SEALEVEL
SYSTEMS INCORPORATED

PLC-16.PCI ™
USER MANUAL

Contents

Introduction

Overview

The **PLC-16.PCI** provides 8 Form C relays that can switch and carry 2A loads making it suitable for latching power, data or other electronic signals for control applications. 8 optically isolated inputs are also provided to allow monitoring of off board switch closures, relays or for any other general purpose monitoring needs. The **PLC-16.PCI** is optimized for 24V DC/AC usage.

What's Included

The **PLC-16.PCI** is shipped with the following items. If any of these items is missing or damaged, contact the supplier.

- **PLC-16.PCI** Adapter
- Sealevel Software

Optional Cables/Accessories

KT108 – Includes CA185, HD44 M/F Cable and TB08, PLC type Terminal Block.
KT109 – Includes CA184, HD44 to (2) DB37 M/F Cable and (2) TB02, 37 pin Terminal Blocks

Installation

Windows Users

Choose **Install Software** at the beginning of the CD and select the **Digital I/O** software drivers, install **SeaIO**, prior to installing hardware.

Linux Users

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

Card Setup

The **PLC-16.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.

System Installation

The **PLC-16.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 **PLC-16.PCI** into the slot. Make sure that the adapter is seated properly.
5. Connect the optional CA184 or CA185 cable assembly.
6. Replace the bracket retaining screw.
7. Replace the computer cover.
8. Connect the power cord.

Installation is complete.

Technical Description

The **PLC-16.PCI** provides two parallel input/output (I/O) ports. The ports are organized as ports A, B, C, and D. Port A is an input port interfaced to optically isolated inputs, while port C is the relay output port.

Features

Digital Inputs

- Number of inputs: Eight.

- Type: Non-polarized, optically isolated from each other and from the computer.

- Voltage Range: 5 to 24V DC or AC.

Relay Outputs

- Number of outputs: Eight.

- Contact Rating: 2A carry current, bifurcated, gold clad, silver palladium.

- Contact Arrangement: SPDT (Single Pole Double Throw) Form C.

- Contact Resistance: Initial 100 milliohms maximum.

- Contact Life: mechanical: 10 million operations minimum.

- Contact Life: electrical: 5 million operations minimum at full load.

- Operating Time: 2 milliseconds maximum.

- Release Time: 1 milliseconds maximum.

Digital Input Port

Port A is an 8 bit input port connected to optically isolated input sensors. Each sensor can be used to interface a voltage input and then sense whether the voltage is on or off. Each sensor is isolated (with respect to a common ground) from every other sensor, and also isolated with respect to the host PC ground. This means that signals such as low-level AC line voltage, motor servo voltage, and control relay signals can be 'sensed', or read by the PC, without the risk of damage due to ground loops or ground faults.

Each sensor input pair has a current limiting resistor (1K ohm) that is used to limit the input current to the opto-isolator. A current path is required to 'turn-on' the sensor.
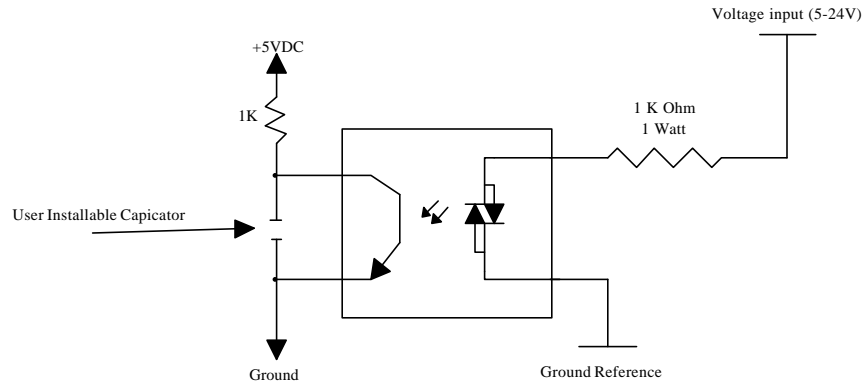
The opto-isolator has two 'back-to-back' diodes internally. This allows AC or DC signals to be sensed, regardless of polarity. When the applied voltage is high enough to cause the LED in the opto-isolator to turn-on, the output of the opto-isolator goes low (0 volts) and the signal is read as a low logic level (binary 0) by the PC. When the input signal is too low to turn on the opto-isolator, the output goes high and the port bit is read by the PC as a high logic level (binary 1).

