1 Introduction

1.1 Functional Description

The USB-COM422-PLUS2 is a USB to a dual interface RS422 level serial UART adaptor incorporating FTDI’s FT2232H Hi-Speed USB2.0 (480Mb/s) to dual serial UART interface IC device. The FT2232H handles all the USB signaling and protocols. The adaptor provides a fast, simple way to connect devices with an RS422 interface to USB.

USB-COM422-PLUS2 is a USB to a dual-port RS422 adapter.

The integrated electronics of the USB-COM422-PLUS2 utilise the FTDI FT2232H and includes RS422 level shifters plus TXD/RXD LEDs to provide a visual indication of data traffic through the module.

Figure 1.1 USB-COM422-Plus2

The module uses a standard USB-B device connector for connection to an upstream host or hub port. RS422-level signals, including modem handshake signals, are available on an industry-standard DE-9P connector. The maximum RS422-level data rate is 10Mbps.

The USB-COM422-Plus2 module requires USB device drivers, available free from www.ftdichip.com, which are used to make the USB-COM422-Plus2 appear as a Virtual COM Port (VCP). This allows existing serial communications software, such as HyperTerminal, to exchange data through the USB-COM422-Plus2 to a legacy RS422 peripheral device.
1.2 LED Description

The USB-COM422-Plus2 uses five LEDs to indicate a valid link as well as data traffic according to the following table:

<table>
<thead>
<tr>
<th>LED Colour</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow x 1</td>
<td>Power</td>
<td>ON when USB-COM-Plus is configured and ready</td>
</tr>
<tr>
<td>Red x 2</td>
<td>TxD Activity</td>
<td>Flashes when data is transmitted from the USB-COM422-Plus2 to the attached RS422 device</td>
</tr>
<tr>
<td>Green x 2</td>
<td>RxD Activity</td>
<td>Flashes when data is transmitted from the attached RS422 device to the USB-COM422-Plus2</td>
</tr>
</tbody>
</table>

Table 1.1 – LED Description

1.3 Block Diagram

![Figure 1.2 USB-COM422-PLUS2 Block Diagram](image)

1.3.1 Block description

**USB B Client Connector**

This connector provides the interface for connection to a USB Host or Hub port. The maximum cable length is 5 meters, according to the USB 2.0 specification.

**FTDI FT2232H**

FT2232H Hi-Speed USB2.0 (480Mb/s) is a dual serial UART interface IC device. Operating system device drivers are required in order to work with the one to provide the Virtual COM Port serial functionality.

**Dual RS422 Level Shifter**

The RS422 level shifter converts the signals provided by the FT2232H into the voltage levels required by RS422 devices.

**Dual DE-9P Connector (Male)**

The DE-9P connector is configured in an industry standard (TIA/EIA-574) pin-out to provide connection to RS422 peripherals through standard cables. See section 3.1.2
1.4 Features

- Adds dual RS-422 serial port by connecting to a USB 2.0 Hi-Speed interface.
- Easy plug & play installation and RS-422 device connection
- Works with USB 1.1 & 2.0 Host and Hub ports
- Industry Standard FTDI chip set & device drivers for maximum compatibility
- Microsoft Windows® WHQL-certified, Mac OS X, Linux and Windows CE device drivers
- Installs as a standard Windows COM port
- COM port number can be changed to any available COM port number, to support HyperTerminal, or any other serial communications software application running in Windows
- FIFO: 4K byte transmit buffer, 4K byte receive buffer
- RS-422 data signals: TxD+, TxD-, RxD+, RxD-, RTS+, RTS-, CTS+, CTS-, GND
- Powered by USB port. No external power adapter required.
- Serial port speed up to 10Mbps
- Serial Communication Parameters
  - Parity: None, Even, Odd
  - Data bits: 7, 8
  - Flow control: RTS/CTS , X-ON/X-OFF, None
- Two DE-9P male connector
- LEDs indicate USB Enumeration, RxD, TxD for monitoring port status & easy diagnostics
- Operating temperature of -40°C to +85°C

1.5 Performance Figures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Interface</td>
<td>480Mbps USB 2.0 High-Speed</td>
</tr>
<tr>
<td>RS422 Interface</td>
<td>Standard Windows baud rates (300bps to 921.6Kbps)</td>
</tr>
<tr>
<td></td>
<td>Custom baud rates (300bps to 10Mbps) through baud rate aliasing.</td>
</tr>
<tr>
<td></td>
<td>See FTDI Application Note: Configuring FT232R, FT2232 and FT232BM Baud Rates</td>
</tr>
<tr>
<td>Max Cable Length</td>
<td>USB=5m, RS422=12m (for 10Mbps)</td>
</tr>
</tbody>
</table>

Table 1.2 - Performance Figures

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB-COM422-Plus2</td>
<td>USB-COM-Plus Hi-Speed USB to dual-Port RS422 module</td>
</tr>
</tbody>
</table>

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2 Installation

2.1 Example Applications and Configurations

2.1.1 Wiring

Insert the A-plug into an available USB Host or Hub port. Insert the mini-B-plug into the USB mini-B-receptacle on the USB-COM422-PLUS2.

