EasySync Ltd

ES-R-2x01-M RS232 to RS422 / RS485 Converter

User Guide

The ES-R-2001-M and ES-R-2101-M provide a simple method of converting RS232 signals to RS422 or RS485 differential signals.

Flexible mounting options allow the ES-R-2001-M and ES-R-2101-M to be used in a variety of applications. Indicator LEDs provide functional status.

EasySync Ltd

Unit 1, 2 Seaward Place, Centurion Business Park, Glasgow, G41 1HH, United Kingdom

Tel.: +44 (0) 141 418 0181   Fax: + 44 (0) 141 418 0110

E-Mail (Support): support@easysync.co.uk   Web: http://www.easysync.co.uk

1 Introduction

1.1 Functional Description

The ES-R-2001-M and ES-R-2101-M are RS232 to RS485 / RS422 adapters that support transfer rates up to 1M baud. The two models are identical, except that the ES-R-2101-M includes optical isolation between the RS232 and RS422 / RS485 connections.

With RS422 mode selected the interface can be configured for four-wire operation with CTS / RTS hardware handshaking. In RS422 mode the transmitter is always on.

With RS485 mode selected the interface can be configured for four-wire full duplex operation or two-wire half duplex operation with optional echo back. The transmitter enable is controlled automatically with a turn-around delay of less than 20us.

Optional RS422 / RS485 termination and bias resistors can also be configured.

The RS232 interface on the ES-R-2x01-M can be configured to be a DCE or a DTE type. The default link settings select a DCE type which allows use of a straight-through DE-9S to DE-9P cable.

1.2 LED Description

The ES-R-2x01-M uses three LEDs to indicate power and data activity. The table below defines the LED functions.

LED Colour	Function	Description
Yellow	Power	Power is being supplied to "DC-IN"
Green	TxD	Shows data activity from RS232 to RS422 / RS485
Red	RxD	Shows data activity from RS422 / RS485 to RS232

Table 1.1 – LED Description

1.3 Features

- Converts RS232 signals to RS422 or RS485 differential signals
- Easy installation
- Power supply provided
- ES-R-2101-M provides TBD KV of optical isolation, including power supply
- Metal case with mounting tabs
- Optional DIN rail clips
- DE-9P connector and screw terminals for a variety of RS422 and RS485 connections
- Termination available through jumpers inside case

1.4 Performance Figures

Parameter	Performance
Asynchronous Speed	Up to 1Mbps

Table 1.2 – Performance Figures

1.5 Ordering Information

Part Number	Description
ES-R-2001-M	RS232 to RS422 / RS485 Asynchronous Serial Converter
ES-R-2101-M	RS232 to RS422 / RS485 Asynchronous Serial Converter with Optical Isolation

Table 1.3 – Ordering Information

2 Installation

2.1 Hardware Installation

2.1.1 Communications Mode

Switch SW selects the communications mode.

S1	S2	S3	Function
ON	ON	ON	RS422 Mode. Four-wire mode with transmitter always on.
ON	ON	OFF	RS485 Full Duplex. Four-wire mode with automatic TX enable
OFF	OFF	ON	RS485 Half Duplex with echo back. Two-wire mode.
OFF	OFF	OFF	RS485 Half Duplex (no echo). Two-wire mode.

Table 2.1 – Communications Mode Selection Switch

2.1.2 Internal Jumpers

There are four sets of internal jumpers within the ES-R-2x01-M that can be accessed by removing the two screws from the side of the unit and removing the top cover. The following figure shows the location of the internal jumpers JP1, JP2, JP5 and JP6.
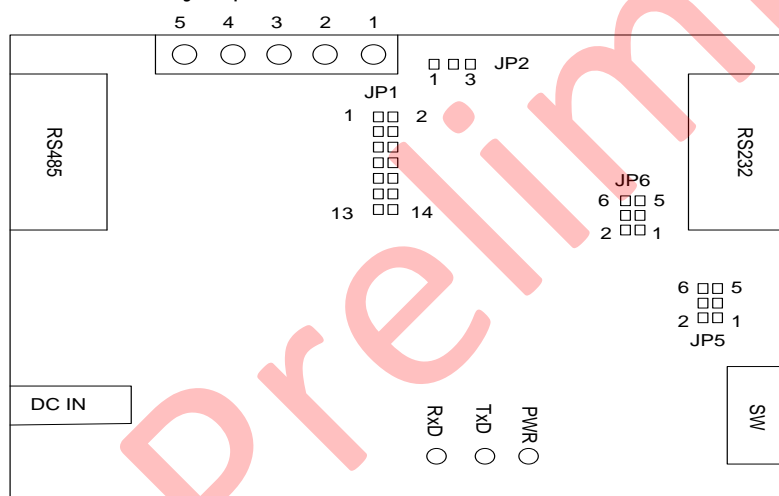
Figure 2.1 – ES-R-2x01-M Jumper Layout

