User manual

ADA-4040A

Addressable RS485 / RS422 Baud Rate Converter

Contents

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.

1.1. WARRANTED INFORMATION

ADA-4040A converter is covered by a two year warranty from date of sale. In case of being damaged it will be repair or the damaged component will be replace. 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 or replaced.
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 disassembly 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

CE

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-4040A converter 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.

1.6. PACK CONTENTS

ADA-4040A converter; User Manual; CE declaration; Line terminators Rt=120Ω,(4 pcs.); CD with ADAConfig software.

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Possibility of adding address to no-addressable device with RS485/422 interface,
- Baud rate and format data frame conversion between RS1 and RS2 ports,
- Possibility of connection RS-422 interface device to RS-485 network without any interference,
- Operating on 2-wire or 4-wire network in RS485/RS422 standard,
- Operating up to 32 devices on RS485 bus,
- Baud rate (bps) of RS485/422 interfaces: 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
- Data format RS485/422: data bit: 5, 6, 7, 8; parity: None, Odd, Even; number of stop bits: 1, 2,
- Transparent for all protocols, which data format is compatible with the above specifications of RS485/422 interface eg. MODBUS, DNP, PROFIBUS and other,
- Power supply 10 - 30 VDC stable min. 2W,
- ~3kV= optoizolation in signal channel between RS485/RS422 (RS1) and RS485/RS422 (RS2) interface,
- 1kV= or 3kV= galvanic isolation between RS485/RS422 (RS1, RS2) interfaces and power supply (depend on version),
- Connection RS485/RS422 network and power supply via screw terminal block,
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 network,
- Implemented protection against power supply reverse connection,

- Cover compatible with DIN 43880 standard– mounting in typical electro-installation unit,
- Cover adapt to rail mounting according to DIN35 / TS35 standard,
- Cover dimensions (W x D x H) 53mm x 62mm x 90mm,

2.2. DESCRIPTION

ADA-4040A addressable baud rate converter is device solving the problem of connecting no addressable devices equipped with the RS-422 or RS-485 interface to multipoint RS485 bus, by adding the address to device connected to RS2 port of converter. Converter enables to connect RS-422 devices to R-S485 bus without any interference. Can be adjust baud rate, number of bits, parity control or non parity or stop bits depending on the configuration – for RS1 and RS2 ports the configuration can be different. ADA-4040A additionally separates devices from RS-485 network and can be used as repeater of RS422/RS485 bus with speed conversion between next segments about the length up to 1200m. The converter's galvanic separation protect system constructed on RS-485/RS-422 network and increase functioning reliability.
ADA-4040A supports an asynchronous baud rate up to 230.4 kbps through four or two pairs of twisted-pair cables connected to screw terminals. The converter use RX+, RX-, TX+/A, TX-/B lines for functioning. It is possible to connect 32 devises to RS485/RS422 network constructed on base of ADA-4040A, working at the half duplex or full duplex mode. Over-voltage protection on each RS485/RS422 line was made on base of 600W over-voltage led and fuses.

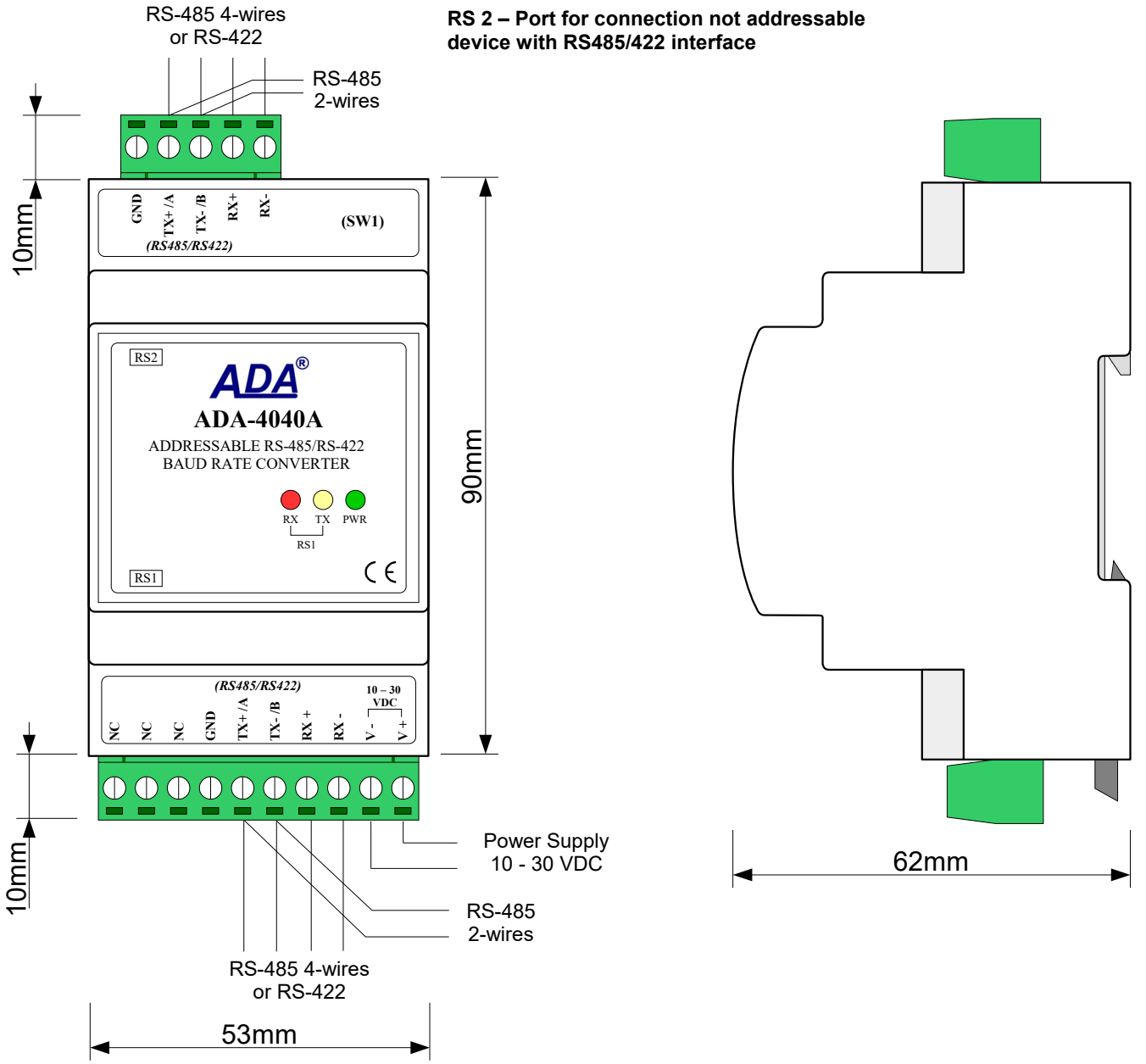

Fig 1. ADA-4040A view and location of SW1

2.3. ISOLATION

Converter ADA-4040A has 2-way or 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.

