



MAP/950

4 PORT ISOLATED RS422/RS485 PCI

SERIAL I/O CARD INSTALLATION MANUAL

HIGH-PERFORMANCE UART FAMILY

This document describes the installation and use of the Axxon Computer Corporation
MAP/950 4 Port RS422/RS485 Isolated PCI Bus Adapter.

Release Version 1.0 (01 June 2007)

1 INTRODUCTION

Thank you for choosing the Axxon line of high performance I/O cards. Please take a few moments to read through this documentation. Device drivers and utilities for this Axxon MAP/950 product are supplied for functionality under Windows 9x, ME, XP, NT4, 2000, 2003, Vista-32, Vista-64, Linux 32/64 bit, OS/2 (RS422), QNX (RS422) operating systems.

2 LICENCE AGREEMENT

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4 OVERVIEW and INSTALLATION

4.1 MAP/950 4 Port RS422/ RS485 Isolated PCI I/O Card

Overview

Axxon manufactures a variety of serial port products based on the enhanced Oxford Semiconductor 16C950 UART. This documentation covers installation of the 4 (Quad) Channel Isolated RS422/RS485 PCI design.

The Axxon MAP/950 4 Port RS422/RS485 Isolated PCI I/O Card offers the following features:

- 4 Independent channels based on the RS422/RS485 Electrical Interface
- Based on the Oxford Semiconductor OX16PCI954 PCI Bus UART (<http://www.oxsemi.com>)
- 128 byte deep Transmit and Receive FIFOs
- Flexible clock prescalar from 1 to 31.875
- RS422/RS485 compliant transceivers
- Support for RS422 Full Duplex Mode (TX and RX always ACTIVE)
- Support for RS485 Half / Full Duplex Mode (TX is auto-gated using hardware)
- True Fail-Safe Mode receivers while maintaining EIA/TIA-485 compatibility
- Devices have 1/8 unit load impedance to permit more devices on the bus (upto 256 similar devices)
- Onboard switch selectable termination resistors for TX and RX lines
- Jumper selectable TX and RX phase reversal to correct external cable wiring
- Maximum baud rate 460k (up to 10 Mbps optional)
- Enhanced Slew-Rate control for error-free data transmission
- 25kv ESD Protected RS485 pins (IEC61000-4-5)
- 3kv Isolated onboard DC-DC Converter (Isolation @ 5kv is optional)
- Low Profile / Standard Height PCI slot compatible
- HD44M to 4 of DB9M Quadplex Cable included (Double shielded - Braid & Foil)
- 4 layer high quality PCB
- PCI 2.2 bus compliant (5 volt)
- Single 5 volt power supply operation

4.1.1 Hardware

This product will permit the addition of 4 serial ports to your PC based on the RS422/RS485 electrical interface. You may install as many of these circuit boards as you have room inside your computer system. Likewise each board will offer 4 serial ports to your operating system. The device driver installation for popular operating systems is discussed in detail in the next section. Please take a few moments to familiarize yourself with the hardware features onboard this MAP/950 product.

There are 4 serial channels offered in this product model. You are free to independently configure each port to suit your application. That is, you may configure Channel #0 to be RS422 while the rest of the serial ports on this device are RS485, etc.

DB9 Male Pinout (Full Duplex)

Pin 9 (DB9) : RX+
Pin 4 (DB9) : RX-
Pin 8 (DB9) : TX-
Pin 7 (DB9) : TX+
Pin 1 (DB9) : Isolated Ground

DB9 Male Pinout (Half Duplex)

Pin 8 (DB9) : Data- (D-)
Pin 7 (DB9) : Data+ (D+)
Pin 1 (DB9) : Isolated Ground

RS422 Configuration

RS422 configuration is typically a FULL DUPLEX (4 wire) mode of communication with balanced lines for the transmitter (TX) and the receiver (RX).

Therefore a serial port configured for RS422 Communication Mode on this MAP/950 circuit board will offer:

TX+ (Transmitter Positive Phase)
TX- (Transmitter Negative Phase)

RX+ (Receiver Positive Phase)
RX- (Receiver Negative Phase)

Galvanic Isolated Ground

Please note again that for the RS422 interface, TRANSMITTER and RECEIVER for this channel will always be **ACTIVE (ENABLED)**.

RS485 Configuration

RS485 configuration is also commonly named Multi-Drop. In this mode of wiring, the TRANSMITTER is ENABLED during transmission and DISABLED (Tri-stated) otherwise. This MAP/950 product provides a hardware mechanism to Auto-Gate the Transmitter using the DTR pin of the OX16PCI954 UART device.

To configure a port for RS485 communication:

- 1) Select (S4) DTR for the respective channel to be ON. This action will permit DTR to ENABLE / DISABLE the transmitter. Be certain to select DTR ACTIVE HIGH mode in the device driver for the respective serial port. The Axxon Quadplex cable ends are labelled 0..3 while the dip switches are labelled 1..4 so please take caution during configuration.
- 2) Select the Slew Rate (J2, J5, J8, J11) best suited for your application. This value should be either equal to or higher than the maximum baud rate you expect to use on this serial port.
- 3) Terminate the serial port (S1, S3) as you see fit for your application. In most cases, the start and end nodes should be terminated with the onboard termination resistors.
- 4) If necessary, turn the respective switch on S2 to OFF for Half Duplex RS485 communication (2 wire).

DB9 Male Pinout (Half Duplex)

Pin 8 (DB9) : Data- (D-)

Pin 7 (DB9) : Data+ (D+)

Pin 1 (DB9) : Isolated Ground

- 5) If necessary, turn the respective switch on S2 to ON for Full Duplex RS485 communication (4 wire).

DB9 Male Pinout (Full Duplex)

Pin 9 (DB9) : RX+

Pin 4 (DB9) : RX-

Pin 8 (DB9) : TX-

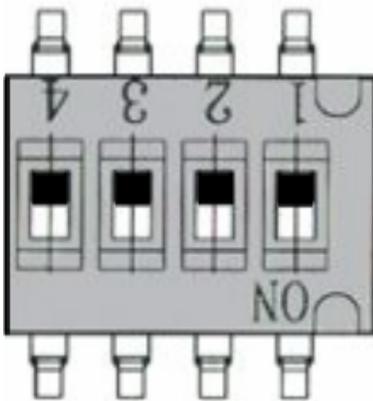
Pin 7 (DB9) : TX+

Pin 1 (DB9) : Isolated Ground

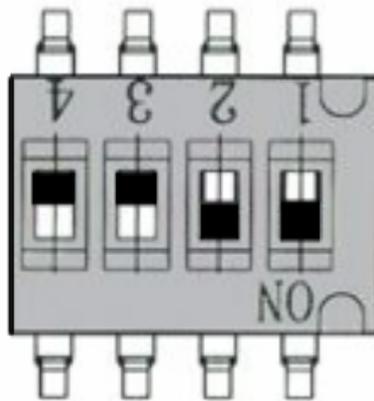
S2 - Duplex Switch

OFF : Half Duplex (2 Wire Mode)

