

Programming External Hardware Interrupts

→ 8051 has 2 Ext H/w interrupts.

→ Pin (P3.2) and Pin 13 (P3.3) of the 8051, named as INT0 & INT1.

→ On activation of these pins, 8051 gets interrupted in whatever it is doing and jumps to the vector table to perform the ISR.

External Interrupts INT0 & INT1.

There are two types of activations for Ext H/w interrupts

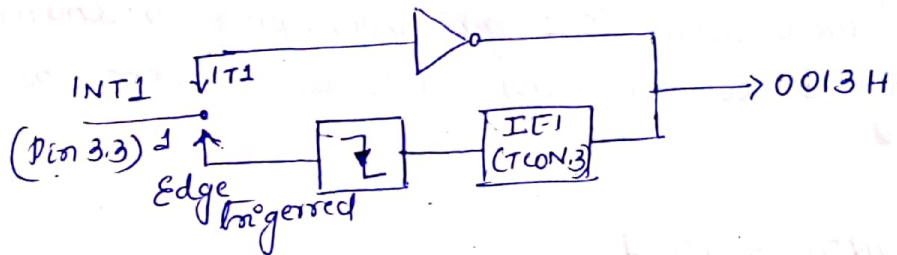
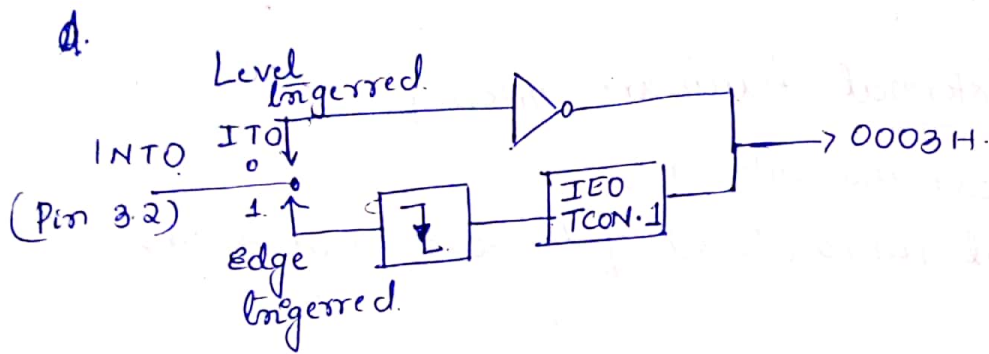
(1) Level Triggered

(2) Edge Triggered.

Level Triggered interrupt

→ In level triggered mode, INT0 & INT1 pins are normally high and if a low level signal is applied to them, it triggers the input interrupt. Then the controller stops whatever it is doing and jumps to the ISR to service the interrupts.

This is called level triggered or level activated interrupt. & is the default mode upon reset of 8051. This low level signal at the INT pin must be removed before the execution of last instⁿ of ISR, RETI, else another interrupt will be generated.



Program

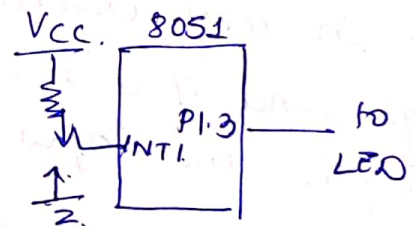
→ Assume that INT1 pin is connected to a switch that is normally high. Whenever it goes low, it should turn on LED. The LED is connected to P1.3 and is normally off. When it is turned on it should stay on for a fraction of a second. As long as switch is pressed low LED should stay on.

```
ORG 0000H
LJMP MAIN
ORG 0013H
SETB P1.3
MOV R3, #255
```

```
Back: DJNZ R3, Back
CLR P1.3
RETI
```

```
ORG 30H
MOV IE, #10000100B
```

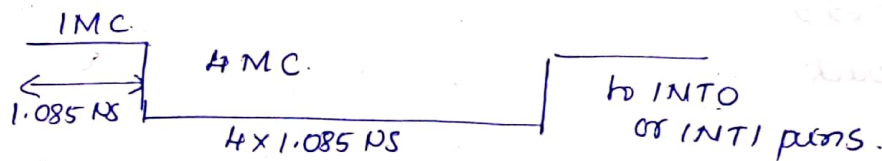
```
Here: SJMP Here
End.
```



EA - ET2 ES ET1 EX1 B70 B70
1 0 0 0 0 1 0 0

Sampling the low level triggered interrupt

- Once the Hardware interrupts in IE register are enabled, the controller keeps sampling the INTn pin for a low level signal once each machine cycle.
- To ensure the activation of hardware interrupt at the INTn pin, the duration of low level signal should be around 4 machine cycles.



Edge Triggered interrupts

- To make interrupts edge triggered, we must program the bits of TCON register.
- In TCON register we have 4 bits related to interrupts. i.e. IEF1 IT1 IEO ITO
- IT1 & ITO = 0 implies interrupts are low level triggered.

IE1/ & IT1

IT1 & ITO = 1 implies interrupts are Edge triggered and are to be done by the programmer.

- When there is a high to low signal applied on Pin P3.3 the controller will be interrupted & forced to jump to the location 0013H in vector table. 111th for P3.2.

* Assuming Pin 3.3 (INT1) is connected to pulse generator, WAP in which falling edge of pulse will send a high to P1.3 which is connected to buzzer. In other words LED is turned on & off at the same rate as pulses are applied to INT1 pin.

```
ORG 0000H
```

```
LJMP MAIN
```

```
ORG 0013H
```

```
SETB P1.3
```

```
MOV R3, #255
```

```
back: DJNZ R3, back.
```

```
CLR P1.3
```

```
RETI
```

```
MAIN: ORG 301H
```

```
MAIN: SETB TCON.2    To make it edge triggered.
```

```
MOV IE, #10000100B
```

```
SJMP $
```

```
End.
```