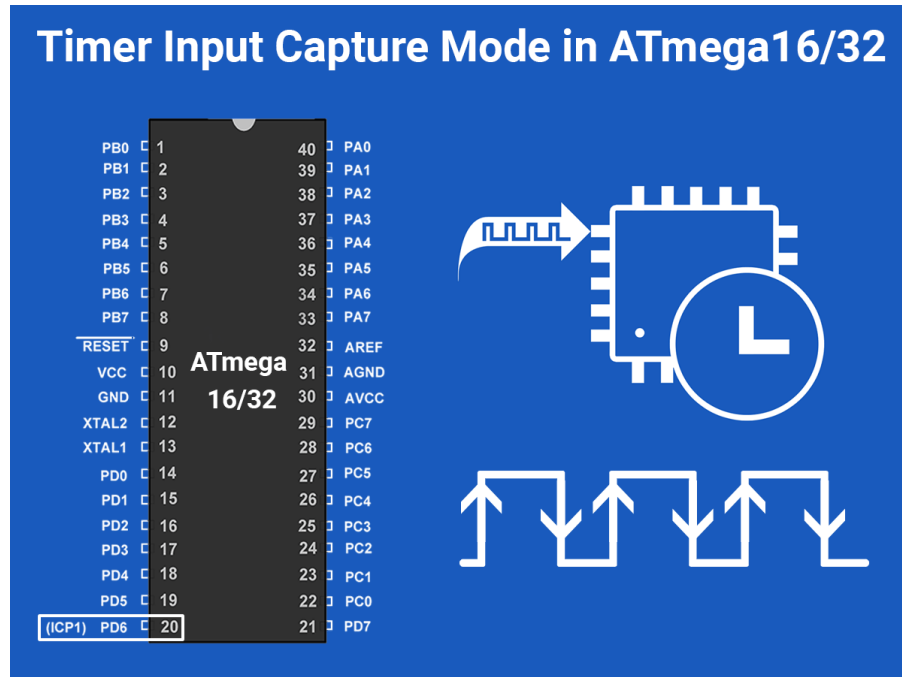




# Timer Input Capture Mode in AVR ATmega16/ATmega32



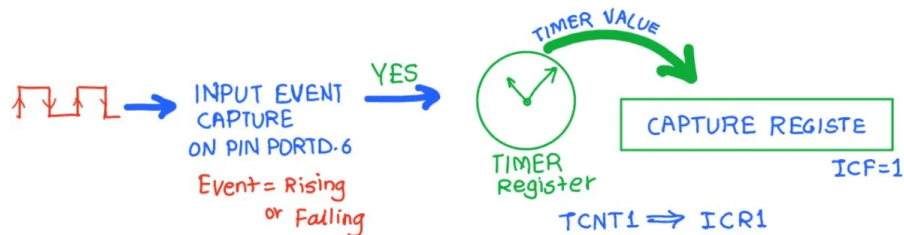
## Introduction to Input Capture Mode

The input capture function is used in many applications such as:

- Pulse width measurement
- Period measurement
- Capturing the time of an event

In AVR ATmega32, Timer1 can be used as an input capture to detect and measure events happening outside the microcontroller.

Upon detection of a defined event i.e. rising edge or falling edge on ICP pin (PORTD.6), the TCNT1(Timer / Counter register) value is loaded into the ICR1 (input capture) register and the ICF1 flag will get set.



## Programming ICP Registers

To program, first, let us see TCCR1B (Timer Counter Control Register B)

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WGM13

WGM12

CS12

CS11

CS10

**Bit 7 - ICNC1:** Input Capture Noise canceller

Setting this bit activates the noise canceller. It causes a delay of 4 clock cycles as it considers a change only if it persists for at least 4 successive system clocks.

**Bit 6 - ICES1:** Input Capture Edge select

Select edge detection for input capture function.

0 = Capture on the falling edge

1 = Capture on rising edge

**Bit 4: 3 - WGM13 : WGM12:** Timer1 Mode select

These bits are used for mode selection like Normal mode, PWM mode, CTC mode, etc. here we will select normal mode, so set these bits to zero.

