



## **ExpressCard Serial Adapters User's Manual**

**QUATECH**

**SSPXP-100**

**DSPXP-100**

**QSPXP-100**

**SSPXP-200/300**

**DSPXP-200/300**

**QSPXP-200/300**



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## Introduction

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This User's Manual describes how to setup and install your Serial Adapter.

The SSPXP-100, DSPXP-100, and QSPXP-100, respectively, provide one, two, or four independent RS-232 serial ports.

The SSPXP-200/300, DSPXP-200/300, and QSPXP-200/300, respectively, provide one, two or four independent RS-422/485 serial ports. Each of these serial ports can be used as desired for RS-422 or RS-485 communications.

Table 1 - Device port and connection options

Device	Ports	Connection	Device	Ports	Connection
SSPXP-100	1	RS-232	SSPXP-200/300	1	RS-422/485
DSPXP-100	2	RS-232	DSPXP-200/300	2	RS-422/485
QSPXP-100	4	RS-232	QSPXP-200/300	4	RS-422/485

Each adapter uses high-speed UARTs and deep FIFOs, allowing each channel to obtain data rates up to 921.6 kbps. The adapters are Plug-and-Play devices and require no hardware configuration.

## System requirements

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The Serial Adapters are supported under the Windows XP (and later) operating systems.

## Installing the Serial Adapter

**Caution!** *Be sure to allow the installation process to finish without interruption.*

This section explains how to install the Serial Adapter under different operating systems. Please locate and follow the procedure for your computer's operating system.

The Serial Adapter includes Windows device drivers that enable the serial ports to appear to Windows as standard COM ports.

### Installing under Windows XP

Follow these steps to install the adapter under Windows XP.

Step	Procedure	Description
❑ Step 1	Turn on the power to your computer system.	<i>This is the system in which the device is to be installed.</i>
❑ Step 2	Plug the ExpressCard into an available ExpressCard slot on the computer.	<i>Windows tells you that it has found new hardware and launches the Found New Hardware Wizard.</i>

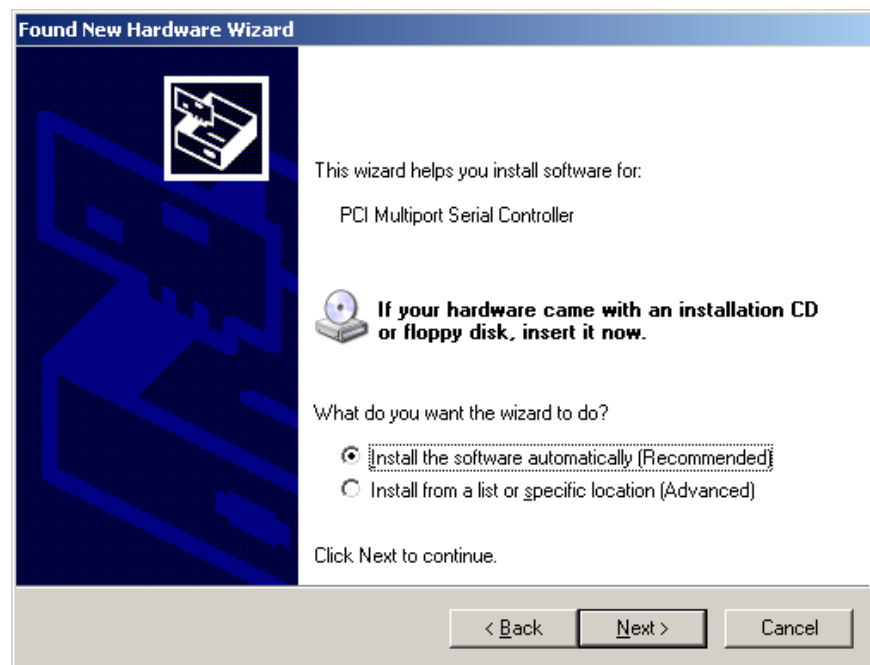
Figure 1 - Windows XP Found new hardware prompt

Figure 1 illustrates the Windows XP Found new hardware prompt. The Found New Hardware Wizard launches automatically when you first plug in the Serial Adapter.



Step	Procedure	Description
❑ Step 3	When the “welcome to the found new hardware wizard” appears, select the “No, not this time” option	<i>Please do NOT allow Windows Update to search for the software on the internet.</i>
❑ Step 4	Click the Next button	<i>Windows will continue to the next step.</i>

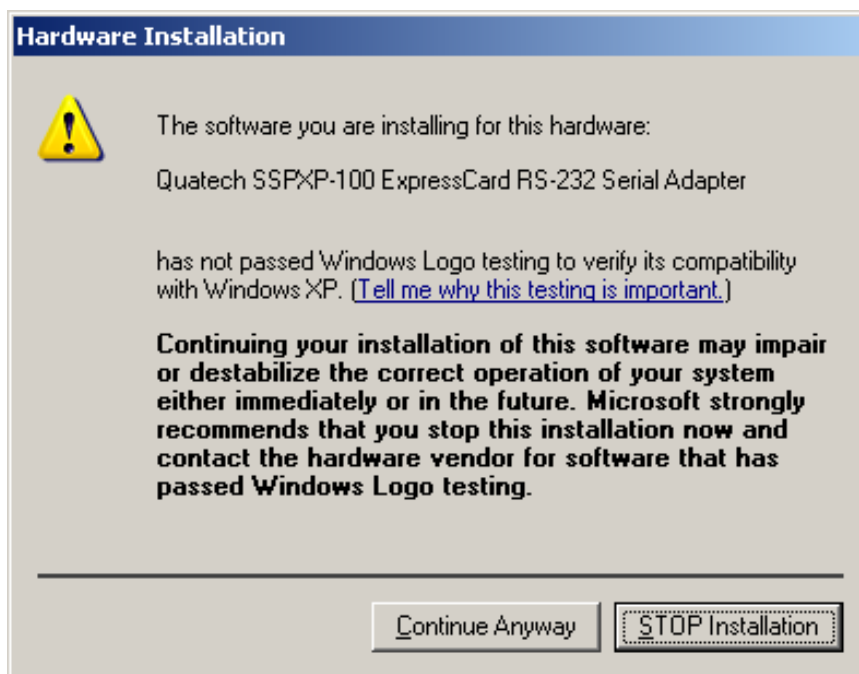
Figure 2 - Windows XP Choose your installation options prompt



	Procedure	Description
❑ Step 5	Insert the installation CD into your CD-ROM drive.	<i>This is the CD that shipped with the product.</i>
❑ Step 6	Select the “install automatically (Recommended)” option.	<i>The installation options prompt displays.</i>
❑ Step 7	Click the Next button.	<i>Windows searches for drivers for the adapter.</i>

Figure 3 - Windows XP “software has not passed Windows logo testing” prompt

Figure 3 illustrates the “software has not passed Windows logo testing” prompt. This prompt will only appear in the case of a new unsigned driver.



Step	Procedure	Description
□ Step 8	In the case of a new unsigned driver, the “software has not passed Windows logo testing” prompt will appear. Please click the [Continue Anyway] button to continue with the installation.	<i>Windows displays a warning prompt if the software drivers are not signed with the Windows logo. New drivers have been tested at our lab facilities, but may not yet have received the official logo from Microsoft.</i>
□ Step 9	The Wizard locates and starts to install the necessary software.	<i>The “wait while the Wizard installs the software” prompt displays (fig.4), followed by the “Finished installing” prompt (fig.5).</i>



