



RESEARCHES RS 232 / RS485 / RS422 - what's difference?

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 simplex device is not a transceiver.** A good example of simplex communications is an FM 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 a fine 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 have the dubious honor of allowing 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 **un-standard** communications protocol.

One important note. You will see that one of the major differences between RS232 and RS422/RS485 is the signaling mode. RS232 is unbalanced while RS422/RS485 is 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, a balanced signal is represented by a pair of wires where a voltage difference is used to transmit/receive binary information: sort of a **push-pull** signal driver. In short, unbalanced voltage level signal travels slower and shorter than a balanced voltage difference signal.

	RS232	RS422	RS485
Cabling	single ended	single ended multi-drop	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	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
Signaling	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 (Note that the driver ICs normally used in PCs are limited to 10 mA)	150 mA	250 mA

DTE & DCE

Let's talk about DCE (Data Communications Equipment) and DTE (Data Terminal Equipment) 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.

DCE devices use a 25-pin female connector while a DTE device uses a 25 pin male connector. Also, complimentary signals lines like transmit and receive are "swapped" between the two types. Thus, 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

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.

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

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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 Wiring Diagram

RS485 is sometimes termed as **RS485 Multidrop LAN** 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 LAN. However, I.C. manufacturers have developed RS485 drivers capable of allowing 128 to 255 nodes on an RS485 LAN. We use these next generation RS485 drivers in our products. This means that you can use our Converters and Remote I/O devices in more expansive situations.

Do you need convert RS-232 to RS-485? You may want to check this page: [Serial interface converter series](#)

Did you know that RS-232/RS-485 can be sent also over fiber? Check this range of products: [Serial fiber modems series \(V.35/RS422/485/232\)](#)

