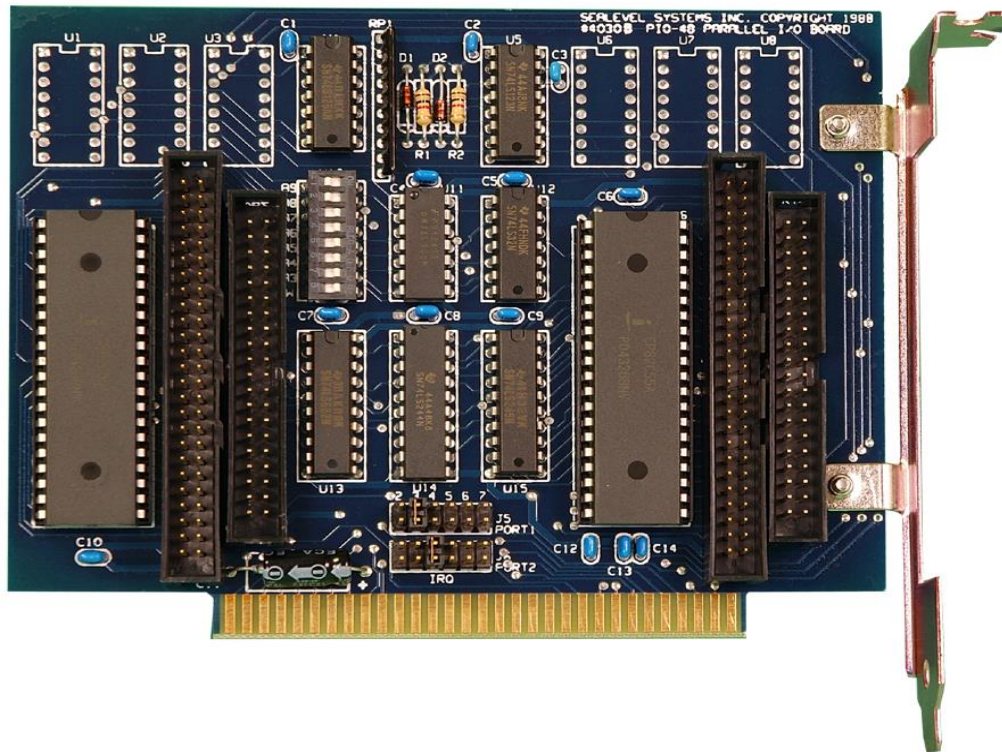


PIO-48

User Manual | 4030



SEALEVEL®

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Introduction

Overview

The PIO-48 part number 4030 digital I/O interface provides 48 channels of buffered drive digital I/O emulating 8255 mode zero. The PIO-48 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-48's 48 digital I/O channels are accessed via two 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 application requirements.

The PIO-48 is designed to be used with a variety of Operating Systems including Windows 98/NT/ME/2000/XP/7/8, Linux, and DOS. The Seal/O API (Application Programmer Interface) included on CD with the PIO-48 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 ISA Digital I/O Products

DIO-16	(P/N 3096)	-8 Reed Relay Outputs / 8 Opto-Isolated Inputs
ISO-16	(P/N 3094)	-16 Optically Isolated Inputs
REL-16	(P/N 3095)	-16 Reed Relay Outputs
DIO-32B	(P/N 3093)	-16 Reed Relay Outputs / 16 Opto-Isolated Inputs
REL-32	(P/N 3098)	-32 Switched Relay Outputs

Before You Get Started

What's Included

The PIO-48 is shipped with the following items. If any of these items is missing or damaged, please contact Sealevel for replacement.

- **PIO-48 Adapter**

Advisory Conventions



Warning

The highest level of importance used to stress a condition where damage could result to the product, or the user could suffer serious injury.



Important

The middle level of importance used to highlight information that might not seem obvious or a situation that could cause the product to fail.



Note

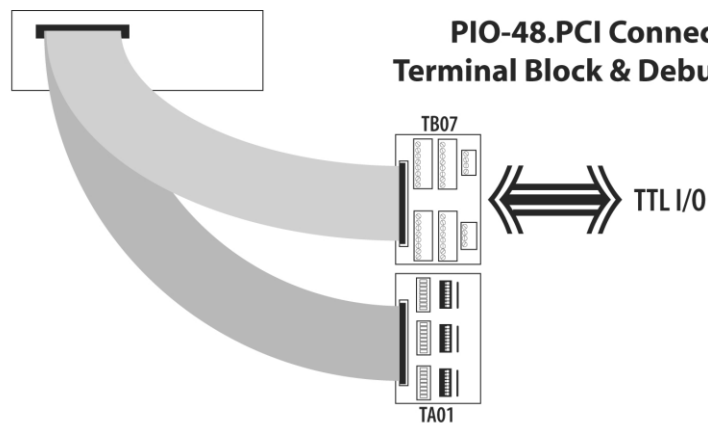
The lowest level of importance used to provide background information, additional tips, or other non-critical facts that will not affect the use of the product.

