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MODEL PCI-COM422/4

USER MANUAL

FILE: MPCICOM422-4.E1d

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Chapter 1: Introduction

The card was designed for effective transmission in RS422 (EIA422) protocol. The card is 6.1 inches long and may be installed in PCI-bus slots of IBM PC or compatible computers. The card features four independent, asynchronous RS422 serial ports, type 16550 buffered UARTs, and, for Windows compatibility, automatic control to transparently enable/disable the transmission drivers.

There are two I/O connector options. The standard model includes a single DB25 male connector on the mounting bracket plus a breakout cable that terminates in four 9-pin female connectors. The optional model has two 9-pin male connectors on the card mounting bracket plus a second mounting bracket with two more 9-pin male connectors with ribbon cables to connect them to headers on the card.

RS422 Balanced Mode Operation

The card supports RS422 communications and uses differential balanced drivers for long range and noise immunity. This card also has the capability to add load resistors to terminate the communications lines. RS422 communications requires that a transmitter supply a bias voltage to ensure a known "zero" state. Also, receiver inputs at each end of the network should be terminated to eliminate "ringing". The card supports biasing by default and supports termination by jumpers on the card. If your application requires the transmitter to be un-biased, please contact the factory.

COM Port Compatibility

Type 16550 UARTs are used as the Asynchronous Communication Element (ACE). These include a 16-byte transmit/receive buffer to protect against lost data in multitasking operating systems, while maintaining 100 percent compatibility with the original IBM serial port. The system assigns the address(es).

A crystal oscillator is located on the card. This oscillator ensures precise selection of baud rates up to 115,200 or, by changing a jumper, up to 460,800 with the standard crystal oscillator.

The driver/receiver used, the SN75176B, is capable of driving extremely long communication lines at high baud rates. It can drive up to +60 mA on balanced lines and receive inputs as low as 200 mV differential signal superimposed on common mode noise of +12 V or -7 V. In case of communication conflict, the driver/receivers feature thermal shutdown.

Communication Mode

This card supports Full-Duplex and Half-Duplex communications with a 4-wire cable connection. Half-Duplex allows traffic to travel in both directions, but only one way at a time.

Baud Rate Ranges

The card has capability for two baud rate ranges and you can select which you wish to use on a port-by-port basis. One range is for up to 115,200 baud applications and the other is up to 460,800 baud applications.

Specifications

Communications Interface

- I/O Connection: 9-pin D-sub connectors
- Serial Ports: Four shielded male D-sub 9-pin IBM AT style connectors compatible with RS422 specifications. (Note: On model an external "spider" or breakout cable terminates with four female D-sub 9-pin connectors.)
- Character length: 5, 6, 7, or 8 bits.
- Parity: Even, odd or none.
- Stop Interval: 1, 1.5, or 2 bits.
- Serial Data Rates: Up to 115,200 baud, Asynchronous, A faster range of rates up to 460,800, is achieved by jumper selection on the card. Type 16550 buffered UART.
- Address: Continuously mappable within 0000 to FFFF (hex) range of PCI bus addresses (Conforms to PCI Specification 2.1).
- Receiver Input Sensitivity: +200 mV, differential input.
- Common Mode Rejection: +12V to -7V
- Transmitter Output Drive Capability: 60 mA, with thermal shutdown.

Environmental

- Operating Temperature Range: 0 °C. to +60 °C.
- Storage temperature Range: -50 °C. to +120 °C.
- Humidity: 5% to 95%, non-condensing.
- Size: 6.1" long (155 mm) by 3.9" (99 mm).
- Power Required: +5VDC at 125 mA typical, -12VDC at 5 mA typical, +12VDC at 5 mA typical, 750 mW total power consumption.