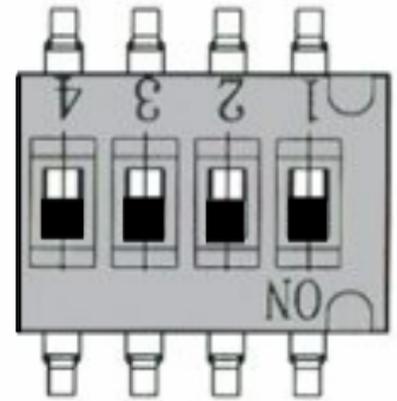
ON : Full Duplex (4 Wire Mode)



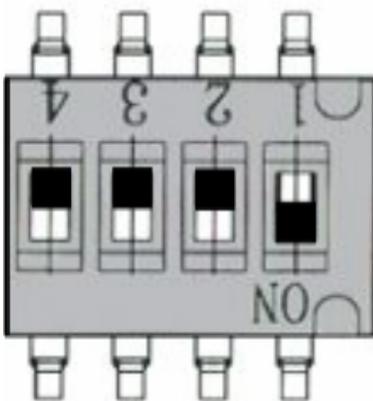
Port 0 : Half Duplex
 Port 1 : Half Duplex
 Port 2 : Half Duplex
 Port 3 : Half Duplex



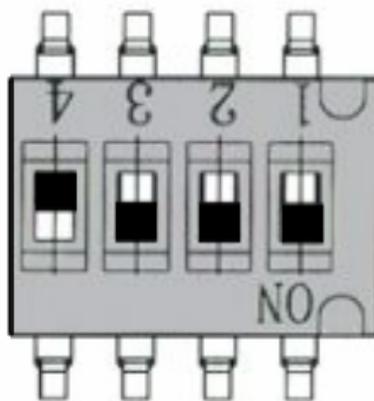
Port 0 : Full Duplex
 Port 1 : Full Duplex
 Port 2 : Half Duplex
 Port 3 : Half Duplex



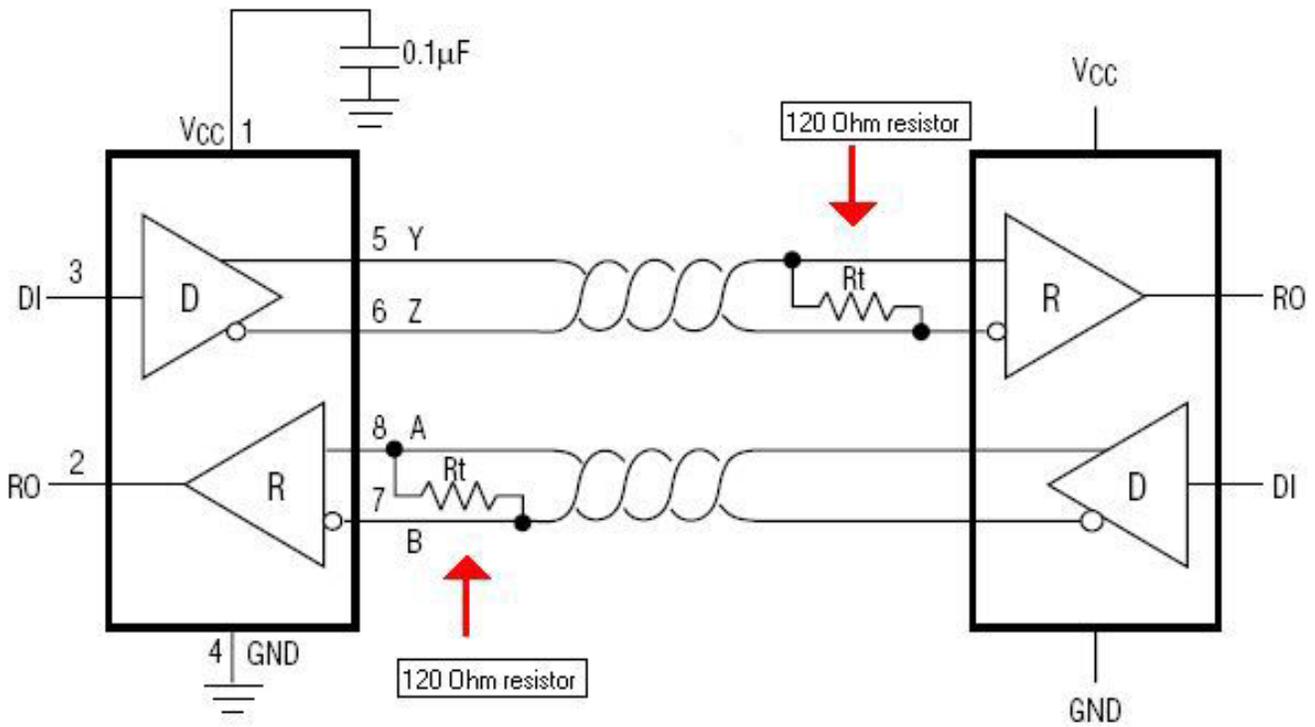
Port 0 : Full Duplex
 Port 1 : Full Duplex
 Port 2 : Full Duplex
 Port 3 : Full Duplex



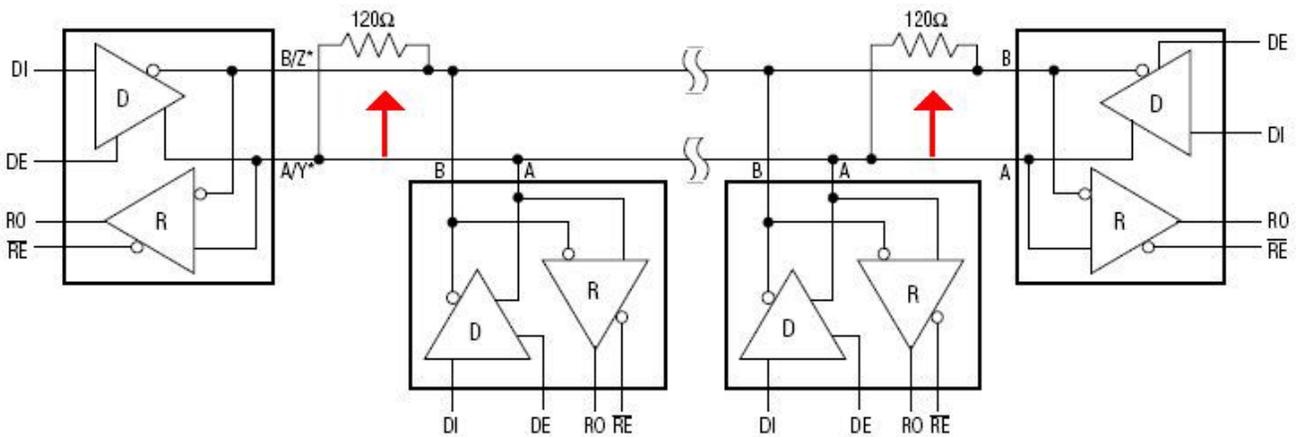
Port 0 : Full Duplex
 Port 1 : Half Duplex
 Port 2 : Half Duplex
 Port 3 : Half Duplex



Port 0 : Full Duplex
 Port 1 : Full Duplex
 Port 2 : Full Duplex
 Port 3 : Half Duplex



Typical Full Duplex RS422 Termination & Point to Point Wiring Diagram. Terminate each Receiver.



