https://www.halvorsen.blog

Arduino and ThingSpeak

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Arduino

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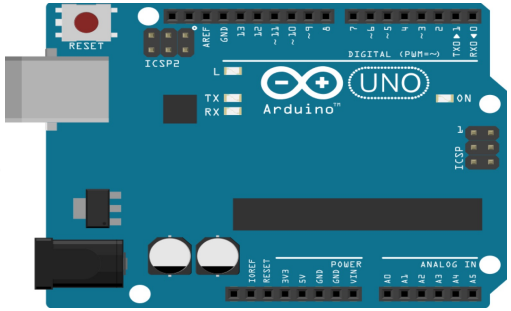
Arduino

- Arduino is an open-source electronics platform based on easy-to-use hardware and software.
- It's intended for anyone making interactive projects, from kids to grown-ups.
- You can connect different Sensors, like Temperature, etc.
- It is used a lots in Internet of Things projects
- Homepage: https://www.arduino.cc

Arduino

- Arduino is a Microcontroller
- Arduino is an open-source platform with Input/Output Pins (Digital In/Out, Analog In and PWM)
- Price about $20
- Arduino Starter Kit ~$40-80
  with Cables, Wires, Resistors, Sensors, etc.

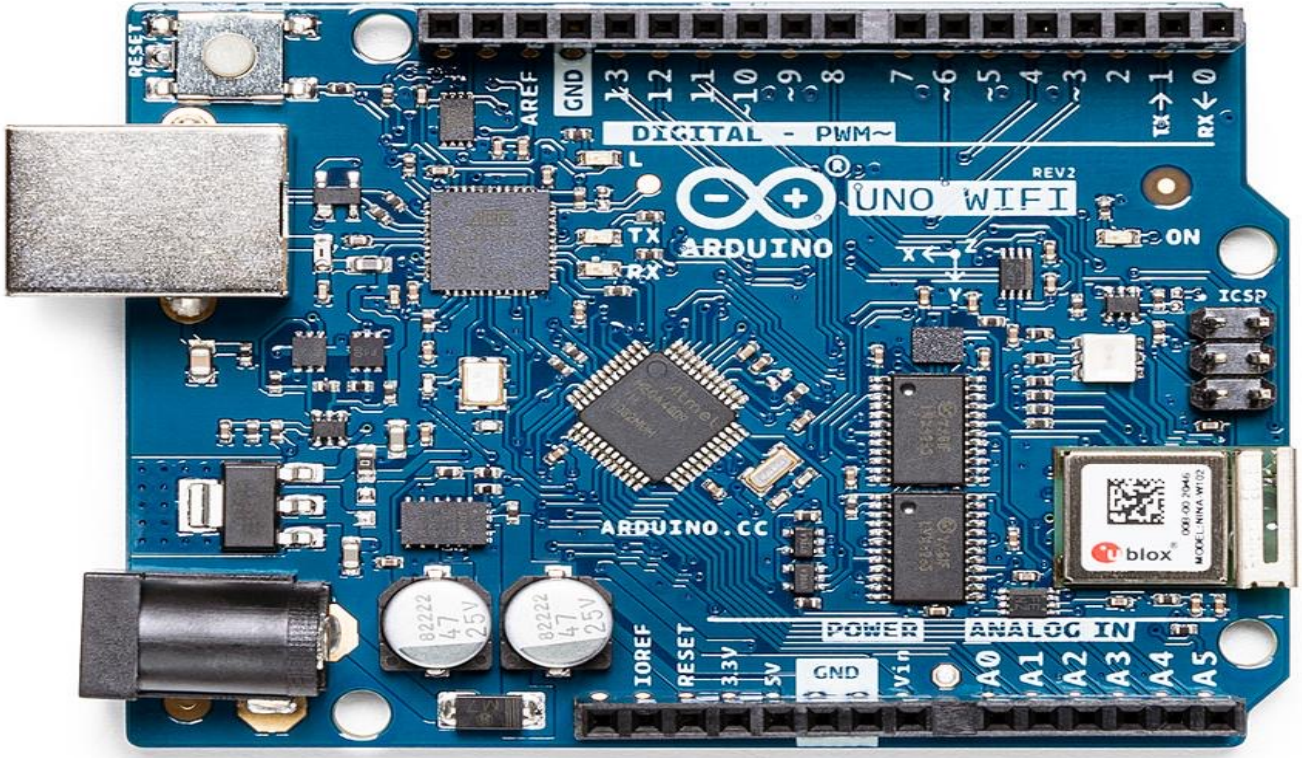


Arduino UNO WiFi Rev 2

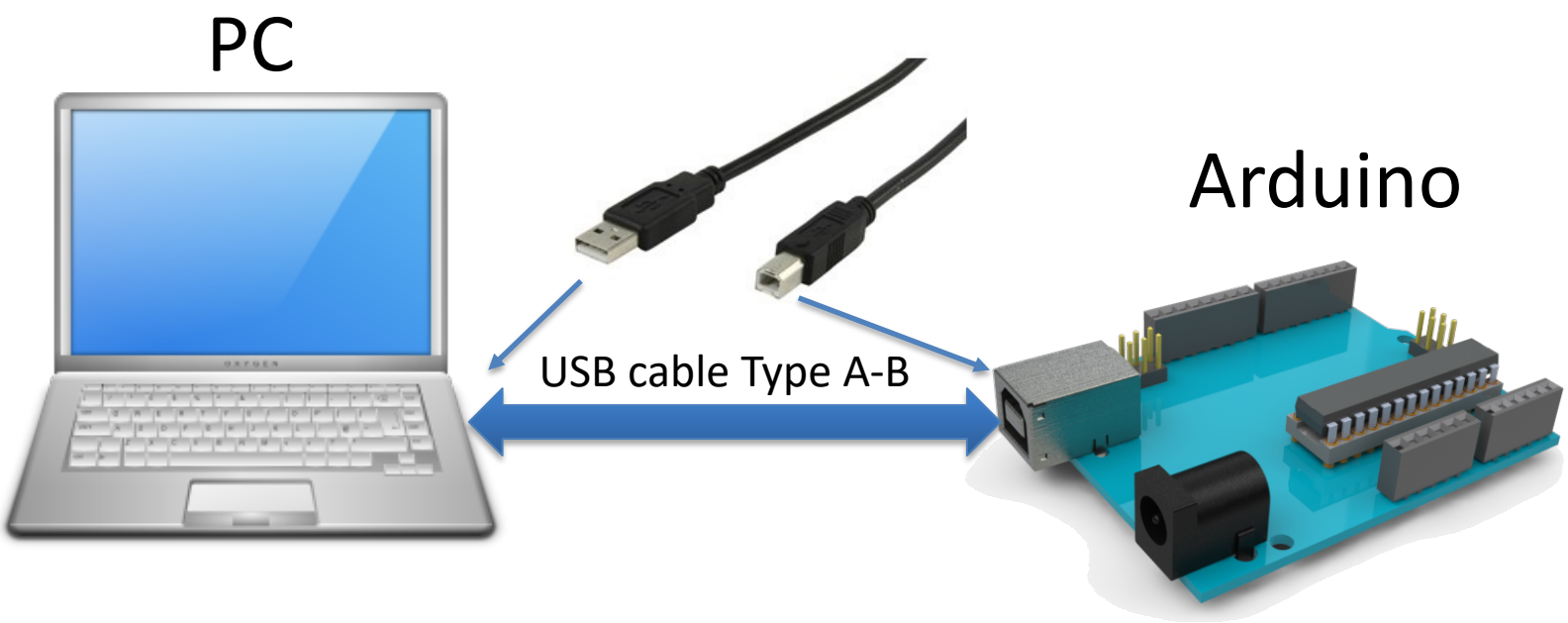
- Lots of different Arduino boards exists
- The basic Arduino UNO don’t have WiFi or Ethernet
- We need to use a board with built-in WiFi or Ethernet
- Or we can use a WiFi or Ethernet Shield
- In this Tutorial an “Arduino UNO WiFi Rev 2” is used

Arduino UNO WiFi Rev 2

The Arduino Uno WiFi is functionally the same as the Arduino Uno Rev3, but with the addition of WiFi / Bluetooth and some other enhancements.



