



RS-232 to RS-422/485 Converters User Guide



Models : SER-COMi-M
SER-COMi-SI-M

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Content

Introduction & Specifications of Hi-Speed RS-232 to RS-422/485 Converters.....	3
Introduction of SER-COMi-M & SER-COMi-SI-M.....	3
Features of Optical Isolation & Surge Protection (SER-COMi-SI-M).....	3
Specifications & Features	4
RS-232 to RS-422/485 Converter (SER-COMi-M).....	4
Opto-isolated RS-232 to RS-422/485 Converter (SER-COMi-SI-M).....	4
Power Supply	5
Setting of RS-232 to DCE or DTE.....	5
RS-232 DCE Pin Assignment	6
RS-232 DTE Pin Assignment	7
RS-422 Output Port Pin Assignment of DB9 Male Connector	8
RS-422 Mode Pin-out	8
RS-485 Output Port Pin Assignment of DB9 Male Connector	9
RS-485 Full Duplex Mode Pin-out	9
RS-485 Half Duplex Mode Pin-out.....	10
RS-422 Output Port Pin Assignment of 5-pin Terminal Block.....	11
RS-422 Mode Pin-out	11
RS-485 Output Port Pin Assignment of 5-pin Terminal Block.....	12
RS-485 Full Duplex Mode Pin-out	12
RS-485 Half Duplex Mode Pin-out.....	13
RS-422 & RS-485 Mode Configuration	14
Termination and Biasing Option Configuration	15
Termination Resistor.....	15
Biasing Resistors	15
Jumper Setting to Enable Termination & Biasing Resistors.....	16
Proper Wiring for RS-422/485 Operation.....	17
RS-422 and RS-485 Transmission Technique	17
RS-422 without handshaking signals connected	17
RS-422 with handshaking signals connected	18
RS-422 and RS-485 4-Wire Scheme.....	19
RS-485 2-Wire Scheme.....	20

Introduction & Specifications of Hi-Speed RS-232 to RS-422/485 Converters

- **RS-232 to RS-422/485 Converter** (SER-COMi-M)
- **Opto-isolated RS-232 to RS-422/485 Converter** (SER-COMi-SI-M)
 - with optical isolation (2000V)
 - with surge protection (25KV ESD) on all signal lines to prevent interference, to protect system and minimize down time

Introduction of SER-COMi-M & SER-COMi-SI-M

The SER-COMi-M and SER-COMi-SI-M are used to convert RS-232 signals to RS-422/485 signals. The converters provide instant connectivity to RS-422/485 communication devices for factory automation equipment, multi-drop data collection devices, barcode readers, time clocks, scales, data entry terminals, PC to PC long distance communications (up to 1.3KM) and serial communication in harsh environments.

The SER-COMi-M and SER-COMi-SI-M provide an industrial solution for applications requiring single node or multi-drop communications over short and long distance.

In RS-485 half-duplex mode, the SER-COMi-M and SER-COMi-SI-M also provide automatic data transmit/receive control.

Features of Optical Isolation & Surge Protection (SER-COMi-SI-M)

Optical isolation and surge protection are available to SER-COMi-SI-M.

The SER-COMi-SI-M converter is optically isolated with 2000 Volt DC optical isolation. The optical isolation protects your PC from spikes and surges on the RS-422/485 network, by converting the electrical pulse into an optical signal and then changing it back into an electrical pulse. Your computer is well protected, since the surges and spikes cannot cross the optical link. The SER-COMi-SI-M is protected by surge protector to withstand electrostatic discharge and power surges up to 25KV ESD. Surge suppression on all signals prevent from damages caused by lightning or high voltage.