2.1.3 RS422/RS485 Interface Configuration

The RS422/485 connector is a 9-way D-Type plug (DE-9P) that provides connection to up to four differential signal pairs.

DE-9P Pin	Name	Comments
1	TxD- (A)	
2	TxD+ (B)	
3	RxD+ (B)	Not used in two-wire mode
4	RxD- (A)	Not used in two-wire mode
5	GND (C)	
6	RTS- (A)	Output. RS422 handshake
7	RTS+ (B)	Output. RS422 handshake
8	CTS+ (B)	Input. RS422 handshake
9	CTS- (A)	Input. RS422 handshake

Table 2.2 – RS422/RS485 DE-9P Pin-Out

The screw terminal block provides access to the first five signals on the RS422/485 connector.

Pin	Name	Comments
1	TxD- (A)	
2	TxD+ (B)	
3	RxD+ (B)	Not used in two-wire mode
4	RxD- (A)	Not used in two-wire mode
5	GND (C)	

Table 2.3 – RS422/RS485 Screw Terminal Pin-Out

The internal Jumper JP1 provides seven possible link settings to set the function of the RS422/485 interface.

JP1 Links		RS422/RS485 Function
1	2	Fit for 120R termination between TxD- and TxD+
3	4	Fit for 750R pull-up bias on TxD+
5	6	Fit for 750R pull-down bias on TxD-
7	8	Fit for 120R termination between RxD- and RxD+
9	10	Fit for 750R pull-up bias on RxD+
11	12	Fit for 750R pull-down bias on RxD-
13	14	Fit for 120R termination between CTS- and CTS+

Table 2.4 – JP1 Termination and Bias Configuration Jumper

The factory setting is for no JP1 links to be fitted.

The need for termination depends on the baud rate and the propagation delay of the cable. A reasonable rule of thumb is that no termination is required if the cable return trip delay is less that the bit time / 6.

For example, 1000m of cable with a propagation delay of 70% (of speed of light) will have a return trip delay of 6.7us. The bit time for a baud rate of 9600 is approximately 100us therefore it is reasonable to assume that any edge reflections have reduced to an insignificant level when the receiver samples the data in the middle of the bit time.

Termination is only fitted to the receiving end of the link if it is required.

In a RS485 two-wire interface, termination may be required on both ends of the link, as each end has a receiver, and is activated by fitting a link between JP1 pins 1 and 2.

In a RS485 four-wire interface termination may be required on the receiver and is activated by fitting a link between JP1 pins 7 and 8. No link would be fitted across JP1 pins 1 and 2.

Bias resistors may be necessary to set a defined logic level at a receiver when the connected transmitter is not enabled. Bias resistors are not required for a RS422 interface as the transmitter is always on.

The RS422/RS485 transceivers used on the ES-R-2x01-M feature fail-safe circuitry to guarantee a logic-high receiver output if the receiver inputs are not connected. Therefore it will not normally be necessary to fit any of the bias resistor options.

2.1.4 Slew Rate Configuration

Jumper JP2 selects the slew rate limit on the RS422/RS485 driver. Select the lowest value that is consistent with the intended baud rate. The factory setting is to link pins 2 to 3 to select a slew rate that supports up to 10M bits/s. Note that the maximum data rate of the ES-R-2x01-M is limited to 1Mbps by the RS232 transceivers.

JP2	Slew Rate Limit
Link 1 – 2	500k bits per second
Link 2 – 3	10M bits per second. Factory Setting.
No link fitted	115k bits per second

Table 2.5 – JP2 RS422/RS485 Slew Rate Configuration Jumper

2.1.5 RS232 Interface Configuration

The RS232 connector is a 9-way D-Type socket (DE-9S) that can be configured as a DCE or a DTE using internal jumpers JP5 and JP6.

