CEL-MAR®
Zakład Informatyki i Elektroniki

User manual

ADA-4040PC2
MODBUS-RTU Device Address Converter

Contents

ADA-4040PC2

1. 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-4040PC2 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

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

Converter ADA-4040PC2 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-4040PC2 converter; User Manual; CE declaration; Line terminators 120Ω (4 pcs.); CD with ADAConfig software.

2. PRODUCT INFORMATION

2.1. PROPERTIES

● Changing the address of device with the MODBUS-RTU / JBUS (RS485/422) protocol to the address accepted on the bus.
● Baud rate and data format conversion between DEV and BUS,
● Operating on 2 or 4 wire buses in RS485/RS422 standard,
● Baud rate setted on RS485/RS422 interfaces (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
● Data format setted on RS485/RS422 interfaces: Data bit: 5, 6, 7, 8; Parity: None, Odd, Even; Number of stop bits: 1, 2,
● Power supply 10 - 30 VDC stable min. 2W,
● ~3kV= optoizolation in signal channel between RS485/RS422 (BUS) and RS485/RS422 (DEV),
● 1kV= or 3kV= galvanic isolation between RS485/RS422 (BUS), RS485/RS422 (DEV) interfaces and power supply (depend on version),
● Connection RS485/RS422 network and power supply via screw terminal block 2.5 mm^2.
● 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-4040PC2 address converter of device with MODBUS-RTU / JBUS protocol, is the converter solves a problem of connection devices having fixed address (SLAVE address) to multipoint RS485 bus, to which connected devices have colliding addresses with the address of the device. The address changing is made by setting the address on the BUS port in ADA-4040PC2 and setting device address with colliding address on the DEV port of the converter. Simultaneously, the converter can convert baud rate and format of transmitted data. Depending on configurations, can be set baud rate, data bits, parity, number of stop bits. The setting can be different for DEV and BUS ports. The convert allows connect RS422 devices to RS485 bus without any collisions. Additionally, ADA-4040PC2 separates devices connected to RS485 bus. Galvanic isolation of ADA-4040PC2, protect the system structured on RS422/485 bus and increases its reliability.

ADA-4040PC2 supports the 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-4040PC2, 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.
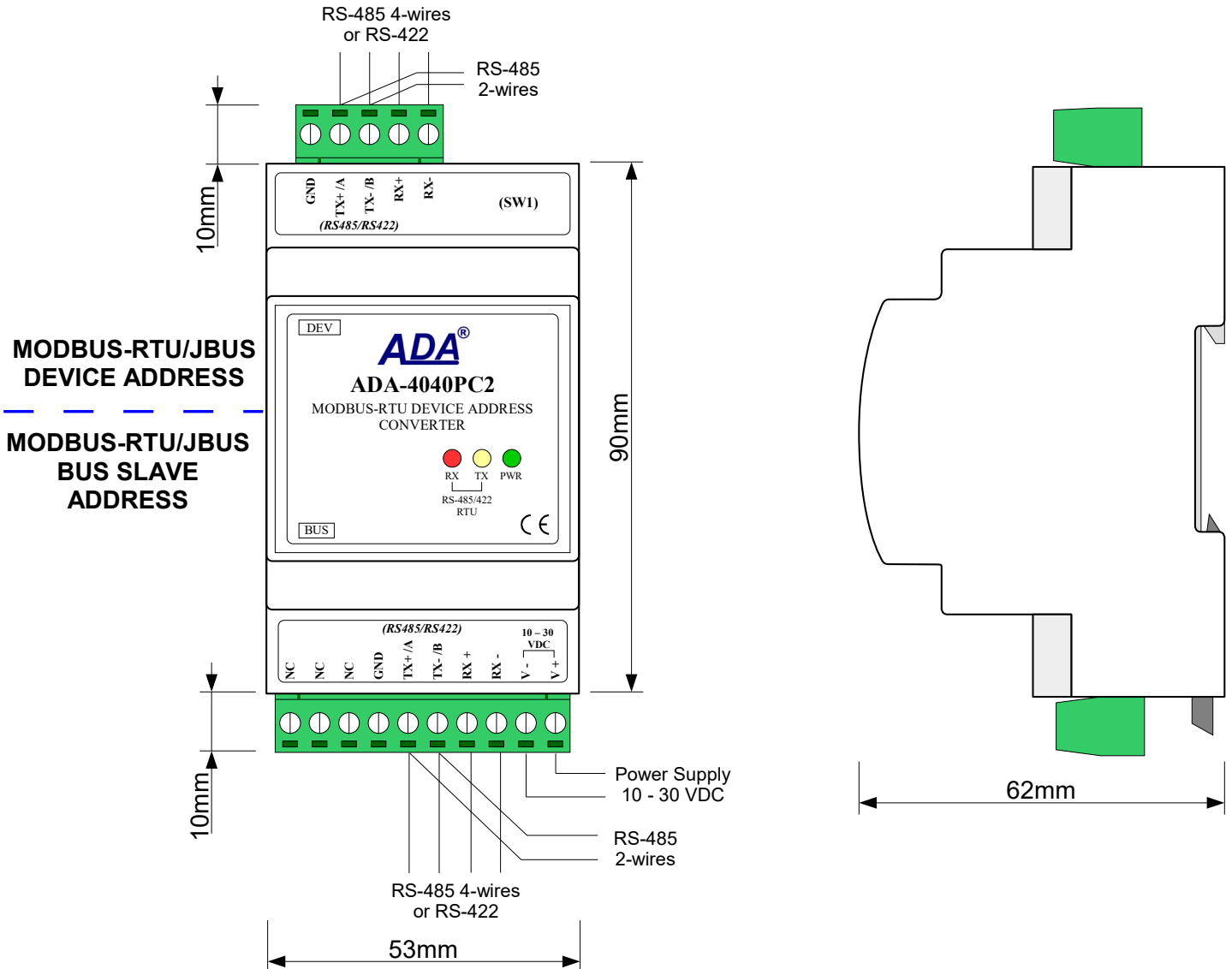