Optional Items

Depending upon your application, you are likely to find one or more of the following items useful for interfacing the PIO-48 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-48'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-48's 50-pin header connectors.
- **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.

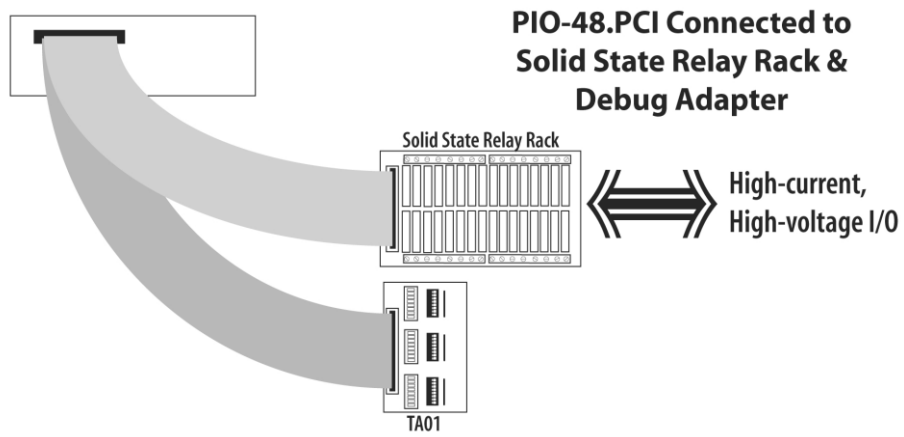


Optional Items, Continued

For high-current, high-voltage applications:

- **IDC 50 to IDC 50 Pin Ribbon Cable (Part Number CA167)**
 - 40" cable connects the PIO-48 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-48 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.

Optional Items, Continued



Card Setup

The PIO-48 contains several jumper straps for each port that must be set for proper operation.

Address Selection

The PIO-48 occupies 8 consecutive I/O locations. Dip-switch SW1 sets the base address for the PIO-48. Be careful when selecting the base address as some selections conflict with existing PC ports. The following table shows several examples that usually do not cause a conflict.

Address	Binary	Switch Settings							
		1	2	3	4	5	6	7	8
280-287	10 1000 0XXX	Off	On	Off	On	On	On	On	On
2A0-2A7	10 1010 0XXX	Off	On	Off	On	Off	On	On	On
2E8-2EF	10 1110 1XXX	Off	On	Off	Off	Off	On	Off	On
2F8-2FF	10 1111 1XXX	Off	On	Off	Off	Off	Off	Off	On
3E8-3EF	11 1110 1XXX	Off	Off	Off	Off	Off	On	Off	Off
300-307	11 0000 0XXX	Off	Off	On	On	On	On	On	Off
328-32F	11 0010 1XXX	Off	Off	On	On	Off	On	Off	On
3F8-3FF	11 1111 1XXX	Off	Off	Off	Off	Off	Off	Off	On

Address Selection Table

The following illustration shows the correlation between the DIP-switch setting and the address bits used to determine the base address. In the example below, address 300 is selected as the base address. Address 300 in binary is 10 0000 XXX where X = a non-selectable address bit and address bit A9 is always a 1.



DIP-Switch Illustration



Setting the switch 'On' or 'Closed' corresponds to a '0' in the address, while leaving it 'Off' or 'Open' corresponds to a '1'.

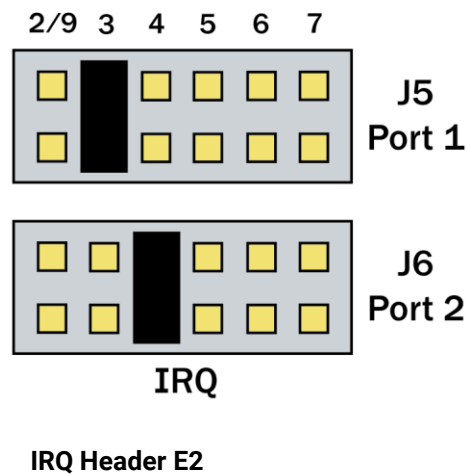
Wait States

The PIO-48 has the option of inserting one 500 nS wait state for each access. This may be required on certain machines with bus clocks in excess of 8 MHz. With the wide variety of machines available, no concrete rules exist concerning wait states. If the PIO-48 does not seem to be responding properly, try inserting a wait state.

