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422

AT Quad RS422/485
4.3 EDITION May 1999

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Hardware Manual

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AT QUAD 4 PORT RS422/485 MANUAL
OUTLINE CONTENTS

Chapter 1. Serial Solutions Software

Chapter 2. At Quad 4 Port RS422 Hardware Configuration

Chapter 3. How to install your card into the PC

Chapter 4. AT Quad 4 Port RS422/485 Software Configuration

Chapter 5. Quad and Quad Shared Interrupt Mechanisms

THE LAYOUT OF THIS MANUAL

Chapter 1 - Serial Solutions Software, is an overview of the companion software package that comes with the Quad card.

Chapter 2 - AT Quad 4 Port RS422/485 Hardware Configuration, after a brief discussion on the after a brief discussion on the RS422 & RS485 standards shows how to configure the settings of the cards. Details of COM, IRQ and Shared Interrupt mechanisms are given.

Chapter 3 - How to install your card into a PC, after configuration a step by step guide to installing the configured card in PC expansion slots.

Chapter 4 - AT Quad 4 Port RS422/485 Software Configuration Guide, details on how to setup the serial solutions software provided with the cards in Windows DOS 3.x, Windows 95, Windows NT.

Chapter 5 - AT Quad 4 Port RS422/485 DOS Software Configuration Guide

Chapter 6, Quad Shared Interrupt Mechanisms, shows you how to link several Quad Cards together so as to use only one interrupt line, multi card ID settings and the Shared Interrupt Status Register operation.

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Intro

Intro

CHAPTER 1
SERIAL SOLUTION SOFTWARE.

Introduction.

This chapter is a brief introduction to the Serial Solutions software package that is bundled with the Quad 4 Port RS422/485 card.

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 95/98
Serial Solutions for Windows NT

All the Serial Solutions drivers have the following features:-

a) Drivers for PC standard UARTs e.g. 8250 and 16450
a) Drivers for PC FIFO UARTs e.g. 16550 as well as the new improved 32 byte 16650 and 64 byte 16750 UARTs.
a) Support for shared interrupt cards e.g. our Quad 232, Quad 232 and Quad 422 cards.
a) Support for any mix of RS422/485, RS422 and RS485 handshake schemes.
a) 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 supporting 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.
	e.g. NEWMODE COM5:38400,E,7,1 01A0 7
	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 EASYPAS 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.

<u>Terminal Emulation Program.</u>

Two sets of terminal programs are included. The EASY disk contains short, simple to understand and use EASYBAS, EASYC and EASYPAS programs, providing straight forward, file type I/O to serial ports with debug information. Use these FIRST, base your sample applications on them.

The 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.

Each of the programs behave in exactly the same way. Once running the PC acts as a terminal; any characters typed at the keyboard are sent to the serial port, and any characters received from the serial port are displayed on the screen. Function keys are used to display the Help screen, use the set up menus or exit the program.

In addition the terminal programs recognise an impressive set of commands, that may be executed automatically or interactively. The commands include features to enable Echoing of transmitted and received data, set up the serial port parameters, set substitution characters and string for both in coming and outgoing data, execute terminal batch files, transmit from and receive to disk, execute DOS commands from within the terminal program.

The input output translations offer the user a way of smoothing over the differences between different pieces of equipment, allowing conversion of data between otherwise incompatible systems.

Additional Sample 8 Port Software

As well as the EASY programs, there is MANYPORT.EXE and its source code MANYPORT.BAS. The .exe version has been compiled using Microsoft Quick Basic V4.5. Its purpose is to demonstrate how to program multi port cards from BASIC. It will work with Quad 8 and Quad 4 port cards, DigiCHANNEL cards, Flytech Flynix-8 FAT-011 cards, as well with any mix of 2 port especially if each port has its own individual IRQ.

Termdef.txt

Termdef.txt is a data file of commands that the terminal emulation programs use to define the properties of the particular emulated terminal. By building up his own library of terminal definitions a user can quickly emulate either his favourite terminal or literally scores of different terminals on the one PC.

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. It 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.
BbQuad.drv	Replacement for COMM.DRV.
QuadAPI.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 the easy way.

Serial Solutions For Windows 95.

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: -

PCI.inf	The information files to aid the
ISA.inf	installationprocess "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
ssmult.vxd	the 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 driver is necessary for Windows NT to drive multiport cards. Serial Solutions for Windows NT consists of the following programs:-

Multiport.cpl   Control panel applet which allows the simple configuration of all ports on a multiport card simultaneously.

Mulport.hlp   Help file for the above control panel applet.

The Comtest.exe Program

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 e.g. non FIFO, 16550 FIFO, 16550AF FIFO and the improved 16650 32 byte FIFO and 16750 64 byte fifos. 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.

Complete Documentation and Technical Backup.

We believe in supplying complete documentation with every package we sell. The Serial Solution Software Package is no exception. This documentation can be found on the CD included.. 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
AT QUAD 4 PORT RS422
HARDWARE CONFIGURATION.

Introduction.

This chapter explains how to configure the AT QUAD 4 PORT RS422 in a PC compatible, giving details for address and IRQ jumper selection. Detailed instructions are given how to set the address select DIP switches and IRQ jumpers.

This half size RS422 card will fit into both long and short slots, in 8 bit XT or 16 bit AT slots and will work happily in any PC compatible up to and exceeding Pentium III 500MHz class machines.

Card Features.
- Four ports independently selectable as RS422 or RS485.
- Reliable communications up to 4000 feet, 1.2 Kilometre.
- 100% IBM Compatible serial port Texas Instruments 16C550
- Jumper selectable serial port address, COM1 -COM8.
- TXD, RXD, RTS and CTS signals.
- Two or Four wire operation.
- RS485 Gating jumper options:
  TXD driver Gating: Always On or RTS enable.
  RXD receiver Gating: Always On or RTS disable.
- RS485 TXD/RXD multiplex selectable by jumpers:- either FULL DUPLEX or HALF DUPLEX.
- On board 120 Ohm terminating resistors.
- On board Fail Safe open circuit and short circuit detection.
- Fully double buffered for reliable asynchronous operation.
- High speed circuitry to ensure operation with fast PC's. WITHOUT use of extra wait states.
- Jumper selectable interrupt level. IRQ 2-7, 10-12, 14 & 15.

Serial Port Features:-

Baud Rate:	50 Baud to 115,200 Baud
Word Length:	5, 6, 7 or 8 bits.
Parity:	Even, Odd, None, Mark or Space.
Start Bit:	1 start bit always sent.
Stop Bits:	1, (1.5 for 5 bit data word length) or 2.
Clock Input:	14.7456MHz
I/O Connection:	37 pin D female connector.
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
Difftial I/P threshold:	200mV max.
Hysteresis:	50mVolt typical
Input Impedance:	>12K Ohm without terminators.

AT Dual Port RS422/485 Dimensions: 5.975 x 4.20 in
                                          15.2 x 10.6 cm

The RS422 Standard.

The RS422 standard defines a serial communications standard. RS422 is for 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 Kilobits 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

TTL——D> ———— <R ——TTL

Figure 2-1 9 pin RS422 pinouts

PIN 6 - RECEIVED DATA (RXD-)
PIN 7 - RECEIVED DATA (RXD+)
PIN 8 - CLEAR TO SEND (CTS-)
PIN 9 - CLEAR TO SEND (CTS+)

PIN 1 - TRANSMITTED DATA (TXD-)
PIN 2 - TRANSMITTED DATA (TXD+)
PIN 3 - REQUEST TO SEND (RTS-)
PIN 4 - REQUEST TO SEND (RTS+)
PIN 5 - GROUND (GND)
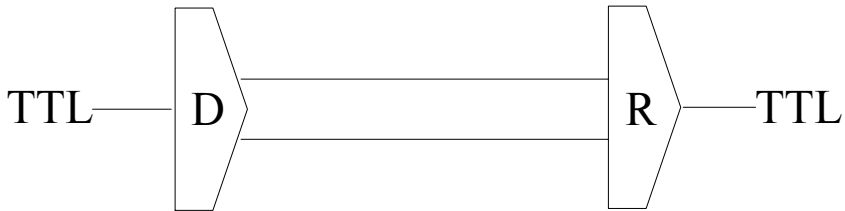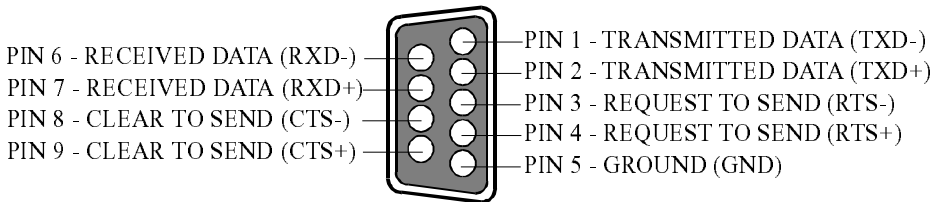
The RS485 Standard.

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
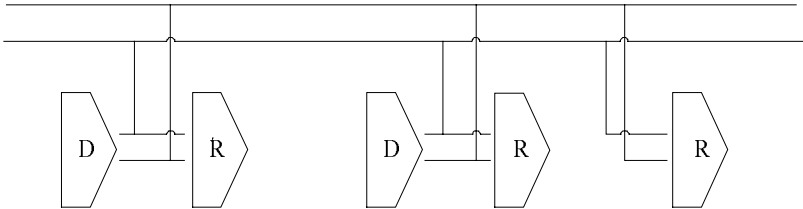
Terminating Impedance's.

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 Quad Port RS422/485 card has the correct 120 Ohm terminating resistors for the RXD twisted pair line and the CTS twisted pair line fitted on the RS422/485 card for all of 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 2-14 Figure 2-15 Figure 2-17 & Figure 2-19 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 is 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.

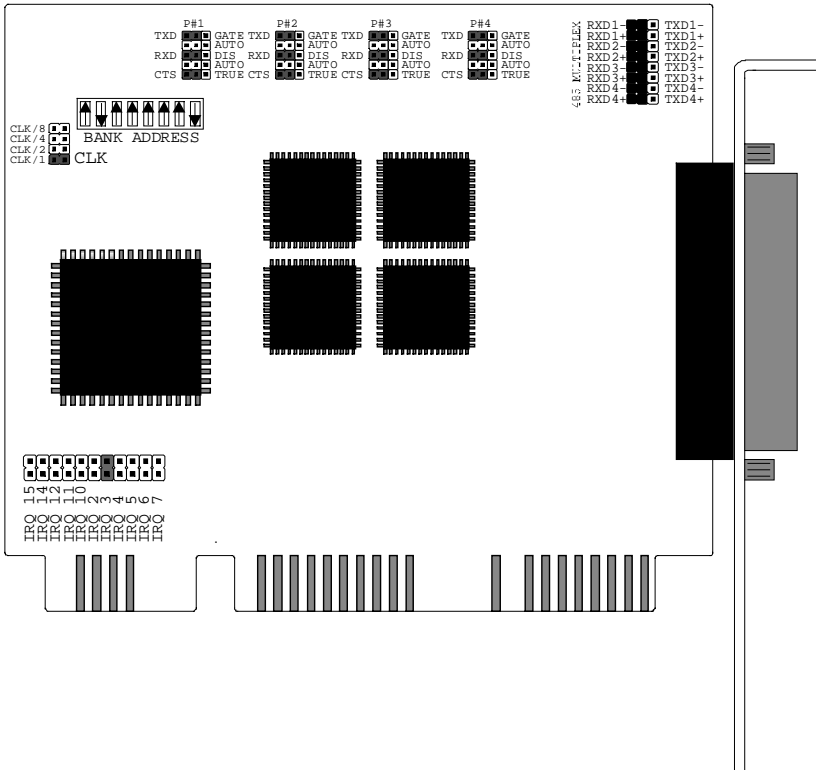# Figure 2-2a AT Quad 4 Port RS422 Layout
COM1 Present Only
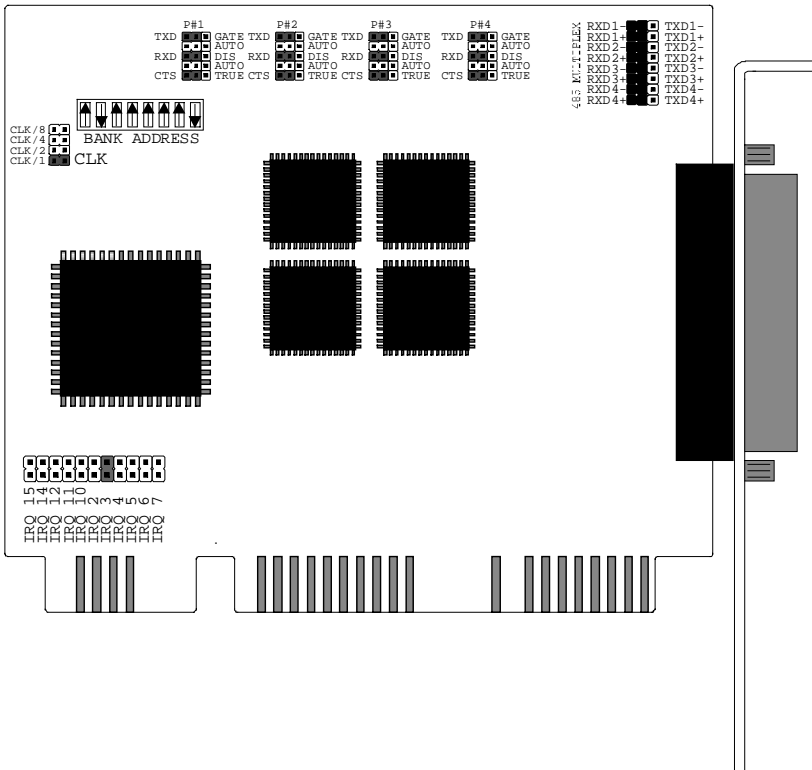
Card Settings	COM 1 Present
Port #1	Bank
Port #2	Bank
Port #3	Bank
Port #4	Bank
Shared IRQ	3
Bank Ad.	110-118h
SISR Ad.	120h
Card ID	0

Figure 2-2b). AT Quad 4 Port RS422 Layout
COM1 and COM2 Present

Card Settings	COM1 &COM2 Present
Port #1	Bank
Port #2	Bank
Port #3	Bank
Port #4	Bank
Shared IRQ	10
Bank Ad.	110-118h
SISR Ad.	120h
Card ID	0

AT Quad 4 Port RS422/485 Specifications:

Dimensions: 4.2 x 6.3 in, 106 x 160 mm
I/O Connection: 37 way female D connector to 4 serial ports
Serial Port 1:   9 pin Male D type.
Serial Port 2:   9 pin Male D type.
Serial Port 3:   9 pin Male D type.
Serial Port 4:   9 pin Male D type.

Configuring The AT Quad 4 Port RS422

In the state it leaves our factory, the AT Quad 4 Port RS422 is ready to plug straight into a PC compatible computer. Unless there is GOOD REASON, do not alter its default setting. However, due to the presence of other serial ports in the PC, your card may need configuring to suit your setup.