Connect Arduino to your PC



Arduino Software

Upload Code to Arduino Board

Save

Open Serial Monitor

Compile and Check if Code is OK

Open existing Code

Creates a New Code Window

```
sketch_nov16b
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

In this window you create your Program

Arduino/Genuino Uno on /dev/cu.usbmodem1A1231

Error Messages can be seen here

The software can be downloaded for free:

www.arduino.cc

Arduino Programs

All Arduino programs must follow the following main structure:

```
// Initialization, define variables, etc.

void setup()
{
      // Initialization
      ...
}

void loop()
{
      //Main Program
      ...
}
```

ThingSpeak

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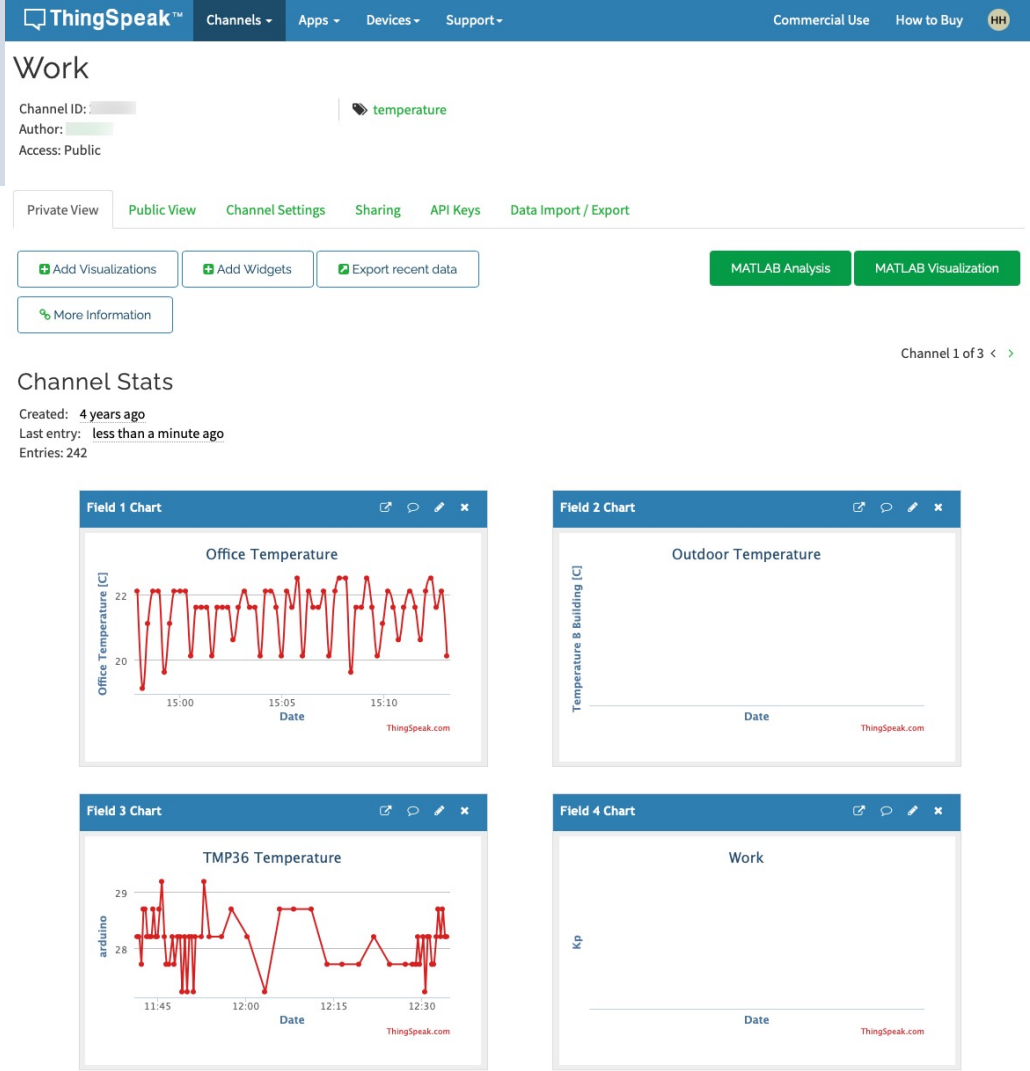
