User manual

ADA-M140
M-1 to RS-485/RS-422 converter (SHORT-HAUL MODEM)

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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-M140 converter is covered by a two year warranty from date of sale. 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.
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 dis-assembly 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

ADA-M140 converter does not require the servicing and maintenance.
Technical support is available at number +48 41 362-12-46 in 8.00-16.00, from Monday to Friday or e-mail support@cel-mar.pl.

1.6. PACK CONTENTS

ADA-M140 converter; User Manual; CE declaration.

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Operating on 2-wires or 4-wires bus in RS485/RS422 standard,
- Operating on 4-wires bus in M1 standard,
- Baud rate up to 115,2 kbps,
- Transparent for all protocols: MODBUS, DNP, PROFIBUS and other,
- Any a data format, specified EIA-485, CCITT V.24 specifications,
- Power supply 10 - 30 VDC stable,
- ~3kV= optoisolation in signal channel between M-1 interface and RS485/RS422 interface,
- 1kV= galvanic isolation between M-1, RS485/RS422 interfaces and power supply (depend on version),
- Connection M1 and RS485/RS422 buses and power supply via screw terminal block,
- Implemented short circuit protection and over-voltage protection on RS485 / RS422 lines,
- Implemented short circuit protection and over-voltage protection on M-1 interface's line,
- 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) 88mm x 90mm x 62mm.

2.2. DESCRIPTION

ADA-M140 converter (SHORT-HAUL MODEM) is use for conversion of RS485/RS422 to M-1 standard, without interfering with format of transmitted data. The converter transmits data with baud rate up to 115,2 kbps via two-pairs of twisted-pair, connected to terminals: Tx+, Tx-, Rx+, Rx- of M-1 interface and two or one twisted-pair, connected to terminals: Tx+/A, Tx-/B, Rx+, Rx- of RS485/RS422 interface's converter.
ADA-M140 converters are used for separation and extension of RS485/422 bus, for next segments of length up to 12km (baud rate 9600bps).
The distances will be reduced in case of transmitting data with large baud rate (over 9600bps). The converter can be use for communication with other, remote from each other devices equipped with RS485 / RS422 interface eg. controllers.
To RS485/RS422 bus, created on the base ADA-M140, can be connected up to 32 devices, operates in half duplex or full duplex modes. To M-1 bus, created on the base ADA-M140, can be connected 2 devices, operates in half duplex or full duplex modes.
Galvanic isolation 1kVDC and optoisolaction ~3kVDC in signal channel, separate RS485/RS422 interface from M-1 interface of converter. Protect devices connected to RS485/RS422 port from overvoltage generated on the bus connected to M-1 interface and in power circuit. Overvoltage protection was made on base safety diodes and fuses on each M-1and RS485/422 lines.
ADA-M140 should be powered from stabilised power pack with minimum power output 3W and voltage from the scope 10 – 30VDC.

