

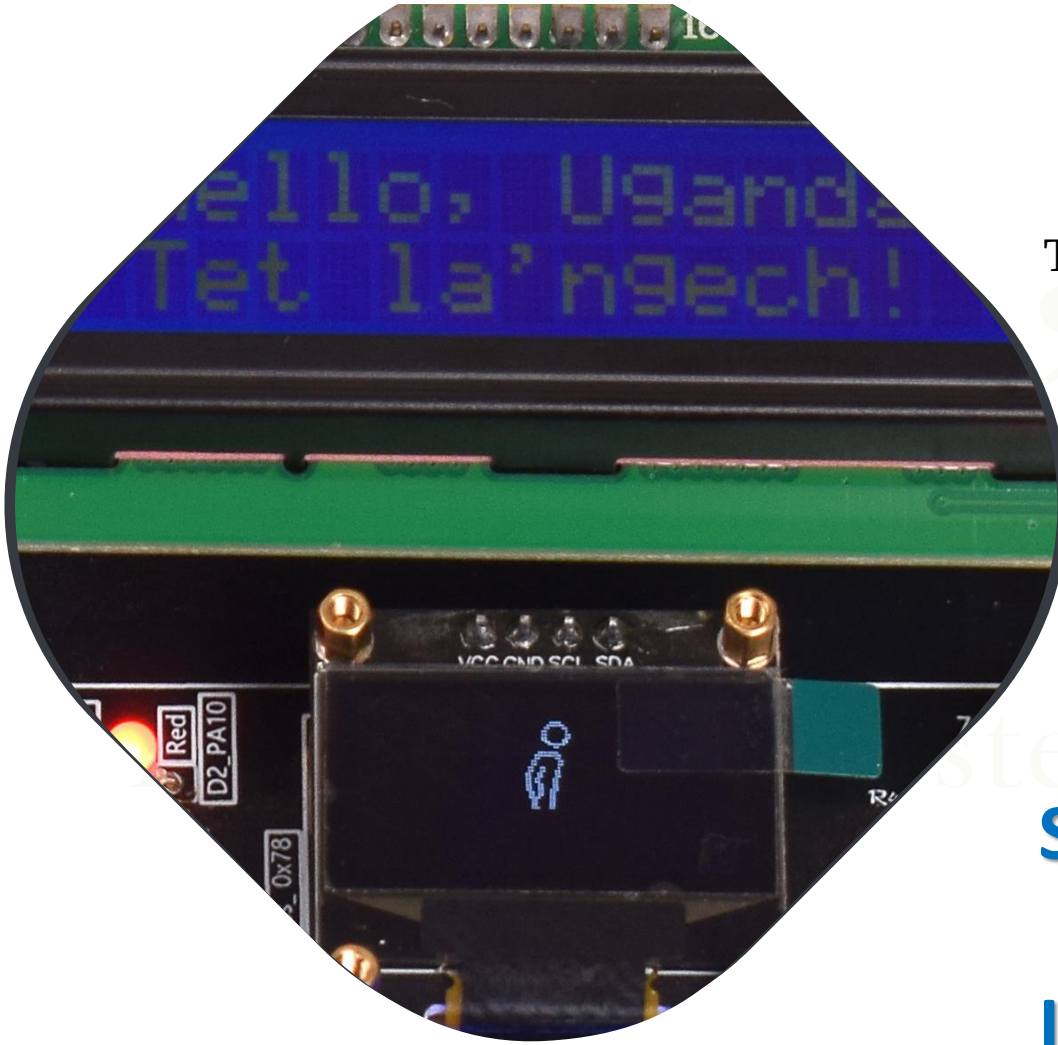
KYAMBOGO



UNIVERSITY

Tet la'ngech

Embedded Systems Technology



TETE 3102 MICROCONTROLLERS AND APPLICATIONS

Lecturer: Dickson Mugerwa (Ph.D.)

