

# Industrial Communication

## RS485 Bus

Extract of  
Technical guide

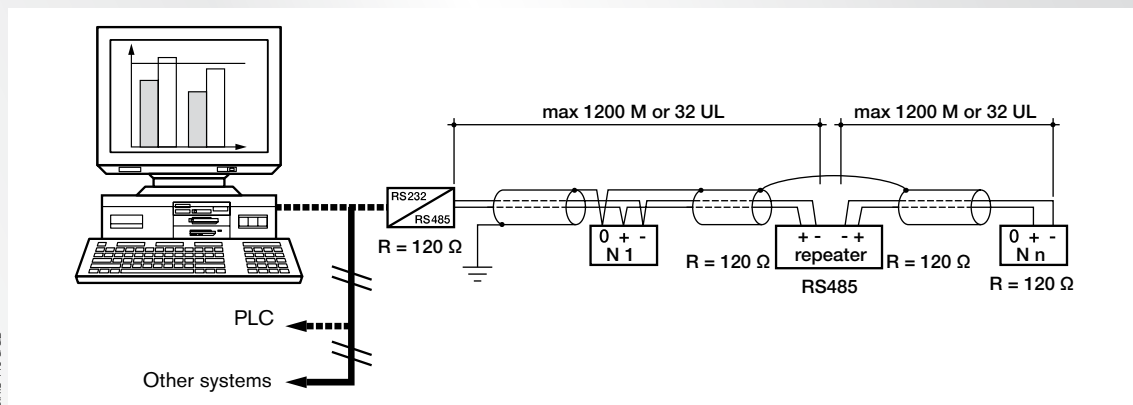
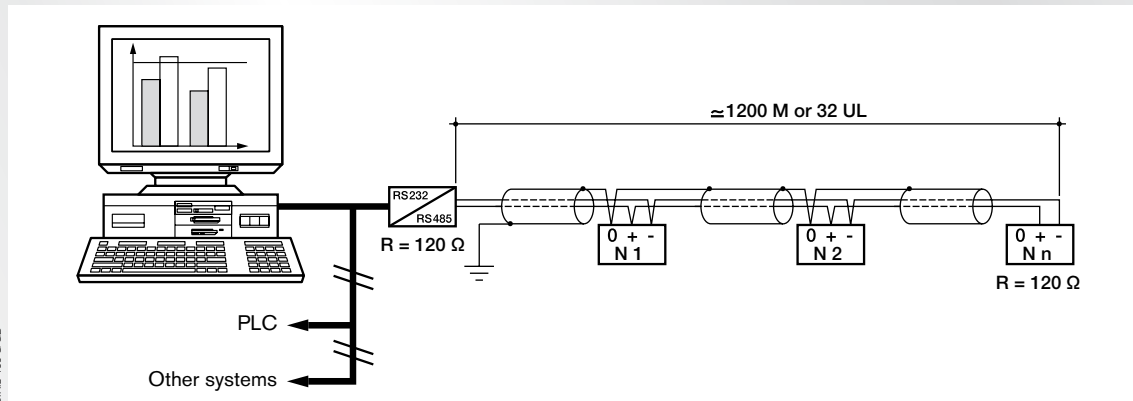
INDUSTRIAL SWITCHING & PROTECTION SYSTEMS

## RS485 Bus

A RS485 bus is defined by the standard EIA-TIA-485-A and the application guidelines TSB-89-A

### ➤ Topology

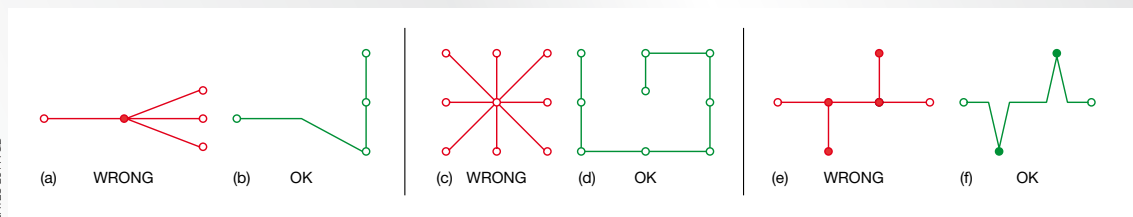
The recommended topology is a serial bus.



