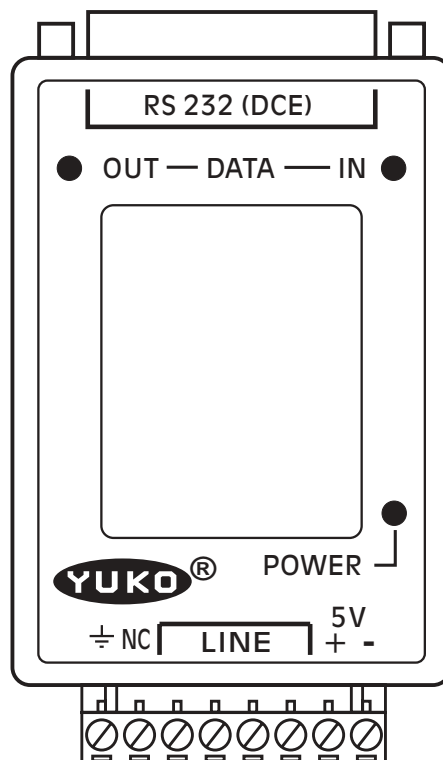


KO-485

RS 232 to RS 485 or RS 422 Interface Converter

User's Guide and Installation Manual



1. General description.

KO-485 can be applied to connections between devices using RS 232C (V.24) interface and devices using RS 485 or RS 422 interface. It converts RS 232C (v.24) interface signals into RS 485 or RS 422 signals. A set of two KO-485 converters can also be used to connect two devices using RS 232 interface (RS 485 or RS422 standard serial transmission is much quicker, interference proof and provides a wider range than RS 232 standard one).

KO-485 converter provides galvanic insulation of both the RS 232 interface and the transmission line.

KO-485 converter can function in one of the following two modes: RS 485 and RS 422. Both of them can be set by means of appropriate switches and jumpers.

KO-485 is manufactured in the following cover variations:

KO-485(a) - box cover,

KO-485(a)d - can be mounted on a standard TS 35 DIN chassis,

KO-485(a)p - panel version.

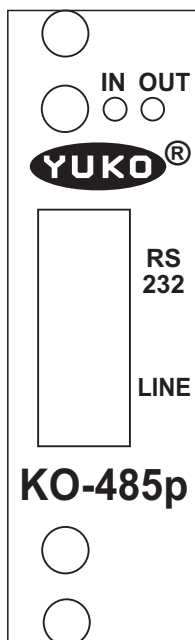
KO-485(a) is available as a small box with DB25 connector on the one side and PHOENIX connector on the other side. The former connects to the interface on the computer and the latter connects to the transmission line and power supply. The device is powered by a separate 6 or 5V power supply. Slots on one side of the cover give access to the device's switches.

KO-485(a)d varies from KO-485(a) only that it is adapted for mounting on a standard TS 35 DIN chassis.

KO-485(a)p is designed to be mounted inside YUKO's 19", 2U high standard case. On the front panel there are two RJ45 female connectors, one for connecting RS 232 interface, the other for connecting RS 485 or RS 422 interface. Up to 16 converters can be mounted in one case. The whole set can be powered by one power supply.

Other supplies for the panel version: cases, handles, power supplies, power cables, etc. are available at YUKO (<http://www.yuko.com.pl/panel.html>).

KO-485(a) is equipped with built in circuits insuring immunity to high voltage.



To sum up, letter „p” means the panel variation, „d” means the variation adapted for mounting on the chassis, and „a” means a device immune to high voltage.

2. Technical data.

The converter's main characteristics are the following:

<i>Transmission type:</i>	voltage, differential
<i>Transmission line type:</i>	twisted pair
<i>Transmission speed:</i>	0÷921 kbps
<i>Maximum line length:</i>	see the table below
<i>Sender line out:</i>	minimum +- 1.5 V
<i>Receiver sensitivity:</i>	+/- 200 mV
<i>Power supply:</i>	5÷6VDC/150mA

KO-485 converter's electrical parameters are shown in the following table:

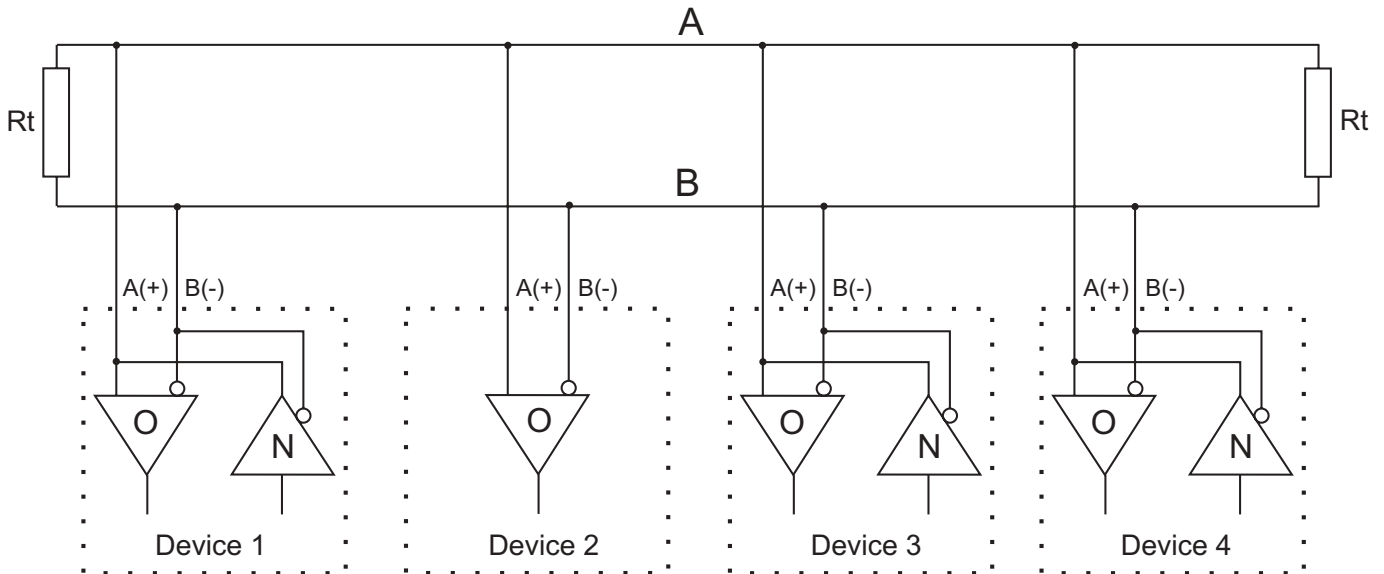
RS 485 (RS 422) line sender			
RS 232 TxD line voltage (pin 2)		Cable voltage "A" in respect to "B"	
Min	Max	Min	Max
+0,8V		-1,5V	
+2V		1,5V	

RS 485 (RS 422) line receiver			
Cable voltage "A" in respect to "B"		RS 232 RxD line voltage (pin 3)	
Min	Max	Min	Max
-200mV		-3V	
+200mV		+3V	

3. RS 485 interface.

RS 485 standard is intended for serial digital data transmission through twisted pair symmetric transmission line. Its particular feature is the possibility of connecting multiple senders and receivers to a single line. Thus, the senders are three-state ones, and can be switched into the high impedance state. When there is no data transmission all senders are in off state. During the transmission one sender controls the line state and all the receivers

KO-485 range for typical telephone twisted wire 2x0,5 mm								
4,8 kbps	9,6 kbps	19,2 kbps	38,4 kbps	57,6 kbps	115,2 kbps	230,4 kbps	460,8 kbps	921,6 kbps only RS 422
5,4 km	4,3 km	3,3 km	2,6 km	2,2 km	1,8 km	1,3 km	0,8 km	0,2 km



Pic 1. RS 485 transmission line

can receive data. RS 485 standard allows for **half duplex** multipoint transmission.

Interface receivers act as differential amplifiers with hysteresis.

Twisted wire with resistors on both ends is most commonly used as a transmission line. Typical value of each of these resistors equals 120Ω.

The transmission line cables are most often labelled as «A» and «B», or «+» and «-», respectively. According to the most common convention voltage over +200 mV on cable «A» in respect to «B» means «Space» state, which is equal to asynchronously transmitted char's start bit polarization. Respectfully, voltage lower than -200mV is equal to «Mark» state, i.e. stop bit polarization. Because of the receivers' hysteresis after sender deactivation it remains in previous state.

Typical RS 485 standard transmission set configuration is presented in picture 1.

