# SEALEVEL®

# REL-16.PCIe User Manual

USER MANUAL

ITEM# 8003e

# Contents

# Before You Get Started

## WHAT'S INCLUDED

The 8003e is shipped with the following items. If any of these items are missing or damaged, please contact Sealevel for replacement.

- 8003e -REL-16.PCIe Digital I/O Adapter
- DB78 Male to DB37 Male cable (Item# CA490)
- Sealevel Software CD – SeaI/O Classic Software and User Manual

## 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.

# Product Description

The REL-16.PCIe provides16 reed relay outputs. The outputs provide high quality, long life, low current (10 Watt maximum), dry contact switch closures. Reed relays are well suited for low current applications. The relays are normally open, and close when energized.

The SeaI/O Classic software drivers and utilities are included on the CD and make installation and operation easy using Windows 7, Vista, and XP operating systems. The SeaI/O API (Application Programmer Interface) 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. SeaI/O also includes sample code and utilities to simplify software development.

## FEATURES

- PCI Express X1 compliant

- 16 Reed relay outputs (SPST)

- Highly reliable 10VA Reed relays

- Power (+5V and +12V) and ground provided on DB78 board connector

- Includes 72" cable with DB78 Male connector to DB37 Maleconnectors (Item# CA490)

- SeaI/O Classic software supports Windows 7, Vista, and XP operating systems

- Software support for Linux available

## OPTIONAL ITEMS

Depending upon your application, you are likely to find one or more of the following items useful with the 8003e. All items can be purchased from our website (www.sealevel.com) by calling our sales team at (864) 843-4343.

### CABLES

| DB37 Male to DB37 Female Extension Cable (Item# CA112) | |
|---|---|
| This cable provides a 6' extension to the CA490. It has one DB37 Male connector and one DB37 Female connector. | |

| DB78 Male to DB78 Female Extension Cable (Item# CA233) | |
|---|---|
| This cable provides a 6' extension to the DB78 board connector on the 8006e. It has one DB78 Male connector and one DB78 Female connector. | |

| DB78 Male to (1) DB37 Male (Output) Cable (Item# CA490) | |
|---|---|
| The CA490 is a 72 inch cable with a DB78 male connector that is compatible with the board connector on the 8003e. The other end of the cable terminates in a DB37 male connector for digital outputs. This is the replacement for the cable that ships with the 8003e PCI Express digital I/O interface. | |

## TERMINAL BLOCKS

### DB37 Terminal Block (Item# TB02-KT)

The TB02-KT terminal block can be used to break out serial and digital DB37 connectors to screw terminals for easy field wiring. The terminal block was designed with both DB37 male and female connectors, therefore; it can be used with any DB37 board regardless of the board's port gender.

The TB02-KT ships with a RoHS compliant TB02 terminal block, a 6 piece of slotted Snap Track, and two DIN-rail mounting clips.

### Terminal Block Kit – TB02 + CA112 Cable (Item# KT101)

Terminal Block KT101 includes the TB02 and CA112 (DB37 M/F cable). This cable kit can be used with both 37 pin Digital I/O and Serial I/O products.

## BOOKS

### The Digital I/O Handbook - A Practical Guide to Industrial Input and Output Applications (Item# REF101)

Renowned technical author Jon Titus and the President and CEO of Sealevel Systems, Tom O'Hanlan, clearly explain real-world digital input/output implementation from both a hardware and software perspective. Whether you are a practicing engineer or a student, The Digital I/O Handbook will provide helpful insight you will use again and again.

# Electrical Specifications

## FEATURES

- 2 I/O ports with each having 8 SPST relays
- DB-37 Male connector for relay outputs
- Highly reliable 10 VA reed relays
- Multiple adapters can reside in same computer

## OUTPUT RELAYS

| | |
|---|---|
| Contact Max Power Rating | 10 W |
| Contact Voltage Maximum | 100 VDC/VAC |
| Contact Current Maximum | .5A AC/DC RMS |
| Contact Resistance, Initial | .15 Ω |
| Rated Life | |
| Low Load | 200 Million Closures |
| Maximum Load | 100 Million Closures |
| Contact Speed | |
| Operate | .5 mS |
| Release | .5 mS |
| Bounce | .5 mS |
| Maximum Operating Speed | 600 Hz |

