PCI Express 4-Port Industrial Serial I/O Cards

The PCIe-400i and PCIe-400i-SI PCI Express 4-port industrial serial I/O cards are plug & play high-speed serial I/O expansion cards for the PCI Express bus. Connecting to a PCI Express bus on your computer, the PCI Express 4-port industrial serial I/O card instantly adds four RS-422/485 serial I/O communication ports to your system. The PCI Express 4-port industrial serial I/O cards are designed to utilize the Exar XR17V354 PCI Express to UART chip. The PCIe-400i & PCIe-400i-SI support high-speed data rate up to 921.6 Kbps. Each serial port is fully compatible with 16C550 UART, with enhanced feature of 256 bytes TX and RX FIFO buffer for higher performance.

The PCI Express 4-port serial I/O card is an advanced and high efficient solution for serial data communication and industrial automation applications.

Features of PCI Express 4-Port Industrial Serial I/O Cards

- PCI Express 2.0 Gen 1 compliant
- PCI Express 1 Lane compliant
- 16C550 compatibility
- 256 bytes receive FIFO buffer
- 256 bytes transmit FIFO buffer for high speed data throughput
- Automatic RTS/CTS or DTR/DSR hardware flow control with programmable hysteresis
- Automatic Xon/Xoff software flow control
- Drivers provided for Windows and Linux O.S
- Wide ambient temperature operation 0°C to 60°C (32°F to 140°F)
- CE, FCC approval

PCIe-400i - Supports four RS-422/485 serial I/O ports

- Supports four high speed RS-422/485 serial ports with data transfer rate up to 912.6 Kbps
- Provides 15KV ESD protection and 600W surge protection for all serial signals
- One DB-37 female connector on board
- Provides one DB-37 to four male DB-9 cable. Cable length: 30 cm
- RS-422 data signals: TxD-, TxD+, RxD+, RxD- , GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: TxD-, TxD+, RxD+, RxD- (4 wire) and data-, data+ (2 wire)

PCIe-400i-SI - Supports Four RS-422/485 serial I/O ports with isolation and surge protection

- Supports four high speed RS-422/485 serial ports with data transfer rate up to 912.6 Kbps
- Provides 15KV ESD protection and 600W surge protection for all serial signals
- Provides 3000 Volt DC optical isolation for all serial signals
- One DB-37 female connector on board
- Provides one DB-37 to four male DB-9 cable. Cable length: 30CM
- RS-422 data signals: TxD-, TxD+, RxD+, RxD- , GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: TxD-, TxD+, RxD+, RxD- (4 wire) and data-, data+ (2 wire)

Specifications

The tables below show the specifications of PCI Express 4-Port Industrial Serial I/O cards

General	
Bus	PCI Express; Single-Lane (x1)
Chipset	EXAR XR17V354
Interface	RS-422/485
Plug & Play	Supported
IRQ &IO Address	Assigned by system BIOS

Serial Port	
Serial Ports Number	4-Port
RS-422 Signals	TxD-, TxD+, RxD+, RxD-, GND, RTS-, RTS+, CTS+,CTS-
RS-485 Signals	TxD-, TxD+, RxD+, RxD- (4 wire), data- , data+ (2 wire)
Max. Bitrates	921,600 bps
Serial Configuration	Data bits : 5,6,7,8 Parity : None, Odd, Even, Mark , Space Stop bits : 1, 1.5 , 2
UART FIFO Buffer size	Each port with 256 Bytes FIFO for transmit and receive

Specification of PCIe-400i and PCIe-400i-SI

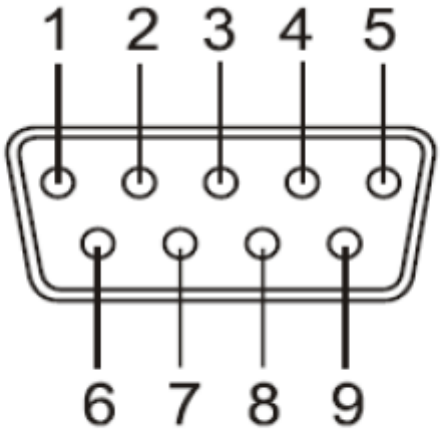
PCIe-400i	
Serial Ports	4-Port RS-422/485
RS-422 Signals	TxD-, TxD+, RxD+, RxD-, GND, RTS-, RTS+, CTS+,CTS-
RS-485 Signals	TxD-, TxD+, RxD+, RxD- (4 wire), data- , data+ (2 wire)
Connectors	One DB-37 female connector
Protection	15KV ESD protection and 600W surge protection for all serial signals
Mechanical	PCIe-400i with standard height bracket
Chipset	EXAR XR17V354 PCI Express to quad UART chip

PCIe-400i-SI	
Serial Ports	4-Port RS-422/485
RS-422 Signals	TxD-, TxD+, RxD+, RxD-, GND, RTS-, RTS+, CTS+,CTS-
RS-485 Signals	TxD-, TxD+, RxD+, RxD- (4 wire), data- , data+ (2 wire)
Connectors	one DB-37 female connector
Protection	15KV ESD protection for all serial signals 600W surge protection for all serial signals 3000 Volt DC optical isolation for all serial signals
Mechanical	PCIe-400i-SI with standard bracket
Chipset	EXAR XR17V354 PCI Express to quad UART chip

Environment	
Operating Temperature	0°C to 60°C
Storage Temperature	-40°C to 85°C
Humidity	0 to 80% RH. Noncondensing
Safety Approvals	CE, FCC

Pin-out Information

Followings are the pin-out of DB-9 connector of DB-37 to quad male DB-9 cable



DB9 Male connector pin numbers

RS-422 Pin-out for DB-9 connector

Pin Number	Pin Type	Description
1	***Output***	TxD- : Transmit Data , negative polarity
2	***Output***	TxD+ : Transmit Data , positive polarity
3	***Input***	RxD+ : Receive Data , positive polarity
4	***Input***	RxD- : Receive Data , negative polarity
5	***Ground***	GND : Signal Ground
6	***Output***	RTS- : Request To Send, negative polarity
7	***Output***	RTS+ : Request To Send, positive polarity
8	***Input***	CTS+ : Clear To Send, positive polarity
9	***Input***	CTS- : Clear To Send, negative polarity

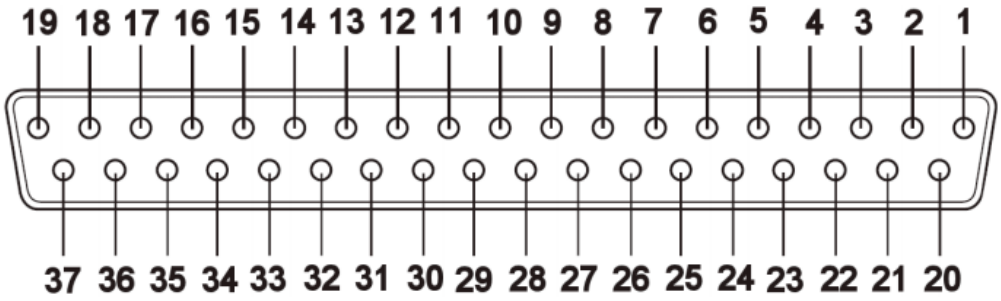
RS-485 full duplex (4 wire) pin-out for DB-9 connector

Pin Number	Pin Type	Description
1	***Output***	TxD- : Transmit Data , negative polarity
2	***Output***	TxD+ : Transmit Data , positive polarity
3	***Input***	RxD+ : Receive Data , positive polarity
4	***Input***	RxD- : Receive Data , negative polarity
5	***Ground***	GND : Signal Ground

RS-485 half duplex (2 wire) pin-out for DB-9 connector

Pin Number	Pin Type	Description
1	***Out/In***	Data- : Transmit /Receive Data , negative polarity
2	***Out/In***	Data+ : Transmit /Receive Data , positive polarity
5	***Ground***	GND : Signal Ground

