

# User manual

## ADA-4040

### Separator-repeater RS-485 / RS-422



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## 1. GENERAL INFORMATION

Thank you for your purchase of **CEL-MAR Company** product. This product has been completely tested and is covered by a two year warranty on parts and operation from date of sale.

If any questions or problems arise during installation or use of this product, please do not hesitate to contact Technical Support at +48 41 362-12-46 or e-mail [support@cel-mar.pl](mailto:support@cel-mar.pl).

### 1.1. WARRANTED INFORMATION

The **ADA-4040 separator-repeater** is covered by a two year warranty from date of sale. The warranty does not cover damage caused from improper use, materials consumption or any unauthorized changes. If the product does not function (is damaged), or not operate in accordance with the instructions will be repaired.

All warranty and no warranty repairs must be returned with paid transport and insuring to the **CEL-MAR Company**.

**CEL-MAR Company** under no circumstances won't be responsible for ensuing damage from improper using the product or as a result of random causes: the lightning discharge, the flood, the fire and the like.

**CEL-MAR Company** is not be held responsible for damages and loss including: loss of profits, loss of data, pecuniary losses ensuing from using or the impossibility of using this product.

In specific cases CEL-MAR Company discontinue all warranties and in particular do not follow the user manual and do not accept terms of warranty by the user.

### 1.2. GENERAL CONDITIONS FOR SAFE USE

The device should be installed in a safe and stable places (eg, electroinstallation cabinet), the powering cable should be arranged so as not to be exposed to trampling, attaching, or pulling out of the circuit.

Do not put device on the wet surface.

Do not connect devices for nondescript powering sources,

Do not damage or crush powering wires.

Do not make connection with wet hands.

Do not adapt, open or make holes in casings of the device!

Do not immerse device in water or no other liquid.

Do not put the fire opened on device sources: candles, an oil lamps and the like.

Complete disable from the supply network is only after disconnecting the power supply circuit voltage.

Do not carry out the assembly or dis-assembly of the device if it is enabled. This may result to short circuit and damage the device.

The device can not be used for applications that determine human life and health (eg. Medical).

### 1.3. CE LABEL



The CE symbol on the device CEL-MAR means compatibility with electromagnetic compatibility Electromagnetic Compatibility Directive **EMC 2014/30/WE**.

Declaration of Conformity is delivered with purchased device.

### 1.4. ENVIRONMENTAL PRESERVATION



This sign on the device inform about putting expended device with other waste materials. Device should send to the recycling. (In accordance with the act about the Electronic Appliance Expended from day 29 of July 2005)

### 1.5. SERVICE AND MAINTENANCE

ADA-4040 separator-repeater does not require the servicing and maintenance.

Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail [support@cel-mar.pl](mailto:support@cel-mar.pl).

### 1.6. PACK CONTENTS

ADA-4040 separator-repeater; user manual; CE declaration; resistors: Rt 120Ω (ohms), 5%, 0,25W(4pcs.).

## 2. PRODUCT INFORMATION

### 2.1. PROPERTIES

- Operating on 2-wire or 4-wire bus in RS485/RS422 standard,
- Baud rate up to 230,4 kbps,
- Transparent for all protocols: MODBUS, DNP, PROFIBUS and other,
- Any a data format, specified EIA-485, CCITT V.24 specifications,
- Power supply 10 - 30 VDC stable,
- ~3kV= optoisolation in signal channel between RS485/RS422 (RS1) and RS485/RS422 (RS2)
- 1kV= or 3kV= galvanic isolation between RS485/RS422 (RS1, RS2) interface and power supply,
- Connection RS485/RS422 networks and power supply via screw terminal block,
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 lines,
- Protection against power supply reverse connection,
- Implemented protection reverse polarity power supply,
- DIN 43880 standard - mounting in typical electro-installation unit,
- Rail mounting according to DIN35 / TS35 standard,
- Dimensions (W x D x H) 53mm x 62mm x 90mm.

**2.2. DESCRIPTION**

ADA-4040 separator-repeater is a device used for separation and extension of RS485/422 bus, about next segment 1200m (without interference with data format). The distance is being reduced in case of large baud rate (over 115,2 Kb). The separator-repeater can be used for communication with other, remote devices with RS485/422 interface eg controllers or scales; using the lines RX+,RX-,TX+/A,TX-/B.

The ADA-4040 transmits data at baud rate up to 230,4 kbps, through four or two twisted-pair connected to a terminal block. To RS485/422 bus created by the use ADA-4040, it is possible to connect 32 devices, operating in half duplex or full duplex mode. The 1kVDC or 3kVDC galvanic isolation and ~3kVDC optoisolation in signals line separate RS1/OUT (RS485/RS422) interface from RS2/IN (RS485/RS422) interface. Protect a device connected to RS2/IN from overvoltage, which appear on RS485/422 bus, connected to RS1/OUT and in the power-circuit.

Over-voltage protection on each RS485/422 lines, was made on the base overvoltage LED's and the fuses. The ADA-4040 should be powered from the power supply stabilized voltage with a voltage in the range 10 - 30 VDC and minimum power 2W.