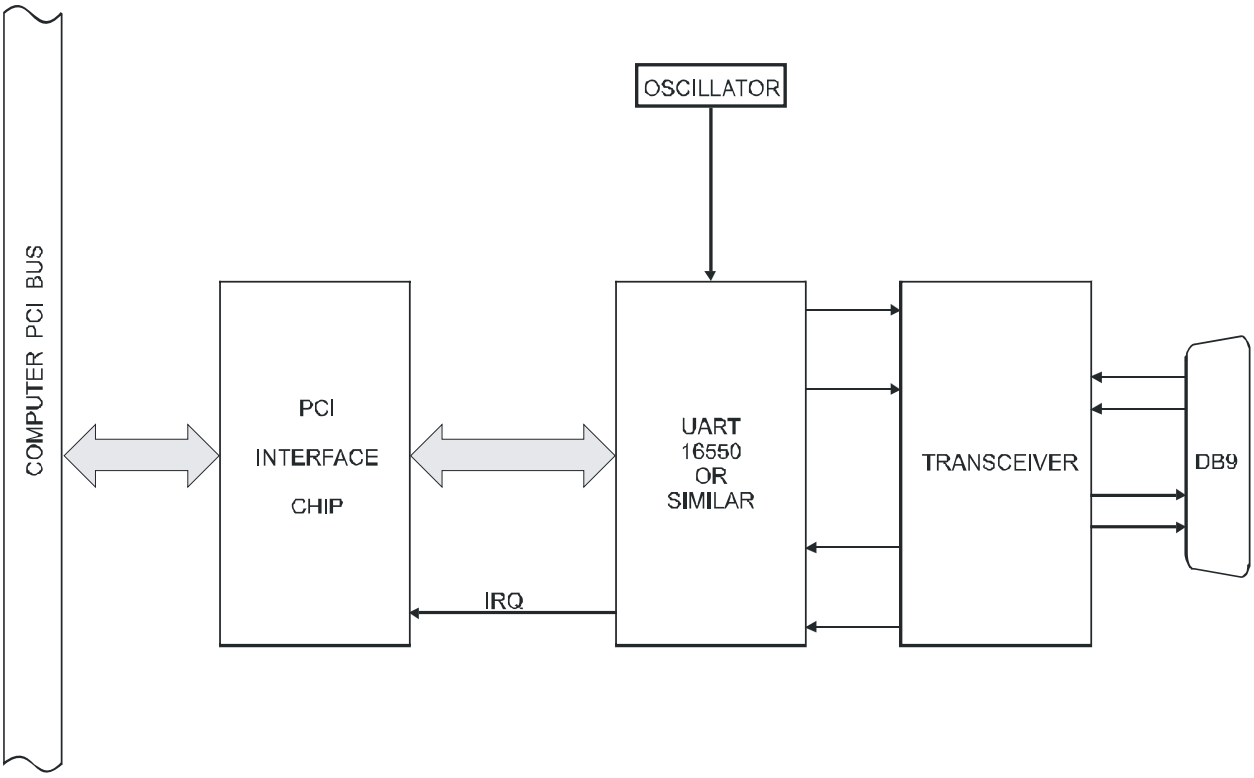


Figure 1-1: Block Diagram(Only One Serial Channel Shown)

Chapter 2: Installation

A printed Quick-Start Guide (QSG) is packed with the card for your convenience. If you've already performed the steps from the QSG, you may find this chapter to be redundant and may skip forward to begin developing your application.

The software provided with this card is on CD and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your operating system.

Configure Card Options via Jumper Selection
Before installing the card into your computer, carefully read Chapter 3: Option Selection of this manual, then configure the card according to your requirements and protocol (RS-232, RS-422, RS-485, 4-wire 485, etc.). Our Windows based setup program can be used in conjunction with Chapter 3 to assist in configuring jumpers on the card, as well as provide additional descriptions for usage of the various card options (such as termination, bias, baud rate range, RS-232, RS-422, RS-485, etc.).

CD Software Installation

The following instructions assume the CD-ROM drive is drive "D". Please substitute the appropriate drive letter for your system as necessary.

DOS
1. Place the CD into your CD-ROM drive.
2. Type D : Enter to change the active drive to the CD-ROM drive.
3. Type I N S T A L L Enter to run the install program.
4. Follow the on-screen prompts to install the software for this board.

WINDOWS
1. Place the CD into your CD-ROM drive.
2. The system should automatically run the install program. If the install program does not run promptly, click START | RUN and type D : I N S T A L L, click OK or press Enter.
3. Follow the on-screen prompts to install the software for this board.

LINUX
1. Please refer to linux.htm on the CD-ROM for information on installing under linux.

Note: COM boards can be installed in virtually any operating system. We do support installation in earlier versions of Windows, and are very likely to support future versions as well.

Caution! * ESD A single static discharge can damage your card and cause premature failure! Please follow all reasonable precautions to prevent a static discharge such as grounding yourself by touching any grounded surface prior to touching the card.

