

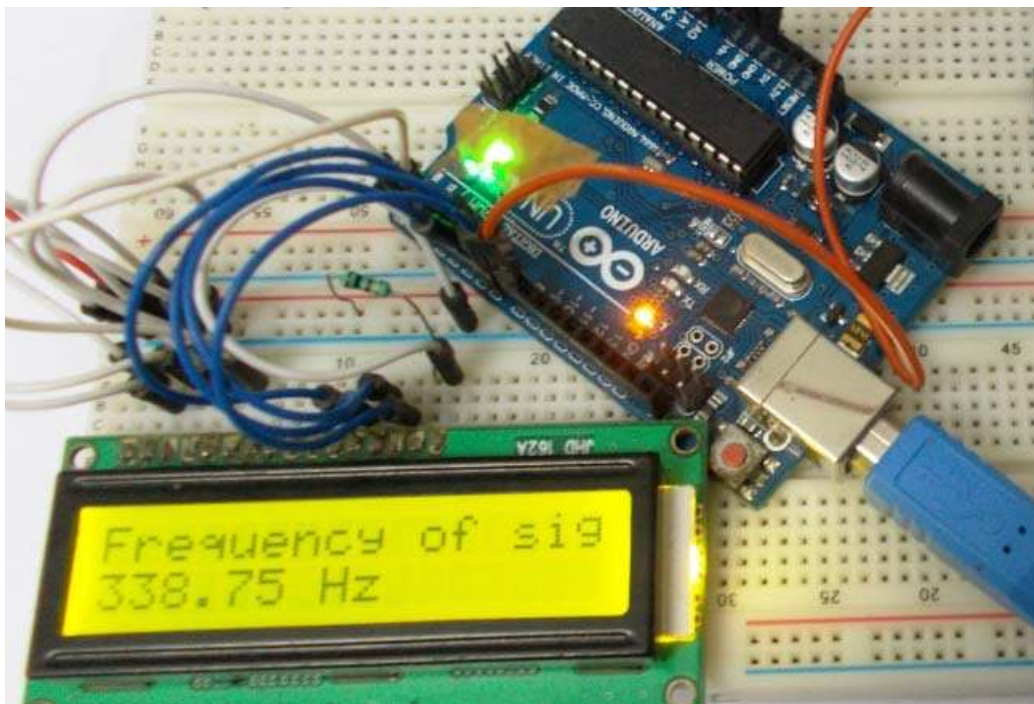


ARDUINO ([HTTPS://CIRCUITDIGEST.COM/ARDUINO-PROJECTS](https://circuitdigest.com/arduino-projects))

Frequency Counter using Arduino (/microcontroller-projects/arduino-frequency-counter-circuit)

By (page_author.html)Dilip Raja (/users/dilip-raja) © Jun 13, 2016

37



Arduino Frequency Counter Tutorial

Almost every electronic hobbyist must have faced a scenario where he or she must measure the frequency of signal generated by a clock or a counter or a timer. We can use oscilloscope to do the job, but not all of us can afford an oscilloscope. We can buy equipment for measuring the frequency but all these devices are costly and are not for everyone. With that in mind we are going to design a simple yet efficient **Frequency Counter using Arduino Uno** and Schmitt trigger gate.

OK, I Understand

This **Frequency Counter** is cost effective and can be easily made, we are going to use **ARDUINO UNO** for the measuring the frequency of signal, UNO is the heart of project here.

To test the Frequency Meter, we are going to make a dummy signal generator. This dummy signal generator will be made by using a **555 timer chip** (<http://circuitdigest.com/article/555-timer-ic>). The timer circuit generates a square wave which will be provided to UNO for testing.

With everything in place we will have a Frequency meter and a square wave generator.

Required Components:

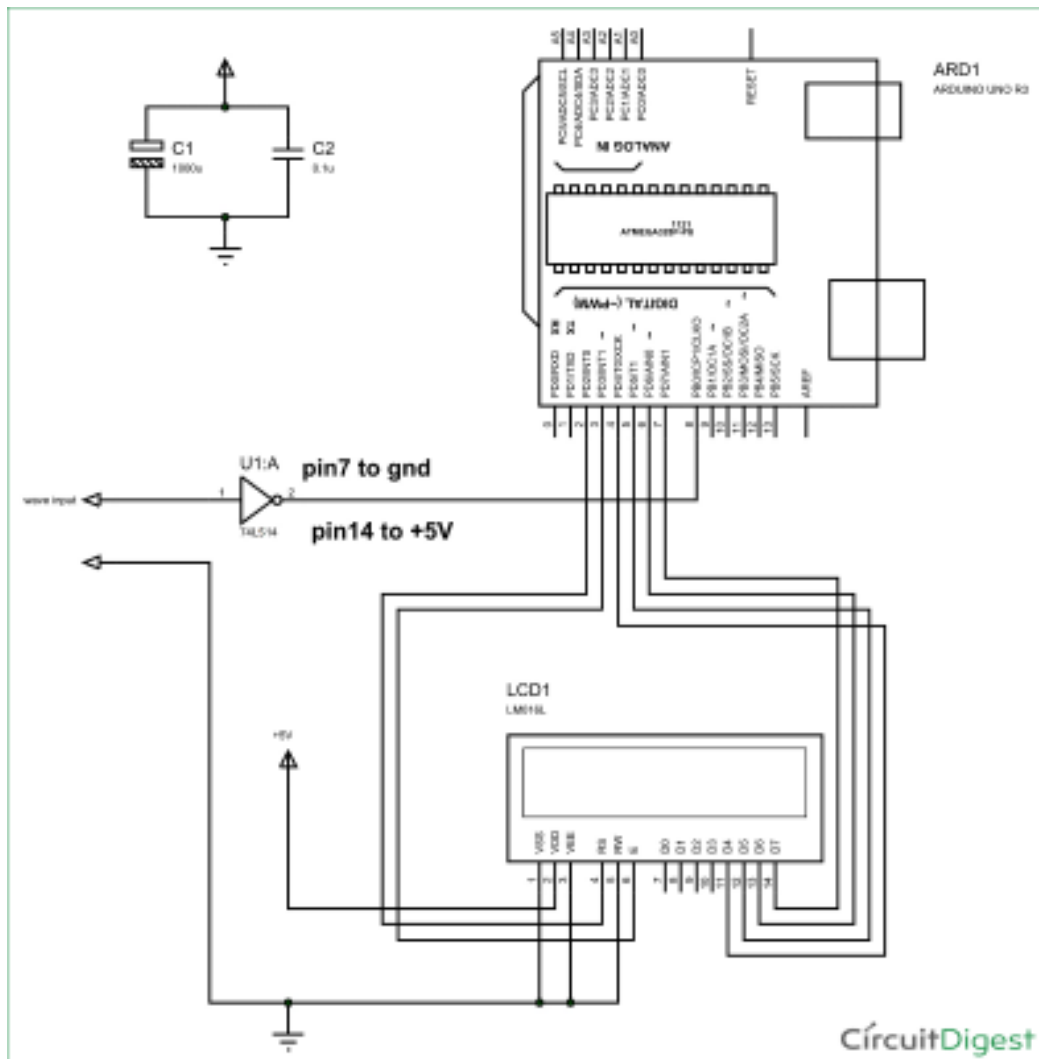
- 555 timer IC and 74LS14 Schmitt trigger gate or NOT gate.
- 1K Ω resistor(2 pieces), 100 Ω resistor
- 100nF capacitor (2 pieces), 1000 μ F capacitor
- 16*2 LCD,
- 47K Ω pot,
- Breadboard and some connectors.

Circuit Explanation:

The circuit diagram of the **Frequency Meter using Arduino** is shown in below figure. Circuit is simple, a LCD is interfaced with Arduino (<http://circuitdigest.com/microcontroller-projects/arduino-lcd-interfacing-tutorial>) to display the measured frequency of signal. 'Wave Input' is going to Signal Generator Circuit, from which we are feeding signal to Arduino. A Schmitt trigger gate (IC 74LS14) is used to ensure that only rectangular wave is fed to Arduino. For filtering the noise we have added couple of capacitors across power. This Frequency Meter can measure frequencies up to **1 MHz**.

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(/fullimage?i=circuitdiagram_mic/frequency-counter-using-arduino-circuit-diagram.png)

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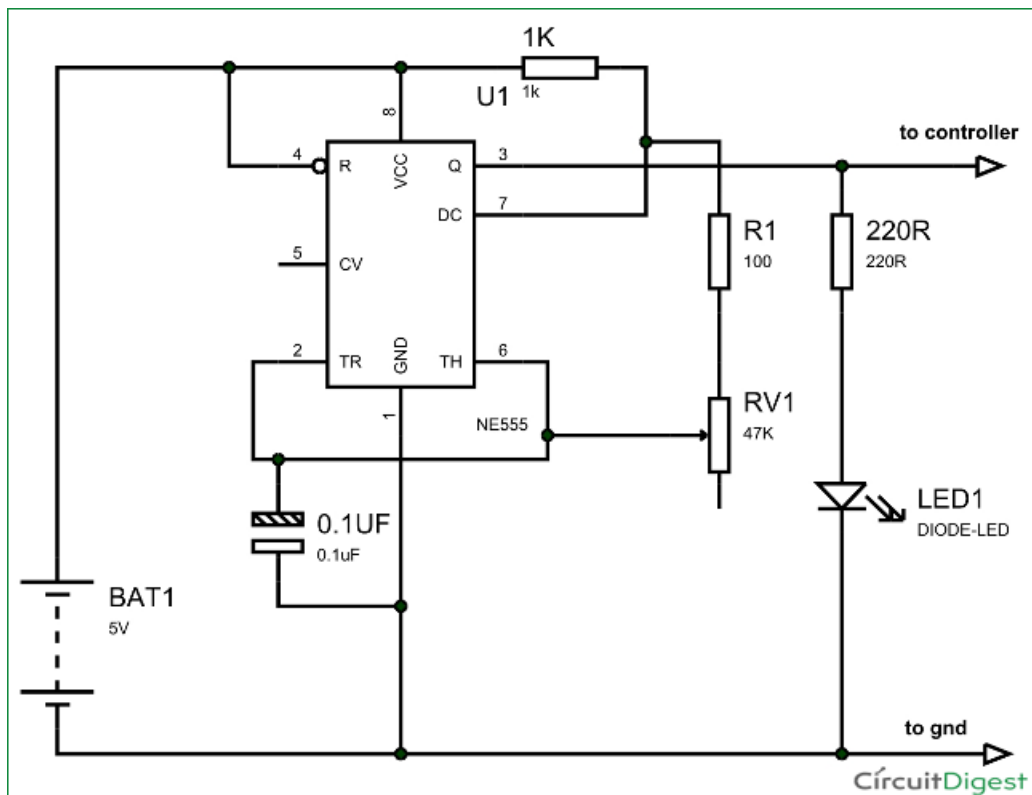
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Signal generator circuit and Schmitt trigger have been explained below.

