

USING TIMERS

IN PIC - 'C'



PIC-Timers Modules



❖ TIMER-0

❖ TIMER-1

❖ TIMER-2

The “Timer0” Module Features:



- 8-bit timer/counter
- Readable and writable
- 8-bit software programmable prescaler
- Internal (4 Mhz) or external clock select
- Interrupt on overflow from FFh to 00h
- Edge select (rising or falling) for external clock



Prescaler – Frequency Divider:



We can use Prescaler for further division of the system clock.

The options are:

- ✓ 1:2 Prescaler
- ✓ 1:4
- ✓ 1:8
- ✓ 1:16
- ✓ 1:32
- ✓ 1:64
- ✓ 1:128
- ✓ 1:256

“OPTION” Register & Initialization:



OPTION_REG REGISTER

R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1
$\overline{\text{RBP}}\text{U}$	INTEDG	TOCS	TOSE	PSA	PS2	PS1	PS0
bit 7							bit 0

- PSA=0; // Prescaler is assigned to the Timer0 module
- PS0=1; // Prescaler rate bits
- PS1=1; // are set to “111”
- PS2=1; // which means divide by 256
- TOSE=0; // rising edge
- TOCS=0; // Internal instruction cycle clock

Timer Calculation:



If using INTERNAL crystal as clock, the division is performed as follow:

$$f_{out} = \frac{f_{clk}}{4 * \text{Prescaler} * (256 - \text{TMR0}) * \text{Count}}$$

where

$$T_{out} = \frac{1}{f_{out}}$$

Timer Calculation:



Sample calculation for EXTERNAL crystal as clock source :

$$f_{out} = \frac{f_{clk}}{\text{Prescaler} * (256 - \text{TMRO}) * \text{Count}} = \frac{100\text{kHz}}{256 * (256 - 0) * 8} = 0.19\text{Hz}$$

$$T_{out} = \frac{1}{f_{out}} = \frac{1}{0.19} = 5.243\text{sec}$$

$f_{out} = 0.19\text{Hz}$ (Output frequency) \rightarrow $T_{out} = 5.243\text{sec}$ (Delay on the output)

Timer0 Example: “C” Code.



```
1
2  #include<pic.h>
3  int Count=0;
4  void main(void)
5  {
6      TMRO=0;           //TMRO initiation
7      TOCS=0;           //Choosing to work with internal CLK
8      TOSE=0;           //Reacting on Low2High edge
9      PSA=0;            //Choosing to work with a Prescaler
10     PS0=1;
11     PS1=1;             //Prescaler value divides in 256
12     PS2=1;
13     while(1)
14     {
15         while(!TOIF);   //Stays here 256 times and then TOIF=1
16         TOIF=0;         //Reseting the Overflow Flag
17         Count++;        //Increasing by 1
18         if (Count==15)
19         {
20             Count=0;    //When Count reaches 15 - Reseting to 0
21         }
22     }
23 }
```


QUERIES??



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