

BRAIN

BOXES



232/422/485 Card

1.1 EDITION February 2000

PCI VELOCITY RS232/422/485 CARD

These products conform to the following standards:

CE standard: EN55022:1987 Class B

IEC 801-2: 1991 Level 2

IEC 801-3: 1984 Level 2

IEC 801-4: 1998 Level 2

PCB: IEC 249-2-5

NEMA L1 1-10

DIN 40802

UTE C 93-711

BS 4584

MIL P-13949E

UL Approved to 94 V0

TIA /EIA: 485 A (1995) ,423 B (1996)

Year 2000: DISC PD2000-1

PCI VELOCITY RS232/422/485 CARD

OUTLINE CONTENTS

Chapter 1 - Supplied Serial Solution Software.

Chapter 2 - PCI Velocity RS232/422/485 Specifications.

Chapter 3 - PCI Velocity RS232/422/485 Software Configuration Guide.

Chapter 4 – RS232 Pinouts and Cabling

Chapter 5 - Additional RS422/RS485 Information.

The Layout Of This Manual

Chapter 1 - Serial Solution Software, is an overview of this companion software package for our range of serial port cards.

Chapter 2 - PCI Velocity RS422/485 Specifications, gives details of the PCI Velocity RS422/485 specifications and shows you how to install your PCI Velocity RS422/485 card.

Chapter 3 - PCI Velocity RS422/485 Software Configuration Guide, shows you how to configure your operating system to successfully allow trouble free operation of your PCI Velocity RS422/485 card. Installation procedures are for DOS, Windows 3.x, Windows 95, Windows 98/Millennium, Windows NT.

Chapter 4 – RS232 Pinouts and Cabling

Chapter 5 - Additional RS422/RS485 Information, gives details on the RS422 and R485 standard, and cabling; as well as examining half and full duplex RS485 systems and information on card grounding systems.

TABLE OF CONTENTS

CHAPTER 1 SERIAL SOLUTIONS SOFTWARE 7

INTRODUCTION.....	7
INTRODUCING SERIAL SOLUTION SOFTWARE.....	7
SERIAL SOLUTIONS FOR DOS.	7
SERIAL SOLUTIONS FOR WINDOWS 3.X.....	9
SERIAL SOLUTIONS FOR WINDOWS 9X.	9
SERIAL SOLUTIONS FOR WINDOWS NT.	10
COMPLETE DOCUMENTATION AND TECHNICAL BACKUP.....	10

CHAPTER 2 PCI VELOCITY RS232/422/485 HARDWARE SETUP..... 11

INTRODUCTION.....	11
PCI RS232/422/485 CARD FEATURES.	11
AUTOGATING.	12
CONFIGURING THE PCI RS232/422/485 CARD.	14
<i>Full Duplex Settings.</i>	14
<i>With Half Duplex Settings.</i>	14

CHAPTER 3 INSTALLING THE PC CARD IN THE COMPUTER..... 15

SERIAL CARD INSTALLATION.....	15
<i>Problems!</i>	17

CHAPTER 4 PCI VELOCITY RS232/422/485 SOFTWARE CONFIGURATION 18

INTRODUCTION.....	18
DOS INSTALLATION.....	18
<i>Determining PCI RS232/422/485 Resources.</i>	18
<i>Baud clock control is at I/O address 02d0.</i>	19
<i>NEWCOM.SYS Parameters.</i>	19
<i>Configuring And Installing NEWCOM.SYS.</i>	21
<i>Modifying Command Line Parameters.</i>	22
WINDOWS 3.X INSTALLATION.....	23

<i>Determining PCI RS422/485 Resources.</i>	23
<i>Windows 3.x Software Installation.</i>	24
<i>Serial Port Installation.</i>	25
<i>Configuring The COM Ports.</i>	27
<i>Deleting Ports in Windows.</i>	28
<i>Restarting Windows.</i>	28
WINDOWS 95 INSTALLATION.....	29
<i>Card Settings In Windows 95.</i>	33
<i>PCI RS232 Port Settings In Windows 95.</i>	34
<i>Maximum Baud Rate Settings.</i>	36
<i>PCI RS422/485 Port Settings In Windows 95.</i>	39
<i>Maximum Baud Rate Settings.</i>	40
WINDOWS 98/MILLENIUM INSTALLATION.....	43
<i>Card Settings In Windows 98/Millennium.</i>	47
<i>PCI RS232 Port Settings In Windows 98/Millennium.</i>	48
<i>Maximum Baud Rate Settings.</i>	50
<i>PCI RS422/485 Port Settings In Windows 95.</i>	53
<i>Maximum Baud Rate Settings.</i>	54
WINDOWS NT 4.0 INSTALLATION.....	57
<i>Software Installation.</i>	57
<i>Examining Card Configuration.</i>	58
<i>Configuring Ports.</i>	59
<i>Advanced Port Settings.</i>	60
<i>Uninstalling Serial Solutions PCI.</i>	62

CHAPTER 4 RS232 PINOUTS AND PORT

CABLING. 64

INTRODUCTION.....	64
<i>The RS232 Standard.</i>	64
<i>Serial Port Pin Outs.</i>	65
9 PIN D SERIAL PORT RS232 CABLES.....	65
9 PIN D SERIAL PORT CONNECTION TO ANOTHER PC.	66
9 PIN D SERIAL PORT TO A MODEM.....	68
9 PIN D SERIAL PORT LOOP BACK CONNECTOR.	68

CHAPTER 5 ADDITIONAL RS422/485 OPERATION

.....	70
THE RS422 STANDARD.	70
THE RS485 STANDARD.	70
TERMINATING IMPEDANCE'S.	71
THERE IS NO NEED TO ADD ANY MORE AT THE PC END.....	71
FAIL SAFE OPEN CIRCUIT DETECTION.....	72
FAIL SAFE SHORT CIRCUIT PROTECTION.	72
RS422 OPERATION.....	72
<i>RS422 Serial Port Cables.</i>	73
RS485 OPERATION.....	74
<i>The three wiring schemes given described below are: -.....</i>	74
<i>RS485 Cable.....</i>	75
<i>RS485 One Talker - Many Listeners, Half Duplex.....</i>	75
<i>RS485 Many Talkers- Many Listeners, Half Duplex.....</i>	76
<i>RS485 Many Talkers- Many Listeners, Full Duplex.</i>	77
<i>Optional Grounding Arrangements.....</i>	78
INDEX	80

Chapter 1

SERIAL SOLUTIONS SOFTWARE

Introduction.

This chapter is a brief description of the Serial Solutions software package; this can also be purchased SEPARATELY and is available from YOUR DEALER.

Introducing Serial Solution Software.

The perfect partner for any Serial Port is Serial Solutions Software! Serial Solutions is a fully featured suite of programs designed to squeeze the most from PC serial communications.

Serial Solutions is made up of the following components: -

Serial Solutions for DOS

Serial Solutions for Windows 3.x

Serial Solutions for Windows 95

Serial Solutions for Windows NT

All the Serial Solutions drivers have the following features: -

- Drivers for PC FIFO UARTs e.g. 16550 as well as the new improved 32 byte 16650 and 64 byte 16750 UARTs.
- Support for any mix of RS232, RS422, and RS485 handshake schemes.
- Support for wider range of Baud rates and for more than 4 serial ports.

Serial Solutions For DOS.

Serial Solutions for DOS consists of the following programs: -

NewCOM.sys A device driver, it supports COM1 to COM16, allowing 16 serial ports to be used under DOS. It also includes an interrupt handler for enhanced performance with user definable buffer sizes. Accessible from all DOS languages, it is the heart

of the Serial Solution.

It has extensive handshaking support, implementing both hardware handshaking using any combination of the DTR, DSR, CTS, RTS, and DCD lines, and a software handshake using the XON/XOFF protocol.

- NewCOM24.sys A device driver providing support for 24 ports.
- NewCOM32.sys A device driver providing support for 32 ports.
- NewMode.exe A replacement for the DOS 'mode com...' command. NewMode is used to set the serial parameters, including the port address, IRQ line used, the baud rate, parity and data and stop bit options. Baud rates supported are from 110 baud to 115,200 baud! Included is a very handy query mode that reports the settings of the various serial ports. Flexible and fast!
- EASY programs. The EASY disk contains short, simple to understand and use EASYBAS, EASYC and ASYPAS programs, providing straight forward, file type I/O to serial ports with debug information. Use these FIRST, base your sample applications on them. Source code, make files and compiled ready to run programs supplied.
- TERM programs A suite of larger terminal emulation programs written in C (Cterm), Assembly language (Aterm), Pascal (Pasterm), BASIC (BASterm) and FORTRAN (FORterm) show how to access the NEWBIOS routines as well as the simple file I/O to ports. They contain many lines of code and are thus harder to grasp. They demonstrate in depth serial port programming in a variety of languages but they are also useful tools for using serial devices.
- Comtest.exe Comtest is a short but invaluable program that is used to check that the serial port at a particular I/O address is functioning correctly and is connected to

the particular IRQ line. The program correctly identifies the UART type by employing the built in loop back capability of the PC serial port chip, a full test of the baud rate generator, transmitting and receiving buffer, parity enable and start stop bit is performed. There is no need for a second serial port or a cable when using this utility.

Serial Solutions For Windows 3.x

Serial Solutions for Windows 3.x works with Windows 3.0, 3.1 and 3.11 as well as Windows For Workgroups 3.11.

Serial Solutions for Windows 3.x consists of the following programs: -

Setup.exe	The install routine for the package.
Port.DLL	Enhanced Control Panel applet. Allows configuration of extra serial ports from the Windows Control Panel. Supports single as well as multiport cards using shared interrupts.
BbLynx.drv	Replacement for COMM.DRV.
LynxAPI.dll	Enhancement to the Windows Comms API's allowing support for more than 9 ports.
Term.exe	Terminal program.
EasyCWIN	C source code, project files and ready to run.exe program for an easy to understand Windows terminal program. Learn how to write Windows comms apps correctly the easy way.

Serial Solutions For Windows 9x.

Windows 95 has an improved communication API and directly supports up to 255 ports. Our Windows 95 driver supports the shared interrupt mechanism used on our multiport cards. Serial Solutions for Windows 95 consists of the following programs: -

SSCards.inf	The information file to aid the installation process "Have Disk...."
Ssmodem.inf	Setup file for Serial Solutions modems.

sscardui.dll

ssportui.dll The device manager configuration DLLs and...

ssenum.vxd

ssv485.vxd ...the virtual device drivers providing the shared
ssvel.vxd interrupt handlers and dispatch routines etc for the
ssmult.vxd various Serial Solutions serial cards.

ssm485.vxd

Serial Solutions For Windows NT.

Windows NT has an improved communication API and directly supports up to 255 ports. No extra driver is necessary for Windows NT to drive multiport cards. Serial Solutions for Windows NT consists of the following programs: -

Setup.exe Expands into the Control Panel applet and associated files which allows the configuration of all ports on Serial Solutions serial cards.

Ssmodem.inf Setup file for Serial Solutions modems.

Complete Documentation and Technical Backup.

We believe in supplying complete documentation with every package we sell. The Serial Solution Software Package is no exception, it has an attractive manual in an A5 binder, containing over 150 pages of in-depth technical detail with comprehensive indexes and table of contents. We guarantee your Serial Solution Software package for a full 12 months from purchase. A complete technical backup service is available to ensure that you get the maximum performance out of your investment.

Chapter 2

PCI VELOCITY RS232/422/485 HARDWARE SETUP

Introduction.

This chapter details the specifications of the PCI Velocity RS232/422/485 card and explains how to configure the RS485 Multiplex jumpers present on this card. This half-sized card will work happily in any PCI 2.0 or greater compliant PC compatible.

PCI RS232/422/485 Card Features.

- One 9 pin D RS422/485 serial port.
- One 9 pin D RS232 serial port.
- Reliable communications up to 4000 feet, 1.2 Kilometers.
- 16C750 FIFO provides 64-byte input and 64-byte output buffer on each port.
- Maximum baud rate of 921,600 Baud (1 Megabaud).
- Word length of 5, 6, 7 or 8 bits.
- Even, Odd, None, Mark or Space parity options.
- 1 start bit always sent.
- 1, (1.5 for 5-bit data word length), or 2 stop bits.
- TXD, RXD, RTS, and CTS signals
- RS485 TXD/RXD multiplex selectable by jumpers: - either FULL DUPLEX or HALF-DUPLEX
- Autogating low level RS485 half duplex (2 wire) control
- Fully double buffered for reliable asynchronous operation.
- High-speed integrated circuitry ensures operation with fast PC's e.g.700 MHz Pentium III WITHOUT extra wait states.

PCI RS422/485 Serial Port Features

Clock Input:	14.7456MHz
Drivers:	SN75174
High Level Voltage:	3.7V typical at 33mA source
Low Level Voltage:	1.1V typical at 33mA source
High Level Current:	-60mA max.
Low Level Current:	60mA max.
Receivers:	SN75175.
Diffital I/P threshold:	200mV max.
Hysteresis:	50mVolt typical.
Input Impedance:	>12K Ohm without terminators.

Autogating.

Multitasking operating systems, like Windows 95, Windows NT, OS/2 and UNIX, cannot successfully use the RTS line to control the gating of the PC's transmitter. Whilst they can set the RTS line true just before the data transmission starts, they cannot set the RTS line false quickly enough after the data has gone. This is due to the time slicing mechanism used by these multitasking operating systems. The interrupt service routines in multitasking OS's have a long latency, i.e. time taken to switch context from the foreground program to the interrupt routine. During this time, the first few bytes of the external devices reply to the PC may be lost since the serial port transmitter is still gated onto the twisted pair cable.

To overcome this problem, Autogating hardware has been added to the to the RS422/485 card. This automatically detects the start of the PC's data transmissions, and gates the PC's transmitter onto the twisted pair cable. It then automatically detects the last stop bit being sent and gates the port off the twisted pair cable. An added bonus of **RS485 AUTOGATING** is that special device drivers no longer need to be written to use RS485 in any operating system. To all intents and purposes, it looks just like an ordinary RS232 COM port to the host PC. Autogating for half duplex operation is a necessity for Windows 95/98, NT and the forthcoming Windows Millennium and Windows 2000.

Figure 2-1. PCI VELOCITY RS232/422/485 Layout.

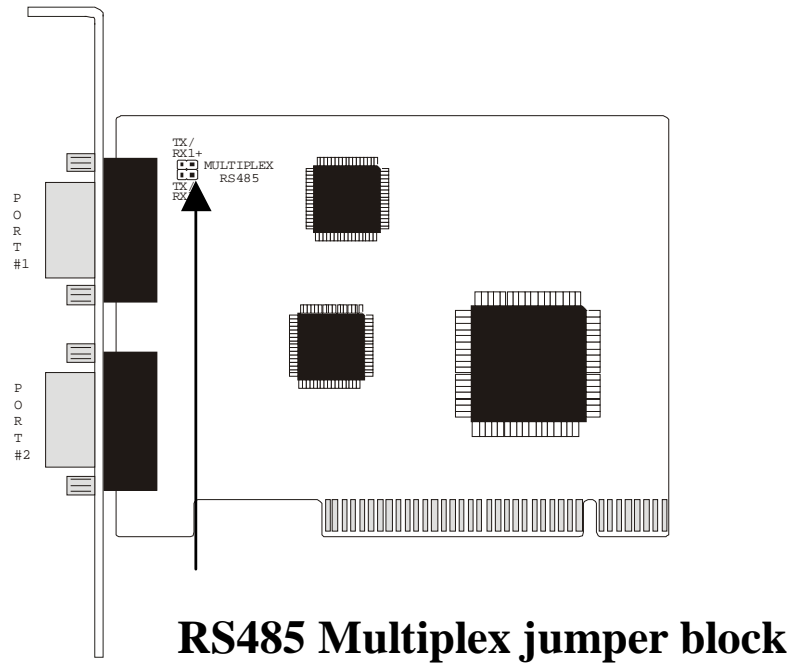


Figure 2-2. 9 Pin D Connector RS422/485 Port Pinouts.

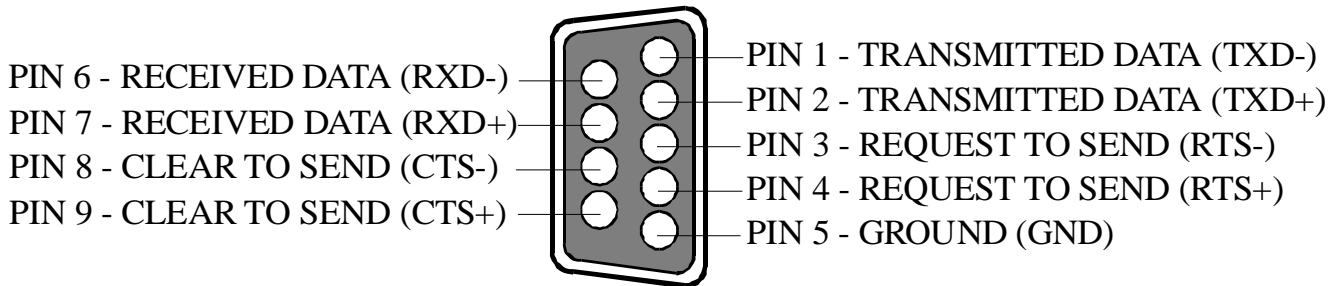
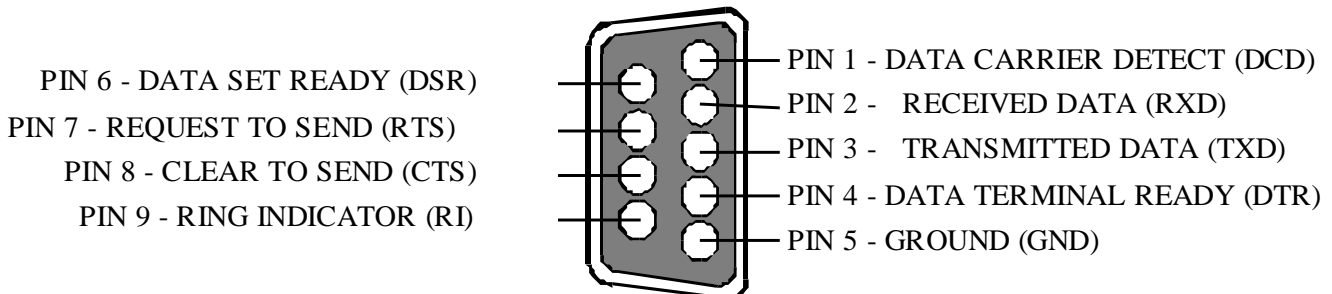


Figure 2-3. 9 Pin D Connector RS232 Port Pinouts.

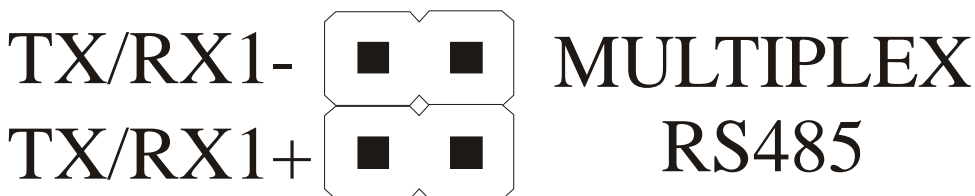


Configuring The PCI RS232/422/485 Card.

PCI cards require no hardware configuration for IRQ and address allocation - this is done automatically at start up by the PC.