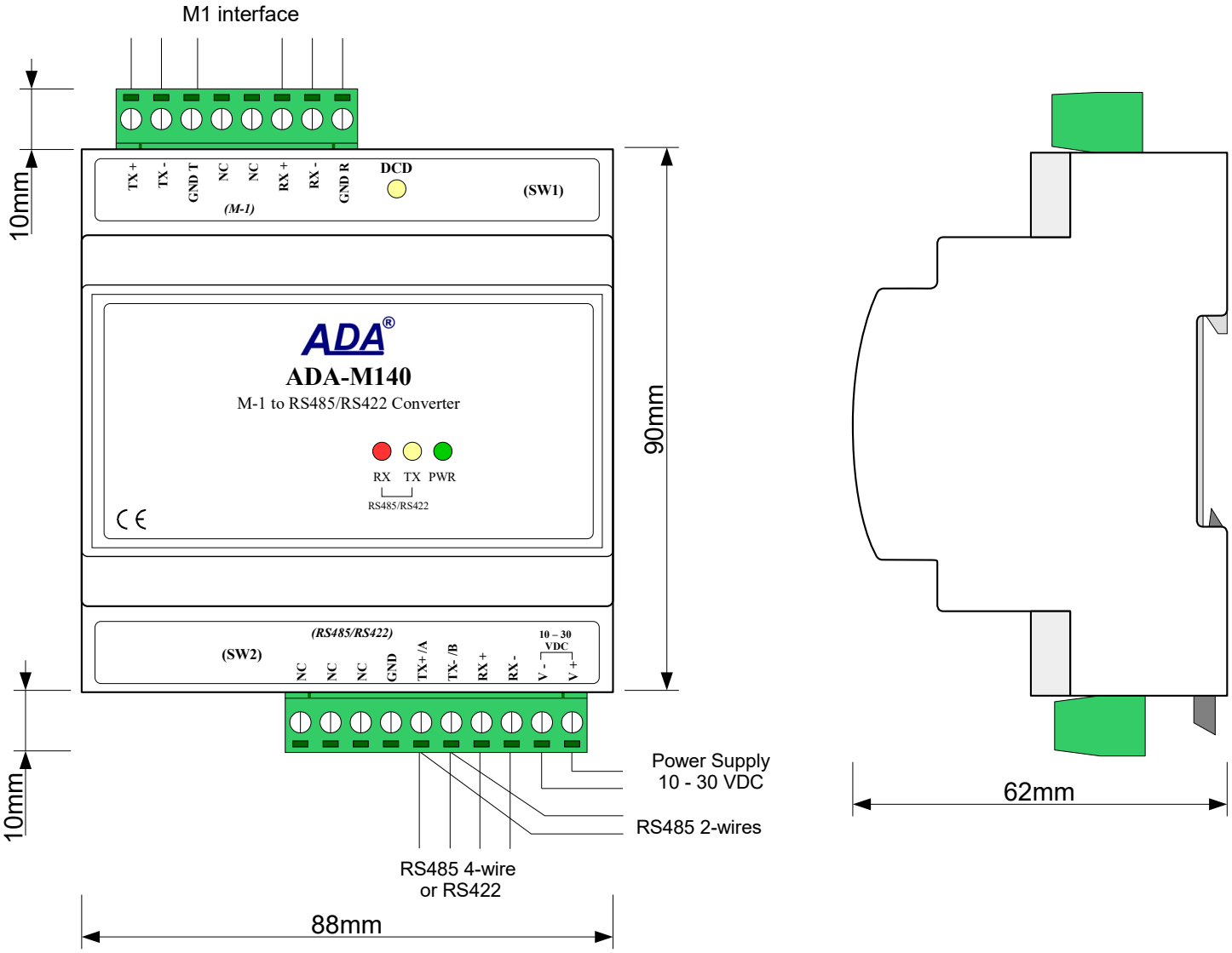


Fig 1. View and location of SW1 and SW2 micro-switches (under the cover)

2.3. ISOLATION

ADA-M140 converter has (depend on version) 2-way or 3-way and 1kV= galvanic isolation. The descriptions are in the section **VERSIONS.**

