

User manual

ADA-4020

RS-485 / RS-422 to Current Loop converter



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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-4020 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.

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 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

ADA-4020 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-4020 converter; user manual; CE declaration; terminators $R_t=120\Omega$ (2 pcs)

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Operating on 4-wire network in Current Loop standard
- Operating 2-wire or 4-wire network in RS485 / RS422 standard,
- Possibility of connection up to 15 devices on Current Loop network,
- Possibility of connection up to 32 devices on RS485 / RS422 network
- Baud rate up to 38,4 kbps,
- Transparent for all protocols: MODBUS, DNP and other,
- Power supply 10 - 30 VDC stable,
- ~3kV= optoizolation in signal channel between RS485 / RS422 and Current Loop interface,
- 1kV= or 3kV= galvanic isolation between RS485 / RS422 interface and power supply,
- 1kV= or 3kV= galvanic isolation between Current Loop interface and power supply,
- Automatic control of transmitter/receiver of RS485 network,
- Screw terminal block connectors for all connections,
- Integrated short circuit protection and over-voltage protection on RS485/RS422 lines,
- Integrated short circuit protection and over-voltage protection on Current Loop lines,
- Protection against power supply reverse connection,
- DIN 43880 standard - mounting in typical electro-installation unit,

- Rail mounting according to DIN35 / TS35 standard,
- Dimensions (W x D x H) 53mm x 62mm x 90mm.

2.2. DESCRIPTION

ADA-4020 converts RS485/RS422 standard to Current Loop without interfering with format of transmitted data with maximum baud rate of 38,4kbps via 2-pair of twisted pair.

The converter has screw terminal blocks for connection of RS485/422, Current Loop networks and power supply. This device use RX+, RX-, TX+, TX- signals for operating.

Over-voltage protection was made on base safety diodes and fuses on each RS485/RS422 and Current Loop lines.

To RS485/RS422 bus, created on the base ADA-4020, can be connected: 32 devices operate in half duplex (query / response) mode on 2-wires or 4-wires bus or full duplex on 4-wires bus.

To Current Loop bus, created on the base ADA-4020, can be connected

- 2 devices operating in half duplex or full duplex mode in point-to-point topology,
- 15 devices operating in half duplex mode in multipoint topology 'current loop network'.

The converter has an internal low-energy surge protection for each line of Current Loop interface. However, for the lightning protection should be used external lightning arresters such as the typical phone line protection.