Figure 4 - Windows XP “please wait” message

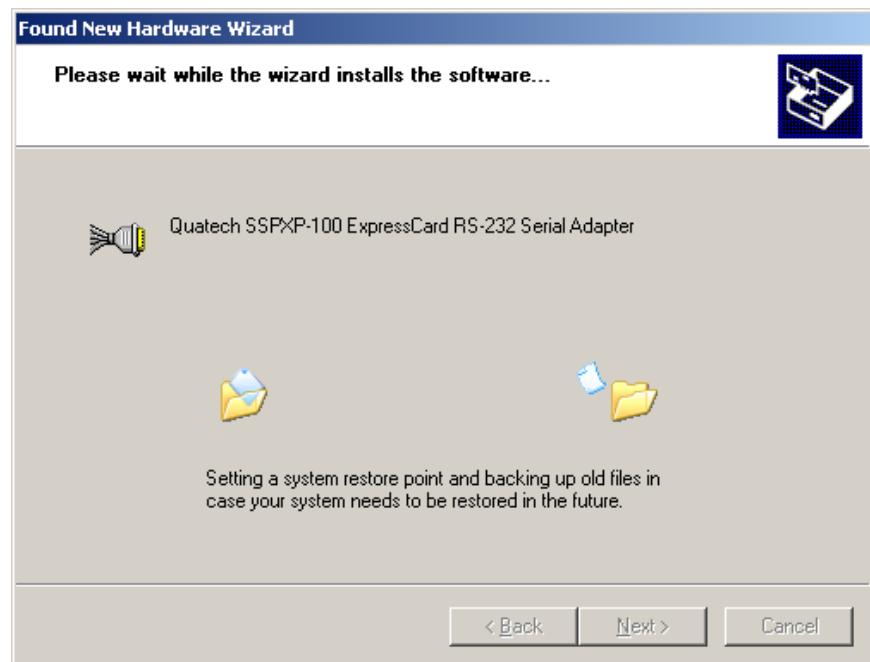


Figure 5 - Windows XP Finished installing prompt



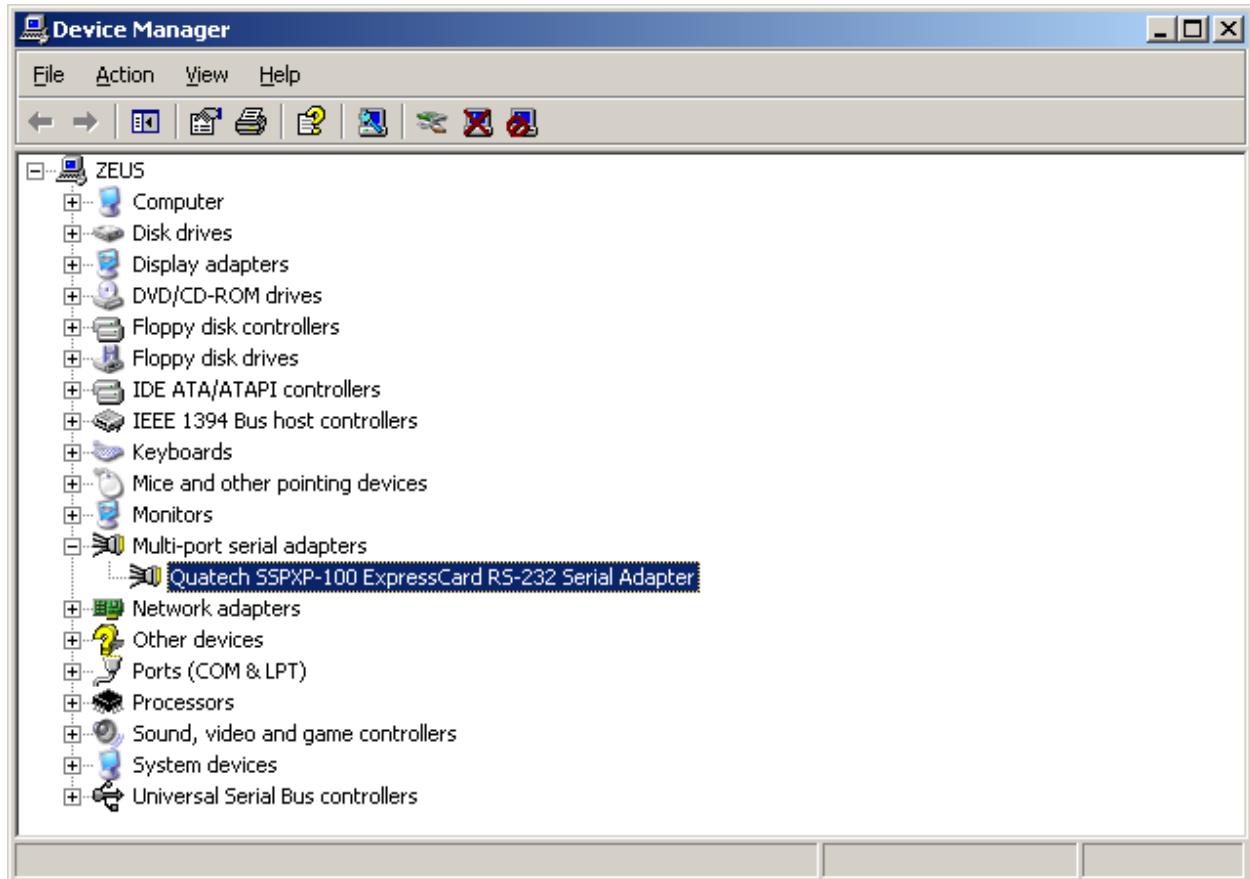
Step	Procedure	Description
□ Step 10	Press the Finish button to continue.	<i>The ExpressCard Adapter installation is complete.</i>

## Uninstalling under Windows XP

Follow these steps in the event that you need to uninstall or reinstall the Serial software.

1. From the Control Panel, select System.
2. Press the Hardware tab.
3. Click on Device Manager.

Figure 6 - Device Manager



4. Scroll down to Multi-port serial adapters and expand.
5. Highlight your Serial Adapter; for example, SSPXP-100 ExpressCard RS-232 Serial Adapter.
6. Select the Action menu option.
7. Select Uninstall from the drop down menu.
8. Click OK at the Confirmation screen. Note that this also removes all the serial ports associated with your Serial Adapter.

## Installing under Windows Vista

Follow these steps to install the adapter under Windows Vista.

Step	Procedure	Description
❑ Step 1	Turn on the power to your computer system.	<i>This is the system in which the device is to be installed.</i>
❑ Step 2	Plug the ExpressCard into an available ExpressCard slot on the computer.	<i>Windows tells you that it has found new hardware and launches the Found New Hardware Wizard.</i>

Figure 7 - Windows Vista "Found new hardware" prompt

Figure 7 illustrates the Windows Vista Found new hardware prompt. The Found New Hardware Wizard launches automatically when you first plug in the Serial Adapter.

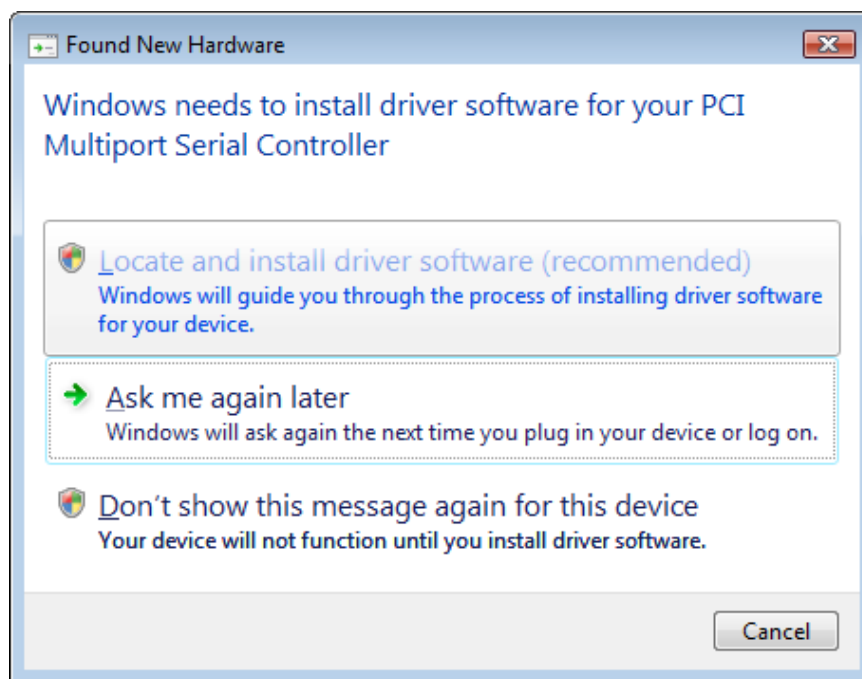
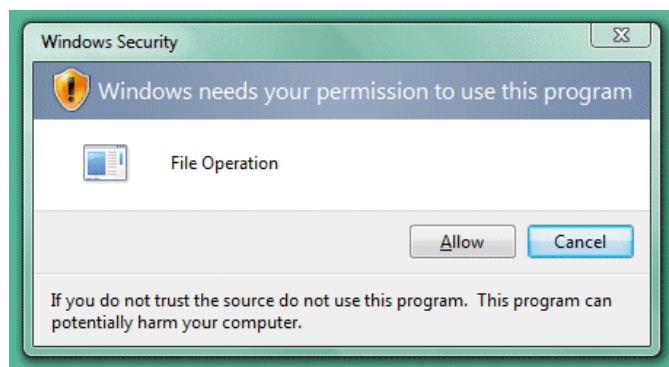


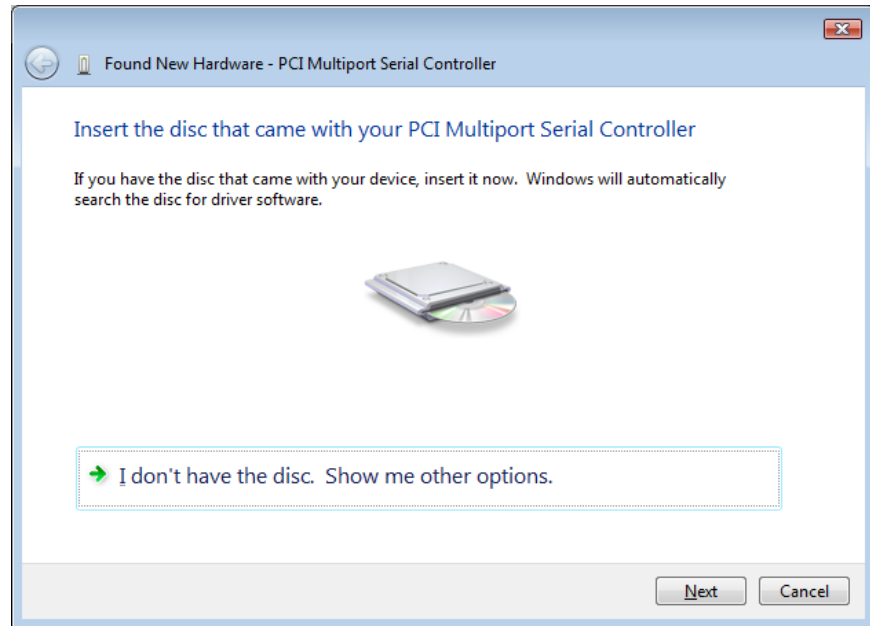
Figure 8 - "Windows needs your permission to use this program" prompt



