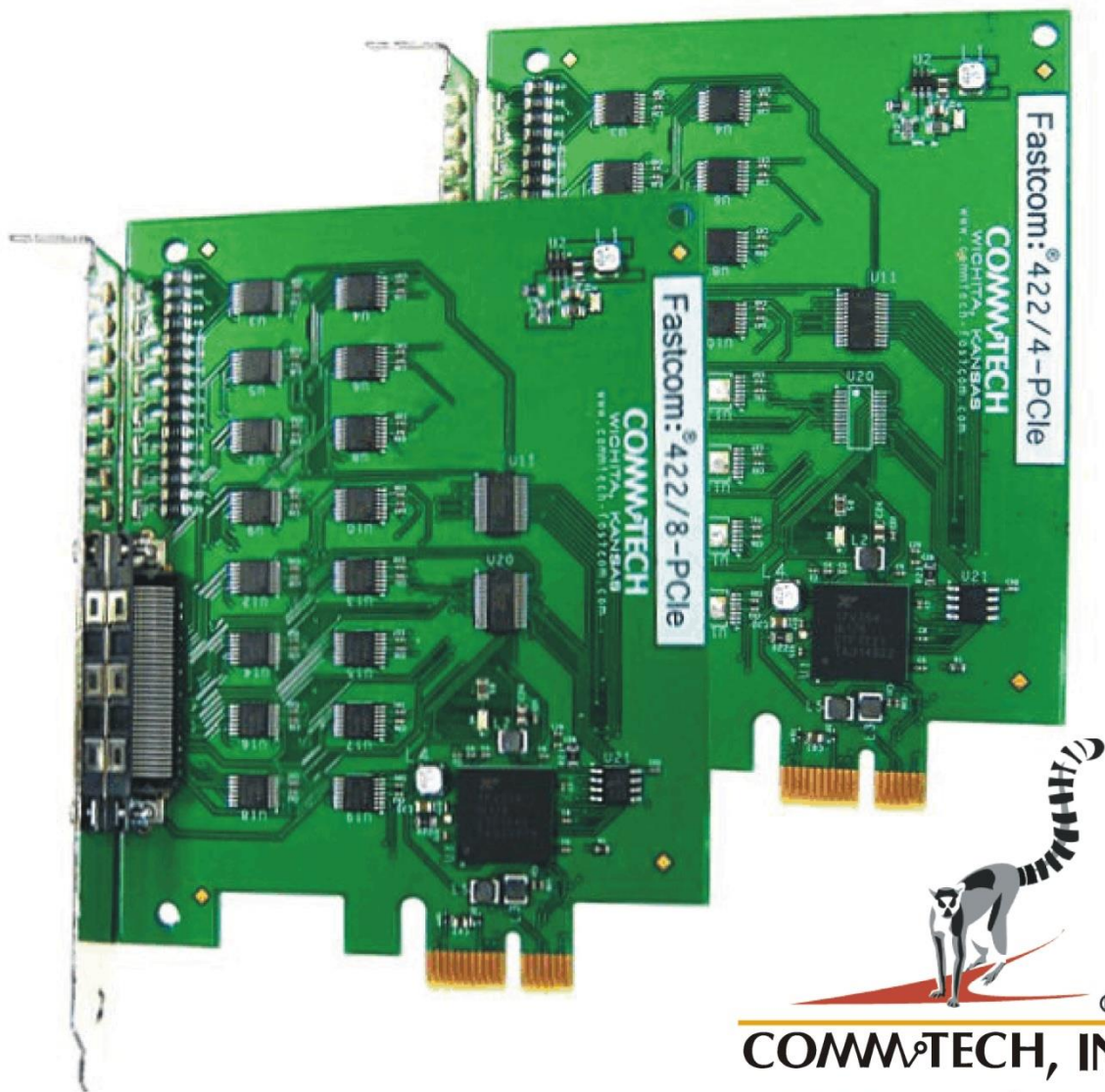# FASTCOM® ADAPTERS

FASTCOM®: 422/4-PCIE
FASTCOM®: 422/8-PCIE

**Four or Eight Channel RS-422/485 Interface for PCI Express Bus
Hardware Reference Manual**

COMM∿TECH

9011 E. 37TH STREET N
WICHITA, KANSAS 67226-2006
(316) 636-1131
FAX (316) 636-1163
http://www.commtech-fastcom.com/

Fastcom®: 422/X-PCIe

REVISION NOTES

REVISION	PAGE	CHANGES MADE
1.0		Document created
1.1	8	Revised software installation and features
1.2	11	Updated GND descriptions on CHAMP 68 connector diagram