The USB-COM422-Plus2 follows EIA-422 standard as a Data Terminal Equipment (DTE) device. If the RS422 equipment being connected is a Data Communication Equipment (DCE) device, it’s typical that a straight-through cable can be used.

<table>
<thead>
<tr>
<th>DTE Pin Number</th>
<th>Signal Name</th>
<th>Expected</th>
<th>Connect Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TXD- = Transmit Data, negative polarity</td>
<td>RXD-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TXD+ = Transmit Data, positive polarity</td>
<td>RXD+</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>RXD+ = Receive Data, positive polarity</td>
<td>TXD+</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>RXD- = Receive Data, negative polarity</td>
<td>TXD-</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND = signal ground</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>RTS- = Request To Send, negative polarity</td>
<td>CTS-</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTS+ = Request To Send, positive polarity</td>
<td>CTS+</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CTS+ = Clear To Send, positive polarity</td>
<td>RTS+</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>CTS- = Clear To Send, negative polarity</td>
<td>RTS-</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.1 – RS422 DTE to DCE connection with straight-through cable

Some serial devices may require certain handshake signals to be connected. Refer to your device manual for cabling details.
2.2 Device Driver Installation

The USB-COM422-PLUS2 module drivers are available for download from:

www.ftdichip.com

2.2.1 Microsoft Windows

With the device drivers being Windows Hardware Quality Labs (WHQL) certified, they are also available through download directly from the Microsoft® Windows® Update service. This is the best choice when connecting the USB-COM422-PLUS2 to a computer running Windows Vista. Additional installation options are noted below:

**Installation Executable shown on Windows XP**

1) Login to your system as Administrator, or a user with Administrator rights.

2) Prior to connecting the USB-COM422-PLUS2 to the USB Host or Hub port, download the latest device driver version from the FTDIChip web site.

3) Run this executable to install the device drivers.

4) Connect the USB-COM422-PLUS2 to your computer. A notification will appear near the task bar indicating that new hardware has been installed and is ready for use. It is normal if this notice appears twice.

---

**Windows Update shown on Windows XP**

You must have an active Internet connection and the Windows Update Service enabled.

1) Connect the USB-COM422-PLUS2 to your USB Host or Hub.

2) The "Found New Hardware" Wizard will appear. The first dialog should ask whether it is acceptable to use the Windows Update Service to find the device driver.

---

3) Select one of the "Yes" choices and click "Next".

4) The following screen appears:
5) Wait while the driver is found, downloaded, and installed. This step may take a couple minutes.

6) After the files are found and installed, click "Finish" to complete the installation.

7) Steps 2 through 6 will repeat. The first time installs the basic USB Serial Converter in the USB device tree. The second time installs the Virtual COM Port layer in the Ports tree and assigns the COM port number.

8) When both portions of the device driver have been installed successfully, the following message will appear, indicating that the device is ready.
COM Port Assignment

Next, to determine which COM port has been assigned, open the Windows Device Manager from the System Control Panel.

Click on the Plus “+” sign next to the Ports tree and Universal Serial Bus controllers tree to list the available USB device. You will see two additional “USB Serial Port”, followed by a COMn assignment. And two additional “USB Serial Converter A” and “USB Serial Converter B”.

Figure 2.5 - Hardware Ready

Figure 2.6 - Device Manager
To determine which COM port has been assigned to Converter A or B, the cursor point to the USB Serial Port (COM10) or (COM11), then right-click on it and select “Properties”, it shows their relationship to the Converter A or B.

In the figure below, the Converter A is assigned to COM10, Converter B is assigned to COM11.

Use this COM port number with your application software in order to access the USB-COM422-PLUS2.
If an application requires use of a different COM port number, the assignment may be changed through the Advanced Driver Options settings.
From the above "Properties", click on the "Port Settings" tab.
Figure 2.9 - Settings Tab
Then click on the “Advanced...” button.

