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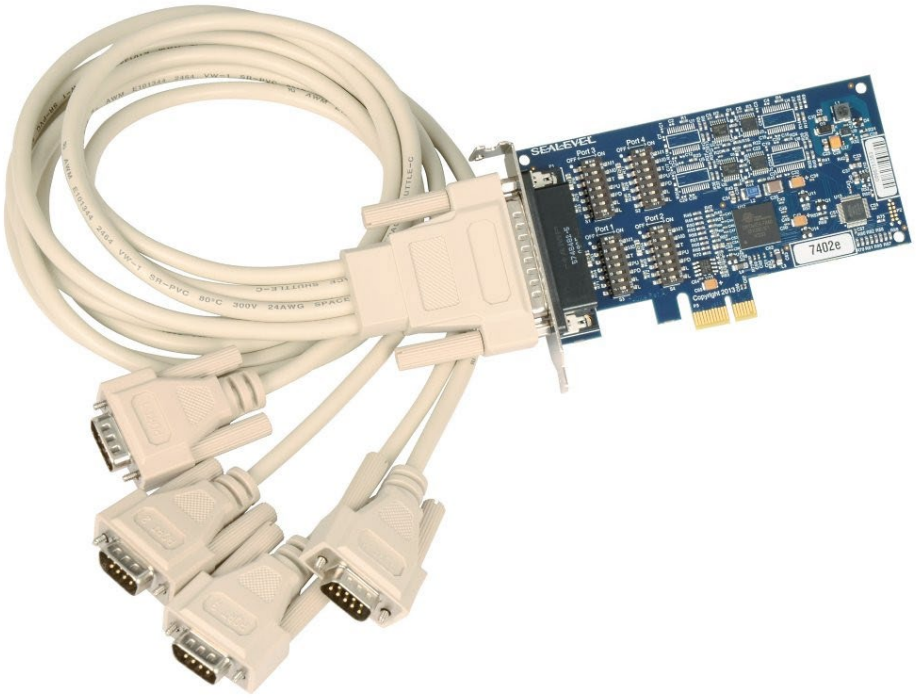
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COMM+4/422.PCIe

User Manual | 7402e and 7402eS



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Introduction

The Sealevel COMM+2.422.PCIe (Item# 7402e) provides a PCI Express 1.0a compliant interface adapter with four asynchronous serial ports for industrial automation and control applications. The serial ports are field selectable for RS-422 or RS-485 and support data rates to 921.6 Kbps.

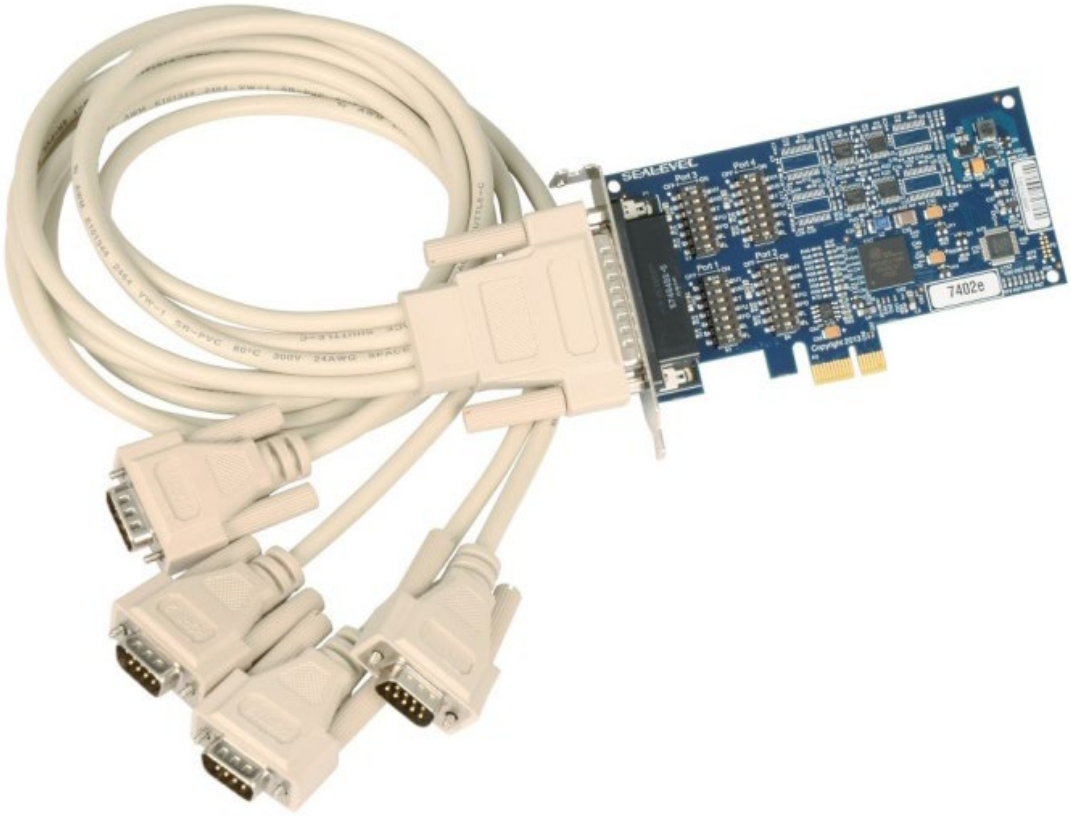
RS-422 mode for is designed for long distance device connections up to 4000ft. where noise immunity and high data integrity are essential. RS-485 mode can capture data from multiple peripherals in an RS-485 multi-drop network. Up to 31 unit load RS-485 devices can be connected to each port to automate your data collection. You can even mix the ports in any of the interface combinations to provide maximum flexibility to your application.