TABLE OF CONTENTS

INTRODUCTION

The Fastcom PCIe bus, asynchronous RS-422/485 adapters utilize the latest technology to live up to today's requirements for high bandwidth in communication systems. The Fastcom: 422/4-PCIe and 422/8-PCIe (referred to hereafter as Fastcom: 422/X-PCIe) are capable of operating at virtually any baud rate up to an astounding maximum serial data rate of 25 Mbps. There is no fine print or asterisks pointing to notes; this card is capable of running at the maximum data rate, without any jumpers or hardware changes, right out of the box.

The Fastcom: 422/X-PCIe adapters utilize an advanced quad Universal Asynchronous Receiver and Transmitter (UART). Each channel of the 17V35x UART is independently controlled and has its own 16C550 compatible register set. Each UART contains its own receive and transmit FIFOs of 256 bytes with programmable trigger levels.

Each of the UART channels on the board can be independently configured as either RS-422 or RS-485 for full or half-duplex communication. This is implemented using an automatic RS-485 transmitter enable/disable function that permits the hardware itself to regulate data flow by only driving lines while actively transmitting. This provides increased speed and convenience over the older software controlled method, while still allowing the use of the software method of flow control. Optionally, in automatic RS-485 mode, the receiver can be disabled during transmits to avoid a receive echo, common in 2-wire 485 networks.

Additionally, each board utilizes a programmable clock generator to create the UART's input frequency. The clock generator is capable of generating frequencies between 6 and 50 MHz. Utilizing this feature, it is possible to configure the board to operate at virtually any serial data rate that the user desires (up to 25 Mbits/second maximum).

With the supplied software driver, the ports on the Fastcom: 422/X-PCIe cards will be seen as standard COM ports and can utilize all the same functions as a standard serial device. With the addition of a few simple I/O commands to control the unique features of the board, the standard software interface to a serial port can be used to simplify program design. C, C++, .NET and python libraries are provided to demonstrate how to effectively use the serial interface as well as control the board-specific features.

Overall, the Fastcom: 422/X-PCIe RS-422/485 adapters are ideal for commercial and industrial applications demanding high data rates, reliability and ease of use.

Software drivers for Windows XP through Windows 8 and Linux are supplied. Multiple Fastcom: 422/X-PCIe adapters can be installed in all operating systems.

Specifications

UART:	Exar 17V354 or Exar 17V358
OS Support:	Windows XP through Windows 8, Linux
Data Rates:	All baud rates up to 25Mbits/second
Buffering:	256 byte Tx FIFO each channel 256 byte Rx FIFO each channel
Drivers/Receivers:	High Speed RS-422
Interface:	RS-422 / RS-485
Signals:	Tx$\pm$, Rx$\pm$, RTS$\pm$, CTS$\pm$
Connector Configuration:	CHAMP 68 male to 4 DB9 female for 422/4-PCIe CHAMP 68 male to 8 DB9 female for 422/8-PCIe
Bus Interface:	PCIe 2.0 Gen 1 (x1)
Power Requirements:	200mA @ +3V (typical)
Operating Temperature Range:	0°C to 70°C
Humidity:	0 to 90% (non-condensing)

Features

- ✓ **New high performance UART**
    - ➢ All baud rates up to 25 Mbits/second
    - ➢ 256 byte FIFO for improved throughput
    - ➢ Four independent channels
    - ➢ Hardware control for 485 drivers
- ✓ **Software-programmable baud rates**
- ✓ **Switchless design for durability and reliability**
- ✓ **Status LEDs for system development / debugging**
- ✓ **Hardware Rx echo cancel available in RS-485 mode**
- ✓ **Software enabling/disabling termination resistors**
- ✓ **Durable cables with RFI shielding**
- ✓ **Hardware documentation, software, and example programs provided on the Fastcom CD**
- ✓ **Made in Wichita, Kansas, USA**

