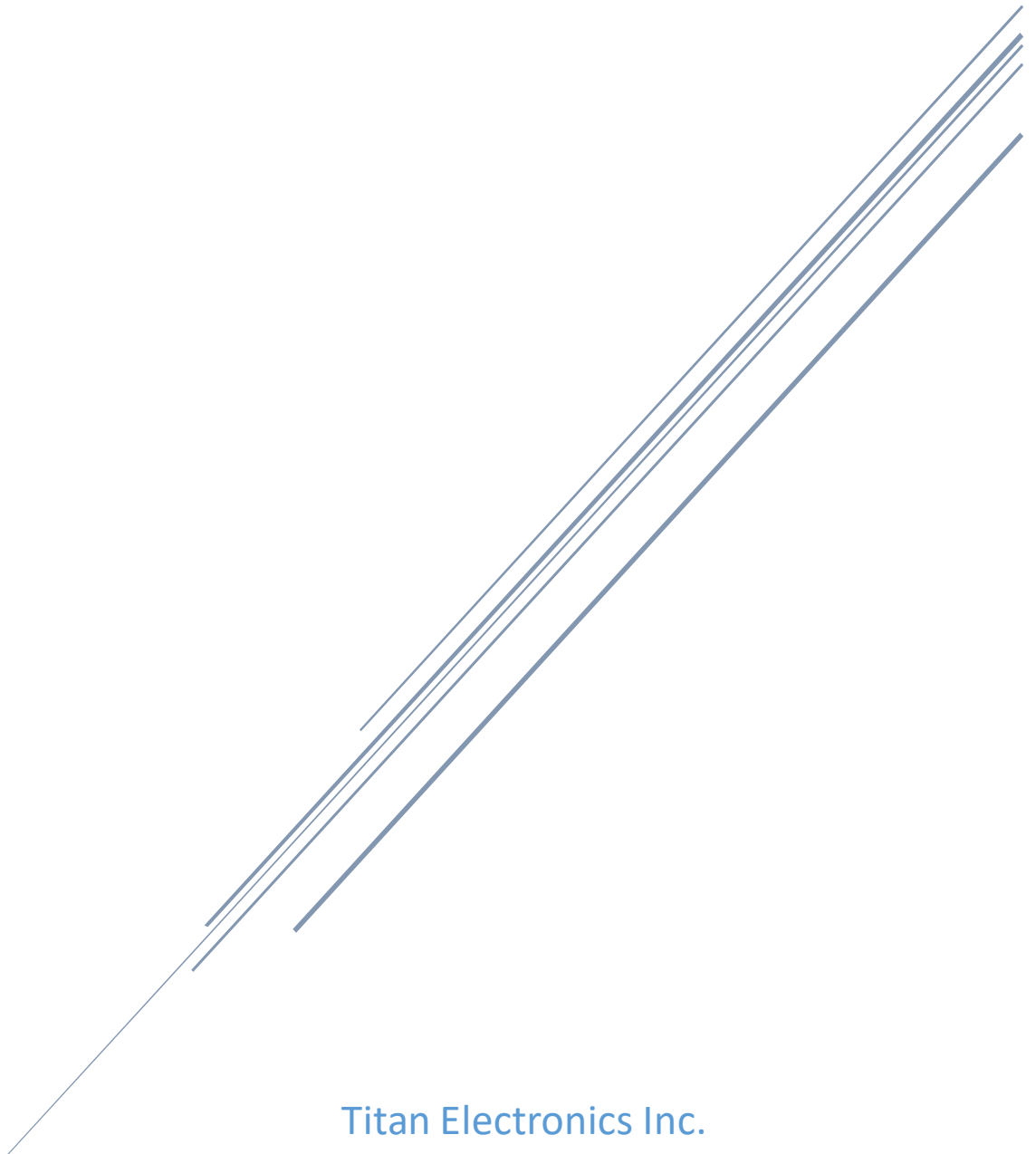


# SER-COMi-M/SER-COMi-SI-M USER'S MANUAL

2017 May Edition



Titan Electronics Inc.  
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## INTRODUCTION

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

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.