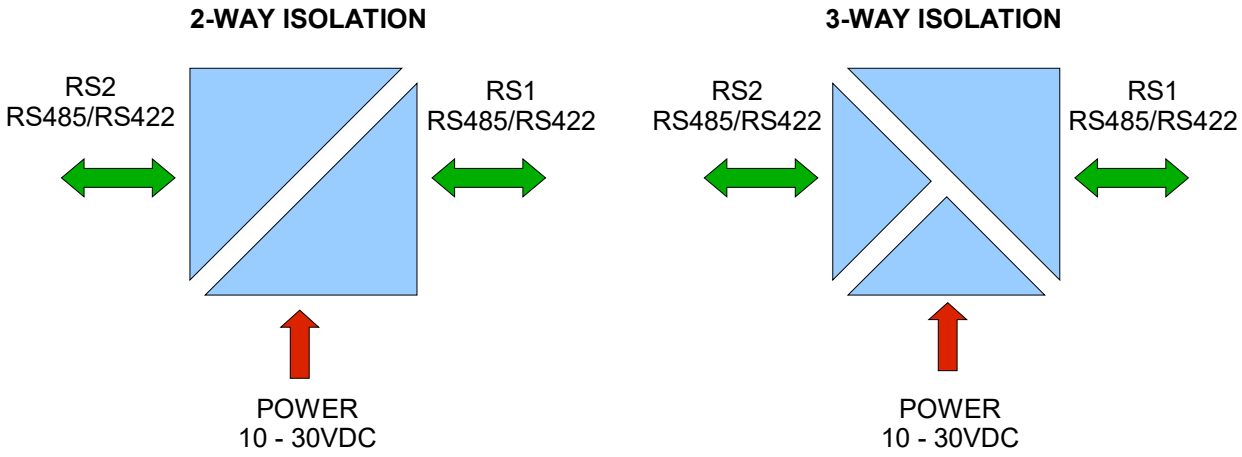

Fig 2. Isolation structure

3. INSTALLATION

This chapter will show you how to use and connect ADA-4040A to RS485, RS422 network and power supply.
In the purpose of minimization of disruptions from environment is being recommended to:
- apply multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
- arrange signal cables in the distance not shorter than 25 cm from powering cables.
- apply cable of adequate cross-section due to voltage drops for converter powering,
- use suppression filters for powering converters that are installed within a single object.
- not supply converter from power circuit device that generates large impulse interference such as transmitters, contactors.

3.1. ASSEMBLING

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

3.2. COMPUTER CONNECTION

To connect ADA-4040A converter to computer equipped with RS-232 or USB interface, is needed additional converter e.g. ADA-I1040 RS232 to RS485/RS422 converter or ADA-I9140 USB to RS485/RS422 converter (or other), which is connected to RS2 port of ADA-4040A.
The ways of connections of ADA-4040A to PC are shown below.

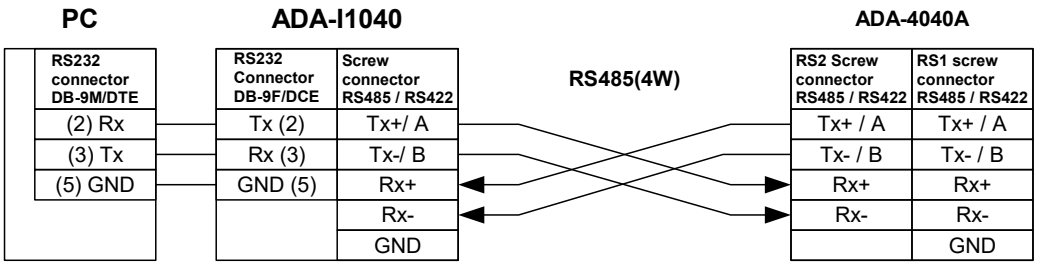

Fig 3. 4-wires connection of ADA-4040A to PC by the use of ADA-I1040 - RS232 to RS485/RS422 converter

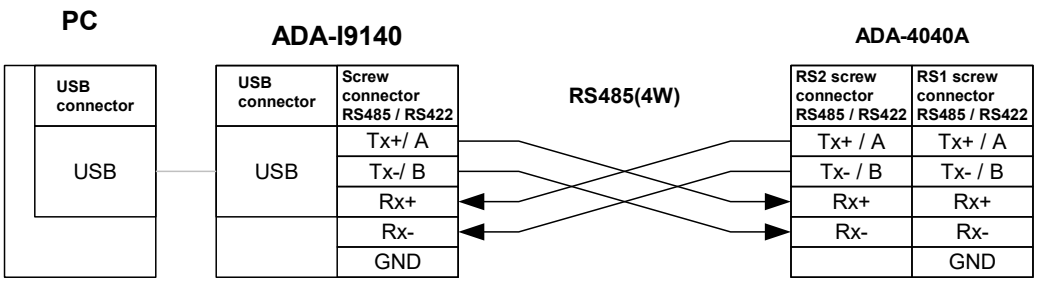

Fig 4a. 4-wires connection ADA-4040A to PC by the use of ADA-I9140 USB to RS485/RS422

