



# Connective Peripherals Pte Ltd

## USB to Serial Converters Manual

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The ES-U-xxxx-x adapters are a series of USB Serial Converters from Connective Peripherals Pte Ltd. They provide a simple method of adapting legacy RS-232 or RS-422/485 devices to work with modern USB ports using a trusted and reliable FTDI chip set. Available in a variety of enclosures and port numbers, they are ideal for allowing factory automation equipment, multi-drop data collection devices, barcode readers, time clocks, scales, data entry terminals and serial communication equipment to be connected to USB ports in industrial environments.

This manual covers the following USB to Serial Converter products. For older products from the ES-U-xxxx-xx series please refer to the earlier version 1.4 of this manual available from the Connective Peripherals website.

ES-U-1001-A	ES-U-1032-RM	ES-U-2002-M	ES-U-2101-MB
ES-U-1101-MB	ES-U-2001B	ES-U-2102-M	ES-U-3001-MB
ES-U-1002-A	ES-U-2101B	ES-U-2104-M	ES-U-3008-RM
ES-U-1002-M	ES-U-2001C	ES-U-2008-M	ES-U-3008-RMB
ES-U-1008B	ES-U-2101C	ES-U-2016-RM	ES-U-3016-RM

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## 1 Introduction

The ES-U-xxxx-x family of converters provide a quick and simple way to add serial communication ports to your computer. They connect to a single USB port on your computer to instantly provide up to 32 serial ports. They take advantage of the plug-and-play and hot-plug features of the USB bus to make it easier than ever to add communication ports to your system.

Installation is easy. There are no IRQ & COM port conflicts as the port doesn't require any additional IRQ, DMA or memory resources on the system. Each RS-232 or RS-422/RS-485 port functions as a native Windows COM port and is compatible with Windows serial communication applications.

The ES-U-xxxx-x converters provide instant connectivity to RS-232 or RS-422/RS-485 compatible devices, including factory automation equipment, multi-drop data collection devices, barcode readers, time clocks, point of sale, scales, data entry terminals and a variety of other devices in industrial environments.

This manual covers the following models:

### USB to RS-232 converters

- Single channel (ES-U-1001-A, ES-U-1101-MB)
- Dual channel (ES-U-1002-A, ES-U-1002-M)
- 8-channel (ES-U-1008B)
- 32-channel (ES-U-1032-RM)

### USB to RS-422/485 converters

- Single channel (ES-U-2001B, ES-U-2101B, ES-U-2001C, ES-U-2101C)
- Dual channel (ES-U-2002-M, ES-U-2102-M)
- Quad channel (ES-U-2104-M)
- 8-channel (ES-U-2008-M)
- 16-channel (ES-U-2016-RM)

### USB to RS-232/422/485 converters

- Single channel (ES-U-3001-MB, ES-U-2101-MB)
- 8-channel (ES-U-3008-RM, ES-U-3008-RMB)
- 16-channel (ES-U-3016-RM)

## 2 Specifications

### 2.1 Standard Features

- Internal Transmit and Receive buffers
- Requires no IRQ, DMA, I/O port
- DB-9 male serial connectors (terminal blocks on some models) (see [Note 1](#))
- LEDs for each port indicate TxD and RxD
- Virtual COM port drivers available
  - Windows 7 up to Windows 11
  - MAC OSX 10.9 onwards
  - Linux Kernel 3.0.0-19 onwards (e.g., Ubuntu version 11.10)
  - Other legacy drivers available from the FTDI website

#### USB to RS-232 Features (available on ES-U-1xxx, ES-U-30xx and ES-U-2101-MB)

- Adds RS-232 ports via USB connection
- RS-232 data signals: DCD, RxD, TxD, DTR, GND, DSR, RTS, CTS, RI (see [Note 2](#))

#### USB to RS-422/RS-485 Features (available on ES-U-20xx and ES-U-30xx) (see [Note 3](#))

- Adds RS-422 / RS-485 ports via USB connection
- Auto transmit buffer control for 2-wire RS-485 half-duplex operation
- Internal termination and bias resistors on some models (enabled by jumper)
- RS-422 data signals: TX-, TX+, RX+, RX-, GND, RTS-, RTS+, CTS+, CTS- (see [Note 2](#))
- RS-485 signals (half duplex): Data+, Data-, GND
- RS-485 signals (full-duplex): TX-, TX+, RX-, RX+, GND

#### Additional Opto-isolation Features (available on ES-U-11xx and ES-U-21xx)

- Each RS-232 or RS-422/RS-485 port is individually isolated with 2000-volt DC optical isolation
- Each RS-232 or RS-422/RS-485 port is individually protected by a surge protector to withstand electrostatic discharge and power surges up to 25KV ESD

**Note 1** ES-U-1032-RM has RJ45 ports which can be converted to DB-9 male if required using the supplied cables

**Note 2** Terminal block has subset of these signals only – see section **Error! Reference source not found.** for details

ES-U-2101-MB also features RS232 but only a subset of these signals – see section **Error! Reference source not found.** for details

**Note 3** Supports multiple serial protocols - Jumpers or DIP switches are used to select the required serial protocol

## 2.2 Features by Model

Table 1 summarises the features for each model in the ES-U-xxxx-x family.

Model Number	Serial Interfaces				Case		Power Supply	Opto Isolated	Additional features and Notes
	Ports	RS232	RS422	RS485	Metal	Rack			
ES-U-1001-A	1	Y	-	-	-	-	USB	-	
ES-U-1101-MB	1	Y	-	-	Y	-	USB	Y	Revision B of ES-U-1101-M which supports higher data throughput
ES-U-1002-A	2	Y	-	-	-	-	USB	-	
ES-U-1002-M	2	Y	-	-	Y	-	USB	-	5V 150mA output on 2-way screw terminal
ES-U-1008B	8	Y	-	-	-	-	USB	-	
ES-U-1032-RM	32	Y	-	-	Y	Y	Int	-	RJ45 serial connectors
ES-U-2001B	1	-	Y	Y	-	-	USB	-	Rev B of ES-U-2001
ES-U-2001C	1	-	Y	Y	-	-	USB	-	Rev C of ES-U-2001
ES-U-2101B	1	-	Y	Y	-	-	USB	Y	Rev B of ES-U-2101
ES-U-2101C	1	-	Y	Y	-	-	USB	Y	Rev C of ES-U-2101
ES-U-2101-MB	1	Y	Y	Y	Y	-	USB	Y	6-way screw terminal
ES-U-2002-M	2	-	Y	Y	Y	-	USB	-	5-way screw terminals
ES-U-2102-M	2	-	Y	Y	Y	-	USB	Y	ES-U-2002-M with isolation
ES-U-2104-M	4	-	Y	Y	Y	-	Ext	Y	5VDC (2A) power adapter (barrel plug) *
ES-U-2008-M	8	-	Y	Y	Y	-	Ext	-	12VDC (1.5A) power adapter (3-pin terminal) *
ES-U-2016-RM	16	-	Y	Y	Y	Y	Int	-	
ES-U-3001-MB	1	Y	Y	Y	Y	-	USB	-	6-way screw terminal, 5V output Rev B of ES-U-3001-M which supports higher data throughput
ES-U-3008-RM	8	Y	Y	Y	Y	Y	Int	-	
ES-U-3008-RMB	8	Y	Y	Y	Y	Y	Ext	-	Rev B with external 5V PSU
ES-U-3016-RM	16	Y	Y	Y	Y	Y	Int	-	