Pin-out of one DB-37 female connector for four RS-422/485 ports



DB37 Female connector pin numbers

Pin	RS-422 Mode	RS-485 “4W” Mode	RS-485 “2W” Mode
1	.NC.		.
2	TxD-(3)	TxD-(3)	Data-(3)
3	Ground	Ground	Ground
4	CTS+(3)		
5	TxD+(3)	TxD+(3)	Data+(3)
6	CTS-(4)		
7	RxD-(4)	RxD-(4)	
8	RTS-(4)		
9	RTS+(4)		
10	RxD+(4)	RxD+(4)	
11	TxD-(2)	TxD-(2)	Data-(2)
12	Ground	Ground	Ground
13	CTS+(2)		
14	TxD+(2)	TxD+(2)	Data+(2)
15	CTS-(1)		

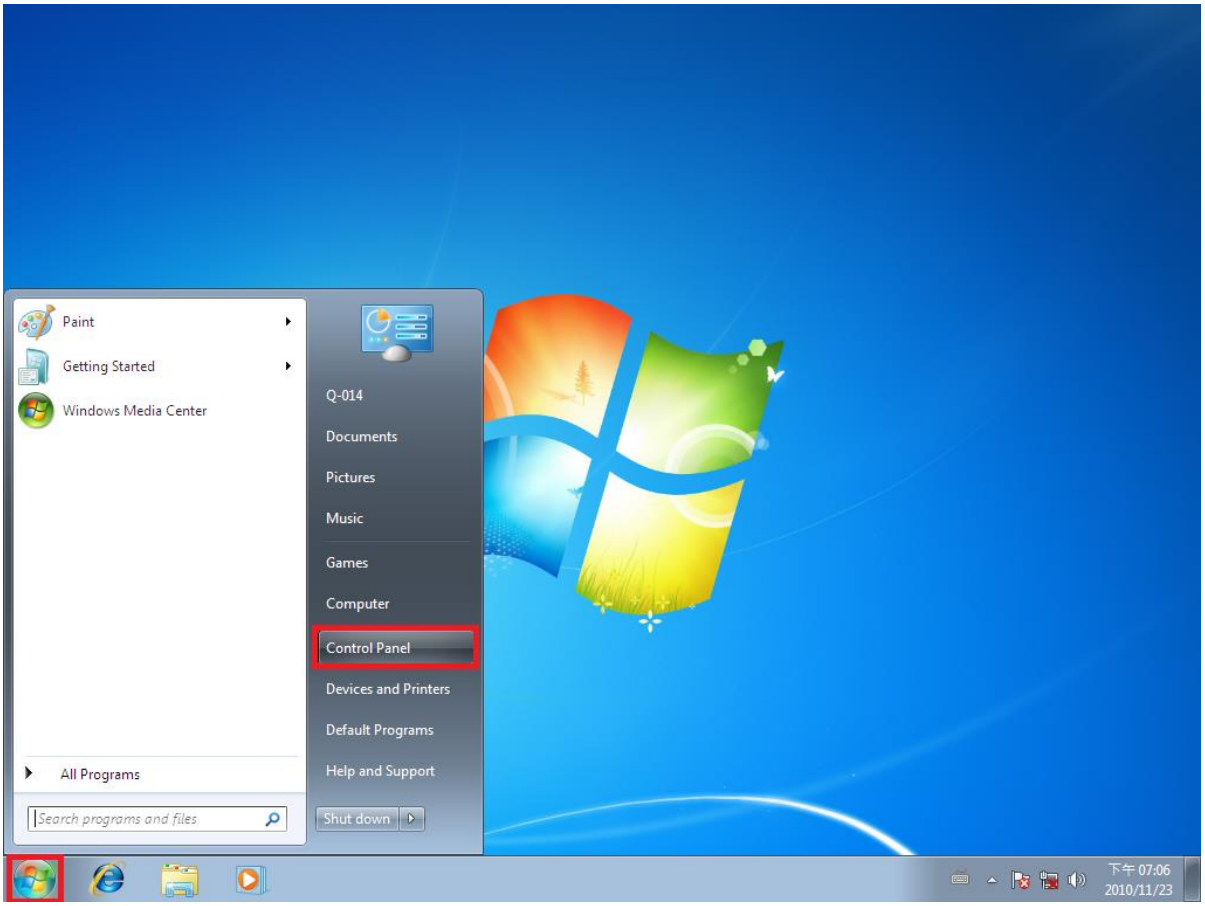
16	RxD-(1)	RxD-(1)	
17	RTS-(1)		
18	RTS+(1)		
19	RxD+(1)	RxD+(1)	
20	CTS-(3)		
21	RxD-(3)	RxD-(3)	
22	RTS-(3)		
23	RTS+(3)		
24	RxD+(3)	RxD+(3)	
25	TxD-(4)	TxD-(4)	Data-(4)
26	Ground	Ground	Ground
27	CTS+(4)		
28	TxD+(4)	TxD+(4)	Data+(4)
29	CTS-(2)		
30	RxD-(2)	RxD-(2)	
31	RTS-(2)		
32	RTS+(2)		
33	RxD+(2)	RxD+(2)	
34	TxD-(1)	TxD-(1)	Data-(1)
35	Ground	Ground	Ground
36	CTS-(1)		
37	TxD+(1)	TxD+(1)	Data+(1)

Installation

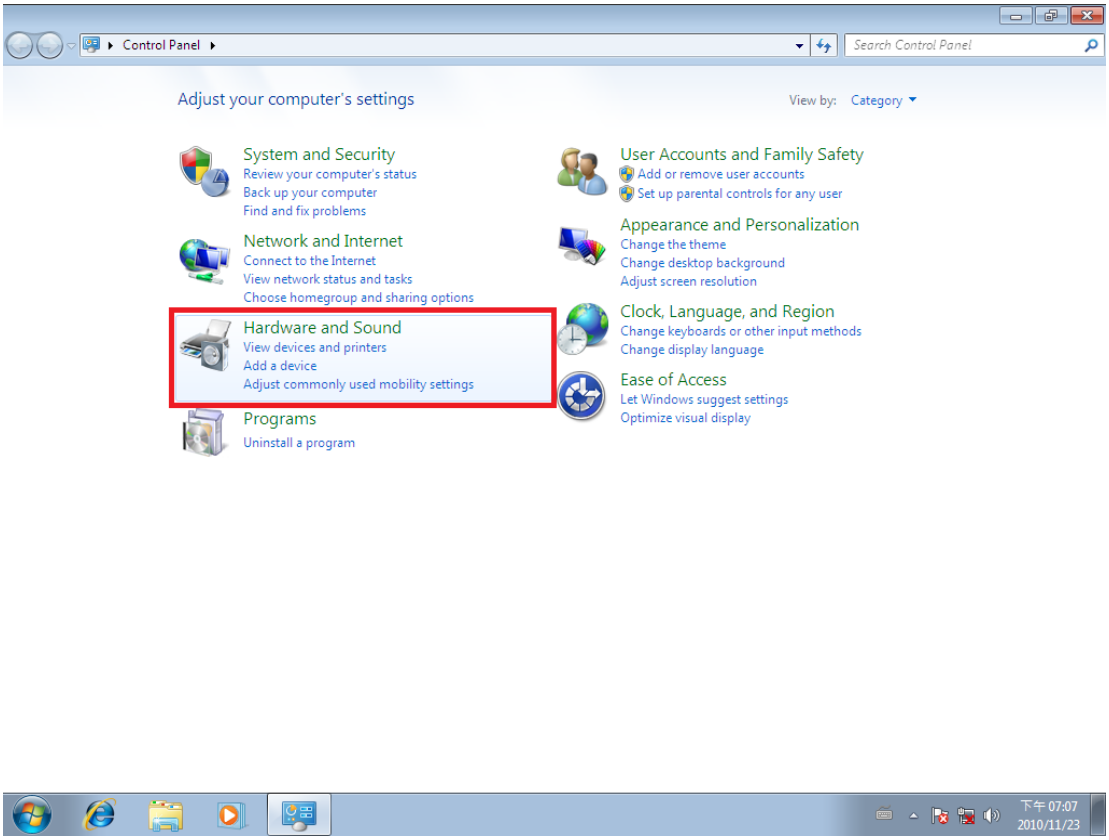
Windows 7/ 8/ 8.1 32-bit & 64-bit Drivers Installation

