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MODEL
PCIe-ICM-4SM, PCIe-ICM-2SM
PCIe-ICM-4S, PCIe-ICM-2S
PCIe-ICM232-4, PCIe-ICM232-2

PCI Express Isolated 4- and 2- Port RS-232/422/485 Serial Communication Cards

USER MANUAL

FILE: MPCIe-ICM-4SM.A1d

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Chapter 1: Introduction

These PCI Express Multiport Isolated Serial cards were designed for RS232, RS422 and RS485 asynchronous communications for use in a variety of applications. These boards offer compatibility with the PCI Express bus and are used by system integrators and manufacturers in the design of industrial communication systems. The cards are available in 4-port and 2-port versions and are compatible with all popular operating systems. The protocol (type) of each port is software selectable between RS232/RS422/RS485 depending on the model ordered. Each COM port is capable of supporting data rates up to 3Mbps (460.8kbps in RS232 mode is standard) and implements full RS-232 modem control signals to ensure compatibility with a wide range of serial peripherals. Existing serial peripherals can connect directly to the industry standard DB9M connectors. The board features a x1 lane PCI Express connector which can be used in any length PCI Express slot.

Features

- 4- and 2-port PCI Express serial communication cards with on board DB9M connectivity
- 2000V isolation port to port and port to computer
- Serial protocol (RS-232/422/485) SOFTWARE CONFIGURED per port, stored in EEPROM for auto-configure at next boot
- High performance 16C950 class UARTs with 128-byte FIFO for each transmit and receive buffer
- Supports data communication speeds up to 3Mbps (standard model RS-232 is 460.8kbps)
- ESD protection +/-15kV on all signal pins
- Supports 9-bit data mode
- Full modem control signals in RS-232 mode
- Software compatible with all operating systems
- Jumper selectable termination for RS-422/485 applications

Applications

- POS (Point-of-Sale) Systems
- Shipboard Data Communication and Control Systems
- Gaming Machines
- Telecommunications
- Industrial Automation
- ATM (Automated Teller Machine) Systems
- Multiple terminal control
- Office Automation
- Kiosks

Functional Description

These cards feature high performance 16C950 class UARTs which support the complete register set of the standard 16C550-type devices. The UARTs support operations in 16C450, 16C550 and 16C950 modes. Each port is capable of data communication speeds up to 3Mbps (standard model up to 460.8kbps in RS-232 mode) in asynchronous mode and has 128-byte deep transmit and receive FIFOs to protect against lost data in multitasking operating systems, to help reduce CPU utilization and to improve data throughput. A crystal oscillator is located on the card which permits precise selection of baud rates.

Serial protocol (RS-232/422/485) is software configured per port via a Port Configuration Utility provided on the CD which ships with each card. When RS-422 or RS-485 are selected, jumper selectable termination is provided per port.

Four-port models (PCIe-ICM-4SM, PCIe-ICM-4S, PCIe-ICM232-4) ship with an additional mounting bracket and cable. This plugs directly into the dual 10-pin IDC headers on board and mounts to an adjacent bracket slot.

Isolation

Ground loops – current flowing through the ground line when ground voltage levels differ between connected devices – are a common problem frequently encountered in many industrial applications. This situation can result in an increasing common-mode voltage produced by the difference in ground levels and also by induced voltage typically from parallel cabling that is carrying current to electrical equipment. Once the common-mode voltage exceeds the capability of the transceivers to reject it, they stop communicating. Isolating serial ports eliminates the effects of this problem and protects the computer system in harsh industrial environments. RS-232 communications are even more susceptible to this condition due to this architecture being only single-ended. This card is rated for 2,000V isolation from port-to-port and port to computer for such applications.

