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elo

USB – RS-485/422 Communication adapter – virtual serial port



ELO E211

Operation manual

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1.0 Introduction

The USB interface is preferred to the COM port with RS-232 interface in personal computer technology. To connect the peripheral devices of the RS-232 interface, the USB/RS-232 adapters along with the driver are applied to create so-called virtual COM on the PC.

ELO E211 is a device which converts virtual COM to the asynchronous line of the symmetric signal via the USB interface. The signals transmission to the duplex RS-422 interface allows the range and the transmission interference immunity to increase. The signals transmission to the half-duplex RS-485 interface allows the range, communication partners' number and the transmission interference immunity to increase.

1.1 Use of the converter

The converter increases transmission immunity against electrical disturbance and isolates both interfaces USB / RS-422 hence it is intended to be used in the environments where lightning over-voltage is not necessary to be considered. To lead the RS-422 link cable outside buildings, it is necessary to provide additional over-voltage protection on the input points.

The adapter allows the transmission rate up to 1 Mbps. This maximum attainable rate decreases due to the line length and/or its impedance growth. Recommended maximum line length is 1200 m at the rate of 9600 bps.

2.0 Operation principles

The adapter converts the RS-422 or RS-485 interface to the USB interface, transmits TxD and RxD signals. The RS-485/422 interface is taken out onto the bus.

RS-485 interface is used to the communication of up to 32 partners in one twisted pair. The transmission is half-duplex that means switching on the RS-485 transmitter only during its own transmitting to allow other communication partners to transmit.

RS-422 interface is mainly designed for two devices communication in the duplex mode. As transmission media there are two twisted pairs, each for one transmission direction. The adapter also supports the MULTIDROP mode where the transmitter may be switched off as with RS-485. In this mode, one partner as the MASTER can communicate with up to 31 other partners operating as the SLAVE.

3.0 Installation

E211 adapter installation is described in this part. There are two problems to be solved: the hardware installation and the SW driver installation.

3.1 USB interface connection

The adapter operates as per specification USB 2.0 full-speed (12 Mbps). The USB adapter connector is of B female type. The adapter is connected to the terminal equipment via the USB jumper cable of AB type.

3.2 RS-485 Installing

The TxRx+ and TxRx- clamps are used to connect the adapter to the bus. The adapter has to be set to the RS-485 mode via the 1-switch in “Off” position. The RS-485 line should be terminated with the 100-120 Ω resistors on both ends. The reasons in more details are given in the 3.4 chapter. The external terminator (the resistor between TxRx+ and TxRx conductors) or the internal one – the 3-switch in “On” position may be used. If the active termination is used (see the 3.4 chapter), it is necessary to place one resistor between TxRx+ and SP(+5V) clamps and one 820 Ω resistor between TxRx- and SG (signal ground) via the internal active terminator using the 5 and 6 switches in “On” position.

3.3 RS-422 Installing

In case of the point-to-point connection, the TxRx+ (TxRx-) clamp of the local adapter is necessary to be connected to the Rx+ (Rx-) clamp of the remote adapter and the Rx+ (Rx-) clamp of the local adapter to the TxRx+ (TxRx-) clamp of the remote adapter. The 1-switch has to be in “On” position, thus RS-422. The point-to-point duplex connection of the maximum rate that can be of up to 1 Mbps on the short line is carried out this way.

For the MULTIDROP transmission system, it is necessary to distinguish if the adapter works in the MASTER or SLAVE mode.

The TxRx+ (TxRx-) of the MASTER adapter is connected to the Rx+ (Rx-) clamps of all SLAVE adapters. The Rx+ (Rx-) clamps of the MASTER adapter are connected to the TxRx+ (TxRx-) clamps of all SLAVE adapters.

The No.1switch of all adapters has to be in “422” position. The No.2 switch as the MASTER is “On” (Normal”), as the SLAVE is set to the “Off” position (“Multidrop”).

3.4 Importance of terminators

The RS-422 recommendation (V.11) uses the symmetric signal transmitted via the twisted pair, there are various marks of the single wires: A-B, P-N, “+ -” and the like. On the long lines there it is necessary to suppress the echo and the electromagnetic interference so the 100-120 Ω resistors (so-called passive terminators) placed between A-B wires on the link ends are applied. The RS-485 recommendation uses the same symmetric signal as the RS-422 hence it requires the use of the passive terminators as the RS-422. On the RS-485 link, another state is defined when no communicating partner transmits all are of the high impedance state and just listening.