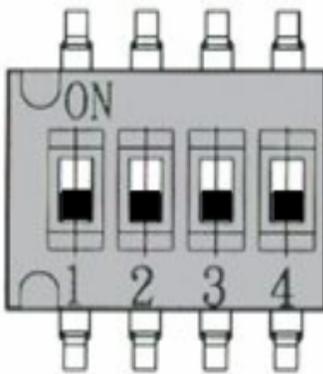
Typical Half Duplex RS485 Termination & Multipoint Wiring Diagram. Terminate each cable end node ONLY.

S4 - DTR Switch

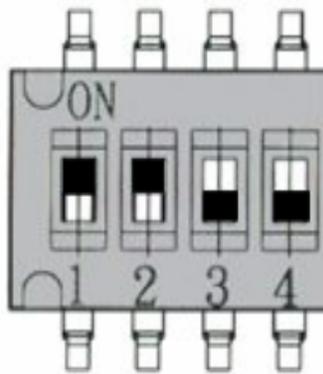
OFF : RS422 Mode (Transmitter always Enabled)

ON : Rs485 Mode (DTR will Enable / Disable Transmitter)*

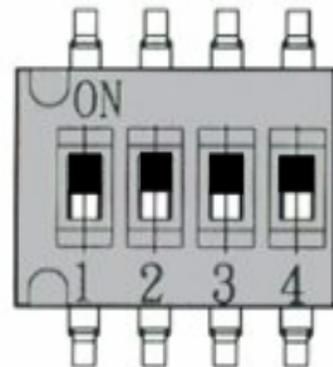
* The DTR Active High function must be selected in the device driver to permit Auto-Gating of the TRANSMITTER in Rs485 Mode



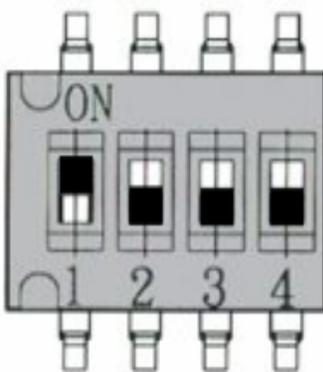
Port 0 : Rs422 Mode
 Port 1 : Rs422 Mode
 Port 2 : Rs422 Mode
 Port 3 : Rs422 Mode



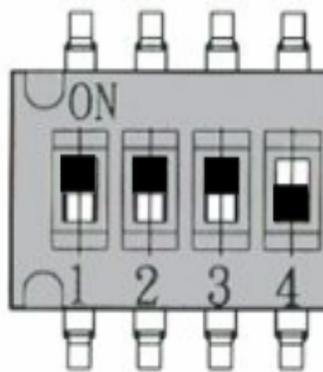
Port 0 : Rs485 Mode
 Port 1 : Rs485 Mode
 Port 2 : Rs422 Mode
 Port 3 : Rs422 Mode



Port 0 : Rs485 Mode
 Port 1 : Rs485 Mode
 Port 2 : Rs485 Mode
 Port 3 : Rs485 Mode



Port 0 : Rs485 Mode
 Port 1 : Rs422 Mode
 Port 2 : Rs422 Mode
 Port 3 : Rs422 Mode

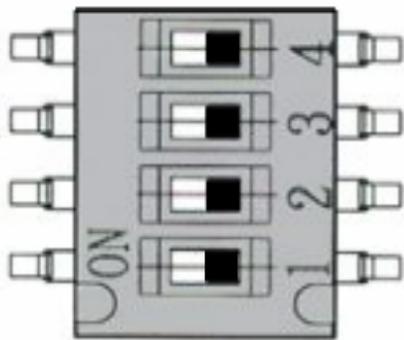


Port 0 : Rs485 Mode
 Port 1 : Rs485 Mode
 Port 2 : Rs485 Mode
 Port 3 : Rs422 Mode

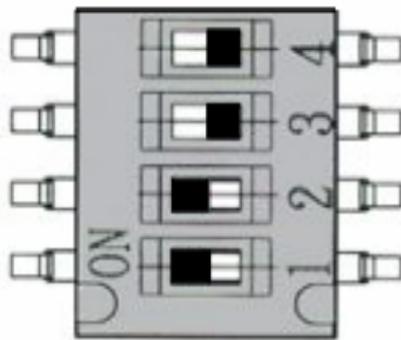
S1 - Port 0 / 1 Termination Switch

OFF : No Termination

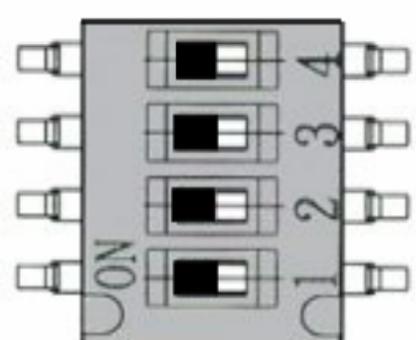
ON : 120 Ohm Termination is applied



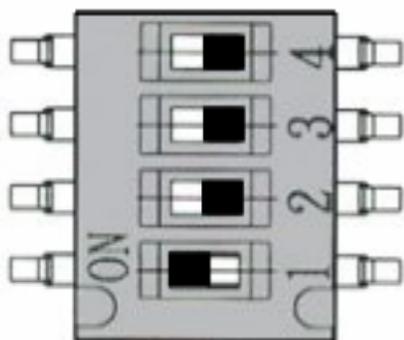
Port 0_RX : Term OFF
 Port 0_TX : Term OFF
 Port 1_RX : Term OFF
 Port 1_TX : Term OFF



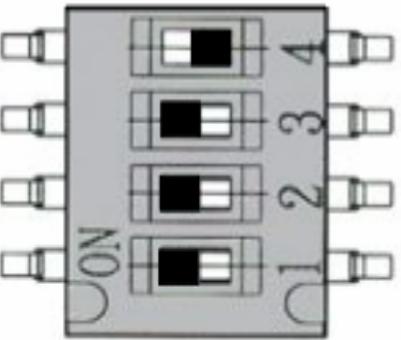
Port 0_RX : Term ON
 Port 0_TX : Term ON
 Port 1_RX : Term OFF
 Port 1_TX : Term OFF



Port 0_RX : Term ON
 Port 0_TX : Term ON
 Port 1_RX : Term ON
 Port 1_TX : Term ON



Port 0_RX : Term ON
 Port 0_TX : Term OFF
 Port 1_RX : Term OFF
 Port 1_TX : Term OFF