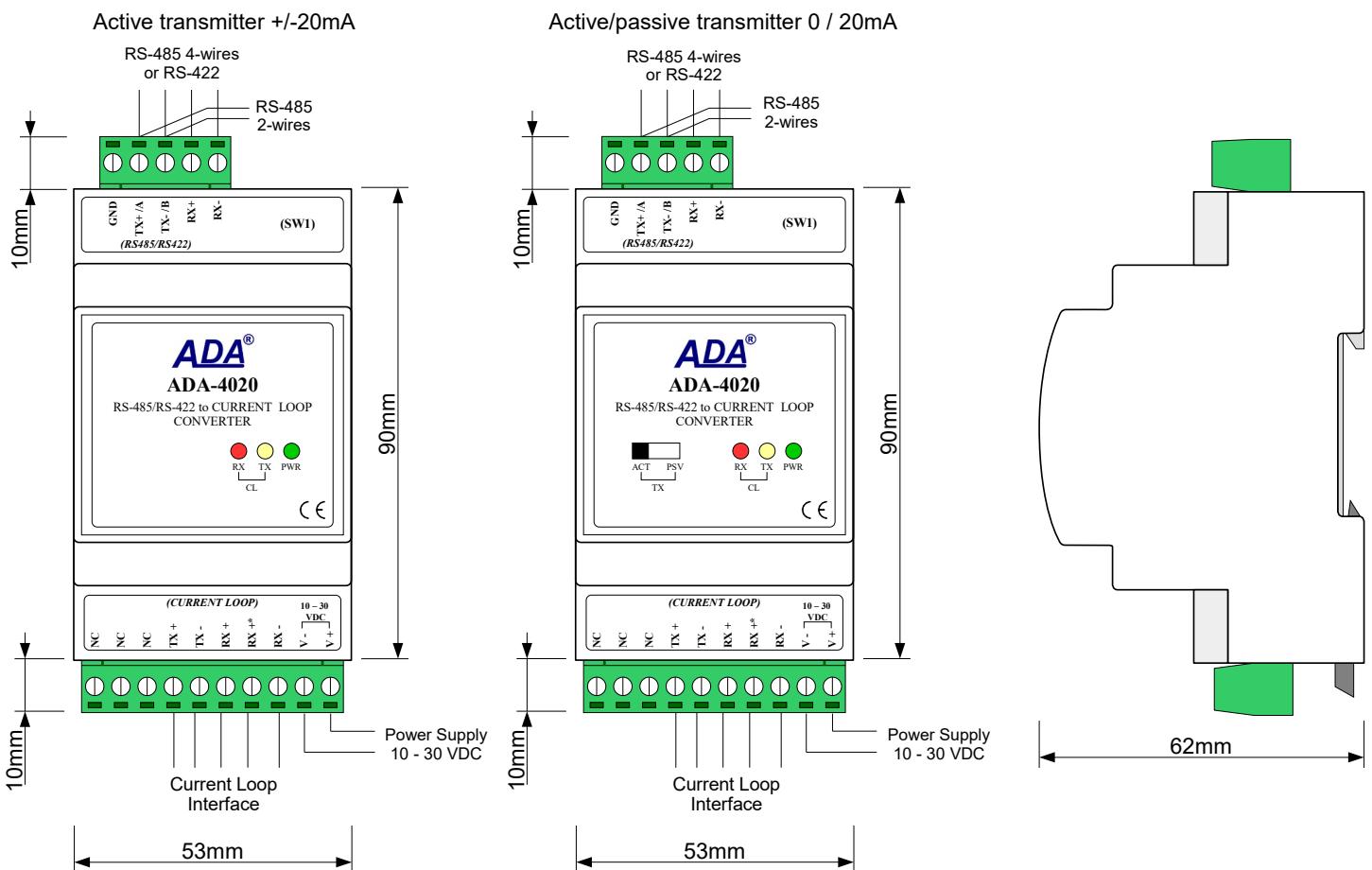


Fig 1. ADA-4020 view and location of SW1 switch

2.3. CURRENT LOOP TRANSMITTER

The Current Loop transmitter at ADA-4020 is made as:

- active, on the base power source generate current +/- 20mA or 0-20mA (depend on converter's version). The transmitter has short circuit protection on TX+ and TX- lines.
- passive 0-20mA, on the base transistor, has also short circuit protection on TX+ and TX- lines.

The transmitter of Current Loop 0-20mA can work as ACTIVE or Passive, the selection is made by the TX switch on the front panel (see Fig.1).

The passive transmitter can be used only for creation of current loop bus, see point 3.5.

The diagram of the transmitter & receiver is shown on figure below.

2.4. CURRENT LOOP RECEIVER

In the ADA-4020 converter has been used passive RX receiver consisting of optoisolator (optical coupler) and protective elements. The receiver circuit has RX+, RX- terminals as well as the terminal marked as RX-*. In the circuit with RX-* terminal has been used additional resistor (1000 ohms or 560 ohms depend on the converter version) to reduce power in the case of connecting the receiver to transmitter which has NOT short circuit current limit to 20mA.

The RX red LED on front panel of the converter is a signalization of NO current flow through optocoupler. This LED is ON when it is:

- not connect transmitter to receiver,
- wrong connection of transmitter to receiver,

- broken connection of transmitter to receiver.
The diagram of the transmitter & receiver is shown on figure below.

