SEALEVEL
SYSTEMS INCORPORATED

ISO-COMM™
USER MANUAL

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Introduction

Overview

The Sealevel Systems **ISO-COMM** provides the PC with additional ground isolated serial ports for terminals, modems, printers, etc. Isolation is important in installations where the equipment being connected to the PC is either far from the PC, or on a different power transformer circuit. Ground loop current is a commonly neglected and misunderstood phenomena that leads to the failure (and destruction) of communication interfaces. The **ISO-COMM** isolated boards provide up to 500 volts DC of isolation.

The **ISO-COMM** provides two or four DOS and Windows compatible serial ports, and also offers extended 'AT' interrupts. Each port is independently addressable as COM1: through COM4:, or any other I/O address up to 3FF Hex.

What's Included

The **ISO-COMM** is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- **ISO-COMM** Serial I/O Adapter
- Cable providing 2 DB-9 connectors.
- Serial Utility Software
- User Manual

Factory Default Settings

The **ISO-COMM** factory default settings are as follows:

Port #	Base Address	IRQ
Port 1	3F8	4
Port 2	2F8	3
Port 3	3E8	4
Port 4	2E8	3

For your reference, record installed **ISO-COMM** settings below:

Port #	Base Address	IRQ
Port 1		
Port 2		
Port 3		
Port 4		

Card Setup

The **ISO-COMM** contains several jumper straps which must be set for proper operation.

Address Selection

Each port on the **ISO-COMM** occupies 8 consecutive I/O locations. A DIP-switch is used to set the base address for these locations. Be careful when selecting the base address as some selections conflict with existing ports. The following table shows several examples that typically do not cause a conflict. SW4 sets the I/O address for port 1, SW3 sets the address for port 2, SW2 sets the address for port 3 and SW1 sets the address for port 4.

Address	Binary		Switch Position Setting						
Hex	A9	A0	1	2	3	4	5	6	7
280-287	1010000XXX		Off	On	Off	On	On	On	On
2A0-2A7	1010100XXX		Off	On	Off	On	Off	On	On
2E8-2EF	1011101XXX		Off	On	Off	Off	Off	On	Off
2F8-2FF	1011111XXX		Off	On	Off	Off	Off	Off	Off
3E8-3EF	1111101XXX		Off	Off	Off	Off	Off	On	Off
300-307	1100000XXX		Off	Off	On	On	On	On	On
328-32F	1100101XXX		Off	Off	On	On	Off	On	Off
3F8-3FF	1111111XXX		Off	Off	Off	Off	Off	Off	Off

Figure 1 - 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 a base. Address 300 in binary is XX11 0000 0XXX where X = a non-selectable address bit.
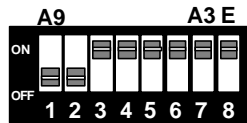

Figure 2 - DIP-Switch Illustration

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

Refer to Appendix A for common address contentions.

Port Enable / Disable

Each port on the **ISO-COMM** can be enabled or disabled with switch position 8 on the DIP-switch. The port is enabled with the switch 'On' or 'Closed' and disabled when 'Off' or 'Open'. If any port is disabled, be sure to disable the interrupt request for that port by removing the IRQ jumper.

IRQ Selection

Headers E1, E2, E3 and E4 select the IRQ for each serial port. If COM1: is selected, this jumper must be on the IRQ4 setting. If COM2: is selected, this jumper must be on IRQ3.

E4 - Port1

2 3 4 5 7 10 11 12 15

E3 - Port2

2 3 4 5 7 10 11 12 15

E2 - Port3

2 3 4 5 7 10 11 12 15

E1 - Port4

2 3 4 5 7 10 11 12 15

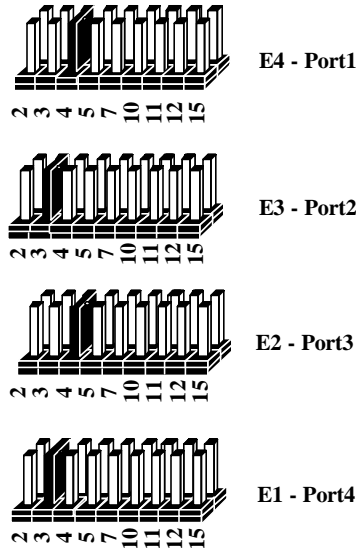*Figure 3 - Headers E1, E2, E3, and E4 (Factory Default)*

Note: Most communications software applications default COM3: to IRQ4 and COM4: to IRQ3. This requires the sharing of interrupts between COM1: and COM3:, and between COM2: and COM4:. While this is the default, it is not always the preferred setting. Check your software configuration instructions to determine the most appropriate IRQ selection.