Specifications & Features

RS-232 to RS-422/485 Converter (SER-COMi-M)

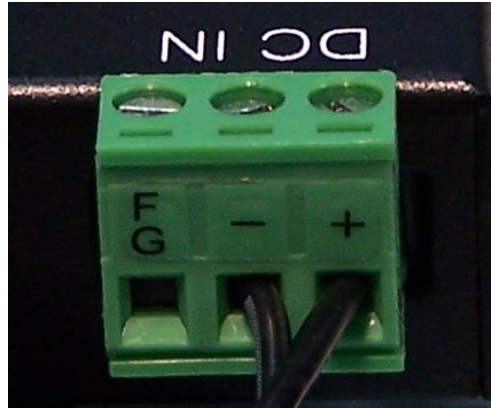
- Converts RS-232 port to high speed RS-422 / 485 port
- RS-232 port can be selected to DCE or DTE pin assignment
- Data rates: 300 bps to 1M bps
- RS-232 Connector: One DB-9 female connector
- RS-422/485 Connector: One DB-9 male connector and one 5-pin terminal blocks
- Auto transmit/receive control for 2-wire RS-485 half-duplex operation
- Termination and Bias resistors installed on-board
- RS-422 data signals: TX-, TX+, RX+, RX-, GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: TX-, TX+, RX+, RX- (4 wire), and data-, data+ (2 wire)
- Monitor LEDs of TxD, RxD indicating port status
- Wide input power range: 9V DC to 48V DC
- Includes an external switching terminal power adapter

Opto-isolated RS-232 to RS-422/485 Converter (SER-COMi-SI-M)

- Converts RS-232 port to high speed RS-422 / 485 port
- RS-232 port can be selected to DCE or DTE pin assignment
- RS-422/485 port is optically isolated with 2000 Volt DC optical isolation
- RS-422/485 port is protected by surge protector on all signal lines to withstand electrostatic discharge and power surges up to 25KV ESD
- Data rates: 300 bps to 1M bps
- RS-232 Connector: One DB-9 female connector
- RS-422/485 Connector: One DB-9 male connector and one 5-pin terminal blocks
- Auto transmit/receive control for 2-wire RS-485 half-duplex operation
- Termination and Bias resistors installed on-board
- RS-422 data signals: TX-, TX+, RX+, RX-, GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: TX-, TX+, RX+, RX- (4 wire), and data-, data+ (2 wire)
- Monitor LEDs of TxD, RxD indicating port status
- Wide input power range: 9V DC to 48V DC
- Includes an external switching terminal power adapter

Power Supply

The SER-COMi-M and SER-COMi-SI-M are working in wide input power range from 9V DC to 48V DC. An external switching terminal power adapter is provided in the package.



9V DC to 48V DC power input connector

Setting of RS-232 to DCE or DTE

Inside the converter, there are two 2x3 (JP1, JP2) header blocks which are jumpered to select the RS-232 port pin assignment to DCE or DTE.

Jumper	Function
JP1 1-3 2-4	RS-232 port assigned to DCE (Data Communications Equipment). (See Figure 2)
JP2 1-3 2-4	
JP1 3-5 4-6	RS-232 port assigned to DTE (Data Terminal Equipment). (See Figure 3)
JP2 3-5 4-6	

The factory default setting is DCE

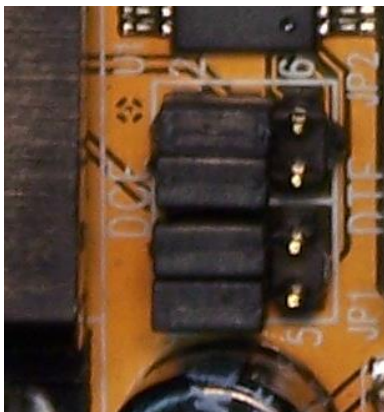


Fig 2. DCE setting

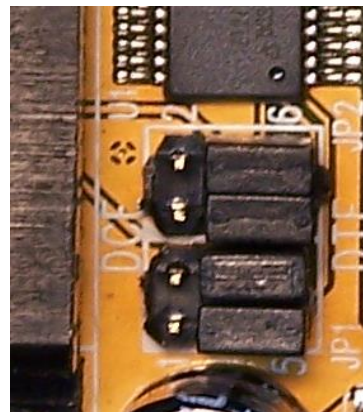
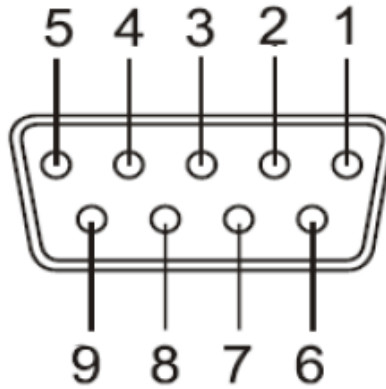


Fig 3. DTE setting

RS-232 DCE Pin Assignment

The RS-232 serial port is a DB-9 female connector. It can be configured as Data Communications Equipment (DCE) or Data Terminal Equipment (DTE) for RS-232 signals input.