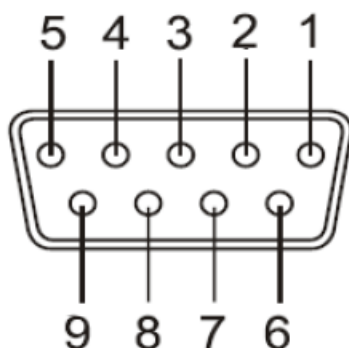
## FEATURES & SPECIFICATIONS

- 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: 300bps to 1Mbps
- RS-232 connector: one DB9 female connector
- RS-422/485 connector: one DB9 male connector and one 5-pin terminal block
- Auto transmit/receive control for 2-wire RS-485 half-duplex operation
- Termination and biasing resistors installed on-board
- RS-422 data signals: TxD-, TxD+, RxD+, RxD-, GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: TxD-, TxD+, RxD+, RxD- (4 wire), Data-, Data+ (2 wire)
- Monitor LEDs of TxD, RxD indicating port status
- Wide input power range: 9VDC to 48VDC
- Includes an external switching terminal power adapter
- SER-COMi-SI-M is optically isolated with 2000VDC optical isolation
- SER-COMi-SI-M is protected by surge protector on all signal lines to withstand electrostatic discharge and power surges up to 25kV ESD

## PIN-OUT INFORMATION

### RS-232 DCE Pin Assignment

The following are the connector pin-outs for RS-232 DCE pin assignment.

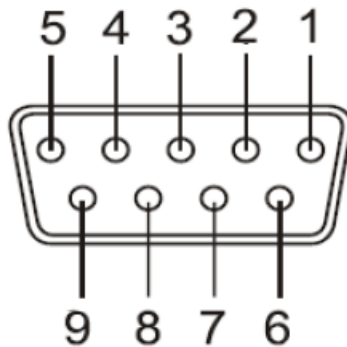


### **DB9 Female connector pin numbers**

Pin Number	Pin Type	Description
1	<i>Input</i>	DCD: Data Carrier Detect
2	<i>Input</i>	RxD: Receive Data
3	<i>Output</i>	TxD: Transmit Data
4	<i>Output</i>	DTR: Data Terminal Ready
5	<i>Ground</i>	GND: Signal Ground
6	<i>Input</i>	DSR: Data Set Ready
7	<i>Output</i>	RTS: Request to Send
8	<i>Input</i>	CTS: Clear to Send
9	<i>Not Connected</i>	

## RS-232 DTE Pin Assignment

The following are the connector pin-outs for RS-232 DTE pin assignment.

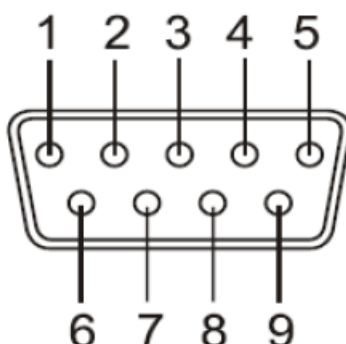


### **DB9 Female connector pin numbers**

Pin Number	Pin Type	Description
1	<i>Input</i>	DCD: Data Carrier Detect
2	<i>Output</i>	TxD: Transmit Data
3	<i>Input</i>	RxD: Receive Data
4	<i>Input</i>	DSR: Data Set Ready
5	<i>Ground</i>	GND: Signal Ground
6	<i>Output</i>	DTR: Data Terminal Ready
7	<i>Input</i>	CTS: Clear to Send
8	<i>Output</i>	RTS: Request to Send
9	<i>Not Connected</i>	

## RS-422 Pin-out for DB9 Connector

The following are the connector pin-outs for RS-422 male connector.