![Advanced Settings for COM10](image)

**Figure 2.10 - Advanced Options**

This will display the various advanced settings. Note the COM port assignment in the upper left. Clicking on the drop-down list will display the available port numbers. Select one that is not in use and click OK on each dialog box to activate the selection. Windows will remember this COM port number.

### 2.2.2 Mac OS X, Linux, Windows CE

Device drivers and FTDI installation guides for Mac OS X, Linux and Windows CE are available for download on the FTDIChip web sites. Follow the respective FTDI installation guides for the chosen operating system.
3 Connections

3.1 External Connectors

3.1.1 USB

The USB-COM422-PLUS2 is a downstream USB 2.0 Device. A standard USB mini type “B” receptacle is mounted inside the USB-F-1001 to facilitate connection to an upstream USB Host or Hub.

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power</td>
<td>VBUS = USB Power provided from upstream USB Host or Hub</td>
</tr>
<tr>
<td>2</td>
<td>Bidirectional</td>
<td>D− = USB data signal, negative polarity</td>
</tr>
<tr>
<td>3</td>
<td>Bidirectional</td>
<td>D+ = USB data signal, positive polarity</td>
</tr>
<tr>
<td>4</td>
<td>ID</td>
<td>No connected</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>GND = USB signal ground</td>
</tr>
<tr>
<td>Shield</td>
<td>Case Ground</td>
<td>Drain = typically connected to the host PC case</td>
</tr>
</tbody>
</table>

Table 3.1 – USB mini type "B" Receptacle Pin-Out

3.1.2 RS422

Both RS422 ports are configured as Data Terminal Equipment (DTE), with a 9-contact D-Sub Pin connector. Pin assignments are according to TIA/EIA-422. Both Connectors are the same pin-out.

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Pin Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Output</td>
<td>TXD− = Transmit Data, negative polarity</td>
</tr>
<tr>
<td>2</td>
<td>Output</td>
<td>TXD+ = Transmit Data, positive polarity</td>
</tr>
<tr>
<td>3</td>
<td>Input</td>
<td>RXD+ = Receive Data, positive polarity</td>
</tr>
<tr>
<td>4</td>
<td>Input</td>
<td>RXD− = Receive Data, negative polarity</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>GND = signal ground</td>
</tr>
<tr>
<td>6</td>
<td>Output</td>
<td>RTS− = Request To Send, negative polarity</td>
</tr>
<tr>
<td>7</td>
<td>Output</td>
<td>RTS+ = Request To Send, positive polarity</td>
</tr>
<tr>
<td>8</td>
<td>Input</td>
<td>CTS+ = Clear To Send, positive polarity</td>
</tr>
<tr>
<td>9</td>
<td>Input</td>
<td>CTS− = Clear To Send, negative polarity</td>
</tr>
</tbody>
</table>

Table 3.2 – DE-9P RS422 Pin-Out
4 Electrical details

4.1 USB

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB_VCC</td>
<td>Input Power Voltage*</td>
<td>4.25</td>
<td>5.0*</td>
<td>5.25</td>
<td>V</td>
<td>*Present when USB cable is attached and USB Host or Hub powered.</td>
</tr>
<tr>
<td>I_{cc}</td>
<td>USB current</td>
<td>30</td>
<td>50</td>
<td></td>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.1 - USB Electrical Details

4.2 RS422

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{trans}</td>
<td>Transmitter output voltage swing</td>
<td>2</td>
<td></td>
<td></td>
<td>V</td>
<td>RL = 50R, CL = 50pF</td>
</tr>
<tr>
<td>V_{rec}</td>
<td>Receiver input voltage range</td>
<td>-7</td>
<td>+12</td>
<td></td>
<td>V</td>
<td>RL = 50R, CL = 50pF</td>
</tr>
<tr>
<td>ESD HBM</td>
<td>N/A</td>
<td>±15</td>
<td></td>
<td></td>
<td>KV</td>
<td>For all RS-422 Inputs and Outputs pin</td>
</tr>
</tbody>
</table>

Table 4.2 - RS422 Electrical Details
5 Mechanical Details

5.1 Module Mechanical Dimensions

Dimensions are in mm. The PCB height is dominated by the D-type connectors and is 17mm +/- 2mm (this includes the tails of the D-type connectors soldered pins). Mounting holes are 5mm in diameter.

Figure 5.1 - USB-COM422-PLUS2 PCB Dimensions
6 Physical Environment Details

6.1 Storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Storage Temperature</td>
<td>-65</td>
<td></td>
<td>+150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.1 - Storage Temperature

6.2 Operating

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Operating Temperature</td>
<td>-40</td>
<td></td>
<td>+85</td>
<td>°C</td>
<td>5% to 95% RH,</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>non condensing</td>
</tr>
</tbody>
</table>

Table 6.2 - Operating Temperature
7 Environmental Approvals & Declarations

7.1 EMI Compatibility

FCC and CE
The USB-COM422-PLUS2 has been tested to be compliant with both FCC Part 15 Subpart B and European EMC Directive.