The input impedance of each isolated input is 1K ohms. The opto-isolator requires approximately 3 mA to turn on. The maximum input current is 60 mA. Adding additional resistors to the input current limiting resistor can increase the voltage to be sensed. Two things to consider when selecting additional input resistance:

1. Turn on voltage for the circuit to sense.

2. The maximum input voltage. Maximum input voltage must not provide too much power to the input resistor, and must not overdrive the opto-isolator input current specification. The following formulas apply:

    Turn on current: 3 mA
    Isolator diode drop: 1.1 V
    Resistor power Max: 1 W

    Turn on Voltage = diode drop + (turn on current) x (resistance)

    Or:
    $$1.1 + (.003) \times R$$
    Maximum voltage = square root of (resistor value)

The input circuits are <u>not</u> for monitoring 120-volt AC circuits.

Output Port (Relay)

The PLC-16.PCI provides 8 Form C (SPDT) Electro-mechanical relays. These relays have three connections; Normally Open (NO), Normally Closed (NC) and a Common. The relays are all de-energized at power-on. Data to the relays is latched by a write to the base+2 address. On/off status of the relays can be read back by a read at the base+2 address.
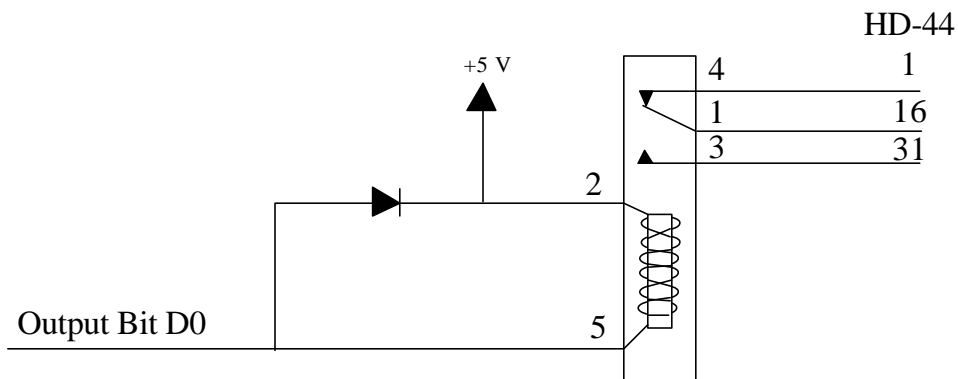
The above is a schematic representation of the Output Bit D0. The NC contact would be Pin 1 on the HD44, N0 would be Pin 31 and the Common would be Pin 16.

Port Pin Assignments

The **PLC-16.PCI** has several different cable and terminal block options. The card itself has a high-density 44-pin connector (HD44), unlike many competitive products. This allows both poles (NO/NC) of the Form C relay to be accessed as well as each input of the optically isolated input circuit to be represented as a unique pin on the connector. The following table shows the correlation between pins on the HD44 and their specific function.

HD44 Pin Assignments

Input:

Port A Bit	P1
D0	9,10
D1	11,12
D2	13,14
D3	23,24
D4	25,26
D5	27,28
D6	29,30
D7	40,41

Output:

Port C Bit	Normally Closed	Common	Normally Open
D0 (K1)	1	16	31
D1 (K2)	2	17	32
D2 (K3)	3	18	33
D3 (K4)	4	34	35
D4 (K5)	5	19	36
D5 (K6)	6	20	37
D6 (K7)	7	21	38
D7 (K8)	8	22	39

Optional Cable CA184 Pin Assignments

In our continuing effort to make our products more easily integrated into systems that may have previously used our I/O interface products, the CA184 was created. This cable mimics several of the pin-out options found on Sealevel's PCI and ISA legacy products and provides a direct connection to Sealevel's TB02, 37 pin Terminal Block. The following table shows the correlation between pins on the CA184 option cable connectors and their specific function.

