USB-RS422

USB to RS422 Serial Converter Cable

Datasheet

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1 Description

The Connective Peripherals USB-RS422 cables are a family of USB to RS422-level serial converter cables. They incorporate the FT232R USB to UART interface IC device which handles all the USB signalling and protocols. The cables provide a fast, simple way to connect devices with an RS422 serial interface to USB.

Each USB-RS422 cable contains a small internal electronic circuit board, utilising the FT232R, which is encapsulated into the USB connector end of the cable. Refer to the FT232R datasheet for details. The integrated electronics also include the RS422 transceiver plus Tx and Rx LEDs which give a visual indication of traffic on the cable (on models with transparent USB connector).

The other end of the cable has bared, tinned wire ended connections by default, allowing a variety of connectors to be attached. The cables can be customised using different connectors to support various applications. Please contact Connective Peripherals Sales (sales@connectiveperipherals.com) for more information.

The cables are FCC, CE, UKCA and RoHS compliant.

The USB side of the cable is USB powered. It is USB 2.0 full speed compatible and can also be used with USB3 hosts. Each cable is 1.8m long and supports a data transfer rate up to 3 MBaud. Each cable supports the FTDIChip-ID™, with a unique USB serial number programmed into the FT232R. This feature can be used to create a security or password protected file transfer access using the cable.

The USB-RS422 cables require USB drivers, available free from Windows Update or from https://connectiveperipherals.com, which are used to make the FT232R in the cable appear as a virtual COM port (VCP). This then allows the user to communicate with the USB interface via a standard PC serial emulation port (for example TTY). The driver also supports using D2xx commands, which can be used with application software to directly access the FT232R on the cable though a DLL. This is illustrated in

Figure 1.1

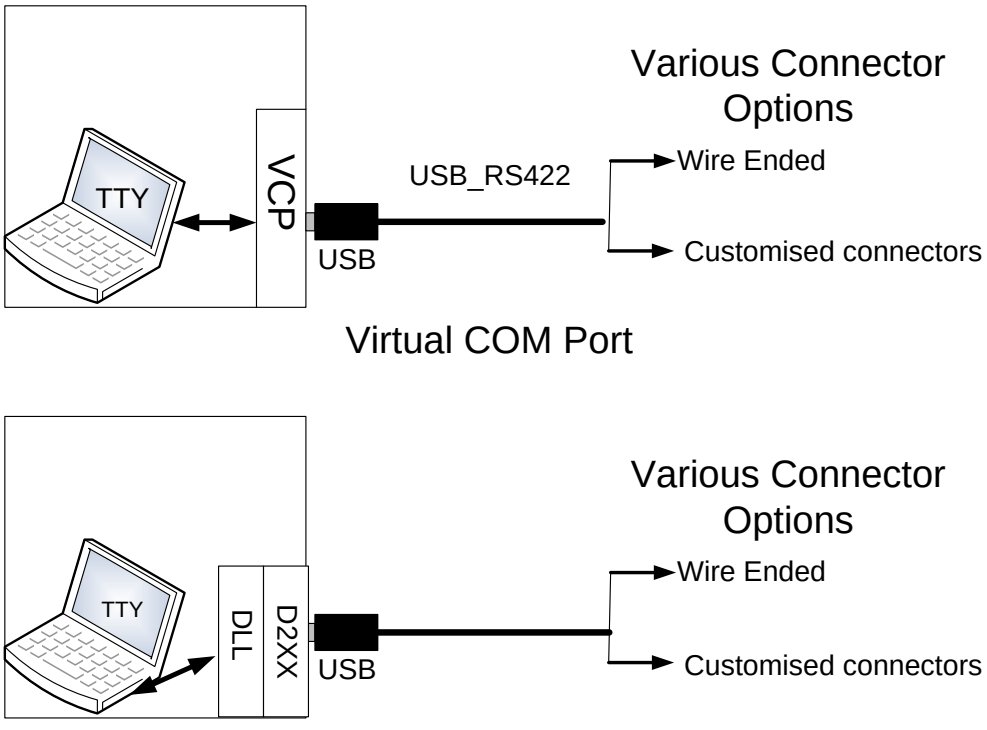

Figure 1.1 Using the USB-RS422 Cable

2 Cable Part Numbers

Table 2.1 gives details of the available USB-RS422 cables.