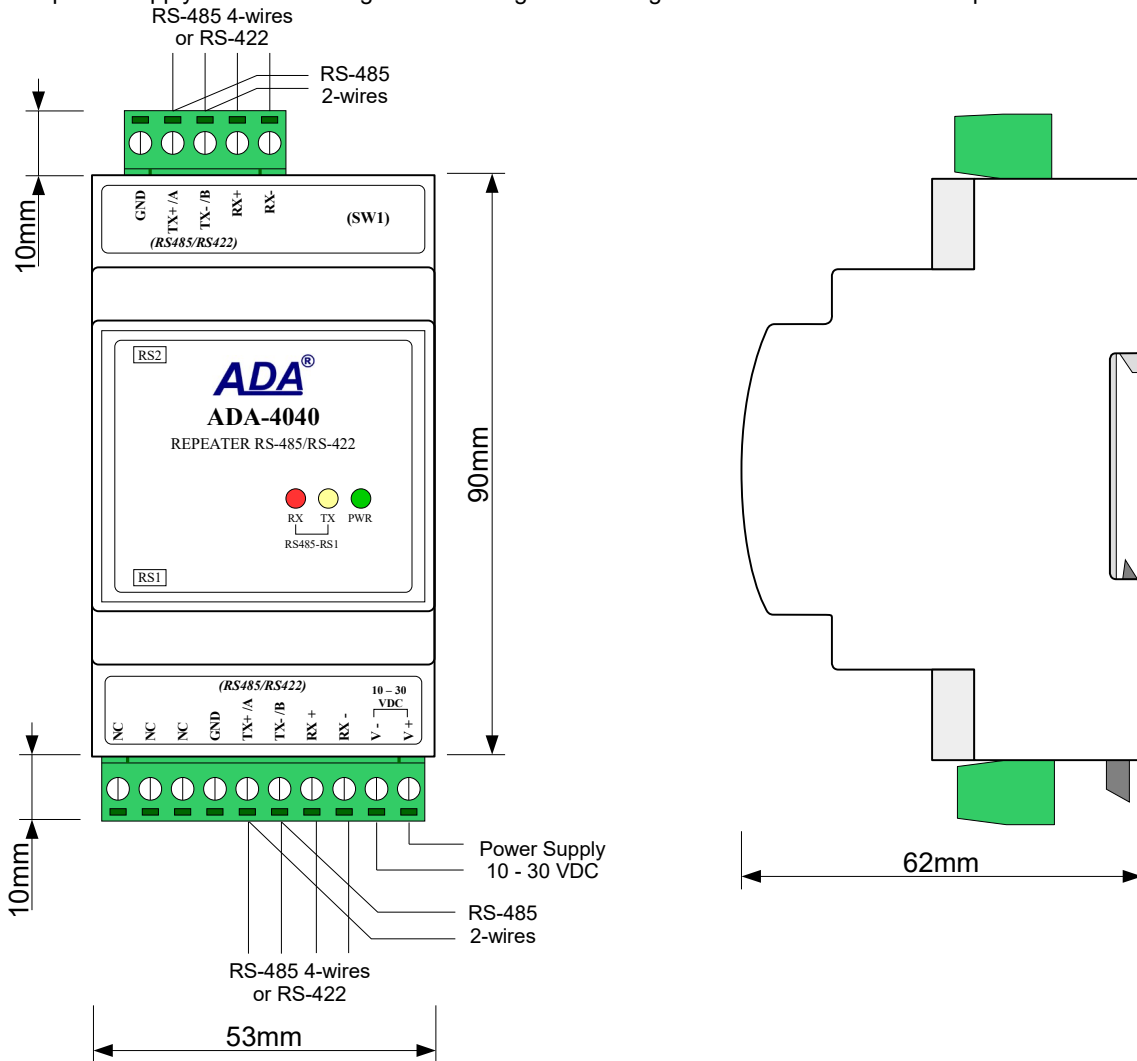


Fig 1. View and location of SW1 micro-switch (under the cover)

**2.3. ISOLATION**

The separator-repeater ADA-4040 has (depend on version) 2-way or 3-way and 1kV= or 3kV= galvanic isolation. The descriptions are in section VERSIONS.