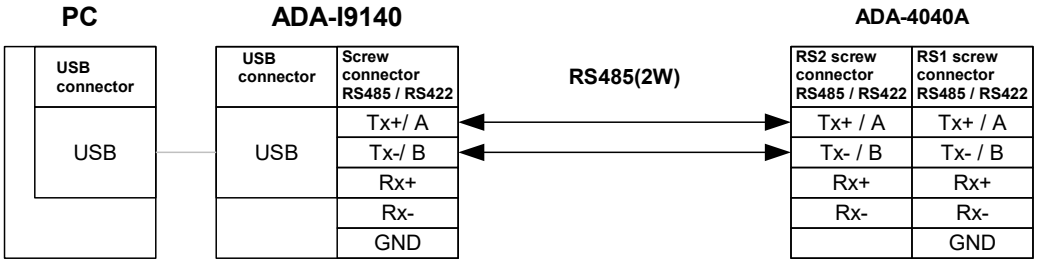

Fig 4b. 2-wires connection ADA-4040A to PC by the use of ADA-I9140 USB to RS485/RS422

3.3. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-4040A converter is described as: Tx+/A, Tx-/B, Rx+, Rx- GND. The ways of connection the converter to RS485(4W) / RS422 bus, are shown below.

3.3.1. RS485(4W) BUS CONNECTION

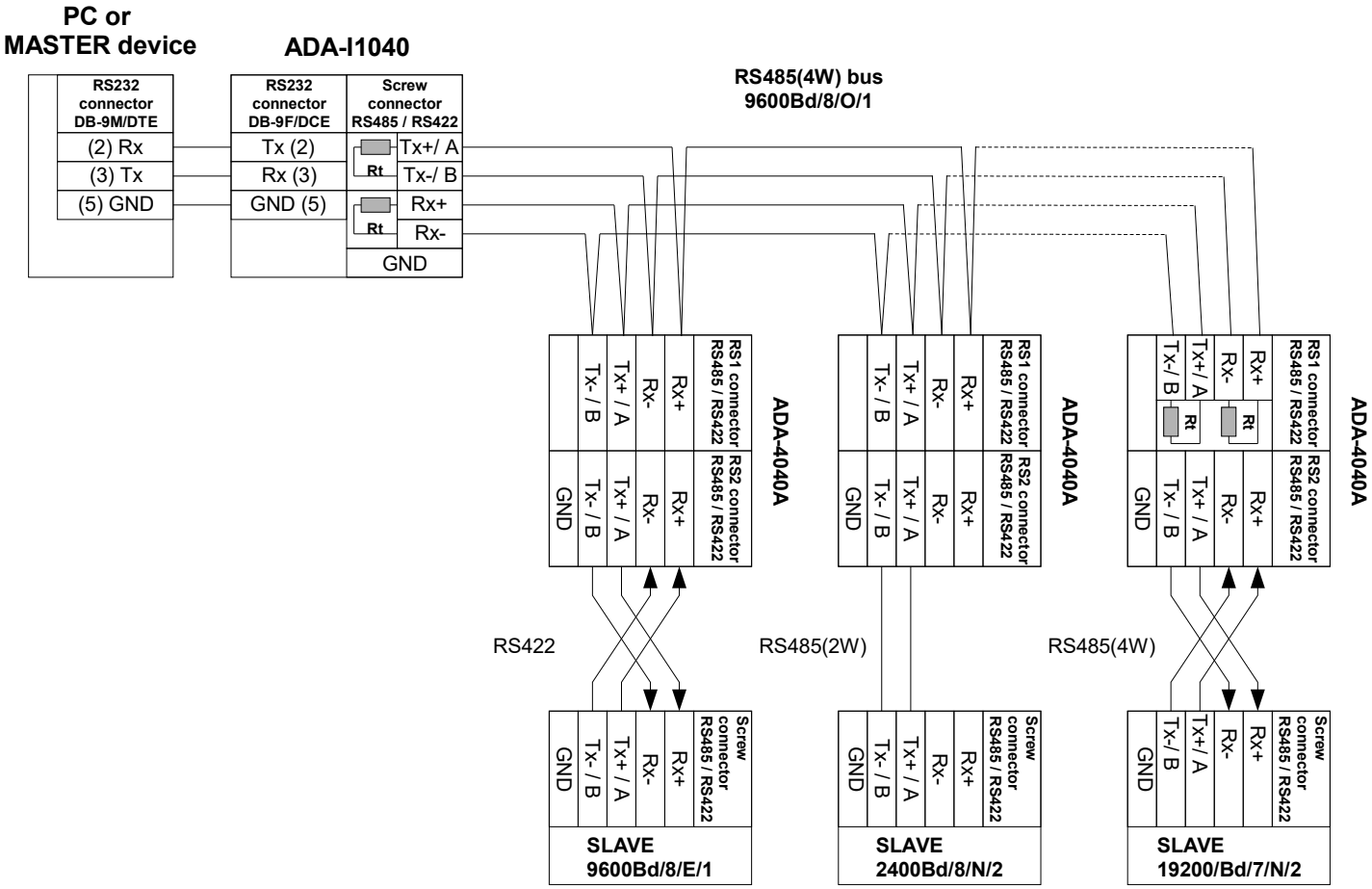

Fig 5. Example connection of ADA-4040A to RS485(4W) 4-wire bus and galvanic separation SLAVE device

