OMG-ULTRACOMM422-PCI
Automatic Four Port PCI RS-422/485 Interface Board
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The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.
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Introduction

Overview
The Omega Engineering OMG-ULTRA COMM+422.PCI is a four channel PCI Bus serial I/O adapter for the PC and compatibles supporting data rates up to 460.8K bps.

RS-422 provides excellent communications for long distance device connections up to 4000ft., where noise immunity and high data integrity are essential. Select RS-485 and capture data from multiple peripherals in a RS-485 multidrop network.

In both RS-485 and RS-422 modes, the card works seamlessly with the standard operating system serial driver. In RS-485 mode, our special auto-enable feature allows the RS-485 ports to be viewed by the operating system as a COM: port. This allows the standard COM: driver to be utilized for RS-485 communications. Our on-board hardware automatically handles the RS-485 driver enable.

What’s Included
The OMG-ULTRA COMM+422.PCI is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- OMG-ULTRA COMM+422.PCI Serial I/O Adapter
- Serial Utility Software
- “Spider” Cable providing 4 DB-9 connectors
- User Manual

Factory Default Settings
The OMG-ULTRA COMM+422.PCI factory default settings are as follows:

<table>
<thead>
<tr>
<th>Port #</th>
<th>Clock DIV Mode</th>
<th>Enable Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port 1</td>
<td>4</td>
<td>Auto</td>
</tr>
<tr>
<td>Port 2</td>
<td>4</td>
<td>Auto</td>
</tr>
<tr>
<td>Port 3</td>
<td>4</td>
<td>Auto</td>
</tr>
<tr>
<td>Port 4</td>
<td>4</td>
<td>Auto</td>
</tr>
</tbody>
</table>

To install the OMG-ULTRA COMM+422.PCI using factory default settings, refer to Installation on page 9.

For your reference, record installed OMG-ULTRA COMM+422.PCI settings below:

<table>
<thead>
<tr>
<th>Port #</th>
<th>Clock DIV Mode</th>
<th>Enable Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Card Setup

In all cases J1x is for port 1, J2x - port 2, J3x - port 3 and J4x – port 4.

RS-485 Enable Modes

RS-485 is ideal for multi-drop or network environments. RS-485 requires a tri-state driver 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 **OMG-ULTRA COMM+422.PCI** 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 **OMG-ULTRA COMM+422.PCI** in an RS-485 application with existing (i.e. standard RS-232) software drivers.

Headers J1B – J4B 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 J1B – J4B 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 J1B – J4B.

Examples on the following pages describe all of the valid settings for J1B – J4B.
Interface Mode Examples J1B – J4B

Figure 1 - Headers J1B – J4B, RS-422

Figure 2 - Headers J1B – J4B, RS-485 ‘Auto’ Enabled, with ‘No Echo’

Figure 3 - Headers J1B – J4B, RS-485 ‘Auto’ Enabled, with ‘Echo’
Interface Mode Examples J1B – J4B (continued)

![Figure 4 - Headers J1B – J4B, RS-485 ‘RTS’ Enabled, with ‘No Echo’](image1)

![Figure 5 - Headers J1B – J4B, RS-485 ‘RTS’ Enabled, with ‘Echo’](image2)

**Address and IRQ selection**

The **OMG-ULTRA COMM+422.PCI** is automatically assigned I/O addresses and IRQs by your motherboard BIOS. Only the I/O addresses may be modified by the user. Adding or removing other hardware may change the assignment of I/O addresses and IRQs.
Line Termination

Typically, each end of the RS-485 bus must have line terminating resistors (RS-422 terminates 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 biases the receiver inputs. Headers J1A – J4A allow the user to customize this interface to their specific requirements. Each jumper position corresponds to a specific portion of the interface. If multiple OMG-ULTRA COMM+422.PCI 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:

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

Figure 6 - Headers J1A – J4A, Line Termination
Clock Modes

The **OMG-ULTRA COMM+422.PCI** 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 7 - Clocking Mode 'Divide By 4'](image)

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 8 - Clocking Mode 'Divide By 2'](image)
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.