**Table 1 - Features of the ES-U-xxxx-x converters**

Power supply types are USB (USB powered), Ext (external power adapter) or Int (internal power supply)

\* Power adapter voltages and currents shown in the comments column is for indication only and are subject to change. To avoid damage, always use the adapter which was provided with your converter to ensure that you are supplying the correct voltage for operation.

### 3 Features of the ES-U-xxxx-x Family

#### 3.1 USB and Serial Interface

##### USB Interface

Devices in the ES-U-xxxx-x series feature a standard USB type-B socket (with standard USB A-B cable supplied to connect to the PC) or a USB type-A plug to connect to the USB port directly.

##### Serial Interface

The ES-U-xxxx-x converters have DB-9 male connectors for connection to the RS-232/422/485 interface. Some models have the following additional features:

- Terminal block connections providing a subset of the signals
- Optional 5V output.

The ES-U-1032-RM unit has RJ45 connectors on the front panel instead of DB-9, but is provided with adapter cables to convert these to DB-9 male connectors if required.



**Figure 1 - DB-9 Male serial connectors. Some models also feature terminal blocks**

**Figure 2 - ES-U-1032-RM (RJ45 connectors) is supplied with RJ45-to-DB-9 cables**

### 3.2 Case Styles

The ES-U-xxxx-x converters are available in Plastic, Metal and Metal Rackmount enclosure styles. All units can be used on a desktop with the self-adhesive feet provided.

- Plastic case desktop converters are supplied with USB cable (except ES-U-1001-A and ES-U-1002-A) and a power adapter localised to country of sale (when required depending on model).
- Metal case converters are supplied with wall mounting hardware, USB cable and power adapter with plug localised to country of sale (when required depending on model).
- Metal rack mount converters are supplied with rack mounting hardware, USB cable and power cable or power adapter localised to country of sale.

Transmit and receive LEDs for each port are included on the front or top panel of the enclosure, to show when data is being transmitted or received by the associated port. A power LED is also included (on units with metal enclosures) to show that the converter is receiving power.

Note that enclosure colour may vary from the photos shown. Some models with metal enclosures are changing to a black colour



**Figure 3 - Example of the Metal Rack-mount enclosure**



**Figure 4 - Examples of the Plastic and Metal (wall mountable) enclosures**



### 3.3 Power Supply

Depending on the model, power will either be supplied from the USB port, from an external power adapter or from an internal switching supply. The different types are described below. Table 1 on page 6 shows which type of power supply is required for each converter model.

#### USB powered

These devices are powered directly from the USB port. No power supply is required for these converters. It is recommended to connect them direct to a PC's USB port. If necessary to use a USB hub, it is strongly recommended to use a self-powered hub (which has its own PSU) as bus-powered hubs may not be able to provide sufficient power.

#### Power Adapter

These devices are provided with an external power adapter in the package. The adapter supplied has a UK, EU or USA plug depending on the country of sale and so may vary from the one shown below. The low voltage connector is either a 3-pin terminal block connector or a barrel-type jack as shown below, depending on the model. For more details, see Table 1 on page 6.

The low voltage cable should be connected to the power (or DC in) socket on the converter, and the AC input plug should be connected to a power source before using the converter.



Always use the supplied adapter to power your ES-U-xxxx-x converter; damage will occur if an adapter providing the wrong voltage is used and is not covered by the warranty.



**Figure 5 - Some models use a power adapter with barrel or terminal connector**

The revision B of the rack-mountable units now also have external power supplies and use the connector shown in Figure 6.



**Figure 6 – ES-U-3008-RMB power connector**

#### Internal Switching Power Supply

The rack mountable (ES-U-xxxx-RM) devices require an AC input (100V ~ 240V, 47 – 63 Hz) for the internal switching power supply. A power cable is supplied with the converter and connects to the power inlet socket on the rear panel. The cable has a UK, EU or USA plug depending on the country of sale and so may vary from the one shown below.

Note that the revision B rack-mountable units (such as ES-U-3008-RMB) now have an external power supply instead of the internal power supply, and uses the connector shown in the Power Adapter section above in Figure 6.



ES-U-2016-RM

**Figure 7 - Rack-mount model with an internal supply with AC input connector**

### 3.4 Optical Isolation & Surge Protection

Optical isolation and surge protection are available in the ES-U-11xx and ES-U-21xx converters.

Each serial port is individually optically isolated with 2000-volt DC optical isolation. The optical isolation protects your PC or notebook from spikes and surges on the RS-232 or RS-422/RS-485 network, by converting the electrical data into an optical signal and then changing it back into electrical data. Your computer is well protected since the surges and spikes cannot cross the optical link.

Each serial port is individually protected by surge protector to withstand electrostatic discharge and power surges up to 25KV ESD.

### 3.5 Configuring for RS-232, RS-422 and RS-485 Modes

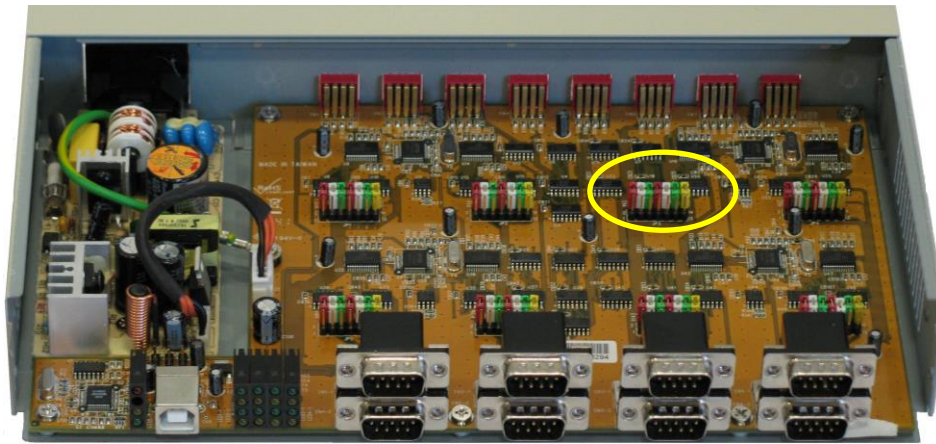
The ES-U-2xxx-x and ES-U-3xxx-x converters can be configured for different interface types. These converters have DIP switches or internal jumpers to select the required interface. They also feature internal jumpers to select options such as termination and biasing of the RS-422 and RS-485 lines.

