ARDUINO ELECTRONICS ENGINEERING HARDWARE HOWTO

Jul 5, 2008 DanielAndrade 97 Comments

Hello people, it's been a while since I have posted projects on this website. This semester was really busy, I didn't have time to much else, but soon I will have my winter holiday (Here in south our summer holiday is from December to February).

SEARCH

TOP POSTS

HOWTO: BLINKING LEDS
HOWTO: EXTERNAL WINAMP CONTROL
10 THINGS TO DO JUST AFTER INSTALLING UBUNTU 7.10
TEMPERATURE SENSOR + ARDUINO
HOW TO MAKE YOUR IPHONE BATTERY LAST LONGER

RECENT COMMENTS

- (James L): This is a mystery. Of course
- (Levi): How should the potentiometer b
- (Burnoutsyndromsymptome): Err, this page has a messed up
- (sush): heya..can anyone plz tell me d
- (Scott): I've made the winamp remote a
- (Kay): Settings > Store> View A

Today I am going to show you how to build a simple temperature sensor using one **LM35 Precision Temperature Sensor** and Arduino, so you can hookup on your future projects. The circuit will send serial information about the temperature so you can use on your computer, change the code as you will. I'm planning to build a temperature sensor with max/min + clock + LCD, and when I get it done, I will post here.

Parts:

Arduino (You can use other microcontroller, but then you will need to change the code).
LM35 Precision Centigrade Temperature Sensor, you can get from any electronic store. Here is the DATA SHEET.
BreadBoard

Assembling:
This is a quick and simple step. Just connect the 5V output from arduino to the 1st pin of the sensor, ground the 3rd pin and the 2nd one, you connect to the 0 Analog Input.

Down goes some pictures that may help you, click to enlarge:

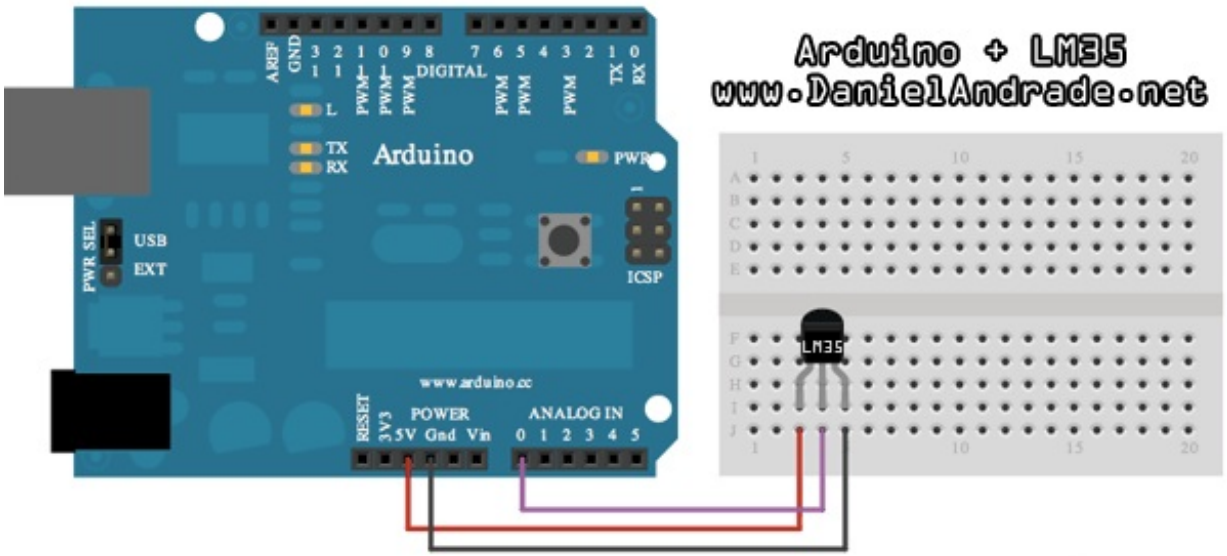
- (Kay): Thank you! I did not realize
- (mar): thanks
- (jens): hello, i was wondering if i
- (DanielAndrade): @Dr it is NOT incorrect! :0)

