

# Input Devices

Last updated 3/1/21

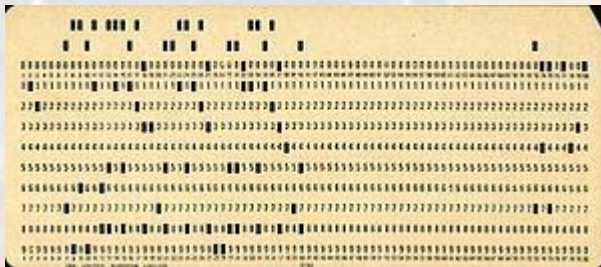
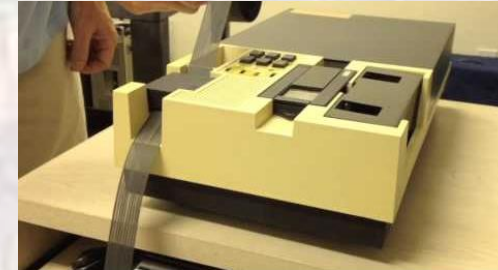
# Input Devices

- When I was your age ...

teletypes

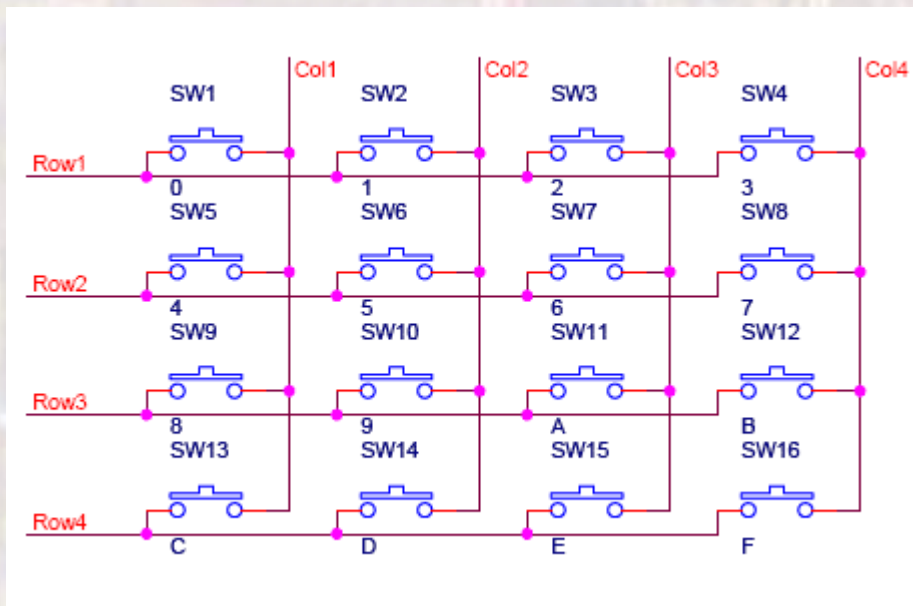
paper punch tapes

computer punch cards



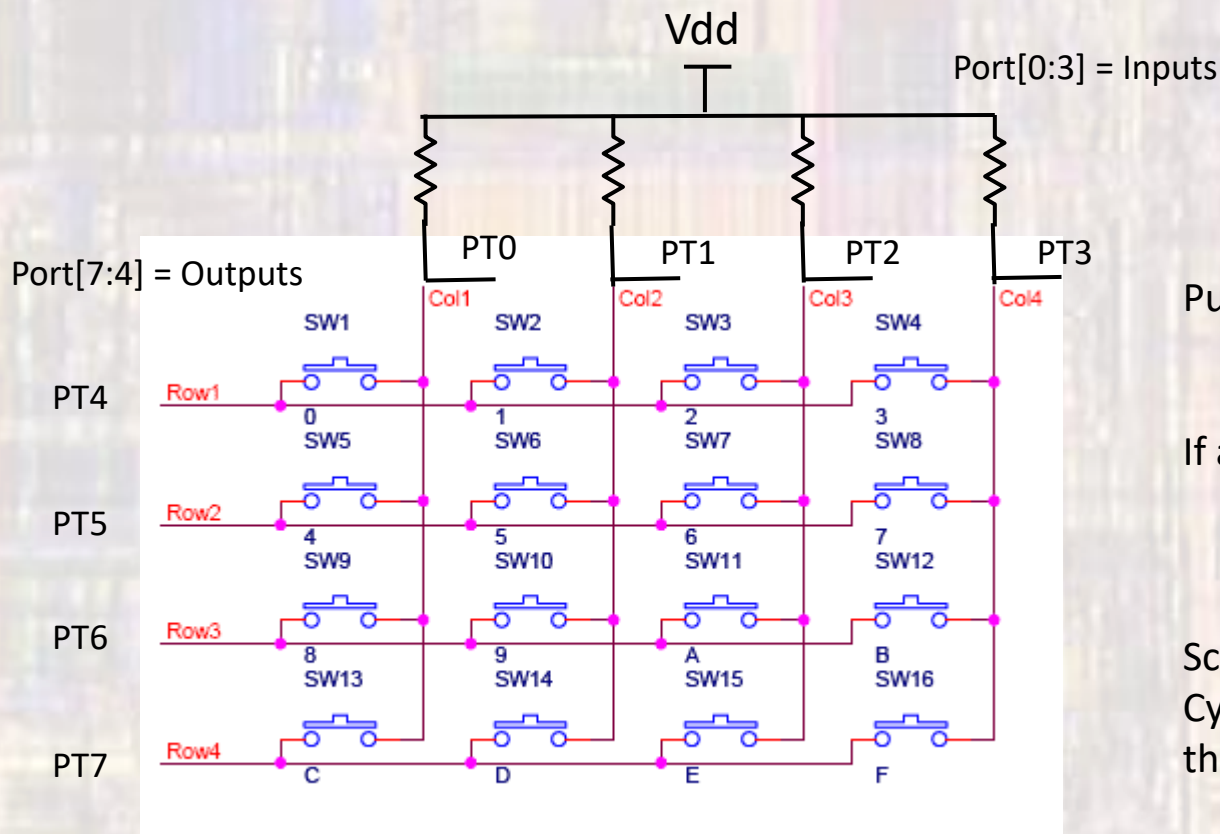
# Input Devices

- Keypad



# Input Devices

- Keypad



Pull one of  
PT4, PT5, PT6, PT7 low

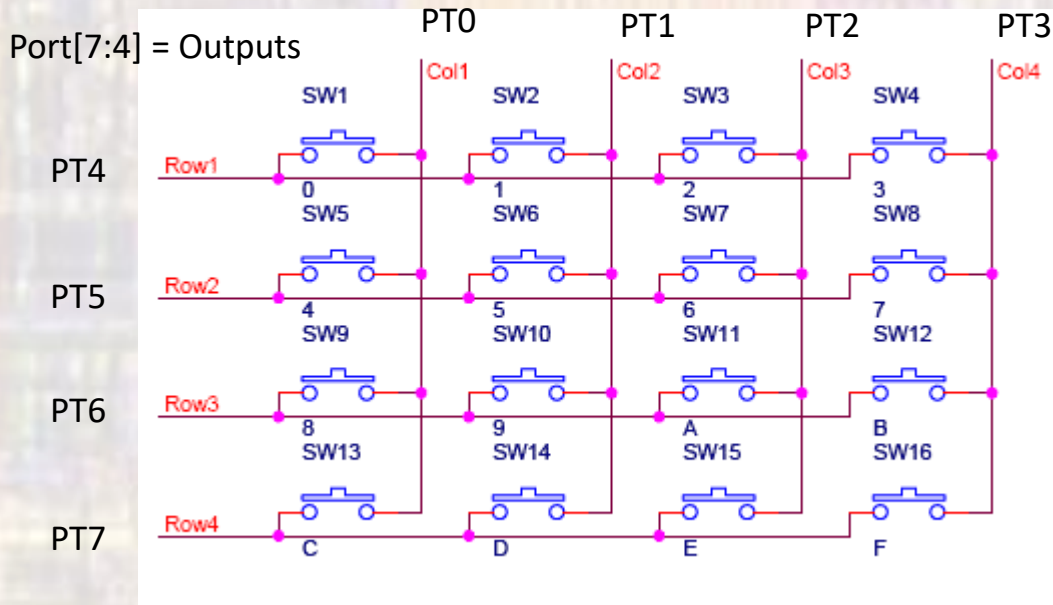
If a key is pressed  
The associated PT[3:0] input  
will be pulled low

