CEL-MAR®
Zakład Informatyki i Elektroniki

User manual

ADA-1020
RS-232 to Current Loop 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. WARRANTED INFORMATION

ADA-1020 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 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-1020 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-1020 converter, user manual, CE declaration.

2. PRODUCT INFORMATION

2.1. PROPERTIES

- Operating on 4-wire network in the standard of the Current Loop ,
- Baud rate up to 38,4 Kbps (dependent from the length of the line),
- Transparent for all protocols: MODBUS, DNP, PROFIBUS and other,
- Any format of byte defined with the specification of RS232 interface,
- Current Loop 0-20mA or -20 - +20mA, active transmitter.
- Power supply 10 - 30 VDC stable, 2W,
- ~3kV= optoisolation in signal channel between RS232 and Current Loop,
- 1kV= or 3kV= galvanic isolation between RS232 interface and power supply,
- 1kV= or 3kV= galvanic isolation between Current Loop interface and power supply,
- Connection Current Loop network and power supply via screw terminal block,
- Connection RS-232 network via Female DB9 connector,
- Implemented short circuit protection and over-voltage protection on Current Loop network,
- 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-1020 converter is a device used to convert the RS232 to current loop standard without interfering with the format of transmitted data and does not require the power supplying from the RS232 port. The converter supports RS232 asynchronous data transmission at baud rate up to 38.4 kbps via two pairs of twisted-pair cable.

ADA-1020 is equipped with one female DB-9F connection to connect RS232 interface and screw terminal block for connection of Current Loop bus and power supply. Connector DB-9F RS232 interface is made like DCE, it let connect converter to computer in use the typical extension cable RS232 (cable for modem connection) without crossing Tx with Rx and RTS with CTS.

Converter uses signals Rx, Tx and GND for operating, which are entered via DB-9F connector. RTS signal is looped with CTS and DTR with DSR and DCD inside the converter. Other signals are not connected.

You can connect to the Current Loop line two ADA-1020 converters operates in full duplex or half duplex mode in point-to-point topology.
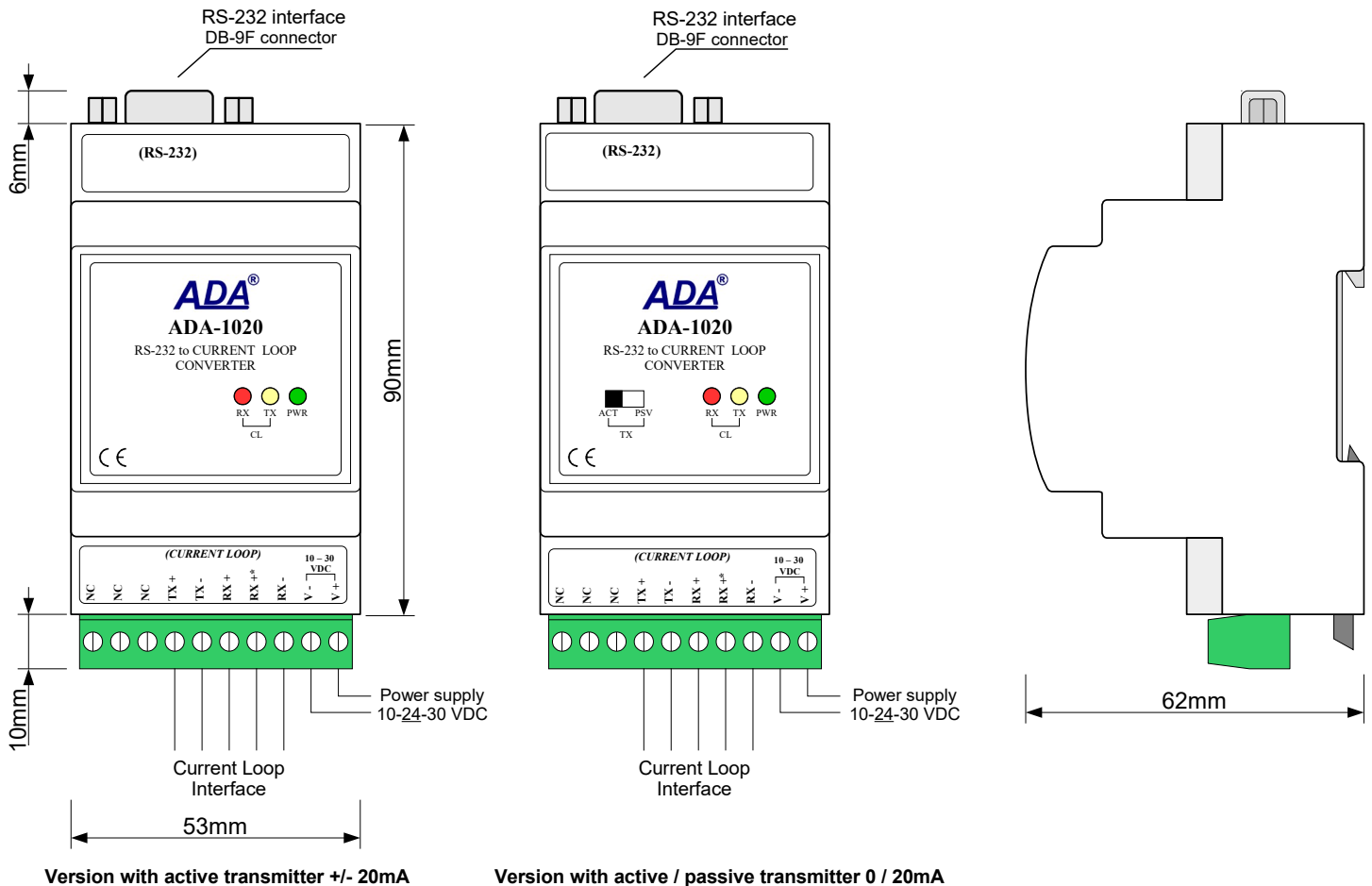