Step	Procedure	Description
------	-----------	-------------

- |          |   |  |
|----------|---|--|
| □ Step 3 | When the “welcome to the found new hardware wizard” appears, select the “Locate and install driver software (recommended)” option | <i>Windows will pop-up the next prompt.</i>    |
| □ Step 4 | When the “Windows needs your permission to use this program” prompt appears, select [allow] to continue with the installation.    | <i>Windows will continue to the next step.</i> |

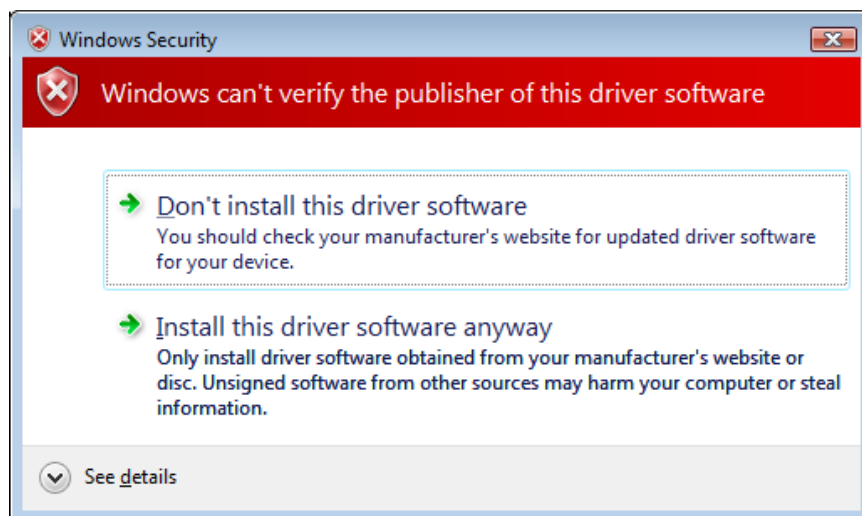
Figure 9 - Windows Vista "Insert the disc that came with your hardware" prompt



	Procedure	Description
□ Step 5	Insert the installation CD into your CD-ROM drive.	<i>This is the CD that shipped with the product.</i>
□ Step 6	Click the Next button	<i>Windows searches for drivers for the adapter.</i>

Figure 10 - Windows Vista “Windows can't verify the publisher of the driver software” prompt

Figure 10 illustrates the “Windows can't verify the publisher of the driver software” prompt. This prompt will only appear in the case of a new unsigned driver.



Step	Procedure	Description
□ Step 7	In the case of a new unsigned driver, the “Windows can't verify the publisher of the driver software” prompt will appear. Please click on [Install this driver software anyway] to continue with the installation.	Windows displays a warning prompt if the software drivers are not signed with the Windows logo. New drivers have been tested at our lab facilities, but may not yet have received the official logo from Microsoft.
□ Step 8	The Wizard locates and starts to install the necessary software.	The “wait while the Wizard installs the software” prompt displays (fig.11), followed by the “Finished installing” prompt (fig.12).

Figure 11 - Windows Vista "Installing driver software" message

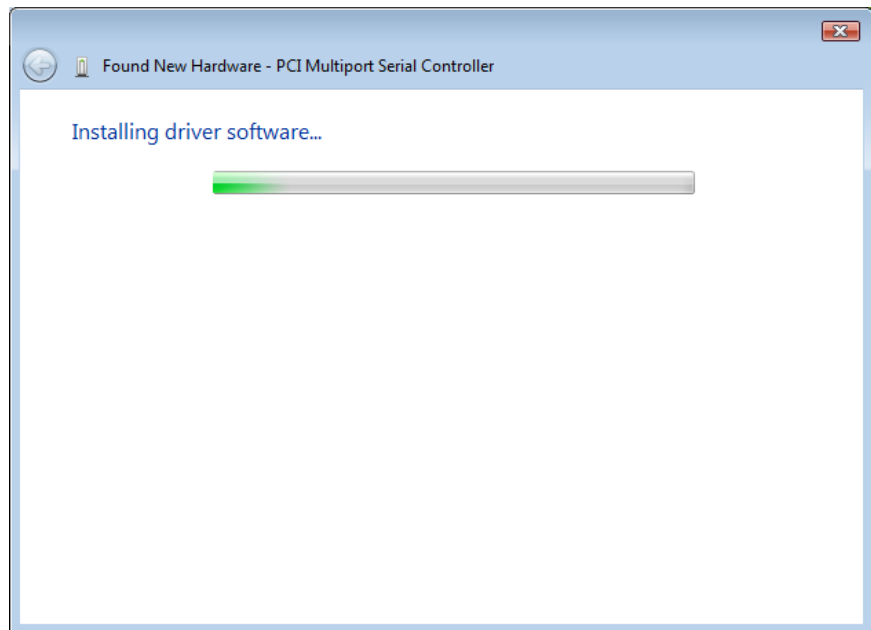
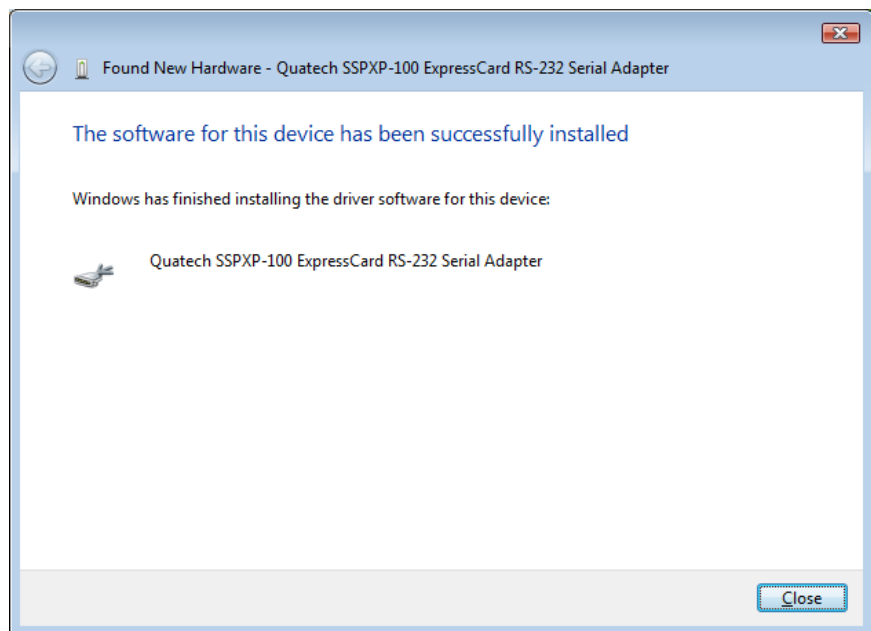


Figure 12 - Windows Vista "The software has been successfully installed" prompt



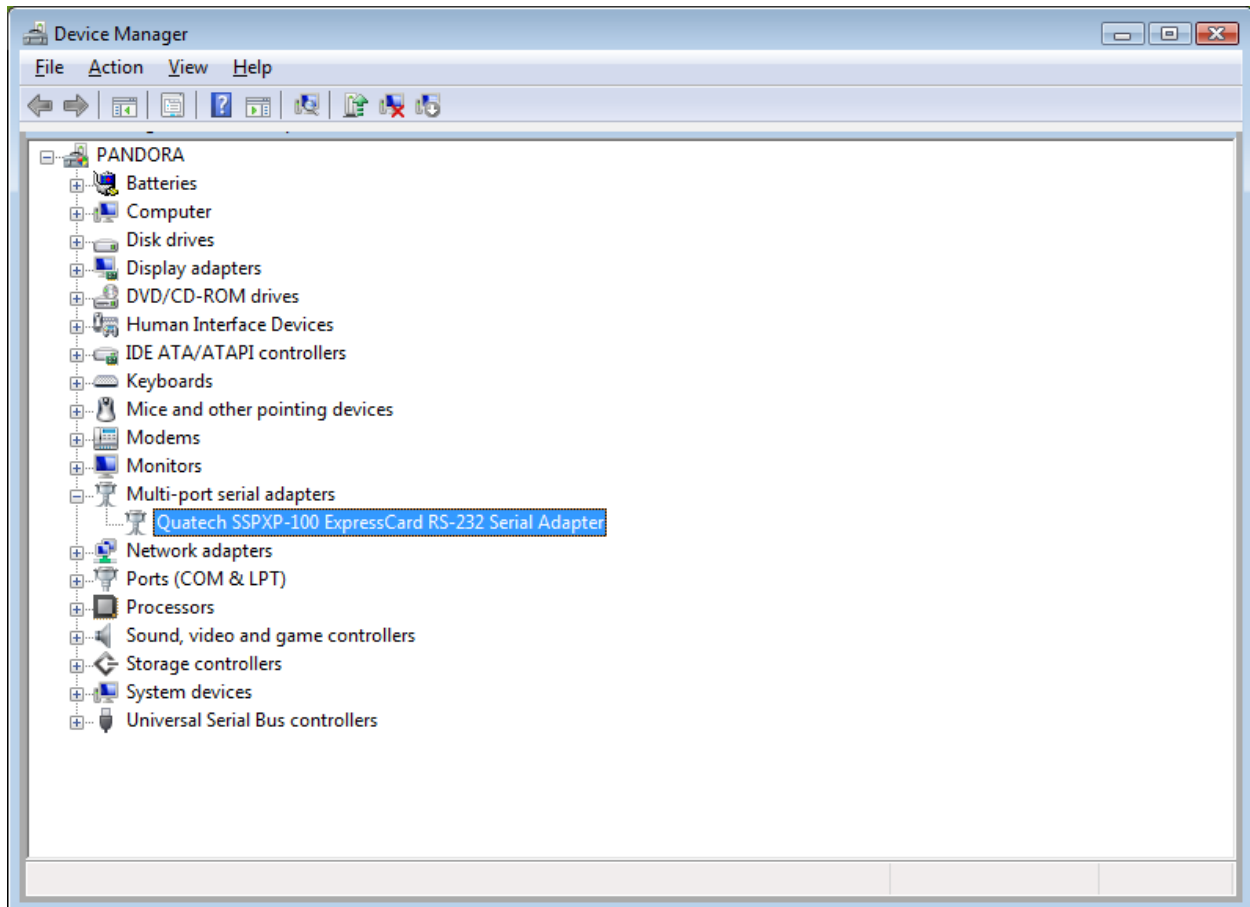
Step	Procedure	Description
□ Step 9	Press the Close button to continue.	<i>The ExpressCard Adapter installation is complete.</i>