Prac session: Mr. Matovu Paul

Department of Electrical and Electronics
Engineering

Embedded Systems

Serial Communication in STM32:

I2C Communication

Inter – integrated communication

“Transforming Lives Through Advanced Embedded Systems Technology”

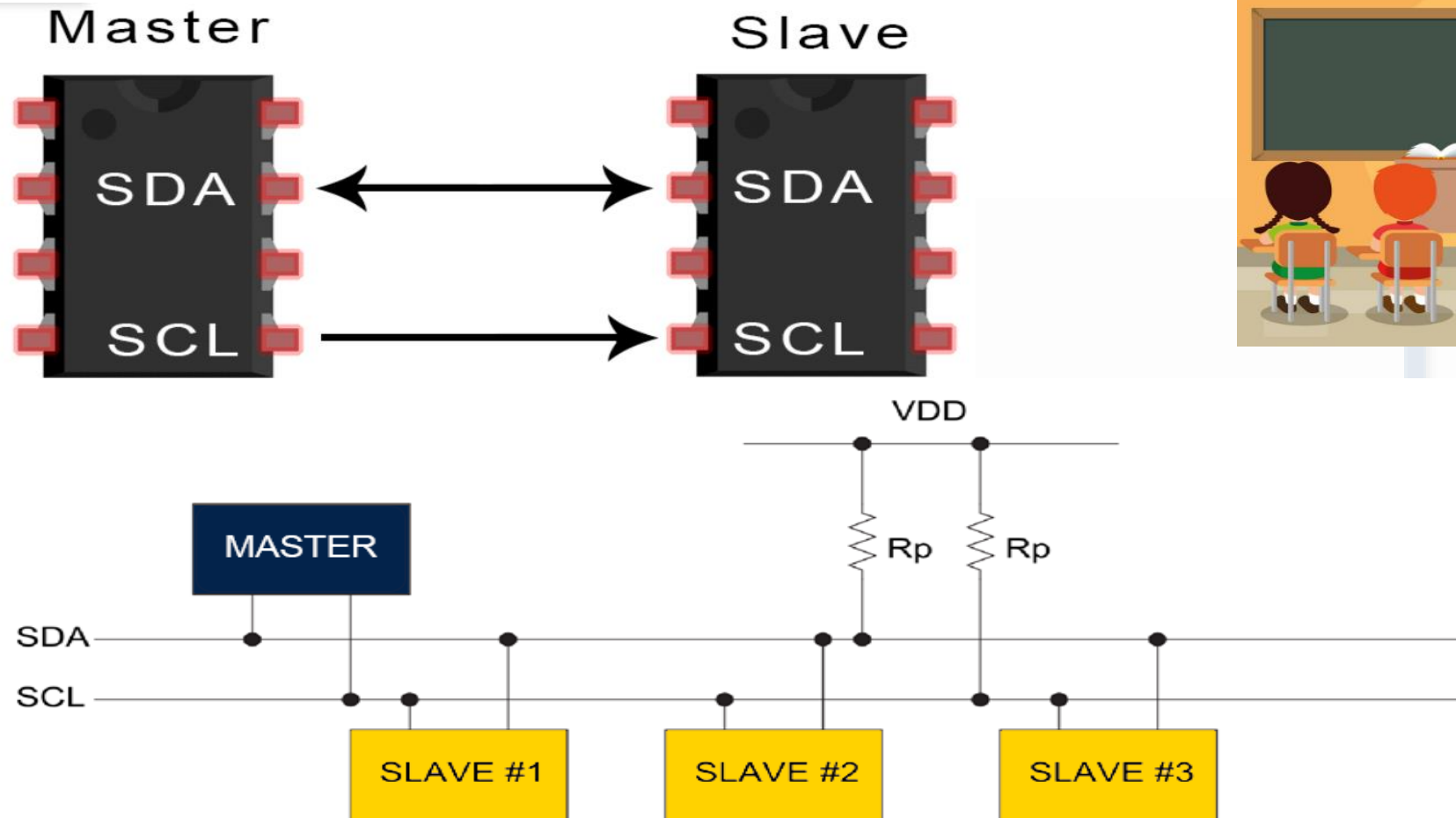


I2C Communication

- ❑ I2C is a two-wire serial communication system used between integrated circuits.
 - ❑ **SDA** (Serial Data) is the line on which master and slave send or receive the information (sequence of bits).
 - ❑ **SCL** (Serial Clock) is the clock-dedicated line for data flow synchronization.
- ❑ I2C can be used as a multi-master, multi-slave, synchronous, bidirectional, half-duplex serial communication bus.