Version with active transmitter +/- 20mA   Version with active / passive transmitter 0 / 20mA

Fig 1. View of the ADA-1020

2.3. CURRENT LOOP TRANSMITTER

The Current Loop transmitter at ADA-1020 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-1020 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.
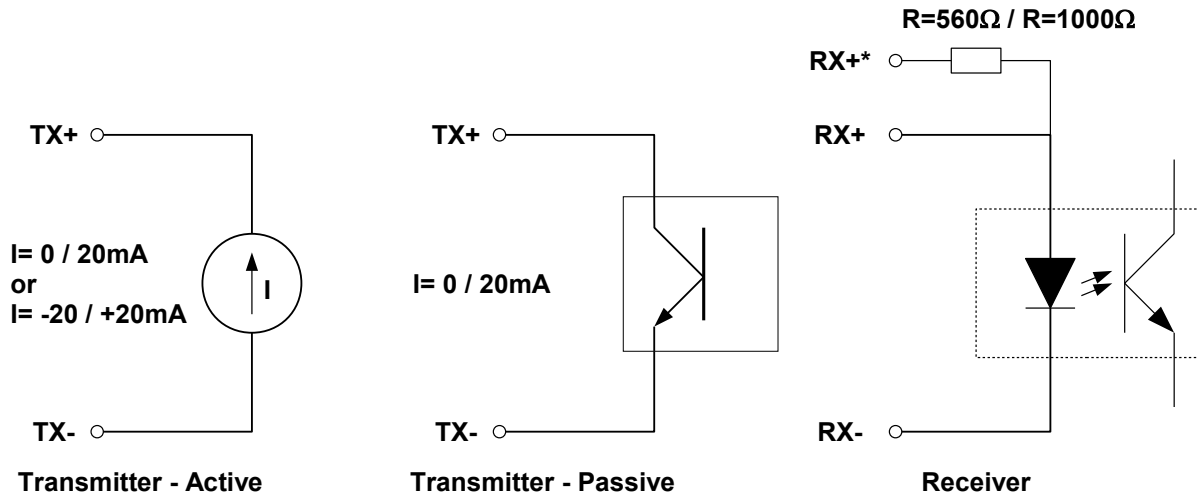The diagram of the transmitter & receiver is shown on figure below.

R=560Ω / R=1000Ω

TX+ ○

I= 0 / 20mA
or
I= -20 / +20mA

I

TX- ○

Transmitter - Active

TX+ ○

I= 0 / 20mA

TX- ○

Transmitter - Passive

RX+* ○

RX+ ○

RX- ○

Receiver

Fig 2. The diagram of the transmitter & receiver Current Loop ADA-1020 Converter

2.5. ISOLATION

The ADA-1020 converter has 3-way, 1kV= or 3kV= galvanic isolation, depend on version described in section *VERSIONS*.
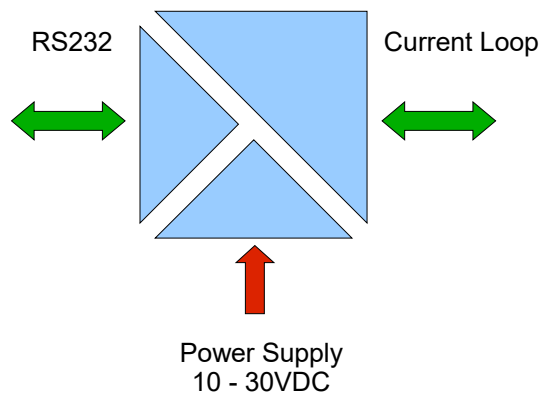
3-WAY ISOLATION

RS232   Current Loop

Power Supply
10 - 30VDC
Fig 3. Insulation structure at ADA-1020

3. INSTALLATION

This chapter will show you how to connect ADA-1020 to RS232 device, current loop line 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,
● not supply converter from power circuit device that generates large impulse interference such as transmitters, contactors,

3.1. ASSEMBLING

The ADA-1020 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 to hear characteristic „Click" sound.