Fig 1. ADA-4040PC2 view and location of SW1

2.3. ISOLATION

ADA-4040PC2 converter has 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.
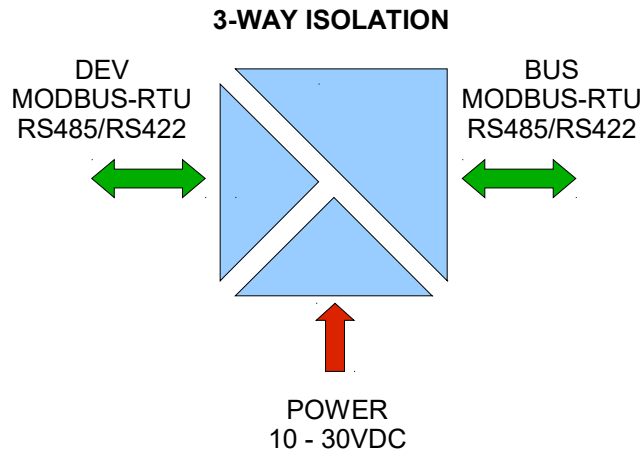
3-WAY ISOLATION

DEV
MODBUS-RTU
RS485/RS422

BUS
MODBUS-RTU
RS485/RS422

POWER
10 - 30VDC

Fig 2. Isolation structure

3. INSTALLATION

This chapter will show how to use and connect ADA-4040PC2 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-4040PC2 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-4040PC2 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; connected to DEV port of ADA-4040PC2.
Typical connections of ADA- 4040PC2 to PC are shown bellow.

PC	ADA-I1040		ADA-4040PC2	
RS232 connector DB-9M/DTE	RS232 Connector DB-9F/DCE	RS485 / RS422 connector	DEV RS485 / RS422 connector	BUS RS485 / RS422 connector
(2) Rx	Tx (2)	Tx+/ A	Tx+ / A	Tx+ / A
(3) Tx	Rx (3)	Tx-/ B	Tx- / B	Tx- / B
(5) GND	GND (5)	Rx+	Rx+	Rx+
		Rx-	Rx-	Rx-
		GND	GND	GND
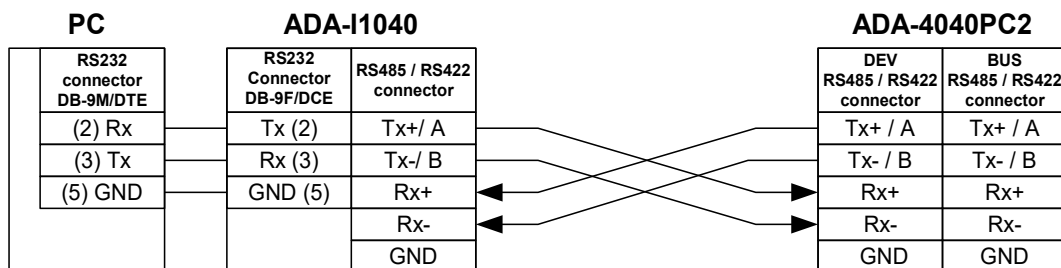
Fig 3. 4-Wires connection of ADA-4040PC2 to PC by the use of ADA-I1040 - RS232 to RS485/RS422 converter.
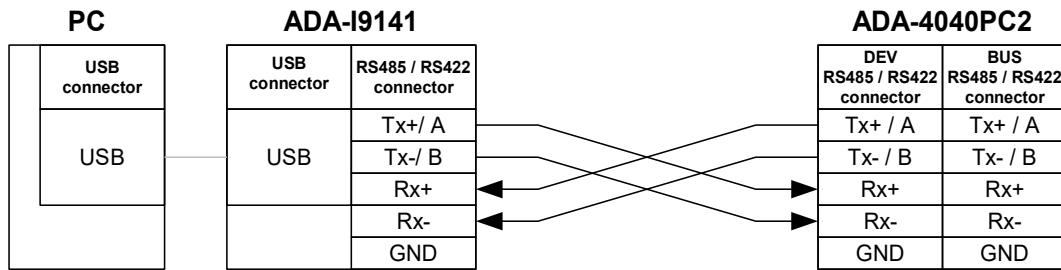
PC   **ADA-I9141**   **ADA-4040PC2**