If your card needs to be reconfigured it is important to know the settings (particularly IRQ allocations) of any other add on cards / motherboard resources that exist in your PC, in order to ensure its trouble free operation. Various means of determining these settings exist, for example, the Device Manager in Windows 95 or the MSD program in MS-DOS, but these do not always give the complete picture and should be used for indication only. Settings for legacy devices such as ISA cards, are determined most accurately by examining the appropriate hardware, or contacting the supplier. PCI device settings can change, but are usually reported by the BIOS at boot time.

The recommended settings layout of the Quad card when the PC only has 1 other serial port, COM1, is shown in Figure 2-2a) (Quad factory default) and also in Table 2-1, on the next page. The recommended configurations of the Quad card when the PC already has 2 other serial ports, COM1 and COM2, installed.

Table 2 -1 AT Quad 4 Port card configuration

Card Settings	COM 1 Present	COM1 & COM2 Present
Port #1	Bank	Bank
Port #2	Bank	Bank
Port #3	Bank	Bank
Port #4	Bank	Bank
Shared IRQ	3	10
Bank Ad.	110-118h	110 - 118h
SISR Ad.	120h	120h
Card ID	0	0

The four configurable options are:-

i) **Serial Port Setup.**

Allocate each serial port its I/O address and interrupt line.

ii) **Shared Interrupt Setup.**

The Shared Interrupt Status Register (SISR) I/O address is set by the card to the Bank address + 20hex. It's interrupt line is set by the movable jumpers at the bottom edge of the card. For more information on this subject refer to **Chapter 5 "AT 4 Port Quad RS422/485 Shared Interrupt Mechanisms**" and the sections below concerning shared interrupt settings.

iii) **RS485 Multiplex Select.**

If the communications port uses the same pair of wires for transmitted data and for received data, this is known as Half Duplex Operation, then the multiplex jumpers must be set across both the RXDn- and TXDn- pair and the RXDn+ and TXDn+ pair. Other wise leave the jumpers attached only to one pin of the header pair.

iv) **RS485 Gating Options.**

If the CTS line is not being used set the CTSn jumper to TRUE. This holds the CTS input true rather than leaving it unconnected.

When in Half Duplex Operation as set in iii) above:-

a) a) If the PC's transmit line is being shared by the transmit lines of the RS422/485 devices then set the TXDn jumper to GATE. This means that the PC has use of the transmit line only when it sets its RTS output line true. This allows the other devices to transmit when the PC sets its RTS line to false. OR Set the TXDn jumper to AUTO. The "Gating" of the RTS line is then dealt with by the card itself, removing the responsibility from the software and ensuring a rapid "Turnaround" time

b) If the PC's receive line is also connected to its transmit lines, set the RXDn jumper to DIS (disabled). This means that the PC takes control of the line for transmitting data, by setting its RTS output line true automatically turns it own receiver OFF, so that it is prevented from hearing its own transmissions. OR

Set the RXDn jumper to AUTO whereapon this task is Automatically completed by the card

The Ideal Situation.

If your serial communications packages are configurable for I/O address and interrupt then set all the serial ports in your system so that each serial port has its own separate I/O address, and interrupt not used by any other device in the PC.

Serial Port Connectors

The AT Quad 4 Port card possesses four 9 pin serial ports, connected via a 37 pin female port, port pin outs are given above in the section "**The RS422 Standard**" and also at the end of this chapter.

Serial Port Setup.

The position of the movable Dip Switches, determines the I/O address of the serial ports, configuring the cards ports to a bank address between 100h to 3F8h.

The 4 serial ports are configured consecutively DIPS 1-7 on the BANK ADDRESS 8 way DIP switch, their locations are listed below.

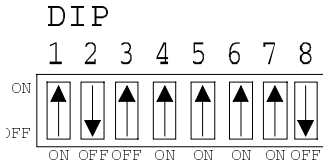**Bank Address Select : Top left, centre**

Serial Port Bank Address Configuration

This 32 byte bank, shown below in figure 2-3 with default settings, containing the 4 serial ports, may be any address on an 8 byte boundary in the range 0100-03C0 Hex. e.g. 0100h, 0108h, 0110h, 0200h, 0240h, 0280h, 02C0h, 03C0h etc. DIP 8 is NOT used.

Serial Port Configuration.

The position of the DIP determines the I/O address of the serial ports, configuring the card to a "bank" address in the range 100h to 3F8h, with the address of the shared interrupt register immediately following the bank address. Thus the AT Quad 422/485 card occupies 34 consecutive I/O address locations starting at the bank address. The bank address is always on an 8 byte boundary.

The bank address is selected by the first 7 DIPs on the DIP switch. DIP 8 is currently not used and should be set in the off position.

Figure 2-3. Serial Port Bank Address Allocation

```
DIP
 1 2 3 4 5 6 7 8            PORT  ADDRESS  SETTINGS
ON                          P#1    P#2     P#3     P#4
OFF                         100h   108h    110h    118h
 ON OFFOFF ON  ON  ON  ON OFF
```

Within this 32 byte bank, port 1 - port 4 are decoded consecutively. e.g. Port 1 is at the bank address, port 2 at bank+8, port 3 at bank+16, port 4 at bank+24, SISR at bank +32.

In all, each of serial ports 1-4 may be set to 1 of 96 addresses. The default bank I/O address is 100hex.

The best addresses for the serial ports are in the range 0100-01EF hex, which is rarely used and 0200-023F hex & 0280-02BF hex which are usually unused.

I/O addresses to avoid are given in Figure 2-6.

Figure 1-5. Valid Quad Port Base Addresses.

	DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	DIP 7	SWITCH	P#1	P#2	P#3	P#4
	On	Off	On	On	On	Off	Off		–	–	–	100
	On	Off	On	On	On	Off	On		–	–	100	108
	On	Off	On	On	On	On	Off		–	100	108	110
Default	On	Off	On	On	On	On	On		100	108	110	118
	On	Off	On	On	Off	Off	Off		108	110	118	120
	On	Off	On	On	Off	Off	On		110	118	120	128
	On	Off	On	On	Off	On	Off		118	120	128	130
	On	Off	On	On	Off	On	On		120	128	130	138
	On	Off	On	Off	On	Off	Off		128	130	138	140
	On	Off	On	Off	On	Off	On		130	138	140	148
	On	Off	On	Off	On	On	Off		138	140	148	150
	On	Off	On	Off	On	On	On		140	148	150	158
	On	Off	On	Off	Off	Off	Off		148	150	158	160
	On	Off	On	Off	Off	Off	On		150	158	160	168
	On	Off	On	Off	Off	On	Off		158	160	168	170
	On	Off	On	Off	Off	On	On		160	168	170	178
	On	Off	Off	On	On	Off	Off		168	170	178	180
	On	Off	Off	On	On	Off	On		170	178	180	188
	On	Off	Off	On	On	On	Off		178	180	188	190
	On	Off	Off	On	On	On	On		180	188	190	198
	On	Off	Off	On	Off	Off	Off		188	190	198	1A0
	On	Off	Off	On	Off	Off	On		190	198	1A0	1A8
	On	Off	Off	On	Off	On	Off		198	1A0	1A8	1B0
	On	Off	Off	On	Off	On	On		1A0	1A8	1B0	1B8

DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	DIP 7	SWITCH	P#1	P#2	P#3	P#4
On	Off	Off	Off	On	Off	Off		1A8	1B0	1B8	1C0
On	Off	Off	Off	On	Off	On		1B0	1B8	1C0	1C8
On	Off	Off	Off	On	On	Off		1B8	1C0	1C8	1D0
On	Off	Off	Off	On	On	On		1C0	1C8	1D0	1D8
On	Off	Off	Off	Off	Off	Off		1C8	1D0	1D8	1E0
On	Off	Off	Off	Off	Off	On		1D0	1D8	1E0	1E8
On	Off	Off	Off	Off	On	Off		1D8	1E0	1E8	1F0
On	Off	Off	Off	Off	On	On		1E0	1E8	1F0	1F8
Off	On	On	On	On	Off	Off		1E8	1F0	1F8	200
Off	On	On	On	On	Off	On		1F0	1F8	200	208
Off	On	On	On	On	On	Off		1F8	200	208	210
Off	On	On	On	On	On	On		200	208	210	218
Off	On	On	On	Off	Off	Off		208	210	218	220
Off	On	On	On	Off	Off	On		210	218	220	228
Off	On	On	On	Off	On	Off		218	220	228	230
Off	On	On	On	Off	On	On		220	228	230	238
Off	On	On	Off	On	Off	Off		228	230	238	240
Off	On	On	Off	On	Off	On		230	238	240	248
Off	On	On	Off	On	On	Off		238	240	248	250
Off	On	On	Off	On	On	On		240	248	250	258
Off	On	On	Off	Off	Off	Off		248	250	258	260
Off	On	On	Off	Off	Off	On		250	258	260	268
Off	On	On	Off	Off	On	Off		258	260	268	270
Off	On	On	Off	Off	On	On		260	268	270	278

DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	DIP 7	SWITCH	P#1	P#2	P#3	P#4
Off	On	Off	On	On	Off	Off		268	270	278	280
Off	On	Off	On	On	Off	On		270	278	280	288
Off	On	Off	On	On	On	Off		278	280	288	290
Off	On	Off	On	On	On	On		280	288	290	298
Off	On	Off	On	Off	Off	Off		288	290	298	2A0
Off	On	Off	On	Off	Off	On		290	298	2A0	2A8
Off	On	Off	On	Off	On	Off		298	2A0	2A8	2B0
Off	On	Off	On	Off	On	On		2A0	2A8	2B0	2B8
Off	On	Off	Off	On	Off	Off		2A8	2B0	2B8	2C0
Off	On	Off	Off	On	Off	On		2B0	2B8	2C0	2C8
Off	On	Off	Off	On	On	Off		2B8	2C0	2C8	2D0
Off	On	Off	Off	On	On	On		2C0	2C8	2D0	2D8
Off	On	Off	Off	Off	Off	Off		2C8	2DO	2D8	2E0
Off	On	Off	Off	Off	Off	On		2D0	2D8	2E0	2E8
Off	On	Off	Off	Off	On	Off		2D8	2E0	2E8	2F0
Off	On	Off	Off	Off	On	On		2E0	2E8	2F0	2F8
Off	Off	On	On	On	Off	Off		2E8	2F0	2F8	300
Off	Off	On	On	On	Off	On		2F0	2F8	300	308
Off	Off	On	On	On	On	Off		2F8	300	308	310
Off	Off	On	On	On	On	On		300	308	310	318
Off	Off	On	On	Off	Off	Off		308	310	318	320
Off	Off	On	On	Off	Off	On		310	318	320	328
Off	Off	On	On	Off	On	Off		318	320	328	330
Off	Off	On	On	Off	On	On		320	328	330	338

DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6	DIP 7	SWITCH	P#1	P#2	P#3	P#4
Off	Off	On	Off	On	Off	Off		328	330	338	340
Off	Off	On	Off	On	Off	On		330	338	340	348
Off	Off	On	Off	On	On	Off		338	340	348	350
Off	Off	On	Off	On	On	On		340	348	350	358
Off	Off	On	Off	Off	Off	Off		348	350	358	360
Off	Off	On	Off	Off	Off	On		350	358	360	368
Off	Off	On	Off	Off	On	Off		358	360	368	370
Off	Off	On	Off	Off	On	On		360	368	370	378
Off	Off	Off	On	On	Off	Off		368	370	378	380
Off	Off	Off	On	On	Off	On		370	378	380	388
Off	Off	Off	On	On	On	Off		378	380	388	390
Off	Off	Off	On	On	On	On		380	388	390	398
Off	Off	Off	On	Off	Off	Off		388	390	398	3A0
Off	Off	Off	On	Off	Off	On		390	398	3A0	3A8
Off	Off	Off	On	Off	On	Off		398	3A0	3A8	3B0
Off	Off	Off	On	Off	On	On		3A0	3A8	3B0	3B8
Off	Off	Off	Off	On	Off	Off		3A8	3B0	3B8	3C0
Off	Off	Off	Off	On	Off	On		3B0	3B8	3C0	3C8
Off	Off	Off	Off	On	On	Off		3B8	3C0	3C8	3D0
Off	Off	Off	Off	On	On	On		3C0	3C8	3D0	3D8
Off	Off	Off	Off	Off	Off	Off		3C8	3D0	3D8	3E0
Off	Off	Off	Off	Off	Off	On		3D0	3D8	3E0	3E8
Off	Off	Off	Off	Off	On	Off		3D8	3E0	3E8	3F0
Off	Off	Off	Off	Off	On	On		3E0	3E8	3F0	3F8

Figure 2-6. I/O Addresses To Avoid.
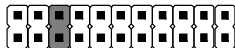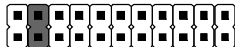
I/O Address	Normal Use
01F0H - 01F7H	IDE Hard Disk
0201H - 0201H	Game Control Adapter
0278H - 027FH	Second Printer Port Adapter
0378H - 037FH	Printer Port Adapter
03B0H - 03BFH	Printer Card
03F8H - 03FFH	COM1 Port Adapter

 If any of these adapter cards are installed in the PC DO NOT set the any of AT Quad RS422/485 card Serial ports to reside in the same range.

Serial Port IRQ Interrupt Jumper Selection.

The position of the movable jumper on the interrupt jumper block, located in the bottom left hand corner of the card, determines the IRQ vector of the serial ports, configuring the card as IRQ2 etc., IRQ2 - IRQ7, IRQ10 to IRQ12, 14 and 15.

Figure 2-7. Shared IRQ Jumper Block.

```
11111
5 4 2 1 0 2 3 4 5 6 7
```

VALUE	NORMAL USE
IRQ 2	Usually free.
IRQ 3	COM 2.Factory Default. Do not use if COM2 already installed.
IRQ 4	COM 1.
IRQ 5	PRINTER PORT #2
IRQ 6	DISK DRIVE STATUS, AVOID!
IRQ 7	PRINTER PORT #1
IRQ 10	Usually free.
IRQ 11	Usually free
IRQ 12	POINTING DEVICE, Usually Free. Free when mouse is on a COM port.
IRQ 15	PRIMARY IDE. Free if SCSI Hazrd drives are being used.
IRQ 15	Usually free

Shared Interrupt Mechanism.

The shared interrupt mechanism is a way of using the few available interrupt lines in the PC efficiently. It allows many serial ports to share only one IRQ line. The priority encoding mechanism also allows higher throughput than simply one port per IRQ line. Latching of the first asserted interrupt prevents one port hogging the interrupt line at the expense of other ports. More information about the shared interrupt mechanism can be found in a separate chapter.

The Shared Interrupt Register is a block consisting of 8 dip switches, to select its I/O address also there is a jumper block to select which PC interrupt line the Shared Interrupt Register is to drive.

The address of the shared interrupt status register is 20hex above the Bank address given by the DIP switches setting the serial ports. Also etc

Serial Port 485 Gating Jumper Block.

By referring to figure 2-2a), locate the Serial Port Gating jumper block at the top centre of the board. Both blocks (port 1 and 2 RS485 gating pictured below with default settings; the second block is identical) are divided into 2 parts, each consisting of 3 rows of pins - the top half of the first block is the gating block for serial #1 and the bottom part of the first block is for serial #2. N.B. The worked example given below is for Port 1's gating, but also applies to Port 2,3 AND 4.