To install the Windows driver from Device Manager for PCI Express 4-port industrial serial I/O card, please follow the steps below:

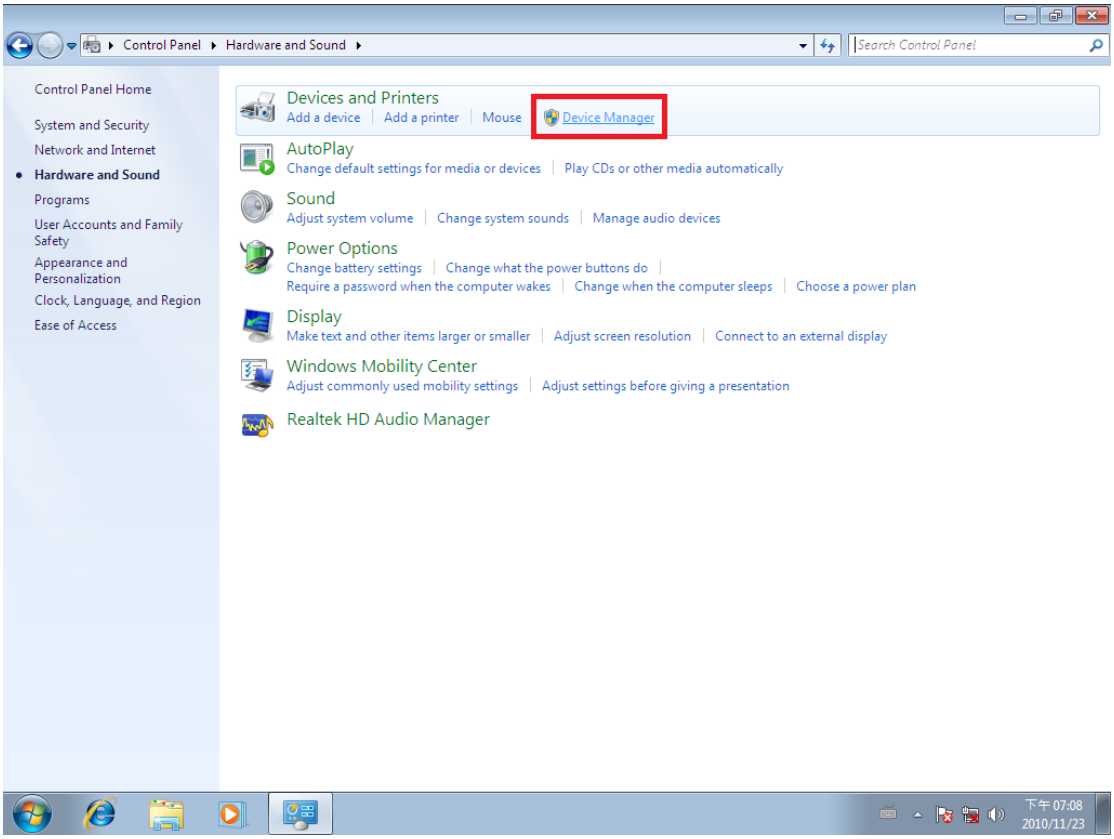
1. Switch off the computer.
2. Insert PCI Express industrial serial I/O card into a free PCI Express Bus slot.
3. Switch on the computer and start Windows O.S.
4. Windows O.S will automatically detect the PCI Express I/O Card.
5. Press “START” button and select “Control Panel”.



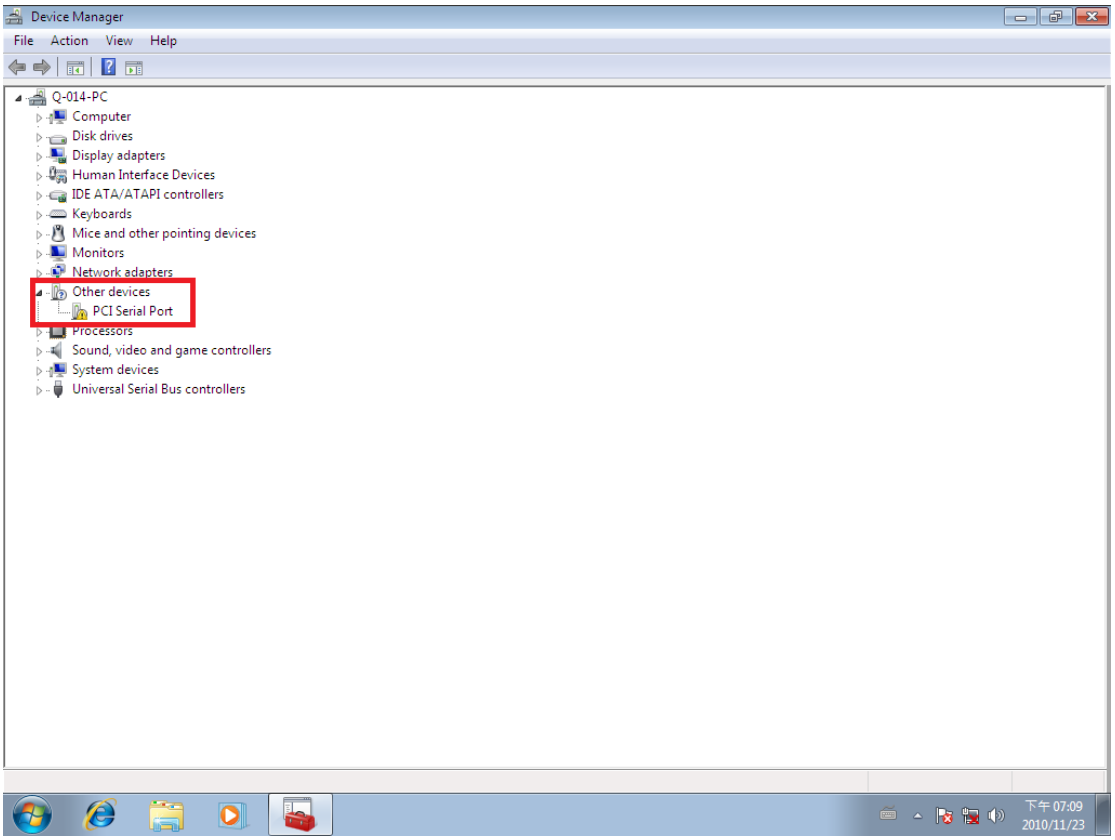
6. Select “Hardware and Sound”.