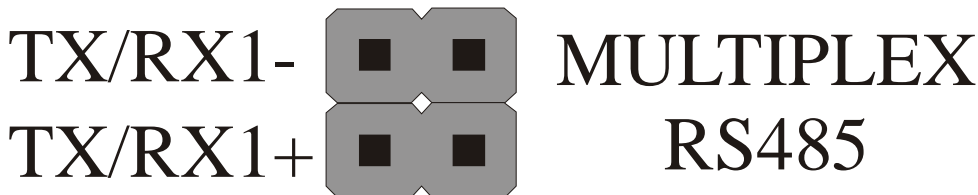
However, the PC Velocity RS232/422/485 has a set of jumpers for configuration of RS485 multiplex modes, details of configuring these jumpers is shown below.

Full Duplex Settings.



- Both jumpers left unconnected (not shorted).

With Half Duplex Settings.



- Both jumpers shorted, causing the RXD- & TXD- and the RXD+ & TXD+ signals to short together at the 9-pin connector. The multiplex jumpers should only be set for RS485 Half Duplex operation, when one twisted pair is used to interconnect both transmit and receive lines.

NOTE: Any changes to RS485 Multiplex Operation must be accompanied with appropriate changes to the driver software; see Chapter 3 - “**PCI Velocity RS232/422/485 Software Configuration**” for more details.

For further details on the RS422 and RS485 standard, pinouts, half duplex and full duplex RS485 systems, wiring diagrams and optional grounding diagrams refer to Chapter 4 - “**Optional RS422/485 Operation.**”

CHAPTER 3

INSTALLING THE PC CARD IN THE COMPUTER.

Serial Card Installation.

Once the card has been correctly configured it can then be installed in the PC.

Finally cables should be attached and communication with the serial peripheral devices should be established.

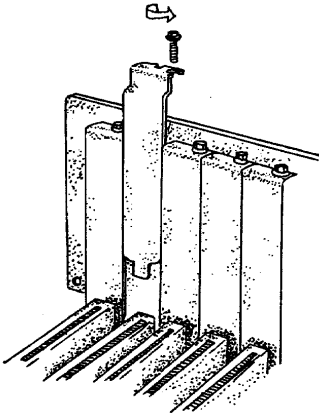
Provided that the installation is attacked in this orderly manner, everything should work first time. If it does not then check the software selectable communications parameters, Baud rate, Parity, stop bits first, and that the communications program is attempting to access the serial port installed. If this fails to solve the problem check the cable connections. Finally check that the card is indeed configured as you believed!

NOTE: Always turn the computer OFF before installing or removing any interface board.

STEP 1: Before the PC card can be installed the power to the PC **MUST** be switched **OFF!**

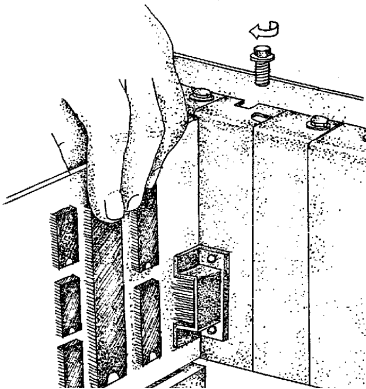
STEP 2: Remove the case.

Figure 3-1. Removing Blanking Cover



STEP 3: Choose an empty appropriate expansion slot. Remove the blanking cover protecting the slot on the PC back panel. KEEP the blanking cover screw safely for later (Figure3-1).

Figure 3-2. Inserting The PC Serial Card.



STEP 4: Now insert the PC Serial card in the available slot. Be careful to ensure that the gold plated PCB fingers fits neatly into the I/O expansion connector. Press down firmly but evenly on the top of the PC Serial card (Figure 3-2).

STEP 5: The D connectors should fit neatly through the slot's aperture to the outside world. NB. Use the screw kept back from the blanking cover to screw the PC Serial retaining bracket into the PC back panel housing.

STEP 6: Now replace the system units cover by carefully sliding it down and back over the system unit. Replace the cover mounting screws.

STEP 7: After attaching all the appropriate cables, power up the PC. Do not forget the mains power cable!

The PC should power on in the normal way.

Problems!

If the system fails to power up normally check the following.:

- i.) Ensure that the PC Serial card is installed correctly.
 - ii.) Ensure that other cards in the PC have not been upset.
 - iii.) Ensure that the power is connected and the PC is switched ON!
- If all these have been checked and the PC still does not power up then there is probably a fault in the hardware. Please contact technical support.

Chapter 4

PCI VELOCITY RS232/422/485 SOFTWARE CONFIGURATION

Introduction.

This section contains the installation procedures of the PCI VELOCITY RS232/422/485 card, with the DOS, Windows 3.x Windows 95, Windows 98/Millennium, Windows NT and Windows 2000 operating systems.

The setup procedures in this chapter assume that your PC has only one serial port present.

DOS Installation.

The DOS installation procedure consists of two steps after the PCI RS232/422/485 card is inserted:

1. Determining the resources that the card has claimed.
2. Informing the Serial Solutions DOS device driver of those resources.

Determining PCI RS232/422/485 Resources.

- Insert card into PC, as described in Chapter 2.
- Run BBCARDS.EXE, from the supplied Serial Solutions CDROM by typing the following:
D:\disking\ssutil\pci\BBCARDS

Where D:\ is the Letter of your CDROM drive

BBCARDS.EXE will return a string that looks similar to the following (values contained in the string may differ in individual PC's due to resource availability):

card 1 is on bus 0, device 16, function 0

Card ID=5, revision 2: Dual Velocity RS232/422/485

interrupt line 11 has been assigned

2 sets of 16550-compatible registers are at I/O address 0140

Baud clock control is at I/O address 02d0

Write 0xf6 for /8 (default), 0xf2 for /4, 0xd6 for /2, 0xd2 for /1.

- Note down IRQ and I/O which in this case:

The IRQ = 11

The I/O address = 0140

NEWCOM.SYS Parameters.

The NewCOM.SYS device driver included with the PCI RS232/422/485 driver software is used to set up the card in DOS and has the following syntax:

NEWCOM.SYS /A port address, /I IRQ,range /B number buffer /S buffer /H hardware handshake

Where */A port address* specifies COM port number followed by a hexadecimal address in the form */Ax,y* where *x* is COM port range and *y* is I/O address.

/I IRQ, range specifies card interrupt and COM port range. The COM port range specifies the COM port(s). Range may be a single port OR a range of ports.

/B number buffer is used to set the number of pairs of buffers to be allocated to ports and is a decimal number in the range 1-maxport.

/S buffer Set size of all buffers in bytes, *buffer* is rounded to the nearest power of 2 and must be a decimal number in the range 32 to 32768. For any serial port opened two buffers of size *buffer* are allocated, one for input and the other for output.

/H hardware handshake selects which hardware handshake type to use on the specified ports. This is used in the following manner: */H range, hs* where *range* specifies the COM port or ports and *hs* selects handshake type. Handshake types available are:

- Type 1 RS422 RTS/CTS - The PC only transmits when CTS is input true. When the PC is able to receive its sets RTS output true. The DSR and DCD inputs are ignored. The DTR output line is set true just in case the external serial device needs a true signal.
- Type 2 RS485 Half duplex - Before any data is sent the PC sets RTS true, after the last byte in the buffer has been sent the PC sets RTS false. RTS is used as a transmit gating control. The CTS, DSR and DCD inputs are ignored. The DTR output line is set true just in case the external serial device needs a true signal.
- Type 3 RS485 Send only - This is a half duplex, transmit only handshake. The PC transmits whenever it wishes, it cannot receive any data. The CTS, DSR and DCD inputs are ignored. The RTS output line is set true just in case the external serial device needs a true signal.
- Type 4 3 Wire Handshake - Really no handshake at all since the PC transmits irrespective of the handshake lines. The 3 wires are TxD, RxD and Ground, no other lines are required. Thus the CTS, DSR and DCD inputs are ignored. The RTS and DTR output lines are set true just in case the external serial device needs a true signal.
- Note:** If hardware handshaking is not specified in the NEWCOM.SYS parameters, type 4, 3 Wire Handshake is selected automatically.

Configuring And Installing NEWCOM.SYS

To load the Serial Solutions for DOS device driver an entry needs to be added to the CONFIG.SYS file. Any simple text editor, EDIT for example, can edit the CONFIG.SYS file for example. The installation procedure given below is for a PCI RS232/422/485 as COM5 & COM6.

The parameter required by the NEWCOM.SYS driver are those returned by the BBCARDS.EXE application earlier. A brief explanation for the parameters required by NEWCOM.SYS follows:

Port Address.

/A5-6,0140

COM port 5 is defined with an i/o address of 0140h.

IRQ, Range.

/I 11,5-6

11 is the IRQ and since the COM port is COM5 is entered 5.

Number Buffer.

/B6

Six buffers are defined, though only four ports are in use - this is because buffers in DOS are assigned in a sequential order from COM1. Since the PCI Velocity RS232/422/485 have been assigned a COM port values of 5 and 6, all preceding COM ports, must have buffers assigned to them also.

Buffer Size.

/S512

Buffer size set to 512 bytes.

Hardware Handshaking.

/H,4

Type 4, 3 Wire Handshake selected for all ports. Type 4, 3 Wire Handshake selected for all ports.

Modifying Command Line Parameters.

When “assembled” the NEWCOM.SYS command line looks like...

```
DEVICE=NEWCOM.SYS /A5-6,0140 /I 11,5-6 /B6 /S 512 /H,4
```

...and should be entered into the CONFIG.SYS file. Once you are sure that these parameters have been entered correctly, restart your PC and your PCI RS232/422/485 card should be ready to use immediately. Sample terminal applications are provided on “Serial Solutions CDROM” enabling communications to be established to your peripherals quickly and easily.

Windows 3.x Installation.

The Windows 3.x installation procedure consists of two steps after the PCI Velocity RS232/422/485 card is inserted:

1. Determining the resources that the PCI Velocity RS232/422/485 card has claimed.
2. Informing Windows 3.x of those resources.

Determining PCI RS422/485 Resources.

- Insert the card into a PC, as described in Chapter 2.
- Run BBCARDS.EXE, from the supplied “Serial Solutions CDROM” by typing the following:

```
D:\diskimg\ssutil\pci\BBCARDS
```

Where D:\ is the Letter of your CDROM drive

BBCARDS.EXE will return a string that looks similar to the following (values contained in the string may differ in individual PC's due to resource availability):

card 1 is on bus 0, device 16, function 0

Card ID=5, revision 2: Velocity RS232/422/485

interrupt line 11 has been assigned

2 sets of 16550-compatible registers are at I/O address 0140

Baud clock control is at I/O address 02d0

Write 0xf6 for /8 (default), 0xf2 for /4, 0xd6 for /2, 0xd2 for /1.

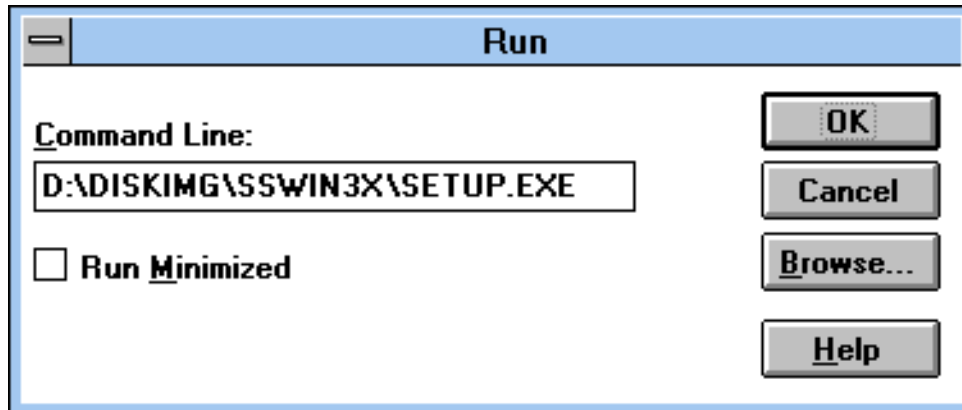
- Note down IRQ and I/O which in this case:
The IRQ = 11
The I/O address = 0140

Windows 3.x Software Installation.

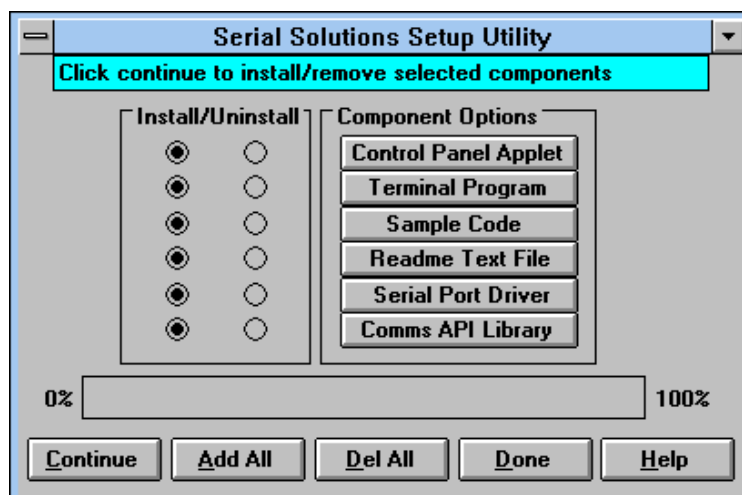
Place the supplied Serial Solutions CDROM in a suitable drive.

From File Manager choose 'Run' and enter

D:\diskimg\sswin3x\setup (where D: is the path to the CDROM drive Containing the disk).



- Click OK, the Setup Program Main Screen is displayed:



By default, all component options will be installed, selecting the "Del All" button will select all installed components for deletion and "Add All" chooses all uninstalled components for installation; options may not be changed when the components are installed. For further details on the Component Options consult the README.TXT file on the supplied disk.

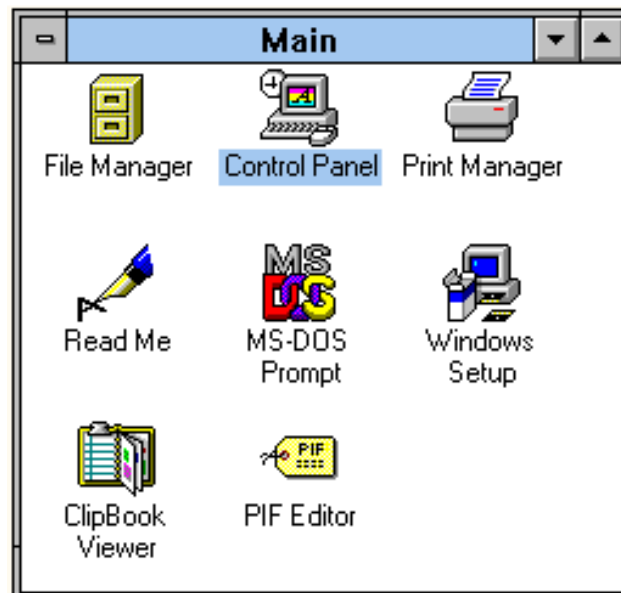
If only logical ports COM1 to COM9 are to be used then de-select the Comms API library option in the "Install" column. This library is only necessary to allow the use of logical ports greater than COM9 e.g. COM10, COM11 etc.

- When you have made your choice of Component Options click **Continue** and when the setup program has finished select the **Done** button.

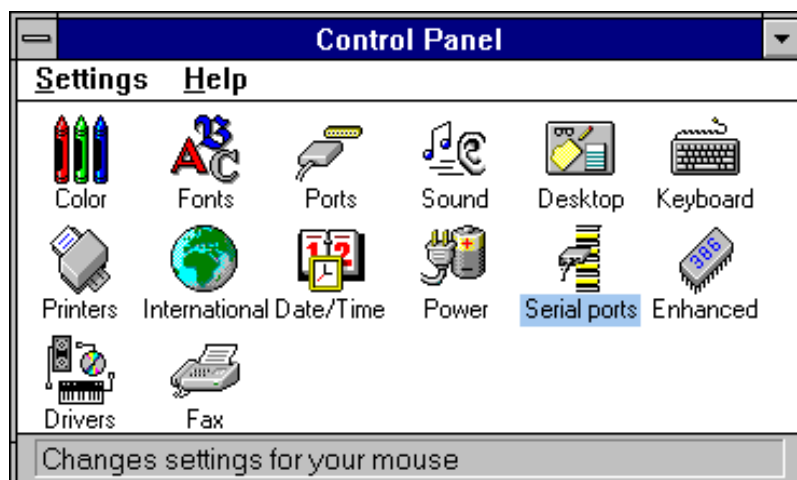
Note: If the Serial Port driver options has been selected, after the setup program has finished, Windows will display a restart message - answer **Yes** and Serial Solutions will be ready to run upon Windows restarting.

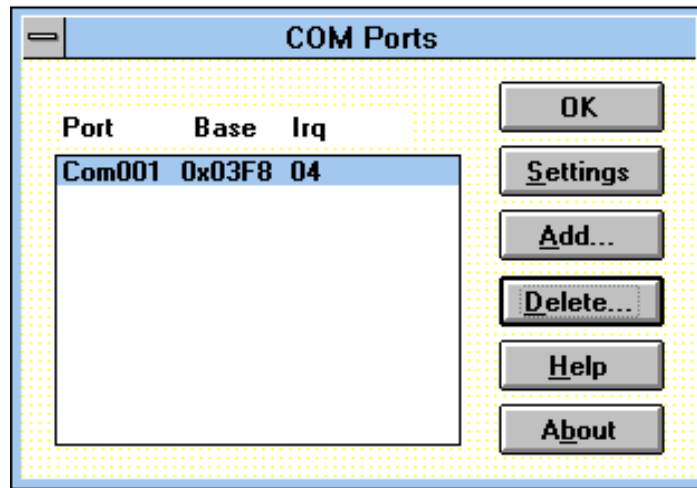
Serial Port Installation.

- From Main, select Control Panel:
- Click on Serial Ports:



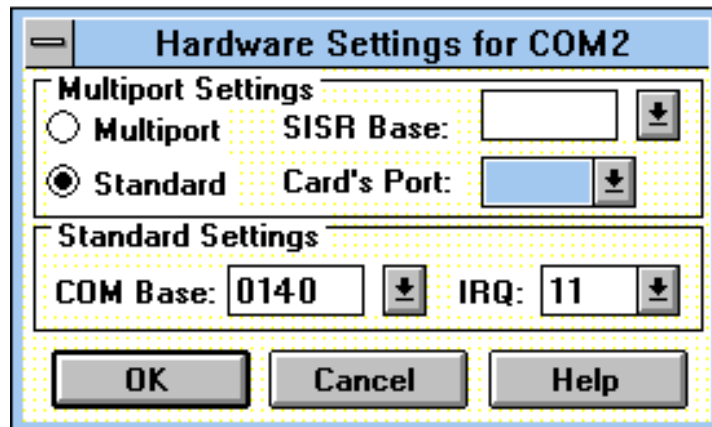
The following dialogue will be displayed:





To add a COM port:

- Click on the **add** button and a Window similar to the following will be displayed:

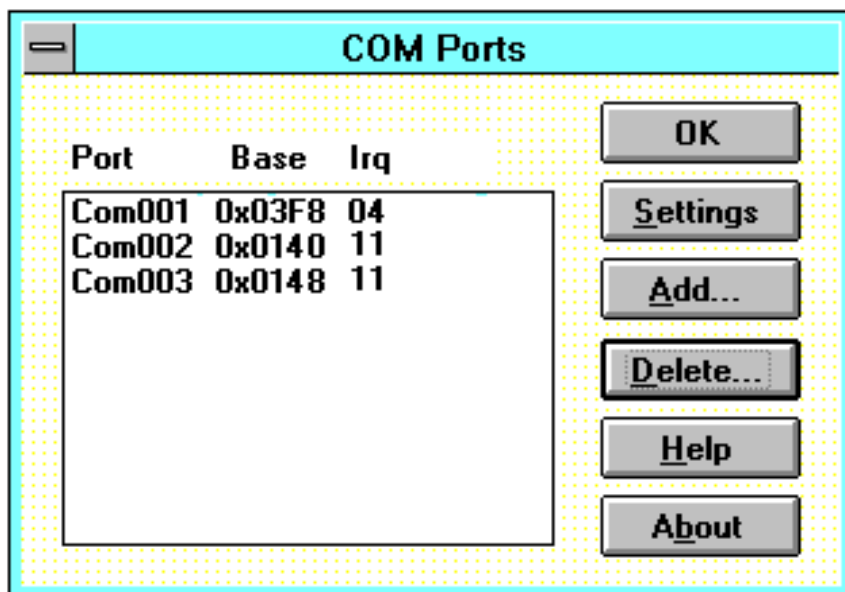


- In Standard Settings:
- In the COM Base field, enter the value 0140.
Note: COM ports are defined with an i/o address range, which in this case, begins at 0140 and all subsequent ports have an i/o address that is 8 higher than the previous. **i.e.** if COM2 has an address of 0140h, then COM3 has an address of 0148h.
- In the IRQ field, enter the value 11.

