 24 bits of digital I/O divided into three eight-bit ports. Each port may be individually configured via software command as input or output.

50-pin Header Connectors

You will need to install the bracket assembly and cables to the PIO-96.PCI prior to installing it in the PC. The PIO-96.PCI's bracket features a unique cable clamp that provides a solid strain relief to prevent inadvertent cable removal.

Each of the four 50-pin connectors has the following pin out which is compatible with a wide variety of solid state relay racks:



Programming the PIO-96.PCI

Sealevel's SeaI/O software is provided to assist in the development of reliable applications for the Sealevel Systems family of digital I/O adapters. Included on the SeaI/O CD are driver functions for use in accessing the I/O as well as helpful samples and utilities.

Programming for Windows

The SeaI/O API (Application Programmer Interface) provides a variety of useful high-level function calls implemented in a Windows dynamic link library (DLL). The API is defined in the help file (Start/Programs/SeaIO/SeaIO Help) under "Application Programmers Interface". This help file also includes detailed information dealing with installation / removal of the software and information about latency, logic states, and device configuration.

For C language programmers we recommend using the API to access the PIO-96.PCI. If you are programming in Visual Basic, using the ActiveX control included with SeaI/O is advised.

Samples and Utilities

A variety of sample programs and utilities (both executable and source code) are included with SeaI/O. Further documentation on these samples can be found by selecting "Start/Programs/SeaIO/Sample Application Description". Information about where the files are physically stored on your disk is also included in this same file.

Programming for Linux

SeaI/O for Linux consists of two major parts: a kernel module and a library. The kernel module is a simple IO pass-through device, allowing the library to handle the more sophisticated functions provided to SeaI/O users. It is provided in a 'tarball' format and can easily be compiled and included in the kernel build.

Direct Hardware Control

In systems where the users program has direct access to the hardware (DOS) the tables that follow give the mapping and functions that the PIO-96.PCI provides.

Reading the Inputs

The inputs are active true. If an input is driven high (2V to 5.25 V) it will read as a logical one, if driven low (0V to 0.8V) it will read as a logical zero. 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 true. Writing a one (1) corresponds to 5V while writing a zero (0) corresponds to 0V, at the output.

Register Description

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	CW Port 1	WR	CW1D7	0	0	CW1D4	CW1D3	CW1D2	CW1D1	CW1D0
Base+4	Interrupt Port 1	RD/WR	0	0	0	0	0	IRQEN1	IRQC11	IRQC10
Base+5	IntStat Port 1 - 4	RD	0	0	0	0	IRQST4	IRQST3	IRQST2	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	Port C2	RD/WR	PC2D7	PC2D6	PC2D5	PC2D4	PC2D3	PC2D2	PC2D1	PC2D0
Base+B	CW Port 2	WR	CW2D7	0	0	CW2D4	CW2D3	CW2D2	CW2D1	CW2D0
Base+C	Interrupt Port 2	RD/WR	0	0	0	0	0	IRQEN2	IRQC21	IRQC20
Base+10	Port A3	RD/WR	PA3D7	PA3D6	PA3D5	PA3D4	PA3D3	PA3D2	PA3D1	PA3D0
Base+11	Port B3	RD/WR	PB3D7	PB3D6	PB3D5	PB3D4	PB3D3	PB3D2	PB3D1	PB3D0
Base+12	Port C3	RD/WR	PC3D7	PC3D6	PC3D5	PC3D4	PC3D3	PC3D2	PC3D1	PC3D0
Base+13	CW Port 3	WR	CW3D7	0	0	CW3D4	CW3D3	CW3D2	CW3D1	CW3D0
Base+14	Interrupt Port 3	RD/WR	0	0	0	0	0	IRQEN3	IRQC31	IRQC30
Base+18	Port A4	RD/WR	PA4D7	PA4D6	PA4D5	PA4D4	PA4D3	PA4D2	PA4D1	PA4D0
Base+19	Port B4	RD/WR	PB4D7	PB4D6	PB4D5	PB4D4	PB4D3	PB4D2	PB4D1	PB4D0
Base+1A	Port C4	RD/WR	PC4D7	PC4D6	PC4D5	PC4D4	PC4D3	PC4D2	PC4D1	PC4D0
Base+1B	CW Port 4	WR	CW4D7	0	0	CW4D4	CW4D3	CW4D2	CW4D1	CW4D0
Base+1C	Interrupt Port 4	RD/WR	0	0	0	0	0	IRQEN4	IRQC41	IRQC40

IntStat = Interrupt Status

I/O Control Word

Each port may be configured as either Input or Output. This is accomplished by writing the correct Control Word (CW) to the proper register.

