CEL-MAR®
Zakład Informatyki i Elektroniki

User manual

ADA-1040D
RS-232 to RS-485(4W)/RS-422 digital converter

Contents

ADA-1040D

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-1040D 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 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 MAINTENANCE

Converter ADA-1040D 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

Converter ADA-1040D, User Manual, CE declaration, Line terminators 120Ω (2 pcs.), CD-ROM with ADAConfig software.

2. PRODUCT INFORMATION

2.1. PROPERTIES

● Signals conversion Tx, Rx, RTS, CTS, DTR, DSR of RS232 interface to RS485(4W) / RS422,
● Conversion data format and baud rate on RS485/RS422 and RS232 converter interfaces,
● Operating on 4-wire bus in Point-to-Point mode,
● Correctness connection control of RS485 /422 bus,
● Automatic data flow control (transmitter/receiver) on RS485 bus,
● Baud rate on RS232 and RS485/422 interfaces (bps): 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200, 230400,
● Data format set on RS232 & RS485/RS422 interfaces: 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 following specifications: MODBUS, DNP, PROFIBUS and other,
● Power supply 10 - 30 VDC stable min. 2W,
● Implemented protection against power supply reverse connection,
● ~3kV= optoizolation in signal channel between RS232 and RS485/422 interfaces,
● 1kV= or 3kV= galvanic isolation between RS232 & RS485/RS422 interfaces and power supply (depend on version),
● Implemented short circuit protection and over-voltage protection on RS485 / RS422 bus,
● Connection RS485/RS422 network and power supply via screw terminal block 2.5 mm^2.
● DB-9F connector for cable connection of RS232 interface to PC, controller etc.
● Cover compatible with DIN 43880 standard– mounting in typical electro-installation unit,

ADA-1040D

- 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-1040D Digital Converter is used to extend RS232 ports of device using for communication signals: Tx, Rx, RTS, CTS, DTR, DSR. The converter receives data from RS-232 port and sends them via RS485(4W) / RS422 to second converter together with information about line condition of RS232 interface. It is possible to configure the baud rate (up to 230,4 kbps), number of data bits, parity or no parity and number of stop bits – the setting of RS-232 can be different on both sides of RS485(4W) / RS422. Additionally, it is possible to set baud rate on RS485(4W) / RS422 link.

Using RS485(4W) /422 bus enables to extend the RS232 device port at a distance 1200m, provides galvanic isolation between connected devices and resistance to interference in the transmission line. Connection of RS485(4W) /422 bus is made by the use of 2-pairs twisted cable. The converter has the connection control for testing the correctness connection of RS485(4W) bus with him.

ADA-1040D is equipped with DSUB-9 female connector from RS232 interface and screw terminal block from RS485(4W) / RS422 and power supply. ADA-1040D supports data rates of up to 230.4 kbps RS232 interface. Converter has 1kVDC or 3kVDC galvanic isolation and 5kVDC optoisolation in signal line. It separates RS232 form RS485/RS422 interface and protect device connected to RS232 port from overvoltage on RS485/RS422 bus and power circuit. Overvoltage protection on each RS485/RS422 line was made on base overvoltage LEDs and fuses. ADA-1040 D should be supplied from the power supply voltage stabilized voltage range of 10 - 30 VDC and minimum power 2W.
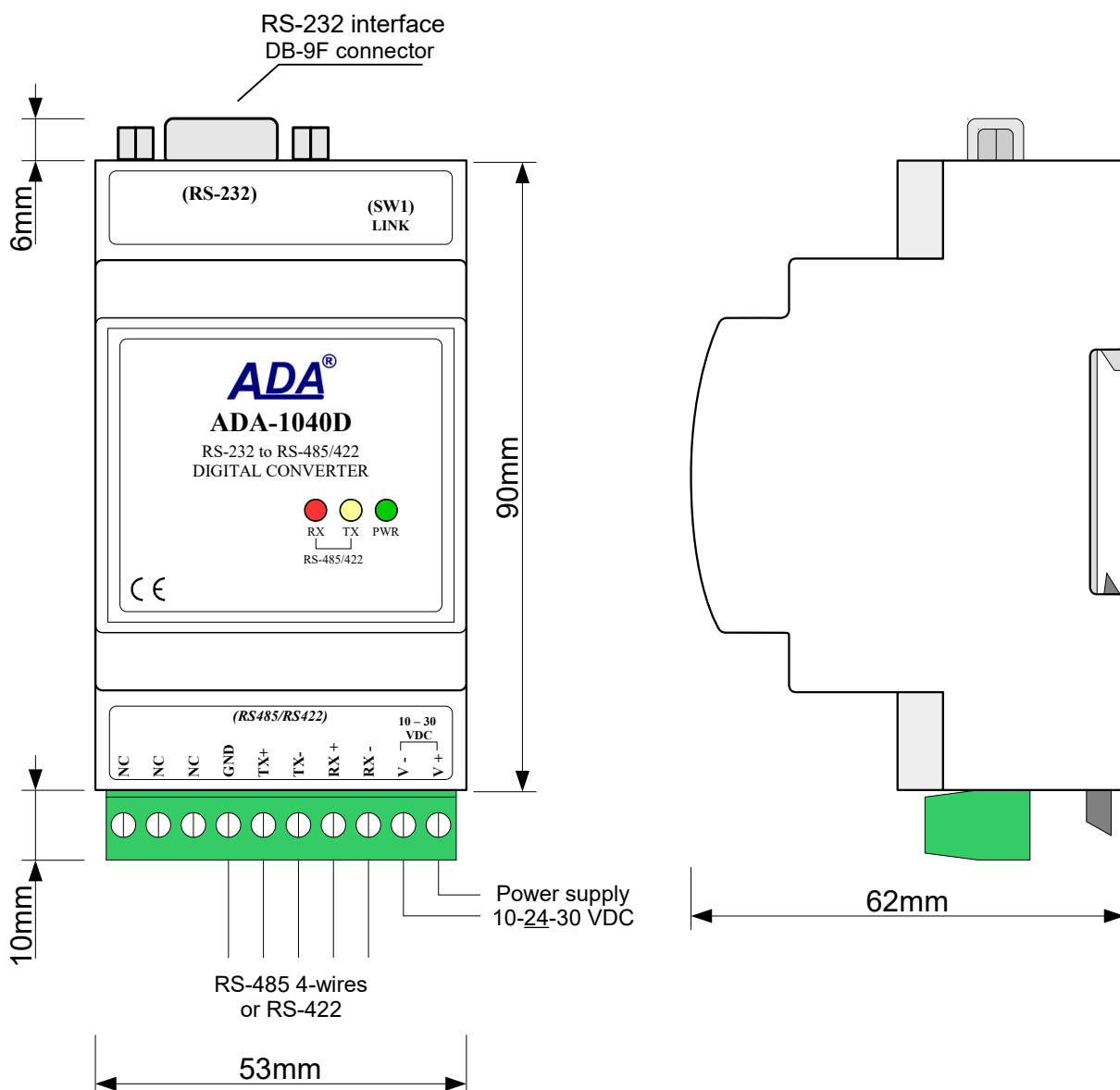