Please refer to section 4 for more information on the DIP switch and jumper settings available on each model of converter.



ES-U-3008-RM

**Figure 8 - ES-U-2xxx and ES-U-3xxx have DIP switches to select the serial mode**



**Figure 9 - ES-U-3008-RM has a set of jumpers for each port (one set circled)**

## 4 Switch and Jumper Settings

This section applies to ES-U-2xxx-x and ES-U-3xxx-x converters, which can be configured for different interface types. These converters have DIP switches and internal jumpers to select the required interface. The following pages give details of the settings required for each model of converter. Ensure that you refer to the correct section for your model of converter. The relevant model numbers are listed at the top of each section. Always read the general notes and warnings on this page before proceeding to configure your device.

### 4.1 General Notes and Warnings

#### Safety



For ES-U-xxxx-RM models with internal power supplies, the power cable must be disconnected before removing the cover. Opening the cover will expose connections and boards carrying lethal voltages. Contact with these will cause severe injury or death. In common with all switching power supplies connected to the mains (120/240VAC), the power supply board in these products can remain charged with dangerous voltages for some time after the power input is disconnected and so avoid contact with the power supply board inside the converter even when un-powered.

#### Serial Bus Configuration

It is important to configure the DIP switches and jumpers to select the correct type of serial bus (RS-232, RS-422 or RS-485) for your application before connecting the ES-U-xxxx-x converter to your serial bus. Otherwise, damage can occur to the converter or other equipment on the RS-232/RS-422/RS-485 bus. To avoid damage, the power supply (or power cable in rack-mount units), serial cables and USB cable should be disconnected from your converter before changing DIP switch settings and before opening the case to change jumper settings.

#### Termination

For RS-422 or RS-485, it may be necessary to enable termination of the data transmission lines. This depends on the way in which your network is connected and if termination is already provided by other devices on the network. Before applying the termination, check your cable specification for proper impedance matching. The termination option connects a 120 Ohm resistor between the data + and - lines. Termination is not needed for RS232 and may affect the signals if enabled.

Termination is normally used in the node at each end of the bus, but nodes in the middle of the bus should not have termination enabled. Enabling termination resistors on additional nodes which are not at the ends of the bus may cause overloading of the line drivers leading to unreliable operation of the unit and the overall system.

The ES-U-xxxx-x converters have jumpers (or DIP switches) to allow internal termination resistors to be enabled if required. This avoids the need to provide an external resistor at the ES-U-xxxx-x end of the bus.

ES-U-xxxx-x converters have separate jumpers/switches for Tx+/Tx- termination and Rx+/Rx- termination allowing termination to be enabled for either or both if required. The product-specific sections throughout chapter 4 describe these in more detail. **When using RS-485 half-duplex, the Tx and Rx pairs are combined into a single bi-directional pair and so only the Tx+/Tx- termination should be enabled. The Rx+/Rx- termination should be disabled.**

#### Biasing

In some cases, the RS-485 lines may float to undefined levels when no transmitter is active, and this can cause additional unexpected characters to appear at the start or end of a message. Biasing resistors are used to set a defined logic level on the serial lines when no node is transmitting. 750 Ohm resistors pull up the Data + line and pull down the Data - line.

Some ES-U-xxxx-x models feature internal 750-ohm resistors with jumpers to enable/disable them.

These should be disabled if another device on your serial bus already provides biasing as biasing of data lines must only occur at a single point in the cabling. Fitting more than one set of bias resistors can cause overloading of the line drivers leading to unreliable operation of the unit and the overall system. Biasing is not required for RS232 and may affect the signals if enabled.

ES-U-xxxx-x converters have four jumpers to select biasing on Tx+, Tx-, Rx+ and Rx-. The product-specific sections throughout chapter 4 describe these in more detail. *When using RS-485 half-duplex, the Tx and Rx pairs are combined into a single bi-directional pair and so only the jumpers for Tx biasing (Pull up of Tx+ and Pull down of Tx-) should be fitted. The Rx biasing should be disabled.*

## 4.2 ES-U-2x01B / ES-U-2x01C Adapters (Plastic Enclosure)

This section applies to the following adapters:

- ES-U-2001B (see note below)
- ES-U-2001C (see note below)
- ES-U-2101B (see note below)
- ES-U-2101C (see note below)

**Note:** This section applies *only* to revision B and C units which have the part numbers listed above. For the original ES-U-2001 and ES-U-2101, please refer to version 1.4 of this guide which is available from the Connective Peripherals website.

This section does not apply to ES-U-2xxx-M (metal case) adapters. Please see sections 4.3 and 4.4 for these products.



See the General Notes and Warnings on page 12 before changing settings or opening the cover. The jumpers should be set to select the correct serial mode before connecting the converter to your RS-422/RS-485 serial bus.

### DIP Switch Settings

On the inside of the unit, there are three DIP switches, which are used to select the required serial mode (RS-422 or RS-485).

	Operation Mode	S1	S2	S3
RS-422	4 Wire with handshaking	ON	ON	ON
RS-485	Full Duplex (4 wire)	OFF	ON	ON
	Half Duplex (2 wire) with Echo	OFF	OFF	ON
	Half Duplex (2 wire) without Echo	OFF	OFF	OFF

**Table 2 - RS-422 & RS-485 Mode Configuration**

### Jumper Settings

Inside the unit, there is a 7x3 (21 pin) header block. Jumpers are used to select features such as 120 Ohm termination on Tx, Rx and CTS, and 750 Ohm biasing resistors on Tx and Rx. You will need to open the cover and set the jumpers as per the requirements of your application.

