RS-232 / RS-485 / RS-422 – 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.

One important note. 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.