<table>
<thead>
<tr>
<th>For this Data Rate</th>
<th>Choose this Data Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 bps</td>
<td>300 bps</td>
</tr>
<tr>
<td>2400 bps</td>
<td>600 bps</td>
</tr>
<tr>
<td>4800 bps</td>
<td>1200 bps</td>
</tr>
<tr>
<td>9600 bps</td>
<td>2400 bps</td>
</tr>
<tr>
<td>19.2K bps</td>
<td>4800 bps</td>
</tr>
<tr>
<td>57.6 K bps</td>
<td>14.4K bps</td>
</tr>
<tr>
<td>115.2 K bps</td>
<td>28.8K bps</td>
</tr>
<tr>
<td>230.4K bps</td>
<td>57.6 K bps</td>
</tr>
<tr>
<td>460.8K bps</td>
<td>115.2 K bps</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>For this Data Rate</th>
<th>Choose this Divisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 bps</td>
<td>384</td>
</tr>
<tr>
<td>2400 bps</td>
<td>192</td>
</tr>
<tr>
<td>4800 bps</td>
<td>96</td>
</tr>
<tr>
<td>9600 bps</td>
<td>48</td>
</tr>
<tr>
<td>19.2K bps</td>
<td>24</td>
</tr>
<tr>
<td>38.4K bps</td>
<td>12</td>
</tr>
<tr>
<td>57.6K bps</td>
<td>8</td>
</tr>
<tr>
<td>115.2K bps</td>
<td>4</td>
</tr>
<tr>
<td>230.4K bps</td>
<td>2</td>
</tr>
<tr>
<td>460.8K bps</td>
<td>1</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>For this Data Rate</th>
<th>Choose this Data Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 bps</td>
<td>600 bps</td>
</tr>
<tr>
<td>2400 bps</td>
<td>1200 bps</td>
</tr>
<tr>
<td>4800 bps</td>
<td>2400 bps</td>
</tr>
<tr>
<td>9600 bps</td>
<td>4800 bps</td>
</tr>
<tr>
<td>19.2K bps</td>
<td>9600 bps</td>
</tr>
<tr>
<td>38.4K bps</td>
<td>19.2K bps</td>
</tr>
<tr>
<td>57.6 K bps</td>
<td>28.8K bps</td>
</tr>
<tr>
<td>115.2 K bps</td>
<td>57.6 K bps</td>
</tr>
<tr>
<td>230.4 K bps</td>
<td>115.2 K bps</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>For this Data Rate</th>
<th>Choose this Divisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 bps</td>
<td>192</td>
</tr>
<tr>
<td>2400 bps</td>
<td>96</td>
</tr>
<tr>
<td>4800 bps</td>
<td>48</td>
</tr>
<tr>
<td>9600 bps</td>
<td>24</td>
</tr>
<tr>
<td>19.2K bps</td>
<td>12</td>
</tr>
<tr>
<td>38.4K bps</td>
<td>8</td>
</tr>
<tr>
<td>57.6K bps</td>
<td>4</td>
</tr>
<tr>
<td>115.2K bps</td>
<td>2</td>
</tr>
<tr>
<td>230.4K bps</td>
<td>1</td>
</tr>
</tbody>
</table>
Installation

Operating System Installation

Windows 95/98/NT

Run Setup on Disk 2 of the Serial Utilities Software.

Windows 3.1x

Refer to the Win3x.hlp file in the \Win31 directory on Disk 1 of the Serial Utilities Software.

DOS

Refer to the Readme.txt file found in the \DOS directory on Disk 1 of the Serial Utilities Software.

Other Operating Systems

Refer to the appropriate directory on Disk 1 of the Serial Utilities Software.

Hardware Installation

The OMG-ULTRA COMM+422.PCI can be installed in any of the PCI expansion slots and 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 PCI slot and remove the blank metal slot cover.
4. Gently insert the OMG-ULTRA COMM+422.PCI into the slot. Make sure that the adapter is seated properly.
5. Replace the screw.
6. Replace the cover.
7. Connect the power cord.

Installation is complete.
Technical Description

The Omega Engineering OMG-ULTRA COMM+422.PCI provides a PCI interface adapter with 4 RS-422/485 asynchronous serial ports for industrial automation and control applications.

The OMG-ULTRA COMM+422.PCI utilizes the 16550 UART. This chip features programmable baud rates, data format, interrupt control and a 16-byte input and output FIFO. Also available is the 16C650 UART that provides a deeper FIFO (32 bytes) and enhanced clocking features and a 16C750 UART providing a 64 byte FIFO.