Fig 1. ADA-1040D view and location of SW1

2.3. ISOLATION

Converter ADA-1040D has 2-way or 3-way galvanic isolation on the levels 1kV= or 3kV=, depend on version described in section VERSIONS.
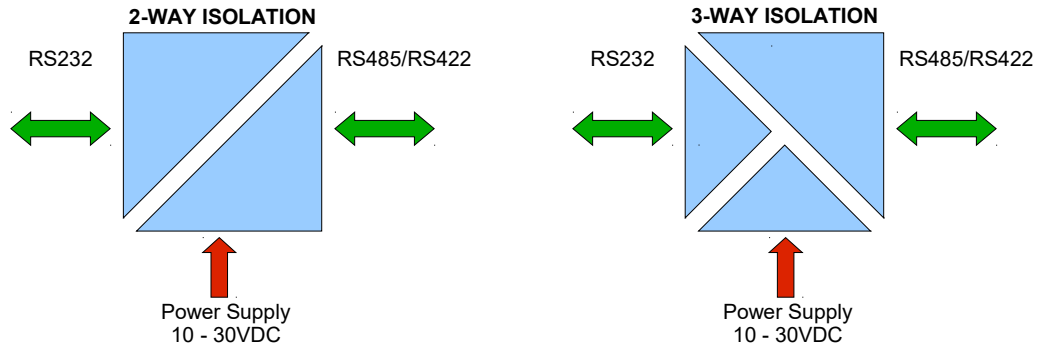
Fig 2. Isolation structure

3. USING

ADA-1040D Digital Converter allows connect two devices with RS232 interface using for communication signals: Tx, Rx, RTS, CTS, DTR, DSR, spaced from each other to 1200m using a twisted two-pair. The converter receives a data from RS232 port and transfers them via RS485/422 port to other converter, together with information about line condition of RS232 interface. The data transmission is made Online without buffering and delays. Thus, the converter can support half-duplex transmission type and full duplex. On the figure below (fig.3.) is shown operating principle of the converter and on fig.4. possibilities of using the converter as extender of RS232 PC port.

Fig.3. Operating principle of ADA1040D

Fig 4. Example connection of a cash register with RS232 interface to PC, 1200 m away.