3.2. CONNECTION OF DEVICES WITH RS232

Not use RI 9
Not use RTS 8
Not use CTS 7
Not use DTR 6

5 GND
4 DSR not use
3 RX
2 TX
1 DCD not use
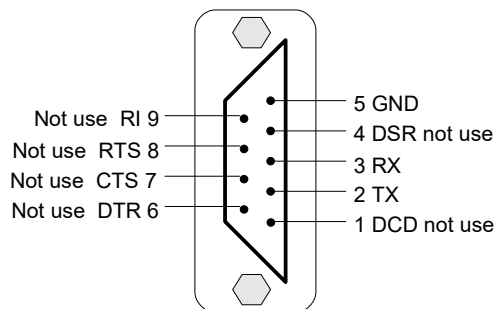
The Signals looped on the converter :
1. DTR – DSR – DCD
2. RTS - CTS
Fig 4. RS232 interface signals in DB-9Female

3.2.1. CONNECTION OF DEVICES WITH RS232 PORT - DTE TYPE (COMPUTER)

In the purpose of connecting ADA-1020 to RS-232 port of PC, should be used RS232 extension cable (1:1). Connection example is shown below.
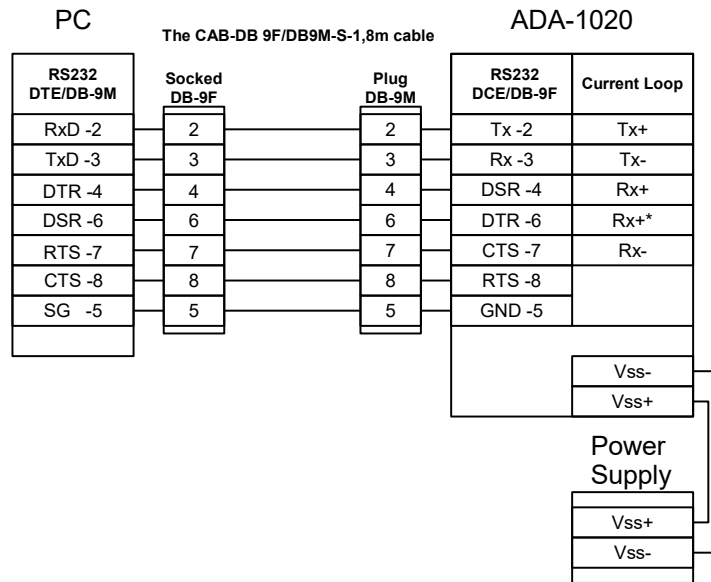
PC	The CAB-DB 9F/DB9M-S-1,8m cable		ADA-1020	
RS232 DTE/DB-9M	**Socked DB-9F**	**Plug DB-9M**	**RS232 DCE/DB-9F**	**Current Loop**
RxD -2	2	2	Tx -2	Tx+
TxD -3	3	3	Rx -3	Tx-
DTR -4	4	4	DSR -4	Rx+
DSR -6	6	6	DTR -6	Rx+*
RTS -7	7	7	CTS -7	Rx-
CTS -8	8	8	RTS -8	
SG -5	5	5	GND -5	
			Vss-	
			Vss+	
			Power Supply	
			Vss+	
			Vss-	

Fig 5. The ADA-1020 connection to RS-232 port of computer

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

In the purpose of connecting ADA-1020 to a device with RS-232 port DCE type (eg. modem), should be used RS232 link cable, with male connectors DB9. Connection example is shown below.

