RS 232 / RS485 / RS422
Specifications and Wiring

What's the "RS" in RS232/RS485/RS422?

The RS stands for **Recommended Standard**. Nothing really agreed upon or official. At least not in the sense of the "made-by-committee" standards like IEEE-1284 and IEEE-1394.

What does this mean? Because RS standards are merely *recommended* and technically general, lots of manufacturers develop products that are at best inferior. They cut corners and cheat in order to manufacture cheaper products.

Simplex & Duplex

One of the most fundamental concepts of communications technology is the difference between Simplex and Duplex.

Simplex can be viewed as a communications "one-way street". Data only flows in one direction. That is to say, a device can be a receiver or a transmitter exclusively. A good example of simplex communications is a radio station and your car radio. Information flows only in one direction where the radio station is the transmitter and the receiver is your car radio. Simplex is not often used in computer communications because there is no way to verify **when** or **if** data is received. However, simplex communications is a very efficient way to distributed vast amounts of information to a large number of receivers.

Duplex communications overcome the limits of Simplex communications by allowing the devices to act as transceivers. Duplex communication data flow in both directions thereby allowing verification and control of data reception/transmission. Exactly when data flows bi-directionally further defines Duplex communications.

Full Duplex devices can transmit and receive data at the same time. RS232 is an example of Full Duplex communications. There are separate transmit and receive signal lines that allow data to flow in both directions simultaneously. RS422 devices also operate Full Duplex.

Half-Duplex devices allow both transmission and receiving, but not at the same time**.** Essentially only one device can transmit at a time while all other half-duplex devices receive. Devices operate as transceivers, but not simultaneous transmit and receive. RS485 operates in a half duplex manner.

Side-By-Side Specification Chart

Here is the short version of the critical specifications. Unfortunately, these are subject to interpretation by individual manufacturers. That is why RS232 is often regarded as an incredibly non-standard communications protocol.

Betterbox Communications Ltd , 43 Burners Lane South, Kiln Farm, Milton Keynes, MK11 3HA
Phone: +44 (0) 1908-560200, Fax: +44 (0) 1908-565533, www.betterbox.co.uk

One important note.

You will see that one of the major differences between RS232 and RS422/RS485 is the signalling mode. RS232 is unbalanced while RS42 and RS485 are balanced. An unbalanced signal is represented by a single signal wire where a voltage level on that one wire is used to transmit/receive binary 1 and 0: the can be considered a push signal driver. On the other hand, paired wires represent a balanced signal where a voltage difference is used to transmit/receive binary information: sort of a push-pull signal driver. In short, an unbalanced voltage signal travels slower and shorter than a balanced voltage difference signal.

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	RS232	RS422	RS485
Cabling	single ended	single ended	Multi-drop
Number of Devices	1 transmit 1 receive	5 transmitters 10 receivers	32 transmitters 32 receivers
Communication Mode	full duplex	full duplex half duplex	Full duplex Half duplex
Max. Distance	50 feet at 19.2 Kbps	4000 feet at 100 Kbps	4000 feet at 100 Kbps
Max. Data Rate	19.2 Kbps for 50 feet	10 MBPS for 50 feet	10 MBPS for 50 feet
Signalling	unbalanced	balanced	balanced
Mark (data 1)	-5 V min. -15 V max.	2 V min. (B>A) 6 V max. (B>A)	1.5 V min. (B>A) 5 V max. (B>A)
Space (data 0)	5 V min. 15 V max.	2 V min. (A>B) 6 V max. (A>B)	1.5 V min. (A>B) 5 V max. (A>B)
Input Level Min.	+/- 3 V	0.2 V difference	0.2 V difference
Output Current	500 mA	150 mA	250 mA

DTE & DCE

Stands for DCE (**D**ata **C**ommunications **E**quipment) and DTE (**D**ata **T**erminal **E**quipment) devices. The difference between DCE and DTE is largely in the Plug and the direction if each pin (input or output). Your desktop PC is termed as a DTE device. A modem is a DCE device.

DCE devices use a 25-pin female connector while a DTE device uses a 25 pin male connector. Although this is not always the case so beware. A straight-through cable can be used to connect a DCE device to a DTE device.

DTE	DCE
25 pin male pinout	**25 pin female pinout**
Pin 1 - Shield Ground	Pin 1 - Shield Ground
Pin 2 - Transmitted Data (TD) **output**	Pin 2 - Transmitted Data (TD) **input**
Pin 3 - Receive Data (RD) **input**	Pin 3 - Receive Data (RD) **output**
Pin 4 - Request To Send (RTS) **output**	Pin 4 - Request To Send (RTS) **input**
Pin 5 - Clear To Send (CTS) **input**	Pin 5 - Clear To Send (CTS) **output**
Pin 6 - Data Set Ready (DSR) **input**	Pin 6 - Data Set Ready (DSR) **output**
Pin 7 - Signal Ground	Pin 7 - Signal Ground
Pin 8 - Carrier Detect (CD) **input**	Pin 8 - Carrier Detect (CD) **output**
Pin 20 - Data Terminal Ready (DTR) **output**	Pin 20 - Data Terminal Ready (DTR) **input**
Pin 22 - Ring Indicator (RI) **input**	Pin 22 - Ring Indicator (RI) **output**

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You can effectively convert DCE/DTE devices by using a **NULL Modem** cable. The null modem cable swaps the complimentary signals and allows a DCE device to act like a DTE and vice-versa.

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The following chart depicts the cabling of the DB9 connector found on an IBM-PC type computer.

DTE
9 pin male pinout
Pin 1 - Carrier Detect (CD) **input**
Pin 2 - Receive Data (RD) **input**
Pin 3 - Transmitted Data (TD) **output**
Pin 4 - Data Terminal Ready (DTR) **output**
Pin 5 - Signal Ground
Pin 6 - Data Set Ready (DSR) **input**
Pin 7 - Request To Send (RTS) **output**
Pin 8 - Clear To Send (CTS) **input**
Pin 9 - Ring Indicator (RI) **input**

RS485 Multidrop

RS485 is sometimes termed as ***RS485 Multidrop*** since it can connect several devices in a LAN network environment. These devices are all connected to a single pair wire. Transmit and receive share the same two wires.

Officially the RS485 specification allows only 32 nodes (devices) on the circuit. However, IC manufacturers have developed RS485 drivers capable of allowing 128 to 255 nodes on an RS485 LAN. This means that you can use our Converters and Remote I/O devices in more expansive situations.

RS422 Single Ended

RS422 is a "drop-in" replacement for most RS232 applications. It is full duplex and capable of long distance communications.

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