## Uninstalling under Windows Vista

Follow these steps in the event that you need to uninstall or reinstall the Serial software.

1. From the Control Panel, select System.
2. Select "Classic view".
3. Click on Device Manager.
4. When the security prompt appears, click [allow] to continue.

Figure 13 - Device Manager



5. Scroll down to Multi-port serial adapters and expand.
6. Highlight your Serial Adapter; for example, SSPXP-100 ExpressCard RS-232 Serial Adapter.
7. Select the Action menu option.
8. Select Uninstall from the drop down menu.
9. Click OK at the Confirmation screen. Also click the check-box to remove the driver software. Note that this also removes all the serial ports associated with your Serial Adapter.

## Making external connections

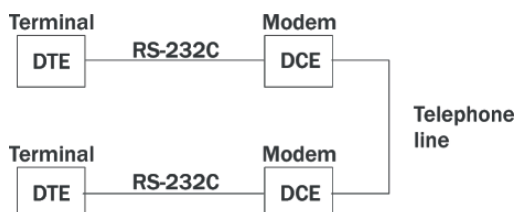
The Serial Adapters are equipped with male DB-9 connectors for RS-232 and with female DB-9 connectors for RS-422/485. The following figures and tables show the serial port pinouts for RS-232 and RS-422/485 applications.

### RS-232 serial connections

RS-232 devices are classified by their function as either Data Terminal Equipment (DTE) or Data Communication Equipment (DCE).

*Note: A DTE device is the communication source. A DCE device provides a communication channel between two DTE-type devices.*

Figure 14 - Use of DTEs and DCEs in a communication link

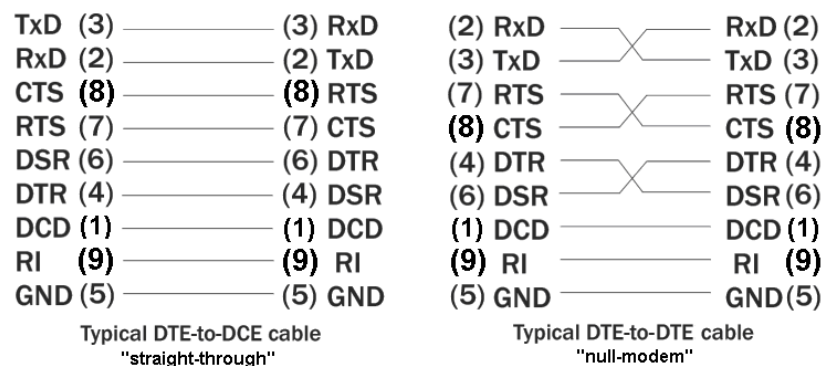


*Note: In many applications, DCEs are unnecessary. This allows you to use a null modem cable (modem eliminator cable) to directly connect two DTE-type devices.*

DTE- and DCE-type devices have complementary pinouts that allow terminals and modems to connect directly using a one-to-one cable as shown in Figure 15. Two DTE-type devices can be connected by a null modem cable. A typical null modem cable is also shown in the figure.

Figure 15 - Cabling requirements for RS-232 devices

*Figure 15 illustrates the RS-232 pinouts for typical DTE-to-DCE and DTE-to-DTE cables with 9-pin connectors.*





The Serial Adapters are DTE devices that connect to peripheral equipment through a male DB-9 connector. The following table lists the serial port connector definitions.

Figure 16 - RS-232 DB-9 pin designations

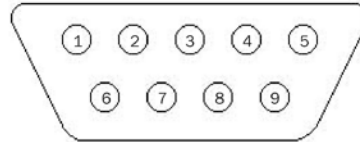


Table 2 - RS-232 DB-9 signal definitions

RS-232 signal description	DB-9 pin
Data Carrier Detect (DCD)	1
Receive Data (RxD)	2
Transmit Data (TxD)	3
Data Terminal Ready (DTR)	4
Signal Ground	5
Data Set Ready (DSR)	6
Request To Send (RTS)	7
Clear To Send (CTS)	8
Ring Indicate (RI)	9

## RS-422/485 serial connections

*Note: Please refer to Setting Advanced Options in the section on Using Device Manager for details on software-selectable advanced options for RS-422/485.*

The Serial Adapters provide four differential communication signals (either RS-422 or RS-485) per channel. Transmit Data (TxD) and Auxiliary Output (AuxOut) are the two output signals. Receive Data (RxD) and Auxiliary Input (AuxIn) are the two input signals. The adapters also provide a ground signal.

The AuxOut pair can carry the UART's RTS signal. The AuxIn pair can carry the UART's CTS signal. Alternatively, the AuxOut pair can be configured to internally loopback to the AuxIn pair, with the UART's RTS signal also looped back to its CTS signal. The signals are available to connect to peripheral devices through a female DB-9 connector. The following table shows the RS-422/485 connector definitions.

Figure 17 - RS-422/485 DB-9 pin designations

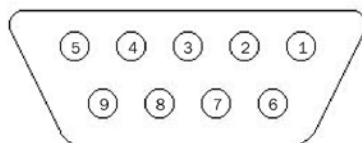


Table 3 - RS-422/485 DB-9 signal definitions

RS-422/485 signal description	DB-9 pin
Auxiliary Output (AuxOut+)	1
Transmit Data (TxD+)	2
Signal Ground	3
Receive Data (RxD+)	4
Auxiliary Input (AuxIn+)	5
Auxiliary Output (AuxOut-)	6
Transmit Data (TxD-)	7
Receive Data (RxD-)	8
Auxiliary Input (AuxIn-)	9

## Testing serial ports in HyperTerminal

This section explains how to test the functionality of your Serial Adapter using HyperTerminal.

An RS-232 loopback connector is included with adapters with a model number ending in "100". An RS-422/485 loopback is included with adapters with a model number ending in "200/300".

### Running Hyperterminal

Step	Procedure	Description
❑ Step 1	Attach the loopback connector to the DB-9 connector.	<i>Be sure to use the correct loopback connector for RS-232 or RS-422/485.</i>
❑ Step 2	Launch HyperTerminal.	<i>In Windows, select Programs/ Accessories/ Communications/ HyperTerminal.</i>
❑ Step 3	Create a new session.	<i>When prompted, give the session any name you wish.</i>
❑ Step 4	Select the COM # associated with port 1 from the drop down list.	<i>You are now set up to test the first serial port.</i> <i>Note: Leave all settings at default.</i>
❑ Step 5	With the session open, type any text.	<i>If the text you type is echoed on the screen, the port is functioning properly.</i>
❑ Step 6	Close the session.	
❑ Step 7	Repeat steps 3 through 6 for each serial port.	<i>If the text you type is echoed on the screen, the port is functioning properly.</i>

## Using Device Manager

This section explains how to use Device Manager to view the properties of the serial ports enumerated by the Serial Adapter.

### Accessing Device Manager

Step	Procedure	Description
□ Step 1	Select Start – Control Panel.	
□ Step 2	Double click the System icon.	<i>The System Properties dialog box opens.</i>
□ Step 3	Click the Hardware tab, and then press the Device Manager button.	<i>Device Manager lists all the hardware devices that are registered inside the Windows registry.</i>

### Exploring Device Manager screens

#### Windows XP / Vista

Device Manager provides two property dialogs that apply to the Serial Adapter.