The 5 movable jumpers are (**see Figure 2-9, Below**):-

i) TXD GATE / TXD AUTO GATING - For RS485 Use.

For use in RS485 Half Duplex systems only, where only one twisted pair connects both receive and transmit lines of all serial devices together. The RTS line is used as a control to allow the outgoing TXD data to reach the 9 pin connector. When RTS is false, the TXD lines are tristated, the PC cannot send data but other devices may send data, which the PC receives. When the RTS line is true, the PC can send data down the TXD line to be received by

other devices. Note the PC will hear its own transmitted data echoed back on the RXD lines unless the RXD DISABLE jumper, below, is set.

If the base address of serial port 1 is BASE, and since RTS is bit, decimal value 2 then:-

```
OUT BASE+4,3+8  REM RTS True TXD Enabled
OUT BASE+4,1+8  REM RTS False TXD Disabled
```

Note the 1+8 keep DTR and OUT2 true.

If the AG (Autogating) jumper is set the card itself will automatically enable / disable the transmitter, thus removing the responsibility from the software and guaranteeing a rapid "Receive turnaround" especially in multitasking. N.B. In this setting the card will autogate regardless of whether or not the users software is toggling the RTS line.

ii) RXD DISABLE / RXD AUTO GATING - For RS485 Use.

This jumper is the compliment of the above RXD GATE jumper. For use in RS485 Half Duplex systems only, where only one twisted pair connects both receive and transmit lines of all serial devices together. This jumper is used to stop the PC hearing its own transmitted data. When the RTS line is true no incoming data, RXD, can be received. When the RTS line is false all data sent by the other serial devices is heard.

If the base address of the serial port 1 is BASE, and since RTS is bit1 decimal value 2 then:-

```
OUT BASE+4,3+8 REM RTS True RXD Disabled
OUT BASE+4,1+8 REM RTS False RXD Enabled
```

Note the 1+8 keep DTR and OUT2 true.

If the AG (Autogating) jumper is set the card will automatically disable / enable the receiver, thus removing the responsibility from the software and guaranteeing a rapid "Receive turnaround" especially in multitasking

iii) CTS FORCE TRUE - Usually For RS485 Use.

This jumper forces 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 is always taken out to the serial port connector.

NOTE : Though there are 5 movable jumpers on each 485 port gating block, there are only 3 jumpers provided - 1 for each of the TXD, RXD and CTS settings. I.e. You should only set TXD to gate OR TXD to AG and NOT both, the same applies to RXD Gating

Figure 2-9. Port 1 Gating Jumper Block.

FACTORY DEFAULT SETTING:
ALL JUMPERS DISABLED (RS422 MODE)

```
TXD [■ ■][■] GATE
    [■ ■][■] AG
RXD [■ ■][■] DIS
    [■ ■][■] AG
CTS [■ ■][■] TRUE
```
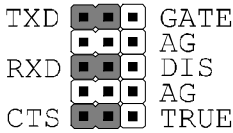
RECOMMENDED ALTERNATE SETTINGS:
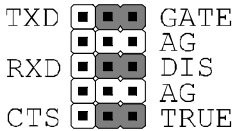
1. RS485 HALF DUPLEX OPERATION	2. AUTOGATING ENABLED RS485 HANDSHAKING	3. RS485 LISTEN TO EVERYTHING
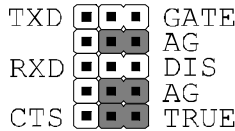
```
TXD [■][■ ■] GATE    TXD [■ ■][■] GATE    TXD [■][■ ■] GATE
    [■][■ ■] AG           [■][■ ■] AG           [■ ■][■] AG
RXD [■][■ ■] DIS     RXD [■ ■][■] DIS     RXD [■ ■][■] DIS
    [■][■ ■] AG           [■][■ ■] AG           [■ ■][■] AG
CTS [■][■ ■] TRUE    CTS [■][■ ■] TRUE    CTS [■][■ ■] TRUE
```
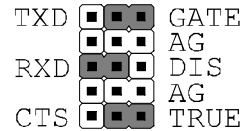
Serial Port Multiplex Jumper Block.

       By referring to the figure 2-2a), locate the Serial Port RS485 Multiplex jumper block at the top right of the board. Shown below with default settings, this block consists of 8 rows of 2pins with 2 two rows each controlling each port. N.B. The worked example given below is for Port 1 multiplex settings, but also applies to Port 2, 3 and 4.

Figure 2-10. Port Multiplex Jumper Block.

```
FACTORY DEFAULT SETTING:
NOT MULTIPLEXED.

RXD 1-  [■|■]  TXD 1-
RXD 1+  [■|■]  TXD 1+

ALTERNATE SETTINGS:
RS485 HALF DUPLEX OPERATION.

RXD 1-  [■ ■]  TXD 1-
RXD 1+  [■ ■]  TXD 1+
```
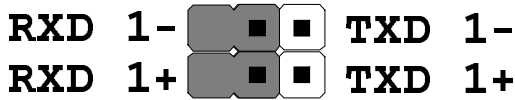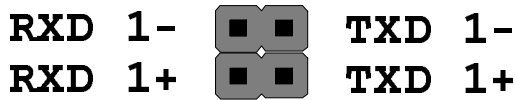
When the Multiplex jumpers are set to the right then the RXD- & TXD- signals and the RXD+ & TXD+ signals are shorted together at the 9 pin connector. The multiplex jumpers should only be set for RS485 Half Duplex operation, when one twisted pair is used to interconnect both transmit and receive lines.

```
RXD 1-  [■|■]  TXD 1-
RXD 1+  [■|■]  TXD 1+
RXD 2-  [■|■]  TXD 2-
RXD 2+  [■|■]  TXD 2+
RXD 3-  [■|■]  TXD 3-
RXD 3+  [■|■]  TXD 3+
RXD 3-  [■|■]  TXD 3-
RXD 3+  [■|■]  TXD 3+
```

Figure 2-11. - RS422 Serial Port Pin Outs.

PIN 6 - RECEIVED DATA (RXD-)
PIN 7 - RECEIVED DATA (RXD+)
PIN 8 - CLEAR TO SEND (CTS-)
PIN 9 - CLEAR TO SEND (CTS+)

PIN 1 - TRANSMITTED DATA (TXD-)
PIN 2 - TRANSMITTED DATA (TXD+)
PIN 3 - REQUEST TO SEND (RTS-)
PIN 4 - REQUEST TO SEND (RTS+)
PIN 5 - GROUND (GND)
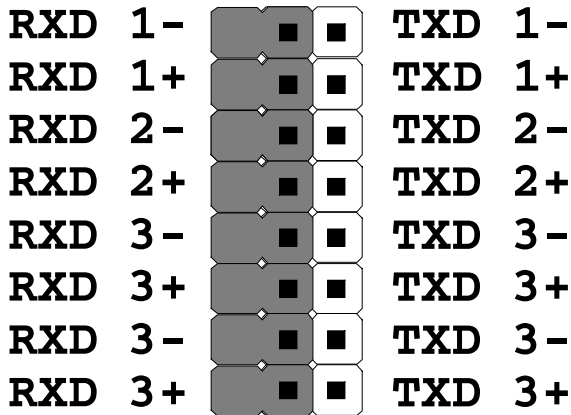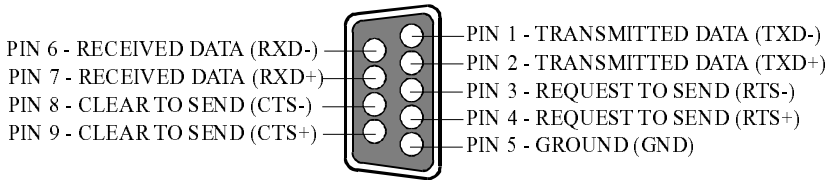
RS422 Handshake.

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 inwards, another pair carries the RTS handshake outwards and the fourth pair brings the CTS handshake inwards. You should not carry the ground from one device to another.

This RS422 arrangement allows data to be transmitted and received simultaneously since each signal has its own data cable pair. In addition the receiver can set RTS true so telling the transmitter on its CTS input that the receiver is ready to accept data. In this way, no data will ever be transmitted when the receiver is unable to accept it, due to a full input buffer etc. And so no data will be lost.

The Serial Solutions software is set up to this option with the following line in the CONFIG.SYS file.

   DEVICE=NEWCOM.SYS /H2,1   **COM2 RS422**

Where H2 means we are setting the Handshake for COM2, and 1 sets handshake type 1 ie the RS422 RTS/CTS handshake. See the Serial Solutions manual for more detail.

Alternatively, the data could be transmitted using the XON/XOFF handshake and so remove the need for the RTS and CTS lines and the extra two twisted pair cables.

The Serial Solutions FOR dossoftware is set up to this

option with the following line in the CONFIG.SYS file.

DEVICE=NEWCOM.SYS /X2   COM2 XON/XOFF

RS422 Serial Port Cables.

Use screened twisted pair Belden cable 9729 and 9829, L type 2493 and 2919 or IBM Part No 4716748 cable to make the RS422 connection. Unscreened Belden type 8795 may also be used in less noisy environments.

The on board resistor networks terminate the receiving end of the twisted pair cable in its characteristic impedance.

Figure 2-12. Serial Port 1 To Other PC Cable.
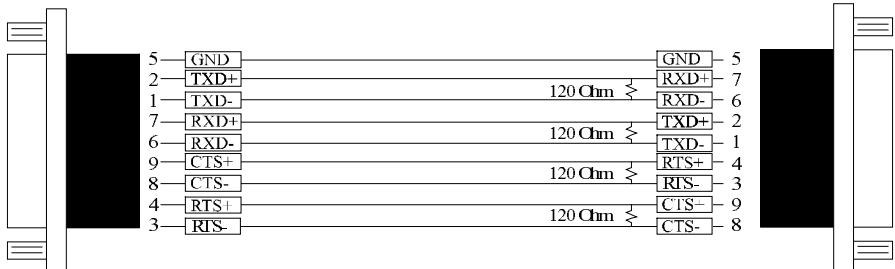
SERIAL PORT 1 Side   Other PC SERIAL PORT Side.
9 Pin Female D Connector   9 Pin Female D Connector

Note: i) Receiver ends terminated in characteristic impedance by

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 single 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 is 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, ie set TXD GATE jumper. This mechanism prevents bus contention caused by multiple transmitters holding the line in opposing states.

The three wiring schemes given described below are:-
 i)   RS485 One Talker Many Listeners. (HALF DUPLEX)
 ii) RS485 Many Talkers Many Listeners (FULL DUPLEX.)
 iii) RS485 Many Talkers Many Listeners (HALF 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 in less noisy environments.

RS485 One Talker - Many Listeners.

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 2-12, below. For the talker the RS485 TXD GATE jumper should remain in the factory set position, ie 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 2-13. RS485 1 Talker Many Listeners.
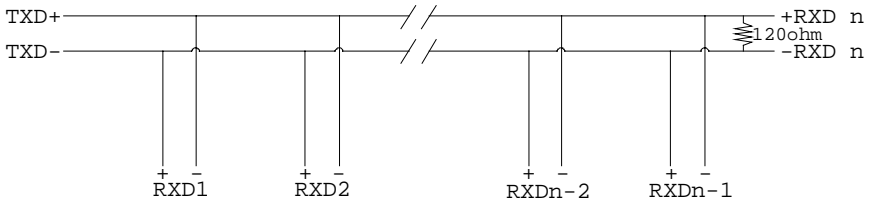
**Note:** The Receiver end of MAIN line terminated in characteristic impedance by ONBOARD resistor networks, stubs off the main not terminated.

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 2-14 gives the RS485 Gating jumper settings.

Figure 2-14. RS485 Jumpers, 1 Talker Many Listeners.
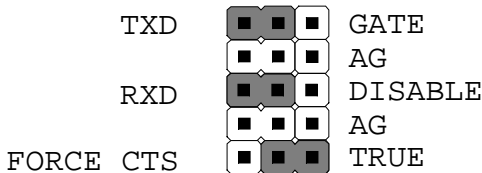
RS485 Many Talkers- Many Listeners, Full Duplex.

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 recognise 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 2-15 below, the PC can transmit data at any time and all the RS485 devices #1 to #n simultaneously receive it.

Only one of the RS485 devices may talk, i.e. transmit data, at any one time. Each RS485 device recognises 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 devices 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 2-16 gives the jumper settings for the serial card in the RS485 Full Duplex mode.

Figure 2-15. RS485 Full Duplex.

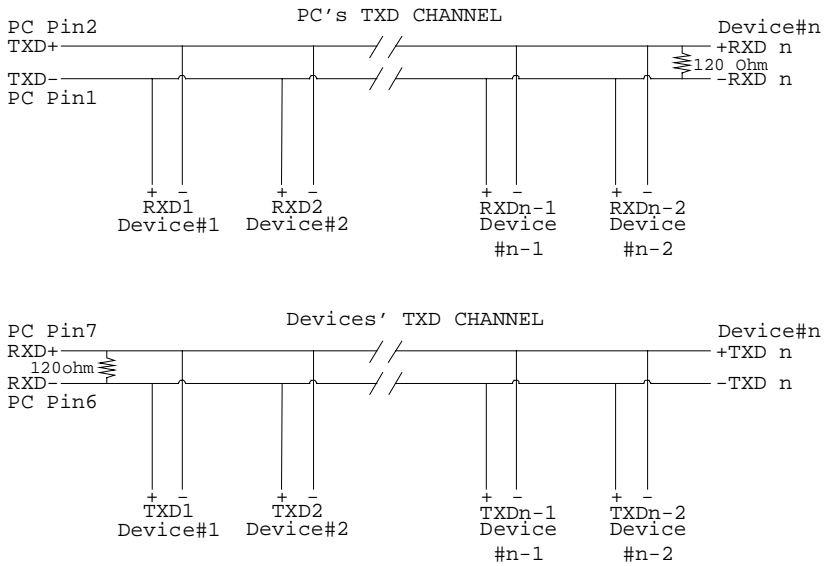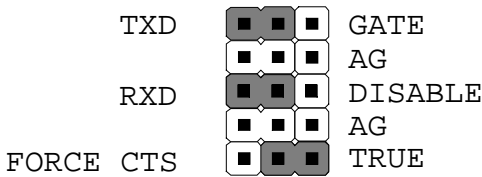**Note:** The receiver end of MAIN line terminated in characteristic impedance, stubs off the main not terminated.

Figure 2-16. RS485 Jumpers, Full Duplex.

```
RS485 GATING JUMPERS.

      TXD    ■ ■ ■   GATE        ALWAYS ABLE TO TRANSMIT
             ■ ■ ■   AG            ALWAYS ABLE TO LISTEN
      RXD    ■ ■ ■   DISABLE         CTS ALWAYS HELD TRUE
             ■ ■ ■   AG
FORCE CTS    ■ ■ ■   TRUE
```

```
RS485 MULTIPLEX JUMPERS.
NON MULTIPLEXED OPERATION
```

RXD 1- ▭ ■ ■ **TXD 1-**
RXD 1+ ▭ ■ ■ **TXD 1+**

RS485 Many Talkers- Many Listeners, Half Duplex.