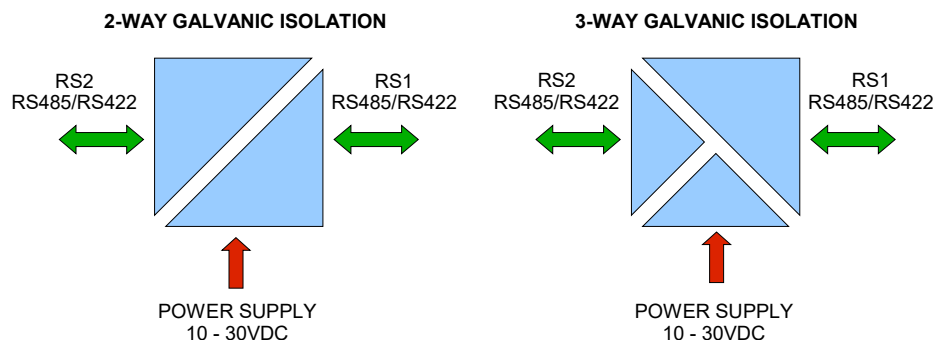


Fig 2. Isolation diagram

**3. INSTALLATION**

This chapter will show how to connect ADA-4040 to RS485/422 bus and power supply and how to use it. To reduce disturbance from environment, it is recommended to:

- use multi-pair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- use the suitable diameter cable for power supply on account of voltage drop,
- use the powering cable with a suitable section because of the voltage drops,
- use the interference eliminators for powering the converter,
- lay signal cables at a distance of not less than 25 cm away from power cables,
- not powering the converters from the power-circuit of devices generate large impulse disturbance like contactors, relays, inverters.

**3.1. ASSEMBLING**

The ADA-4040 case is adapted to assembly on TS-35 (DIN35) rail. To install converter should mount device on the rail upper part of the case then press bottom part to hearing characteristic „Click” sound.

**3.2. CONNECTION TO RS485/RS422 NETWORK**

RS485/RS422 interface at ADA-4040 separator-repeater is available on terminal block described as: Tx+/A, Tx-/B, Rx+, Rx- GND. ADA-4040 support operating on RS422 bus and RS485 (2-wire and 4-wire). Both buses need proper cabling.

**3.2.1. EXTENSION AND SEPARATION OF RS-485 / RS-422 BUS**

Using the ADA-4040 it is possible to extend the RS485/422 bus of next segment 1200m and make the galvanic separation of next segments of the bus. It increases the reliability of the system operation based on RS485/422 bus. Example connections of the ADA-4040 are shown below.