UL = unity of loads, see corresponding page below.

The serial bus topology is the one that best limits signal reflection.

Example of adaptation from existing topologies to a serial bus :



For the diagram (e) spurs of up to 30 cm can be tolerated (Vertical connections on the diagram (e)).

### ➤ Cable type

We recommend to use a shielded twisted pair (general shield) with minimal section  $0,20 \text{ mm}^2$  (AWG 24) of 120 ohms impedance and type L IYCY-CY.

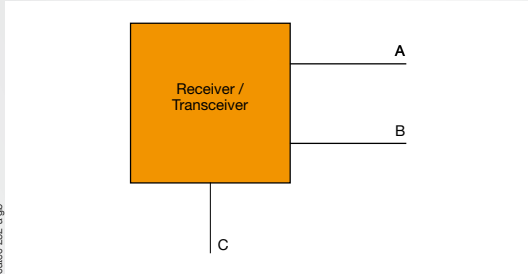
### ➤ Earthing

Only link the shield to the earth on one end to guarantee the equipotentiality of the shield. There is no other required earthing.

## RS485 Bus (continuation)

### Identification of SOCOMEC terminals according to RS485 standard

A RS485 transceiver is from a standard point of view connected through 3 points on the network.



Manufacturers may give other names to their terminals that differ from A, B or C.

Below is the correspondence with SOCOMEC terminal labelings:

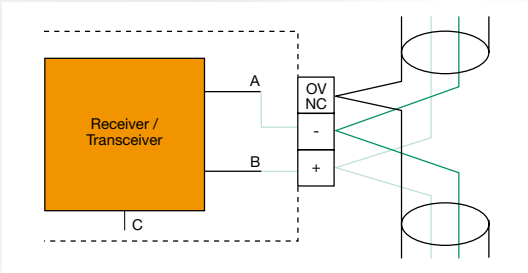
- B = +
- A = -
- C = « 0V / NC »

The SOCOMEC transceivers do not need the 3rd terminal (C) to communicate correctly.

Apply the following recommendations:

- in a 3 wire network connect the 3<sup>rd</sup> terminal (C) in the terminal (0V / NC)
- in a 2 wire network use the 3<sup>rd</sup> terminal (C) to provide the shield continuity.

### Principle of SOCOMEC products connections



The terminal « 0V / NC » of the SOCOMEC connector is not linked internally to the « C » terminal of the RS485 transceiver.

This isolated terminal can thus be used to facilitate shield continuity.

Connection diagram of SOCOMEC products in a 2 wire network

### Termination Resistor

The termination resistor, with the same value as the line impedance (120 ohm), eliminates the majority of the signal reflection. It has to be placed at both ends of the bus. It could be directly integrated in the interface unit, depending on models.

#### Manual activation on products

Device	Termination resistor
DIRIS A20, A40, A60, E53	<p>Set:</p> <ul style="list-style-type: none"> <li>• the 2 dip switches to ON to activate the resistor</li> <li>• the 2 dip switches to OFF to deactivate the resistor</li> </ul>
DIRIS A10, COUNTIS E33, E43, E44	<p>A 120 ohm resistor is supplied with the product (loose component) Connect between + and - terminals.</p>
COUNTIS Ci	<p>Set:</p> <ul style="list-style-type: none"> <li>• the 4 dip switches to ON to activate the resistor</li> <li>• the 4 dip switches to OFF to deactivate the resistor</li> </ul>
DIRIS N	<p>Set:</p> <ul style="list-style-type: none"> <li>• the dip switch to ON to activate the resistor</li> <li>• the dip switch to OFF to deactivate the resistor</li> </ul>

Note: the first termination (start) should be placed on the first network device which is generally an interface or PLC and not the first slave (meter).

