CEL-MAR®
Zakład Informatyki i Elektroniki

User Manual

ADA-4010A
Addressable RS-485/RS-422 to RS-232 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. GUARANTEE INFORMATION

ADA-4010A 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 **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 install in the safe and stable place (e.g. switchbox unit), the powering cable should be arranged this way isn't exposed to treading, catching or tear out from power 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 leaving out of the powering network is coming only after disconnecting voltage in the powering circuit.
Do not take the installation or device disassembly if it is turn on. It can lead to the electric short circuit and damaging 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 converter.

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 CONSERVATION

ADA-4010A converter doesn't require the periodic conservation.
Technical support at the number: +48 41 362-12-46 in 8.00-16.00, from Monday to Friday.

1.6. PACK CONTENTS

ADA-4010A converter; user manual; CE declaration; resistors: Rt=120Ω (2 pcs.); CD with ADAConfig software.

2. PRODUCT INFORMATION

2.1. PROPERTIES

● Possibility for adding the address to not addressable device connected to RS232 interface,
● Conversion data format and baud rate on RS485 / RS422 and RS232 converter ports,
● Operating on 2 or 4 wire bus in point-to-point or multi-point mode,
● Conversion of TX, RX signals to RS485/RS422 standard,
● RTS data flow control via RS232 port,
● Operating up to 32 devices on RS485 network,
● Baud rate of RS232 and RS485/422 interfaces (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
● RS232 & RS485/422 interface's data format: Number of data bites: 5, 6, 7, 8; Parity: None, Odd, Even; Number of stop bits : 1, 2,
● Transparent for all protocols which data format is in accordance with the above specifications of RS485/422 interfaces e.g. MODBUS, DNP, PROFIBUS and others,
● Power supply 10 - 30 VDC stable min. 2W,
● 5kV= optoisolation in signal channel between RS232 and RS485/RS422 interface,
● 1kV= or 3kV= galvanic isolation between RS485/RS422 interface and power supply,
● Connection RS485/RS422 and RS232 buses and power supply via screw terminal block 2.5 mm^2,
● Implemented short circuit protection and over-voltage protection on RS-485/RS-422 interface's lines,
● Protection against power supply reverse connection,

- 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-4010A addressable converter is device solving the problem of connecting no addressable devices equipped with the RS232 interface to multi-point RS485 bus by adding the address to RS232 device.

At the same time converter turns RS485/422 standard to RS232 standard with possibility of interference with the format of transmitted data. It can be set baud rate, number of data bites, control parity and number of stop bits depend on configuration. The setting can be different for RS232 port and RS485/422 port.

It is not required for operating, power supply form RS232 port, converter supports asynchronous baud rate up to 230,4 kbps through one or two pairs of twisted cable of RS485/422 interface. ADA-4010A is equipped with screw terminal block for connection of RS232, RS485/422 and power supply. Converter uses RX, TX, GND signals and RTS signal of RS232 is used for data flow control type: RTS-ON, RTS-TOGGLE, RTS-OFF and CTS signal is not use, DTR signal is connected with DSR. Other signals are not connected. If is not needed looping above signals, can be not connect DTR to the terminal block.

Surge protection on each RS485/422 lines, has been made on the base of diode suppressors and fuses.
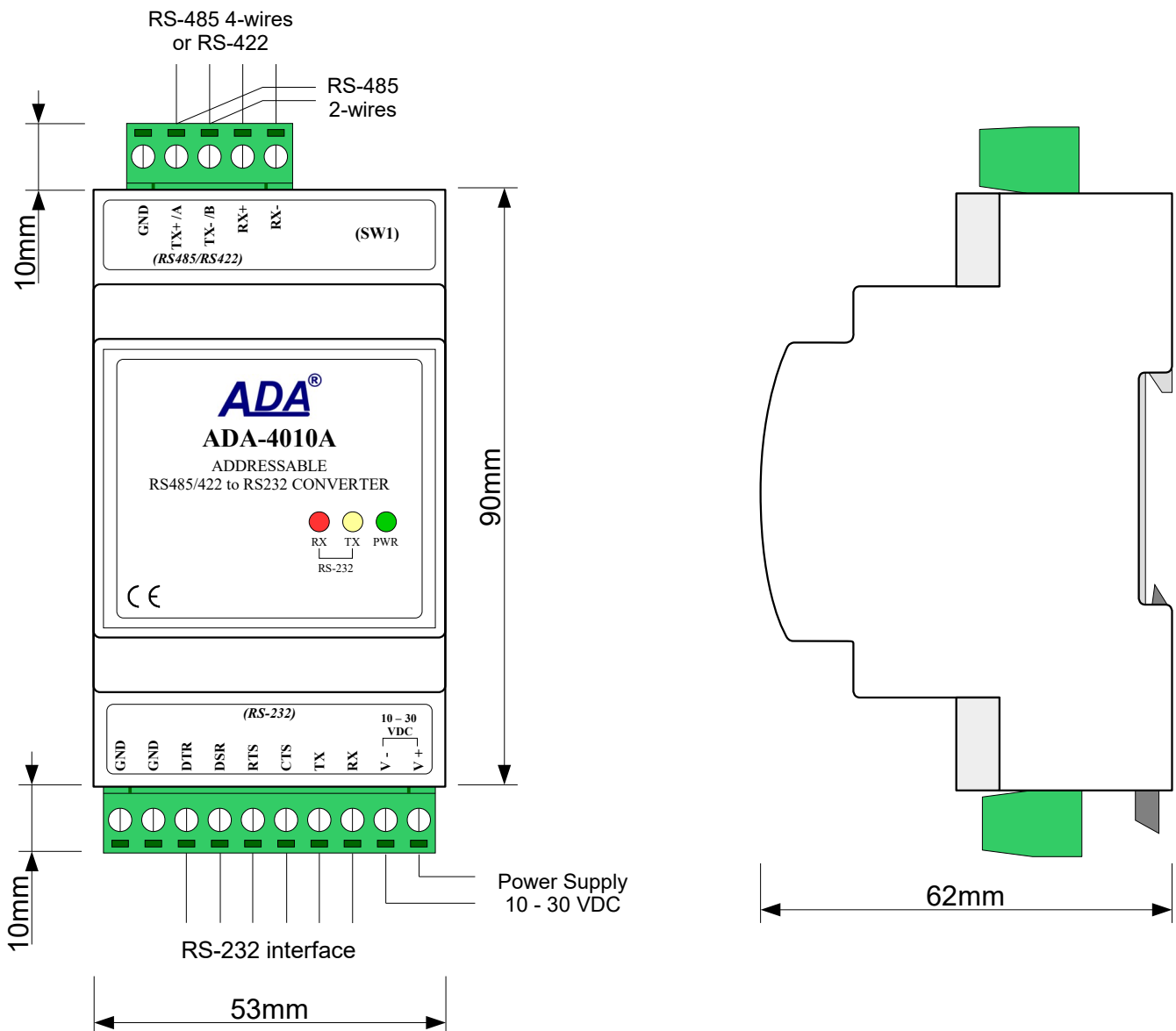