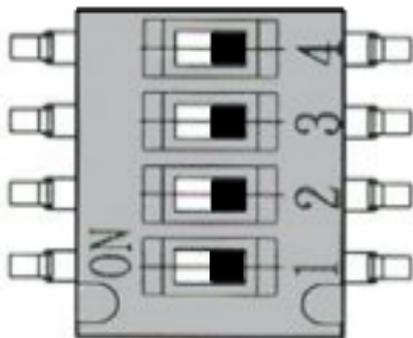


Port 0_RX : Term ON
 Port 0_TX : Term ON
 Port 1_RX : Term ON
 Port 1_TX : Term OFF

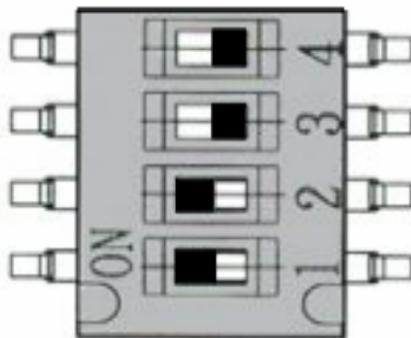
S3 - Port 2 / 3 Termination Switch

OFF : No Termination

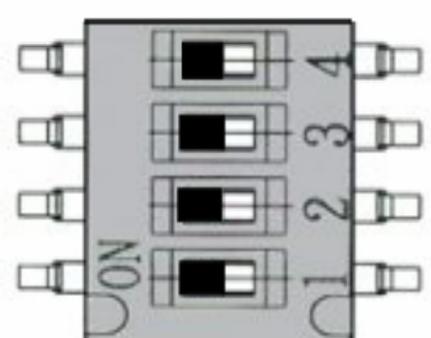
ON : 120 Ohm Termination is applied



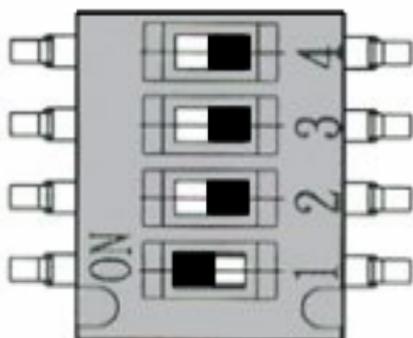
Port 2_RX : Term OFF
 Port 2_TX : Term OFF
 Port 3_RX : Term OFF
 Port 3_TX : Term OFF



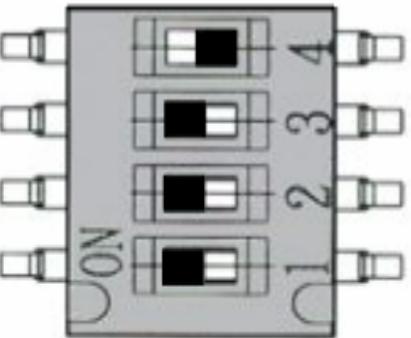
Port 2_RX : Term ON
 Port 2_TX : Term ON
 Port 3_RX : Term OFF
 Port 3_TX : Term OFF



Port 2_RX : Term ON
 Port 2_TX : Term ON
 Port 3_RX : Term ON
 Port 3_TX : Term ON



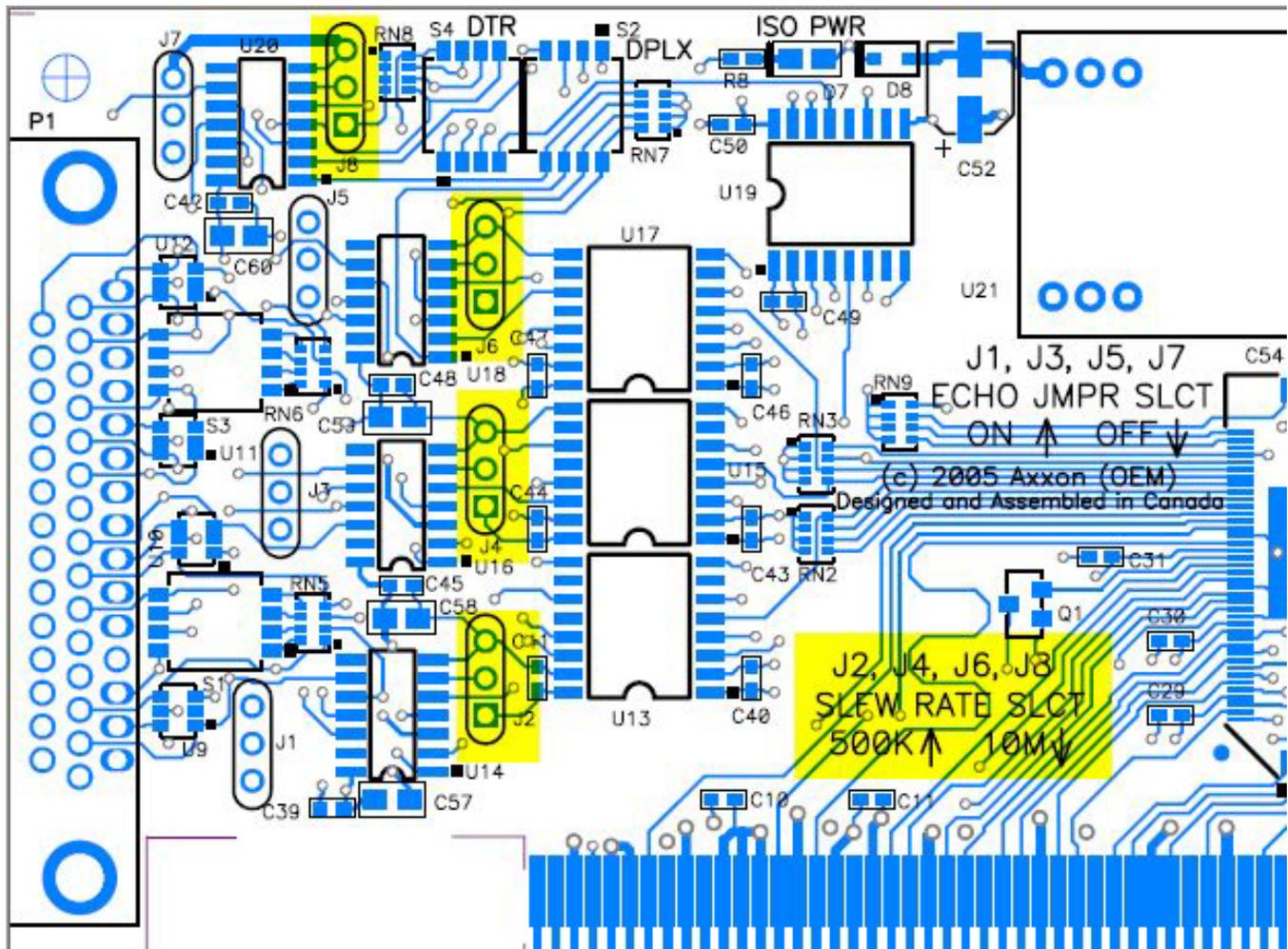
Port 2_RX : Term ON
 Port 2_TX : Term OFF
 Port 3_RX : Term OFF
 Port 3_TX : Term OFF



Port 2_RX : Term ON
 Port 2_TX : Term ON
 Port 3_RX : Term ON
 Port 3_TX : Term OFF

Slew Rate Control Jumper Configurations

For the most reliable communication integrity please configure the Slew Rate jumper to best suit your application. Select the highest baud rate jumper setting for your communication speed. For example, if your application will communicate at 460k baud then it is recommended that you select 500k Slew Rate. Another example, if your application will communicate at 921k baud then it is recommended that you select 10M for the Slew Rate jumper. A proper configuration of this jumper block will allow for the optimal cable lengths for the communications.