**3.2.1.1. SEPARATION OF RS485 INTERFACE OF DEVICE FROM THE RS485 4-WIRE BUS**

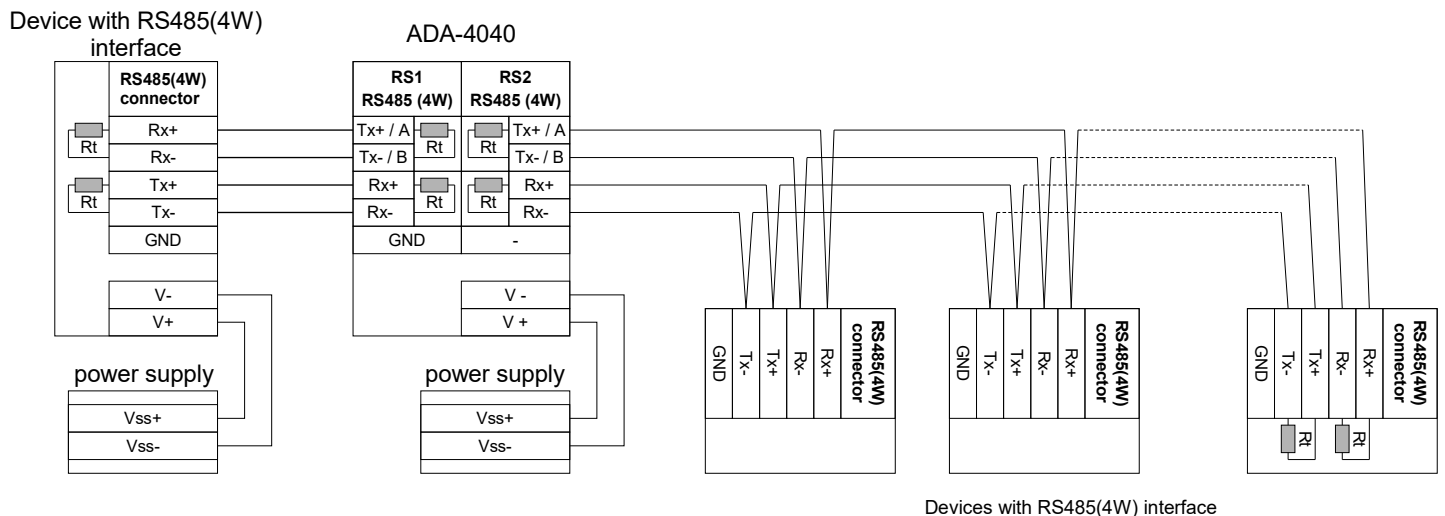


Fig 3. Separation of RS485(4W)/422 port of device from RS485 4-WIRE bus

**3.2.1.2. SEPARATION OF RS485 (2-WIRE) INTERFACE OF DEVICE FROM THE RS485 (4-WIRE) BUS**

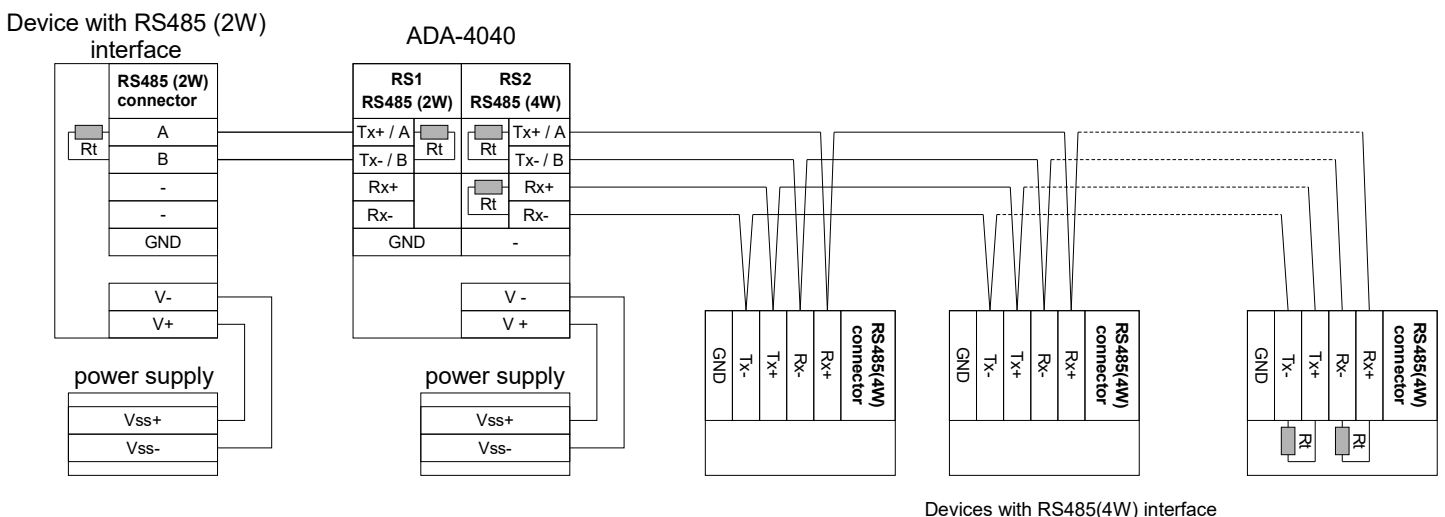
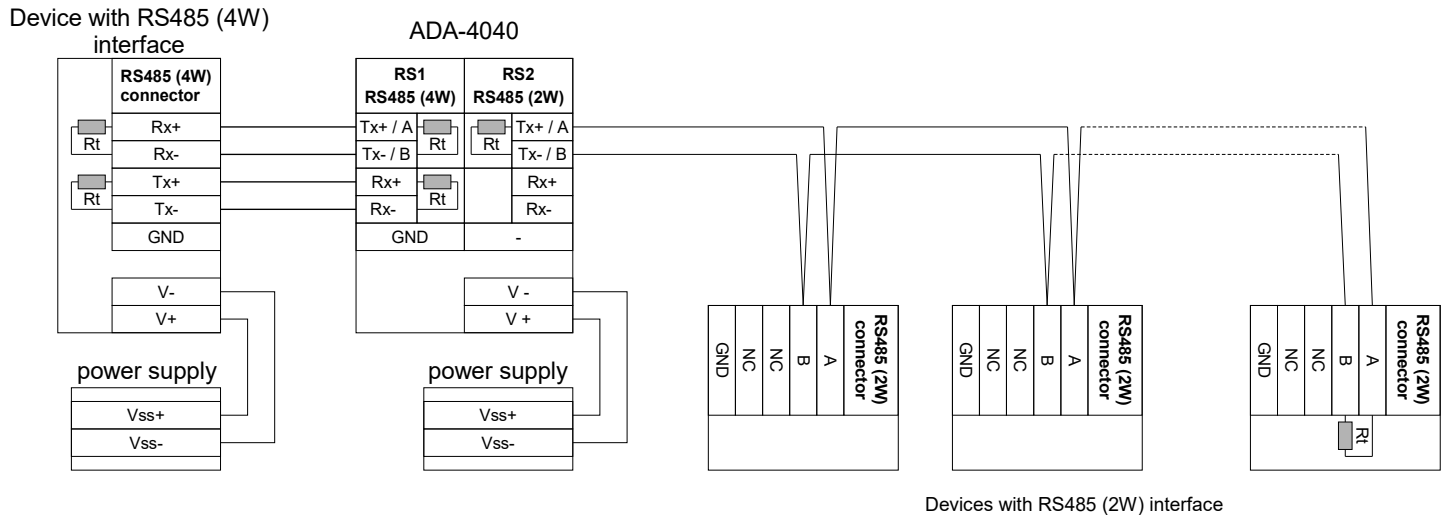