Jumper	Function
1 - 2	Enable Tx+/- Termination with 120 Ohm (see notes below table)
2 - 3	Disable Tx+/- Termination
4 - 5	Enable Tx Bias - Pull-up Tx+ to VCC by 750 Ohm Bias resistor (see notes below table)
5 - 6	Disable Pull-up of Tx+ to VCC
7 - 8	Enable Pull-down of Tx- to GND by 750 Ohm Bias resistor (see notes below table)
8 - 9	Disable Pull-down of Tx- to GND

10 - 11	Enable Rx+/- Termination with 120 Ohm (see notes below table)
11 - 12	Disable Rx+/- Termination
13 - 14	Enable Pull-up of Rx+ to VCC by 750 Ohm Bias resistor (see notes below table)
14 - 15	Disable Pull-up of Rx+ to VCC
16 - 17	Enable Pull-down of Rx- to GND by 750 Ohm Bias resistor (see notes below table)
17 - 18	Disable Pull-down of Rx- to GND
19 - 20	Enable CTS Termination with 120 Ohm (populate for RS422 mode if termination is required)
20 - 21	Disable CTS Termination

**Table 3 - Jumpers to select Termination and Biasing**

**Note on Termination:**

For RS485 half-duplex, if termination is required, only Tx Termination should be enabled as the Tx and Rx lines are linked. Enable Tx+/- termination (jumper 1-2) and disable Rx+/- termination (jumper 11-12).

For RS485 full-duplex and RS422, termination can be enabled/disabled for Tx+/- and Rx+/- pairs independently using the jumpers as required. See the notes on Termination in section 4.1 before setting these options

**Note on Biasing:**

For RS485 half-duplex, if biasing is required, enable Tx+/- biasing only (jumper 4-5 and 7-8) and disable Rx+/- biasing (jumper 14-15 and 17-18).

For RS485 full-duplex and RS422, biasing can be enabled/disabled for Tx+/- and Rx+/- pairs independently as required. See the notes on Biasing in section 4.1 before setting these options.

### 4.3 ES-U-2xxx-M and ES-U-2xxx-RM with 3 DIP Switches

This section applies to the following adapters:

- ES-U-2002-M
- ES-U-2102-M
- ES-U-2008-M
- ES-U-2016-RM



See the General Notes and Warnings on page 12 before changing settings or opening the cover. The DIP switches should be set to select the correct serial mode before connecting the converter to your RS-422/RS-485 serial bus.

**DIP Switch Settings**

On the outside of the unit, there are three DIP switches, which are used to select the required serial mode (RS-422 or RS-485).

	Operation Mode	S1	S2	S3
RS-422	4 Wire with handshaking	ON	ON	ON
RS-485	Full Duplex (4 wire)	OFF	ON	ON
	Half Duplex (2 wire) with Echo	OFF	OFF	ON
	Half Duplex (2 wire) without Echo	OFF	OFF	OFF

**Table 4 - RS-422 & RS-485 Mode Configuration**

## Jumper Settings

Inside the unit, there is a 7x2 (14 pin) header block for each serial port. Jumpers are used to select features such as 120 Ohm termination on Tx, Rx and CTS, and 750 Ohm biasing resistors on Tx and Rx. You will need to open the cover and set the jumpers as per the requirements of your application.

Jumper	Function
1 – 2	Enable Tx+/- Termination with 120 Ohm (see notes below table)
3 – 4	Enable Tx Bias – Pull-up Tx+ to VCC by 750 Ohm Bias resistor (see notes below table)
5 – 6	Enable Tx Bias – Pull-down Tx- to GND by 750 Ohm Bias resistor (see notes below table)
7 – 8	Enable Rx+/- Termination with 120 Ohm (see notes below table)
9 – 10	Enable Rx Bias – Pull-up Rx+ to VCC by 750 Ohm Bias resistor (see notes below table)
11 – 12	Enable Rx Bias – Pull-down Rx- to GND by 750 Ohm Bias resistor (see notes below table)
13 – 14	Enable CTS Termination with 120 Ohm (populate for RS422 mode if termination is required)

**Table 5 – Jumpers to select Termination and Biasing**

### **Note on Termination:**

For RS485 half-duplex, if termination is required, only Tx Termination should be enabled as the Tx and Rx lines are linked. Enable Tx+/- termination (jumper 1-2) and disable Rx+/- termination (leave jumper 7-8 open)

For RS485 full-duplex and RS422, termination can be enabled/disabled for Tx+/- and Rx+/- pairs independently using the jumpers as required. See the notes on Termination in section 4.1 before setting these options

### **Note on Biasing:**

For RS485 half-duplex, if biasing is required, enable Tx+/- biasing only (jumper 3-4 and 5-6) and disable Rx+/- biasing (leave jumper 9-10 and 11-12 open)

For RS485 full-duplex and RS422, biasing can be enabled/disabled for Tx+/- and Rx+/- pairs independently as required. See the notes on Biasing in section 4.1 before setting these options

## 4.4 ES-U-2xxx-M with 4 DIP Switches

This section applies to the following adapters:

- ES-U-2104-M



See the General Notes and Warnings on page 12 before changing settings or opening the cover. The DIP switches should be set to select the correct serial mode before connecting the converter to your RS-422/RS-485 serial bus.

### DIP Switch Settings

On the outside of the unit, there are four DIP switches, which are used to select the required serial mode (RS-422 or RS-485).

	Operation Mode	S1	S2	S3	S4
RS-422	4 Wire with handshaking	ON	ON	OFF	OFF
RS-485	Full Duplex (4 wire)	ON	OFF	OFF	OFF
	Half Duplex (2 wire) with Echo	OFF	OFF	OFF	ON
	Half Duplex (2 wire) without Echo	OFF	OFF	ON	ON

**Table 6 - RS-422 & RS-485 Mode Configuration**

Switch S4 selects 120R termination of TxD. It is normally enabled for half-duplex RS-485 modes but may not be required if both ends of your network are already terminated.

### Jumper Settings

Inside the unit, there is a 6x2 (12 pin) header block for each serial port. Jumpers are used to select features such as 120 Ohm termination on Rx and CTS, and 750 Ohm biasing resistors on Tx and Rx. You will need to open the cover and set the jumpers as per the requirements of your application.

Jumper	Function
1 - 2	Enable Tx Bias - Pull-up Tx+ to VCC by 750 Ohm Bias resistor (see notes below table)
3 - 4	Enable Tx Bias - Pull-down Tx- to GND by 750 Ohm Bias resistor (see notes below table)
5 - 6	Enable Rx+/- Termination with 120 Ohm (see notes below table)
7 - 8	Enable Rx Bias - Pull-up Rx+ to VCC by 750 Ohm Bias resistor (see notes below table)
9 - 10	Enable Rx Bias - Pull-down Rx- to GND by 750 Ohm Bias resistor (see notes below table)
11 - 12	Enable CTS Termination with 120 Ohm (populate for RS422 mode if termination is required)

**Table 7 - Jumpers to select Termination and Biasing**

#### **Note on Termination:**

For RS485 half-duplex, if termination is required, only Tx Termination should be enabled as the Tx and Rx lines are linked. Enable Tx+/- termination (using DIP switch 4 on this model) and disable Rx+/- termination (leave jumper 5-6 open)

For RS485 full-duplex and RS422, termination can be enabled/disabled for Tx+/- and Rx+/- pairs independently using the jumpers as required. See the notes on Termination in section 4.1 before setting these options

#### **Note on Biasing:**

For RS485 half-duplex, if biasing is required, enable Tx+/- biasing only (jumper 1-2 and 3-4) and disable Rx+/- biasing (leave jumper 7-8 and 9-10 open).