Control Word (X = 0)								Hex Value	Port Setup		
7	6	5	4	3	2	1	0		A	B	C
1	X	X	0	0	X	0	0	80	Out	Out	Out
1	X	X	0	0	X	0	1	81	Out	Out	In
1	X	X	0	0	X	1	0	82	Out	In	Out
1	X	X	0	0	X	1	1	83	Out	In	In
1	X	X	0	1	X	0	0	88	Out	Out	In
1	X	X	0	1	X	0	1	89	Out	Out	In
1	X	X	0	1	X	1	0	8A	Out	In	In
1	X	X	0	1	X	1	1	8B	Out	In	In
1	X	X	1	0	X	0	0	90	In	Out	Out
1	X	X	1	0	X	0	1	91	In	Out	In
1	X	X	1	0	X	1	0	92	In	In	Out
1	X	X	1	0	X	1	1	93	In	In	In
1	X	X	1	1	X	0	0	98	In	Out	In
1	X	X	1	1	X	0	1	99	In	Out	In
1	X	X	1	1	X	1	0	9A	In	In	In
1	X	X	1	1	X	1	1	9B	In	In	In

Interrupt Control

When enabled interrupts are generated on port bit D0 of each A port.

n = port number

IRQENn	interrupt enable	1 = enabled	0 = disabled (0 on power up)
IRQCn0	Interrupt mode select, see table below		
IRQCn1	Interrupt mode select, see table below		

Interrupt mode select table

IRQCn1	IRQCn0	INT Type
0	0	Low level
0	1	High level
1	0	Falling edge
1	1	Rising edge

Interrupt Read

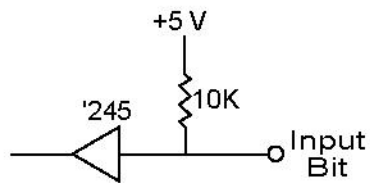
Reading the INTSTAT port (Base+5) clears any interrupt pending.

IRQST1	(D0) Interrupt status	1 = interrupt pending, 0 = none
IRQST2	(D1) Interrupt status	1 = interrupt pending, 0 = none
IRQST3	(D2) Interrupt status	1 = interrupt pending, 0 = none
IRQST4	(D3) Interrupt status	1 = interrupt pending, 0 = none

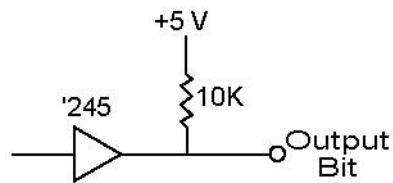
Electrical Characteristics

The PIO-96.PCI uses 74LS245 octal bi-directional transceivers to provide TTL input/output capabilities. Each bit is pulled to +5V through a 10K ohm pull-up resistor to insure each bit is at a known state when not driven.

Input Circuit Schematic



Output Circuit Schematic



Specifications

Inputs

- Logic High: Min 2VDC
- Logic Low: Max 0.8VDC

Outputs

- Logic High: Min 2VDC @ 15 mA
- Logic Low: Max 0.5VDC @ 24 mA

Temperature Range

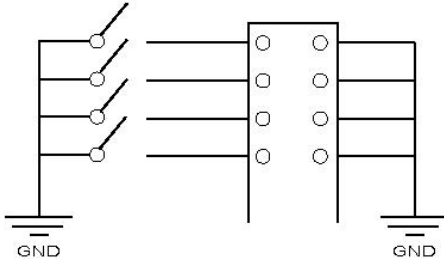
- Operating: 0°C – 70°C
- Storage: -50°C – 105°C