4. INSTALLATION

This chapter will show how to connect ADA-1040D to PC, RS485 & RS422 bus, and power supply and how to use it.
To reduce disturbance from environment, it is recommended to:
– use multipair type shielded cables, which shield can be connected to the earthing on one end of the cable,
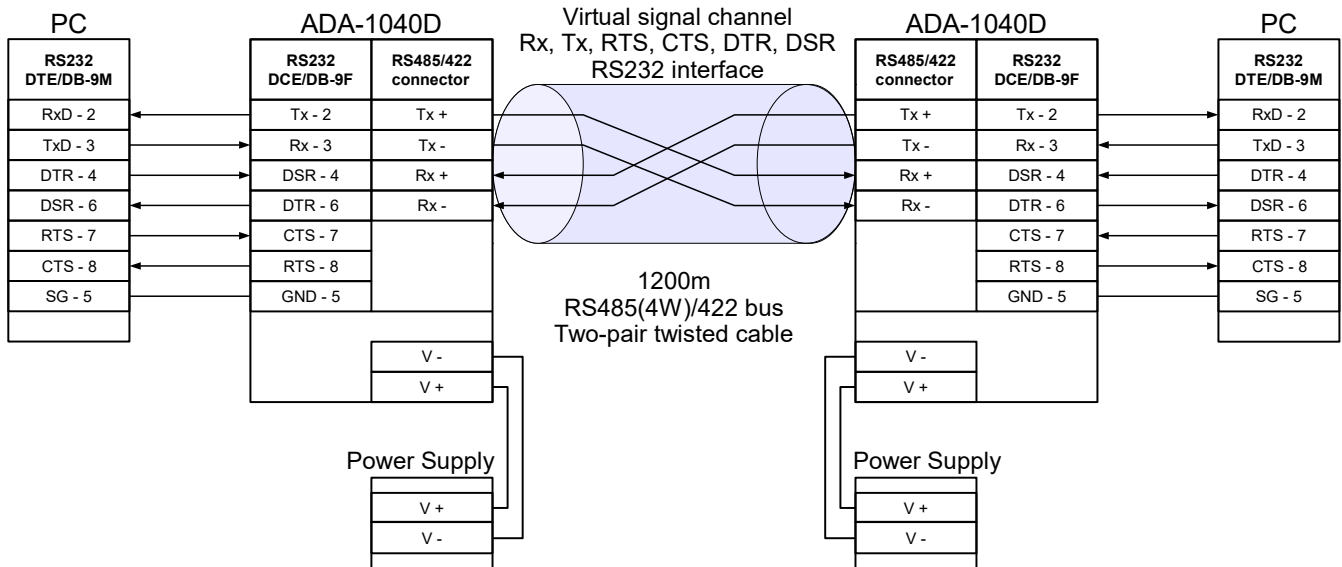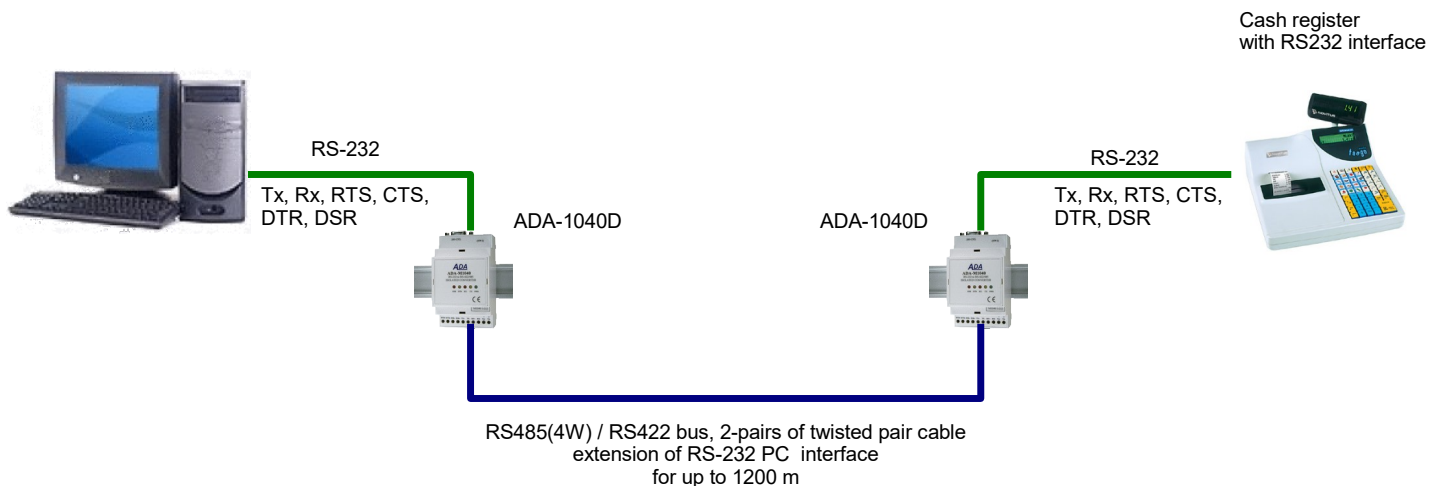– use the suitable diameter cable for power supply on account of voltage drop,
– use the powering cable with a suitable section because of the voltage drops,
– use the interference eliminators for powering the converter,
– lay signal cables at a distance of not less than 25 cm away from power cables,
– not powering the converters form the power-circuit of devices generate large impulse disturbance like contactors, relays, inverters

4.1. ASSEMBLING

ADA-1040D converter case is adapted to assembly on TS-35 (DIN35) rail. To install converter should mount device on the rail upper part of the case then press bottom part to hearing characteristic „Click" sound.