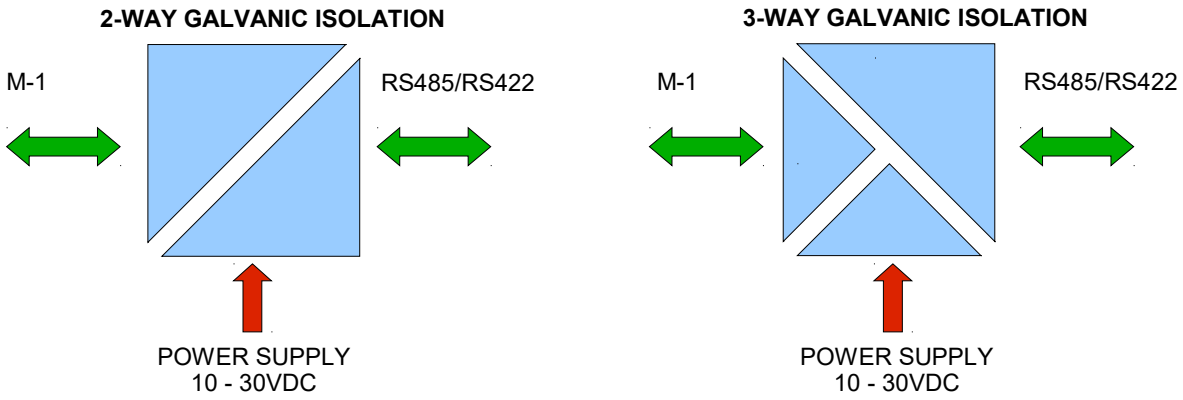


Fig 2. Isolation diagram

3. INSTALLATION

This chapter will show how to connect ADA-M140 to M-1 and RS485/RS422 interfaces and to the power supply and how to use it.
To reduce disturbance from environment, it is recommended to:

- use multi-pair 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.

3.1. ASSEMBLING

ADA-M140 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.

3.2. CONNECTION TO COMPUTER

ADA-M140 can be connected to computer by the use of additional converter USB to RS485/RS422 eg. ADA-I9140.
Example connection of 4-wires and 2-wires buses are shown on the figures below.