Interrupt Mode Options

Header E5 selects the interrupt mode for each port. Each port must be set in the correct mode to insure proper installation.

'**N**' indicates the (**N**)ormal, single interrupt per port mode. '**S**' Indicates the (**S**)hared interrupt mode, which allows more than one port to access a single IRQ. Any two or more ports can share a common IRQ by placing the jumpers on the same IRQ setting, and setting the appropriate selections at E5. Consult your particular software for IRQ selection. If no interrupt is desired, remove the jumper. '**M'** indicates the inclusion of a 1K ohm pull-down resistor required on one port when sharing interrupts.
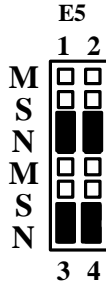
Figure 4 - Header E5, Normal IRQ Mode

Set jumpers to '**S**' for shared interrupt mode on all blocks sharing an IRQ except one. Set that port block for '**M**'. This provides the pull-down resistor circuit that makes sharing of IRQs possible. If you are using more than one **ISO-COMM** or a compatible card in a bus you should only have one port set to '**M**'. The following example shows all four ports sharing a single IRQ.

Figure 5 - Header E5, Shared IRQ Mode

Set jumper to '**S**' if you are using more than one **ISO-COMM** in a bus or you wish to completely remove the pull-down resistor for hardware compatibility. **Setting the board in this configuration when it is not accompanied by a pull-down resistor will prevent the ports from triggering an interrupt**.

Figure 6 - Header E5, Sharing IRQs with another adapter

Figure 7 - IRQ Headers E1 - E5 (Factory Default)

The above example shows the correlation between jumper block E5 and the interrupt jumpers (E1-E4). This example shows the **ISO-COMM** shipping configuration with COM1: & COM3: sharing interrupt 4 and COM2: & COM4: sharing interrupt 3.

Headers E8 and E9

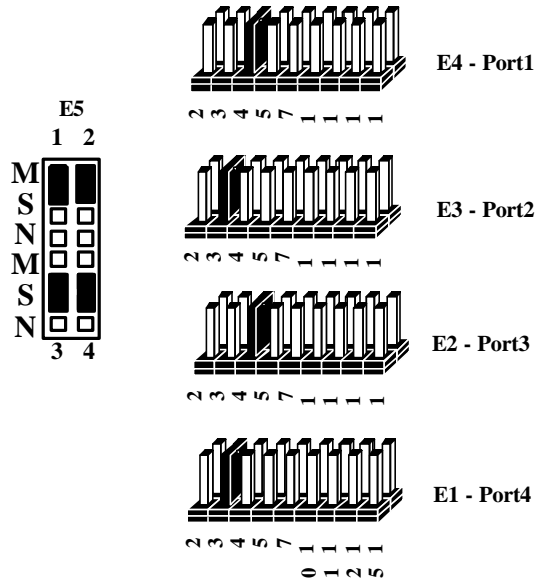RS-485 is backwardly compatible with RS-422, however it is optimized for partyline or multi-drop applications. The output of the RS-422/485 driver is capable of being active (enabled) or tri-state (disabled). This capability allows multiple PCs to be connected in a multi-drop bus and selectively polled. Half-duplex two-wire operation is also possible by connecting TX+ to RX+ and TX- to RX- in your cable hood. The enable to the driver is connected to the UART Request To Send (RTS) line for RS-485 communications. This allows the RS-485 driver to be tri-stated when inactive on a multi-drop polled network. The software that you are using must "know how" to enable the driver when it is answering a poll. Failure to correctly set this jumper can cause transmitter contention problems preventing operation by any nodes on the network. Sealevel Systems communication software is compatible with this mode of operation. To enable the driver with RTS install jumpers at E9-A for port 1, E9-C for port 2, E8-A for port 3 and E8-C for port 4.

The RS-485 'Echo' is the result of connecting the receiver inputs to the transmitter outputs. Every time a character is transmitted; it is also received. This can be beneficial if the software can handle the 'echoing' (i.e. using received characters to throttle the transmitter) or it can confuse the system if the software does not. The RS-485 echo can also be disabled at E8 and E9. To disable the echo install a jumper at E9-B for port 1, E9-D for port 2, E8-B for port 3 and E8-D for port 4.