Jumper J2 – 3 Post Jumper – Slew Rate Control for Port # 0

- Open : Maximum Baud Rate 115.2k
- Short 1 & 2 (Middle & Bottom) : Maximum Baud Rate 500k
- Short 2 & 3 (Middle & Top) : Maximum Baud Rate 10M

Jumper J4 – 3 Post Jumper – Slew Rate Control for Port # 1

Open : Maximum Baud Rate 115.2k
Short 1 & 2 (Middle & Bottom) : Maximum Baud Rate 500k
Short 2 & 3 (Middle & Top) : Maximum Baud Rate 10M

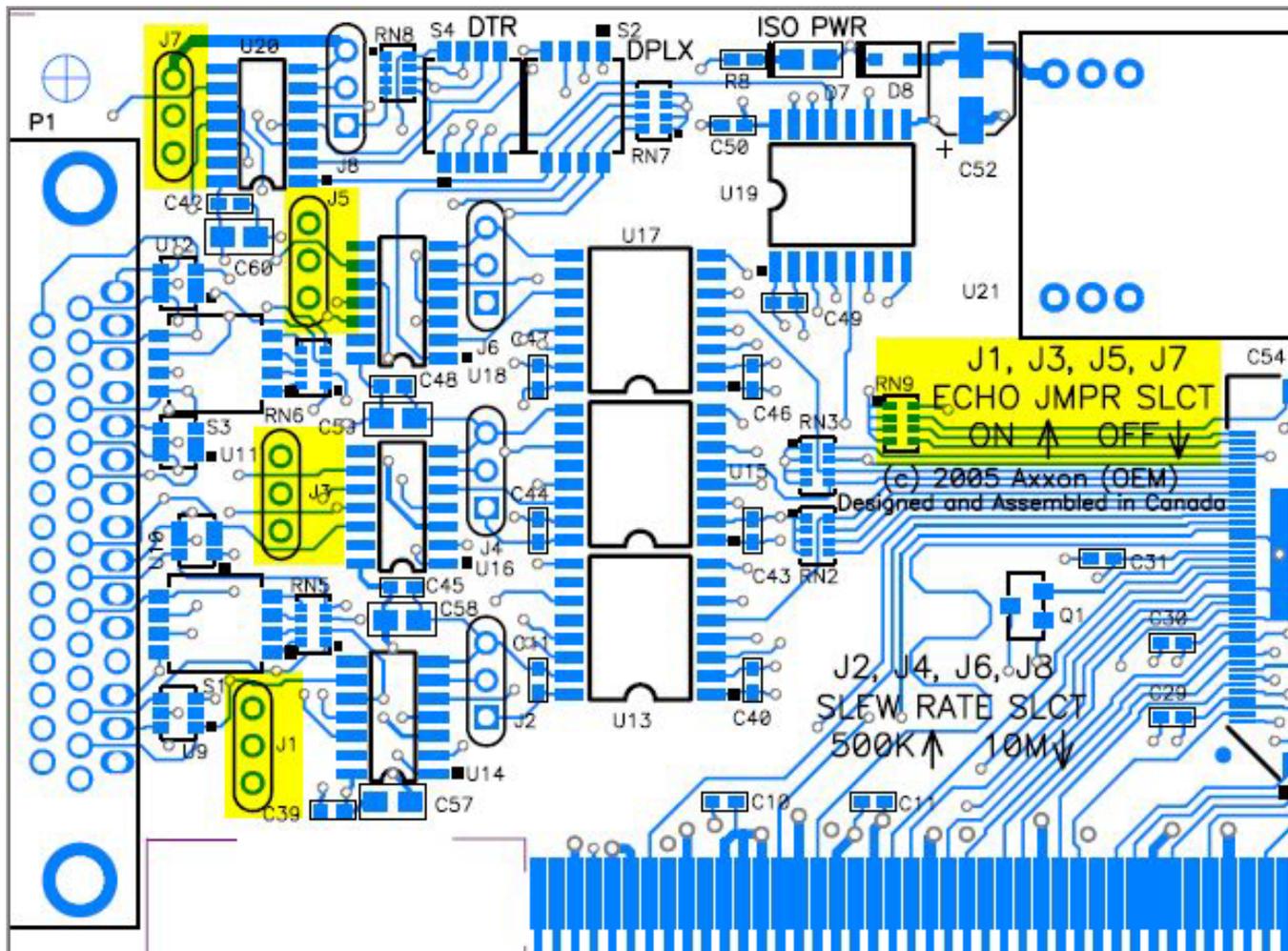
Jumper J6 – 3 Post Jumper – Slew Rate Control for Port # 2

Open : Maximum Baud Rate 115.2k
Short 1 & 2 (Middle & Bottom) : Maximum Baud Rate 500k
Short 2 & 3 (Middle & Top) : Maximum Baud Rate 10M

Jumper J8 – 3 Post Jumper – Slew Rate Control for Port # 3

Open : Maximum Baud Rate 115.2k
Short 1 & 2 (Middle & Bottom) : Maximum Baud Rate 500k
Short 2 & 3 (Middle & Top) : Maximum Baud Rate 10M

Local Echo Enable / Disable Jumper Configurations



Jumper J1 – 3 Post Jumper – Local Echo Enable / Disable Control for Port # 0

Short 1 & 2 (Middle & Bottom) : Receiver will automatically DISABLE when the local transmitter is ENABLED. Local Echo is OFF.
 Short 2 & 3 (Middle & Top) : Receiver is always ENABLED. Local Echo is ON.

Jumper J3 – 3 Post Jumper – Local Echo Enable / Disable Control for Port # 1

Short 1 & 2 (Middle & Bottom) : Receiver will automatically DISABLE when the local transmitter is ENABLED. Local Echo is OFF.
 Short 2 & 3 (Middle & Top) : Receiver is always ENABLED. Local Echo is ON.

Jumper J5 – 3 Post Jumper – Local Echo Enable / Disable Control for Port # 2

Short 1 & 2 (Middle & Bottom) : Receiver will automatically DISABLE when the local transmitter is ENABLED. Local Echo is OFF.
 Short 2 & 3 (Middle & Top) : Receiver is always ENABLED. Local Echo is ON.