Note: The values used in the above section were those returned by the BBCARDS program, as described in the above section.

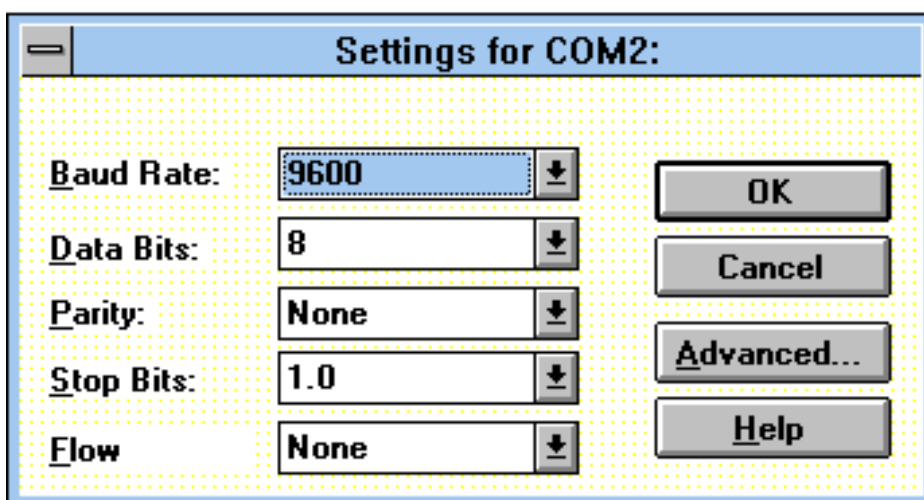
When you have finished, click on **OK**. A restart message will be displayed; to save time only restart when both ports have been added and correctly configured.

- After adding the COM ports the COM Ports Window will look similar to the following:



Configuring The COM Ports.

- From the COM Ports window choose the port that you wish to configure and click on **Settings** - the following dialogue will be displayed:



Note: A port that has been added has the default values of:

Baud Rate:	9600
Data Bits:	8
Parity:	None
stop Bits:	1.0
Flow:	None

Change the communications Settings in the COM Ports to match the baud rate, parity settings etc. of the remote serial device.

Deleting Ports in Windows.

The **Delete** button can be used to discard the entries of ports that have been removed from the system.

Note. Never try to leave out a serial port number when using the delete button, because Windows may automatically shift serial port numbers which results in a mis-match of settings in the Serial Ports Applet (COM1-COM4 only).

Restarting Windows.

Whenever certain values have been entered or changed in the hardware settings window, a message prompting to restart Windows will appear. Only after having made ALL the necessary changes restart Windows so that the new settings come into effect.

Windows 95 Installation.

To obtain a trouble free mix-and-match of the COM ports:

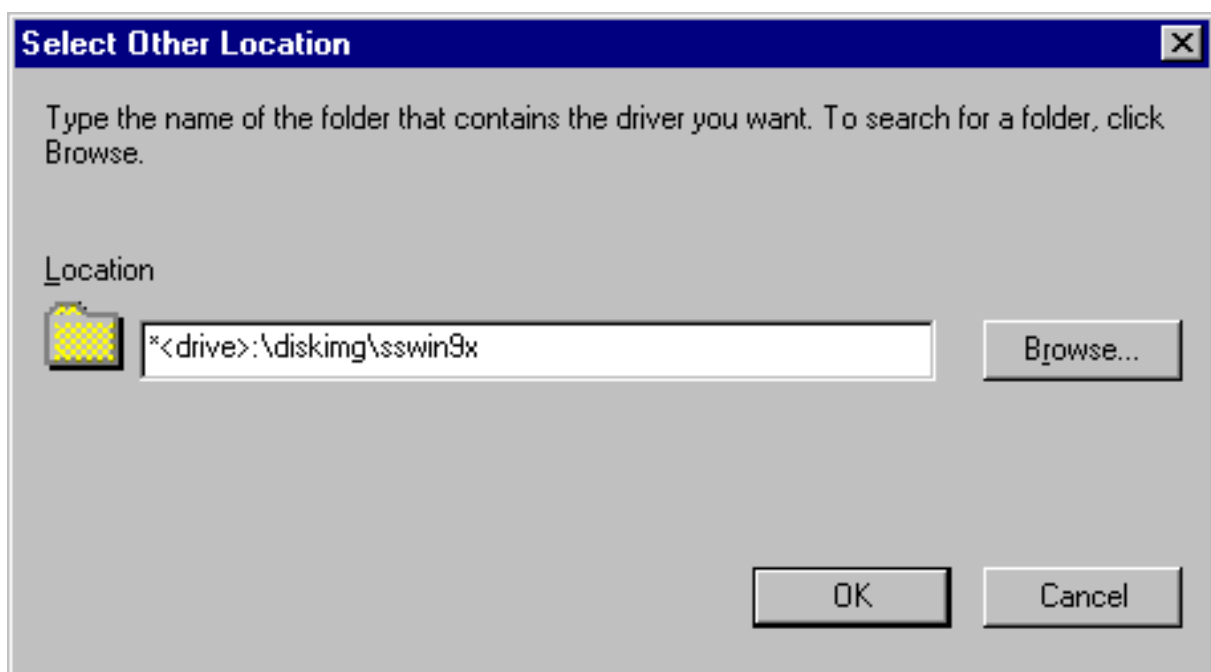
- Switch off your computer, insert your PCI RS422/485 card into a free PCI slot, as described in the section “**Hardware Installation**” in Chapter 2, and switch your computer on again.
- During the booting process, Windows 95 will detect the PCI Velocity RS232/422/485, but will display it simply as a “PCI CARD”, and you will briefly see a message box to this effect.
- Windows will then display the “Update Device Driver Wizard”, which asks you to “insert any disk which came with the PCI card”. Insert the Serial Solutions CD ROM into an appropriate drive and click ‘Next’.



- The Wizard should then display the following:



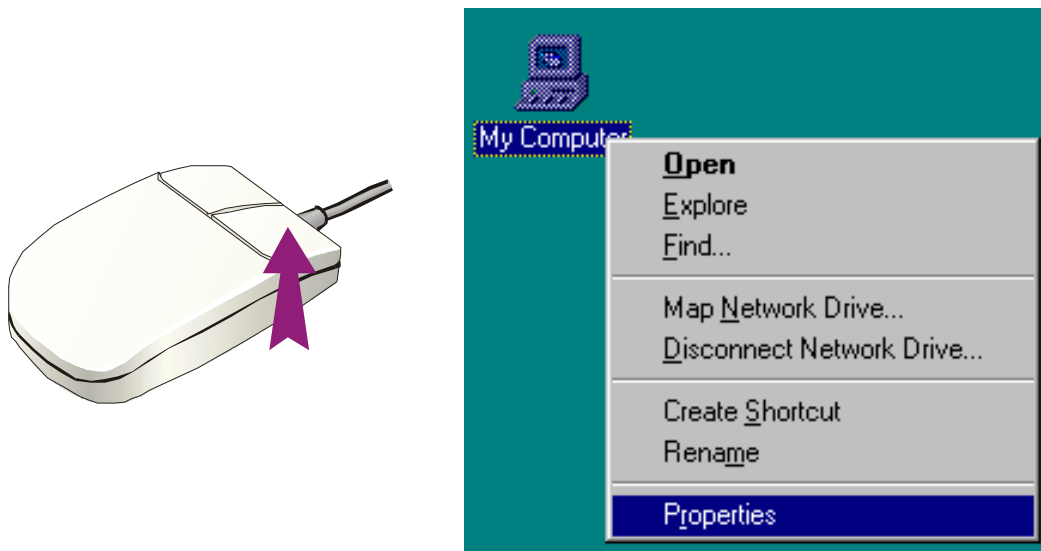
- Click Other Locations
- In the location space type **<drive>:\diskimg\sswin9x** where drive is the appropriate letter for your CDROM drive



- Click **OK**

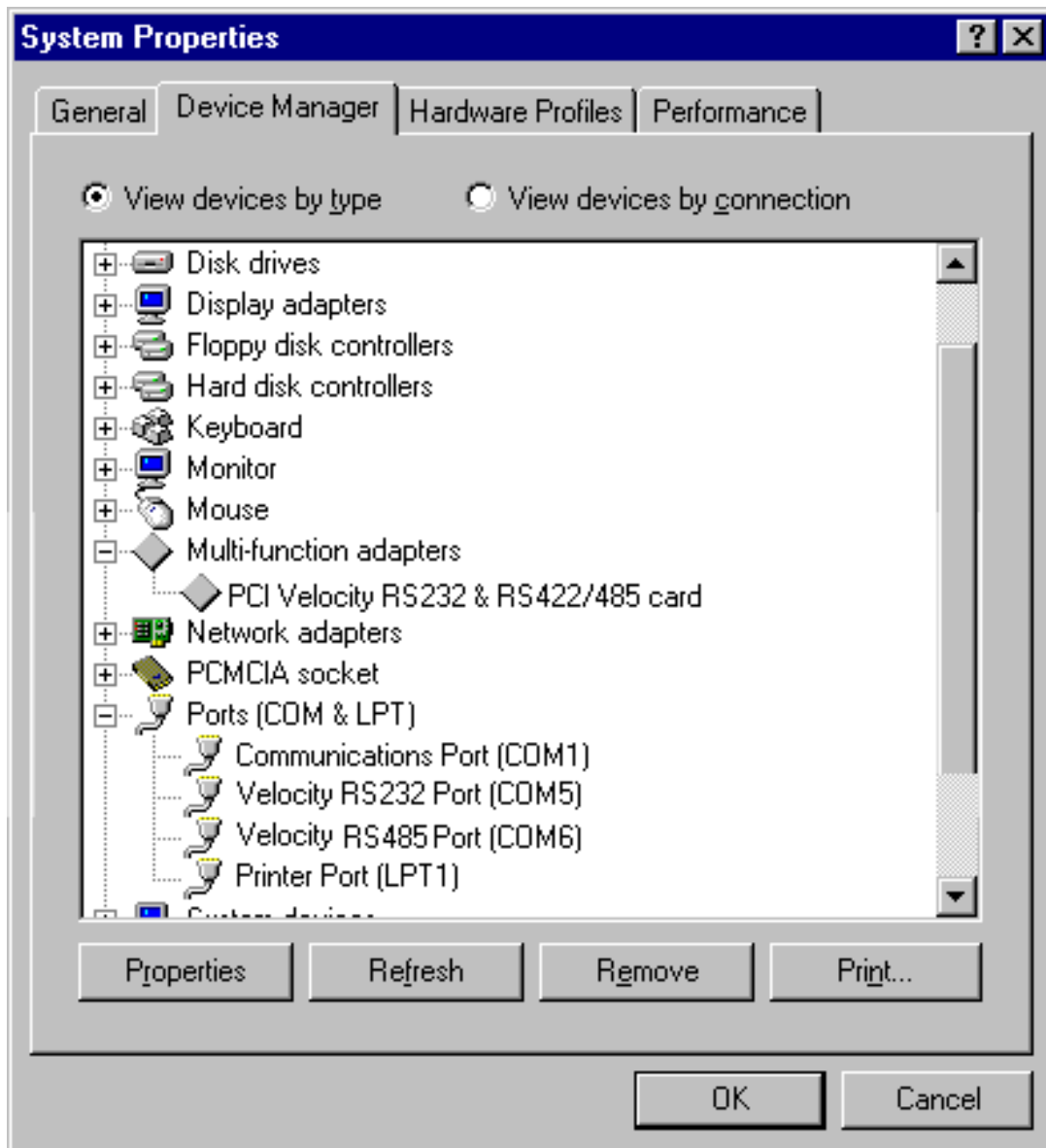


- Click Finish
- After copying the file, Windows 95 will then detect each of the serial ports in turn and install them as velocity ports.



- Using the right-hand mouse button click on the **My Computer** icon on your desktop. Click on **Properties**.

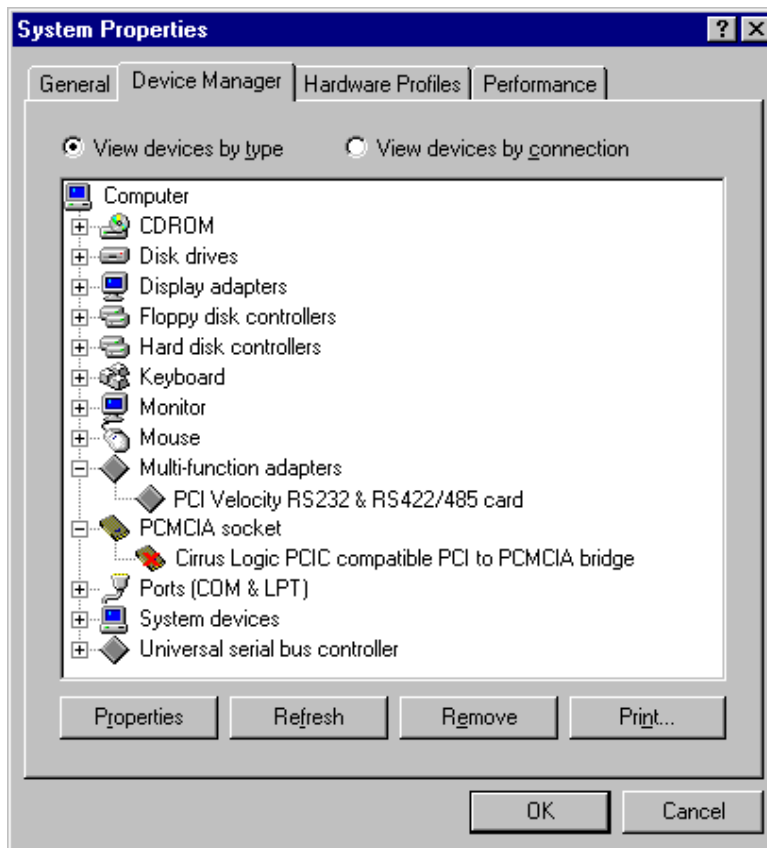
- Click on the **Device Manager** tab



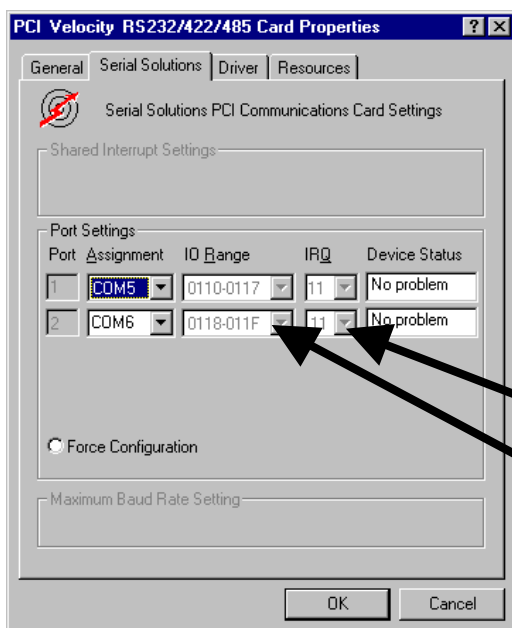
When the “**Device Manager**” is viewed the PCI Velocity RS232/422/485 card will appear under the “**Multi-function adapters**” branch. Also, two velocity ports will appear under the “**Ports (COM & LPT) branch**”.

For most users who have 4 or less COM ports the new port will appear as COM5 as pictured above, for users with more than 5 COM ports the new port will appear as the first available COM ports.

Card Settings In Windows 95

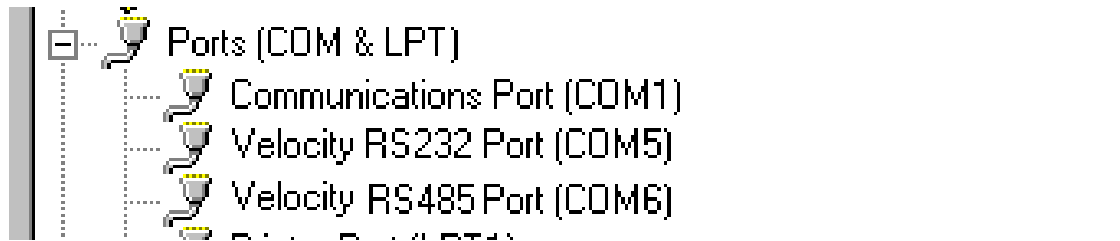


- Select the PCI Velocity RS422/485 card from the “**Multi-Function Adapter**” entry in **Device Manager** serial and click on properties to view the cards general properties.
- Click on the **Serial Solutions** tab Solutions tab produces.



The I/O address and interrupt are assigned to the card by the "Plug and play" system of the PC. These values CANNOT be changed with the current version of the driver.

In this window, the COM port assignment may be changed, simply by selecting a new COM port value from the pull down menu relevant to the port. However, COM port usage other than those for the PCI 1 Port Velocity RS422/485 card itself are not checked, so it is advisable to first check which COM ports are in use - port availability can be checked by viewing the **Device Manager**:

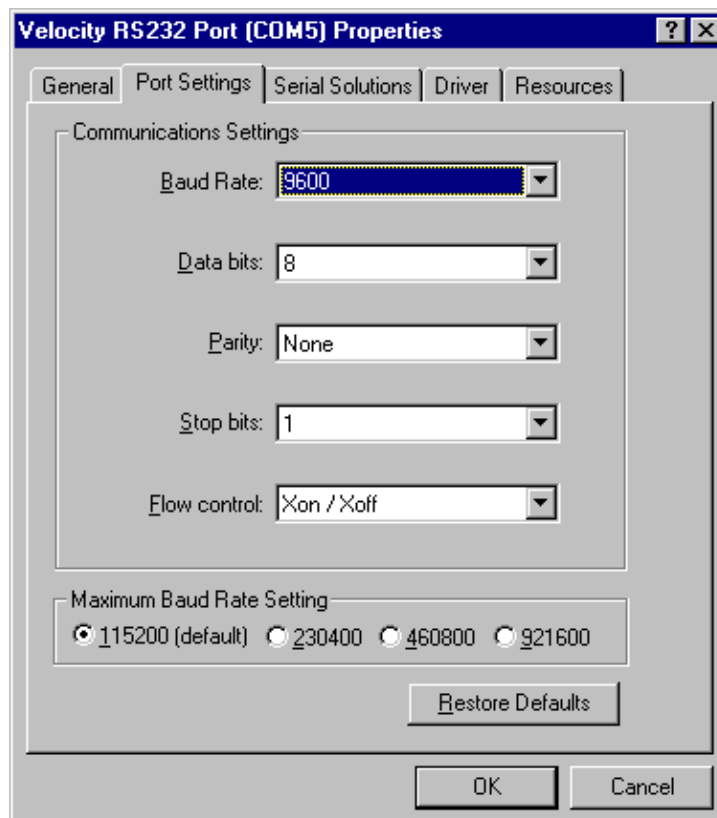


All COM ports present will be listed under the entry “**Ports (COM & LPT)**.” The above screenshots indicates that COM2 - 4 and COM6 and above are not installed, and therefore may be used.