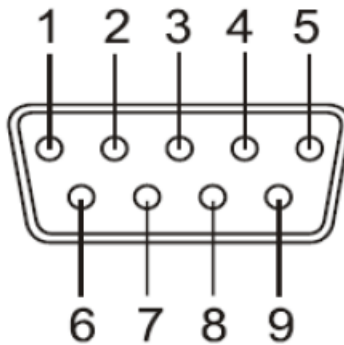
### DB9 Male connector pin numbers

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 Pin-out for DB9 Connector

The following are the connector pin-outs for RS-485 male connector.



### **DB9 Male connector pin numbers**

#### RS-485 Full Duplex Mode Pin-out

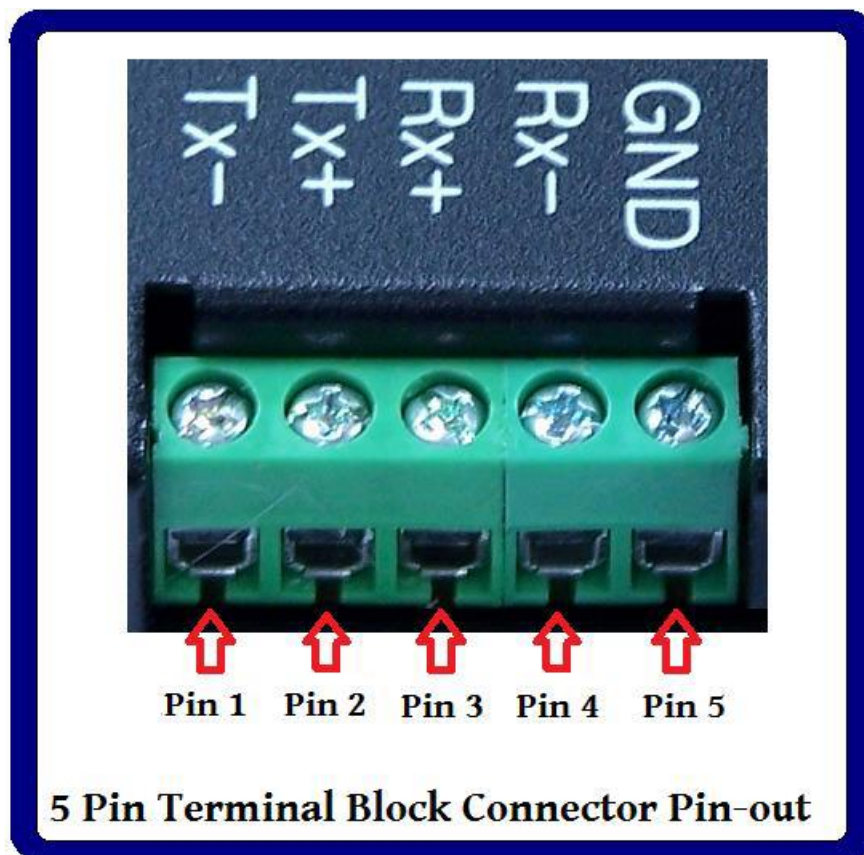
Pin Number	Pin Type	Description
<b>1</b>	<i>Output</i>	TxD-: Transmit Data, negative polarity
<b>2</b>	<i>Output</i>	TxD+: Transmit Data, positive polarity
<b>3</b>	<i>Input</i>	RxD+: Receive Data, positive polarity
<b>4</b>	<i>Input</i>	RxD-: Receive Data, negative polarity
<b>5</b>	<i>Ground</i>	GND: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

#### RS-485 Half Duplex Mode Pin-out

Pin Number	Pin Type	Description
<b>1</b>	<i>Output/Input</i>	Data-: Transmit/Receive Data, negative polarity
<b>2</b>	<i>Output/Input</i>	Data+: Transmit/Receive Data, positive polarity
<b>5</b>	<i>Ground</i>	GND: Signal Ground