BOARD LAYOUT
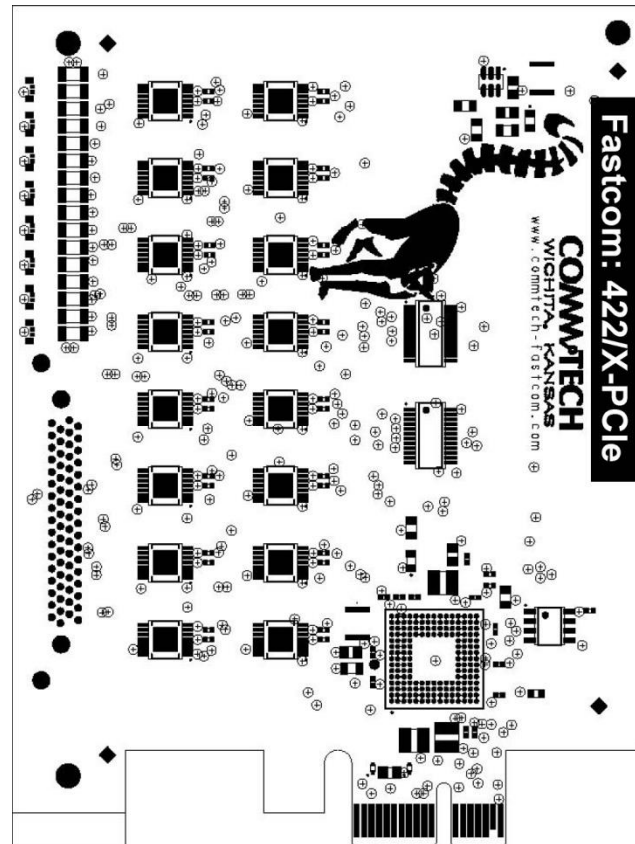
PACKING LIST

Fastcom: 422/X-PCIe Card
422/X-PCIe Cable Assembly
Fastcom CD

If an omission has been made, please call customer service at 316-636-1131 for a replacement.

INSTALLATION

Hardware Installation

Important: Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedures to reduce the risk of damage to components. Commtech, Inc. strongly encourages you to follow proper ESD procedures, which can include wrist straps and smocks, when handling Fastcom: 422/X-PCIe boards.

1. Turn off PC power. Disconnect the power cord.
2. Remove the PC case cover (if applicable).
3. Unpack the Fastcom: 422/X-PCIe.
4. Select an open PCIe slot in your PC.
5. After removing the blank bracket from your PC, install the Fastcom: 422/X-PCIe in the PC by pressing it firmly into the slot. Install the bracket screw to hold it firmly in place.
6. Re-install the cover on your PC (if applicable).
7. Refer to Software Installation in the next section for information on installing the software for the board.
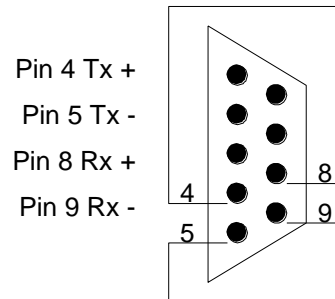
Software Installation

Once your card is installed in the computer, you can power on the computer and begin installing the drivers for the card.

1. Windows will detect a new device and start the found new hardware wizard.
2. If it asks to connect to the internet to search for the software, tell it no.
3. The next screen will ask you to automatically search for a driver. DO NOT do this. Select the option that lets you specify a location to search for the driver.
4. Next it will ask you where to search for the drivers. Put a checkbox next to the option that lets you specify a location and clear the rest of the boxes.
5. Click the Browse button and browse to where you have the 422/X-PCIe software. If you are using the Fastcom CD, that will be the X:\fastcom_disks\ asyncpcie\ folder (where X is your CD drive). If you downloaded the zip file from our website, you will need to browse to the path where you extracted the zip file. Again select the folder that corresponds to your version of Windows. Click OK and then click Next.
6. The next screen may ask you which board type you have and will also show you the path to the driver that it is about to use. Make sure that path is what you think it should be. Select your board and click Next.
7. The wizard will finish and should report that the installation was successful.
8. The driver for the board itself has now been installed. You will repeat this process multiple times – once for each of the async ports (COM). The steps will be almost exactly the same as listed above.

