NEW

$C\epsilon$
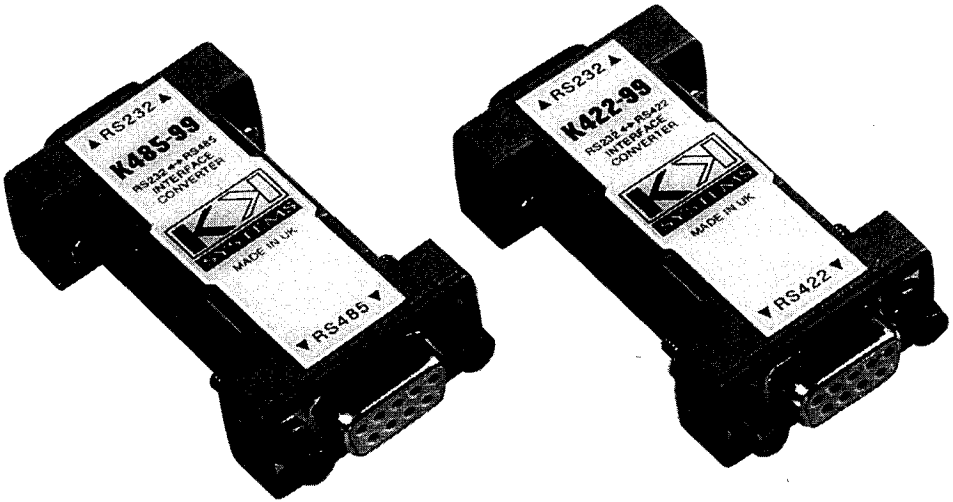
RS232 ↔ RS485   RS232 ↔ RS422

- ✔ **RS422 (4-wire) and RS485 (2/4-wire) models available**
- ✔ **Plugs into IBM "AT" 9-way serial port**
- ✔ **RS422/485 pin-outs for professional broadcast and video equipment**
- ✔ **No separate power supply required**
- ✔ **Baud rate independent – 0-115 kbaud**
- ✔ **Controlled slew rate driver – low EMC**
- ✔ **Very low cost**

The K422-99™/K485-99™ converters provide interface conversion between RS232 and RS422/RS-485.

The K422-99/K485-99 use very low power CMOS circuitry and are powered entirely from the RS232 interface. No external power is required in most applications.

The RS422/485 pin-outs are suitable for direct 1:1 connection to professional broadcast and video equipment such as VTRs and sound/video mixers.

Both RS-422 and RS-485 use a twisted-pair wire (i.e. 2 wires) for *each* signal. They both use the same differential drive with identical voltage swings: 0 to +5V. The main difference between RS-422 and RS-485 is that while RS-422 is strictly for point-to-point communications (and the RS-422 driver is always enabled), RS-485 can be used for multidrop systems (and the driver in a RS-485 device has a tri-state capability).

RS-422 (K422-99)

RS-422 uses *two* separate twisted pairs and data can therefore flow in both directions simultaneously. RS-422 is often used simply for extending RS-232 cables. The K422 is the correct choice in all cases. Fig. 1 shows a typical RS-422 connection:

Fig 1
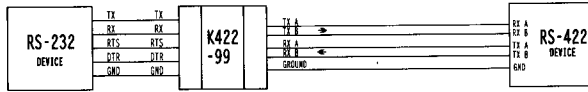
RS-485 (K485-99 or K422-99)

RS-485 exists in two varieties: **2-wire** and **4-wire**. These are supported with the K485-99 and K422-99 resp., but there are special cases to consider. All these systems are usually "Master/Slave"; each Slave device has a unique address and it responds only to a correctly addressed message (a "poll") from the Master. A Slave never *initiates* a dialogue. Naturally, the Master software must emit the correct addresses. All Slaves drive a common 2-wire bus and must therefore have tri-state drivers. Please read the following carefully:
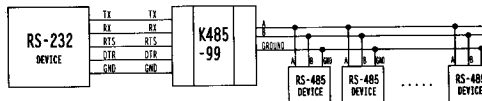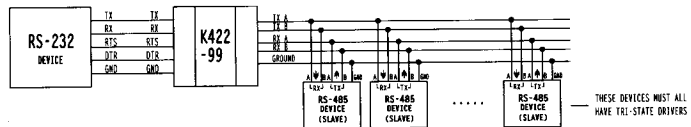
Fig 2a

Fig 2b

2-wire RS-485 only: because *all* the devices are attached to a *single* bus, all devices (including the Master) must have tri-state capability. Only the **K485-99** may be used in this system. The Master RS-232 device must control the RS-232 RTS signal to properly control the K485-99 driver. In the unusual case where the Slaves are *RS-232* devices, a K485-99 must be used on each Slave, and again each Slave device must control its RS-232 RTS signal to control its K485-99 driver. See Fig 2a.