Jumper J7 – 3 Post Jumper – Local Echo Enable / Disable Control for Port # 3

Short 1 & 2 (Middle & Bottom) : Receiver will automatically DISABLE when the local transmitter is ENABLED. Local Echo is OFF.
 Short 2 & 3 (Middle & Top) : Receiver is always ENABLED. Local Echo is ON.

High Density Connector (P1) Wiring Details

P1 is a right angled through hole HD44F (High Density DB44 pin Female) connector.

Connector Wiring is as follows:

Pin 16_P1 : Isolated Ground
Pin 17_P1 : Isolated TX+ / Data+ (Full Duplex RS485 / RS422 mode) for UART # 0
Pin 2_P1 : Isolated TX- / Data- (Full Duplex RS485 / RS422 mode) for UART # 0
Pin 18_P1 : Isolated RX- for UART # 0
Pin 3_P1 : Isolated RX+ for UART # 0

25kv ESD protected by U9. For baud rates > 1 Mbaud on this port, U9 should be removed due to the capacitive load of this component. Without U9 15kv protection is default.

Pin 4_P1 : Isolated Ground
Pin 21_P1 : Isolated TX+ / Data+ (Full Duplex RS485 / RS422 mode) for UART # 1
Pin 22_P1 : Isolated TX- / Data- (Full Duplex RS485 / RS422 mode) for UART # 1
Pin 7_P1 : Isolated RX- for UART # 1
Pin 23_P1 : Isolated RX+ for UART # 1

25kv ESD protected by U10. For baud rates > 1 Mbaud on this port, U10 should be removed due to the capacitive load of this component. Without U10 15kv protection is default.

Pin 8_P1 : Isolated Ground
Pin 25_P1 : Isolated TX+ / Data+ (Full Duplex RS485 / RS422 mode) for UART # 2
Pin 26_P1 : Isolated TX- / Data- (Full Duplex RS485 / RS422 mode) for UART # 2
Pin 11_P1 : Isolated RX- for UART # 2
Pin 27_P1 : Isolated RX+ for UART # 2

25kv ESD protected by U11. For baud rates > 1 Mbaud on this port, U11 should be removed due to the capacitive load of this component. Without U11 15kv protection is default.

Pin 12_P1 : Isolated Ground
Pin 29_P1 : Isolated TX+ / Data+ (Full Duplex RS485 / RS422 mode) for UART # 3
Pin 30_P1 : Isolated TX- / Data- (Full Duplex RS485 / RS422 mode) for UART # 3
Pin 15_P1 : Isolated RX- for UART # 3
Pin 44_P1 : Isolated RX+ for UART # 3

25kv ESD protected by U12. For baud rates > 1 Mbaud on this port, U12 should be removed due to the capacitive load of this component. Without U12 15kv protection is default.

4.1.2 Windows Device Drivers for Model # IC0545KB PCI I/O Cards

It is recommended that you download the most current device driver suite from our website at:

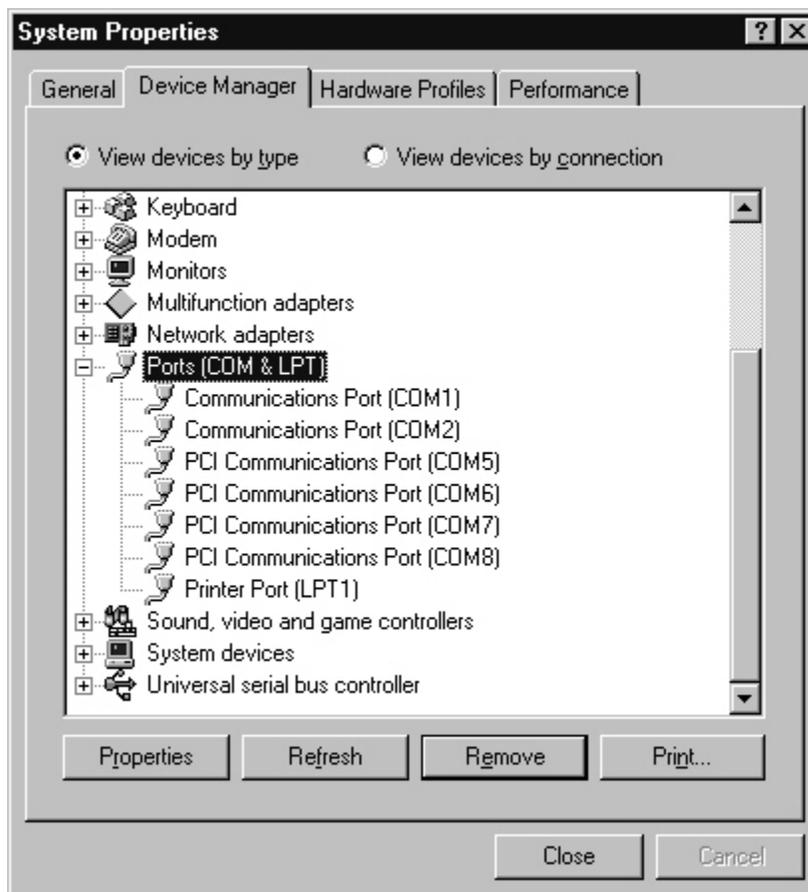
<http://www.softio.com> -> Downloads -> Latest driver for the MAP/950 series.

At this time of writing, the most current driver suite is posted at:

http://www.softio.com/drivers/UART_Driver_v605.zip

The architecture of the Windows drivers is very similar. Each UART is hooked by a single-port driver, which enables the following 16C95x features:

- 128-byte receiver and transmitter FIFOs
- Adjustable receiver and transmitter interrupt trigger level with Automatic flow control
- Quad speed (using Times clock register)
- Flexible baud rate generation