Scanning:  
Cycle through the outputs, check  
the inputs

# Input Devices

- Keypad

Port[0:3] = Inputs with pull-up turned on



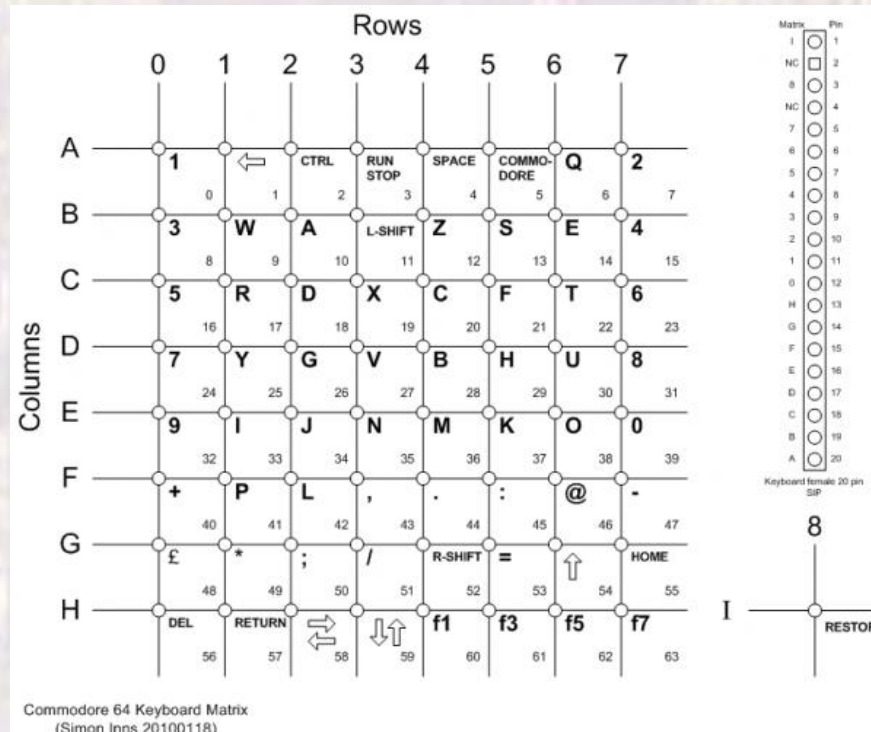
Pull one of  
PT4, PT5, PT6, PT7 low

If a key is pressed  
The associated PT[3:0] input  
will be pulled low

Scanning:  
Cycle through the outputs, check  
the inputs

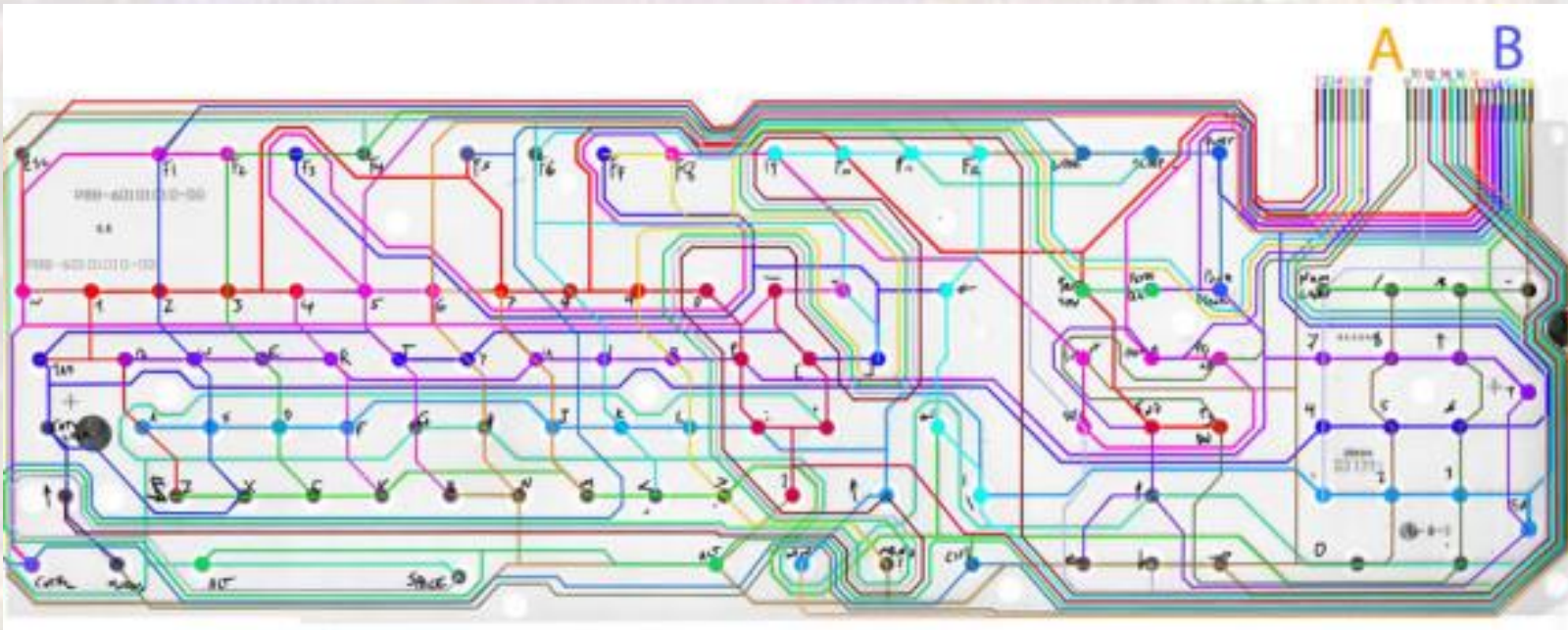
# Input Devices

- Keyboard
- N x M matrix of switches