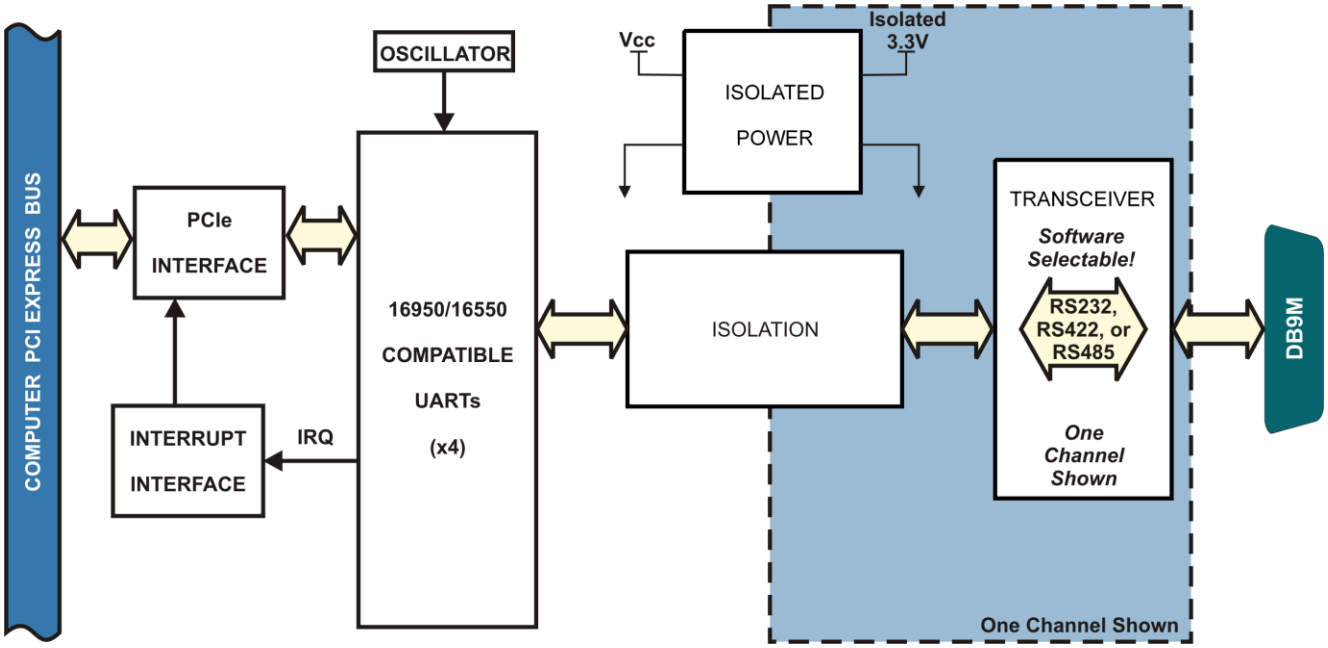


Figure 1-1: Block Diagram

Ordering Guide

- PCIe-ICM-4SM PCI Express isolated four-port RS-232/422/485*
- PCIe-ICM-4S PCI Express isolated four-port RS-422/485*
- PCIe-ICM232-4 PCI Express isolated four-port RS-232*
- PCIe-ICM-2SM PCI Express isolated two-port RS-232/422/485
- PCIe-ICM-2S PCI Express isolated two-port RS-422/485
- PCIe-ICM232-2 PCI Express isolated two-port RS-232

***** Four-port models require the use of a provided additional mounting bracket.

Model Options

- -T Extended temp. operation (-40° to +85°C)
- -F Fast version (RS-232 up to 921.6kbps)
- -RoHS RoHS compliant version
- -W Remote wake-up enable (see Chapter 3: Hardware Details)

Optional Accessories

ADAP9	Screw terminal adaptor DB9F to 9 screw terminals	
ADAP9-2	Screw terminal adaptor with two DB9F connectors and 18 screw terminals	

Special Order

Virtually any custom baud rate can be achieved with the standard card (see Table 5-2: Sample Baud Rate Setting) and still be within the standard tolerance range for asynchronous serial communications. If that method doesn't produce an exact enough baud rate a custom crystal oscillator may be specified, contact factory with your precise requirement. Other examples of special orders would be conformal coating, custom software, etc., we will work with you to provide exactly what is required.