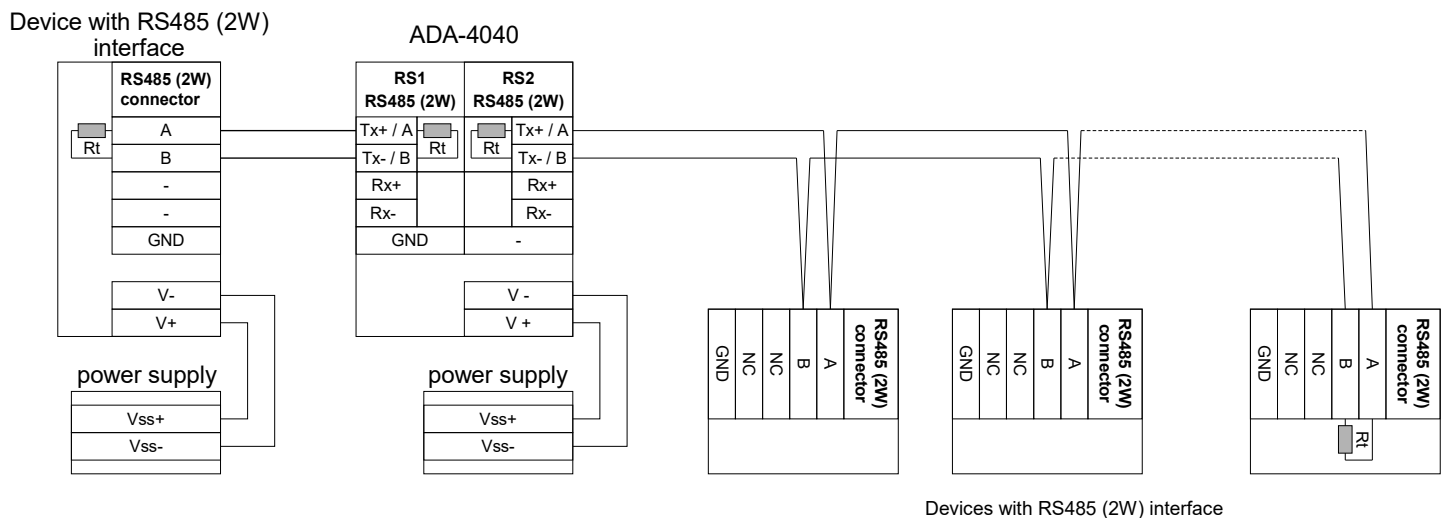
Fig 4. Separation of RS485(2W) port of device from RS485 4 WIRE bus

**3.2.1.3. SEPARATION OF RS485 (4-WIRE)/ RS422 INTERFACE OF DEVICE FROM THE RS485 (2-WIRE) BUS**



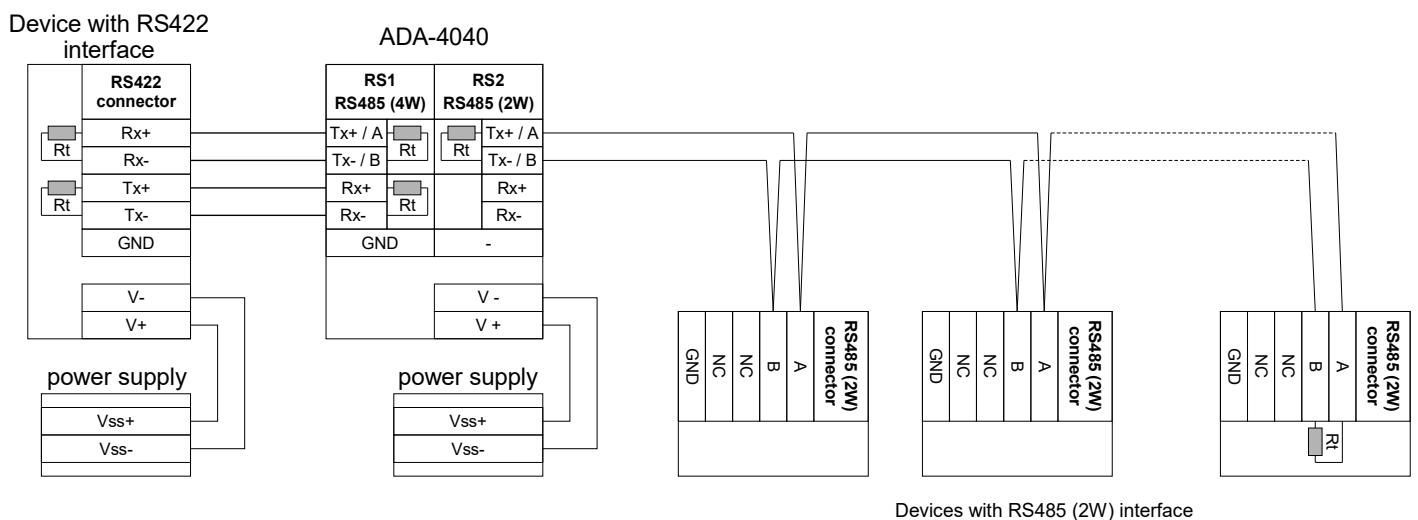
**Fig 5. Separation of RS485(4W)/422 port of device from RS485 2-WIRE bus**