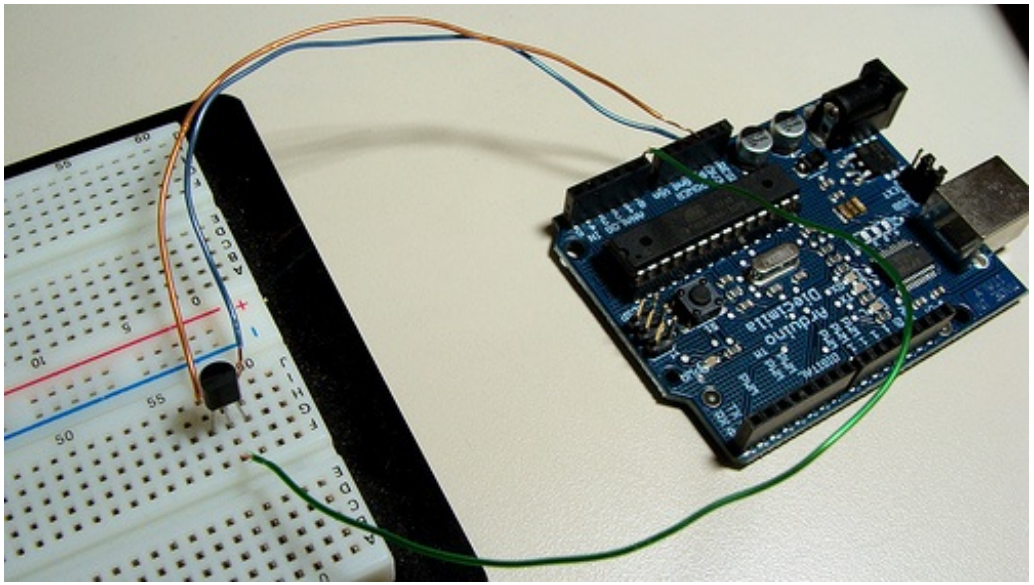
STATUS

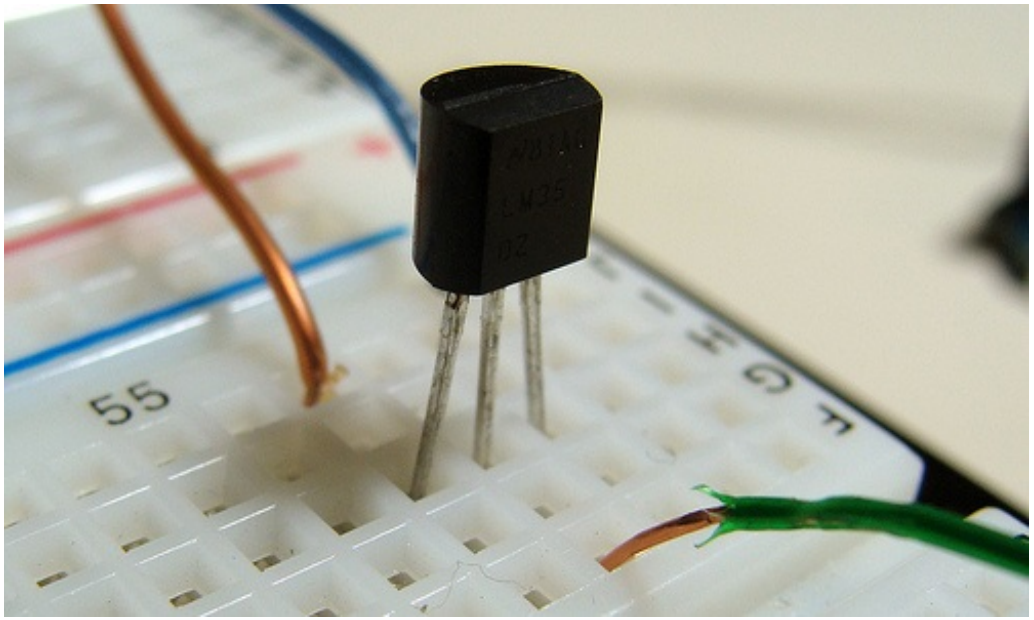
Posts: 190
Comments:1383
Comments/Posts: 7

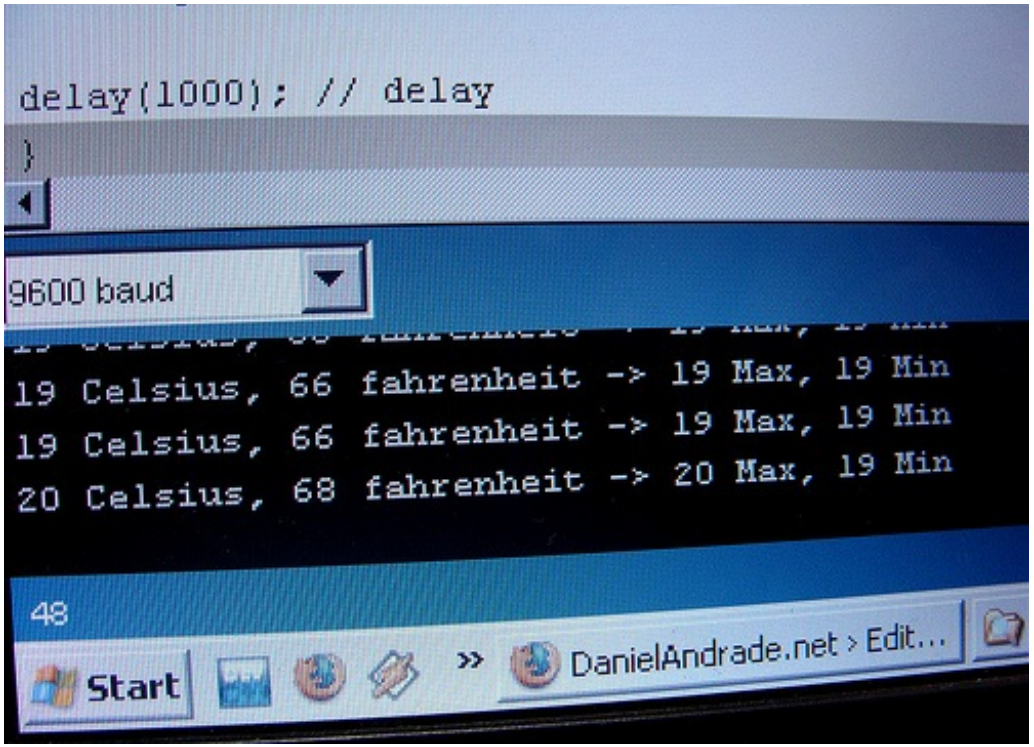
I SUPPORT

I support the Open Source Hardware Definition v1.0









Here is the **Arduino** Code, just upload it and check the **Serial Communication** Option.