- Ports (COM & LPT) device group property box
- Multi-port serial adapters device group property box

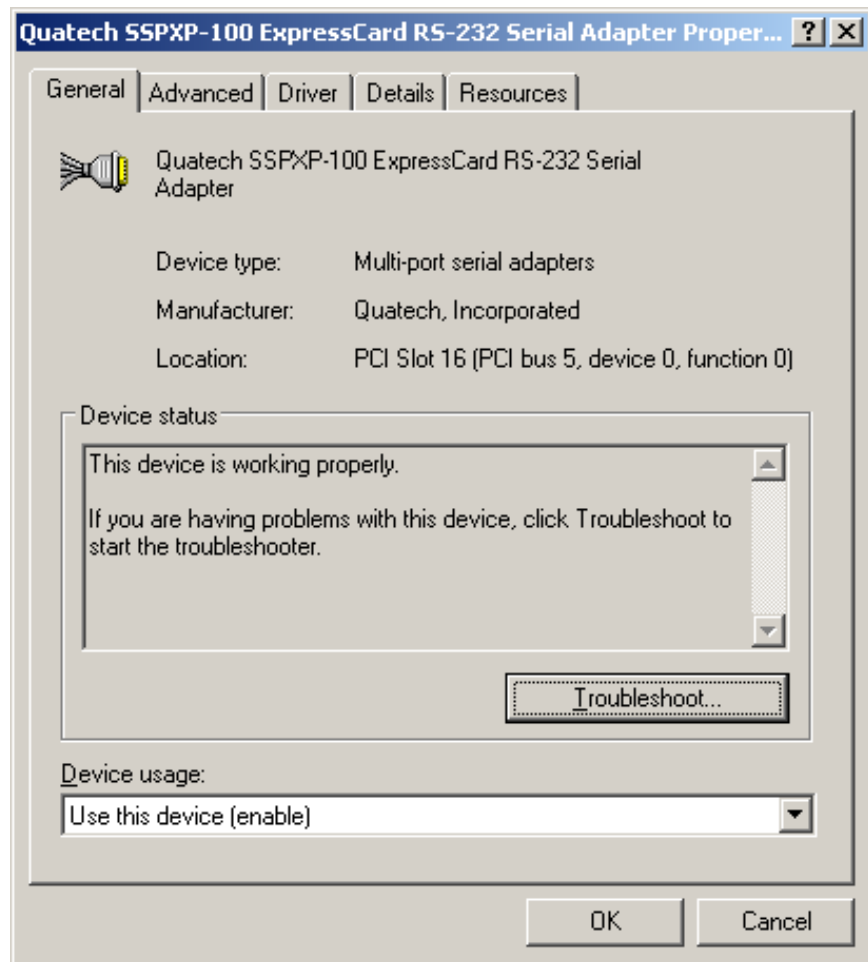
Use the Ports (COM & LPT) device group property box to view and set the port settings and to view device usage and driver information for the serial ports. Use the Multi-port serial adapters device group property box to view and set the advanced options and to view device usage and driver information for the Serial Adapter.

Vista Users, please note that aside from some aesthetic changes, the on-screen displays are virtually identical to the ones shown from XP.

Step	Procedure	Description
□ Step 1	With Device Manager open, expand the Multi-port serial adapters device group.	<i>Your Serial Adapter should appear in the list – for example, SSPXP-100 ExpressCard Adapter (see fig.6)</i>
□ Step 2	Double click the Serial Adapter.	<i>The Properties dialog box opens and displays the General tab.</i>

Figure 18 - Windows XP Device Manager - Adapter properties, General tab

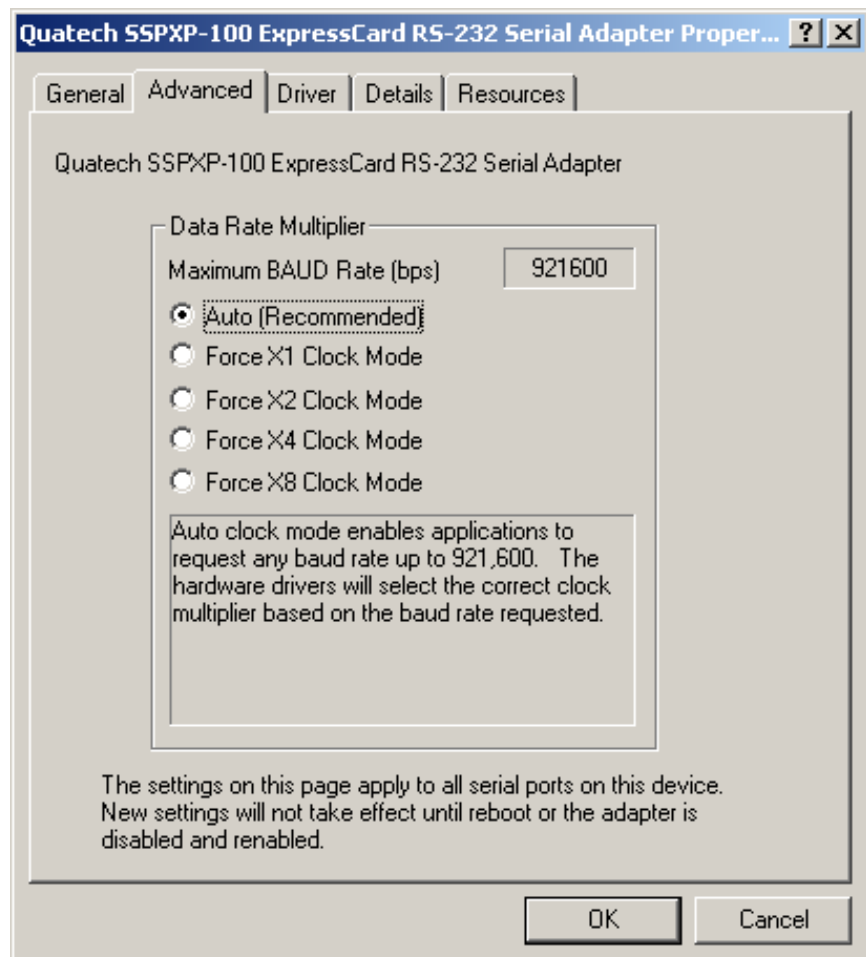
Figure 18 illustrates the Adapter Properties, General Tab which tells you whether the Adapter is working properly



Step	Procedure	Description
□ Step 3	Click the ExpressCard Serial Ports Advanced Options tab to view the port setting properties.	<i>The Advanced Options dialog box displays.</i>

Figure 19 - Windows XP Device Manager - Adapter properties, Advanced tab

Figure 19 illustrates the Serial Adapter, Advanced Options Tab for RS-232 devices.



Step	Procedure	Description
□ Step 4	The ExpressCard Serial Port Advanced Options Tab allows you to force a clock multiplier to increase the effective maximum data rate with some legacy applications. The clock rate will be applied to all serial ports on the card Additional RS-422/485 Advanced Option Settings are available for each individual port and will allow you to set the connector signals selection and the duplex mode, and receiver control.	<i>See the Setting advanced options section for details.</i>
□ Step 5	Click Cancel to close the property box.	
□ Step 6	With Device Manager open, expand the Ports (COM & LPT) device group.	<i>The ports associated with the Serial Adapter should appear in the list of ports.</i>
□ Step 7	Double click the desired port.	<i>The ExpressCard Serial Port Properties dialog box opens and displays the General tab.</i>
□ Step 8	Click the Port settings tab.	<i>The Port Settings dialog box displays.</i>

Figure 20 - Windows XP Device Manager - Serial Port, General Tab

Figure 20 illustrates the Serial Port, General Tab, which tells you whether the selected port is working properly.