Included with your board

The following components are included with your shipment, depending on options ordered. Please take the time now to ensure that no items are damaged or missing.

- **Four-** or **two-port** card
- 2 x Header to 2 x DB9M cable/bracket for Four-port model cards
- Software Master CD
- Quick-Start Guide

Chapter 2: Installation

A printed Quick-Start Guide (QSG) is packed with the card for your convenience. If you've already performed the steps from the QSG, you may find this chapter to be redundant and may skip forward to begin developing your application.

The software is provided with this card on the CD and must be installed onto your hard disk prior to use. Perform the following steps as appropriate for your operating system.

A complete driver support package is provided including an easy-to-use Windows terminal program for testing out your COM ports. This simplifies the verification of proper COM port operating. The card installs as standard COM ports in all operating systems.

A software reference manual is installed as part of the software and support package for this product. Please refer to this document for extensive information and guidance on software tools and programming support at your disposal.

CD Software Installation

The following instructions assume the CD-ROM drive is drive "D". Please substitute the appropriate drive letter for your system as necessary.

DOS

1. Place the CD into your CD-ROM drive.
2. Type D : Enter to change the active drive to the CD-ROM drive.
3. Type I N S T A L L Enter to run the install program.
4. Follow the on-screen prompts to install the software for this board.

Windows

1. Place the CD into your CD-ROM drive.
2. The system should automatically run the install program. If the install program does not run promptly, click START | RUN and type D : I N S T A L L, click OK or press Enter.
3. Follow the on-screen prompts to install the software for this board.

Linux

1. Please refer to linux.htm on the CD-ROM for information on installing under linux.

Note: COM boards can be installed in virtually any operating system. We do support installation in earlier versions of Windows, and are also likely to support future versions.

Hardware Installation

Caution! * ESD ***A single static discharge can damage your card and cause premature failure! Please follow all reasonable precautions to prevent a static discharge such as grounding yourself by touching any grounded surface prior to touching the card.***

1. Do not install the card into the computer until the software has been fully installed.
2. Turn OFF computer power AND unplug AC power from the system.
3. Remove the computer cover.
4. Carefully install the card in an available PCIe expansion slot (you may need to remove a backplate first).
5. Inspect for proper fit of the card and install and tighten the mounting bracket screw. Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.
6. Install the header to DB9M cable accessory in an adjacent mounting bracket / slot location. Tighten the mounting bracket screw.

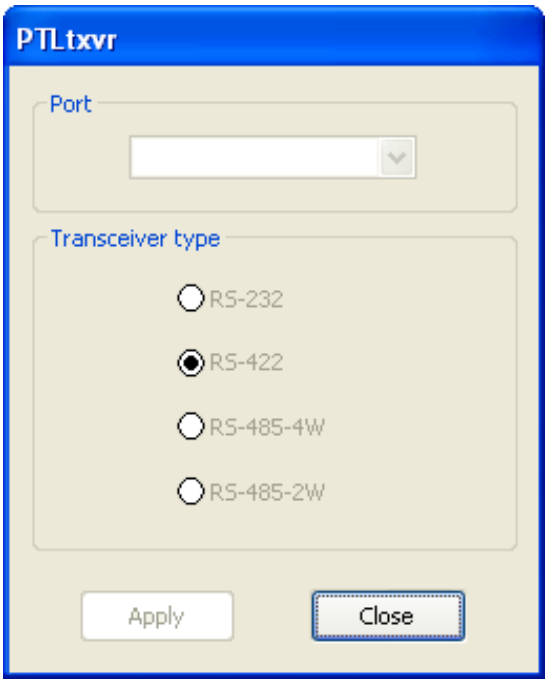


Figure 2-1: Port Configuration Utility Screenshot

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7. Replace the computer cover and turn ON the computer.
8. Most computers should auto-detect the card (depending on the operating system) and automatically finish installing the drivers.
9. Run the Port Configuration Utility program (setup.exe) to configure the protocol (RS-232/422/485) for each COM port.
10. Run one of the provided sample programs that was copied to the newly created card directory (from the CD) to test and validate your installation.