Input: DB37 Female

Port A Bit	Input
D0	3,22
D1	4,23
D2	5,24
D3	6,25
D4	7,26
D5	8.27
D6	9,28
D7	10,29

Output: DB37 Male

Port C Bit	Normally Closed	Common	Normally Open
D0 (K1)	1	2	3
D1 (K2)	4	5	6
D2 (K3)	7	8	9
D3 (K4)	10	11	12
D4 (K5)	22	23	24
D5 (K6)	25	26	27
D6 (K7)	28	29	30
D7 (K8)	31	32	33

Optional Terminal Block Kit KT108

The third option for termination of the **PLC-16.PCI** is the KT108 Terminal Block Kit, which features the CA185 (HD44 M/F) and the TB08 Terminal Block adapter. This adapter is designed to allow the user to group the common connections of the **PLC-16.PCI** into groups of four. The following is the silkscreen for the TB08. Note that the connections are labeled for ease in wiring and troubleshooting:

RC 1	TB08 Revision B
K1NC	Made in USA
K1NO	
K2NC	IC 1
K2NO	ID0
K3NC	ID1
K3NO	ID2
K4NC	ID3
K4NO	IC 2
RC 2	ID4
K5NC	ID5
K5NO	ID6
K6NC	ID7
K6NO	
K7NC	
K7NO	
K8NC	NC= Normally Closed
K8NO	NO= Normally Open
	RC = Relay Common
	IC = Isolated Input Common
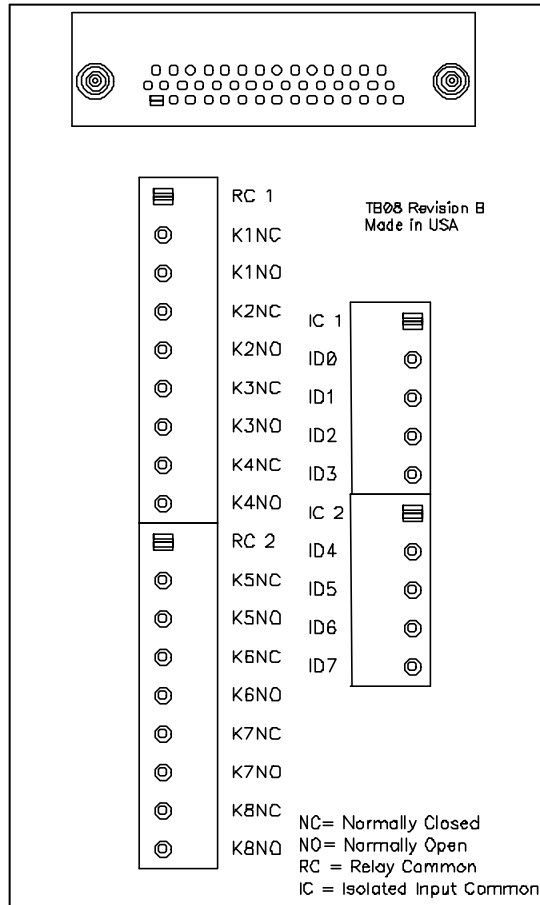
Programming

The **PLC-16.PCI** ships with Sealevel Systems' SeaI/O suite of Windows 98/NT/ME/2000 drivers. SeaI/O provides the user with a consistent and straightforward API, allowing the developer to concentrate on the details of the application as opposed to low level driver development. Popular development environments are supported for application development. SeaI/O includes sample applications and a utility for configuring the driver parameters under Windows, further simplifying installation.

Linux Users

The **PLC-16.PCI** ships with software for Linux, including a kernel-mode driver, API, and the SeaIOTst diagnostic tool. The kernel-mode driver is provided as a module, so future driver upgrades may be performed with minimal (usually zero) downtime. The Linux API is identical to its Windows counterpart, facilitating quick and easy ports of existing SeaI/O-aware applications to the Linux operating system. All source code for the Linux software suite is provided under the GNU Public License (GPL v2.0), to assist in "roll-your-own"-type applications.

3rd Party Software Support

Third party software support for many HMI/MMI and other process control software is included on the product installation CD. For the most up to date information on third party software support, please visit http://www.sealevel.com/3rdpartysw.htm.

Application Programmers Interface (API)

Most modern operating systems do not allow direct hardware access. The SeaIO driver and API have been included to provide control over the hardware in Windows and Linux environments. The purpose of this section of the manual is to help the customer with the mapping of the API to the actual I/O and relays for the **PLC-16.PCI** specifically. Complete documentation of the API can be found in the SeaI/O help file.

Relative Addressing Vs. Absolute Addressing

The SeaIO API makes a distinction between "absolute" and "relative" addressing modes. In absolute addressing mode, the Port argument to the API function acts as a simple byte offset from the base I/O address of the device. For instance, Port #0 refers to the I/O address base + 0; Port #1 refers to the I/O address base + 1.