# Technical Specifications

## DIMENSIONS

| PCB Length | PCB Height |
|---|---|
| 6.5" (16.5 cm) | 4.2" (10.7 cm) |

## ENVIRONMENTAL SPECIFICATIONS

| Specification | Operating | Storage |
|---|---|---|
| Temperature Range | 0° to 70° C (32° to 158° F) | -50° to 105° C (-58° to 221° F) |
| Humidity Range | 10 to 90% R.H. Non-Condensing | 10 to 90% R.H. Non-Condensing |

## 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.
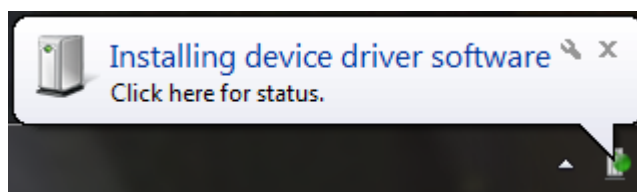
# Hardware Installation

⚠️  Do not install the PCI Express board until the software has been successfully installed.

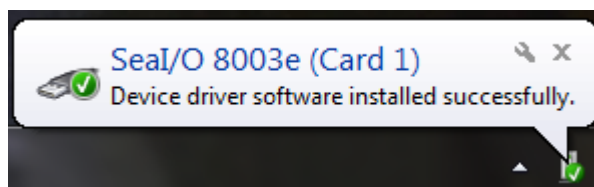The REL-16.PCIe does not need to be configured prior to installation.

Once you have installed the SeaI/O Classic software, install the board into an available PCI Express slot and boot the computer. The Found New Hardware wizard will appear. The drivers that were installed during the software installation process will automatically be used to configure the adapter.

The following instructions are applicable to the Windows XP operating system and may vary depending on your version of Windows.  If you are using the Microsoft Windows 7 operating system, the installation is automatic.

1.  After the software installation is complete, shut down the PC. Install the REL-16.PCIe into an available PCI Express slot and boot the computer.

2.  A 'Found New Hardware' alert will appear above the system tray.



3.  When the 'Found New Hardware' alert informs you that your hardware is installed and ready to use, you can proceed with verifying the installation to check functionality if necessary.



## VERIFYING INSTALLATION

To confirm that the digital I/O card has been successfully installed and recognized by your operating system, look in the Windows Device Manager.

To access Device Manager, follow the steps below:

1.  Right click on 'Computer' icon on your desktop or in the Start menu.

2.  Click 'Manage' in the fly out menu to launch the 'Computer Management' console window.

3.  In the left pane under 'System Tools', click 'Device Manager'.

4. In right pane near the bottom, expand the 'SeaI/O Device' section by clicking the '+' symbol. This shows the parent device is installed correctly.

5. You should see the card assignment listed as 'SeaI/O 8003e' with the card number in parentheses. The card number will increment for each additional SeaI/O device installed.



The REL-16.PCIe is now ready for use.

# Programming the REL-16.PCIe

Sealevel's SeaI/O Classic software is provided to assist in the development of reliable applications for the Sealevel Systems family of PCI and PCI Express digital I/O adapters. The SeaI/O Classic software is included on the CD that shipped with the board. The software contains driver functions for use in accessing the I/O as well as helpful samples and utilities.

## PROGRAMMING FOR WINDOWS

The SeaI/O Classic 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 REL-16.PCIe.  If you are programming in Visual Basic 6 or earlier, 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.

## DIGITAL I/O INTERFACE

The REL-16.PCIe provides two parallel output ports. The ports are organized as ports A and B. Ports A and B are reed relay output ports. Assuming an I/O address of 4000 Hex the following table shows the Port Addresses.

| Base Address | Hex | Decimal | Mode |
|---|---|---|---|
| Port A Address | 4002 | 16386 | Reed Relay Output Port |
| Port B Address | 4003 | 16387 | |

## OUTPUT PORTS (REED RELAY)

Reed relays provide very high quality, long life, low current (10 Watt maximum), dry contact switch closures. Reed relays are not suited for high current applications, and can be destroyed by inductive load switching, where a spark occurs across the contacts internally. The relays are normally open, and close when energized.