Power Requirements

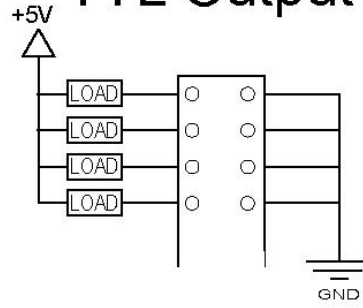
- +5VDC @ 1A

Example Circuits

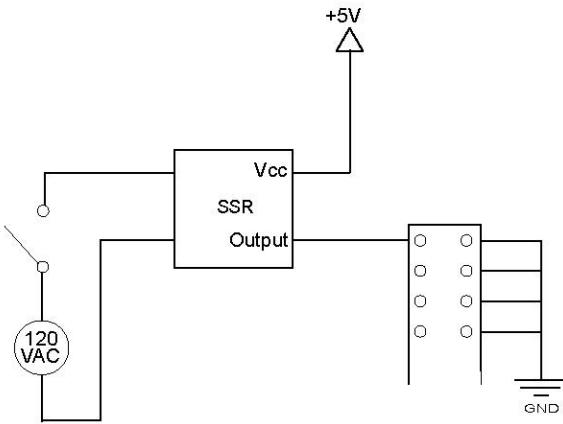
TTL Input



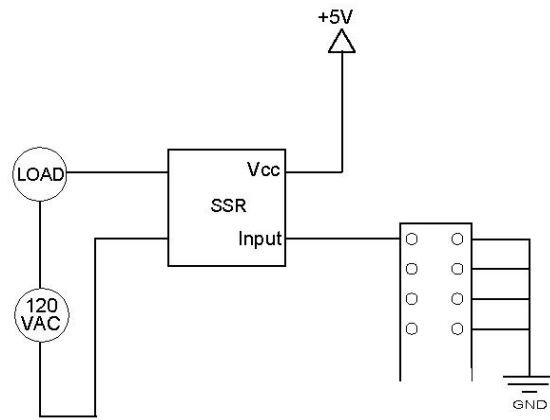
TTL Output



Solid State Relay Input



Solid State Relay Output



Appendix A - Troubleshooting

Following these simple steps can eliminate most common problems.

1. **Install software first.** After installing the software then proceed to adding the hardware. This places the required installation files in the correct locations.
2. Read this manual thoroughly before attempting to install the adapter in your system.
3. Use Device Manager under Windows to verify proper installation.
4. Use the SeaIO Control Panel applet or the Device Manager's property page for card identification and configuration.
5. 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. For email support contact <mailto:support@sealevel.com>.

Appendix B - How To Get Assistance

Begin by reading through the Trouble Shooting Guide in Appendix A. If assistance is still needed please see below.

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.