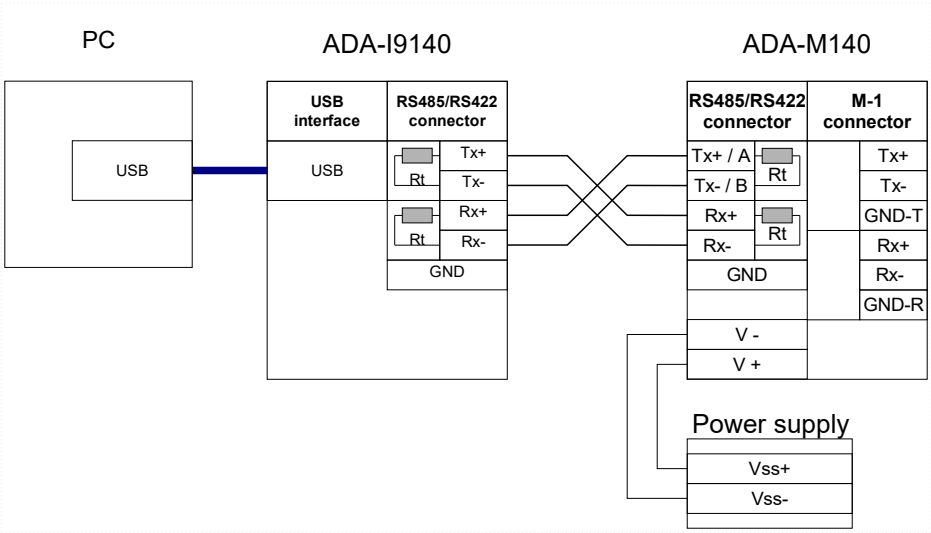


Fig 3. 4-wires connection of converter to computer

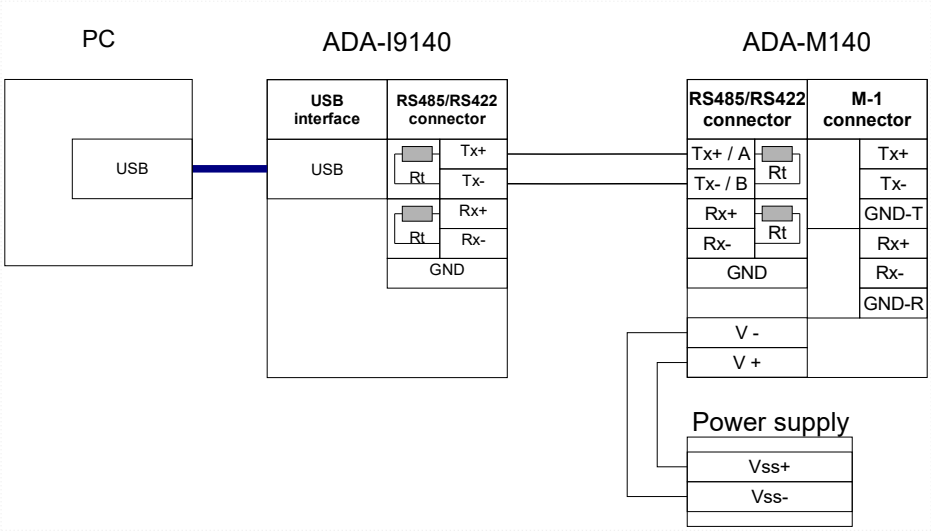


Fig 4. 2-wires connection of converter to computer

3.3. RS422 / RS485 BUS CONNECTION

The RS485/RS422 interface at ADA-M140 converter is available on terminal block described as: Tx+/A, Tx-/B, Rx+, Rx-, GND. ADA-M140 can operates on RS422 bus and RS485(4W) and RS485(2W). The both buses should be the proper wiring. Examples wiring are shown on figures below.