USB connector	USB connector	RS485 / RS422 connector		DEV RS485 / RS422 connector	BUS RS485 / RS422 connector
USB	USB	Tx+/ A		Tx+ / A	Tx+ / A
		Tx-/ B		Tx- / B	Tx- / B
		Rx+		Rx+	Rx+
		Rx-		Rx-	Rx-
		GND		GND	GND

Fig 4. 4-wire connecting ADA-4040PC2 to PC by the use of ADA-I9141 USB to RS485/RS422

PC   **ADA-I9141**   **ADA-4040PC2**

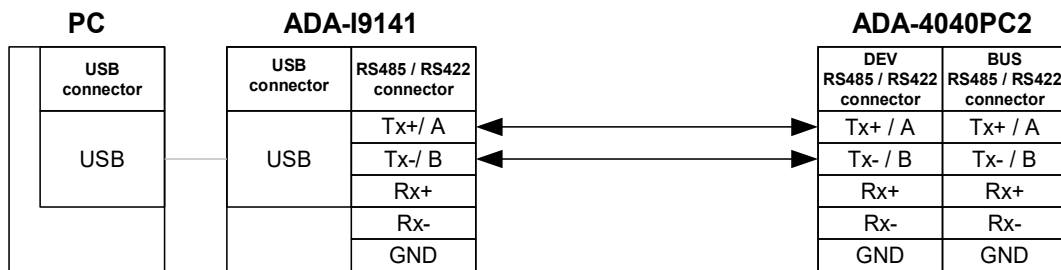| USB connector	USB connector	RS485 / RS422 connector		DEV RS485 / RS422 connector	BUS RS485 / RS422 connector
USB	USB	Tx+/ A		Tx+ / A	Tx+ / A
		Tx-/ B		Tx- / B	Tx- / B
		Rx+		Rx+	Rx+
		Rx-		Rx-	Rx-
		GND		GND	GND

Fig 5. 2-wire connecting ADA-4040PC2 to PC by the use of ADA-I9141 USB to RS485/RS422