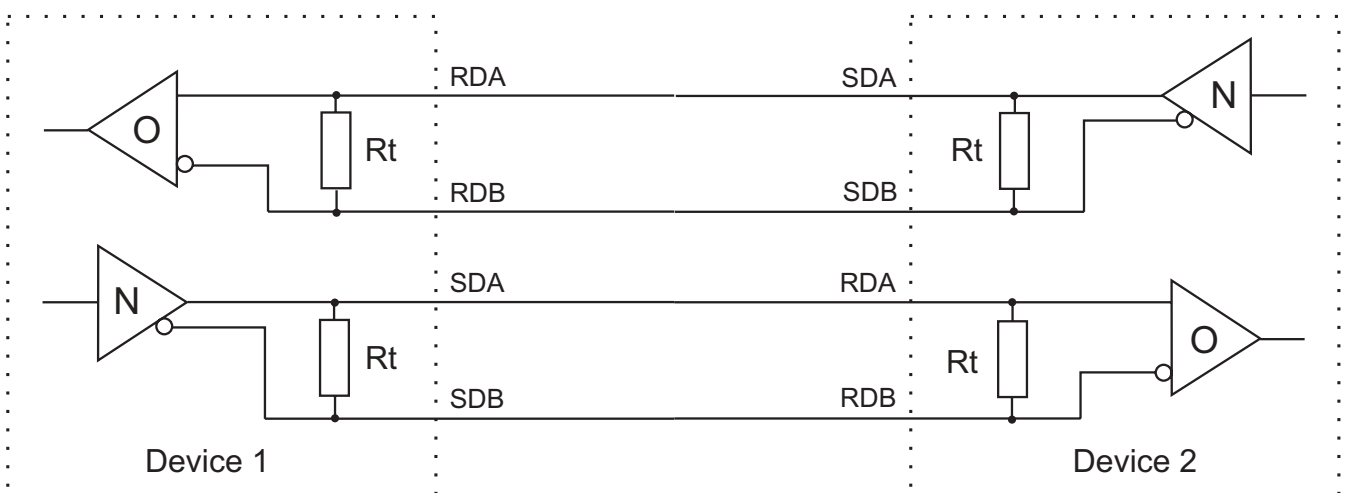
The senders and receivers' remaining electrical standardized parameters allow connecting up to 32 devices. In order to increase the number of devices connected together proper signal repeaters should be used.

4. RS 422 interface.

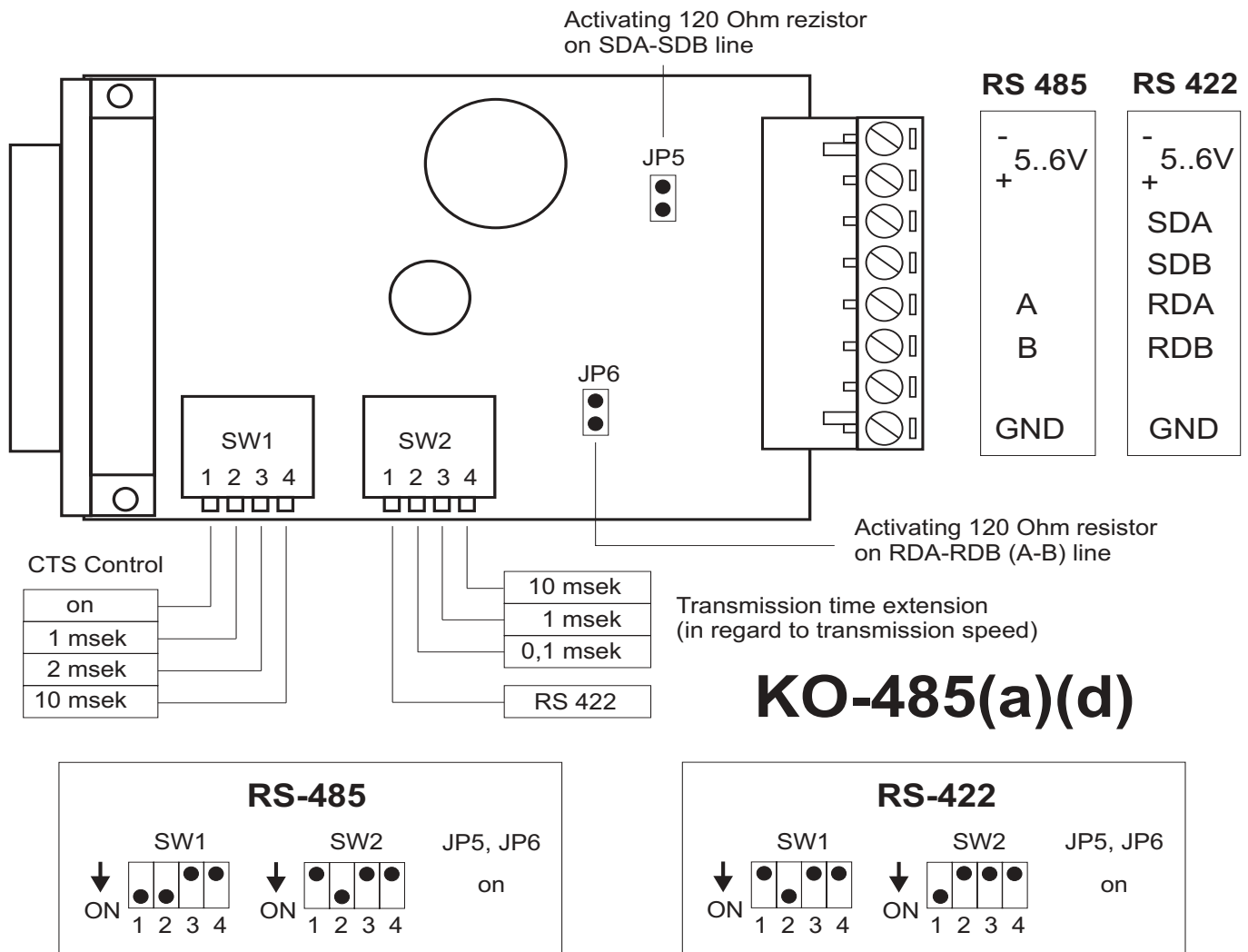
RS 422 interface electrical standard is identical to RS 485. However, it allows to connect only one sender and up to ten receivers to one cable pair. The senders need not be three-state, because the only sender connected to the line is always transmitting. In order to ensure two-way transmission between two devices, two pairs of cables are necessary (picture 2). In such case the transmission is taking place in Full Duplex mode (i. e. simultaneously sending and receiving data).