Interrupts

A good description of an interrupt and its importance to the 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 it’s own interrupt, frequently called an IRQ (short for Interrupt ReQuest).

In the early days of PC’s Omega Engineering 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 Omega Engineering 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 throughput 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 OMG-ULTRA COMM+422.PCI will allow any one of the available locations to be read to obtain the value in the status register. Both status ports on the OMG-ULTRA COMM+422.PCI are identical, so any one can be read.

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

<table>
<thead>
<tr>
<th>Bit Position</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Read</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Connector Pin Assignments**

**RS-422/485**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Name</th>
<th>Pin #</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>Ground</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>TX+</td>
<td>Transmit Data Positive</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>TX-</td>
<td>Transmit Data Negative</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>RTS+</td>
<td>Request To Send Positive</td>
<td>6</td>
<td>Output</td>
</tr>
<tr>
<td>RTS-</td>
<td>Request To Send Negative</td>
<td>7</td>
<td>Output</td>
</tr>
<tr>
<td>RX+</td>
<td>Receive Data Positive</td>
<td>1</td>
<td>Input</td>
</tr>
<tr>
<td>RX-</td>
<td>Receive Data Negative</td>
<td>2</td>
<td>Input</td>
</tr>
<tr>
<td>CTS+</td>
<td>Clear To Send Positive</td>
<td>9</td>
<td>Input</td>
</tr>
<tr>
<td>CTS-</td>
<td>Clear To Send Negative</td>
<td>8</td>
<td>Input</td>
</tr>
</tbody>
</table>
Specifications

Environmental Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Operating</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>0º to 50º C</td>
<td>-20º to 70º C</td>
</tr>
<tr>
<td></td>
<td>(32º to 122º F)</td>
<td>(-4º to 158º F)</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>10 to 90% R.H.</td>
<td>10 to 90% R.H.</td>
</tr>
<tr>
<td></td>
<td>Non-Condensing</td>
<td>Non-Condensing</td>
</tr>
</tbody>
</table>

Manufacturing

- All Omega Engineering 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

<table>
<thead>
<tr>
<th>Supply line</th>
<th>+5 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>620 mA</td>
</tr>
</tbody>
</table>

Mean Time Between Failures (MTBF)

Greater than 150,000 hours. (Calculated)

Physical Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Measurement</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board length</td>
<td>5.0 inches</td>
<td>(12.7 cm)</td>
</tr>
<tr>
<td>Board Height including Goldfingers</td>
<td>4.2 inches</td>
<td>(10.66 cm)</td>
</tr>
<tr>
<td>Board Height excluding Goldfingers</td>
<td>3.875 inches</td>
<td>(9.841 cm)</td>
</tr>
</tbody>
</table>
Appendix A - Troubleshooting

A Serial Utility Diskette is supplied with the Omega Engineering 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 Omega Engineering 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 Omega Engineering adapter is using a unique IRQ. While the Omega Engineering 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 Omega Engineering adapter is securely installed in a motherboard slot.

5. When running DOS, Windows 3.x or other operating systems refer to the Serial Utilities Disk 1 and the User Manual to verify that the Omega Engineering 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 README.txt file on the supplied diskette for detailed instructions on using 'SSD'.

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

Always use the Omega Engineering 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.

RETURN AUTHORIZATION MUST BE OBTAINED FROM OMEGA ENGINEERING BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING OMEGA ENGINEERING 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. A start 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 (usual 1, 1.5 or 2). An extra bit used for error detection is often appended before the stop bits.

![Asynchronous Communications Bit Diagram](image)

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 refereed 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 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”
- **EN50082-1** - “Electromagnetic compatibility - Generic immunity standard” Part 1: Residential, commercial and light industry
- **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.
OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a “Basic Component” under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

**RETURN REQUESTS/INQUIRIES**

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. **BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS).** The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

- 1. Purchase Order number under which the product was PURCHASED,
- 2. Model and serial number of the product under warranty, and
- 3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

- 1. Purchase Order number to cover the COST of the repair,
- 2. Model and serial number of the product, and
- 3. Repair instructions and/or specific problems relative to the product.

OMEGA’s policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Pumps & Tubing
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- Industrial Water & Wastewater Treatment
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