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Brainboxes Serial Solutions Range Manual

Version: 1



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1. Introduction

1.1. The Serial Solutions Range

1.1.1. UC, UP and EP Product Range

The UC range includes 1, 2, 4, and 8 port devices which will provide an RS232 and/or RS422/485 9-pin COM port to any device with a PCI slot. The UC cards are compatible with 3.3V and 5V signalling.





1.1.2. PM Product Range

The PM Product range includes 1 and 2 port devices which provide an RS232 or RS422/485 9-pin COM port to any device with a PCMCIA slot.





1.1.3. CC Product Range

The CC Product range includes 1, 2, 4 and 8 port devices which provide an RS232 and/or RS422/485 9-pin COM port to any device with a PCMCIA slot. The CC cards are only capable of 5V signalling



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1.1.4. PX-275/279

The Serial Solutions driver covers the PX-279 which provides 8 RS232, 9-pin COM ports to any device with a PCI express slot.



1.2. The Serial Solutions Software

Serial Solutions is the device driver for managing the UC, CC, PM range and the PX-279 from Windows. For a full list of supported Operating Systems, please see the list below.

1.3. Supported Operating Systems

The UC, UP, EP, CC, PM ranges and the PX-279/275 can be used with the following Microsoft Operating systems with the supplied drivers;

- Windows 7 32 & 64 bit
- Windows Vista 32 & 64 bit
- Windows Server 2008 32 & 64 bit
- Windows Server 2008 R2
- Windows XP 32 & 64 bit
- Windows Server 2003 32 & 64 bit
- Windows 2000
- Window 98
- MS DOS
- Windows NT

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2. Installation Instructions

2.1. DOS Installation

The DOS installation procedure consists of 2 steps after the PCI Quad RS232 card is inserted:

1. Determining the resources that the PCI Quad RS232 has claimed.
2. Informing the Serial Solutions DOS device driver of those resources.

Determining PCI Multiport Resources

- Insert card into PC, as described in Chapter 2.
- Run BBCARDS.EXE, from the supplied DOS driver disk titled “Utility Disk” by typing the following:

  A:\ >BBCARDS

  Where A:\ is the drive containing the supplied disk.

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

PCI Quad Users:

```
Card 1 is on bus 0, device 16, function 0
Card ID=2, revision 3: Quad RS232
Interrupt line 11 has been assigned
4 sets of 16550-compatible registers are at I/O address 0140
SISR is at I/O address 0104
Baud clock control is at I/O address 02d0
Write 0xf6 for /8 (default), 0xf2 for /4, 0xd6 for /2, 0xd2 for /1.
```

Note down IRQ, I/O address and SISR (the SISR is the Shared Interrupt Status Register, which is a read only register which returns an index value that identifies which port on the card has an interrupt awaiting servicing by the driver software.) In this case:

The IRQ = 11
The I/O address = 0140
The SISR = 0104

NEWCOM.SYS Parameters

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

NEWCOM.SYS /A *port address*, /L *SISR, IRQ, range* /B *number buffer* /S *buffer* /H *Hardware Handshake*

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

/L *SISR, IRQ*, range specifies SISR address, card interrupt and COM port range. The COM port(s). Range may be a single port OR a range of ports.

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

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

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

Handshake types available are:

Type 0 RS232 DTR/CTS – The PC only transmits when CTS is input true. When the PC is able to receive its sets DTR output true. The DSR and DCD inputs are ignored. The RTS output line is set true in case the external serial device needs a true signal.

Type 4 3 Wire Handshake – Really no handshake at all since the PC transmits irrespective of the handshake lines. The 3 wires are TxD, RxD and Ground, no other lines are required. Thus the CTS, DSR and DCD inputs are ignored. The RTS and DTR output line is set true just in case the external serial device needs a true signal.

Configuring and Installing NEWCOM.SYS

To load the Serial Solutions for DOS device driver an entry needs to be added to the CONFIG.SYS file. Any simple test editor, EDIT for example, can edit the CONFIG.SYS file. The installation procedure given below is for a PCI Lynx 8 port RS232 as COM5-COM12

The parameter required by the NEWCOM.SYS follows:

Port Address
/A5-8, 0140

COM ports 5, 6, 7 and 8 are defined with an I/O address range that begins at 0140h and all subsequent ports have an I/O address that is 8 higher than the previous i.e. if COM5 has an address of 0140h, then COM6 will have an address of 0148h, COM7 an address of 0150h etc.

PCI Lynx 8 port RS232 Users: /A5-12,0140

SISR, IRC, Range.

/L 0104,11,5-8

0104h is the i/o address SISR, 11 is the IRQ and since the COM port range is COM5 – COM 8 range is entered as 5-8

PCI Lynx 8 port RS232 Users: /L 0104,11,5-12

Number Buffer.

/B8

8 buffers are defined, though only four ports are in use – this is because buffers in DOS are assigned in a sequential order from COM1. Since the PCI Quad RS232 has been assigned COM port values of 5 to 8, all preceding COM ports, must have buffers assigned to them also.

PCI Lynx 8 port RS232 Users: /B12

Buffer Size

/S512

Buffer size set to 512 bytes.

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Hardware Handshaking

/H,4

Type 4,3 Wire Handshake selected for all ports.

Modifying Command Line Parameters.

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

DEVICE=NEWCON.SYS /A5-8,0140 /L 0140,11,5-8 /B8 /S 512 /H,4 …and should be entered into the CONFIG.SYS file. Once you are sure that these parameters have been entered correctly, restart your PC and your PCI Quad RS232 should be ready to use immediately.

Sample terminal applications are provided on “Serial Solutions Disk 1 & 2” enabling communications to be established to your peripherals quickly and easily.

PCI Lynx 8 Port RS”£” Users: When “assembled” the NEWCOM>SYS command line looks like:

DEVICE=NEWCOM.SYS /A5-12, 0140 /L0104,11,5-12 /B!” /S512 /H,4

2.2. NT Installation

Insert the PCI Multiport Card into your PC, and restart. Place the supplied floppy disc titles “Serial Solutions for Windows NT” in a suitable drive and from the start menu choose Run and enter a:\setup (where a: is the path to the floppy driver with the installation disk).



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

2.3. Windows 98 Installation

During the boot up process, Windows 98 will detect the Brainboxes card and you will briefly see a message box to this effect.

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Insert the Serial Solutions CD ROM into an appropriate drive and click **Next**.



Select **Search for the best driver for your device**.

Click **Next** then Click **Specify a location**

In the location space type <drive>:\sswin9x where drive is the appropriate letter for your CDROM drive. Or select the location of the folder which contains the drivers.

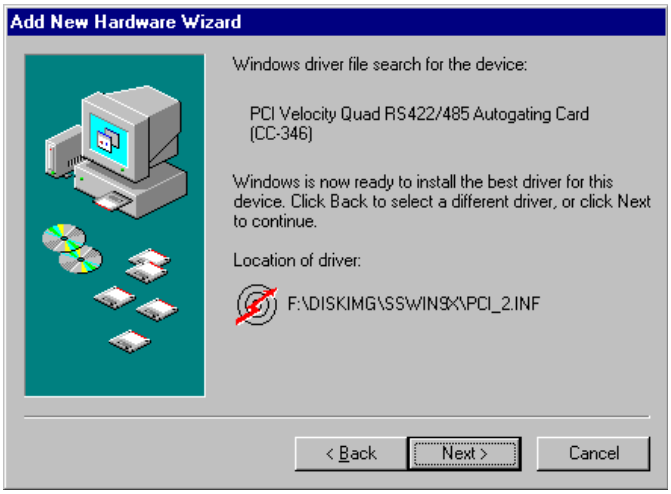
Click **Next**



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Click **Next**



Click **Finish**

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

2.4. Windows XP/Server 2003 Installation

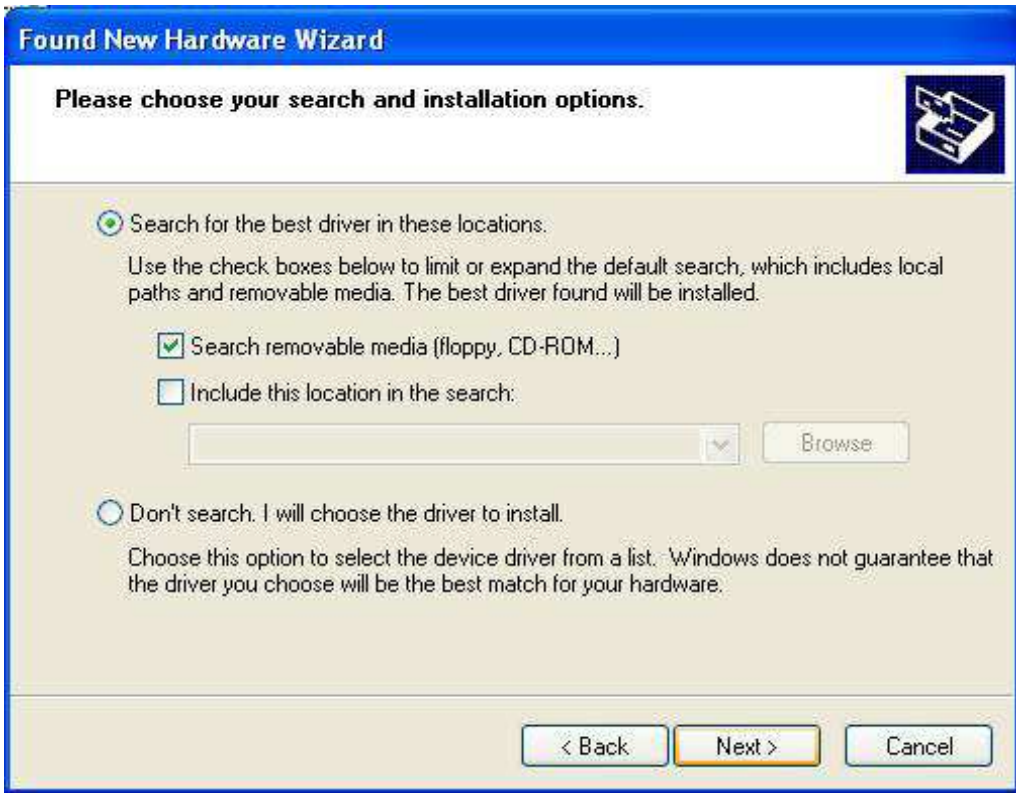
1. After your computer has booted up, a New Found Hardware Wizard will appear for the card that you inserted into the computer.