Chapter 3: Hardware Details

There only user-selectable options for this card are for applying a termination load to the RS-422 or RS-485 lines. Channel protocols are selected via software.

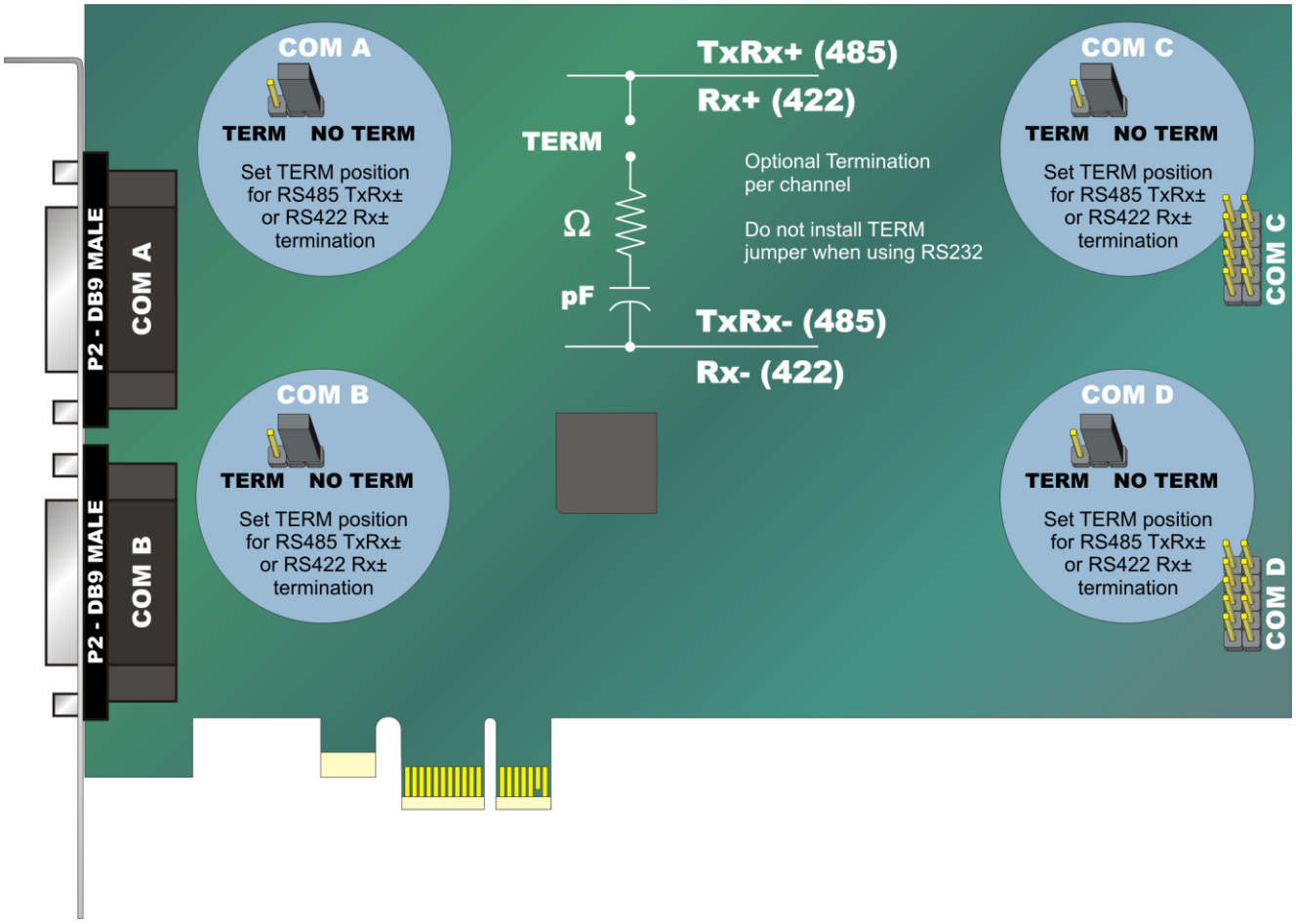


Figure 3-1: Option Selection Map

DB9M connector

Industry standard 9-pin Male D-Subminiature connector with screw locks.