ThingSpeak

- ThingSpeak is an IoT analytics platform service that lets you collect and store sensor data in the cloud and develop Internet of Things (IoT) applications.
- ThingSpeak has a free Web Service (REST API) that lets you collect and store sensor data in the cloud and develop Internet of Things applications.
- It works with Arduino, Raspberry Pi, MATLAB and LabVIEW, Python, etc.

https://thingspeak.com

ThingSpeak



https://thingspeak.com

Arduino + ThingSpeak

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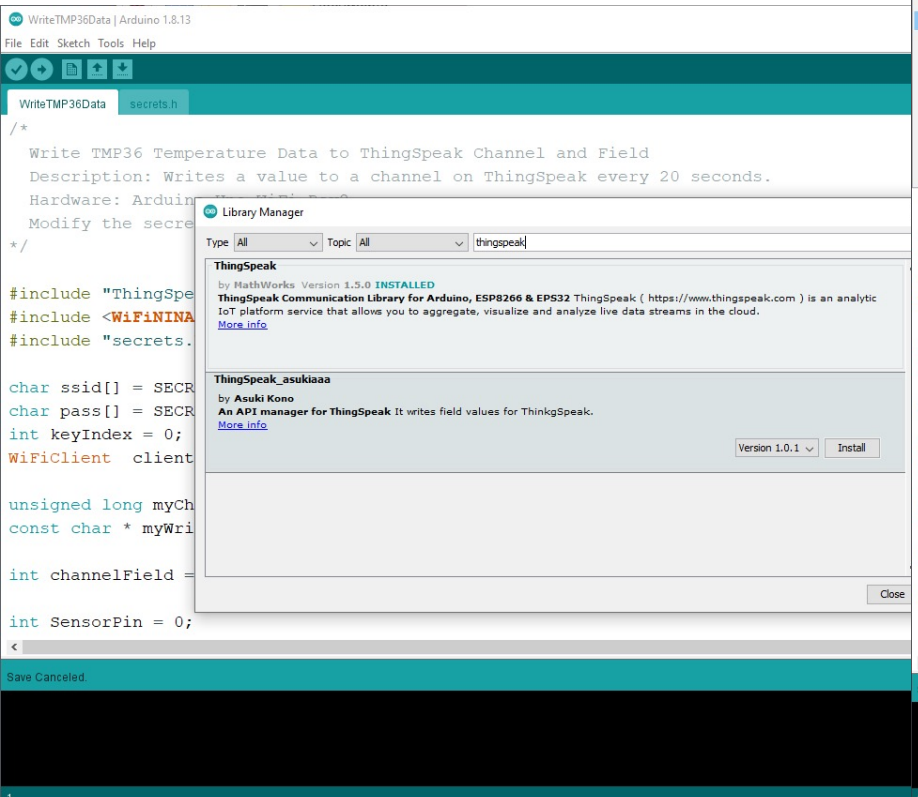
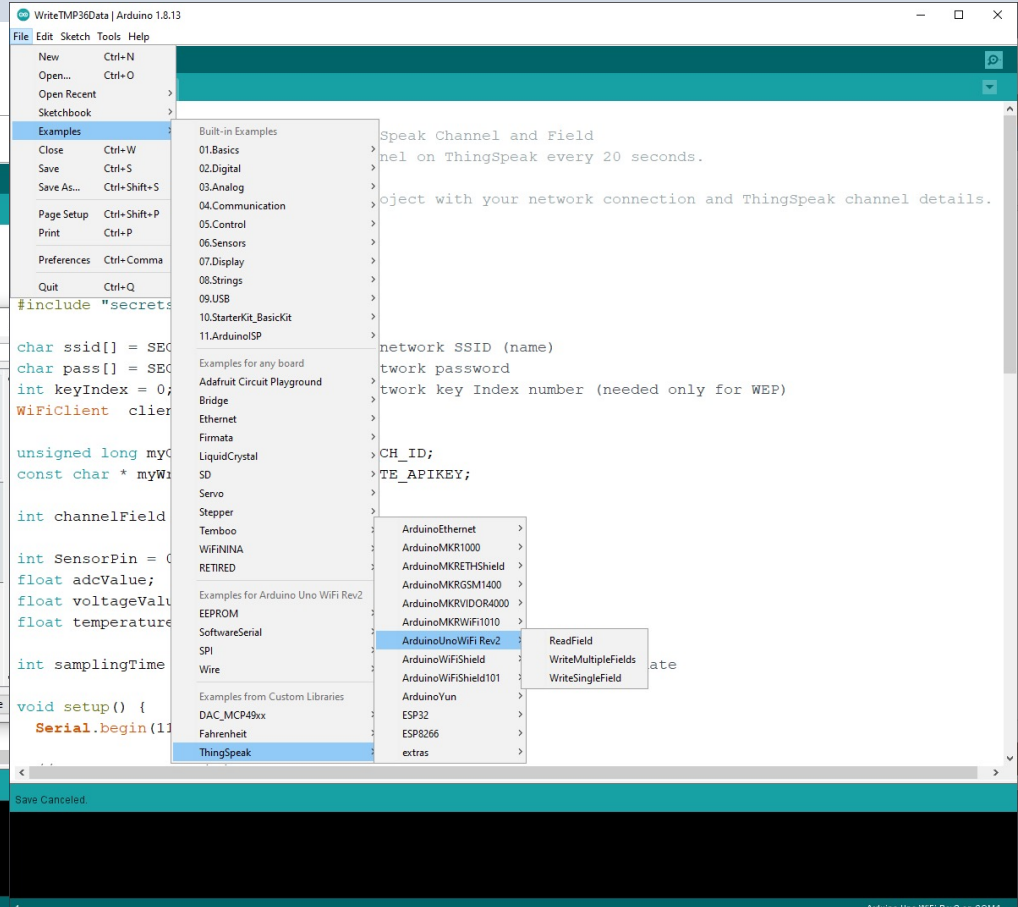
ThingSpeak + Arduino

- Install the “thingspeak“ Arduino Library using the Library Manager in your Arduino IDE