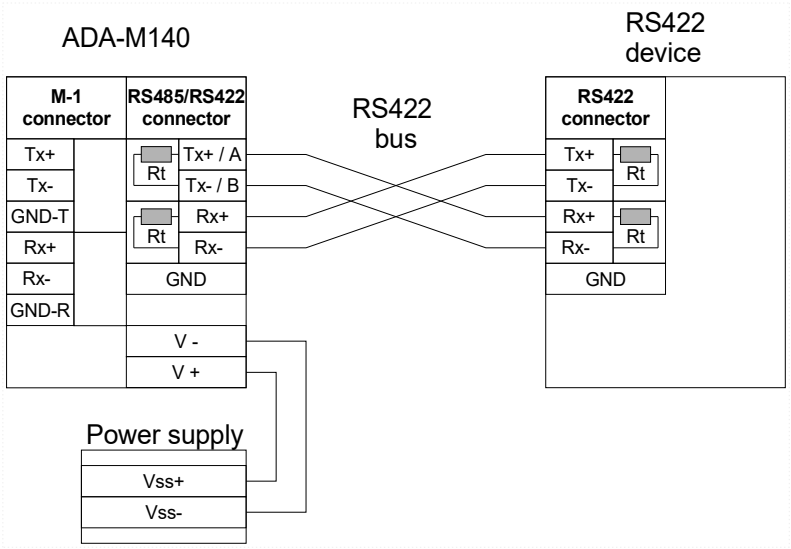


Fig 5. Connection of converter to RS422 interface device

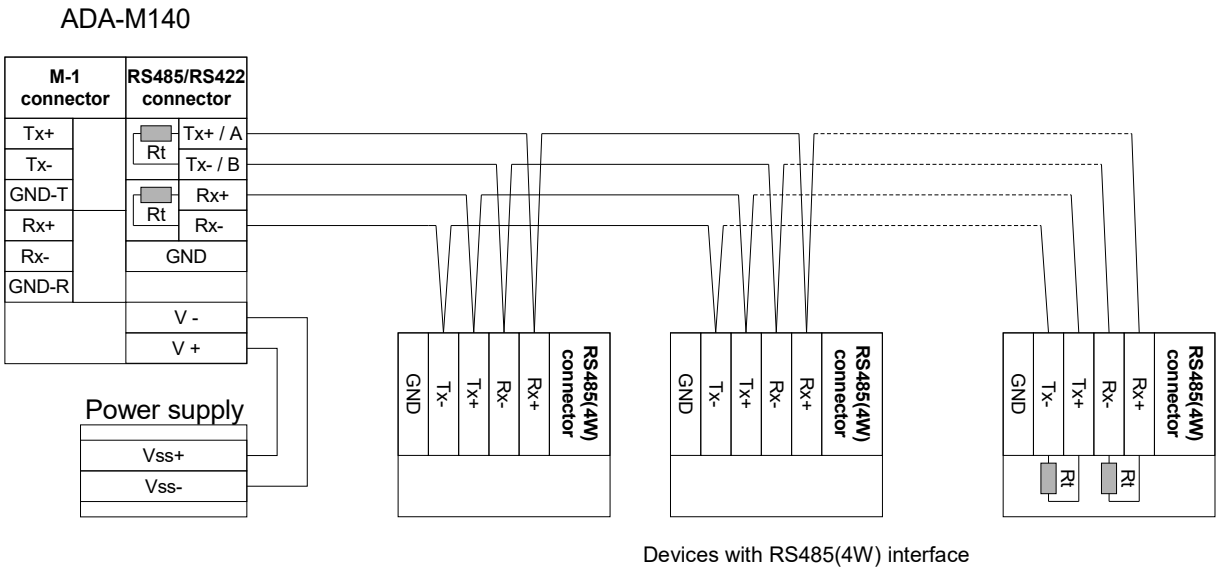


Fig 6. Connection of converter to RS485(4W) bus 4-wires

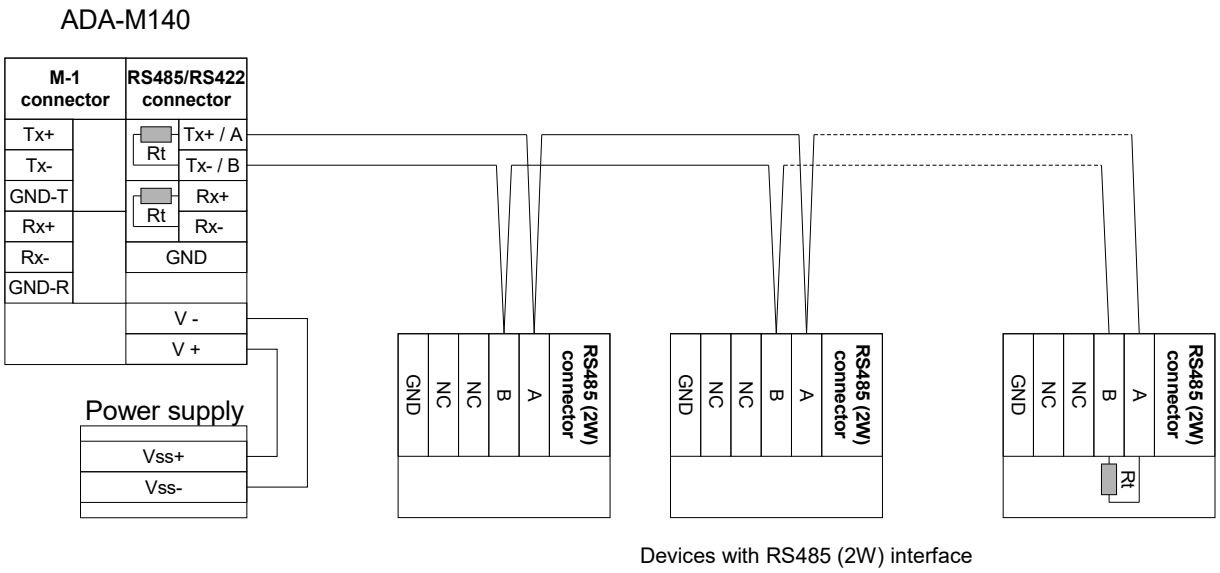


Fig 7. Connection of converter to RS485(2W) bus 2-wires

3.3.1. DESCRIPTION OF RS485/RS422 INTERFACE TERMINALS

Terminal	RS422 interface	RS485 interface
TX+/A	Transmitting data (+)	Transmitting data (+) 4-wires bus. Transmitting/Receiving data (+) 2-wires bus.
TX-/B	Transmitting data (-)	Transmitting data (-) 4-wires bus. Transmitting/Receiving data (-) 2-wires bus.
RX+	Receiving data (+)	Receiving data (+) 4-wires bus.
RX-	Receiving data (-)	Receiving data (-) 4-wires bus.
GND	Interface signal ground	Interface signal ground

3.3.2. 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.