Fig 1. View of ADA-4010A and SW1 location

2.3. ISOLATION

Converter ADA-4010A has 2-way or 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.
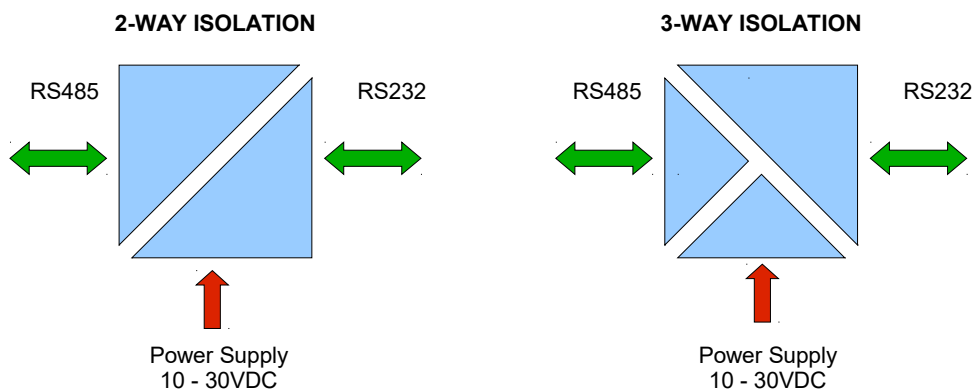
2-WAY ISOLATION

RS485   RS232

Power Supply
10 - 30VDC

3-WAY ISOLATION

RS485   RS232

Power Supply
10 - 30VDC

Fig 2. Isolation structure

3. INSTALLATION

This chapter will show how to use and connect ADA-4010A to computer, 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-4010A converter is adapted to assembly on TS-35 (DIN35) rail. To install the converter, should be mounted on the rail upper part of the cover then press bottom part to hear characteristic „Click" sound.

3.2. COMPUTER CONNECTION

ADA-4010A can be connected to RS232 port or USB of PC by the use of additional converter eg. RS232 to RS485 (ADA-I1040) or USB to RS485 (ADA-I9140). The connection is made via RS485/RS422 bus, as on the figure bellow.

PC   **ADA-I1040**   **ADA-4010A**

RS232 connector DB-9M/DTE	RS232 Connector DB-9F/DCE	Screw connector RS485 / RS422	RS485(4W)	Screw connector RS485 / RS422	Screw connector RS232
(2) Rx	Tx (2)	Tx+/ A		Tx+ / A	Tx
(3) Tx	Rx (3)	Tx-/ B		Tx- / B	Rx
(5) GND	GND (5)	Rx+		Rx+	RTS
		Rx-		Rx-	CTS
		GND			GND
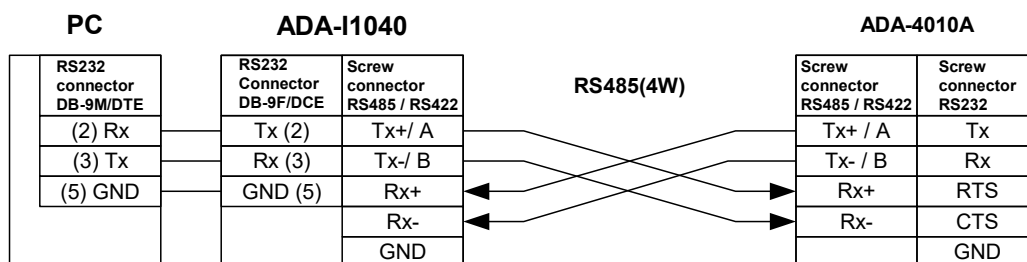
Fig 3. ADA-4010A connection to PC by the use of RS232 to RS485/RS422 converter ADA-I1040