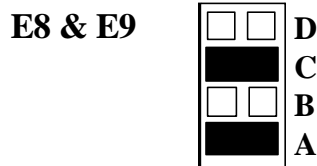The following example shows the driver in the RS-485 mode and the echo enabled.

Figure 8 - Headers E8 and E9 RS-485 Mode Enable

Interface Options

Due to the versatility of the **ISO-COMM** series a wide range of interface configuration options are available to the end user. Please use this section as a guide in configuring your board to provide the interface you require.

RS-232

To configure the board as RS-232 insure that the 75174 driver at U33 & U27 and the DIP resistor pack at RP15 have been removed (if previously installed). By installing the MAX234 driver at U34 & U28, the board will be configured as RS-232. Please note that on two port versions of the **ISO-COMM** series only one driver chip will be provided at either U33 or U34.

RS-422

To configure the **ISO-COMM** as RS-422 insure that the MAX234 driver at U34 & U28 have been removed (if previously installed). By installing the 75174 driver at U33 & U27 and installing a 100 ohm DIP resistor at RP-15, the board will be configured as RS-422. Please note that on two port versions of the **ISO-COMM** series only one driver chip will be provided at either U33 or U34.

Combined RS-232 and RS-422

On the four port **ISO-COMM** boards two ports of RS-232 and two ports of RS-422 is possible, but it is complicated to configure. The configuration requires that you selectively bend (or float) pins on the DIP-resistor pack out of the socket.

Configuration	Drivers	RP-15 Pin Positions
Ports 1 & 2 RS-232	U34 & U27 Installed	Pins 1, 7, 8, 4 "Floated"
Ports 3 & 4 RS-422	U33 & U28 Removed	All Others Installed
Ports 1 & 2 RS-422	U33 & U28 Installed	Pins 2, 3, 5, 6 "Floated"
Ports 3 & 4 RS-232	U34 & U27 Removed	All Others Installed

Figure 9 - Four Port RS-232/RS-422 Configuration Table

Installation

Operating System Installation

For Windows Users

Start by choosing **Install Software at the beginning of the CD. Choose Asynchronous COM: Port Software, SeaCOM.**

Other Operating Systems

Refer to the appropriate section of the Serial Utilities Software.

System Installation

The **ISO-COMM** can be installed in any of the PC expansion slots, but to access the 'AT' or (E)ISA IRQs (10, 11, 12, 15) the adapter must be installed in one of the 16 bit slots. The **ISO-COMM** contains several jumper straps for each port which must be set for proper operation prior to installing the card into the computer.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover.
3. Locate an available slot and remove the blank metal slot cover.
4. Gently insert the **ISO-COMM** into the slot. Make sure that the adapter is seated properly.
5. Replace the screw.
6. Install the twin DB-9 (ports 3 and 4) Cable
7. Replace the cover.
8. Connect the power cord.

Installation is complete.

Technical Description

The Sealevel Systems **ISO-COMM** provides the PC with two or four additional ground isolated RS-422/485/232 or two or four non-isolated RS-422/485 serial ports for terminals, modems, printers, etc. Isolation is important in installations where the equipment being connected to the PC is either far from the PC, or on a different power transformer circuit. Ground loop current is a commonly neglected and misunderstood phenomena that leads to data loss and the destruction of communications interfaces. The **ISO-COMM** isolated boards provide up to 500 volts DC of isolation.

The **ISO-COMM** utilizes the 16550 UART. This chip features programmable baud rate, data format, interrupt control and a 16 byte input and output FIFO. Also available as an option is the 16C650 UART that provides a deeper FIFO (32 bytes) and enhanced clocking features.

- Two / four serial ports with RTS and CTS modem control signals
- Individually selectable port addresses
- Individually selectable interrupt (2-7, 10, 11, 12, and 15)
- Multiple cards can share the same IRQ signal
- DB-9 male connectors
- Software available for interrupt buffering

- **ISO-COMM-1** Four Port **Isolated** RS-422/485
    Part # 3415
    Part # 3415-232 (includes RS-232 chips)
- **ISO-COMM-2** Four Port **Non-Isolated** RS-422/485
    Part # 3416 (options same as 3415)
- **ISO-COMM-3** Two Port **Isolated** RS-422/485
    Part # 3417
    Part # 3417-232 (includes RS-232 Chip)
- **ISO-COMM-4** Four Port **Isolated** RS-232
    Part # 3418
- **ISO-COMM-5** Two Port **Isolated** RS-232
    Part # 3419

Note: Part # 34xx-232 specifies RS-232 chips to be included for mixed RS-232 and RS-422 on same board.