TESTING THE INSTALLATION

To fully test the installation of your Fastcom: 422/X-PCIe, you will need to build a "loop back plug". Materials needed are a DB9 male plug, solder-cup style, and two short pieces of 20 or 24 AWG stranded wire. This loop back plug can be used to test any RS-422 port. Jumper the pins together on the DB9 as illustrated below:

Pin 4 Tx +
Pin 5 Tx -
Pin 8 Rx +
Pin 9 Rx -

These instructions assume that you have already installed the card and have followed the installation instructions. The Device Manager should show the boards/ports that are installed.

1. Attach the cable assembly to the card and then the loop back to the end of the cable assembly.

2. Open a command prompt (Click Start->Run->type "cmd"->click OK) and change to the directory where you copied the *422/X-PCIe* software.

3. Change to the test directory (serialfc\test\).

4. Run the included test program on a port:

    a. # test 3

The output will look something like this:

```
Visual Studio 2008 Command Prompt

c:\Users\Will\Desktop>cd serialfc\test

c:\Users\Will\Desktop\serialfc\test>test 3
This is a very simple test to verify your card is
communicating correctly.

NOTE: This will change your registers to defaults.

1) Connect your loopback plug.
2) Press any key to start the test.

Passed, you can begin development.
c:\Users\Will\Desktop\serialfc\test>
```

Fastcom®: 422/X-PCIe

FASTCOM SERIAL SETTINGS

The 422/X-PCIe includes many Fastcom specific features that can be altered. Here are some of the options:

- ✓ Custom baud rates
- ✓ Termination
- ✓ Echo cancellation
- ✓ RS485
- ✓ Trigger levels
- ✓ Integrations with fixed baud rate programs

For a full list of the available features please review our programming guide (README) included with the driver, as we are always adding more.

Fastcom®: 422/X-PCIe

FASTCOM: 422/X-PCIe ADAPTER CABLE

We provide access to the individual channels of the FASTCOM: 422/X-PCIe through a shielded CHAMP 68-Pin connector and an adapter cable (supplied with the board). The adapter cable consists of a CHAMP 68-pin male plug fanning out to four standard DB9 female receptacles for the 422/4-PCIe and to eight standard DB9 female receptacles for the 422/8-PCIe.

CHAMP68 Pin Description

4-port cards will only use channels A-D.


P2
CONNECTOR CHAMP-68
5796055-1
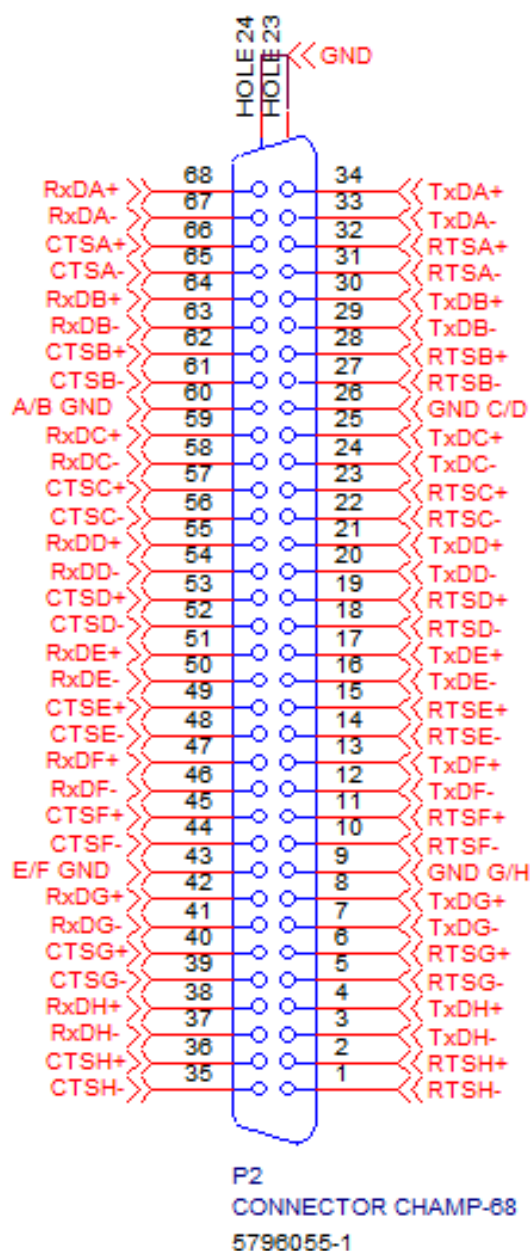
DB9 Pin Description

The FASTCOM: 422/X-PCIe features four (or eight) RS-422/485 channels, which are accessed through the four (or eight) DB9 connectors on the cable assembly.