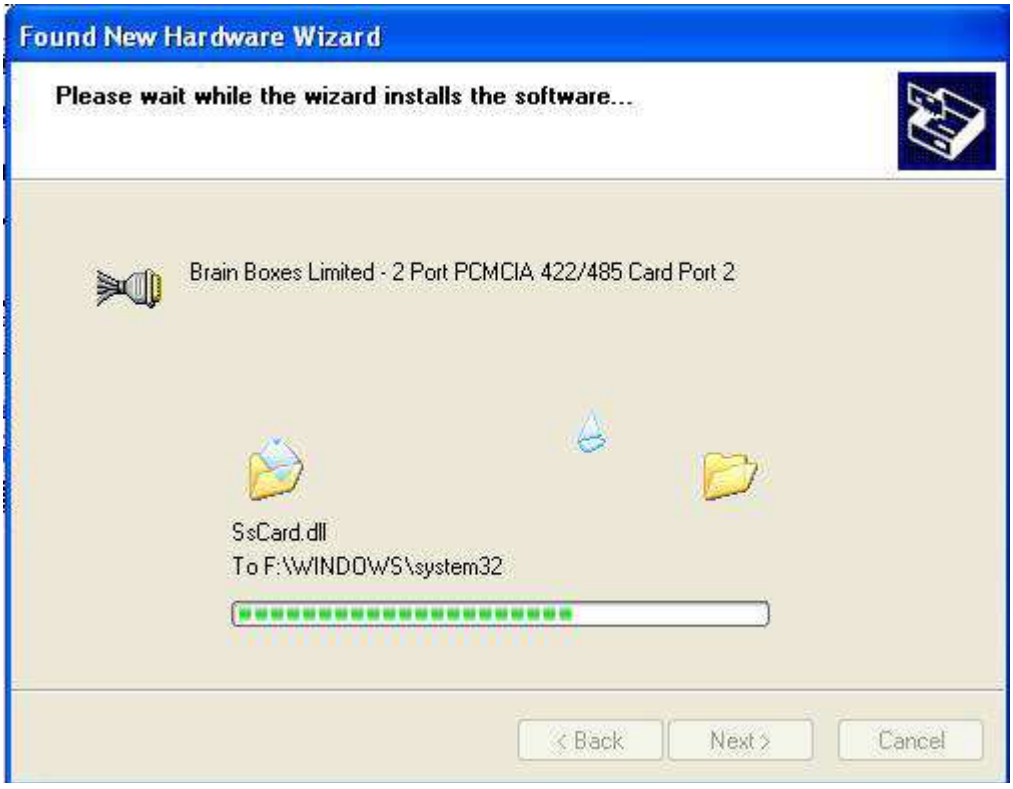
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2. Insert the CD that came with your Brainboxes device and point the New Found Hardware Wizard to the CD.



3. The driver files will start to copy across to your computer. This example is for the PM-121 and may differ slightly for each product.



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4. When the files have finished copying across the New Found Hardware Wizard will finish. Press 'Finish'.



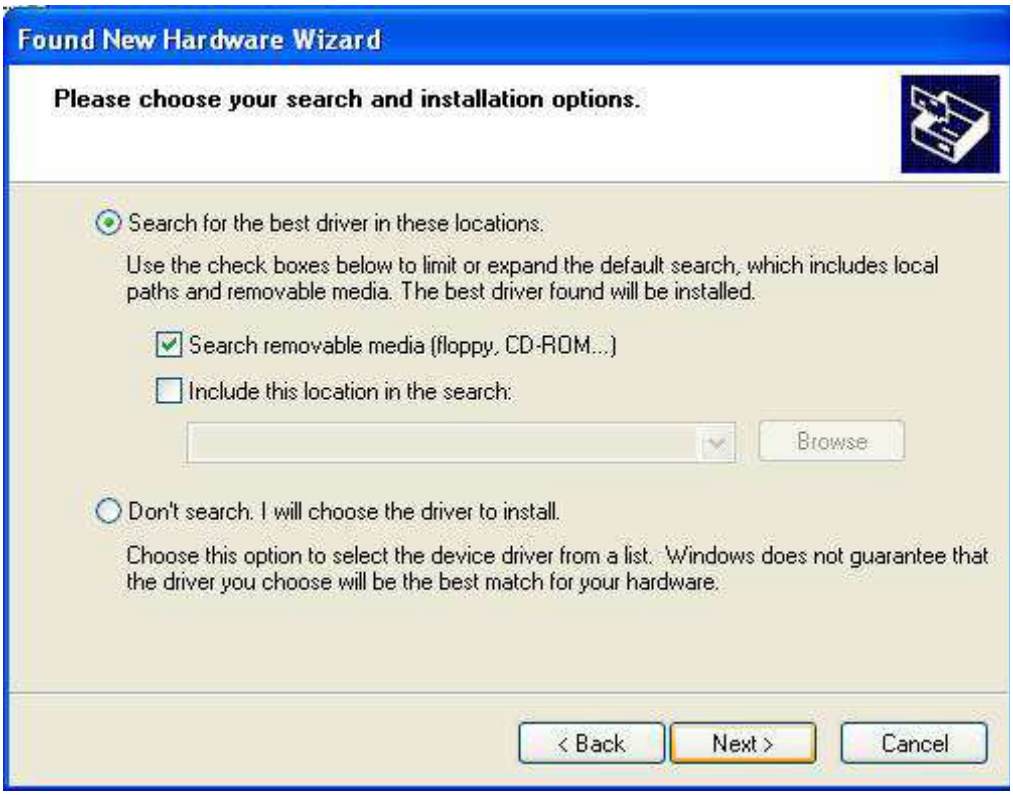
5. A second New Found Hardware Wizard will appear. Choose to Install from a specific location (Advanced)



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6. Again select to search from the removable media to search the CD.



7. When the files have finished copying across the Found New Hardware Wizard will finish. Press 'Finish'.



8. The New Found Hardware Wizard will appear again for other ports that are on the device. Follow the above instructions again to install the ports.

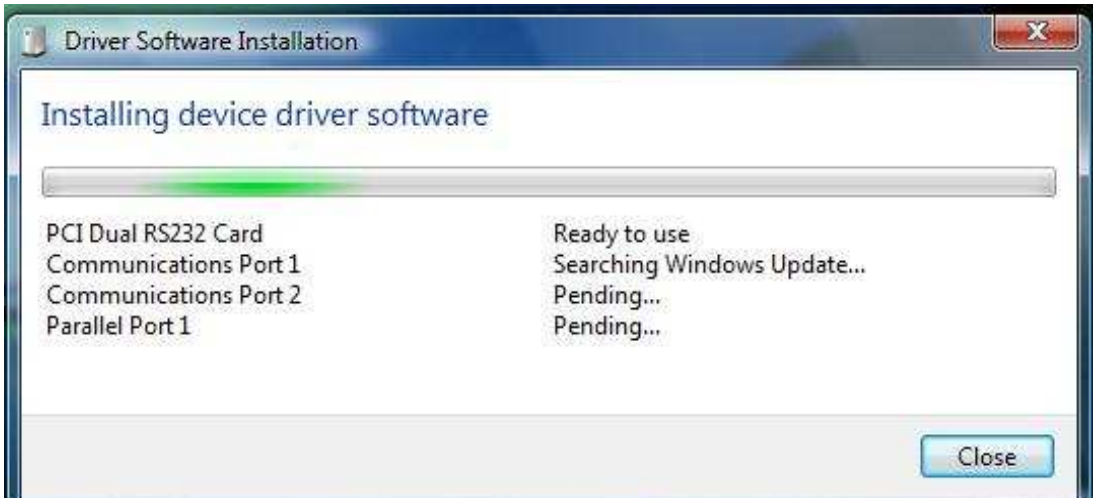
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2.5. Windows Vista/Server 2008 Installation

1. Once you have booted up the computer the Found New Hardware wizard will appear and give you options to install the driver software for the Serial Solutions card. Click on the Locate and install driver software option and Windows update will be searched and install the drivers for the card and ports.



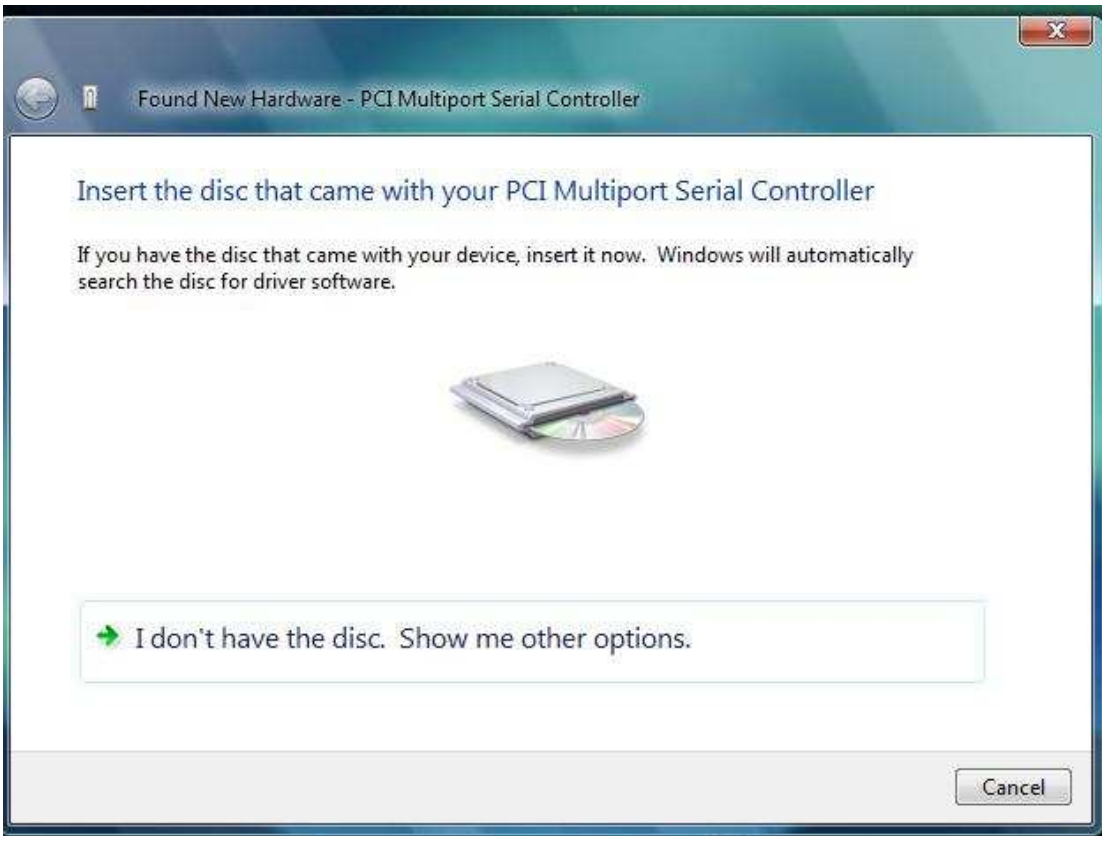


2. If the search on Windows update fails, or you are not connected to the internet you will be asked to insert the CD that came with the Brainboxes card. The CD will then be searched for the drivers and installed automatically. Please move on to step 6 if the drivers install automatically.

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3. If you don't have a disc, or have downloaded the latest drivers from our website, click on the option at the bottom of the page to show other options.