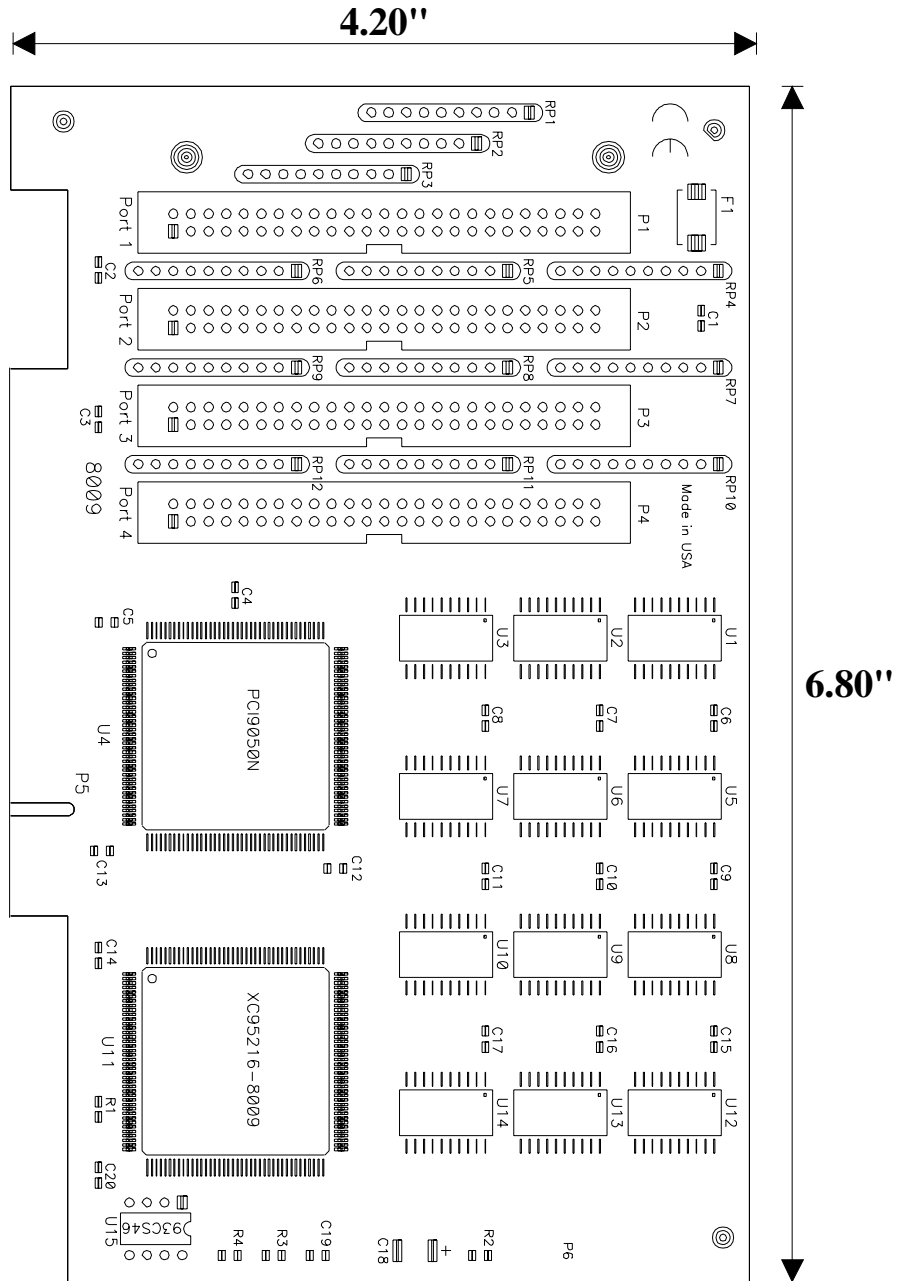
Sealevel Systems provides an FAQ section on its web site. Please refer to this to answer many common questions. This section can be found at <http://www.sealevel.com/faq.asp>

Sealevel Systems maintains a Home page on the Internet. Our home page address is <http://www.sealevel.com>. The latest software updates, and newest manuals are available via our FTP site that can be accessed from our home page.

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 – 8009 PCB



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 the users 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 to prevent or correct the interference.

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's commitment to providing the best I/O solutions is reflected in the Lifetime Warranty that is standard on all Sealevel manufactured products. We are able to offer this warranty due to our control of manufacturing quality and the historically high reliability of our products in the field. Sealevel products are designed and manufactured at its Liberty, South Carolina facility, allowing direct control over product development, production, burn-in and testing.

Sealevel Systems, Inc. (hereafter "Sealevel") warrants that the Product shall conform to and perform in accordance with published technical specifications and shall be free of defects in materials and workmanship for life. In the event of failure, Sealevel will repair or replace the product at Sealevel's sole discretion. Failures resulting from misapplication or misuse of the Product, failure to adhere to any specifications or instructions, or failure resulting from neglect or abuse are not covered under this warranty.

Warranty service is obtained by delivering the Product to Sealevel and providing proof of purchase. **Return authorization must be obtained from Sealevel Systems before returned merchandise will be accepted. Authorization is obtained by calling Sealevel Systems and requesting a Return Merchandise Authorization (RMA) number.** The Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to Sealevel, and to use the original shipping container or equivalent. Warranty is valid only for original purchaser and is not transferable.

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.

This warranty applies to Sealevel manufactured Product. Product purchased through Sealevel but manufactured by a third party will retain the original manufacturer's warranty.

**Sealevel Systems, Incorporated
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Liberty, SC 24857 USA
(864) 843-4343 FAX: (864) 843-3067
www.sealevel.com
email: support@sealevel.com**

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

Trademarks

Sealevel Systems, Incorporated acknowledges that all trademarks referenced in this manual are the service mark, trademark, or registered trademark of the respective company.