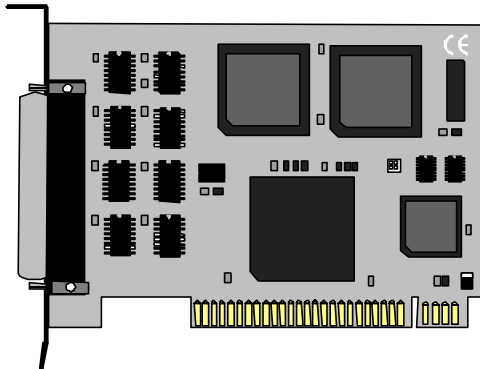


ULTRA COMM+422™

USER'S MANUAL

Part Number 3440



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Introduction

Overview

The Sealevel Systems **ULTRA COMM+422** provides the PC with four additional RS-422/485 serial ports for terminals, modems, printers, etc.

The unique feature of the **ULTRA COMM+422** is the ability to be RS-485 compatible without the need for special software or drivers. This ability is especially useful in Windows, Windows NT, and OS/2 environments where the lower level I/O control is abstracted from the application program. This ability means that the user can effectively use the **ULTRA COMM+422** in an RS-485 application with existing (i.e. standard RS-232) software drivers.

Note: The 'Auto Enable' feature is not available on the p/n 3441.

What's Included

The **ULTRA COMM+422** is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- **ULTRA COMM+422** Serial I/O Adapter
- DB-37 to four DB-9 'Spider Cable'
- Serial Utility Software
- User Manual

Factory Default Settings

The **ULTRA COMM+422** factory default settings are as follows:

Port #	Base Address	IRQ	Electrical Specification
Port 1	280	10	RS-422
Port 2	288	5	RS-422
Port 3	290	10	RS-422
Port 4	298	5	RS-422

To install the **ULTRA COMM+422** using factory default settings, refer to Installation on page 13.

For your reference, record installed **ULTRA COMM+422** settings below:

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

Card Setup

The **ULTRA COMM+422** contains several jumper straps, which must be set for proper operation.

Address Selection

Each port on the **ULTRA COMM+422** occupies eight consecutive I/O locations. A DIP-switch is used to set the base address for these locations.

The **ULTRA COMM+422** has a unique addressing scheme that allows it to be completely compatible with Sealevel Systems' older four port RS-422/485 interface adapter (p/n 3067) and provide for the ability to select address combinations more commonly used.

The first addressing scheme allows the **ULTRA COMM+422** to select the addresses for its ports from a table of available address combinations.

The following table shows the addressing combinations available. If different address combinations are required, please contact Sealevel Systems Technical Support about a custom PAL option.

Switch6	Switch 7	Switch 8	Port 1	Port 2	Port 3	Port 4
On	On	Off	3F8	2F8	3E8	2E8
On	Off	On	2F8	3E8	2E8	2E0
On	Off	Off	3E8	2E8	280	288
Off	On	On	500	508	510	518
Off	On	Off	580	588	590	598
Off	Off	On	1500	1508	1510	1518
Off	Off	Off	3220	3228	4220	4228
On	On	On	Addresses set up by switches 1-5			

Figure 1 - Available Address Combinations

Note: Each COM: port in the system should have a unique address. Typically COM1: - COM4: addresses are 3F8, 2F8, 3E8 and 2E8 Hex.

Refer to Appendix A for common address contentions.

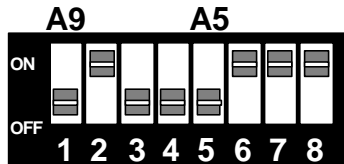
The second mode of address selection provides the compatibility mode. In this mode the DIP-switch sets the base address and the adapter occupies 32 consecutive I/O locations. The following table illustrates the location of each port and its relationship to the other ports.

Note: For switches 1 - 5 to become active, switches 6, 7 & 8 must be set in the 'On' or 'Up' position.

Address lines →	Switch Settings				
	A9	A8	A7	A6	A5
Address Selected	1	2	3	4	5
280-29F	Off	On	Off	On	On
2A0-2BF	Off	On	Off	On	Off
380-39F	Off	Off	Off	On	On
1A0-1BF	On	Off	Off	On	Off
2E0-2FF	Off	On	Off	Off	Off

Figure 2 - 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 2E0 is selected as a base. Address 2E0 in binary is XX 10 111X XXXX where X = a non-selectable address bit.