3.3. RS485 NETWORK CONNECTION

RS485/RS422 interface in ADA-4040PC2 converter is available on terminal block, described as: Tx+/A, Tx-/B, Rx+, Rx-. Connection of ADA-4040PC2 to RS485(4W) and RS485(2W) network are shown bellow.
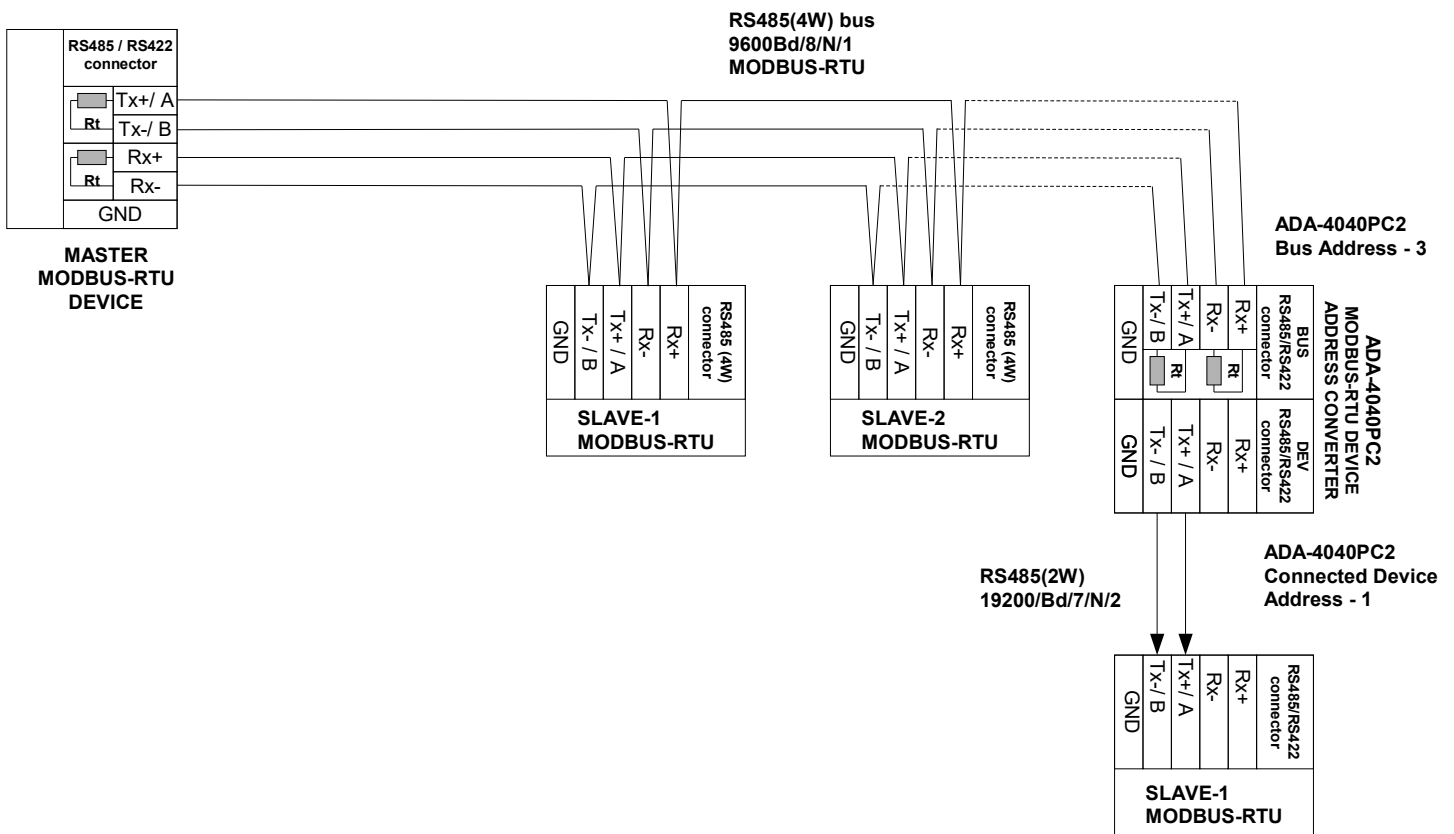
3.3.1. RS485 (4W) BUS CONNECTION