PC   **ADA-I9140**   **ADA-4010A**

USB connector	USB connector	Screw connector RS485 / RS422	RS485(4W)	Screw connector RS485 / RS422	Screw connector RS232
USB	USB	Tx+/ A		Tx+ / A	Tx
		Tx-/ B		Tx- / B	Rx
		Rx+		Rx+	RTS
		Rx-		Rx-	CTS
		GND			GND
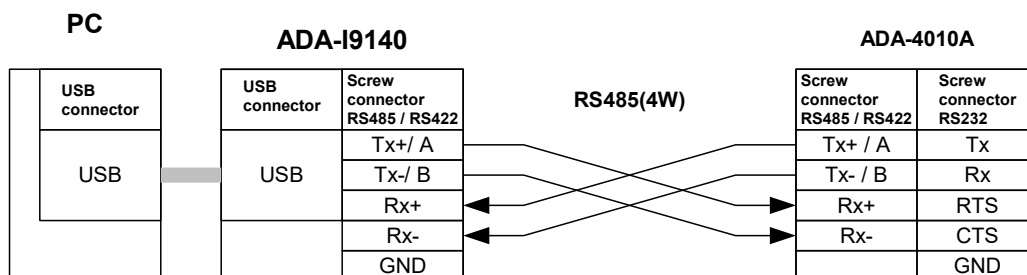
Fig 4a. ADA-4010A 4-wires connection to PC by the use of USB to RS485/RS422 converter ADA-I9140

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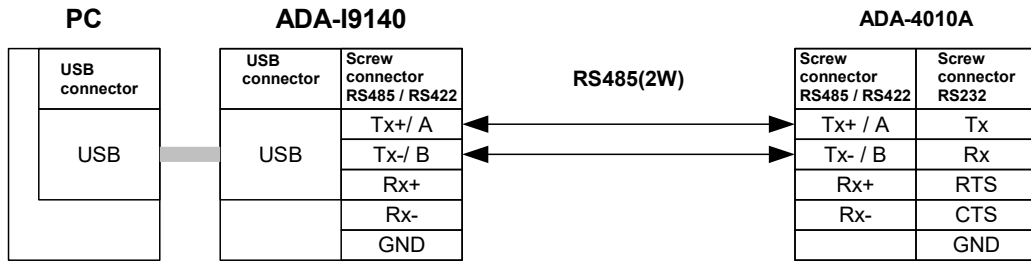
Fig 4b. ADA-4010A 2-wires connection to PC by the use of USB to RS485/RS422 converter ADA-I9140

3.3. RS485 BUS CONNECTION

The RS485/RS422 interface at ADA-4010A converter is available on terminal block described as: Tx+/A, Tx-/B, Rx+, Rx-, GND. Below are shown connections of ADA-4010A converter to RS485(4W) and RS485(2W) buses.

3.3.1. RS485(4W) BUS CONNECTION

Fig 5. Example connection of ADA-4010A to RS485(4W) 4-wire bus and galvanic separation SLAVE device

3.3.2. RS485(2W) BUS CONNECTION

Fig 6. Example connection of ADA-4010A to RS485(2W) 2-wire bus and galvanic separation SLAVE device