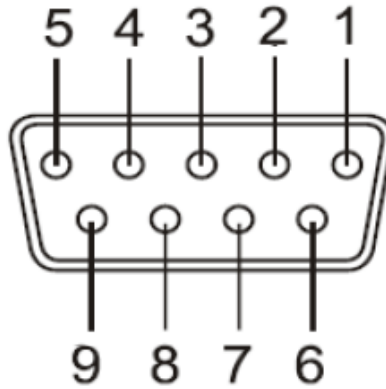
DB9 Female connector pin numbers

Following is the table of RS-232 pin assignments for Data Communications Equipment (DCE).

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 : Signal Ground
6	Input	DSR : Data Set Ready
7	Output	RTS : Request To Send
8	Input	CTS : Clear To Send
9	Not Connected	

RS-232 DTE Pin Assignment

The RS-232 serial port is a DB-9 female connector. It can be configured as Data Communications Equipment (DCE) or Data Terminal Equipment (DTE) for RS-232 signals input.

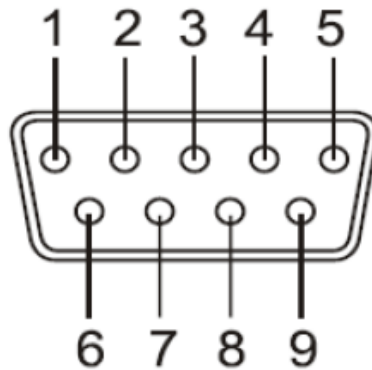


DB9 Female connector pin numbers

Following is the table of RS-232 pin assignments for Data Terminal Equipment (DTE).

Pin Number	Pin Type	Description
1	Input	DCD : Data Carrier Detect
2	Output	TXD : Transmit Data
3	Input	RXD : Receive Data
4	Input	DSR : Data Set Ready
5	Ground	GND : Signal Ground
6	Output	DTR : Data Terminal Ready
7	Input	CTS : Clear To Send
8	Output	RTS : Request To Send
9	Not Connected	

RS-422 Output Port Pin Assignment of DB9 Male Connector



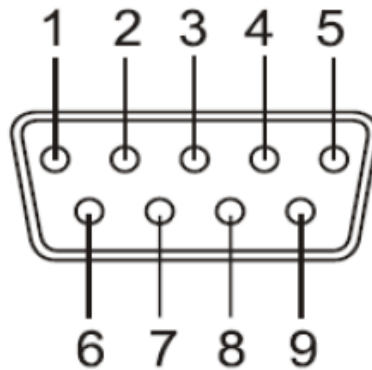
DB9 Male connector pin numbers

RS-422 Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-422 mode 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

RS-485 Output Port Pin Assignment of DB9 Male Connector



DB9 Male connector pin numbers

RS-485 Full Duplex Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-485 full-duplex mode pin-out of the DB-9 Male connector.