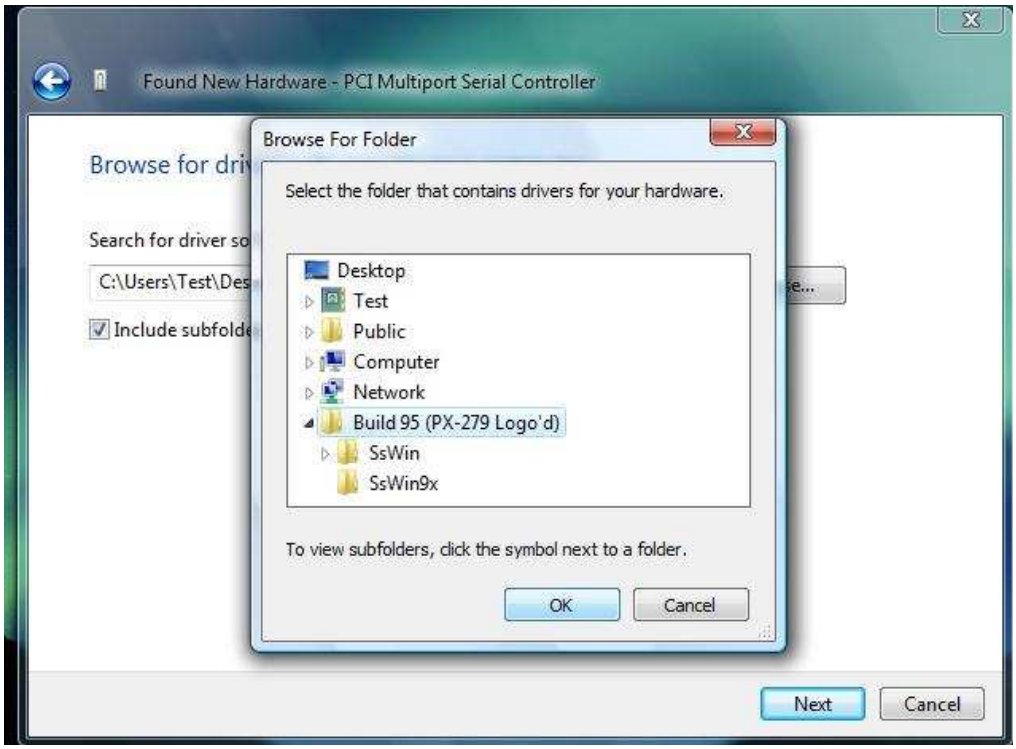
4. You will then be presented with two options. Click on the second one to browse your computer for the driver software.



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5. You will then be asked to browse your computer for the folders with the drivers in. Select the file that has the drivers you want to install and click OK. Click next and the drivers will be automatically installed for the card.



6. The drivers for the card will then have been successfully installed.



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2.6. Windows 7 Installation

1. When you boot up your computer on Windows 7, Windows update will automatically search for the latest drivers. If you have a connection to the internet, the drivers will be installed and the device will be ready to use.

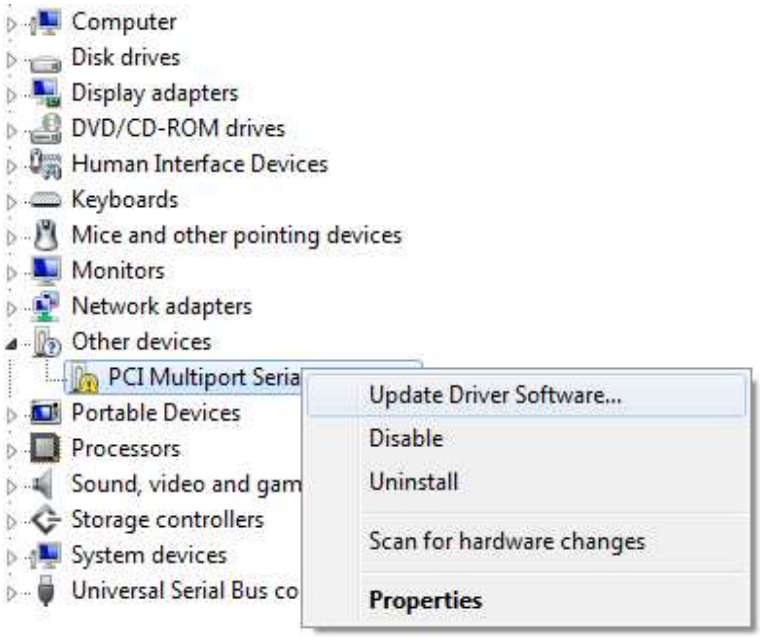


2. If there is no connection to the internet available then a message will appear saying that the drivers were not installed successfully.



3. To install the drivers Device manager will need to be opened. To open device manager go to the control panel, system, hardware tab, then click on device manager button.

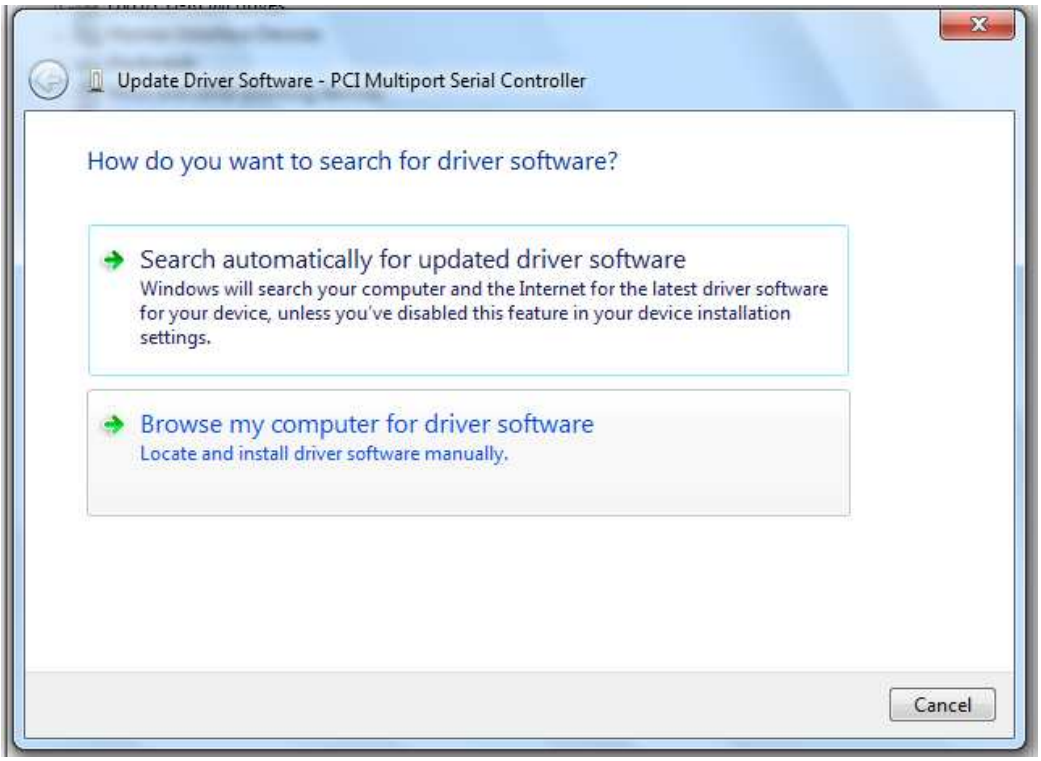
4. Once this is open you will see the yellow ! icon in the other devices node. Right click on the device and select Update Driver Software.



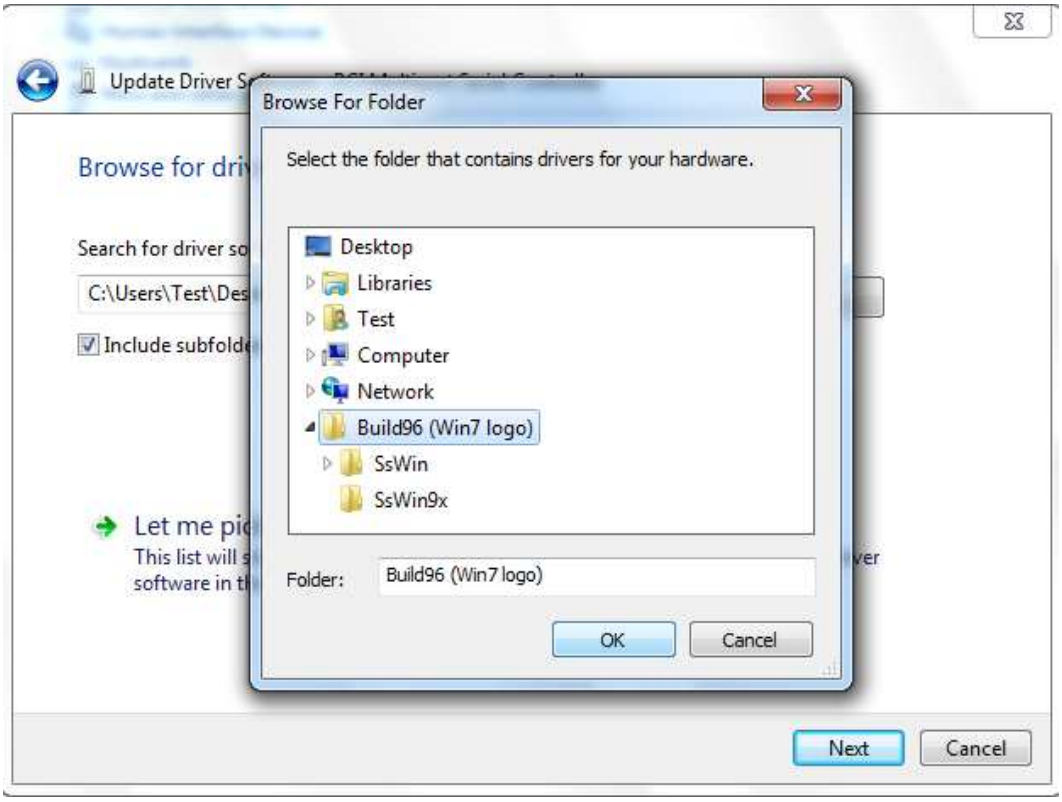
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5. If your Brainboxes card came with a CD insert it now and select to search automatically and the driver software will be found and installed. If not and you have a folder with the drivers, select to browse your computer for the drivers.



6. Select the folder which contains the driver files and then the folder will be searched and the drivers found. The drivers will then be installed and then you will get a message saying that the drivers have been installed successfully.



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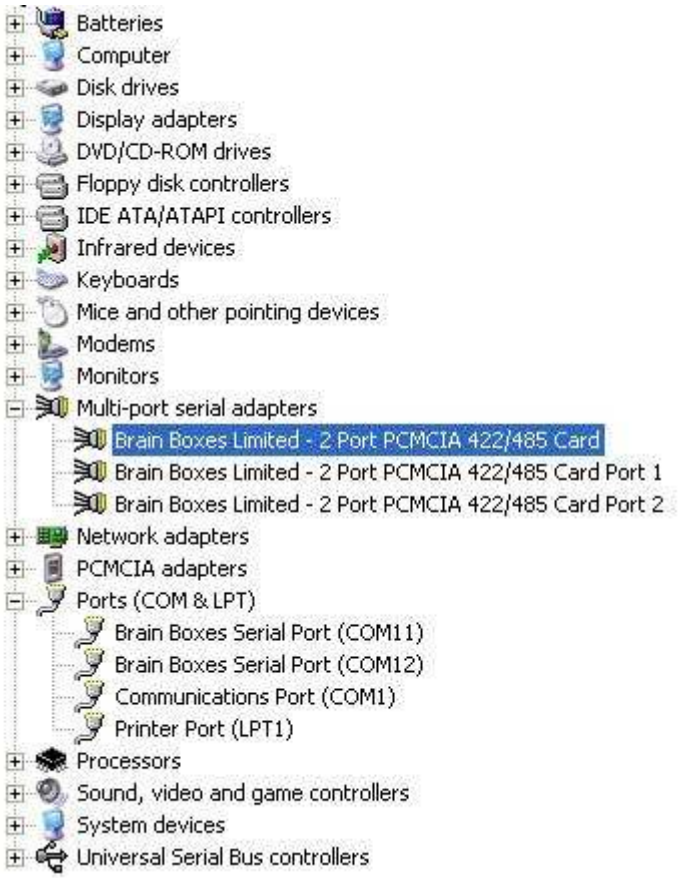
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3. Product Configuration