4.2. CONNECTION OF RS232 INTERFACE DEVICES
4.2.1. CONNECTION OF DEVICES WITH RS232 PORT - DTE TYPE (COMPUTER)

Not use RI 9
RTS 8
CTS 7
DTR 6

5 GND
4 DSR
3 RX
2 TX
1 DCD   Not use
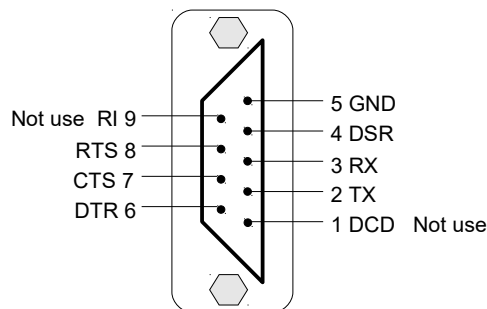
Fig. 5. RS232 interface signals of DB-9F (female) connector.

In purpose of connecting ADA-1040D to RS232 port of computer, should be used the RS232 extension cable (available in CEL-MAR offer). Example connection is shown below.

PC | CAB-DB 9F/DB9M-S-1,8m cable | | ADA-1040D

RS232 DTE/DB-9M	DB-9F Socket	DB-9M plug	RS232 DCE/DB-9F	RS485/422 connector
RxD - 2	2	2	Tx - 2	Tx +
TxD - 3	3	3	Rx - 3	Tx -
DTR - 4	4	4	DSR - 4	Rx +
DSR - 6	6	6	DTR - 6	Rx -
RTS - 7	7	7	CTS - 7	
CTS - 8	8	8	RTS - 8	
SG - 5	5	5	GND - 5	
				V -
				V +

Power Supply

V +	
V -	

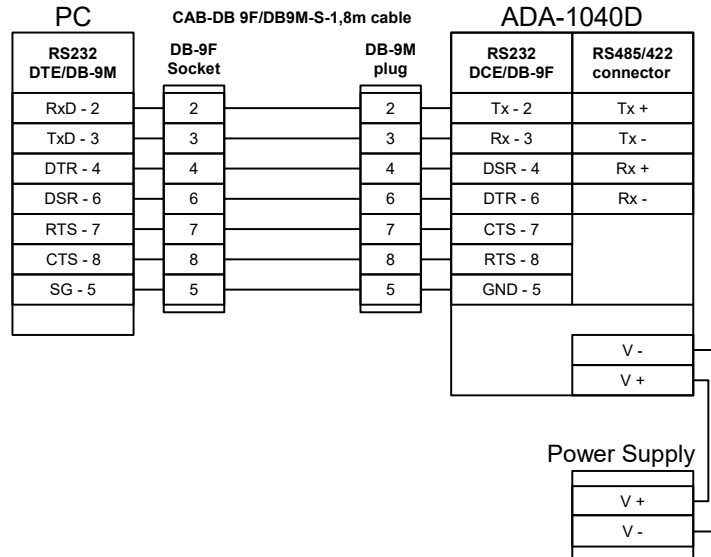**Fig. 6. Connection to RS-232 computer port**

4.2.2. CONNECTION OF DEVICES WITH RS232 PORT - DCE TYPE (MODEM)

In purpose of connecting ADA-1040D to RS232 port type DCE (eg modem), should be used the RS232 cable, LINK type (available in CEL-MAR offer). Example connection is shown below.
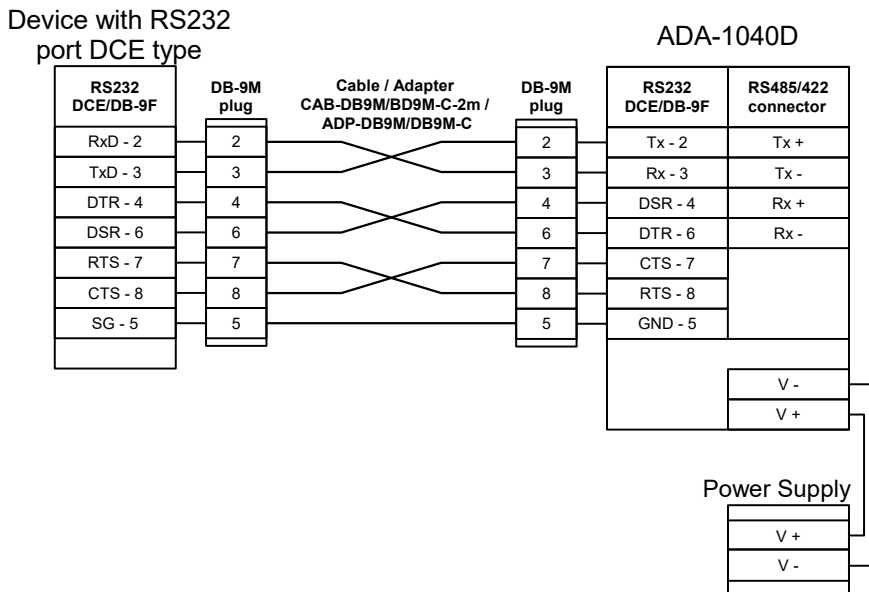
Fig. 7. Connection to device with RS232 type DCE