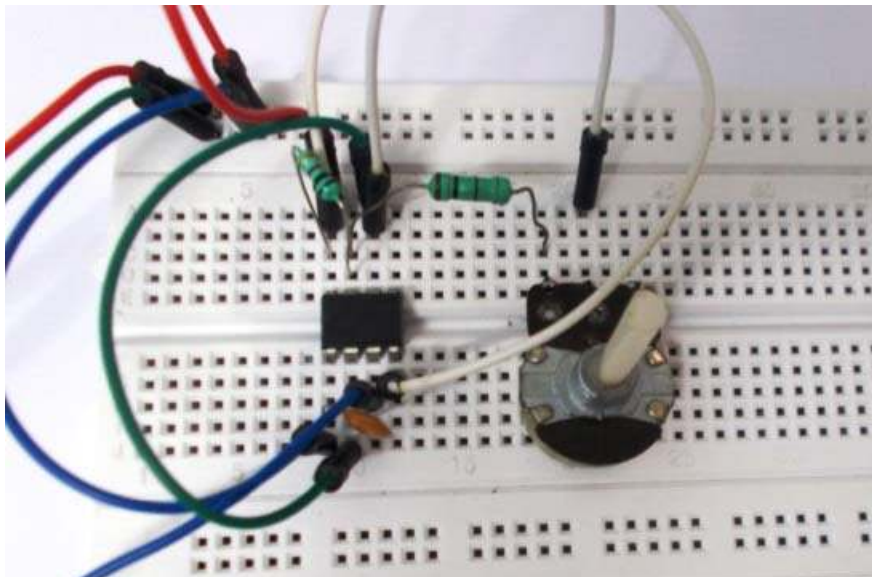
Signal Generator using 555 Timer IC:

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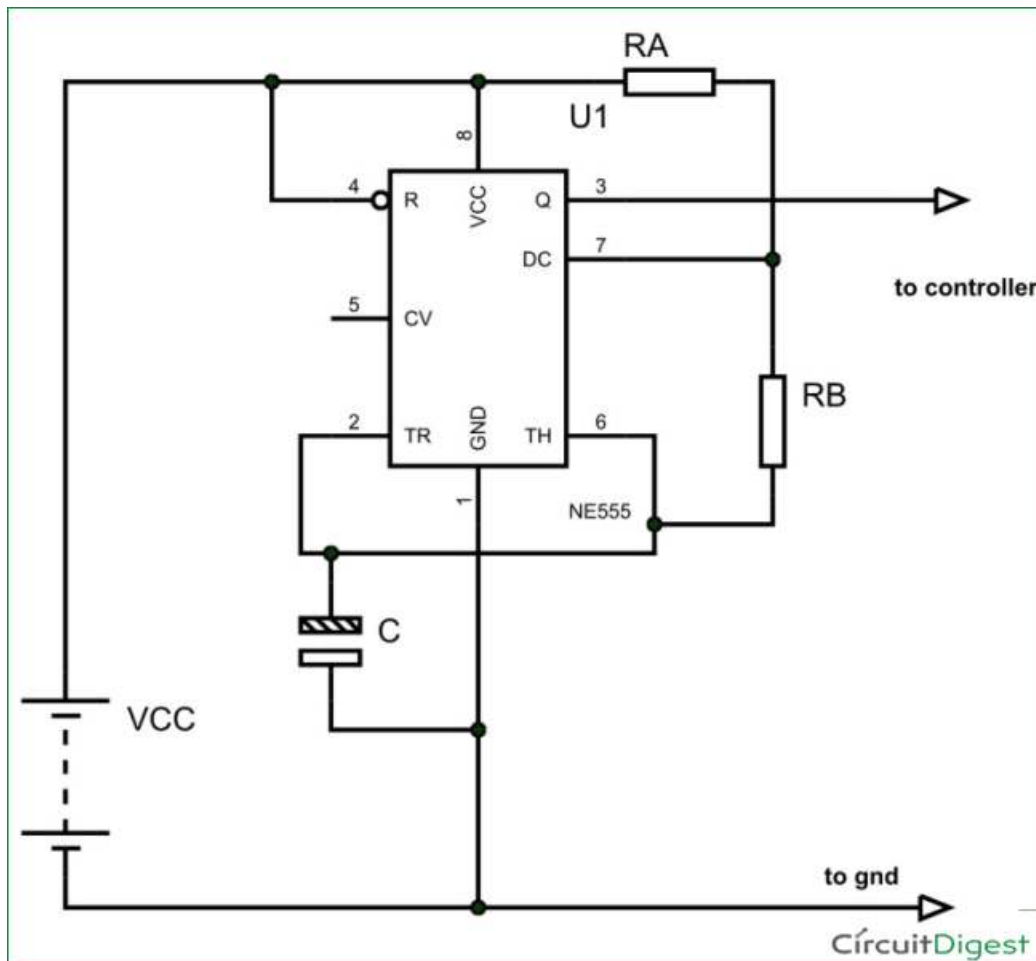