- Use e.g., the built-in example "**WriteSingleField**" as a starting point.
- This example is available for different boards and configuration, such as Arduino WiFi rev2 board, Arduino WiFi shield, etc.
- Then you can modify the example to suit your needs

Currently, a single channel can only be **updated once every 15 seconds**.

ThingSpeak + Arduino





Arduino Example

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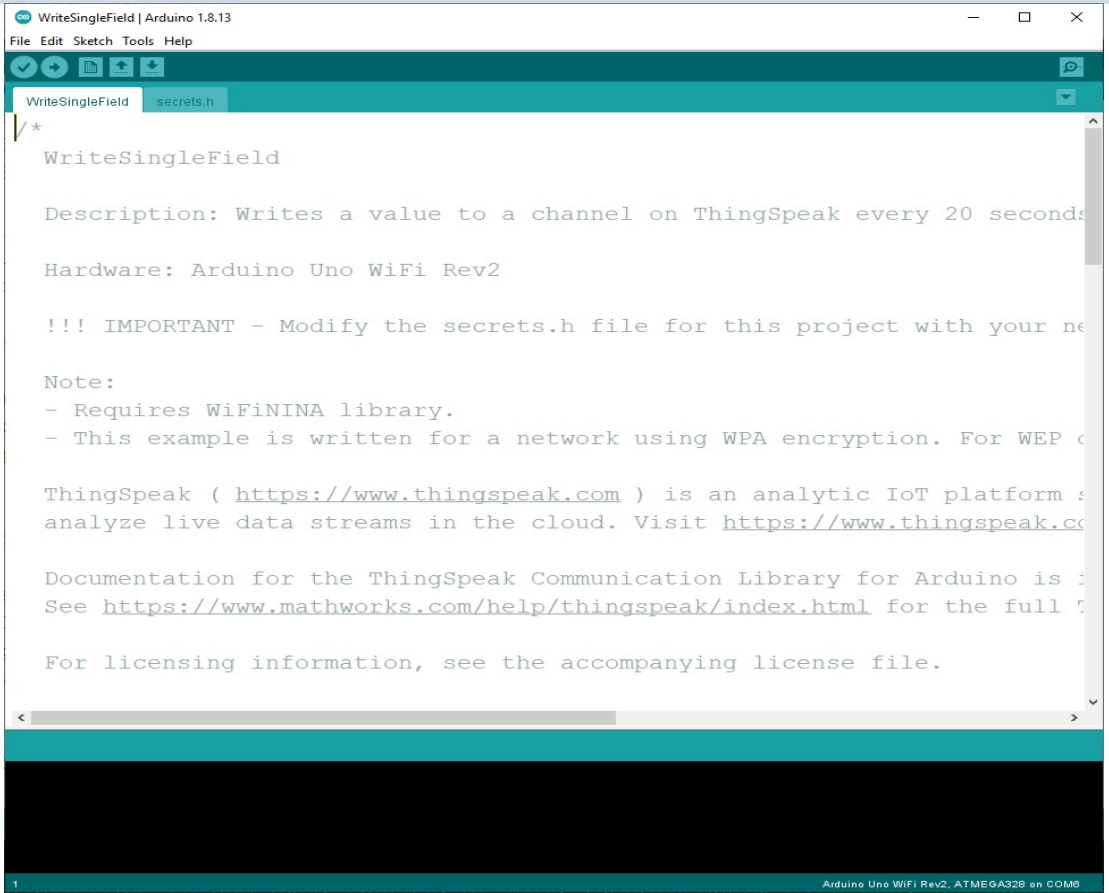
WriteSingeField Example

We use the the “WriteSingleField” Example as a starting point.

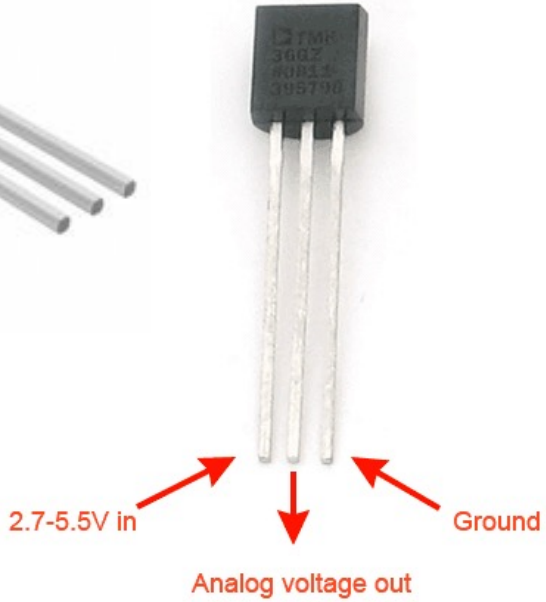
We just need to change WiFi information, like Password, etc.

Then we change ThingSpeak Information.