**3.2.1.4. SEPARATION OF RS485 (2-WIRE) INTERFACE OF DEVICE FROM THE RS485 (2-WIRE) BUS**



**Fig 6. Separation of RS485(2W) port of device from RS485(2W) 2-WIRE bus**

**3.2.1.5. RS422 INTERFACE DEVICE CONNECTION TO RS485(2W) BUS**



**Fig 7. Connection of device with RS422 to RS485(2W) 2-WIRE bus**

3.2.1.6. EXTENSION AND SEPARATION OF RS485(4W) BUS SEGMENTS

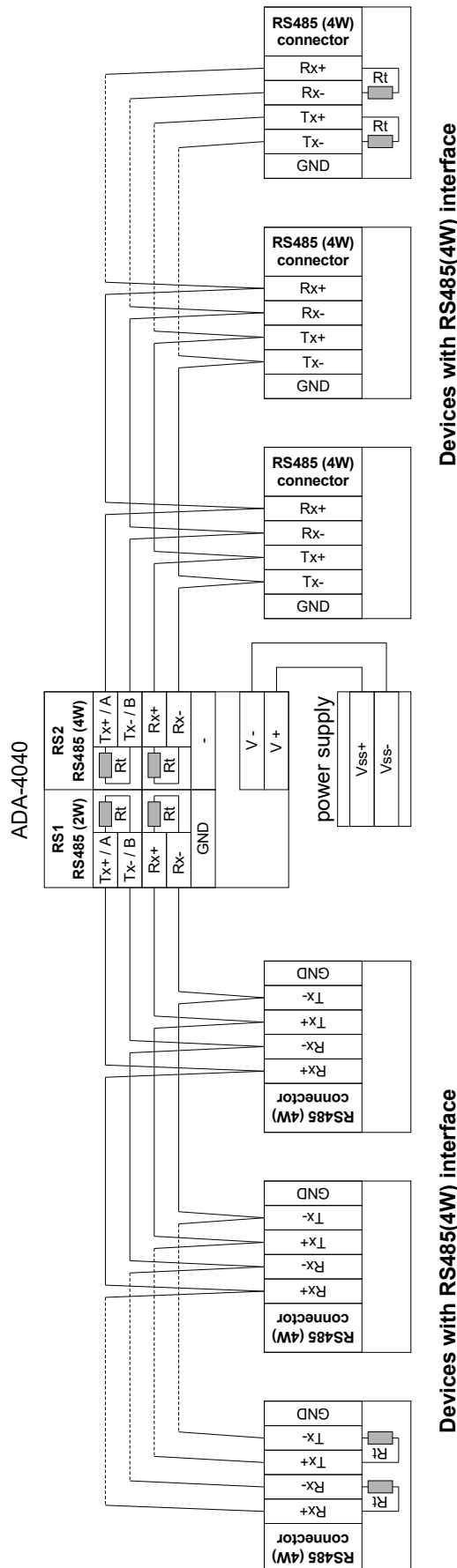


Fig 8. Extension about 1200m and separation of RS485(4W) bus segments

3.2.1.7. EXTENSION AND SEPARATION OF RS485(2W) BUS SEGMENTS

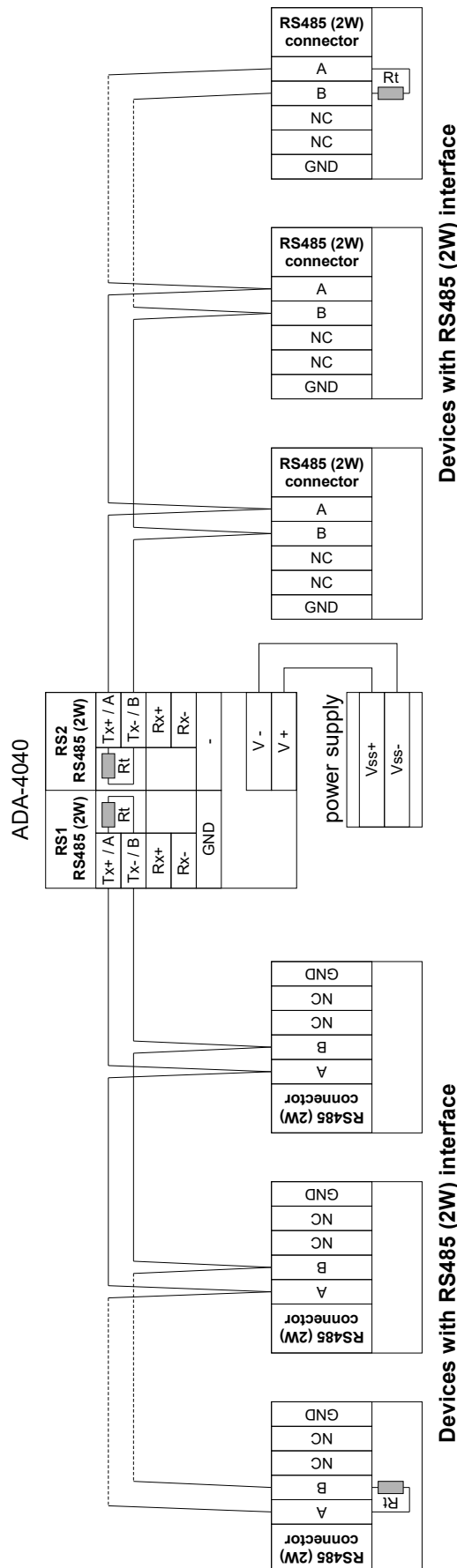


Fig 9. Extension about 1200m and separation of RS485(2W) bus segments



3.2.1.8. EXTENSION AND SEPARATION OF RS485(2W) & RS485(4W) BUS SEGMENTS

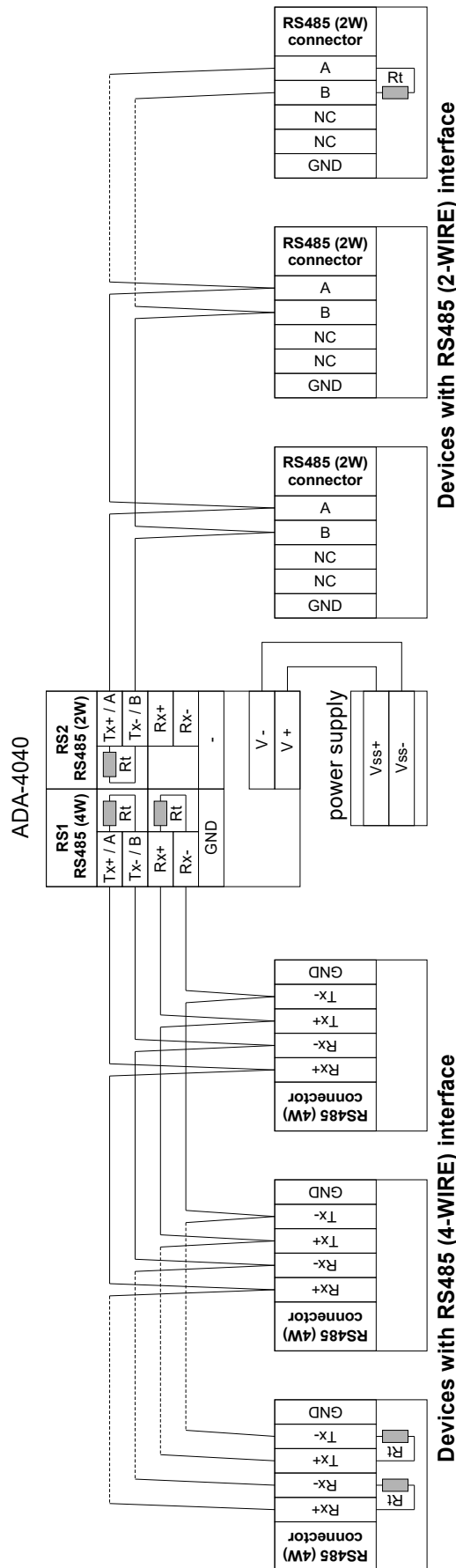


Fig 10. Extension and separation of RS485(4W) 4-WIRE and RS485(2W) 2-WIRE bus segments

### 3.2.2. GND TERMINAL CONNECTION

Connection of GND terminals of RS485/422 interfaces, devices connected to RS485/422 bus, should be done in the case of a potential difference of the signals grounds on interfaces RS485 / RS422, which prevents proper data transmission.

**Cannot connect to the GND terminal - cables screens, PE circuit of electrical installation, signals grounds of other devices.