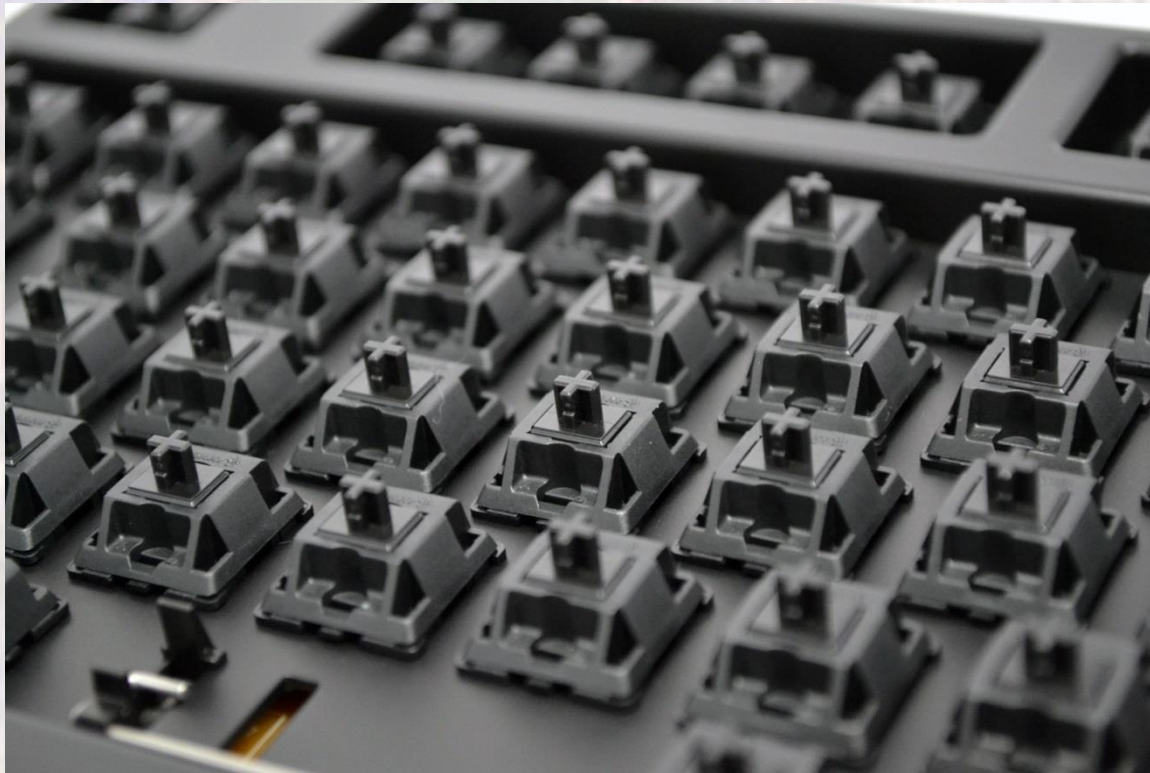
# Input Devices

- Keyboard
- $N \times M$  matrix of switches



# Input Devices

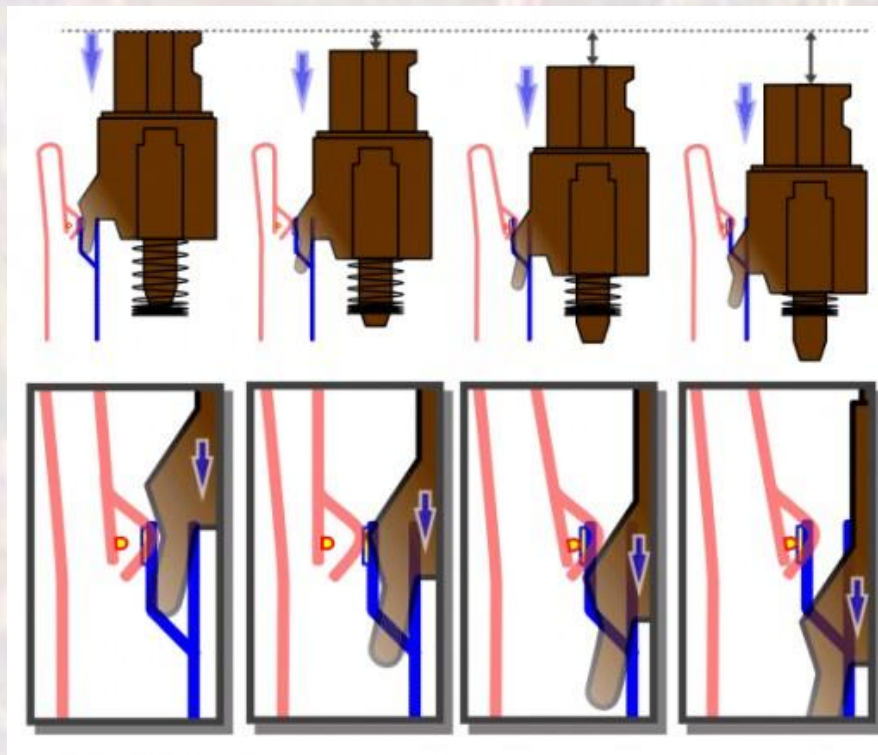
- Keyboard
- Mechanical Switches

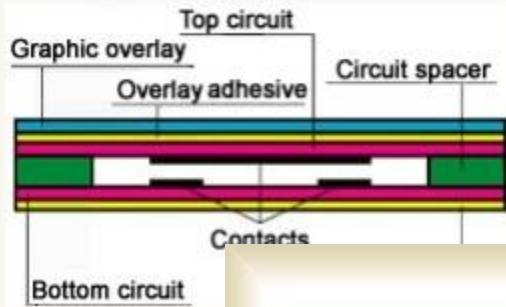




# Input Devices

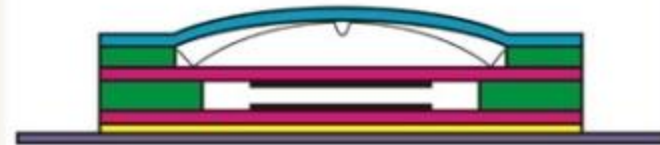
- Keyboard
- Mechanical Switches



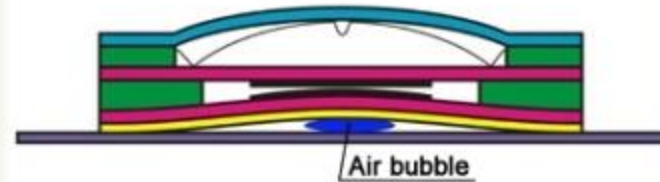


S

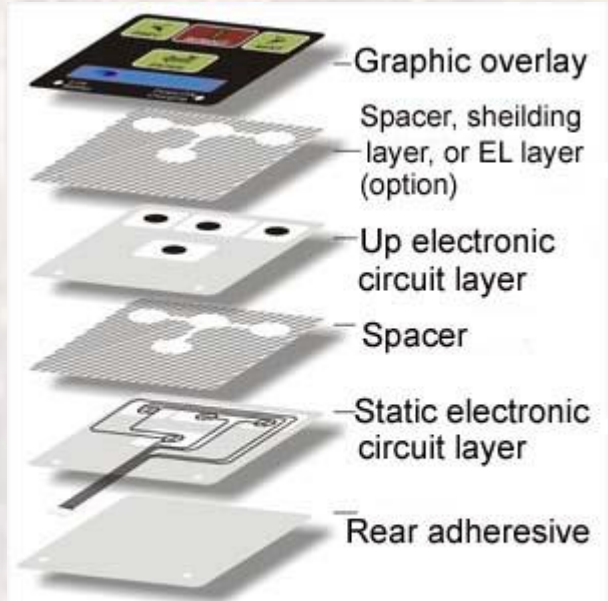