The following is a pin description of the DB9 connectors:

PIN NO.	SIGNAL NAME	DIRECTION
1	SIGNAL GROUND (GND)	GROUND
2	READY TO SEND (RTS) +	OUTPUT
3	READY TO SEND (RTS) –	OUTPUT
4	TRANSMIT DATA (TX) +	OUTPUT
5	TRANSMIT DATA (TX) –	OUTPUT
6	CLEAR TO SEND (CTS) -	INPUT
7	CLEAR TO SEND (CTS) +	INPUT
8	RECEIVE DATA (RX) +	INPUT
9	RECEIVE DATA (RX) –	INPUT
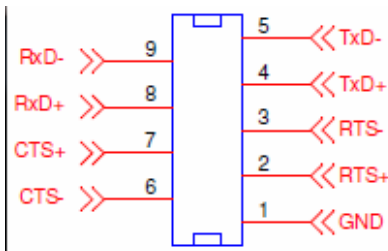
Cable

We recommend using vinyl-jacketed, shielded, multiple twisted pair cable (30 AWG wire) for use with the FASTCOM: 422/X-PCIe. The following cable illustration shows how to connect two RS-422 devices. Note that disabling handshaking can eliminate CTS/RTS lines.
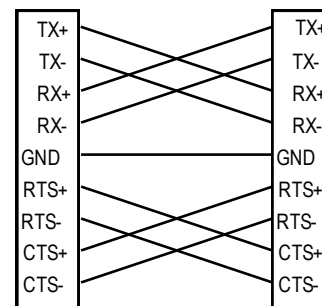
PROGRAMMING

To interface with the serial ports on the Fastcom: 422/X-PCIe in a Windows application, your code will use the standard Win32 COM API. Documentation pertaining to how to use the Win32 API is beyond the scope of this document. For more information on using the API, refer to the "Using Communications Resources" in the MSDN.

In addition to the Win32 API, you can also use several special Fastcom-specific commands that allow you to accomplish all of the options from the Fastcom Serial Settings property page. These commands, as well as the custom structures used in them, are defined in the serialfc.h header file.

Fastcom SerialFC Serial Setting	DeviceIOControl *dwIoControlCode*
Termination	IOCTL_FASTCOM_{ENABLE, DISABLE}_TERMINATION
Echo Cancel	IOCTL_FASTCOM_{ENABLE, DISABLE}_ECHO_CANCEL
Sampling Rate	IOCTL_FASTCOM_SET_SAMPLE_RATE
RS 485	IOCTL_FASTCOM_{ENABLE, DISABLE}_RS485
Tx FIFO Trigger Level	IOCTL_FASTCOM_SET_TX_TRIGGER
Tx FIFO Trigger Level	IOCTL_FASTCOM_SET_RX_TRIGGER

Refer to the SerialFC\examples directory on the Fastcom CD or in the downloaded zip file for some example C programs that demonstrate how to use the Fastcom-specific serial settings as well as providing a general sense of how to use the Win32 API.

RS422 / RS485

Most engineers have worked with RS-232 devices at least once in their career. If you have never worked with an RS-422 or RS-485 device, you will be pleased to know that working with the FASTCOM: 422/X-PCIe is not much different from working with a standard RS-232 device.

The RS-422 standard was developed to correct some of the deficiencies of RS-232. In commercial and industrial applications, RS-232 has some significant problems. First, the cable length between RS-232 devices must be short (usually less than 50 feet at 9600 baud). Second, many RS-232 errors are the result of cables picking up normal industrial electrical noises such as fluorescent lights, motors, transformers, and other EMF sources. Third, RS-232 data rates are functionally limited to 19.2K Baud. On the other hand, the newer RS-422 standard makes cable lengths up to 5000 feet possible and is highly immune to most industrial noises. Data rates are also improved -- the FASTCOM: 422/X-PCIe features data rates up to 25 Mbits/second. These improvements were made possible by differentially driving and receiving the data as opposed to the single ended method employed by the RS-232 standard. With the RS-422 standard, the transmit signal (TX in RS-232) is a differential signal consisting of TX+ and TX-; the receive signal (RX in RS-232) consists of RX+ and RX-.