NOTE: This is a Class B product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

FCC
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

7.2 Safety
The USB-COM422-PLUS2 is defined as Limited Power Supply (LPS) device, with operating voltages under 60VDC.

7.3 Environmental
The USB-COM422-PLUS2 is a lead-free device that complies with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

7.4 Reliability
The USB-COM422-PLUS2 is designed as a robust USB-Serial module for use in many environments. There are no user-serviceable parts. Any failure will require a replacement of the unit.

7.4.1 MTTF
The Mean Time To Failure is calculated at TBD hours.
### 7.5 Import / Export Information

<table>
<thead>
<tr>
<th>Import / Export Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country of Origin</td>
</tr>
<tr>
<td>Harmonized Code</td>
</tr>
<tr>
<td>Product Description</td>
</tr>
<tr>
<td>USA ECCN</td>
</tr>
</tbody>
</table>

*Table 7.1 - Import / Export Information*
8 Troubleshooting

8.1 Hardware

Cables are the most common sources of trouble with external devices.

Check the following:
- USB cable is properly inserted at both ends
- Computer power is ON
- Computer is not in Sleep or Standby
- If a USB Hub is used, be sure it is set for “Self-Powered” operation
- If a USB Hub is used, be sure all cables are properly inserted
- If all the above are OK, the Yellow LED should be lit, indicating the device has been recognized by the USB subsystem.

RS422 cables – check the following:
- Output signals (TXD+, TXD-, RTS+, RTS-) are connected to the respective inputs (RXD+, RXD-, CTS+, CTS-) in each direction.
- Check for specific handshake requirements of your RS422 peripheral.
- If handshake signals are not used, ensure the application is set to “No Hardware Handshake”, or equivalent.
- Test the port with a loop-back connector. Connect TXD+ to RXD+, TXD- to RXD-, RTS+ to CTS+ and RTS- to CTS-. Use a simple terminal program to check that data is transmitted and received.

8.2 Device Driver

Ensure the latest device driver is in use. See www.ftdichip.com

If other devices with FTDI chips are installed in the system, check with all manufacturers of these devices for the latest device drivers.

See the FTDI installation guides for additional details: http://ftdichip.com/Documents/InstallGuides.htm

Common Windows Device Driver Troubles:

- **DEVICE TIMES OUT**: The default settings of the device driver assume typical data transfers of hundreds to thousands or more bytes at a given time. Some applications, such as a GPS device, only send data in short packets, often only a few bytes. If this is the case, it may be necessary to adjust the driver buffer size and/or latency timer to smaller values. These values can be adjusted through the Advanced driver options as noted in Figure 2.13. The buffer size can be reduced to 64 bytes. The latency timer can be set as low as 2ms. A setting of 1ms will cause unnecessary USB traffic and could adversely affect data transmission.

- **ERRATIC MOUSE POINTER**: The device driver defaults to query an attached device to find out whether it is a mouse or modem, consistent with native COM port operation. Some RS422 peripherals constantly send short packets of data, causing the host system to “think” a mouse or modem has been attached. These short packets will interfere with normal mouse operation causing the pointer to jump around the screen. If this happens, disconnect the RS422 device and uncheck the Serial Enumerator option, also found on the Advanced driver options screen in Figure 2.13.

- **COM PORT IN USE**: Windows keeps track of all COM port assignments. If multiple FTDIChip products have been connected to a single system, the COM port number will increase, even if the other devices are not attached. If the higher COM port assignments are not acceptable for the application, known unused COM port numbers should be uninstalled according to the FTDI installation guide: http://ftdichip.com/Documents/InstallGuides.htm.
9 Contact Information

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Distributor and Sales Representatives

Please visit the Sales Network page of the FTDI Web site for the contact details of our distributor(s) and sales representative(s) in your country.
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<td>06 July 2009</td>
</tr>
<tr>
<td>Version 1.0</td>
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<td>27 August 2009</td>
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<td>Edited Section 1.3.1, Removed the statement</td>
<td>12th April 2010</td>
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<td>&quot;A standard &quot;A to B&quot; cable is provided&quot;</td>
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<tr>
<td>Version 1.2</td>
<td>Added more details to dimensions drawing</td>
<td>6th May 2011</td>
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