Connective Peripherals Pte Ltd

USB2-F-5001 Full-Speed USB to 1-Port RS485 Adapter

Datasheet

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The USB-COM-Plus adaptors are a family of communication devices from Connective Peripherals Pte Ltd. This model, USB2-F-5001, provides a simple method of adapting legacy serial devices with RS485 interfaces to modern USB ports by incorporating the FTDI FT232R bridge chip.

A power supply output of +5VDC @ up to 250mA is available on the 9-pin D-sub connector. Indicator LEDs provide functional status.

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1 Introduction

1.1 Functional Description

The USB-COM-Plus adaptors are a family of communication devices. This model, USB2-F-5001, provides a simple method of adapting legacy serial devices with RS485 interfaces to modern USB ports. This is accomplished by incorporating the industry standard FTDI FT232R USB-Serial bridge chip.

Each USB2-F-5001 adapter contains a small internal electronic circuit board which utilises the FTDI FT232R, mounted inside a rugged plastic enclosure capable of withstanding industrial temperature ranges. The integrated electronics also include RS485 level shifters and TXD/RXD LEDs to provide a visual indication of data traffic through the adapter.

Figure 1.1 USB-COM-Plus USB2-F-1001

Flexible mounting allows the USB2-F-5001 to be used in a variety of applications, from a portable adapter to accompany a laptop to permanent installations in industrial, commercial, and retail locations.

The enclosure incorporates a standard USB-B client connector for connection to an upstream host or hub port. RS485-level signals are available on an industry-standard DE-9P connector. The maximum RS485-level data rate is 3Mbps.

The USB2-F-5001 adapter requires USB device drivers, available free from http://www.connectiveperipherals.com, which are used to make the USB2-F-5001 appear as a Virtual COM Port (VCP). This allows existing serial communications software, such as HyperTerminal, to exchange data through the USB2-F-5001 to a legacy RS485 peripheral device.

Pin 9 of the D-sub connector can provide +5V power output with maximum 250mA.

1.2 LED Description

The USB2-F-5001 uses three LEDs to indicate a valid link as well as data traffic according to the following table:

LED Color	Function	Description
Yellow	Enumerated	ON when USB2-F-5001 is configured and ready
Red	TxD Activity	Flashes when data is transmitted from the USB2-F-5001 to the attached RS485 device
Green	RxD Activity	Flashes when data is transmitted from the attached RS485 device to the USB2-F-5001

Table 1.1 – LED Description
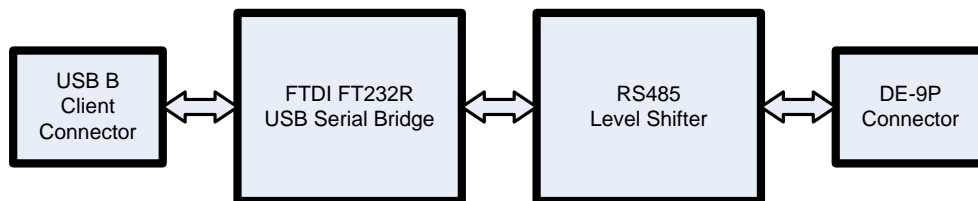
1.3 Block Diagram

Figure 1.2 USB2-F-5001 Block Diagram

1.3.1 Block description

USB B Client Connector
This connector provides the interface for connection to a USB Host or Hub port. A standard "A to B" cable is provided, though one of a different length may also be used. The maximum cable length is 5 meters, according to the USB 2.0 specification.

FTDI FT232R
The FTDI FT232R provides the USB-to-Serial conversion. Operating system device drivers are required in order to work with the FT232R to provide the Virtual COM Port serial functionality.

RS485 Level Shifter
The RS485 level shifter converts the signals provided by the FT232R into the voltage levels required by RS485 devices.

DE-9P Connector (Male)
The DE-9P connector is configured in an industry standard (TIA/EIA-485) pin-out to provide connection to RS485 peripherals through standard cables. See section 3.1.2.