In RS-485 mode, the transmitter is automatically enabled in hardware, eliminating the need for application software control. This allows the 7402e to be used with standard serial communications applications and removes the risk of bus contention and data corruption.

The 7402e ships with a low profile PC bracket for use in systems with a low profile PCI Express slot. If you need a standard size PC bracket, order the 7402eS.

Features

- **PCI Express four-port serial interface adapter**
- **Each port individually configurable for RS-422 or RS-485**
- **High performance OXPCIe954 UART with 128-byte FIFOs**
- **Each port supports data rates to 921.6K bps**
- **Oscillator and clock prescaler support wide range of baud rates**
- **Supports 9-bit protocol framing**
- **PCI Express 1.0a compliant via x1 connector**
- **Compatible with all low profile and standard size PCI Express slots**
- **Includes 36” cable that terminates to four DB9M connectors (Item# CA200)**
- **Automatic RS-485 enable/disable**


SEALEVEL
7402e

Before You Get Started

What's Included

The COMM+4.422.PCIe is shipped with the following items. If any of these items are missing or damaged, please contact Sealevel for replacement.

- **COMM+422.PCIe Serial I/O Adapter – Four-Port 422/485 Serial Interface**
- **7402e – PCI Express Board with Low Profile PC Bracket**
- **7402eS – PCI Express Board with Standard Height PC Bracket**
- **CA200 - DB44 Male to (4) DB9 Male Cable**

Advisory Conventions



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



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



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

Optional Items

Depending upon your application, you are likely to find one or more of the following items useful with the COMM+4.422.PCIe. All items can be purchased from our website (www.sealevel.com) by calling our Sales team at +1 864-843-4343.

DB9 to DB25 Serial Cable (Item# CA176)	
DB9 Female (RS-422) to DB25 Male (RS-530) Cable, 10 in Length	
DB9 to DB25 Serial Cable (Item# CA177)	
DB9 Female to DB25 Male Standard RS-232 Modem Cable, 72 inch Length	
DB9 Serial Extension Cable (Item# CA127)	
DB9 Female to DB9 Male Extension Cable, 72 inch Length	
Terminal Block Kit (Item# KT106)	
Terminal Block Kit - TB06 + (2) CA127 Cables	
Terminal Block Kit (Item# KT105)	
Terminal Block Kit - TB05 + CA127 Cable	
Terminal Block Kit (Item# TB34-4)	
Terminal Block Kit (4 Pack) - DB9 Female to 5 Screw Terminals (RS-422/485)	