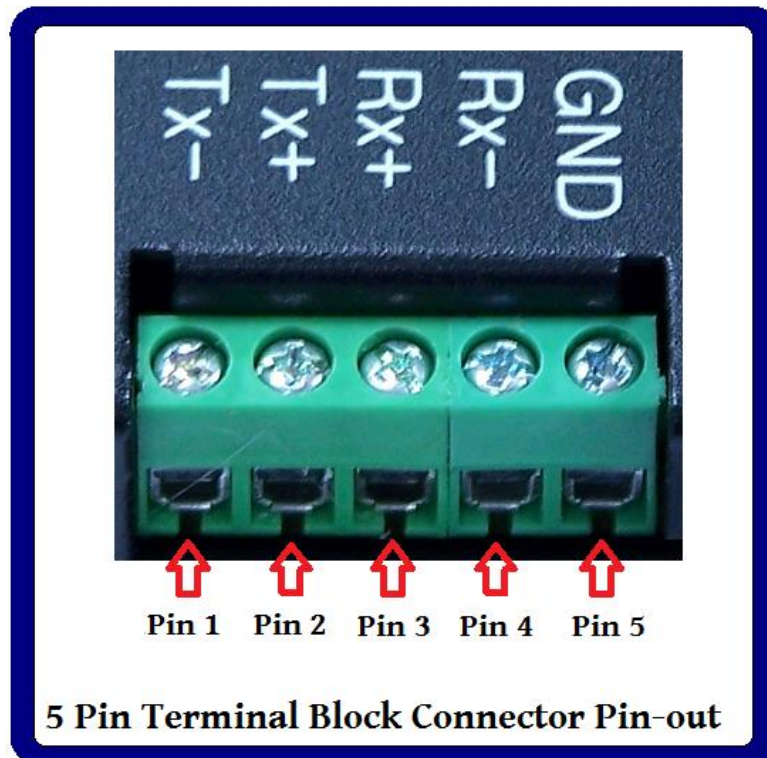
Pin Number	Pin Type	Description
1	Output	TxD- : Transmit Data , negative polarity
2	Output	TxD+ : Transmit Data , positive polarity
3	Input	RxD+ : Receive Data , positive polarity
4	Input	RxD- : Receive Data , negative polarity
5	Ground	GND : Signal Ground

RS-485 Half Duplex Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-485 half duplex mode pin-out 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

RS-422 Output Port Pin Assignment of 5-pin Terminal Block

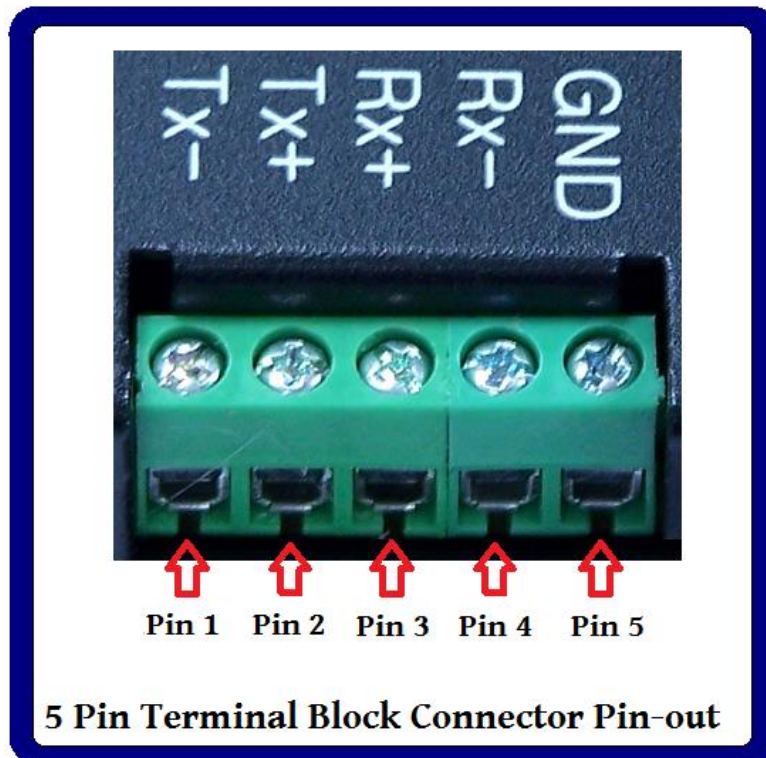


RS-422 Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-422 mode pin-out of the 5-pin terminal block 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

RS-485 Output Port Pin Assignment of 5-pin Terminal Block



RS-485 Full Duplex Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-485 full-duplex mode pin-out of the 5-pin terminal block 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

RS-485 Half Duplex Mode Pin-out

The table below shows the SER-COMi-M/ SER-COMi-SI-M's RS-485 half duplex mode pin-out of the 5-pin terminal block 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

RS-422 & RS-485 Mode Configuration

Outside the converter, there is a 3-pin DIP switches which are set to select the mode of operation. You will need to set the switch settings to RS-422 mode, or RS-485 mode, as per the requirements of your application. The RS-422 & RS-485 Mode Block Configuration Settings are listed as follows.