Port #	Connector Location	Address	Example (Base=2E0)
1	1	Base+0	2E0-2E7
2	2	Base+8	2E8-2EF
3	3	Base+16	2F0-2F7
4	4	Base+24	2F8-2FF

Figure 3 - Port to Connector Table

Jumper Selections

For ease of configuration, the headers are grouped by port. Port one headers have a 'J1' prefix; Port two headers have the 'J2' prefix, etc. For example, the header that controls the Port one IRQ selection is J1B; the header that controls the Port 2 IRQ selection is J2B. The silk-screen also provides information for configuring the adapter without the use of the manual. This is particularly useful in field re-configuration.

IRQ Selection

Headers J1B through J4B select the interrupt request for each serial port. If COM1: is selected, the corresponding jumper must be on the IRQ4 setting. If COM2: is selected, the corresponding jumper must be on IRQ3.

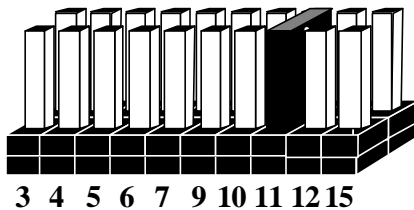


Figure 4 – Headers J1B – J4B, IRQ Selection

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.

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 J1A through J4A. Consult your particular software for IRQ selection. If no interrupt is desired, remove the jumper.

Interrupt Modes

Headers J1A through J4A select the interrupt modes for each port. Each port must be set in the correct mode to insure proper operation.

‘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. ‘M’ indicates the inclusion of a 1K ohm pull-down resistor required on one port when sharing interrupts.



Figure 4 - Header J1A, Normal IRQ Mode

Set the 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 IRQs possible. If you are using more than one **ULTRA COMM+422** or a compatible adapter in a bus you should only have one port set to ‘M’. The following example shows two ports sharing a single IRQ.

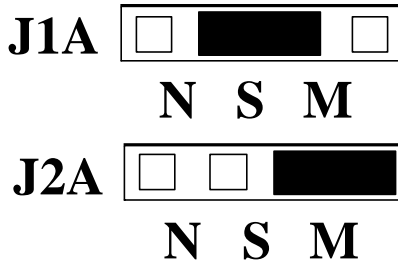


Figure 5 - Header J1A & J2A, Shared IRQ Mode

Set the jumper to ‘S’ if you are using more than one **ULTRA COMM+422** in a bus or to completely remove the pull-down resistor for hardware compatibility. **Setting the adapter in this configuration when it is not accompanied by a pull-down resistor will prevent the ports from triggering an interrupt.**

RS-485 Enable Modes

RS-485 is ideal for multi-drop or network environments. RS-485 requires a tri-state driver (not dual-state) that will allow the electrical presence of the driver to be removed from the line. The driver is in a tri-state or high impedance condition when this occurs. Only one driver may be active at a time and the other driver(s) must be tri-stated. The output modem control signal **Request To Send (RTS)** is typically used to control the state of the driver. Some communication software packages refer to RS-485 as RTS enable or RTS block mode transfer.

One of the unique features of the **ULTRA COMM+422** is the ability to be RS-485 compatible without the need for special software or drivers. This ability is especially useful in Windows, Windows NT, and OS/2 environments where the lower level I/O control is abstracted from the application program. This ability means that the user can effectively use the **ULTRA COMM+422** in an RS-485 application with existing (i.e. standard RS-232) software drivers.

Headers J1D through J4D are used to control the RS-485 mode functions for the driver circuit. The selections are 'RTS' enable (silk-screen 'RT') or 'Auto' enable (silk-screen 'AT'). The 'Auto' enable feature automatically enables/disables the RS-485 interface. The 'RTS' mode uses the 'RTS' modem control signal to enable the RS-485 interface and provides backward compatibility with existing software products.

Position 3 (silk-screen 'NE') of J1D through J4D is used to control the RS-485 enable/disable functions for the receiver circuit and determine the state of the RS-422/485 driver. 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 echoing (i.e. using received characters to throttle the transmitter) or it can confuse the system if the software does not. To select the 'No Echo' mode select silk-screen position 'NE'.

For RS-422/530/449 compatibility remove the jumpers at J1D through J4D.

Examples on the following pages describe all of the valid settings for J1D - J4D.