3.3.3. GND TERMINAL CONNECTION

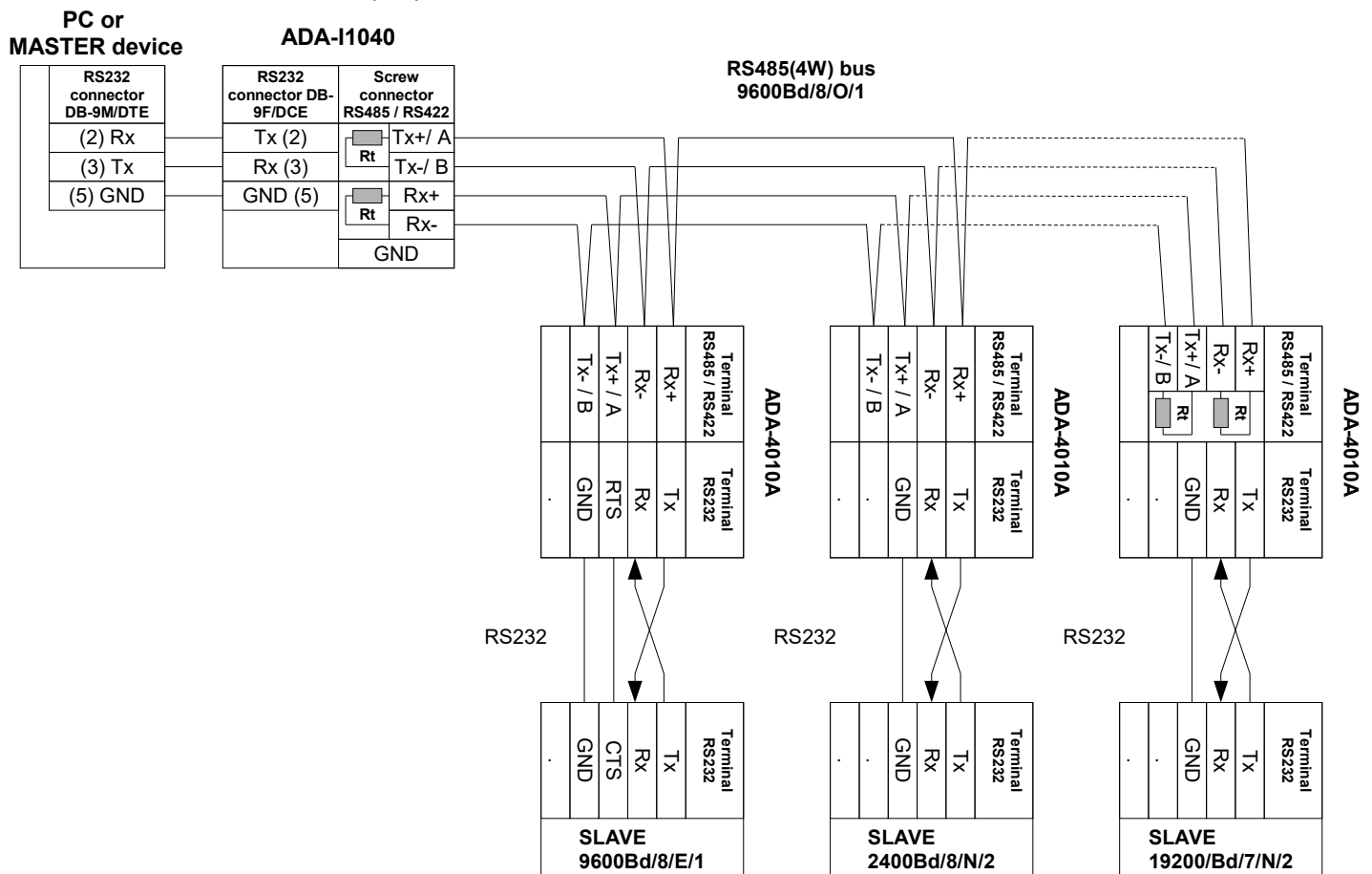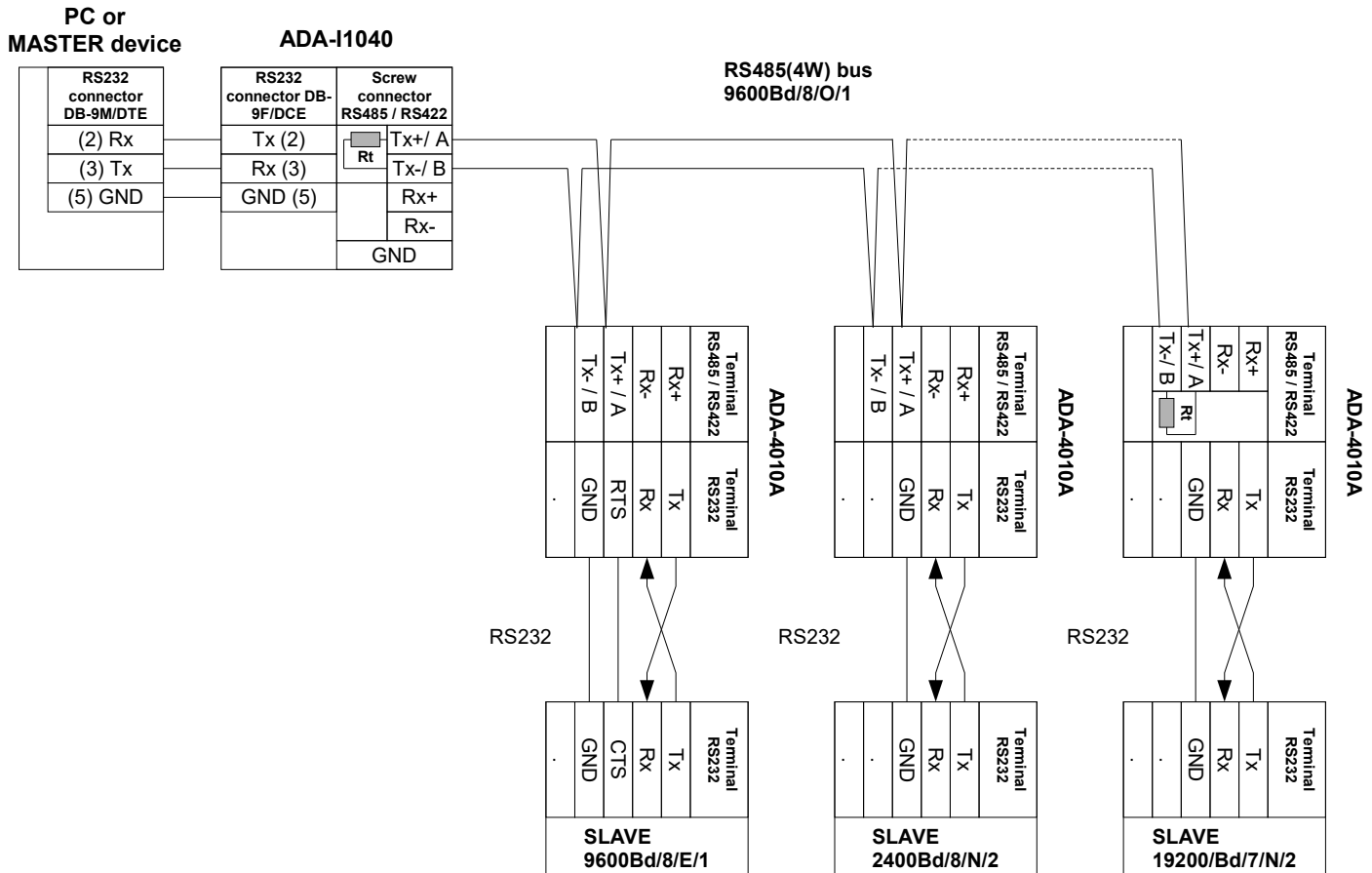Connection of GND terminals of RS485/422 interfaces, devices connected to RS485/422 bus, should be done in the case of a potential difference of the signals grounds on interfaces RS485 / RS422, which prevents proper data transmission.
Cannot connect to the GND terminal - cables screens, PE circuit of electrical installation, signals grounds of other devices.