4.3. CONNECTION TO RS485 (4-WIRE) /422 BUS

RS485/RS422 interface in ADA-1040D converter is available on screw terminal block and is described as: Tx+, Tx-, Rx+, Rx-. Connection of ADA-1040D to RS485(4W) /RS422 network is shown bellow.
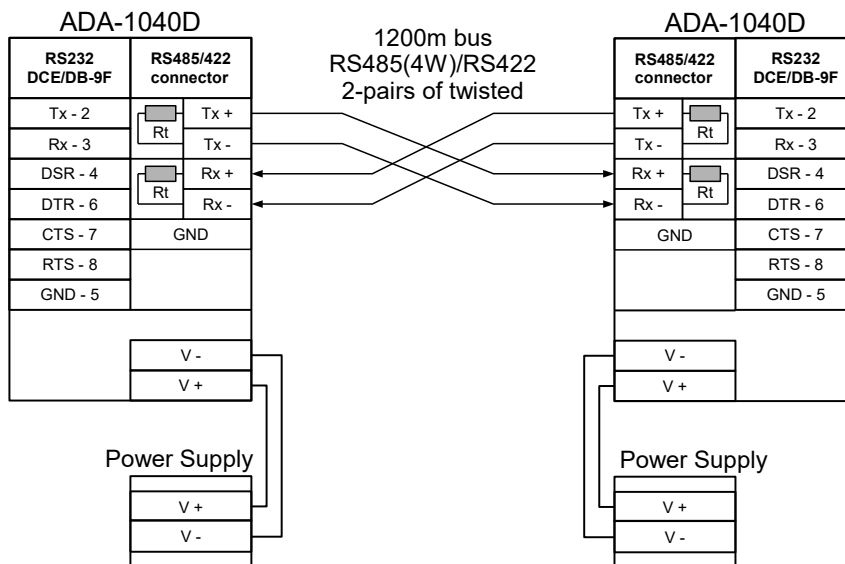
Fig. 8. Example connection of ADA-1040D to RS485(4W) 4-wire bus

4.3.1. 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.

4.3.2. LINE TERMINATION Rt

The application of Line Termination (terminator) Rt = 120 Ω (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. 8. Two Rt=120 Ω , 5%, 0,25W are delivered with the converter.

4.3.3. EXAMPLE CONNECTION OF CONVERTER AS THE EXTENSION PORT RS232 PC

Fig. 9. RS232 Extension type connection

4.4. 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+ converter's terminal and negative (-) end to V- on terminal block. ADA-1040D has protection against power supply reverse connection.
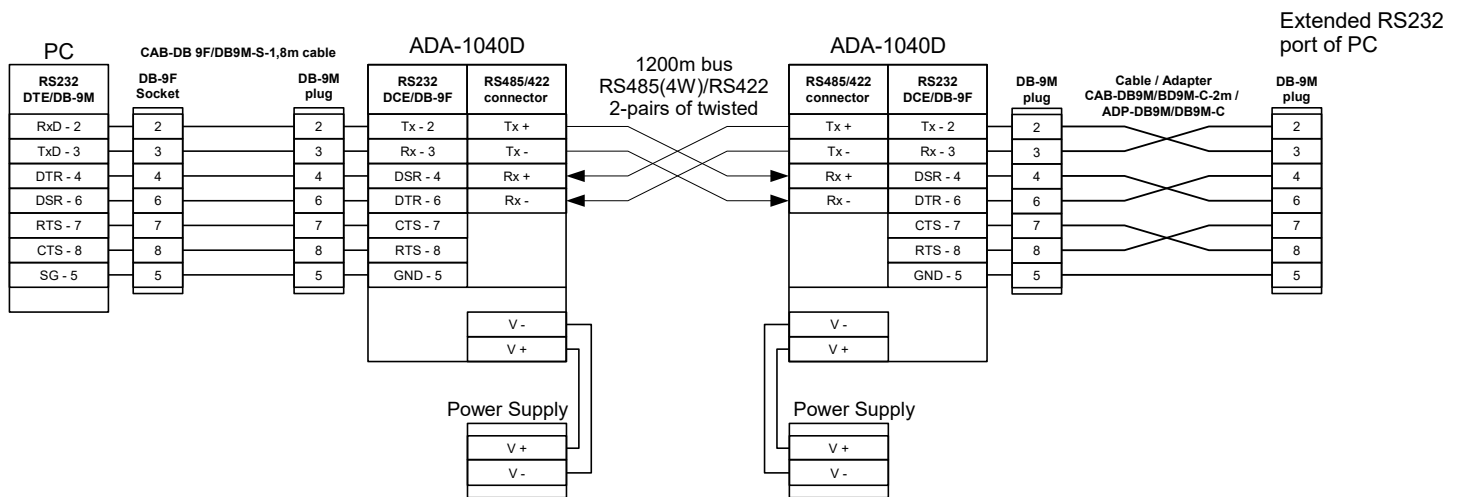
5. ACTIVATION

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.