	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

Termination and Biasing Option Configuration

Termination Resistor

When transmitted signals arrive at the end of a cable, they get reflected. They travel on the cable some more times, which is called ringing. This can cause false reading of transmitted data. For long cables termination resistors are required. These increase the damping of reflection. The value of the termination resistor must match the impedance of the cable, typically 120 ohms.

Biasing Resistors

In RS-485 operation, the sender must activate the transmitter before sending data, and deactivate it when all data is sent. At times when no devices send data all transmitters are inactive. As the result the data lines are floating, and the differential voltage is undefined. It may happen the next data is not correctly recognized, because the change from undefined to data signals is not detected. To avoid such problems the data lines should be polarized by biasing resistors. The biasing resistors must not be too small, typical biasing resistors are 750 ohms in high and low level.

Jumper Setting to Enable Termination & Biasing Resistors

Inside the converter, there is one 7 x 3 (21 pins, Fig. 4) header blocks which are jumpered to enable Tx, Rx, CTS 120 Ohm termination resistors and Rx, Tx 750 Ohm biasing resistor. You will need to open up the metal case and set the jumpers to RS-422 mode or RS-485 mode as per the requirements of your application. Termination and biasing settings are listed as follows:

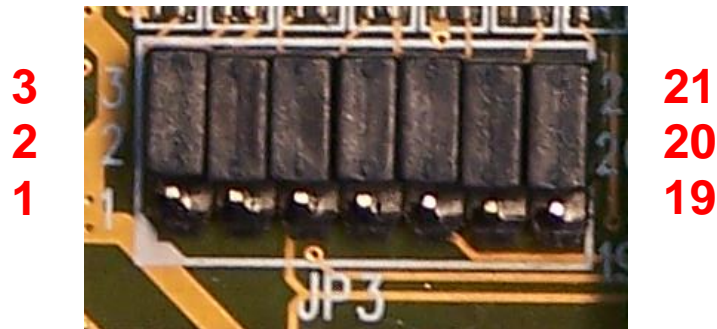


Fig. 4 Termination and Biasing resistors setting

Jumper	Function
1-2 enable	Tx+/- Termination of 120 Ohm.
2-3 disable	This jumper should always be populated for RS485 Half-Duplex mode.
4-5 enable	Pull-up Tx+ to VCC by 750 Ohm Bias resistor.
5-6 disable	This jumper should be populated for pull-up Tx+.
7-8 enable	Pull-down Tx- to GND by 750 Ohm Bias resistor.
8-9 disable	This jumper should be populated for pull-down Tx-.
10-11 enable	Rx+/- Termination of 120 Ohm.
11-12 disable	This jumper should always be populated for RS-422 and RS-485 Full-Duplex mode.
13-14 enable	Pull-up Rx+ to VCC by 750 Ohm Bias resistor.
14-15 disable	This jumper should be populated for pull-up Rx+.
16-17 enable	Pull-down Rx- to GND by 750 Ohm Bias resistor.
17-18 disable	This jumper should be populated for pull-down Rx-.
19-20 enable	CTS Termination of 120 Ohm.
20-21 disable	This jumper should always be populated for RS-422 mode.

Note: Sometimes, when operating in RS-422 or RS-485, it is necessary to configure termination and biasing of the data transmission lines. Generally this must be done in the cabling, since this depends on the installation of connections. Before applying the option, check your cable specification for proper impedance matching.

Biasing of data lines must only occur at a single point anywhere in the cabling. SER-COMi-M and SER-COMi-SI-M provide biasing for ease of installation. Please be sure to disable this inside the unit, if your cabling already provides biasing.

Termination must not be installed in the middle of the cable. It is only permitted at both ends. Since a computer controlled serial port is almost always at one end of the cable, termination is enabled by default.

Proper Wiring for RS-422/485 Operation

This section will provide proper wiring information about RS-422 and RS-485 data communication. It is necessary to have the basic knowledge to avoid or to find errors in data transmission. Failures in cabling are responsible for the vast majority of transmission problems.