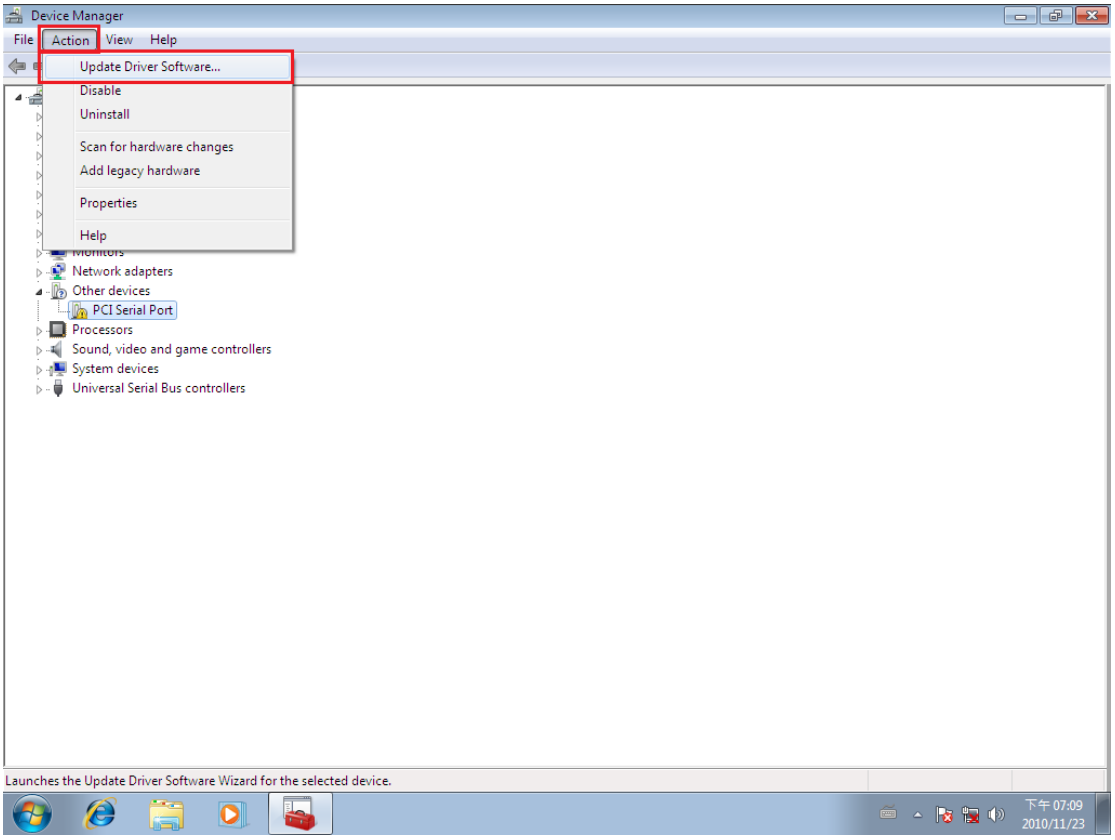
7. Select “Device Manager”.



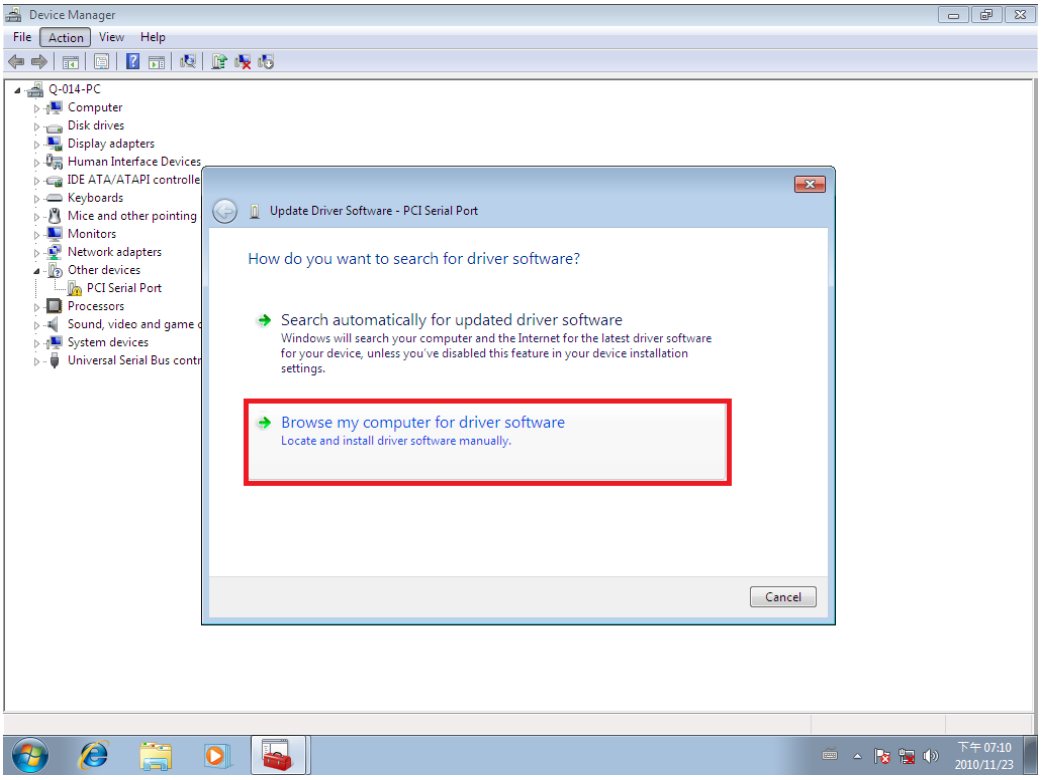
8. Under “Device Manager” of the System properties, you can find “PCI Serial Port” attached to “Other devices”. Select “PCI Serial Port”.



9. Select “Action” and execute “Update Driver Software”.

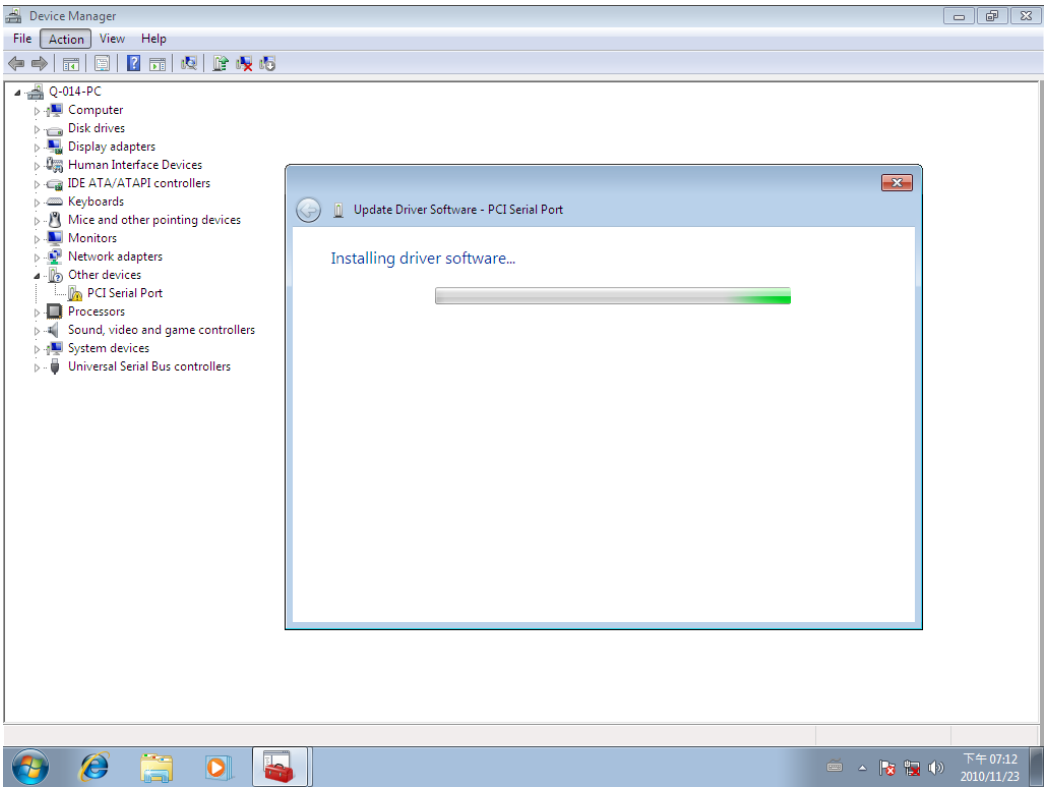


10. Click “Browse my computer for driver software”.

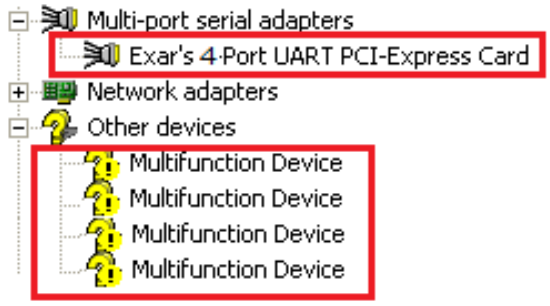


11. Insert the driver CD into the CD-ROM or DVD-ROM drive.

12. Select the directory "\PCIe Drivers\x86” for 32 bits Windows O.S (“\PCIe Drivers\x64 for 64 bits Windows O.S”) as the target. Click on "OK", and on “Next” to install driver.