## RS-422 Pin-out for 5-pin Terminal Block

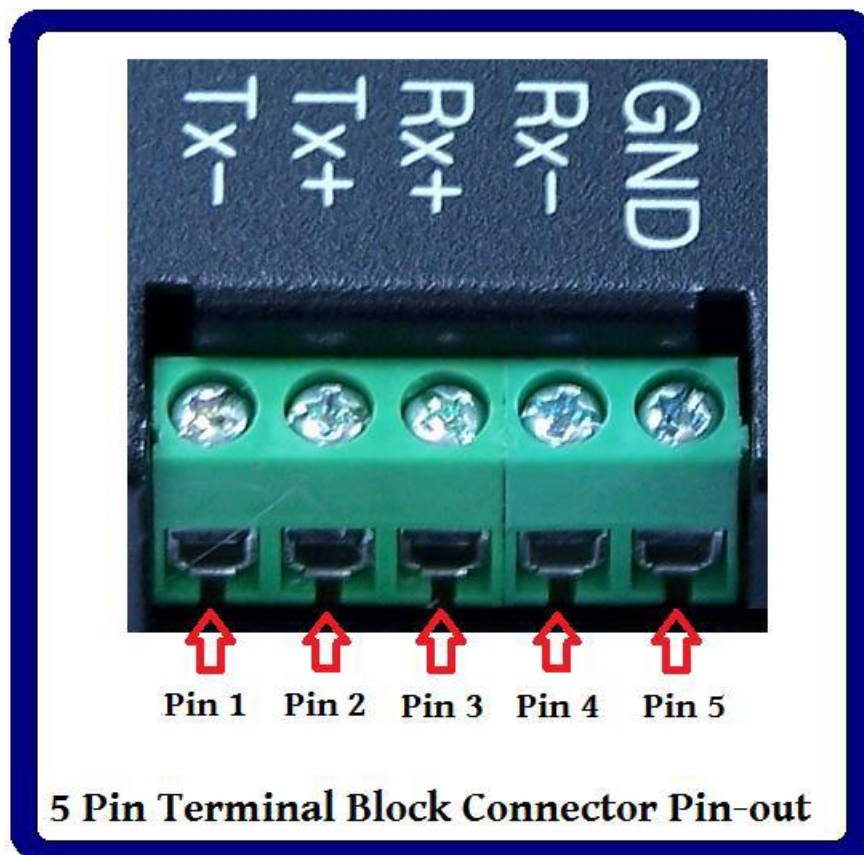
The following are the connector pin-outs for RS-422 5-pin terminal block.



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 Pin-out for 5-pin Terminal Block

The following are the connector pin-outs for RS-485 5-pin terminal block.



## RS-485 Full Duplex Mode Pin-out

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

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

# HARDWARE SETTINGS

## Power Supply

The SER-COMi-M and SER-COMi-SI-M works in a wide input power range from 9VDC to 48VDC. An external switching terminal power adapter is provided in the package.

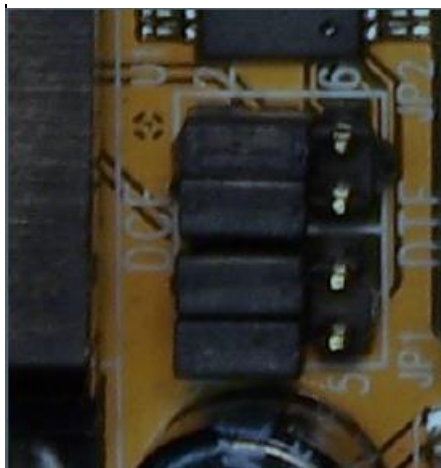


## Setting RS-232 to DCE or DTE

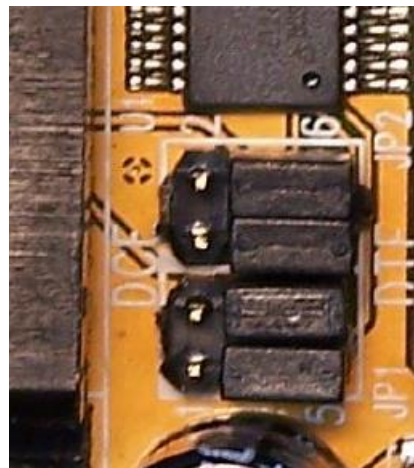
Inside the converter, there are two 2 × 3 jumper header blocks (JP1, JP2) which are used to select the RS-232 port pin assignment to DCE or DTE.