3.3.4. LINE TERMINATION Rt

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. Should be used the Line Termination resistor if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd, and if the disturbance in transmission will appear.
Example connection of resistor Rt are shown on fig.5 & fig.6. Two resistors Rt=120 Ω , 5%, 0,25W is delivered with ADA-4010A.

3.3.5. CONNECTION OF RS232 INTERFACE DEVICES

Connections of SLAVE device with RS232 interface to ADA-4040A are shown on fig.5 & fig.6.

3.4. POWER SUPPLY CONNECTION

To connect power supply to the converter, should have DC power supplies (regulated) output voltage from 10 V= to 30V=, min. nominal power 2W, e.g. DR-15-24. Power cable from DC power supplies to device can not be longer than 3m. Should connect positive (+) end of DC power supplies to V+ device terminal and negative (-) end to V- on terminal block. ADA-4010A has protection against power supply reverse connection. If after power connection the green LED PWR on front panel is not lit, check correctness of power supply connection (polarisation).

4. ACTIVATION

The converter can be power on after properly connection according to section above.
If after connection power supply on front panel will not light green led PWR, check correctness of power supply connecting (polarization). When data is present the LEDs Tx and Rx should blink

4.1. DESCRIPTION OF SIGNALLING LEDS

LED	Description
PWR	Signalling of Power Supply
Normal Operating	
RX	Signalling of data receiving through ADA-4010A converter from RS232 port.
TX	Signalling of data transmitting from ADA-4010A converter through RS232 port.
Configuration	
LED by SW1	Blink with frequency1 Hz - signalling of configuration mode (see micro-switch SW1 setting).
Software 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 not light	Check polarization and parameters of connected power supply.
Tx led light 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 blinking.	RS485(4W) / RS422 bus. Check connection correctness of Tx, Rx terminals according to chapter 3.

5. CONFIGURATION

5.1. CONVERTERS OPERATION MODE

ADA-4010A converter can operate in few modes as:
– run,
– configuration,
– factory default,
– emergency firmware update