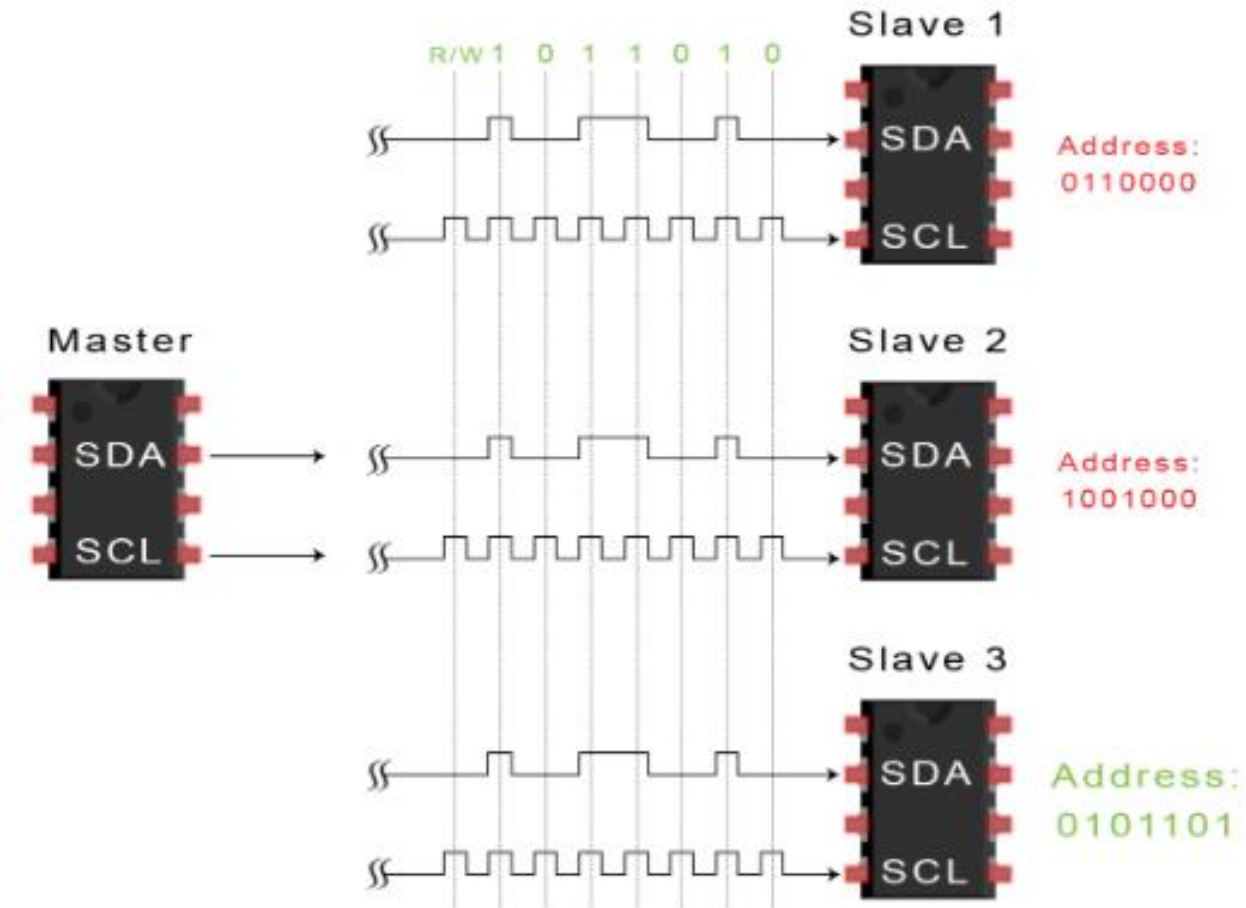
12C Communication protocol



SDA and SCL lines need to be pulled up with resistors. The value of these resistors depends on the bus length (the bus capacitance) and the transmission speed. The common value is 4.7k Ω . I2C lines default to a high state and facilitate proper communication between the master and slave devices on the bus.