Hardware Description

PCI Express Board

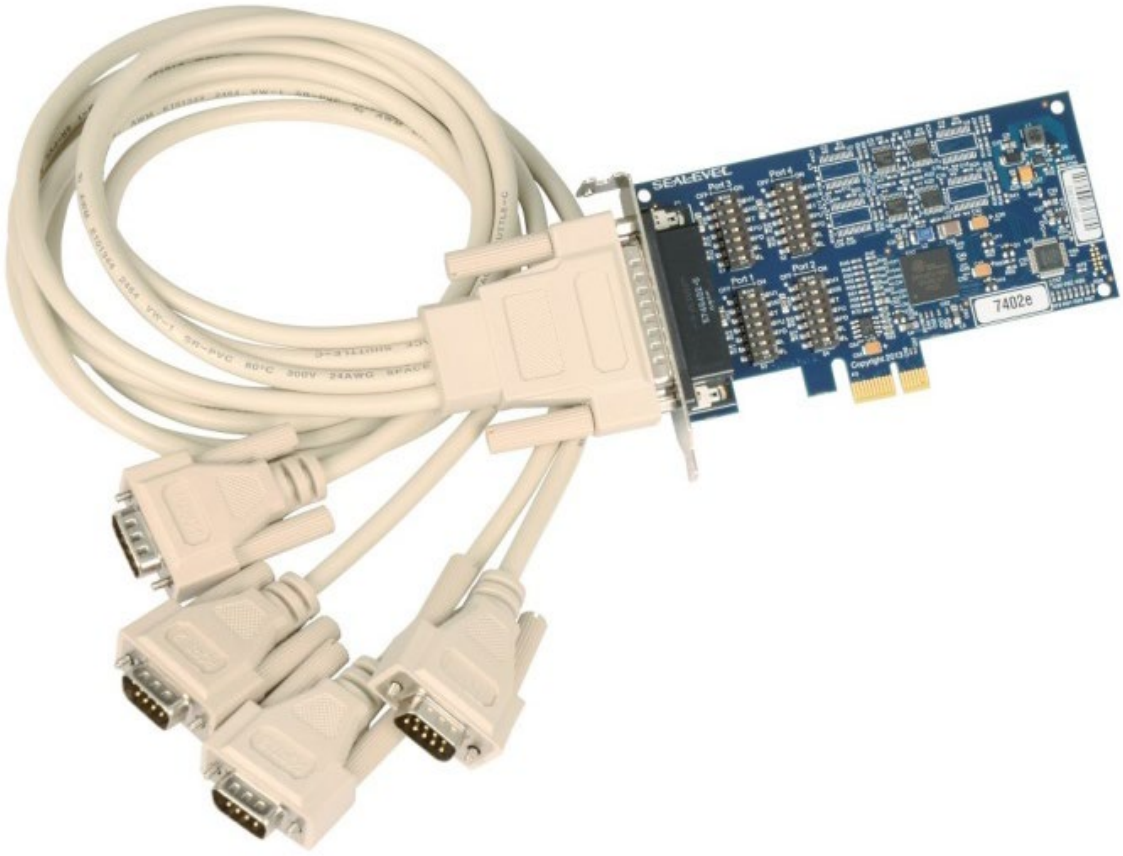
The 7402e is a low profile PCI Express 1.0a compliant board via single lane x1 slot. It can be used in any single- or multi-lane PCI Express slot. It is available in standard height PCI Express as item# 7402eS.

DB44F Board Connector

The board integrates a DB44 female connector for interfacing the four serial ports via the included cable.

DB25M Serial Connectors

The 7402e ships with a four-port cable (Item# CA200) that includes four DB9 male serial connectors. The pin out for these connectors is detailed in the following Technical Description section.



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Hardware Configuration

Address and IRQ selection

The COMM+4.422.PCIe is automatically assigned I/O addresses and IRQs by your motherboard BIOS or by a 'Plug-n-Play' Operating System. Adding or removing other hardware or moving the adapter to another slot may change the assignment of I/O addresses and IRQs.

Clock Modes

The COMM+4.422.PCIe derives a 62.5MHz clock from the PCI express link which is divided by a 8 bit clock prescaler and a 16 bit clock divisor to provide a wide range of possible baud rates. Note that there are many combinations that can give the same result (e.g. Prescaler=1 and Divisor = 8, Prescaler =2 and Divisor = 4, or Prescaler=8 and Divisor = 1). As long as the calculated data rate is within +/- 2% you should communicate fine.

Baud Rates

The following table shows some common data rates and the rates you should choose to achieve them when using the COMM+4.422.PCIe.