Finally, we add code for reading Temperature values from the TMP36 Temperature Sensor

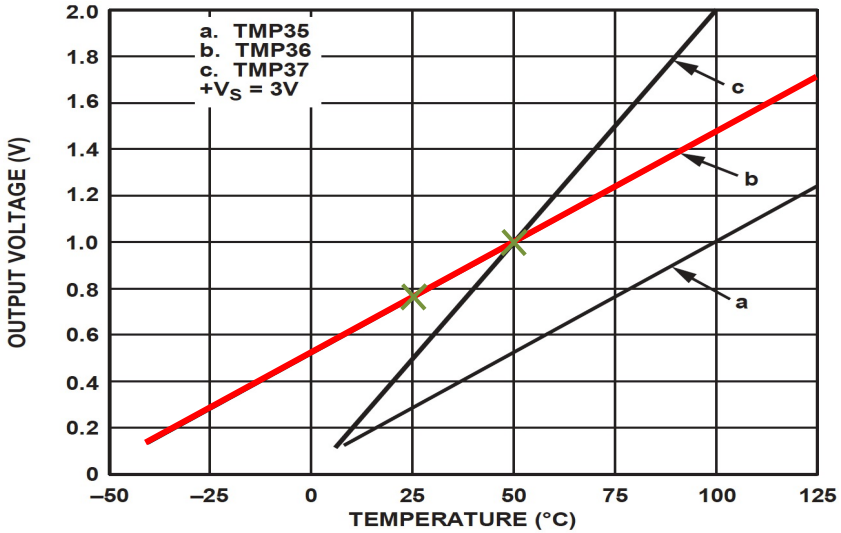


TMP36



TMP is a small, low-cost temperature sensor and cost about $1 (you can buy it “everywhere”)

Linear Scaling



Convert form Voltage (V) to degrees Celsius
From the Datasheet we have:

$$(x_1, y_1) = (0.75V, 25°C)$$
$$(x_2, y_2) = (1V, 50°C)$$

There is a linear relationship between Voltage and degrees Celsius:

$$y = ax + b$$

We can find a and b using the following known formula:

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

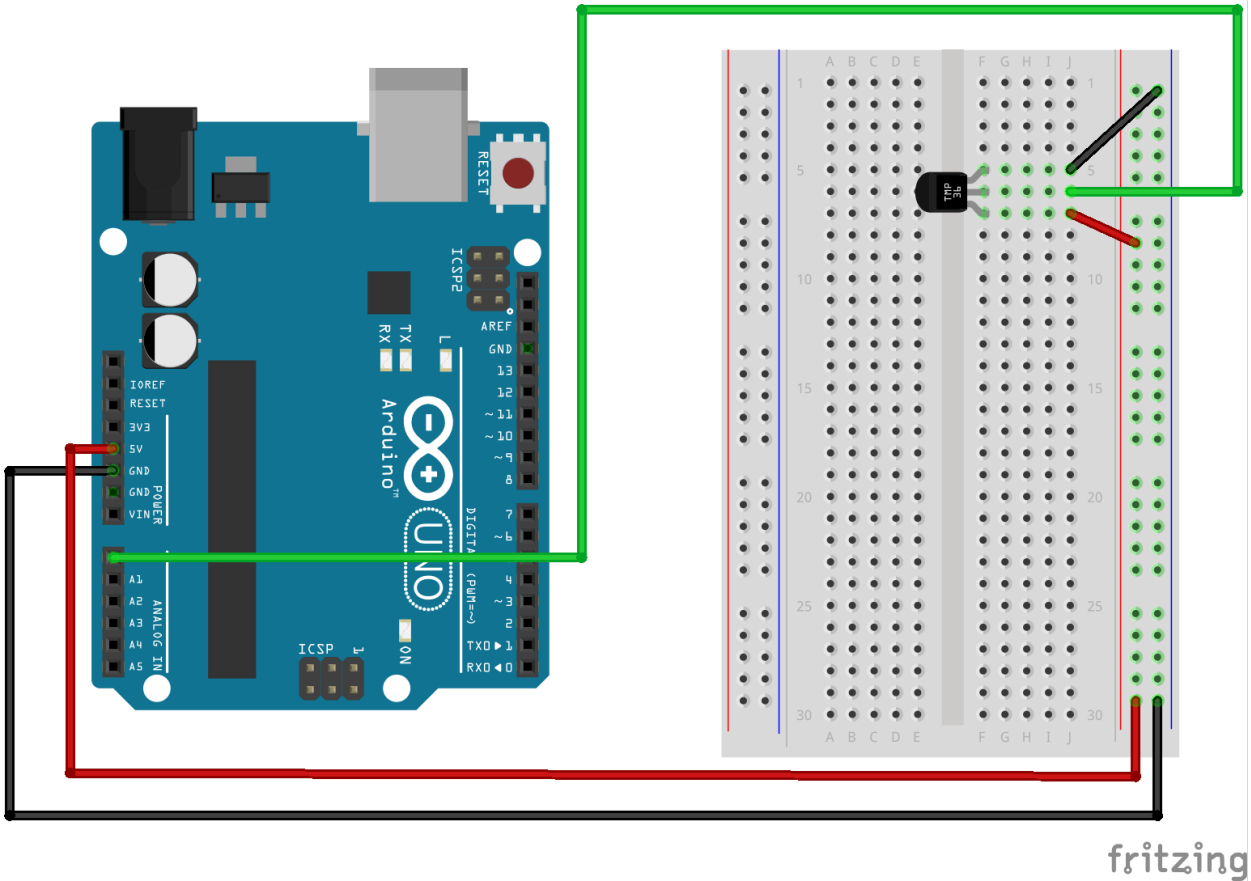
This gives:

$$y - 25 = \frac{50 - 25}{1 - 0.75}(x - 0.75)$$

Then we get the following formula:

$$y = 100x - 50$$

Wiring


RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TXO 1
RXO 0
DIGITAL (PWM=~)
L
TX
RX
Arduino
UNO
ON
ICSP
1
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
A1
A2
A3
A4
A5
ANALOG IN
A B C D E
F G H I J
1
5
10
15
20
25
30
fritzing

Temperature Conversion

We want to present the value from the sensor in degrees Celsius:

1. The function analogRead() gives a value between 0 and 1023 (Arduino UNO has a built-in 10-bit ADC, 2^10=1024)
2. Then we convert this value to 0-5V.
3. Finally, we convert to degrees Celsius using information from the Datasheet presented on the previous page ($y = 100x - 50$)
4. The we can, e.g., show the Temperature value in the Serial Monitor

Code

WriteTMP36Data | Arduino 1.8.13

File Edit Sketch Tools Help

WriteTMP36Data secrets.h