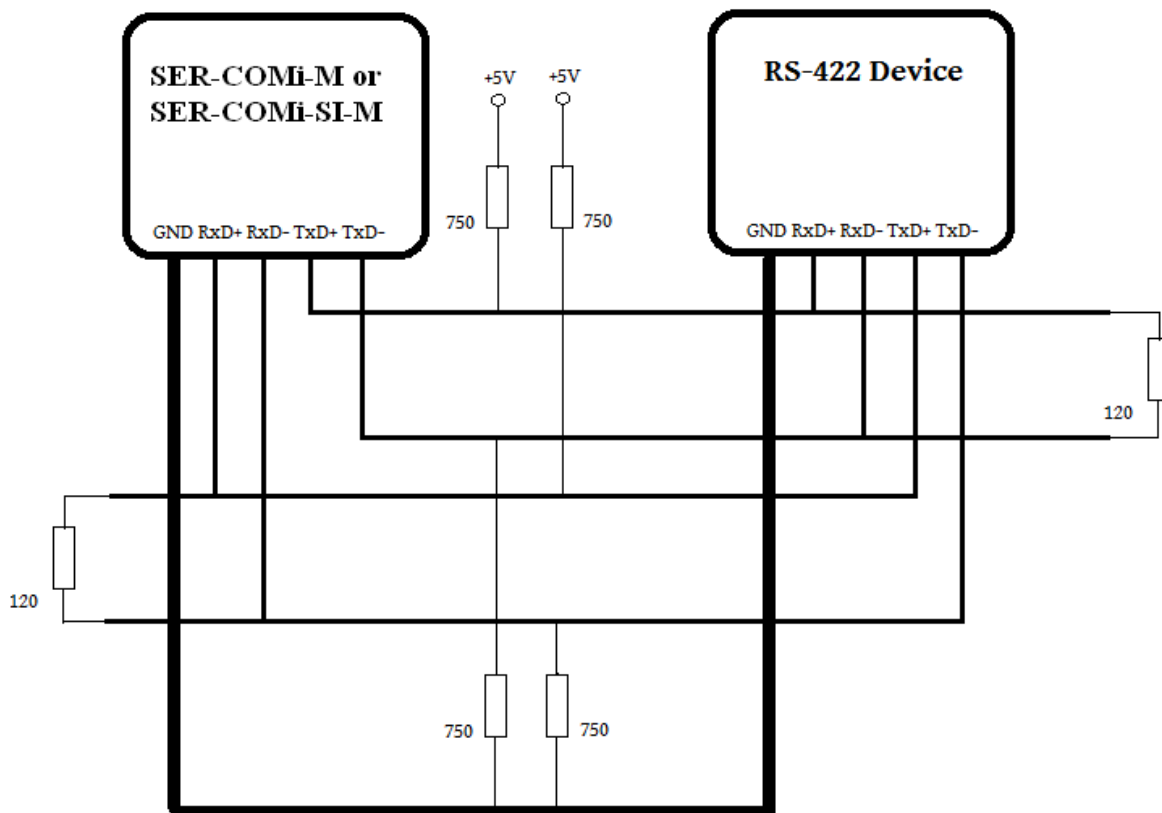
RS-422 and RS-485 Transmission Technique

The RS-422 and RS-485 use the same balanced transmission method. Signals are not transmitted as voltage on a single wire, as RS-232 does. Instead two wires are used; when one carries high voltage, the other one carries low voltage. The signal is defined by the different in voltage between those two wires. This hardens the transmission against noise. Usually twisted pair cables are used, which further reduces the sensitivity for noise.

To make sure the signals meet the common voltage range, the GND of sender and receiver must be connected somehow. To insure the signals are in the valid voltage range and the differential voltage can be correctly sensed by the receiver the GND lines of the transmitter and receiver must be connected.