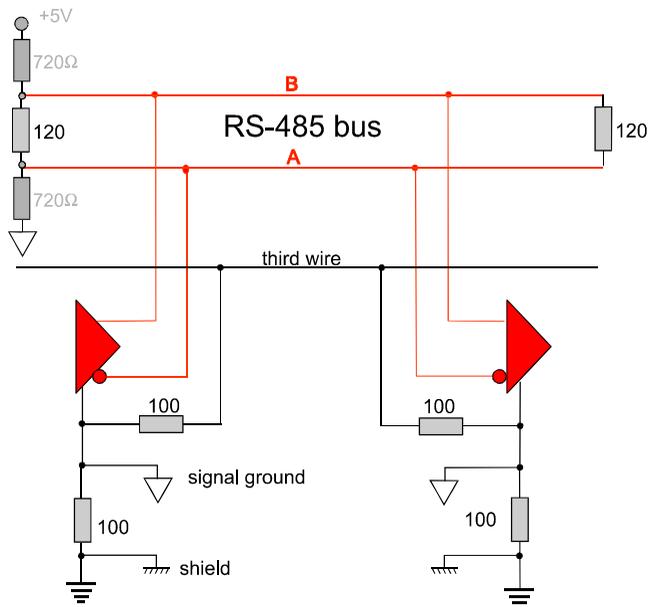
The partner differential receiver interprets the difference $U_A - U_B$. The receiver interprets the obtained signal as $|U_A - U_B| > 200 \text{ mV}$ as log 1 or log 0. In the described still state, so-called IDLE, no communicating partner transmits so $|U_A - U_B| < 200 \text{ mV}$. The problem is how to interpret the state (so-called the third) in the two-state logic.

The active terminator (may be only one in each section) gives the signal $|U_A - U_B| > 200 \text{ mV}$ into the idle state line and it is interpreted as IDLE in the two-state logic.

The RS-422 MULTIDROP operation with the signal third state is similar to the RS-485 hence the active terminators are used in this mode, too.

3.5 Ground potentials differences elimination

The symmetric signal can deal with the cases when the signal ground potentials difference at the connection points of the partners differs by 5-7V. To eliminate influence of the ground potentials differences, the third conductor is used (see the Fig.). 100 Ω resistors are needed in this case to eliminate currents resulting from the ground potentials differences. The signal ground clamp (labeled SG) may be used to this effect.



3.6 Adapter setting

The mode switch is necessary to set to use the adapter in the situations mentioned above. First two switches (SW1, SW2) are used to the transmission mode setting the rest four switches place the terminators.

Mode	SW1	SW2
RS-485	OFF	--
MultiDrop	ON	OFF
RS-422	ON	ON

Termination	SW3	SW4	SW5	SW6
Without terminators	OFF	OFF	OFF	OFF
Passive terminator between TxRx+ and TxRx-	ON	OFF	OFF	OFF
Active and passive termin. on TxRx+and TxRx-	ON	OFF	ON	ON
Passive terminator between Rx+ and Rx-	OFF	ON	OFF	OFF

The switching automatics implemented into the USB 485/422 converter switches on the transmitter before the start bit transmission of a bit set-up time and switches off after the stop bit finish of a bit delay.

3.7 Installing driver

The E211 adapter may be applied on the PC computers under the MS Windows 98/Me/2000/XP operating systems under the Linux operating system from 2.4 core version or on the Apple computers of OS-8 and OS-9 systems. The following chapter will only describe the drivers' installation of MS Windows systems.

The drivers are supplied together with the other files and the installation CD. They may be downloaded from the producer web-sides www.elo.cz.

There are two ways how to use the adapter according to the type of installed drivers. The port may be accessed via the dynamic library or the virtual port. The access via the virtual port installed into the Device Manager is more comfortable and universal because any communication application which is able to select the number of the port to access may be applied. The access via the dynamic library when the user SW accesses to the adapter via the DLL library (chapter 3.4) requires programming knowledge but it offers much higher effectiveness and the real data rate.

The proper installation of the drivers is indicated via the lit READY indicator on the cover connected to the adapter.

While installing, the newer operating systems can display warnings the drivers are not certified. Do not worry, click **Continue**.