## OUTPUT PORTS (REED RELAY) PIN ASSIGNMENTS (DB-37 MALE)

Outputs are interfaced via the DB-37 male connector on the supplied CA490 cable.

| Signal Name | Port A Output Pin Pairs |
|---|---|
| Port A Bit 0 | 2,20 |
| Port A Bit 1 | 3,21 |
| Port A Bit 2 | 4,22 |
| Port A Bit 3 | 5,23 |
| Port A Bit 4 | 6,24 |
| Port A Bit 5 | 7,25 |
| Port A Bit 6 | 8,26 |
| Port A Bit 7 | 9,27 |
| Port B Bit 0 | 10,28 |
| Port B Bit 1 | 11,29 |
| Port B Bit 2 | 12,30 |
| Port B Bit 3 | 13,31 |
| Port B Bit 4 | 14,32 |
| Port B Bit 5 | 15,33 |
| Port B Bit 6 | 16,34 |
| Port B Bit 7 | 17,35 |
| Ground | 18,36,37 |
| + 5 Volts | 19 |
| + 12 Volts | 1 |

## DB-78 FEMALE PIN ASSIGNMENTS (CARD EDGE CONNECTOR)

| Bit | Port A Pins | Port B Pins |
|-----|-------------|-------------|
| 0 | 2,20 | 10,28 |
| 1 | 3,21 | 11,29 |
| 2 | 4,22 | 12,30 |
| 3 | 5,23 | 13,31 |
| 4 | 6,24 | 14,32 |
| 5 | 7,25 | 15,33 |
| 6 | 8,26 | 16,34 |
| 7 | 9,27 | 17,35 |

| | | |
|------|----------|----------|
| GND | 39,57,58 | 18,36,37 |
| +12V | 38 | 1 |
| +5V | 56 | 19 |

## 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 REL-16.PCIe provides.

| Function Available | Port | Address Hex | Port Type |
|---|---|---|---|
| RD/WR | A | Base + 2 | Reed Relay Output Port |
| RD/WR | B | Base + 3 | |

RD/WR = Read or Write

## READING THE OUTPUTS

The relay ports return the ones complement of the value that is currently being used to drive the relays.
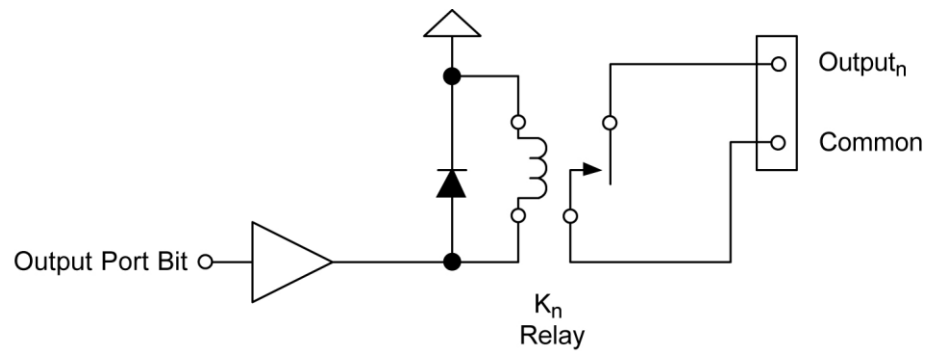
## WRITING THE OUTPUTS

The output ports are the only ports that can be written.  The relays on a standard REL-16.PCIe are normally open. To close a relay a one must be written to the appropriate bit.

## REGISTER DESCRIPTION

| Address | | Mode | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|---|---|
| Base+2 | Output Port A | RD/WR | PCD7 | PCD6 | PCD5 | PCD4 | PCD3 | PCD2 | PCD1 | PCD0 |
| Base+3 | Output Port B | RD/WR | PDD7 | PDD6 | PDD5 | PDD4 | PDD3 | PDD2 | PDD1 | PDD0 |

# Example Circuits

In the above circuit diagram, $Output_n$ is one of the two Output Pair Pins from the table labeled Output Ports Pin Assignments.  Common is the other pin listed in Output Pair Pins.  Since this is an isolated output, the polarity is not important.

# Software Installation

This section contains helpful information pertaining to the installation of supported Sealevel Systems, Inc. software packages. First, the process of acquiring the software is discussed. Next, the installation is detailed in a step-by-step guide for Windows and Linux operating systems.