Interface Mode Examples J1D – J4D

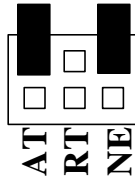


Figure 6- Headers J1D- J4D, RS-422

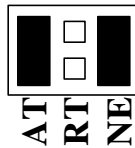


Figure 7 - Headers J1D- J4D, RS-485 'Auto' Enabled, with 'No Echo'

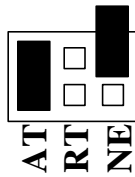


Figure 8 - Headers J1D- J4D, RS-485 'Auto' Enabled, with 'Echo'

Interface Mode Examples J1D – J4D (continued)

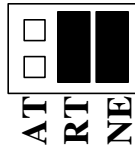


Figure 9 - Headers J1D- J4D, RS-485 'RTS' Enabled, with 'No Echo'

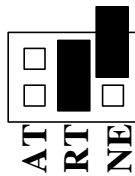


Figure 10 - Headers J1D- J4D, RS-485 'RTS' Enabled, with 'Echo'

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-530/422/485 input in addition to a 1K ohm pull-up/pull-down combination that bias the receiver inputs. Headers J1E through J4E allow the user to customize this interface to their specific requirements. Each jumper position corresponds to a specific portion of the interface. If multiple **ULTRA COMM+422** adapters are configured in an RS-485 network, only the boards on each end should have jumpers T, P & P **ON**. Refer to the following table for each position's operation:

Name	Function
P	Adds or removes the 1K ohm pull-down resistor in the RS-422/RS-485 receiver circuit (Receive data only).
P	Adds or removes the 1K ohm pull-up resistor in the RS-422/RS-485 receiver circuit (Receive data only).
T	Adds or removes the 120 ohm termination.
L	Connects the TX- to RX- for RS-485 two wire operation.
L	Connects the TX+ to RX+ for RS-485 two wire operation.

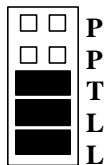


Figure 11 - Headers J1E - J4E, Line Termination

Clock Modes

The **ULTRA COMM+422** employs a unique clocking option that allows the end user to select from divide by 4, divide by 2 and divide by 1 clocking modes. These modes are selected at Headers J1C through J4C.

To select the Baud rates commonly associated with COM: ports (i.e. 2400, 4800, 9600, 19.2, ... 115.2K Bps) place the jumper in the divide by 4 mode (silk-screen DIV4).

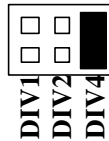


Figure 12 - Clocking Mode 'Divide By 4'

To double these rates up to a maximum rate for 230.4K bps place the jumper in the divide by 2 (silk-screen DIV2) position.

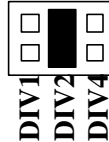


Figure 13 - Clocking Mode 'Divide By 2'

To select the maximum data rate (460.8K bps) place the jumper in the divide by 1 (silk-screen DIV1) position.

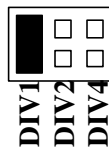


Figure 14 - Clocking Mode 'Divide By 1'

Baud Rates and Divisors for the 'Div1' mode

The following table shows some common data rates and the rates you should choose to match them if using the adapter in the 'Div1' mode.

For this Data Rate	Choose this Data Rate
1200 bps	300 bps
2400 bps	600 bps
4800 bps	1200 bps
9600 bps	2400 bps
19.2K bps	4800 bps
57.6 K bps	14.4K bps
115.2 K bps	28.8K bps
230.4K bps	57.6 K bps
460.8K bps	115.2 K bps

If your communications package allows the use of Baud rate divisors, choose the appropriate divisor from the following table:

For this Data Rate	Choose this Divisor
1200 bps	384
2400 bps	192
4800 bps	96
9600 bps	48
19.2K bps	24
38.4K bps	12
57.6K bps	8
115.2K bps	4
230.4K bps	2
460.8K bps	1

Baud Rates and Divisors for the 'Div2' mode

The following table shows some common data rates and the rates you should choose to match them if using the adapter in the 'Div2' mode.

For this Data Rate	Choose this Data Rate
1200 bps	600 bps
2400 bps	1200 bps
4800 bps	2400bps
9600 bps	4800 bps
19.2K bps	9600 bps
38.4K bps	19.2K bps
57.6 K bps	28.8K bps
115.2 K bps	57.6 K bps
230.4 K bps	115.2 K bps

If your communications package allows the use of Baud rate divisors, choose the appropriate divisor from the following table:

For this Data Rate	Choose this Divisor
1200 bps	192
2400 bps	96
4800 bps	48
9600 bps	24
19.2K bps	12
38.4K bps	8
57.6K bps	4
115.2K bps	2
230.4K bps	1

Installation

The **ULTRA COMM+422** can be installed in any of the PC expansion slots. The **ULTRA COMM+422** contains several jumper straps for each port that must be set for proper operation.

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 **ULTRA COMM+422** into the slot. Make sure that the adapter is seated properly.
5. Replace the screw.
6. Install the “Spider” Cable
7. Replace the cover.
8. Connect the power cord.

Installation is complete.

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.