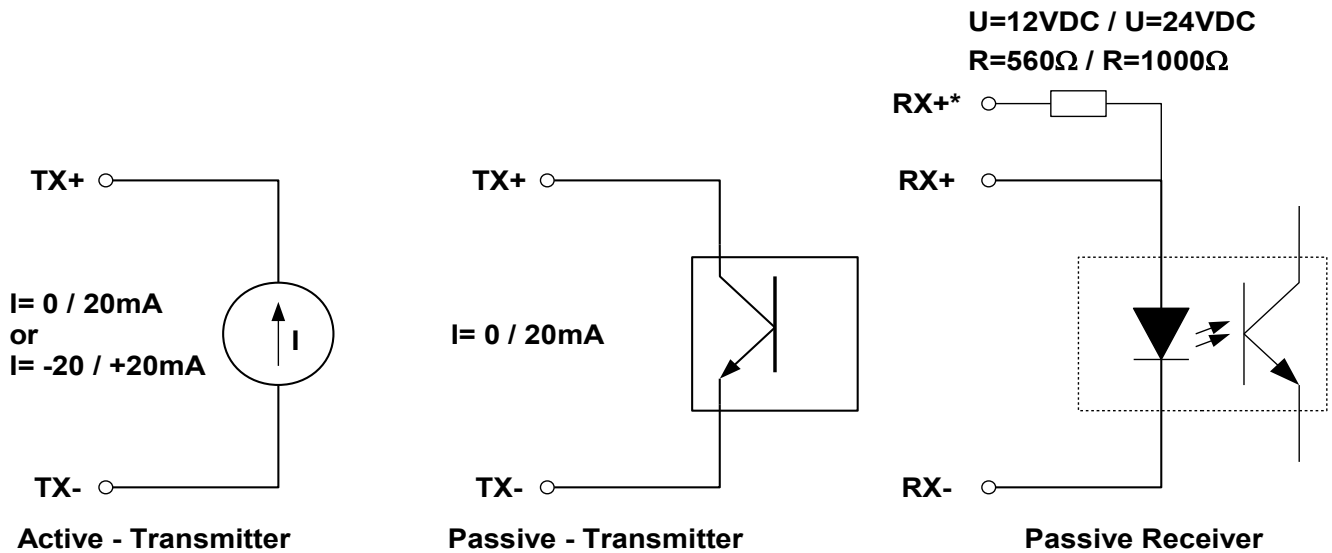


Fig 2. Review diagram of the transmitter & receiver Current Loop ADA-4020

2.5. ISOLATION

Converter ADA-4020 has 3-way, 1kV= or 3kV= galvanic isolation (depend on version). Converter versions are described in section *VERSIONS*.

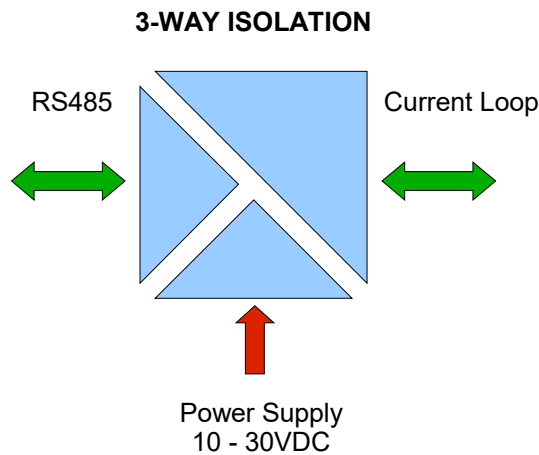


Fig 3. Insulation structure

3. INSTALLATION

This chapter will show how to connect ADA-4020 to PC, RS485,RS422 buses and power supply and how to use it. In the purpose of minimization of disruptions from environment is being recommended to:

- apply multipair 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 Interference suppression filters for power supply converters that are installed within a single object,
- not power the converter from power circuit device that generates large impulse interference such as transmitters, contactors,

3.1. ASSEMBLING

ADA-4020 enclosure is adapted to assembly on TS-35 (DIN35) rail. To install repeater you should mount device on the rail upper part of the enclosure then press bottom part to hear characteristic „Click” sound.

3.2. CONNECTION TO RS232 COMPUTER PORT

To connect ADA-4020 converter to computer RS232 port should be used additional converter eg RS232 to RS485 ADA-I1040 or USB to RS485 ADA-I9140. This converter should be connected with ADA-4020 via RS485 or RS422 bus as shown on the example figure below.

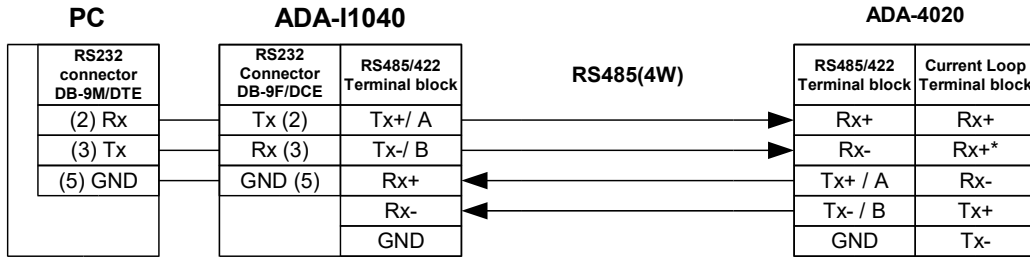


Fig 4. Connection of ADA-4020 to a PC by the use of RS232 to RS485/422 ADA-I1040 converter