3.1. Windows XP, Server 2003 Vista, Server 2008 and 7

3.1.1. Finding your Brainboxes COM port

- Open device manager (Found by right clicking on My Computer and clicking *Manage*. Then select *Device Manager* from the left hand pane.)
- Find the Brainboxes Serial Port entry in Device Manager. (Found under “Ports” section)
- The Brainboxes Serial Port entry displays the current COM number in brackets after the name. (This is usually COM3 following install, but may be different if other serial devices have been installed in the past)
- To change your COM label, see **Section 3.3: Changing your COM label**



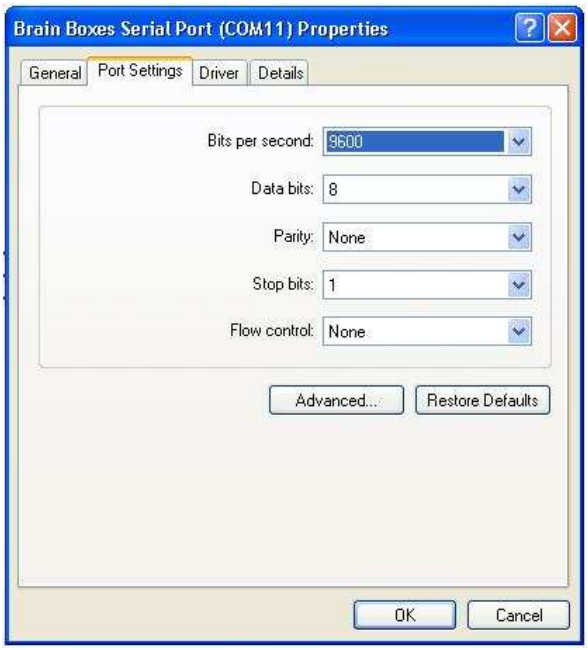
3.1.2. Port Settings

The port settings allow you to set a Default or Override Settings for the Serial Communication and how to deal with incoming hardware handshaking events.

- To open ‘Port Settings’, open Device Manager and Double Click on the Brainboxes COM port entry under the ‘Ports’ section.
- Then click on the ‘Port Settings’ tab.

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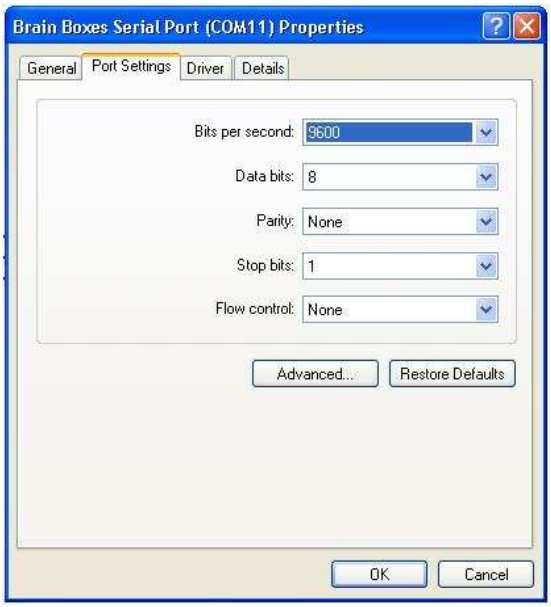
- All options can be selected from the dropdown menus.

NB – Once the desired settings have been achieved, you must click **OK** to activate them. At any time click the 'Restore Defaults' button to return to the original set up.

3.1.3. Changing the COM labels

- If you need to change the COM label, **Double Click** on the Brainboxes COM port entry under the 'Ports' Section.

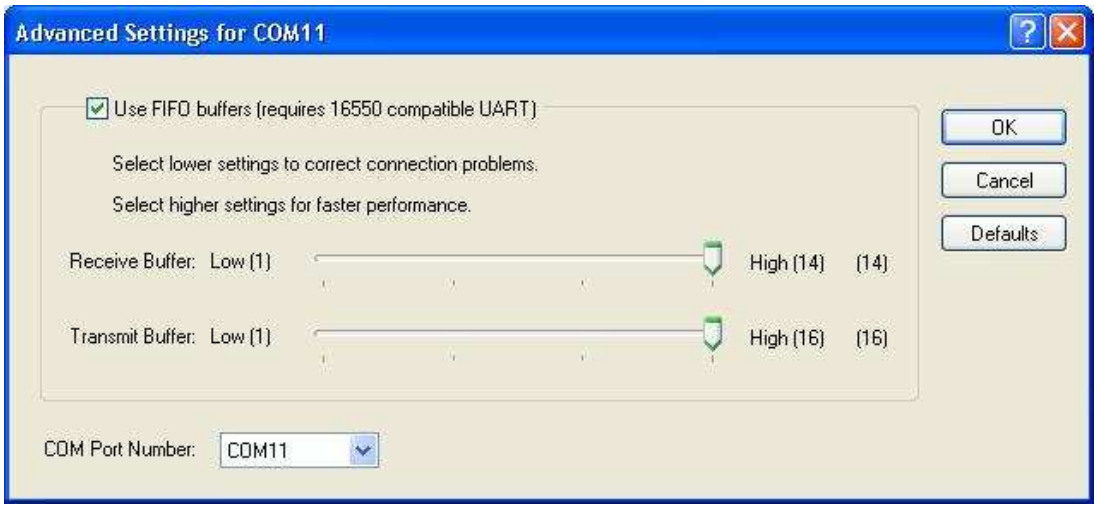
- Click on the port settings tab and click **Advanced**



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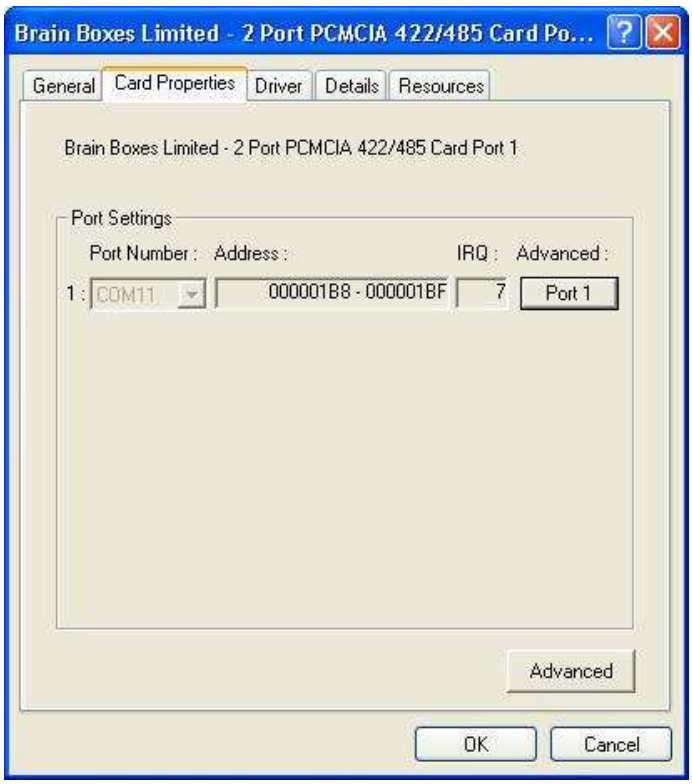
- A new COM port number can then be selected from the drop down box.



- If the COM port number is labelled 'In Use', it is either currently used by a COM port present on the system, or is reserved for a device which is not currently present. It is possible to select this COM number and force the change, if you are sure it is not required by another device.

3.1.4. RS422/485 Settings

For RS422/485 products only, in the 'Multi-port Serial Adaptors' section in Device Manager double click on the Brainboxes card port number then click on the Card Properties tab.

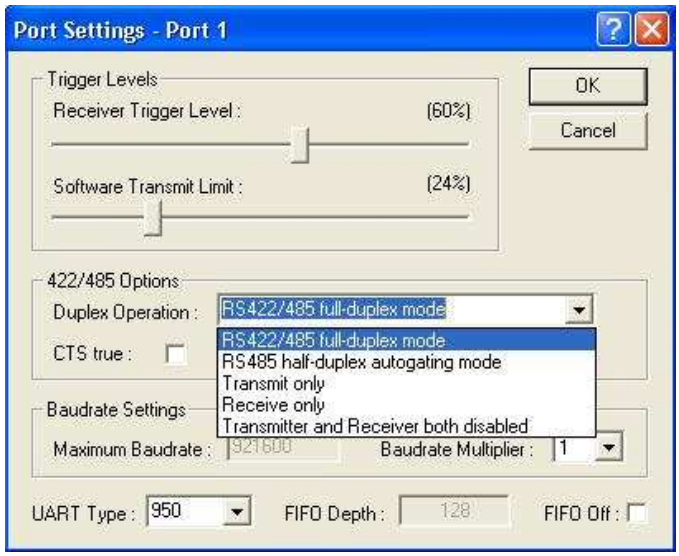


- Click Port 1 advanced button to open up the Ports settings window.

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- The drop down list for Duplex operation allows users to choose the desired RS422/485 operations mode.

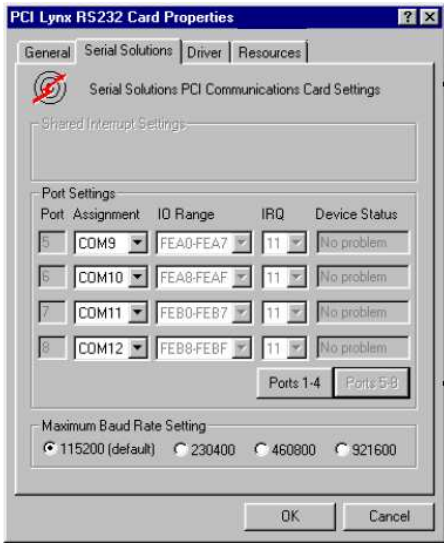


- Select 'RS422/485 full-duplex mode' for full duplex communications
- Select 'RS485 half-duplex autogating mode' for half duplex communications
- Select 'Transmit only' to just transmit communications
- Select 'Receive only' to just receive communications
- Select 'Transmitter and Receiver both disabled' for no communications
- For further details on wiring see **Section 9.2: Device Pinout**

3.2. Windows 98

Note: A RS232 card was used during this example but it is the same for RS422/485 cards.

- Double clicking a card entry under the "Multi-Function Adapters", in Device Manager will display general properties for the selected card.
- Click on the serial Solutions tab (for a PCI Lynx 8 port) will display:



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Some communications applications require the serial ports they access to be as named COM 4 or lower. The COM port assignment may be changed, simply by selecting a new COM port value from the pull down menu relevant to the port. However, COM port usage other than those for the selected card itself are not checked, so it is advisable to first check which COM ports are in use – port availability can be checked by viewing device manager.

All COM ports present will be listed under the entry "Ports (COM & LPT)."

Selecting the Maximum Baud Rate

The baud clock determines the maximum rate at which the serial ports of the PCI Multiport card can communicate. The standard PC serial ports allow baud rates up to a maximum of 115,200; however, both PCI Multiport cards can be set to use baud rates of up to 230,400 and beyond.

Double clicking a card entry under the "Multi-Function Adapters", in Device Manager and select the Serial Solutions tab. The maximum Baud Rate settings are located at the bottom of the Window.