Technical Description

The **ULTRA COMM+422** utilizes the 16550 UART. This chip features programmable baud rates, data format, interrupt control and a 16-byte input and output FIFO. Also available as options are the Startech 16C650 and the Texas Instruments 16C750 UARTs, that provide deeper FIFOs (32 bytes) and enhanced clocking features.

A second version of the **ULTRA COMM+422**, p/n 3441 is available without the auto enable feature for a reduced price. If point to point RS-422 or RTS enabled RS-485 operations are desired, this option should be considered.

Features

- Automatic RS-485 driver enable/disable allows card to appear to be RS-232 requiring no additional drivers
- 'PAL' option allows for unique OEM address selection
- 'Shareable' IRQs allow more than one port to share a single IRQ
- IRQs 2/9-7, 10, 11, 12, 15 supported
- 16550 buffered UARTs standard, 16650 and 16750 UARTS available
- 16 Bit address decode allows for easier integration
- Speeds up to 460.8 K bps available
- Multiple clocking modes insuring compatibility with existing software products

Modem Control Signal Considerations

Some software packages require the use of the modem handshake signals such as RTS or CTS. Refer to your application software manual to determine the requirements for modem control signals. If no requirements are mentioned, a safe configuration is to tie RTS to CTS. This configuration will typically satisfy the modem control signal requirements for most communications software.

Interrupts

A good description of an interrupt and its importance to the IBM PC can be found in the book 'Peter Norton's Inside the PC, Premier Edition':

“ One of the key things that makes a computer different from any other kind of man-made machine is that computers have the capability to respond to the unpredictable variety of work that comes to them. The key to this capability is a feature known as interrupts. The interrupt feature enables the computer to suspend whatever it is doing and switch to something else in response to an interruption, such as the press of a key on the keyboard.”

A good analogy of a PC interrupt would be the phone ringing. The phone 'bell' is a request for us to stop what we are currently doing and take up another task (speak to the person on the other end of the line). This is the same process the PC uses to alert the CPU that a task must be preformed. The CPU upon receiving an interrupt makes a record of what the processor was doing at the time and stores this information on the 'stack'; this allows the processor to resume its predefined duties after the interrupt is handled, exactly where it left off. Every main sub-system in the PC has its own interrupt, frequently called an IRQ (short for **I**nterrupt **R**e**Q**uest)..

In these early days of PC's Sealevel Systems decided that the ability to share IRQs was an important feature for any add-in I/O card. Consider that in the IBM XT the available IRQs were IRQ0 through IRQ7. Of these interrupts only IRQ2-5 and IRQ7 were actually available for use. This made the IRQ a very valuable system resource. To make the maximum use of these system resources Sealevel Systems devised an IRQ sharing circuit that allowed more than one port to use a selected IRQ. This worked fine as a hardware solution but presented the software designer with a challenge to identify the source of the interrupt. The software designer frequently used a technique referred to as 'round robin polling'. This method required the interrupt service routine to 'poll' or interrogate each UART as to its interrupt pending status. This method of polling was sufficient for use with slower speed communications, but as modems increased their through put abilities this method of servicing shared IRQs became inefficient.

Why use an ISP?

The answer to the polling inefficiency was the **Interrupt Status Port (ISP)**. The ISP is a read only 8-bit register that sets a corresponding bit when an interrupt is pending. Port 1 interrupt line corresponds with Bit D0 of the status port, Port 2 with D1 etc. The use of this port means that the software designer now only has to poll a single port to determine if an interrupt is pending.

The ISP is at Base+7 on each port (Example: Base = 280 Hex, Status Port = 287, 28F... etc.). The **ULTRA COMM+422** will allow any one of the available locations to be read to obtain the value in the status register. All four status ports on the **ULTRA COMM+422** are identical, so any one of the four can be read.

Example: This indicates that Channel 2 has an interrupt pending.

Bit Position:	7	6	5	4	3	2	1	0
Value Read:	0	0	0	0	0	0	1	0

Connector Pin Assignments

DB-9 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

DB-37 Connector Pin Assignments

Port #	1	2	3	4
GND	33	14	24	5
TX-	35	12	26	3
RTS-	17	30	8	21
TX+	34	13	25	4
RX-	36	11	27	2
CTS-	16	31	7	22
RTS+	18	29	9	20
RX+	37	10	28	1
CTS+	15	32	6	23

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

Manufacturing

- IPC 610-A Class-III standards are adhered to with a 0.1 visual A.Q.L. and 100% Functional Testing.
- 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

Supply line	+5 VDC
3440 Rating	600 mA
3441 Rating	570 mA

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

Board length	8.0 inches	(20.32 cm)
Board Height including Goldfingers	4.2 inches	(10.66 cm)
Board Height excluding Goldfingers	3.9 inches	(9.91 cm)

