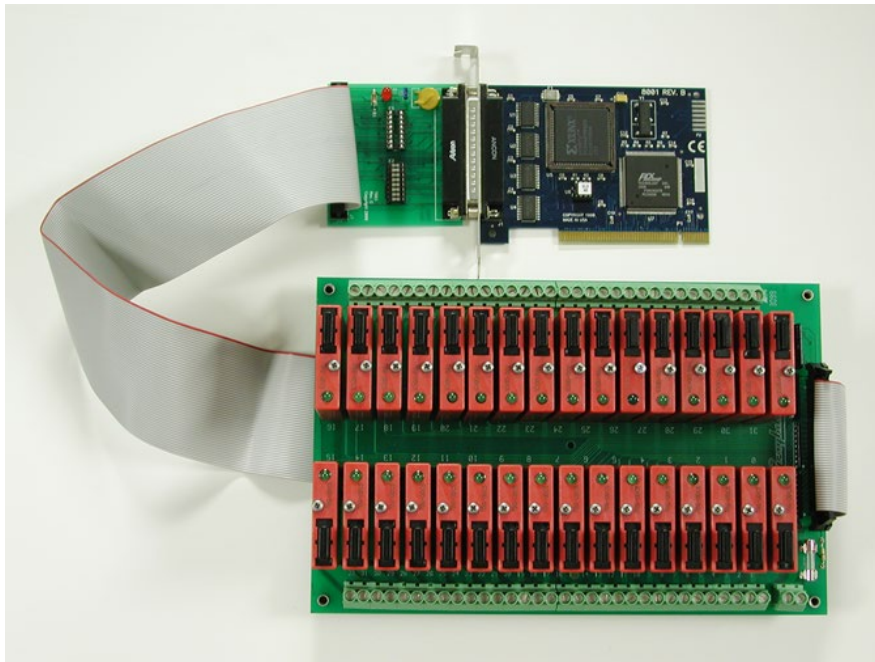


PIO-32.PCI™

User Manual | 8001



SEALEVEL®

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Introduction

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

Before You Get Started

What's Included

The PIO-32.PCI is shipped with the following items. If any of these items are missing or damaged, please contact Sealevel for replacement.

- **PIO-32.PCI Serial I/O 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.

Installation

Card Setup

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

Windows Installation



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



Only users running Windows 7 or newer should utilize these instructions for accessing and installing the appropriate driver via Sealevel's website. If you are utilizing an operating system prior to Windows 7, please contact Sealevel by calling 864.843.4343 or emailing support@sealevel.com to receive access to the legacy driver download and installation instructions.

1. Select the download for the SealO Classic for Windows ([Software: SealO Classic V5 - Windows - Sealevel.](#)) 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. 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 available to remove SealO files and registry/INI file entries from the system.
2. If installing in NT, skip to step 11. 'Windows NT Card Installation.'
3. Go to the "Add New Hardware Wizard" in the Control Panel.
4. When the Wizard asks if you want Windows to search for the new hardware, choose "No, I want to select the hardware from a list."
5. Scroll through the list of categorized hardware and select 'SealO Devices.' If this is the first SealO device you may need to select 'Other Devices' and 'Sealevel Systems, Inc.' instead of 'SealO Devices.'
6. Click "Next."
7. Select the card model and press "Next."
8. The Wizard will guide you through a few more informational prompts; continue to click "Next" until it is completed.
9. Your card's resource assignments may be adjusted through the Device Manager (if, for instance, you need to change the I/O port address Windows assigned when you installed the card).
10. Windows software installation is complete

Windows Installation, Continued

11. Windows NT Card Installation: After accomplishing step 1, bring up the Control Panel and double-click on the SealIO Devices icon. To install a new card, click "Add Port." Repeat this procedure for as many SealIO cards as you wish to install.

Linux Installation



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



The syntax is case sensitive.



Users can obtain a README file included in the SealIO Linux package which contains important installation and configuration instructions that makes the Linux installation more user friendly.

1. Login as "root"
2. Select download for the version of SealIO Classic for Linux ([Software: SealIO Classic - Linux - Sealevel.](#))

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

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

4. Change to your home directory by typing:

```
cd
```

5. Unzip and Untar the drivers and software by typing:

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

6. Change to the SealIO directory by typing:

```
cd seaio
```

7. User must download and compile a Linux kernel source.

8. Now compile and prepare the drivers for use by typing:

```
make install
```

9. Using your favorite text editor, edit the /etc/seaio.conf

10. Within the quote marks, insert

```
cardtype=0xYourSealOcardType io=0xCardBaseAddress
```

Linux Installation, Continued



YourSealOcardType = Model Number of your SealO Card.
CardBaseAddress = What base address you have your SealO card addressed at.

11. Save the file and exit your editor.
12. With the system off and unplugged, install your SealO PCI card.
13. Plug system back in and boot Linux. Login as "**root**".
14. Load the SealO driver by typing:

seaioload

15. The driver has enabled the card and is ready to use.

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

For additional software support, please call Sealevel Systems' Technical Support, (864) 843-4343. Our technical support is free and available from 8:00 AM - 5:00 PM Eastern Time, Monday through Friday. For email support contact: support@sealevel.com.

Hardware Installation

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

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

Installation is complete.

Technical Description

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

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

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

Features

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

Software

The PIO-32.PCI Software

The Seal/O software provides the user with a consistent and straightforward API, allowing the developer to concentrate on the details of the application as opposed to low level driver development. Popular development environments are supported for application development. Seal/O includes sample applications and a utility for configuring the driver parameters under Windows, further simplifying installation.