4-wire RS-485 only: because the Master drives a bus which is separate from the bus driven by the Slaves, the Master does not need tri-state capability. The **K422-99** should therefore be used on the Master. In the unusual case where the Slaves are *RS-232* devices, a **K422-99-4W** (available to special order) must be used on each Slave, and again each Slave device must properly control its RS-232 RTS signal to control its K485-99-4W driver. See Fig 2b.

The main advantage of **4-wire** RS-485 systems is that the Master does not need tri-state capability. This often allows Master software and drivers originally developed for RS-232 to be used in a multidrop system, provided of course that the Master software emits the correct device addresses. See Fig 2b.

Sometimes a 4-wire "RS-485" system is used to interconnect just *two* devices; this is virtually identical to RS-422 and a K422-99 can be used at both ends because there is no need for a tri-state capability. See Fig 1.

RTS control (K485-99 and K485-99-4W only): when RTS is at RS-232 HIGH level, the RS-485 tri-state driver is enabled, otherwise it is disabled. Also, when RTS is HIGH, RS-232 receive data is inhibited, i.e. the converter does not receive its own transmitted data.

RS-485 supports up to 32 devices connected to a common bus, but this number is usually reduced when the K485-99/K422-99 is powered from the RS-232 interface. When the converters are powered from the RS-232 interface, they require that either RTS or DTR (or both) are continuously in the HIGH state. Due to the limited amount of power available from RTS or DTR on most PCs, the following rules should be observed:

● If the twisted pair cable is resistively terminated (e.g. with a 220Ω resistor) then a capacitor (e.g. 1000pF) should be connected in series with the resistor. This is because a resistor alone would consume more power than most PC RS-232 interfaces can supply.

- The RS-232 signal which provides the power to the converter (RTS or DTR) must be in the HIGH state for at least 50 milliseconds prior to any data communication taking place.

- K485-99/K485-99-4W only: assuming the standard RS-485 receiver input impedance of 12kΩ, a maximum of approximately 10 devices should be connected to the common bus.

- If the *total* capacitance of the cable exceeds a certain value, the power required to drive the cable may exceed what can be derived from RTS or DTR. This is baud rate dependent; see the following table:
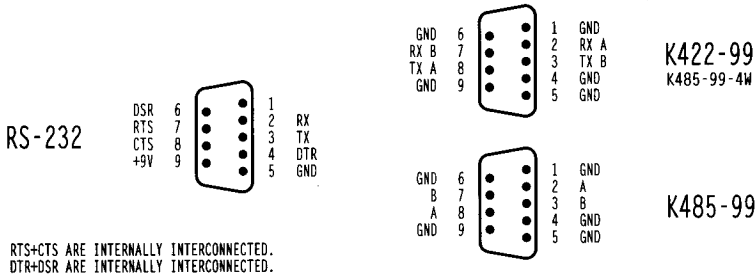
Baud Rate (baud)	Max total cable capacitance (pF)	Baud Rate (baud)	Max total cable capacitance (pF)
1200	250000	19200	15000
2400	120000	38400	7500
4800	60000	57600	5000
9600	30000	115200	2500

The above table shows that the converters may not be able to drive very long cables at high baud rates *and* remain powered from the RS-232 interface alone. This is not normally a problem because the vast majority of RS-422 and RS-485 applications involve cable lengths which are much shorter than the maximum permitted by the relevant standards. **If the power derived from RTS or DTR is insufficient, an external 9V DC power supply can be connected to pin 9 of the RS-232 interface as shown in the Connections section below.**

Some manufacturers' claims contradict this and suggest that a device can draw much more current from a PC. With some PCs this may be true but the above table is a useful if conservative guide.

Connections

K422-99 and K485-99 are designed to plug directly into a standard 9-way IBM "PC-AT" RS-232 serial port, with the RS-422/485 interface being available on the converter's other 9-way connector.

RS-232

DSR	6		1	
RTS	7		2	RX
CTS	8		3	TX
+9V	9		4	DTR
			5	GND

RTS+CTS ARE INTERNALLY INTERCONNECTED.
DTR+DSR ARE INTERNALLY INTERCONNECTED.

K422-99
K485-99-4W

GND	6		1	GND
RX B	7		2	RX A
TX A	8		3	TX B
GND	9		4	GND
			5	GND

K485-99

GND	6		1	GND
B	7		2	A
A	8		3	B
GND	9		4	GND
			5	GND

☛ **Since BOTH ends of the K4xx-99 converter have the same 9-way female connector, be careful to install it the right way round!**

If your PC has a *25-way* RS-232 connector, you will need the commonly available 25-9 moulded converter. Alternatively, the K422 and K485 are available and these plug directly into a 25-way PC serial port.

The 9V DC power supply can be connected to pin 9 of the RS-232 interface. If the converter is required to provide the full specified RS-422/485 drive, the power supply must provide up to 50mA with its voltage always remaining in the range +6V to +13V.

A or B: Following published RS-422 and RS-485 standards, the converter twisted-pair connections are marked **A/B**. When connecting to other RS-422/485 equipment, you may encounter other markings such as HI/LO or +/– respectively. Such non-standard markings are ambiguous and you may need to experiment with the polarity (i.e. reverse the wires) to get the link to operate.