PCI RS232 Port Settings In Windows 95.

Double clicking on a Velocity RS485 Port entry from the entry “**Ports (Com & LPT)**” branch in **Device Manager** will the display general properties window for the selected port (in this case COM5).

- Selecting the Port Settings tab produces:



Settings available in this window are:

1. **Baud Rate** - determines the baud rate at which the selected port operates, the maximum value available is dependant upon the Maximum Baud Rate Setting (see below.)

 2. Data Bits.
 3. Parity.
 4. Stop Bits.
 5. Flow Control.
- } Change to suit remote device.
-
6. **Maximum Baud Rate Setting** - four values are available, which selects the maximum baud rate at which the port may operate. The table below, indicates the ranges of baud rate values available at the Maximum Baud Rate Settings.

Maximum Baud Rate Settings.

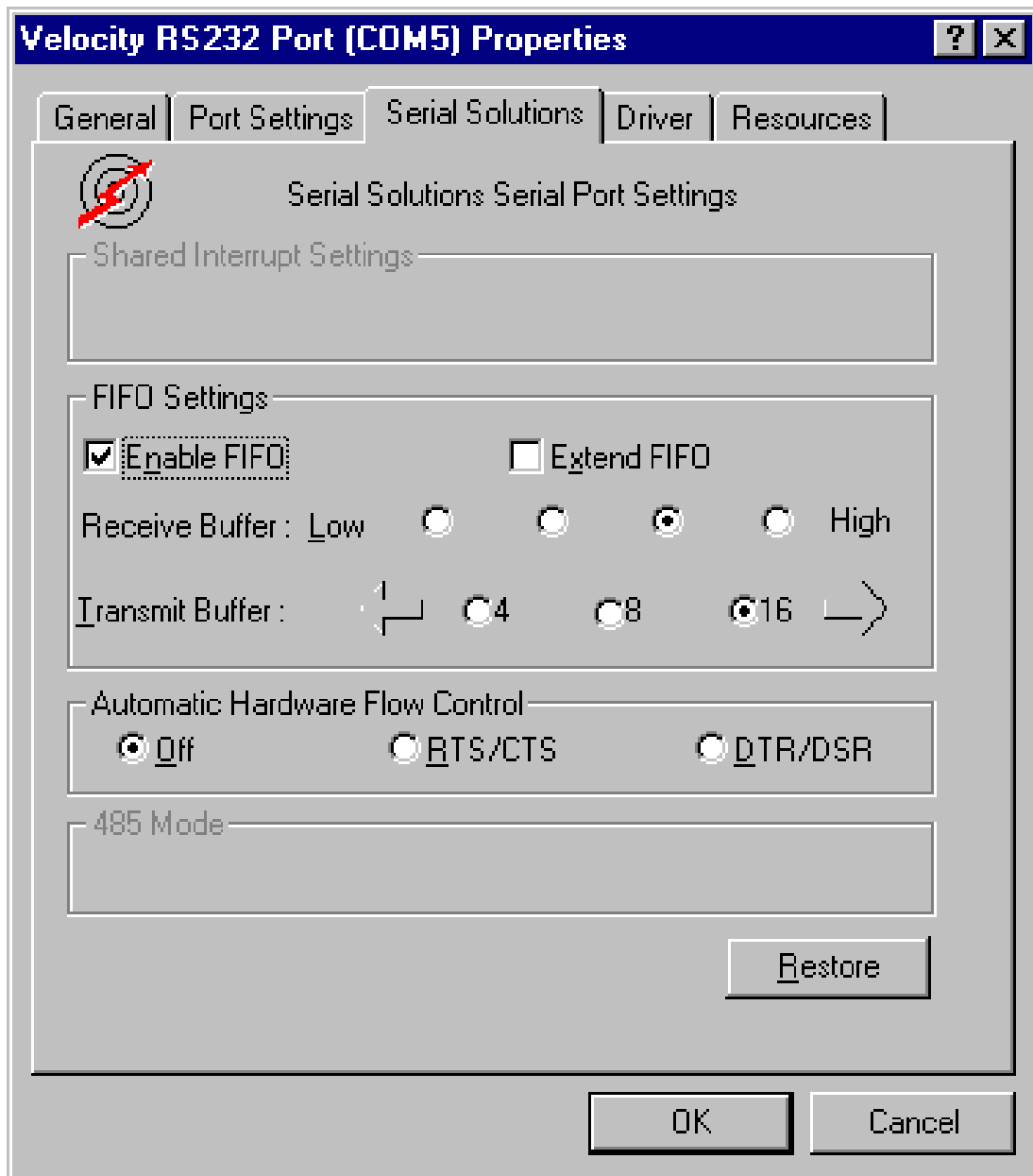
		Maximum Baud Rate			
		115200	230400	460800	921600
Selectable Baud Rates	50	100	200	400	
	75	150	300	600	
	110	220	440	880	
	150	300	600	1200	
	300	600	1200	2400	
	600	1200	2400	4800	
	1200	2400	4800	9600	
	1800	3600	7200	1440	
	2000	4000	8000	16000	
	2400	4800	9600	19200	
	3600	7200	14400	28800	
	4800	9600	19200	38400	
	7200	14400	28800	57600	
	9600	19200	38400	76800	
	19200	38400	76800	153600	
	38400	76800	153600	230400	
57600	115200	230400	460800		
115200	230400	460800	921600		

Note: Many serial comms applications will not actually register the ports as running at baud rates of above 115200.

- 7. **Restore Defaults** - when clicked, resets the selected COM port to the following values:

Baud Rate: 9600
 Data Bits: 8
 Parity: None
 Stop Bits: 1
 Flow Control: Xon / Xoff
 Maximum Baud Rate Setting: 115,200

Clicking on the Serial Solutions tab will display:



Settings available in this window are:

1. FIFO Settings.
 - **Enable FIFO** - turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
 - **Extend FIFO** - when checked, extends the selected ports FIFO buffer from 16 to 64 bytes.
 - **Receive Buffer** - These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow

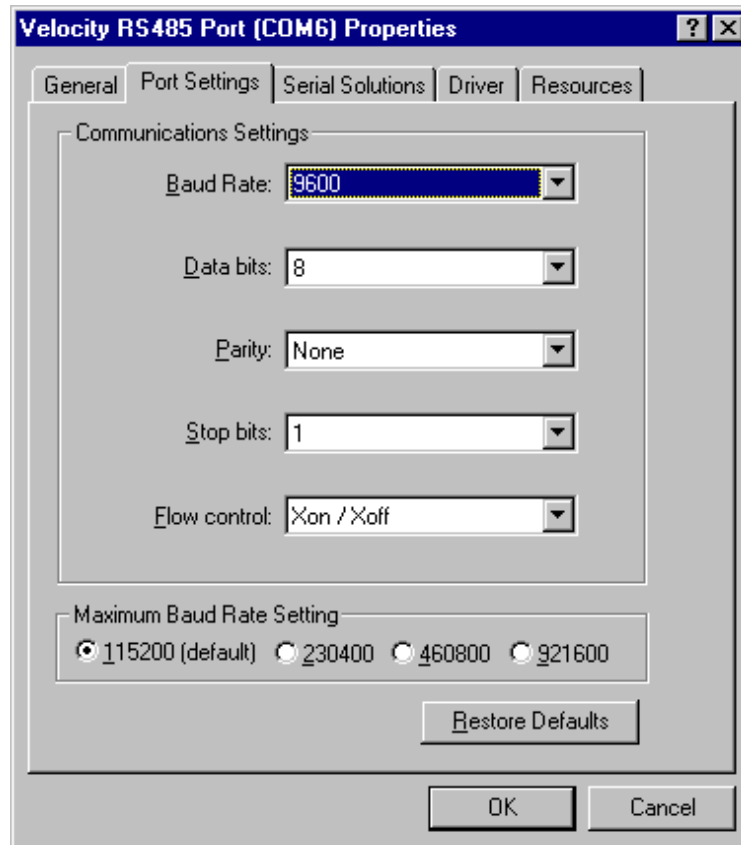
the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.

- **Transmit Buffer** - These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.
2. **Automatic Hardware Flow Control.** One of two options may be selected:
- **Off** (Default) - This will turn off automatic flow control. (If you have no data transfer problems then selecting this option is fine.)
 - **RTS/CTS** - This will use the RTS and CTS lines for automatic hardware flow control.

PCI RS422/485 Port Settings In Windows 95.

Double clicking on a Velocity RS485 Port entry from the entry “**Ports (Com & LPT)**” branch in **Device Manager** will the display general properties window for the selected port (in this case COM5).

- Selecting the Port Settings tab produces:



Settings available in this window are:

- 1. Baud Rate** - determines the baud rate at which the selected port operates, the maximum value available is dependant upon the Maximum Baud Rate Setting (see below.)
 - 2. Data Bits.**
 - 3. Parity.**
 - 4. Stop Bits.**
 - 5. Flow Control.**
- } Change to suit remote device.
- 6. Maximum Baud Rate Setting** - four values are available, which selects the maximum baud rate at which the port may operate. The table below, indicates the ranges of baud rate values available at the Maximum Baud Rate Settings.

Maximum Baud Rate Settings.

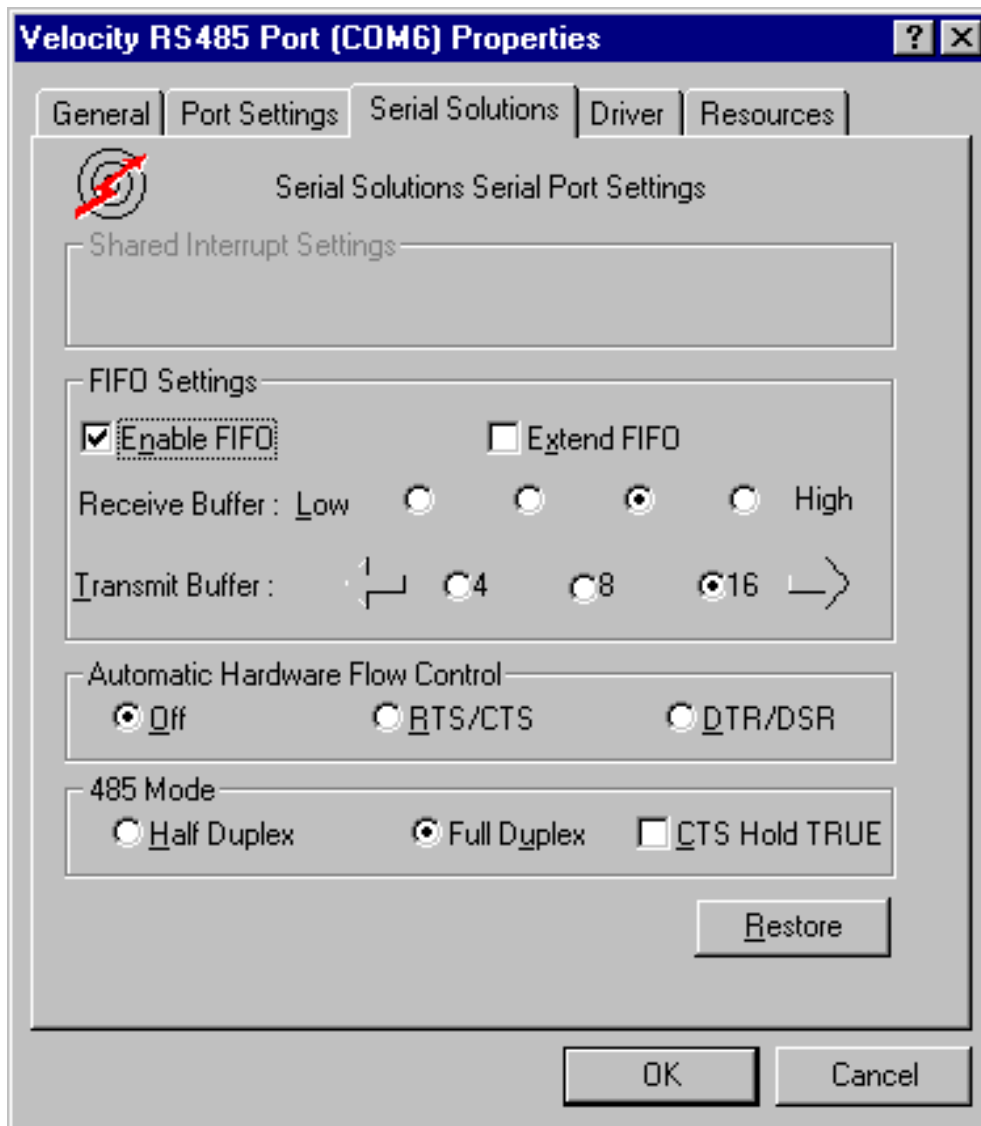
		Maximum Baud Rate			
		115200	230400	460800	921600
Selectable Baud Rates	50	100	200	400	
	75	150	300	600	
	110	220	440	880	
	150	300	600	1200	
	300	600	1200	2400	
	600	1200	2400	4800	
	1200	2400	4800	9600	
	1800	3600	7200	1440	
	2000	4000	8000	16000	
	2400	4800	9600	19200	
	3600	7200	14400	28800	
	4800	9600	19200	38400	
	7200	14400	28800	57600	
	9600	19200	38400	76800	
	19200	38400	76800	153600	
	38400	76800	153600	230400	
57600	115200	230400	460800		
115200	230400	460800	921600		

Note: Many serial comms applications will not actually register the ports as running at baud rates of above 115200.

7. Restore Defaults - when clicked, resets the selected COM port to the following values:

- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: Xon / Xoff
- Maximum Baud Rate Setting: 115,200

Clicking on the Serial Solutions tab will display:



Settings available in this window are:

3. FIFO Settings.
 - **Enable FIFO** - turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
 - **Extend FIFO** - when checked, extends the selected ports FIFO buffer from 16 to 64 bytes.
 - **Receive Buffer** - These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.

- **Transmit Buffer** - These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.
4. **Automatic Hardware Flow Control.** One of two options may be selected:
 - **Off (Default)** - This will turn off automatic flow control. (If you have no data transfer problems then selecting this option is fine.)
 - **RTS/CTS** - This will use the RTS and CTS lines for automatic hardware flow control.
 5. **485 Mode** offers the options:
 - **Half Duplex / Full Duplex**(default) - are used in conjunction with the RS485 Multiplex Jumper Settings.

NOTE: These software settings must match the RS485 Multiplex Jumper configuration, as described in the section “**RS485 Multiplex Jumper Settings**” in Chapter 2, to ensure accurate and error free data transmission.
 - **CTS Hold True**, determines whether the CTS handshake signal is INPUT from the external serial device or is permanently forced true on the card. The serial ports own RTS OUTPUT handshake signals are always taken out to the serial port connector.
 6. **Restore** - when this button is clicked the settings in the current window will be reset to the default values of:

Enable FIFO:	On (Checked)
Extend FIFO:	Off (Unchecked)
Receive Buffer:	3 rd from left.
Transmit Buffer:	16
Automatic Hardware flow Control:	Off
485 Mode:	Full duplex.

Windows 98/Millennium Installation.

To obtain a trouble free mix-and-match of the COM ports:

- Switch off your computer, insert your PCI RS422/485 card into a free PCI slot, as described in the section “**Hardware Installation**” in Chapter 2, and switch your computer on again.
- During the booting process, Windows 98 will detect the PCI Velocity RS422/485, but will display it simply as a “PCI CARD”, and you will briefly see a message box to this effect.
- Windows will then display the “Update Device Driver Wizard”, which asks you to “insert any disk which came with the PCI card”. Insert the Serial Solutions CD ROM into an appropriate drive and click ‘Next’.



- The Wizard should then display the following:



- Select Search for the best driver for your device.
- Click **Next**



- Click Specify a location
- In the location space type **<drive>:\disking\sswin9x** where drive is the appropriate letter for your CDROM drive
- Click **Next**

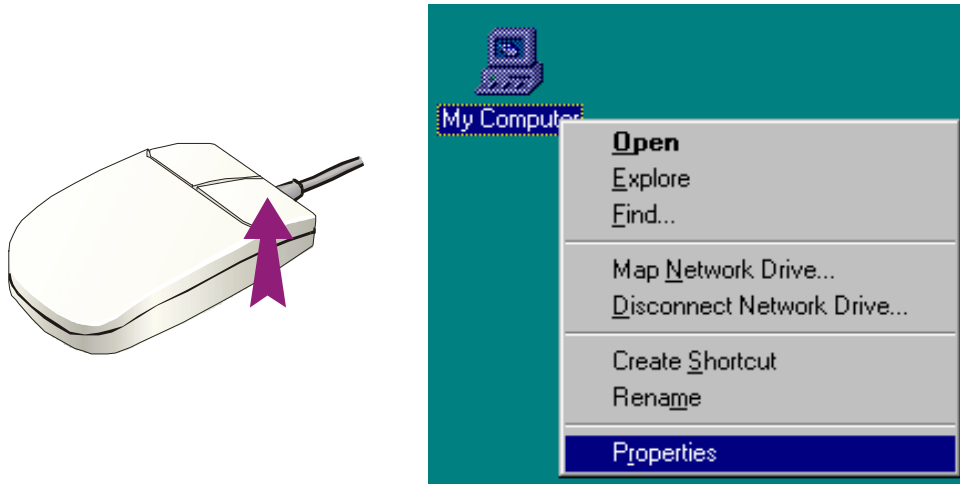


- Click **Next**

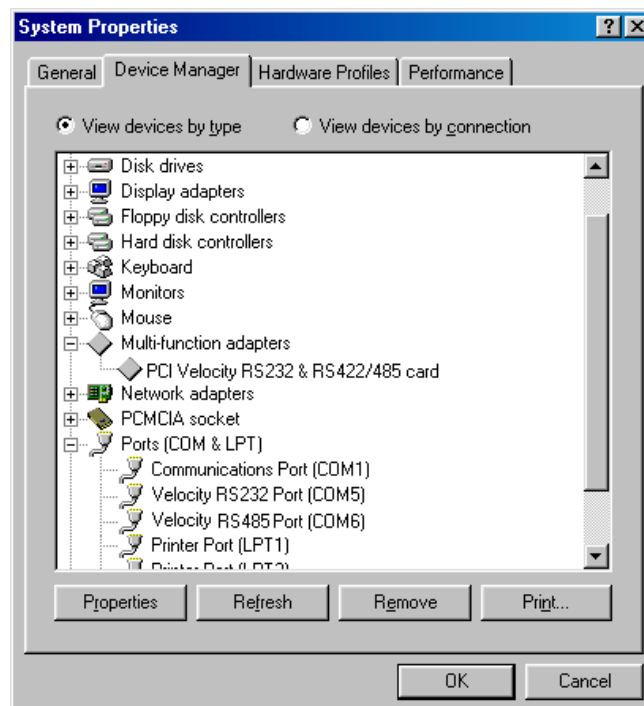


- Click **Finish**

- After copying the file, Windows 98 will then detect each of the serial ports in turn and install them as communications ports.