**

### 3.2.3. LINE TERMINATION

The application of Line Termination (terminator)  $R_t = 120 \Omega$  (ohms) will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. The Line Termination resistor should be used if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission, the resistor can be necessary if there are problems with the transmission correctness. The terminators/resistors are connected to the terminal block of ADA-4040 on the RS485/RS422 interface. Example connection of  $R_t$  are shown on Fig. 3, 4, 5, 6, 7, 8, 9.

### 3.3. POWER SUPPLY

The power supply to ADA-4040 should be DC (regulated) from the scope 10 V= to 30V= and nominal power 2W. The power cable from DC power supplies to the device must not be longer than 3m. Observe the polarity, connect positive (+) of DC power supplies to V+ and negative (-) end to V- terminal. ADA-4040 has the protection from opposite connection power supply.

If after power, on the front panel is not lit green LED PWR, check the power connection (polarity).

## 4. CONFIGURATION

For configuration of ADA-4040 operating mode use a six-position dip switch SW1.

The SW1 is located next to RS485 terminal block (Fig.1) under the cover. For setting, remove the cover and use small, flat screwdriver.

### 4.1. OPERATING MODE SETTING

The setting of SW1 dipswitch for operating mode of ADA-1040 is shown in the Table 1 (below).

In case of any questions, contact the support: support@cel-mar.pl.