Part Number	Description	End Connector*	Cable details
USB-RS422-WE-1800-BT	**USB** to UART cable with **RS422** level UART signals. **B**lack cable, **T**ransparent USB connector	**W**ire **E**nded (no connector)	**1.8m** cable,9 core, UL2464 28 AWG, diam=5mm
* USB-RS422-CC-LLLL-CU	**USB** to UART cable with **RS422** level UART signals. **C =** cable colour (**B** black or **T** transparent), **U** = USB connector colour (**T** transparent or **B** black)	**CC** = Connector description.	LLLL **=** Length of cable.

Table 2.1 USB-RS422 Cables Descriptions and Part Numbers

* CP supports customised end connector designs. For more information, please contact sales@connectiveperipherals.com

2.1 Certifications

USB-RS422 cable is fully RoHS compliant as well as CE, UKCA and FCC certified.

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3 Typical Applications

- USB to serial RS422 level converter.
- Upgrading legacy peripherals to USB.
- Interface Microcontroller UART or I/O to USB*
- USB Instrumentation PC interface.
- USB industrial control.
- Interface FPGA or PLD to USB*

* Note that most MCUs and FPGAs use logic level UART signals and so an RS422 transceiver would be needed between the USB-RS422 cable and the MCU/FPGA to convert the signals from the USB-RS422 cable back to logic levels.

3.1 Driver Support

Royalty free VIRTUAL COM PORT (VCP) DRIVERS for…

- Windows 11, 10, 8.x, 7
- Windows XP (legacy)
- Windows CE 4.2, 5.0 and 6.0 (Legacy)
- macOS 10.9 and above
- Linux 2.4 and greater

Royalty free D2XX *Direct* Drivers (USB Drivers + DLL S/W Interface)

- Windows 11, 10, 8.x, 7
- Windows XP (legacy)
- Windows CE 4.2, 5.0 and 6.0 (Legacy)
- macOS 10.9 and above
- Linux 2.4 and greater

The drivers listed above are all available to download for free from https://connectiveperipherals.com Various 3rd Party Drivers are also available for other operating systems. Refer to https://connectiveperipherals.com and www.ftdichip.com for details.

3.2 Driver Installation

For driver installation, please refer to the **Connective Peripherals USB to Serial Converters Driver Installation Guide (CP_000084)** which is available from www.connectiveperipherals.com.

3.3 Features

- USB-RS422 converter cable provides a USB to RS422 serial interface with wire ended connections
- Entire USB protocol handled by the electronics in the cable.
- EIA/TIA-422 communication interface with low power requirements.
- RS422 level UART interface with support for 7 or 8 data bits, 1 or 2 stop bits and odd / even / mark / space / no parity.
- Internal EEPROM with user writeable area.
- FTDI's royalty-free VCP drivers allow for communication as a standard emulated COM port and D2XX 'direct' drivers provide DLL application programming interface.
- Visual indication of Tx and Rx traffic via LEDs in the transparent USB connector.
- Fully assisted hardware (RTS#/CTS#) or X-On / X-Off software handshaking.
- Data transfer rates from 300 baud to 3 M Baud.
- Support for FT232R FTDIChip-ID™ feature for improved security.
- Low USB bandwidth consumption.
- UHCI / OHCI / EHCI host controller compatible.
- USB 2.0 Full Speed compatible, compatible with USB3 host ports
- -40°C to +85°C operating temperature range.
- Cable length is 1.80m (6 feet).
- ESD Protection for RS-422 I/O's
  ±15kV Human Body Model (HBM)
  ±15kV EN61000-4-2 Air Gap Discharge
  ±8kV EN61000-4-2 Contact Discharge
- FCC, UKCA and CE compliant.
- Custom versions available on request (subject to MOQ).
- RoHS Compliant

4 Features of FT232R applicable to USB-RS422 Cable

The USB-RS422 cable uses FT232R USB to serial UART IC device. This section summarises the key features of the FT232R which apply to the USB-RS422 USB to serial RS422 converter cables. For further details, and a full features and enhancements description refer to the FT232R datasheet.

