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.

1.3. CE LABEL

CE symbol on organizing the company CEL-MAR a conformity of the device to the directive of the electromagnetic **EMC 2004/108/WE** compatibility means (Electromagnetic Compatibility Directive). The declaration of the agreement is accessible through the contact with the technical service at the address e-mail: support@cel-mar.pl or on the phone at the +48 41 362-12-46.

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

The 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.

2. PRODUCT INFORMATION

Converter is delivered with: User Manual, Line terminators 120Ω (2 pcs.), CD-ROM with ADAConfig software.

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 network in point-to-point or multi-point mode,
● Operating up to 32 devices on RS485 network,
● Conversion of TX, RX signals to RS485/RS422 standard,
● Possibility of connection up to 32 devices on RS485 network,
● Baud rate up to 230,4 kbps,
● Automatic data flow control on RS485 network,
● Transparent for all protocols: MODBUS, DNP and other,
● Any format of byte defined with the specification of RS232 interface,
● 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 suppl,
● Implemented short circuit protection and over-voltage protection on RS-485/RS-422 network,
● Connection RS485/RS422 and RS232 network and power supply via screw terminal block,
● Casing compatible with DIN 43880 standard– mounting in typical electro-installation unit,
● Casing adapt to rail mounting according to DIN35 / TS35 standard,
● Casing dimensions (W x D x H) 53mm x 58mm x 90mm.

![CEL-MAR logo] CEL-MAR®
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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 pair 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 is looped with CTS and DTR with DSR inside converter. Other signals are not connected. If it is not need to looped this signals, do not connect RTS or DTR to terminal block.

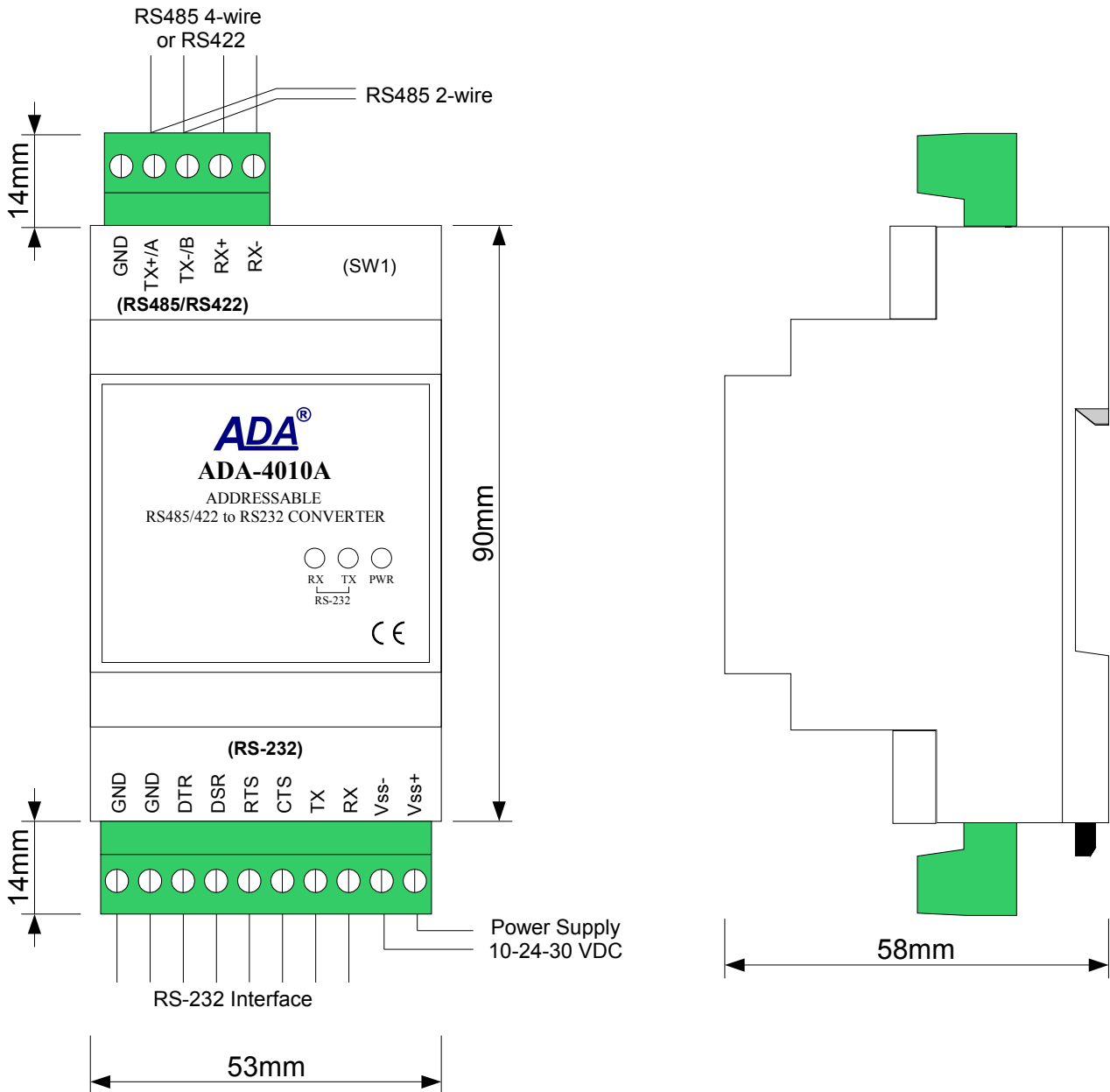Surge protection on each RS485/422 line been based on diode suppressors and fuses.