Appendix A - Troubleshooting

A Serial Utility Diskette is supplied with the Sealevel Systems adapter and will be used in the troubleshooting procedures. By using this diskette 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. While the Sealevel Systems adapter does allow the sharing of IRQs, many other adapters (i.e. SCSI adapters & on-board serial ports) do not. 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 or Windows 3.x refer to the Serial Utilities disk 1 and the User Manual to verify that the Sealevel Systems adapter is configured correctly. The supplied diskette contains a diagnostic program 'SSD' that 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 'README' file on the supplied diskette for detailed instructions on using 'SSD'.
6. For Windows 95 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 eliminate any software issues from the equation.

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. Please refer to your included diskette for any post production manual updates and application specific information.
10. Always use the Sealevel Systems diagnostic software when Troubleshooting a problem. This will eliminate the software issue from the equation.

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. 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. Sealevel Systems maintains a forum on CompuServe providing utilities and new product information. This forum is accessed by typing 'GO Sealevel' at the command prompt.
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 - Electrical 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. 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 (usual 1, 1.5 or 2). An extra bit used for error detection is often appended before the stop bits.

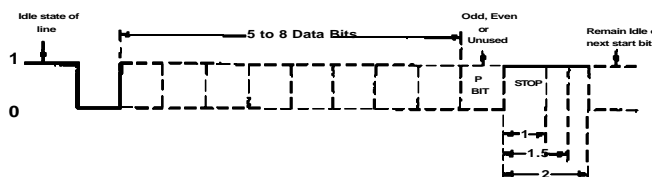
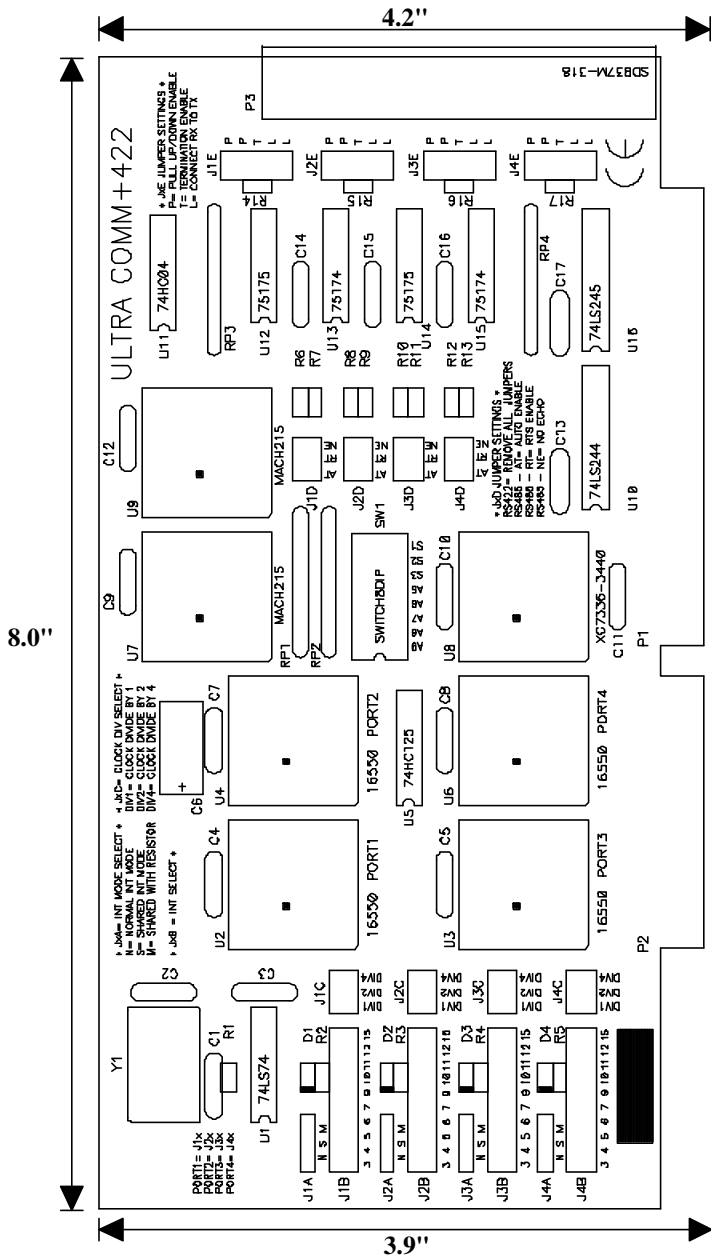


Figure 15 - Asynchronous Communications Bit Diagram

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 - 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.

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