3.3.3. 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. The Line Termination resistor should be used if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission, the resistor can be necessary if there are problems with the transmission correctness. The Rt terminator is integrated in the converter and activated by the use of SW2 micro-switch.

3.4. M-1 BUS CONNECTION

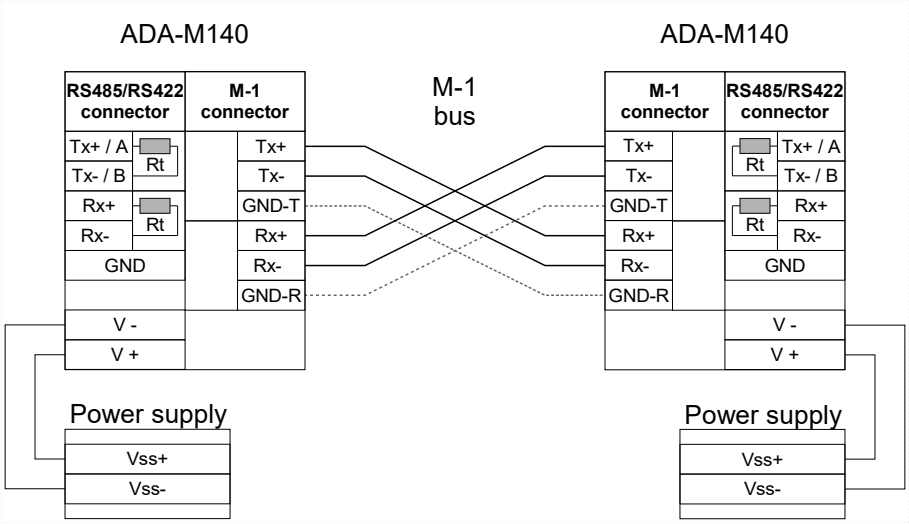


Fig 8. Connection of converters by the use of M-1 bus

3.4.1. DESCRIPTION OF M-1 INTERFACE TERMINALS

Terminal	M-1 interface
TX+	Transmitting data (+)
TX-	Transmitting data (-)
GND-T	Transmitter signal ground
RX+	Receiving data (+)
RX-	Receiving data (-)
GND-R	Receiver signal ground

3.4.2. GND-R & GND-T TERMINALS CONNECTION

Connection of GND terminals of M-1 interfaces, converters connected to M-1 bus, should be done in the case of a potential difference of the signals grounds on interfaces M-1, which prevents proper data transmission. Optionally, combine terminals GND-T withGND-R. **Cannot connect to the GND-T & GND-R terminals - cables screens, PE circuit of electrical installation, signals grounds of other devices.**

3.5. POWER SUPPLY

The power supply to ADA-M140 should be DC (regulated) from the scope 10 V= to 30V= and nominal power min. 3W eg. ZS-12/500 or DR-15-24. The power cable from DC power supplies to the device must not be longer than 3m.
Observe the polarity, connect positive (+) of DC power supplies to V+ and negative (-) end to V- terminal. ADA-M140 has the protection from opposite connection power supply. If after power, on the front panel is not lit green LED PWR, check the power connection (polarity).

4. CONFIGURATION

For configuration of ADA-M140 operating mode use a four-position dip switch SW1 and two-position dip switch SW2.
The locations of SW1 and SW2 are shown on the figure 1.
For setting, remove the covers and use small, flat screwdriver.

4.1. OPERATING MODE SETTING

The setting of SW1 section used for configuration mode of ADA-M140 are shown in the table 1 (below).
In case of any questions, contact the support: support@cel-mar.pl or +48 41 362-12-46.

Table 1. SW1 setting – operating mode RS422 or RS485.