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.
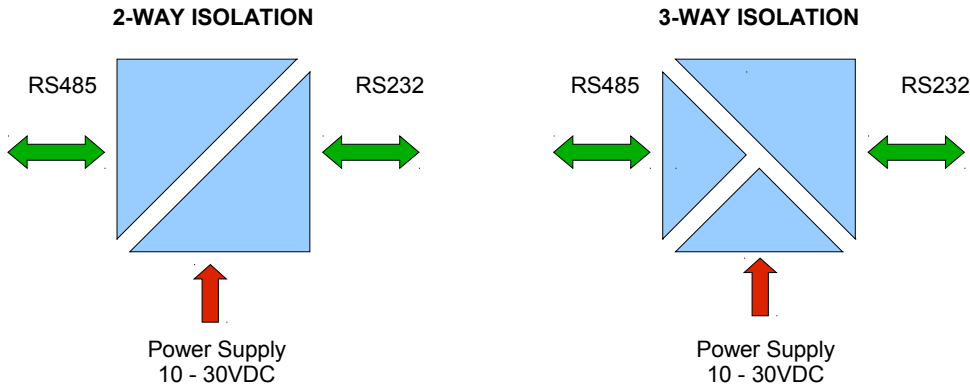
2-WAY ISOLATION

3-WAY ISOLATION

RS485   RS232   RS485   RS232

Power Supply
10 - 30VDC

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

To connect ADA-4010A converter to:
– RS232 port of computer should be made a cable according to schema on Fig.3,
– USB port of computer is needed additional converter USB to RS232 e.g. ADA-I9110 converter or ADA-I9111 converter. Typical connection of ADA-4010A to PC is shown on Fig. 4.

Transmission parameters of PC <=> ADA-4010A used during configuration:
● baud rate 9600 bps,
● 8 data bits,
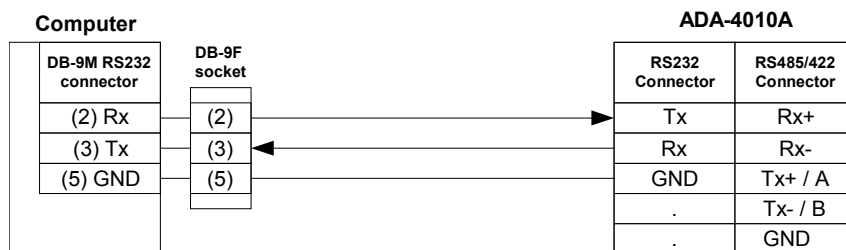● non parity bit,
● 1 stop bit.