## RS485 Bus (continuation)

### Line fail-safe biasing

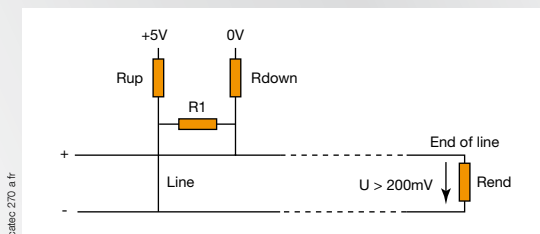
The RS485 standard imposes one differential level of 200 mV minimum to detect the signal.

If the RS485 line is not biased, this level will not be reached (without communication on the line) and successful communication will not be guaranteed.

For this, we apply a bias to only one place on the bus and it is best applied at the master. On certain models of interface unit, it is possible to activate this biasing otherwise, it would be necessary to add an external supply which guarantees a level of 250-280 mV on the whole bus when there is no active communication. One supply of 250-280 mV is a good compromise which guarantees to be upper of 200 mV and does not lead to excessive consumption.

In order to prove this, it is best to apply the biasing at one end of the bus (on the interface side) and verify the voltage level on the other end of the bus; this ensures adequate biasing throughout the bus.

Warning, the sign of the voltage (U) must be positive.



Fail-safe biasing principle diagram

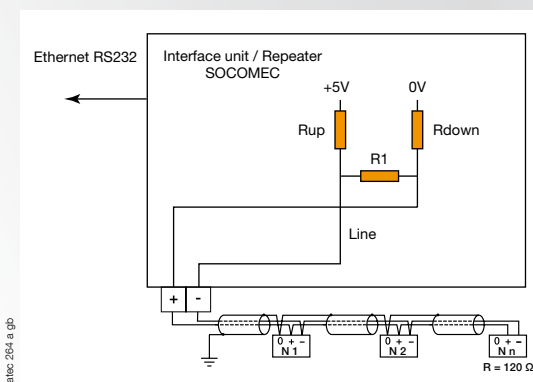


Diagram of a bus connection with SOCOMEC interface units with integrated biasing

### Sizing

The sizing of  $R_{up}$ ,  $R_1$ ,  $R_{down}$  depends on the exact level of the voltage supply and the termination resistor values.

Standard values (for a voltage supply of 5V) are:

$$R_{up} = R_{down} = 560 \text{ ohms (+/- 5 \%, 1/4 W)}$$

$$R_1 = 120 \text{ ohms (+/- 5 \%, 1/4 W)}$$

$$R_{end} = 120 \text{ ohms (+/- 5 \%, 1/4 W)}$$

The method of determination is achieved through a process of selection.

The approach is to check if, with these standard resistor values, the voltage level U at the end of line is in the expected range (250 - 280 mV). If not, you can adjust the  $R_{up}$  and  $R_{down}$  resistors between 390 and 750 ohms to reach this voltage level.

Repeat these actions until obtaining a corresponding voltage.

### Limitations

#### 2 limitations have to be taken into account in a RS485 network

##### Maximum number of devices

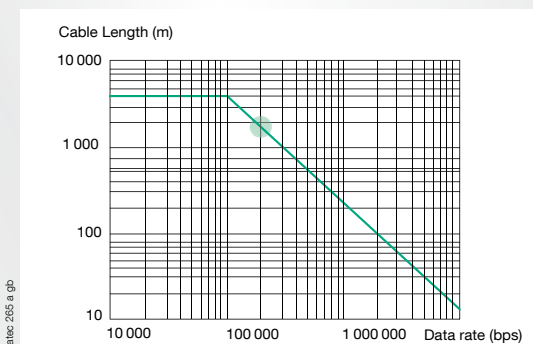
A RS485 driver should be able to communicate on a network with a load of 32 UL (Unity of load).

Device	UL Value	Number of devices to reach 32 UL
DIRIS A10	1	32
DIRIS A20	1	32
DIRIS A40	1	32
DIRIS A60	1	32
DIRIS N	1	32
COUNTIS Ci	1	32
COUNTIS E53	1	32
COUNTIS E33	1/2	64
COUNTIS E43	1/2	64
COUNTIS E44	1/2	64

Over a load of 32 UL, a repeater will be needed.

##### Maximum length of the bus

The maximum length for a speed up to 100 kbps is 1200 m.



Longer, a repeater is needed.

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