Internal EEPROM. The internal EEPROM in each cable is used to store USB Vendor ID (VID), Product ID (PID), device serial number, product description string and various other USB configuration descriptors. Each cable is supplied with the internal EEPROM pre-programmed as described in Appendix A - Cable EEPROM Configuration**.**

EEPROM Configuration. The internal EEPROM descriptors can be programmed in circuit, over USB without any additional voltage requirement. It can be programmed using the utility software called FT_Prog . Additionally, there is a user area of the internal EEPROM available to system designers to allow storing of data (note that this is not modified by FT_Prog).

Lower Operating and Suspend Current. The FT232R has a low 15mA operating supply current and a very low USB suspend current of approximately 70µA. (Note that during suspend mode, the current drawn by any customised cable application which uses the USB supply, should not exceed 2.5mA to remain USB compliant)

Low USB Bandwidth Consumption. The USB interface of the FT232R, and therefore the USB-RS422 cables has been designed to use as little as possible of the total USB bandwidth available from the USB host controller.

UART Pin Signal Inversion. The sense of each of the UART signals can be individually inverted by configuring options in the internal EEPROM. For example, CTS# (active low) can be changed to CTS (active high), or TXD can be changed to TXD#.

FTDIChip-ID™. The FT232R includes the new FTDIChip-ID™ security dongle feature. This FTDIChip-ID™ feature allows a unique number to be burnt into each cable during manufacture. This number cannot be reprogrammed. This number is only readable over USB can be used to form the basis of a security dongle which can be used to protect any customer application software being copied. This allows the possibility of using the USB-RS422 cables as a dongle for software licensing. Further to this, a renewable license scheme can be implemented based on the FTDIChip-ID™ number when encrypted with other information. This encrypted number can be stored in the user area of the FT232R internal EEPROM, and can be decrypted, then compared with the protected FTDIChip-ID™ to verify that a license is valid.

Improved EMI Performance. The USB-RS422 cables are FCC, UKCA and CE certified.

Extended Operating Temperature Range - The USB-RS422 cables are capable of operating over an extended temperature range of -40º to +85º C thus allowing them to be used in automotive or industrial applications.

5 USB-RS422-WE-LLLL-CU

The USB-RS422-WE cable is un-terminated; it has bared and tinned wires.

The LLLL specifies the length of the cable in cm. The CU specifies the colour of the cable and the colour of the USB connector. The cable can be either Black or transparent. The USB connector can either be black or transparent. The USB connector comes by default as transparent because of the LEDs implemented inside the plug. For simplicity, the LLLL and CU have been dropped from the following descriptions.

Note that the product is supplied with black cable and transparent connector by default and other combinations require a custom cable request.

5.1 USB-RS422-WE Connections and Mechanical Details

Figure 5.1 shows the cable signals and the wire colours for the signals on the USB-RS422-WE cable. **Figure 5.2** shows dimensions in millimetres.