Computer			ADA-4010A	
DB-9M RS232 connector	**DB-9F socket**		**RS232 Connector**	**RS485/422 Connector**
(2) Rx	(2)		Tx	Rx+
(3) Tx	(3)		Rx	Rx-
(5) GND	(5)		GND	Tx+ / A
			.	Tx- / B
			.	GND

Fig 3. Connection to computer by the cable.

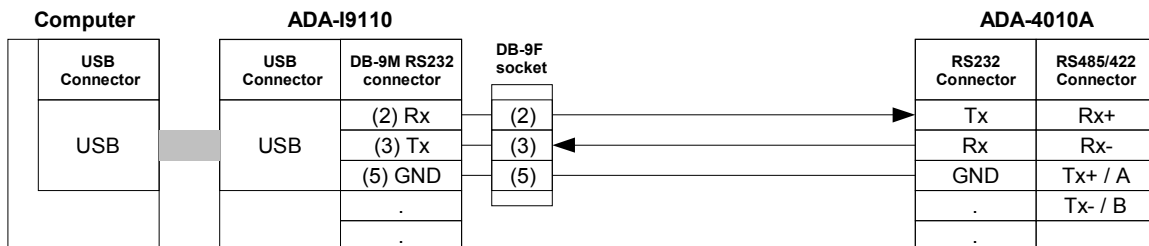| Computer	ADA-I9110		DB-9F socket		ADA-4010A	
USB Connector	**USB Connector**	**DB-9M RS232 connector**			**RS232 Connector**	**RS485/422 Connector**
		(2) Rx	(2)		Tx	Rx+
USB	USB	(3) Tx	(3)		Rx	Rx-
		(5) GND	(5)		GND	Tx+ / A
		.			.	Tx- / B
		.			.	

Fig 4. Connection to Computer by the use of USB to RS232 converter (ADA-I9110/ADA-I9111)

3.3. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-4010A converter is described as:
Tx+/A, Tx-/B, Rx+, Rx-, GND.
Connection of ADA-4010A to RS485(4W) and RS485(2W) network are shown bellow.