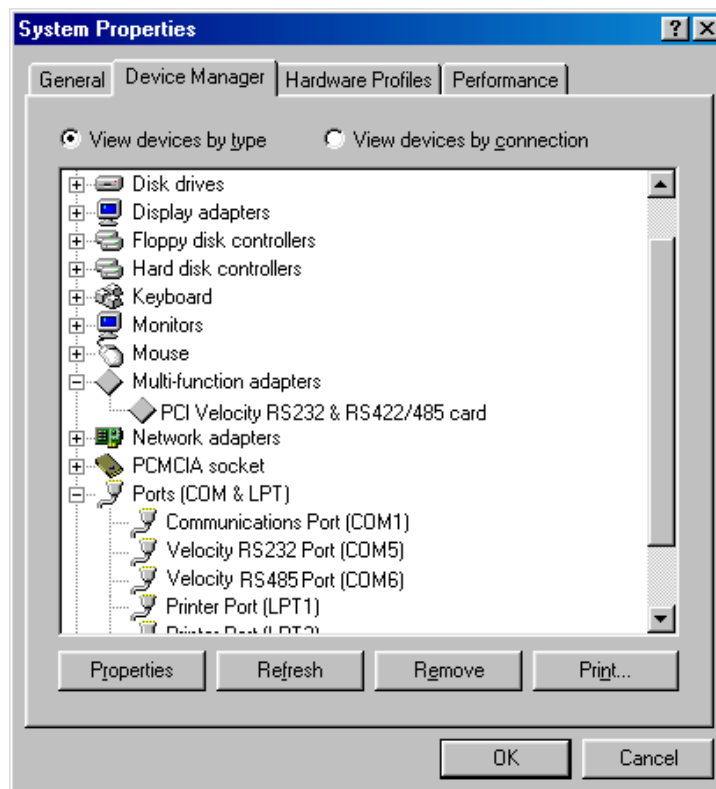
- Using the right-hand mouse button click on the **My Computer** icon on your desktop. Click on **Properties**.
- Click on the **Device Manager** tab



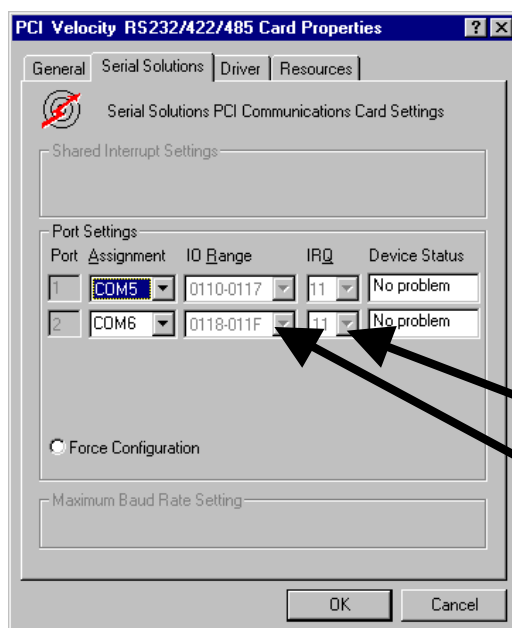
When the “**Device Manager**” is viewed the PCI Velocity RS232/422/485 card will appear under the “**Multi-function adapters**” branch. Also, a Velocity RS232 and a Velocity RS485 Port will appear under the “**Ports (COM & LPT) branch**”.

For most users who have 4 or less COM ports the new ports will appear as COM5 and COM6 as pictured above, for users with more than 5 COM ports the new ports will appear as the first available COM ports.

Card Settings In Windows 98/Millennium.

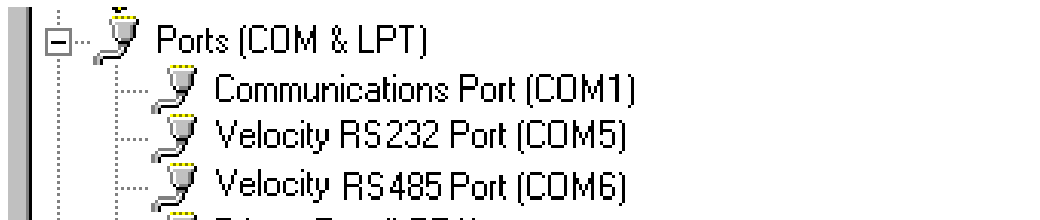


- Select the PCI Velocity RS232 & RS422/485 card from the “Multi-Function Adapter” entry in **Device Manager** serial and click on properties to view the cards general properties.
- Click on the **Serial Solutions** tab Solutions tab produces.



The I/O address and interrupt are assigned to the card by the "Plug and play" system of the PC. These values **CANNOT** be changed with the current version of the driver.

In this window, the COM port assignment may be changed, simply by selecting a new COM port value from the pull down menu relevant to the port. However, COM port usage other than those for the PCI Velocity RS232 & RS422/485 card itself are not checked, so it is advisable to first check which COM ports are in use - port availability can be checked by viewing the **Device Manager**:

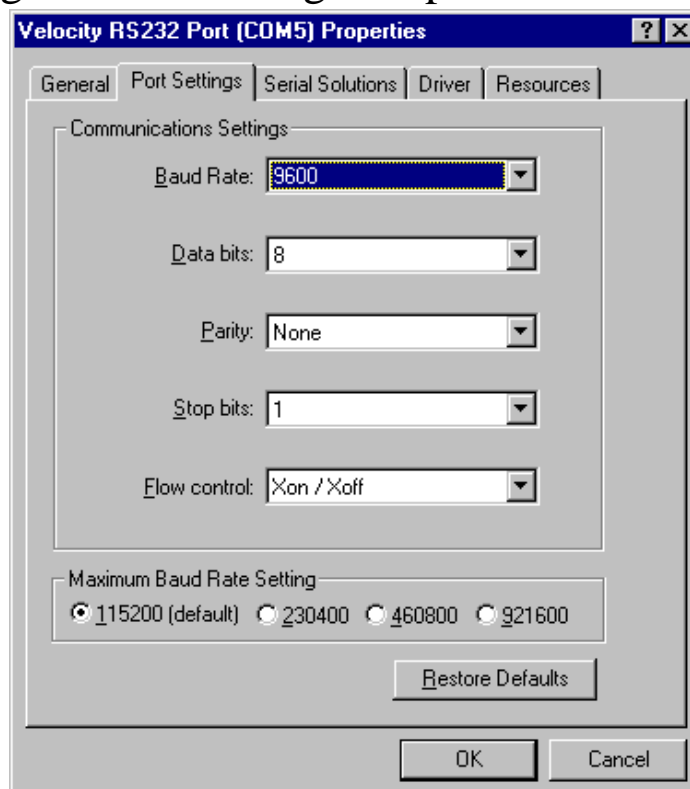


All COM ports present will be listed under the entry “**Ports (COM & LPT)**.” The above screenshots indicates that COM2 - 4 and COM6 and above are not installed, and therefore may be used.

PCI RS232 Port Settings In Windows 98/Millennium.

Double clicking on a Velocity RS485 Port entry from the entry “**Ports (Com & LPT)**” branch in **Device Manager** will the display general properties window for the selected port (in this case COM5).

- Selecting the Port Settings tab produces:



Settings available in this window are:

1. **Baud Rate** - determines the baud rate at which the selected port operates, the maximum value available is dependant upon the Maximum Baud Rate Setting (see below.)

 2. Data Bits.
 3. Parity.
 4. Stop Bits.
 5. Flow Control.
- } Change to suit remote device.
-
6. **Maximum Baud Rate Setting** - four values are available, which selects the maximum baud rate at which the port may operate. The table below, indicates the ranges of baud rate values available at the Maximum Baud Rate Settings.

Maximum Baud Rate Settings.

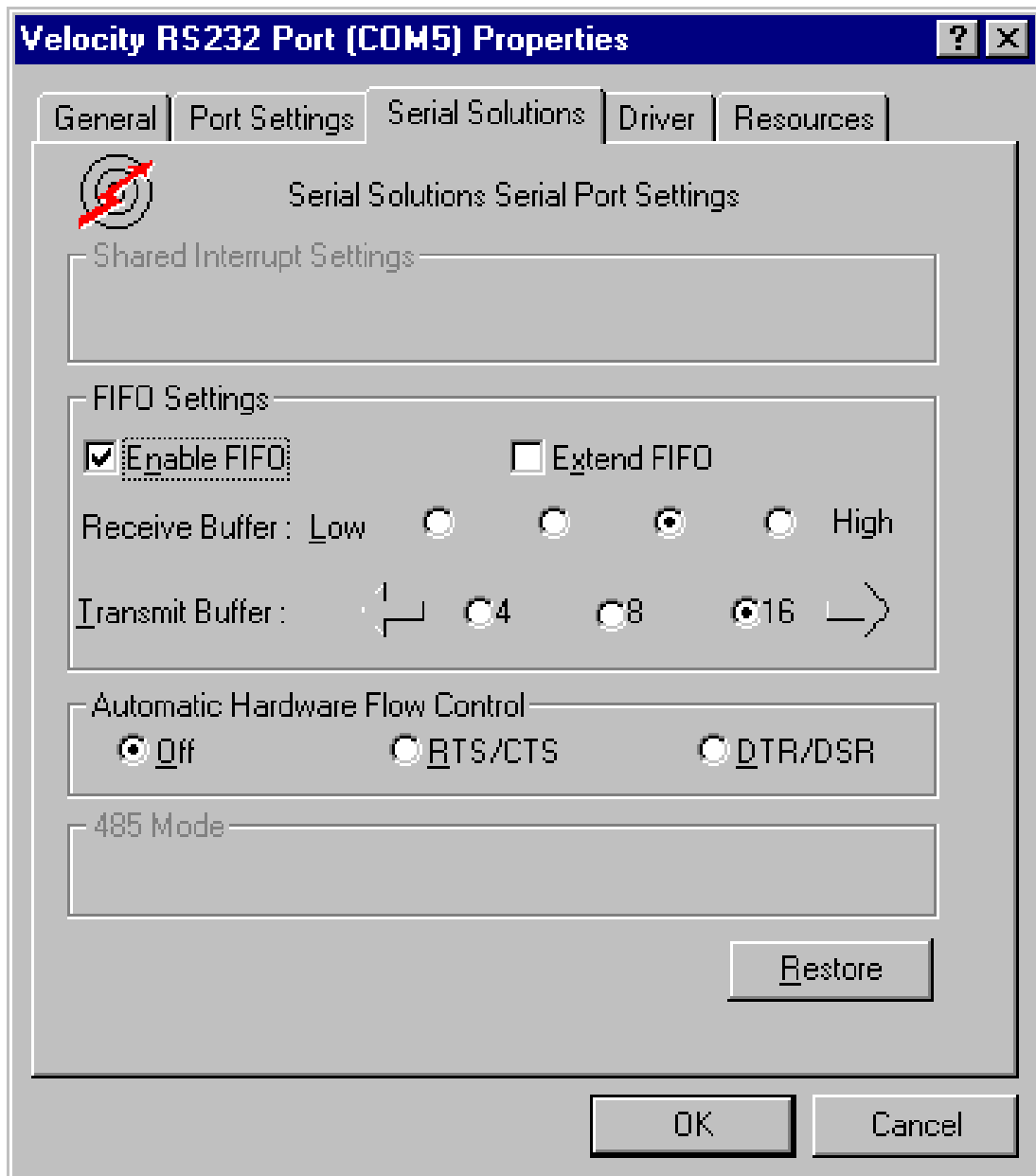
		Maximum Baud Rate			
		115200	230400	460800	921600
Selectable Baud Rates	50	100	200	400	
	75	150	300	600	
	110	220	440	880	
	150	300	600	1200	
	300	600	1200	2400	
	600	1200	2400	4800	
	1200	2400	4800	9600	
	1800	3600	7200	1440	
	2000	4000	8000	16000	
	2400	4800	9600	19200	
	3600	7200	14400	28800	
	4800	9600	19200	38400	
	7200	14400	28800	57600	
	9600	19200	38400	76800	
	19200	38400	76800	153600	
	38400	76800	153600	230400	
	57600	115200	230400	460800	
115200	230400	460800	921600		

Note: Many serial comms applications will not actually register the ports as running at baud rates of above 115200.

7. **Restore Defaults** - when clicked, resets the selected COM port to the following values:

- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: Xon / Xoff
- Maximum Baud Rate Setting: 115,200

Clicking on the Serial Solutions tab will display:



Settings available in this window are:

7. FIFO Settings.
 - **Enable FIFO** - turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
 - **Extend FIFO** - when checked, extends the selected ports FIFO buffer from 16 to 64 bytes.
 - **Receive Buffer** - These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow

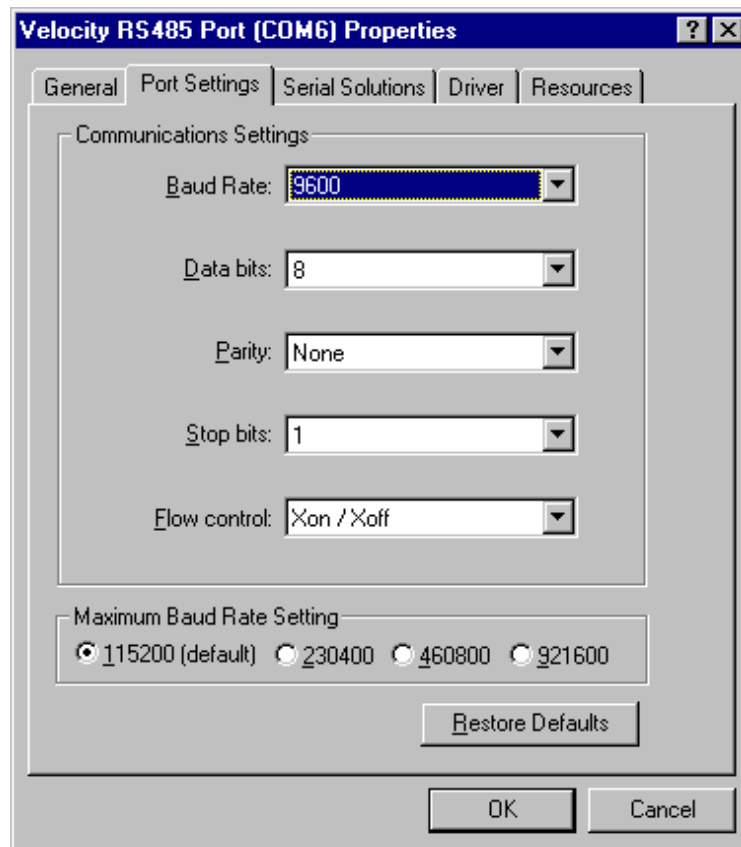
the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.

- **Transmit Buffer** - These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.
8. **Automatic Hardware Flow Control.** One of two options may be selected:
- **Off** (Default) - This will turn off automatic flow control. (If you have no data transfer problems then selecting this option is fine.)
 - **RTS/CTS** - This will use the RTS and CTS lines for automatic hardware flow control.

PCI RS422/485 Port Settings In Windows 95.

Double clicking on a Velocity RS485 Port entry from the entry “**Ports (Com & LPT)**” branch in **Device Manager** will the display general properties window for the selected port (in this case COM5).

- Selecting the Port Settings tab produces:



Settings available in this window are:

1. Baud Rate - determines the baud rate at which the selected port operates, the maximum value available is dependant upon the Maximum Baud Rate Setting (see below.)

2. Data Bits.

3. Parity.

4. Stop Bits.

5. Flow Control.

} Change to suit remote device.

6. Maximum Baud Rate Setting - four values are available, which selects the maximum baud rate at which the port may operate. The table below, indicates the ranges of baud rate values available at the Maximum Baud Rate Settings.

Maximum Baud Rate Settings.

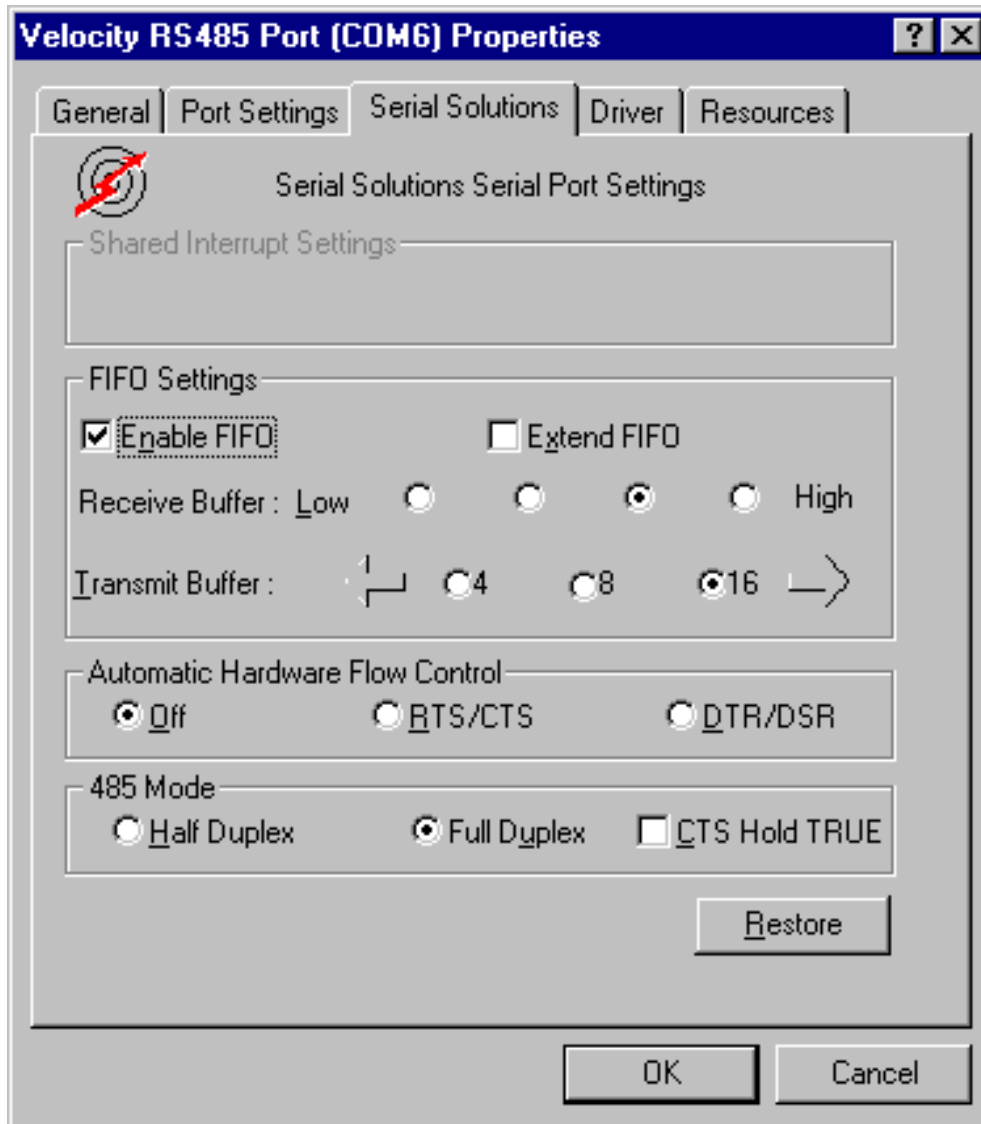
		Maximum Baud Rate			
		115200	230400	460800	921600
Selectable Baud Rates	50	100	200	400	
	75	150	300	600	
	110	220	440	880	
	150	300	600	1200	
	300	600	1200	2400	
	600	1200	2400	4800	
	1200	2400	4800	9600	
	1800	3600	7200	1440	
	2000	4000	8000	16000	
	2400	4800	9600	19200	
	3600	7200	14400	28800	
	4800	9600	19200	38400	
	7200	14400	28800	57600	
	9600	19200	38400	76800	
	19200	38400	76800	153600	
	38400	76800	153600	230400	
57600	115200	230400	460800		
115200	230400	460800	921600		

Note: Many serial comms applications will not actually register the ports as running at baud rates of above 115200.