Jumper	Function
<b>JP1</b> 1-3 2-4 <b>JP2</b> 1-3 2-4	RS-232 port assigned to DCE (data communications equipment)
<b>JP1</b> 3-5 4-6 <b>JP2</b> 3-5 4-6	RS-232 port assigned to DTE (data terminal equipment)

**Note:** The factory default setting is DCE



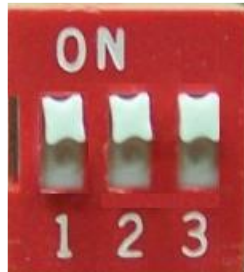
DCE setting



DTE setting

## RS-422 & RS-485 Mode Configuration

Outside the converter, there is a 3-pin DIP switch which is used 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		1	2	3
<b>RS-422</b>	4 wire with Handshaking	ON	ON	ON
<b>RS-485</b>	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 & Biasing Resistors

### **Termination Resistor**

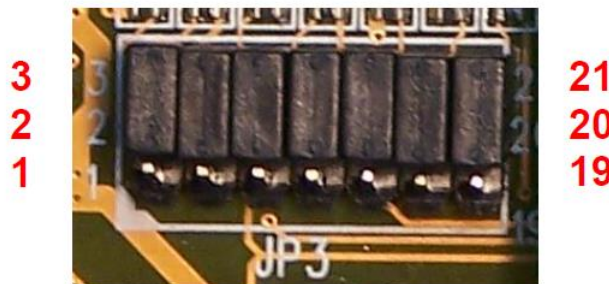
When transmitted signals arrive at the end of a cable, they get reflected. They travel on the cable more than once, which is called ringing. This can cause false reading of transmitted data. For long cables, termination resistors are required. These increase the damping, which reduces reflection. The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

### **Biasing Resistor**

In RS-485 mode, the sender must activate the transmitter before sending data, and deactivate it when all data is sent. When no devices send data, all transmitters are inactive. As the result, the data lines are floating, and the differential voltage is undefined. This can cause the next data to be not correctly recognized, because the change from an undefined voltage to actual 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, typically  $750\Omega$  in high and low level.

## Enabling Termination and Biasing Resistors

Inside the converter, there is a 7 × 3-pin jumper header block which is used to enable Tx, Rx, CTS 120Ω termination resistors and Rx, Tx 750Ω 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:



Jumper		Function
1-2	Enable	Tx+/- termination of 120Ω. This jumper should always be populated for RS-485 half-duplex mode.
2-3	Disable	
4-5	Enable	Pull-up Tx+ to VCC by 750Ω bias resistor. This jumper should be populated for pull-up Tx+.
5-6	Disable	
7-8	Enable	Pull-down Tx- to GND by 750Ω bias resistor. This jumper should be populated for pull-down Tx-.
8-9	Disable	
10-11	Enable	Rx+/- termination of 120Ω. This jumper should always be populated for RS-422 and RS-485 full duplex mode.
11-12	Disable	
13-14	Enable	Pull-up Rx+ to VCC by 750Ω bias resistor. This jumper should be populated for Rx+.
14-15	Disable	
16-17	Enable	Pull-down Rx- to GND by 750Ω bias resistor. This jumper should be populated for Rx-.
17-18	Disable	
19-20	Enable	CTS termination of 120Ω. This jumper should always be populated for RS-422 mode.
20-21	Disable	

**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.

## WIRING INFORMATION FOR RS-422/485

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 find errors in data transmission. Failures in cabling are responsible for the vast majority of transmission problems.