For RS485 full-duplex and RS422, biasing can be enabled/disabled for Tx+/- and Rx+/- pairs independently as required. See the notes on Biasing in section 4.1 before setting these options

## 4.5 ES-U-3xxx-x and ES-U-2101-MB

This section applies to the following adapters:

- ES-U-3001-MB
- ES-U-3008-RM
- ES-U-3016-RM
- ES-U-2101-MB



See the General Notes and Warnings on page 12 before changing settings or opening the cover. The DIP switches should be set to select the correct serial mode before connecting the converter to your RS-232/RS-422/RS-485 serial bus.

### DIP Switch Settings

On the outside of the unit, there are four DIP switches, which are used to select the required serial mode (RS-232, RS-422 or RS-485).

	Operation Mode	S1	S2	S3	S4
RS-232		OFF	ON	ON	ON



RS-422	4 Wire with handshaking	ON	ON	ON	ON
RS-485	Full Duplex (4 wire)	ON	OFF	ON	ON
	Half Duplex (2 wire) with Echo	ON	OFF	OFF	ON
	Half Duplex (2 wire) without Echo	ON	OFF	OFF	OFF

**Table 8 - RS-232, RS-422 & RS-485 Mode Configuration**

### Jumper Settings

Inside the unit, there is a 7x2 (14 pin) header block for each serial port. Jumpers are used to select features such as 120 Ohm termination on Tx, Rx and CTS, and 750 Ohm biasing resistors on Tx and Rx. You will need to open the cover and set the jumpers as per the requirements of your application.

Jumper	Function
1 - 2	Enable Tx+/- Termination with 120 Ohm (see notes below table)
3 - 4	Enable Tx Bias - Pull-up Tx+ to VCC by 750 Ohm Bias resistor (see notes below table)
5 - 6	Enable Tx Bias - Pull-down Tx- to GND by 750 Ohm Bias resistor (see notes below table)
7 - 8	Enable Rx+/- Termination with 120 Ohm (see notes below table)
9 - 10	Enable Rx Bias - Pull-up Rx+ to VCC by 750 Ohm Bias resistor (see notes below table)
11 - 12	Enable Rx Bias - Pull-down Rx- to GND by 750 Ohm Bias resistor (see notes below table)
13 - 14	Enable CTS Termination with 120 Ohm (populate for RS422 mode if termination is required)

**Table 9 - Jumpers to select Termination and Biasing**

#### **Note on Termination:**

For RS485 half-duplex, if termination is required, only Tx Termination should be enabled as the Tx and Rx lines are linked. Enable Tx+/- termination (jumper 1-2) and disable Rx+/- termination (leave jumper 7-8 open)

For RS485 full-duplex and RS422, termination can be enabled/disabled for Tx+/- and Rx+/- pairs independently using the jumpers as required. See the notes on Termination in section 4.1 before setting these options

#### **Note on Biasing:**

For RS485 half-duplex, if biasing is required, enable Tx+/- biasing only (jumper 3-4 and 5-6) and disable Rx+/- biasing (leave jumper 9-10 and 11-12 open)

For RS485 full-duplex and RS422, biasing can be enabled/disabled for Tx+/- and Rx+/- pairs independently as required. See the notes on Biasing in section 4.1 before setting these options

### **5V Power Enable Jumper (ES-U-3001-MB and ES-U-2101-MB)**

The ES-U-3001-MB and ES-U-2101-MB can supply 5V (at up to 150mA) through Pin 5 of the terminal block to allow external devices to be powered. To enable the power, you need to open the metal case and set the jumper (JP2) to the position of "ON".

Jumper	Function
ON	Enable the 5V 150mA output on pin 5 of the Terminal Block to provide power for external devices
OFF	Disable the 5V 150mA power (Default)

**Table 10 - Jumper to select 5V output**

### **RS232 Pin-Out (ES-U-2101-MB)**

The ES-U-2101-MB has only a subset of the signals on the DB-9 connector to provide TxD, RxD, RTS, CTS and GND. The pinout can be found in Table 12.

## 5 Connector Pinout Information

This section shows the connector pinouts used on the ES-U-xxxx-x converters.

### 5.1 RS-232 Signal Pin-out

#### DB-9 Male connector

The RS232 ports are configured as Data Terminal Equipment (DTE), with a 9-contact D-Sub Pin connector. Pin assignments are according to TIA/EIA-574 which formally defines the assignments for a COM port found on many personal computers.

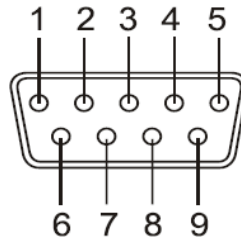


Figure 10 - DB-9 Male Connector Pin Numbers

Pin Number	Pin Type	Description
1	Input	DCD = Data Carrier Detect
2	Input	RXD = Receive Data
3	Output	TXD = Transmit Data
4	Output	DTR = Data Terminal Ready
5	Ground	GND = RS232 signal ground
6	Input	DSR = Data Set Ready
7	Output	RTS = Request To Send
8	Input	CTS = Clear To Send
9	Input	RI = Ring Indicator
Shield	Case Ground	Drain = typically connected to the host PC case

Table 11 - RS-232 Pin-Out for DB-9 connector

#### RS232 DB-9 Pin-Out (ES-U-2101-MB)

The ES-U-2101-MB has a reduced set of signals which are shown in Table 12. It includes the most used signals TxD/RxD/RTS/CTS/GND.

Note that the other pins of the connector must be left unconnected as indicated below.

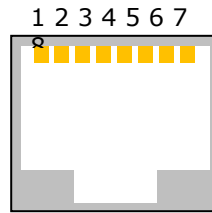
Pin Number	Pin Type	Description
1		Leave un-connected
2	Input	RXD = Receive Data
3	Output	TXD = Transmit Data
4		Leave un-connected
5	Ground	GND = RS232 signal ground
6		Leave un-connected
7	Output	RTS = Request To Send
8	Input	CTS = Clear To Send
9		Leave un-connected

Table 12 - RS-232 Pin-Out for DB-9 connector on ES-U-2101-MB

#### RJ45 connector

Table 13 shows the pin-out of the RJ45 connectors used on the ES-U-1032-RM converter.

This converter is also provided with adapter cables which convert the RJ45 into a DB-9 connector. This connector uses the same pin-out as in Table 11 above but the Ring Indicator signal is not available as it is not brought out on the RJ45 connector.