The default Maximum Baud rate setting is 115,200 baud, which provides full backward compatibility with standard serial ports. Any change to the baud rate settings here will affect all of the cards ports. Table 3-1, below, lists the baud rates available at the various Maximum Baud Rate Settings. Setting the card to a higher baud rate requires connection to a device that supports this higher baud rate. Whatever setting you use will be stored by the PCI Multiport configuration software and set up again the next time Windows is started. It has been found during testing that the PCI Quad / Lynx 8 Port RS232 will operates correctly up to 230,400 baud at distances of up to 10 metres.

Double clicking on a selected Multiport 232 Port entry in Device Manager will the display general properties window for the selected port (in this case COM5)

Shared Interrupt Settings

Enable sharing – Clicking on this setting will remove the selected port from the shared interrupt, and will require the particular port to be assigned its own unique IRQ value from the Resources Tab.

SISR address- This value is used in conjunction with the Enabling Sharing checkbox, and will appear greyed out if the Enabling Sharing checkbox has been un-checked.

Port index – This is only used for interrupt sharing cards.

FIFO Settings

Enable FIFO – turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.

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 volume 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.

Restore

Clicking on this button will restore the port setting of the Serial Solutions tab for the selected port to:

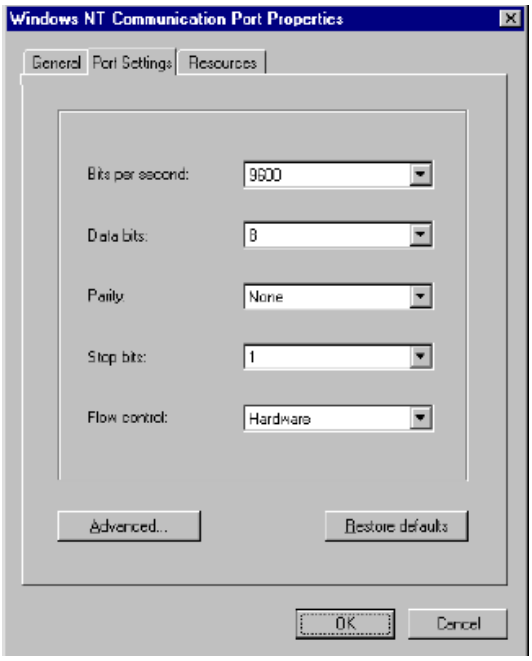
Enable Sharing: On (Checked)
SISR Address: 3a0
Port Index: 0
Enable FIFO: On (Checked)
Receive Buffer: 3rd from right.
Transmit Buffer: High.

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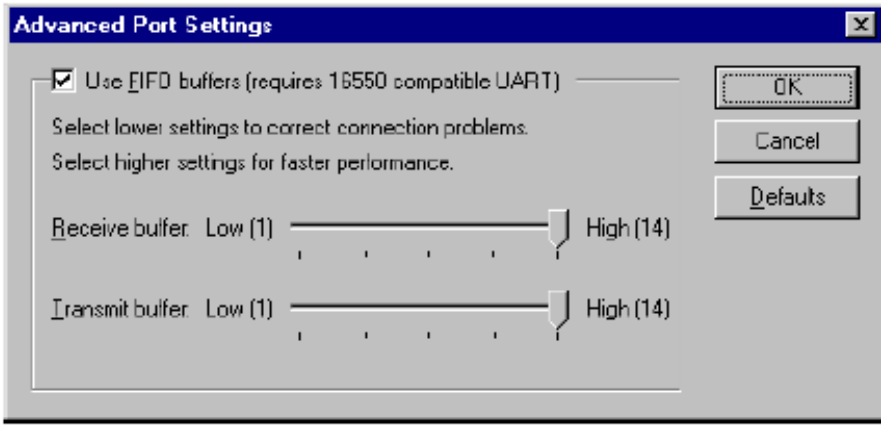
3.3. Windows NT

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



3.3.1. Advanced port settings.

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



FIFO settings:

- Use FIFO buffers – turns the selected ports FIFO buffer on or off. It is strongly recommended that the FIFO for both ports is left enabled.
- Receive Buffer – These settings allow the selection of a receiver FIFO trigger setting. Selecting a low value will allow the interrupt to be serviced quicker, which is good for slow machines. If you have a fast machine, setting a high value will give you more time for multi-tasking operations.
- Transmit Buffer – These settings allow the selection of a transmitter FIFO trigger setting. Selecting a low value will send fewer data-bytes per interrupt, and this is recommended if you are communicating to a slower machine. Selecting a high value will send more data-bytes per interrupt, and will give more time for multi-tasking operations.

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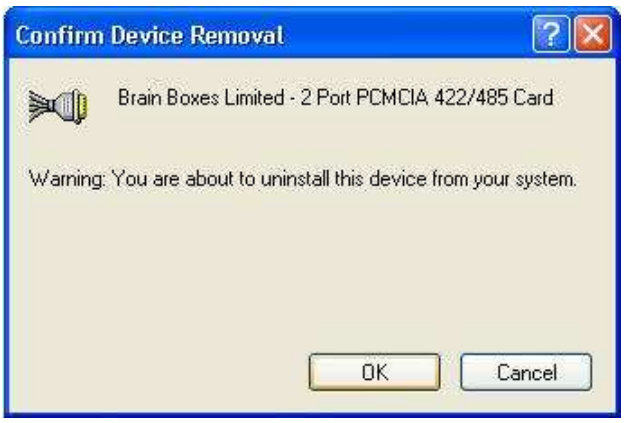
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4. Un-installation

The un-installation steps below are applicable to all the cards in the UC, CC, PM and UP ranges.

4.1. Un-installation on Windows XP, Server 2003, Vista, Server 2008, 7

- Open Device Manager and right click on the Card entry in Device Manager, and click uninstall.
- Click *OK* to confirm device removal



- The Brainboxes Serial Solutions installer will launch. Please see **Section 4.2: Brainboxes Serial Solutions Uninstaller**.

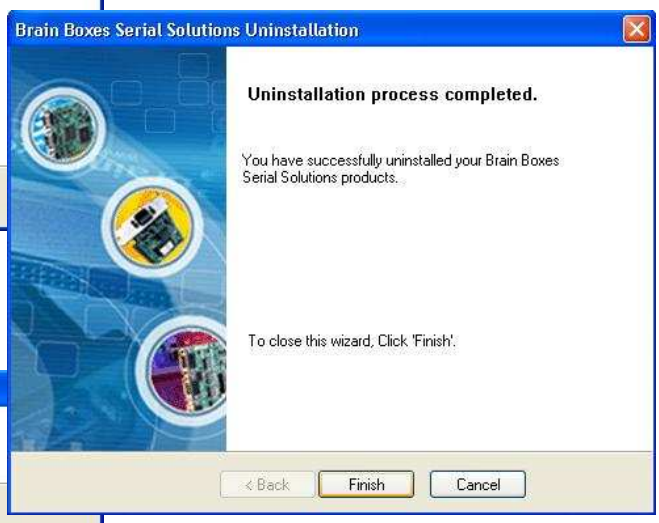
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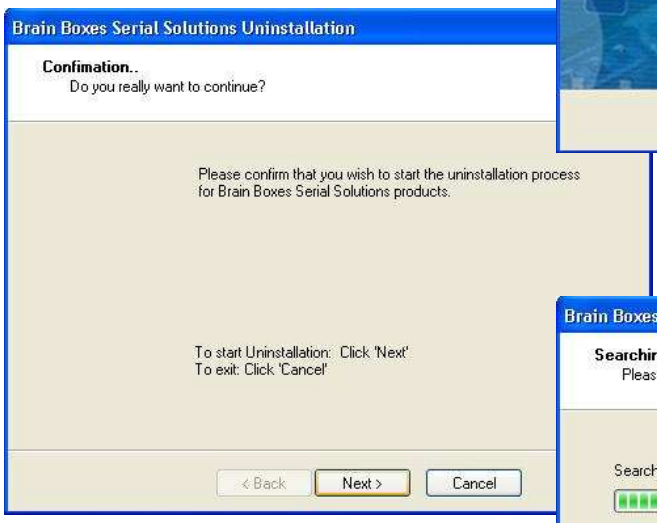
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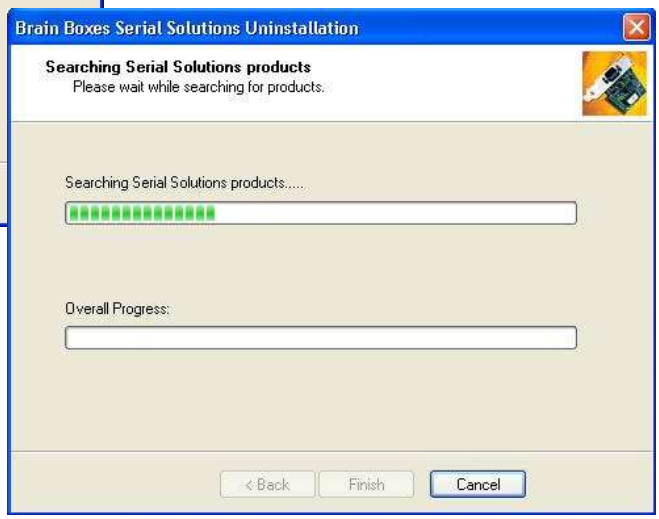
4.2. Brainboxes Serial Solutions Uninstaller

- The Brainboxes Un-installation wizard will launch which will remove all driver files and associated registry entries. Just click **Next** on each page of the Wizard. When the drivers have been uninstalled, click **Finish**.









- When finished, you may turn off your PC and unplug your Serial Solutions card. To reinstall, simply plug in the card again and follow the installation instructions as in **Section 2: Installation Instructions**. Alternatively, restart your PC, or scan for hardware changes in device manager and the New Found Hardware Wizard will appear.

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5. Serial Solutions Driver Upgrade / Rollback

There are two parts to the Serial Solutions driver.

