Processor and I/O Communication

Synchronous Transmission

- In **synchronous transmission**, data moves in a complete paired approach in the form of chunks or frames. Synchronization between the source and target is required so that the source knows where the new byte begins since there is no space between the data.
- Synchronous transmission is effective, dependable and is utilized for transmitting a large amount of data. It offers real-time communication between linked devices.

Characteristics of Synchronous Transmission

- There are no spaces in between characters being sent.
- Timing is provided by modems or other devices at the end of the transmission.
- Special syn characters goes before the data being sent.
- The syn characters are applied between chunks of data for timing functions.

Examples of Synchronous Transmission

- Chatrooms
- Video conferencing
- Telephonic conversations
- Face-to-face interactions

Asynchronous Transmission

- In **asynchronous transmission** data moves in a half-paired approach, 1 byte or 1 character at a time. It sends the data in a constant current of bytes. The size of a character transmitted is 8 bits where a parity bit is added each at the beginning and at the end which makes it a total of 10 bits.
- It doesn't need a clock for integration; rather it utilizes the parity bits to inform the receiver how to translate the data.
- It is straightforward, quick, cost-effective and doesn't need a 2-way communication.

Characteristics of Asynchronous Transmission

- Each character is headed by a beginning bit and superseded by one or more end bits.
- There may be gaps or spaces in between characters.

Examples of Asynchronous Transmission

- Emails
- Forums
- Letters
- Radios
- Televisions

Synchronous vs Asynchronous Transmission

Point of Comparison	Synchronous Transmission	Asynchronous Transmission
Definition	Transmits data in the form of chunks or frames	Transmits 1 byte or character at a time
Speed of Transmission	Quick	Slow
Cost	Expensive	Cost-effective
Time Interval	Constant	Random
With gap between the data?	Yes	None
Examples	Chat Rooms, Telephonic Conversations, Video Conferencing	Email, Forums, Letters

Parity Check

- A **parity check** is the process that ensures accurate data transmission between nodes during communication.
- A **parity bit** is appended to the original data bits to create an even or odd bit number; the number of bits with value one.
- The source then transmits this data via a link, and bits are checked and verified at the destination. Data is considered accurate if the number of bits (even or odd) matches the number transmitted from the source.
- The parity check method is used for error detection.

- A **parity bit**, or **check bit**, is a bit added to a string of binary code to ensure that the total number of 1-bits in the string is even or odd. Parity bits are used as the simplest form of error detecting code.
- There are two variants of parity bits: **even parity bit** and **odd parity bit**.

7 bits of data	(count of 1-bits)	8 bits including parity	
		even	odd
0000000	0	**0**0000000	**1**0000000
1010001	3	**1**1010001	**0**1010001
1101001	4	**0**1101001	**1**1101001
1111111	7	**1**1111111	**0**1111111

- In the case of **even parity**, for a given set of bits, the occurrences of bits whose value is 1 is counted. If that count is odd, the parity bit value is set to 1, making the total count of occurrences of 1s in the whole set (including the parity bit) an even number. If the count of 1s in a given set of bits is already even, the parity bit's value is 0.
- In the case of **odd parity**, the coding is reversed. For a given set of bits, if the count of bits with a value of 1 is even, the parity bit value is set to 1 making the total count of 1s in the whole set (including the parity bit) an odd number. If the count of bits with a value of 1 is odd, the count is already odd so the parity bit's value is 0.

BAUD

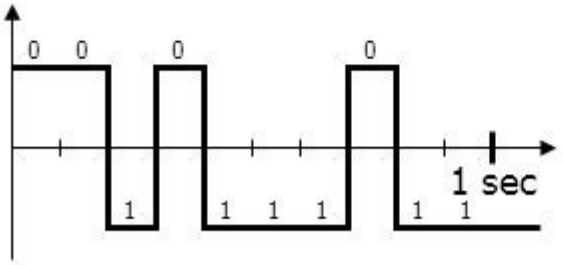
- Defined as number of signal changes per second, that is the rate at which the serial data is being transferred (bits per second).