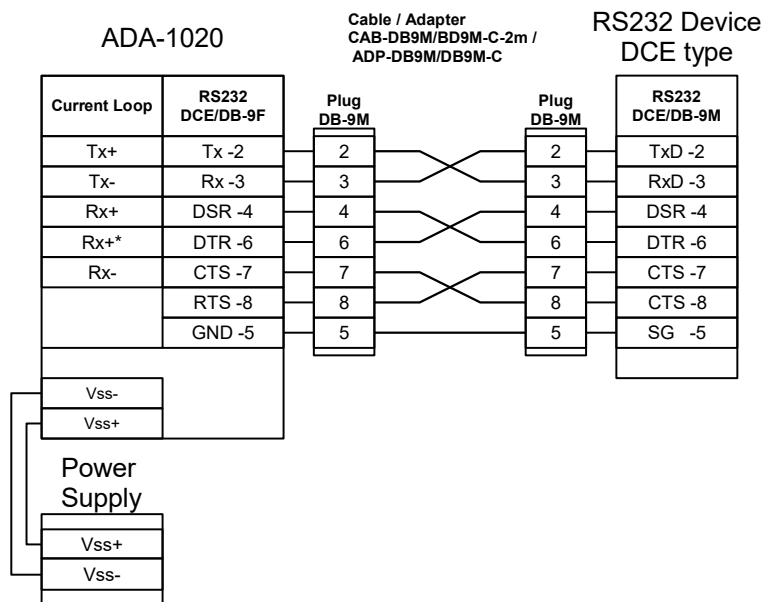| ADA-1020		Cable / Adapter CAB-DB9M/BD9M-C-2m / ADP-DB9M/DB9M-C		RS232 Device DCE type	
Current Loop	**RS232 DCE/DB-9F**	**Plug DB-9M**	**Plug DB-9M**	**RS232 DCE/DB-9M**	
Tx+	Tx -2	2	2	TxD -2	
Tx-	Rx -3	3	3	RxD -3	
Rx+	DSR -4	4	4	DSR -4	
Rx+*	DTR -6	6	6	DTR -6	
Rx-	CTS -7	7	7	CTS -7	
	RTS -8	8	8	CTS -8	
	GND -5	5	5	SG -5	
Vss-					
Vss+					
Power Supply					
Vss+					
Vss-					

Fig 6. DCE type connection of ADA-1020 to device with RS232 interface (eg. modem)

3.3. CONNECTION OF THE CURRENT LOOP INTERFACE DEVICES

3.3.1. CONNECTION OF THE CURRENT LOOP LINE TO ADA-1020 CONVERTER

The Current Loop line should be connected to the converter's terminals:TX+, TX-, RX+, RX- or TX+, TX-, RX+*, RX-, like on the figures below.

On the converters with 0-20mA active/passive transmitter the TX switch should be set in ACT position
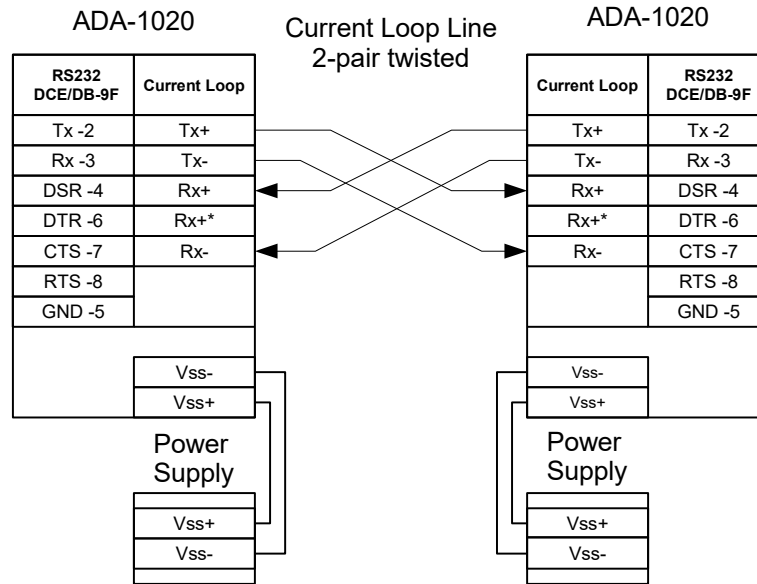
Fig 7. Example connection of two ADA-1020 together. The line length larger than 500m.
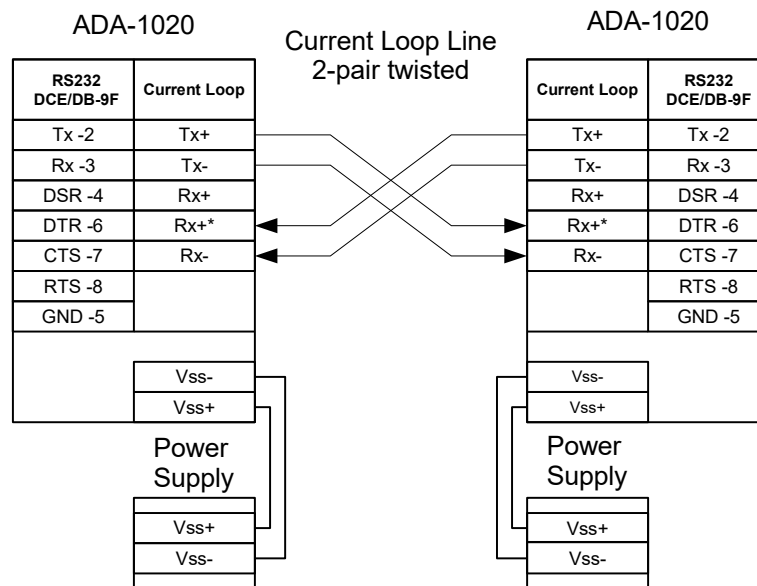
Fig 8. Example connection of two ADA-1020 together. The line length less than 500m.