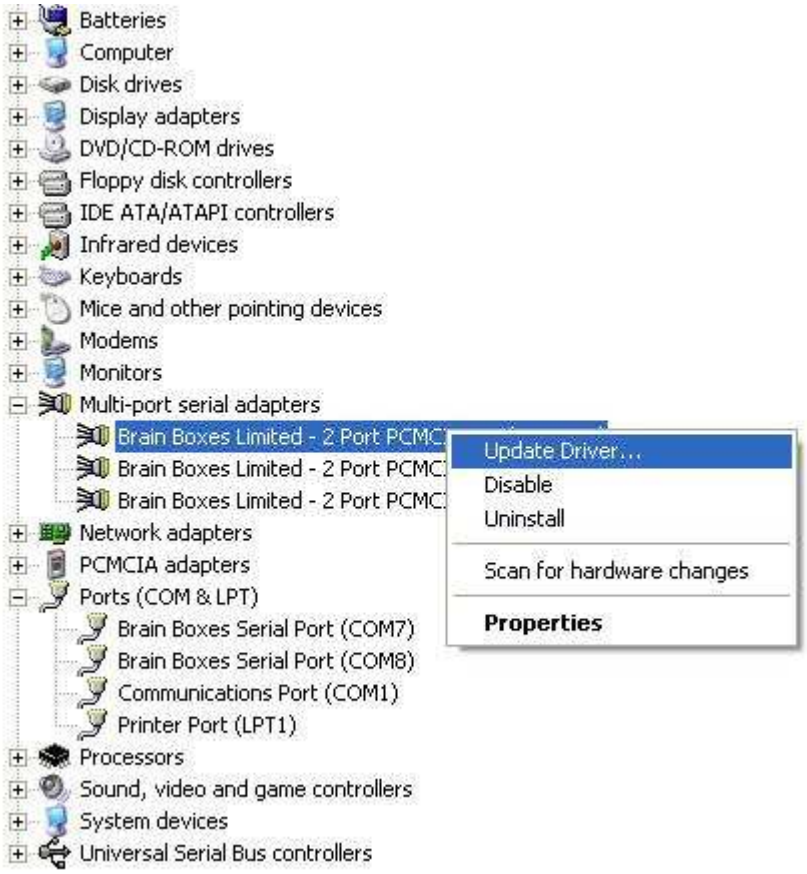
(Taking for example the PCMCIA PM-121 2 port Device)

- Card Driver: “Brainboxes Limited – 2 Port PCMCIA 422/485 Card”
- Card Driver: “Brainboxes Limited – 2 Port PCMCIA 422/485 Card Port 1”
- Card Driver: “Brainboxes Limited – 2 Port PCMCIA 422/485 Card Port 2”
- Port Driver: “Brainboxes Serial Port (COM7)
- Port Driver: Brainboxes Serial Port (COM8)

NB: If you need to upgrade or roll back the Serial Solutions driver, we recommend to completely uninstall the existing drivers first, and then to install the new drivers from fresh. This will restore all the factory settings to default. However, if you instead wish to keep all of your existing settings, you can use the ‘Update Driver’ or ‘Rollback driver’ in device manager for upgrading/rolling back the Serial Solutions driver.

5.1. Upgrading the Serial Solutions Driver

1. Go to Device Manager and Right click on the Serial Card entry (Found under Multiport Serial Adaptors – see image below)



2. Select Upgrade Driver. This will launch the Found New Hardware Wizard. Follow the on screen instructions and point to the location of the new driver package.

3. Repeat this for every Serial card and port entry.

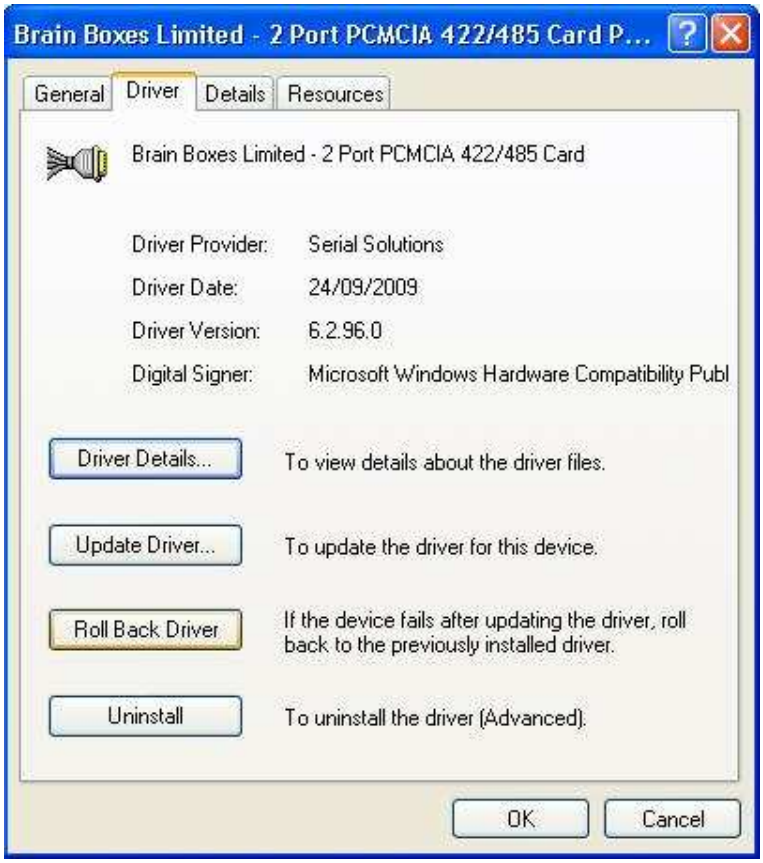
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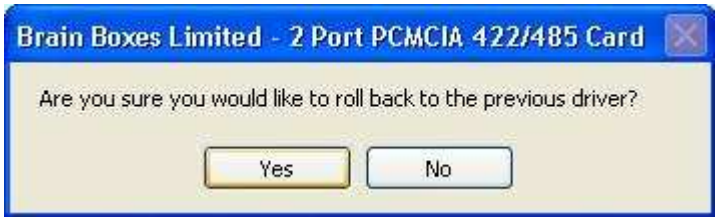
5.2. Rolling back the Serial Solutions Driver

1. Go to Device Manager and Double click on the Serial Card entry. Click on the Driver tab of the Card properties page.

2. Click on the Roll back Driver button.



3. Click Yes to roll back the driver to the previous version, and click No to keep the current driver version.



4. Click on the Close button to close the properties

5. You may have to restart your computer for the changes to take effect.



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6. Troubleshooting and Testing

6.1. Installation Problems

- Check the Brainboxes card is correctly installed, and the ports appear in Device Manager without any errors (Errors indicated by yellow ! icons)
- If the installation did not complete or shows any error messages then restart the computer.
- If Device Manager is still showing error messages, it is wise to uninstall and re-install. This should cure issues such as Resource Conflicts or failed installations. See **Section 2: Installation Instructions** and **Section 4: Uninstallation**.
- If the problem still persists try the following to try and help narrow down the problem.

  1. A different PCI/PCMCIA slot
  2. A different PC

- If the problem still persists please contact Brainboxes Technical Support. **See Section 8: Lifetime Warranty and Support**

6.2. Communication Problems

If you are experiencing communication problems:

- Check the Brainboxes card is installed correctly, and the ports appear in device manager without any errors (Errors are indicated by a yellow ! icon). If there are any errors follow **Section 6.1**.
- Perform a loopback test on one of the ports. A loopback test will verify that your card is able to Transmit and Receive Data. The Transmit and Receive pins will need to be connected so that any data sent out of the card is then received back in the same port.
- Please contact Brainboxes Technical Support with your loopback test result should the problem persist with your application.

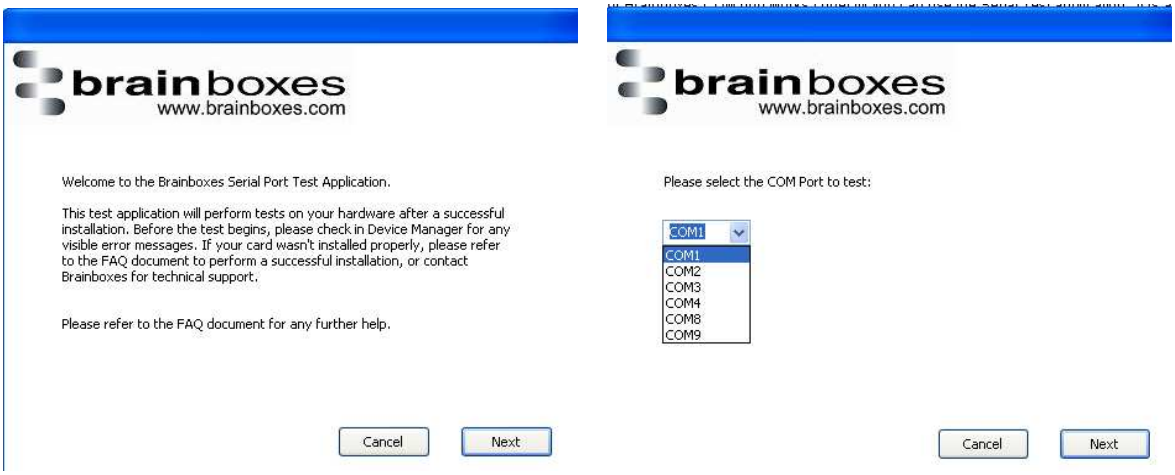
6.3. Testing your Serial COM port

To test your Brainboxes COM port works correctly you can use the Serial Test application. It is a simple application which will guide you through the steps to check that your Brainboxes COM port is working correctly.

You will need to select the COM port you want to test, and connect a loopback connector to transmit and receive pins of the respected COM port. You will then be given a result as to whether the test has passed or failed.

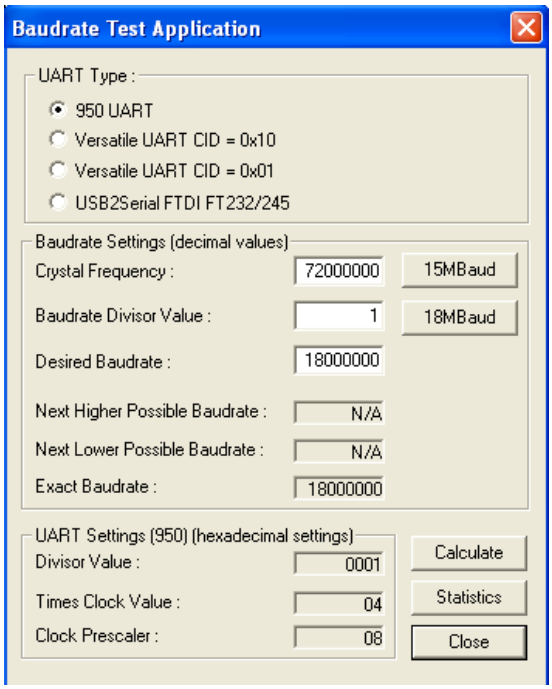
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6.4. Baud rate test application

To test to see if a specific baud rate is supported by one of our cards, the Baud rate test application can be used. You simply put the Baud rate details into the program and then click calculate and it will give you the details. This software is supplied on the Serial Solutions CD.



The following settings need to be applied for specific Brainboxes products

- If you have a PM-121 or CC-530/525 you will need to select the 950 UART type.
- If you have any UC card set the UART type to Versatile UART CID = 0x10 and crystal frequency to 14745600
- If you have any other PM card set the UART type to Versatile UART CID = 0x01 and crystal frequency to 14745600.
- The last option is for USB devices so is not applicable for the Serial Solutions software product ranges.

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7. Optional RS422/485 Operation

7.1.1. The RS422 Standard

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

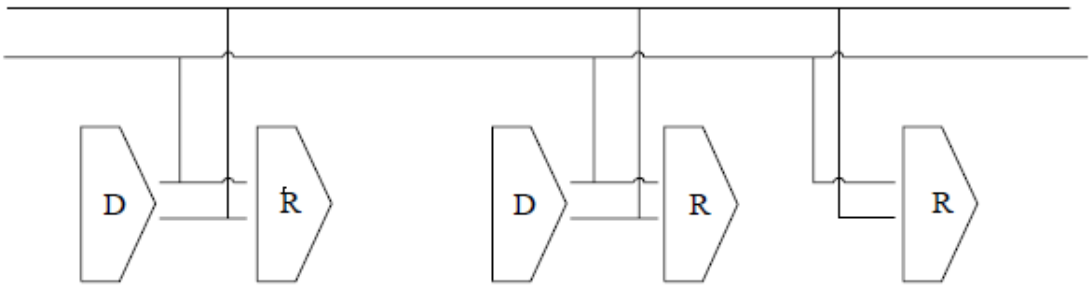
RS422 Standard 1 Driver up to 10 receivers	
Line Length	Max Baud Rate
40 feet = 12m	10 Mbits/sec
400 feet = 122m	1 Mbits/sec
4000 feet = 1219m	100 Kbits/sec



7.1.2. 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 Baud Rate
40 feet = 12m	10 Mbits/sec
400 feet = 122m	1 Mbits/sec
4000 feet = 1219m	100 Kbits/sec



7.1.3. Terminating Impendence'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.

PCI Quad 422/485 Card Chapter 10 Optional RS422/485 Operation • 49 The AT Dual Port RS422/485, Opto Isolated AT Dual Port RS422/485 and AT Velocity RS422/485 cards have the correct 120 Ohm (nominal)

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terminating resistors for the RXD twisted pair line and the CTS twisted pair line fitted on the RS422/485 card for both the serial ports on the card.