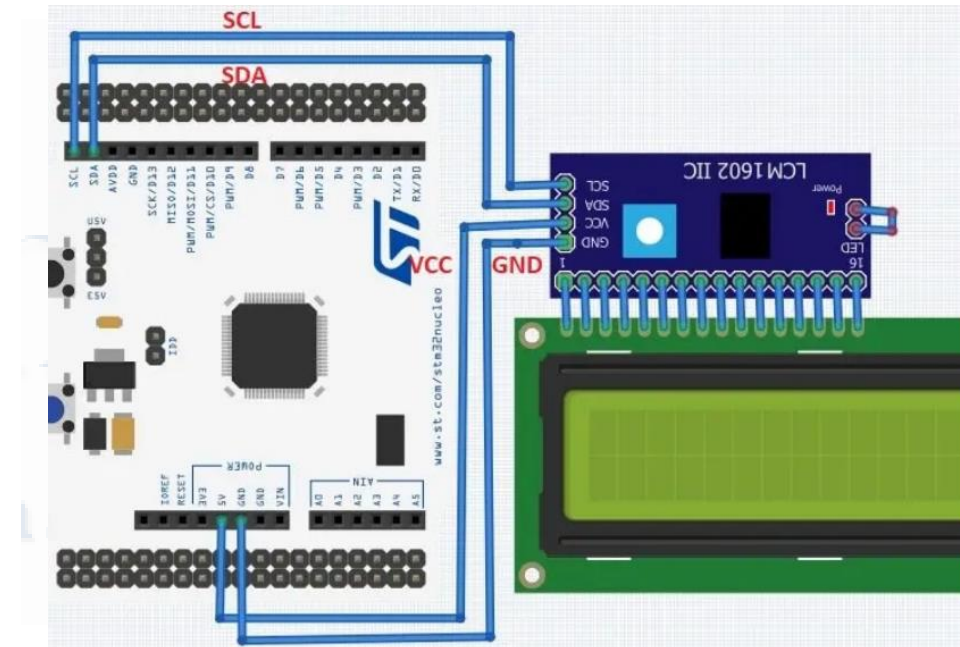


12C Communication protocol



7	6	5	4	3	2	1	0
A6	A5	A4	A3	A2	A1	A0	R W

ensures that only the addressed slave communicates on the bus at any time to avoid any collisions