3.4. EXAMPLE CONNECTION OF DEVICES TO THE CONVERTER

Using the ADA-1020 can be separated the RS232 computer port from the devices and extend the RS232 computer port (TX, RX signals), even up to few kilometres. Example connection is shown below (fig.9)
For this type of connection (extending the RS232 computer ports), should be done according to below figure.

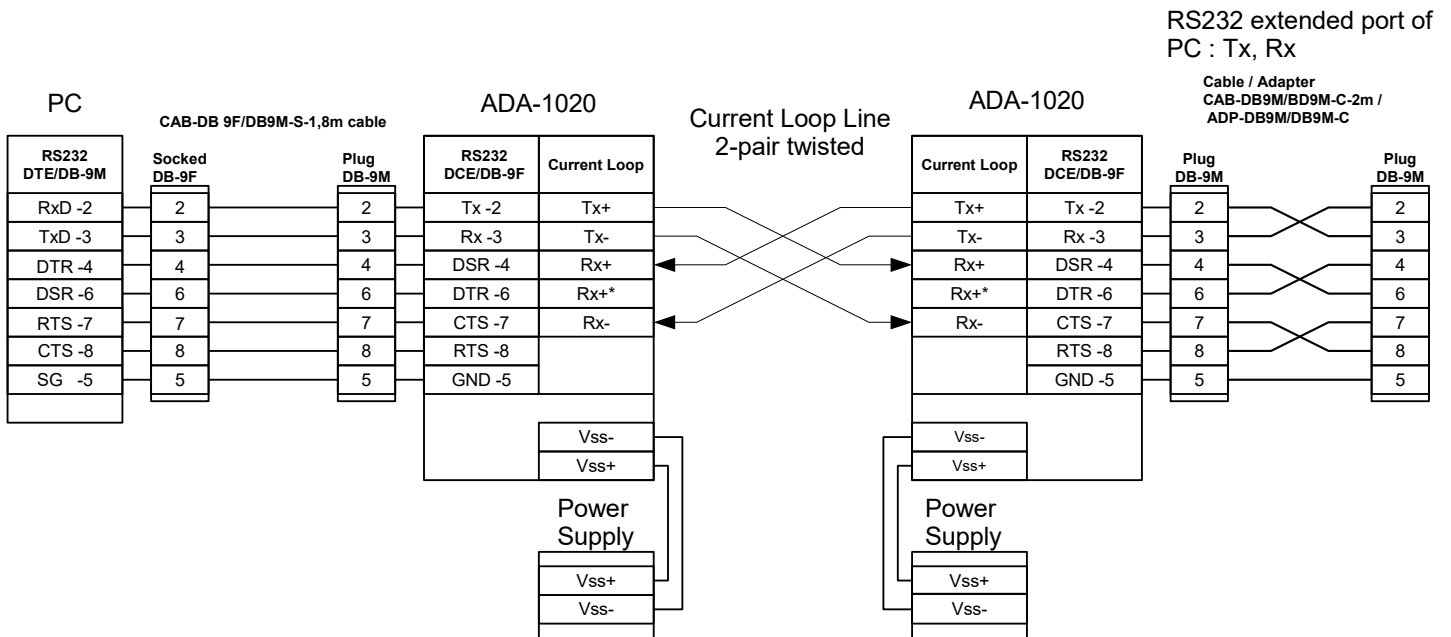On the converters with 0-20mA active/passive transmitter the TX switch should be set in ACT position

Fig 9. Connection of two ADA-1020 for extension the RS232 computer port

3.5. CONNECTION OF RS232 INTERFACE DEVICES TO CURRENT LOOP BUS

Using ADA-1020 in the version with Active/Passive current loop transmitter (I= 0-20 mA), can be created the current loop bus as on the figures below.