3.3.2. RS485(2W) BUS CONNECTION

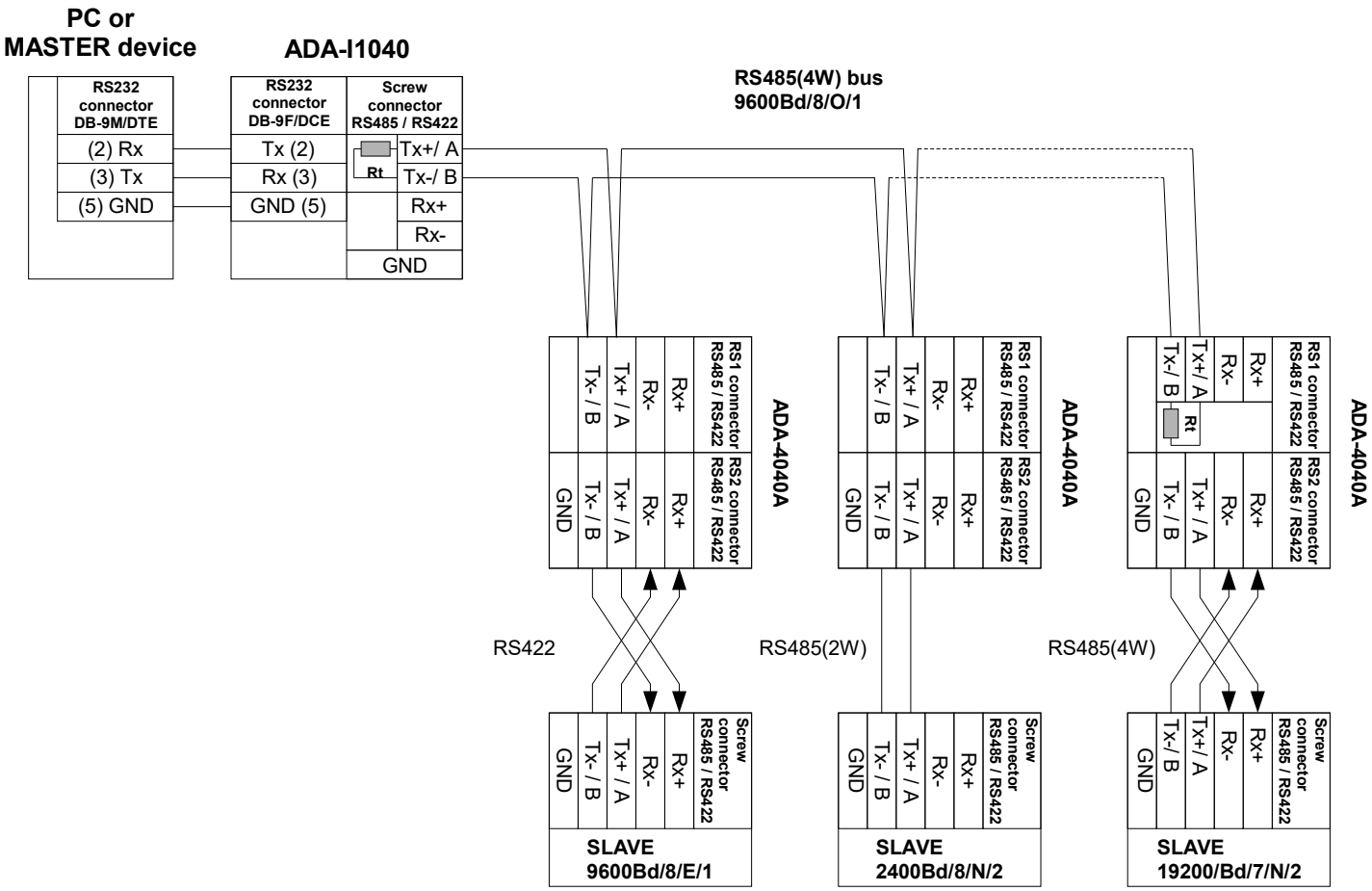

Fig 6. Example connection of ADA-4040A to RS485(2W) 2-wire bus and galvanic separation SLAVE device

3.3.3. GND TERMINALS 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.

3.3.4. LINE TERMINATION

The application of Line Termination (terminator) Rt = 120 ohms will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. You should use the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission. Example connection of Rt are shown on Fig. 5 & 6. Four Rt=120 Ω, 5%, 0,25W are delivered with the converters.

3.3.5. SLAVE DEVICE CONNECTION

Connection of SLAVE device to ADA-4040A is shown on fig.5 and fig.6.

3.4. CONNECTION OF POWER SUPPLY

The power supply of the converter should be done by the use of DC power supplies (regulated) output voltage from 10 V= to 30V=, min. nominal power 2W, e.g. HDR-15-24. Power cable from DC power supplies to device can not be longer than 3m. Should be connected positive (+) end of DC power supplies to V+ device terminal and negative (-) end to V- on terminal block. ADA-4040A has protection against power supply reverse connection. If the power is properly connected, on the front panel will light green LED PRW, if not check the power supply connection (polarization).

4. ACTIVATION

After properly connection according to section above, the converter can be powered.
If the power is properly connected, on the front panel will light green LED PRW.
When data is present the LEDs Tx and Rx should blink

4.1. SIGNALLING LEDS

LED	*Description*
PWR	Signalling of Power Supply
Run	
RX	Signalling of data receiving through ADA-4040A converter from RS1 RS485/RS422 port
TX	Signalling of data transmitting from ADA-4040A converter through RS1 RS485/RS422 port
Configuration	
LED by SW1	Blink with frequency1 Hz - signalling of configuration mode (see micro-switch SW1 setting).
Firmware updating	
LED by SW1	Blinking signalling data flow of software to converter.

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

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not lights	Check polarization and parameters of connected power supply
Rx LED lights continuously	RS485(4W) /422 bus. Wrong polarization on terminals: Rx+, Rx-; change polarization
	RS485(2W) bus. Wrong polarization on terminals Tx+/A, Tx-/B; change polarization
No transmission Tx LED is blinking	RS485(4W) /422 bus. Check correctness of connection to terminals Tx, Rx; according to point 3

5. CONFIGURATION

5.1. OPERATION MODE

The ADA-4040A converter can operates in a few modes :
– run,
– configuration,
– factory default,
– emergency firmware update
Those modes can be set by use SW1 located by terminal block RS2 after removing terminal cover marked as SW1.

All available adjusting the SW1 switch are shown in table below.

Operation modes

SW1- 1	*SW1- 2*	*Mode*
OFF	OFF	Run
ON	OFF	Configuration
OFF	ON	Factory default Turning OFF and ON the power of the converter, the configuration will be set to factory default.
ON	ON	Emergency Firmware Update

5.2. CONFIGURATION BY THE USE OF ADACONFIG

The configuration of ADA-4040A converter should be done by use of **ADAConfig** software - selling with converter.
To make the configuration, connect converter to computer (see pt. 3.2) and power supply. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity). If the PWR LED lights, set the section of SW1 switch to configuration mode as in table below.