First of all we will talk about 555 IC based square wave generator, or should I say 555 Astable Multivibrator (<http://circuitdigest.com/electronic-circuits/555-timer-astable-multivibrator-circuit-diagram>). This circuit is necessary because, with the Frequency Meter in place we must have a signal whose frequency is known to us. Without that signal we will never be able to tell the working of Frequency Meter. If we have a square wave of known frequency we can use that signal to test the UNO meter and we can tweak it for adjustments for accuracy, in case of any deviations. The picture of **Signal Generator using 555 Timer IC** is given below:



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The output signal frequency depends on RA, RB resistors and capacitor C. The equation is given as,

$$\text{Frequency (F)} = 1 / (\text{Time period}) = 1.44 / ((RA + RB * 2) * C).$$

Here RA and RB are resistance values and C is capacitance value. By putting the resistance and capacitance values in above equation we get the frequency of output square wave.

One can see that RB of above diagram is replaced by a pot in the Signal Generator Circuit; this is done so that we can get variable frequency square wave at the output for better testing. For simplicity, one can replace the pot with a simple resistor.

Schmitt Trigger Gate:

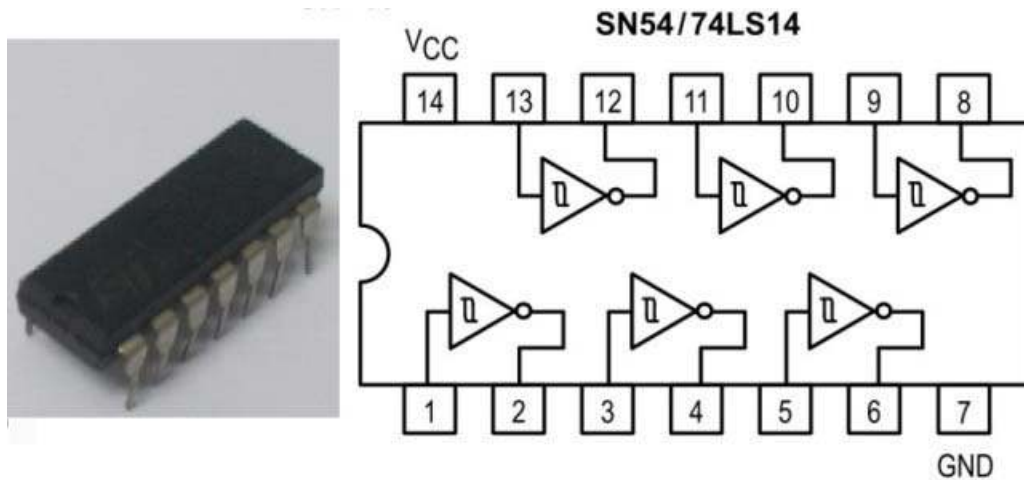
We know that all the testing signals are not square or rectangular waves. We have triangular waves, tooth waves, sine waves and so on. With the UNO being able to detect only the square or rectangular waves, we need a device which could alter any signals to rectangular waves, thus we use **Schmitt Trigger Gate** (<http://circuitdigest.com/electronic-circuits/schmitt-trigger-gate-circuit-diagram>). Schmitt trigger gate is a digital logic gate, designed for arithmetic and logical operations.

This gate provides OUTPUT based on INPUT voltage level. A Schmitt Trigger has a THRESHOLD voltage level, when the INPUT signal applied to the gate has a voltage level higher than the THRESHOLD of the logic gate, the output of the gate will be HIGH. When the INPUT signal applied to the gate has a voltage level lower than the THRESHOLD of the logic gate, the output of the gate will be LOW. We don't usually get Schmitt trigger separately, we always have a NOT gate following the Schmitt trigger.

Schmitt Trigger working is explained here: Schmitt Trigger Gate (<http://circuitdigest.com/electronic-circuits/schmitt-trigger-gate-circuit-diagram>)

OK, I Understand

We are going to use **74LS14** chip, this chip has **6 Schmitt Trigger gates** in it. These SIX gates are connected internally as shown in below figure.



The **Truth Table of Inverted Schmitt Trigger gate** is show in below figure, with this we have to program the UNO for inverting the positive and negative time periods at its terminals.

$$Y = \bar{A}$$

Input	Output
A	Y
L	H
H	L

H = High Logic Level

L = Low Logic Level

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Now we will feed any type of signal to ST gate, we will have rectangular wave of inverted time periods at the output, we will feed this signal to UNO.