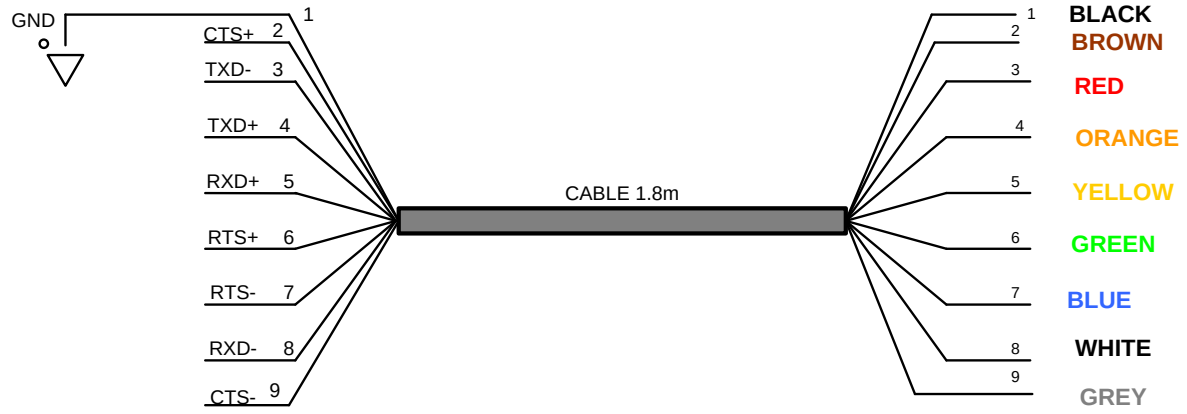

Figure 5.1 USB-RS422-WE Connections

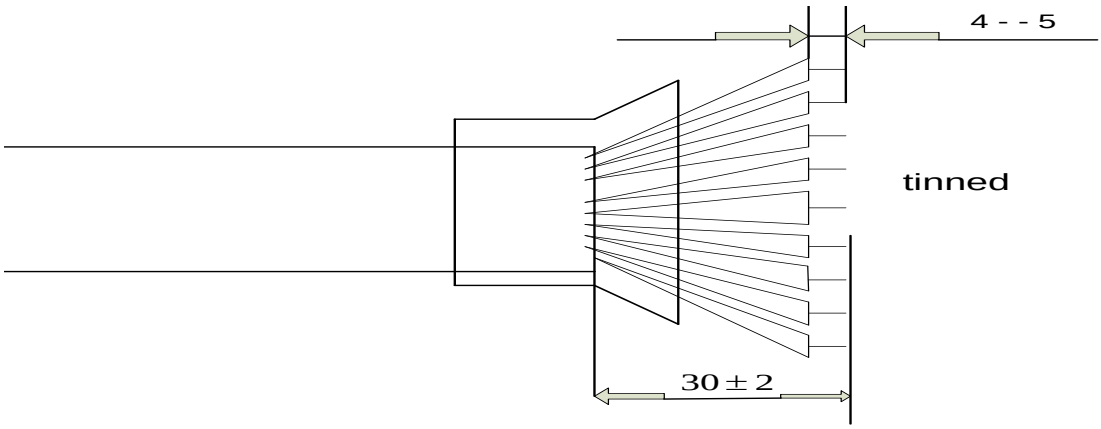

Figure 5.2 USB-RS422-WE Mechanical Details (dimensions in mm)

Figure 5.3 USB-RS422-WE Cable images

5.2 USB-RS422-WE Cable Signal Descriptions

Colour	Name	Type	Description
Black	GND	GND	Device ground supply pin.
Brown	CTS+	Input	Clear to Send Control + (B), Input
Red	TXD-	Output	Data – (A) Output
Orange	TXD+	Output	Data + (B) Output
Yellow	RXD+	Input	Data + (B) Input
Green	RTS+	Output	Request To Send Control + (B), Output
Blue	RTS-	Output	Request To Send Control – (A), Output
White	RXD-	Input	Data – (A) Input
Grey	CTS-	Input	Clear to Send Control input – (A), Input

Table 5.1 USB-RS422-WE Cable Signal Descriptions

5.3 USB-RS422-WE Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
Receiver Input						
VCM	Common-mode input voltage range	-7		+12	V	
IN	Input Current			1.0	mA	VIN = +12V
				–0.8		VIN = –7V
VTH	Differential Threshold Voltage, VTH	-0.2		+0.2	V	
VIHYST	Input Hysteresis		20		mV	
RIN	Input Resistance, RIN	12	15		kΩ	
Transmitter Output						
VOD	Differential Output Voltage, dVOD	1.5		5	V	With RL = 54Ω. CL = 50pF *

Table 5.2 USB-RS422-WE I/O Characteristics

* - The 54 ohms is the equivalent of two 120-ohm termination resistors placed on each side of the transmission line and the input impedance of 32 receivers on the line.