Relative addressing mode, on the other hand, refers to input and output ports in a logical fashion. With a Port argument of 0 and an API function meant to output data, the first (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.

Interrupts

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

Example Tables: API Port/bit reference numbers for Absolute and Relative Addressing

R = Read
W = Write
R/W = Read or Write

Port	API Port # Absolute Address (function)	API Port # Relative Address (function)	Port Type

A	0 (R)	0 (R)	Input Port (Opto Input)
B			Not Used
C	2 (R/W)	0 (W)	Output Port (Form C Relays)
D			Not Used

API Bit # Absolute Address (function)	API Bit # Relative Address (function)	Port Bit
0 (R)	0 (R)	A0 - Input
1 (R)	1 (R)	A1 - Input
2 (R)	2 (R)	A2 - Input
3 (R)	3 (R)	A3 - Input
4 (R)	4 (R)	A4 - Input
5 (R)	5 (R)	A5 - Input
6 (R)	6 (R)	A6 - Input
7 (R)	7 (R)	A7 - Input
16 (R/W)	0 (W)	C0 – Output (Change from NO to NC Pole)
17 (R/W)	1 (W)	C1 – Output (Change from NO to NC Pole)
18 (R/W)	2 (W)	C2 – Output (Change from NO to NC Pole)
19 (R/W)	3 (W)	C3 – Output (Change from NO to NC Pole)
20 (R/W)	4 (W)	C4 – Output (Change from NO to NC Pole)
21 (R/W)	5 (W)	C5 – Output (Change from NO to NC Pole)
22 (R/W)	6 (W)	C6 – Output (Change from NO to NC Pole)
23 (R/W)	7 (W)	C7 – Output (Change from NO to NC Pole)

Direct Hardware Control

In systems where the users program has direct access to the hardware (DOS) the table below gives the mapping and functions that the **PLC-16.PCI** provides, a base address of 300 was used. If a different base address is used then the port addresses are calculated as shown in the table.

Reading the Inputs (direct):

The inputs are active Low. If no voltage is applied across one of the differential inputs it returns a one on that bit. If an AC or DC voltage (of sufficient magnitude) is applied it returns a zero on that bit.

Reading the Outputs (relays) (direct):

The relay ports return the ones complement of the value that is currently being used to drive the relays. When using the API the value is returned not the complement of the value.

Writing the Outputs (relays) (direct):

The output ports are the only ports that can be written. The Form C relays on a standard **PLC-16.PCI** have a normally open (NO) pole and a normally closed (NC) pole and a common (CO). To switch the relay from the NO pole to the NC pole a one must be written to the appropriate bit.

R = Read
W = Write
R/W = Read or Write

Function Available	Port	Address Hex	Address Decimal	Port Type
R	A	300 (Base + 0)	768	Input Port (Opto Input)
	B	301(Base + 1)	769	Not Used
R/W	C	302 (Base + 2)	770	Output Port (Reed Relays)
	D	303 (Base + 3)	771	Not Used

Register Description

Address	Mode	D7	D6	D5	D4	D3	D2	D1	D0
Base+0	RD/WR	PAD7	PAD6	PAD5	PAD4	PAD3	PAD2	PAD1	PAD0
Base+1	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+2	RD/WR	PCD7	PCD6	PCD5	PCD4	PCD3	PCD2	PCD1	PCD0
Base+3	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+4	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+5	RD/WR	IRQEN	IRQST	{0}	{0}	{0}	{0}	IRC1	IRC0
Base+6	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}
Base+7	RD	{0}	{0}	{0}	{0}	{0}	{0}	{0}	{0}

Note: 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) Input port.
PCD0-7 = Port C (Base+2) Output port.
IRC0-1= Interrupt Mode select (Base+5)

IRC1	IRC0	Interrupt Type
0	0	Low Level
0	1	High Level
1	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	380mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board Length	4.90 inches	(12.446m.)
Board Height including Goldfingers	4.20 inches	(10.668m.)
Board Height excluding Goldfingers	3.575 inches	(9.842 cm.)
Board Weight	3.2 ounces	(90.71g)

Appendix A - Troubleshooting

Following these simple steps can eliminate most common problems without the need to call Technical Support.

1. Install software **<u>first</u>**. After installing the software then proceed to adding the hardware. This places the required installation files in the correct locations.