3.3.1. RS485(4W) BUS CONNECTION

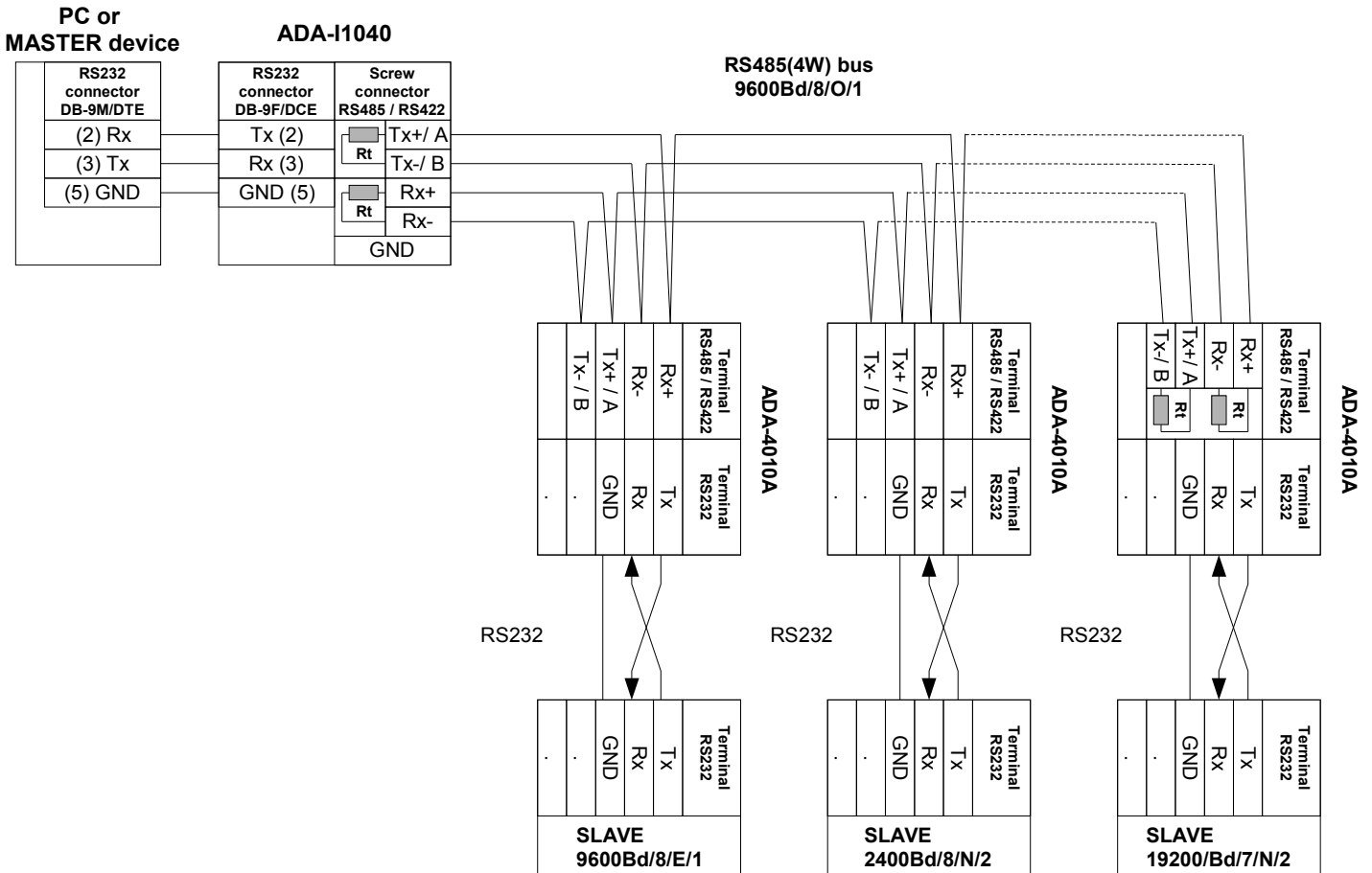**Fig 5. Example connection of ADA-4010A to RS485(4W) 