Linux Users

The Seal/O for Linux, includes a kernel-mode driver, API, and the SealOTst 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 Seal/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

For the most up to date information on third party software support, please visit [3rd Party Software Support - Sealevel](#).



I/O Connector Pin-Out DB-37 Male

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

Electrical Characteristics

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

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

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

Programming

Application Programmers Interface (API)

Most modern operating systems do not allow direct hardware access. The SealIO driver and API are available to provide control over the hardware in Windows and Linux environments.

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

Presetting an Output Port

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

Interrupts

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

Port Configuration

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

Control Word 0 = input 1 = output

Port A – Bit 0

Port B – Bit 1

Port C – Bit 2

Port D – Bit 3



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

Relative Addressing vs. Absolute Addressing

The SealO 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 (0th) 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 (0th) input port of the device will be utilized.

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

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

Absolute and Relative Addressing

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

R = Read

W = Write

R/W = Read or Write

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

Table 3-API Port/Bit Reference Numbers

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

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

Direct Hardware Control

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

Reading the Inputs

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

Reading the Outputs

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

Presetting an Output Port

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

Writing the Outputs

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

Port Configuration

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

Interrupts

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

Register Description (for direct hardware control)

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	R/W	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	R/W	PBD7	PBD6	PBD5	PBD4	PBD3	PBD2	PBD1	PBD0
Base+2	R/W	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	R/W	PDD7	PDD6	PDD5	PDD4	PDD3	PDD2	PDD1	PDD0
Base+4	R/W	{0}	{0}	{0}	{0}	DIRD	DIRC	DIRB	DIRA
Base+5	R/W	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	R Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	R Only	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Table 5-Register Description



All ports are set to input after reset or power up.

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

PAD0-7 = Port A (Base+0)
 PBD0-7 = Port B (Base+1)
 PCD0-7 = Port C (Base+2)
 PDD0-7 = Port D (Base+3)
 DIRA-D = Port A-D direction control (Base+4)

0 = input
 1 = output

IRC0-1= Interrupt Mode select (Base+5)

IRC1 IRC0

1	0	Low level
1	1	high level
2	0	falling edge

1 1 RISING EDGE

IRQEN = enable interrupts (Base+5)

0 = disabled

1 = enabled (disabled after reset or power up).

IRQST = interrupt status (Base+5)

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

Specifications

Environmental Specifications

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

Power Consumption

Supply line	+5 VDC
Rating	500 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board length	4.721 inches (12.00 cm)
Board height including Goldfingers	3.300 inches (8.39 cm)
Board height excluding Goldfingers	2.975 inches (7.56 cm)
Board weight	3.2 ounces (90.71g)

Appendix A – Troubleshooting

The adapter should provide years of trouble-free service. However, in the event that device appears to not be functioning incorrectly, the following tips can eliminate most common problems without the need to call Technical Support.

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 Seal/O control panel applet for card identification and configuration.
4. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.
5. Configure your Sealevel Systems adapter so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address.
6. Make sure the Sealevel Systems adapter is using a unique IRQ The IRQ is typically selected via an on-board header block. Refer to the section on Card Setup for help in choosing an I/O address and IRQ.
7. Make sure the Sealevel Systems adapter is securely installed in a motherboard slot.
8. If you are utilizing an operating system prior to Windows 7, please contact Sealevel's Technical support as directed below to receive more information regarding the utility software which will determine if your product is functioning properly.
9. Only users running Windows 7 or newer should utilize the diagnostic tool '[WinSSD](#)' installed in the SeaCOM folder on the Start Menu during the setup process. First find the ports using the Device Manager, then use 'WinSSD' to verify that the ports are functional.
10. Always use the Sealevel Systems diagnostic software when troubleshooting a problem. This will help eliminate any software issues and identify any hardware conflicts.

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 8:00 A.M.- 5:00 P.M. Eastern Time Monday through Friday. For email support contact support@sealevel.com.

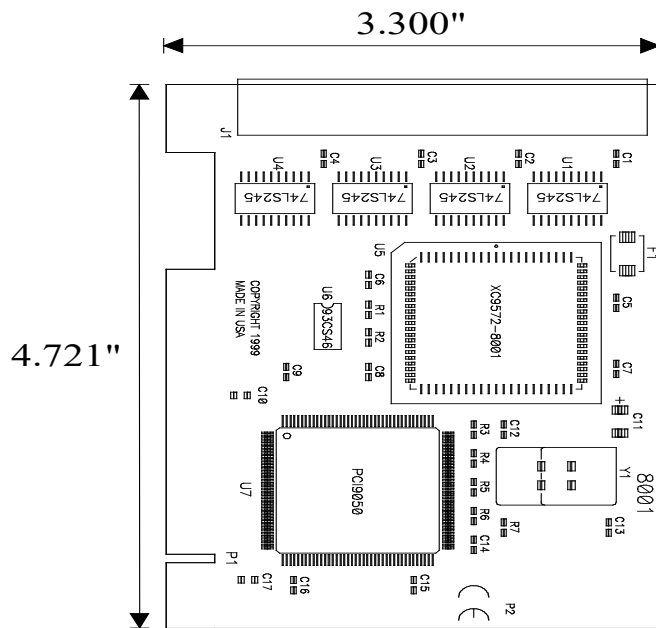
Appendix B – How To Get Assistance

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.asp>.
4. Sealevel Systems maintains a web page on the Internet. Our home page address is <https://www.sealevel.com/>. The latest software updates, and newest manuals are available via our web site.
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 (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 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".



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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