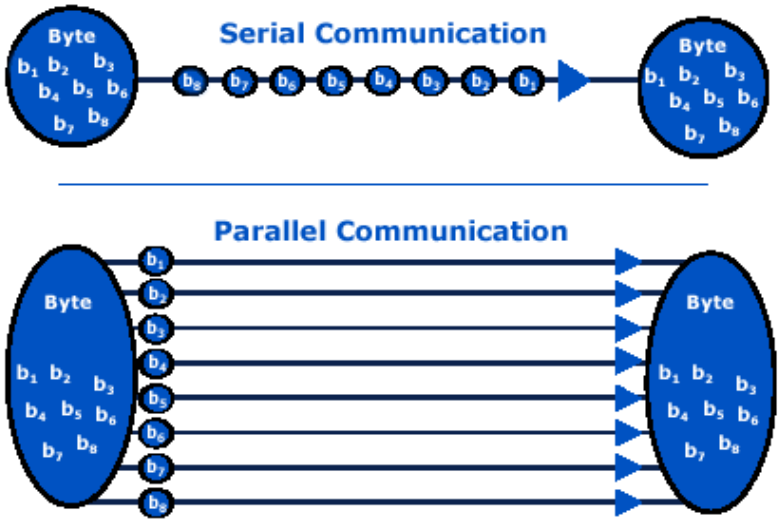
RS232

The original 8-bit parallel port was developed by IBM in 1981 as a faster interface to dot matrix printers than the then standard one-bit serial port. The parallel port greatly increases transfer speeds by using an eight wire connector which transmits the eight bits in a byte of data simultaneously, thus sending an entire byte of data in the time it takes to send a single bit in a serial system. This byte of data is supplemented by several other handshaking signals, each sent on its own wire, which ensure that data transfer takes place smoothly



RS-232 SERIAL COMMUNICATION OVERVIEW

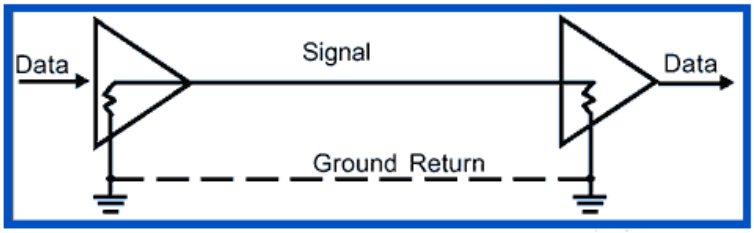
- Data is typically transmitted between two points either asynchronously or synchronously.
- However, what happens to the data between point A and point B is another discussion. This in-between area is a cable made up of wires through which data travels. Specifications for this cable were developed to maximize signal integrity (to limit the possible degradation that could be caused by external noise or ground shifts). Quatech supports three major protocols for asynchronous and synchronous communication: RS-232, RS-422 and RS-485. Differences between the three are highlighted in the chart below, and in the sections which follow.

	RS-232	**RS-422**	**RS-485**
Mode of Operation	single ended	differential	differential
Drivers per Line	1	1	32
Receivers per Line	1	10	32
Maximum Cable Length	50 feet	4000 feet	4000 feet
Maximum Data Rate	20 kbps	10 Mbps	10 Mbps
Driver Output Maximum	±25V	-0.25 to +6V	-7 to +12V

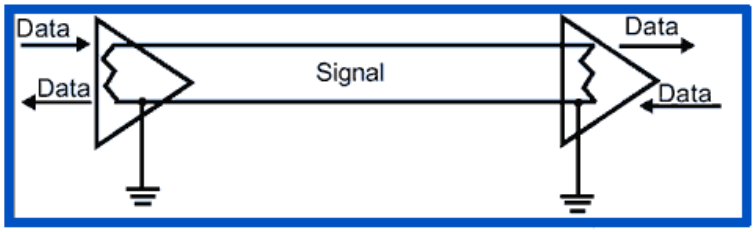
Voltage			
Driver Output Signal Level (loaded)	±5V	±2V	±1.5V
Driver Output Signal Level (unloaded)	±15V	±5V	±5V
Driver Load Impedance	3k to 7k	100k	54k
Max. Driver Output Current (Power on)	n/a	n/a	±100A
Max. Driver Output Current (Power off)	$V^{MAX/300}$	±100A	±100A
Slew Rate	30V/s max.	n/a	n/a
Receiver Input Voltage Range	±15V	-7V to +7V	-7V to +12V
Receiver Input Sensitivity	±3V	±200mV	±200mV
Receiver Input Resistance	3k to 7k	4k	12k