Hardware Installation

1. Make sure to set switches and jumpers from either the Option Selection section of this manual or from the suggestions of SETUP.EXE.
2. Do not install card into the computer until the software has been fully installed.
3. Turn OFF computer power AND unplug AC power from the system.
4. Remove the computer cover.
5. Carefully install the card in an available 5V or 3.3V PCI expansion slot (you may need to remove a backplate first).
6. Inspect for proper fit of the card and tighten screws. Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.
7. Install an I/O cable onto the card's bracket mounted connector.
8. Replace the computer cover and turn ON the computer. Enter the CMOS setup program of your system and verify that the PCI plug-and-play option is set appropriately for your system. Systems running Windows 95/98/2000/XP/2003 (or any other PNP-compliant operating system) should set the CMOS option to OS. Systems running under DOS, Windows NT, Windows 3.1, or any other non-PNP-compliant operating system should set the PNP CMOS option to BIOS or Motherboard. Save the option and continue booting the system.
9. Most computers should auto-detect the card (depending on the operating system) and automatically finish installing the drivers.
10. Run PCIfind.exe to complete installing the card into the registry (for Windows only) and to determine the assigned resources.
11. Run one of the provided sample programs that was copied to the newly created card directory (from the CD) to test and validate your installation.

Input/Output Connections

There are two I/O connector configurations. The typical model card has a male DB25 connector on the card mounting bracket and breakout cables that terminate in four female DB9 connectors. The optional model has two DB9 connectors on the card mounting bracket (Ports A and B) and two more DB9 connectors on a separate mounting bracket (for Ports C and D).

To ensure that there is minimum susceptibility to EMI and minimum radiation, it is important that the card mounting bracket be properly screwed into place and that there be a good connection to the chassis. Also, proper EMI cabling techniques (cable connect to chassis at the aperture, shielded twisted-pair wiring, etc) be used for the input/output wiring.

Chapter 3: Option Selection

To help you locate the jumpers described in this section, refer to Figure 3-2, Option Selection Map at the end of this section. Operation of the serial communications section is determined by jumper installation as described in the following paragraphs.

Terminations

A transmission line should be terminated at the receiving end in its characteristic impedance. Installing a jumper at the locations labeled LDxO and LDxI apply a 120Ω load across the transmit/receive input/output for RS422 operation.

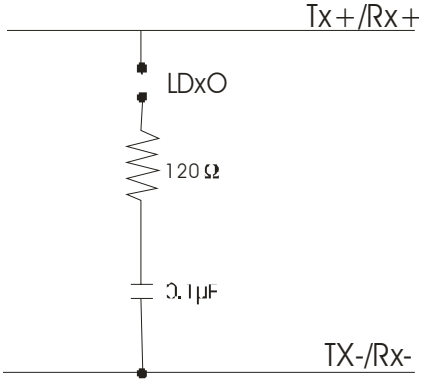


Figure 3-1: Simplified Termination Schematic

In RS422 operations where there are multiple terminals, only the RS422 ports at each end of the network should have terminating impedance as described above. To so terminate the COM A port, place a jumper at the location labeled LDAO. To terminate the COM B, COM C, and COM D ports, place jumpers at locations labeled LDBO, LDCO, and LDDO respectively. Similarly, inputs are terminated at jumpers labeled LDAI, LDB1, etc.

Also, for RS422 operation, there must be a bias on the Tx+ and Tx- lines. If the card is not to provide that bias, contact the factory technical support.

Data Cable Wiring

SignalPin Connection

TX+	2
TX-	3
RX+	9
RX-	1
Ground	5

Baud Rate Ranges

The jumpers labeled CLK X1 and CLK X4 provide means to select baud rates in either of two ranges. When in the "X1" position, the baud rate range is up to 115,200 baud. When in the CLK X4 position, the baud rate range is 200 to 460,800 baud.

Interrupts

Please note that, in Windows NT, changes must be made to the system registry to support IRQ sharing. The following is excerpted from "Controlling Multiport Serial I/O Cards" provided by Microsoft in the

MSDN library, documentid:mk:@ivt:nt40res/D15/S55FC.HTM, also available in the WindowsNT Resource Kit. The text enclosed in brackets ("[ ]") denotes a comment by the editors.