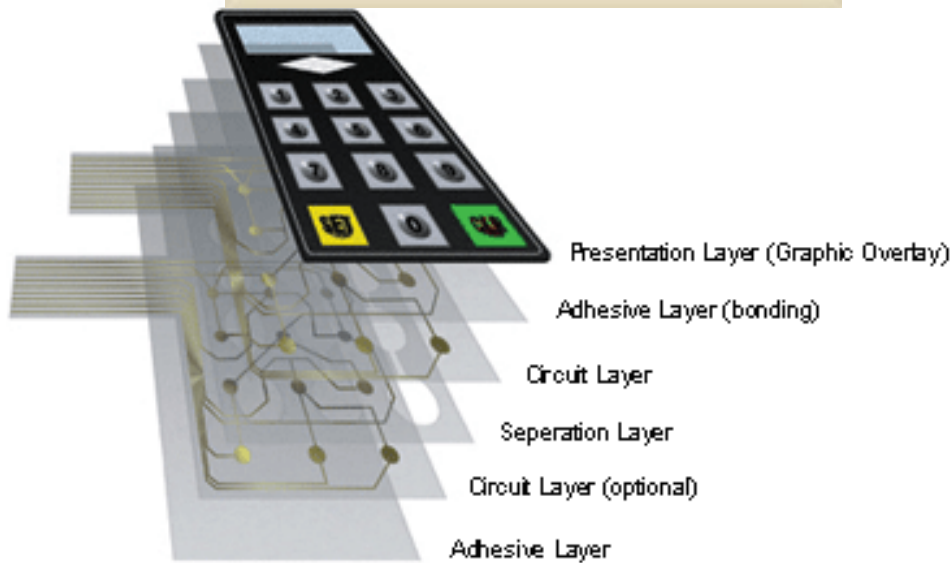
Correctly bonded switch



Incorrectly bonded switch (trapped air)



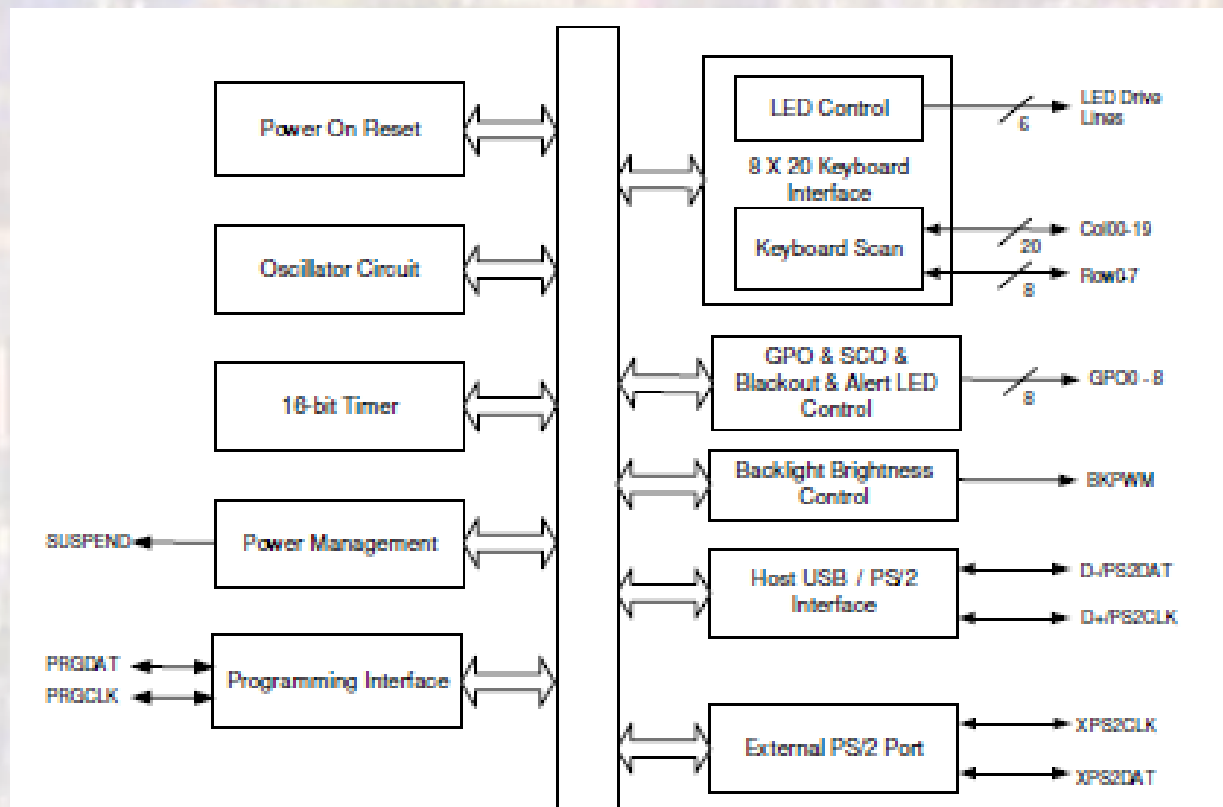
Mem



None tactile membrane switch

# Input Devices

- Keyboard
  - Controller

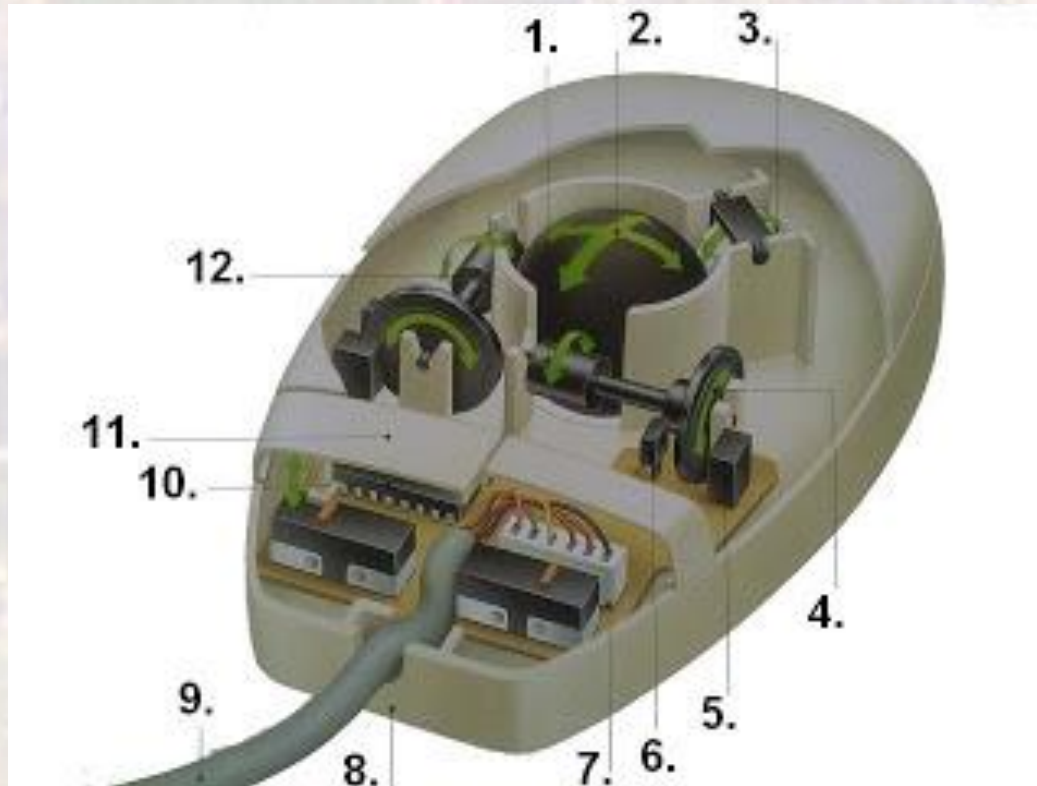


# Input Devices

- Keyboard
  - Controller
    - Performs debounce – 1-5ms typical
    - Polling rate -  $< 200\text{Hz}$
    - Interface – USB, wireless, SPI, TWI