For This Data Rate	Clock Prescaler	Choose This Divisor DLM:DLL
1200 bps	1	3255
2400 bps	3.625	449
4800 bps	1.875	434
9600 bps	1.875	217
19.2K bps	1.375	148
38.4K bps	1.375	74
57.6K bps	22.625	3
115.2K bps	1	34
230.4K bps	1	17
460.8K bps	2.125	4
921.6K bps	2.125	2

Electrical Interface Selection

Each of the four ports on the COMM+4.422.PCIe can be individually configured as an, RS-422, or RS-485 interface. This is selectable via the port DIP-switch; each is labeled with its port number.

Switch 1 (Silk M1)	Switch 2 (Silk M0)	Mode Select
OFF	OFF	RESERVED
OFF	ON	422
ON	OFF	485 With Echo
ON	ON	485 No Echo

Line Termination

Typically, each end of the RS-485 bus must have line-terminating resistors (RS-422 terminates at the receive end only). A 120-ohm resistor is across each RS-422/485 input in addition to a 1K-ohm pull-up/pull-down combination that biases the receiver inputs. Each switch allows customization of this interface to specific requirements. Each switch position corresponds to a specific portion of the interface. If multiple COMM+4.422.PCIe adapters are configured in an RS-485 network, only the boards on each end should have switches T, P & P ON. Refer to the following table for each position's operation:

Switch	Name	Function
3	T	Adds or removes the 120 ohm termination.
4	PU	Adds or removes the 1K ohm pull-up resistor in the RS-422/RS-485 receiver circuit
5	PD	Adds or removes the 1K ohm pull-down resistor in the RS-422/RS-485 receiver circuit
6	L	Connects the TX- to RX- for RS-485 two-wire operation.
7	L	Connects the TX+ to RX+ for RS-485 two-wire operation.

RS-485 'Echo'

In 'RS-485 With Echo' mode both the receiver and the transmitter are enabled simultaneously. Every time a character is transmitted, it is also received. This can be beneficial if the software can handle echoing (i.e. using received characters to throttle the transmitter) or it can confuse the system if the software does not. An RS-485 'No Echo' option is selected by placing both Mode switches (M0, M1) in the 'On' position.

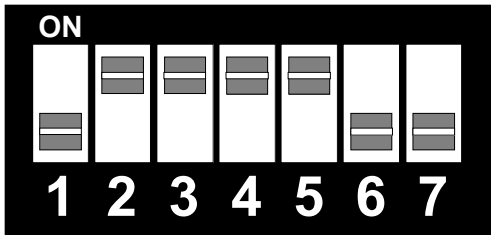


Figure 1 - RS-422 Mode

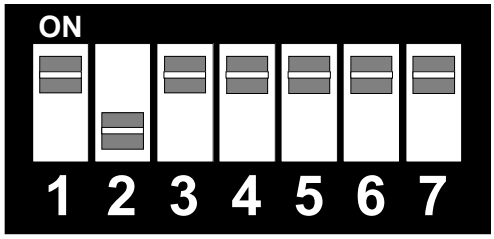


Figure 2 - RS-485 two-wire with 'Echo'

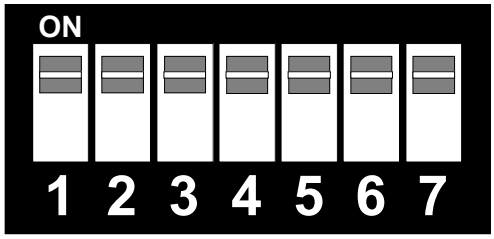


Figure 3 - RS-485 two-wire No 'Echo'

Software Installation

Windows Installation



Do not connect the hardware 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 proper driver download and installation instructions.

1. Begin by locating, selecting, and installing the correct software from the Sealevel software driver database.
2. Type in or select the part number (#**7402e**) for the adapter from the listing.
3. Select "Download Now" for SeaCOM for Windows.
4. The setup files will automatically detect the operating environment and install the proper components. Follow the information presented on the screens that follow.
5. A screen may appear with text similar to: "The publisher cannot be determined due to the problems below: Authenticode signature not found." Please click the 'Yes' button and proceed with the installation. This declaration simply means that the operating system is not aware of the driver being loaded. It will not cause any harm to your system.
6. During setup, the user may specify installation directories and other preferred configurations. This program also adds entries to the system registry that are necessary for specifying the operating parameters for each driver. An uninstall option is also included to remove all registry/INI file entries from the system.
7. The software is now installed, and you can proceed with the hardware installation.