13. After driver installation is done successfully, you can find “Exar’s 4-Port UART PCI-Express Card” and four “Multifunction Device” under Device Manager.



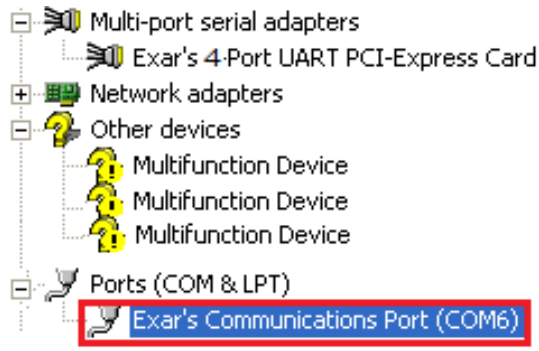
14. Select first “Multifunction Device”.

15. Select “Action” and execute “Update Driver Software”.

16. Click “Browse my computer for driver software” again.

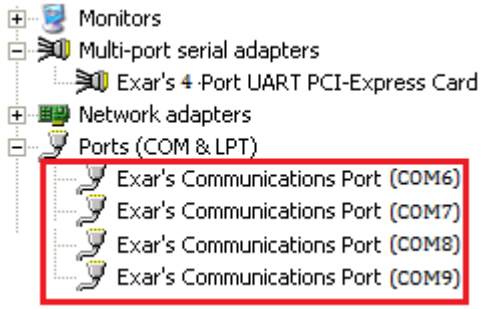
17. Select the directory "\PCIe Drivers\x86” for 32 bits Windows O.S (“\PCIe Drivers\x64 for 64 bits Windows O.S”) as the target. Click on "OK", and on “Next” to install COM port driver.

18. After COM port driver installation is done successfully, you can find first “Exar’s Communications Port (COMx)” under “Ports (COM & LPT)” in Device Manager.



19. Select next “Multifunction Device” by order and repeat step 15~17 to install COM port driver for all “Multifunction Device”.

20. After all COM port driver installation is done successfully, you can find four “Exar’s Communications Port (COMx)” under “Ports (COM & LPT)” in Device Manager.

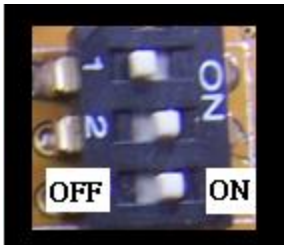


21. Restart computer to complete installation.

Hardware Setting and Installation:

Selecting the RS-422/485 operation mode

There are four 3-pin DIP switches, SW1, SW2, SW3, SW4, on PCIe-400i and PCIe-400i-SI cards. The DIP switches are set to select the mode of operation. You will need to set the switch settings to RS-422 mode, or RS-485 mode, as per the requirements of your application. The RS-422 & RS-485 Mode Block Configuration Settings are listed as follows.

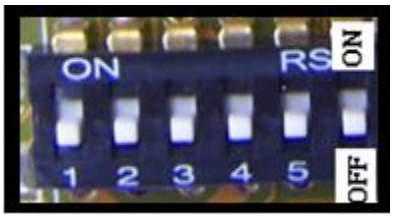


SW1, SW2, SW3, SW4 for Mode Setting

	Operation Mode	1	2	3
RS-422	4 wire with Handshaking	ON	ON	ON
RS-485	Full Duplex (4 wire)	OFF	ON	ON
	Half Duplex (2 wire) - with Echo	OFF	OFF	ON
	Half Duplex (2 wire) - without Echo	OFF	OFF	OFF

When PCIe-400i and PCIe-400i-SI working in RS-485 operation mode, you need to enable the automatic direction control of the RS-485 transceiver buffer by setting the driver configured to enable RS-485 function (refer to page 16).

There are four 6-pin DIP switches, S1, S2, S3, S4, on PCIe-400i and PCIe-400i-SI cards. The DIP switches are set to enable TxD, RxD, 120 ohm termination resistors and RxD, TxD 750 Ohm biasing resistors. You will need to set the four 6-pin DIP switches, S1, S2, S3, S4, for RS-422 mode, or RS-485 mode, as per the requirements of your application. Settings are listed as follows:

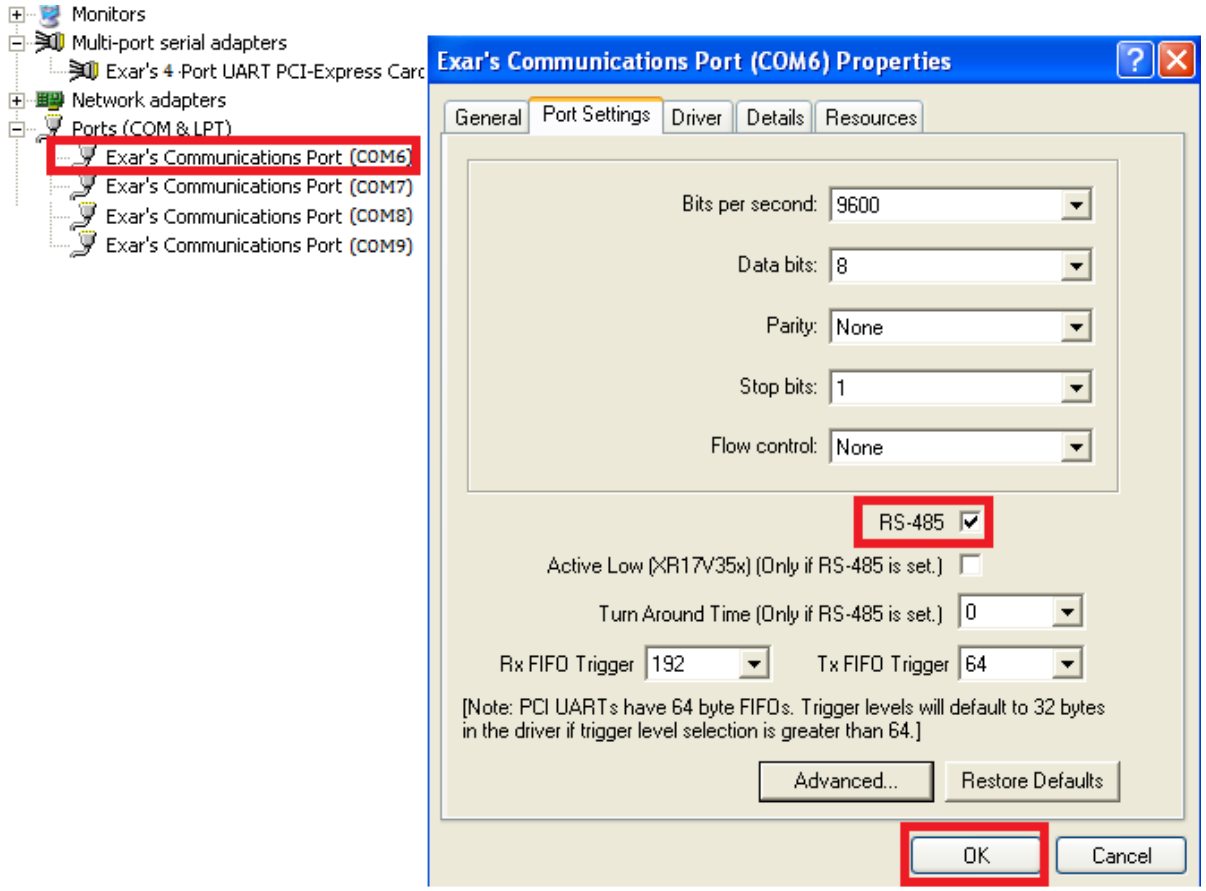


DIP Switch	Function	Remark
S1,2,3,4 pin1 ON	Enable TxD+ biasing resistor	Pull-up TxD+ with 750 ohm resistor
S1,2,3,4 pin2 ON	Enable TxD+/TxD- termination resistor	120 ohm termination resistor
S1,2,3,4 pin3 ON	Enable TxD- biasing resistor	Pull-down TxD- with 750 ohm resistor
S1,2,3,4 pin4 ON	Enable RxD+ biasing resistor	Pull-up RxD+ with 750 ohm resistor
S1,2,3,4 pin5 ON	Enable RxD+/RxD- termination resistor	120 ohm termination resistor
S1,2,3,4 pin6 ON	Enable RxD- biasing resistor	Pull-down RxD- with 750 ohm resistor

Enable RS-485 operation mode for PCIe-400i and PCIe-400i-SI.

When PCIe-400i or PCIe-400i-SI works in RS-485 operation mode, you need to enable the automatic direction control of the RS-485 transceiver buffer by setting the driver configured to enable RS-485 function.

1. Double click on “Exar’s Communications Port (COMx)” under Device Manager into “Exar’s Communications Port (COMx) Properties”. Check the “RS-485” to enable the automatic direction control of the RS-485 transceiver buffer in the RS-485 operation mode.



2. Click on “OK” under “Exar’s Communications Port (COMx) Properties” to enable the automatic direction control of the RS-485 transceiver buffer for RS-485 mode operation.

3. Repeat step 1 to 2 for other COM port to enable the automatic direction control of RS-485 mode operation.

Proper Wiring for RS-422/485 Operation

This section will provide proper wiring information about RS-422 and RS-485 data communication. It is necessary to have the basic knowledge, to avoid or find errors in data transmission. Failures in cabling are responsible for the vast majority of transmission problems.

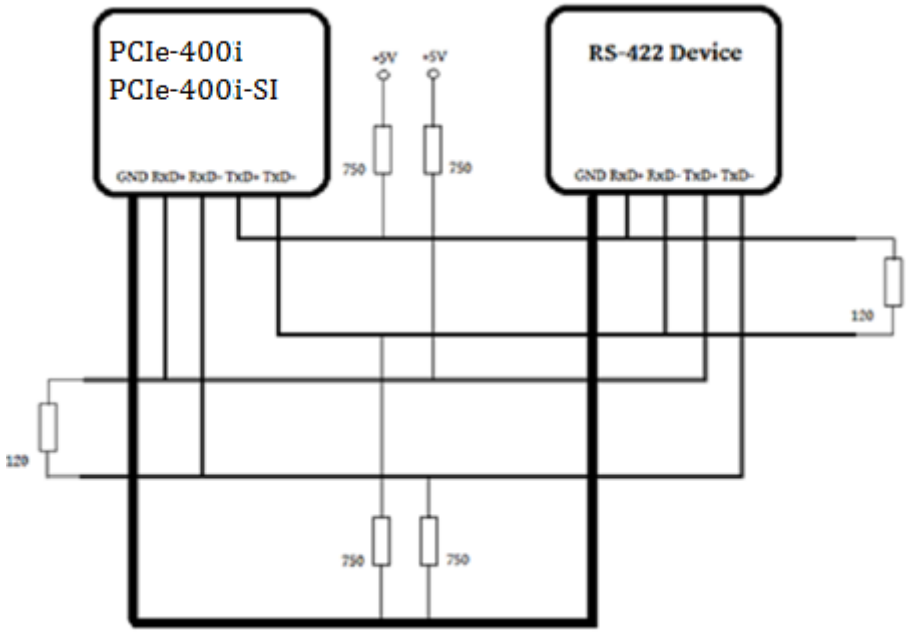
RS-422 and RS-485 Transmission Technique

The RS-422 and RS-485 use the same balanced transmission method. Signals are not transmitted as voltage on a single wire, as RS-232 does. Instead two wires are used; when one carries high voltage, the other one carries low voltage. The signal is defined by the difference in voltage between those two wires. This hardens the transmission against noise. Usually twisted pair cables are used, which further reduces the sensitivity for noise.

To make sure the signals meet the common voltage range, the GND of sender and receiver must be connected somehow. To insure the signals are in the valid voltage range and the differential voltage can be correctly sensed by the receiver, the GND lines of the transmitter and receiver must be connected.

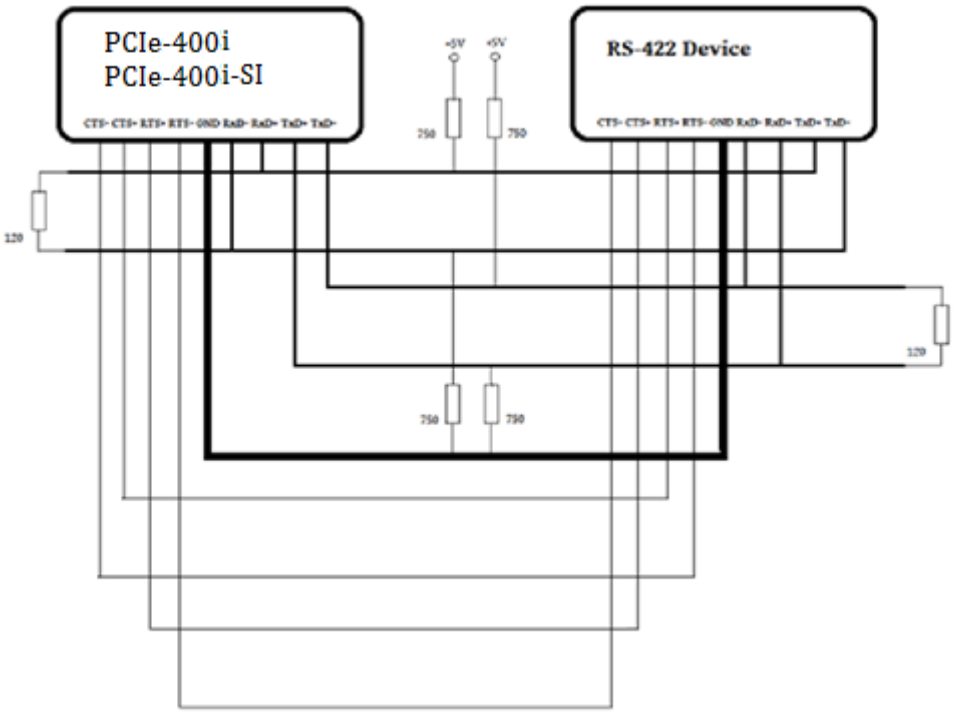
RS-422 without handshaking signals connected

The following diagram shows RS-422 without handshaking signals connected.