You can also download the **.pde** HERE.

```
/*
An open-source LM35DZ Temperature Sensor for Arduino. This project will be
(cc) by Daniel Spillere Andrade , http://www.danielandrade.net
http://creativecommons.org/license/cc-gpl
*/

int pin = 0; // analog pin
int tempc = 0,tempf=0; // temperature variables
int samples[8]; // variables to make a better precision
int maxi = -100,mini = 100; // to start max/min temperature
int i;

void setup()
{
  Serial.begin(9600); // start serial communication
}

void loop()
{


for(i = 0;i< =7;i++){ // gets 8 samples of temperature

  samples[i] = ( 5.0 * analogRead(pin) * 100.0) / 1024.0;
  tempc = tempc + samples[i];
  delay(1000);

}

tempc = tempc/8.0; // better precision
tempf = (tempc * 9)/ 5 + 32; // converts to fahrenheit

if(tempc > maxi) {maxi = tempc;} // set max temperature
if(tempc < mini) {mini = tempc;} // set min temperature
```

```
Serial.print(tempc,DEC);
Serial.print(" Celsius, ");

Serial.print(tempf,DEC);
Serial.print(" fahrenheit -> ");

Serial.print(maxi,DEC);
Serial.print(" Max, ");
Serial.print(mini,DEC);
Serial.println(" Min");

tempc = 0;

delay(1000); // delay before loop
}
```

Anything just ask!

9

lucas goulart July 7, 2008 at 1:30 pm REPLY

nice and quick project!

Ricardo Boabaid July 10, 2008 at 11:21 pm REPLY

You rock man... Your website is awesome!

Silver July 19, 2008 at 5:29 am REPLY

Hey Daniel,

I did almost the same thing back in May and posted it to LadyAda's website. However, mine didn't have the nice pictures yours has. Nice job.

http://forums.ladyada.net/viewtopic.php?t=5763

Temperature sensor + Arduino | The Kevin Pipe July 19, 2008 at 6:00 am REPLY

[...] writes-Today I am going to show you how to build a simple temperature sensor using one LM35 Precision Temperature Sensor and Arduino, so you can hookup on your future projects. [...]

John July 19, 2008 at 10:10 am REPLY

I don't understand where the multiplying by 5 comes from here:

samples[i] = (5.0 * analogRead(pin) * 100.0) / 1024.0;

Cool Project, thanks!

Oscar G. July 19, 2008 at 12:05 pm REPLY

Hello guys,
Cool and easy to understand circuit. Well done!
I have made a similar one as tutorial at my friend blog uchobby.com using Arduino adn LM35, including RPM fan control. I've used basicaly the same this as well as same formula to get temperature value. You can heck it out here:
http://www.uchobby.com/index.php/2007/09/23/arduino-temperature-controlled-pc-fan/

Also would be fun to check also by website (in spanish):
http://www.bricogeek.com

Best regards from spain and keep on the good work!
Oscar G.

Les Garwood July 19, 2008 at 2:00 pm REPLY

Hi,

Thanks for sharing; it will be helpful to me. I'm working on a similar project. I used Silver's code, mentioned above, to get me off the ground, but now I have to advance it and your code will help improve my understanding and capability, so thanks again.
Currently, I'm on the hunt for code that will display a bar graph in real time of the temperature data. So far, this has been daunting.

Regards,

Les

Jim Tobias July 19, 2008 at 6:01 pm REPLY

how many of the sensors can be connected to 1 arduino, and how long can the wires be? thanks, and sorry for the ignorance….

Chief Robot July 19, 2008 at 8:28 pm REPLY

Great post!
I am also currently working on a similar project. I have the LM35 working and have just received my LCD 16 X 2 screen. Now to solder on the header pins….
How would you alter your code to not only give a readout of the temperature, but also turn something on and off like a small fan?

Silver July 20, 2008 at 5:04 am REPLY

John,

Short answer:
The 5 refers to the 5v supply voltage.

Long answer:
The Analog to Digital Converter (ADC) compares a sample voltage to the supply voltage and provides a digital number based on 1024 steps. The formula (Sample Voltage * 1024 / Supply voltage) shows that 2.5volts * 1024 / 5volts would result in a digital number of 512 which is what we would expect for a voltage half the supply voltage.

To get the find the sample voltage from a digital number the formula is reversed (Digital number * supply voltage / 1024). So our count of 512 would give (512 * 5volts / 1024) and tell us that there is 2.5volts on the sample pin.

However, that doesn't explain the 100 in his formula. That is there because the LM35 supplies 10 millivolts per degrees Celsius. So, let's look at an example. The room temperature is 19 Celsius which means the LM35 supplies 190 millivolts, or .190volts. Putting that number into the first formula (.19volts * 1024 / 5volts) means we would expect to see a digital number of 39 on the analog pin. So let's say we do get a reading of 39, what does the program do with it?

The formula in the program says (5volts * 39 * 100 / 1024) which equals 19 meaning 19 Celsius. As I said in my program, a close approximation of the temperature in Celsius can be found by dividing the input number by 2. Daniel's program divides the number by 2.048 (5 * 100 / 1024) which is a little more accurate but because both programs are using integer values, the result is roughly the same. Use which ever formula you will be able to understand when reading your program six months from now. (grin)

Silver

GB Vehicles Info » Blog Archive » Temperature sensor + Arduino July 22, 2008 at 8:09 am REPLY

[...] writes- Today I am going to show you how to build a simple temperature sensor using one LM35 Precision Temperature Sensor and Arduino, so you can hookup on your future projects. [...]