To install Sealevel software, you must log in as an administrator or have administrator privileges in Windows. All Sealevel Systems software drivers have been fully tested by Sealevel. Clicking "OK" button to continue.



This is a notification that if you are upgrading from a previous driver version, you should remove the associated Device Manager hardware entries and reinstall the adapter after the installing the SeaCOM software.

Upgrading to the Current SeaCOM Driver

1. Download the current driver using the Instructions from the Where to Get Software section above. Please take note of the destination directory it will save to.
2. Uninstall the currently loaded driver SeaCOM driver found in the Control Panel. Prior to Windows Vista SeaCOM will be populated in 'Add/Remove Programs' list. In Vista and newer OSs it will be found in the 'Programs and Features' list.
3. Navigate to the Device Manager and remove the Sealevel adapter by right clicking on the line item choosing 'Uninstall'. Depending on your product, it can be found under either 'Multiport Serial adapters' or 'Universal Serial Bus controllers'.
4. In the Device Manager under 'Action', choose 'Scan for Hardware changes'. This will prompt the installation of the adapter and associate it with the newly installed SeaCOM driver.

Linux Installation



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



The syntax is case sensitive.

SeaCOM for Linux can be downloaded here: https://www.sealevel.com/support/software-seacom-linux/. It includes the **README** and the **Serial-HOWTO** help files (located at seacom/dox/howto). This series of files both explains typical Linux serial implementations and informs the user about Linux syntax and preferred practices.



User can use a program such as 7-Zip to extract the tar.gz file.

In addition, the software selectable interface settings can be accessed by referencing **seacom/utilities/7402emode.**

Linux Support

The 7402e is supported natively in Linux kernels 2.6.28 and later.

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.

Technical Description

The COMM+4.422.PCIe provides four RS-422/485 ports from a single PCIe slot.

The COMM+4.422.PCIe utilizes the OXPCIe954 type UART. This chip features programmable baud rates, data format, interrupt control and industry leading 128-byte transmit and receive FIFOs.

The UARTs are register compatible with 16C450, 16C550, 16C654 and 16C750 UARTs. The FIFO depth can be changed to match the depth of these UARTs.

RS-422/485 (CA-200 DB-9) Connector Pin Assignments

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-422/485 (DB-44)

Port #	1	2	3	4
RS-422/485				
TX-	1	5	9	13
RX-	4	8	12	30
RTS-	2	6	10	14
CTS-	16	20	23	27
TX+	32	36	40	43
RTS+	31	35	39	42
RX+	3	7	11	15
CTS+	33	37	41	44
GND	17	21	24	28

The RTS output is only available in RS-422 mode. The RTS output is tri-stated in RS-485 mode and therefore unusable. The CTS input is available in all modes. Terminating these pins, if not used, will help ensure you get the best performance from your adapter.

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Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 70º C (32º to 158º F)	-50º to 105º C (-58º to 221º 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.

Power Consumption

Supply line	+3.3 VDC	+12VDC
Rating	100 mA	25 mA

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. 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. 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.

6. 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.

7. 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 – 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: Transport boards and cards in electrostatically secure containers or bags.
- Keep electrostatically sensitive components in their containers, until they arrive at an electrostatically protected workplace.
- Only touch electrostatically sensitive components when you are properly grounded.
- 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:

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

Appendix C – Electrical Interface

RS-232

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 party line 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.

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 Unil Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. A starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8) defines character boundaries for asynchronous communications. 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.