7. Restore Defaults - when clicked, resets the selected COM port to the following values:

Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	Xon / Xoff
Maximum Baud Rate Setting:	115,200

Clicking on the Serial Solutions tab will display:



Settings available in this window are:

9. FIFO Settings.
 - **Enable FIFO** - turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
 - **Extend FIFO** - when checked, extends the selected ports FIFO buffer from 16 to 64 bytes.
 - **Receive Buffer** - These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.

- **Transmit Buffer** - These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.

10. **Automatic Hardware Flow Control.** One of two options may be selected:

- **Off (Default)** - This will turn off automatic flow control. (If you have no data transfer problems then selecting this option is fine.)
- **RTS/CTS** - This will use the RTS and CTS lines for automatic hardware flow control.

11. **485 Mode** offers the options:

- **Half Duplex / Full Duplex**(default) - are used in conjunction with the RS485 Multiplex Jumper Settings.

NOTE: These software settings must match the RS485 Multiplex Jumper configuration, as described in the section “**RS485 Multiplex Jumper Settings**” in Chapter 2, to ensure accurate and error free data transmission.

- **CTS Hold True**, determines whether the CTS handshake signal is INPUT from the external serial device or is permanently forced true on the card. The serial ports own RTS OUTPUT handshake signals are always taken out to the serial port connector.

12. **Restore** - when this button is clicked the settings in the current window will be reset to the default values of:

Enable FIFO:	On (Checked)
Extend FIFO:	Off (Unchecked)
Receive Buffer:	3 rd from left.
Transmit Buffer:	16
Automatic Hardware flow Control:	Off
485 Mode:	Full duplex.

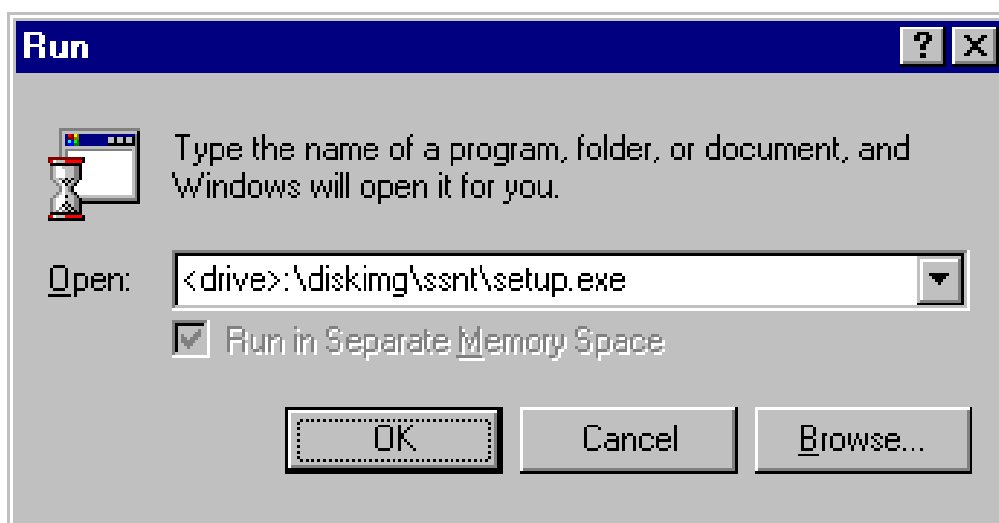
Windows NT 4.0 Installation.

Microsoft Windows NT Provides built in support for 255 standard serial ports. To setup your PCI RS232/422/485 serial card you should follow these steps. Please note that to change any kind of hardware configuration under Windows NT you must be logged in as a user with Administrator level privileges, if you do not have these please contact your system administrator.

Software Installation.

Insert the PCI Velocity RS232/422/485 into your PC, as described in chapter 2, and restart. Place the supplied CDROM titled “Serial Solutions Software” in a suitable drive and from the Start Menu choose Run and enter

<drive>:\diskimg\ssnt\setup (where <drive>: is the path to the CDROM drive containing the installation disk).



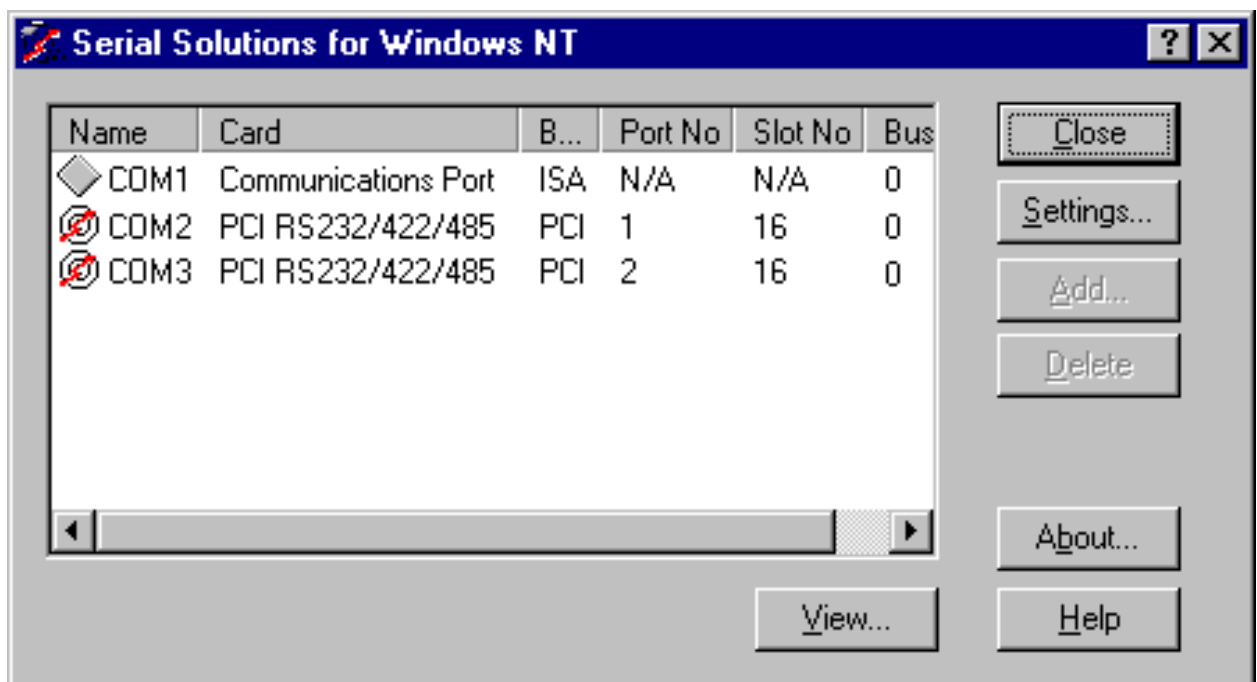
- InstallShield will then install the driver software automatically - it will then copy the necessary files and start itself. This automatically detects your new PCI serial card(s) and does not require any further system restarting.

Examining Card Configuration.

Go to Control Panel (Start/Settings/Control Panel) and double click on Serial Solutions PCI:

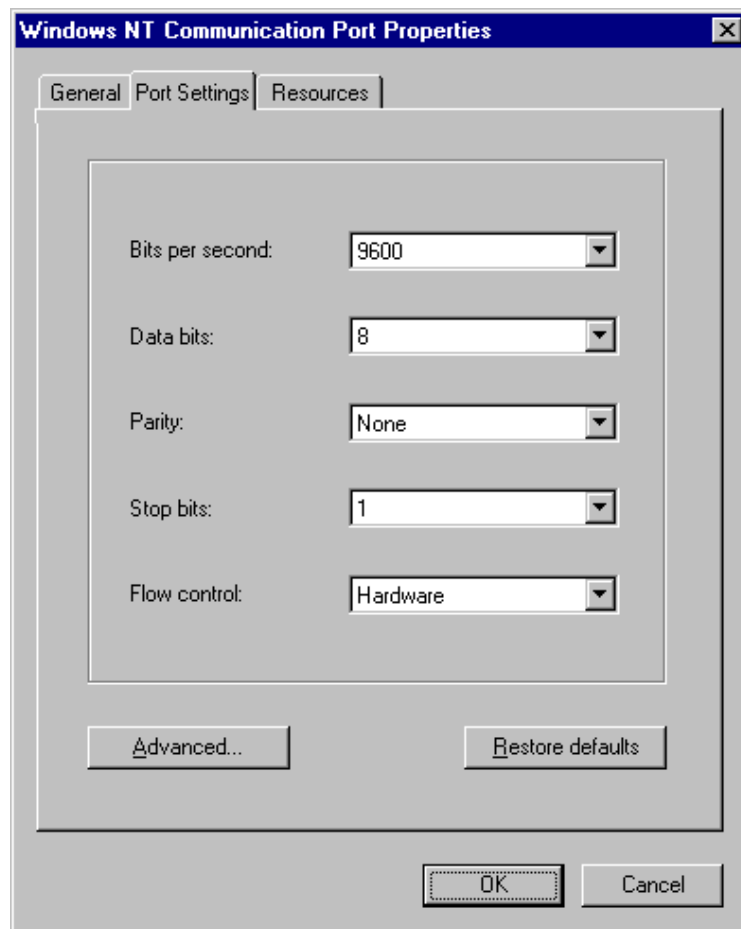


You will be presented with a Serial Solutions PCI Port Configuration window:



Configuring Ports.

To view the settings of a port, select it and click on settings, and then click on the resources tab:



Settings available in this window are:

Settings available in this window are:

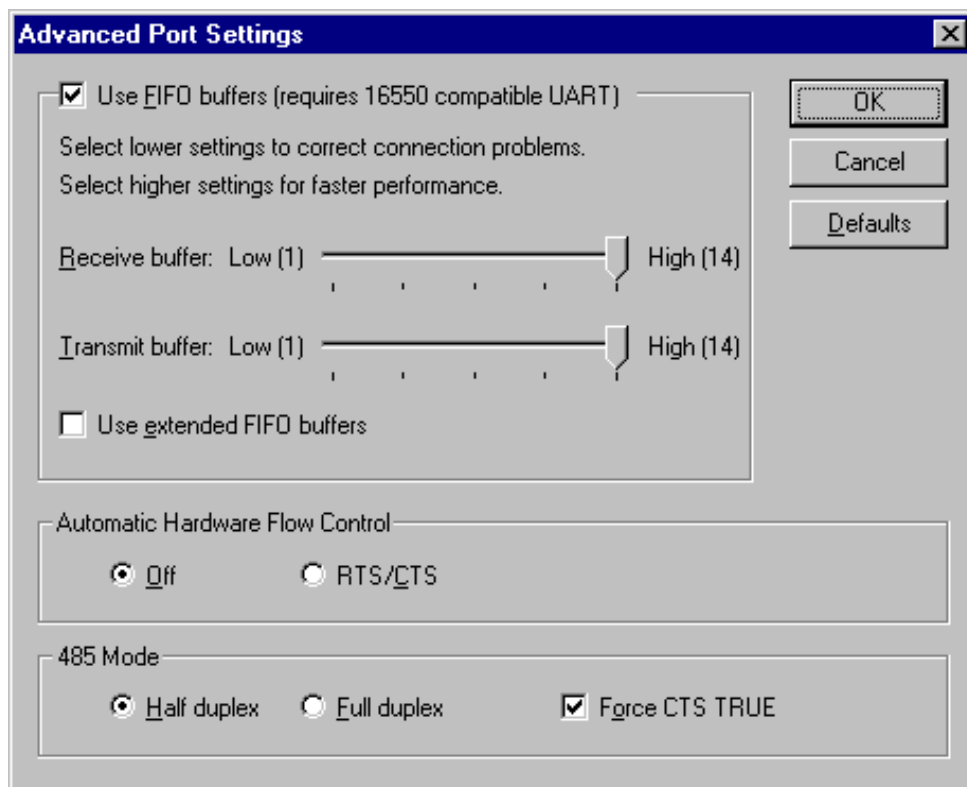
1. **Baud Rate** - determines the baud rate at which the selected port operates, the maximum value available is 921,600 (1 Megabaud.) **Note:** Many serial comms applications will not actually register the ports as running at baud rates of above 115200.
 2. Data Bits.
 3. Parity.
 4. Stop Bits.
 5. Flow Control.
 6. **Advanced** - see the section below, titled "Advanced Port Settings."
- } Change to suit remote device.

7. **Restore Defaults** - when clicked, resets the selected COM port to the following values:

Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	Hardware

Advanced Port Settings.

When the **Advanced** button of Port Settings is selected the following dialogue is displayed:



Settings available in this window are:

1. FIFO settings.
 - **Use FIFO Buffers** - turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
 - **Receive Buffer** - These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow

the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.

- **Transmit Buffer** - These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.
 - **Use Extended FIFO Buffers** - when checked, extends the selected ports FIFO buffer from 16 to 64 bytes.
2. **Automatic Hardware Flow Control.** One of three options may be selected:
- **Off** (Default) - This will turn off automatic flow control. (If you have no data transfer problems then selecting this option is fine.)
 - **RTS/CTS** - This will use the RTS and CTS lines for automatic hardware flow control.
3. **485 Mode** (available on the 485 port) offers the options:
- **Half Duplex / Full Duplex**(default) - are used in conjunction with the RS485 Multiplex Jumper Settings.
NOTE: These software settings must match the RS485 Multiplex Jumper configuration, as described in the section “**RS485 Multiplex Jumper Settings**” in Chapter 2, to ensure accurate and error free data transmission.
 - **Force CTS True**, determines whether the CTS handshake signal is INPUT from the external serial device or is permanently forced true on the card. The serial ports own RTS OUTPUT handshake signals are always taken out to the serial port connector.
4. **Defaults** - When clicked this button resets the advanced properties to the followed settings:

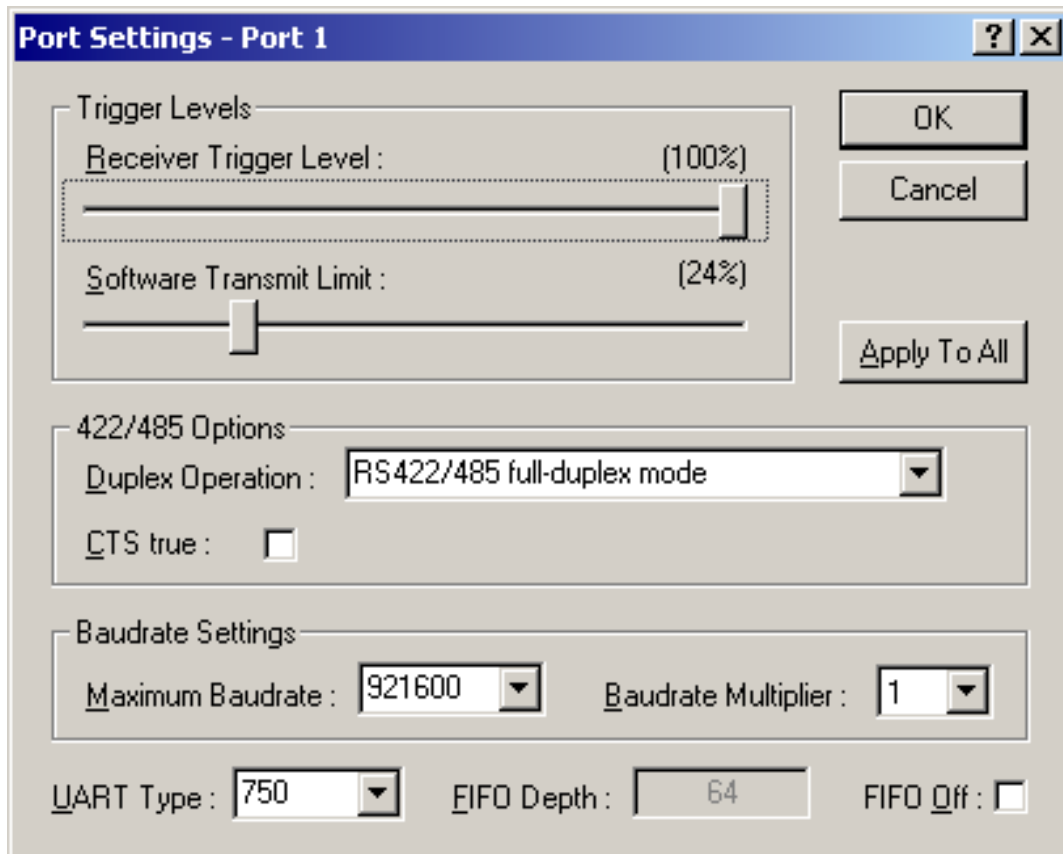
Use FIFO Buffers:	On (checked)
Transmit Buffers:	1
Receive Buffers:	8
Use Extended FIFO:	Off (Unchecked)
Automatic Hardware	
Flow Control:	Off
485 Mode:	Full Duplex

Uninstalling Serial Solutions PCI.

To uninstall Serial Solutions PCI:

- From Control Panel, open the Add/Remove Programs applet, then close the Control Panel.
- Select from the list Serial Solutions PCI.
- Click the Add/Remove button.

Windows NT will then uninstall the Serial Solutions PCI applet without the need for restarting.



Chapter 4 RS232 PINOUTS AND PORT CABLING.

Introduction.

This chapter gives details of the 9 and 25 pin RS232 pin outs, cabling and connections, with information on how to connect the serial ports of two PCs and how to make a selftest loop back connector.

The RS232 Standard.

The RS232 standard is ancient in computer industry terms. Introduced in 1962, it is now widely established. RS232 is a slow speed, short distance, single ended transmission system (i.e. only one wire per signal). Typical RS232 maximum cable length is 50 feet with a maximum data rate of 20K bits per second.

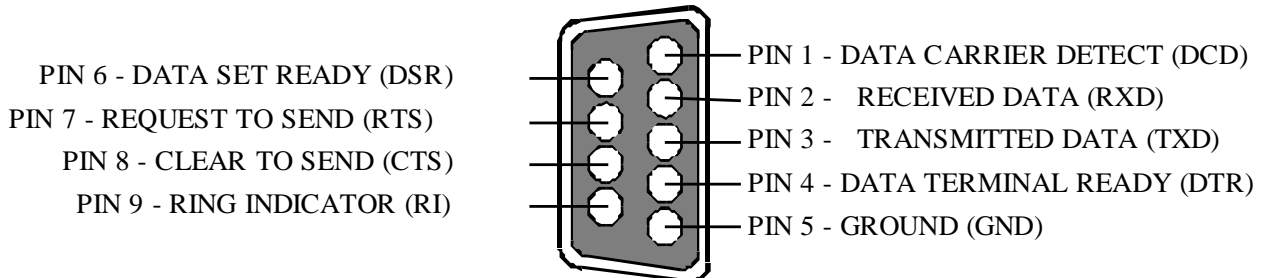
Figure 4-1. RS232 Point To Point Connection.



RS232C Standard	
1 Driver 1 Receiver	
Line Length	Max Data Rate
50 Feet = 15m	20 Kbits/sec

Serial Port Pin Outs.

The pinouts of the 9 pin Male D connector is given below.

Figure 4-2. Serial Port RS232 Pin Outs.**9 Pin D Serial Port RS232 Cables.**

To connect to the AT style RS232 Serial Port you will need a cable terminating in a 9 way female D connector. It is sound practice to use cables with screws fitted that will allow you to fasten the cable securely to the PC card.