Fig 6. Example connection of ADA-4040PC2 to RS485(4W) 4-wire bus and galvanic separation of SLAVE device
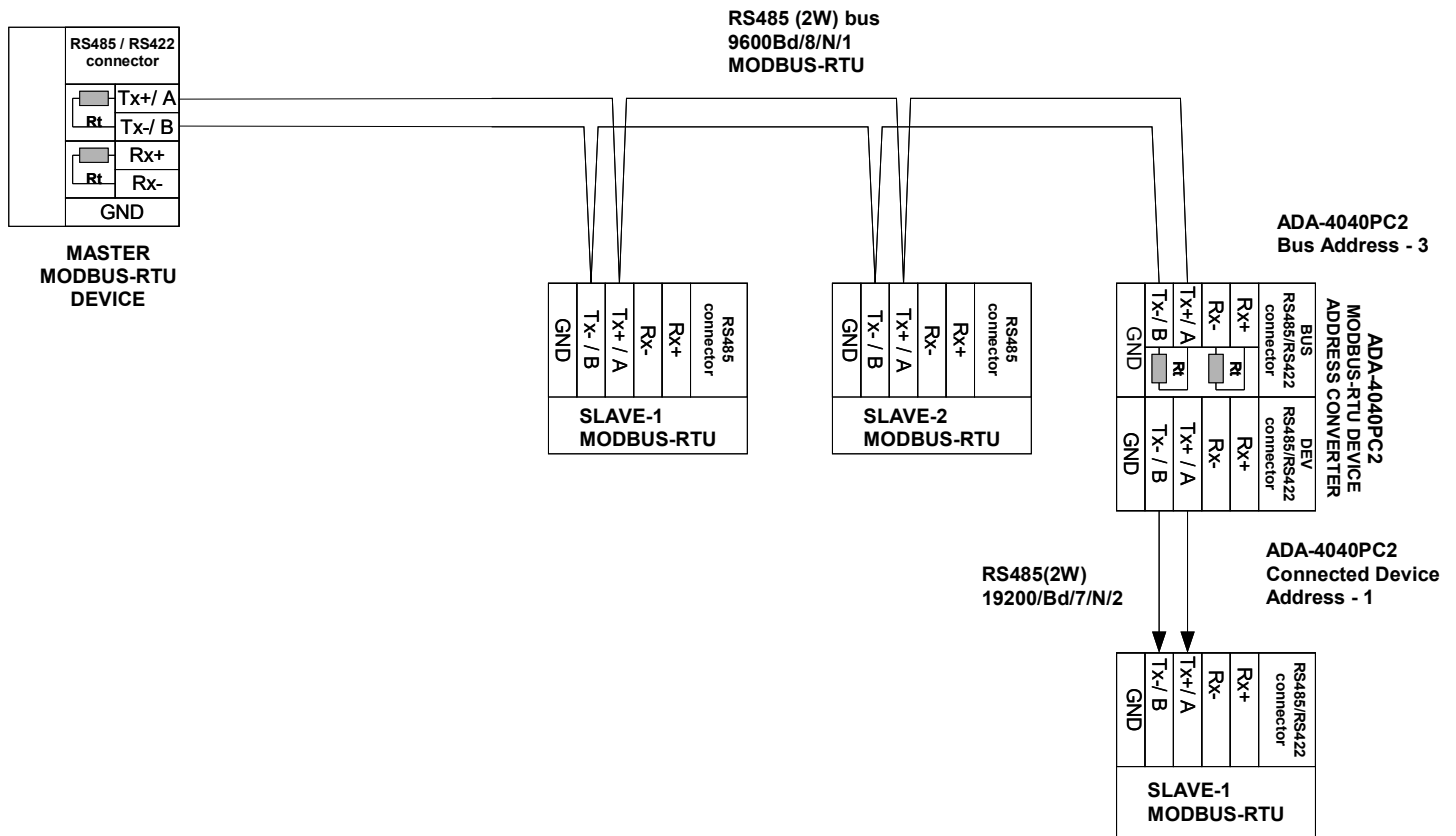
3.3.2. RS485(2W) BUS CONNECTION

Fig 7. Example connection of ADA-4040PC2 to RS485(2W) 2-wire bus and galvanic separation of 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 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 Rt are shown on Fig. 6 & 7. Four Rt=120 Ω , 5%, 0,25W are delivered with the converters.

3.3.5. SLAVE DEVICE CONNECTION

Connection of SLAVE devices to ADA-4040PC2 are shown on fig. 5 and 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. HDR-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-4040PC2 has protection against power supply reverse connection.

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
RX	Signalling of data receiving through ADA-4040PC2 from BUS RS485/RS422 port.
TX	Signalling of data transmitting from ADA-4040PC2 through BUS RS485/RS422 port.
Yellow LED by SW1	Not light – signalling of normal operating mode (RUN)
	Blinking at frequency 1 Hz - signalling of configuration mode or data flow of software to the converter.
	Blinking at frequency 2 Hz - signalling of factory default mode
	Lit continuously – signalling of emergency firmware update

4.2. TROUBLESHOOTING

Problem	Solutions
PWR LED is not light	Check polarization and parameters of connected power supply.
Rx LED lights continuously	RS485(4W) /422 network. Wrong polarization on terminals: Rx+, Rx- BUS port; change polarization.
No transmission Tx LED is blinking	RS485(4W) / RS422 network. Check correctness of connection to terminals Tx, Rx; according to point 3 and the converter configuration.

5. CONFIGURATION

5.1. OPERATION MODE

ADA-4040PC2 converter can operates in a few modes:
● RUN,
● configuration,
● factory default,
● emergency firmware update mode,
Those modes can be set by use SW1 located by terminal block DEV port. To set the switch section, should remove terminal cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver. Figure 1 present the location of two-position SW1 micro-switch.
All available adjusting the SW1 switch are shown in table below.

Converter 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 USING ADACONFIG

The configuration of ADA-4040PC2 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. First should be set the number of **[COM port]** **[1]** for communication with the converter, then readout the configuration from ADA-4040PC2 memory, using the button *[Read configuration]* **[2]** and make the proper changes of each interfaces setting, as below.
[3] setting converter address from side **BUS** port RS485 MODBUS-RTU,
In the section **[Converter Address]** select the field **[Enable]** and in the field **[Address]** enter the address of MODBUS-RTU converter, from the scope 1-247.
[4] setting of device address, connected to **DEV RS485 MODBUS-RTU** port,
In the section **[Mapped address]** select the field **[Address mapping]** and in this section field enter the address of SLAVE device, connected to **DEV** port from the scope 1-247.
[5] setting transmission parameters for the DEV port:

– 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),
[6] setting transmission parameters for the BUS port:
– 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 configuration]* **[7]**. Return to work in run mode is made by using SW1 switch as below.