Bruce Schechter July 23, 2008 at 3:36 pm REPLY

I like this! I previously used a Dallas 18B20 sensor, which is far more accurate but works over a one-wire interface, making it tough to program. This seems plenty accurate enough, so I'll give it a try!

Not that it makes much of a difference, but you really don't require the array samples[i] to perform averaging. A single variable can easily be used to keep a running total, which can be zeroed out after each reading.

Raj July 26, 2008 at 8:45 am REPLY

Hey,

Can you tell me how you connect the Arduino board to PC? What is the cost of that board?

Skyler July 27, 2008 at 6:52 pm REPLY

Great tutorial! This makes a very nice and easily put together temperature sensor.

DELACREW.net WEBLOG » Blog Archive » Arduino a go-go July 31, 2008 at 5:03 pm REPLY

[...] http://www.danielandrade.net/2008/07/05/temperature-sensor-arduino/ [...]

Flavio Curella July 31, 2008 at 7:12 pm REPLY

Didn't you use any resistance from 5v to the temp sensor?

DanielAndrade July 31, 2008 at 8:32 pm REPLY

@Raj Just use a USB cable. It costs around U$34.

@Flavio No need to.

Brutus August 10, 2008 at 2:15 am REPLY

Just played with this and changed one thing:

Since the Arduino default vref is 5V, the analog read from 0 to 1024 represents 0 to 5V.

Changing the Vref to internal, means the Arduino will use 1.1V as a reference. This gives you more precision in the reading, and helps calm down the 19/20 degrees changes you see. the 0 to 1024 now represents 0 to 1.1V (So long as your arduino uses the ATmega168)

In your setup(), add this line:
analogReference(INTERNAL);

and your formula:
samples[i] = (5.0 * analogRead(pin) * 100.0) / 1024.0;

could be changed for simplicity to
samples[i] = (analogRead(pin) * 500.0) / 1024.0;

and so you would update to
samples[i] = (analogRead(pin) * 110.0) / 1024.0;

This will give you a more precise reading from the sensor. (Just don't exceed 100 degrees Celsius with the sensor, as it will then generate a voltage higher than vref)

Also.. a delay(200) is quite enough of a delay between sample reads.. the sensor output is constant, so the 8 samples can be accomplished in 1/5 of the time. Just change your main loop delay to a higher value, something of the order of delay(5000).

At least here, I noticed a more stable operation.

If your arduino uses the ATmega8, the above will still give a more precise reading, but you will need to change the formula to:
samples[i] = (analogRead(pin) * 256.0) / 1024.0;

which in this case could be simplified again to
samples[i] = analogRead(pin) / 4.0;

AnalogReference page:
http://www.arduino.cc/en/Reference/AnalogReference

jorge November 27, 2010 at 3:59 pm REPLY

I´m using ARDUINO Diecimila.

Will my LM35 sensor is faulty? For my reading in celcius have very high values, 99, 104 degrees ?

DanielAndrade August 10, 2008 at 12:19 pm REPLY

@Brutus great comment, I will take a look at that! Thanks for sharing!

Michael Higgins September 9, 2008 at 9:39 pm REPLY

Is there a way to make this sensor work for liquids, in particular pond water. what is the max length for a cable between board and sensor. I hope this string has not been abandoned.

Michael Higgins September 10, 2008 at 12:56 am REPLY

SOLAR WATER HEATER PUMP CONTROLLER
I want to make a simplistic controller for a solar water heater pump, for a fish pond. It would consist of a solar water heater panel with an air temp sensor LM35 inside panel box. A 120VAC submersible pump, a 3000gal fish pond with a water temp sensor LM35 (waterproofed), and a controller box supplied by 120VAC.
The logic should be
1. If the pond water Temp is below ~75°F, and the Solar Panel Temp is above ~90°F, Turn ON AC to the pump.
2. If pond water Temp reaches ~80°F, Turn OFF pump
3. If pond water drops to ~68°F sound remote alarm
*Temperatures should be variables that can be adjusted
What do I need to make this controller and program it, I am thinking this is well within the capabilities of the Arduino board. But maybe someone has a better solution. I am a novice but have skills in board assembly but little programming experience.

action_owl September 12, 2008 at 11:04 pm REPLY

is it possible to save the temperature readings to an SD card or USB flash drive?

DanielAndrade September 13, 2008 at 12:12 pm REPLY

@Michael Higgins, yes, it's possible to do that, take a look gere:
http://www.instructables.com/id/Waterproof-a-LM35-Temperature-Sensor

@action_owl Yep, on the web you will find information about that. I haven't tried yet, but I want to do it too. If you do it, please share with us!!

dharmang September 18, 2008 at 5:18 pm REPLY

hey i tried using the same code and the sensor, the only problem i faced it it doesn't show

anything. I am working with arduino decimila 0011 is it anything related to software or the hardware ??

dharmang September 18, 2008 at 5:22 pm REPLY

it just shows
Done uploding
Binary sketch size: 3578 bytes (of a 14336 byte maximum)

DanielAndrade September 22, 2008 at 2:33 am REPLY

@dharmang After uploading, you must check the serial communication option. have you tried that?