- Common baud rates are 300, 600, 1200, 2400, 4800, 9600 & 19200.

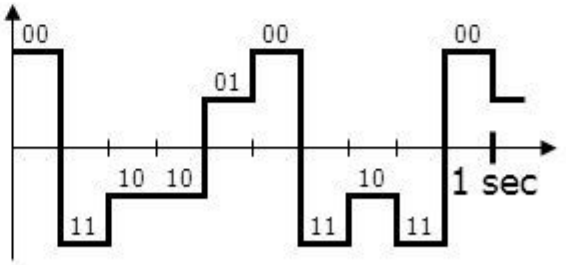
- Bit time is the delay between two successive bits, determined as 1/baud.

Baud and Bit Rate

- **Baud** → How many times a signal changes per second
- **Bit rate** → How many bits can be sent per time unit (usually per second)
- Bit rate is controlled by baud and number of signal levels



Baud = 10
Bit rate = 10 bps



Baud = 10
Bit rate = 20 bps

RS 232 Standard

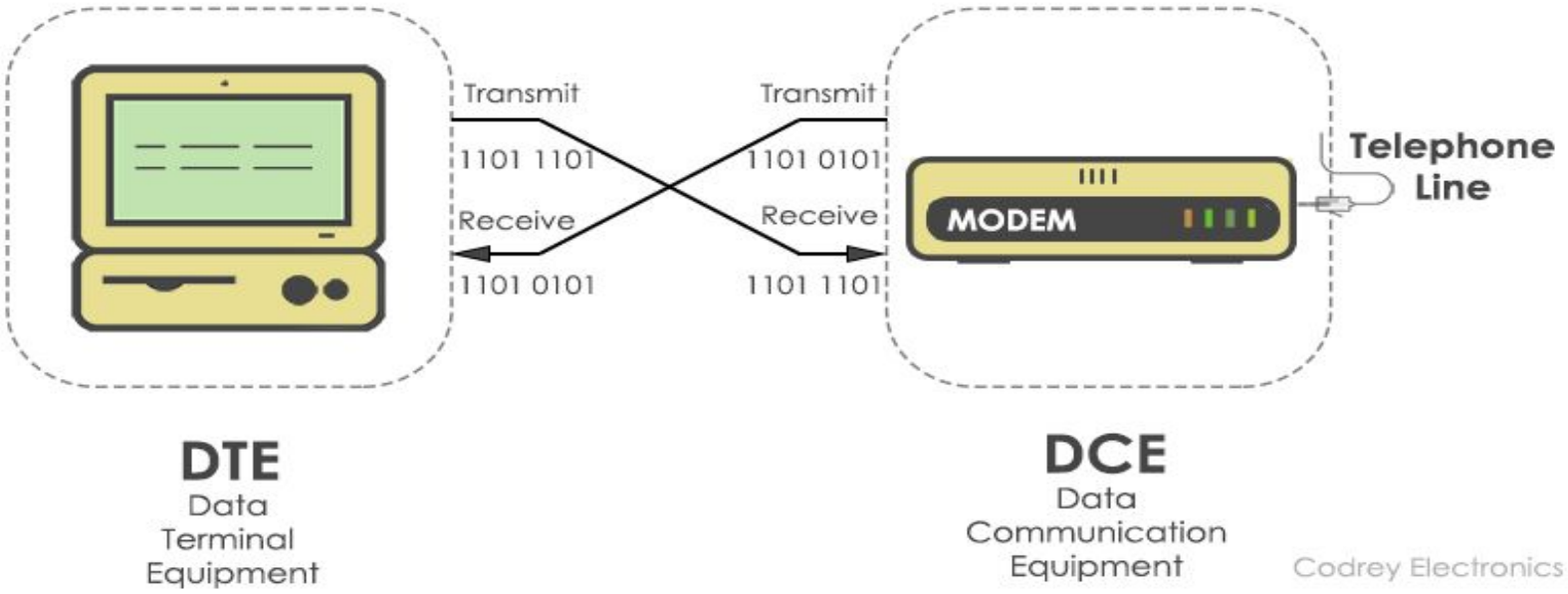
- **RS-232 (Recommended Standard 232).**
- The RS-232C standard is an ***asynchronous serial*** communication method.
- Serial means that the information is sent 1-bit at a time.
- Asynchronous means that no clock signal is sent with the data. Each side uses its own clock and a start and stop bit. Synchronous communication means that a clock signal is sent in addition to a data signal (or interwoven with it)