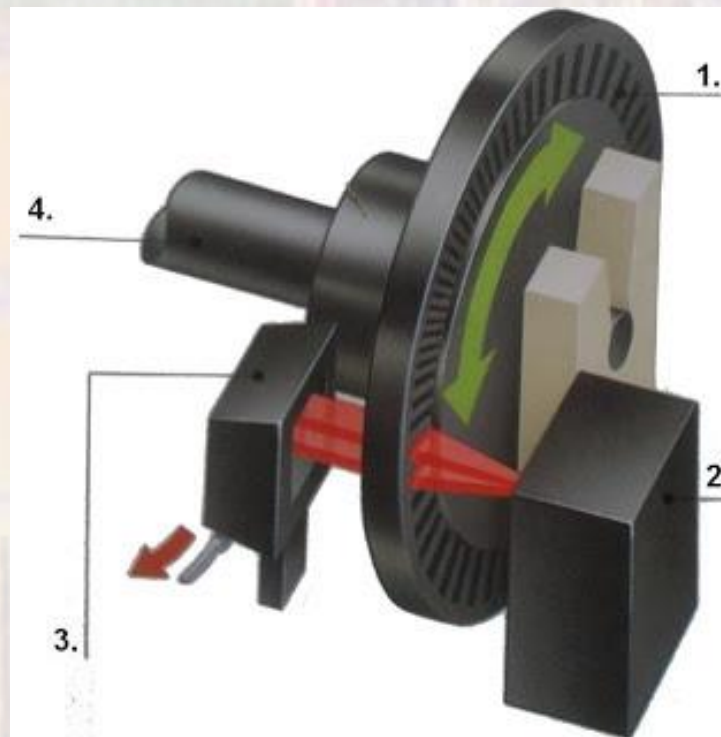
# Input Devices

- Mouse
  - Opto-Mechanical



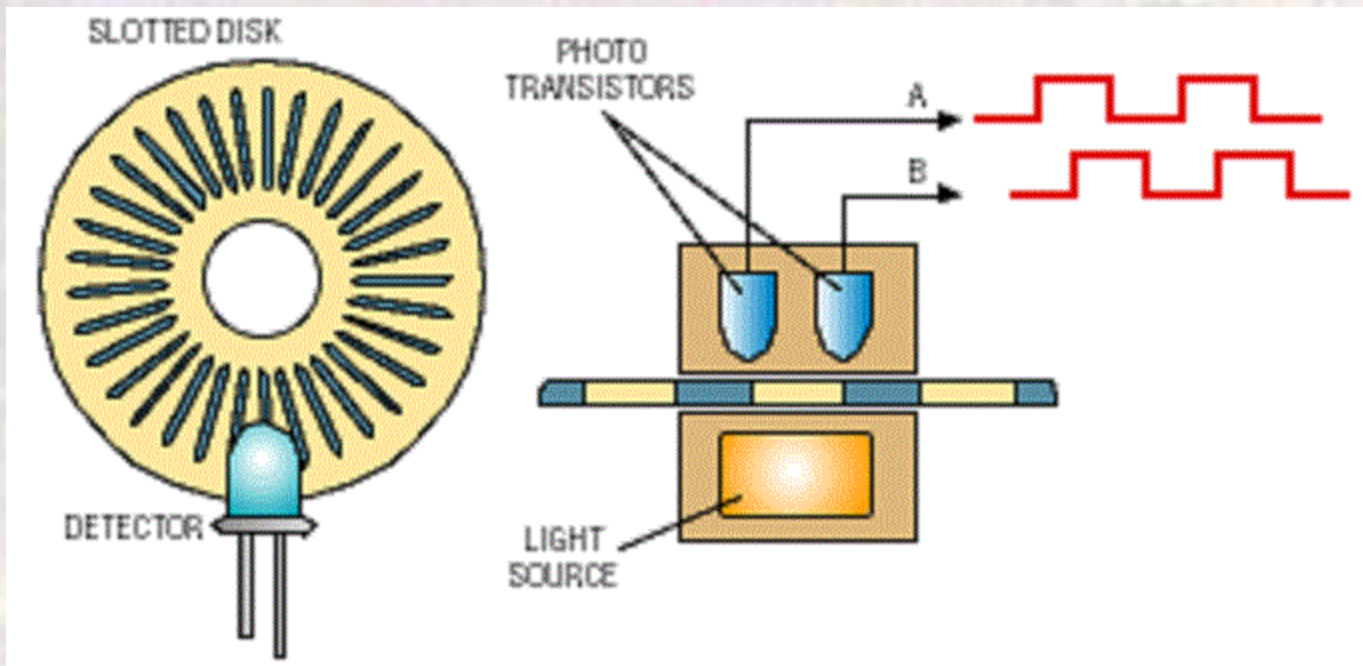
# Input Devices

- Mouse
  - Opto-Mechanical



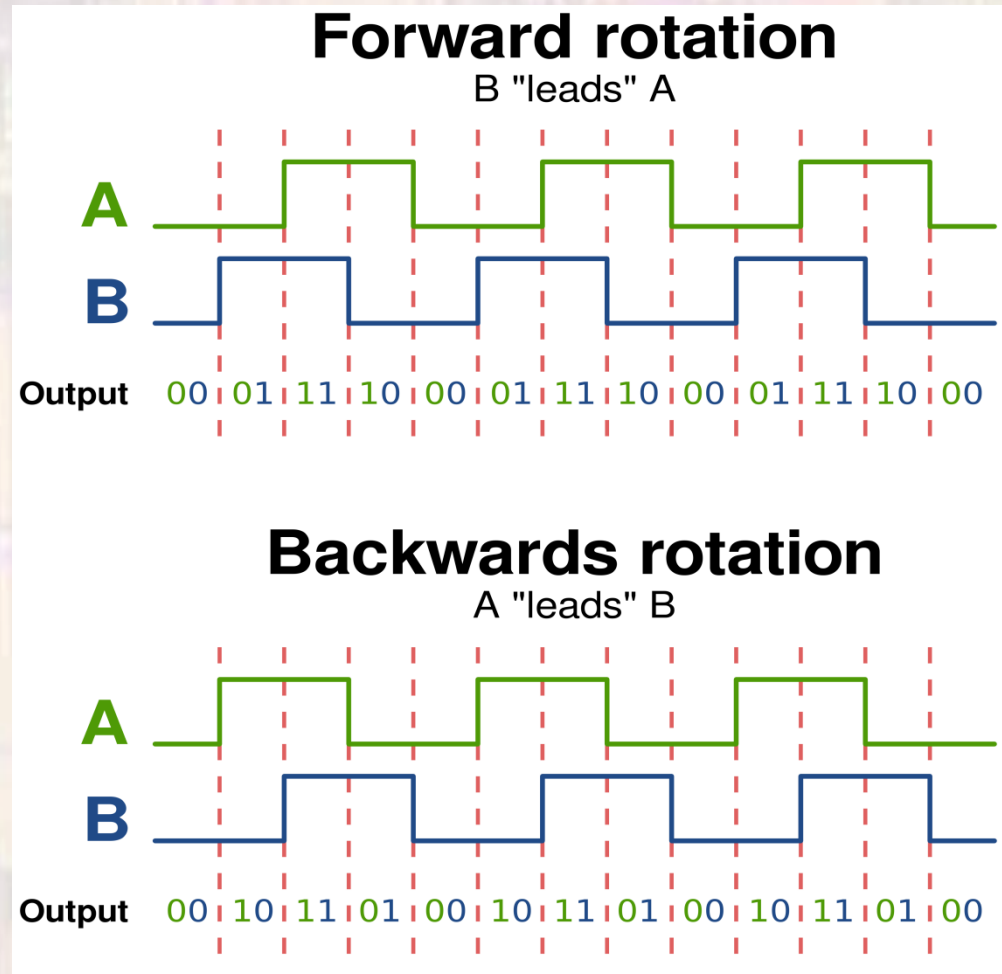
# Input Devices

- Mouse
  - Opto-Mechanical