In general, you will need to make up a “cross over” cable to correctly interface the PC to the RS232 port of another computer or device. Traditionally, making up the cross over cable has been considered a black art. However, provided you have the pin outs and handshake requirements of both sides of your RS232 connection, the cross over cable becomes a matter of common sense. The cross over cable is simply to ensure that the right signals going out of one RS232 port go into the appropriate lines of the other RS232 port.

9 Pin D Serial Port Connection To Another PC.

Suppose we want to connect the AT style 9 pin D Serial Port to the serial port of another IBM PC. See Figure 4-3.

- 1) Connect the earth lines.

Line 5 of Serial Port 2 to lines 1 & 7 of the other PC.

This gives the two devices a common earth level.

- 2) Connect the Transmit and Receive lines together.

Line 3, TXD, Port 2 goes to line 3, RXD, of the other PC.

Line 2, RXD, Port 2 goes to line 2, TXD, of the other PC.

This allows each to receive the data transmitted by the other.

- 3) Connect the Port 2 DTR line, pin 4 to the other PC DCD, pin 8 and CTS, pin 5, lines.

Also, connect up the other PC DTR line, pin 20 to the Port 2 DCD, pin 1 and CTS, pin 8, lines.

This allows the receiving device to signal when it can no longer accept data. The receiving device sets DTR false when it is unable to receive any more data. The sending device reads DTR on its CTS and DCD pins. It should stop sending when CTS goes false.

- 4) Connect the Port 2 RTS line, pin 7, to the other PC DSR line, pin 6. Also, connect the other PC RTS line, pin 4, to the Port 2 DSR line, pin 6.

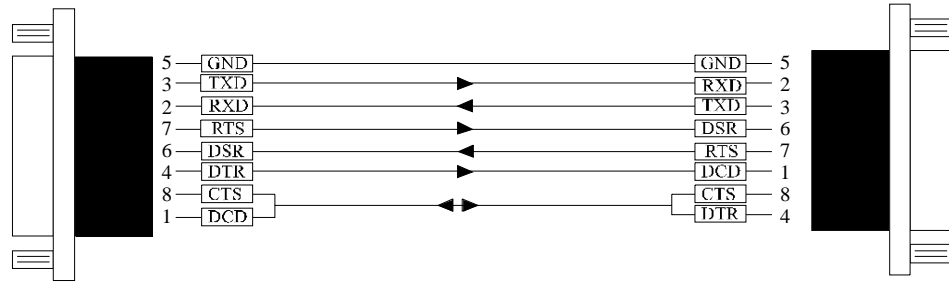
This RTS line is used to let the other device know that it is ready for data exchange.

Figure 4-3. 9 Pin D Serial Port To Other PC Cable.

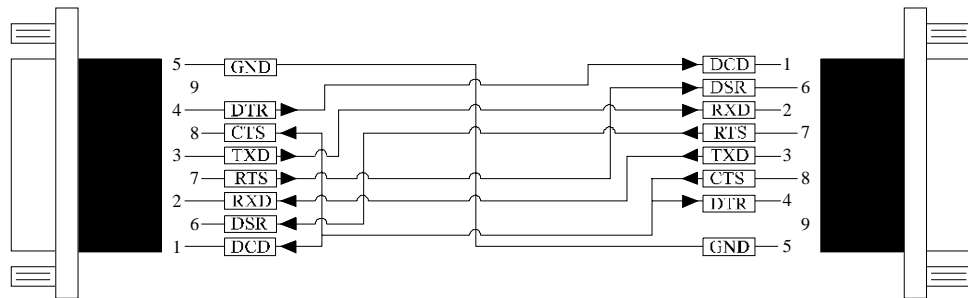
AT SERIAL PORT Side
9 PIN D CONNECTOR

Other PC SERIAL PORT Side.
9 PIN D CONNECTOR

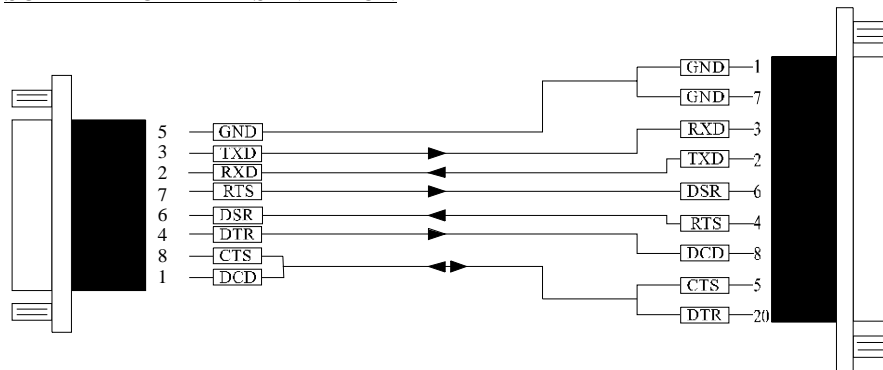
SCHEMATIC REPRESENTATION:



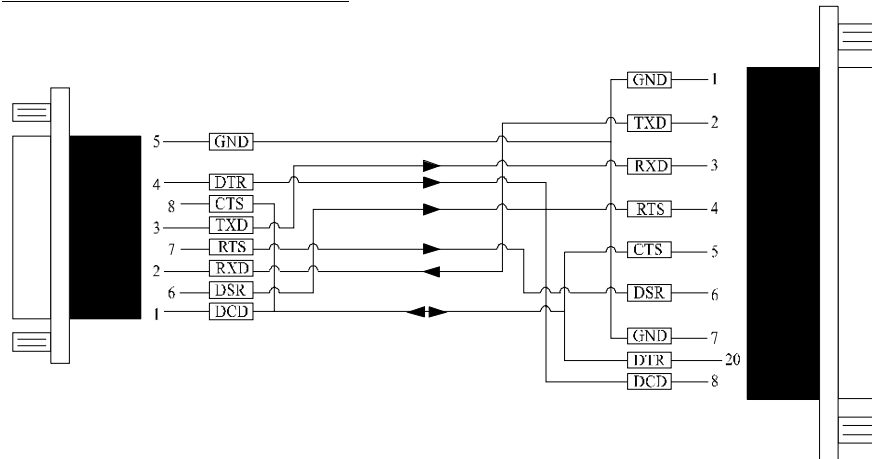
ACTUAL REPRESENTATION:



SCHEMATIC REPRESENTATION



ACTUAL REPRESENTATION



9 PIN D CONNECTOR

25 PIN D CONNECTOR

9 Pin D Serial Port To A Modem.

If you are connecting a MODEM to a 9 pin D Serial Port then you will NOT need a cross over cable and a straight through cable connected as the 9 to 25 pin adapter given in Figure 4-5.

9 Pin D Serial Port Loop Back Connector.

A loop back connector can be used to echo RS232 data transmitted by a serial port back into its own RS232 receiver. In this way, the function of the serial port can be tested.

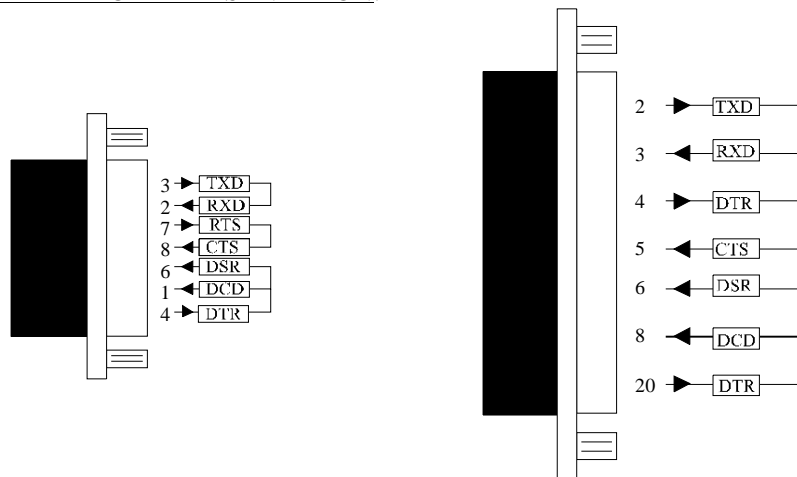
For an AT style Serial Port use the a female 9 way connector wired as in Figure 4-4.

Figure 4-4. 9 Pin D Serial Loop Back Connector.

9 PIN D CONNECTOR

25 PIN D CONNECTOR

SCHEMATIC REPRESENTATION:



ACTUAL REPRESENTATION:

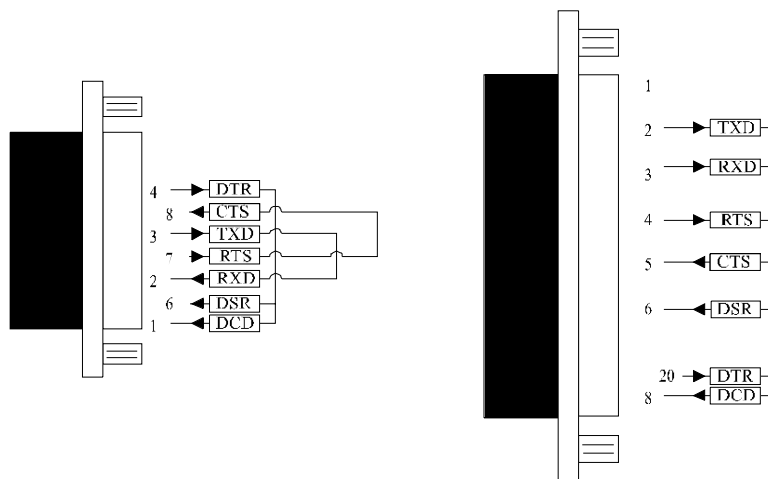


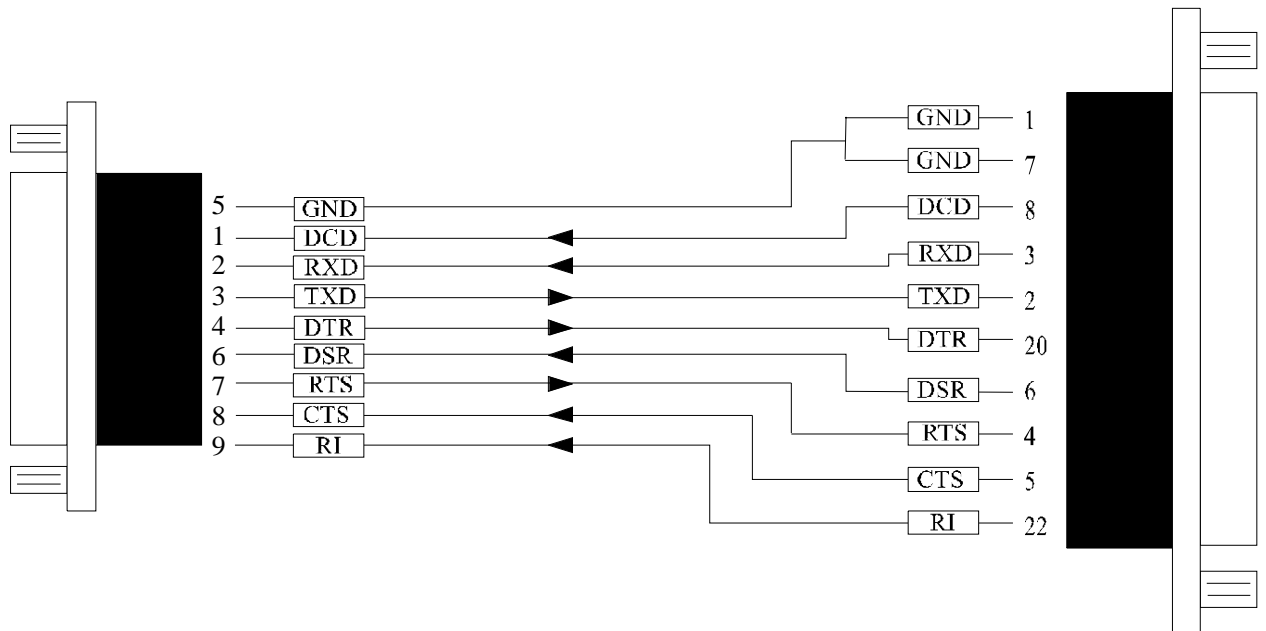
Figure 4-5. 9 To 25 Way Adapter.

This adapter cable makes the AT style 9-pin serial port, look like the standard PC 25 pin serial port. It is NOT a cross over cable!

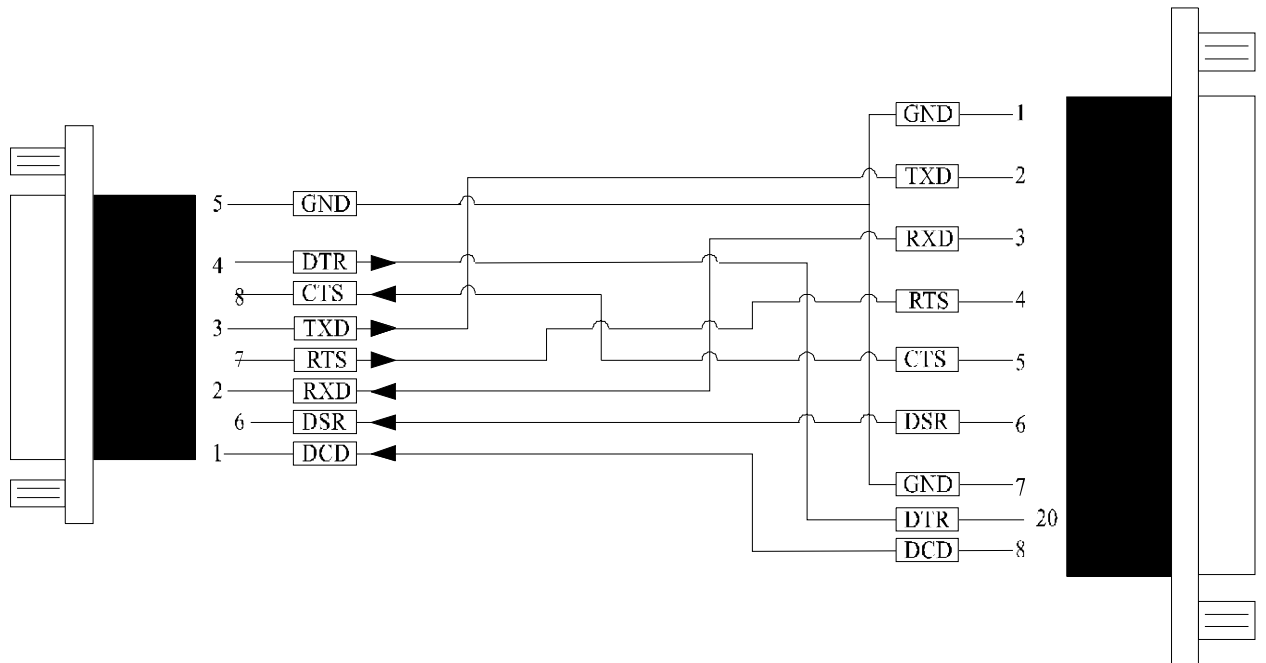
9 Pin AT SERIAL PORT
9 Pin Female D Connector

25 Pin PC SERIAL PORT
25 Pin Male D Connector

SCHEMATIC REPRESENTATION:



ACTUAL REPRESENTATION:



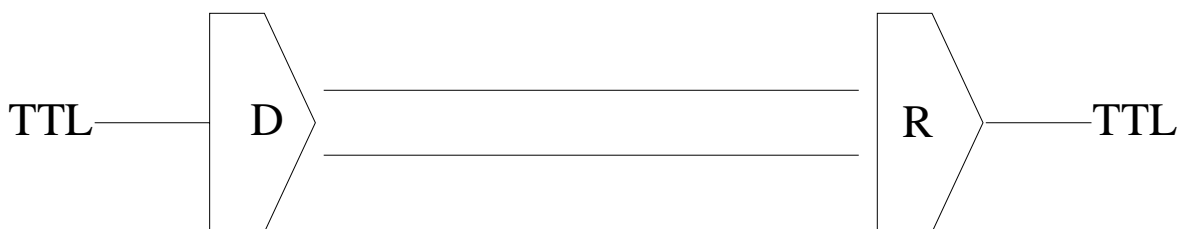
Chapter 5

ADDITIONAL RS422/485 OPERATION

The RS422 Standard.

The RS422 standard defines a serial communications standard. RS422 is a high speed and/or long distance data transmission. Each signal is carried by a pair of wires and is thus a differential data transmission system. Over distances up to 40 feet the maximum data rate is 10 Megabits per second, and for distances up to 4000 feet the maximum data rate is 100 Kilobytes per second. A 120-Ohm resistor should be used to terminate the receiving end of the line. It is generally used between one transmitter receiver pair to ONLY one other transmitter receiver pair, but each output can drive up to 10 receivers.

RS422 Standard	
1 Driver up to 10 Receivers	
Line Length	Max Data Rate
40 Feet = 12m	10 Mbits/sec
400 Feet = 122m	1 Mbits/sec
4000 Feet = 1219m	100 Kbits/sec

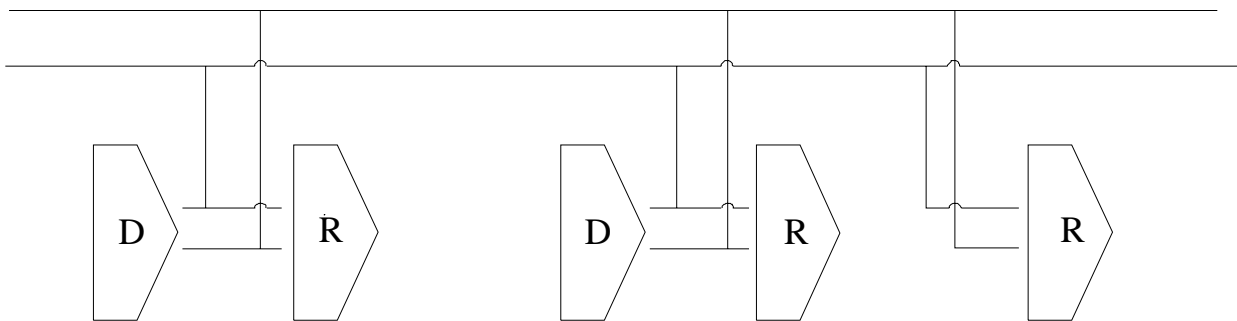


The RS485 Standard.

The RS485 standard is similar to the RS422 standard upon which it is based. The main difference is that up to 32 transmitter receiver pairs may be present on the line at one time. A 120-Ohm resistor should be used to terminate either end of the main line. If more

than one device may transmit data, the RTS line is used as transmit enable signal, so preventing contention between talkers.

RS485 Standard	
Up to 32 Driver/Receiver Pairs	
Line Length	Max Data Rate
40 Feet = 12m	10 Mbits/sec
400 Feet = 122m	1 Mbits/sec
4000 Feet = 1219m	100 Kbits/sec



Terminating Impedance's.

RS422 and RS485 lines should be terminated at the end of the main branch of the RECEIVER, in the cables characteristic impedance. These terminating impedance's stop echoes caused by the serial data being reflected back at the cable ends. It is not necessary to terminate the transmitter end of the twisted pair.

The AT Dual Port RS422/485, Opto Isolated AT Dual Port RS422/485 and AT Velocity RS422/485 cards have the correct 120 Ohm (nominal) terminating resistors for the RXD twisted pair line and the CTS twisted pair line fitted on the RS422/485 card for both the serial ports on the card.

There is no need to add any more at the PC end.