SW1-1	SW1-2
ON	OFF

In the configuration mode the yellow LED located by SW1 micro-switch will blink with frequency 1 Hz. Start the ADAConfig software and make the configuration of transmission parameters for each interfaces and set his visible address from RS1 port (RS485 bus). Firstly should be set a number of COM port for communication with the converter, then readout the configuration from ADA-4040A memory using the button [Read converter configuration] and make the proper changes of interfaces setting.

5.2.1. CONFIGURATION OF ADDRESSING MODE

If the option Converter Address will be enabled, on configuration window should be set a proper converter address from range 1 - 255. If this option is disabled the converter will operate as baud rate converter.

5.2.2. CONFIGURATION OF BAUD RATE AND DATA FORMAT

In both operating modes (addressing / baud rate converter), is possible to set additional transmission parameters for RS1 (RS485/422) & RS2 (RS485/422) interfaces separately, as below:
– baud rate (kbps): 0.3, 0.6, 1.2, 1.8, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, 57.6, 76.8, 115.2, 230.4,
– number of data bites: 5, 6, 7, 8,
– control parity: no control, parity control, control of none parity,
– number of stop bits : 1, 2,
– frame spacing – range from 4 to 255 (silence time as frame's end),

5.2.3. CONFIGURATION DATA FLOW CONTROL

In the section ***Data flow control*** for RS1 & RS2 interfaces, can be set:
– signal DE – Off – RS485/RS422 interface operates only in receiving data mode,
– signal DE – Toggle – RS485 interface operates in receiving & transmitting data mode for RS485 bus 2-wires and 4-wires,
– signal DE – On – RS485/RS422 interface operates in RS422 mode,

After configuration the setting should be saved on converter memory by using button ***[Write converter configuration].***
Return to work in run mode is made by using SW1 switch (yellow LED blink OFF) as below.

SW1-1	SW1-2
OFF	OFF

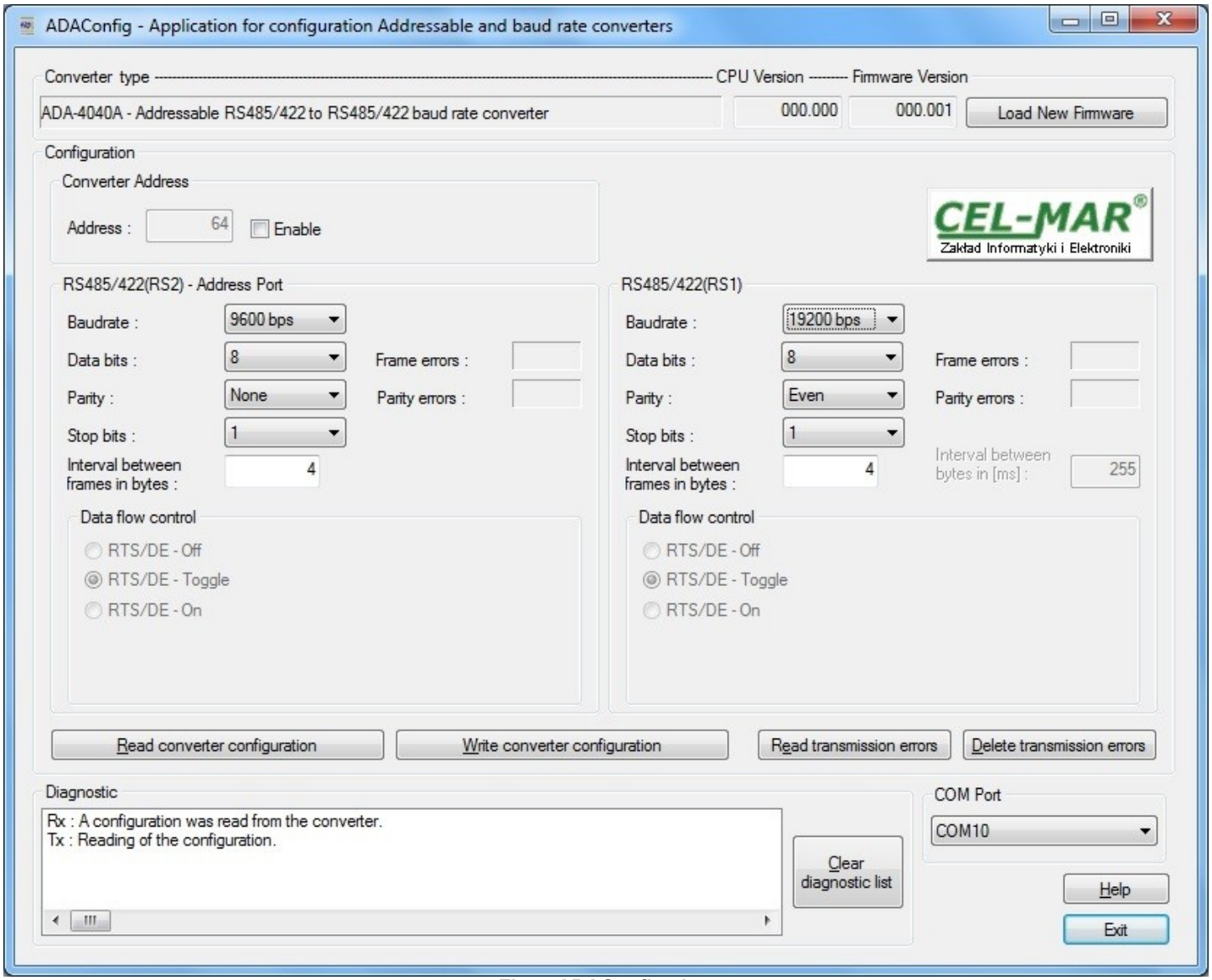

Fig 7. ADAConfig view

5.3. FIRMWARE UPDATE

ATTENTION!!!
THE SOFTWARE IN 0.007 VERSION AND UPPER WILL NOT OPERATE WITH THE CONVERTERS WITH CPU 1.0. VERSION.
IN CASE OF UPDATE THE SOFTWARE TO 0.007 VERSION AND UPPER IN THE CONVERTERS WITH CPU 1.0. VERSION PLEASE CONTACT TO SERVICE.

