RS-485 Interface Repeater

ELO E122

Operation manual

1.0   Introduction

The RS-485 interface is a standard in automation. Its main advantage is its immunity to the electromagnetic interference and more devices´ connection via the bus.

1.1   Use of the repeater

The RS-485 interface enables up to 32 partners´ communication connected via the twisted pair up to 1200m long. The rate is of 9600 to 19200 bps in most cases. The repeater enables to prolong the communication line and to increase the partners´ number. The repeater is mainly suitable:

  1) if the line is necessary to be prolonged – each repeater allows the extension by 1200m,
  2) if the partners´ number is necessary to increase – each repeater allows 30 more partners´ connection
  3) if the rate is necessary to increase via the existing line division into several shorter sections
  4) if a part of the line is necessary to be isolated.

The repeater ELO E122 solves these problems.

2.0   Operation principles

ELO E122 converts the signal received from one RS-485 link section to the other RS-485 link section and the same contrariwise. Except the signals conversion, the repeater also solves the half-duplex operation problem on the RS-485 link, which means the RS-485 transmitter has to be switched on only during its own transmitting and at the rest of time switched off to enable other partners to communicate.

The transmitter is switched on at the moment of the data detection in the other arm. **The E122 model delays the received data by the interval that equals to 0.5 bit transmission.** The switching speed is sufficient to use the converter in the data transmission network organized as MASTER-SLAVE and MULTI MASTER. The repeater also corrects bits width distortion which could occur during transmission.

3.0   Installation

There are a few problems of the repeater installation to differ: connection to the RS-485 link, the data format setting and the power supply connection.

3.1   RS-485 Interface Connection

There is the isolation between the RS-485 interface clamps and all the other converter circuits. The 3kV voltage can be applied for 1 second without a failure. The RS-485 interface signal is placed on A1-B1 clamps (or A2-B2), +5V on the Vcc1 clamp and the signal ground on SG1 (or Vcc2, SG2).
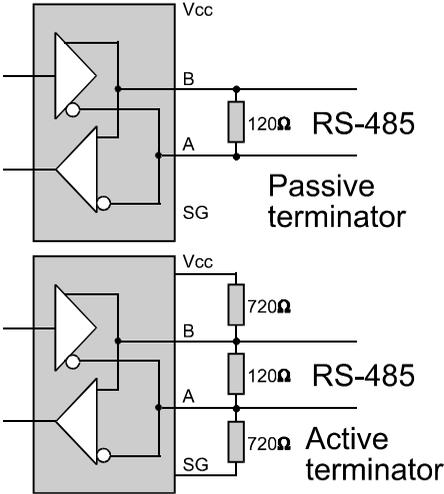
Both the RS-485 link ends should be terminated with the 100-120Ω resistors (so-called passive terminators), which are placed between A-B wires. These terminators are used for the converter impedance matching, they suppress the undesirable echo and they influence the transfer immunity against interference. Inserting the repeater into the metallic link terminates this link right on the A-B clamps of the repeater therefore it is necessary to connect the passive terminators.

There are also the active terminators beside the passive ones. Only one active terminator can be installed to one metallic section of the link and its role is as follows:

The RS-485 signal is symmetric. The differential receiver interprets the difference U_A-U_B. It does not depend on the neutral potential. The receiver interprets the obtained signal $|U_A - U_B| > 200$ mV as log 1 or log 0.

In addition to these levels the third state can occur, it is so-called IDLE state. No transmitter is activated, each communicating partner is just listening so $|U_A - U_B| < 200$ mV. The problem is how to interpret the third state in the two-state logic. The active terminator gives the signal into the IDLE state line and it is interpreted as IDLE in the two-state logic.

The repeater divides the line into two sections. If the active terminator is needed in an application hence two terminators have to be used, each for one section.

3.2   Repeater setting

The repeater is transparent for the asynchronous communication protocols or it is not dependent on such parameters such as the "packet length" type. The only

parameters have to be set relate to the transmitted byte format thus the data rate and the asynchronous word length. There is the rotating switch on the top converter case. Thus the byte format of eight or nine data bits may be set. The last data bit is not important to be the parity one. Consequently, the transmitted formats may range from seven data bits with parity (switch position 8 bit – dark part of the scale) to nine data bits without parity (switch position 9 bit – light part of the scale).

3.3   Power Connection

The external supply has to have the output voltage of 9-24V and it is connected to the + clamps and GND. The power supply take-off depends on the applied supply voltage:

9V supply	c. 150mA consumption
12V supply	c. 110mA consumption
24V supply	c. 60mA consumption

The repeater consists of three isolated zones. The RS-485 circuits are isolated from each other and from the other circuits, too. To comply with this condition, the external power supply has to be isolated from all RS-485 partners´ signal grounds.
If the supply is connected the RUN diode switches on.
The external power supply is protected by the 0.6A slow-acting fuse or the supply of 0.2A output current limiter is applied.

4.0   Specification
4.1   Parameters

Transmitted signals	differential signal AB
Type and connection of RS-485 connectors	clamps
Isolation	RS-485 galvanic isolation from GND 3 kV/1 sec supply
Transmission mode	asynchronous, half-duplex
Transmission delay	0.5 bit
Maximum data rate	115 200 bps
Minimum data rate	1200 bps
Supply	external ss supply 9-24V/200mA

4.2   Other

Dimension: Length x Width x Height	100 x 56 x 19 mm
Stocking temperature	$- 10^{\circ}$ to $+55^{\circ}$ C

Working temperature $+ 0^o$ to $+50^o$ C
Humidity $0 – 85\%$ (non-condensing)

5.0   Testing

In case of proper installation the RUN diode is alight. If 9bit data format is selected (the data rate index points to the light part of the scale) the 9 bits indicator must be alight. The TxD and RxD indicators must blink during transmission.

6.0   Troubleshooting

Symptom	Action
The repeater does not work after installation	Check if the RUN is alight. Check the power supply. Check the RS-485 link connection.
Connection in normal operation quit working	Check the power supply. Check if the cables are OK. Turn off and on the power supply and detect if the repeater starts again.

7.0   Ordering Information

Supply code is ELO E122.

Note