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1.0 Introduction

Fiber Optic (SINGLE MODE and/or MULTI MODE) has been used for signal transmission in automation for communication more and more often.

The main advantage of Fiber Optic is its immunity to electromagnetic interference, slight radiation and high transmission capacity

So they have been used for instance in high voltage distribution points, in the workrooms with high level of electromagnetic disturbances and in outdoor installations.

2.0 Operation principles

The principles of ELO E243, E244 and E245 operation are identical. They differ as to the type of optical connector and the optical cable type. So the next parts will describe only ELO E243 and the other models will be meant just if it will be necessary to describe the differences. In duplex (RS422) mode ELO E243 transfers signal received from RS422 interface (TxD) to transmitting fiber of the optic cable and the signal from receiving fiber is transmitted to RS422 (RxD).

In half-duplex (RS485) mode the data received from optics are transmitted to RS485 bus. After the end of data modem switches off its transmitter and starts listening if there is any signal from RS485 bus. In this data-flow direction switching mode only some data rates can be used. They must be set by the switches on the back side of modem. The lowest data rate is 4 800 bps and the highest one is 3 Mbps.

If the modem is set correctly, **the transmission is independent on communication protocol.**

ELO E243 and ELO E244 are designed for multimode optic fibers and ELO E245 for singlemode one. ELO E243 has optical connector ST, ELO E244 and ELO E245 have SC connectors.

3.0 Installation

There are two different problems of installation to discuss: RS-485 or RS-422 link and fiber optic link connection and setting characteristics of the modem.

In the RS485 mode modem needs data range and data format setting (asynchronous word length). There is the DIL switch on the back side of modem case. When the RS422 mode has been used, the setting is not necessary.

3.1 RS422 Interface Connection

The RS422 is set when the switch No.3 is Off. The duplex interface needs 2 twisted pairs each for one direction of data flow. Contacts 3-8 are used to receive data from RS-422, 2-7 are transmitters. The terminators 120Ω can be set using the DIL switch No 1 and 2.

contact	signal	meaning	note
1	alarm	optic line is out of order	open collector output output from modem input to modem don't use as a source output from modem input to modem
2	Rx+	received data (with 7)	
3	Tx+	transmitted data (with 8)	
4	--	not used	
5	GND	signal ground	
6	Vcc	supply for terminator	
7	Rx-	received data (with 2)	
8	Tx-	transmitted data (with 3)	
9	PWR	alternative supply input	

GND contact is not used to data transfer. Despite of this fact it is useful to connect it to the opposite devices' similar signal. Vcc contact is necessary to supply an active terminator which is not used in RS422 mode, but in RS485.

The data rate can be any at the range from 0 to 5 Mbps. The RS422 cable length limits the maximum data rate. Mbps can be reached if the RS422 cable is about meters long.

If the maximum cable length is applied the data rate can be up to 9500 bps.

Signal "ALARM" is set if the optic line doesn't work properly. A 24 V relay can be applied if it doesn't take more than 100 mA.

3.2 RS485 Interface Connection

The RS485 interface is half duplex. The signals are described below.

contact	signal	meaning	note
1	alarm	optic line is out of order	open collector output input/output - bus see following text input/output - bus
2	--	not used	
3	TxRx+	data (with 8)	
4	--	not used	
5	GND	signal ground	
6	Vcc	supply for terminator	
7	--	not used	
8	TxRx-	data (with 3)	
9	PWR	alternative supply input	

The switch No. 3 = On sets the half-duplex mode of the modem. The RS485 bus can be terminated with switch No.2 = On. The contacts 3-8 are connected to 120 Ω resistor. Some RS485 devices can have a problem how to interpret the third state of RS485 bus (the voltage between both wires is less than 200 mV). In that case it is useful to connect one external resistors 680 Ω between Vcc (+5V) and TxRx+ and second one

No.5	6	7	8	data rate bps
Off	Off	Off	Off	4 800
On	Off	Off	Off	9 600
Off	On	Off	Off	19 200
On	On	Off	Off	38 400
Off	Off	On	Off	57 600
On	Off	On	Off	62 500
Off	On	On	Off	93 750
On	On	On	Off	115 200
Off	Off	Off	On	187 500
On	Off	Off	On	230 400
Off	On	Off	On	375 000
On	On	Off	On	500 000
Off	Off	On	On	750 000
On	Off	On	On	1 000 000
Off	On	On	On	1 500 000
On	On	On	On	3 000 000

between SG (signal ground) and TxRx-. This active terminator will give a voltage higher than 200 mV with a polarity according to IDLE state (stop bit).

For the correct operation the right data rate has to be set by the switches 5-8. Besides the data rate the data format must be set.>

No.4	data	parity
Off	7 bit	yes
Off	8 bit	no
On	8 bit	yes

If the switches aren't set correctly, the data will not be damaged when they pass through the modem, but during the data flow direction

switching (bad or inaccurate packet end indication).

Warning!!!

There is a disunity of the marks of the wires. Correctly the IDLE state (stop bit polarity) means that TxRx+ has a higher voltage than TxRx-. Some producers call the wires A-B, some B-A, but we can see also P-N, Data+ - Data- and so. If the wires aren't connected to modem correctly, the data are negated. In IDLE state modem has activated its RS485 transmitter and the other RS485 devices cannot transmit their data.

3.3 Two modems connection

The fibre optic cable is connected through the ST (model E243), or SC (E244 and E245) connectors. To connect the ELO E243, the transmitter of the remote modem must be connected to the receiver of the local ELO E243 and the remote receiver must

be connected to the local transmitter (fibres cross). The connection is OK when the LINK indicator lights. In other case LINK doesn't shine and ALARM signal is activated.

Both modems must be set to the right data range and data format in RS-485 mode.

3.4 Power Connection

The external supply has to have the output voltage of 9-24V and it is connected via DC connector on the back side, or via the DB9 contacts 9 (+) and 5(-). So, one of inputs can be used for back-up supply connection. The supply take off is c.200 mA. If the supply is on operation the indicator PWR switches on.

4.0 Specification

4.1 Parameters

Transmitted interface		RS485/422
Transmit mode RS485		asynchronous, half-duplex
Transmit mode RS422		duplex
Type of RS485/422 connector		DB9 female
Optic connector E243 / E244 / E245		ST / SC / SC
Range E243. E244		2 km typically
Range E245		15 km typically
Fibre optic cable		two fibers
E243, E244		multimode 50/125 μm (62/125 μm)
E245		singlemode 9/125 μm
Maximum/minimum data rate RS485		3 Mbps / 4800 bps
Maximum data rate RS422		5 Mbps
Supply		external DC supply 9-24V/260-100 mA
Dimension:	Length	120 mm
	Width	80 mm
	Height	25 mm
Weight		160 g

4.2 Other

Stocking temperature	-10° to +55°C
Working temperature	+0° to +50°C
Humidity	0 – 85% (non-condensing)

5.0 Testing

In case of proper installation the PWR and LINK diode is alight. The yellow LED indicates the data transfer.

6.0 Troubleshooting

Symptom	Action
ELO E24x does not work after installation	Check if the PWR and LINK is alight. Check the power supply. Check the RS-485 /422 link connection. If necessary use the terminators.
In RS485 mode data are Transferred, but a part of them is lost.	Check if the data rate and data format are set correctly Check how the wires are marked.
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 modem starts again.

7.0 Ordering Information

Supply codes are

ELO E243	RS-485/422 / ST multimode,
ELO E244	RS-485/422/ SC multimode,
ELO E245	RS-485/422/ SC singlemode

7.1 Related products

ELO E0Q6	DC supply 12V / 500 mA
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