3.5.1. CONNECTION OF 15 RS232 INTERFACE DEVICES TO CURRENT LOOP BUS

In this case/example the Current Loop bus is created by one ADA-1020 converter (MASTER **– active transmitter**) and one ADA-1020 converter (SLAVE **– active transmitter** - the furthest located from the MASTER) and max. 14 converters ADA-1020 (SLAVE – **passive transmitter**). The number of the SLAVE converters can be less for long lines. Example of connection is shown below.
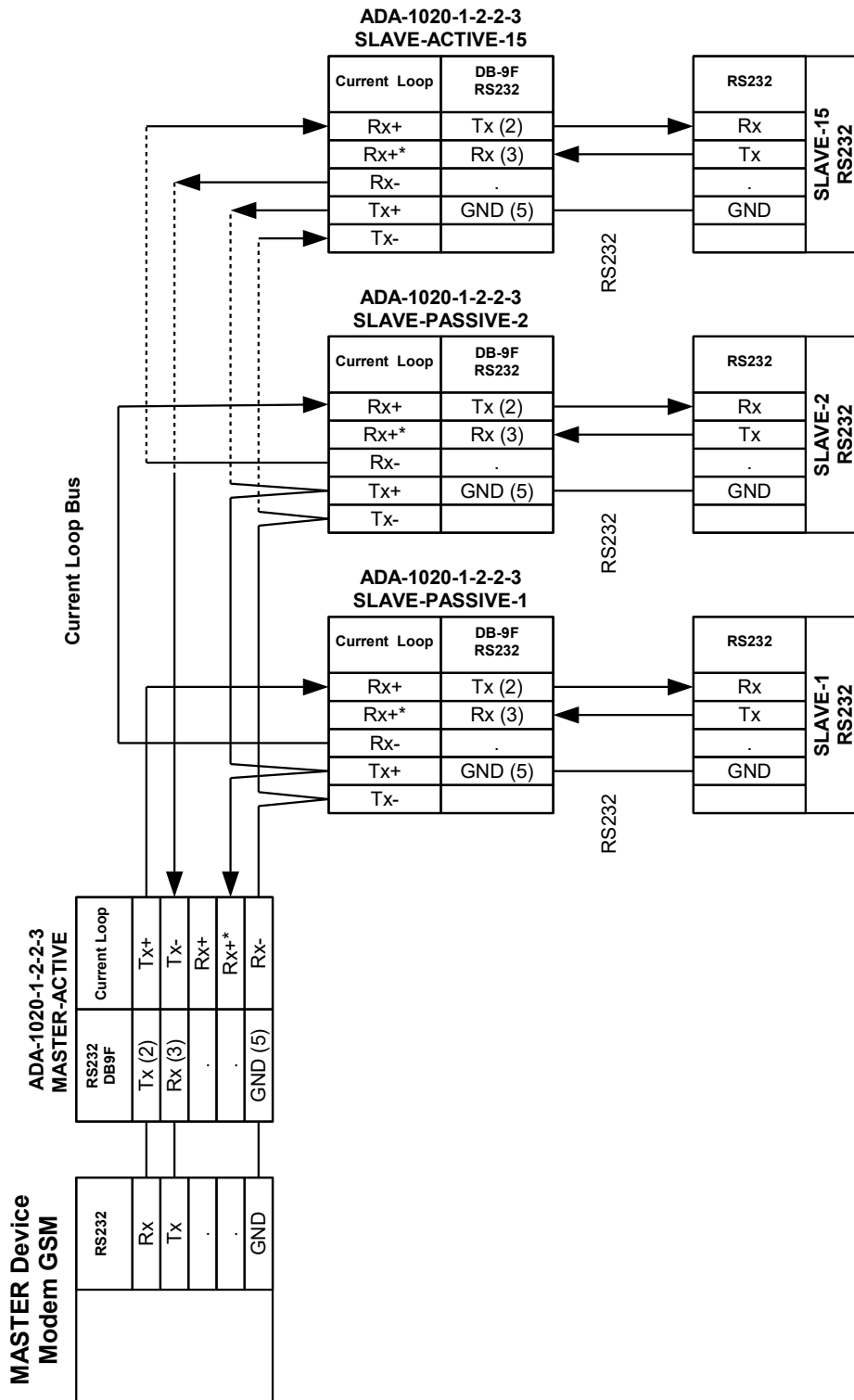
Fig 10. Example connection of ADA-1020 converters as Current Loop bus for 15 SLAVE converters

3.5.2. 3.5.1. CONNECTION OF 5 RS232 INTERFACE DEVICES TO CURRENT LOOP BUS

In this case/example the Current Loop bus is created by one ADA-1020 converter (MASTER **– active transmitter**) and one ADA-1020 converter (SLAVE **– active transmitter** - the furthest located from the MASTER) and max. 4 converters ADA-1020 (SLAVE – **passive transmitter**). Connection made via Rx+* receiver terminal increases the resistance of the current loop receiver of overvoltage arising Current Loop bus.