## WHERE TO GET SEALEVEL SOFTWARE

All Sealevel products are shipped with media containing the installers for each software package available. If the media is otherwise unavailable or if desired, the current versions of Sealevel software packages can be obtained from the Sealevel website (see following instructions). If you already have the Sealevel software, proceed to the Windows or Linux installation section.

1. Sealevel software for Windows and Linux operating systems is available at these links:

   - [Software for Windows](#)

   - [Software for Linux](#)

2. Choose the link for the desired software package and click on the 'Download File' link to download the current driver.

3. Proceed to the Manual Software Installation guide for your operating system.


## WINDOWS INSTALLATION

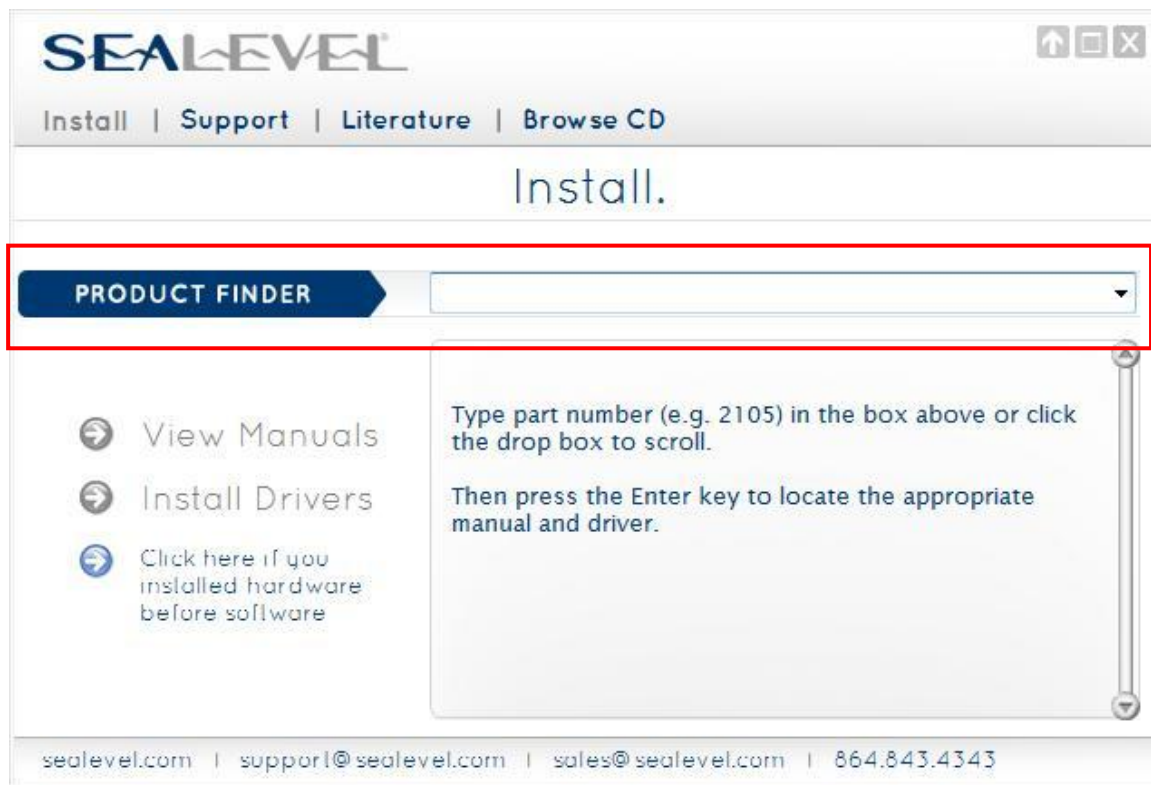Do not connect the hardware until the software has been successfully installed.

To install Sealevel software, you must log in as an administrator or have administrator privileges in Windows.

## GUIDED SOFTWARE INSTALLATION

1. Insert the Sealevel media into your PC.
2. If the 'AutoRun' feature is enabled for this media the software will automatically launch.
3. Otherwise, navigate to the root directory of the media and double-click the 'autorun.exe' application to launch the installation window.
4. Select 'Install' as demonstrated in the image below.

5. Type the part number for your adapter in the text box and press the 'Enter' key, or click on the drop box to scroll from the listing to select your product.



If you installed your hardware prior to loading/installing the software, please click on the 'Click here if you installed hardware before software' link and follow the listed instructions.