Those modes can be set by use SW1 located by terminal block RS455/RS422. To set the switch section, should remove terminal cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver.
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-4010A converter should be done by use of **ADAConfig** software - selling with converter.
To make the configuration, connect converter to computer (see pt. CONNECTION TO PC) 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 RS485 bus. Firstly should be set a number of COM port for communication with the converter, then readout the configuration from converter's 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 RS485/422 & RS232 interfaces separately, like:
– 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 RS232 & RS485/RS422 interfaces, can be set:
a) for RS232 interface:
– signal DE – Off – disabled continuously,
– signal DE – Toggle – RTS is setted ON during data transmission and OFF after end data transmission,
– signal DE – On – enabled continuously,
b) for RS485/RS422 interface:
– 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.
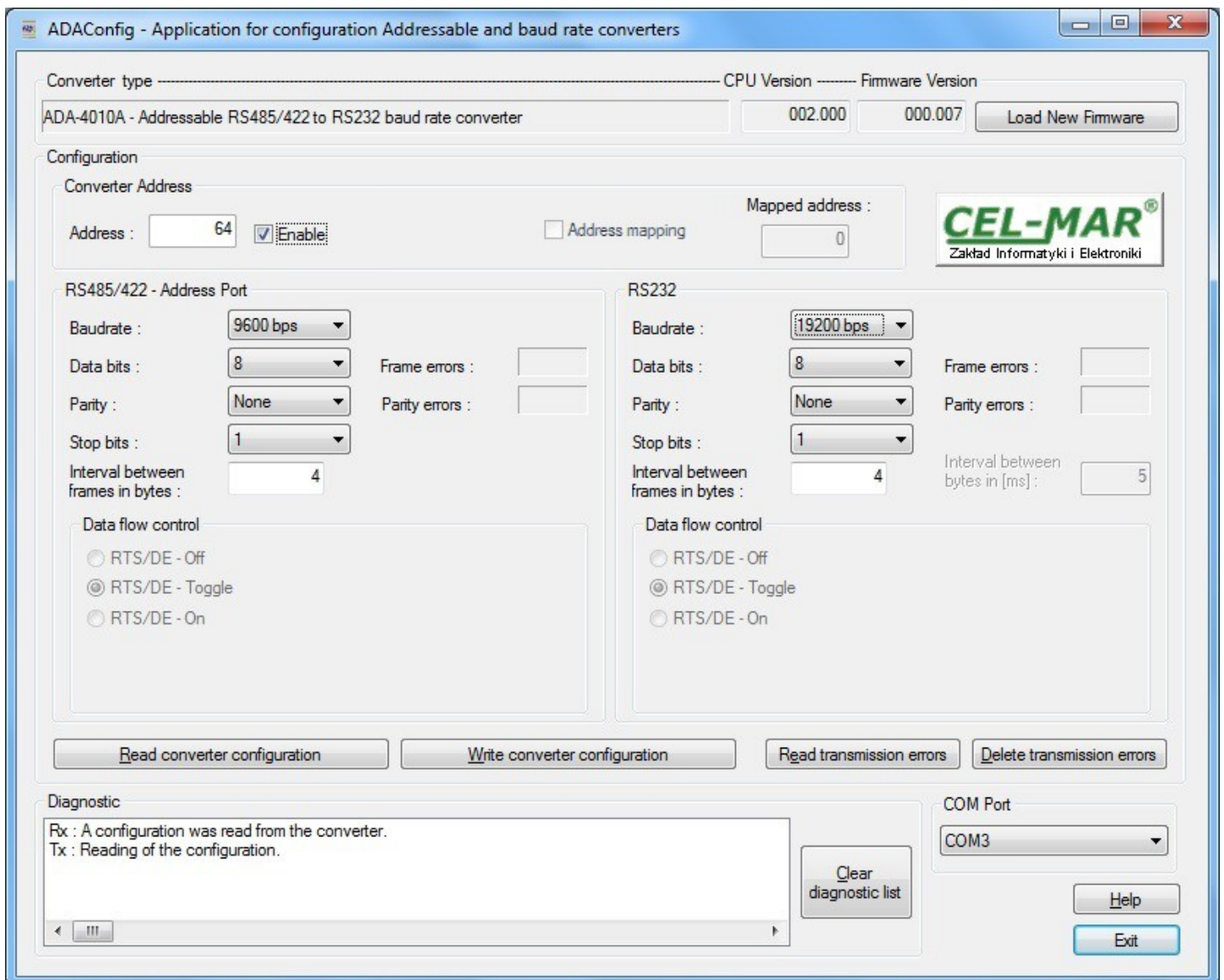
SW1-1	SW1-2
OFF	OFF

Fig 7. ADAConfig view

5.3. FIRMWARE UPDATE

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 this 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, change converter software. Process of updating is visualized by ADAConfig in use Progress Window and after proper changing confirmed by correct message.
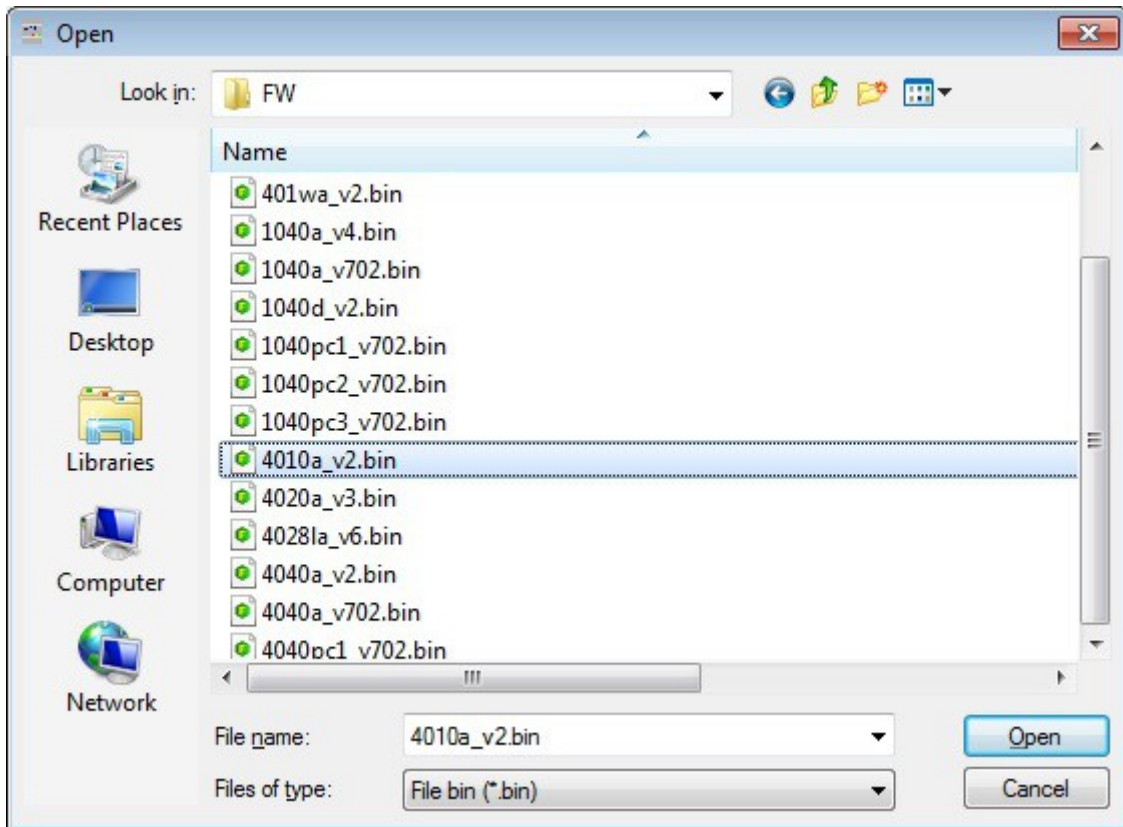