**Bit 2: 0 - CS12: CS10:** Timer1 Clock Select

CS02	CS01	CS00	Description
0	0	0	No clock source (Timer / Counter stopped)
0	0	1	clk (no pre-scaling)
0	1	0	clk / 8
0	1	1	clk / 64
1	0	0	clk / 256
1	0	1	clk / 1024
1	1	0	External clock source on T0 pin. Clock on falling edge
1	1	1	External clock source on T0 pin. Clock on rising edge.

## Steps to Program

1. Initialize the TCCR1A and TCCR1B for proper timer mode (any mode other than 8, 10, 12, 14), to select the edge (Positive or Negative).
2. Monitor the ICF1 flag in the TIFR register to see if the edge has arrived. Upon the arrival of the edge, the TCNT1 value is loaded into the ICR1 register automatically by the controller.

**Note:** Input capture pin, which is PORTD.6, has one more function i.e. output of the analog comparator. We can use ACIC bit from the ACSR register, to make this pin function as the 'analog comparator output' by setting it to logic HIGH. Otherwise, this pin remains as an ICP pin by default after power on or reset. So we don't need to define this Register here.

## Input Capture Mode Program

Assuming that the clock pulses are fed into the pin ICP1, the following program will read the TCNT1 value at every rising edge and place the result on PORTA and PORTB.

```

DDRB = 0xFF;
PORTD = 0xFF;

TCCR1A = 0;
TIFR = (1<<ICF1); /* clear input capture flag */
TCCR1B = 0x41; /* capture on rising edge */

while ((TIFR&(1<<ICF1)) == 0); /* monitor for capture*/
t = ICR1;
TIFR = (1<<ICF1); /* clear capture flag */

while ((TIFR&(1<<ICF1)) == 0); /* monitor for next rising
                                edge capture */

t = ICR1 - t; /* period= recent capture-
              previous capture */
PORTA = t; /* put period count on PORTA & F
PORTB = t>>8;

while (1);
return 0;
}

```

[+ Project \(/publish/project\)](#)

## Measuring Frequency and Duty Cycle

Program to measure the frequency and duty cycle and displaying it on the LCD16x2

```

/*
Measuring ATmega16 frequency and duty cycle using input capture
http://www.electronicwings.com
*/

#define F_CPU 8000000UL
#include <avr/io.h>
#include <util/delay.h>
#include <avr/interrupt.h>
#include <stdlib.h>
#include "LCD_16x2_H_file.h"

int main ( )
{
    unsigned int a,b,c,high,period;
    char frequency[14],duty_cy[7];


    LCD_Init();
    PORTD = 0xFF; /* Turn ON pull-up resistor */

    while(1)

```


## Video

Components Used


  
(https://www.mouser.in?utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

Powered By

ATmega 16  
ATmega 16 X 1



(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA16L-8PU?qs=%2Fha2pyFaduiGCJtTvs2wv8fVZbVAaLLu7lq%2FglTS0tALAx6fMenLvg%3D%3D&utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)



Datasheet (/components/atmega-16/1/datasheet)

## Components Used

Atmega32

Atmega32

X 1

(https://www.mouser.in/ProductDetail/Microchip-Technology-Atmel/ATMEGA32-16PU?qs=aqrrBurbvGdpkmgj7RWmsQ%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

Datasheet (/components/atmega32/1/datasheet)

LCD16x2 Display

LCD16x2 Display

X 1

(https://www.mouser.com/ProductDetail/Adafruit/1447?qs=XAKIUOoRPe6AClmsjw7y7g%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

## Downloads

Proteus Simulation File

Dow (/api/download/platform-attachment/39)

d

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Atmega16\_Freq\_DutyCycle\_Project\_File

[Dow \(/api/download/platf  
nload-attachment/303\)  
d](#)

## Comments



Comment



wicaksonoagung95

[\(/users/wicaksonoagung95/profile\)](#)  
2018-01-23 11:33:17

Thank you for explanation, i want ask you why the register TICIE1 is not set??