1.4 Features

- Adds one RS-485 serial port by connecting to USB
- Easy plug & play installation and RS-485 device connection
- USB 2.0 Full-speed (works with USB 1.1, 2.0 and 3.0 Host and Hub ports)
- Industry Standard FTDI chip set & device drivers for maximum compatibility
- Microsoft Windows® WHQL-certified drivers (Windows 7 - Windows 11)
- Legacy drivers also available for older Windows versions back to XP, and Windows CE
- MacOS and Linux 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: 128 bytes transmit buffer, 256 bytes receive buffer
- RS-485 data signals: Data+, Data-, GND

- Powered by USB port. No external power adapter required.
- Pin 9 of DE-9P can provide +5VDC output at 250mA
- Serial port speed up to 3Mbps
- Serial Communication Parameters
  o Parity: None, Even, Odd
  o Data bits: 7, 8
  o Flow control: X-ON/X-OFF, None
- One DE-9P male connector
- LEDs indicate USB Enumeration, RxD, TxD for monitoring port status & easy diagnostics
- High-temperature plastic enclosure
- Operating temperature of -40°C to +85°C
- USB cable of length 0.9 meters included

1.5 Performance Figures

Parameter	Performance
USB Interface	12Mbps USB 2.0 Full-Speed
RS485 Interface	Standard Windows baud rates (300bps to 921.6Kbps) Custom baud rates (300bps to 3Mbps) through baud rate aliasing. See FTDI Application **Note:** AN_120_Aliasing_VCP_Baud_Rates

Table 1.2 - Performance Figures

1.6 Ordering Information

Part Number	Description
USB2-F-5001	USB-COM-Plus Full-Speed USB to 1-Port RS485 Adapter

Table 1.3 - Ordering Information

2 Installation

2.1 Hardware Installation

There are no switches or jumpers to configure on the USB-COM-Plus USB2-F-5001.

2.2 Mounting

The USB2-F-5001 is provided with two mounting options: UniClip™ Wall/DIN rail mount and rubber feet. The UniClip Wall/DIN rail mount allows the USB2-F-5001 to be permanently mounted to a wall or attached to a DIN rail. The rubber feet can be used when mobility or desktop use is desired. NOTE: The UniClip provides a permanent mounting style. The USB2-F-5001 case may be damaged if the UniClip is removed.

The following figures indicate various mounting styles.

Figure 2.1 - USB2-F-5001 with UniClip Brackets

Figure 2.2 - USB2-F-5001 with Rubber Feet

2.2.1 Wiring

A standard 0.9m USB "A" to "B" cable is provided.

Insert the A-plug into an available USB Host or Hub port. Insert the B-plug into the B-receptacle on the USB2-F-5001.

DTE Pin Number	Signal Name	Expected Connecting Signal
1	DATA- = Transmit/Receive Data, negative polarity Also, Terminator 2	DATA- Pin 2 of 120R Terminating Resistor. Only Required if the USB2-F-5001 is the first or last device in a multi-drop RS485 System, to meet RS485 Termination Requirements.
2	DATA+ = Transmit/Receive Data, positive polarity	DATA+
3	Terminator 1	Pin 1 of 120R Terminating Resistor. Only Required if the USB2-F-5001 is the first or last device in a multi-drop RS485 System, to meet RS485 Termination Requirements.
4	N/A	N/A
5	GND = RS485 signal ground	GND
6	N/A	N/A
7	N/A	N/A
8	N/A	N/A
9	PWR = +5V DC output	PWR

Table 2.1 – RS485 DTE to DCE connection with straight-through cable
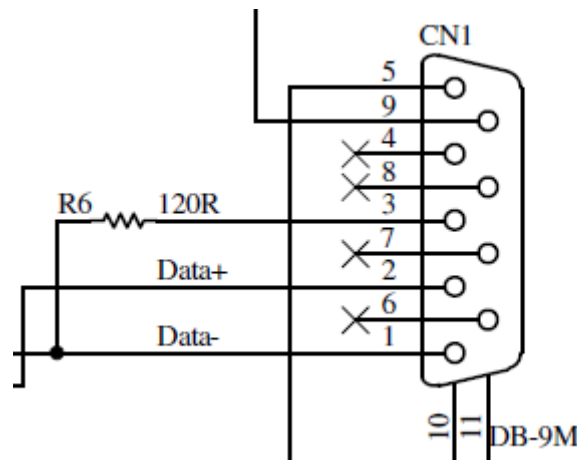
Figure 2.3 USB-COM485-PLUS1 Termination resistor