### RS-422 and RS-485 Transmission Technique

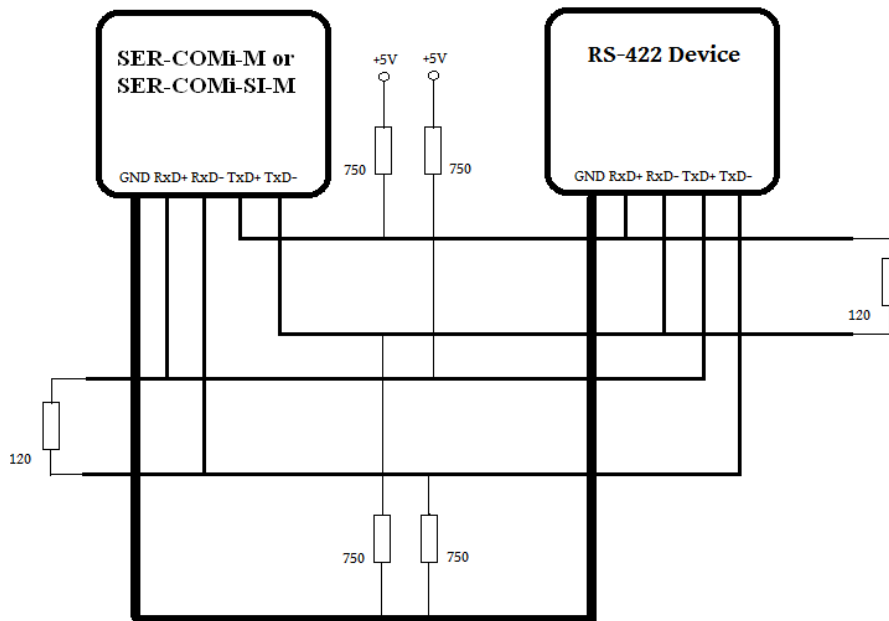
RS-422 and RS-485 use the same balanced transmission method. Signals are not transmitted as voltage on a single wire like in RS-232. Instead, two wires are used; when one carries high voltage, the other one carries low voltage. The signal is defined by the difference in voltage between those two wires.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

To make sure the signals meet the common voltage range, the GND of sender and receiver must be connected. To ensure the signals are in the valid voltage range so that 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

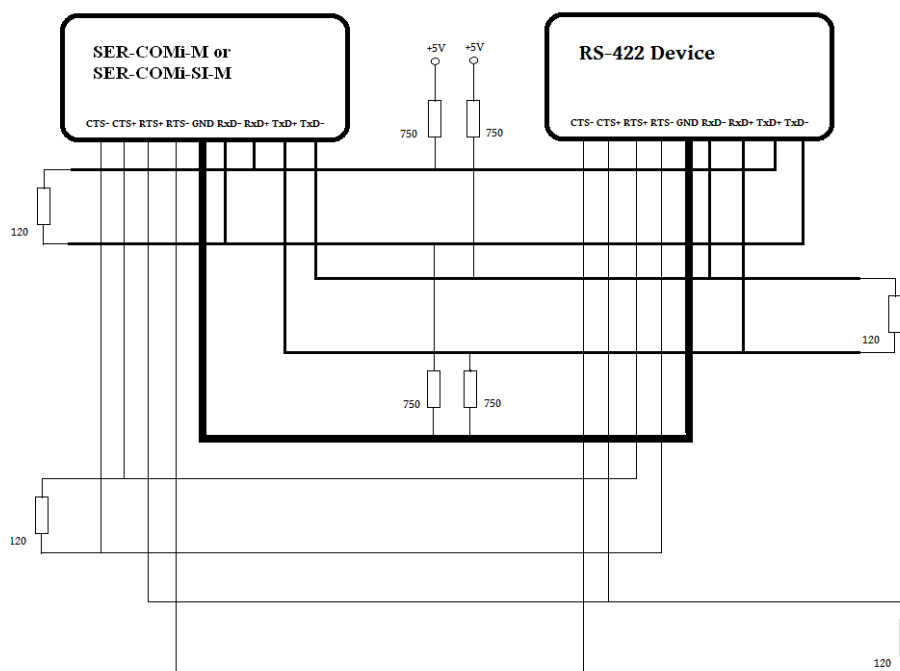
The following diagram shows RS-422 without handshaking signals connected.