4-wire bus and galvanic separation SLAVE device**
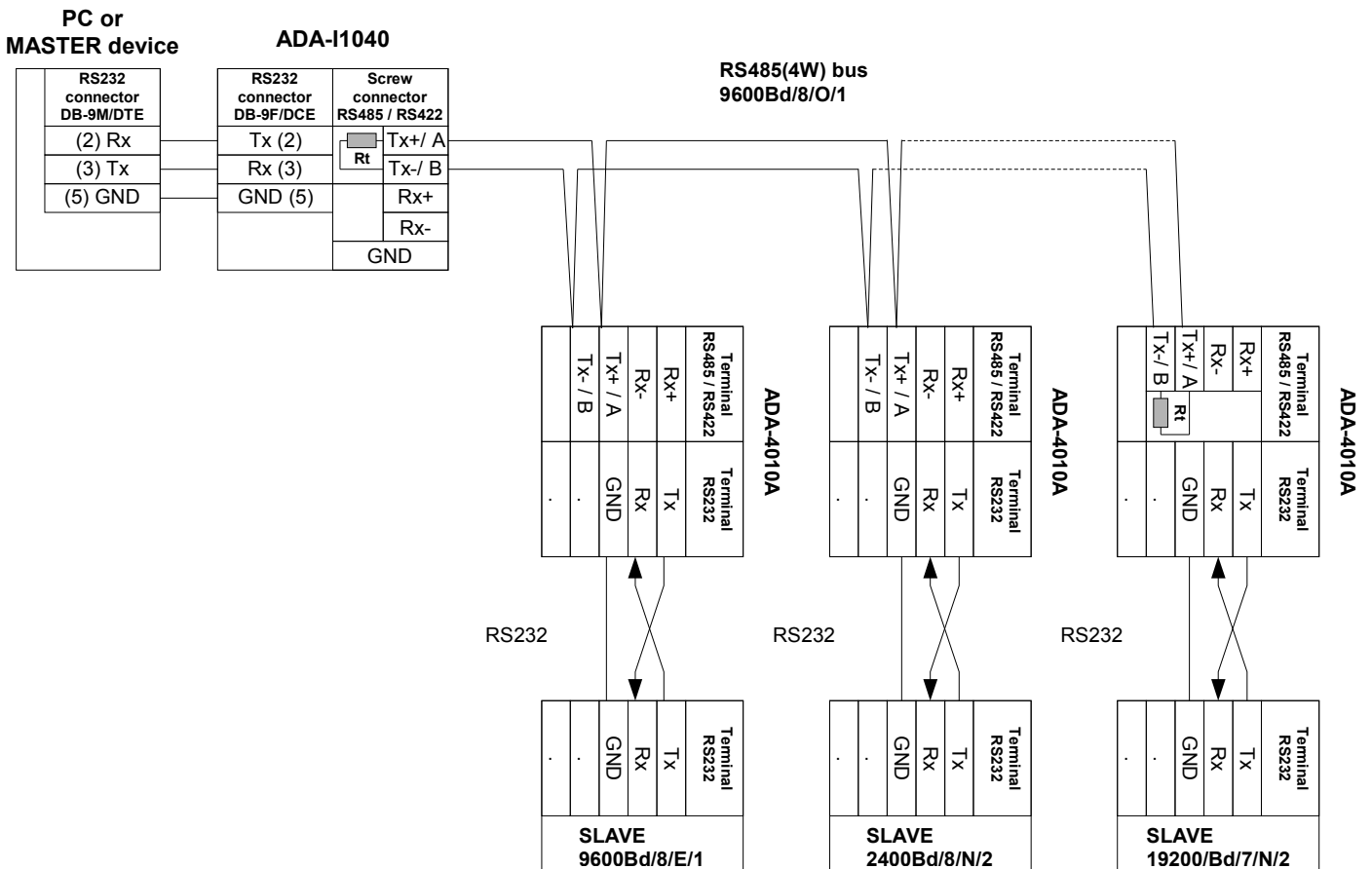
3.3.2. RS485(2W) BUS CONNECTION