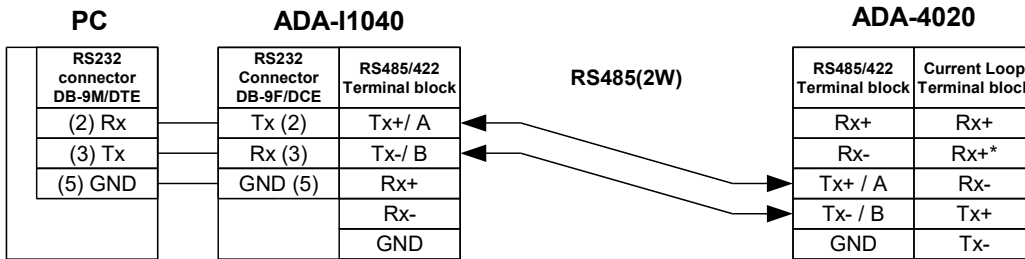


Fig 5. Connection of ADA-4020 to a PC by the use of RS232 to RS485/422 ADA-I1040 converter

3.3. CONNECTION TO RS485/422 BUS

RS485/RS422 interface at ADA-4020 converter is available on terminal block described as: Tx+/A, Tx-/B, Rx+, Rx-. Types of connection the ADA-4020 converter to RS485(4W)/RS422 and RS485(2W) networks are shown below.

3.3.1. CONNECTION TO RS485 4-WIRES BUS

After connection devices according to figure below, ADA-4020 should be set to operate on RS485 network.