Connector Pin Assignments

RS-422   (DB 9 Male)

Signal	Name	Pin #	Mode
GND	Ground	5	
TX +	Transmit Data Positive	4	Output
TX-	Transmit Data Negative	3	Output
RTS+	Request To Send Positive	6	Output
RTS-	Request To Send Negative	7	Output
RX+	Receive Data Positive	1	Input
RX-	Receive Data Negative	2	Input
CTS+	Clear To Send Positive	9	Input
CTS-	Clear To Send Negative	8	Input

RS-232   (DB 9 Male)

Signal	Name	Pin #	Mode
GND	Ground	5	
TD	Transmit Data	3	Output
RTS	Request To Send	7	Output
RD	Receive Data	2	Input
CTS	Clear To Send	8	Input

Note: These are the only pins that should be connected in your cable. Connecting any other pins on the DB-9 connector could result in intermittent data.

Technical Note: Please terminate any control signals that are not going to be used. The most common way to do this is connect RTS to CTS and RI. Also, connect DCD to DTR and DSR. Terminating these pins, if not used, will help insure you get the best performance from your adapter.

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 50º C (32º to 122º F)	-20º to 70º C (-4º to 158º 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 U.L. 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Power Consumption

Part #	+5 V Dc Supply line
3415	880mA
3416	450mA
3417	450mA
3418	600mA
3419	450mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board length	13.33 inches	(33.86 cm)
Board Height including Goldfingers	4.2 inches	(10.66 cm)
Board Height excluding Goldfingers	3.9 inches	(9.91 cm)

Appendix A - Troubleshooting

Serial Utility test software is supplied with the Sealevel Systems adapter and will be used in the troubleshooting procedures. By using this software and following these simple steps, most common problems can be eliminated without the need to call Technical Support.

1. 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.

2. 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.

3. 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.

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

5. When running DOS, Windows 3.x or other operating systems refer to the Serial Utilities software for that operating system and the User Manual to verify that the Sealevel Systems adapter is configured correctly. The supplied software contains a diagnostic program 'SSD' that runs under DOS and will verify if an adapter is configured properly. This diagnostic program is written with the user in mind and is easy to use. Refer to the DIAG.txt file in the dos\diag directory for detailed instructions on using 'SSD'.

6. For Windows 95/98 and Windows NT, the diagnostic tool 'WinSSD' is installed in the Sealevel 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.

7. Always use the Sealevel Systems diagnostic software when troubleshooting a problem. This will help eliminate any software issues and identify any hardware conflicts.

8. The following are known I/O conflicts:

- The 278 and 378 settings may conflict with your printer I/O adapter.
- 3B0 cannot be used if a Monochrome adapter is installed.
- 3F8-3FF is typically reserved for COM1:
- 2F8-2FF is typically reserved for COM2:
- 3E8-3EF is typically reserved for COM3:
- 2E8-2EF is typically reserved for COM4:

9. Remember to use Sealevel Systems diagnostic software when troubleshooting a problem. This will help eliminate any software issues and identify any hardware conflicts.

Appendix B - How To Get Assistance

Please refer to Appendix A - Troubleshooting 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. 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 - Electrical Interface

RS-232

Quite possibly the most widely used communication standard is RS-232. This implementation has been defined and revised several times and is often referred to as RS-232 or EIA/TIA-232. The IBM PC computer defined the RS-232 port on a 9 pin D sub connector and subsequently the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard is defined as the *9-Position Non-Synchronous Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*. Both implementations are in wide spread use and will be referred to as RS-232 in this document. RS-232 is capable of operating at data rates up to 20 Kbps at distances less than 50 ft. The absolute maximum data rate may vary due to line conditions and cable lengths. RS-232 often operates at 38.4 Kbps over very short distances. The voltage levels defined by RS-232 range from -12 to +12 volts. RS-232 is a single ended or unbalanced interface, meaning that a single electrical signal is compared to a common signal (ground) to determine binary logic states. A voltage of +12 volts (usually +3 to +10 volts) represents a binary 0 (space) and -12 volts (-3 to -10 volts) denotes a binary 1 (mark). The RS-232 and the EIA/TIA-574 specification defines two type of interface circuits, Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE). The Sealevel Systems adapter is a DTE interface.