Another popular RS485 layout is for multiple talkers and multiple listeners. This is shown in Figure 2-17, 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 2-18 for jumper settings.
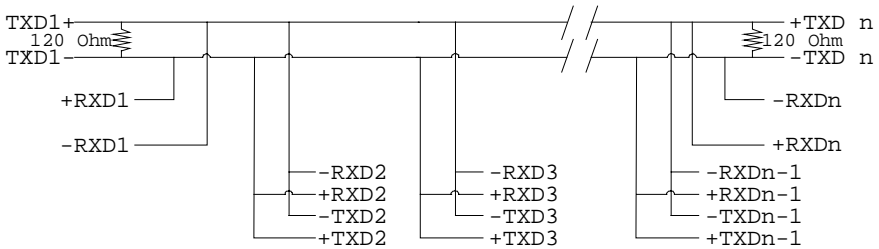
The Serial Solutions software is set up to this option with the following line in the CONFIG.SYS file.

   DEVICE=NEWCOM.SYS /H2,2

Where H2 means we are setting the Handshake for COM2, and 2 sets handshake type 2 i.e. the RS485 RTS enable handshake. See the Serial Solutions manual for more details.

Figure 2-17. 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.

Note: The twisted pair ends are wired to both RXD+ & TXD+ and RXD- & TXD- at each RS485 device!

Figure 2-18. RS485 Half Duplex Jumper Block.

RS485 GATING JUMPERS.

```
                              TXD ONLY ENABLED WHEN RTS  TRUE
                               RXD DISABLED WHEN RTS TRUE
                                          NOTE NO ECHO
                                 CTS ALWAYS HELD TRUE
```
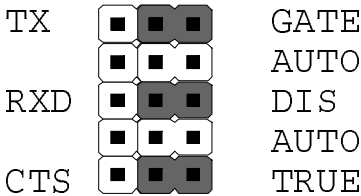


```
TX          GATE
            AUTO
RXD         DIS
            AUTO
CTS         TRUE    RS485 MULTIPLEX JUMPERS.
                    MULTIPLEXED OPERATION
```


RXD 1-   **TXD 1-**
RXD 1+   **TXD 1+**
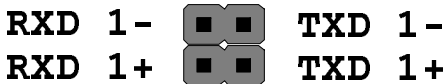
To program the RTS line true and false, if the base address of serial port 2 is BASE, and since RTS is bit1, decimal value 2 then:-

`OUT BASE+4,3+8 REM RTS True TXD Enabled`

```
OUT BASE+4,1+8 REM RTS False TXD Disabled
```
Note the 1+8 keep DTR and OUT2 true.

The Quad Cable Pinouts

The Quad cable consists of a 37 way female D connector attached to 4 9 way Male D connectors. Each of the cables carries 9 cores plus a sheath. Each of the 9 pin D connectors has 9 connections, based on the standard PC serial port configuration. Figure 2-18, on the next page shows the 37 way female connector pin numbers corresponding to each of the 4 separate port pin outs and pin functions. Each cable is approximately 1 metre long and is clearly marked as P1 for Port 1, P2 for Port 2 etc.

Figure 2-19. Pin outs of the AT Quad 4 Port RS422/485 38 pin D connector

PIN20 - RXD1-   PIN1 - TXD1-
PIN21 - RXD1+   PIN2 - TXD1+
PIN22 - CTS1-   PIN3 - RTS1-
PIN23 - CTS1+   PIN4 - RTS1+
PIN24 - TXD2-   PIN5 - GND1
PIN25 - TXD2+   PIN6 - RXD2-
PIN26 - RTS2-   PIN7 - RXD2+
PIN27 - RTS2+   PIN8 - CTS2-
PIN28 - GND2   PIN9 - CTS2+
PIN29 - RXD3-   PIN10 - TXD3-
PIN30 - RXD3+   PIN11 - TXD3+
PIN31 - CTS3-   PIN12 - RTS3-
PIN32 - CTS3+   PIN13 - RTS3-
PIN33 - TXD4-   PIN14 - GND3
PIN34 - TXD4+   PIN15 - RXD4-
PIN35 - RTS4-   PIN16 - RXD4+
PIN36 - RTS4+   PIN17 - CTS4-
PIN37 - GND4   PIN18 - CTS4+
          PIN19 - GROUND

NOTE: On the above diagram the number after the 3 letter code is used to notify a port on the cable. E.g. GND4 means ground on port 4, hence PIN 37 - GND4 is pin 37 of the 37way connector, which corresponds to the GND function on port 4.

Figure 2-20. Quad Cable by 9 and 25 pin D Connector

38 way D connector Pinouts					
Port #1	**Port #2**	**Port #3**	**Port #4**	**Pin Function**	**9 Pin**
1	24	10	33	Transmitted Data (TXD-)	1
2	25	11	34	Transmitted Data (TXD+)	2
3	26	12	35	Request to Send (RTS-)	3
4	27	13	36	Request to Send (RTS+)	4
5	28	14	37	Ground (GND)	5
20	6	29	15	Received Data (RXD-)	6
21	7	30	16	Received Data (RXD+)	7
22	8	31	17	Clear to Cend (CTS-)	8
23	9	32	18	Clear to Cend (CTS+)	9

NOTE: Pin 19 on the 37 pin D connector is the ground for the D connector shell

CHAPTER 3
INSTALLING THE PC SERIAL CARD IN THE COMPUTER.

Serial Card Installation.

Once the card has been correctly configured then it can be installed in the PC. It is best to make a note of the serial port I/O address selection and IRQ jumper settings for later use.

In general, the card should be configured, then installed and if your BIOS only detects 2 serial ports, run or add to the AUTOEXEC.BAT file, the ADDRCOM3/4 programs, see Chapter 4 - "**AT Quad 4 Port RS422 Software Configuration**".

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

Provided that the RS422 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..!!!

After having made sure that the I/O address and jumpers are correctly set, now is the time to insert the PC Serial card into the I/O connector slots in the computer.

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

# Figure 3-1. Remove Cover Mounting Screws.
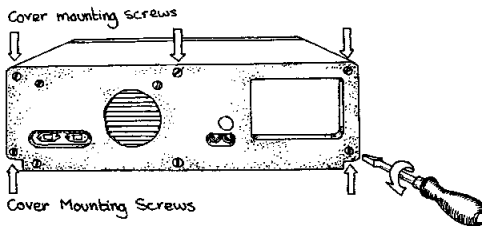
STEP 2: Then using a screw driver, remove the cover mounting screws on the back panel of the PC system unit.

Figure 3-2. Removing The PC Cover.
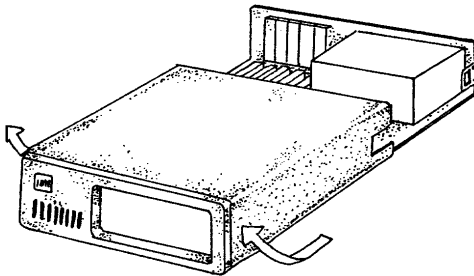
STEP 3: Next, remove the PC's cover by sliding it forward and up. It usually helps to disconnect the keyboard from the PC since it tends to get in the way when the case is removed.

Figure 3-3. Removing Blanking Cover
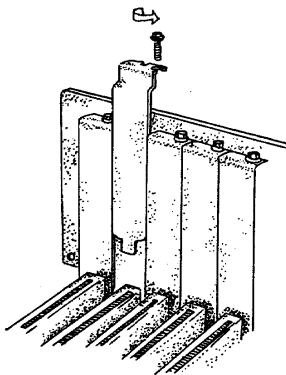
STEP 4: Choose an empty expansion slot. The PC Serial card will fit either a full length or a short slot, a 8 bit PC type slot or a 16 bit AT type slot. In general it is wise to leave the larger slots free for those boards that insist on greater room. Remove the blanking cover protecting the slot on the PC back panel. KEEP the blanking cover screw safely for later.

Figure 3-4. Inserting The PC Serial Card.
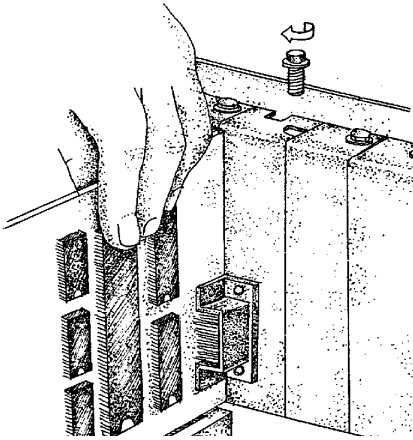
STEP 5: Now insert the PC Serial card in the slot. Be careful to ensure that the gold plated PCB fingers fits neatly into the I/O expansion connector. Press down firmly but evenly on the top of the PC Serial card.

STEP 6: The card's D connector 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. It is recommended that a careful inspection of the area surrounding the card is made to ensure that any potentially harmful bits of metal etc. are not present.

STEP 7: Now replace the system units cover by carefully sliding it down and back over the system unit. Replace the cover mounting screws.

STEP 8: After attaching all the monitor and keyboard 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!
iv.)   Ensure that the PC Serial I/O address is set correctly (Quad

Port1 default is COM2 02F8h, Port2 default is COM3 03E8h, Port3 default is COM4 02E8h and Port 4 default is 198h.)

● If all these have been checked and the PC still does not power up then there is probably a conflict of I/O address between the PC Serial card and another board in the PC. Ask your dealer to check this or contact the HELP line as given on Intro. page 2.
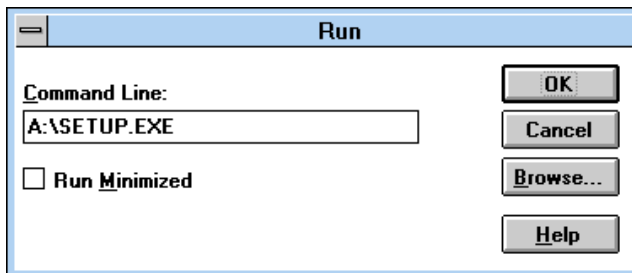
CHAPTER 4
SOFTWARE INSTALLATION

Introduction

This section describes installation procedures for Serial Solutions driver for Windows 3.x, Windows 95/98 and for Windows NT. The drivers are on the supplied CDRom

Serial Solutions Installation for Windows 3.x

To install the software from the supplied disk, insert the disk from Windows **Program Manager's** File menu choose "Run" and in the Command Line entry window type <drive:>\diskimg\sswin3x\setup.exe (CDROM) or
<drive:>\setup.exe (FLOPPY)
(where <drive:> is the path to installation disk).

```
┌─────────────────────────────────────────────────────┐
│ ─ │                       Run                         │
├─────────────────────────────────────────────────────┤
│                                             ┌───────┐ │
│ Command Line:                               │  OK   │ │
│ ┌─────────────────────────────────────┐    └───────┘ │
│ │ A:\SETUP.EXE                        │    ┌───────┐ │
│ └─────────────────────────────────────┘    │ Cancel│ │
│                                             └───────┘ │
│ ☐ Run Minimized                             ┌───────┐ │
│                                             │Browse...│ │
│                                             └───────┘ │
│                                             ┌───────┐ │
│                                             │ Help  │ │
│                                             └───────┘ │
└─────────────────────────────────────────────────────┘
```
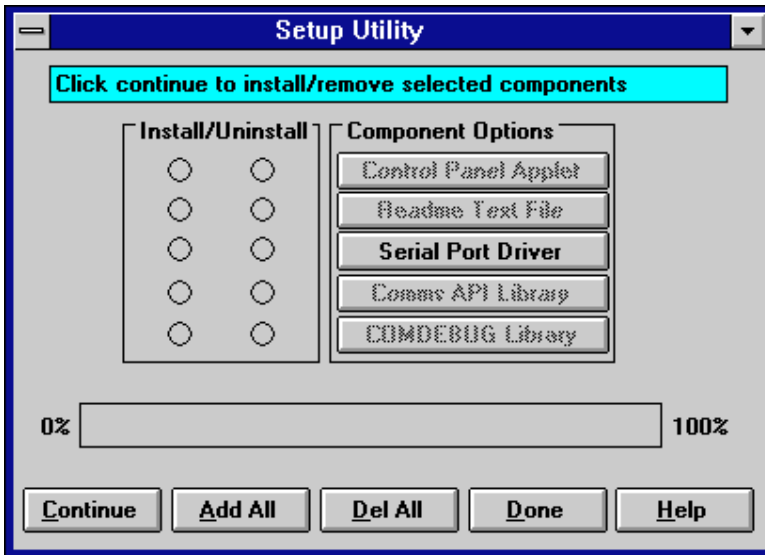
Selecting the "OK" button shows the setup program main screen, Figure 4-1, which will automatically select components for installation that have not already been installed. Selecting the "Del All" button will select all installed components for deletion and selecting "Add All" chooses all uninstalled components for installation. Several of the components have user selectable parameters, e.g. target install directory, which can be changed by clicking on the button. In order to install the correct driver for the AT Quad RS422/485 card, you sould click the button labelled "Serial Port Driver" and then select one of the "INT sharing Driver" options depending on how many other serial ports your system contains

Note: If it is necessary to re-install an OLDER version of a component then the NEWER version component must be FIRST removed by selecting the component's button in the "Uninstall" column then selecting the "Continue" button.

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

<u>Figure 4-1. Setup Program Main Display.</u>

Selecting the **Continue** button will start the installation process. When the setup program has finished select the **Done** button. A Windows restart message will be shown only if the Windows communications driver option has been selected, and you should choose **Yes** to allow the new driver to run.

TIP

When installing serial cards the parameter that usually causes the greatest trouble is finding an unused Interrupt Request line, a free IRQ.

If the system already has a COM2 port installed IRQ 3 will be allocated to that. In this case, and whenever IRQ 3 is being used by other devices, the Quad port RS422/485 card will not be able to be installed at it's default settings. However there should be no need to change the Bank address as set in the DIP switch just change the IRQ jumper setting to an unused IRQ e.g. 5, 10 or 11. Which IRQ is free depends on what other devices you have installed in your PC.