Collin September 29, 2008 at 1:56 am REPLY

This is great! I'm using your code to make an Arduino thermostat. Im going to use it to control the temperature in my Bull Snakes cage. But Im sure it would work great for a Kegerator or various other projects.
Heres what Ive come up with so far.

```
/*
An open-source LM35DZ Temperature Sensor for Arduino. This project will be enhanced on a regular basis
(cc) by Daniel Spillere Andrade , http://www.danielandrade.net
http://creativecommons.org/license/cc-gpl
*/

int heat = 2; // heater output on pin 2
int pin = 0; // analog pin
int tempc = 0, tempf = 0; // temperature variables
int samples[8]; // variables to make a better precision
int maxi = -100,mini = 100; // to start max/min temperature
int i;

void setup()
{
pinMode(heat, OUTPUT);
Serial.begin(9600);
```

```
backlightOn();
}

void loop()
{

for(i = 0;i maxi) {maxi = tempf;} // set max temperature
if(tempf = 85) {digitalWrite(heat, LOW); // turn heater off if temp is 85 or higher;
clearLCD();} // Removes HEATING from lcd

delay(10);
Serial.print(0xFE, BYTE);
Serial.print(128, BYTE); //position line 1 c1
Serial.print(tempf); //display Temp F data
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(132, BYTE); //position line 1 c4
Serial.print("fahrenheit"); //display Temp F
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(192, BYTE); //position line 2 c1
Serial.print(tempc); //display Temp C data
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(196, BYTE); //position line 2 c4
Serial.print("Celsius"); //display Temp C
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(148, BYTE); //position line 3 c1
Serial.print("Max"); //display Temp Max
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(152, BYTE); //position line 3 c4
Serial.print(maxi); //display Temp Max data
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(212, BYTE); //position line 4 c1
Serial.print("Min"); //display Temp Min
delay(10);
Serial.print(0xFE, BYTE);
Serial.print(216, BYTE); //position line 4 c4
Serial.print(mini); //display Temp Min data
```

```
tempc = 0;

delay(500); // delay before loop
}
void backlightOn(){ //turns on the backlight
Serial.print(0x7C, BYTE); //command flag for backlight stuff
Serial.print(157, BYTE); //light level 157 = 100% 128 = off
}
void clearLCD(){
Serial.print(0xFE, BYTE); //command flag
Serial.print(0×01, BYTE); //clear command.
}
```

dharmang November 2, 2008 at 11:54 pm REPLY

hi again but i was thinking if you can guide me out with sending real time data on to web for temperature and humidity !!! through http://www.pachube.com !!!

Jeff Bricker November 4, 2008 at 11:55 am REPLY

I set up something similar with a LM34 (which reads in degrees F).
The device would overheat unless I put a current limiting resistor in series with the LM34. (10K at Vs). I don't see the resistor on anyone else's circuit, am I missing something?

Paul November 21, 2008 at 6:01 am REPLY

Hi,

Would any one have any idea how to modify this to work with an LM135?

http://www.jaycar.com.au/products_uploaded/LM135.pdf

Thanks

Bookmarks about Sensor December 25, 2008 at 3:30 am REPLY

[...] – bookmarked by 2 members originally found by postforvibhu on 2008-11-17 Temperature Sensor + Arduino http://www.danielandrade.net/2008/07/05/temperature-

sensor-arduino/ – bookmarked by 6 members [...]

Edward January 4, 2009 at 4:08 pm REPLY

Hey Paul,

This can easily be used with an LM335 (135,235). The only modification to the code is to subtract 273.15 from your samples[i]to convert from Kelvin to Celsius.

On the hardware side, you only use 2 pins with the LM335. Your reference voltage connects to the center( ) pin through a 2k2 resistor and the negative pin goes to ground, Analog 0 then connects directly to the center pin.

That's the way I have things set up, and it seems to be working well.

Vbryan January 14, 2009 at 1:09 pm REPLY

How to do this with Temprature-Sensor SMT 160-30 ?

Richard January 14, 2009 at 8:57 pm REPLY

Hi Daniel,

Any progress on adding the LCD and RTC to this project yet? Im a noob and i will be using this as part of my own learning project.

DanielAndrade January 15, 2009 at 9:28 pm REPLY

Richard, not yet, right now I am traveling in USA, but this year I will do for sure! Thanks for reading!

Online Kurser - Video Guider - Video Foredrag - Podcast Foredrag » Archive » arduino singleboard ressourcer January 17, 2009 at 12:07 pm REPLY

[...] kode til lm35 temperatur måling med arduino [...]

ScaredyCat January 30, 2009 at 12:10 pm REPLY

The ladyada.net link shows the use of a resistor – your circuit doesn't .. was it an omission or is it not needed?

ScaredyCat January 30, 2009 at 12:40 pm REPLY

Ok,

Just to reply to my own question. Without the resistor you will only be measuring temperatures of +2 Deg C to 150 Deg C. If you want to measure the full -55 Deg C to +150 Deg C you need the resistor.

DanielAndrade January 30, 2009 at 10:57 pm REPLY

@ScaredyCat Thanks for sharing this!

rascunho » Blog Archive » links for 2009-01-31 January 31, 2009 at 6:06 pm REPLY

[...] Temperature Sensor + Arduino at DanielAndrade.net Today I am going to show you how to build a simple temperature sensor using one LM35 Precision Temperature Sensor and Arduino, so you can hookup on your future projects (tags: http://www.danielandrade.net 2009 mes0 dia31 arduino temperatura sensor) [...]

joel s. bacoor March 2, 2009 at 4:00 am REPLY

can i use zilog? what is the code when i use zilog?

faby February 2, 2011 at 10:16 am REPLY

pls help me by sending details about the arduino lilypad,for doing my project related to robotic textiles

Silent Dream » Blog Archive » Das erste Projekt March 25, 2009 at 7:45 pm REPLY

[...] Sonsitge wichtige Links: LCD4Bit Library, ohne die das Sketch nicht läuft LM35 Turotial auf danielandrade.net [...]