**RS-422 without handshaking signals connected**

## RS-422 with Handshaking Signals Connected

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

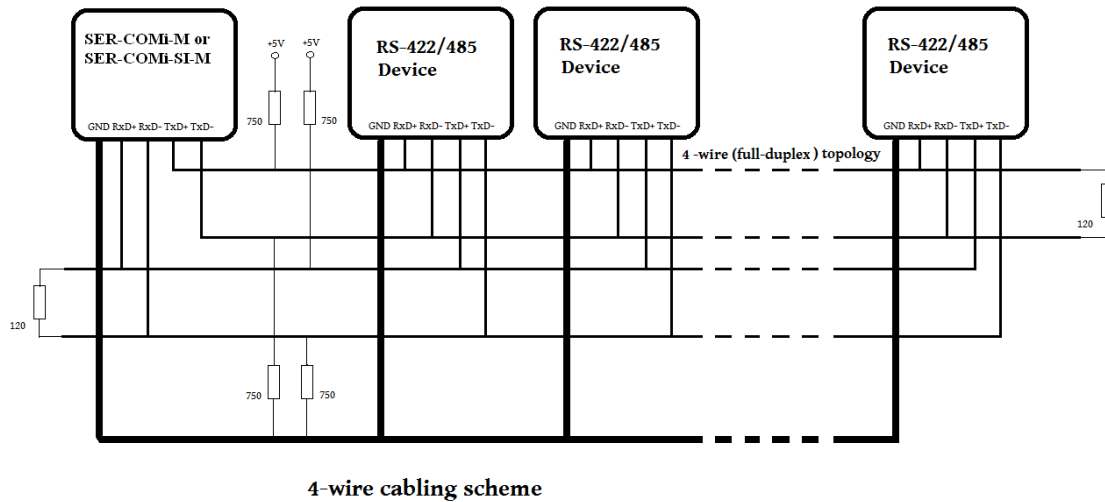


**RS-422 with handshaking signals connected**

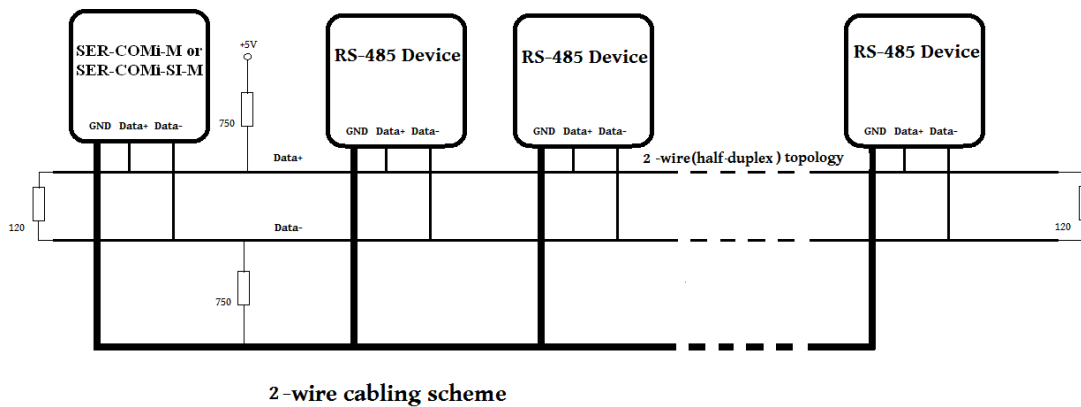
## RS-422 and RS-485 4 Wire Scheme

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 use RS-485 Line Driver technology, up to 32 receivers are possible.

The following diagram shows RS-422 and RS-485 4 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.