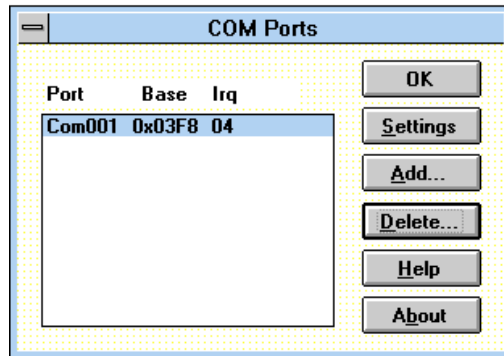## <u>Serial Port Installation</u>

If your PC has only one COM port (COM1), and you are installing a Quad RS422/485 card, click on **Control Panel** from the **Main** Window:
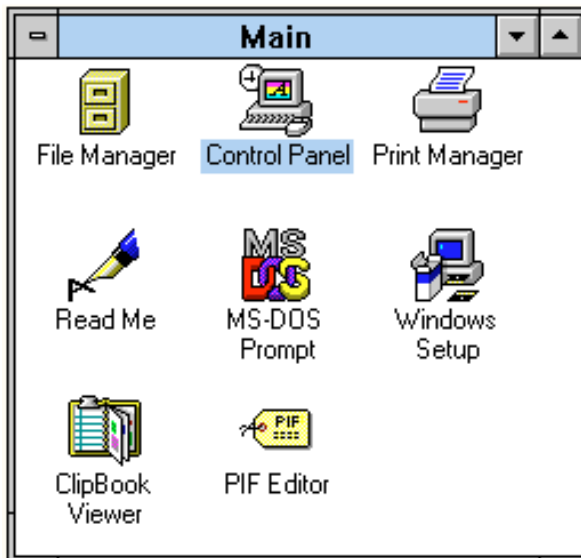
Then click on **Serial Ports**:
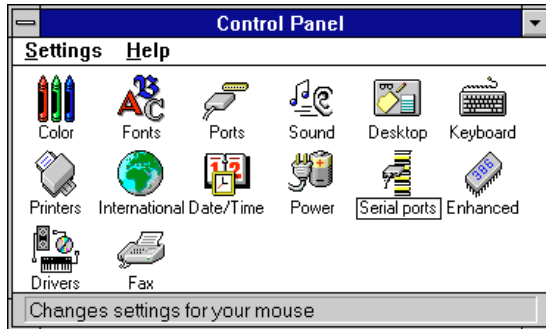
The following dialogue should then appear:

ISA Quad port RS422/485 in Win 3.x Overview

The two configurable options on the Quad port RS422/485 card are the Bank address DIP switch and the IRQ jumper block. The IRQ must match that set on the Quad port RS422/485 card. The bank address DIP switch determines the COM Base address of each port and also the SISR Base address of the card.
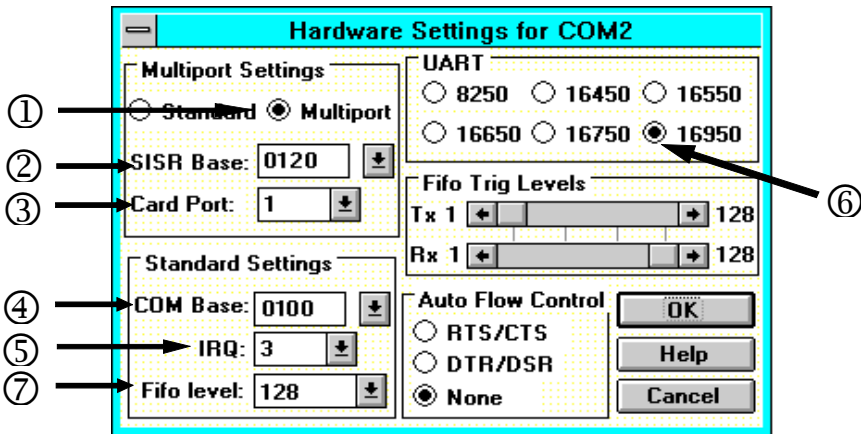
COM Base of port 1 = the Bank Address
COM Base of port 2 = the Bank Address + 8hex
COM Base of port 3 = the Bank Address + 10hex
COM Base of port 4 = the Bank Address + 18hex
SISR Base   = the Bank Address + 20hex

Adding an ISA Quad port RS422/485 Serial Card.

For each port on the Quad port RS422/485 card we need to **ADD** a port and fill in the following 7 settings in the order given.

Multiport Settings:-

①Each Port should have the **Multiport** button selected, this tells Windows 3.x that the port is one of several ports using a SISR (shared interrupt status register).

② The **SISR Base** address needs setting to a value 20hex greater than the bank address set on the DIP switch on the Quad port RS422/485 card.

③The **Card Port** setting tells Windows whether this is the first, second, third or fourth port of the Quad port RS422/485 card.

Standard Settings:-

④ The **COM Base** address is the I/O address of each serial card.

⑤ The **IRQ** as set on the Quad port RS422/485 jumper block should be set according to the advice in the tip above (p56).

⑥ The **UART** on the port is a 16550.

⑦ Having selected the 16550 you can then set the **FIFO level** at 16 bytes.

Default Settings for Quad port RS422/485 Card COM1 Present

COM Port	SISR	Card Port	COM Base	IRQ	UART	FIFO Trip
COM2	120	1	100	03	16550	Default
COM3	120	2	108	03	16550	Default
COM4	120	3	110	03	16550	Default
COM5	120	4	118	03	16550	Default

NOTE: Set Quad port RS422/485 Hardware to reflect these settings

The only settings that change from port to port are the COM Base and the Card Port Settings

Settings for Quad port RS422/485 Card COM1 & 2 Present

| COM Port	SISR	Card Port	COM Base	IRQ	UART	FIFO Trip
COM3	120	1	100	5*	16550	Default
COM4	120	2	108	5*	16550	Default
COM5	120	3	110	5*	16550	Default
COM6	120	4	118	5*	16550	Default

*As COM2 is already set to IRQ 3 you will need to set the IRQ to 5, 10 or 11 dependent on what interrupts are free because of other installed devices. IRQ 5 is used in these examples

NOTE: Set Quad port RS422/485 Hardware to reflect these settings

The only settings that change from port to port are the COM Base and the Card Port Settings

Alternate Settings for Quad port RS422/485 Card COM1 - 4 Present

COM Port	SISR	Card Port	COM Base	IRQ	UART	FIFO Trip
COM5	320	1	300	11*	16550	Default
COM6	320	2	308	11*	16550	Default
COM7	320	3	310	11*	16550	Default
COM8	320	4	318	11*	16550	Default

*you will need to set the IRQ to 5, 10 or 11 dependent on what interrupts are free, because of other installed devices. IRQ 11 is used in these examples.

 NOTE: Set Quad port RS422/485 Hardware to reflect these settings
The only settings that change from port to port are the COM Base and the Card Port Settings

Select the **OK** button to finish adding the port. This will display a Windows restart message, but do not restart until you have installed all four ports. Be sure to restart Windows after all serial ports have been added so that the new configuration takes effect.

Figure 4-3. After Adding a QUAD PORT RS422/485 Card (COM1 present).
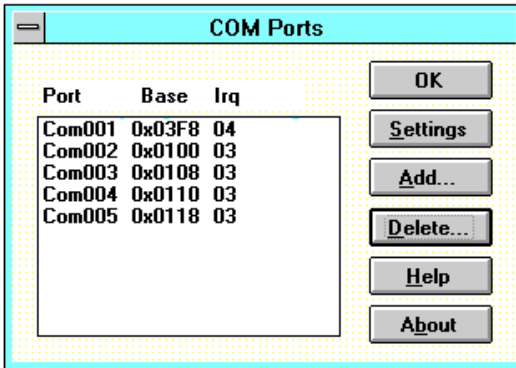
Note: Adding a port automatically sets default values for the communications settings to 9600 baud, no parity, 8 data bits and 1 stop bit. These values can be changed as described below.

Figure 4-4. ISA Quad port RS422/485 Card Comms Settings.
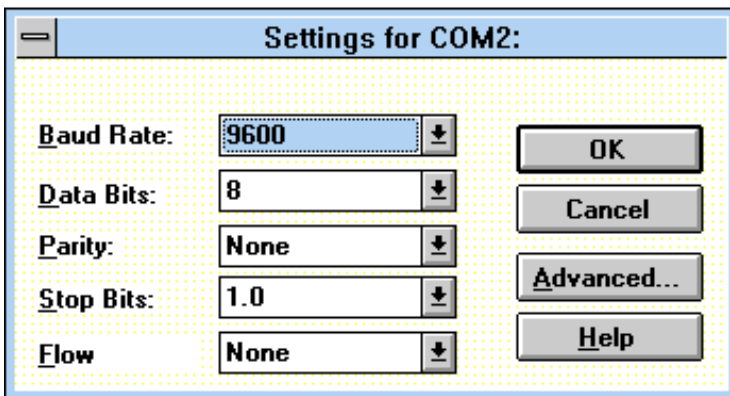
Changing Serial Port Settings

Once the Quad port RS422/485 card has been installed it may be necessary to change the communications settings in the COM Ports to match the baud rate, parity settings etc. of the remote serial device.

● Highlight the serial port required, e.g. COM2., in Serial Ports, Control Panel

● Click on the **Settings** button to change the communications settings, Figure 4-3.

● Select the appropriate communications settings, which must match the communications settings on the remote device.

● Click on the **OK** button to leave the communications **Settings** window.

The **Advanced** option in **Settings** can be used to change the hardware settings to match a new base address and IRQ physically set on the Quad port RS422/485 serial port cards if it becomes necessary to reconfigure the card due to the installation of other new hardware.

● Click on the **Advanced** button for the hardware settings window, Figure 4-4. Enter the 7 options in the same manner as described in the section "Adding an ISA Quad port RS422/485 Serial Card"

Deleting Ports in Windows.

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

Note. Due to problems with the standard Windows Serial Ports Applet in the Control Panel **Make sure** that there are no gaps in the numbering of the first four serial ports, COM 1-4. If necessary leave a "place holder" otherwise Windows may automatically reorder the COM port numbers resulting in serious problems.

Restarting Windows.

Whenever certain values have been changed in the **Advanced** window, a message prompting the user to restart Windows will appear. Once ALL necessary changes have been made Windows should be restarted so that the new settings may come into effect.

Serial Solutions Installation for Windows 95 & 98.

The following steps describe the installation of the Serial Solutions driver for Windows 95, which is supplied, on the CDROM provided. The listed installation procedure assumes that only 1 COM port (COM1) is present.

Open the **Control Panel** - there are several routes to the **Control Panel**, the simplest is to open the **Start** menu and select **Settings**.
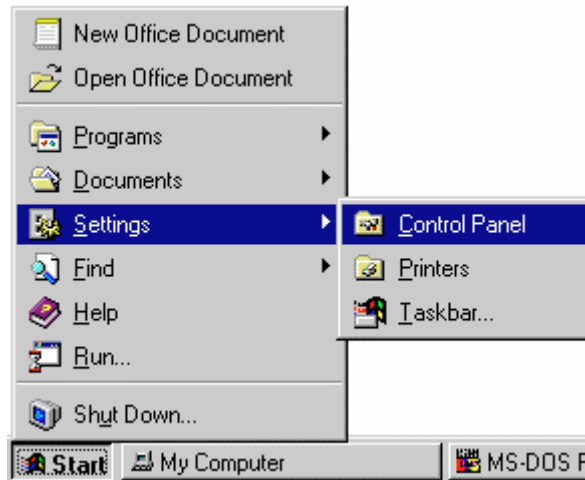

Double click the **Add New Hardware** icon in the control panel.
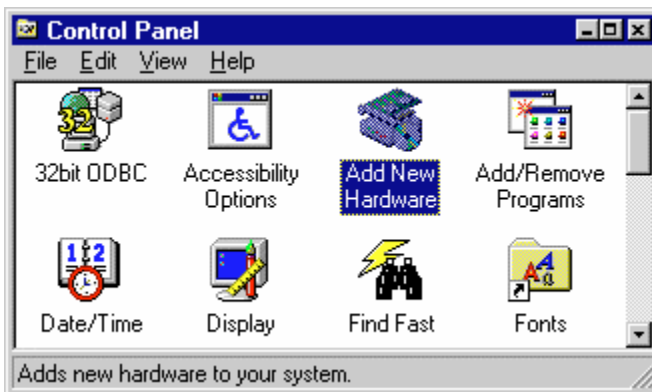
Click **next** on the applet dialogue.

The **Add New Hardware** wizard will ask you if you wish Windows to search for your hardware. Click the **No** radio button since Windows cannot find Multiport Serial Solutions serial ports and it will save some time. Click **next**

AT QUAD 4 PORT RS422/485   **Software Configuration**

From the hardware types list on the next page select **Multi Function-Adapter**. Click **next**.
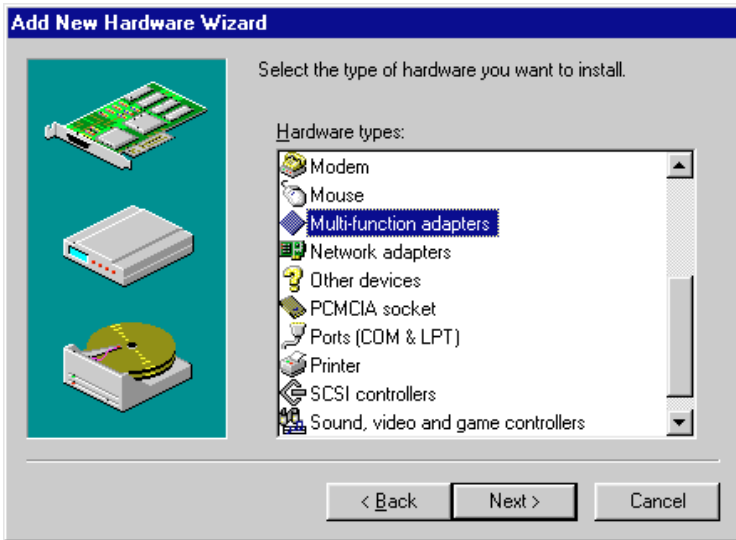

click **Have Disk**.
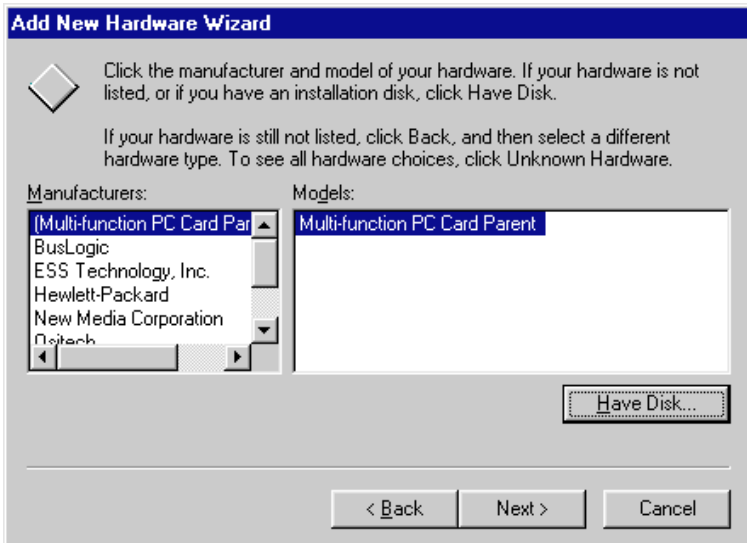
Windows will then ask you for the location of the Serial Solutions files you will see the following:

If you are installing from the Serial Solutions CDROM the path is
<drive:>\diskimg\sswin9x\

(where <drive:> is the letter of your CDROM.)