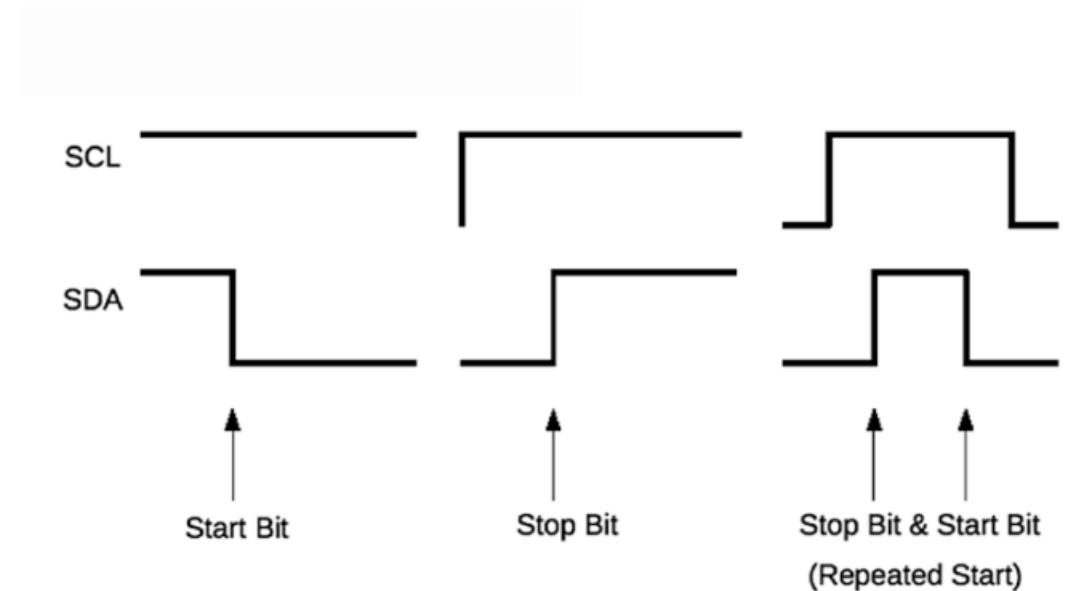
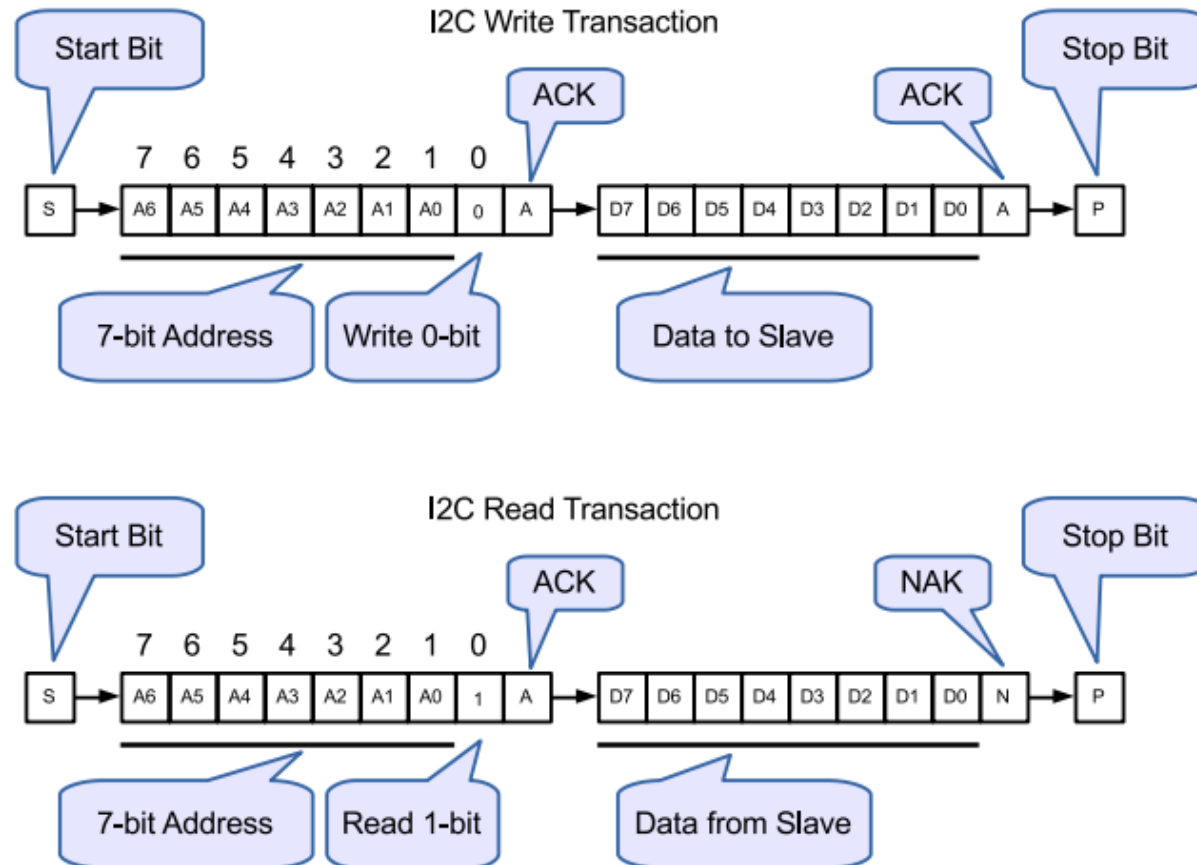


0X27

1-bit indicates that a read operation from the slave device will follow
0-bit indicates that a write operation to the slave device will follow