2.3 Device 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.

2.4 Local Echo

The ability to enable or disable local echo on the RS485 data is controlled by the setting in the FT232R EEPROM. A free utility is provided to change the configuration. The default is for local echo to be disabled.

3 Connections

3.1 External Connectors

3.1.1 USB

The USB-F-5001 is a downstream USB 2.0 Device. A standard USB Series "B" receptacle is mounted inside the USB-F-5001 to facilitate connection to an upstream USB Host or Hub.

Pin Number	Pin Type	Description
1	Power	VBUS – USB Power provided from upstream USB Host or Hub
2	Bidirectional	D– = USB data signal, negative polarity
3	Bidirectional	D+ = USB data signal, positive polarity
4	Ground	GND = USB signal ground
Shield	Case Ground	Drain = typically connected to the host PC case

Table 3.1 – USB "B" Receptacle Pin-Out

3.1.2 RS485

The RS485 port is configured as Data Terminal Equipment (DTE), with a 9-contact D-Sub Pin connector. Pin assignments are according to TIA/EIA-485. In addition, Pin9 of this connector can provide +5VDC to an external device with a maximum current draw of 250mA once the USB2-F-5001 has been enumerated by the system.

Pin Number	Pin Type	Description
1	Input/Output	DATA- = Transmit/Receive Data, negative polarity Pin 2 of 120R Terminating Resistor. Only Required if the USB2-F-5001 is the first or last device in a multi-drop RS485 System, to meet RS485 Termination Requirements.
2	Input/Output	DATA+ = Transmit/Receive Data, positive polarity
3	Input/Output	Pin 1 of 120R Terminating Resistor. Only Required if the USB2-F-5001 is the first or last device in a multi-drop RS485 System, to meet RS485 Termination Requirements.
4	N/A	N/A
5	Ground	GND = signal ground
6	N/A	N/A
7	N/A	N/A
8	N/A	N/A
9	Power	*+5VDC @ 250mA max*
Shield	Case Ground	Drain = typically connected to the host PC case

Table 3.2 – DE-9P RS485 Pin-Out

A 120R Resistor is connected internally between pin 1 and pin 3 of the 9-way D-type connector – see Figure 2.3.

4 Electrical details

4.1 USB

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
USB_VCC	Input Power Voltage*	4.25	5.0*	5.25	V	*Present when USB cable is attached, and USB Host or Hub powered.
I_{CC}	USB current		16		mA	Unit connected to USB port and idle (no RS485 cabling connected and no data transfer). Does not include power supplied to external device connected to pin 9
			20		mA	RS485 port running at 1MBaud (loopback through the echo feature). Actual current consumption depends on the characteristics of the RS485 cabling and attached devices. Does not include power supplied to external device connected to pin 9

Table 4.1 - USB Electrical Details

4.2 RS485

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 *
ESD Tolerance						
ESD HBM	RS485 Inputs and Outputs		±15		kV	
EN61000-4-2ContactDischarge	RS-485 Inputs and Outputs		±8		kV	
EN61000-4-2AirGapDischarge	RS-485 Inputs and Outputs		±15		kV	

Table 4.2 – RS485 Electrical Details

4.3 Power Output

The USB2-F-5001 assigns pin9 of DE-9P to provide +5V DC for an external device that requires power. The maximum allowable current that can be supplied from the USB bus is 500mA, including the circuitry of the USB2-F-5001 itself. Up to 250mA may be used by the external device.