1. Click the 'Install Drivers' button to launch the Installation Wizard.
2. When the InstallShield Wizard' window appears, click the 'Next' button to initiate the software installation.
3. When the 'License Agreement' window appears, accept the terms and click 'Next' to continue. You can click the 'Print' button to print out a copy of the agreement for your records. If you do not accept the terms of the agreement, the installation will stop.
4. When the 'Ready to Install the Program' window appears, click the 'Install' button to install the software onto the hard drive of your computer. The files will be automatically installed into the 'C:\Program Files' folder on your computer. Please note that on 64-bit operating systems, the files will be installed to 'C:\Program Files (x86)\'. Some versions of Windows will halt the installation and provide you with a dialog box which will ask you for permission for the installer to make changes to your computer. Click on the "Allow" button to continue installation of your Sealevel software.

5.  The setup file will automatically detect the operating environment and install the proper components. Next follow the information presented on the screens that follow. Once the installation is complete, close the disk installation window.
6.  Refer to the Physical Installation section to connect and install your hardware.

## MANUAL SOFTWARE INSTALLATION

1.  To install a software package from the Sealevel media, browse the Sealevel Systems media 'Software' directory.  For example: Software\SeaIO\Windows\SeaIO Installer.exe
2.  If you are using Windows Vista or newer operating systems, *right* click on the installer executable and choose 'Run as Administrator'. If you are using an operating system prior to Windows Vista, double click on the executable to launch the InstallShield and initiate the driver installation.
3.  Please refer to step six above in the Guided Software Installation section and follow the remaining installation steps.

## LINUX INSTALLATION

Most Sealevel Linux software is distributed as source code. To use the software, it must be compiled. Refer to the README file in each package for system prerequisites.

You must have administrative privileges to install the software. It is not necessary to have administrative privileges to build or use the software.

All command syntax is case sensitive.

1.  Insert the Sealevel media into your PC.
2.  If your desktop environment does not auto-mount the media, you will need to do so manually using the `mount` command. You may need administrative privileges for the `mount` command to succeed.
3.  Next change to the Sealevel media directory. For example, if the mount point of your optical drive is `/cdrom`:

    ```
    $ cd /cdrom/Software/SeaIO/Linux
    ```

4.  Copy [package name].tar.gz to your home directory by typing:

    ```
    $ cp SDXXYYZZ.tar.gz ~
    ```

5.  Change to your home directory by typing:

    ```
    $ cd
    ```

6.  Extract the software from the compressed archive by using:

    ```
    $ tar -zxvf SDXXYYZZ.tar.gz
    ```

7.  Change to the package directory by typing:

    ```
    $ cd seaio
    ```

8.  Compile the software from source by typing:

    ```
    $ make
    ```

9. Elevate permission level by changing to root:

```
$ su
```

Or use the 'super user do' command:

```
$ sudo -s
```

10. Install the drivers by typing:

```
$ make install
```

11. If the package contains drivers, refer to the documentation for your package to find the command that will load your drivers. For example, the SeaI/O package uses:

```
$ seaioload
```

At this point, the driver has enabled the hardware and it is ready to use.  You now have the option to run a test utility on it.  Test utilities were compiled in step 8, and they are located in the package's folder named `seaio/utilities/` and installed globally in step 10 to: `/usr/bin`.

# Appendix A – Handling Instructions

## ESD WARNINGS

### ELECTROSTATIC DISCHARGES (ESD)

A sudden electrostatic discharge can destroy sensitive components. Proper packaging and grounding rules must therefore be observed. Always take the following precautions:

1. Transport boards and cards in electrostatically secure containers or bags.
2. Keep electrostatically sensitive components in their containers, until they arrive at an electrostatically protected workplace.
3. Only touch electrostatically sensitive components when you are properly grounded.
4. Store electrostatically sensitive components in protective packaging or on anti-static mats.
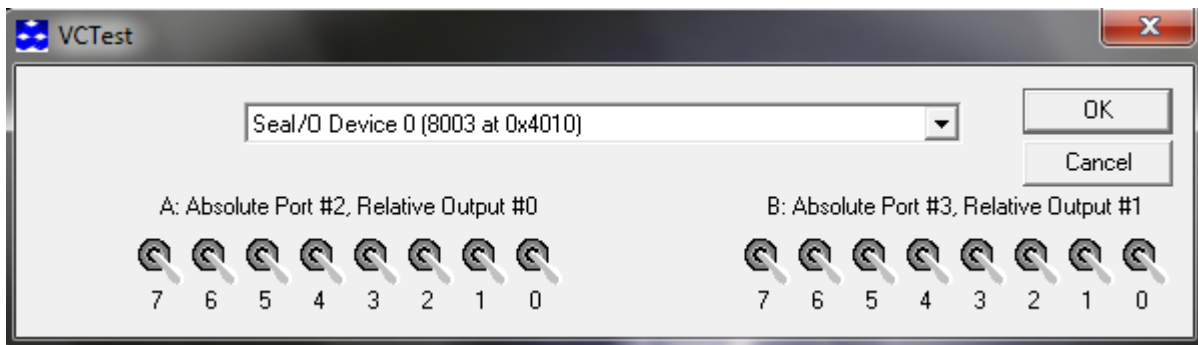
### GROUNDING METHODS

The following measures help to avoid electrostatic damages to the device:

1. Cover workstations with approved antistatic material. Always wear a wrist strap connected to a properly grounded workplace.
2. Use antistatic mats, heel straps, and/or air ionizers for more protection.
3. Always handle electrostatically sensitive components by their edge or by their casing.
4. Avoid contact with pins, leads, or circuitry.
5. Turn off power and input signals before inserting and removing connectors or connecting test equipment.
6. Keep work area free of non-conductive materials such as ordinary plastic assembly aids and Styrofoam.
7. Use field service tools such as cutters, screwdrivers, and vacuum cleaners that are conductive.
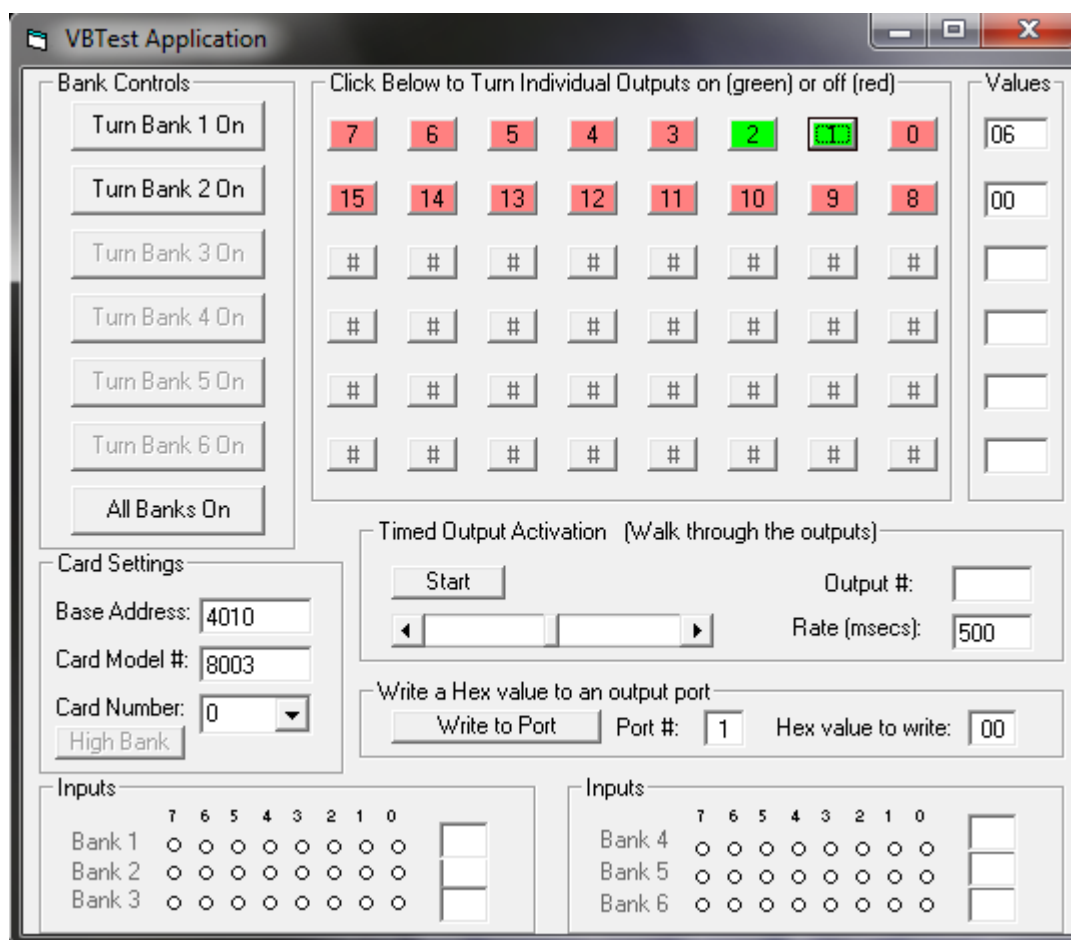
# Appendix B – Troubleshooting