Arduino measures the Frequency:

The Uno has a special function **pulseIn**, which enables us to determine the positive state duration or negative state duration of a pin. For more information, read our [cookie policy](https://circuitdigest.com/cookie-policy)

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```
Htime = pulseIn(8,HIGH);
Ltime = pulseIn(8, LOW);
```

OK, I Understand

The given function measures the time for which High or Low level is present at PIN8 of Uno. So in a single cycle of wave, we will have the duration for the positive and negative levels in Micro seconds. The *pulseIn* function measures the time in micro seconds. In a given signal, we have high time = 10mS and low time = 30ms (with frequency 25 HZ). So 30000 will be stored in Ltime integer and 10000 in Htime. When we add them together we will have the Cycle Duration, and by inverting it we will have the Frequency.

Code

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

int Htime;      //integer for storing high time
int Ltime;      //integer for storing low time
float Ttime;    // integer for storing total time of a cycle
float frequency; //storing frequency

void setup()
{
  pinMode(8,INPUT);
  lcd.begin(16, 2);
}

void loop()
{
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Frequency of signal");

  Htime=pulseIn(8,HIGH); //read high time
  Ltime=pulseIn(8,LOW);  //read low time

  Ttime = Htime+Ltime;

  frequency=1000000/Ttime; //getting frequency with Ttime is in Micro seconds
  lcd.setCursor(0,1);
  lcd.print(frequency);
  lcd.print(" Hz");
  delay(500);
}
```

Video

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ARDUINO (/TAGS/ARDUINO)

SCHMITT TRIGGER (/TAGS/SCHMITT-TRIGGER)

FREQUENCY COUNTER (/TAGS/FREQUENCY-COUNTER)

555 TIMER IC (/TAGS/555-TIMER-IC)

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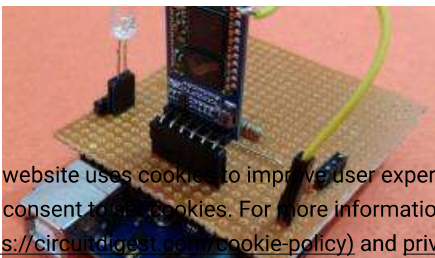
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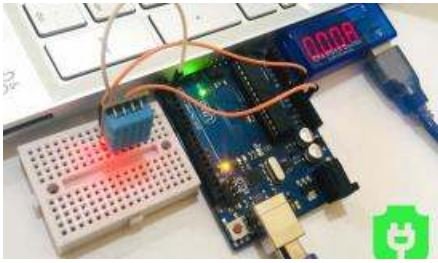
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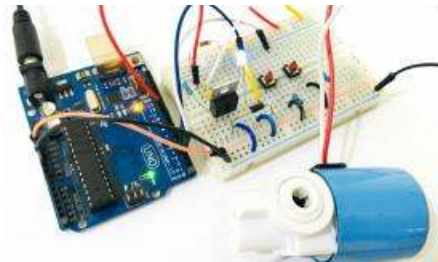
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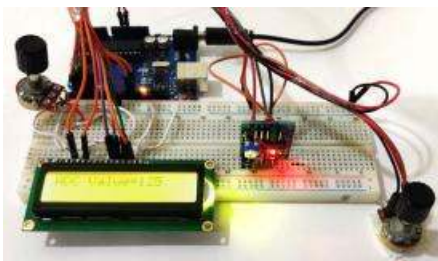
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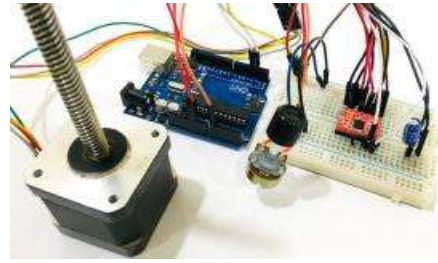
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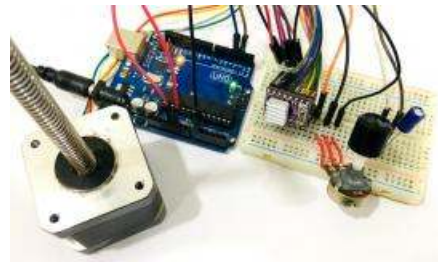
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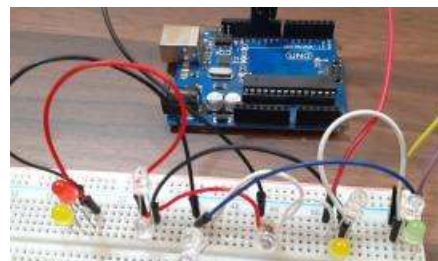
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16x2 LCD Interfacing with Raspberry Pi using Python (<https://circuitdigest.com/microcontroller-projects/raspberry-pi-lcd-display-tutorial>)

COMMENTS



Brij mohan

Apr 14, 2016

I like only Audio amplifier. so maked to Aurduino measurement. Hz, Amp, Mili Amp, Log in (/user/login?destination=node/290%23comment-form) or register (/user/register?destination=node/290%23comment-form) to post comments
Wattes, Etc.



Deepika yadav

Jun 20, 2016

this project is simple to make and vry interesting.
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sumon

Jun 22, 2016

can i use this circuit as an oscilloscope?and where to modify??
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Chief1820

Jun 28, 2016

Hi, going to make this when the parts come in. I know I have some 555s around here
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some place, but I can't for the life of me find them, probably have a couple Schmid triggers as well but you can never have too many parts, and for the cost of them now days, ordering a lot of 10 for 3 bucks doesn't seem to much to invest in a good signal generator. Now to decide which display I want to use, and which project box will house it. Details, details, always details...>>>>



Chief1820

Jun 28, 2016

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my low power CW field rig. Perhaps find a place to hook a test lead in the radio at a test

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point....



DILIP RAJA

Jun 30, 2016

No you cannot, The frequency counter cannot measure frequencies higher than
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6Mhz. So it cannot detect radio signals.



