

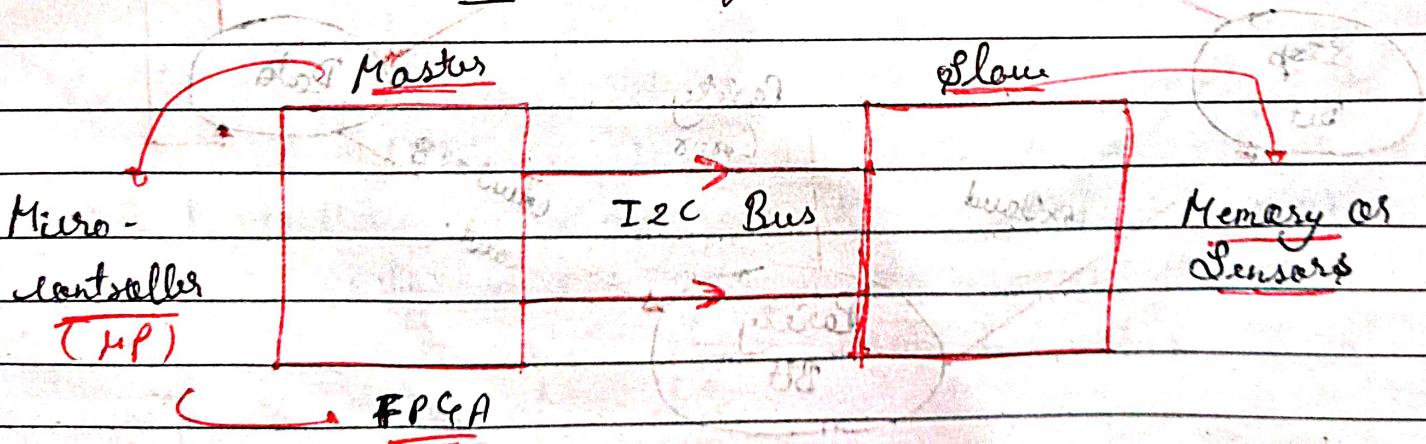
I₂C Protocol

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Inter - Integrated Circuit (I₂C)

- I₂C (Inter connected IC)
- Developed by PHILIPS Semiconductor, (Important bus used in consumer electronics).
- (low cost and simple interface, easy to use, used for simple interconnect).
- Used to send data between microcontrollers & peripheral like EEPROM, RTC, SENSORS, SD CARD, LCD, RFID CARD MODULE, consumer electronics.
- It's a serial communication protocol.
- Max speed 5 Mbps.

Block diagram



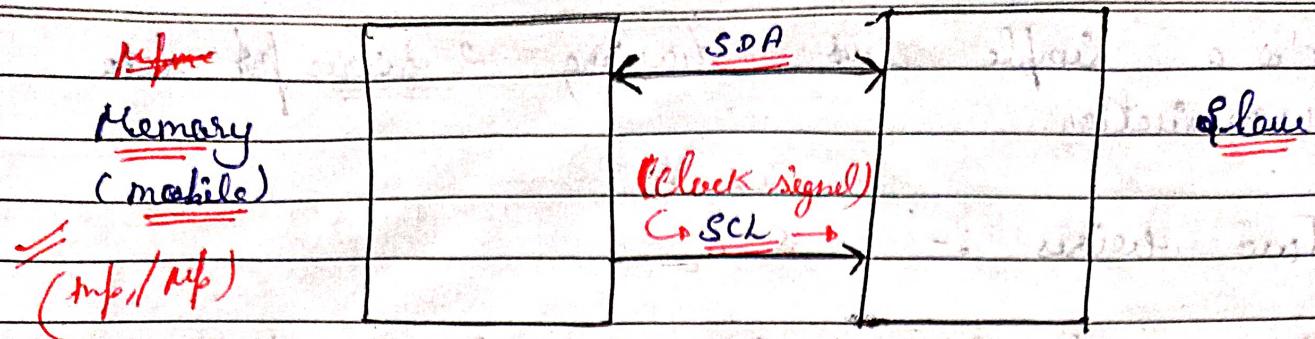
- This is also master-slave communication protocol.
- With the help of I₂C bus, they communicate (master & slave communicate each other).

- It's a simple bus having 2 wires for data communication.
- Two wires :-
 - 1. SCL = clock signal line (Serial clock used for all data comm.)
 - 2. SDA = data signal line (Serial data).
- It is half duplex (either master or slave can send data at same time through SDA line).
- Either read or write operation possible via bus at a single time.
- Transmitter :- A device that sends data to bus.
It can either put data on the bus of its own or in response to a request from another device.
- Receiver :- A device that receives data from bus.
- Master :- The one which initializes a transfer, generates clock signal, terminates the transfer.

Master

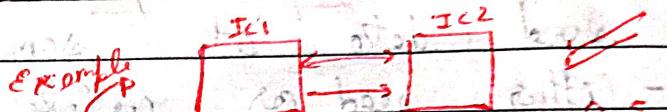
camera module

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→ master can put data on SDA line or slave can put data.