# Input Devices

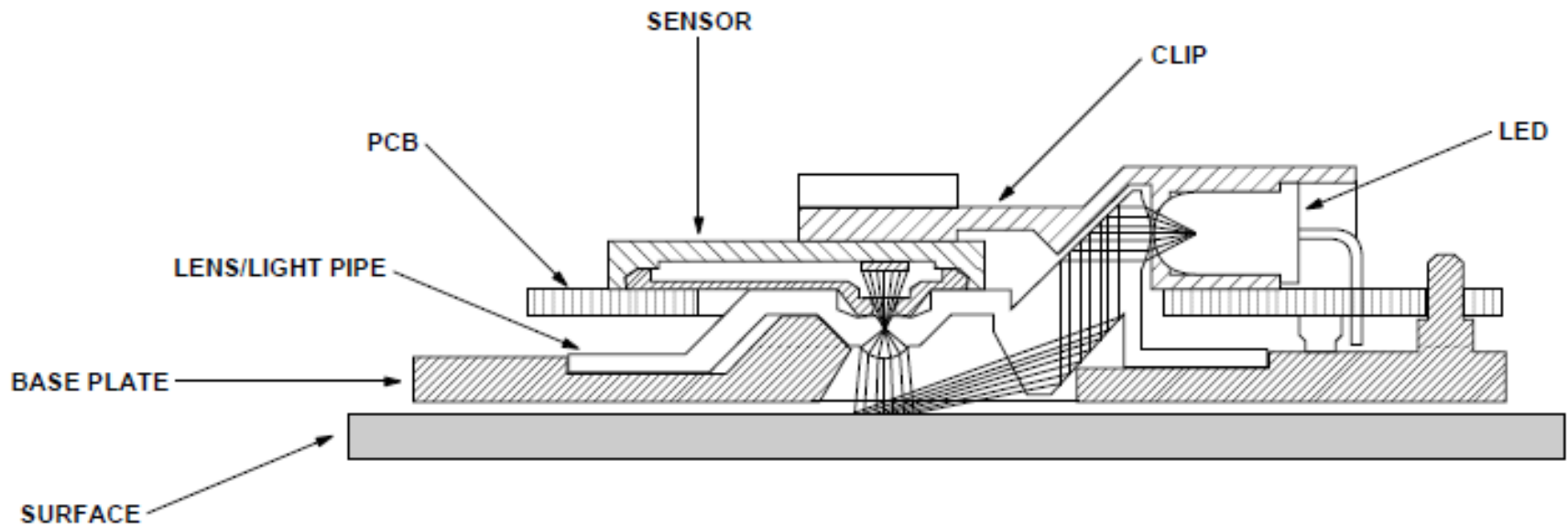
- Mouse
- Opto-Mechanical





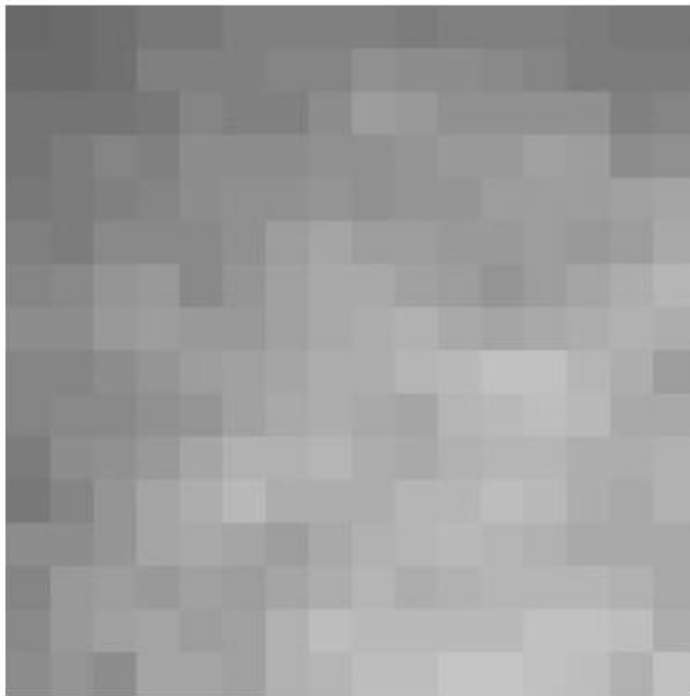
# Input Devices

- Mouse
- Optical Mouse

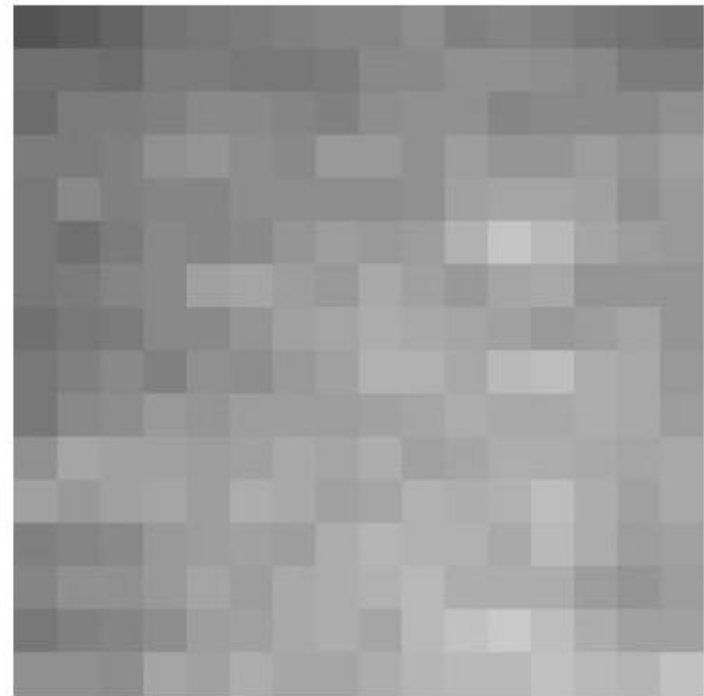


# Input Devices

- Mouse
- Optical Mouse