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

The terminating impedance's shown later in the wiring diagrams are automatically provided by the on board resistors and do not have to be added by the user.

7.1.4. Fail Safe Open Circuit Detection

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

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

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

7.1.5. 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.

7.1.6. RS422 Operation

Generally, in RS422 systems all 8 signal lines from the 9 pin D connector participate in the data transfer sequence, thus 4 twisted pair cables are used. One twisted pair carries the TXD data outwards, one pair brings the RXD data inward, another pair carries the RTS handshake outwards and the fourth pair brings the CTS handshake inwards. There is no need to 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.

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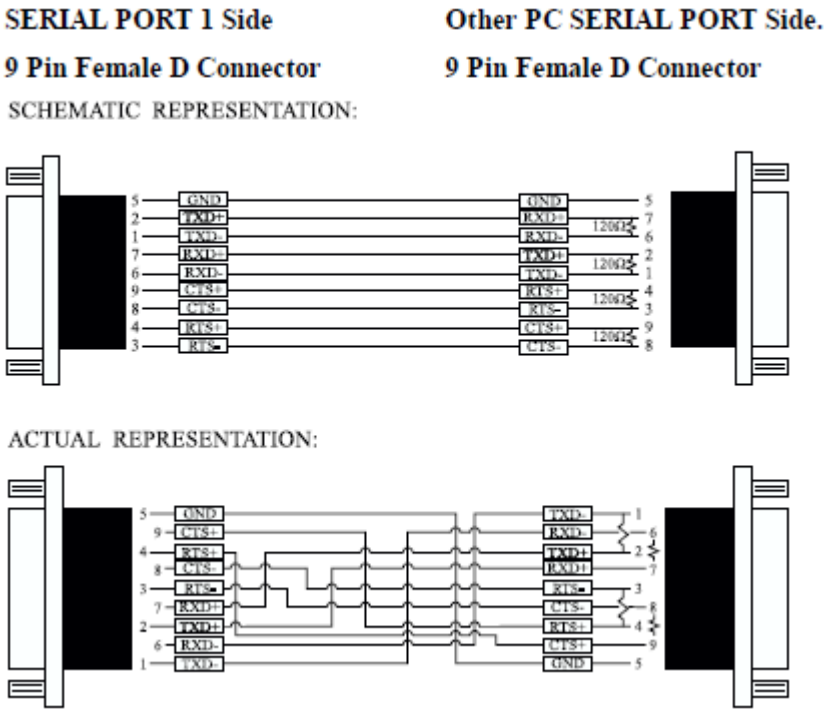
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7.1.7. RS422 Serial Port Cables

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.

7.1.8. Serial Port 1 to Other PC Cable



7.1.9. RS485 Operation

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

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

The three wiring schemes given described below are: -

RS485 One Talker Many Listeners (HALF DUPLEX)
RS485 Many Talkers Many Listeners (HALF DUPLEX.)
RS485 Many Talkers Many Listeners (FULL DUPLEX.)

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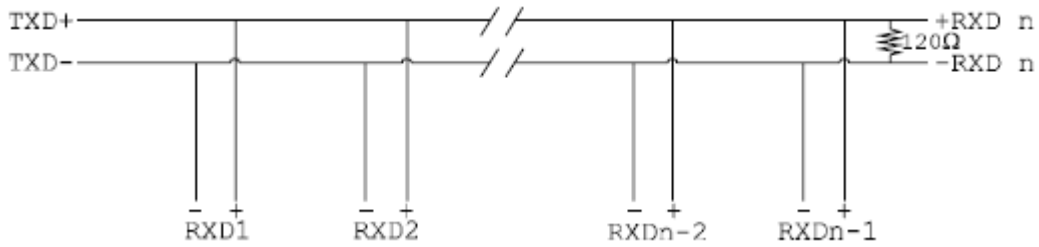
7.1.10. RS485 Cable

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

7.1.11. RS485 One Talker – Many Listeners, Half Duplex

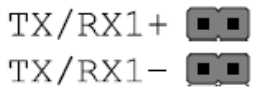
There are several schemes for connecting RS485 devices depending on the characteristics of the system. In many cases there will be only one device, which can transmit, data and all the others simply listen to it. This scheme is used for theatrical lighting intensity control in the DMX512 standard. This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



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.

7.1.12. Half Duplex Settings of RS485 Multiplex



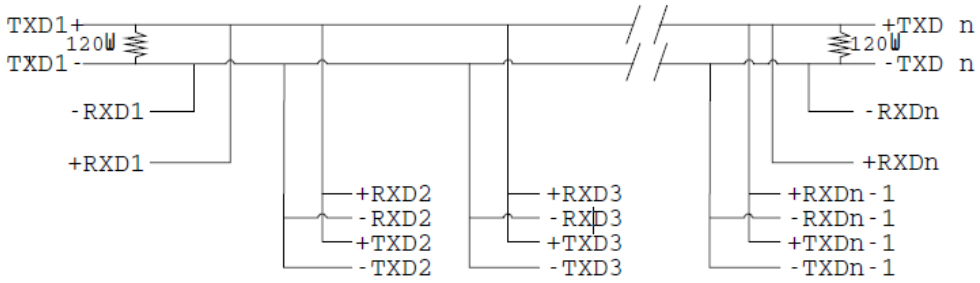
Both jumpers shorted, causing the RXD- & TXD- and the RXD+ & TXD+ signals to short together at the 9-pin connector.

7.1.13. RS485 Many Talkers – Many Listeners, Half Duplex

Another popular RS485 layout is for multiple talkers and multiple listeners. This is shown 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.

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

7.1.14. RS485 Many Talkers – Many Listeners, Full Duplex

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

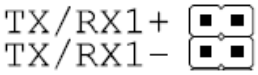
a) The PC is connected to only ONE RS485 device.

b) The PC is communicating with several RS485 devices that are each able to recognize and respond to their own unique address. The RS485 devices only drive their TXD lines when they are responding to requests from the PC to send data. In effect, the RS485 device's address and the command it receives is used to control access to the devices TXD channel.

This is a Full Duplex system. Two twisted pair cables are required. One twisted pair, is the PC's TXD channel, it carries the data sent from the PC's TXD outputs to the RXD inputs of each of the RS485 devices. The second twisted pair, is the Devices TXD channel, it carries the data sent from each of the devices' TXD outputs to the RXD inputs of the PC.

The advantages of this system are great, since no new communications, software is needed, and the PC can talk and listen at the same time. In effect, the handshaking is performed by the intelligence of the RS485 devices attached to the PC. When wired as 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 recognizes commands and data addressed to it, it only talks when the PC commands it to do so. When the RS485 device receives the command to talk from the PC, it gates its TXD drivers on, sends the data down the device TXD channel, and disables its TXD drivers. The other RS485 devices remain in the receive only mode when they are not being addressed, they do not transmit any data at all.

RS485 Jumpers

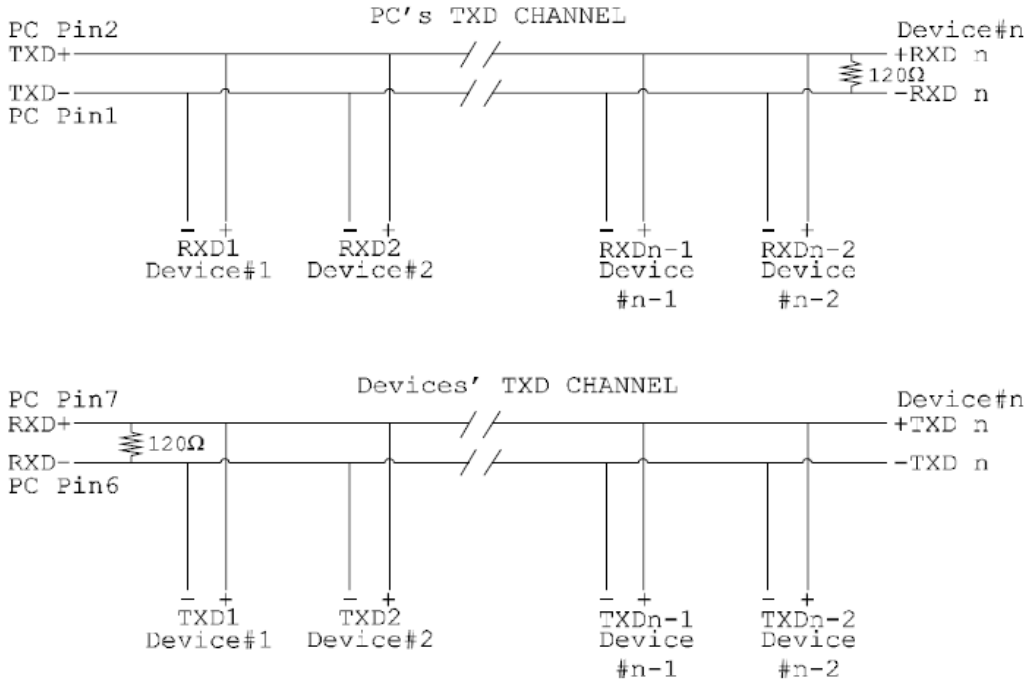


Both jumpers left unconnected (not shorted)

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RS485 Full Duplex

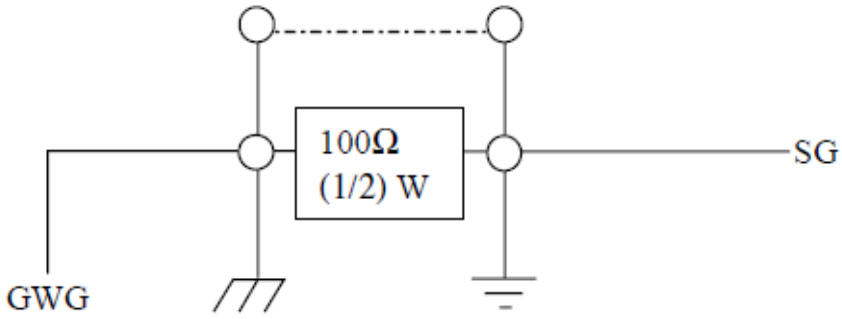


Note: The receiver end of MAIN line terminated in characteristic impedance, stubs off the main not terminated.

7.1.15. Optional Grounding Arrangements

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

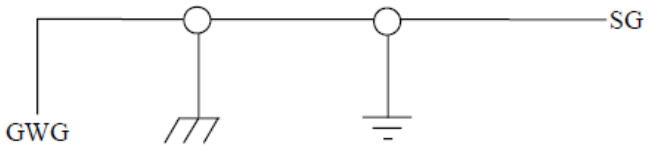
Configuration A)



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Configuration B)



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

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

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8. Lifetime Warranty and Support

To receive the lifetime warranty, you need to register your product with us using our online form.