RS 232 Standard (Cont.)

- In RS-232, user data is sent as a timeseries of bits.
- Both synchronous and asynchronous transmissions are supported by the standard.
- RS-232 devices may be classified as Data Terminal Equipment (DTE) or Data Communication Equipment (DCE), this defines that each device which wires will be sending and receiving each signal.
- DTE refers to terminals and computers that sends and receives data.
- DCE refers to communication equipment, such as modems, that are responsible for data transferring.

- The DTE (computer) transmits the information serially to the other end equipment DCE (modem). In this case, DTE sends binary data “11011101” to DCE and DCE sends binary data “11010101” to the DTE device.
- RS232 describes the common voltage levels, electrical standards, operation mode and number of bits to be transferred from DTE to DCE. This standard is used for transmission of information exchange over the telephone lines.

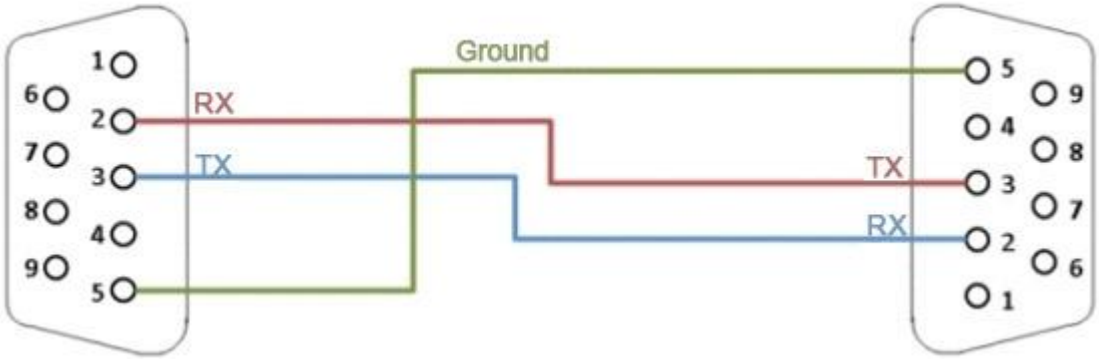
Communication between DTE and DCE



Null Modem

- A null modem is a specially designed cable that allows a “head-to-head” connection between two nearby serial devices (computers) through their communication ports (RS-232). Having a length limitation of up to 30 feet, it is most commonly used to connect PCs within the same room for gaming and other purposes such as sending and receiving files.
- A null modem is also known as a crossover cable.

- **Null modem** is a communication method to directly connect two DTEs (computer, terminal, printer, etc.) using an RS-232 serial cable.
- Null-modem connections are made possible through the use of a null mode cable. This is the simplest solution to connecting the two computers.
- The null modem cable is comprised of three lines. One wire serves as the signal ground with the other two lines fostering the transmitting and receiving of your data. Based on the software used in this connection, some kind of authenticating handshake may be necessary.