SW1-1	SW1-2
OFF	OFF

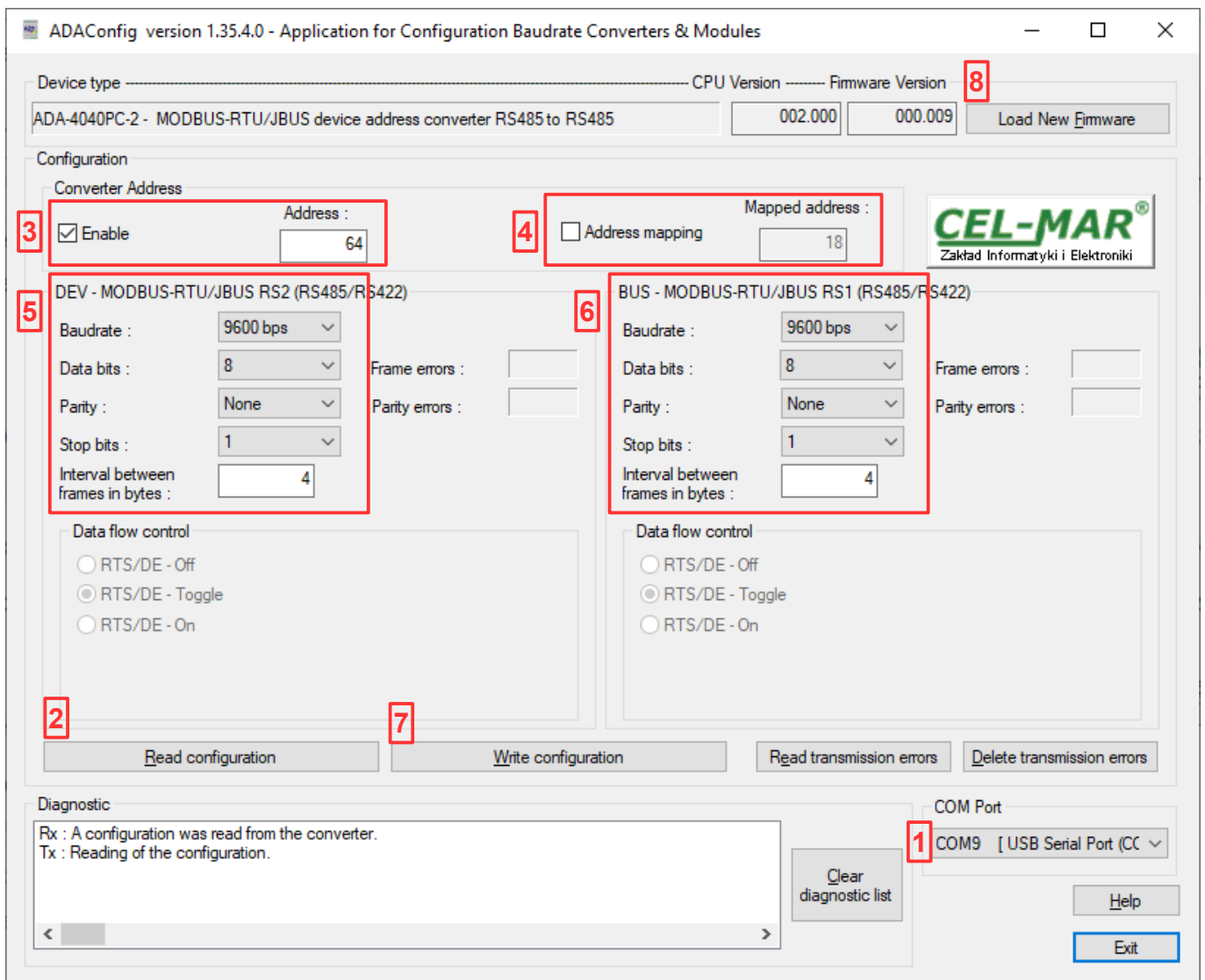The yellow LED (located near the SW1) will turn off in the RUN mode.

Fig. 8. View of ADAConfig software interface

5.3. FIRMWARE UPDATE

Set SW1 micro switch to configuration mode as in table below.