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. ZS-12/250. 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-4040PC1 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
Tx led light continuously	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 (normal operating),
● configuration,
● emergency firmware update,
● factory default
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.

Converters operation mode

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

5.2. CONFIGURATION BY USING ADACONFIG

The configuration of ADA-4010A converter can be made by the 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 converter interfaces and set visible address from RS485/422 port.

First, should be set the number of COM port for communication with the converter, then readout the configuration from ADA-4010A memory using the button *[Read converter configuration]* and make the proper changes of each interfaces setting.

If is enabled the option addressing converter (on configuration window), set proper converter address from range 1 – 255. If this option is disabled, the converter works as baud rate & data format converter.

In both cases is possible to set additional transmission parameters for RS232 interface and RS485/422 interface as bellow:
- 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 1 to 255 (time silence as frame's end),

After configuration, the setting should be saved on converter memory by using button *[Write converter configuration]*.

Return to RUN mode is made by using SW1 switch as below.

SW1-1	SW1-2
OFF	OFF

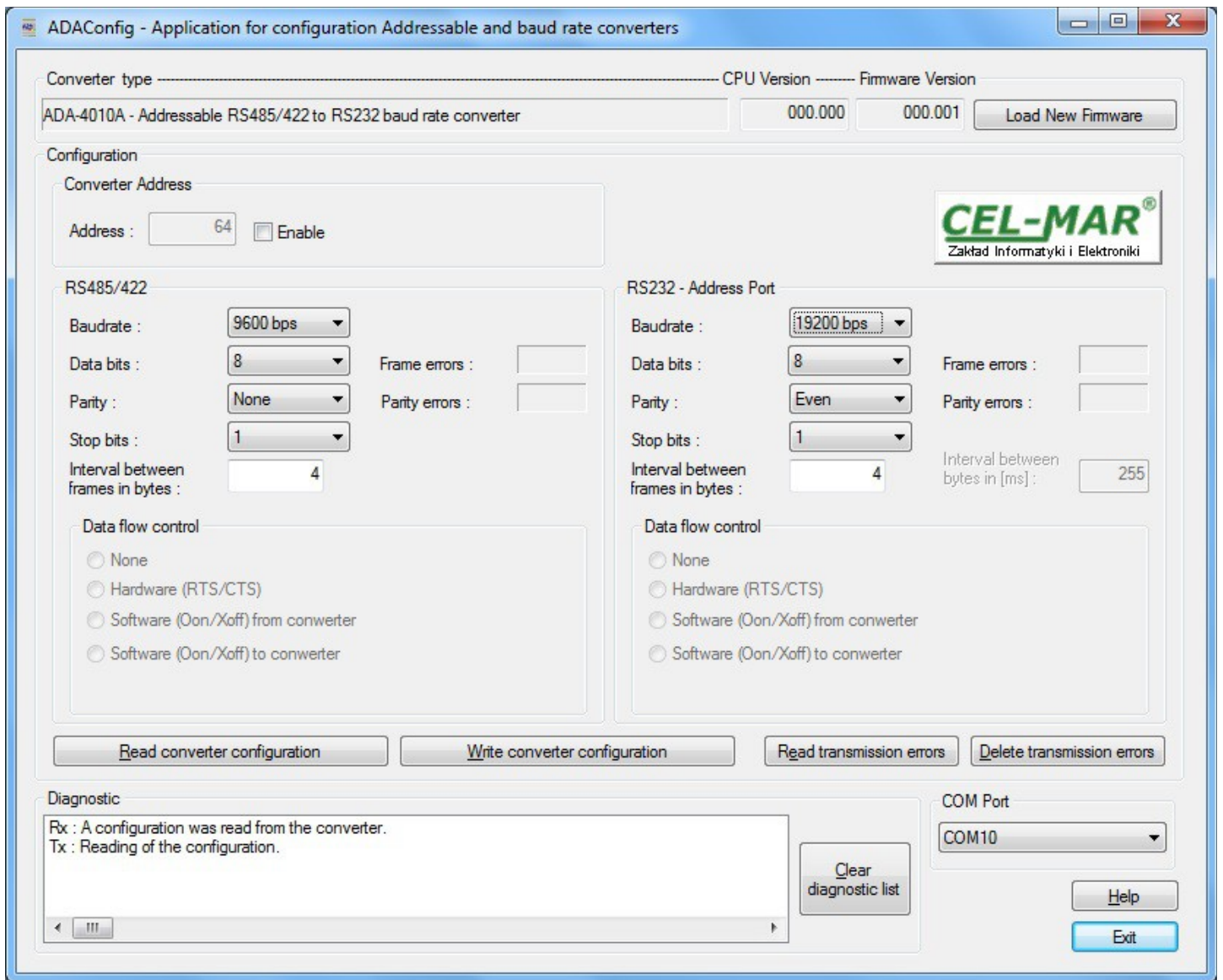In the RUN mode the yellow LED (located near the SW1), will turn off.