SW1-1	SW1-2	SW1-3	SW1-4	Description
ON	OFF	OFF	OFF	Setting for baud rate < 19200bps, Operating mode RS-485 2-wires & 4-wires bus
OFF	ON	OFF	OFF	Setting for baud rate > 19200bps and baud rate< 57600bps, Operating mode RS-485 2-wires & 4-wires bus
OFF	OFF	ON	OFF	Setting for baud rate > 57600bps, Operating mode RS-485 2-wires & 4-wires bus
X	X	X	ON	Baud rate 0 – 115200bps, Operating mode RS422 – 4-wires bus

X – any position

Table 2. SW2 – activation of line termination

Section	Description
SW2-1	ON – connection of Line Termination to Tx+ and Tx- terminals of RS485/RS422 interface OFF – disconnection of Line Termination from Tx+ and Tx- terminals of RS485/RS422 interface
SW2-2	ON – connection of Line Termination to Rx+ and Rx- terminals of RS485/RS422 interface OFF – disconnection of Line Termination from Rx+ and Rx- terminals of RS485/RS422 interface

4.2. FACTORY DEFAULT

During production ADA-M140 converter is configured to operating in RS485 mode as in table below.

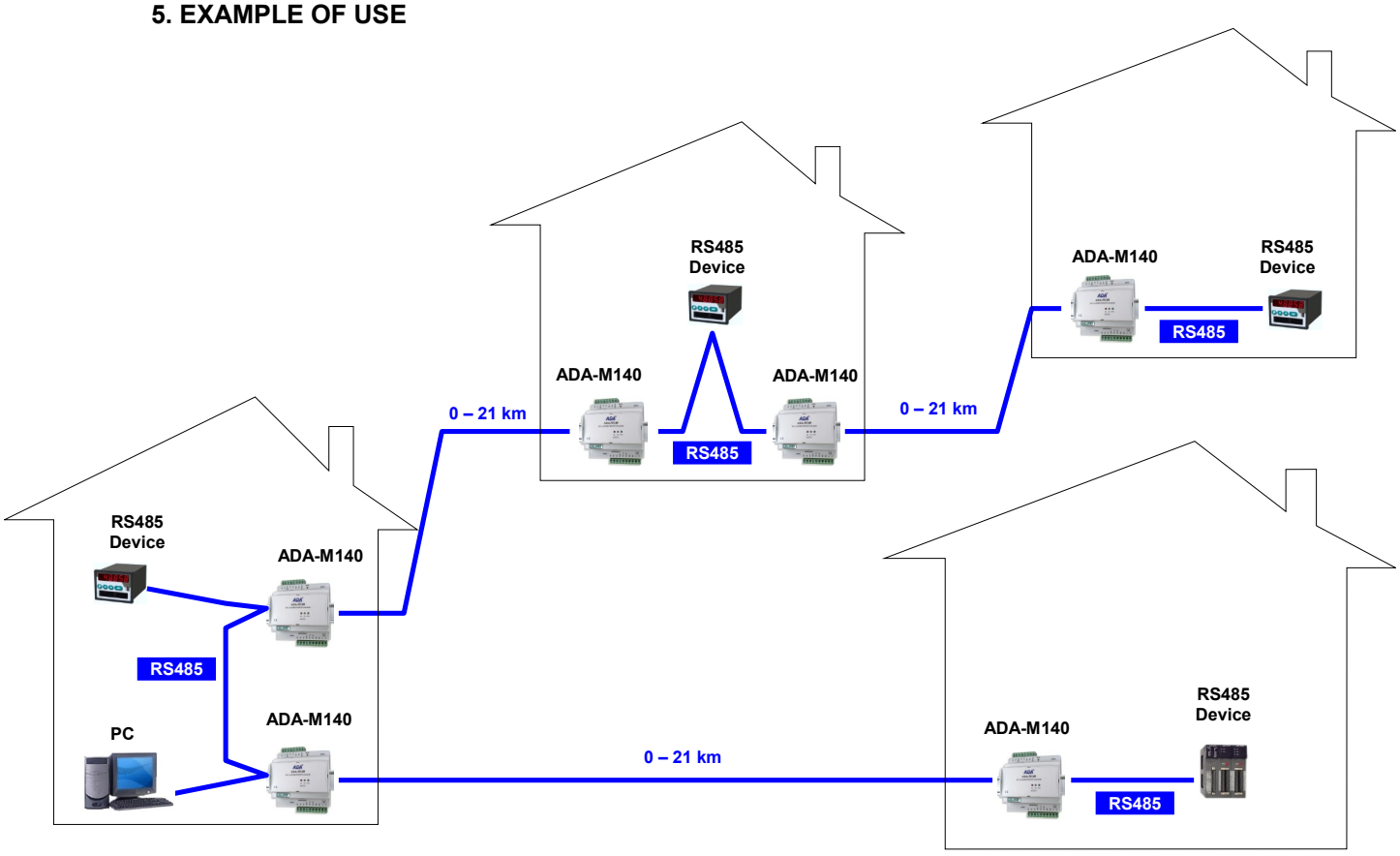
Table 3. SW1 factory default

SW1-1	SW1-2	SW1-3	SW1-4
ON	OFF	OFF	OFF

Table 4. SW2 factory default

SW2-1	SW2-2
OFF	OFF

5. EXAMPLE OF USE



6. ACTIVATION

Converter can be powered after proper connection according to steps above.
If connection was made properly green LED PWR on front panel of converter should light, if not check polarization of power connection. When data is present the LEDs Tx and Rx should blinking.

6.1. SIGNALLING LEDS

LED	*Description*
PWR	Signalling of Power Supply
RX	Signalling of data receiving from RS485/RS422 port of ADA-M140
TX	Signalling of data transmitting from converter via RS485/RS422 port of ADA-M140
DCD	Signalling of correctness connection of converters by the use of M-1 buses.

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

6.2. TROUBLESHOOTING

Problem	Solutions
PWR led not light	Check polarization and parameters of connected power supply.