SW1-1	SW1-2
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz. Press a button **[Load New Firmware] [8]** to change the software delivered by manufacturer. The Select File window will open (fig. below) 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.
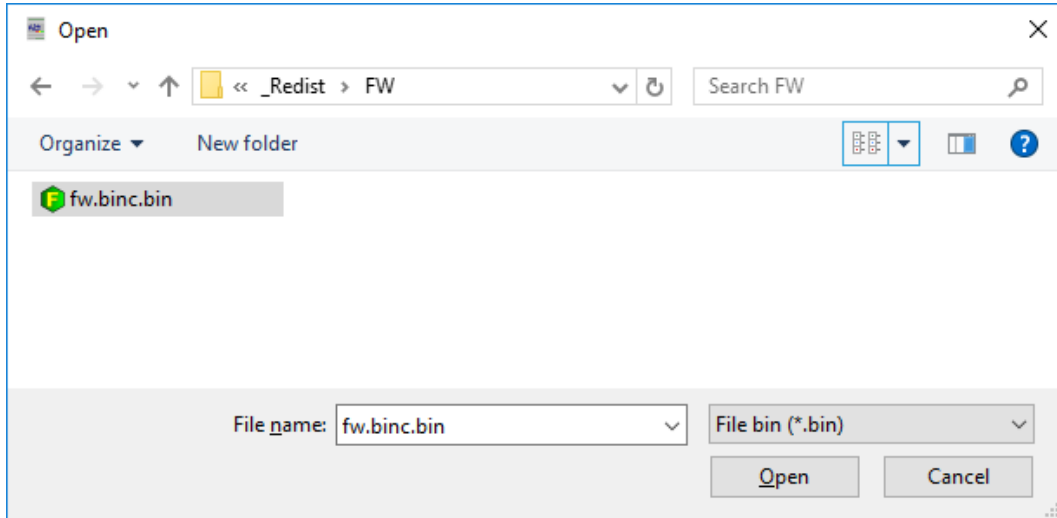

Fig. 9. Selection of firmware file

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

SW1-1	SW1-2
OFF	OFF

The yellow LED (located near the SW1) will turn off in the RUN mode.

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-4040PC2, 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.
After successful software update, set microswitch SW1 to the run mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

The yellow LED (located near the SW1) will turn off in the RUN mode.

5.5. FACTORY DEFAULT

In case of faulty functioning of ADA-4040PC2, 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	DEV interface RS485/RS422	BUS interface RS485/RS422
Baud rate	9600bps	9600bps
Data bits	8	8
Parity	Non	Non
Stop bits	1	1
Interval between frames in bytes	4	4

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 as shown in the table below.

SW1-1	SW1-2
OFF	OFF

The yellow LED (located near the SW1) will turn off in the RUN mode.

5.6. DATA TRANSMISSION DIAGNOSTICS

To readout diagnostics, the SW1 microswitch should be set to the configuration mode.

SW1-1	SW1-2
ON	OFF

In the configuration mode the yellow LED will blink with frequency 1Hz.

Correctness of transmission proceed on DEV (RS485) and BUS (RS485) 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-4040PC2 converter's configuration and correctness connection of RS485 bus to BUS and DEV converter ports.
After finishing the diagnostics, the SW1 microswitch should be set to the run mode as shown in the table below.

SW1-1	SW1-2
OFF	OFF

The yellow LED (located near the SW1) will turn off in the RUN mode.

6. OPERATION

ADA-4040PC2 is the address converter of SLAVE device to non-colliding address on the bus MODBUS-RTU/JBUS protocol, with possibility of conversion a baud rate, a data format (number of data bits, parity bit, stop bits) and interface type (RS485 to RS422). Additionally, is a separator of DEV port to BUS port.
It should be always connect SLAVE (MODBUS-RTU/JBUS) device to the DEV port (RS485/RS422) and to the BUS (RS485/RS422) port should be connected the bus with SLAVE (MODBUS-RTU/JBUS) and MASTER (MODBUS-RTU/JBUS) devices.
Frames of MODBUS/JBUS protocol having the errors CRC are rejected by the converter.