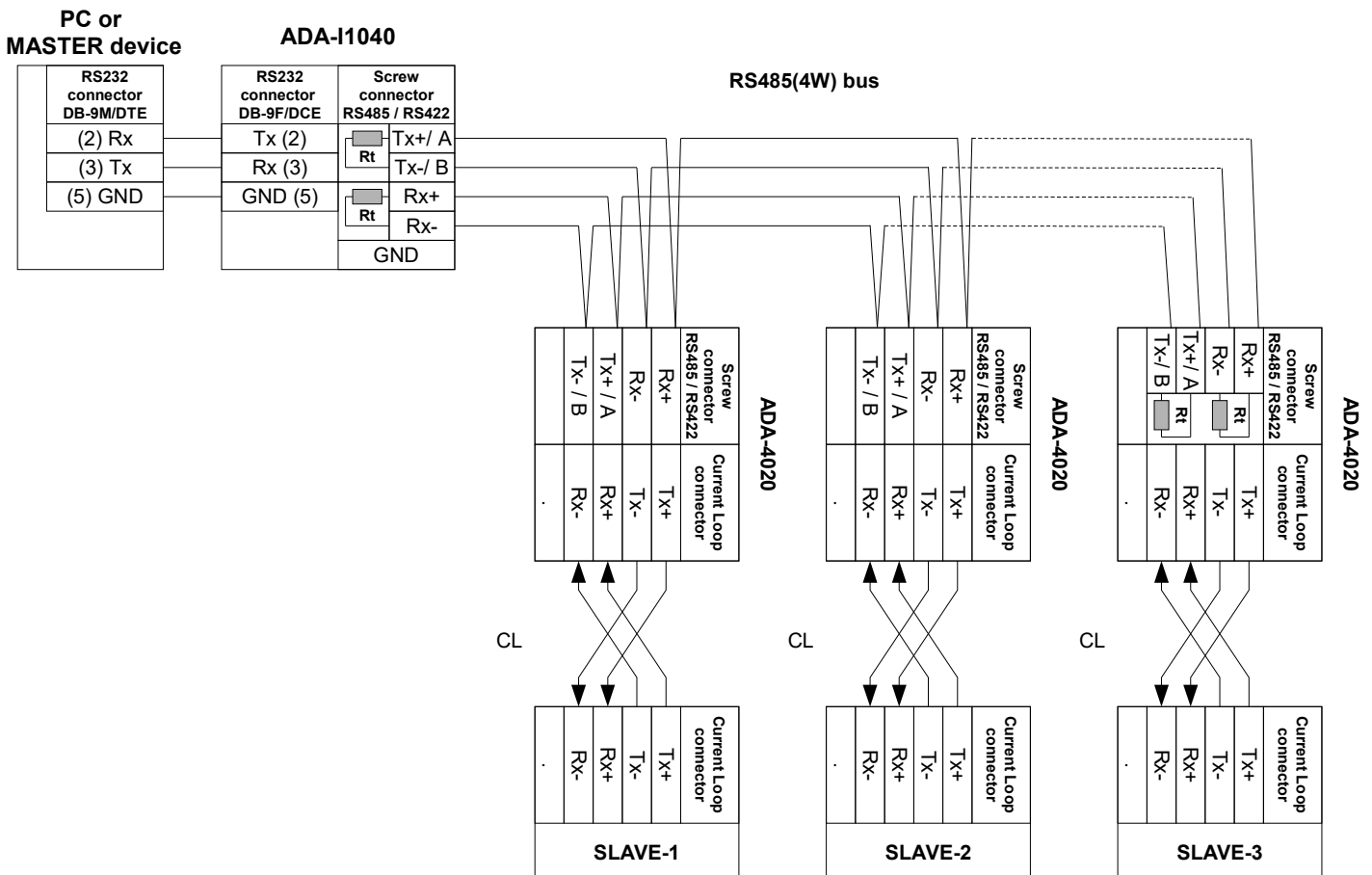


Fig 6. Example connection of the ADA-4020 to RS485(4W) 4-wire network and galvanic separation of SLAVE device

3.3.2. CONNECTION TO RS485 2-WIRES BUS

After connection devices according to figure below, ADA-4020 should be setted to operate on RS485 network.

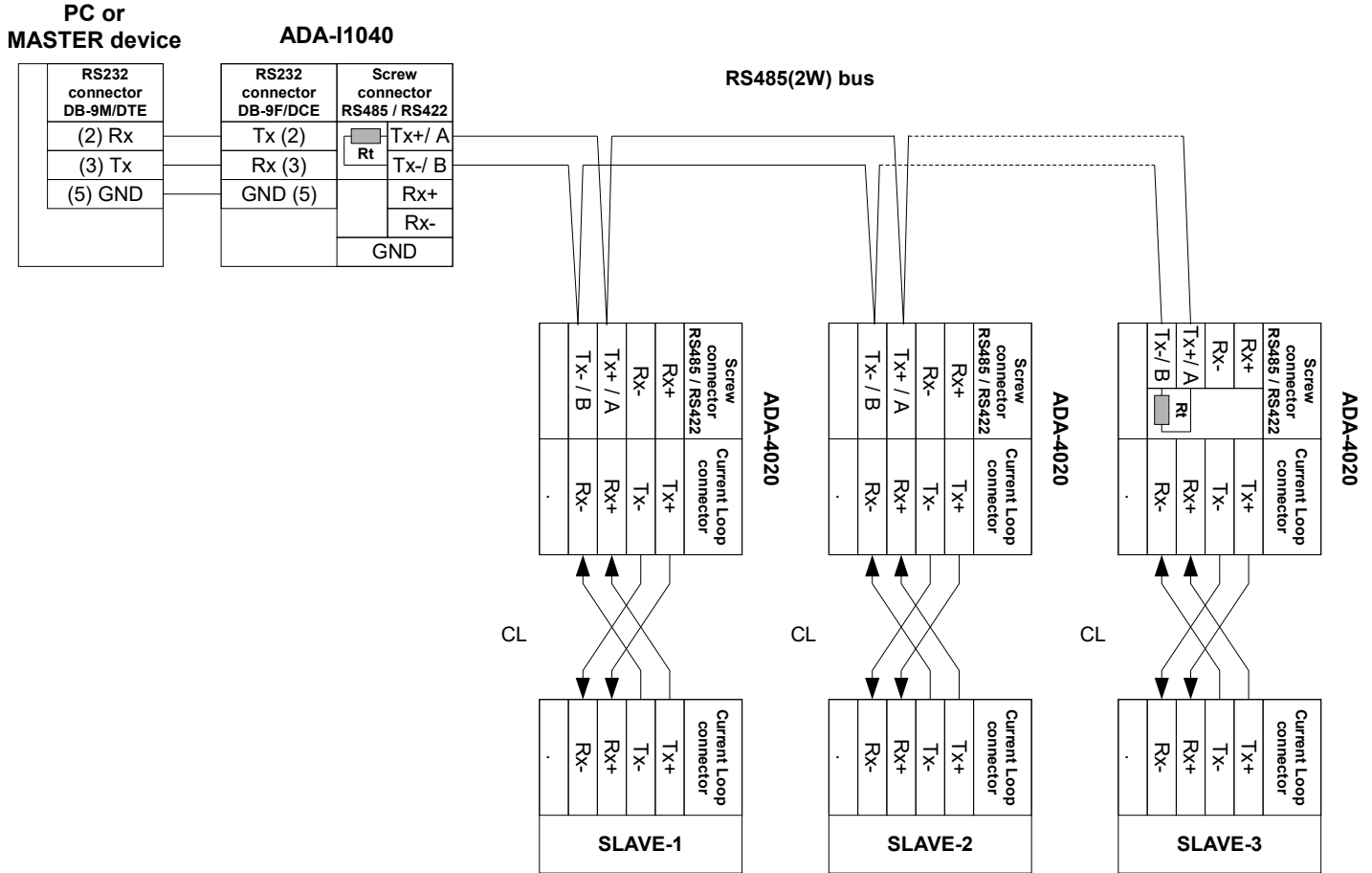


Fig 7. Example connection of the ADA-4020 to RS485(2W)2 -wire network and galvanic separation of SLAVE device