[Reply](#) [Like](#)

pran0506

[\(/users/pran0506/profile\)](#)  
2018-06-07 05:07:46

Sir , when I simulate this in proteus it always shows duty cycle 50% and frequency to be half of what is set , for eg if PWM is 20% at 2KHz , it shows 1000 Hz and 50%

[Reply](#) [Like](#)

lokeshc

[\(/users/lokeshc/profile\)](#)  
2018-06-07 06:11:02

hi pran056

please check your crystal frequency selected in proteus. May be it is more than 8 MHZ selected.

To check/change the frequency, do double-click on ATmega IC and check CKSEL Fuses.

check for 8MHz frequency to get proper output. It will work for you,

[Reply](#) [Like](#)

pran0506

[\(/users/pran0506/profile\)](#)  
2018-06-07 08:29:01 • Edited

Thank you so much Sir, I got the error :)

[Reply](#) [Like](#)

chandannegich

[\(/users/chandannegich/profile\)](#)  
2019-01-21 22:55:16

Hello sir how we move 0108 Blvd cursor

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nn10

[\(/users/nn10/profile\)](#)  
2018-09-18 12:32:41

Hello. What is the range of frequency/period that this code is capable of measuring? I need to measure period in the micro or milli range, how can i accomplish this?

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mehmetcankarsima



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purvikjetpace

(/users/purvikjetpace/profile)

2019-01-25 11:34:52

Can i use this program in ATmega328P Controller ?

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authorized

(/users/authorized/profile)

2019-01-31 16:55:13

yes. but you need to make sure that registers and their config bits are same in both controllers

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purvikjetpace

(/users/purvikjetpace/profile)

2019-01-31 17:20:19

Its work

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abdoibra989

(/users/abdoibra989/profile)

2022-05-12 08:09:19

how it can be done using atmega 328p ?

i tried but there's ICRH,ICRL don't know which of them to use for calcuations

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purvikjetpace

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2019-01-25 13:21:55

how to use for 16 MHz freq. ?

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kanishkasandaruwan

(/users/kanishkasandaruwan/profile)

2021-04-03 00:10:56

could you please tell me that if you've found the method

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trungkiendt9

(/users/trungkiendt9/profile)

2019-04-02 10:54:09

Can you do this using ICP3?. Because there are some difference between Timer1 and Timer3.

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sayemal25

(/users/sayemal25/profile)

2019-09-12 01:28:24

sir can you give the proteus file of this code

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amrmagdi50

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2019-09-30 04:59:32

why do define PORTD in the first code as high ?

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mohamedsalahtaman

(/users/mohamedsalahtaman/profile)

2020-04-04 06:13:34



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amrmagdi50  
(/users/amrmagdi50/profile)  
2019-09-30 05:01:45

what is the maning of this line PORTB = t>>8;?

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muhammedimdaad16

(/users/muhammedimdaad16/profile)  
2020-07-03 21:03:19

using PORTA we get the LS bits of time and using PORTB we get the MSBits of the time. so in order fill only the MSBs into port B we need to shift the values by 8 bits

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amrmagdi50  
(/users/amrmagdi50/profile)  
2019-09-30 07:27:15

need an explation for this code :long freq= F\_CPU/period; ??

why do we divide th frquency by the calculated period

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muhammedimdaad16

(/users/muhammedimdaad16/profile)  
2020-07-03 21:05:39

because period = c-a is not actual period. Since TCNT1 register doesn't increment one bit at a second. it increment at the clock rate. so you have to take that into consideration. some logical thinking will sort that out.

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muhammedimdaad16  
(/users/muhammedimdaad16/profile)  
2020-07-03 21:06:41

we haven't considered the overflow in TCNT1. I think we have to consider that for a generalized input capture

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vahidn2  
(/users/vahidn2/profile)  
2020-12-31 12:57:17

TNKS

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leonardopadovano  
(/users/leonardopadovano/profile)  
2021-09-21 22:21:11

Como se conecta el lcd?

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EslamFayad  
(/users/EslamFayad/profile)  
2022-10-29 21:35:56

Working with very precise readings ,  
But when disconnect the input captured signal, The whole program stop ,stucked in the while waiting the Flag to be set ,  
How to avoid program stuck waiting for input capture flag

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