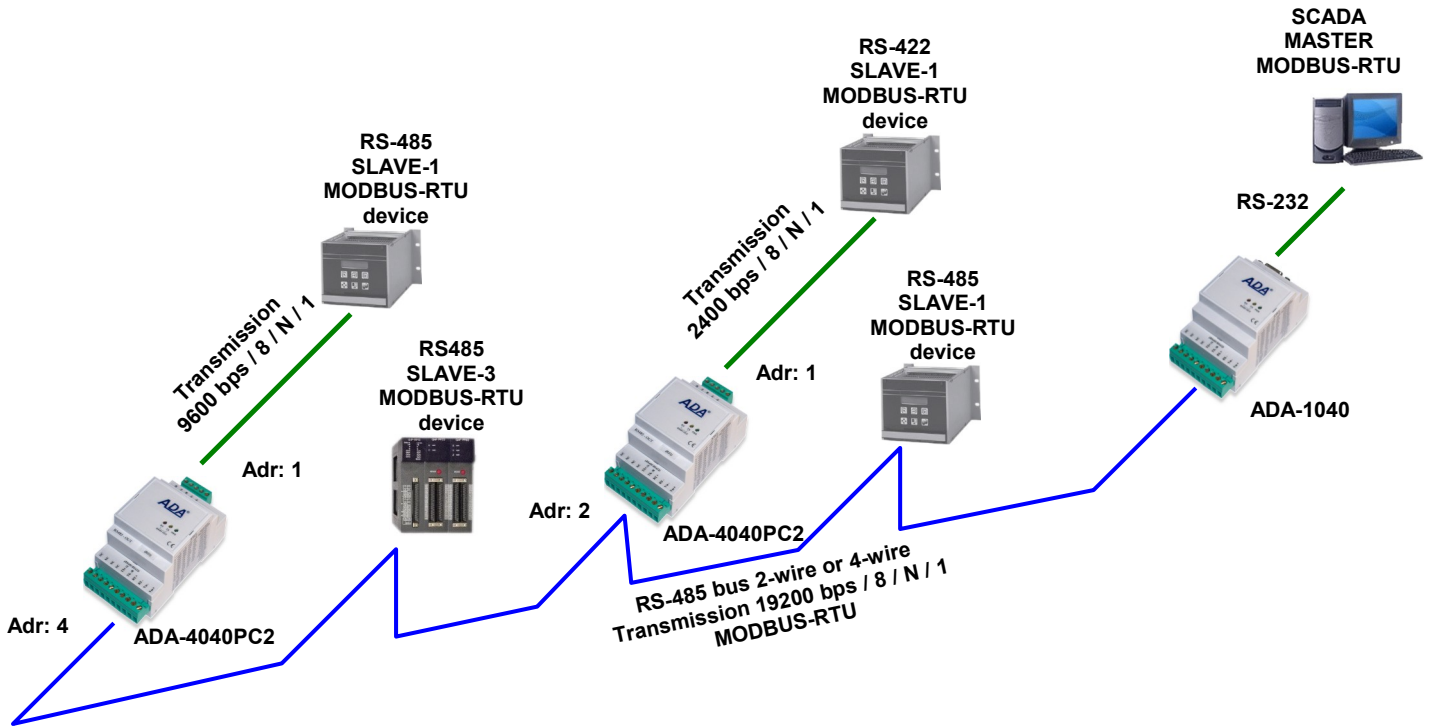**Fig. 10. Connection of MODBUS-RTU/JBUS devices with permanent address to RS485 MODBUS-RTU/JBUS bus.**

7. VERSIONS

ADA-4040PC2 - ☐ - ☐

Version:	
Standard	**1**

3-way galvanic isolation:	
1kV=	**23**
3kV=	**33**

Order example:
Product Symbol: **ADA-4040PC2-1-23**
1 – standard version,
23 – 1kV=, 3-way galvanic isolation,

ADA-4040PC2

8. SPECIFICATION

TECHNICAL DATA		
Transition Parameters		
Interface	**RS-485/RS-422 (DEV)**	**RS-485/RS-422 (BUS)**
Connector	Screw terminal, wire max. Ø 2,5mm^2	Screw terminal, wire max. Ø 2,5mm^2
Line length	1200m (depends on baud rate)	1200m (depends on baud rate)
Max. number of connected device	Up to 32 devices	
Baud rates (bps)	300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,	
Data formats	Data bits 5, 6, 7, 8, Parity: None, Parity, Odd, Number of stop bits: 1, 2,	
Transmission line	Twisted cable 1-pair or 2-pair, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5(24AWG).	
Transmission type	Asynchronism full duplex, half duplex.	
Standards	EIA-485, CCITT V.11	
Optical signalisation	• PWR – green LED power supply, • RX - red LED data receiving from BUS port – RS485/RS422, • TX - yellow LED data transmission through BUS port – RS485/RS422.	
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	1kVDC or 3kVDC between power circuit and RS-485/RS-422 (DEV) and (BUS) – depend on version.	
Optoisolation	~3kV - between signal line RS-485/RS-422 (DEV) and RS-485/RS-422 (BUS)	
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 standard	DIN EN50022, DIN EN43880	
Position during operation	Free	
Mounting	Rail mounting according to DIN35 standard / TS35.	

Dear Customer,

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

We hope that this user manual helped connect and start up the **ADA-4040PC2 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, 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.

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