After the installation procedure, the Window will display a list of all supported cards. For the Quad Velocity RS422/485 card, you should select the option titled "ISA 4-Port Velocity RS485 Card"

Select the **ISA 4-Port Velocity RS485 Card**
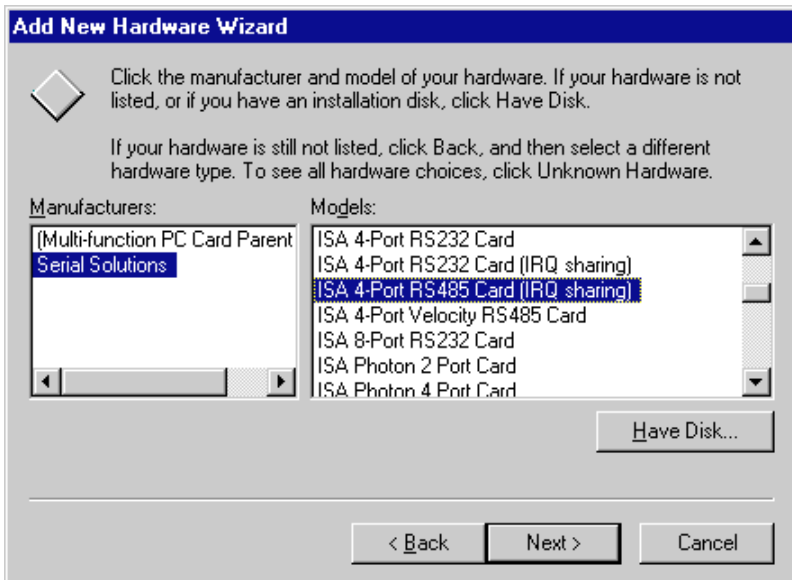
Click **Next.**

Windows 95 will then inform you of the settings it has assumed for the new ports.
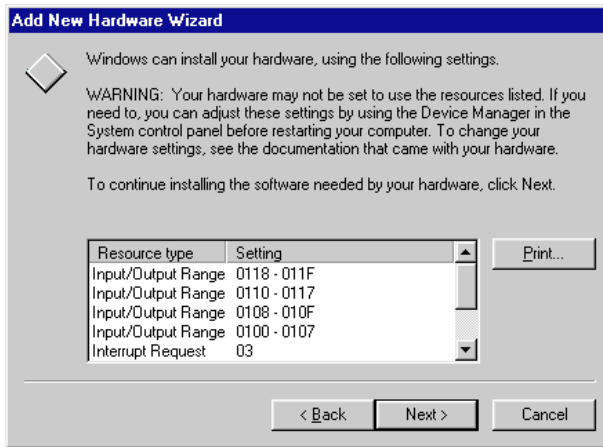

Click **next.**

Click **finish**.

You will then be asked if you wish to re-boot the system. Since the Quad port RS422/485 card will now need to be installed, select yes. Turn the PC off and insert the Quad port RS422/485 card . Restart the computer and allow Windows 95 to load normally. Upon loading it will then "detect" each of the ports on the Quad port RS422/485 card individually and install them, in a similar manner to that of a Plug and Play card.

However, if you choose not to restart your PC Windows 95 will still "detect" each of the ports on the Quad port RS422/485 card as described above, despite the card not being installed - this is due to the nature of the driver software.

Quad port RS422/485 Card Settings in Win 95 & 98.

Upon installation of the Quad port RS422/485 card and Windows being restarted, the **Device Manager** will appear similar to the following:
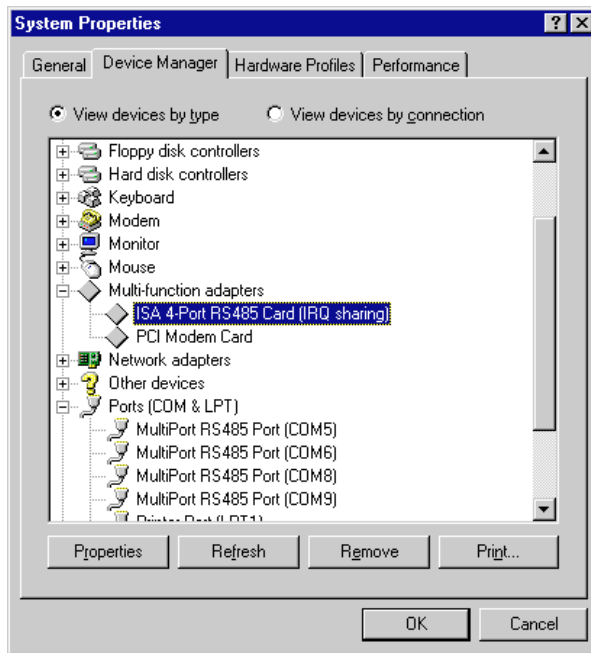
If you have changed the physical settings on the card (i.e. moved the DIP switches or changed the interrupt jumper, it is now necessary to change the settings of the parent device (the Quad port RS422/485 Card), to match those physically set on the card, double click the Quadport RS422/485 card entry under the **Multi-Function adapter** branch, and select the Serial Solutions Tab:

AT QUAD 4 PORT RS422/485   Software Configuration

For each port on the Quad port RS422/485 card we need to and fill in the following 4 settings shown below
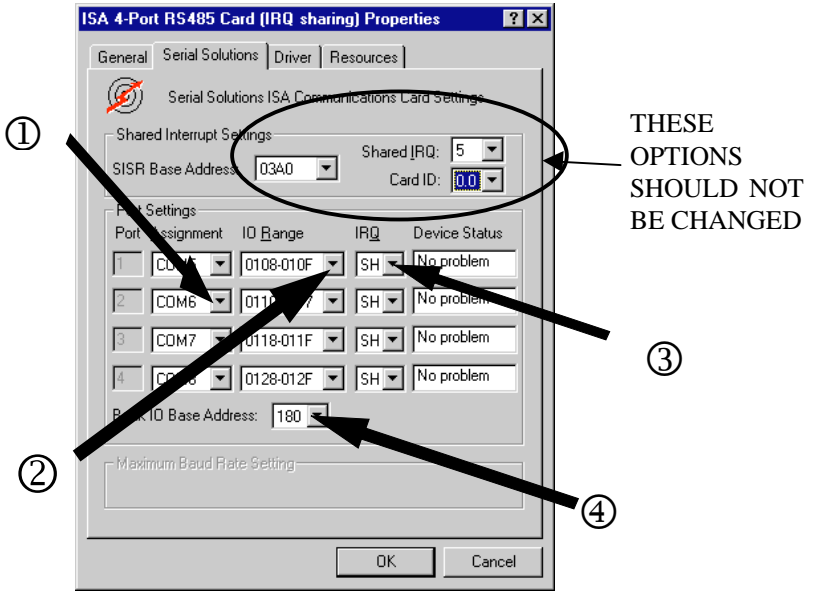
The adjustable options available in this window are:

① The **COM Port** assignment determines the names by which the Quad port RS422/485 Ports are known to the system. Windows 95 supports up to 255 COM ports known as COM1 to COM255. The ports can be numbered in any order without affecting the operation of the driver.

② **IO Range: WITH QUAD PORT RS422/485 CARDS THIS MUST ALWAYS BE SET TO BANKED**

③ **IRQ.** All four ports should be set to the same IRQ as that set physically on the card's IRQ Jumper Block.

④ **Bank I/O Base Address:** this is the address which is set physically by the Bank DIP switch. **THIS MUST BE SET TO 100**

ISA Quad port Card Port Settings In Win 95/98.

Double clicking upon an individual port entry in the **Device Manager,** and selecting the **Port Settings** tab will display:
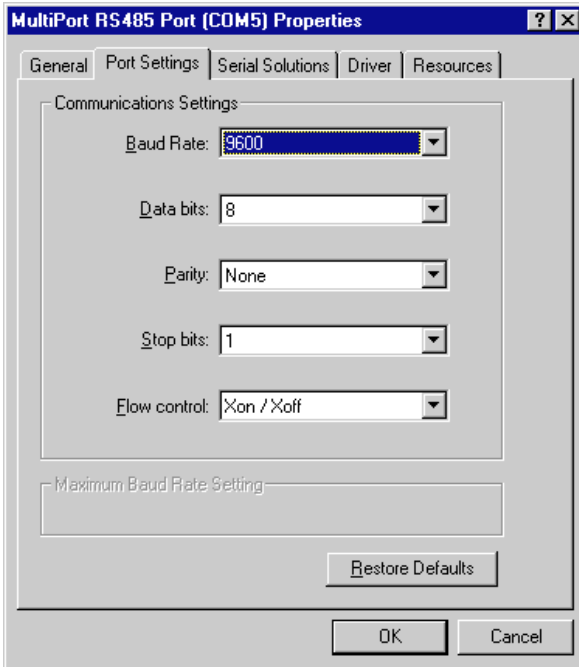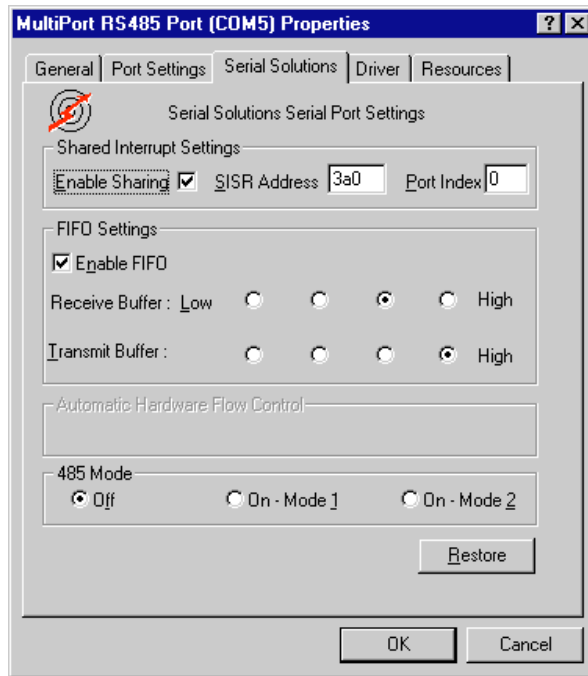

Settings available in this window are:

1. **Baud Rate.**
2. **Data Bits**.
3. **Parity**.   Change to suit remote device.
4. **Stop Bits**.
5. **Flow Control**.
6. **Restore Defaults** - When clicked, this will reset the selected port to the default values of:

Baud Rate:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow Control:	Xon / Xoff

Selecting the **Serial Solutions** tab of the selected port properties Window 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 all ports is left enabled.

- **Extend FIFO** – When the FIFO is enabled the default FIFO size is 16 Bytes. The extended FIFO size is 128 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. **Restore-**

   Clicking on this port will restore the port setting of the Serial Solutions tab to the values set on entry to this page.

.

ISA Quad port RS422/485 in Win NT4 Overview

The ISA Quad port RS422/485 card requires the use of one interrupt (IRQ) and 22hex = 34dec contiguous I/O locations i.e. a BANK of 22hex I/O addresses. The two configurable options on the Quad port RS422/485 card are the Bank address DIP switch and the IRQ jumper block. The Bank address DIP switch determines the COM Base address of each port and also the SISR Base address of the card.

> COM Base of port 1 = the Bank Address
> COM Base of port 2 = the Bank Address + 8hex
> COM Base of port 3 = the Bank Address + 10hex
> COM Base of port 4 = the Bank Address + 18hex
> SISR Base   = the Bank Address + 20hex

Serial Solutions Installation for Windows NT4

The suggested installation sequence is:

1.   Check Windows NT's I/O usage, to determine which IRQs and I/O addresses are already in use on your PC and thus which are available.
2.   Choose an unused IRQ and select an I/O address range.
3.   Configure the Quad port RS422/485 Card to match these settings, noting down the settings of the IRQ jumper and DIP switches, switch the PC off and Install the card into the PC, then switch the PC back on.
4.   a. If this is the first time that you have installed the card then you will need to install the software from the CD
        b. If you already have other card and drivers installed then you will need to run the **ADD** option from the Serial Solutions icon in the **Control Panel**.
5.   Enter the IRQ and Bank address as set on the Quad port RS422/485 card into the card setting window when prompted.
Note To install this software or change serial port settings under Windows NT 4 you must be logged in as a user with

> **Administrator** level privileges, consult your NT
> documentation to see how this can be set.

Checking Windows NT 4 I/O Usage

The simplest way to find out which I/O addresses and IRQ's are available for the serial card is to examine those that Windows NT believes are free. This is done using **Windows NT Diagnostics.** From the **Start Menu** choose **Programs**, **Administrative Tools (Common)** and **Windows NT Diagnostics**. Click the **Resources** tab, and if the **IRQ** button is not selected, select it.
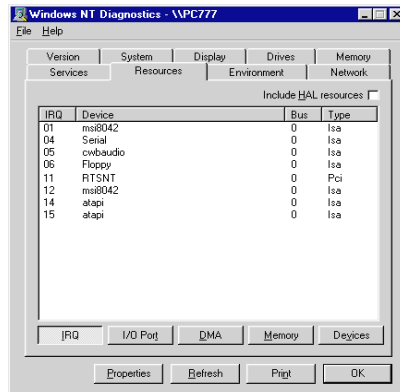
In the list shown IRQ 1, 4, 5, 6, 11, 12, 14 & 15 are used leaving IRQ 3, 7, 9, &10 free. Any interrupt not shown on the list can be used, make a note of a free IRQ and set the card to use it. Also click the **I/O Port** tab and make a note of a free address space for the card. This card requires 22hex/32dec consecutive bytes of I/O space. Select **OK** to clear this dialogue.

TIP

When installing serial cards the parameter that usually causes the greatest trouble is finding an unused Interrupt Request line, a free IRQ.   If the system already has a COM2 port installed IRQ 3 will be allocated to that. In this case, and whenever IRQ 3 is being used by other devices, the card will not be able to be installed at it's default settings however there should be no need to change the Bank address DIP switch just the IRQ jumper setting .

Configuring and Installing the Serial Card

Having chosen a free IRQ and I/O address range, physically set the IRQ jumper and the Bank DIP switches on the card as shown in **Chapter 1.**

Note down the IRQ and Bank addresses for use later when entering the Quad port RS422/485 card settings when configuring the driver.

Install the serial interface card in an available slot.

Installing the Serial Solutions Software

To install the software place the Serial Solutions CD-ROM into a suitable drive, from Start Menu choose "Run" and in the resulting window type:

<drive:>\drivers\speed\winnt\setup.exe (where <drive:> is the path to the drive containing the installation disk).

Selecting the "OK" button begins the conventional InstallShield setup process, there are no options for this installation, all items must be installed in the NT System32 directory. Once the software has been installed, you may run the **Serial Solution** applet by double clicking on it's icon from the **Control Panel**.