Sensor de Temperatura con Arduino y Delphi | The Penguin Cult Labs REPLY
April 5, 2009 at 5:37 am

[...] algunos datos esta vez desde Arduino hacia Delphi. Asi que decidi poner en práctica el tutorial de Daniel Andrade sobre sensado de temperatura en Arduino con un LM35, modificar un poco su C&oacutedigo y [...]

jpang April 20, 2009 at 7:37 pm REPLY

You guys are so admirable that you can build a solution like this. I am in the market looking for a temperature sensor which can alert me should the temperature goes out of range. To do this, I want to use SNMP utilities to make query on the temperature and send email alert if it is too high. The SNMP utility will also log data and plot graph.

How can we further develop your project to make it SNMP ready? Am I asking for too much?

atoweha May 1, 2009 at 1:13 pm REPLY

Hi, can you tell me what kind of temperature sensor you used? is it a 1K or 50? i want to try this project out and im buying the temp sensor you used. please email me back with the answer at Atoweha11@yahoo.com
thanks!

Rudolph July 7, 2009 at 3:39 pm REPLY

Hi, awesome tutorial !
I'm testing the code using an Arduino NANO and some LM35DZ-NS

The LM35 is hooked to 5v, Grd, A0

I'm getting "weird" temperature readings:

109 Celsius, 228 fahrenheit -> 109 Max, 100 Min
109 Celsius, 228 fahrenheit -> 109 Max, 100 Min

109 Celsius, 228 fahrenheit -> 109 Max, 100 Min

What can be the cause of this false reading ..?

Best regards

Simon August 10, 2009 at 6:40 pm REPLY

Good stuff, but I'm having a similar problem to Rudolph above – my temperature readings are all over the place. My room is warm, but I think I'd notice if it really was 415 deg C

>415 Celsius, 779 fahrenheit -> 416 Max, 100 Min
>415 Celsius, 779 fahrenheit -> 416 Max, 100 Min

I note in one of the entries above it says -

>Changing the Vref to internal, means the Arduino will use 1.1V as a reference. This gives you more precision in the reading, and helps calm down the 19/20 degrees changes you see. the 0 to 1024 now represents 0 to 1.1V (So long as your arduino uses the ATmega168)

I'm using a 328 – would that make a difference?

yalefe August 21, 2009 at 6:32 am REPLY

Hi
I don't understand
i copy your sketch (the first without LCD) but i obtain lot of warnings when i try to compil.(with Arduino v. 0017)

for exemple this :

Serial.print(" fahrenheit -> ");

error: missing terminating " character In function 'void loop()':

yalefe August 21, 2009 at 6:36 am REPLY

oups
sorry
i found the error with the "

yalefe August 21, 2009 at 7:24 am REPLY

@Edward

i have a lm335 and i try to do what you say , but i don't understand

what is your your reference voltage ? 3,3 V or 5 Volts ? and why a resistance ? is the same with 3,3 v then with 5 v ?
why don't use the pin Adjust on the LM335 ?
i connect as you say but the temp doesn't move (with or without my finger on the lm335)

can you show me your code, please ?

Sorry for my bad english, I'm french....

yalefe August 21, 2009 at 2:37 pm REPLY

ok , it's good

@Brutus

i don't understand how

this

samples[i] = (analogRead(pin) * 500.0) / 1024.0;

you update to this:

samples[i] = (analogRead(pin) * 110.0) / 1024.0;

DanielAndrade August 21, 2009 at 9:53 pm REPLY

@yalefe
you need to use the 5V for the code to work, otherwise the Analog-Digital converter will not work right.

Check the datasheet to see how many mV per temp.

Rmg August 23, 2009 at 7:20 am REPLY

The jumpy temperatures also come from the arduino not rounding for example

19.1 will become 19
and
19.6 will become 19

you can add 0.5 to your analog readout and with this you numbers get rounded

like this :

room_temp = (analogRead(ro_temp) * 110.0) / 1024.0 0.5;
(using internal ref)

19.1 0.5 = 19.6 > 19
19.6 0.5 = 20.1 > 20

CaptainObvious August 25, 2009 at 11:38 am REPLY

I'm so confused! I'm using the LM335AZ, and I've tried original method, and.. well realized it wasn't the same part.. so that was no good! But then I tried Edwards post.. and again, it was just way off. The original(obviously) was very high, 230C, and after trying Edwards.. dropped down to too low, almost a -3C, and it's not freezing(yet) in my room

@Edward, when you connect it as you were saying, just the 2 pins, AREF to center pin through a 2.2k resistor, and ground, grounded, with the output pin between the resistor and the thermistor, are you changing the analogReference in software to anything? I tried (INTERNAL) and still, way off.

But great write up on the sensor in use, haha hope you don't mind if I ask some questions!:X

yalefe August 25, 2009 at 1:40 pm REPLY

i connect a LM335 and it's good for me
i connect it as a calibrated sensor (p. 4 on the datasheet :
http://www.datasheetcatalog.org/datasheet/nationalsemiconductor/DS005698.PDF)

but when I try the changes proposed by Brutus (internal ref) is not working anymore

Anders Pedersen October 2, 2009 at 5:15 am REPLY

i don't get it, im getting readings like this.

?¦?Å¤??¦ä?îÄ????Dæb?¼¦?E¤??Îä??Ä????Dæ?¡¦?ÅX??¦ä??8???NDæb?½¦?ÅX??¦ä??D???FDæb
?¦æÅ¤??¦ä¶?Ä????´æb??¦?Å\??¦ä??$???NDæb??¦þÅ¤??¦ä¦?Ä???Ds1

Any one who knows what the problem can be?