5. KO-485 converter operation.

KO-485 converter can function in the following modes: RS 485 and RS 422. The modes are selected by setting appropriate switches and jumpers on the converter. In RS 422 (Full Duplex) mode the transmission occurs in both directions, simultaneously, through separate transmission lines. Two transmission lines (cable pairs) are necessary. Communication software can ignore all converter's control signals.



Pic 2. RS 422 transmission line



Pic 3. RS 485 converter's switches functions

In RS 485 (Half Duplex) mode one transmission line is used in turns for transmission in each direction. While there is no transmission in any direction the converters' are in the receiving state. The converter switches into sending mode when a char is present on RS 232 interface's TxD line (sent data). After sending the char the converter temporarily remains in sending state for a period of time controlled by SW2 switch in KO-485(a) or JP2 jumper in KO-485(a)p.

When the converter receives a char it sends the char to RS 232 interface's RxD line and switches CTS line into off state for a period of time controlled by SW1 switch in KO-485(a) (picture 3) or JP1 jumper in KO-485(a)p (picture 4).

In RS 485 mode only one sender connected to the line may transmit. Thus, the data transmitting devices that cooperate with the converters should properly read RS 232 interface's RTS and CTS signals. The RTS signal should be permanently in ON state or it should be switched into ON state prior to each transmission. Sending char can only take place in CTS signal's ON state. This is available in most communication systems and is most commonly called «Hardware flow control» or «RTS-CTS

handshaking». RTS-CTS signals may be ignored provided that the applied communication protocol has only one sender connected to the line is transmitting at any time.

DSR and DCD signals are permanently switched into OFF state regardless of the other devices' states.

6. The switches' settings.

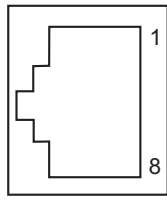
KO-485(a) converter's layout of the switches and their functions is shown in picture 3, and KO-485(a)p converter's layout is shown in picture 4. RS 485 and RS 422 modes standard recommended settings are shown in the boxes. In most cases these settings insure the correct device operation. In the following description «p» (panel) converter's settings are shown in italics.

SW1 (JP1)

SW1 (JP1) controls CTS line's working mode for converter's RS 485 mode. It also controls the line's OFF state's time extension (SW1-1 (JP1-4) must be in ON state). The input time period should be longer than one char's transmission time and interval between the chars in any block being transmitted. In most cases the standard 1 millisecond setting is appropriate. In some cases, when the devices are in a bigger distance from each other and trans-