5.1. TROUBLESHOOTING

Problem	Solutions
PWR LED is not light	Check polarization and parameters of connected power supply.
Rx LED lights continuously	Wrong polarization on terminals: Rx+, Rx-; change polarization.
	Wrong polarization on terminals: Tx+/A, Tx-/B; change polarization.
LINK LED flashes with a frequency of 10 Hz.	No communication between ADA-1040D converters on RS485(4W)/RS422 bus (link break, no connection converters). Should be checked: - correctness of bus connection, - is there no break or short-circuit of the bus, - is there connected the converter on the other side of the bus to power supply 10 – 30VDC stabilized, - are there set the same baud rate on RS485(4W)/RS422 converter's ports.
No communication. Errors on RS232 port.	Check if the converter is powered from 10 – 30VDC stabilized, Check correctness connection of ADA-1040D to device, Check if baud rate and data format are the same in the converter and connected device.
No communication. No errors on RS232 port.	Check if the converter is powered from 10 – 30VDC stabilized, Check correctness connection of ADA-1040D to device,
No communication. Errors on RS485 (4W)/RS422	Check if the converter is powered from 10 – 30VDC stabilized, Check if are set the same baud rate on RS485(4W)/RS422 converter's ports. Reduce baud rate of RS485(4W)/RS422 port for both converters, Check if there is correct twisted cable used for RS485(4W)/RS422 bus.

5.2. DESCRIPTION OF SIGNALLING LEDS

LED	Description
PWR	Signalling of Power Supply
RUN mode	
RX	Signalling of data receiving through ADA-1040D from RS485 port
TX	Signalling of data transmitting from ADA-1040D through RS485 port
Configuration mode	
LINK (by SW1)	Blink with frequency 1 Hz - signalling of configuration mode (see micro-switch SW1 setting)
Firmware update mode	
LINK (by SW1)	Blinking signalling software data flows to converter.
Improper connection of converters, break for RS485 (4W) / 422 bus	
LINK (by SW1)	Blink with frequency 10Hz - signalling of no communication between the converters on RS485(4W)/RS422 bus (break the link, no connection of converters).

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

6. CONFIGURATION

6.1. HARDWARE CONFIGURATION

Hardware configuration of ADA-1040D is done by setting of SW1 micro-switch to suitable operating mode.
The SW1 located by terminal block RS232. To set the switch section, should remove terminal cover marked as SW1 and make the appropriate settings by the use a small, flat screwdriver.

6.1.1. OPERATION MODE

ADA-1040D converter can operates in a few modes:
● run,
● configuration,
● factory default,
● emergency firmware update

Those modes can be set by use SW1 located by DB-9F connector, labelled as RS232. To set the switch section, should remove the 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. If there are additional question please contact with technical department: +48 41 362-12-46

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

6.2. CONFIGURATION BY USING ADACONFIG

The configuration of ADA-1040D converter can be made by the use of *ADAConfig* Software - selling with converter.
To make the configuration, connect converter to computer 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 RS-232 and RS485. First, should be set the number of COM port for communication with the converter, then readout the configuration from ADA-1040D memory using the button **[Read converter configuration]** and make the proper changes of each interfaces setting.

6.2.1. CONFIGURATION OF RS232 INTERFACE

After readout the configuration, for RS232 interface can be set parameters:

– 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) – not available for ADA-1040D,
– data flow control - not available for ADA-1040D,

Above transmission parameters can be different for both converters creating extension RS232. This allows connecting devices together which have different baud rate and data format.

6.2.2. CONFIGURATION OF RS485(4W)/RS422 INTERFACE

For RS485(4W) / RS422 interface can be set only the baud rate, in order to adapt transmission parameters to the length of RS485 / 422 bus.
Available baud rates (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 .

ATTENTION !
IN BOTH CONVERTERS CREATING CONNECTION LIKE IN FIGURE 9, SHOULD BE SET SAME BAUD RATE FOR PORTS RS485 (4W) / RS422.
THE BAUD RATE SET ON RS485(4W)/RS422 PORTS, CAN NOT BE LESS THAN BAUD RATE SET ON RS232 PC PORTS.

6.2.3. SAVING CONVERTER CONFIGURATION AND RETURNING TO RUN 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 as below.