Rx LED lights 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 the correctness of connection to Tx, Rx terminals according to chapter 3.
	RS485(2W) bus. Check the correctness of configuration setting according to chapter 4.
DCD led not light	Interruption or incorrect connected of M-1 bus. Check the correctness of connection. Check the continuity of M-1 bus.
DCD led not light, Tx led lights.	M-1 bus. Wrong polarization on Rx+, Rx- terminals of M-1 bus. Change polarization.

7. VERSIONS

ADA-M140 - [ ] - [ ] - [ ]

Electronics version:			
Basic	**1**		
Special	**2**		
Galvanic isolation:			
1kV=, 2-way		**2**	
1kV=, 3-way		**23**	
Terminals & Terminals 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-M140-1-2-3**
1 – basic electronics version,
2 – 1kV=, 2-way galvanic isolation,
3 – cover without inlets, plug-in screw terminal block.

8. SPECIFICATION

TECHNICAL DATA		
Transition Parameters		
Interface	**RS485/RS422**	**M-1**
Connector	Screw terminal block - max. Ø 2,5mm^2	
Line length	1200m / 115200bps	21000m / 600bps 15000m / 2400bps 12000m / 9600bps 4000m / 38400bps 2000m / 57600bps
Max. number of connected device	32	2
Transmission line	1-pair or 2-pair twisted cable, UTP Nx2x0,5 (24AWG), shield inside large interferences STP Nx2x0,5 (24AWG)	
Standards	EIA-485, CCITT V.11	M-1
Maximum baud rate	0-115,2 kbps	0-115,2 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 interface	
Electrical Parameters		
Power requirements	10 - 24 – 30 V DC	
Power Cable	Recommended length of power cable – up to 3m	
Power	3W	
Protection from reverse power polarization	YES	
Galvanic Isolation	1kV DC 2-way - between power circuit and M1 signal line, 1kV DC 3-way - between power circuit and RS485/422 and M1 signal lines,	
Optoisolation	~3kV - between signal line RS485/RS422 and M1	
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 (W x D x H)	88mm x 90mm x 62mm	
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-M140 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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