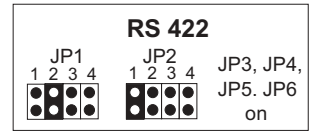
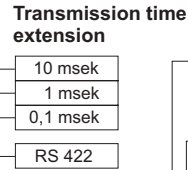
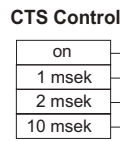
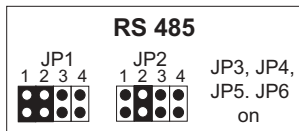
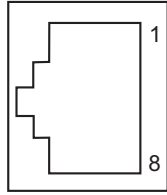
P1. RS 232 interface lines

Pin	Signal
1	--
2	RTS
3	RxD
4	DCD
5	GND
6	TxD
7	DTR
8	CTS



P2. Telecommunication signals

Pin	RS 485	RS 422
1		
2		
3		SDA
4	B	RDB
5	A	RDA
6		SDB
7		
8		



Pic 4. RS 485p converter's switches functions

mit information blocks with longer intervals between chars, or the transmission speed is smaller than 9600 bps the OFF state time should be obtained experimentally. Increasing CTS line's OFF period results in effective transmission speed decrease.

For transmission in RS 422 mode or while RTS-CTS signal is not being used SW1(JP1) should be switched into OFF state. In this case CTS line is always in the same state as RTS line. One of the SW1-2÷4 (JP1-2÷4) switches should be ON or CTS signal would be obscure (CTS would adopt random values).

SW2-1 (JP2-1)

This switch controls converter's working mode:

- SW2-1 (JP2-1) = OFF : RS 485,
- SW2-1 (JP2-1) = ON : RS 422.

SW2-2÷4 (JP2-2÷4)

This switch controls the time period in which the converter stays in sending mode after a char has been transmitted. The time period is selected with respect to the transmission speed.

- 115200 bps - 0.1 msek
- 9600 ÷ 57600 - 1 msek
- <9600 bps - 10 msek

The time period should be longer if the device sends data blocs with bigger intervals between chars.

SW2-2÷4 (JP2-2÷4) switches' settings are irrelevant for converter's RS 422 mode transmission.

JP5 and JP6 (JP5 and JP4)

JP5 and JP6 (JP5 and JP4) jumpers allow synchronizing with transmission line's wave impedance. When they are on a standard 120* resistor is added to the transmis-

sion line's ends. JP6 (JP4) controls RDA-RDB (A-B) line's resistor and JP5 (JP6) controls SDA-SDB line's resistor. These resistors should be added only if the converter is connected to the end of the transmission line (see pictures 1 and 2). When the converter is connected elsewhere (the RS 485 line is connected to and from the converter) the resistors should be disconnected (the jumpers should be off). In such a jumper's state the transmission line may be terminated with a resistor. In this way the converter can be configured for custom transmission lines and custom RS 485 systems.

There are two additional jumpers in KO-485(a)p model, JP3 and JP6. They control receiver's voltage (RDA-RDB line) when there is no transmission from the senders. These jumpers should be on in at least one device connected to the line, but in no more than two of them.

7. Connecting to the transmission line.

The connection should be made according to picture 1 or 2 dependant on the converter's mode. Symetric cable pairs providing galvanic connection of the devices should be used as transmission lines. Line quality affects transmission's range and speed.

The pairs' layout in the converter's connector is shown in pictures 3 and 4. It should be noted that A and B lines in the cable couples are not interchangeable.

In case a shielded cable has been used the shield can be connected to GND.

Another way of connecting the transmission line is available in case of KO-485(a)p converter. At the back of the cover there are four screw connector which can be used.

8. Connecting to RS 232 interface.

KO-485(a)

KO-485(a) converter has 25-pin DCE standard (Data Communication Equipment) connector. Therefore, a standard, carrying signals „1 to 1”, modem cable can be used.

The following signals are sent to the RS 232 interface connector:

<i>name</i>	TxD	RxD	RTS	CTS	DSR	GND	DCD
<i>pin no</i>	2	3	4	5	6	7	8

The cable that carries only the above signals is sufficient.

In case the communication software does not use all the above signals an even simpler cable can be used.

For RS 485 connection:

<i>name</i>	TxD	RxD	RTS	CTS	GND
<i>pin no</i>	2	3	4	5	7

For RS 422 connection:

<i>name</i>	TxD	RxD	GND
<i>pin no</i>	2	3	7

The converter can be plugged directly into RS 232 interface 25-pin connector without the use of any cable. Such a connection is not always possible and depends on the interface connector's size and shape.

KO-485(a)p

This model has RJ45 female connector. The same signals as in the other models are carried to the connector. Thus, a special interface cable with RJ45 connector and DB9 or DB25 typical interface connector is needed. RJ45 connector's interface signal layout is shown in picture 4.