SW1-1	SW1-2
OFF	OFF

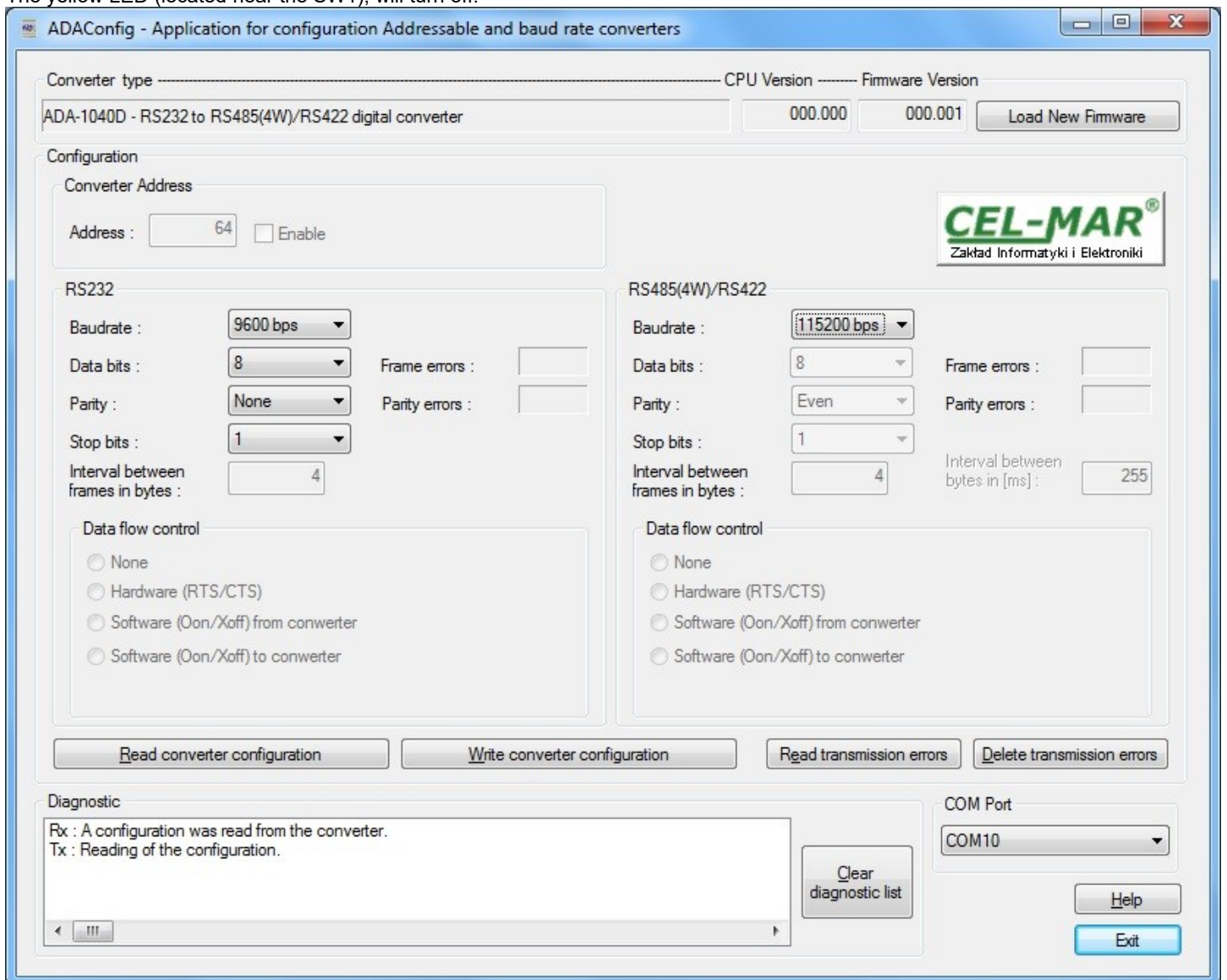The yellow LED (located near the SW1), will turn off.

Fig. 10. View of ADAConfig software interface

6.3. 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 RS232 and 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-1040D converter's configuration and correctness connection of RS485 bus and RS232 device to 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.

6.4. 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]* 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.