3.8 Installing virtual port under Windows XP

- 1) When the PC turned on and the adapter connected to the USB port via the cable is detected the operating system reports a new hardware has been found.
- 2) The system runs the Add New Hardware Wizard automatically. Failing this, the **Control panel** may be used to start the Wizard. Select the second option in the Wizard menu – “Install from a list or specific location”.
- 3) In the next Wizard menu leave the system search for the proper driver on the supplied CD, in the directory \ e211 _drivers\serial_ port.
- 4) Leave the system to install the found driver.
- 5) Thus the USB device installing is completed. The virtual port installing follows automatically the same way as with 2-4, the device name is only different.
- 6) After successful installation the Wizard reports the installing has been completed.

3.9 Installing driver for direct access

- 1) When the PC turned on and the adapter connected to the USB port via the cable is detected the operating system reports a new hardware has been found.
- 2) The system runs the Add New Hardware Wizard automatically. Failing this, the **Control panel** may be used to start the Wizard. Select the second option in the Wizard menu – “Install from a list or specific location”.
- 3) In the next Wizard menu leave the system search for the proper driver on the supplied CD, in the directory \ e211 _drivers \serial_ port .
- 4) Leave the system to install the found driver.
- 5) Now click “Finish” in the dialog box of the installing device completion.

3.10 Virtual port properties setting

When connection is established the adapter virtual port appears as the next COM port in the Device Manager. Go to Control panel and select System / Hardware and run the Device Manager. The next COM called **USB 485/422 Serial Port** has appeared among the Ports. In Properties, its setting, e.g. transmission speed, character format and/or flow control can be changed. Caution!!! The control signals are not transmitted hence no hardware flow control can be used.

The port number assignment (e.g. COM3, COM4,...) may be changed under the Specify option.

3.11 DLL Library use

The annotated examples and English documentation of FT232BM chip used in E211 – USB 485/422 adapter are on the CD. As the file streams are applied the programmer access does not differ from the common port access. In the most widespread VisualC language the methods accessible through the header file FTD2XX are needed and their names are derived from the names of the corresponding Win32 API methods adding FT_ prefix.

Similarly, the DLL library can be used in Delphi, Builder and Visual Basic.

4.0 Specification

4.1 Parameters

USB interface	USB 2.0 full-speed (12 Mbps)
USB connector	B type
RS-422, RS-485 connector	clamps
Communication mode	full duplex, half-duplex
Isolation between USB/RS4xx	isolation barrier of 1 kV for 1 sec
Transmission mode	asynchronous, duplex/half-duplex
Maximum data rate	1 Mbps

4.2 Other

Supply	from USB interface
Power take-off	to 100mA (Low power)
Dimension: Width	55 mm
Length	65 mm
Height	20 mm
Stocking temperature	- 10° to +55 °C
Working temperature	+ 0° to +50 °C
Humidity	0 – 85% (non-condensing)

5.0 Testing

When the USB cable is connected and the drivers are installed properly the LED READY has to light up. When the transmitter and receiver clamps are interconnected (TxRx+ to Rx+, TxRx- to Rx-) and 422 mode set to No.1 switcher the transmitted and received data has to be equal. The Hyper-terminal programme which is of the MS Windows part or E211_test supplied on the installation CD may be used for testing.

The TxD and RxD LED diodes blink during the transmission. If there is the transmission of the low rate and the data blocks are very short the LED brightness is low because they only shine if the data signal is on the active level. It means the short data transmission (or even a sign transmission) of the high data rate are not perceptible to the

eye. To connect TxRx+ to Rx-, TxRx- to Rx+ clamp in the 422 mode, the correct operation in the idle state can be checked. Thus we create the transmitter signal negation for the receiver and the RxD diode has to light up.

6.0 Troubleshooting

Symptom	Action
Adapter does not work after installation	Check if the metallic link and the USB cable are connected properly Check the mode switches position. Check if the terminators are set properly. Check if READY is alight.
Connection in normal operation quit working.	Check if READY is alight. Check the cables connection.
The 485-USB adapter is missing in the Device Manager	Turn it off and on. If need be, repeat the installation.

7.0 Ordering information

Supply code is ELO E211. The adapter is supplied with the installation CD. The USB cable of the required length can be ordered separately as it is not provided.

Note