Fig 8. Selection of firmware file

During loading software the yellow LED located beside SW1 micro-switch will blink, showing data flow to ADA-4010A. 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 microswitch setting, should be restarted ADA-4010A, 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. Yellow LED will be OFF.

SW1-1	SW1-2
OFF	OFF

5.5. FACTORY DEFAULT

In case of faulty functioning of ADA-4010A, 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	RS485/RS422 interface	RS232 interface
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.

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. DATA TRANSMISSIONS DIAGNOSTIC

To readout diagnostics should be set SW1 microswitch to the configuration mode (see pt. OPERATION MODE).
Correctness of transmission proceed on RS232 interface and RS485/422 interface 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. To check those 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, should be checked the ADA-4010A converter's configuration and correctness connection of RS485 bus to RS485/422 port and RS232 device connected to the converter RS232 ports.
After finishing the diagnostics, the SW1 micro-switch should be set to run mode (see pt. OPERATION MODE).

6. OPERATION

ADA-4010A converter can operate in addressable mode and not addressable mode.

6.1. OPERATING IN NOT ADDRESSABLE MODE

ADA-4010A operates as baud rate and data format converters in not addressable mode and lets to set different baud rates and data formats on RS232 and RS485/422 interfaces.
This allows connecting old devices operates with not configure baud rate and data format on RS485 bus, where operate devices with different baud rate or different data format.

6.2. OPERATING IN ADDRESSABLE MODE

In this mode ADA-4010A operates as baud rate and data format converters and lets to connect not addressable RS322 interface devices transmitting data with different baud rates and data frames format to RS485 bus, and thus lets to cooperate with not addressable devices.
Example connection is shown on figures below.
Frame of protocol for not addressable devices connected to RS232 port of ADA-4010A on RS485 bus should be created in the following way:

ADDRESS ADA-4010A	FRAME OF PROTOCOL FOR NOT ADDRESSABLE DEVICES

Where:

ADDRESS ADA-4010A   - one byte of address from 1-255 scope - set in the memory of ADA-4010A during configuration in use of ADAConfig,

FRAME OF NOT ADDRESSABLE DEVICES   - free sequence of bytes containing the appropriate frame of connected device of the RS232 port. Not longer than 950 bytes.

ADA-4010A converter with set up addressing is listening constantly to frame on RS485 bus via RS485/22 port. If received frame contains byte of address equal to converter address 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 RS232 port.

In case of errors in received frame, it isn't transmitted to RS232 port. In this case should be send the previous frame. The frame received from device connected to RS232 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 via RS485/RS422 port. Frame containing errors isn't being transmitted to RS232 port. In case of transmitting of frames containing more than 950 bytes converter receive only 950 bytes and next are ignored. ADA-4010A was equipped with separate buffers for RS232 and RS485/422 ports, therefore converter can operate at full duplex mode on RS-422 and RS-485 (RS2) 4-wire bus.

Additionally, can be set data flow control for RS485/RS422 and RS232 interfaces according to pt. CONFIGURATION BY THE USE OF ADACONFIG.