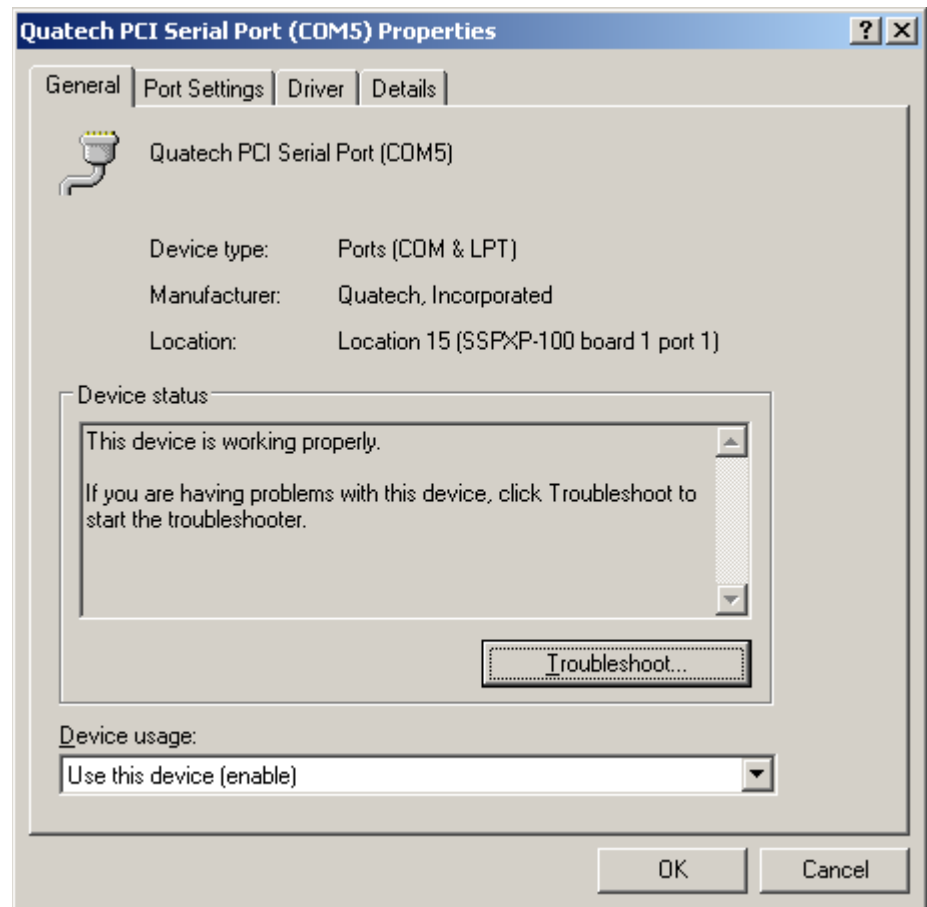
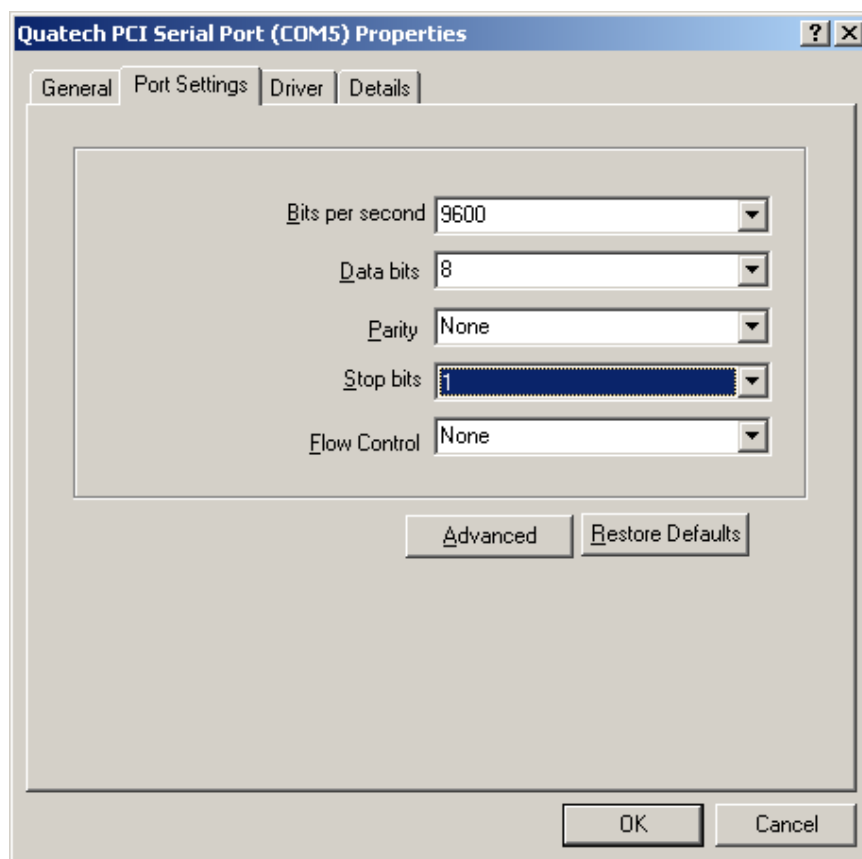




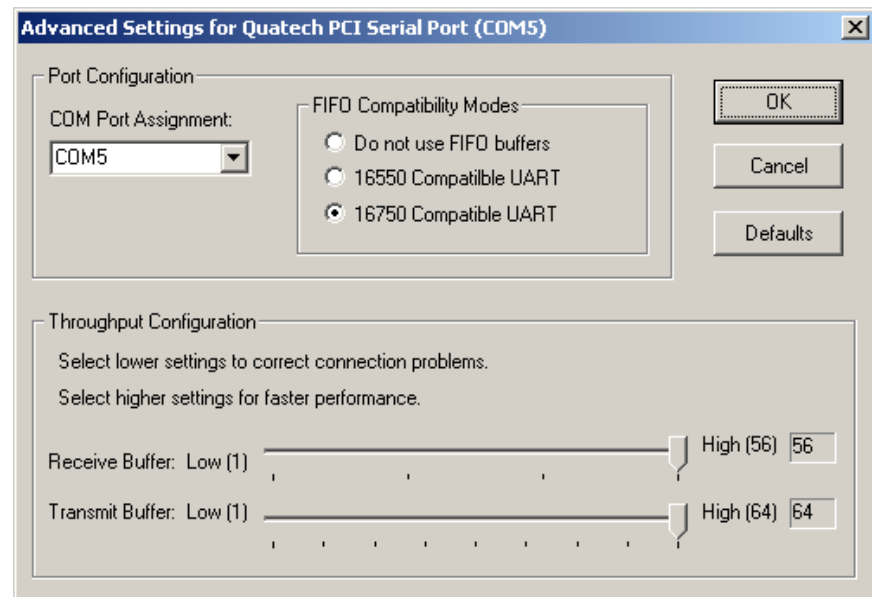
Figure 21 - Windows XP Device Manager - Serial Port, Port settings tab

Figure 21 illustrates the Serial Port, Port Settings Tab.



Step	Procedure	Description
❑ Step 9	This Port Settings tab allows you to set default values for the following: <ul style="list-style-type: none"> <li>➤ Bits per second</li> <li>➤ Data bits</li> <li>➤ Parity</li> <li>➤ Stop bits</li> <li>➤ Flow control</li> </ul>	<i>Most applications do not make use of these default settings, but prefer to make their own settings.</i> <i>See the Setting advanced options section for details.</i>
❑ Step 10	Press the Advanced button.	<i>The Advanced Options dialog box opens.</i>

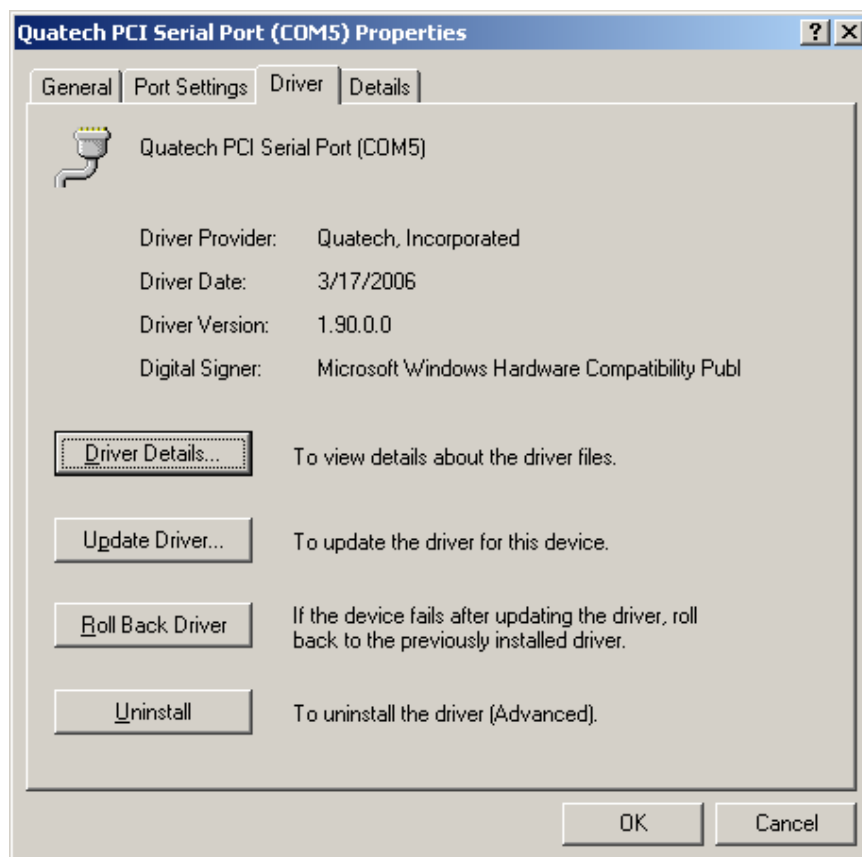
Figure 22 - Windows XP Device manager - Serial Port, Advanced settings box



Step	Procedure	Description
□ Step 11	Use the drop down box to select the port whose settings you wish to change. Click OK or Cancel to return to the Port Settings tab.	
□ Step 12	Click the Driver tab to view the driver information and update the driver.	<i>The ExpressCard Serial Driver properties dialog box displays.</i>

Figure 23 - Windows XP Device Manager - Serial Port, Driver tab

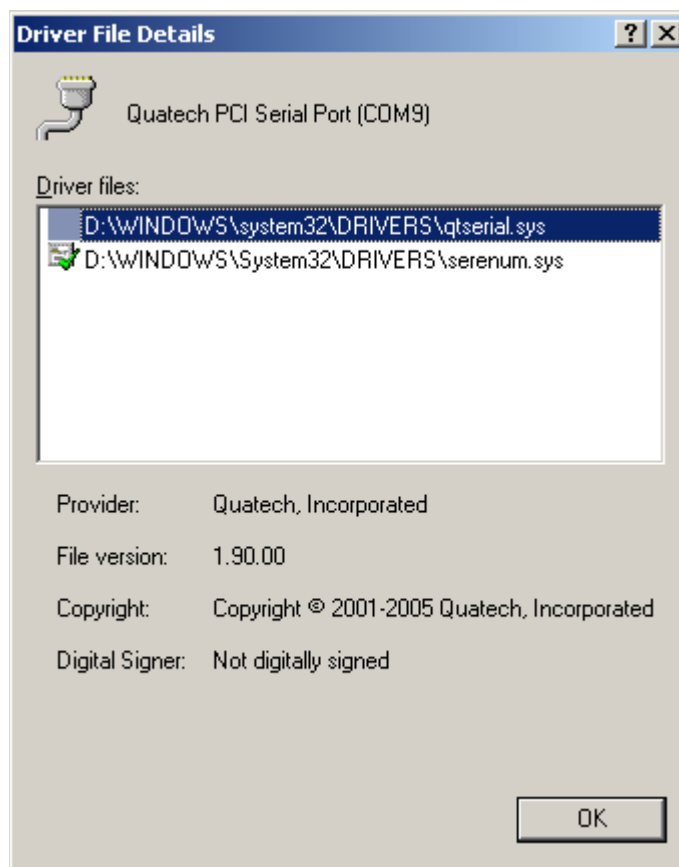
Figure 23 illustrates the Serial Port, Driver Tab, which lets you view the driver details and update, roll back, or uninstall the driver.