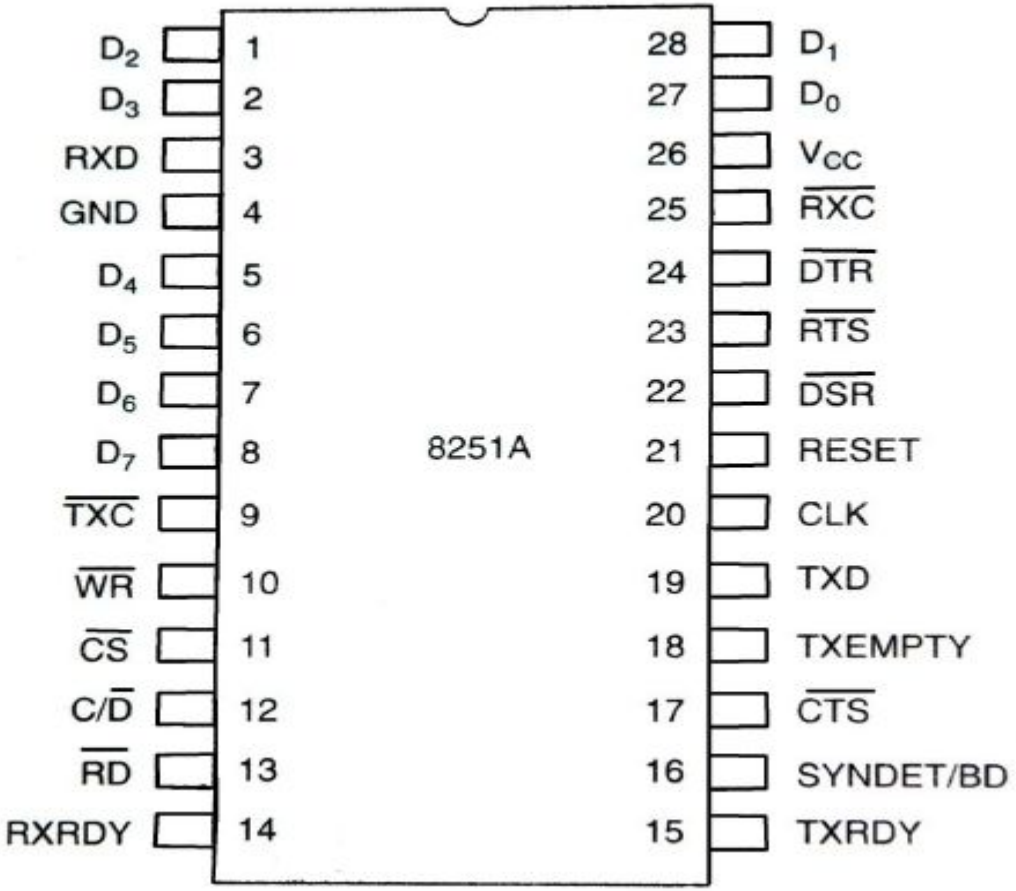
Limitations of the Standard

- The limited transmission speed, relatively large voltage swing, and large standard connectors motivated development of the universal serial bus(USB) which has displaced RS-232.
- Multi-drop connection among more than two devices is not defined.
- Also multi-drop have limitations in speed and compatibility.