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
I_O	Output Power Current	0		250	mA	USB2-F-5001

Table 4.3 - Power Output Option

5 Mechanical Details
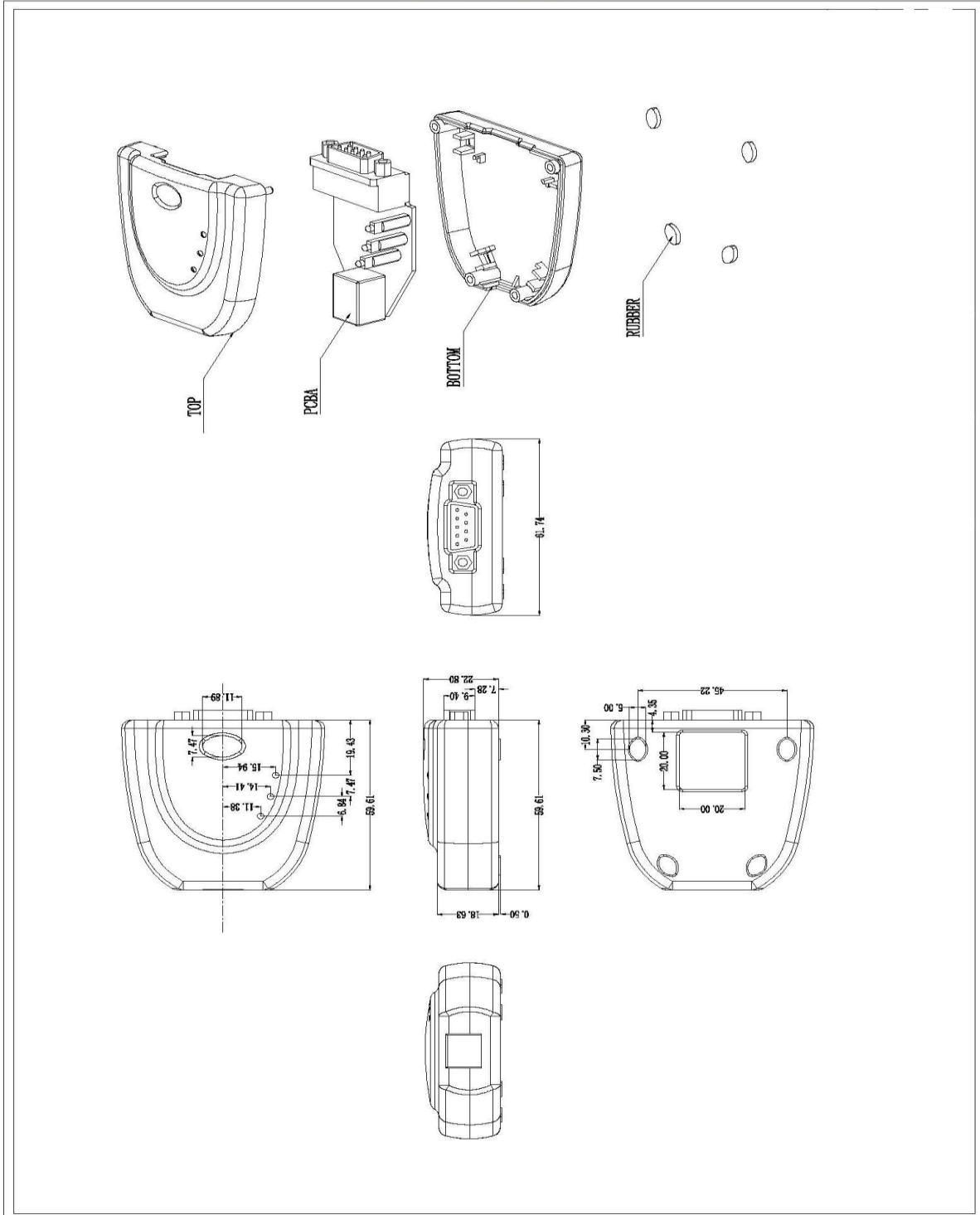
5.1 Module Mechanical Dimensions

Figure 5.1 USB2-F-5001 Case Dimensions
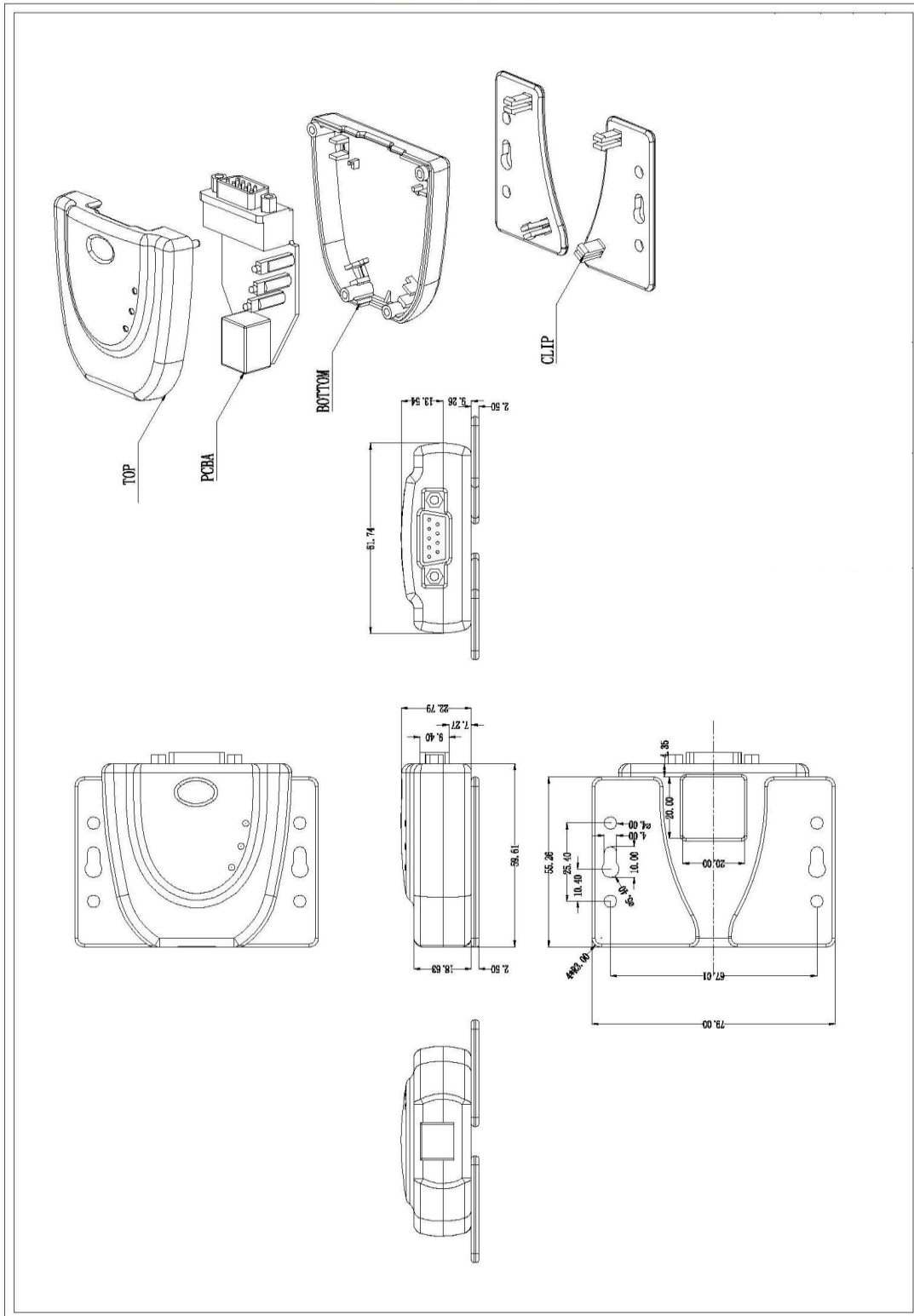
5.2 UniClip™ Mechanical Dimensions

Figure 5.2 USB2-F-5001 Case Dimensions with UniClip

6 Physical Environment Details

6.1 Storage Temperature

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Storage Temperature Range		25		⁰C	Dry and dust-free space with a constant temperature and relative humidity less than 65%.