Another drawback of RS-232 is that no more than two devices can share a single cable. This is also true of RS-422, and that's why the RS-485 standard was developed. RS-485 offers all of the benefits of RS-422 and also allows multiple units (up to 32) to share the same "twisted pair" of wires (see diagram on next page). RS-485 is often referred to as a "multi-drop" or "two-wire, half duplex" network. In order for an RS-485 system to work, only one driver (transmitter) can occupy the network at a time. This means that each station on the network must control the enabling/disabling of their drivers in order to avoid network conflicts. If two drivers engage the network at the same time, data from both will be corrupted. In RS-485 mode, the receivers are always enabled.

Termination Resistance

In both the RS-422 and the RS-485 mode, the receiver end of the cable between two stations must be terminated with a resistor equal to the characteristic impedance of the wire. This is to prevent signal reflections in the wire and to improve noise rejection. However, **you do not need to add a terminator resistor to your cables when you use the Fastcom: 422/X-PCIe. The termination resistance is built in.**

If you are using the Fastcom: 422/X-PCIe in a multi-drop network, the termination resistor should be disabled from all units except the first and last (see the RS-485 illustration below). Observe the resistors in the following drawings and remember that they are built into the Fastcom: 422/X-PCIe (shown below):

Typical RS-422 Installation
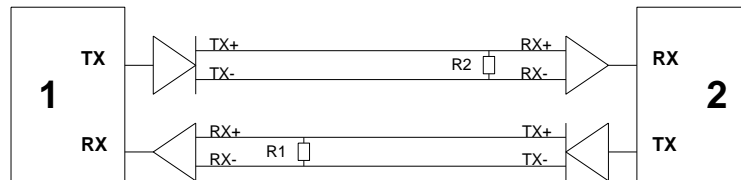
R1 & R2 - Line Termination (100 ohms)

Typical RS-485 Installation
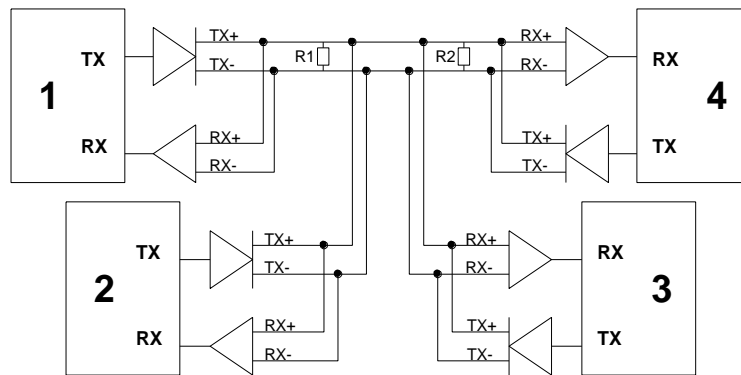
R1 & R2 - Line Termination (100 ohms)

RS-485 Mode

RS-485 is often referred to as a multi-drop or two-wire, half duplex network because the drivers (transmitters) and receivers share the same two lines. In fact, up to 32 stations can share the same twisted pair. In order for an RS-485 system to work, only one driver (transmitter) can occupy the network at a time. This means that each station on the network must control the enabling/disabling of its drivers in order to avoid network conflicts. If two drivers engage the network at the same time, data from both will be corrupted. In RS-485 mode, the receivers are always enabled.
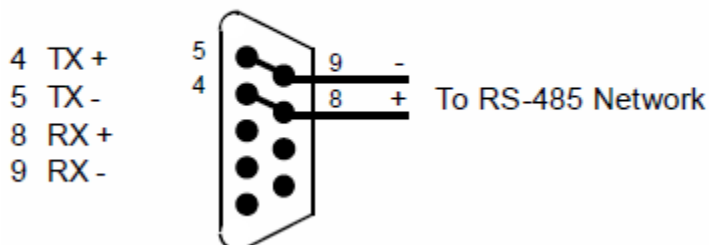
The following cable illustration shows four RS-485 Devices sharing the same twisted pair:
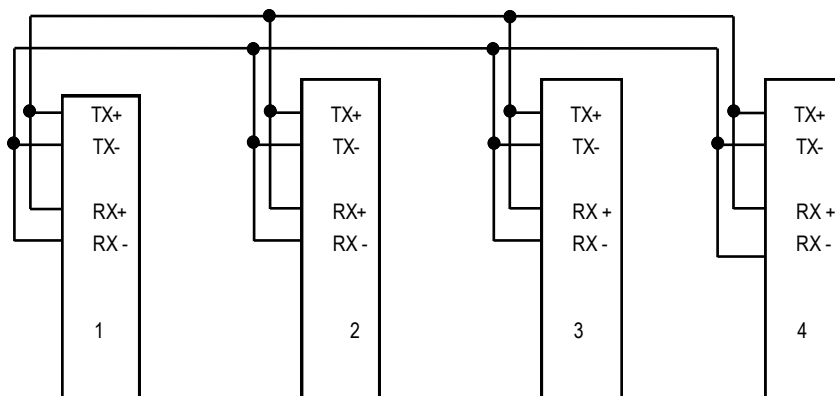
Note: The termination resistors from Station #2 and Station #3 have been removed.