→ Only master can generate the clock.



- It's normally used for short distance communication means communication within same circuit board.

- It supports multi-master means two many devices can access the I2C bus at a given time with arbitration process (it decides which device acts as master in multi master system). Slave takes instruction from master.

- Adding new slave is easy, Add. slave device without adding a new slave select line unlike SPI.
It is the advantage :-

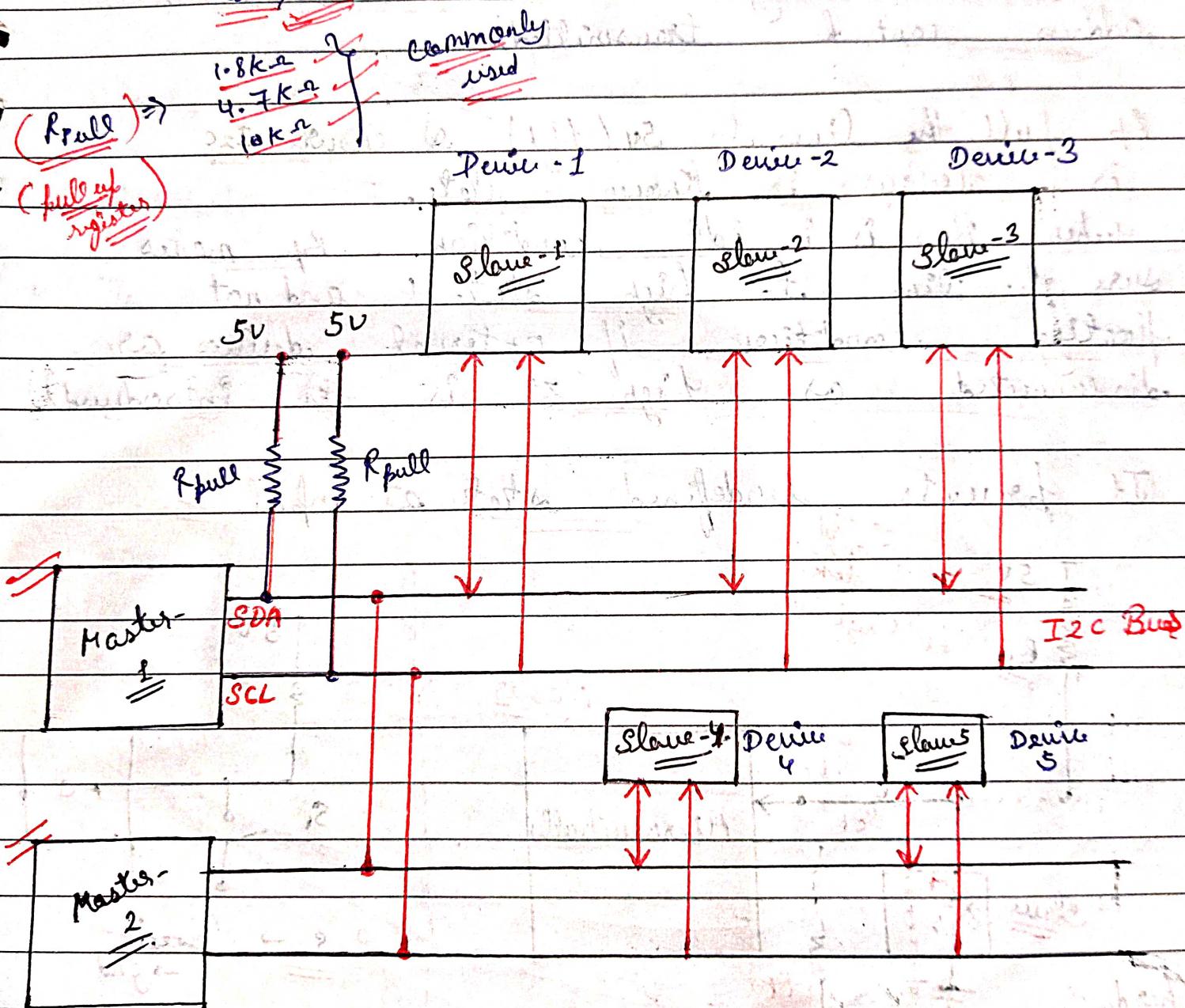
(5Mbps)

→ net consuming extra space

→ advantage over SPI.

- I₂C is slower than SPI (10 Mbps)
- I₂C uses a pull up resistor.
- It's preferable where large amounts of high speed data is not transferred.

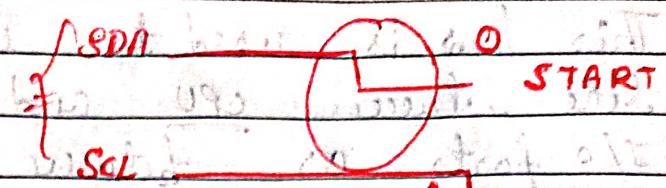
- This bus is used to connect component of system like between CPU and Memory, Memory and I/O ports or between peripheral devices.
- It has extra start or stop bit (SPI doesn't have).