Step 7, l/.	Procedure	Description
<p>❑ <b>Step 13</b></p> <p>You have several options:</p> <ul style="list-style-type: none"> <li>➤ View detailed driver information</li> <li>➤ Update the device drivers</li> <li>➤ Uninstall your Serial Adapter.</li> <li>➤ Return to the previously installed driver. (XP only)</li> <li>➤ Save your changes and exit.</li> <li>➤ Abandon your changes and return to the Device Manager.</li> </ul>		<p>See below.</p> <p>Don't use this option. Uninstall the entire device instead by using the Driver dialog for the multiport serial adapter.</p>
<p>❑ <b>Step 14</b></p> <p>Click the Driver Details button to view detailed driver information.</p>		<p>The Driver File Details dialog box opens. See the following figure.</p>

Figure 24 - Windows XP Device manager - Serial Port, Driver file details box

Figure 24 illustrates the Driver Details dialog, which tells you the name and location of the driver files, the provider, file version, copyright date, and the digital signature status of the driver.



Step	Procedure	Description
□ Step 15	<p>The Driver File Details dialog box displays the following information</p> <ul style="list-style-type: none"> <li>➤ Provider</li> <li>➤ File version</li> <li>➤ Copyright</li> <li>➤ Digital Signer (Windows XP only)</li> </ul> <p>Click OK to return to the Driver tab.</p>	<p><i>B&amp;B Electronics is the provider of the driver.</i></p> <p><i>This is the version number of the installed software.</i></p> <p><i>Copyright date and holder</i></p> <p><i>Indicates whether Microsoft has approved this version.</i></p>
□ Step 16	Click Cancel to close the dialog.	

## Setting advanced options

The Serial port advanced properties can be altered from the Device Manager window. Options for each serial port can be individually controlled.

Changes are applied:

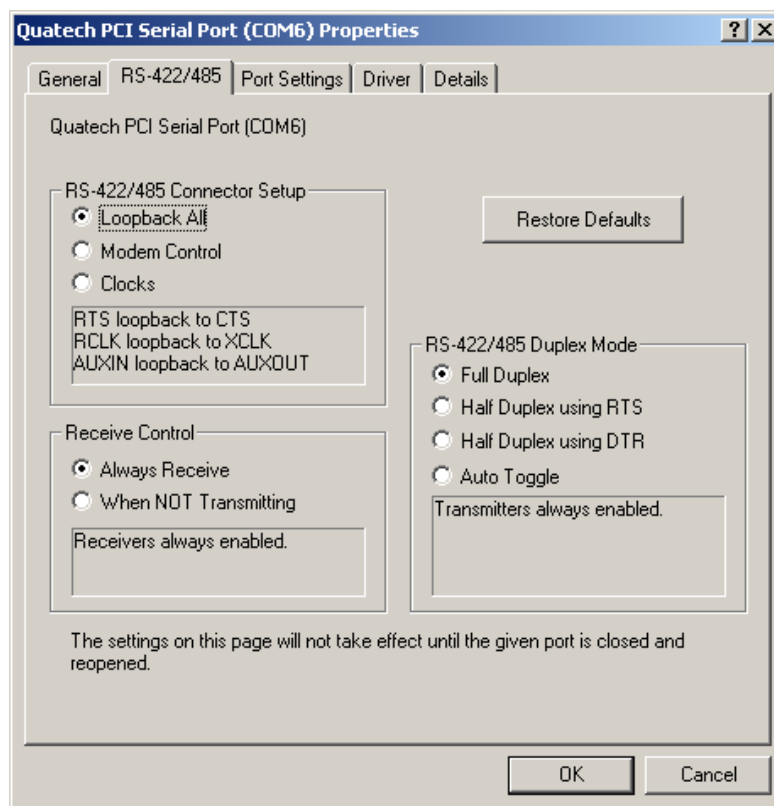
- To all serial ports when the Serial Adapter is unplugged from the ExpressCard slot and plugged back in,

OR

- To a single port the next time an application opens the serial port.
- If an application already has a port open, it must be closed and re-opened for the changes to take affect.

## Operating Mode (RS-422/485 adapters only)

Figure 25 - Windows XP Device Manager - Serial Port, RS-422/485 tab



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**RS-422/485 Full Duplex (4-wire)**

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This mode allows simultaneous transmit and receive operation. Transmit and receive data move over separate dedicated pairs of conductors in the attached cable. Each UART's transmit drivers are always active in this mode. The AuxOut/AuxIn signals are also available in 4-wire mode.

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**RS-422/485 Half Duplex (2-wire) Auto-Toggle**

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*Note: The Auto-Toggle mode is the best choice for most half-duplex scenarios. It offers the best performance and the best ease-of-use.*

This mode only permits data to flow in one direction at a time. Transmit and receive operations share a single pair of conductors in the attached cable. This configuration is often referred to as "multidrop."

The transmit drivers are automatically enabled before data is transmitted, then disabled immediately after all data has been transmitted. This feature is implemented in hardware for near-instantaneous response.

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**RS-422/485 Half Duplex (2-wire) RTS control**

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The half-duplex operation is the same as in the Auto-Toggle mode, except that the RTS signal is used to control the transmit drivers instead of the automatic control.

The software application can disable the port's transmit drivers by deasserting the UART's RTS output. To allow transmission again, the software application must assert the RTS output.

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**RS-422/485 Half Duplex (2-wire) DTR control**

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This mode operates the same as Half Duplex using RTS, except that the UART's DTR output is used.

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## Receiver Control (RS-422/485 adapters only)

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In RS-422/485 half-duplex operating modes, the serial port's receivers can be set to be active all the time or to be active only when the port is not transmitting. The desired choice is selected from the dropdown box.

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### Always (default)

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Select this option to force the receivers to be active all the time. This selection will cause the receiver to hear the echo of whatever the serial port transmits.

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### Only when not transmitting

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This selection is useful for scenarios where the serial port should not hear the echo of its own transmissions. The receivers will be disabled whenever the serial port transmits data.

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## Connector Set-up : AuxOut/AuxIn (RS-422/485 adapters only)

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This setting determines which signals are routed to the AuxIn and AuxOut pins of the serial port connectors. Regardless of which setting is chosen, each UART's DTR output is internally looped back to its own DSR, DCD, and RI inputs.

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### Loopback (default)

---

Select this choice when only transmit and receive data signaling is required.

- Each UART's RTS output is internally looped back to its CTS input.
- Each port's AuxIn signal pair is looped back to its AuxOut signal pair at the connector.

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### Modem Control

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Select this choice when hardware flow control is required.

- Each UART's RTS output and CTS input are routed to the AuxOut and AuxIn signal pairs, respectively.

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### Clocks

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Select this choice when it is necessary to connect together two ports at different baud rates. In order to properly function, both ports must support and have the feature enabled.

- Each UART's RTS output and CTS input are looped back together.
- The UART's transmit clock (TClk) is fed out to the AuxOut line.
- The UART's receive clock (RClk) is fed in from the AuxIn line.

## Troubleshooting

*Note: Any unauthorized repairs or modifications will void the adapter's warranty.*

This section lists some common problems and their causes. If the information below does not provide a solution, contact B&B Electronics technical support.

Problem	Cause	Solution
The Serial Adapter cannot communicate with other equipment.	➤ The card is not seated properly.	1. Check the card to make sure that it is firmly seated in the card slot.
	➤ The device driver is not installed.	1. Double check the Device Manager per the instructions in Using Device Manager to ensure that drivers are installed correctly and that all devices are working properly. 2. Try uninstalling the ExpressCard Adapter from the Device Manager window and then repeat the hardware installation instructions.
	➤ The ExpressCard port is faulty.	1. If possible, connect a known good ExpressCard device to the PC and see if it operates properly.