Set SW1 micro switch to configuration mode as in table below

SW1-1	SW1-2
ON	OFF

Yellow LED will blink with frequency 1Hz in the configuration mode. Press a button ***[Load New Firmware]*** to change the software delivered by manufacturer. The Select File window will open (Fig.8) and select the *.bin file then click ***[Open]*** - software will be load to *ADAConfig* buffer storage and will be checked. If the *ADAConfig* not detect errors in loaded file you can change converter software. Process of updating is visualized by *ADAConfig* in use Progress Window and after proper changing confirmed by correct message.

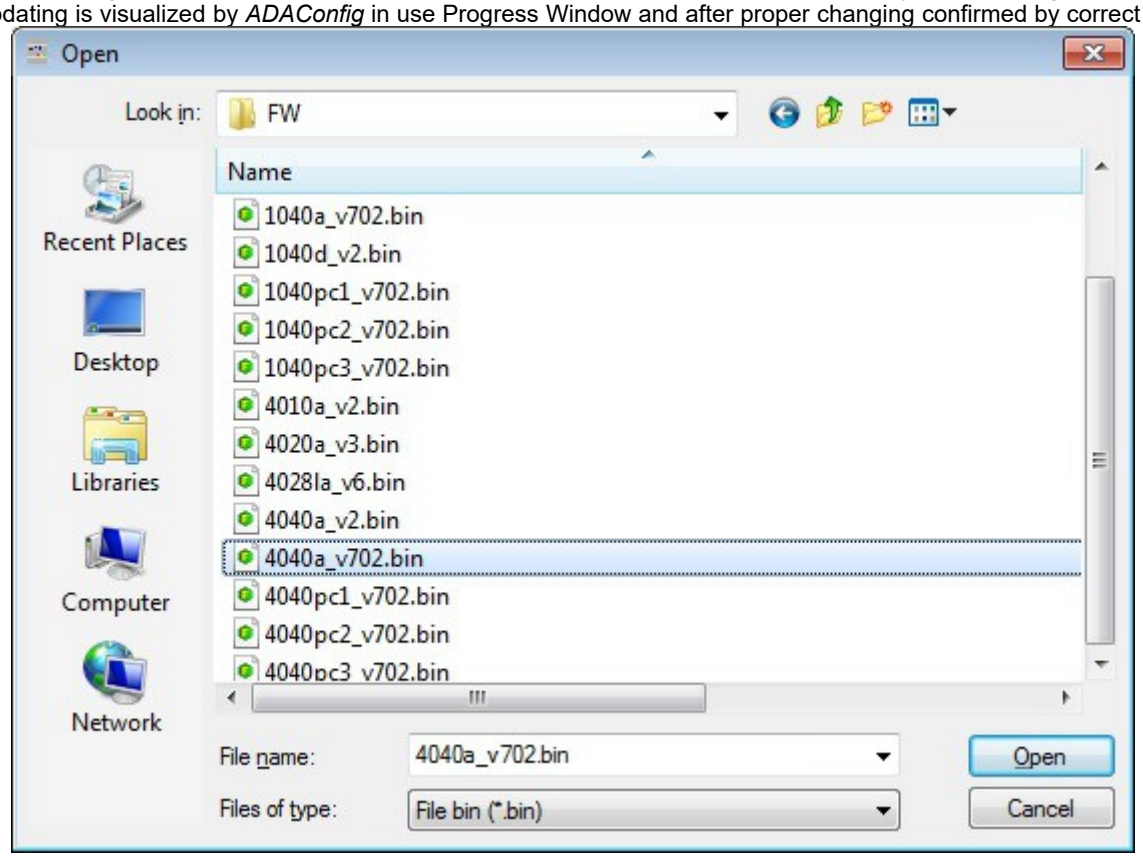

Fig 8. Selection of firmware file

During loading software the yellow LED located beside SW1 micro-switch will blink, showing data flow to ADA-4040A. If the software loaded correctly yellow LED will be blink with frequency 1 Hz.
After that set micro switch SW1 to run mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

Yellow LED will be OFF.

5.4. EMERGENCY FIRMWARE UPDATE

In case of the unsuccessful update of the converter software, try again according to description in point FIRMWARE UPDATE If the update is still incorrect use emergency firmware update. Set SW1 microswitch mode as in the table below.

SW1-1	SW1-2
ON	ON

After micro-switch setting restart the ADA-4040A by turning OFF and then ON the power supply. The yellow LED will light continuously and the converter will be in Emergency Firmware Update mode. Now follow the description in point FIRMWARE UPDATE. After successful updating, set SW1 micro-switch as in table below

SW1-1	SW1-2
OFF	OFF

Yellow LED will be OFF.

5.5. FACTORY DEFAULT

In case of faulty functioning of ADA-4040A, like:
- no communication in the configuration mode,
- transmission errors on RS485/422 bus,
can be restored the factory default setting of the converter internal registers.

Factory default

Parameter	RS1 interface RS485/RS422	RS2 interface RS485/RS422
Converter address - Enable	unset	
Converter address – Address	no active	
Baud rate	9600bps	9600bps
Data bits	8	8
Parity	Non	Non
Stop bits	1	1
Interval between frames in bytes	4	4
Data flow control	DE-TOGGLE	DE-TOGGLE

Set SW1 microswitch mode as in the table below.

SW1-1	SW1-2
OFF	ON

Disconnect the power and after while connect again the power. After that, will be loaded the factory default setting to the converter internal registers.
After this operation, the converter parameters should be set again for operating in the application.
Set micro switch SW1 to run mode (Yellow LED will be OFF) as shown in the table below.

SW1-1	SW1-2
OFF	OFF

5.6. DIAGNOSTICS DATA TRANSMISSION

To readout diagnostics set SW1 to configuration mode (see pt OPERATION MODE).
Correctness of transmission proceed on RS1 and RS2 can be checked by readout the errors list by *ADAConfig* Software from the converter memory. Frames error counter will be increased, in case of: improper speed set compared to real speed of data transmission. Parity error counter will be count the errors which can arise in case of misrepresent bytes in transmitted sign. This counter will not work in case of disable control parity. For checking this counters press the button ***[Read transmission errors],*** and to delete (zeroing of counters in the memory of the converter) press ***[Delete transmission errors].***
In case of parity errors or frame errors check ADA-4040A converter's configuration and correctness connection of RS485 network to RS1 port and addressable device to converter's RS2 port.
When diagnostic is finish, set SW1 micro-switch to run mode (see pt. OPERATION MODE).