To enable wait state insertion, set position 8 of the dip-switch to "ON". To disable wait states, set position 8 "OFF".

Interrupt Headers J5 and J6

The headers marked J5 and J6 allow the use of interrupts with the parallel ports. J5 selects IRQ2 through IRQ7 for Port 1 (U9 and J1), while J6 selects the IRQ for Port 2 (U16 and J3).



Optional Cable Connector P4

Discrete access to both sides of all relays is provided by attaching the optional cable (CA-108) to pin header P4 with the colored edge of the ribbon cable attached to pin one. Removing all the jumpers connecting row P1 to P2 places the A-side of each relay at the on-board DB-37 and the B-side at the optional cable's DB-37.

Installation

Software Installation

Windows Operating System Installation

For Windows Users

Begin by locating, selecting, and installing the correct software from the [Sealevel software driver database](#).

Seal/O software can also be downloaded from the 4030-product webpage: [ISA 48 Channel TTL Digital Interface](#).

1. Select the Part Number for your adapter from the listing.
2. Select 'SealO Classic for Windows V5.13.' Select 'Download Now.' The setup file will automatically detect the operating environment and install the proper components. Follow the information presented on the screens that follow.
3. 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.
4. 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 SealO Devices icon. To install a new card, click "Add Port." Repeat this procedure for as many SealO cards as you wish to install.

Other Operating Systems

Refer to the appropriate section of the Serial Utilities Software.

LINUX INSTALLATION

Refer to [Linux Archives - Sealevel](#). This link contains valuable information on installing your serial adapter in the various Linux releases. Also included is a series of files explaining proper Linux syntax and typical Linux serial implementations. SealO Classic for Linux V2.21 software can also be downloaded by following the instructions above and selecting 'SealO Classic for Linux V2.21' on Step 2.

For additional software support, 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: support@sealevel.com.

INSTALLATION, CONTINUED

Hardware 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 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. Replace the screw. (This is required to ensure FCC Part 15 compliance.)
6. Replace the cover.
7. Connect the power cord

Installation is finished.

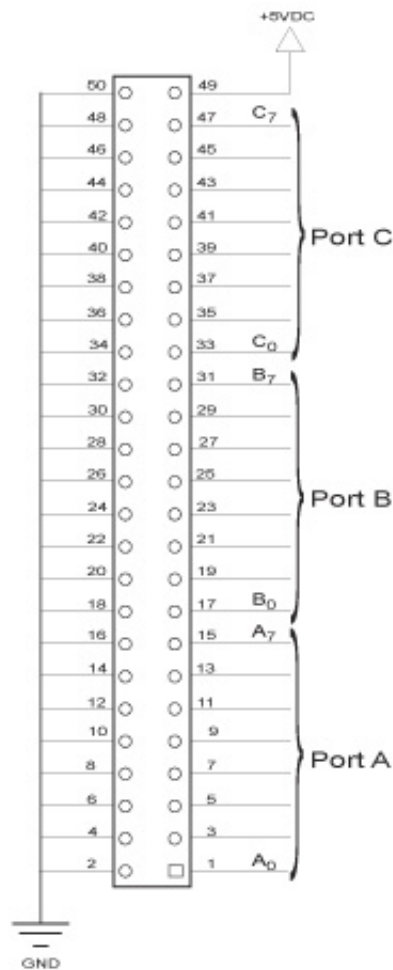
Digital I/O Interface

The PIO-48's 48 digital I/O channels are accessed via two 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-48 prior to installing it in the PC. The PIO-48's bracket features a unique cable clamp that provides a solid strain relief to prevent inadvertent cable removal.

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



Programming the PIO-48

Sealevel's Seal/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 Seal/O CD are driver functions for use in accessing the I/O as well as helpful samples and utilities.

Programming for Windows

The Seal/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/SealO/SealO 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-48. If you are programming in Visual Basic, using the ActiveX control included with Seal/O is advised.

Samples and Utilities

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

Programming for Linux

Seal/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 Seal/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 user's program has direct access to the hardware (DOS) the tables that follow give the mapping and functions that the PIO-48 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.