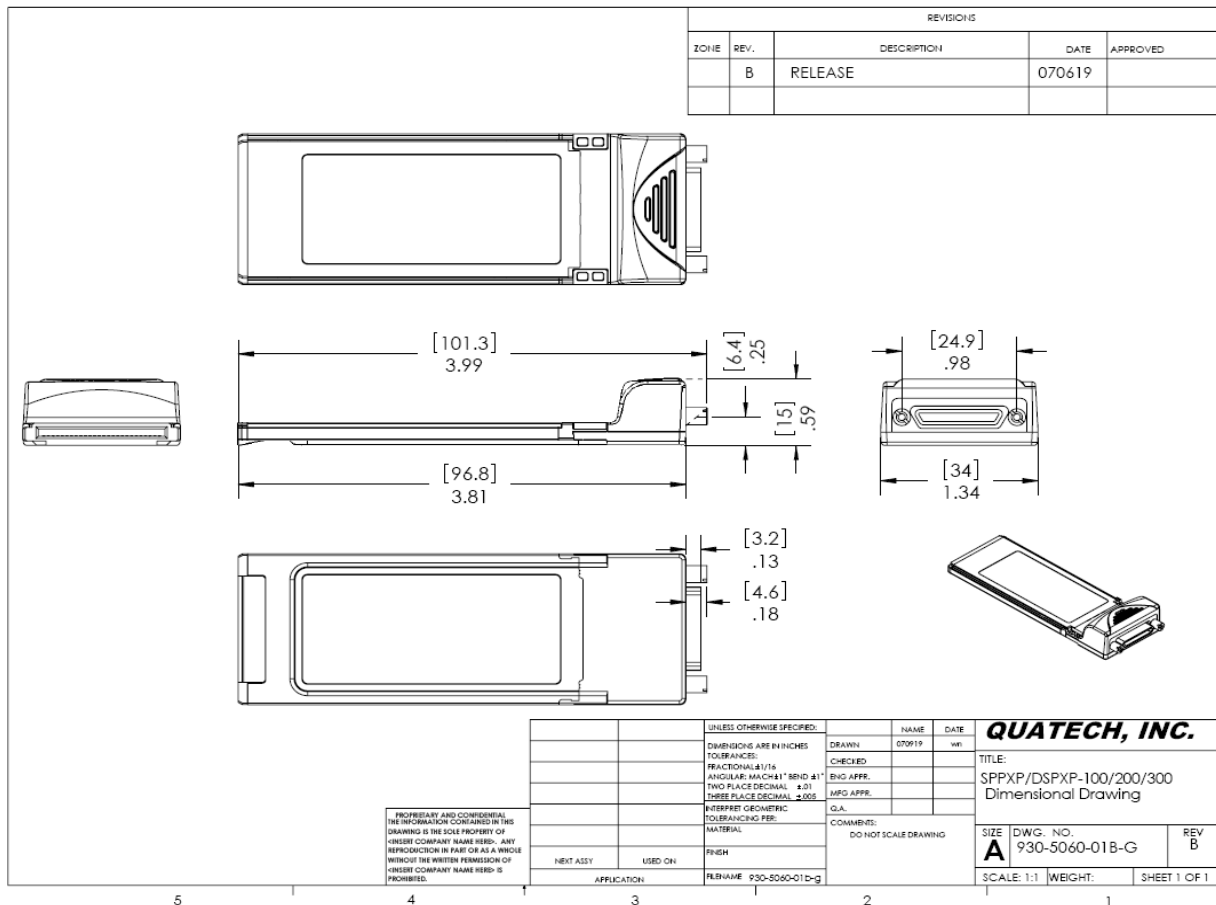
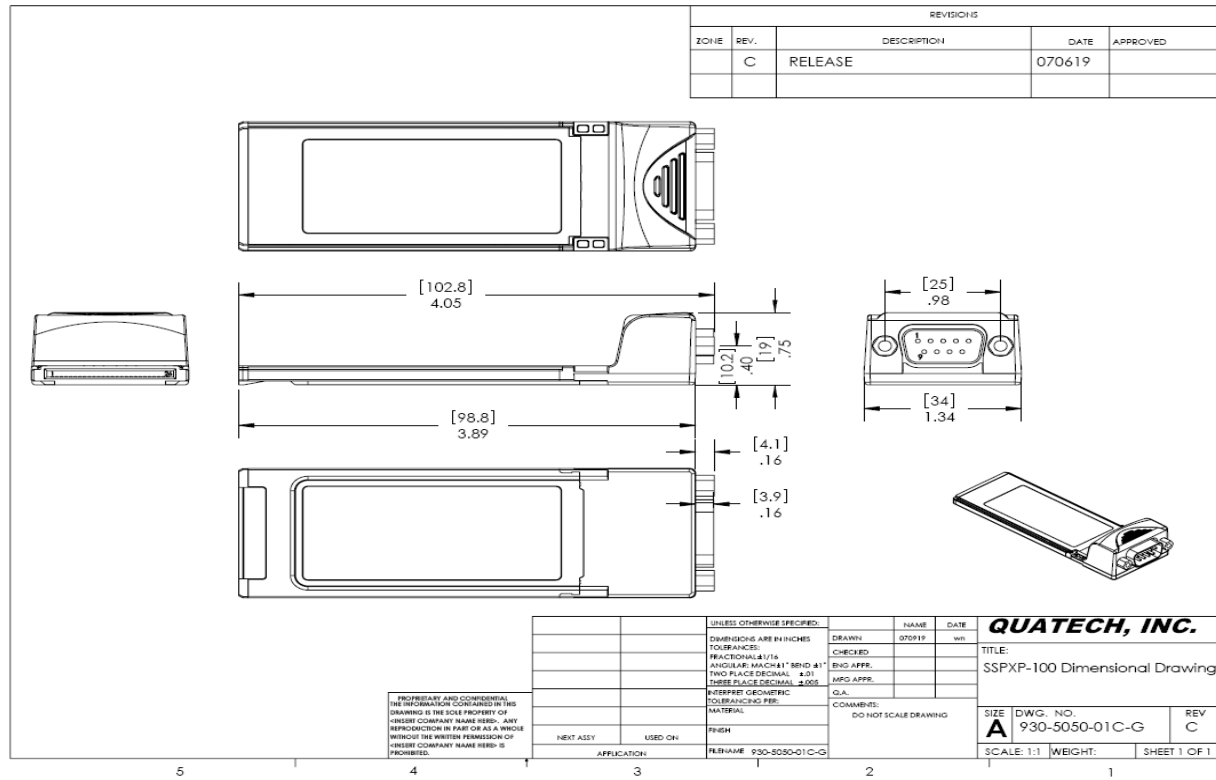


## Appendix A

### Specifications

Bus interface	PCI Express, revision 1.1
Baud rates	Up to 921,600 bps. Factors impacting performance include: <ul style="list-style-type: none"> <li>➤ Hardware flow control</li> <li>➤ Horsepower of the host computer</li> <li>➤ Quality of and length of cables</li> <li>➤ Continuous or “bursty” data</li> </ul>
Ports	SSPXP-100: 1 DSPXP-100: 2 QSPXP-100: 4 SSPXP-200/300: 1 DSPXP-200/300: 2 QSPXP-200/300: 4
UARTs	Custom high-speed UARTs with 1024-byte FIFOs for both transmit and receive. Automatic hardware and software flow control.
Transceivers:	<u>RS-232 Output</u>
SSPXP-100	Voltage Swing: +/-5V min, +/-5.4V typical
DSPXP-100	<u>RS-232 Input</u>
QSPXP-100	Voltage Range: -15V min, +15V max Input Threshold Low: 0.6V max, 1.0V typical Input Threshold High: 2.4V min, 1.5V typical
Transceivers:	RS-422/485:
SSPXP-200/300	Differential Driver Output (50Ω Load): +2V min +3.3V max
DSPXP-200/300	Differential Driver Output (27Ω Load): +1.5V min +3.3V max
QSPXP-200/300	High Input: +2V min Low Input: +0.8V max Driver Rise or Fall Time: 5 ns typ, 20.5 ns max Driver Input to Output Delay: 20 ns min, 40 ns typ, 60ns max Receiver Input to Output Delay: 40 ns min, 70 ns typ, 100 ns max

Connectors:	
-100	DB-9 Male
-200/300	DB-9 Female
Dimensions	See drawings
Power Requirements	+3.3v = <1000 mA +3.3v aux = 0 mA +1.5v = 0 mA
Temperature:	Operating: 0 to 70 C Storage: -50 to 80 C
Humidity	10 to 90%
OS Support	Windows XP, Windows Vista



## Appendix B

### Warranty information

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B&B Electronics warrants the SSPXP/DSPXP/QSPXP/-100/200/300 to be free of defects for five (5) years from the date of purchase. B&B Electronics will repair or replace any board that fails to perform under normal operating conditions and in accordance with the procedures outlined in this document during the warranty period. Any damage that results from improper installation, operation, or general misuse voids all warranty rights. No representation is made regarding the suitability of this product for any particular purpose.

Please complete the following information and retain for your records.

DATE OF PURCHASE: \_\_\_\_\_  
MODEL NUMBER: SSPXP/DSPXP/QSPXP/-100/200/300  
PRODUCT DESCRIPTION: Serial Adapter  
SERIAL NUMBER: \_\_\_\_\_

All products returned to B&B Electronics for either warranty or non-warranty repair **MUST** be assigned a Returned Material Authorization (RMA) number prior to shipment. This RMA number must be clearly marked on the exterior of the product's return packaging and in any correspondence to ensure proper routing and prompt attention. To obtain an RMA number, contact B&B Electronics Technical Support Department at 1-800-553-1170 or (330) 655-9000. In order to prevent damage to returned merchandise during shipment, please package electronic components in anti-static/shock proof materials.

For **warranty** repair/returns, please have the following information available when contacting the Technical Support department:

1. Model number and serial number of the product under warranty
2. Repair instructions and/or specific description of the problem

For **non-warranty** repairs or upgrades, contact the Technical Support department for current repair charges and please have the following information available:

1. Purchase order number to cover the cost of the service
2. Model number and serial number of the product
3. Repair or upgrade instructions relative to the product