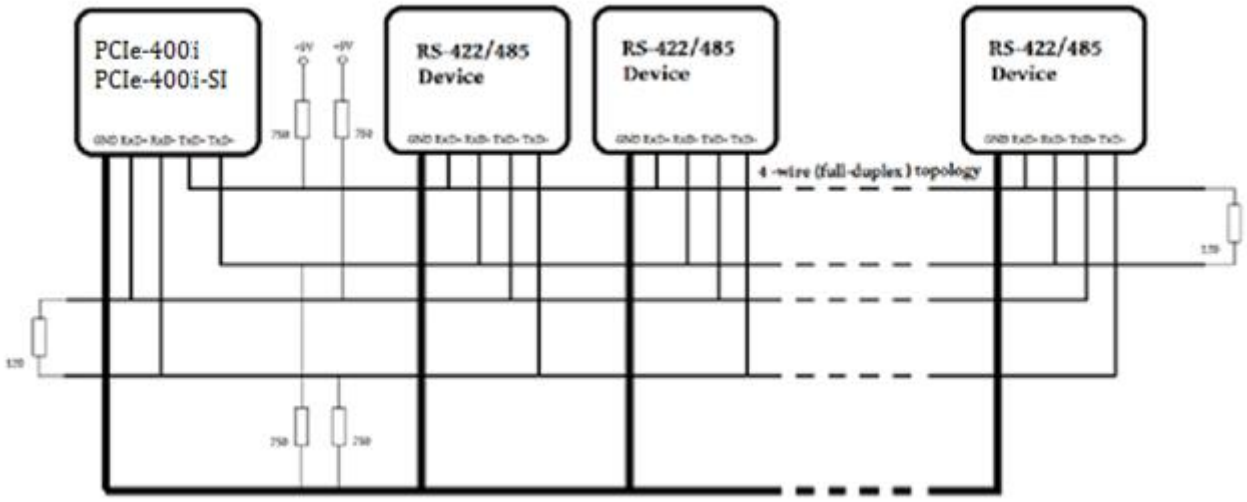
RS-422 with handshaking signals connected

The following diagram shows RS-422 with handshaking signals connected.

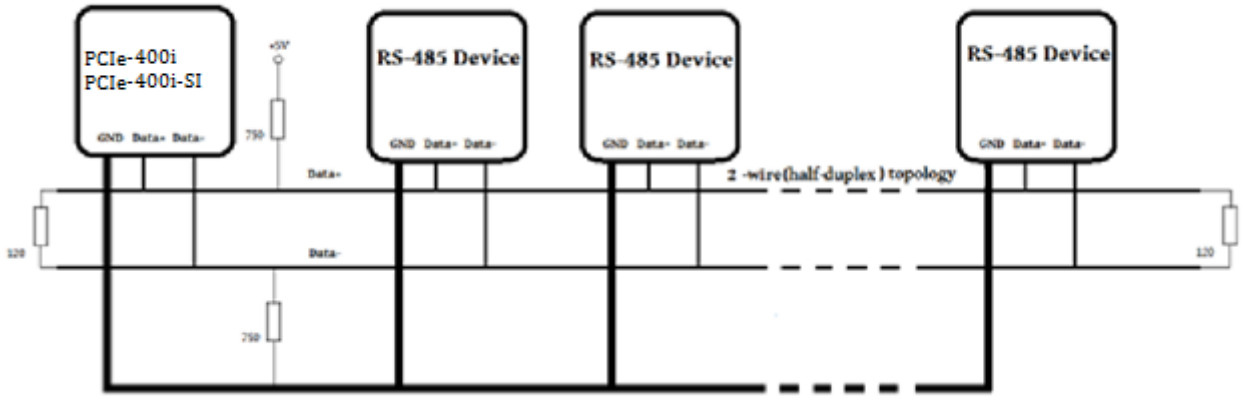


RS-422 and RS-485 4-Wire Scheme

The RS-422 requires dedicated wire pairs for transmit and receive. The transmit wires are used to send data to as many as 10 receivers, as stated in the specifications of RS-422. Since the PCIe-400i and PCIe-400i-SI use RS-485 line driver technology, up to 32 receivers are possible. The following diagram shows RS-422 and RS-485 4-wire scheme:



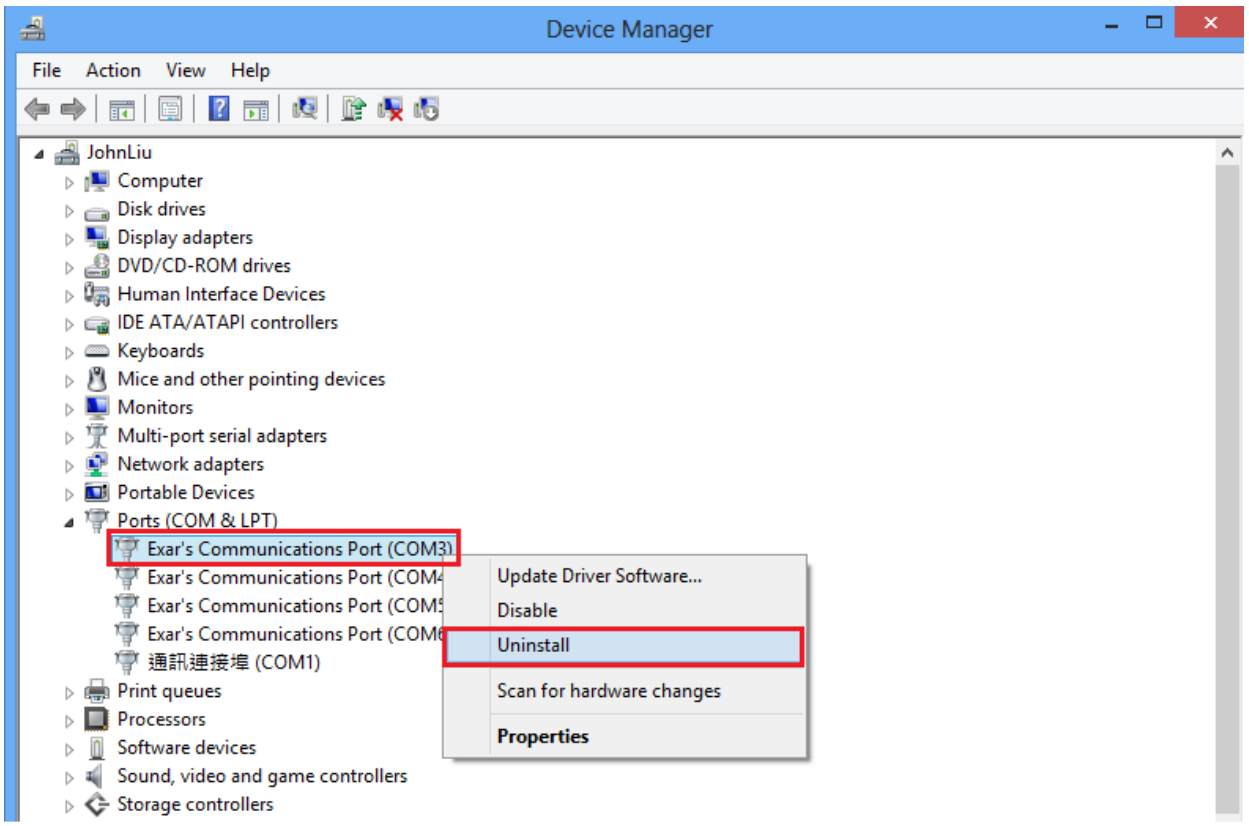
The following diagram shows RS-485 2-Wire scheme:



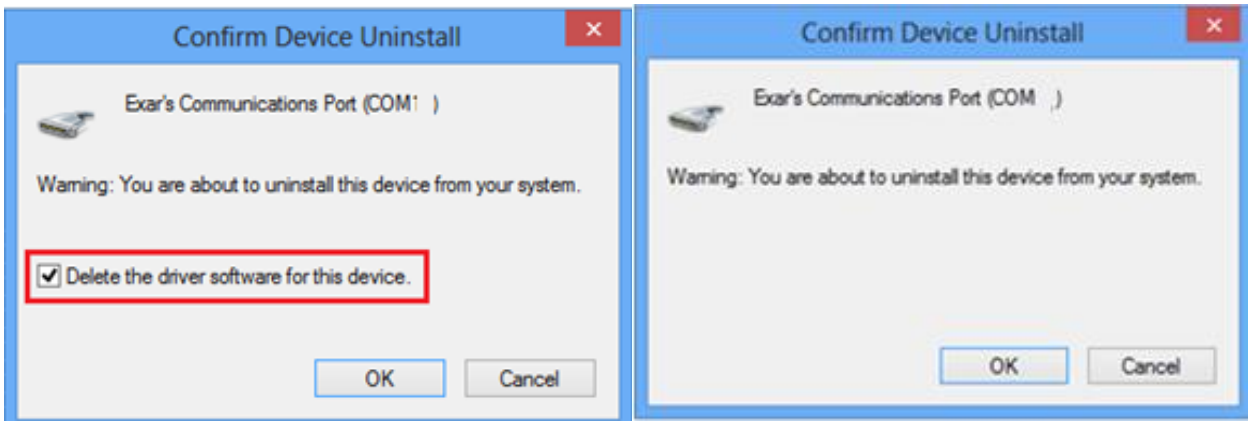
Uninstalling Windows Drivers:

To uninstall the Windows driver from Device Manager for PCI Express 4-port industrial serial I/O card, please follow the steps below:

1. Right click on “Exar’s Communications Port (COMx)” under Device Manager to bring up “Device Control” screen. Then, select “Uninstall” to start Exar’s Communications Port (COMx) driver uninstall.

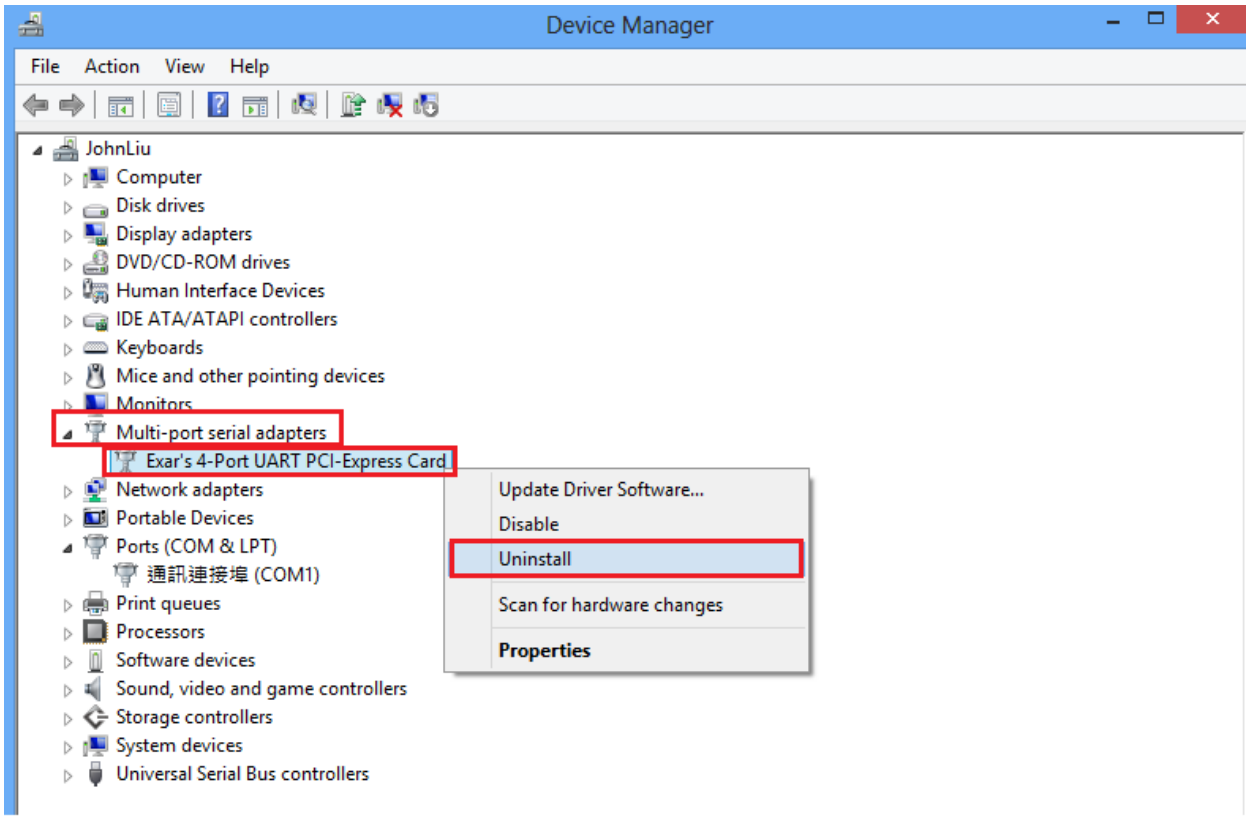


2. Under “Confirm Device Uninstall” screen, check “Delete the driver software for this device.” Click “OK” to uninstall the software driver. If you don’t find “Delete the driver software for this device” message, please only click “OK” to uninstall the software driver.

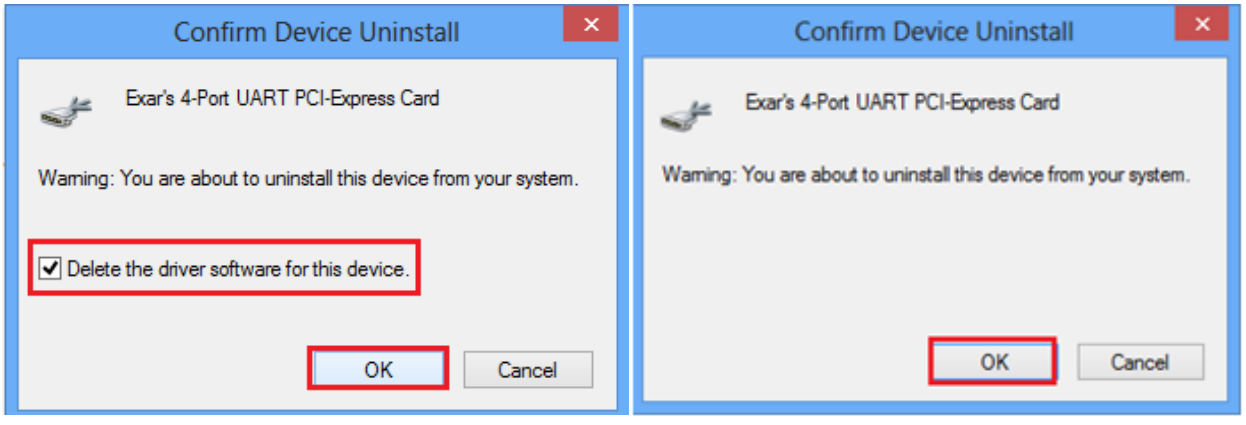


3. Right click on other “Exar’s Communications Port (COMx)” and repeat step 1 and 2 to uninstall all Exar’s Communications Port driver.

4. Right click on “Exar’s 4-Port UART PCI-Express Card” under Device Manager to bring up “Device Control” screen. Select “Uninstall” to start “Exar’s 4-Port UART PCI-Express Card” software driver uninstall.



5. Under “Confirm Device Uninstall” screen, check “Delete the driver software for this device.” Click “OK” to uninstall the software driver. If you don’t find “Delete the driver software for this device.” message, please only click “OK” to uninstall the software driver.



6. If you install more than one PCI Express 4-port serial I/O cards in system, please right click on other “Exar’s 4-Port UART PCI-Express Card” and repeat step 4~5 to uninstall all PCI Express 4-port serial I/O cards software driver.