Table 6.1 - Storage Temperature

6.2 Operating Temperature

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Operating Temperature Range	−40		+85	⁰C	5% to 95% RH, non-condensing

Table 6.2 - Operating Temperature

7 Environmental Approvals & Declarations

7.1 EMI Compatibility

FCC, CE and UKCA

The USB2-F-5001 has been tested to be compliant with both FCC Part 15 Subpart B, European and UK EMC Directives.

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.

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 USB2-F-5001 is defined as Limited Power Supply (LPS) device, with operating voltages under 60VDC.

7.3 Environmental

The USB2-F-5001 is a lead-free device that complies with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

7.4 Reliability

The USB2-F-5001 is designed as a robust USB-Serial adapter for use in many environments. There are no user-serviceable parts. Any failure will require a replacement of the unit.

7.5 Import / Export Information

Import / Export Information	
Country of Origin	China
Harmonized Code	TBD
Product Description	USB to RS485 Computer Adapter, Single Port
USA ECCN	EAR99 – No License Required

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.

RS485 cables – check the following:

- Check for specific handshake requirements of your RS485 peripheral.
- Because there are no handshake signals, ensure the application is set to "No Hardware Handshake", or equivalent.
- Test the port with a loop-back connector connected between the port to be tested and another RS485 adapter. Connect DATA+ of the port to be tested to DATA+ of the second port. Connect DATA- of the port to be tested to DATA- of the second port. Use a simple terminal program to check that data is transmitted and received between the port under test and the other port.

8.2 Device Driver

Ensure the latest device driver is in use. For instructions on how to remove and re-install the latest driver, refer to the **Connective Peripherals USB to Serial Converters Driver Installation Guide (CP_000084)** which is available from www.connectiveperipherals.com

If other devices with FTDI chips are installed in the system, check with all manufacturers of these devices for the latest device drivers. The FTDI installation guides also have additional information on driver installation: 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 which can be accessed by double-clicking on the device under the Ports (COM & LPT) section of the Windows Device Manager and clicking the advanced button in the Port Settings tab. 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 serial 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 RS485 device and *uncheck the Serial Enumerator* option. This setting is in the advanced driver options which can be accessed by double-clicking on the device under the Ports (COM & LPT) section of the Windows Device Manager and clicking the advanced button in the Port Settings tab.

- COM PORT IN USE: Windows keeps track of all COM port assignments. If multiple 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 can be uninstalled as shown in the **Connective Peripherals USB to Serial Converters Driver Installation Guide (CP_000084)** which is available from www.connectiveperipherals.com and the FTDI driver installation guides at https://ftdichip.com/document/installation-guides/

8.3 Technical Support

Technical support may be obtained from your nearest Connective Peripherals office. See details below.

E-Mail (Support): support@connectiveperipherals.com
Web: http://www.connectiveperipherals.com

9 Contact Information

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Appendix A - List of Figures and Tables

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Appendix B - Revision History

Revision	Changes	Date
1.0	Initial release	22-05-2009
1.01	Added details of I20R termination resistor	11-06-2009
1.02	Removed debug suggestion to fit a loopback connector; Corrected max power available from 450mA to 250mA; Added section 2.4 for local echo	24-08-2009
1.03	Modified module colours and images to silver/black	30-03-2010
1.1	Re-branding to reflect the migration of the product from EasySync to Connective Peripherals name – logo change, copyright changed, contact information Changed, all internal hyperlinks changed.	20-03-2019
1.2	Updated to include UKCA mark. Replaced driver install section with link to Connective Peripherals USB to Serial Converters Driver Installation Guide (CP_000084). Updated current consumption and storage temperature. Updated table 1.1 (Tx and Rx LED description)	30-08-2022