3.3.3. EXTENDER TYPE CONNECTION

After connection devices according to figure below ADA-4020 should be setted to operate on RS485 or RS422 network – depend on which interface are on connected devices.

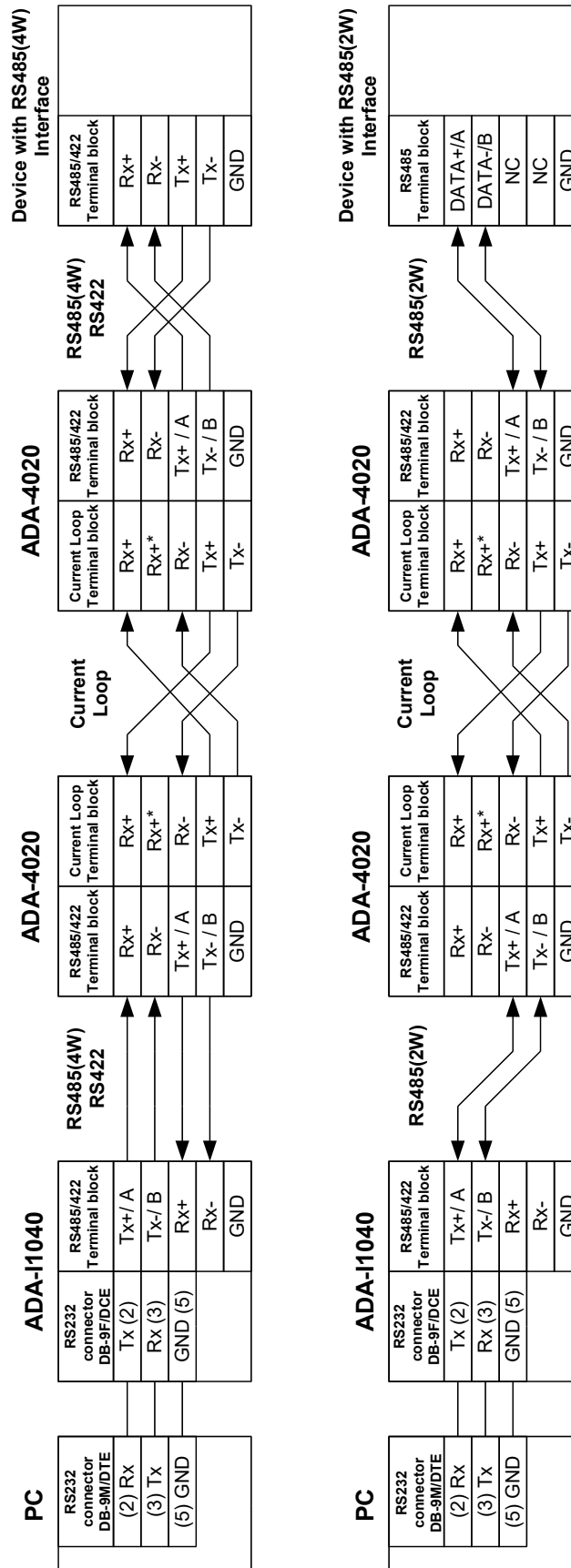


Fig 8. Example connection of ADA-4020 converter as extender

3.3.4. LINE TERMINATION

The application of Line Termination (terminator) $R_t = 120$ ohms will reduce electrical reflection in data line at high baud rate. It is not needed below 9600Bd. Line Termination resistor should be used if the distance is over 1000m @ 9600Bd or 700m @ 19200Bd transmission. Example connection of R_t are shown on Fig. 6 & 7. Two resistors $R_t = 120\Omega$, 5%, 0,25W are supplied with ADA-4021 converter, free of charge.

3.4. CONNECTION OF CURRENT LOOP INTERFACE DEVICE

Figures 6, 7 & 8 show connection of SLAVE device Current Loop interface to ADA-4020.