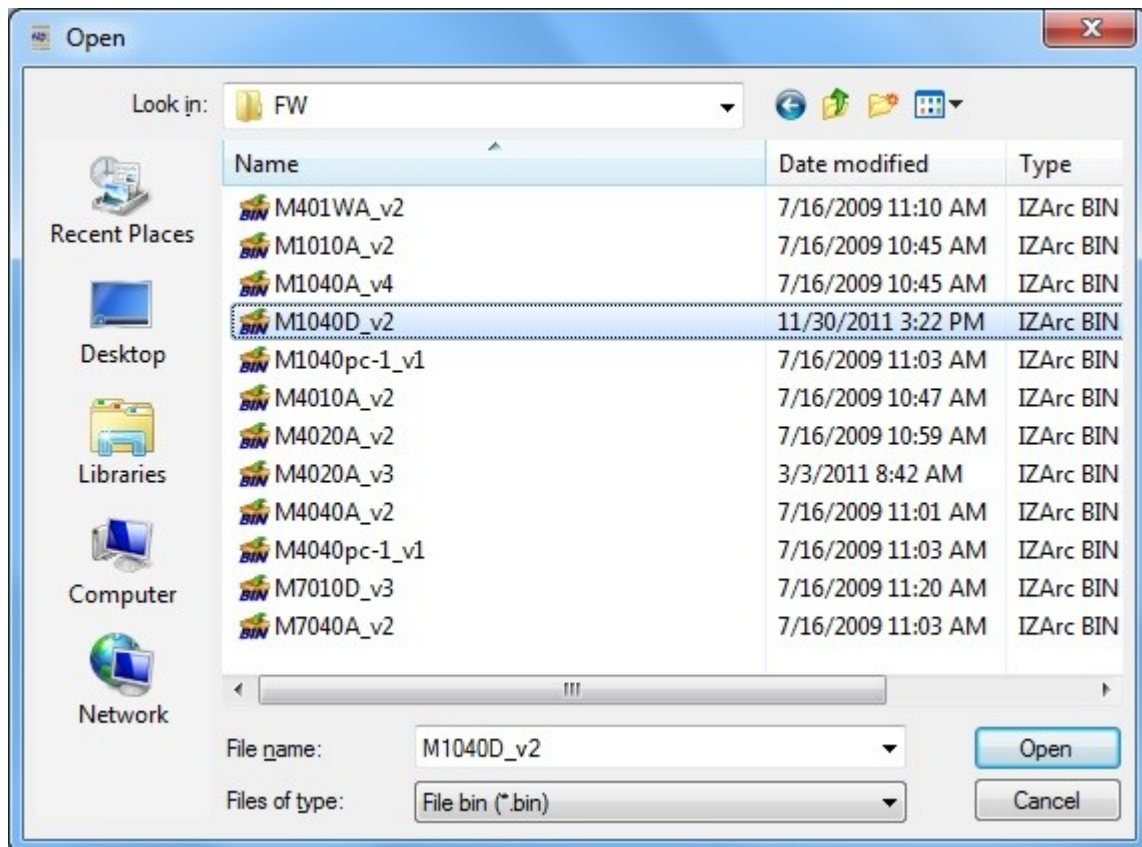**Fig. 11. Selection of firmware file**

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 again 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

The yellow LED will be OFF.

6.5. 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
OFF	ON

After micro-switch setting, should be restarted the ADA-1040D, 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.

ATTENTION!
AFTER SUCCESSFUL UPDATING SET SW1

SW1-1	SW1-2
OFF	OFF

6.6. FACTORY DEFAULT

In case of faulty functioning the ADA-1040D, can be restored the factory default setting. Set SW1 microswitch mode as in the table below

SW1-1	SW1-2
ON	OFF

Disconnect the power and after while connect again. After that, will be loaded the factory default setting. Parameters are as follows:

RS232	RS485(4W) / 422
Baud rate 9600 bps	Baud rate 19200 bps
8 data bits	8 data bits
none parity control	parity control
1 stop bit	1 stop bit

After this operation should return to run mode by setting micro- switch section of SW like in table below.

SW1-1	SW1-2
OFF	OFF

The yellow LED will be OFF.

7. RS232 INTERFACE – PIN DESCRIPTION OF DSUB-9F-DCE SOCKET

Pin	Signal	Description	ADA-1040D
1	(DCD)	Level of receiver signal	Connected with DSR
2	(TxD)	Data transmission from ADA-1040D	Transmitter
3	(RxD)	Data receiving via ADA-1040D	Receiver
4	(DSR)	Readiness of data transmitting/receiving	Receiver
5	(SG)	Signal ground	GND
6	(DTR)	Readiness of ADA-1040D to data receiving/ transmission	Transmitter
7	(CTS)	Device confirm of receiving RTS signal from ADA-1040D	Receiver
8	(RTS)	ADA-1040D reports to device readiness to receiving data	Transmitter
9	(RI)	Call rate	Not connected

ADA-1040D

8. VERSIONS

ADA-1040D - [ ] - [ ]

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-1040D-23-3**
23 - galvanic isolation: 1kV= 3-way,
3 - cover without inlets, plug-in screw terminal block

9. SPECIFICATION

TECHNICAL DATA		
Transmission Parameters		
Interface	**RS-232**	**RS-485/RS-422**
Connector	DSUB-9 Female	Screw terminal block - max. Ø 2,5mm²
Max. Line length	15 m	1200 m
Max. number of connected device	1	1
Transmission line	DB9F/DB9M multicore cable 9x0,34 shielded or 9-pair twisted cable, UTP 9x2x0,5 (24AWG) shield inside large interferences STP 9x2x0,5 (24AWG).	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
Max. baud rate	230,4 kbps	
Transmission type	Asynchronous full duplex, half duplex.	
Optical Signalization	• PWD – green LED power supply, • RX - red LED data receiving on RS485/RS422, • TX - yellow LED data transmission via RS485/RS422.	
Electrical Parameters		
Power requirements	10 - 24 – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m	
Power	<2W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kVDC or 3kVDC - between power circuit and RS-232 signal line	
Optoisolation	3kV - between signals lines RS-232 and RS-485	
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		
Ambient temperature	-30 ÷ 60°C	
Relative air humidity	5 ÷ 95% - non-condensing	
External 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** products.

We hope that this user manual helped connect and start up the **ADA-1040D converter**. We also wish to inform 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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