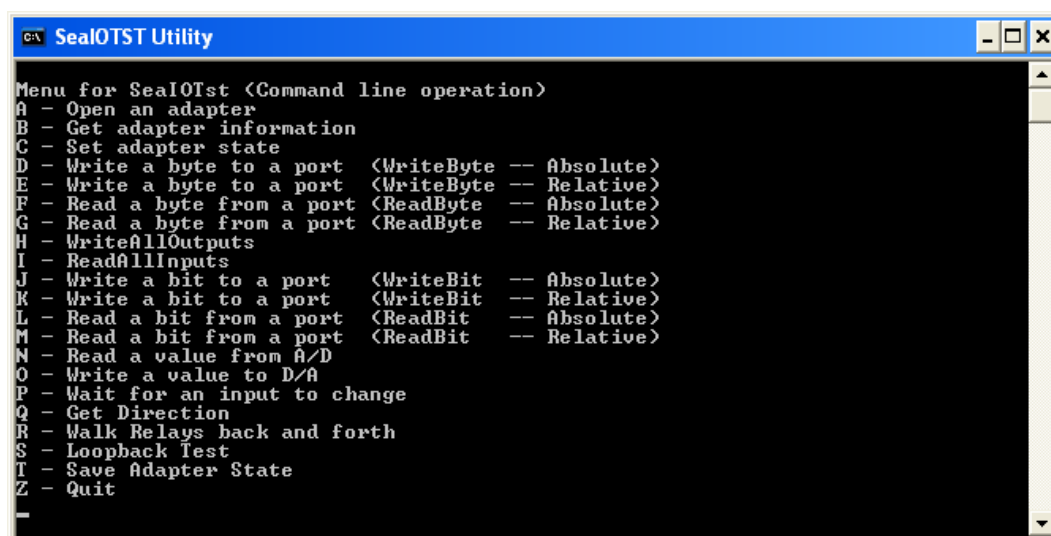Following these simple steps can eliminate most common problems.

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. Refer to the Verifying Hardware section of this manual for instructions.

4. Several utilities with source code are included to verify the functionality of the outputs and to aid in application development. Consult the pin out diagrams to test at the card edge connector or at the end of the cable.

5. Use the VCTest to verify the basic I/O functionality of your digital I/O board. The source code is included to simplify application development in the programming language C.

1.  VBTest is another utility included with SeaI/O Classic software. The source code is included to aid with Visual Basic application development.



2.  SeaIOTST is a command line utility that allows you to test the function calls from the SeaI/O Classic API.

The source code for all utilities is located in the following folder:
C:\Program Files\SeaIO\Samples

The API is documented in the SeaIO help file. Start → All Programs → SeaIO → SeaIO Help. Launch the help file and expand the Programmers Interface section.

If these steps do not solve your problem, please call Sealevel's Technical Support at (864) 843-4343. Our technical support is free and available from 8:00AM-5:00PM EST Monday through Friday. For email support contact support@sealevel.com.

# Appendix C - How to Get Assistance

When calling for technical assistance, please have the device installed and ready to run diagnostics.  If possible, have your user manual and current settings ready.