3.5. CONNECTION TO CURRENT LOOP BUS OF DEVICES WITH RS485/RS422 INTERFACE

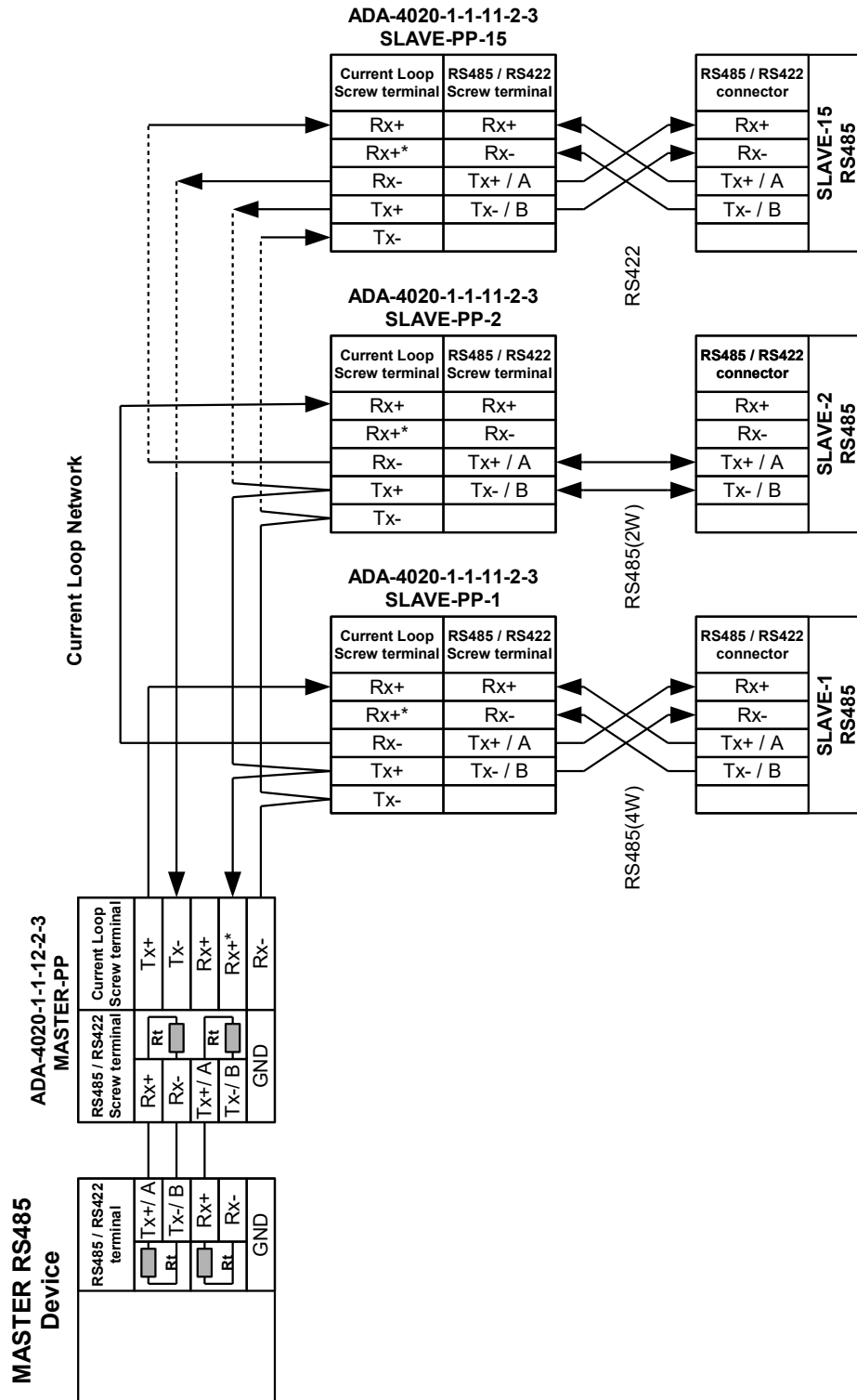


Fig 9. Example connection of the ADA-4020 converters to Current Loop bus

Using ADA-4020 converters it is possible to create Current Loop bus as above.

In above example the current loop bus creates on converter ADA-4020-1-1-2-2-3 (MASTER – **Active Transmitter**), one converter ADA-4020-1-1-2-2-3 (SLAVE - **Active Transmitter**) furthest from the converter MASTER and max. 14 converters ADA-4020-1-1-2-2-3 (SLAVE – **Passive Transmitter**). The number of SLAVE converters can be less for long lines.

