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When dealing with PCs' or other electronic devices it is sometimes desirable to exchange data between two units. There are two methods of doing this, parallel and serial. Both terms refer to whether bit data is sent one at a time (serial) or several bits simultaneously (parallel). Parallel transmission can be 8, 16, 32 or any number of bits you so desire. Its' main advantage is exactly what its' name implies, that is the bits are transferred all at once. The main disadvantage is that it takes a lot of wires to do that, and that the distance you can send is normally relatively close. Serial data on the other hand takes a lesser amount of wires and can generally be sent longer distances. Comparatively speaking it is slower than parallel, by definition but owing to different methodologies can actually be quite fast.

There are many forms of serial communications in use today, but RS-232 is one of the most common forms of serial communications you will find. It has been in use for a relatively long period of time and because of its' inclusion in PCs' has become more known to the general public. This does not mean however that everyone understands how it functions, or what the electronic characteristics are. Our discussion here centers on RS-232 serial communications.

Serial communications can be classified into three broad categories simplex, full duplex and half duplex. Full duplex can send and receive data simultaneously with full flow control. Simplex can send and receive data simultaneously but without any flow control. Half duplex can both send and receive data, but not simultaneously, and without flow control.

RS by the way means Recommended Standard and as defined is a method of trying to keep everyone on the same playing field so that different manufacturers' products can easily interface with other manufacturers' products with as little confusion as possible. The "normal" RS-232 mode is full duplex and the easiest way to define and explain the operation is to first identify the signals involved. The fully recommended standard defines many signals, but generally only nine are widely used. Furthermore the standard also defines either a nine or twenty-five pin D type connector to be used, with specific pinouts for both.

Signal Name	Abbreviation	D type nine pin number assigned	D type twenty five pin number assigned
Carrier Detect	CD	Pin 1	Pin 8
Receive Data	RD	Pin 2	Pin 3
Transmit Data	TD	Pin 3	Pin 2
Data Terminal Ready	DTR	Pin 4	Pin 20
Signal Ground	SG	Pin 5	Pin 7
Data Set Ready	DSR	Pin 6	Pin 6
Request To Send	RTS	Pin 7	Pin 4
Clear To Send	CTS	Pin 8	Pin 5
Ring Indicator	RI	Pin 9	Pin 22



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NULL MODEM CONNECTIONS FOR DB 9

Signal Name	Abbreviation	D type nine pin number assigned	D type nine pin number assigned
Carrier Detect	CD	Pin 1	NA
Receive Data	RD	Pin 2	PIN 3
Transmit Data	TD	Pin 3	PIN 2
Data Terminal Ready	DTR	Pin 4	PIN 6
Signal Ground	SG	Pin 5	PIN 5
Data Set Ready	DSR	Pin 6	PIN 4
Request To Send	RTS	Pin 7	PIN 8
Clear To Send	CTS	Pin 8	PIN 7
Ring Indicator	RI	Pin 9	NA

NULL MODEM CONNECTIONS FOR DB 25

Signal Name	Abbreviation	D type twenty five pin number assigned	D type twenty five pin number assigned
Carrier Detect	CD	NA	Pin 8
Receive Data	RD	PIN 2	Pin 3
Transmit Data	TD	PIN 3	Pin 2
Data Terminal Ready	DTR	PIN 6	Pin 20
Signal Ground	SG	PIN 7	Pin 7
Data Set Ready	DSR	PIN 20	Pin 6
Request To Send	RTS	PIN 5	Pin 4
Clear To Send	CTS	PIN 4	Pin 5
Ring Indicator	RI	NA	Pin 22

In addition to all of this there also exists an equipment break down into two categories, DTE and DCE. DTE is Data Terminal Equipment, which means terminal or specifically your PC. DCE is Data Communications Equipment, which means equipment that your computer would like to communicate with like a modem, a diagram plotter, bar code scanner etc. The Recommended Standards for RS-232 also state that the D type connectors on DTE equipment should be male type connectors and that the connectors on DCE equipment should be female type connectors.



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The signal levels defined by the recommended standard for use with RS-232 are:

DC Voltage	-3 to -25 volts	+3 to +25 volts
Binary state	1	0
Signal condition	Mark	Space
Signal function	Off	On

The voltage condition of -3 to +3 volts is undefined. Maximum open circuit voltage should not exceed 25 volts.

The easiest way to understand how the RS232 communications protocol (as well as any communications protocol) functions is to look at it from the aspect of two people talking to each other. We'll assume that the DTE (the PC) is going to communicate with a DCE (a modem). The PC says to the modem by setting the DTR line to a mark condition "Hey I'm awake". The modem says to the PC, by setting the DSR to a mark condition, "Hey I'm awake too". Generally these two signals let each other know that the equipment is turned on and the communications ports are active. The PC then tells the modem by setting the RTS line to a mark condition "Hey I'd like to send you data". Upon hearing this the modem says to the PC, by setting the CTS line to a mark condition "I'm all set; send me your data". At this point the PC starts sending data from its TX line to the modem. If along the way the modem is unable to receive anymore data (maybe its' buffer is full), it tells the PC, by setting the CTS to a spacing state "I'm not ready anymore; don't send me anymore data". The PC stops sending data now until the CTS signal is restored by the modem. When all the data is sent, the PC then clears the RTS line and the modem then clears the CTS line.

One more word as far as connection is concerned. The nomenclature used for signal connections at the DTE (the PC) end of the RS-232 is considered to be originating. The nomenclature used for signal connections at the DCE (the modem) end of the RS-232 is considered to be terminating. What this means is that the TX signal from the DTE device connects to the TX signal at the DCE device. Actually the TX signal at the DCE device is the RX input. All the signals at the DCE device follow this format.