Factory Option Descriptions

Fast RS-232 transceivers (-F)

The standard RS-232 transceivers used are capable of speeds up to 460.8kbps which is adequate in many applications. For this factory option, the board is populated with high-speed RS-232 transceivers enabling error-free communications at up to 921.6kbps.

Remote Wake-Up (-W)

The “Remote Wake-Up” factory option is for use in RS232 mode when your PC enters the L2 low-power state. When the Ring Indicator is received on serial port COM A in the L2 power state, Wake-Up is asserted.

Extended temperature (-T)

This factory option is for use in harsh environments and is populated with all-industrial rated components, specified at a minimum temperature range of -40°C to +85°C.

RoHS compliance (-RoHS)

For international customers and other special requirements, this factory option is available in RoHS compliant versions.

Chapter 4: Address Selection

The card uses one I/O address space PCI BAR[0]. COM A, COM B, COM C, COM D, COM E, COM F, COM G and COM H each occupy eight consecutive register locations.

The Vendor ID is 494F.
The Device ID for the PCIe-ICM-4SM card is 11D8h.
The Device ID for the PCIe-ICM-4S card is 115Ah.
The Device ID for the PCIe-ICM232-4 card is 1198h.
The Device ID for the PCIe-ICM-2SM card is 11D0h.
The Device ID for the PCIe-ICM-2S card is 1152h.
The Device ID for the PCIe-ICM232-2 card is 1190h.

Chapter 5: Programming

Sample Programs

There are sample programs with source-code provided with the card in a variety of common languages. DOS samples are located in the DOS directory and Windows samples are located in the WIN32 directory.

Windows COM Utility Program

WinRisc is a COM utility program provided on CD with the installation package for this card that is very useful when working with any serial ports and serial devices. If you haven't used this program yet, do yourself a favor and run this program to test your COM ports.

Windows Programming

The card installs into Windows as COM ports so standard API functions can be used.

See the documentation for your chosen language for details.
In DOS the process is identical to programming 16550- compatible UARTs.

Baud Rate Generation

The built-in Baud Rate Generator (BRG) allows a wide range of input frequency and flexible Baud Rate generation. To obtain the desired Baud Rate, the user can set the Sample Clock Register (SCR), Divisor Latch Low Register (DLL), Divisor Latch High Register (DLH) and Clock Prescale Registers (CPRM and CPRN). The Baud Rate is generated according to the following equation:

$$BaudRate = \frac{InputFrequency}{Divisor * \Pr escaler}$$

The parameters in the equation above can be programmed by setting the "SCR", "DLL", "DLH", "CPRM" and "CPRN" registers according to the table below.

Setting	Description
Divisor	DLL + (256 * DLH)
Prescaler	2^{M-1} *(SampleClock + *N*)
SampleClock	16 - *SCR* , (SCR = '0h' to 'Ch')
M	CPRM, (CPRM = '01h' to '02h')
N	CPRN, (CPRN = '0h' to '7h')

Table 5-1: Baud Rate Generator Setting

To ensure the proper operation of the Baud Rate Generator, users should avoid setting the value ‘0’ to Sample Clock, Divisor and Prescaler.

The following table lists some of the commonly used Baud Rates and the register settings that generate a specific Baud Rate. The examples assume an Input Clock frequency of 14.7456 Mhz. The SCR register is set to ‘0h’, and the CPRM and CPRN registers are set to ‘1h’ and ‘0h’ respectively. In these examples, the Baud Rates can be generated by different combination of the DLH and DLL register values.