6. OPERATION

The ADA-4040A converter can operate in to two modes: not addressable and addressable.

6.1. OPERATION IN NON ADDRESSABLE MODE

In this mode ADA-4040A operates as baud rate converter and data format converter and lets to set different baud rates and data format on RS1 & RS2 interfaces. It lets connect to RS485 network old devices operate with non-configure baud rate and data format, on which operate devices with different baud rate or data format.

6.2. OPERATION IN ADDRESSABLE MODE

In this mode ADA-4040A operates as baud rate converter and data format converter and lets to connect no addressable devices with RSRS485/422 interface, transmitting data at different rates and formats of data frame to the RS485 bus, in the process of enabling the cooperation with addressable devices.
Example connections of ADA-4040A are shown on figures below.
Frame of protocol for no addressable RS485/422 devices, connected to RS2 of ADA-4040A should be created in the following way:

ADDRESS ADA-4040A	*FRAME OF NO ADDRESSABLE DEVICES*

Where::

ADA-4040A ADDRESS - one byte of address from 1-255 scope, - set in the memory of ADA-4040A during configuration in use of *ADAConfig,*

FRAME OF NO ADDRESSABLE DEVICES - free sequence of bytes containing the appropriate frame of device, connected to RS2 port. Not longer than 950 bytes.

ADA-4040A converter with set up addressing is listening constantly to frame on RS485 bus via RS1 port. If received frame contains byte of address equal to address of converter, then another bytes of frame are received, right up to silence on RS-485 bus equal to 'space between frames in signs'. If the frame is received correctly, the address byte is deleted and transmitted over as typical to the RS2 port. In case of errors in received frame, it isn't transmitted to RS2. In this case should be send the previous frame one more.
The frame received from device connected to RS2 port is being tested of transmission errors and in case of their missing converter adds address to beginning of frame and send it to RS-485 bus through RS1.
Frame containing errors isn't being transmitted to RS1 port.
In case of transmitting of frames containing more than 950 bytes converter receive only 950 bytes and next are ignored.
ADA-4040A has equipped with separate buffers for RS1 and RS2, therefore converter can operate in full duplex mode on RS-422 and RS-485 4-wire bus.
Additionally, can be set data flow control for RS1 (RS485/RS422) interface and RS2 (RS485/RS422) interface according to pt. CONFIGURATION BY THE USE OF ADACONFIG.
Figures below present possibility of using the addressable ADA-4040A baud rate converter.