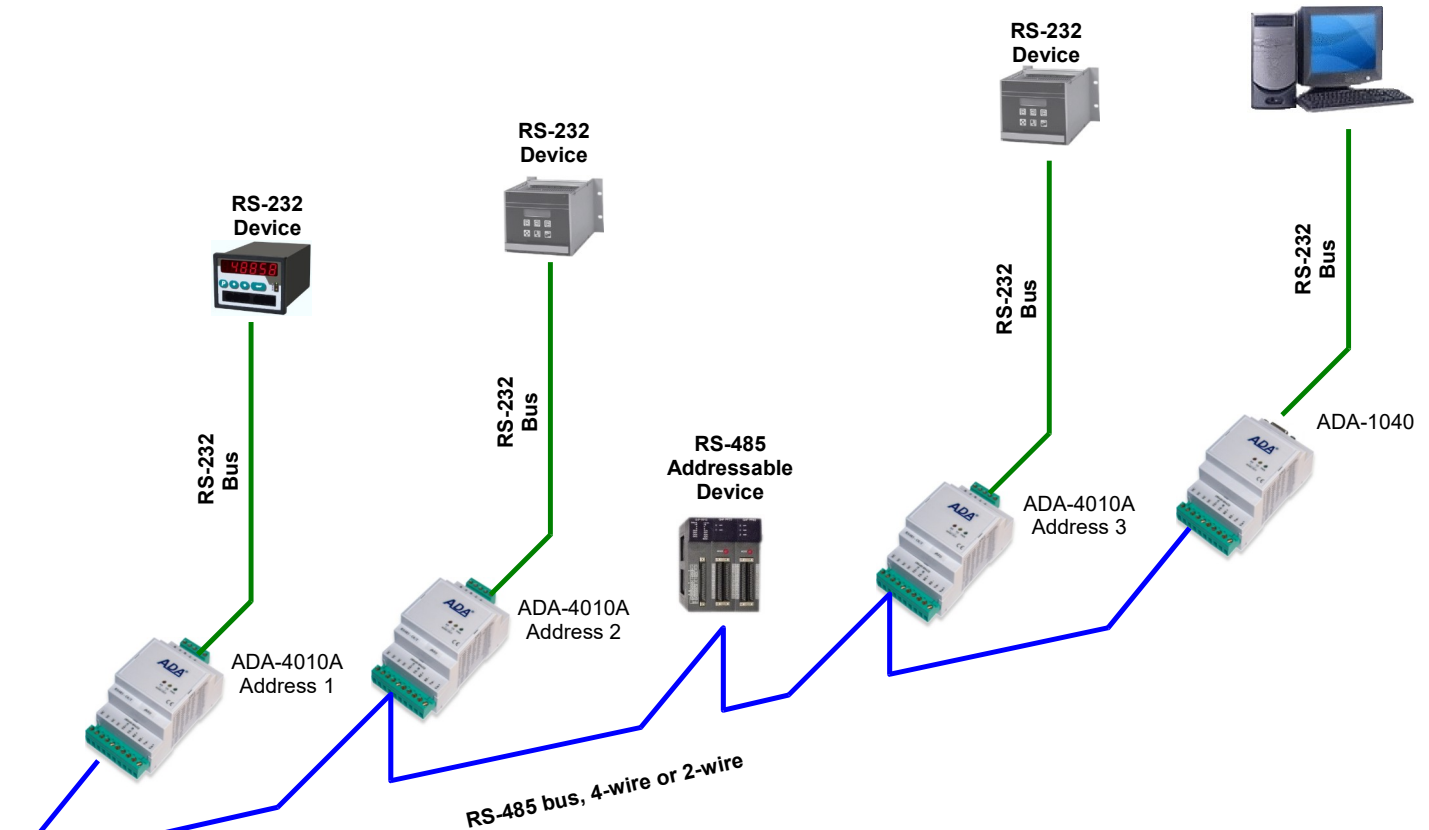On a picture below are shown the possibilities of using the addressable ADA-4010A baud rate converter.

Fig 9. Connection of not addressable RS232 devices to RS485 Bus

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 RS485/RS422 interfaces and flow data control of RS232 signal for RS232 interface. 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!!!

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.

8. DESCRIPTION OF RS232 INTERFACE

Terminal	Signal	Description	ADA-4010A
TX	(TD)	Transmitted Data	Transmitter
RX	(RD)	Received Data	Receiver
RTS	(RTS)	Request To Send	Looped with CTS
CTS	(CTS)	Clear To Send	Looped with RTS
DSR	(DSR)	Data Set Ready	Looped with DTR
DTR	(DTR)	Data Terminal Ready	Looped with DSR
GND	(SG)	Signal ground	GND

9. VERSIONS

ADA-4010A - ☐ - ☐

Galvanic isolation:

1kV=, 2-way	**2**
1kV=, 3-way	**23**
3kV=, 2-way	**3**
3kV=, 3-way	**33**

Terminals & Terminals Cover:

Cover without inlets, screw terminal block	**1**
Cover without inlets, screw terminal block	**2**
Cover without inlets, plug-in screw terminal block	**3**

Order example:
Product Symbol: **ADA-4010A-23-3**

23 – 3-way galvanic isolation 1kV=,

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

10. SPECIFICATION

TECHNICAL DATA		
Transmission Parameters		
Interface	**RS-232**	**RS-485/RS-422**
Connector	Screw terminal block - max. Ø 2,5mm^2	Screw terminal block - max. Ø 2,5mm^2
Line length	up to 15 m	1200 m
Max. number of connected device	1	32
Transmission line	Multi-wire cable 9x0,34 in shield	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5 (24AWG)
Standards	EIA-232, CCITT V.24,	EIA-485, CCITT V.11
Transmission type	Asynchronous full duplex, half duplex.	
Optical Signalization	• PWD – green LED power supply, • RX - red LED data receiving on RS-232 side, • TX - yellow LED data transmission via RS-232 interface.	
Electrical Parameters		
Power requirements	10 - <u>24</u> – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m	
Power	<2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	2-way or 3-way on the level 1kV= or 3kV= DC between power circuit and RS-485/422 signal line	
Optoisolation	3kV= between signal line RS485/422 and RS-232	
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-4010A 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.

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

CEL-MAR sp.j.
Computers Science and Electronic Factory
Sciegiennego 219C Str.
25-116 Kielce, POLAND

Tel..: +48 41 362-12-46
Tel/fax...: +48 41 361-07-70
Web.. : http://www.cel-mar.pl
Office...: office@cel-mar.pl
Sales department............................ : sales@cel-mar.pl
Technical information .... : support@cel-mar.pl