Baud Rate	DLH	DLL
1,200	3h	00h
2,400	1h	80h
4,800	0h	C0h
9,600	0h	60h
19,200	0h	30h
28,800	0h	20h
38,400	0h	18h
57,600	0h	10h
115,200	0h	08h
921,600	0h	01h

Table 5-2: Sample Baud Rate Setting

We re-define the parameter of "Baudrate" on DCB structure,

Bit[30:28]: User Defined Baudrate, this value has to be non-zero

Bit[27:24]: to indicate the value of SCR (SampleClock)

Bit[23:16]: to indicate the value to put in DLH

Bit[15:8]: to indicate the value to put in DLL

Bit[7:3]: to indicate the value to put in M (CPRM)

Bit[2:0]: to indicate the value to put in N (CPRN)

If you want to set

DLL=1

DLH=0

SCR=12

then, the parameters of Baudrate in the DCB structure should be set to 0x1c000108. When the driver finds the parameter "Baudrate" does not exist on the default baudrate table, and Bit 28 is set to "1", it will get the values of SCR, DLL, DLH, M and N from the Baudrate parameter and set to the registers directly.

Chapter 6: Connector Pin Assignments

Input/Output Connections

The serial communications ports are interfaced at the card and adjacent mounting brackets via 4x DB9M connectors.

PIN	RS-232	RS-422 and 4-Wire RS-485	2-Wire RS-485
1	DCD	TX-	-
2	RX	TX+	-
3	TX	RX+	TX+/RX+
4	DTR	RX-	TX-/RX-
5	GND	GND	GND
6	DSR	-	-
7	RTS	-	-
8	CTS	-	-
9	RI	-	-

Table 6-1: DB9 Male Connector Pin Assignments

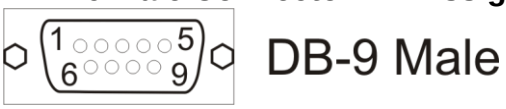


Figure 6-1: DB9 Male Connector Pin Locations

RS-232 Signals	RS-232 Signal Descriptions	RS-422 Signals (4-w 485)	RS-422 Signal Descriptions	RS-485 Signals (2-wire)	RS-485 Signal Descriptions
DCD	Data Carrier Detected	TX+	Transmit Data +	TX/RX +	Transmit / Receive +
RX	Receive Data	TX-	Transmit Data -	TX/RX -	Transmit / Receive -
TX	Transmit Data	RX+	Receive Data +	GND	Signal Ground
DTR	Data Terminal Ready	RX-	Receive Data -		
GND	Signal Ground	GND	Signal Ground		
DSR	Data Set Ready				
RTS	Request To Send				
CTS	Clear to Send				
RI	Ring Indicator				

Table 6-2: COM signal names to corresponding signal descriptions

To ensure that there is minimum susceptibility to EMI and minimum radiation, it is important that the card mounting bracket be properly screwed into place and that there be a positive chassis ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the aperture, shielded twisted-pair wiring, etc.) should be used for the input/output wiring.

Chapter 7: Specifications

Communications Interface

- I/O connection: DB9M
- Serial ports: 4 (or 2) RS-232/422/485
- Isolation: 2000V isolation port to port and port to computer
- Serial data rates: RS-232 460.8k (921.6k avail)
  RS-422/485 3Mbps
- UART: Quad type 16C950 with 128-byte transmit & receive FIFO, 16C550 compliant
- Character length: 5, 6, 7, 8, or 9 bits
- Parity: Even, Odd, None, Space, Mark
- Stop interval: 1, 1.5, or 2 bits
- Flow Control: RTS/CTS and/or DSR/DTR, Xon/Xoff
- ESD Protection: ±15kV on all signal pins

Environmental

- Operating temp.: Commercial: 0°C to +70°C
  Industrial: -40°C to +85°C
- Storage temp.: -65°C to +150°C
- Humidity: 5% to 95%, non-condensing
- Power required: +3.3VDC @ 0.8W (typical)
  +12VDC @ 0.9W (typical)
- Size: 6.600“ long x 4.200” high
  (167.65 mm long x 106.68 mm high)

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: ***manuals@accesio.com.*** Please detail any errors you find and include your mailing address so that we can send you any manual updates.

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