RS-422 without handshaking signals connected

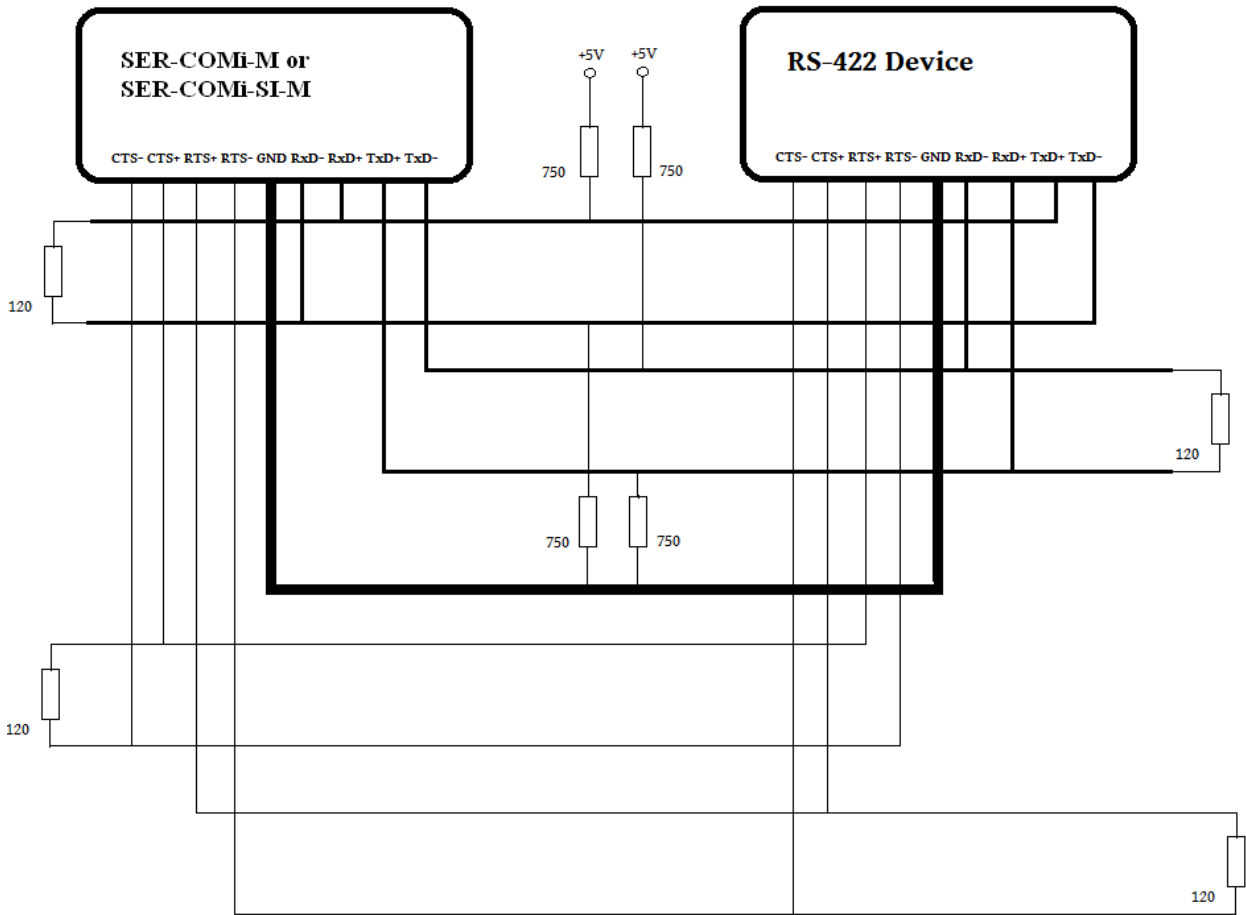
The following diagram shows RS-422 without handshaking signals connected.