Typical Ports Environment for Axxon MAP/950 4 Port PCI Installation

COM5 : P0, COM6 : P1, COM7 : P2, COM8 : P3

Timing Background

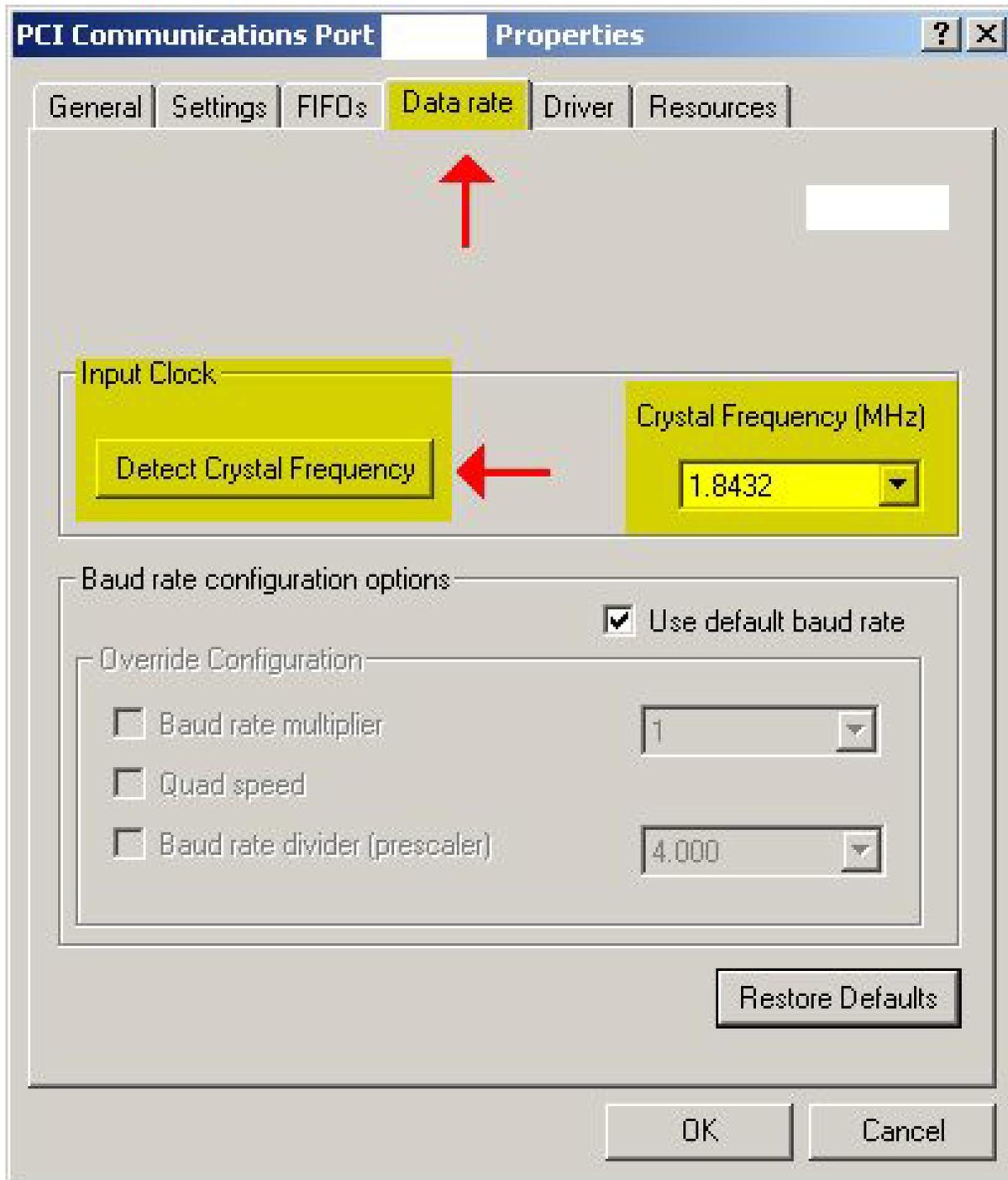
The serial ports found on the IBM personal computer have historically evolved around a clock source of 1.8432 MHz (industry standard). The Axxon MAP/950 PCI series is shipped by default with a 1.8432 MHz clock source. Such a clock source permits a logical 1:1 mapping of desired baud rate to a target serial port device. Using the 16c95x UART internal clock multiplier(s) and pre-scalars in the provided device drivers, you may select upto 460K baud rate communication speed between the host PC and a serial port device (provided the target device supports upto 460K baud operation).

Select the DETECT CRYSTAL button in the device drivers to allow for the proper application requested baud rate to hardware baud rate relationship. Select the QUAD BAUD RATE (option) to activate the X4 baud rates. When active, this X4 option will map the application selected baud rate to target hardware baud rate by a ratio of X4. As an example, when this option is SELECTED, 300 Baud in the Windows application will map to and run the serial port at an actual value of 1200 Baud.

Crystal Detection for Input Clock

This configuration is required to allow the device driver to correctly calculate the Input Clock being fed into the onboard UARTS. In most applications, this value will auto-detect to 1.8432 MHz which permits a 1:1 mapping ratio relationship for Application Selected baud rate to Target Hardware baud rate.

To configure the clock source please review the following GUI property sheet:



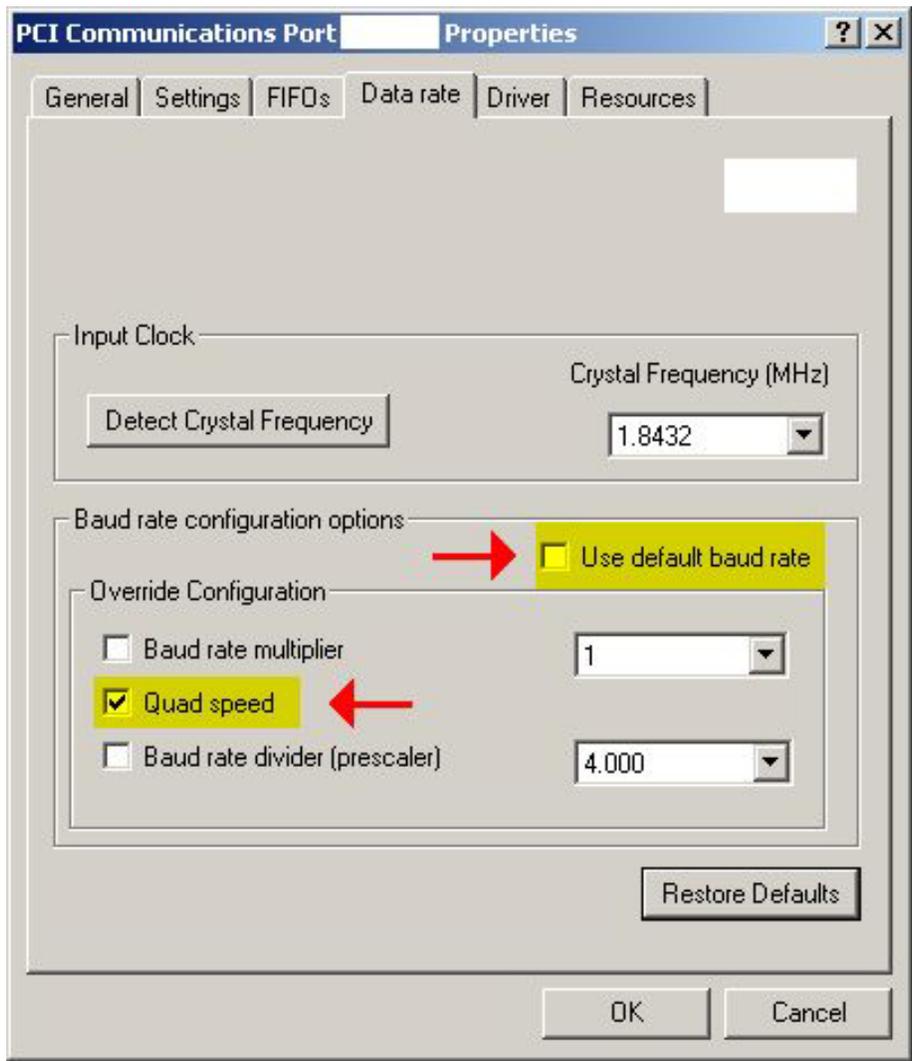
- 1) Select the DATA RATE tab.
- 2) Select the Detect Crystal Frequency button.
- 3) The device driver will then return with "Working..." for a few seconds and return a value of 1.8432 MHz for the crystal frequency. This is default on most product shipped from the factory. If a request was made for a custom, non-standard clock substitution then DO NOT select the Detect Crystal Frequency button. Instead, force the pull down menu for the Crystal Frequency selection to remain at 1.8432 MHz regardless of which value has been applied to the circuit board.