Table 1

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6	Description	Operation mode
OFF	OFF	OFF	OFF	OFF	OFF	RS-422 Bus	RS422 bus 4-wire. Transmission full duplex or half duplex
ON	ON	ON	ON	ON	ON	RS485 Bus automatic data flow control	RS485 bus 2-wire and 4-wire. Transmission full duplex or half duplex.

### 4.2. FACTORY DEFAULT

During production ADA-4040 separator-repeater is configured to operating in RS485 mode as in table below.

Table 2

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6
ON	ON	ON	ON	ON	ON

## 5. ACTIVATION

Converter can be powered after proper connection according to steps above.

If connection was made properly green LED PWR on front panel of converter should light, if not check polarization of power connection. When data is present the LEDs Tx and Rx should blinking.

### 5.1. SIGNALLING LEDES

LED	Description
PWR	Signalling of Power Supply
RX	Signalling of data receiving through RS1 port
TX	Signalling of data transmitting through RS1 port

### ATTENTION!

**AT BAUD RATE ABOVE 38.4 KBPS THE LED'S TX, RX WILL LIGHT WEAKLY DURING DATA TRANSMISSION**

### 5.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not lights.	Check polarization and parameters of connected power supply.
Rx LED lights continuously	RS485(4W) /RS422 bus. Wrong polarization on Rx+, Rx- terminals. Change polarization. RS485(2W) bus. Wrong polarization on Tx+/A, Tx-/B terminals. Change polarization.
No transmission, Tx LED is blinking	RS485(4W) /RS422 bus. Check the correctness of connection to Tx, Rx terminals according to chapter 2. RS485(2W) bus. Check the correctness of configuration setting according to chapter 3.

6. VERSIONS

		ADA-4040 -	<input type="text"/>	-	<input type="text"/>	-	<input type="text"/>
<b>Electronics version:</b>							
Basic			1				
Special			2				
<b>Galvanic isolation:</b>							
1kV=, 2-way					2		
1kV=, 3-way					23		
3kV=, 2-way					3		
3kV=, 3-way					33		
<b>Terminal &amp; Terminal Cover:</b>							
Cover without inlets, screw terminal block						1	
Cover with inlets, screw terminal block						2	
Cover without inlets, plug-in screw terminal block						3	

Order example:

Product Symbol: **ADA-4040-1-23-3**

1 – basic electronics version,

2 – 1kV=,3-way galvanic isolation,

3 – cover without inlets, plug-in screw terminal block

7. SPECIFICATION

TECHNICAL DATA		
Transition Parameters		
Interface	RS1 RS-485/422	RS2 RS-485/422
Connector	Screw terminal block - max. Ø 2,5mm <sup>2</sup>	
Line length	1200 m	
Maximum number of connected device	32	
Transmission line	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield in environment of large interference STP Nx2x0,5 (24AWG)	
Standards	EIA-485, CCITT V.11	
Maximum baud rate	230,4 kbps	
Transmission type	Asynchronous full duplex, half duplex.	
Optical signalisation	<ul style="list-style-type: none"> <li>• PWD – green LED power supply,</li> <li>• RX - red LED data receiving on RS1 – RS485/RS422,</li> <li>• TX - yellow LED data transmission via RS1 – RS485/RS422.</li> </ul>	
Electrical Parameters		
Power requirements	10 - 24 – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m	
Power	2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kV DC or 3kV DC - between power circuit and RS485/422 signal line	
Optoisolation	~3kV - between signals lines RS-485/RS-422 (RS1) and RS-485/RS-422 (RS2)	
Electromagnetic compatibility	Resistance to disruptions according to the standard PN-EN 55024. Emission of disruptions according to the standard PN-EN 55022.	
Safety requiring	According to the PN-EN60950 norm.	
Environment	Commercial and light industrial.	
Environmental Parameters		
Operating temperature	-30 ÷ 60°C	
Humidity	5 ÷ 95% - non-condensing	
Storage temperature	-40 ÷ 70 °C	
Mounting	Rail mounting according to DIN35 standard / TS35.	

<b>Casing</b>	
<b>Dimensions</b>	53mm x 90mm x 62 mm
<b>Material</b>	PC/ABS
<b>Degree of casing protection</b>	IP40
<b>Degree of terminal protection</b>	IP20
<b>Weight</b>	0,10 kg
<b>According to standard</b>	DIN EN50022, DIN EN43880
<b>Location during work</b>	Free
<b>Mounting method</b>	On the rail compliant with DIN35 / TS35 standard.

**Dear Customer,**

Thank you for purchasing **CEL-MAR Company** products.

We hope that this user manual helped connect and start up the **ADA-4040 separator-repeater**. We also wish to inform you that we are a manufacturer of the widest selections of data communications products in the world such as: data transmission converters with interface RS232, RS485, RS422, USB, Current Loop, Fibre-Optic Converters and Ethernet or Wi-Fi.

Please contact us to tell how you like our products and how we can satisfy you present and future expectation.

**CEL-MAR sp.j.**

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