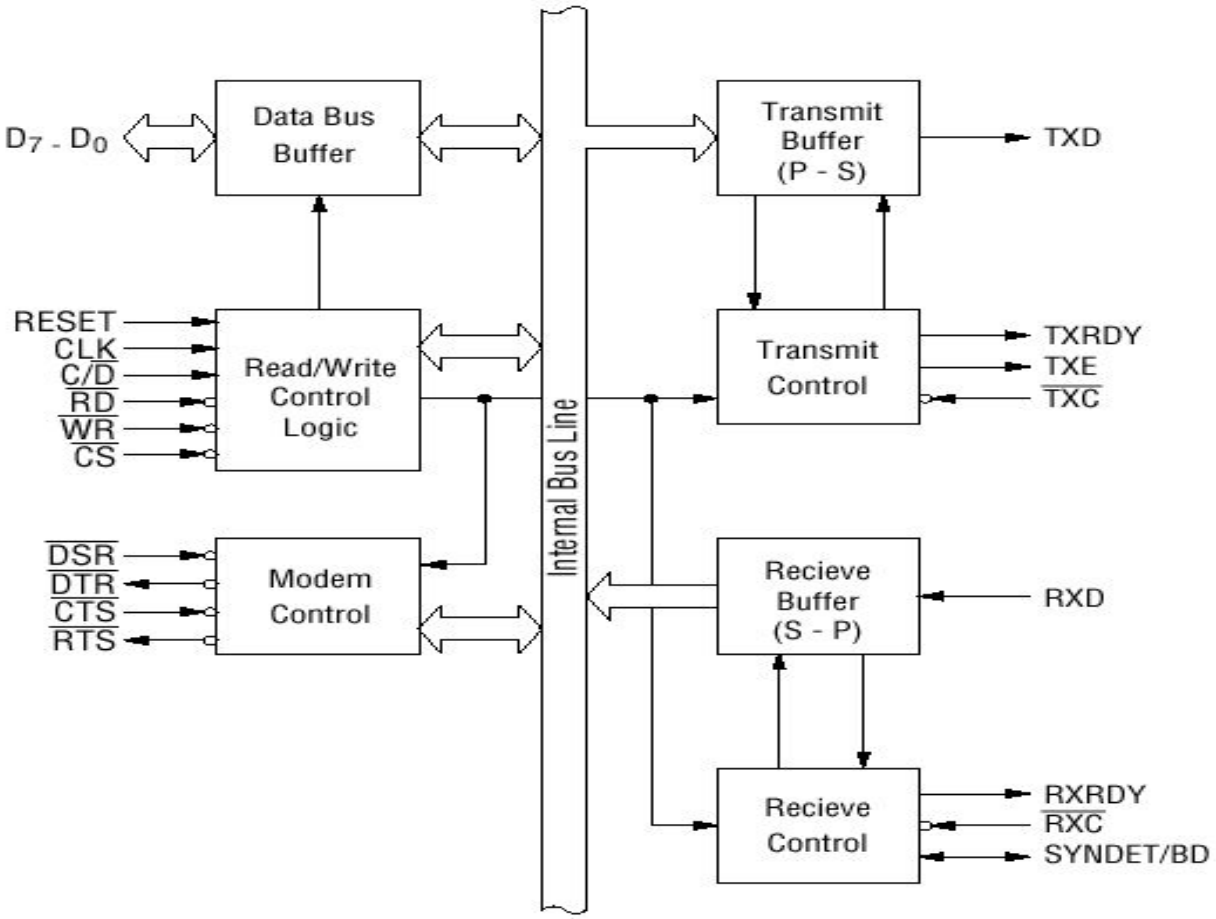
8251 Programmable Communication Interface

- 8251 is a programmable device to perform either synchronous or asynchronous serial communication , called as universal synchronous asynchronous receiver transmitter - USART.

Pin diagram


D2 1
D3 2
RXD 3
GND 4
D4 5
D5 6
D6 7
D7 8
TXC 9
WR 10
CS 11
C/D 12
RD 13
RXRDY 14
8251A
28 D1
27 D0
26 VCC
25 RXC
24 DTR
23 RTS
22 DSR
21 RESET
20 CLK
19 TXD
18 TXEMPTY
17 CTS
16 SYNDET/BD
15 TXRDY

8251: Block diagram



C/D– : control or data write / read
DSR– : data set ready
DTR– : data terminal ready
CTS– : clear to send data
RTS– : request to send data
TxD : transmitter data
TxRDY : transmitter ready
TxE : transmitter empty
TxC– : transmitter clock
RxD : receiver data
RxRDY : receiver ready
RxC– : receiver clock
SYNDET / BD : sync detect / break detect

Interfacing RS 232 Terminal using the 8251A