Arv K7HKL

Aug 16, 2016

Yes. You can measure radio frequencies of up to about 6 MHz. If you add a pre-
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scaler (divide by N) you can then change the code to multiply the displayed
frequency by the pre-scale division and see the actual input frequency. To improve
accuracy you can add or subtract a few microseconds in the code to
compensate if your Arduino crystal is off frequency by a small amount.



Arv

Jun 15, 2018

Yes you can use this idea to make an Arduino based frequency meter but for the
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higher frequencies encountered on HF bands you will need to add a pre-scaler. That
will bring the HF signals down to where they can be measured by the pulse-width
functions in Arduino libraries.
A better way might be to use something like a 74HC4060 as a pre-scaler and make
your Arduino software interrupt-driven so it toggles at LOW->HIGH transitions of
the pre-scaled signal. Then use the micro-seconds() counter to determine time
between subsequent LOW->HIGH transitions and calculate the frequency. Since
some Arduino boards use a ceramic resonator for the 16 MHz oscillator you may
see some temperature induced drift. Frequency correction can be done in software
but this does not stop the drift. There are some Arduino Pro-mini boards available
from Ebay vendors that use a real crystal for the 16 MHz oscillator. These are much
better for Arduino-based frequency counters.
[K7HKL]



MRBRAINERPOP

Aug 06, 2016

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I built this circuit as per your instructions & tested it against my O-scope. I get a non-lin
additive drift of about 15hz per 100 ie.: 100hz= 114.7 to 15ish (arduino output floats) ,
200hz= 230ish etc from my frequency generator. My O-scope verifies that the generator
is right on the money. Is this an inherent accuracy expectancy or could something else
OK, I Understand

be at play here? How accurate where your readings? Any ideas or input greatly appreciated.



Arv K7HKL

Aug 16, 2016

/* fcounter.ino

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This code is based on a simpler version that has become standard among Arduino users. Some problems with the original code have been fixed and operation speed has been improved (slightly).

Arv K7HKL 2016

STRATEGY:

This code is actually a period counter with conversion of period to frequency in software. Refresh time is less for higher frequency inputs, which provides a pseudo auto-ranging operation.

A prescaler is needed for frequencies higher than one third CPU Clock. If a prescaler is used, its division factor should be set in the "int prescale = N;" code line. This will cause frequency to be multiplied by the pre-scal factor before it is written to the LCD. Higher prescale factors may noticeably slow counting of VLF and audio signals.

*/

#include <LiquidCrystal.h>

LiquidCrystal lcd(2, 3, 4, 5, 6, 7); // LCD pin connections

int Htime; // integer for storing high time

int Ltime; // integer for storing low time

float Ttime; // integer for storing total time of a cycle

float frequency; // for storing frequency

int prescale = 1; // change this if a pre-scaler is added

void setup()

{

pinMode(8,INPUT); // pin D8 is frequency input

lcd.begin(16, 2); // set LCD = 16 char by 2 lines

lcd.clear(); // clear the whole LCD

lcd.setCursor(0,0); // set cursor to the first character, top line

lcd.print(" Frequency"); // label the LCD top line

}

void loop()

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Htime=pulseIn(8,HIGH); //read high time

Ltime=pulseIn(8,LOW); //read low time

Ttime = Htime+Ltime; // total time = high time + low time

OK, I Understand

```
frequency=1000000/Ttime; //calculate frequency from Ttime in Micro seconds
frequency = frequency * prescale; // handle any pre-scaler division factor
lcd.setCursor(0,1); // set cursor to first character of LCD second line
lcd.print(" "); // clear the second line
lcd.setCursor(0,1); // set cursor to first character of LCD second line
lcd.print(frequency); // print frequency on LCD second line
lcd.print(" Hz"); // add suffix to show measurement is in Hz.
}
```



Socaltilt

Jul 01, 2018

Would this work with a frequency range of 108-136 MHz? I would like to add this to
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a Airband Receiver project. What would I have to change in order to get these frequencies displayed? "int prescale = 1; // change this if a pre-scaler is added"
Would you still recommend the 74HC4060 chip substitution?



Pete Cineema

Sep 05, 2016

Great project ! I'm just starting with the Arduino and would like to put this project
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together. I'm in the USA and I can't find the LCD JHD_162ALCD referred to in the companion article (LCD is interfaced with Arduino). Can anyone provide a source for the LCD or is there an alternative (please provide part nbr) ? Also, the sketch refers to the LiquidCrystal.h library: Being new to the Arduino is this part of the Arduino code base or do I need to download the library from some where? Any help is appreciated !
Thanks.



(/users/abhishek)

Abhishek (/users/abhishek)

Oct 01, 2016

You can use any 16x2 LCD, no need to get exact one.
Log in (/user/login?destination=node/290%23comment-form) or register (/user/register?destination=node/290%23comment-form) to post comments
And LiquidCrystal.h is the part of Arduino code base, you just need to use latest Arduino IDE to burn the code: <https://www.arduino.cc/en/Main/Software>
(<https://www.arduino.cc/en/Main/Software>)



(/users/aswinth-raj)

Aswinth Raj (/users/aswinth-raj)

Jul 01, 2018

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You can buy any 16*2 Alphanumeric LCD module that is available in your local market. It should be easy for you to find one in you local

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hardware store. The LCD library for Arduino will be loaded by default in your Arduino IDE so you don't have to worry about it.