Quad Speed

The **Quad Speed** option will force any host application software’s baud rate to be multiplied by a factor of 4 (Four). That is, when an application selects 115K, as an example, the actual hardware baud rate will result in a 460K communication speed with this option active.

Mappings for Windows Application Selected Baud Rate to Target Hardware Baud Rate with QUAD BAUD RATE (x4) Option ON :

110	Baud (application software) maps to	440	Baud (target hardware)
300	Baud (application software) maps to	1200	Baud (target hardware)
600	Baud (application software) maps to	2400	Baud (target hardware)
1200	Baud (application software) maps to	4800	Baud (target hardware)
2400	Baud (application software) maps to	9600	Baud (target hardware)
4800	Baud (application software) maps to	19200	Baud (target hardware)
9600	Baud (application software) maps to	38400	Baud (target hardware)
19200	Baud (application software) maps to	76800	Baud (target hardware)
38400	Baud (application software) maps to	153600	Baud (target hardware)
57600	Baud (application software) maps to	230200	Baud (target hardware)
115200	Baud (application software) maps to	460800	Baud (target hardware)



4.1.3 Windows NT4 driver for MAP/950

Overview

The Windows NT4 driver creates a Device Object for each port, and registers this with the operating system. The serial port driver enables the following 16C95x features:

- 128-byte receiver and transmitter FIFOs
- Optimized receiver interrupt handling – uses readable fill levels and thresholds
- Automatic clock speed detection

A separate parallel port driver is provided, which creates the device Object and registers it with the Printer class driver.

Installation

Install the hardware by following system instructions. Power up the system. Then follow the instructions below depending on which functions are required. To **upgrade** the NT4 driver, simply install over the existing version.

Serial driver

1. Run "Install_Serial.exe" from the \NT4_Serial subdirectory on the disk.
2. When the install application starts, click Next to continue
3. Ensure 'install' is selected, then click Next.
4. Click OK to accept the licence agreement.
5. The system will install the driver and start it. The ports are immediately ready for use.

5 USING THE SERIAL DRIVER

The serial drivers for Windows make use of a number of enhanced 95x UART features, and are highly configurable. This section describes the configuration utilities, accessible through Device Manager, which can be used to enable and configure the various features

The driver will install the correct number of serial ports and Windows will assign COM numbers to them (e.g. COM5). You can then attach modems etc. to the ports and make use of them in the same fashion as any other generic port. The serial driver has extra configuration options available over and above the standard 'settings' tab supplied with the generic 16550 driver. To adjust any of the UART parameters, follow these steps:

1. Click on Start / Settings / Control Panel
2. Double click "System" to bring up the system properties dialog box
3. Select the "Device Manager" tab of this dialog (with the "View devices by type" option selected)
4. Now click on the [+] next to the "Ports (COM & LPT)" icon to show the list of installed COM ports
5. Double click on an PCI port to display the settings dialog for that port

The enhanced features are configurable through three dialog pages:

Settings	- Standard port settings found on normal COM port settings pages
Data Rate	- Advanced data rate selection options
FIFOs	- Device mode selection and FIFO trigger level settings

5.1.1 Windows configuration

Settings

This page contains the standard Baud rate / Data bits / Parity / Stop bits and Flow control options found on most COM port settings pages. These settings modify the **default** settings used by Windows. Most applications that use COM ports will override these settings with their own comms parameters.

This page also provides configurable RS485 operation. For RS485 operating mode, the device driver must be configured to use the DTR pin to enable the transmitter using active-high form. This Axxon MAP/950 product requires the use of *ACTIVE-HIGH* mode.

Data Rate

This page provides a list of common crystal values used with COM ports. Select "Detect crystal frequency" to detect the input clock frequency to the UART. (This requires that the port is not currently in use by another application).

The baud rate can optionally be adjusted according to the data rate required. To enable the advanced baud rate configuration options, deselect the "Use default baud rate" box. In normal operation, the driver will generate the desired baud rate from the crystal frequency. The quad speed option will multiply all application selected baud rates by 4 by utilising the OX16C95x Times clock register (TCR). The driver can multiply this baud rate, or divide it using the Clock Prescaler register (CPR).

The clock pre-divisor is used to divide the input clock prior to baud rate generation. This means a high speed crystal (E.g. 50MHz) can be pre-divided to generate standard baud rates (In this case $50 / 27.125 = 1.8433$ MHz, which will emulate a 1.8432 MHz crystal with less than 0.01% bit rate error). Alternatively, the pre-divisor could be switched off to allow data rates up to 12.5Mbps to be generated.

FIFOs

This page is used to configure the FIFO trigger levels, i.e. at what fill levels the device will generate an interrupt, or apply automatic flow control. In addition, the FIFOs can be completely disabled; although this is not recommended for normal operation.

The four sliders allow adjustment of the various trigger levels in 550 and 950 modes. These are described below:

- Transmitter FIFO interrupt trigger level - When the level of data in the transmit FIFO falls below this value, a transmitter interrupt is triggered. Setting this value to zero will not trigger an interrupt until the transmitter is completely idle.
- Receiver FIFO interrupt trigger level - When the level of data in the receiver FIFO reaches this value, a receiver data interrupt is triggered.
- Flow On flow-control limit - When the level of data in the receiver FIFO reaches this value as data is read from the FIFO, a handshake is triggered to instruct the remote transmitter that it is free to transmit data (E.g. Transmit an XON character to the remote machine).
- Flow Off flow-control limit - When the level of data in the receiver FIFO reaches this value as it fills up, a handshake is triggered to instruct the remote transmitter to stop sending data as the FIFO is becoming full. (E.g. Transmit an XOFF character to the remote machine).

The FIFO trigger levels can be fine-tuned to gain optimum performance, depending on system performance, baud rate used, levels of serial traffic etc.

5.1.2 Linux configuration

This adapter card design uses the following PCI IDs for a PnP enumeration under Linux:

Vendor ID: 1415h
Device ID: 9501h

Therefore, by design, this adapter card will be PnP enumerated and supported as a 4 channel RS422 adapter card without add-on drivers, without kernel recompiles, without add-on modules.

For RS485 operation, a small modification is required to the Linux source code. Please contact our tech support staff for further details.

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6 CONTACT INFORMATION

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