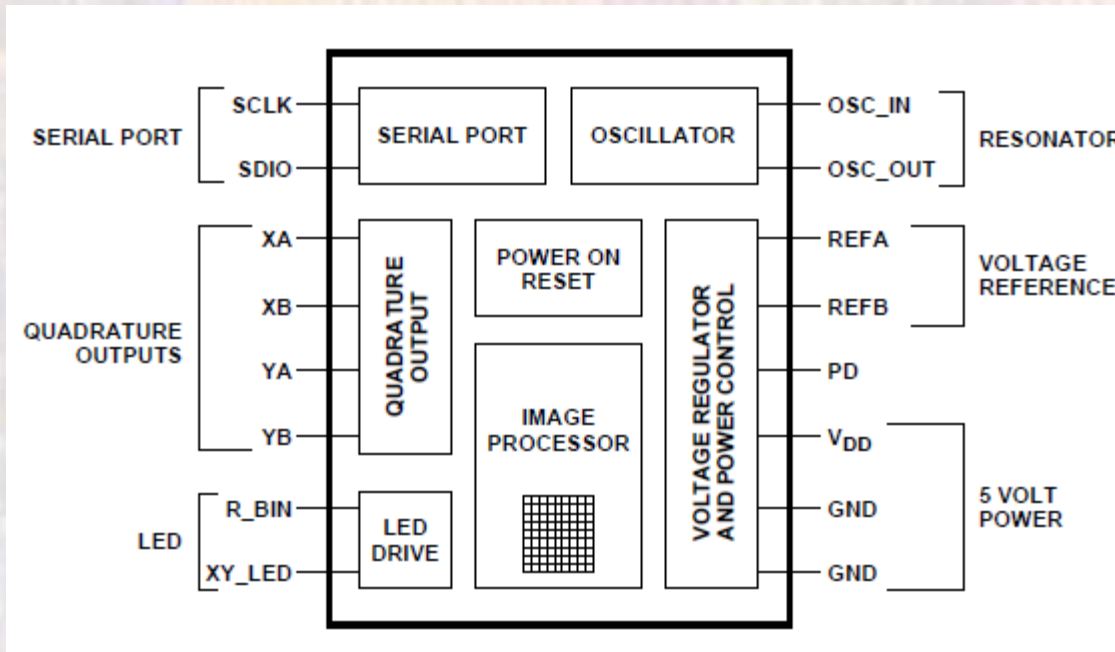
**(a) White Paper**



**(b) Manila Folder**

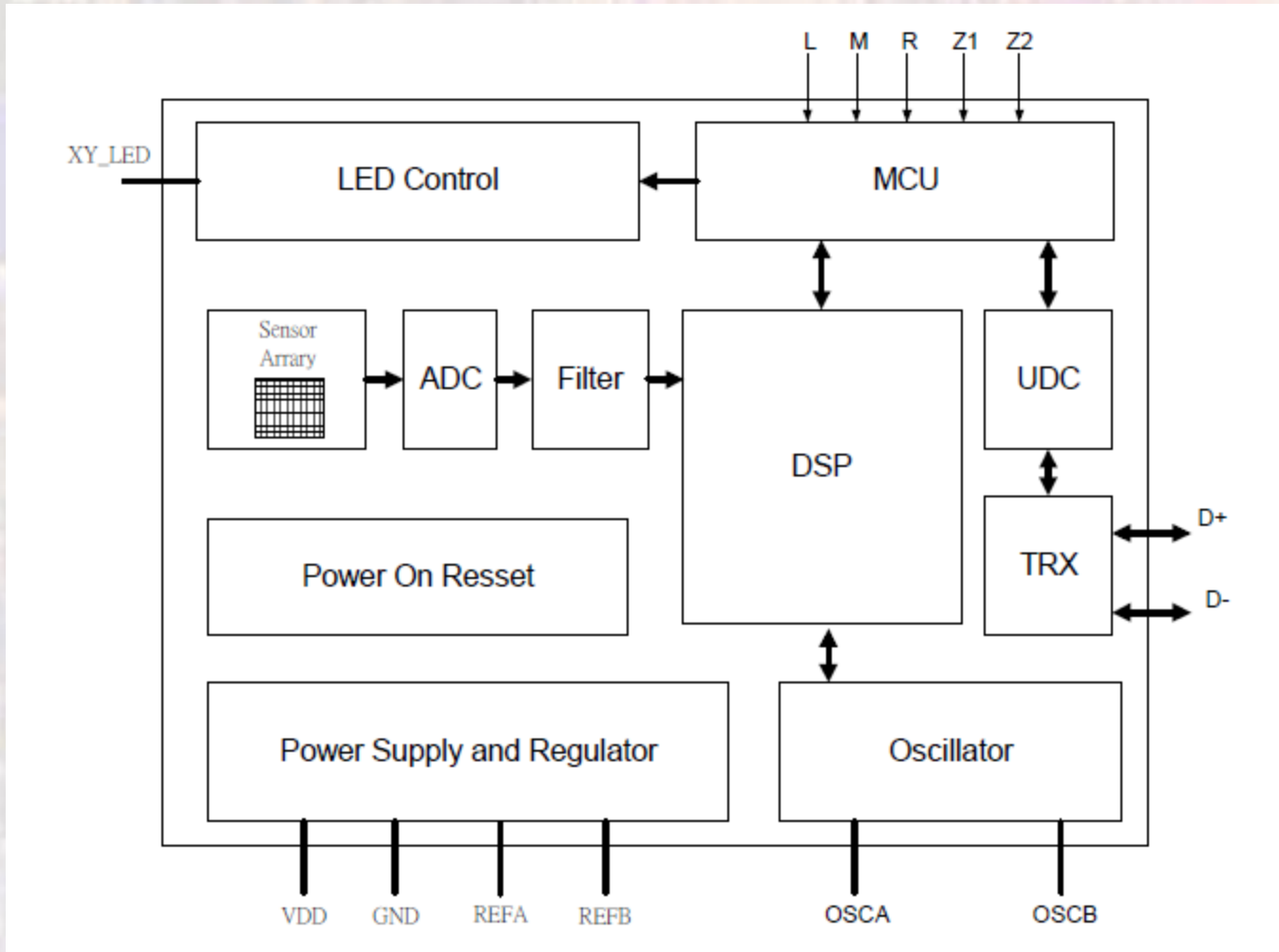
# Input Devices

- Mouse
  - Optical Mouse Sensor
    - By comparing images – direction and distance can be calculated