**Figure 11 -RJ45 Connector Pin Numbers**

Pin Number	Pin Type	Description
1	Output	RTS = Request To Send
2	Output	DTR = Data Terminal Ready
3	Ground	GND = RS232 signal ground
4	Output	TXD = Transmit Data
5	Input	RXD = Receive Data
6	Input	DCD = Data Carrier Detect
7	Input	DSR = Data Set Ready
8	Input	CTS = Clear To Send

**Table 13 - RS-232 Pin-Out for RJ45 Connector**

### Terminal Block RS232 Pin-Out (ES-U-2101-MB)

On the ES-U-2101-MB (version B) an RS232 mode has been added. On the terminal block, only the TxD and RxD signals are available in addition to the GND and an optional 5V output. The other terminals must be left unconnected.

Pin Number	Pin Type	Description
1		Leave un-connected
2	Input	RXD = Receive Data
3	Output	TXD = Transmit Data
4		Leave un-connected
5	Power	For ES-U-2101-MB, pin 5 is optional 5VDC output
6	Ground	GND = Signal ground

**Table 14 - RS-232 Pin-Out for Terminal Block on ES-U-2101-MB**

## 5.2 RS-422 Signal Pin-out

### DB-9 Male connector

Table 15 shows the RS-422 pin-out of the DB-9 Male connector

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	Ground	GND = Signal ground
6	Output	RTS- = Request to send, negative polarity
7	Output	RTS+ = Request to send, positive polarity
8	Input	CTS+ = Clear to send, positive polarity
9	Input	CTS- = Clear to send, negative polarity

Shield	Case Ground	Drain = typically connected to the host PC case
--------	-------------	---

**Table 15 - RS-422 Pin-Out for DB-9 Connector**

### 5-way Terminal Block

Table 16 shows the RS-422 pin-out of the 5-way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	Ground	GND = Signal ground

**Table 16 - RS-422 Pin-Out for 5-way Terminal Block**

### 6-way Terminal Block

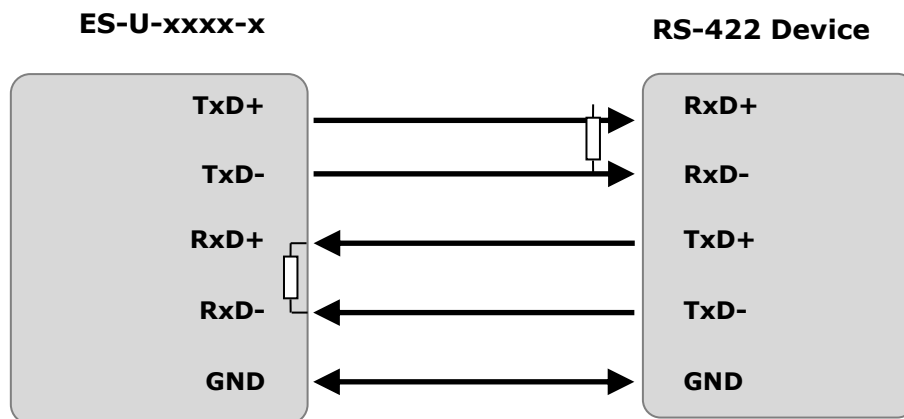
Table 17 shows the RS-422 pin-out of the 6 way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	See Description	For ES-U-2101-M, pin 5 is GND For ES-U-3001-MB, pin 5 is optional 5VDC output For ES-U-2101-MB, pin 5 is optional 5VDC output
6	Ground	GND = Signal ground

**Table 17 - RS-422 Pin-Out for 6-way Terminal Block**

### Wiring Diagrams

Figure 12 shows an RS-422 full-duplex bus. The ES-U-xxxx-x has a built-in resistor for terminating its RxD +/- input, which can be enabled using a jumper. The Tx +/- lines which are outputs from the ES-U-xxxx-x are terminated at the receiver at the other end of the bus as shown. Twisted pair wires are required for each signal pair.



**Figure 12 - RS-422 4 Wire Full Duplex**

Figure 13 shows an RS-422 full-duplex bus with handshaking signals connected. The ES-U-xxxx-x has built-in resistors for terminating its RxD +/- and CTS +/- inputs, which can be enabled using jumpers. The TxD +/- and RTS +/- lines which are outputs from the ES-U-xxxx-x are terminated at the receiver at the other end of the bus as shown. Twisted pair wires are required for each signal pair.

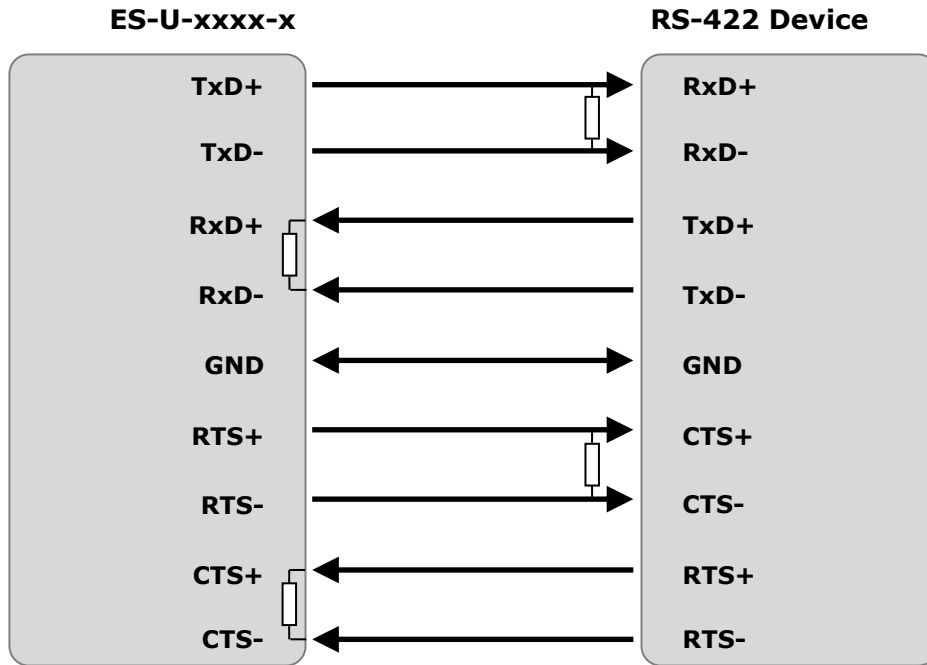


Figure 13 - RS-422 with Handshaking Signals Connected

### 5.3 RS-485 Signal Pin-out (Half Duplex)

#### DB-9 Male connector

Table 18 shows the RS-485 (half duplex) pinout of the DB-9 male connector.