12C Communication protocol





12C Communication modes

☐ Standard-Mode (Sm) with a bit rate

up to 100 kbit/s

☐ Fast-Mode (Fm) with a bit rate up

to 400 kbit/s

☐ Fast-Mode Plus (Fm+) with a bit

rate up to 1 Mbit/s

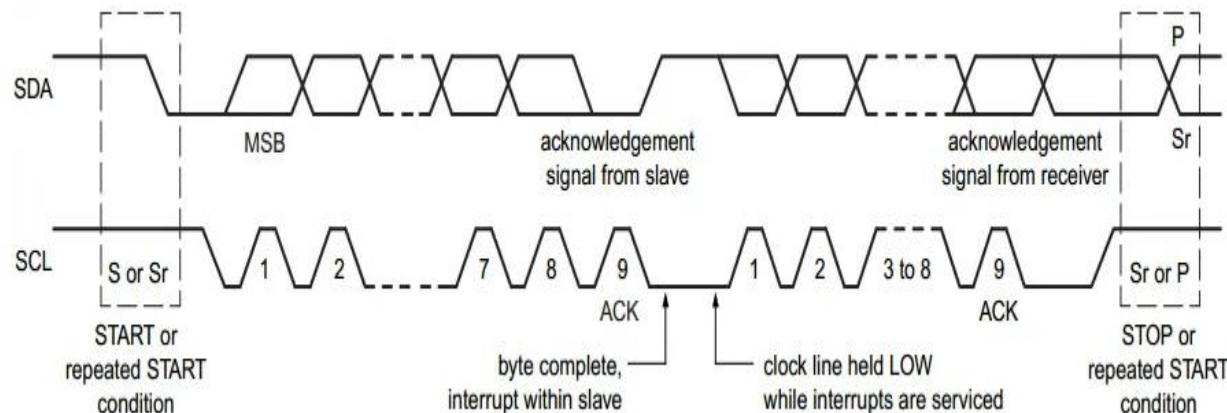
☐ Start Condition (S)

☐ Stop Condition (P)

☐ Repeated Start (Restart) Condition
(Sr)

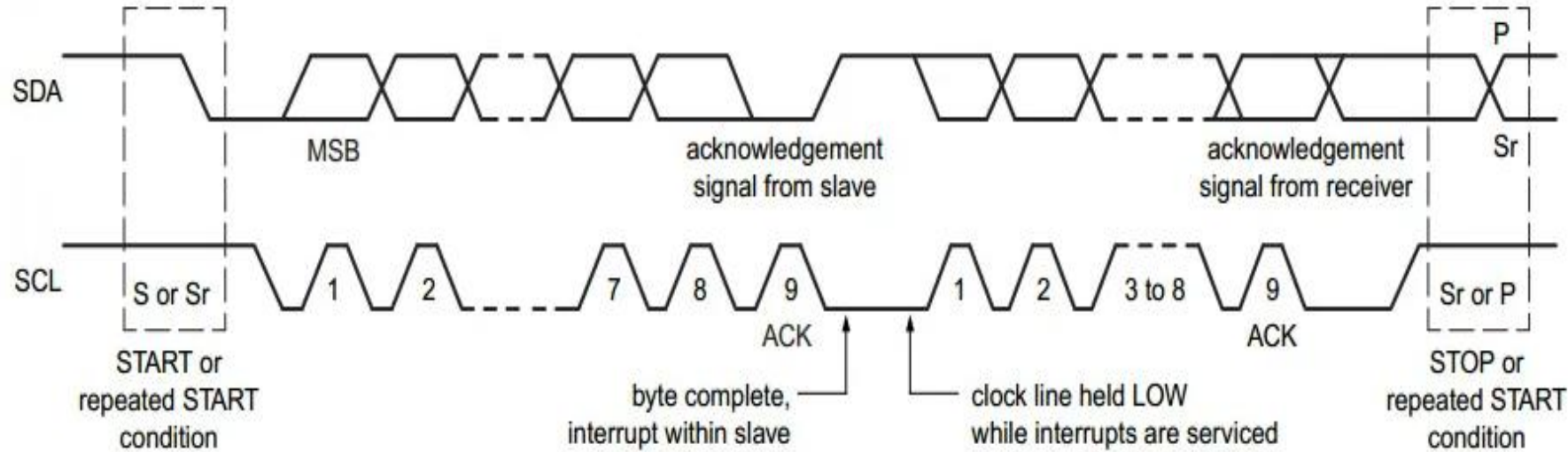
☐ Acknowledge ACK (A)

☐ Not Acknowledge NACK (/A)