Description	Conditions	Minimum	Typical	Maximum
ESD HBM	RS-422 Inputs and Outputs		±15 kV	
EN61000-4-2ContactDischarge	RS-422 Inputs and Outputs		±8 kV	
EN61000-4-2AirGapDischarge	RS-422 Inputs and Outputs		±15 kV	

Table 5.3 USB-RS422-WE ESD Tolerance

6 Cable PCB Block Diagram

The block diagram for the small internal electronic circuit board, utilising the FT232R, which is encapsulated into the USB connector end of the cable, is shown in **Figure 6.1**.

Customised versions of the cable are also available. Users interested in customised versions of these cables should contact CP Sales (sales@connectiveperipherals.com).

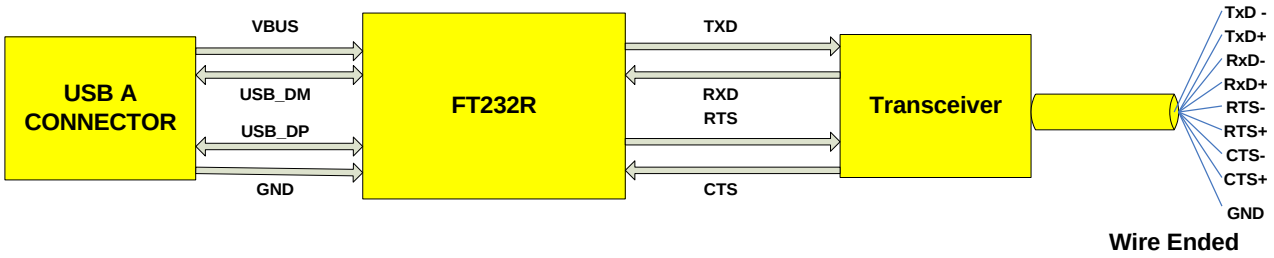

Figure 6.1 Block diagram of PCB Used in the USB to RS422 Serial Converter Cable

7 USB-RS422 Schematic

The detailed schematic of Converter Cable USB-RS422 is shown in **Figure 7.1**.