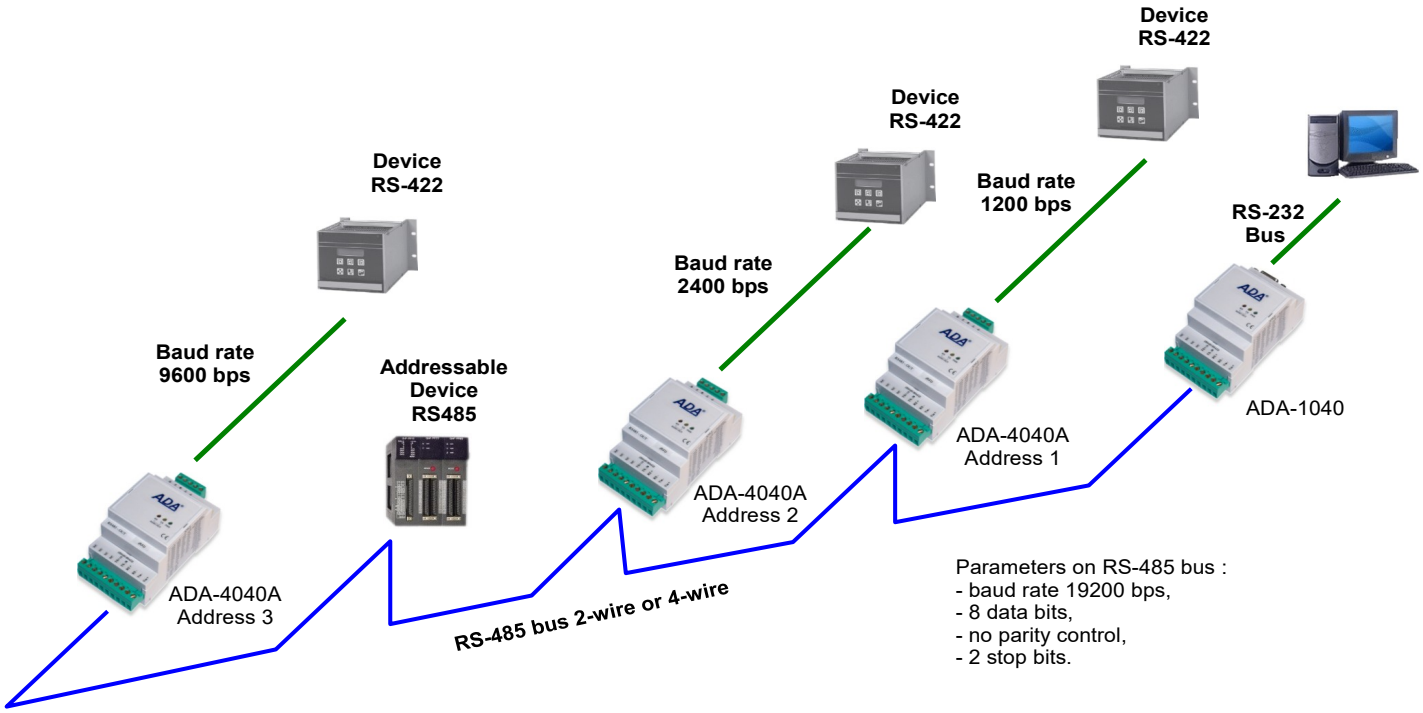

Fig 9. Connection of no addressable RS422 devices to RS485 bus

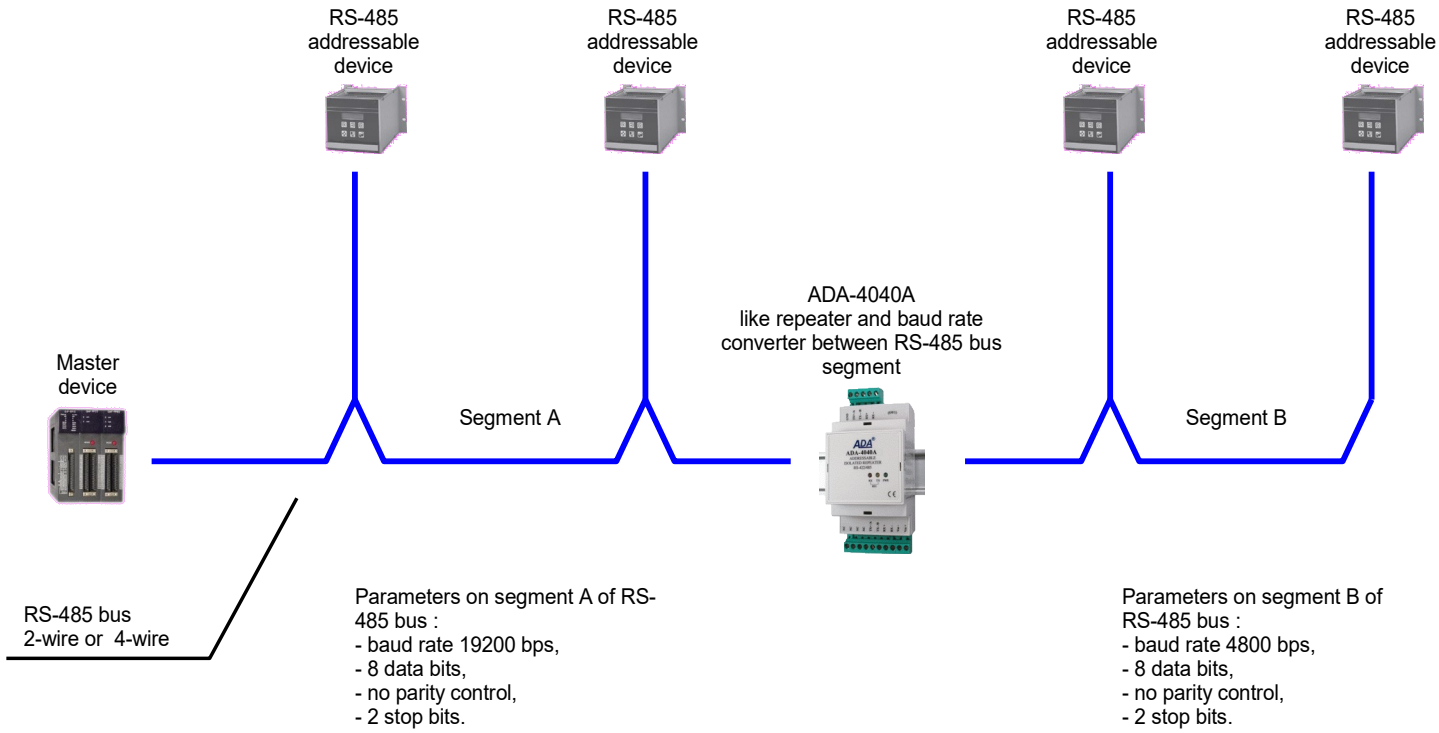

Fig 10. Connection of RS485 bus segments with different baud rate and format data frame devices, additionally galvanic separation of bus segments

7. CHANGES IN THE SOFTWARE

From CPU 2.0 and software 000.007 versions, was added:
- flow data control by the use of DE signal for RS1 (RS485/RS422) & RS2 (RS485/RS422) interfaces. Description of using new option is in pt. CONFIGURATION BY THE USE OF ADACONFIG,
- converter operating mode *factory default* is set by the use of SW1 micro-switch, see pt. OPERATING MODE

ATTENTION!!!

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IN CASE OF UPDATE THE SOFTWARE TO 0.007 VERSION AND UPPER IN THE CONVERTERS WITH CPU 1.0. VERSION PLEASE CONTACT TO SERVICE.

8. VERSIONS

ADA-4040A - [ ] - [ ]

Galvanic isolation:	
1kV=, 2-way	**2**
1kV=, 3-way	**23**
3kV=, 2-way	**3**
3kV=, 3-way	**33**

Terminal & Terminal Cover:	
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-4040A-23-3**
23 – 3-way galvanic isolation on the level 1kV=,
3 - cover without inlets, plug-in screw terminal block,

9. SPECIFICATION

TECHNICAL DATA		
Transition Parameters		
Interface	**RS-485/RS-422 (RS1)**	**RS-485/RS-422 (RS2)**
Connector	Screw terminal block - max. Ø 2,5mm^2	Screw terminal block - max. Ø 2,5mm^2
Line length	1200 m (depend on baud rate)	1200 m (depend on baud rate)
Max. number of connected device	32	
Baud rates	300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,	
Data format	Data bit: 5, 6, 7, 8, Parity: None, Odd, Even, Number of stop bits: 1, 2,	
Transmission line	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5 (24AWG)	
Transmission type	Asynchronous full duplex, half duplex.	
Standards	EIA-485, CCITT V.11	
Optical Signalization	• PWD – green LED power supply, • RX - red LED data receiving on RS1 – RS485/RS422 side, • TX - yellow LED data transmission via RS1 – RS485/RS422 Bus.	
Electrical Parameters		
Power requirements	10 – 24 – 30 V DC	
Power Cable	Recommended length of power cable – do 3m.	
Power	<2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kVDC or 3kVDC - between power circuit and RS-485/RS-422 (RS1,RS2) signal line	
Optoisolation	~3kV - between signal 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
Casing	
Dimensions	53 x 90 x 62 mm
Material	PC/ABS
Degree of casing protection	IP40
Degree of terminal protection	IP20
Weight	0,10 kg
According to standards	DIN EN50022, DIN EN43880
Location during work	Free
Mounting	Rail mounting according to DIN35 standard / TS35.

Dear Customer,

Thank you for purchasing **CEL-MAR Company** product.
We hope that this user manual helped connect and start up the **ADA-4040A converter.** 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, Ethernet, Wi-Fi, Current Loop, Fibre-Optic Converters and other.

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