The Microsoft serial driver can be used to control many dumb multiport serial cards. Dumb indicates that the control includes no on-board processor. Each port of a multiport card has a separate subkey under the CurrentControlSet\Services\Serial subkey in the registry. In each of these subkeys, you must add values for **DosDevices, Interrupt, InterruptStatus, PortAddress,** and **PortIndex** because these are not detected by the Hardware Recognizer. (For descriptions and ranges for these values, see Regentry.hlp, the Registry help file on the WindowsNT Workstation Resource Kit CD.)

For example, if you have a four-port card configured to use address 0xFFF0 with an interrupt of 0xFFF8, the values in the Registry are: [assuming that every port is configured to use the same IRQ and that the addresses are configured to be consecutive and contiguous]

Serial2 Subkey: PortAddress = REG_DWORD 0xFFF0 Interrupt = REG_WORD 5 DosDevices = REG_SZ COM3 InterruptStatus = REG_DWORD 0xFFF8 PortIndex = REG_DWORD 1	**Serial4 Subkey:** PortAddress = REG_DWORD 0xFF90 Interrupt = REG_DWORD 5 DosDevices = REG_SZ COM5 InterruptStatus = REG_DWORD 0xFFF8 PortIndex - REG_DWORD 3
Serial3 Subkey: PortAddress = REG_DWORD 0xFFE0 Interrupt = REG_DWORD 5 DosDevices = REG_SZ COM4 InterruptStatus = REG_DWORD 0xFFF8 PortIndex = REG_DWORD 2	**Serial5 Subkey:** PortAddress = REG_DWORD 0xFF80 Interrupt = REG_DWORD 5 Dos Devices = REG_SZ COM6 InterruptStatus = REG_DWORD 0xFFF8 PortIndex = REG_DWORD 4