The number of the SLAVE converters can be less for long lines. Example of connection is shown below.

CEL-MAR®
Zakład Informatyki i Elektroniki
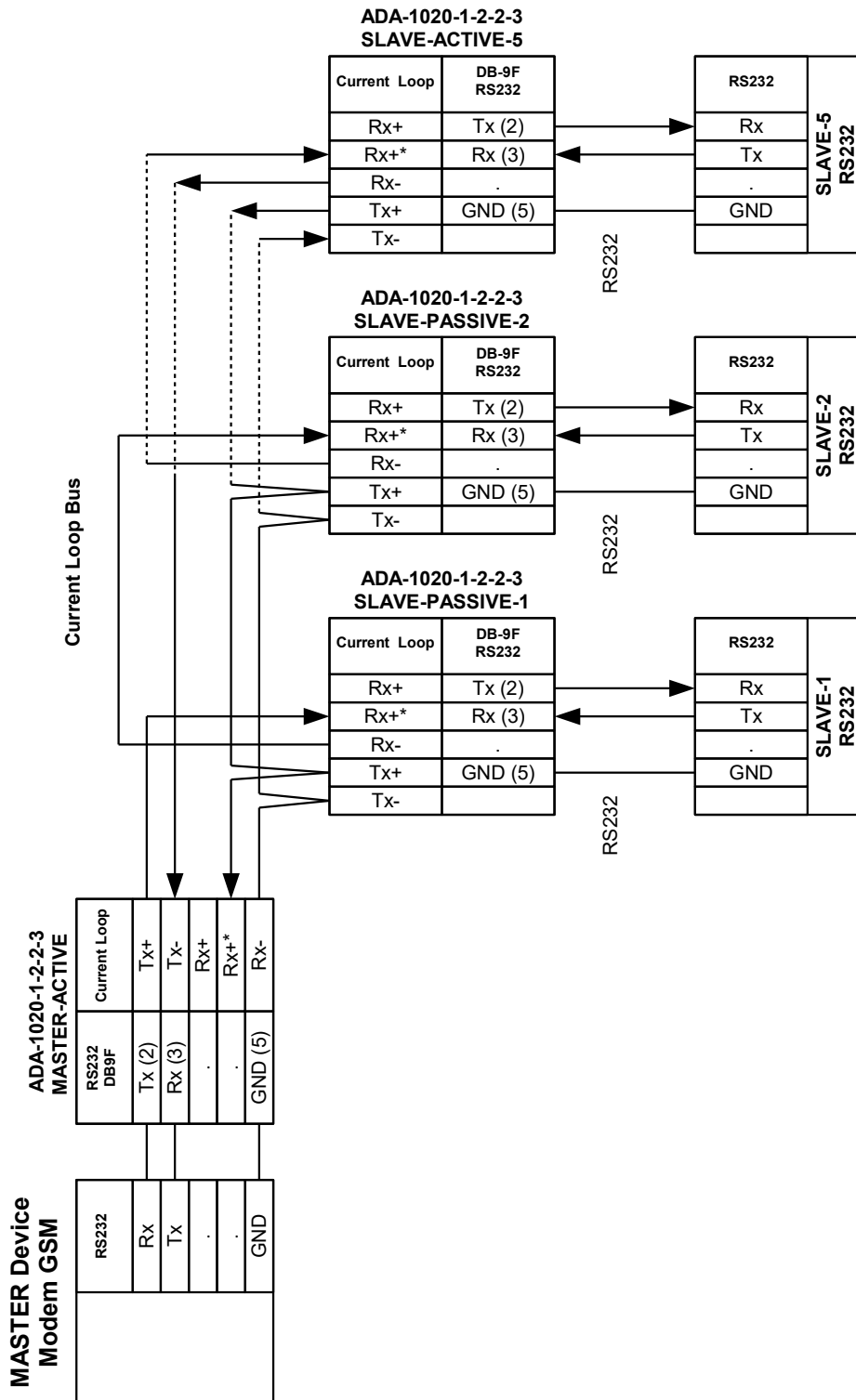
ADA-1020-1-2-2-3
SLAVE-ACTIVE-5

Current Loop	DB-9F RS232		RS232	
Rx+	Tx (2)	→	Rx	
Rx+*	Rx (3)	←	Tx	SLAVE-5 RS232
Rx-	.		.	
Tx+	GND (5)		GND	
Tx-				

RS232

ADA-1020-1-2-2-3
SLAVE-PASSIVE-2

Current Loop	DB-9F RS232		RS232	
Rx+	Tx (2)	→	Rx	
Rx+*	Rx (3)	←	Tx	SLAVE-2 RS232
Rx-	.		.	
Tx+	GND (5)		GND	
Tx-				