# Input Devices

- Mouse



# Input Devices

- Mouse

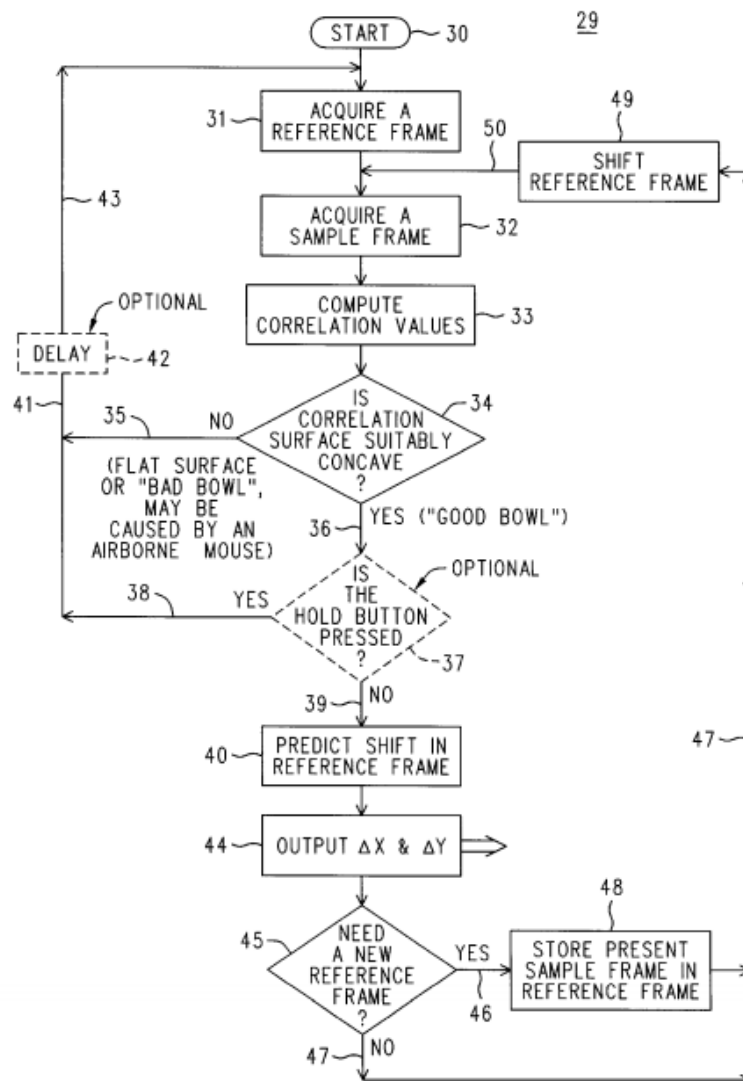


FIG. 5

# Input Devices

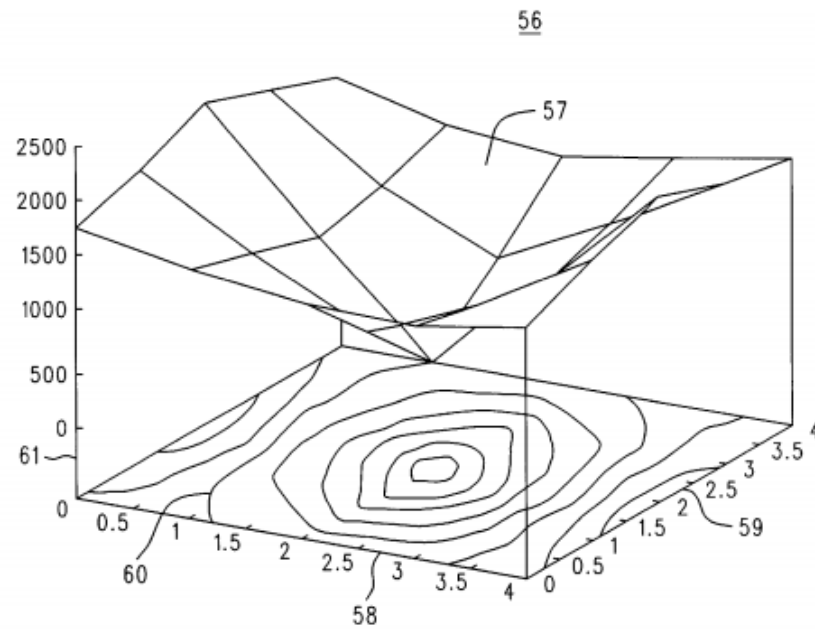
- Mouse

U.S. Patent

Aug. 13, 2002

Sheet 7 of 7

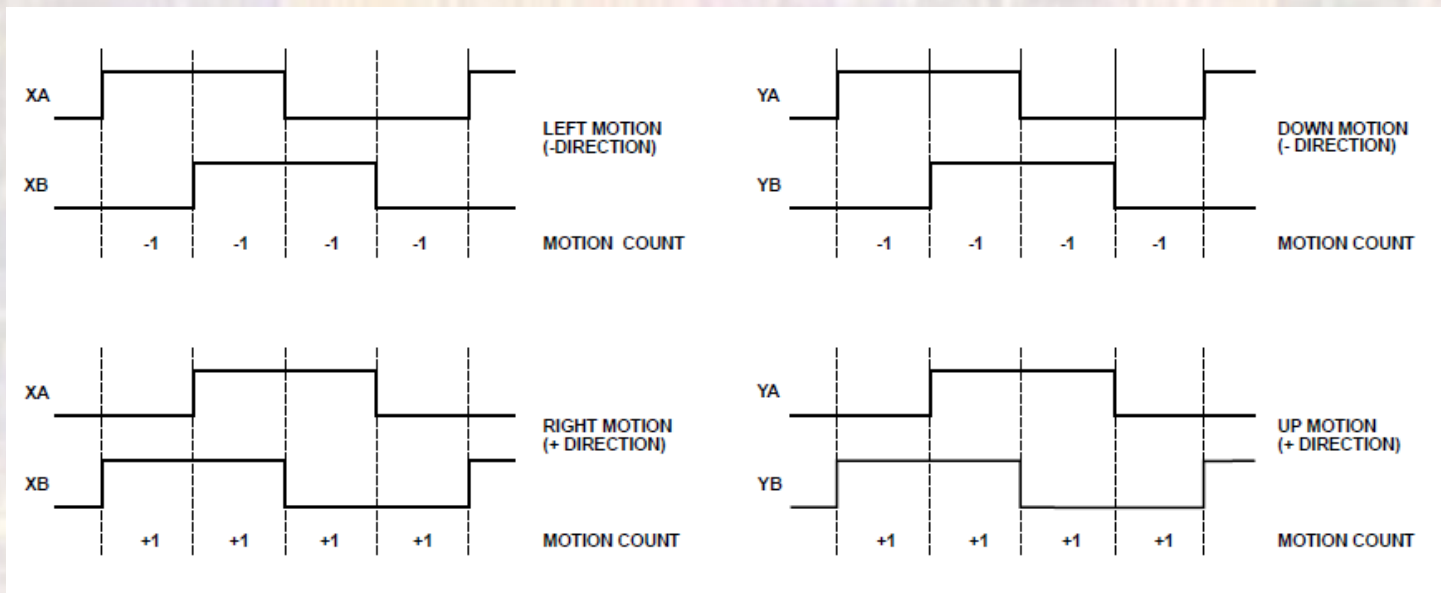
US 6,433,780 B1



**FIG. 7**

# Input Devices

- Mouse
  - Optical Mouse Sensor
    - Output is a quadrature signal - just like a mechanical mouse



# Input Devices

- Mouse
  - Optical Mouse Sensor
    - Frame Rate: 1500 frames/sec
    - Typical resolution: 400-800 cpi (counts/inch)
    - Speed: 14ips (inches per second)
    - Typical sensor dimension: 16x16 to 32x32
    - Typical Path error: 0.5%



# Input Devices

- Mouse
  - Optical Mouse Sensor
    - Limited focal range