The K422-99 and K485-99 converters are non-inverting from input to output. This means that when the **TX** input is at the RS-232 HIGH level (+12V nominal) the **A** output is at the RS-422/485 HIGH level (+5V) and the **B** output is at the LOW level (0V). This conforms to the published RS-422/485 standards.

Termination: Short cables (e.g. below 200m) do not generally require termination. For longer lengths, connect a resistor (whose value is approximately equal to the cable characteristic impedance) with a series capacitor (e.g. 1000pF) across each end of the cable. Two terminators are therefore required. However, the controlled slew rate of the special low-EMC driver (transition time approx 1μs) used in all K4xx-99 products eliminates the need for terminators in most applications.

If the link does not operate, please check the following:

● Check that the **A/B** connections on the converter are connected to the corresponding terminals at the other end. Due to frequently non-standard markings on some equipment you may need to experiment by swapping the **A/B** wires.

● Check that the converter is receiving a supply from the RS-232 RTS or DTR signals. This can be checked by checking the voltage levels on RTS/DTR; at least one of these must be in the range +6V to +13V DC (relative to GND), particularly while transmitting.

● Check that any terminator resistors have a series capacitor (see preceeding text).

● Check that you have not swapped over the connections between the RS-232 device and the converter. Note that, on the K4xx-99 RS-232 connector, **TX** (pin 3) is an **input** and **RX** (pin 2) is an **output**.

● While grounding is rarely a problem with RS-232, some poorly wired RS-422/485 systems use only two (or four) wires with no GND. Although this can work, it is wrong and a GND connection should always be present.

● K485-99/K485-99-4W only: check that your RS-232 device controls the RS-232 RTS signal so that it is HIGH when transmitting and LOW when receiving. Note that it must remain HIGH until the very last bit of the message has shifted out of the UART.

● The K4xx-99 RS-232 output swings from 0 to +5V only. This is compatible with 99% of PCs. The standard RS-232 threshold is approx +1.5V but some PCs use non-standard RS-232 receivers. Test with a different PC. The K4xx-ISOL (2kV isolated) versions have RS-232 voltage levels that swing above *and* below zero.

K422/K485™

The K422 and K485 are similar to the K422-99 and K485-99 but they have a 25-way D connector at the RS-232 end and can thus be plugged directly into a standard *25-way* PC serial port. They also have different RS422/485 pin-outs.
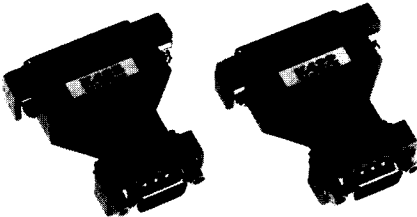
K422-ISOL/K485-ISOL™

The K422-ISOL and K485-ISOL are functionally similar to the K422 and K485 but also offer 2000V AC (RMS) isolation. This makes the K4xx-ISOL ideal for severe industrial environments.
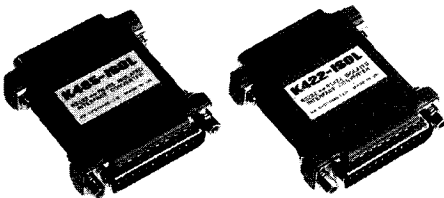
Also available is an isolated DIN rail mounted converter, the KD485, with auto driver enable and other intelligent features.

PPC™

The PPC Programmable Protocol Converter is a unique user-programmable datacomms device which enables a customised protocol converter to be produced very quickly.

The PPC contains four RS-232/422/485 serial ports with baud rate capability up to 115 kbaud and full modem control. It contains a specially extended Pascal compiler, a Basic interpreter, a full-screen Wordstar-compatible editor and a filing system capable of storing 20 programs.

To program the PPC, all you need is an ANSI-compatible "dumb" terminal or a PC, and some straightforward programming. ANSI C development is also supported and the PPC can support C programs of over 10,000 lines.

PPC options include a real-time clock and I/O expansion cards. A single Eurocard version (PPC/E) with 4 RS232/422/485 ports is also available for 3U rack mounting.
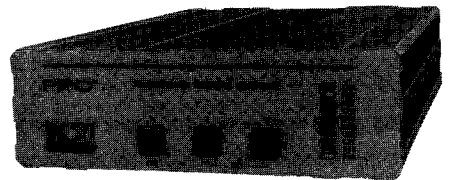
The PPC is widely used for industrial protocol conversion, with particular applications in MODBUS and other PLC-related protocols. Also, many customised versions of the PPC have been supplied, some with custom hardware added.

All KK Systems products are CE marked.

Address correction:

KK Systems Ltd
Tates, London Road
Pyecombe, Brighton
BN45 7ED
Great Britain

☎ +44 1273 857185
fax +44 1273 857186
e-mail info@kksystems.com
www http://www.kksystems.com