If installing from the Serial Solutions CDROM
Insert your CDROM into your CD Drive.
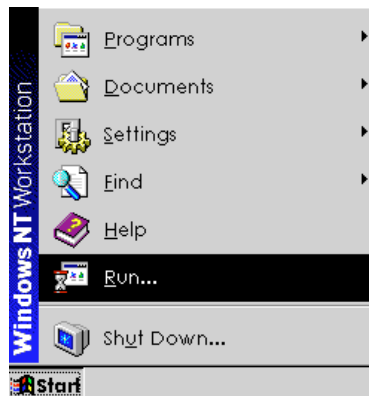
Click **Start** => **Run**
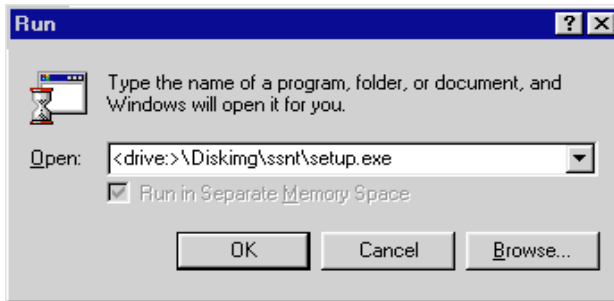
<drive:> = the letter assigned to your CDROM drive
click on OK. The driver software will then be installed
If you are installing from Floppy Disk then the path for installation
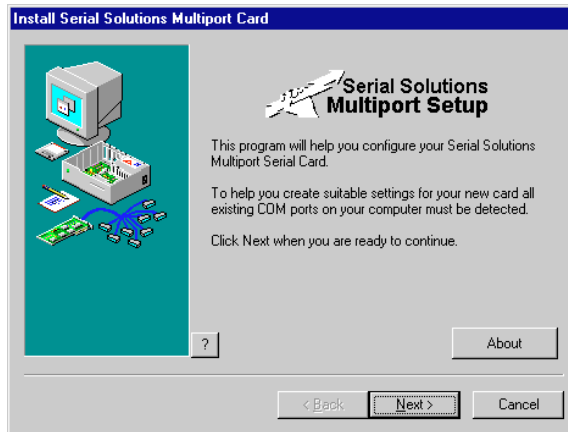will be <drive:>\setup.exe

Adding the RS422/485 Card to Windows NT4
All that remains is that the Quad port RS422/485 card is added to
NT4 using the installed Serial Solutions Control Panel Applet.

**AT QUAD 4 PORT RS422/485   Software Configuration**
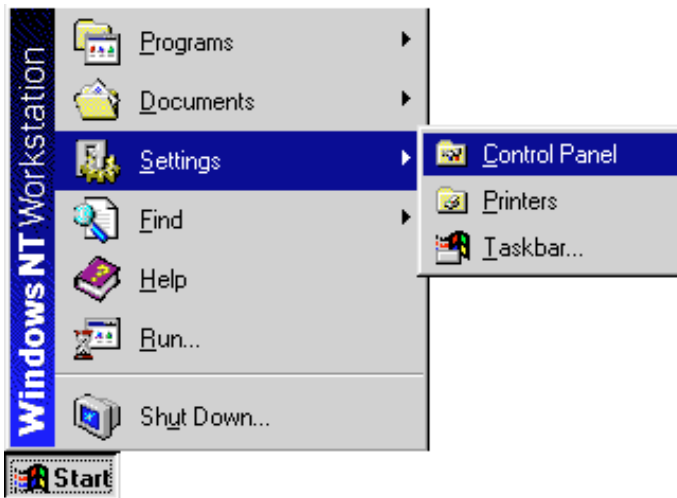
Click the start button, select **Settings** and then **Control Panel**
This will launch the Serial Solutions Setup Wizard for Windows NT.

This introductory screen will warn you if you are running the program without administrator permissions (you are not allowed to continue if this is the case since you cannot alter settings). If all is well it will appear as above. When you are ready to continue click **Next**. Note that at any stage in the use of this wizard clicking the Cancel button will terminate setup without any changes having been made. Only when a **Finish** button is pressed will settings be committed.
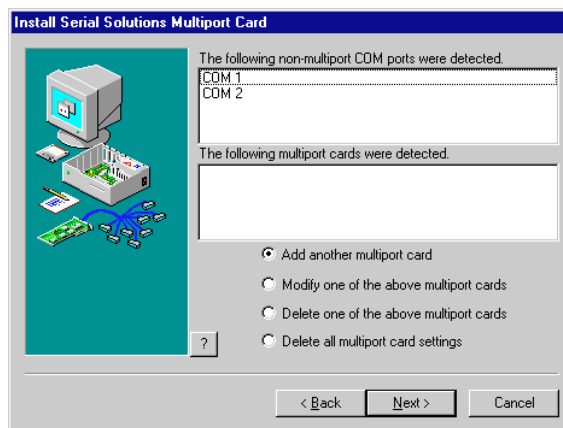
You will now be shown a list of serial ports that were installed on your computer when NT was started. If you have since installed a serial port without restarting, or you have installed a serial port that is not functioning correctly, it might not be shown on this list, be aware of this in these situations.

There are now four options for continuing:

> The default is to add another card, to do this ensure that the **Add another multiport card** radio button is selected then click **Next**.

If you have previously installed a Serial Solutions multiport card you will see entries in the lower list. You can then :

> **Modify one of the above multiport cards**, select the card you want to change and the appropriate radio button and click **Next**.
> **Delete one of the above multiport cards**, select the card you want to delete and the appropriate radio button and click **Next**.
> **Delete all multiport card settings**, this will remove entries for all cards in the list.

Add Another Multiport Card

The first step when adding another multiport card is to specify the number of ports that the card has and an optional identification name that you give to the card.
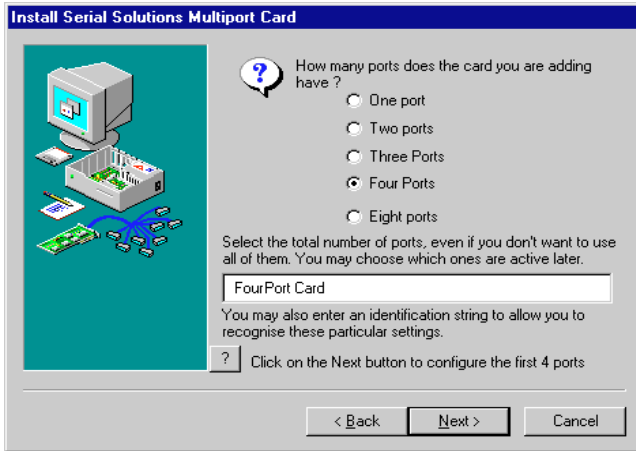
You set the number of ports on your card using the appropriate radio button. This must be the total number of ports on your card, even if you do not want to use all of them (individual ports can be disabled later). An optional name can be entered for the card, this allows it to be identified when a number of multiport cards have been installed. In the above example a four port card (the default), which has been called "Four Port Card". Once these entries are present click Next to continue configuring your card.
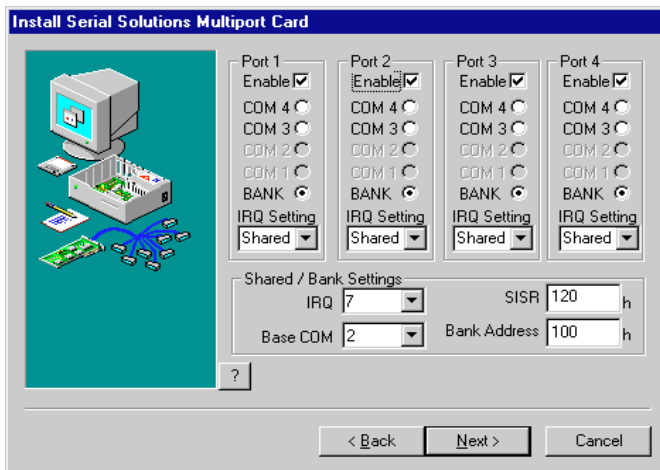
You are now ready to begin configuring ports. This dialogue is in two separate sections, the four boxes along the top are to allow you to configure individual ports. The box in the lower part of the dialogue is for settings shared amongst the ports. These settings follow closely those which may be set on the card itself (these settings must match of course).

<u>Configuring Ports</u>
The values for each port are as below:
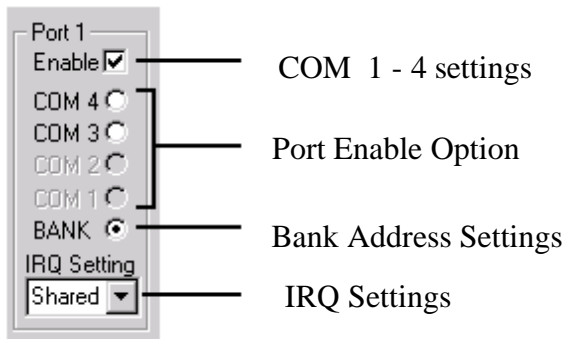
Port enable option - This allows a port to be omitted from this setup, clearing this tick box ensures that this program will generate no settings for this port. This port can be left deactivated or can be setup using a separate port setup program.

COM 1 to COM 4 settings - Under Windows NT any COM port can use one of the standard COM port addresses (from 1 to 4), this part of the dialogue allows you to assign one of these addresses to a port. (In the examples shown above a port is already using the COM 1 address and so this may not be selected). How a port is given a COM number depends on what other COM ports exist on the machine. In an example where port 2 on the card is set to use COM 3 with the appropriate radio button then :

   If a COM 3 exists (using some other address, since the
   default COM 3 address is free), setting a port to use
   COM 3 will use the COM 3 address but its COM port
   number will be generated from the Base COM port
   value (see below). If for example Base COM is 18 then
   this port will be COM 19.

   If no COM 3 exists, a standard COM 3 will be created,
   using the COM 3 address and called COM 3.

Both of these situations are independent of the IRQ setting.

Bank Address setting - The alternative to giving a port a standard
   address (one of the COM 1 to COM 4 values) is to give it an
   address based on the bank address (see below). If the BANK
   radio button is set this port will be given an address based on
   the bank address. For example if all ports are banked (and the
   bank address 100 is being used) port 1 is given the address 100,
   port 2 108, port 3 110 and so forth.

IRQ setting - This is the IRQ value that a port will use, each port
   can use its own individual interrupt value or the shared interrupt
   value (see below). Only the interrupt values which can be set on
   the card are available on this list for obvious reasons.

Shared Settings

There are four shared settings, if all ports are set to use one of the
default COM port addresses and their own interrupt (which is not
possible on an eight port card) then these settings do not matter.
However to use shared interrupt settings these settings are
important.

IRQ - This is the shared interrupt request value, any port whose
   IRQ has been set to Shared will use this interrupt value. Again
   only those interrupts which may be selected on the card are
   available on this list.

Base COM - This is the COM port number of the first active port
   on the card. Settings will be generated for the first enabled port

to use this value and the second enabled port to use this value plus one and so on. If port 2 is disabled (or using a default COM port number, as above) then ports 1 and 3 will be given consecutive COM port numbers.

SISR - This is the Shared Interrupt Status Register, this is a register which handles shared interrupt events, a valid address must be given. Suitable settings for the SISR are listed elsewhere in this manual.

Bank Address Ports - Ports that are not using one of the default COM 1 to 4 addresses are given an address based on the bank address. The first active port is given the bank address and the next is given the bank address plus 8 and so on.

Completing Card Setup

Having entered all settings for your card you will be shown a summary of the settings you have entered on a port by port basis.

These values have not yet been created, to enter them into the registry click **Finish**. If you want to change any of these settings click the **Back** button. You may print a copy of this report to the default Windows printer using the **Print** button.

The example shown above is a card installed using the defaults on a machine with an existing COM 1.
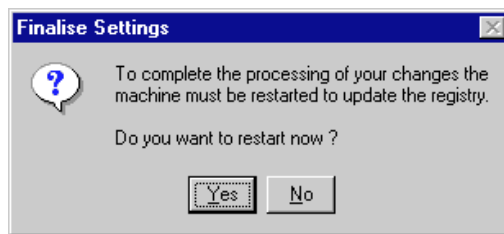
Having clicked **Finish** you will be asked if you want to restart the computer to create these ports. Before you can use the ports you must restart the computer, to do this click **Yes**. If however you want to add more ports before restarting then click **No** and restart the wizard.

CHAPTER 5
DOS SOFTWARE CONFIGURATION

Introduction

This section contains the quick start software installation procedures for Serial Solutions for DOS, Windows 3.x, Windows 95 and Windows NT(the Serial Solutions installation is discussed in greater detail in the Serial Solutions Manuals, which come bundled with the Quad/Quad card.) Also included are the software setup for OS/2 version 2.x, OS/2 Warp and SCO Unix / Xenix.

In each section, the worked example IRQ selections have been changed for indication only. You should change to these settings ONLY if you PC configuration allows this, refer to previous chapters for details on changing these settings. The setup procedures in this chapter also assume that your PC has only one serial port present. For more information on configuring the AT Quad 4 Port RS422/485 refer to Chapter 2 - "**AT Quad 4 Port RS422Hardware Installation Guide**". If you have changed the default settings of the cards in any way, then substitute the appropriate values in the relevant sections.

Informing The PC Of The Port Address.

The BIOS of most new PC's automatically detects whether serial ports COM1 - COM4 addresses are present in a machine. Other, older PC's are capable of detecting serial ports COM1 - COM2, but the problem comes with serial ports COM3 and COM4. PC's have a table of information that stores the setup of the PC, this is the BIOS data area. It has space for 4 serial port addresses. The trick, for the older PC's, is to get the right addresses into the third and fourth port areas. However, PC's are not capable of recognising ports above COM4 - specific device drivers are responsible for this.

AT QUAD 4 PORT RS422/485 **Dos Setup**

On the utility disk included with your card there are several programs for setting the COM3 and COM4 addresses. To set COM3 address from the DOS command line enter:-

ADDRCOM3 03E8 <return>

To set COM4 address from the DOS command line enter:-

ADDRCOM4 02E8 <return>

To set the COM port address from within the AUTOEXEC.BAT file use a text editor to add the following lines to the file:-

ADDRCOM3 03E8
ADDRCOM4 02E8

DOS 4, 5 and DOS 6 have features allowing access to COM3 and COM4. DOS 2 and DOS 3 only allowed access to COM1 and COM2, though some manufacturers their own DOS versions, e.g. COMPAQ, had enhanced MODE commands etc. to set up and use the extra ports. Please see Chapter 4, Serial Utility Disk for more details.

If you are uncertain how many serial and parallel ports are in the machine, it is wise to run the ADDRCOM3 program BEFORE installing a Quad 4 Port RS422/485 series card type :-

ADDRCOM3 <return>**.**

The PC responds with something like:-

COM1: 03F8
COM2: 02F8
COM3: <not set>
COM4: <not set>

LPT1: 03BC
LPT2: <not set>
LPT3: <not set>

Provided that the RS422 installation is attacked in this orderly manner, every thing 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.

Settings for DOS Software.

Most users will require that the IRQ is set to correspond to the interrupt used by their serial communications software. **Note**, that a serial port that is USING interrupts must not share the same IRQ line as another serial port that is USING interrupts AT THE SAME TIME, otherwise some interrupts will be missed. IE no two ports may use the same IRQ line simultaneously.

Some serial communications software, especially older versions, assume that COM1 and COM3 both use IRQ4 and that COM2 and COM4 both use IRQ3. Other older packages assume that COM1 is on IRQ4 and that COM2, COM3 and COM4 all use IRQ3. Both kinds of older packages will therefore not allow simultaneous interrupt driven I/O on all four ports. It may be necessary to upgrade your serial communications software.

Newer, more up to date, serial communications programs are configurable. They allow the user to specify the I/O address and the interrupt used by the serial port. Procomm and many other packages are configurable in this way.

Serial Solution Configuration For Quad Cards.

The Serial Solution software has been especially written to extract the highest performance out of the Quad 4 Port RS422/485 card. The NewCOM.SYS device driver, the heart of Serial Solutions, needs however to be told that it is using the Quad card and how the card is configured. The following is the CONFIG.SYS file entry that boots NewCOM.SYS ready to use the Quad card in its default factory configuration. This assumes that the PC has one port, COM1, already installed. **N.B.** This software may not work correctly or work at all in Windows NT or Windows 95.