Pin Number	Pin Type	Description
1	Out / In	Data- = Transmit / Receive Data, negative polarity
2	Out / In	Data+ = Transmit / Receive Data, positive polarity
5	Ground	GND = Signal ground
Shield	Case Ground	Drain = typically connected to the host PC case

Table 18 - RS-485 Half-Duplex Pin-out for DB-9 Connector

**Note:** Other pins have no function in this mode and should be left un-connected.

#### 5-way Terminal Block

Table 19 shows the RS-485 (half duplex) pinout of the 5-way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Out / In	Data- = Transmit / Receive Data, negative polarity
2	Out / In	Data+ = Transmit / Receive Data, positive polarity
5	Ground	GND = Signal ground

Table 19 - RS-485 Half-Duplex Pin-Out for 5-way Terminal Block

**Note:** Other terminals have no function in this mode and should be left un-connected.

## 6-way Terminal Block

Table 20 shows the RS-485 (half duplex) pinout of the 6 way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Out / In	Data- = Transmit / Receive Data, negative polarity
2	Out / In	Data+ = Transmit / Receive Data, positive polarity
5	See Description	For ES-U-2101-M, pin 5 is GND For ES-U-3001-MB, pin 5 is optional 5VDC output For ES-U-2101-MB, pin 5 is optional 5VDC output
6	Ground	GND = Signal ground

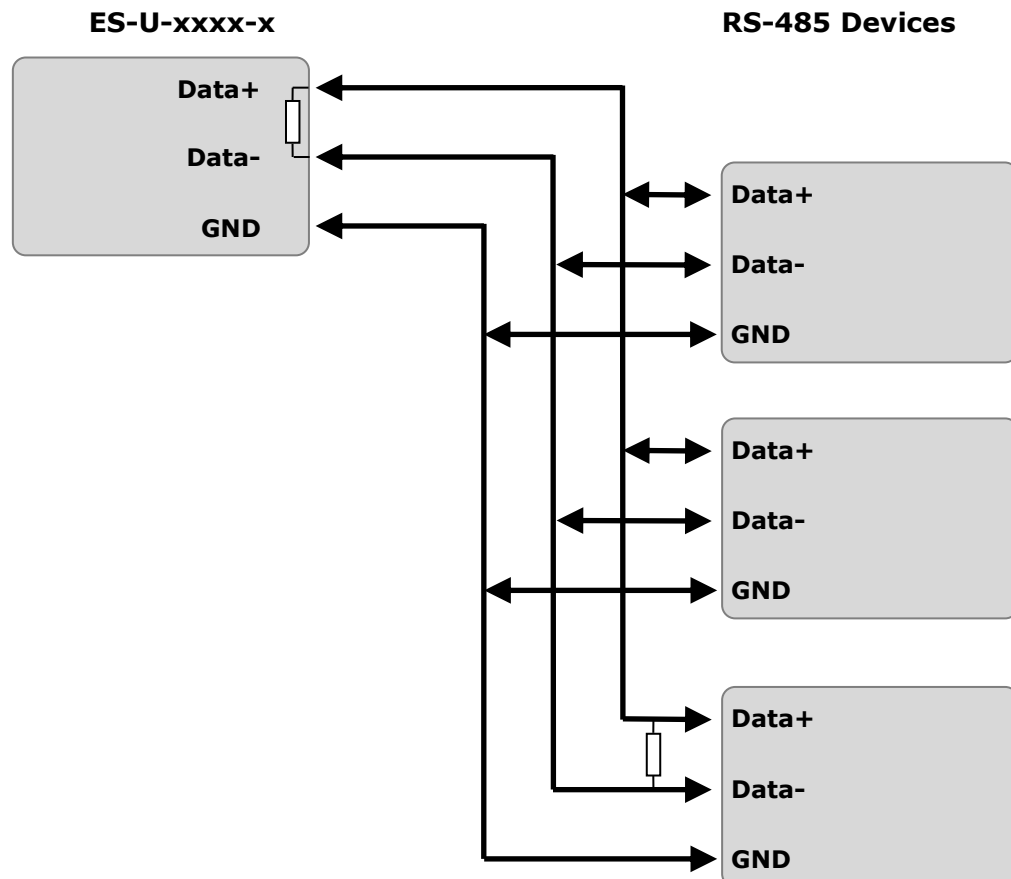
**Table 20 - RS-485 Half-Duplex Pin-out for 6-way Terminal Block**

**Note:** Other terminals have no function in this mode and should be left un-connected.

## Wiring Diagrams

Figure 14 shows an ES-U-xxxx-x converter connected to an RS-485 half-duplex bus. If the ES-U-xxxx-x is at one end of the bus (as shown), the built-in resistor can be enabled to terminate the Data +/- lines. The Tx +/- termination jumper or DIP switch is used to enable this resistor. A second termination resistor is fitted at the other end of the bus as shown.

If additional unexpected zero bytes are being received, some models of ES-U-xxxx-x converter also features bias resistors (not shown below) which can be enabled by fitting the *Pull up Tx+ to VCC* and *Pull down Tx- to GND* jumpers. These should not be enabled if another device on the bus is already providing biasing. Twisted pair wires are required for each signal pair.



**Figure 14 - RS-485 Half Duplex Wiring**

## 5.4 RS-485 Signal Pin-out (Full Duplex)

### DB-9 Male connector

Table 21 shows the RS-485 (full duplex) pinout of the DB-9 male connector.

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	Ground	GND = Signal ground
Shield	Case Ground	Drain = typically connected to the host PC case

**Table 21 - RS-485 Full Duplex Pin-out for DB-9 Connector**

**Note:** Other pins have no function in this mode and should be left un-connected.

### 5-way Terminal Block

Table 22 shows the RS-485 (full duplex) pinout of the 5-way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	Ground	GND = Signal ground

**Table 22 - RS-485 Full Duplex Pin-out for Terminal Block**

### 6-way Terminal Block

Table 23 below shows the RS-485 (full duplex) pin-out of the 6 way terminal block (only available on some models).

Pin Number	Pin Type	Description
1	Output	TxD- = Transmit data, negative polarity
2	Output	TxD+ = Transmit data, positive polarity
3	Input	RxD+ = Receive data, positive polarity
4	Input	RxD- = Receive data, negative polarity
5	See Description	For ES-U-2101-M, pin 5 is GND For ES-U-3001-MB, pin 5 is optional 5VDC output For ES-U-2101-MB, pin 5 is optional 5VDC output
6	Ground	GND = Signal ground

**Table 23 - RS-485 Full Duplex Pin-out for Terminal Block**

## Wiring Diagrams

The following diagram shows an RS-485 full-duplex bus. The ES-U-xxxx-x has a built-in resistor for terminating its RxD +/- input, which can be enabled using a jumper. The Tx +/- lines which are outputs from the ES-U-xxxx-x would be terminated at the receiver at the other end of the bus as shown. Twisted pair wires are required for each signal pair.