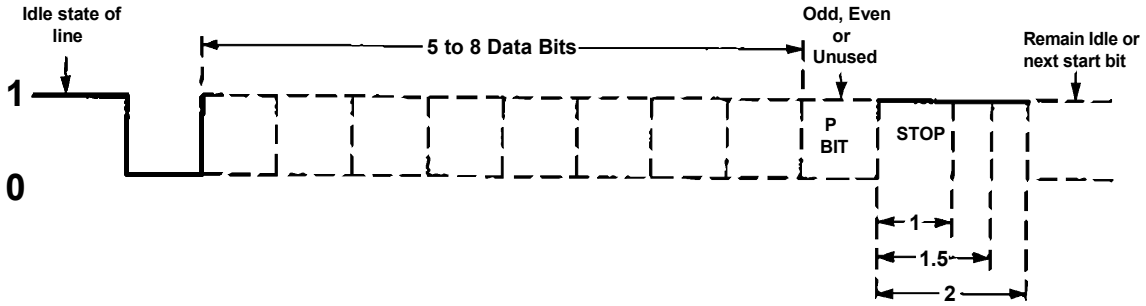
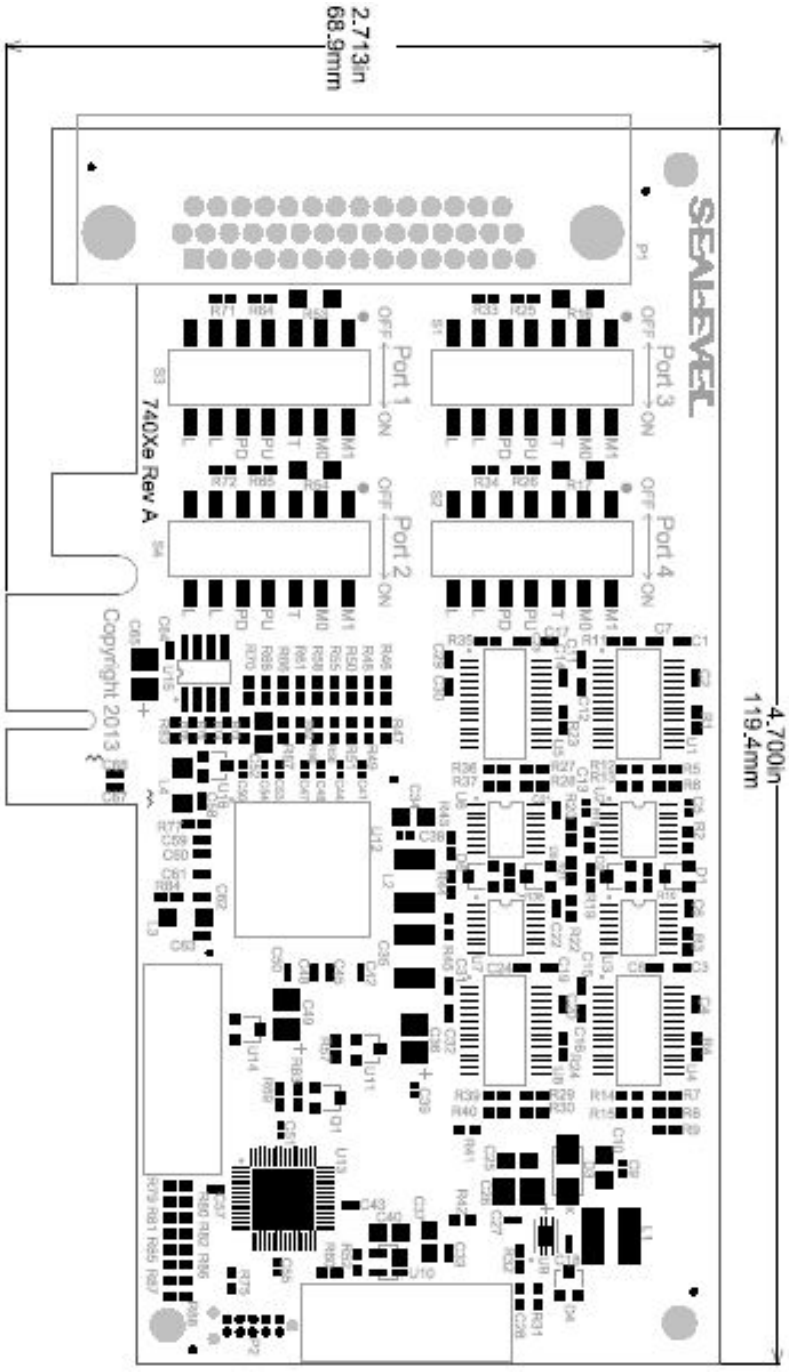


Figure 4 - Asynchronous Communications Bit Diagram

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 – Mechanical Drawing



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

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