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.
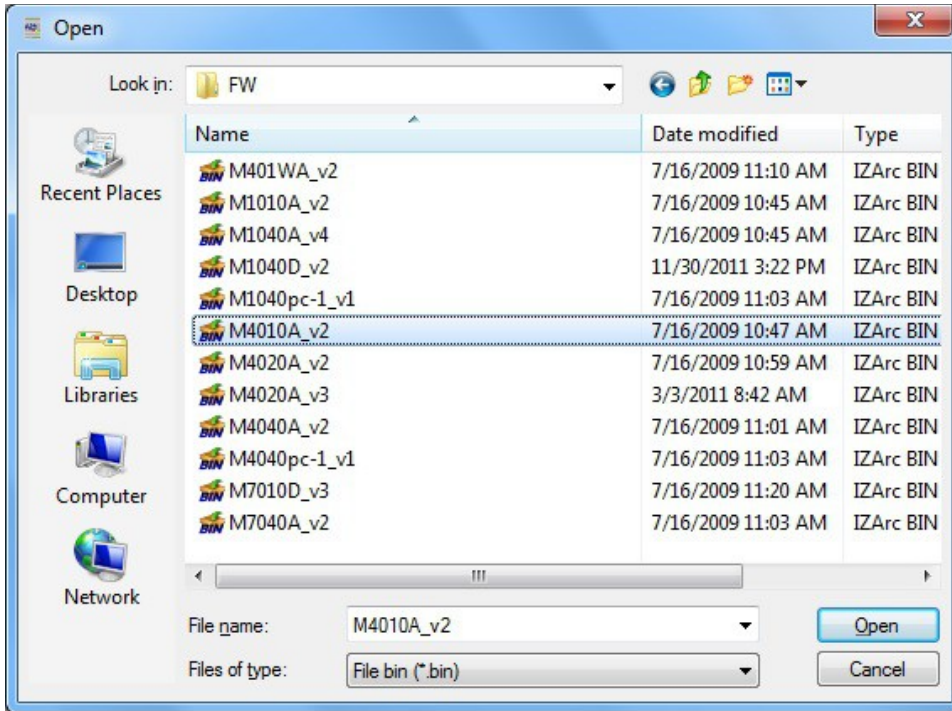
Fig 8. Selection of firmware file

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 the above point. 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 the above point.

ATTENTION!!!
AFTER SUCCESSFUL SOFTWARE UPDATE, SET MICROSWITCH SW1 TO THE RUN MODE AS SHOWN IN TABLE BELOW.

SW1-1	SW1-2
OFF	OFF

6. DATA TRANSMISSIONS DIAGNOSTIC

To readout diagnostics, the SW1 microswitch should be set to the *configuration mode*. (see paragraph 5.1).

Correctness of transmission proceed on RS232 and RS485/RS422 interfaces, 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/RS422 converter's ports.
- addressable device to converter's RS232 port.

After finishing the diagnostics, the SW1 microswitch should be set to the *run mode*. (see paragraph 5.1).

7. OPERATION

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

7.1. 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.