Not all RS-422 devices feature RS-485 compatibility; only RS-485 devices can be connected to the RS-485 network.

Note that when in the RS-485 mode, you will need to externally connect TX+ to RX+ and TX- to RX-.

TECHNICAL SUPPORT

Commtech provides extensive technical support and application suggestions. Most of the problems that may occur with the FASTCOM: 422/X-PCIe can be corrected by double-checking your cables and your program. We recommend that you build the loop back plug that is described in the Programming section of this manual. With that plug, you can quickly isolate the problem to the board, cable, or software.

If you still have unresolved questions, use the following procedure to get technical support:

1. Call our Technical Support Staff at (316) 636-1131. They are on duty from 9:00 AM to 5:00 PM Central Time.

2. Ask for technical support for the FASTCOM: 422/X-PCIe. Be ready to describe the problem, your computer system, your application, and your software.

3. If necessary, our staff will give you an RMA number (Return Material Authorization). Use this number on the mailing label and in all references to your board. Put the board back in its static bag and in its box. Ship the board back to us as directed.

4. If you prefer, you may FAX a description of the problem to us at (316) 636-1163, or we can be reached on the Internet at http://www.commtech-fastcom.com/TechSupport.html or by email at techsupport@commtech-fastcom.com.

FASTCOM LIMITED LIFETIME WARRANTY
Commtech's entire FASTCOM product line is covered by a limited lifetime warranty against defects in workmanship. This warranty is available only to the original purchaser and only covers defects in our workmanship. Any FASTCOM board that is returned to Commtech will, at the option of Commtech, be repaired or replaced at no charge -- except for circumstances excluded by this warranty.

A Return Materials Authorization (RMA) number must be obtained from Commtech before a return will be accepted. Please contact us via telephone or email to obtain an RMA number.

You are responsible for shipping charges when you return a FASTCOM board to Commtech. We will pay the shipping charges to send the board back to you if a defect in workmanship is found. However, if no defect in workmanship is found, or the board is not found to be defective, or any of the following warranty exclusions occur, you will be responsible for shipping charges both ways.

Warranty Exclusions
This warranty does not cover problems or damage resulting from, but not limited to, the following:
1. Any modification, misuse, abuse, disassembly, misapplication, or unauthorized repair by anyone other than Commtech.
2. Any improper operation, including any use not in accordance with any verbal product instructions or documentation.
3. Connection to an improper voltage supply or ESD damage.
4. Any other cause not related to workmanship.

Non-Warranty Repairs
We can provide a quote for non-warranty repairs upon request.

If any Commtech product is damaged such that it cannot be repaired, you can return it to Commtech for replacement under our *Non-Repairable Replacement* policy, regardless of the cause of damage. Commtech will replace the unit at 60% of the then-current list price.

Limitation of Liability
Commtech shall not be liable for any special, incidental, indirect, or consequential damages whatsoever, including but not limited to loss of profits, revenue, or data (whether direct or indirect), or commercial loss for breach of any express or implied warranty on your product even if Commtech has been advised previously of the possibility of such damages. Commtech does not warrant that its products will work in every system or every system configuration. We do not warrant that our products will be suitable for your application. If you are dissatisfied with our product, contact customer service to arrange for a return of our product and refund of your money. Commtech's liability, in any case, is limited to the original product purchase price and is available to the original customer only.

APPENDIX A

[17V354](#) & [17V358](#) UART
Data Sheet