Figure 5-1 Quad 4 Card With NewCOM.SYS.

DEVICE=NEWCOM.SYS /A2,0100 /A3,0108 /A4,0110 /A5,0118
/L 0120,3,2,3,4,5 /B 5 /S 512 /H,4
PC already has COM1 installed on IRQ 4
Quad card set as COM2 to COM5
All interrupts set to Shared
Shared Interrupt set to IRQ 3

The following shows a typical entry for NEWCOM in the
CONFIG.SYS file when the PC already has two serial ports
installed as COM1 and COM2. Remember to change the PORT 1-
3 and SHARED IRQ jumpers to suit.

Figure 5-2 Qaud 4 as COM3-COM6

DEVICE=NEWCOM.SYS /A3,0100 /A4,0108 /A5,0110 /A6,0118
/L 0120,10,3,4,5,6 /B 6 /S 512 /H,4

- PC already has COM1 installed on IRQ 4
- PC already has COM2 installed on IRQ 3
- Quad card set as COM3 to COM6
- All interrupts set to Shared
- Shared Interrupt set to IRQ 5

The following is the CONFIG.SYS file entry that boots
NewCOM.SYS ready to use the Quad port card with Digiboard
PC/4. This assumes that the PC has one port, COM1:, already
installed.

On power up the PC will display the following messages:-
Serial Solutions serial port Device Driver V2.5 6th Jan 1993
Copyright (c) 1990 - 1993
Set address COM3 to 0100h

Set address COM4 to 0108h
Set address COM5 to 0110h
Set address COM6 to 0118h
Setup Quad 8 Port card, status register at 03A0h with interrupt line 7
COM3 is card's port 1
COM4 is card's port 2
COM5 is card's port 3
COM6 is card's port 4
Setting number of Buffers to 10
Setting buffer size in bytes to 512

Figures 5-1 and 5-2 above contains several new command line switches for NewCOM.SYS that are not documented in the earlier Serial Solutions manuals. In all there are four new command line options, these are given in full later. A brief explanation is given now.

The /A switch is used to set the address of the chip used for a particular COM: port. Thus:-
/A3,0100 specifies COM3 has an I/O address of 0100
/A4,0108 specifies COM4 has an I/O address of 0108
/A5,0110 specifies COM5 has an I/O address of 0110
/A6,0119 specifies COM6 has an I/O address of 0118

This is the default setting for the Quad cards port 1-4.

The /L switch is used to specify a multiport card with interrupt sharing is in use.
The parameters specify the SISR address, the interrupt line, and how the Quad ports are assigned as COM: ports. Thus:-
/L 120,3,2,3,4,5,6,7,8,9
Specifies that the Shared Interrupt Status Register, SISR, is at I/O address 0120 hex, that interrupt 3 is the shared interrupt line, and that:-
Quad port#1 is mapped as COM2

Quad port#2 is mapped as COM3
Quad port#3 is mapped as COM4
Quad port#4 is mapped as COM5
Quad port#5 is mapped as COM6

The /B switch, /B 9, works as before and sets the number of buffers to 9. The 9 buffers are 1 for the (built in) COM1: port and one each for the 8 ports on the Quad card.

The /S switch, /S 512, also works as before and sets the buffer size for the 9 buffers specified. This is a 512 byte input buffer and a 512 byte output buffer. When many ports are simultaneously in use in a PC then the larger the buffer the better especially at high baud rates. This allows more time for processing the data before any port's buffer becomes full.

I/O Address.

Switch: /A n,add
Switch: /A n-m,add NEW
Switch: /A n-,add NEW

Purpose:
Set the I/O address of one serial port, COMn.
Sets the I/O address of several ports starting at COMn.
'n' specifies the COM port. 'n' must be given.
If only 'n' is given only one ports address is set.
If 'n-m' or 'n-' are given then the addresses of all the ports in the range is set starting at the I/O address 'add'.
'add' is the address of the port, it must be in hexadecimal, and can be optionally suffixed with an 'h' or 'H'.

 For example:
        /A1,3f8 /a2,02f8H
Sets COM1 to 03F8H and COM2 to 02F8H.

For example:
> /A3,02F8 /A4,02 E8 /A5,0198 /A6,01A0 /A7,01A8
> /A8,01B0 /A9,01B8

Is used with the Quad card to set the I/O address of the serial ports. The above line specifies COM3 to COM9, port#2-8 on the Quad card. The built in COM1 port on the PC and the Quad port#1 will both be found by the PC's BIOS on power up since they are at the default COM1 and COM2 addresses.

Number Buffers.

Switch: /B n

Purpose:
Set number of pairs of buffers to set up.
n is in range 0 to 16 and is the number of buffers to allocate. This is one factor which sets the maximum number of serial ports that can be used in interrupt mode. NewCOM reserves space for the buffers from main memory when the machine is booted.

For example:
/B 9
Reserves 9 buffers, one for the built in COM 1 port and one each for the 8 ports on the Quad card.

For example:
/B 4
Reserves space for four pairs of buffers, enough for four serial ports. The default is six pairs. The buffer allocated contains an equal amount of room for both the incoming data and the outgoing data.

Hardware Handshake.

Switch: /H [n],[hs]

Purpose:
Select which hardware handshake type to use on port COMn.
'n' specifies the COM port. If n is not specified the handshake is applied to all serial ports.
'hs' is a number indicating the type of handshake, and 0 is the default. This does <u>not</u> override a previous XON/XOFF setting, in conjunction with which it may be used. The types are listed below and detailed under 'hardware handshakes' later.

For example:
/H1,2 Set COM1, handshake 2
/H,1 Set handshake 1 for all ports
The /H switches are processed from left to right, so for example
/H,2 /H1,0 /H2,1 would set COM3 to COM16 to handshake mode 2, COM1 to mode 0 and COM2 to mode 1.

The hardware handshake currently supported are:
Type 0 RS422/485 DTR/CTS
Type 1 RS422 RTS/CTS
Type 2 RS485 Half duplex
Type 3 RS485 Send only.
Type 4 No handshake used, only TxD, RxD and Gnd need be connected.

Hardware Interrupt.

Switch: /I n,i

Purpose:
Set interrupt lines for COMn.
'n' specifies the COM port. If n is not specified the interrupt line is applied to all ports.
'i' is the interrupt line in the range 2 to 7 and 10 to 15 or, to indicate no interrupt line, -1 or nothing.

For example:
/I1,4 set COM1 to use line 4
/i,-1 sets all ports to no interrupt
/i2, sets COM2 to no interrupt

The /I switches are processed from left to right, so for example /I,3 /I1,4 sets COM1 to line 4 and COM2 to COM16 to line 3.

A serial port must be assigned an interrupt line before it can be used. On PC/XT/AT machines and EISA bus machines only one serial port can use an interrupt line. On PS/2 machines serial ports can share interrupts. Multiport cards with special interrupt hardware have different rules- see the information for setting up those cards.
        When allocating interrupt lines to serial ports note that the six IRQ lines available to PC cards are traditionally designated as follows:

IRQ 2 Usually Free.
IRQ 3 COM2, COM3, COM4 etc.
IRQ 4 COM1
IRQ 5 LPT2:
IRQ 6 Floppy disk
IRQ 7 LPT1

IRQ 10 Usually Free.
IRQ 11 Usually Free.
IRQ 12 Usually Free.
IRQ 15 Usually Free.

Quad 8 Port RS422/485 cards

Switch: /L add,i,p1,p2...
Purpose:
Set up one or more Quad cards. This command is entirely equivalent with the /D command with which it is interchangeable.
'add' is the address of the Shared Interrupt Status Register, SISR, set on the card.
'i' is the interrupt line set on the Shared IRQ jumper block.
'p1', 'p2, etc. are the COM port allocation for the Quad card. For example if p1 is '3', then port 1 on the card will be accessed as COM3. The COM3 I/O address, ie the address of the Quad card port#1, is specified elsewhere on the CONFIG.SYS file line, using the /A3 switch. The 'p' places can be empty, indicating those ports on the card that are not being set up to use the shared interrupt mechanism.

For example:
 /L 0120,3,2,3,4,5
Specifies that the Shared Interrupt Status Register, SISR, is at I/O address 0120 hex, that interrupt 3 is the shared interrupt line, and that:-

Quad port#1 is mapped as COM2
Quad port#2 is mapped as COM3
Quad port#3 is mapped as COM4
Quad port#4 is mapped as COM5

For example:
        /L 300,7,3,4,5,6
sets up a Quad card with a status register at 0300H. The card uses

interrupt 7 as the shared interrupt line. Ports 1 and 2 are designated as COM3 and COM4, Ports 3 and 4 are designated COM5 and COM6, and all the shared interrupt IRQ 7.

Buffer Size.

Switch: /S n

Purpose:
Set size of all buffers in bytes. n is rounded to the nearest power of 2, and must be in the range 32 to 32768. For any serial port opened two buffers of size n are allocated, one for input and the other for output. The space for the buffers is reserved by the driver when the machine is booted. For example:
/S 512
sets the buffer size to 512 bytes. The default size is 256 bytes.
Note that in actual operation only n-1 bytes are available, so the default buffer, nominally 256 bytes long, can only hold 255 bytes.

Software Handshaking.

Switch: /X n[,xon,xoff]

Purpose:
Set port COMn to XON/XOFF handshaking. In this mode the hardware handshake lines are ignored and the characters XON and XOFF are used to control the flow of characters on the serial line. The optional parameters XON and XOFF are decimal numbers which are to be used as the XON and XOFF characters. Their default values are 17 (DC1) and 19 (DC3) respectively. For example:
/X2 or /X3,18,20
If n, the port number, is not given, then XON/XOFF handshaking and any specified handshake characters are set for all ports, as

/X or /X,18,20

Driver Defaults.

When no switches are specified in the CONFIG.SYS file the following defaults are used:

I/O Addresses.

On PC/XT/AT machines the ROM BIOS checks for COM1 and COM2 at their usual I/O addresses (03F8H and 02F8H respectively), and so these ports are automatically recognised. If a port is present at 02F8H only then this becomes COM1. IBM PS/2 machines recognise the first 4 serial ports are automatically.

Interrupt Lines.
 COM 1- 4
 COM 2- 3
 COM 8- -1 (meaning none set)

Multiport Cards.

No multiport cards are assumed to be present.

Hardware Handshake.

All ports default to H0, the DTR/CTS handshake used by RS422/485 systems.

Software Handshake.

XON/XOFF handshaking is disabled and the characters are XON=17, XOFF=19, should software handshaking be turned on.

Buffer Size.

Buffers are 256 bytes long.

Buffer Number.

The maximum number of pairs of buffers is 6 (that is up to six ports can use buffered I/O).

Baud rate etc.

These depend on a variety of factors. Ports recognised by the ROM BIOS are reset to 2400 Baud, no parity, 8 data bits and one stop bit when the machine is powered up. The other ports reset to no parity, 5 data bits and one stop bit via the chip reset. They maintain their baud rates over a reboot, but tend to loose them if the machine is switched off, when they reset to approximately 1.8 Baud.

Buffer enabling.
When the machine is rebooted all buffers are deallocated. When a port is first used its buffers are allocated and enabled.

CHAPTER 6
SHARED INTERRUPT MECHANISMS.

Introduction.

This chapter discusses the shared interrupt mechanism used on the Quad 8 and Quad port RS422/485 cards and the Quad RS422/485 cards. This interrupt system is 100% compatible with that used on the Digiboard PC/8 and PC/4 dumb cards. The extensive range of software written for the Digiboard cards will work with the Quad 8 and 4 port cards.

Digiboard Compatibility.

The Quad 8 port and Quad port cards are 100% Digiboard PC/8 and PC/4 compatible. They also have additional features allowing them to be used in far more applications than the original Digiboard products. These include half size 4 port Quad card, AT interrupts 10, 11, 12 and 15, interrupt chaining for up to 7 boards.

Why Do We Need A Shared Interrupt Mechanism?

In the standard PC design, only IRQ2-7 are available on the expansion bus, COM1 was allocated to use IRQ4, whilst COM2-8 all are allocated to IRQ3. Due to limitations in the standard PC design, only one device can be actively using interrupts on any particular IRQ line at a time, thus COM2 -COM8, can only have one interrupt driven serial port BETWEEN them and the other 6 must used the substantially slower polled RS422/485 input output. On an 4 and 8 port serial card this will slow down throughput considerably and may cause input data to be lost on those ports without interrupts.

Both Serial Solutions Software (see Chapter 4 - "**AT Quad 4 Port RS422/485 Software Configuration**" and the appropriate Serial Solutions Manual) and the Quad 4 & 8 port serial cards implement interrupt sharing. Any or all of the serial ports can

AT QUAD 4 PORT RS422/485   Shared Interrupt Mechanisms
share a single interrupt line. As well as hardware allowing sharing of a single interrupt, there is a shared interrupt status register.

-Shared Interrupt Status Register.

The shared interrupt status register uses a PRIORITY encoding system. Reading the Shared Interrupt Status Register, SISR, returns 0FF Hex if there are no interrupts pending, it returns 00 Hex if Serial Port 1 has an interrupt pending, it returns 03 Hex if Serial Port 4 has an interrupt pending, it returns 07 hex if Serial Port 8 has an interrupt pending. Reading the SISR does NOT clear the interrupt condition, that must be cleared by servicing the serial port chip in the normal way. The first interrupt generated is latched, successive interrupts received between the first interrupt being generated and serviced will be queued and prioritised. The higher priority port will always override interrupts from the lower priority port. For best results place those devices with higher baud rates, or higher data rates(=same baud rate but more data) on the higher priority ports. The latching of the first interrupt and the queuing of later ones means that no one port can permanently lock out other ports, and is a good method of ensuring fairness.

Figure 5-1. Shared Interrupt Priority.

Port	Priority	Shared Status Register
No Interrupt	None	FF Hex= 256 decimal
Port 1	Highest	01 Hex= 1 decimal
Port 2	High	02 Hex= 2 decimal
Port 3	High	03 Hex= 3 decimal
Port 4	Middle	04 Hex= 4 decimal
Port 5	Middle	05 Hex= 5 decimal
Port 6	Low	06 Hex= 6 decimal
Port 7	Low	07 Hex= 7 decimal
Port 8	Lowest	08 Hex= 8 decimal

AT QUAD 4 PORT RS422/485   Shared Interrupt Mechanisms

The first interrupt generated causes all successive interrupts to be "hidden" from the SISR, until the interrupt it has been serviced.

Later interrupts are prioritised so that those of lower priority have their interrupt "hidden" from the SISR, until the interrupt on the higher priority port has been serviced.

The Shared Interrupt Register address is set by 9 DIP switches on the card and there is a jumper block to select which PC interrupt line the Shared Interrupt Register is to drive.

AT QUAD 4 PORT RS422/485   Shared Interrupt Mechanisms

AT QUAD 4 PORT RS422/485   Shared Interrupt Mechanisms

AT QUAD 4 PORT RS422/485   Shared Interrupt Mechanisms