12C Communication frame



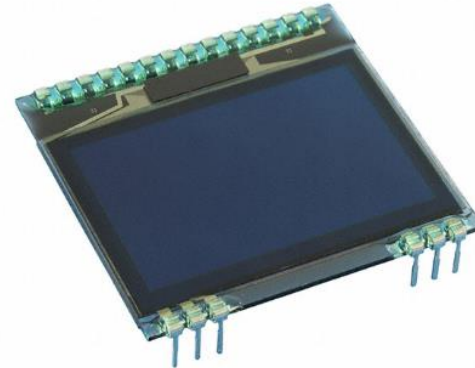
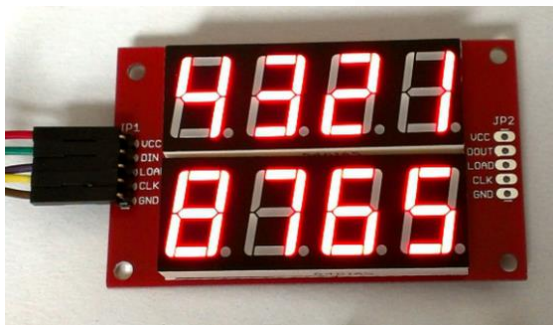
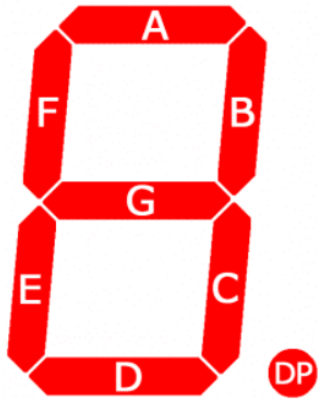
- ☐ Start Condition (S)
- ☐ Stop Condition (P)
- ☐ Repeated Start (Restart) Condition (Sr)
- ☐ Acknowledge ACK (A)
- ☐ Not Acknowledge NACK (/A)

Modes: Polling/blocking mode, interrupt mode and DMA mode



DISPLAY MODULES

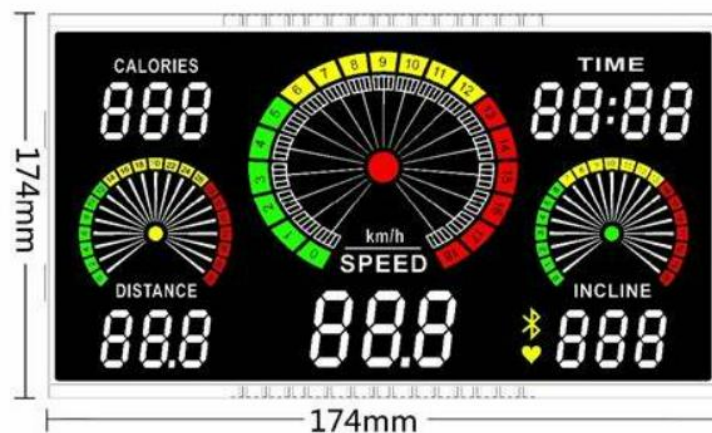
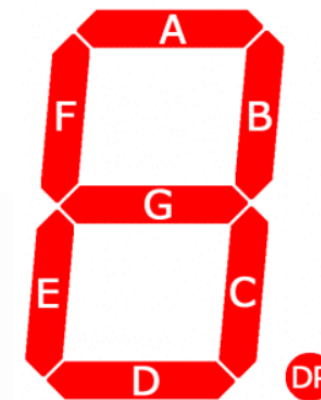
□ Displaying output





SEGMENT DISPLAYS

- ❑ They consist of 7,14,16... LEDs arranged in shape 8
- ❑ Each segment can be controlled individually
- ❑ There are cathode and anode displays





LCD DISPLAYS

- ❑ Used to display alphanumeric / graphical data
- ❑ They can display many characters based on size
- ❑ There are two types, parallel and serial