The First Standard

- RS-232 was introduced in 1960, and is currently the most widely used communication protocol.
- It is simple, inexpensive to implement, and though relatively slow, it is more than adequate for most simple serial communication devices such as keyboards and mice.
- RS-232 is a single-ended data transmission system, which means that it uses a single wire for data transmission.
- (Since useful communication is generally two way, a two-wire system is employed, one to transmit and one to receive.)
- Signals are processed by determining whether they are positive or negative when compared with a ground.
- Because signals traveling this single wire are vulnerable(week) to degradation, RS-232 systems are recommended for communication over short distances (up to 50 feet) and at relatively slow data rates (up to 20 kbps).
- However, in practice, these limits can be exceeded.



Unbalanced Single-Wire Transmission



Unbalanced Two-Wire Transmission

DTE and DCE Cable Configurations

DTE and DCE: Serial Communication Partners

A typical system is made up of two types of device, data communication equipment (DCE) and data terminal equipment (DTE). Typically DTE is defined as the communication source, and DCE is defined as the device that provides a communication channel between two DTE-type devices.

In order for DCE and DTE devices to communicate with each other, two wires must be used--one for transmission and the other for reception--and both devices must not use the same wire for the same purpose. Should this happen, nothing would get communicated because both devices would be talking on the same line and listening to a line on which nothing is transmitted. To solve this problem, DTE and DCE devices have complementary pinouts to allow terminals and modems to be connected directly using a one-to-one cable (see Figure below).

Situations arise in which no DCE device is needed, such as a desktop computer communicating with a laptop. In this case, a null modem cable or modem eliminator cable is used to connect the two DTE devices. This cable effectively changes the wires the second device uses for transmission and reception (see below-left) to assure that both sides can communicate.

Connectors: The Communication Conduit

As discussed in the asynchronous and synchronous communication sections, there is more to a serial transmission than simply data. Additional information must be transmitted between both ends of a conversation to make sure that when point A sends, point B is listening, and vice versa. This is called handshaking. These handshaking lines take up considerable space on a serial connector.

Connectors for RS-232 devices are always constructed using standard assignments for the wires in a RS-232 cable in order to maintain the DTE-DCE relationship described above. These connectors can be modular (phone jack) or male D-shell (pins configured in a rough "D" shape which fit into sockets on the device). The signal assignments for the RS-232 wires follow. The descriptions reference the standard DB-9 and DB-25 connectors used by most serial

devices, however the definitions are applicable to modular connectors as well (though in modular connections not all of the handshaking signals are implemented). See ESC-100M for Quatech modular adapters for PCI that include modular connector pinout information.

RS-232 Signal Descriptions

Abbreviations used in the following definitions of RS-232 wire functions will be used throughout Quatech's website.

DTR: Data Terminal Ready--Used by a DTE to signal that it is plugged in and available to begin communication.

DSR: Data Set Ready--Sister signal to DTR, it is used by the DCE to indicate it is ready to begin communication.

CTS: Clear to Send--Used by DCE to signal it is available to send data, and used in response to a RTS request for data.

RTS: Request to Send--Used by a DTE to indicate that it wants to send data. Also, in a multi-drop network, used to turn carrier on the modem on and off.

DCD: Data Carrier Detect--Used by a DCE to indicate to the DTE that it has received a carrier signal from the modem and that real data is being transmitted.

RI: Ring Indicator--Used by DCE modem to tell the DTE that the phone is ringing and that data will be forthcoming.

TxD: Transmit Data--This wire is used for sending data.

RxD: Receive Data--This line is used for receiving data.

GND: Signal Ground--This pin is the same for DTE and DCE devices, and it provides the return path for both data and hand-shake signals.

Synchronous Communication Only

TxCLK: Transmit Signal Element Timing--Used by DTE to provide DCE with timing information for data transfer.

RxCLK: Receiver Signal Element Timing--Used by DCE to provide DTE with timing information for data transfer.

LLBK: Local Loopback--Used by DTE to make sure the local transmit and receive interface is functioning properly.

RLBK: Remote Loopback--Used by DTE to make sure a remote transmit/receive interface is functioning properly.

TEST MODE: Test Mode--Used by DCE to indicate that it is testing itself in response to a local or remote loopback signal from a DTE.