2.1.5.1 DCE Configuration

The factory settings for JP5 and JP6 select a DCE type RS232 interface that results in the 9-way RS232 D-Type socket having the following pin-out and signal directions.

DE-9S Pin	Name	Comment
1	DCD	Linked to pin 4 and pin 6
2	Rx (Out)	An output pin for DCE type RS232 interface
3	Tx (In)	An input pin for DCE type RS232 interface
4	DTR	Linked to pin 1 and pin 6
5	GND	GND
6	DSR	Linked to pin 1 and pin 4
7	RTS (In)	An input pin for DCE type RS232 interface
8	CTS (Out)	An output pin for DCE type RS232 interface
9		No connection
Shield	Shield	No connection

Table 2.6 – RS232 DE-9S DCE Pin-Out (Default)

To select the DCE configuration fit links between the following pins on JP5 and JP6.

JP5 DCE Selection
Link pins 1 – 3
Link pins 2 – 4
JP6 DCE Selection
Link pins 1 – 3
Link pins 2 – 4

Table 2.7 – JP5 & JP6 DTE-DCE Configuration Jumper – Set for DCE

2.1.5.2 DTE Configuration

The RS232 interface can be configured as a DTE type interface. A DTE type RS232 interface results in the 9-way RS232 D-Type socket having the following pin-out and signal directions.

DE-9S Pin	Name	Comment
1	DCD	Linked to pin 4 and pin 6
2	Rx (In)	An input pin for DTE type RS232 interface
3	Tx (Out)	An output pin for DTE type RS232 interface
4	DTR	Linked to pin 1 and pin 6
5	GND	GND
6	DSR	Linked to pin 1 and pin 4
7	RTS (Out)	An output pin for DTE type RS232 interface
8	CTS (In)	An input pin for DTE type RS232 interface
9		No connection
Shield	Shield	No connection

Table 2.8 – RS232 DE-9S DTE Pin-Out

To select the DTE configuration fit links between the following pins on JP5 and JP6.

JP5 DTE Selection
Link pins 3 – 5
Link pins 4 – 6
JP6 DTE Selection
Link pins 3 – 5
Link pins 4 – 6

Table 2.9 – JP5 & JP6 DTE-DCE Configuration Jumper – Set for DTE

2.1.6 DC-IN Connector

The ES-R-2x01-M is supplied with an external +5V, 10W DC power supply. It is recommended that the ES-R-2x01-M is only used with this power supply.

If an alternative power supply is used it must be a +5V +/-5% DC supply capable of providing at least 1A. The DC-IN connector accepts a DC Jack with a 2.1mm pin and a 5.5mm barrel with +5V on the centre pin. There is no reverse voltage protection.

The Yellow PWR LED is illuminated when power is applied to the ES-R-2x01-M.

2.2 Mounting

The ES-R-2x01-M is supplied with rubber feet for desktop use. In addition, the case has integrated mounting flanges that can be used for securing to a flat surface. The flange holes are spaced to attach to an optional DIN-rail bracket clip.

3   Connections

3.1 RS422 Signal Wiring

3.1.1 RS422 Four-wire full-duplex

ES-R-2x01-M		Direction	RS422 Device
1	TxD- (A)	⇨	RxD- (A)
2	TxD+ (B)	⇨	RxD+ (B)
3	RxD+ (B)	⇦	TxD+ (B)
4	RxD- (A)	⇦	TxD- (A)
5	GND (C)	▫	GND (C)

Table 3.1 – RS422 Wiring – Full Duplex Without Handshake

3.1.2 RS422 Four-wire full-duplex with handshaking

ES-R-2x01-M		Direction	RS422 Device
1	TxD- (A)	⇨	RxD- (A)
2	TxD+ (B)	⇨	RxD+ (B)
3	RxD+ (B)	⇦	TxD+ (B)
4	RxD- (A)	⇦	TxD- (A)
5	GND (C)	▫	GND (C)
6	RTS- (A)	⇨	CTS- (A)
7	RTS+ (B)	⇨	CTS+ (B)
8	CTS+ (B)	⇦	RTS+ (B)
9	CTS- (A)	⇦	RTS- (A)