RS-422

The RS-422 specification defines the electrical characteristics of balanced voltage digital interface circuits. RS-422 is a differential interface that defines voltage levels and driver/receiver electrical specifications. On a differential interface, logic levels are defined by the difference in voltage between a pair of outputs or inputs. In contrast, a single ended interface, for example RS-232, defines the logic levels as the difference in voltage between a single signal and a common ground connection. Differential interfaces are typically more immune to noise or voltage spikes that may occur on the communication lines. Differential interfaces also have greater drive capabilities that allow for longer cable lengths. RS-422 is rated up to 10 Megabits per second and can have cabling 4000 feet long. RS-422 also defines driver and receiver electrical characteristics that will allow 1 driver and up to 32 receivers on the line at once. RS-422 signal levels range from 0 to +5 volts. RS-422 does not define a physical connector.

RS-485

RS-485 is backwardly compatible with RS-422; however, it is optimized for partyline or multi-drop applications. The output of the RS-422/485 driver is capable of being **Active** (enabled) or **Tri-State** (disabled). This capability allows multiple ports to be connected in a multi-drop bus and selectively polled. RS-485 allows cable lengths up to 4000 feet and data rates up to 10 Megabits per second. The signal levels for RS-485 are the same as those defined by RS-422. RS-485 has electrical characteristics that allow for 32 drivers and 32 receivers to be connected to one line. This interface is ideal for multi-drop or network environments. RS-485 tri-state driver (not dual-state) will allow the electrical presence of the driver to be removed from the line. Only one driver may be active at a time and the other driver(s) must be tri-stated. The output modem control signal RTS controls the state of the driver. Some communication software packages refer to RS-485 as RTS enable or RTS block mode transfer. RS-485 can be cabled in two ways, two wire and four wire mode. Two wire mode does not allow for full duplex communication, and requires that data be transferred in only one direction at a time. For half-duplex operation, the two transmit pins should be connected to the two receive pins (Tx+ to Rx+ and Tx- to Rx-). Four wire mode allows full duplex data transfers. RS-485 does not define a connector pin-out or a set of modem control signals. RS-485 does not define a physical connector.

Appendix D - Asynchronous Communications

Serial data communications implies that individual bits of a character are transmitted consecutively to a receiver that assembles the bits back into a character. Data rate, error checking, handshaking, and character framing (start/stop bits) are pre-defined and must correspond at both the transmitting and receiving ends.

Asynchronous communications is the standard means of serial data communication for PC compatibles and PS/2 computers. The original PC was equipped with a communication or COM: port that was designed around an 8250 Universal Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. Character boundaries for asynchronous communications are defined by a starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8). The end of the character is defined by the transmission of a pre-defined number of stop bits (usually 1, 1.5 or 2). An extra bit used for error detection is often appended before the stop bits.
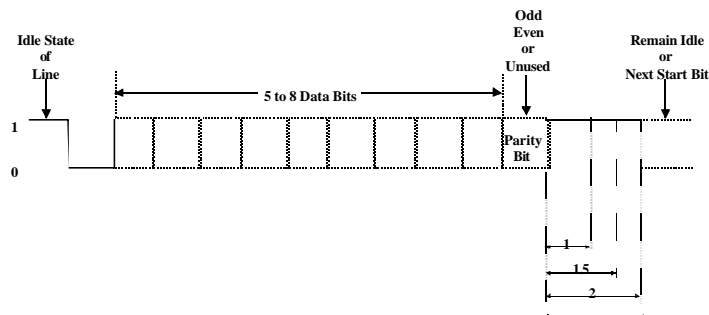

Figure 10 - Asynchronous Communications Bit Diagram

This special bit is called the parity bit. Parity is a simple method of determining if a data bit has been lost or corrupted during transmission. There are several methods for implementing a parity check to guard against data corruption. Common methods are called (E)ven Parity or (O)dd Parity. Sometimes parity is not used to detect errors on the data stream. This is referred to as (N)o parity.

Because each bit in asynchronous communications is sent consecutively, it is easy to generalize asynchronous communications by stating that each character is wrapped (framed) by pre-defined bits to mark the beginning and end of the serial transmission of the character. The data rate and communication parameters for asynchronous communications have to be the same at both the transmitting and receiving ends. The communication parameters are baud rate, parity, number of data bits per character, and stop bits (i.e. 9600,N,8,1).

Appendix E - Silk-Screen

Appendix F - Schematic

Appendix G - 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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Trademarks

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