NB: this must be done within 28 days of purchase.

Lifetime Warranty Sign up

*Terms and Conditions are available online. Standard warranty period is 3 years if a product is not registered.



Since 1983, Brainboxes have designed, tested and manufactured our products all under one roof. One of our greatest strengths is after sales service. Technical Support is provided by members of our Test Team, who know our products inside out and have direct access to the chip and board designers as well as the technicians who built and tested your product.

If you have any issues, questions or suggestions about our Products and Services then please contact us.

Technical support is free*. As long as you have a Brainboxes Product we will be happy to help, even if it's discontinued or out of warranty. Excellent Customer Service, just as it should be.

For the quickest solution to your issue, if you email us, please include as much detail of your setup and the fault you are experiencing.

*Standard rate call charges for phone support apply.

Email

Technical Support: support@brainboxes.com

Sales Enquiry: sales@brainboxes.com

Telephone

You can speak to Brainboxes Support or Sales teams direct.

Monday – Friday, 9am to 5pm (UK Time)

Tel: +44(0)151 220 2500

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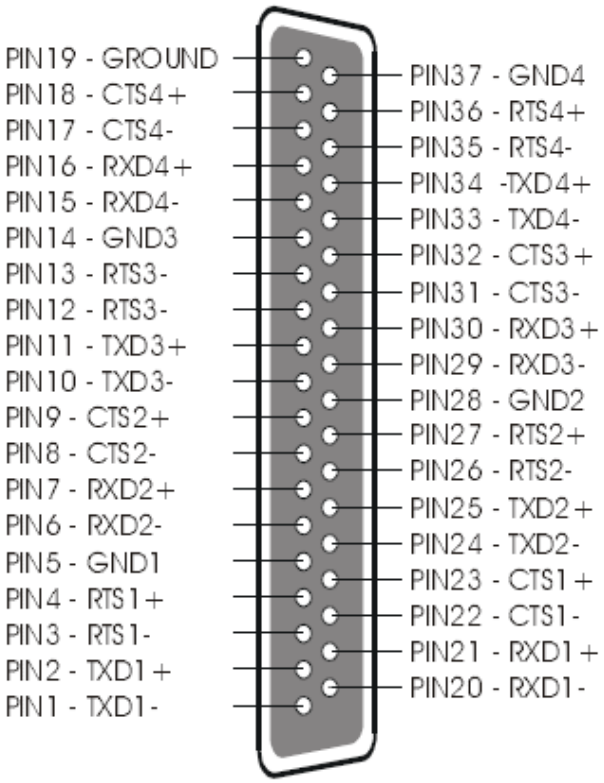
9. Technical Specifications

9.1. Supported Serial Settings

Serial Setting	
Baud Rate	Up to 921,600
Data Bits	5,6,7 or 8
Parity	None, Odd, Even, Mark & Space
Stop Bits	1, 1.5 or 2
Handshaking	RTS/CTS DTR/DSR Xon/Xoff
Break	Supported

9.2. Device Pin-out

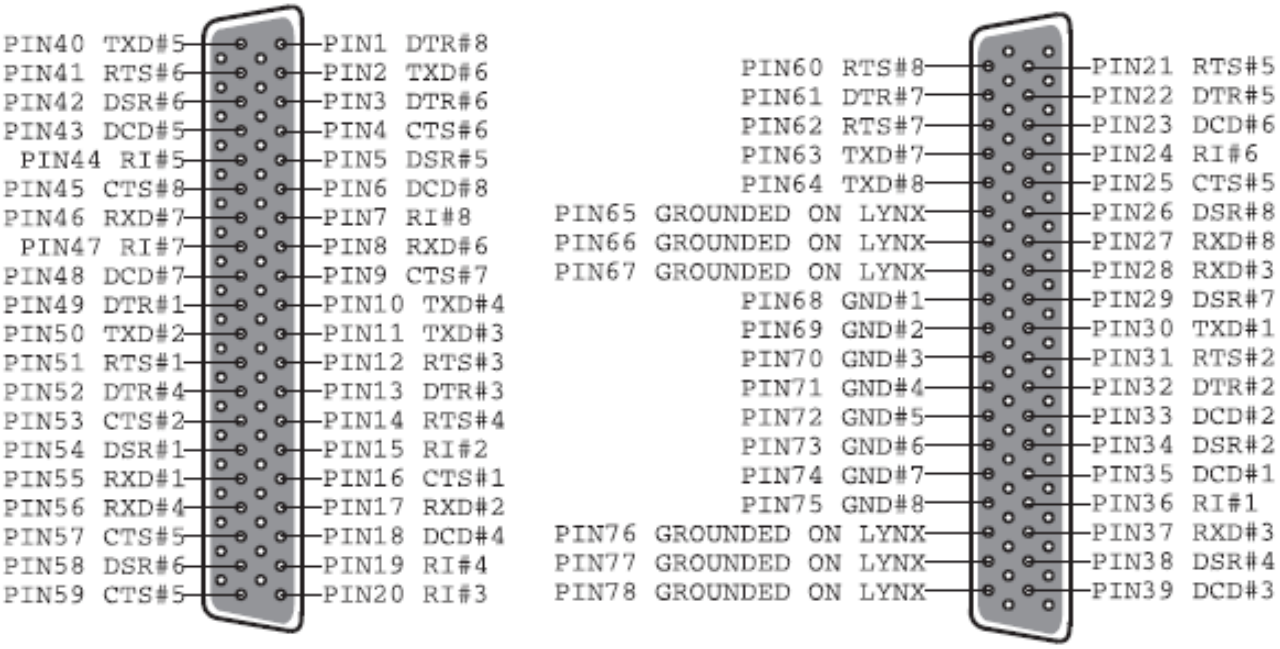
9.2.1. 37 Way D Connector



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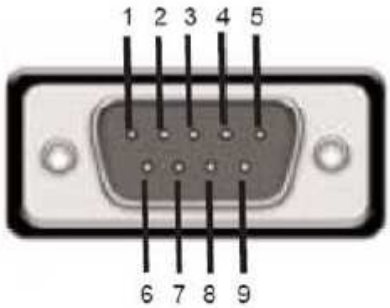
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9.2.2. 78 Way D pin connector



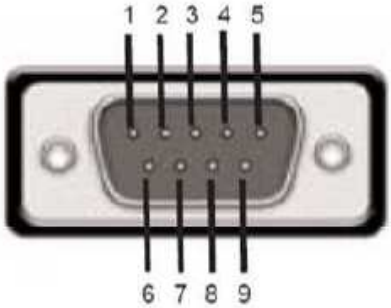
9.2.3. RS232 Devices

Pin 1	:	DCD
Pin 2	:	RXD
Pin 3	:	TXD
Pin 4	:	DTR
Pin 5	:	GND
Pin 6	:	DSR
Pin 7	:	RTS
Pin 8	:	CTS
Pin 9	:	RI



9.2.4. RS422/485 Devices

Pin 1	:	TXD-
Pin 2	:	TXD+
Pin 3	:	RTS-
Pin 4	:	RTS+
Pin 5	:	GND
Pin 6	:	RXD-
Pin 7	:	RXD+
Pin 8	:	CTS-
Pin 9	:	CTS+



PLEASE NOTE:

- DTR/DSR Handshaking is not available on RS422/485 devices
- For RS422 Full Duplex communications, please note outputs above.
- To achieve RS485 Half Duplex communications, using two wires for communication, Pins 1 and 6, 2 and 7 must be physically shorted.

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- Once your wiring is setup, you will also need to set the card to FULL or HALF Duplex mode in the software. For further details, see **Section 3: Product Configuration.**

9.3. Terminating Resistors

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

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

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

The terminating impendence's shown later in the wiring diagrams are automatically provided by the on board resistors and do not have to be added by the user.

9.4. Storage and Operating Environment Guidelines

Storage

Temperature: -10 ˚C to +70 ˚C

Humidity: 8% to 95% non-condensing

Operational

Temperature: 0˚C to +70˚C

Humidity: 20% to 75% non-condensing

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10. Regulatory Approvals / Compliance

For up to date details of global certifications, please check the product datasheet on the Brainboxes website.

10.1. Company Accreditation

Brainboxes achieved accreditation to the ISO 14001 environmental standard early 2008. This globally recognised standard ensures Brainboxes can demonstrate effective management of all its environmental impacts, together with a process of continuous improvement.

Brainboxes have also been an ISO9001 registered company since 1994. This has ensured that all Brainboxes products, right from design to manufacture, have been produced to the highest standards. We operate this Quality Management System through out the company, and it is subject to regular external surveillance visits.

Brainboxes have always been aware of the need to continually review company processes and has been working with National Quality Assurance (www.nqa.com) since 1994, helping the company to create and maintain internationally recognised accreditation standards.

Linked with our Lean and Six Sigma techniques, we believe we have the most reliable products on the market, and to back this up we are offering a Lifetime Warranty* on all our Serial Products.

10.2. Europe – EU Declaration of Conformity

The Serial Solutions devices are designed to conform to the protection requirements of European Council Directive 2004/108/EC

The products are designed to meet the standards detailed below. The Declaration of Conformity and supporting Technical Construction File is available by request from Brainboxes.

EN 55022:1998 A2:2003 Class A	Information technology equipment - Radio disturbance charastics - Limits and methods of measurement
EN 55024:1998 A2:2003 Class A	Information technology equipment - Immunity characteristics - Limits and methods of measurement

10.3. WEEE Directive (Waste Electrical and Electronic Equipment)

The WEEE Directive 2004/96/EC came into force, in the UK, at the beginning of 2007.

Customer Responsibilities

You are encouraged to dispose of WEEE in an environment friendly way.

This can be done through your local civic amenities site, an approved treatment facility or alternatively through a relevant compliance scheme.

Brainboxes' Responsibilities

Brainboxes has a legal responsibility, as producer, to provide a free of charge collection service to our customers for our obligated WEEE.

Brainboxes is defined as a producer under the WEEE regulations because we sell own brand Electrical & Electronic Equipment (EEE) in the UK. Our WEEE Producer Registration Number is WEE/AH0004XR.

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For details of our WEEE recovery service options, please see our Website, or email us at:

weeerecovery@brainboxes.com

10.4. RoHS Compliance

All Brainboxes Serial and Bluetooth products are fully RoHS compliant.

Brainboxes identified at an early stage the importance of rapid compliance to RoHS guidelines and established a project team to actively manage the transition. The initial step in the process was to use our close relationships with suppliers to ensure early access to RoHS compliant components for all of our Bluetooth and Serial Products. In addition, the project team worked to ensure that our manufacturing processes meet all RoHS requirements well in advance of the deadline.

To verify supplier declarations on RoHS compliancy, we have also sent fully built products to an external test house for X-Ray system XDAL. This technique is capable of determining percentages of different elements and is accurate to 0.1% Wt.

RoHS Compliant Brainboxes products have been available since January 2005.

What is the RoHS Directive?

The RoHS directive (2002/95/EC the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment) prohibits the sale of electrical and electronic equipment containing hazardous substances. A list of these hazardous substances includes lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls and polybrominatied diphenylethers. RoHS affects each and every electronics manufacturer, directly or indirectly, regardless of geographical location or the equipment they produce.

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11. Copyright

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