RS232

ADA-1020-1-2-2-3
SLAVE-PASSIVE-1

Current Loop	DB-9F RS232		RS232	
Rx+	Tx (2)	→	Rx	
Rx+*	Rx (3)	←	Tx	SLAVE-1 RS232
Rx-	.		.	
Tx+	GND (5)		GND	
Tx-				

RS232

Current Loop Bus

ADA-1020-1-2-2-3 MASTER-ACTIVE

	Current Loop	Tx+	Tx-	Rx+	Rx+*	Rx-
RS232 DB9F	Tx (2)	Rx (3)	.	.	GND (5)	

MASTER Device Modem GSM

RS232	Rx	Tx	.	.	GND

Fig 11. Example connection of ADA-1020 converters as Current Loop bus for 5 SLAVE converters

3.6. POWER SUPPLY

The power supply to ADA-1020 should be DC (regulated) from the scope 10 V= to 30V= (option from 10V= to 48V=) and nominal power more 2W eg. HDR15-24. 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-1020 has the protection from opposite connection power supply. If after powering, on the front panel is not lit green LED PWR, check the power connection (polarity).

4. ACTIVATION

Converter can be power on 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 and if RX red LED is lighted check the correctness of connection of the Current Loop transmitter circuit. If RX red LED is continuously lit, the current is not flow through transoptor in the receiver circuit. When data is present the LEDs Tx and Rx should blinking.

4.1. DESCRIPTION OF SIGNALLING LEDS

LED	Description
PWR	Signalling of Power Supply
RX	Signalling of data receiving through ADA-1020 converter from Current Loop port.
TX	Signalling of data transmitting from ADA-1020 converter through Current Loop port.

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

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

Pin	Signal	Description	ADA-1020
1	(DCD)	Level of receiver signal	Connected with DSR
2	(TxD)	Data transmission via ADA-1020	Transmitter
3	(RxD)	Data receiving via ADA-1020	Receiver
4	(DSR)	Readiness of a device to receiving/transmitting date	Connected with DTR
5	(SG)	Signal ground	GND
6	(DTR)	Readiness of the ADA1020 to receiving/transmitting date	Connected with DSR
7	(CTS)	The device confirm receiving RTS signal from ADA-1020	Connected with RTS
8	(RTS)	The ADA-1020 confirm readiness of date receiving to device	Connected with CTS
9	(RI)	Call rate	NC

6. VERSIONS

ADA-1020 - ☐ - ☐ - ☐ - ☐ - ☐

Current Loop Voltage:

24VDC **1**

12VDC **2**

Current Loop Type:

± 20mA (active transmitter, passive receiver) **1**

0 – 20mA (active/ passive transmitter, passive receiver) **2**

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**

Power supply :

From 10 to 30VDC stable

From 10 to 48VDC stable **48**

Order example:
Product Symbol: **ADA-1020-1-1-2-3**
1 – Current Loop Voltage 24VDC
1 – Current Loop Type ± 20mA
2 – 1kV= galvanic isolation
3 – cover without inlets, plug-in screw terminal block.
Power supply 10 – 30VDC

Product Symbol: **ADA-1020-1-1-2-3-48**
1 – Current Loop Voltage 24VDC
1 – Current Loop Type ± 20mA
2 – 1kV= galvanic isolation
3 – cover without inlets, plug-in screw terminal block .
48 - power supply 10 - 48VDC

7. SPECIFICATION

TECHNICAL DATA		
Transmission Parameters		
Interface	RS-232	Current Loop
Connector	DSUB-9 female	Screw terminal, wire max. Ø 2,5mm^2.
Line length	15 m	Depend on baud rate eg. for BUS made by UTP cable Cat.5E 4x2x05 (24 AWG) and baud rate 300 bits/s can be 15 km.
Maximum number of connected device	1	1

ADA-1020

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).	2-pair twisted cable eg UTP 4x2x0,5 (24AWG), shield inside large interferences eg STP 4x2x0,5 (24AWG)
Standards	RS-232C /CCITTV.24	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	Current Loop asynchronic half duplex or full duplex	
Optical signalisation	• 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	Standard : 10 - 24 – 30 V DC Option : 10 - 24 – 48 V DC	
Power cable	Recommended length of power cable < 3m	
Power	<3W	
Protection from reverse power polarization	YES	
Galvanic isolation	1kV= or 3kV= (between power circuit and RS232 signal lines RS-232) 1kV= or 3kV= (between power circuit and Current Loop signal lines)	
Optoisolation	~3kV= (between Current Loop signal line and and RS-232)	
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** product.

We hope that this user manual helped connect and start up the **ADA-1020 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.