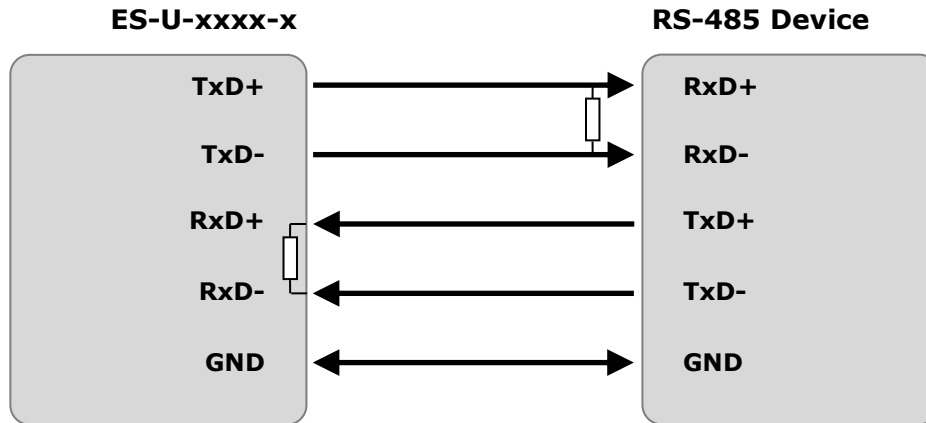


Figure 15 - RS-485 Full Duplex Wiring

## 5.5 5V Power Output (ES-U-1002-M only)

### 2-way Terminal Block

Table 24 shows the pin-out of the 2-way terminal block on the ES-U-1002-M converter. This provides 5V at up to 150mA for external devices. This power is supplied by the USB port of the computer.

Pin Number	Pin Type	Description
1	Output	5V output at up to 150mA
2	Ground	Ground

Table 24- 5V Power Output



## 6 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](http://www.connectiveperipherals.com)

## 7 Troubleshooting

This section provides some advice to help if you encounter problems during installation or use of your converter. Please check these items before contacting Connective Peripherals technical support. If you still have problems, you can contact technical support using the contact details in section 8.

### 7.1 Hardware

Cables are the most common source of problems with external devices. Please check the following:

#### USB Connections:

- USB cable is properly connected at both the Computer and the Converter ends
- Use the USB cable provided with the unit
- Computer power is ON, and computer is not in Sleep or Standby

#### USB Hubs:

- If a USB Hub is used, be sure all cables are securely connected
- It is strongly recommended to either connect the USB cable from the converter directly to a port on the PC or via a self-powered hub (which has its own PSU). This is recommended for all converters but may be essential for the converters within the ES-U-xxxx-x series which are powered by the USB port as bus-powered USB hubs can't provide as much power.
- If using a hub which can be either self- or bus-powered, use in self-powered mode and try powering up the hub's power supply before connecting it to the PC's USB port so that it recognises that it is self-powered.
- Hubs certified by the USB-IF are recommended.

#### Power Connections:

- Check that the power LED on the converter is on.
- If your converter requires an external power supply, ensure that the power supply is securely connected to both the power input socket on the converter and the AC power outlet.
- If your converter has an internal power supply, ensure that the power cable is securely connected to both the power inlet socket on the rear panel of the converter and the AC power outlet.

#### RS-232 Connections:

- On converters supporting multiple protocols, check that the DIP switches are set for RS-232 mode.
- Output signals (TXD, RTS, DTR) are connected to the respective inputs (RXD, CTS, DSR) in each direction.
- Signal naming conventions can vary between different manufacturers. This manual indicates whether each signal is an input or output on the ES-U-xxxx-xx device. Check the user guide of your RS232 device for the corresponding table and ensure that outputs from the ES-U-xxxx-xx converter go to inputs on the attached device and vice versa.
- Check for specific handshake requirements of your RS232 peripheral. If handshake signals are not used, ensure the application is set to "No Hardware Handshake", or equivalent. Handshaking is recommended however if supported by the attached serial device.
- Ensure that the converter's baud rate and parity settings match the equipment on the other end of the cable.
- Test the port with a loop-back connector. Connect TXD to RXD, RTS to CTS and DTR to DSR. Use a simple terminal program to check that data is transmitted and received.

#### RS-485/RS-422 Connections:

- Check that the DIP switches or jumpers are set for the serial correct mode (see section 4). The DIP switch and jumper settings are slightly different for some models of converter, please ensure that you use the instructions in section 4 which correspond to your model of converter.

- Ensure that you have connected the correct pins/terminals according to the tables in section **Error! Reference source not found.**
- Signal naming conventions vary between manufacturers. This includes notations A and B for RS485. Connective peripherals therefore indicate Data + and Data - instead. Check the manual for your serial device to determine which terminal is Data + and which is Data -.
- Confirm if the jumper settings, such as termination and biasing, are correct for your application. This will depend on the other devices on your RS-422/RS-485 network and how they are connected.
- If your application is receiving additional unexpected zero bytes, the biasing resistors can be enabled to resolve this. Section 4 gives details of how to enable the biasing resistors for each model of converter. Note that some ES-U-xxxx do not have internal biasing resistors and so these would need to be fitted externally.
- Some application programs cannot work with the Echo enabled. This can be resolved by disabling the Echo option using the DIP switches or jumpers (depending on model of converter). Section 4 gives details of how to select RS-485 mode without Echo on each model of converter.

## 7.2 Drivers

Troubleshooting advice for drivers can be found in the Connective Peripherals USB to Serial Converters Driver Installation Guide (CP\_000084) which is available from [www.connectiveperipherals.com](http://www.connectiveperipherals.com)

## 8 Contact Information

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## Appendix B - Revision History

Revision	Changes	Date
1.0	Initial release	06-12-2010
1.1	Added operating temperature specification to section 2.1	26-01-2011
1.2	Added section 5.3 for ES-U-2001B and ES-U-2101C Updated driver screenshots to show latest version (2.08.14) Recommend setting Rx biasing only when using RS-485 half-duplex	23-08-2011
1.3	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
1.4	The following part number have been updated - ES-U-2101B to ES-U-2101C ES-U-3001-M to ES-U-3001-MB ES-U-1101-M to ES-U-1101-MB Updated Figure 10 – Driver Download from FTDI Website	29-04-2019
2.0	Updated the driver to link to the latest Windows7 – Windows 11 driver 2.12.36.4	15-12-2021
2.1	Driver install section moved to USB to Serial Converters Driver Installation Guide (CP_000084) Updated guidance on biasing and termination Added ES-U-3008-RMB	01-04-2022