Programming the PIO-48, Continued

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	Port A2	RD/WR	PA2D7	PA2D6	PA2D5	PA2D4	PA2D3	PA2D2	PA2D1	PA2D0
Base+5	Port B2	RD/WR	PB2D7	PB2D6	PB2D5	PB2D4	PB2D3	PB2D2	PB2D1	PB2D0
Base+6	Port C2	RD/WR	PC2D7	PC2D6	PC2D5	PC2D4	PC2D3	PC2D2	PC2D1	PC2D0
Base+7	CW Port 2	WR	CW2D7	0	0	CW2D4	CW2D3	CW2D2	CW2D1	CW2D0

Programming the PIO-48, Continued

I/O Control Word

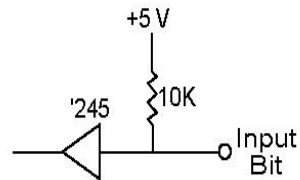
Each port may be configured as either Input or Output. This is accomplished by writing the correct Control Word (CW) to the proper register.

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

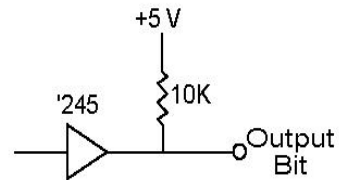
Electrical Characteristics

The PIO-48 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 ensure 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

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0° to 70° C	-50° to 105° C

Power Consumption

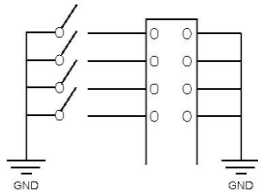
Supply Line	+12VDC	+5 VDC
Rating	25 mA	200 mA

Manufacturing

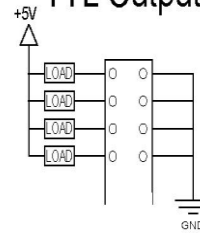
All Sealevel Systems Printed Circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Example Circuits

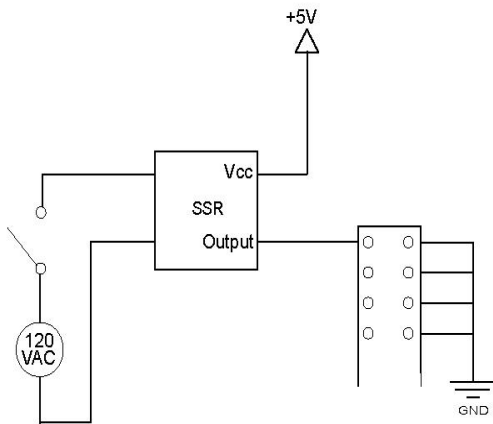
TTL Input



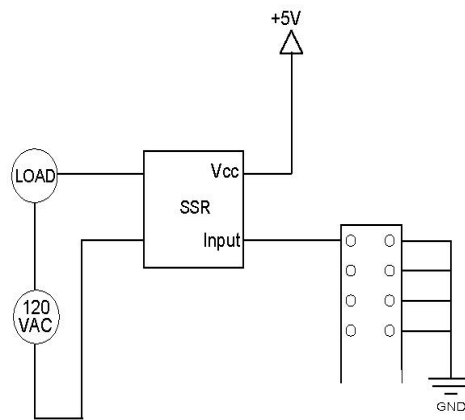
TTL Output



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 SealIO Control Panel applet or the Device Manager's property page for card identification and configuration.

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: support@sealevel.com.

Appendix B – How To Get Assistance

Please refer to: Appendix A – Troubleshooting Guide prior to calling Technical Support.

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 web page on the Internet. Our home page address is www.sealevel.com. The latest software updates, and newest manuals are available via our web site.

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– Compliance Notices

Federal Communications Commission (FCC) Statement



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 user's 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".



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 I/O 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 achieved ISO-9001:2015 certification in 2018.

Warranty Policy

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 the warranty period. 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, abuse, accidents, or acts of nature are not covered under this warranty.

Warranty service may be obtained by delivering the Product to Sealevel and providing proof of purchase. Customer agrees to ensure 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.

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

Non-Warranty Repair/Retest

Products returned due to damage or misuse and Products retested with no problem found are subject to repair/retest charges. A purchase order or credit card number and authorization must be provided in order to obtain an RMA (Return Merchandise Authorization) number prior to returning Product.

How to obtain an RMA (Return Merchandise Authorization)

If you need to return a product for warranty or non-warranty repair, you must first obtain an RMA number. Please contact Sealevel Systems, Inc. Technical Support for assistance:

Available	Monday – Friday, 8:00AM to 5:00PM EST
Phone	864-843-4343
Email	support@sealevel.com

Trademarks

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