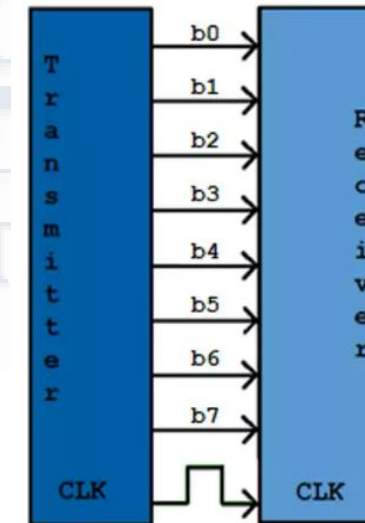
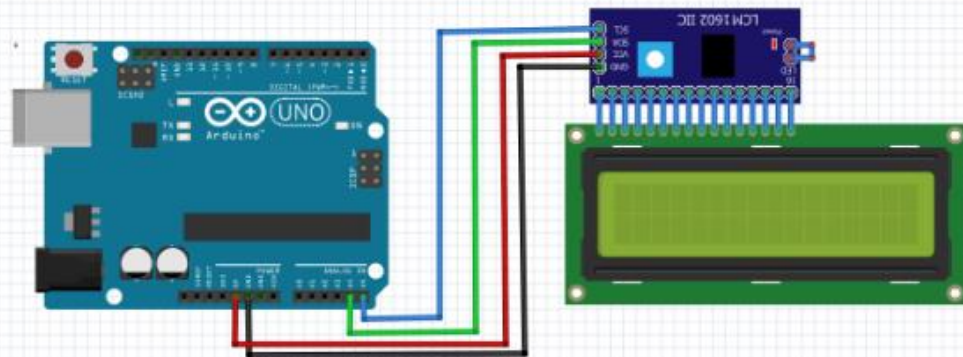
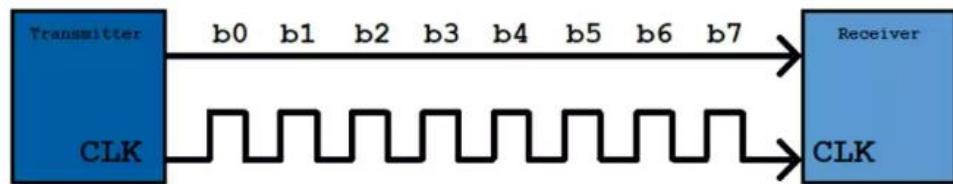


SERIAL vs PARALLEL LCDs

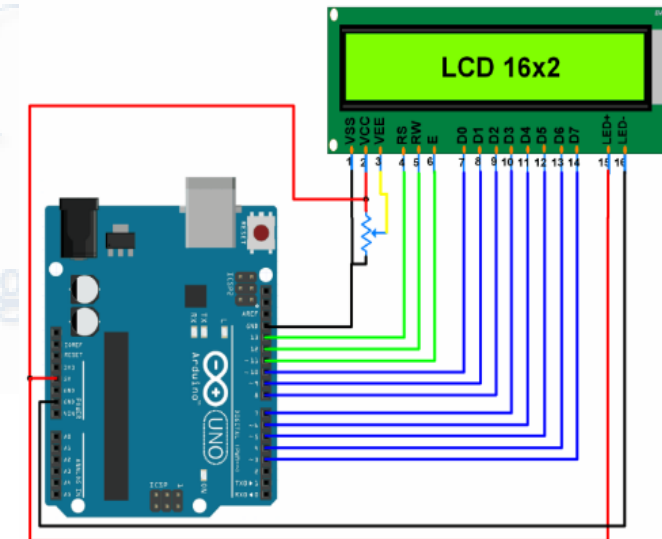
❑ Difference in data transfer mechanism

❑ Parallel, multiple bits

❑ Serial, it is sent one bit at a time over clock pulses ❑ 4, 8, 16 bits etc. at a time



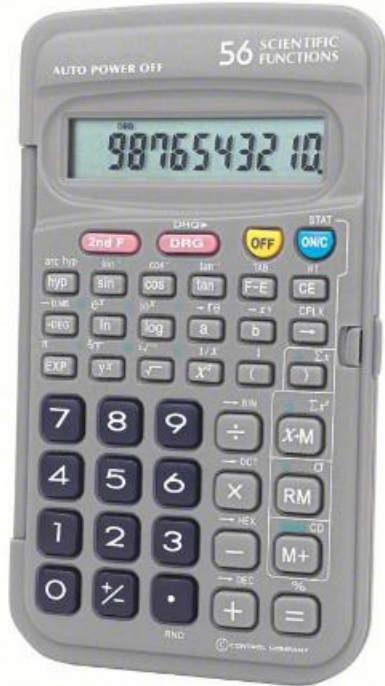
8-bit Parallel Interface





REAL WORLD APPLICATIONS

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12C Communication protocol