All the best.



Lee

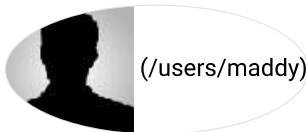
Oct 04, 2016

Hi, I want to measure a phonic wheel sensor which submit between 0 hz to 1300 hz, I

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wonder if this method could shows accurate results for this range?

Lee



Maddy (/users/maddy)

Oct 07, 2016

This circuit can measure upto 1MHz of frequency but it is most

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suitable for measuring frequency of digitally generated Square wave.



Salvatore

Nov 04, 2016

this simple code has helped me to simplify my ground capacitive moisture meter .

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I had all the pins in Arduino Uno engaged and I could not use the Frequencycounter library that requires the pin D5 free.

thank you !!

Best regards friend



thirumalai

Nov 22, 2016

after programming whether the led name (L) will blink or not blink or stand steadily

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waseem abbas khan

Dec 07, 2016

hy, every one.

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Moumita

Mar 21, 2017

OK, I Understand



Where to connect the capacitor c1 and c2

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harish

Apr 15, 2017

Can i use 20*4 lcd display ??If possible ,how?

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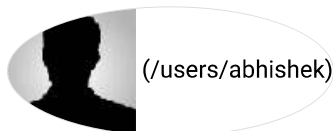
harish

Apr 18, 2017

why the hell the frequency is changing when we are changing 47k pot for same signal.

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For a particular signal it should show some frequency,for different signals it should show different frequency . Frequency counter means it should count the frequency of the given signal ,for example if we give our household power signal it should show approx 50 Hz. I am not able to understand the main idea behind signal generator(using 555 timer), when the input signal is fed to the arduino through schmitt trigger gate arduino will count number of pulses passing per second from which we get frequency then what is the use of dummy signal generator there ???



Abhishek (/users/abhishek)

Jul 05, 2017

house hold AC can damage the circuit, and if you have square

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wave of known frequency you can provide input from that too. Here 555 is just to give demonstration of the protect.



Louis

Jul 04, 2017

Worked like a charm!

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Sayantana

Jul 16, 2017

Can we use a simple NOT gate instead of your Schmidt Trigger NOT gate???

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If not plz tell in short why. What's special with this 7414 gate?

Leifjoha

Nov 11, 2017

OK, I Understand



1.

You must find the correct libraries for the LCD you have. For me I use

```
#include <LCD.h>
```

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```
#include <LiquidCrystal_I2C.h>
```

2.

You made one measuring of time and then display the floating number of frequency.

You will get a more correct measuring as an average of several measuring's. I have placed a for .. until loop with counter to 1000 and add up Ttime in variabel Tsum and then calculate frequency from Tsum/1000. You can also convert this frequency to an integer if you like

```
frekvens=long(frequency+0.5);
```

3.

I have a better way don't use pulseIn() function because this is an indirect way and have many complicated process's , but count the number of transitions from HIGH to LOW (or LOW to HIGH) in a second that is frequency.

/*

```
**Frequency counter - count the number of trasitions from HIGH to LOW in a second
```

```
**The use of LCD is taken from other programs
```

*/

```
#include <Wire.h>
```

```
#include <LCD.h>
```

```
#include <LiquidCrystal_I2C.h>
```

```
#define I2C_ADDR 0x27 // <----- Add your address here. Find it from I2C Scanner
```

```
#define BACKLIGHT_PIN 3
```

```
#define En_pin 2
```

```
#define Rw_pin 1
```

```
#define Rs_pin 0
```

```
#define D4_pin 4
```

```
#define D5_pin 5
```

```
#define D6_pin 6
```

```
#define D7_pin 7
```

```
long frekvens;//storing frequency - danish for frequency
```

```
long number; // counter for transitions
```

```
long time1; // starttime for 1 second in micros()
```

```
long time; // measuring time in micros()
```

```
LiquidCrystal_I2C lcd(I2C_ADDR,En_pin,Rw_pin,Rs_pin,D4_pin,D5_pin,D6_pin,D7_pin);
```

```
void setup()
```

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```
lcd.begin (16,2); // <----- My LCD was 16x2
```

```
pinMode(8,INPUT); //impuls ind på digital ben nr 8
```

```
Serial.begin(9600);//initialize the serial
```

OK, I Understand

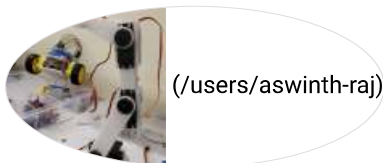
```
// Switch on the backlight
lcd.setBacklightPin(BACKLIGHT_PIN,POSITIVE);
lcd.setBacklight(HIGH);
lcd.home (); // go home
}

void loop()
{
  number=0;
  time1=micros();

  do
  /* loop for one second*/
  {
    if (digitalRead(8)==HIGH)
    {
      do
      {
        /* empty loop waiting for transition*/

      }
      while (digitalRead(8)==HIGH);
      /* now from HIGH to LOW */
      number++;
    }
    time=micros();
  }
  while (time<(time1+1000000));

  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("Frequency :");
  lcd.setCursor(0,1);
  lcd.print(number);
  lcd.print(" Hz");
  delay(1000);
}
```



Aswinth Raj (/users/aswinth-raj)

Nov 14, 2017

True that! nice suggestions

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Jk

Aug 12, 2018

Can you share with me your libraries?