The terminating impedance's shown later in the wiring diagrams of Figure 4-1, Figure 4-2, Figure 4-4 & Figure 4-6 are automatically provided by the on board resistors and do not have to be added by the user.

Fail Safe Open Circuit Detection.

Open circuit is when there are no drivers on the circuit. This occurs by design in party line multi driver/receiver systems and unintentionally when the twisted pair line is accidentally cut or disconnected or the transmitting device fails. In RS485 party line systems there are extended periods of time when none of the many possible talkers are gated onto the bus. This is known as the line idle state and occurs when all the driver outputs are in the high impedance state. The lines float, perhaps being pulled to the high or low state by noise or other voltages on the line.

Without fail safe open circuit detection false start bits are detected by the receivers, either corrupting good communications or causing noise to masquerade as good data.

The on board fail safe open circuit detection causes the receiver to go to a known, pre-determined state and prevents false start bits and bad data being detected during open circuits.

Fail Safe Short Circuit Protection.

Short circuits are when the two lines of a twisted pair are connected together. This occurs due to either accidental damage to the cable or due to failure of one or more transmitter/receivers on the line. The short circuit condition is dangerous since damage to the receiver may occur and communication may be corrupted or prevented.

The on board fail safe short circuit detection prevents the line impedance from going to zero and thus protects the inputs of receivers and the outputs of drivers.

RS422 Operation.

Generally, in RS422 systems all 8 signal lines from the 9 pin D connector participate in the data transfer sequence, thus 4 twisted pair cables are used. One twisted pair carries the TXD data outwards, one pair brings the RXD data inward, another pair carries the RTS handshake outwards and the fourth pair brings the

Note:

- i.) Receiver ends terminated in characteristic impedance ONBOARD resistor networks.
- ii.) USE BELDEN TYPE 9729 etc. see above.
- iii.) RS485 Gating & Multiplex Jumpers as Factory Set.

RS485 Operation.

The RS485 standard is intended for up to 32 driver receiver pairs on the bus. The line drivers used in the Serial Solutions RS422/485 card are designed to work correctly in both RS422 and RS485 systems. The main difference therefore is in how the system is implemented. Though the card uses a 9 pin D connector, in general, not all the lines are used for RS485 systems. The RTS+/- and CTS+/- lines, though driven by the card, are usually not connected. In two wire, Half-Duplex configurations the TXD+ line is connected to the RXD+ whilst the TXD- line is connected to the RXD-, only one pair of twisted wire cable is used in RS485 Half Duplex communications.

The hardware handshaking performed by the CTS+/- and RTS+/- lines in RS422 systems are handled by a software protocol in RS485 systems. In situations where more than one device may transmit data on the shared data line, each cards RTS line is used as a gating signal to enable the TXD driver only when that card needs to transmit data, i.e. set TXD GATE or AUTO jumper. This mechanism prevents bus contention caused by multiple transmitters holding the line in opposing states. Revision 3 and higher versions of this card have a facility which automatically “gates” the RTS line, thus enabling the transmitter independently of any software. This “Auto gating” is described in more detail in the previous 485 half duplex section

The three wiring schemes given described below are:

-

- i.) RS485 One Talker Many Listeners (HALF DUPLEX)
- ii.) RS485 Many Talkers Many Listeners (HALF DUPLEX.)
- iii.) RS485 Many Talkers Many Listeners (FULL DUPLEX.)

RS485 Cable.

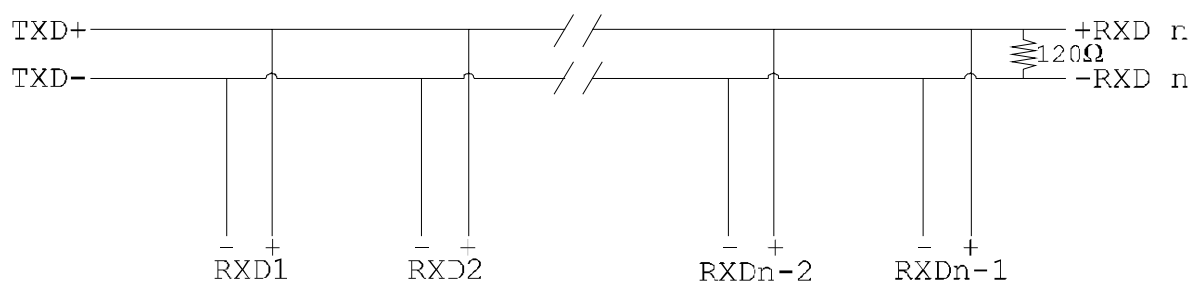
For best noise immunity use twisted pair cables to make the RS485 connection. In Half Duplex wiring only 1 twisted cable pair is needed. Two twisted pair cables are needed for Full Duplex communications.

Use screened twisted pair Belden cable 9729 and 9829, UL type 2493 and 2919 or IBM Part No 4716748 cable to make the RS485 connection. Terminate the twisted pair cable at either end in its characteristic impedance, which for the Belden 9729 cable is 120 Ohms. Unscreened Belden type 8795 may also be used.

RS485 One Talker - Many Listeners, Half Duplex.

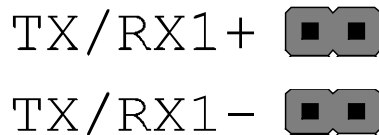
There are several schemes for connecting RS485 devices depending on the characteristics of the system. In many cases there will be only one device, which can transmit, data and all the others simply listen to it. This scheme is used for theatrical lighting intensity control in the DMX512 standard. This is shown in Figure 4-2, below. For the talker the RS485 TXD GATE jumper should remain in the factory set position, i.e. transmitter is always enabled. There is NO multiplexing of the TXD and RXD lines. Data is only flowing one way, from PC outwards, and is thus a Half-Duplex configuration, only one twisted pair cable is needed.

Figure 5-2. RS485 1 Talker Many Listeners.



Note: The Receiver end of MAIN line terminated in characteristic impedance by ONBOARD resistor networks, stubs off the main not terminated. In the above scheme, one RS485 device is talk only, it transmits data, but it does not receive any. The other RS485 devices are receive only, they do not transmit any data at all. Figure 5-3 gives the RS485 Gating jumper settings.

Figure 5-3 Half Duplex Settings of RS485 Multiplex

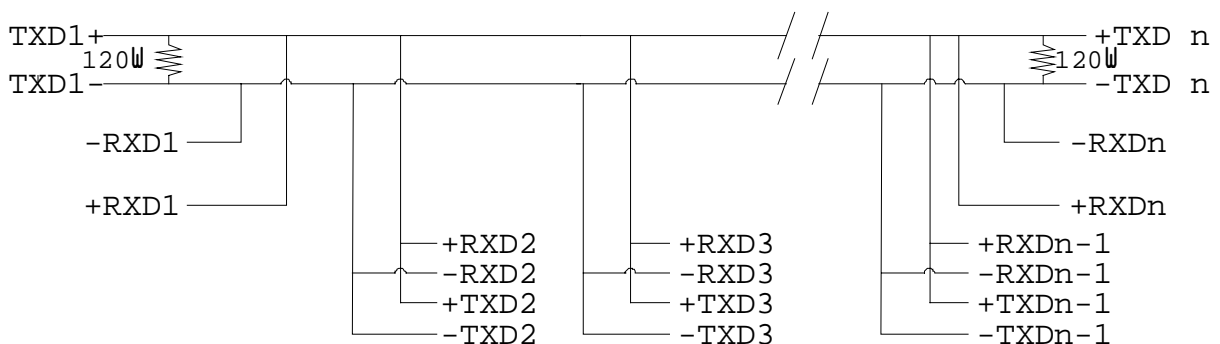


- Both jumpers shorted, causing the RXD- & TXD- and the RXD+ & TXD+ signals to short together at the 9-pin connector.

RS485 Many Talkers- Many Listeners, Half Duplex.

Another popular RS485 layout is for multiple talkers and multiple listeners. This is shown in Figure 5-4, below. This is also known as “party line” transmission. It is imperative to have some method of preventing two devices trying to drive the data lines at the same time. The normal method is to use the RTS line as a talk enable. The RTS line should go true immediately prior to the data transmission and go false immediately after the last byte in the stream is sent. See Figure 5-3 for jumper settings.

Figure 5-4. RS485 Many Talkers & Listeners. Half Duplex



Note: BOTH ends of MAIN line terminated in characteristic impedance, stubs off main line not impedance, since both ends receive. The twisted pair ends are wired to both RXD+ & TXD+ and RXD- & TXD- at each RS485 device!

RS485 Many Talkers- Many Listeners, Full Duplex.

The RS485 many talkers, many listeners, Full Duplex system can be used when all the RS485 devices have separate Transmit and Receive channels. There is NO multiplexing of the TXD and RXD signals on the same device. This system is especially useful when there is no flow control available on the PC, usually due to the use of a third party communications program that prevents the use of the RTS signal as a “transmit enable” control, via the TXD GATE jumper. It can be used in the following situations:-

- a) The PC is connected to only ONE RS485 device.
- b) The PC is communicating with several RS485 devices that are each able to recognize and respond to their own unique address. The RS485 devices only drive their TXD lines when they are responding to requests from the PC to send data. In effect, the RS485 device’s address and the command it receives is used to control access to the devices TXD channel. This is a Full Duplex system. Two twisted pair cables are required. One twisted pair, is the PC’s TXD channel, it carries the data sent from the PC’s TXD outputs to the RXD inputs of each of the RS485 devices. The second twisted pair, is the Devices TXD channel, it carries the data sent from each of the devices’ TXD outputs to the RXD inputs of the PC.

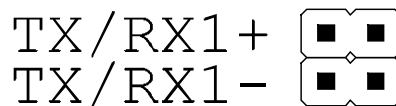
The advantages of this system are great, since no new communications, software is needed, and the PC can talk and listen at the same time. In effect, the handshaking is performed by the intelligence of the RS485 devices attached to the PC.

When wired as in Figure 5-6 below, the PC can transmit data at any time and all the RS485 devices #1 to #n simultaneously receives it.

Only one of the RS485 devices may talk, i.e. transmit data, at any one time. Each RS485 device recognizes commands and data addressed to it, it only talks when the PC commands it to do so. When the RS485 device receives the command to talk from the PC, it gates its TXD drivers on, sends the data down the device

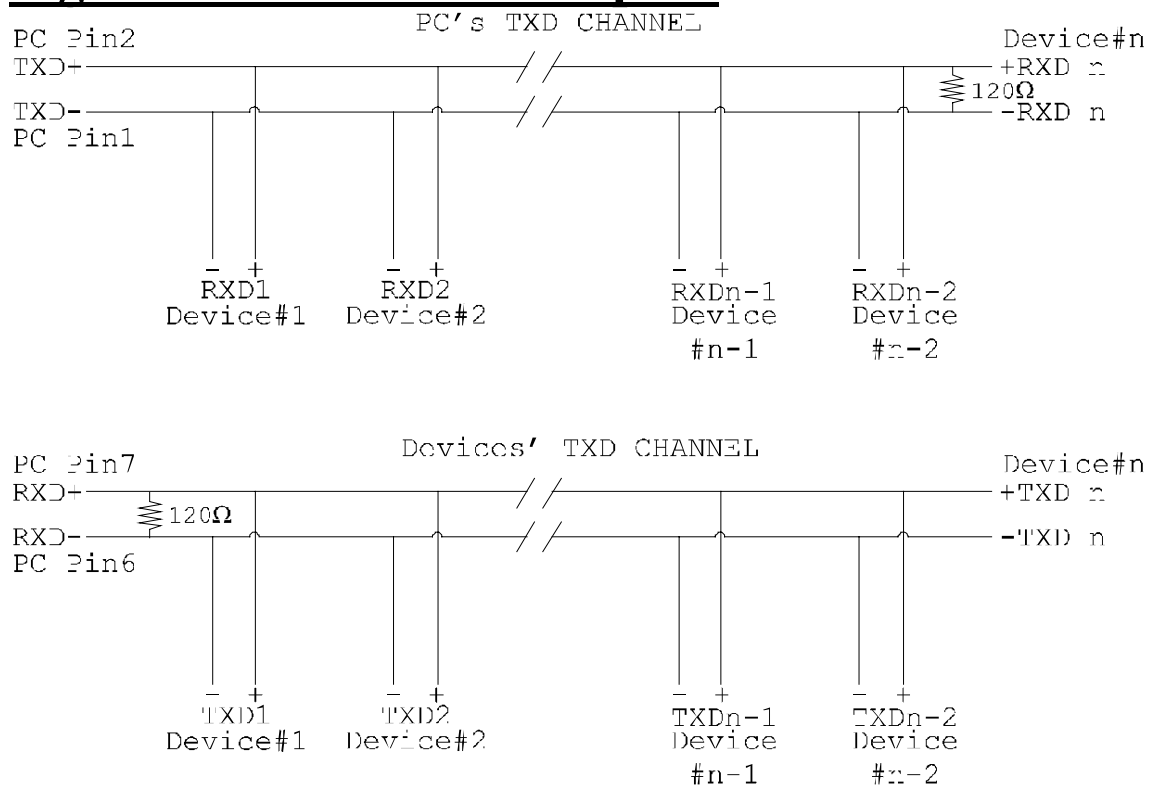
TXD channel, and disables its TXD drivers. The other RS485 devices remain in the receive only mode when they are not being addressed, they do not transmit any data at all. Figure 4-5 gives the jumper settings for the serial card in the RS485 Full Duplex mode.

Figure 5-5. RS485 Jumpers, Full Duplex.



- Both jumpers left unconnected (not shorted).

Figure 5-6. RS485 Full Duplex.



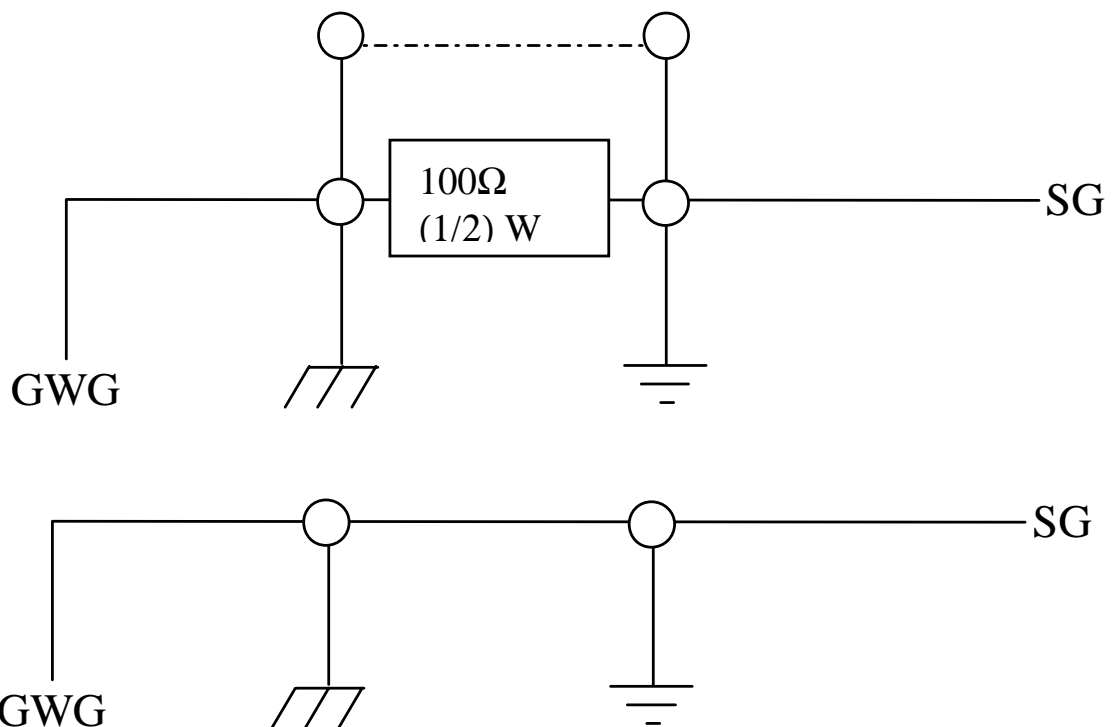
Note: The receiver end of MAIN line terminated in characteristic impedance, stubs off the main not terminated.

Optional Grounding Arrangements.

Proper operation of the cable circuit, according to TIA EIA: 485 A (1995) requires that the cable ground shield is not connected directly to the equipment ground shield. A current limiting resistor should be used in series with the shield to avoid possible large current flow due to differences in ground potential. Any one of the methods shown in Figure 5-7, below can do this.

Figure 5-7 - Optional Grounding Arrangements For A PCI RS422/485 Card.

Configuration A)



Configuration B)

Configuration A) The circuit common of the equipment is connected to protective ground, at one point only by a 100 Ω, ±20% resistor with a power dissipation rating of 1/2W. An additional provision may be made for the resistor to be bypassed with a strap to connect signal common and protective ground directly together when specific installation conditions necessitate.

SG	=	Signal Ground Interchange circuit.
GWG	=	Green wire ground of power system.
	=	Protective ground of frame ground.
	=	Circuit ground or circuit

Index

1 Megabaud	11
115200 Baud.....	36, 40, 50, 54
16450 / 16550	7, 11
460800 Baud.....	36, 40, 50, 54
921600 Baud.....	36, 40, 50, 54
adapter	68, 69
asynchronous	11
Autogating	11, 12
baud / baud rate.....	8, 9
BBCARDS.EXE	18, 21, 23
Belden.....	74
bits	15, 64, 72
buffer	73
Buffer.....	21
buffer / buffered	7, 9, 11
cable.....	9, 15, 16, 64, 65, 68, 69, 71, 72, 73, 74, 75
Changing COM numbers in Windows 95	34, 48
command	8, 77
Configuring Ports In Microsoft Windows NT.....	57
connectors.....	16, 65
cross over.....	65, 68, 69
CTS	8, 11, 66, 71, 73, 74
data word length.....	11
DCD	8, 66
device driver	18, 19, 21
DSR	8, 66
DTR.....	8, 66
emulation	8
fail safe	72
FIFO	7, 11
gating.....	74
handshake	7, 8, 65, 72
impedance.....	71, 72, 73, 74, 75, 76, 78
installation	9, 15, 18
Installing Ports In DOS.	18

Installing Ports In Microsoft Windows 95 & 98.....	29
Installing ports in Windows 3.x.....	24
interrupts.....	9
jumper.....	74, 75, 76, 77, 78
last	76
loop back	9, 64, 68
Maximum Baud Rate	35, 36, 39, 40, 49, 50, 53, 54
mode	8, 78
open circuit	72
parity.....	8, 9
party line	72, 76
pin outs	64, 65
port / ports.....	7, 8, 9, 11, 15, 18, 57, 64, 65, 66, 68, 69, 71
Port Address.....	21
protocol.....	8, 74
receive	14, 66, 75, 76, 77, 78
resistor	70, 73, 74, 75
RS232	7, 11, 14, 15, 64, 65, 68
RS422 / RS485.....	11, 12, 14, 42, 56, 61, 70, 71- 78
RS422 Pinout	13
RS485 Multiplex Jumper Settings	42, 56, 61
RTS	8, 11, 66, 71, 72, 73, 74, 76, 77
RXD	11, 14, 66, 71, 72, 74, 75, 76, 77
serial port.....	7, 8, 9, 15, 18, 57, 64, 66, 68, 69, 71
shared interrupt	9, 10
short circuit	72
SISR	19
speed.....	11, 70
stop bits.....	15
technical.....	10
twisted pair	14, 71, 72, 73, 75, 76, 77
TXD.....	11, 14, 66, 72, 74, 75, 76, 77
Uninstalling Serial Solutions PCI for Windows NT	62
Windows.....	7, 9, 57