Table 3.2 – RS422 Wiring – Full Duplex With Handshake

3.2 RS485 Signal Wiring

3.2.1 RS485 Two-wire half-duplex

ES-R-2x01-M		Direction	RS485 Device/s[1]
1	TxD- (A)	⇔	Data- (A)
2	TxD+ (B)	⇔	Data+ (B)
5	GND (C)	▫	GND (C)

Table 3.3 – RS485 Wiring – Half Duplex

3.2.2 RS485 Four-wire full-duplex

ES-R-2x01-M		Direction	RS485 Device/s[2]
1	TxD- (A)	⇨	RxD- (A)
2	TxD+ (B)	⇨	RxD+ (B)
3	RxD+ (B)	⇦	TxD+ (B)
4	RxD- (A)	⇦	TxD- (A)
5	GND (C)	▫	GND (C)

Table 3.4 – RS485 Wiring – Full Duplex

---

[1] Can be multiple RS485 devices sharing the same wiring

[2] Can be multiple RS485 devices sharing the same wiring

4   Electrical details

4.1 Input Power

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
DC-IN	Input Power Voltage	4.75	5.0*	5.25	V	
I_{cc}	Input current		TBD	TBD	mA	

Table 4.1 – Input Power Electrical Details

5   Mechanical Details

5.1 Module Mechanical Dimensions

TBD
Figure 5.1 – ES-R-2x01-M Case Dimensions

6 Physical Environment Details

6.1 Storage

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Storage Temperature Range	TBD		TBD	ºC	

Table 6.1 – Storage Temperature

6.2 Operating

Parameter	Description	Minimum	Typical	Maximum	Units	Conditions
T	Operating Temperature Range	0		+60	ºC	5% to 95% RH, non condensing

Table 6.2 – Operating Temperature

7   Environmental Approvals & Declarations

7.1 EMI Compatibility

FCC and CE

The ES-R-2001-M and ES-R-2101-M have been tested to be compliant with both FCC Part 15 Subpart B and European EMC Directive.

$C\epsilon$

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.

FC

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 ES-R-2001-M and ES-R-2101-M are defined as Limited Power Supply (LPS) devices, with operating voltages under 60VDC.

7.3 Environmental

The ES-R-2001-M and ES-R-2101-M are lead-free devices that comply with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

7.4 Reliability

The ES-R-2001-M and ES-R-2101-M are designed as robust RS232 to RS422/RS485 adapters 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 TBD.

7.5 Import / Export Information

Import / Export Information	
Country of Origin	China
Harmonized Code	8471.80.1000
Product Description	RS232 to RS422/RS485 Computer Adapter, Single Port
USA ECCN	EAR99 – No License Required

Table 7.1 – Import / Export Information

Technical Support

Technical support may be obtained from your nearest EasySync office:

United Kingdom: support@easysync.co.uk

United States: support@easysync-ltd.com

8   Contact Information

Head Office – Glasgow, UK

EasySync Limited
Unit 1, 2 Seaward Place,
Centurion Business Park
Glasgow, G41 1HH
United Kingdom
Tel: +44 (0) 141 418 0181
Fax: +44 (0) 141 418 0110

E-mail (Sales)	sales@easysync.co.uk
E-mail (Support)	support@easysync.co.uk
E-mail (General Enquiries)	admin@easysync.co.uk
Web Site URL	http://easysync.co.uk
Web Shop URL	http://easysync.co.uk

Branch Office – Hillsboro, Oregon, USA

EasySync Limited (USA)
7235 NW Evergreen Parkway, Suite 600
Hillsboro, OR 97123-5803
USA
Tel: +1 (503) 547 0909
Fax: +1 (503) 547 0990

E-Mail (Sales)	sales@easysync-ltd.com
E-Mail (Support)	support@easysync-ltd.com
E-Mail (General Inquiries)	admin@easysync-ltd.com
Web Site URL	http://easysync-ltd.com
Web Shop URL	http://easysync-ltd.com

Appendix A - List of Figures and Tables

Appendix B - Revision History

Version 1.0   Initial Release   April   2009

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[EasySync](#):
   [ES-R-2001-M](#)