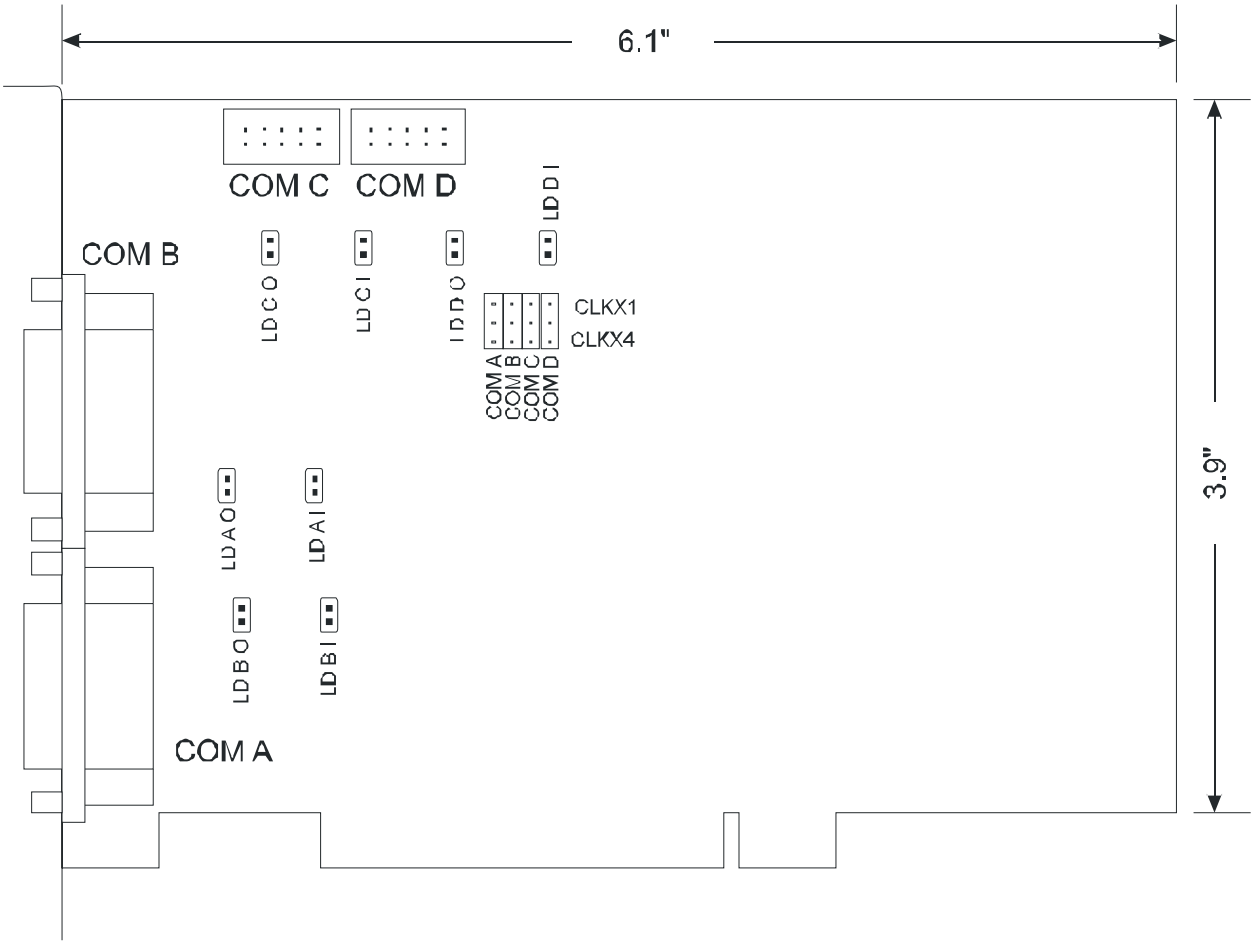


Figure 3-2: Option Selection Map

Chapter 4: Address Selection

The card uses four separate address spaces. COM A occupies 16 consecutive register locations and COM B, COM C, and COM D each occupy eight consecutive register locations.

PCI architecture is Plug-and-Play. This means that the BIOS or Operating System determines the resources assigned to PCI cards rather than you selecting those resources with switches or jumpers. As a result, you cannot set or change the card's base address. You can only determine what the system has assigned.

To determine the base address that has been assigned, run the PCIFind.EXE utility provided. This utility will display a list of all of the cards detected on the PCI bus, the addresses assigned to each function on each of the cards, and the respective IRQs (if any) allotted.

Alternatively, some operating systems (Windows95/98/2000) can be queried to determine which resources were assigned. In these operating systems, you can use either PCIFind (Windows95) or PCINT (WindowsNT), or the Device Manager utility from the System Properties Applet of the control panel. The card is installed in the Data Acquisition class of the Device Manager list. Selecting the card, clicking Properties, and then selecting the Resources Tab will display a list of the resources allocated to the card.

PCIFind uses the Vendor ID and Device ID to search for your card, then reads the base address and IRQ.If you want to determine the base address and IRQ yourself, use the following information.

The Vendor ID for this card is 494F. (ASCII for "IO")
The Device ID for the card is 1058h.

The PCI Bus supports 64K of I/O space, so your card's addresses may be located anywhere in the 0000 to FFFF hex range

Chapter 5: Programming

Sample Programs

There are sample programs provided with the card in C, Pascal, QuickBASIC, and several Windows languages. DOS samples are located in the DOS directory and Windows samples are located in the WIN32 directory.

Windows Programming

The card installs into Windows as COM ports. Thus the Windows standard API functions can be used. In particular:

- CreateFile() and CloseHandle() for opening and closing a port.
- SetupComm(), SetCommTimeouts(), GetCommState(), and SetCommState() to set and change a port's settings.
- ReadFile() and WriteFile() for accessing a port.

See the documentation for your chosen language for details.

Under DOS, the process is very different. The remainder of this chapter describes DOS programming.

Initialization

Initializing the chip requires knowledge of the UART's register set. The first step is to set the baud rate divisor. You do this by first setting the DLAB (Divisor Latch Access Bit) high. This bit is Bit 7 at Base Address +3. In C code, the call would be:

```
outportb(BASEADDR +3,0x80);
```

You then load the divisor into Base Address +0 (low byte) and Base Address +1 (high byte). The following equation defines the relationship between baud rate and divisor:

```
desired baud rate = (UART clock frequency) / (32 * divisor)
```

On the card, the UART clock frequency is 1.8432 MHz. The following is a table for the popular divisor frequencies:

Baud Rate	Divisor	Max Diff. Cable Length *
115200	1	2200 ft
57600	2	4000 ft
38400	3	4000 ft
28800	4	4000 ft
19200	6	4000 ft
14400	8	4000 ft
9600	12	4000 ft
4800	24	4000 ft
2400	48	4000 ft
1200	96	4000 ft

*These are theoretical maximums based on typical conditions and good quality cables based on the EIA 485 and EIA 422 standard for balanced differential drivers. RS-232 communication lines have a maximum length of 50 feet, regardless of speed.