3.6. POWER SUPPLY CONNECTION

The power supply to the ADA-4020 converter should be DC (regulated) from 10 V= to 30V=. Nominal power is typically 2W, e.g. HDR-15-24. Power cable from DC power supplies to 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-4020 has the protection from opposite connection power supply. If after connection power supply on the front panel of the converter not light green LED PWR, check correctness of power connection (polarization).

4. CONFIGURATION

The operating mode of ADA-4020 converter is set by the use of 6-positions SW1 switch.

This switch is located near the screw terminal block (see Fig.1). To set the SW1 should be removed a terminal cover and using small, flat screwdriver make correct setting.

4.1. OPERATING MODE SETTING

All available operating modes are shows in table below.

If there are any additional questions, please contact with technical support: support@cel-mar.pl or on the phone: +48 41 362-12-46.

Table 1.

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6	Description	Operating mode
OFF	OFF	OFF	OFF	OFF	OFF	RS-422 network	4-wire RS422 network. Full duplex or half duplex transmission.
ON	ON	ON	ON	ON	ON	RS-485 network, automatic data flow control	2-wire and 4-wire RS485 network. Full duplex or half duplex transmission.

4.2. FACTORY DEFAULT

During production ADA-4020 converter is configured to operating in RS485 mode as in table below.

Table 2.

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6
ON	ON	ON	ON	ON	ON

5. ACTIVATION

Converter can be powered after proper connection according to steps above. If the connection was made properly green LED PWR on front panel of converter should lit, if not check polarization of power connection. If the red LED RX is lit check correctness of connection transmitting line of Current Loop Device. The lighting of RX LED indicates no current flow through the optocoupler in the receiver's circuit.

During proper data transmission through converter the LEDs Tx and Rx should blink.

LED	Description
PWR	Signalization of Power Supply
RX	Signalization of data receiving by ADA-4020 from Current Loop.
TX	Signalization of data transmission from ADA-4020 converter through Current Loop

6. VERSIONS

ADA-4020 -		-	-	-	-	-
Electronic versions:						
Basic,	1					
Special,	2					
Current Loop Voltage:						
24VDC	1					
12VDC	2					
Current Loop Type:						
± 20mA (active transmitter, passive receiver)	1					
0 – 20mA (active/passive transmitter, passive receiver)	2					
0 – 20mA Network/Slave (not produced anymore)	11					
± 20mA Network/Master (not produced anymore)	12					
Galvanic isolation:						
1kV=, 3-way					2	
3kV=, 3-way					3	
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-4020-1-1-1-2-3**

- 1 – basic version of electronic,
- 1 – Current Loop Voltage 24VDC,
- 1 – Current Loop Type ± 20mA,
- 2 – 1kV= galvanic isolation,
- 3 – cover without inlets, plug-in screw terminal block .

7. SPECIFICATION

TECHNICAL DATA

Transmission Parameters

Interface	RS-485/RS-422	Current Loop
Connector	Screw terminal, wire max. Ø 2,5mm ² .	Screw terminal, wire max. Ø 2,5mm ² .
Line length	up to 1200 m	Depend on baud rate, several kilometres
Maximum number of connected device	up to 32	1 / up to 15 (connection in Current Loop network)
Transmission line	1-pair, 2-pair twisted cable eg UTP 4x2x0,5(24AWG), shield inside large interferences eg STP 4x2x0,5(24AWG)	2-pair twisted cable eg UTP 4x2x0,5 (24AWG), shield inside large interferences eg STP 4x2x0,5 (24AWG)
Standards	EIA-485, CCITT V.11	Current Loop 0-20mA +/-20mA
Maximum baud rate	38,4 kbps (depend on line length Current Loop) /19,2kbps (for Current Loop network)	
Transmission type	Asynchronous half duplex or full duplex	
Optical signalisation	<ul style="list-style-type: none"> • PWR – green LED power supply, • RX - red LED data receiving from Current Loop side, • TX - yellow LED data transmission through Current Loop interface 	
Electrical Parameters		

Power requirements	10 - 24 – 30 V DC
Power cable	Recommended length of power cable < 3m
Power	2W
Protection from reverse power polarization	YES
Galvanic isolation	1kVDC or 3kVDC between power circuit and signal lines RS485/422 and Current Loop
Optoisolation	~3kV between Current Loop signal line and RS485/422
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 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 method	On the rail compliant with DIN35 / TS35 standard.

Dear Customer,

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

We hope that this user manual helped connect and start up the **ADA-4020 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.

CEL-MAR sp.j.

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