DanielAndrade October 3, 2009 at 4:42 pm REPLY

@Anders, that's strange! Check only the analogRead of your AD, to see if it's working.

C October 8, 2009 at 11:06 am REPLY

@Anders – you've got the wrong baud rate set. Try 9600

Wouterk November 4, 2009 at 7:38 am REPLY

Hi,

I've been trying to get this working in exactly the same way as you did (also with arduino duemilanova).
I'm using the same code and hardware setup. Everything seems to be working just fine, but the temperatures i get are just not right, its giving me 71 degrees celcius when it should be like 20 degrees (room temperature).

I've tried different LM35's but they all do the same, what am i overlooking here? any help would be appreciated!

Grant December 9, 2009 at 10:30 am REPLY

I have a tip if you are powering through USB. Since it doesn't go through the voltage regulator, and USB rarely gives exactly 5v, you need to adjust for the voltage your USB port puts out.

Change "samples[i] = (5.0 * analogRead(pin) * 100.0) / 1024.0;" to "samples[i] = (voltage * analogRead(pin) * 100.0) / 1024.0;"

and at the top, add “float voltage = 5.0;”

Then measure the 5V and GND pins with a volt meter, and put in the actual voltage. In my case it was 4.71. This made my sensor (LM335) quite a bit more accurate.

rogkmyers December 10, 2009 at 9:33 am REPLY

@ Simon and Rudolph – my readings are … 307 Celsius, 584 fahrenheit, 307 Max, 100 Min, even after I tried Grant’s fix. I am using a Duemilanove atmega328. my usb voltage is 5.09

Also. if i put my fingers over the sensor, the temperature goes down, which is kinda good because, a fever of 300 C would be bad.

Diego December 12, 2009 at 9:05 pm REPLY

I have a question I’m using a teensy which uses a USB instead of a serial how could I modify the program?
Thanks in advance

DanielAndrade December 13, 2009 at 8:36 pm REPLY

@Diego, sorry, didn’t get what you are saying. Are you brazilian, if so. Fala em português mesmo.

Marcos December 15, 2009 at 5:56 pm REPLY

Danie, muito bom seu post!
Parabéns principalmente pela explicação da fórmula. Confesso que eu entendia mais ou menos essa parte. Agora ficou claro pra mim.
Abraço.

DanielAndrade December 15, 2009 at 7:45 pm REPLY

@Marcos , não esqueça de visitar o meu blog em português ->

http://blog.danielandrade.net
Valeu

Ross Dargan January 12, 2010 at 10:44 pm REPLY

This works well via USB, but is all over the place when powered via the mains! (I'm reading the results via Ethernet).

Has anyone else experienced this?

Ross Dargan January 13, 2010 at 12:22 pm REPLY

Here shows what I mean (sample taken every minute)
http://tweetphoto.com/8634960

Ta

Ross

DanielAndrade January 20, 2010 at 6:05 pm REPLY

@Ross Amazing! Good job

Erik January 30, 2010 at 9:30 pm REPLY

If you want to have a decimal value (ie 22.6), you can do this:

for (i = 0; i maxi) {maxi = tempc;} // set max temperature
if(tempc

Erik January 31, 2010 at 2:02 am REPLY

Not sure what happened to my comment.

If you want to show 22.6 for temp, multiply your constants by 10 and then you can get them out when you report the data.

for (i = 0; i

Dimitris February 3, 2010 at 12:08 am REPLY

Hi there,

anyone used a 1N4148 diode for temperature sensor? I'm trying to get results but I don't know how to convert the given voltage.

Francesco February 3, 2010 at 9:43 am REPLY

When you change Vref, the first reading isn't correct so I added a void reading soon after analogReference():

```
void setup {

/* … */

analogReference(INTERNAL);
analogRead( analogPin );

/* … */
```

Solar Pond Pumps March 4, 2010 at 3:18 am REPLY

Good post. I put you in RSS now so I can see more from you sometime again.

Paul Hopkinson March 13, 2010 at 8:21 pm REPLY

For anyone who wants to plug an LM35 directly into the Arduino board here is a version that uses analog inputs only to power
the LM35 sensor.

```
/*

Reads from a LM35DZ connected directly to an Arduino
Also prints the temperature to the serial monitor.

The circuit:
* LM35 Vcc connected analog input pin 0
* LM35 Vout connected to analog input pin 1
```

```
* LM35 Gnd connected to analog input pin 2

created 13th March 2010
by Paul Hopkinson [Modified from an original Tom Igoe sketch]

*/

// These constants won't change. They're used to give names
// to the pins used:

const int analogInPin = 1; // Analog input pin that Vout of the LM35 is connected to

int sensorValue = 0; // value read from the LM35DZ
int TempInCelcius = 0; // Calculated temperature in Celcius

void setup() {
// initialize serial communications at 9600 bps:
Serial.begin(9600);
}

void loop() {

// Setup analog port 0 as Vcc
pinMode(14, OUTPUT);
digitalWrite(14, HIGH);
// Setup analog port 2 as 0v
pinMode(16, OUTPUT);
digitalWrite(16, LOW);

// read the analog in value:
sensorValue = analogRead(analogInPin);

// Calculate Temperature in Celcius

TempInCelcius = ( 5.0 * analogRead(analogInPin) * 100.0) / 1024.0;

// print the results to the serial monitor:
Serial.print("\n Temperature = " );
Serial.print(TempInCelcius);
Serial.print(" Degrees c");

// wait 1 second before the next temperature reading

delay(1000);
}
```

hardik March 23, 2010 at 4:51 pm REPLY

hw can i interfacw the lm 358 with lm 35 to achive maximum gain??/??/ just plz.. rpl.. as soon aa possible…….thank you…….