RS-422 without handshaking signals connected

RS-422 with handshaking signals connected

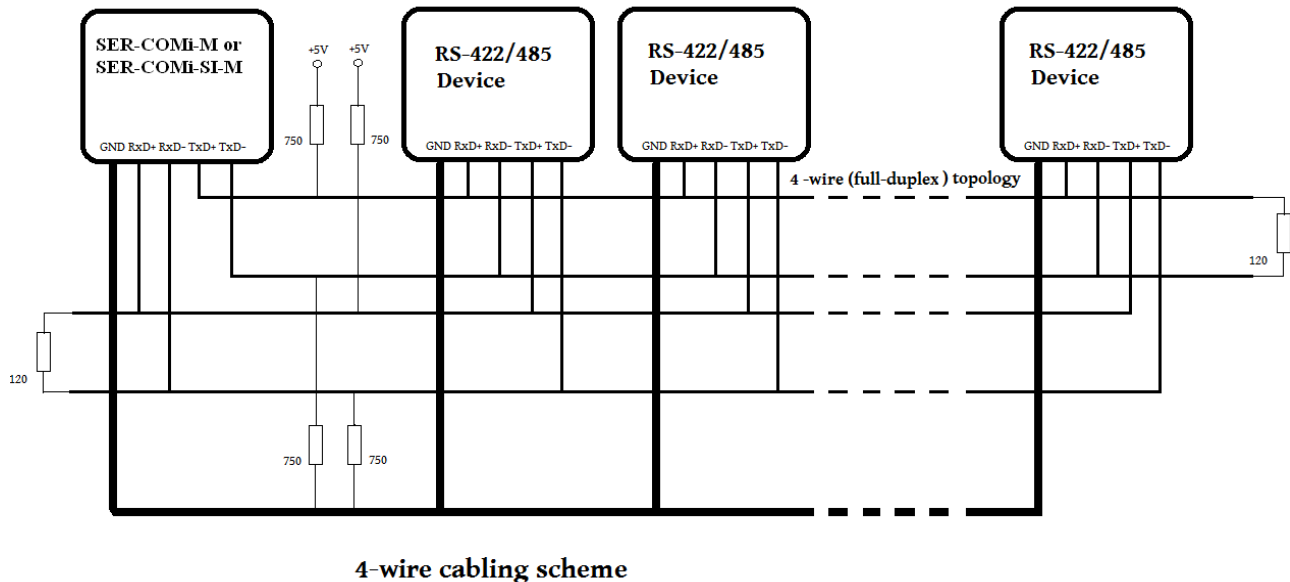
The following diagram shows RS-422 with handshaking signals connected.



RS-422 with handshaking signals connected

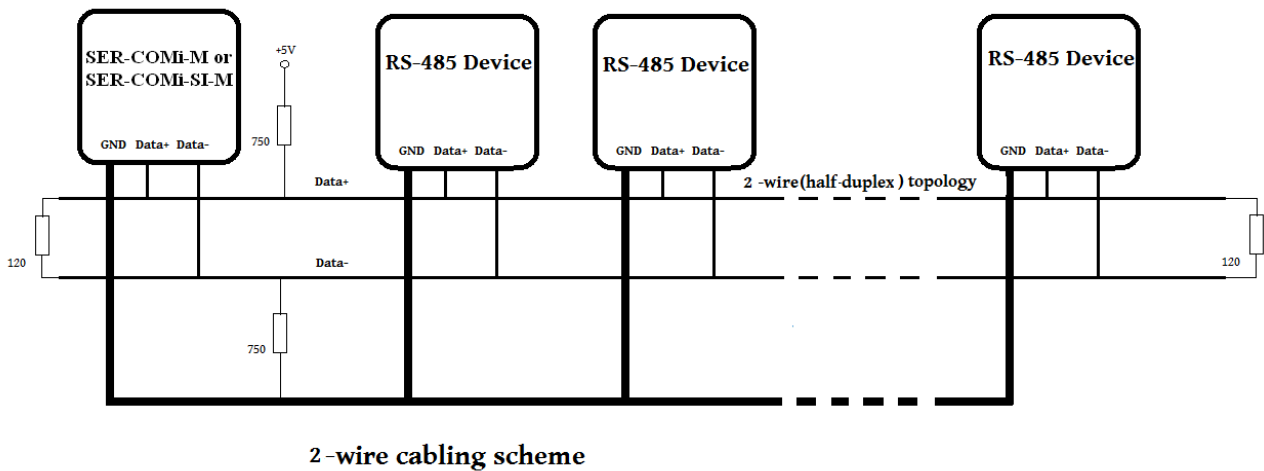
RS-422 and RS-485 4-Wire Scheme

The RS-422 requires dedicated wire pairs for transmit and receive. The transmit wires are used to send data to as many as 10 receivers, as stated in the specifications of RS-422. Since the SER-COMi-M/SER-COMi-SI-M uses RS-485 line driver technology, up to 32 receivers are possible. The following diagram shows RS-422 and RS-485 4-wire scheme:



RS-485 2-Wire Scheme

The following diagram shows RS-485 2-Wire scheme:



The RS-485 operation of SER-COMi-M/SER-COMi-SI-M allows for 2-wire cabling. Several RS-485 2-wire devices are connected in parallel to the wires, which is called bus topology. Each device can either send or receive data at a given time, so it is operating in half-duplex mode.

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