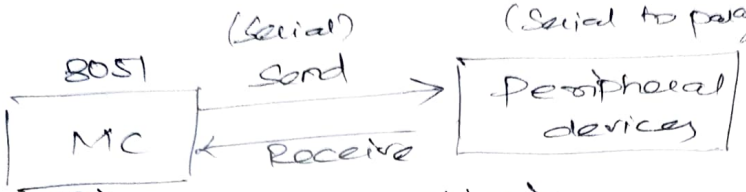
Serial communication

8051 can able to send or receive the data from the outside world.

The transmission of data (receiving/sending) from MC to the I/O devices → communication → transmission of data



<communication>

(Parallel to Serial)

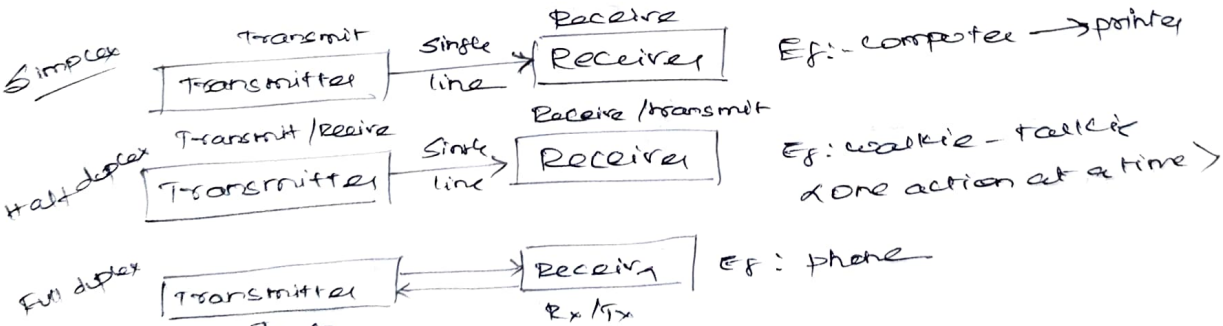
Serial
<one by one>
⇓
<single line>

Parallel
<all at same time>
⇓
as many of data

for long distance communication, Serial comm is best bcoz of simplicity (single line)

Types of serial communication links

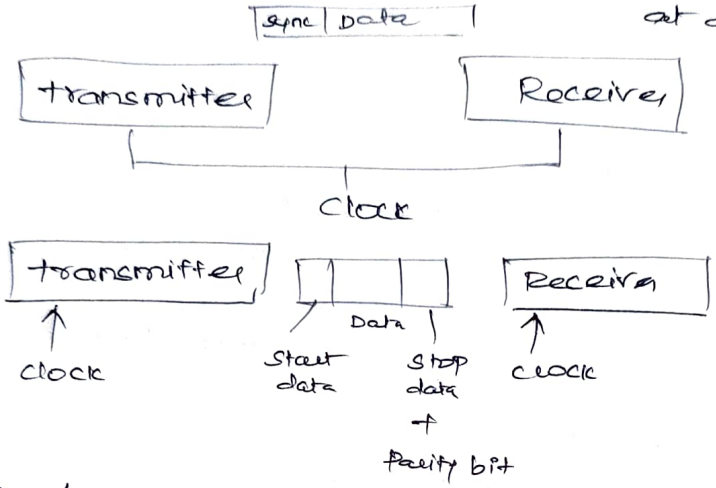
1. Simplex
2. Half duplex
3. Full duplex



Types of Serial communication

1. Synchronous - Tx & Rx are syn (same clock)
2. Asynchronous - Tx & Rx are not in sync (both have separate clocks)

Synchronous	Asynchronous
- transmitted & receiver are synchronized	- not synchronized
- share a common clock	- different
- first sync character is sent & data	- start bit, data, stop bit
- block of data	- single bit is transferred at a time



Baud rate / transfer rate.

⇓

Bits transmitted per second.

→ Asynchronous → start & stop bit / different clock signal

→ Synchronous

Ex: 9600 bits/data per second

$$1 bit = \frac{1 second}{9600} = 0.104 ms$$

→ x ←

8051 Serial communication.

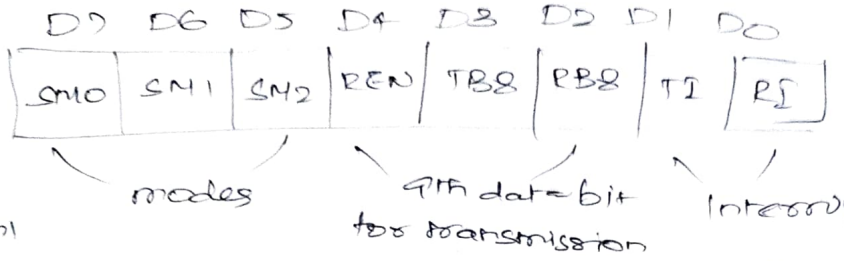
- supports full duplex serial port.
- 3 SFR — SBUF (Serial buffer)
  - SCON registers (Serial control)
  - PCON (Power control)

SBUF:

- transmission of data, it can transmit as well as receive data, so it need some space to save those data, buffer.
- 8 bit register
- TXD line — transmission
- RXD pin — Receiving

SCON:

- 8 bit register
- mode selection, serial port interrupt bit (TI & RI), 9th data bit for transmission & reception



SM0 SM1

0 0 – mode 0 – 8 bit shift register mode
0 1 – mode 1 – 8 bit UART
1 0 – mode 2 – 9bit UART
1 1 – mode 3 – 9 bit UART

SM2 → multiprocessor communication bit

mode 2, SM2 = 1, then it enables
mode 3, SM2 = 1, ↑

REN → enable serial reception

TB8 – 9th bit that is transmitted in mode 2 & 3
RB8 – " " " received " " "

9th bit → start/stop bit

TI – Transmit Interrupt flag
RI – Receive Interrupt flag

TI, RI = 0 ↑ Reset

PCON:

- 8 bit register
- control the power of 8051 MC
- 1 bit in PCON is used for serial communication

D7	D6	D5	D4	D3	D2	D1	D0
SMOD	–	–	–	GF1	GF0	PD	IDL

SMOD → serial mode
↳ (serial rate modify bit)
↳ used to select baud rate selection

If SMOD=1 - double baud rate using timer 1
SMOD=0 - used timer-1 baud rate

8c modes in 8051

mode 0 → 8 bit shift register mode

clock signal
data signal

data is transmitted & received through RXD pin
TXD is used for clock signal.

Baud rate for transmission = $\frac{1}{12}$ of clock freq

mode 1 → 8 bit UART

SBUF → 10 bit full duplex transceiver.

ten bits — 1 start bit
— 8 data bit
— 1 stop bit

TI/RI will set once transmission/reception is done

Baud rate (variable) = $[2^{SMOD}/32] \times$ Timer-1 overflow freq

$= [2^{SMOD}/32] \times \frac{[\text{Oscill freq}]}{12} \times (256 - (TH1))$

↓ timer 1 overflow freq

mode 2 → 11 bits UART

11 bit — 1 start bit
— 8 data bit
— 2 stop bit — 1 programmable 9th data bit → SCON (TB8, RB8)
— 1 stop bit

baud rate = $[2^{SMOD}/64] \times$ Oscillator clock freq

mode 3 → 11 bits

11 bit ⟵

baud rate is calculated as mode 1.