~~(idle condition)~~ :- No start using

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* If we don't use R_p



1. SDA of SCL lines will always be (Low) (0V) \rightarrow (Default)

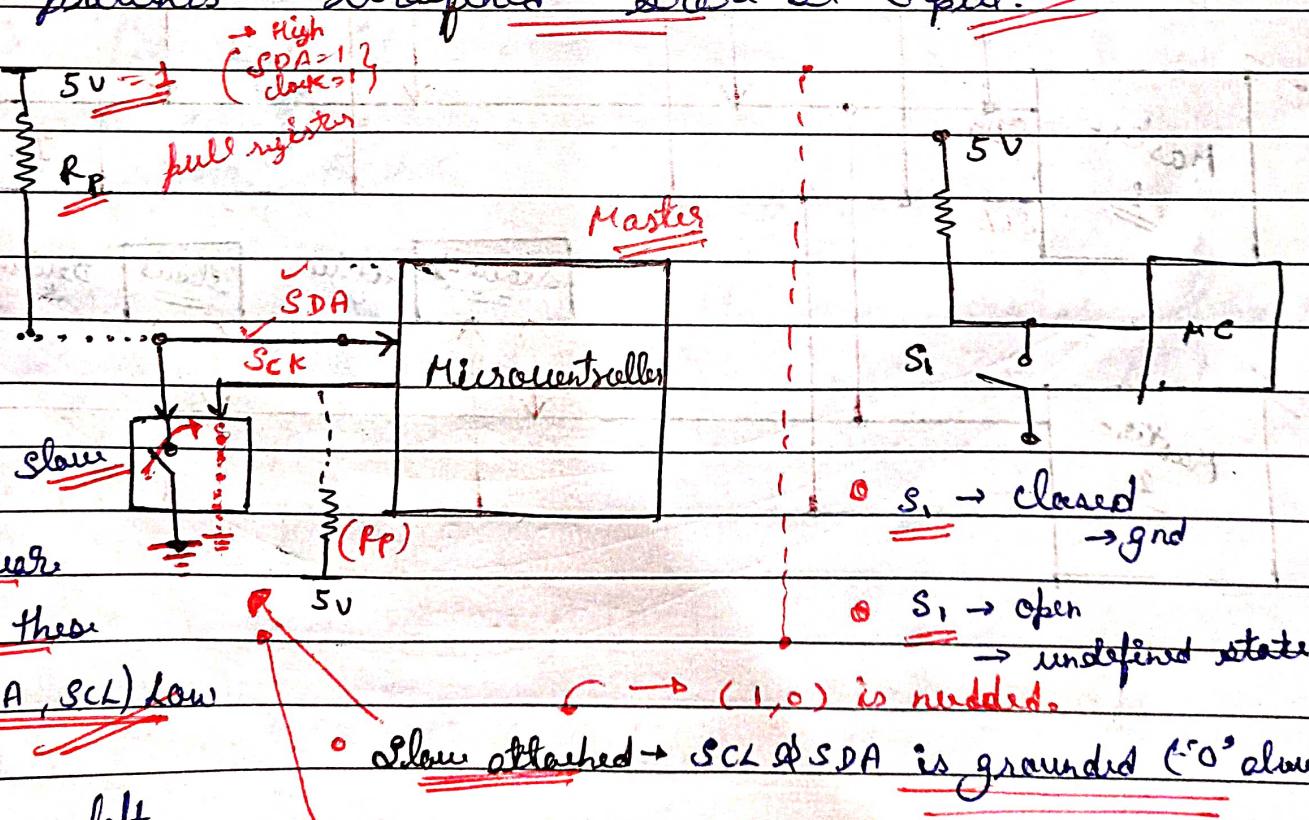
I_c bus won't work

(master can't generate I_c start condition address can't be transmitted).

(*) R_p pull the lines to 5V (high) & ensure I_c is always in known state.

* When Bus is in idle condition, R_p makes sure the line is high state (and not floating condition if external devices are disconnected or high 'z' is introduced)

- It prevents undefined state at input.



* They are left floating when not zero.

* Slave attached \rightarrow Floating value or removed undefined value.

Important points

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1. The devices on I₂C bus can be either master or slave.
 2. Master is the device that drives or generates clock signal. Only master can initiate the transfer over I₂C bus and terminates the communication.
 3. Slave is the device which responds to master and can not initiate a transfer and acts according to master's instruction.
 4. In a multiple master system (but multiple masters can also communicate with multiple slaves) we can have multi master but at a time usually only one master access the slave.
 5. Both master and slave can send data over I₂C bus and the transfer is controlled by master.
- o Controlling and initiate part is done by MASTER.
 - o Responding part is done by SLAVE.