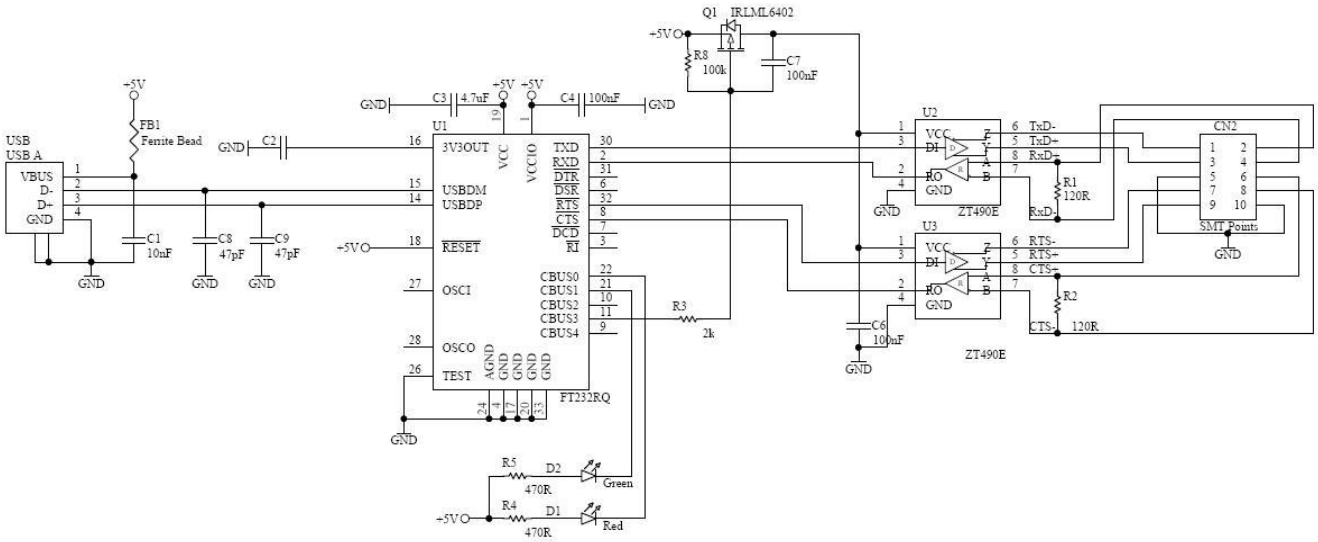

Figure 7.1 Schematic for USB-RS422 Converter Cable

8 Contact Information

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Appendix A - Cable EEPROM Configuration

Each USB-RS422 cable is controlled by the FT232R IC. This FT232R device contains an EEPROM which contains the USB configuration descriptors for that device. When the cable is plugged into a PC or a USB reset is performed, the PC will read these descriptors. The default values stored into the internal EEPROM are defined in **Table 0.1**.

Parameter	Value	Notes
USB Vendor ID (VID)	0403h	FTDI default VID (hex)
USB Product UD (PID)	6001h	FTDI default PID (hex)
Serial Number Enabled?	Yes	
Serial Number	See Note	A unique serial number is generated and programmed into the EEPROM during device final test.
Pull down I/O Pins in USB Suspend	Disabled	Enabling this option will make the device pull down on the UART interface lines when the power is shut off (PWREN# is high). Note that these are the lines between the FT232R and the RS422 line driver and not the RS422 outputs accessible on the wire ends.
Manufacturer Name	FTDI	
Product Description	See note	USB-RS422-WE
Max Bus Power Current	90mA	
Power Source	Bus Powered	
Device Type	FT232R	
USB Version	0200	Returns USB 2.0 device description to the host. Note: The device is a USB 2.0 Full Speed device (12Mb/s) as opposed to a USB 2.0 High Speed device (480Mb/s).
Remote Wake Up	Disabled	
High Current I/Os	Enabled	Enables the high drive level on the UART and CBUS I/O pins. Note that these are the lines between the FT232R and the RS422 line driver and not the RS422 outputs accessible on the wire ends.
Load VCP Driver	Enabled	Makes the device load the VCP driver interface for the device.
Invert TXD	Disabled	Signal on this pin becomes TXD# if enable.
Invert RXD	Disabled	Signal on this pin becomes RXD# if enable.
Invert RTS#	Disabled	Signal on this pin becomes RTS if enable.
Invert CTS#	Disabled	Signal on this pin becomes CTS if enable.

Table 0.1 Default Internal EEPROM Configuration

The internal EEPROM in the cable can be re-programmed over USB using the utility program FT_Prog. Users who do not have their own USB Vendor ID but who would like to use a unique Product ID in their design can apply to CP for a free block of unique PIDs. Contact CP support for this service - support@connectiveperipherals.com.

Note that the EEPROM is supplied programmed ready to use for most applications. Changing the EEPROM settings is for advanced users only. Changing the settings can cause incorrect operation of the device. Before editing the VID or PID, note that this requires the user to have a driver with matching VID/PID in order to install the device before it can be used again. It is recommended to contact technical support if in doubt before making any changes.

Appendix B - References

Document References

FT232R USB UART IC Datasheet

Acronyms and Abbreviations

Terms	Description
COM	General Purpose Input/output
DLL	Dynamic Link Library
EEPROM	Serial Peripheral Interconnect
EHCI	Enhanced Host Controller Interface
FPGA	Field Programmable Gate Array
HBM	Human Body Model
LED	Light Emitting Diode
OHCI	Open Host Controller Interface
RoHS	Restriction of Hazardous Substance Directive
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver Transmitter
UHCI	Universal Host Controller Interface
VCP	Virtual COM Port

Appendix C - List of Figures and Tables

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Appendix D - Revision History

Revision	Changes	Date
Version 1.0	Document transferred from FTDI to CP	29-12-2020
Version 1.1	Updated to reflect UKCA compliance. Added driver install section and other minor updates.	30-01-2023