7.2. 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 Fig.9.
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 RS2 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.
Figure 9 presents possibility of using the addressable ADA-4010A baud rate converter.
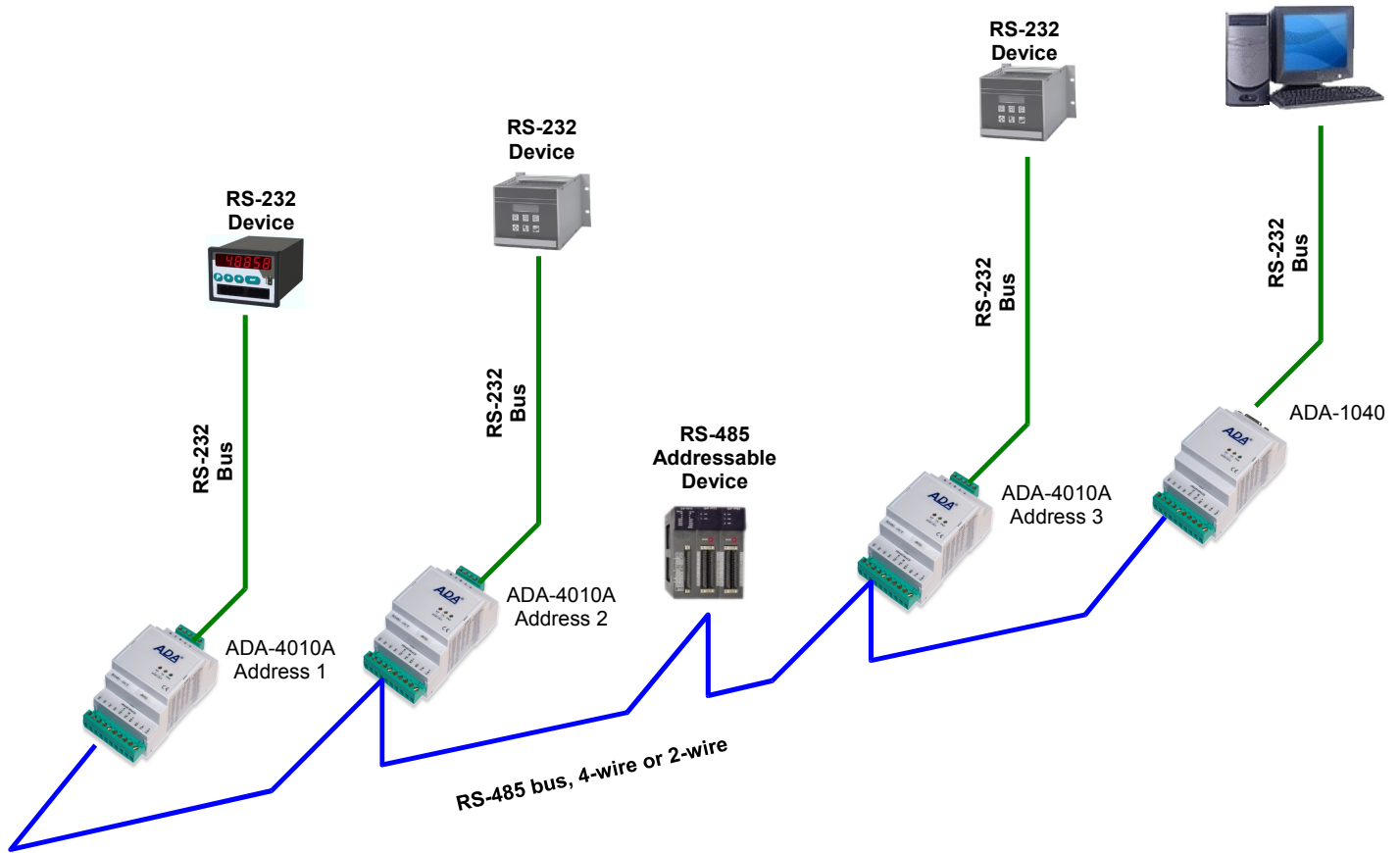
Fig 9. Connection of not addressable RS232 devices to RS485 Bus

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

Transition 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 inteface.	
Nominal Operating Conditions		
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	2-way or 3-way on the level 1kV= or 3kV= DC between power circuit and RS-485/422 signal line	
Optoisolation	5kV= between signal line RS485/422 and RS-232	
Operating temperature	-25 ÷ +23 ÷ +50°C	
Humidity	5 ÷ 95% - non-condensing	
Location during work	Free.	
Mounting	Rail mounting according to DIN35 standard / TS35.	
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.	
Casing		
Dimensions	53 x 90 x 58 mm	
Material	Noryl UL. 94 V-O	
Degree of casing protection	IP40	
Degree of terminal protection	IP20	
Weight	0,10 kg	
According to standards	DIN EN50022, DIN EN43880	
Storing and Transportation		
Storage temperature	-40 ÷ +70°C	
Humidity	5 ÷ 95% - non-condensing	

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.

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