Flavio July 2, 2010 at 1:50 pm REPLY

Hi everyone!
This code is great and simple for people like me just beginning with Arduino..
Could anyone tell me how to get also decimal values of temperature?
If I want to get 26.7 degrees or even better 26.78 degrees which part of the code do I have to modify? and how?..

Thanks!!!

Hughesy July 4, 2010 at 8:49 pm REPLY

Flavio,

That is not possible with this IC as it doesn't have the required precision. You will be able to out put values to 2 decimal places but they will be incorrect you require a more accurate sensor.

If you find one that is fairly cheap please let me know as I am also interested.

Flavio July 6, 2010 at 11:23 am REPLY

Hi Hughesy!
Actually I'm using a LM35CAZ that is quite precise but I paid one sensor 10 euro. That's ok for me 'cause I'm using it in a research project so I've a bit of money to spend on it..

But could someone help me and tell where and how to modify the code so that in my screen I'll get a 27.7°C or better a 27.78°C instead of a no-decimal value like 27°C?… Please!

ben February 24, 2011 at 4:36 am REPLY

Hi

You will need to change the variables that temperature values from int datatypes to double

i.e:
‘double samples[8];’ instead of ‘int samples[8];’

(int datatype only stores whole numbers)

Ben.

Capn Scott July 6, 2010 at 5:54 pm REPLY

Simon – your positive and negative are backwards…

faiz October 21, 2010 at 2:43 pm REPLY

please tell me the coding for program, if lm35 detect 150 degree Celcius, fan will on, and if below it will turn off..please help me ?..thank

luan November 29, 2010 at 2:17 am REPLY

Opa, sei que você é brasileiro né ? Então, eu estou trabalhando em um projeto que tem 1 sensor, um dallas 18B20. eu tentei usar esse código que vc utilizou e ele me retorna uma leitura 0°C,32F,0K … o que está totalmente equivocado.Tem alguma noção do pq ele não está lendo corretamente ?

DanielAndrade December 3, 2010 at 11:19 pm REPLY

Da uma olhada no datasheet do sensor, e ajusta os cálculos que deve funcionar!

mazai January 7, 2011 at 6:10 am REPLY

Hello.
What is the maximum distance between the temperature sensor and arduino can be?

Shiji February 16, 2011 at 1:19 pm REPLY

Dear sir
Can You tell me How can i keep milk at 35 degree centegrade in a electrical cooker
For all the day

thank u
shiji

Jason February 20, 2011 at 6:01 pm REPLY

Hi can this temperature sensor work on ATmega328?

ben February 24, 2011 at 4:22 am REPLY

Hi, thanks for doing this – very neat!

just minor note: the for loop in the code at the moment has a space that needs to be removed ‘i< =7' should be '1<=7'

ben February 24, 2011 at 4:25 am REPLY

oops sorry that should read: ‘i< =7' should be 'i<=7'

DanielAndrade February 25, 2011 at 1:00 am REPLY

@Jason yes it will!!
@Ben thanks, I’ll fix that! ^

Blaze March 5, 2011 at 11:14 pm REPLY

I am a beginner at using the Arduino Uno, and I hope you can help me with something that I am having trouble with. I used some of your code for a LM335 temperature sensor that I am using. I have made a buffer circuit to convert the

10mV/K into a degrees celsius circuit. The circuit outputs for 0 degrees and 100 degrees is 2.73V and 3.73V respectively; but I am having problems getting the arduino to display the temperature. Could you look at my code at tell me if I did something wrong? Where should my voltage from my circuit go into the Arduino (A0 pin?) Can you help me?

```
int pin = 0; //analog pin
int tempc = 0;

void setup()
{
Serial.begin(9600); //start serial communication
}

void loop()
{
tempc = (5 * analogRead(pin)*100)/1024;
delay(1000);

Serial.print(tempc, DEC);
Serial.print(" Celsius");
delay(1000);
}
```

gamezat March 22, 2011 at 9:32 pm REPLY

hello , i have built it and work greate
but any body develop software to read from ardino direact
thank you

Muzammil March 27, 2011 at 10:03 am REPLY

Hi i m having a ardunio Uno board n i uploaded the code but i m getting strange output

287 Celsius, 548 fahrenheit -> 288 Max, 100 Min
287 Celsius, 548 fahrenheit -> 288 Max, 100 Min

i have tried other options + i have changed lm35 and tested it again but its the same.
plz help

Dotklok + LM35 Temperature Sensor « DanielAndrade.net April 10, 2011 at 2:41 am REPLY

[...] Temperature Sensor + Arduino [...]

jens June 15, 2011 at 6:48 am REPLY

hello,

i was wondering if i could use this type of sensor to measure a water temperature, because i am using an arduino to control the water flood of a jaccuzi.

thxxx and greetings from Jens

sush July 11, 2011 at 5:52 am REPLY

heya..can anyone plz tell me dat can i use GH 311 ultrasonic tranciever module for temperature measurement?? earlier i used TS 601 and it worked quite well.
can anyone tell me the coding..!!!

Name (required)

Mail (not published) (required)

Website

Comment

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I use wordpress :)