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```
#include <LCD.h>
```

```
#include <LiquidCrystal_I2C.h>
```

Please!!



marcel

Dec 15, 2017

Hello community,

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I have a problem regarding to the pulseIn() function. I am using an Arduino Micro for my work.

The problem is that I get false results in PWM measurement. I used the Code shown on this page. My PWM Signal is simulated by the Arduino and has 2Hz.

My Serial Monitor just Shows for HIGH and LOW both 0 and for the frequency it shows inf (Infinite?? Dont know what that is). I already tried to change pins, the timeout length and even used external HIGH or LOW to measure a pulse which still gave me a 0 as time in Serial Monitor....

here is my Code:

```
int PWM = 8; // Input for the frequency
int READYLED = 10; // PWM generator
float T = 0;
int L;
int H;
float frequency;
```

```
void setup() {
  Serial.begin(9600);
  pinMode(PWM, INPUT);
  pinMode(READYLED, OUTPUT);
}
```

```
void loop(){
  digitalRead(PWM);
  H = pulseIn(PWM, HIGH, 300);
  L = pulseIn(PWM, LOW, 300);
```

```
T = H+L;
```

```
frequency=1000000/T;
```

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```
digitalWrite(READYLED, HIGH);
delay(250);
digitalWrite(READYLED, LOW);
delay(250);
```

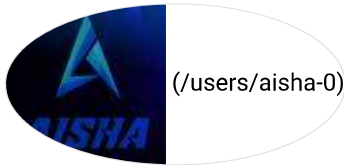
OK, I Understand

```
}

```

it would be nice if you guys could help me with that problem.

best regards,
Marcel



AISHA (/users/aisha-0)

Dec 19, 2017

I doubt problem is more with your hardware. Are you sure you

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are getting nice PWM at the input? Also what is the use of "digitalRead(PWM);"

You can try using the forum for this question



noname

Jul 06, 2018

I may be wrong, but aren't you trying to read pwm with the same arduino that

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generates it? When you want to detect a pulse it is not there because at the end of the loop you turned the signal low. H and L are 0, so dividing 1000000 by 0 gives you an error.



thilak

Jan 21, 2018

This is fantastic. Good job. Thanks.

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DMonty

Apr 07, 2018

Can you PLEASE post a diagram of how the 555 and SN54 are connected? I had it

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working last week and for the life of me I cannot get it working again! Better yet, post a diagram of the entire circuit. Whenever I run the sketch I only get ~60Hz, which is the powerline frequency. I had it working perfectly and then when I went to implement it into my lighted electric drum project it no longer worked.



Moaz

Apr 9, 2018

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yogybear

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May 10, 2018

Very nice and well explained project. My questions are:

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No1: may I use HEF40106BP (CMOS HEX SCHMITT TRIGGER) as a substitute of 74LS14?

No2: Quote:"For filtering the noise we have added couple of capacitors across power."
(End of quote.)

Do you mean the +5V DC power pin and Gnd pin of the Aduino board, or the Vcc pin of the Schmitt trigger IC?

Best regards



(/users/zidane-santos)

zidane santos (/users/zidane-santos)

Apr 08, 2019

Olá alguém pode me ajudar a desenvolver um simulador de

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roda fonica com arduino que tenha display e ajuste de rotação?



(/users/pete-1)

Pete (/users/pete-1)

Apr 30, 2019

I am certainly not a expert about this stuff, or about anything, for that

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matter, so, if you see something wrong with my conclusions, please let me know.

My conclusions:

Below 707 Hz, it is able to resolve on one Hz difference.

At ten kiloHertz, resolution is down to about 100 Hertz.

Audio range: Even if you consider the top of the range to be 15 kHz, you can't come any closer than about 300 Hz to the actual frequency at that point.

At one hundred KiloHertz, the minimum difference it can resolve is 11.1 kilohertz. For

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instance, if you wanted to know whether the actual signal was 100 kHz or 108 kHz, you'd never know. All you would see is some number in that range, and, possibly that number jumping up or down by 11.1 kiloHertz from one sample to the next.

OK, I Understand

At one megaHertz, there would be a one megaHertz minimum resolution! No, it really won't be useful anywhere near to one megahertz and certainly not beyond.

If you can live with this lack of precision, or whatever you call it, then this circuit is for you.

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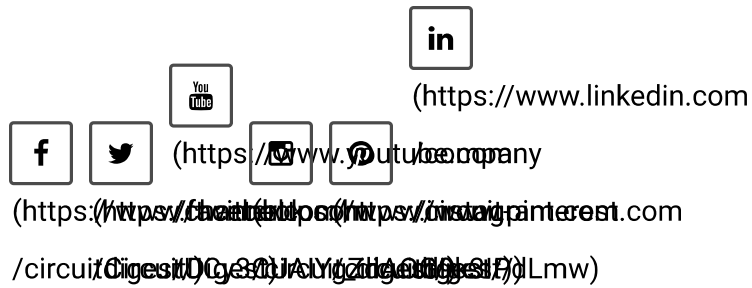
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New Whitepaper for LED drivers in automotive rear lighting by Texas Instruments.

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