The Sealevel website is an excellent resource located at www.sealevel.com. The most current software updates and user manuals are available via our homepage by clicking on the " or ' links located under 'Technical Support.' Manuals and software can also be downloaded from the product page for your device.
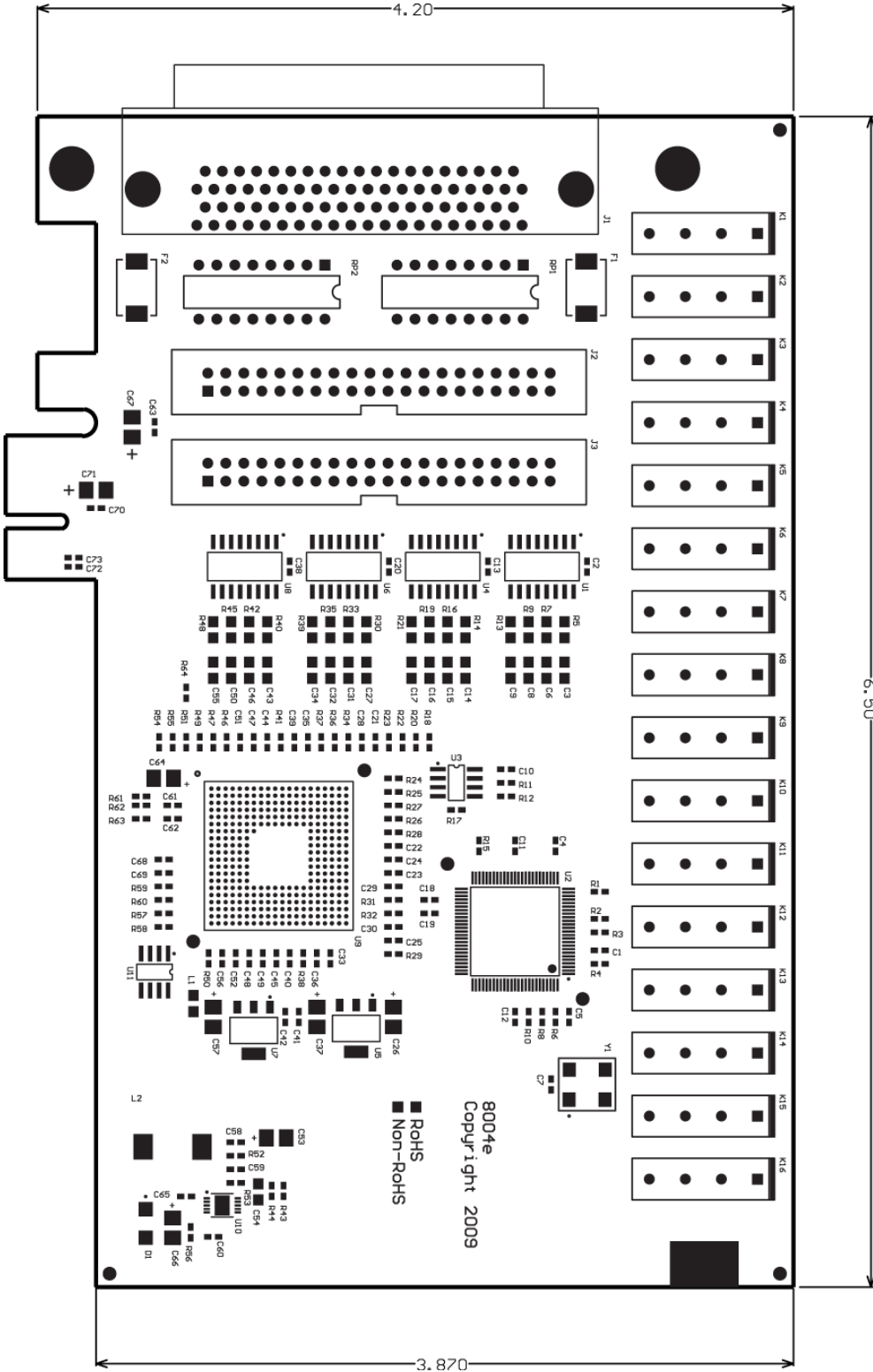
The FAQ section of our website answers many common questions. Refer to this helpful resource by visiting sealevel.com/support/category/8/FAQs

## TECHNICAL SUPPORT

Monday – Friday
8:00 am to 5:00 pm EST
Phone:  +1 (864) 843-4343
Email:  support@sealevel.com

**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 D – Drawing

# Appendix E – Compliance

## FEDERAL COMMUNICATIONS COMMISSION 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 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"

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. Relio™ industrial computers are warranted for a period of two years and the R9 family is warranted for a five year period from date of purchase. 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-9001:2008 certification in 2011.

## 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 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.

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

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