Table 5-1: Baud Rate Divisor Values

In C, the code to set the chip to 9600 baud is:

```
outportb(BASEADDR, 0x0C);
outportb(BASEADDR +1,0);
```

The second initializing step is to set the Line Control Register at Base Address +3. This register defines word length, stop bits, parity, and the DLAB.

Bits 0 and 1 control word length and allow word lengths from 5 to 8 bits. Bit settings are extracted by subtracting 5 from the desired word length.

Bit 2 determines the number of stop bits. There can be either one or two stop bits. If Bit 2 is set to 0, there will be one stop bit. If Bit 2 is set to 1, there will be two stop bits.

Bits 3 through 6 control parity and break enable. They are not commonly used for communications and should be set to zeroes.

Bit 7 is the DLAB discussed earlier. It must be set to zero after the divisor is loaded or else there will be no communications.

The C command to set the UART for an 8-bit word, no parity, and one stop bit is:

```
outportb(BASEADDR +3, 0x03)
```

The final initialization step is to flush the receiver buffers. You do this with two reads from the receiver buffer at Base Address +0. When done, the UART is ready to use.

Reception

Reception can be handled in two ways: polling and interrupt-driven. When polling, reception is accomplished by constantly reading the Line Status Register at Base Address +5. Bit 0 of this register is set high whenever data are ready to be read from the chip. A simple polling loop must continuously check this bit and read in data as it becomes available. The following code fragment implements a polling loop and uses a value of 13, (ASCII Carriage Return) as an end-of-transmission marker:

```
do
{
while (!(inportb(BASEADDR +5) & 1));          /*Wait until data ready*/
data[i++]= inportb(BASEADDR);
}
while (data[i]!=13);                          /*Reads the line until null character rec'd*/
```

Interrupt-driven communications should be used whenever possible and is required for high data rates. Writing an interrupt-driven receiver is not much more complex than writing a polled receiver but care should be taken when installing or removing your interrupt handler to avoid writing the wrong interrupt, disabling the wrong interrupt, or turning interrupts off for too long a period.

The handler would first read the Interrupt Identification Register at Base Address +2. If the interrupt is for Received Data Available, the handler then reads the data. If no interrupt is pending, control exits the routine. A sample handler, written in C, is as follows:

```
readback = inportb(BASEADDR +2);
if (readback & 4)                     /*Readback will be set to 4 if data are available*/
data[i++]=inportb(BASEADDR);
outportb(0x20,0x20);                  /*Write EOI to 8259 Interrupt Controller*/
return;
```

Transmission

RS422 transmission is simple to implement. The AUTO feature of the card automatically enables the transmitter when data is ready to send so no software enabling is required. The following software example is for non-AUTO operation.

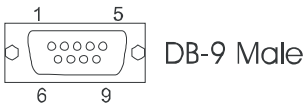
To transmit a string of data, the transmitter must first check Bit 5 of the Line Status Register at Base Address +5. That bit is the transmitter-holding-register-empty flag. If it is high, the transmitter has sent the data. The process of checking the bit until it goes high followed by a write is repeated until no data remains.

The following C code fragment demonstrates this process:

```
outportb(BASEADDR +4, inportb(BASEADDR +4)|0x02);
                                        /*Set RTS bit without altering states of other bits*/
while(data[i]);                         /*While there is data to send*/
{
while(!(inportb(BASEADDR +5)&0x20)); /*Wait until transmitter is empty*/
outportb(BASEADDR,data[i]);
i++;
}
outportb(BASEADDR +4, inportb(BASEADDR +4)&0xFD);
                                        /*Reset RTS bit without altering states of other bits*/
```

Chapter 6: Connector Pin Assignments

The popular 9-pin D subminiature connector is used for interfacing to communication lines. The connector is equipped with 4-40 threaded standoffs (female screw lock) to provide strain relief.



Pin No.	RS422 Signals
1	Rx-
2	Tx+
3	Tx-
4	
5	GND Ground
6	
7	
8	
9	Rx+

Table 6-1: Connector Pin Assignments

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: ***manuals@accesio.com.*** Please detail any errors you find and include your mailing address so that we can send you any manual updates.

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