2. 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.

3. Ensure that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address and may not be allowed to share IRQs.

4. Make sure the Sealevel Systems adapter is securely installed in a motherboard slot.

Appendix B - How To Get Assistance

Please refer to Troubleshooting Guide prior to calling Technical Support.

1. Read this manual thoroughly before attempting to install the adapter in your system.

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

4. 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

4.2"

4.9"
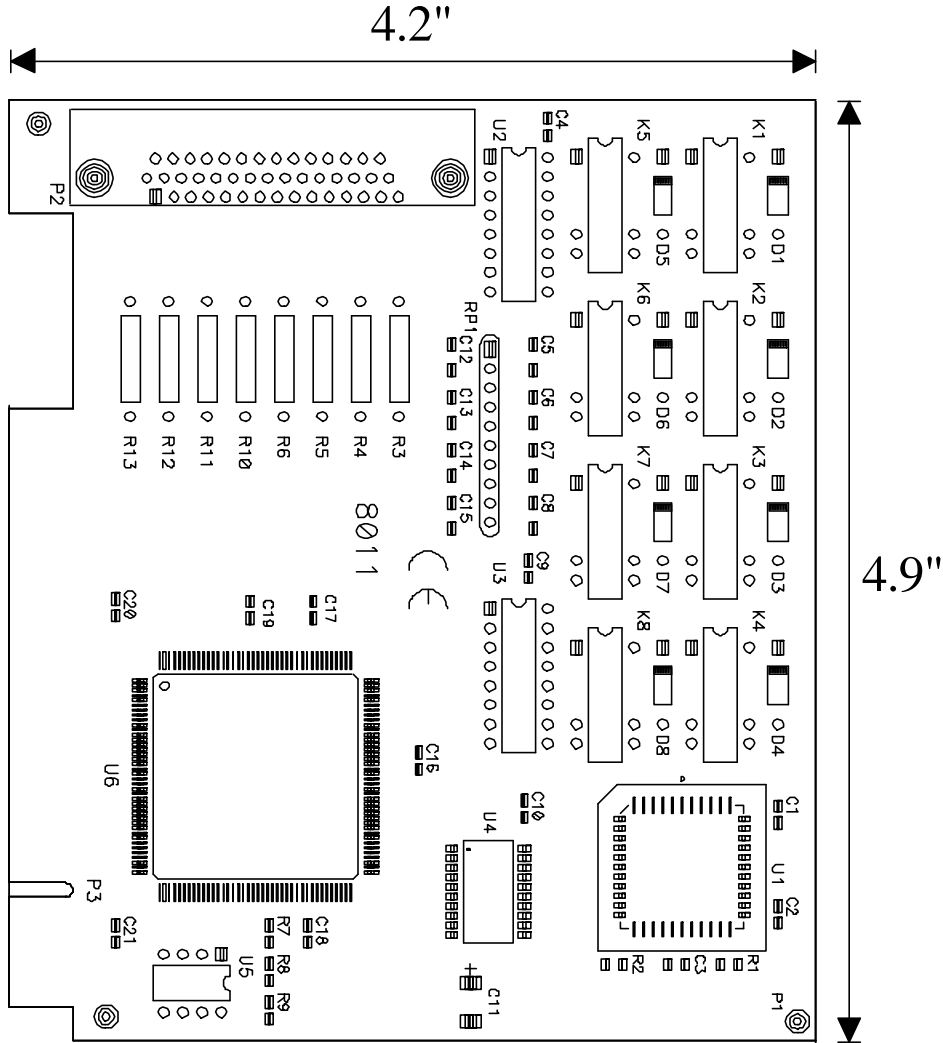
Appendix D - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. In such case the user will be required to correct the interference at his own expense.

EMC Directive Statement

Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

- **EN55022 Class A** - "Limits and methods of measurement of radio interference characteristics of information technology equipment"

- **EN55024** -'Information technology equipment Immunity characteristics Limits and methods of measurement'

- **EN60950 (IEC950)** - "Safety of information technology equipment, including electrical business equipment"

Warning
This is a Class A Product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.

Warranty

Sealevel Systems, Inc. provides a lifetime warranty for this product. Should this product fail to be in good working order at any time during this period, Sealevel Systems will, at it's option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster.

Sealevel Systems assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Sealevel Systems will not be liable for any claim made by any other related party.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

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

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