```
/*
  Write TMP36 Temperature Data to ThingSpeak Channel and Field
  Description: Writes a value to a channel on ThingSpeak every 20 seconds.
  Hardware: Arduino Uno WiFi Rev2
  Modify the secrets.h file for this project with your network connection and ThingSpe
*/

#include "ThingSpeak.h"
#include <WiFiNINA.h>
#include "secrets.h"

char ssid[] = SECRET_SSID;    //  your network SSID (name)
char pass[] = SECRET_PASS;   // your network password
int keyIndex = 0;            // your network key Index number (needed only for WEP)
WiFiClient  client;

unsigned long myChannelNumber = SECRET_CH_ID;
const char * myWriteAPIKey = SECRET_WRITE_APIKEY;

int channelField = 3;

int SensorPin = 0;
float adcValue;
float voltageValue;
```

Done uploading.

```
Sketch uses 18155 bytes (37%) of program storage space. Maximum is 48640 bytes.
Global variables use 470 bytes (7%) of dynamic memory, leaving 5674 bytes for local va
avrdude: WARNING: invalid value for unused bits in fuse "fuse5", should be set to 1 ac
```

59 Arduino Uno WiFi Rev2 on COM6

Code

```
#include "ThingSpeak.h"
#include <WiFiNINA.h>
#include "secrets.h"
char ssid[] = SECRET_SSID;    //  your network SSID (name)
char pass[] = SECRET_PASS;   // your network password
int keyIndex = 0;            // your network key Index number (needed only for WEP)
WiFiClient  client;
unsigned long myChannelNumber = SECRET_CH_ID;
const char * myWriteAPIKey = SECRET_WRITE_APIKEY;
int channelField = 3;
int SensorPin = 0;
float adcValue;
float voltageValue;
float temperatureValue = 0;
int samplingTime = 20000; // Wait 20 seconds between each hannel update
void setup() {
  Serial.begin(115200);  // Initialize serial
  if (WiFi.status() == WL_NO_MODULE) {
    Serial.println("Communication with WiFi module failed!");
    // don't continue
    while (true);
  }
String fv = WiFi.firmwareVersion();
  if (fv != "1.0.0") {
    Serial.println("Please upgrade the firmware");
  }

  ThingSpeak.begin(client);  //Initialize ThingSpeak
}
void loop() {
 // Connect or reconnect to WiFi
  if(WiFi.status() != WL_CONNECTED){
    Serial.print("Attempting to connect to SSID: ");
    Serial.println(SECRET_SSID);
    while(WiFi.status() != WL_CONNECTED){
      WiFi.begin(ssid, pass); // Connect to WPA/WPA2 network. Change this line if using open or WEP network
      Serial.print(".");
      delay(5000);
    }
    Serial.println("\nConnected.");
  }
  adcValue = analogRead(SensorPin); // Get Data from Temperature Sensor
  voltageValue = (adcValue*5)/1023;
  temperatureValue = 100*voltageValue - 50;
  Serial.println(temperatureValue);

  // Write to ThingSpeak
  int x = ThingSpeak.writeField(myChannelNumber, channelField, temperatureValue, myWriteAPIKey);
  if(x == 200){
    Serial.println("Channel update successful.");
  }
  else{
    Serial.println("Problem updating channel. HTTP error code " + String(x));
  }
 delay(20000); // Wait 20 seconds to update the channel again
}
```

This Example uses an Arduino WiFi rev2 board.
The Example reads values from TMP36 Temperature Sensor and write the values to ThingSpeak

secrets.h

```
// Use this file to store all of the private credentials
// and connection details

#define SECRET_SSID "MySSID"      // replace MySSID with your WiFi network name
#define SECRET_PASS   "xxxxxx"    // replace MyPassword with your WiFi password

#define SECRET_CH_ID 000000       // replace 0000000 with your channel number
#define SECRET_WRITE_APIKEY   "XYZ"      // replace XYZ with your channel write API Key
```

Serial Monitor

COM6

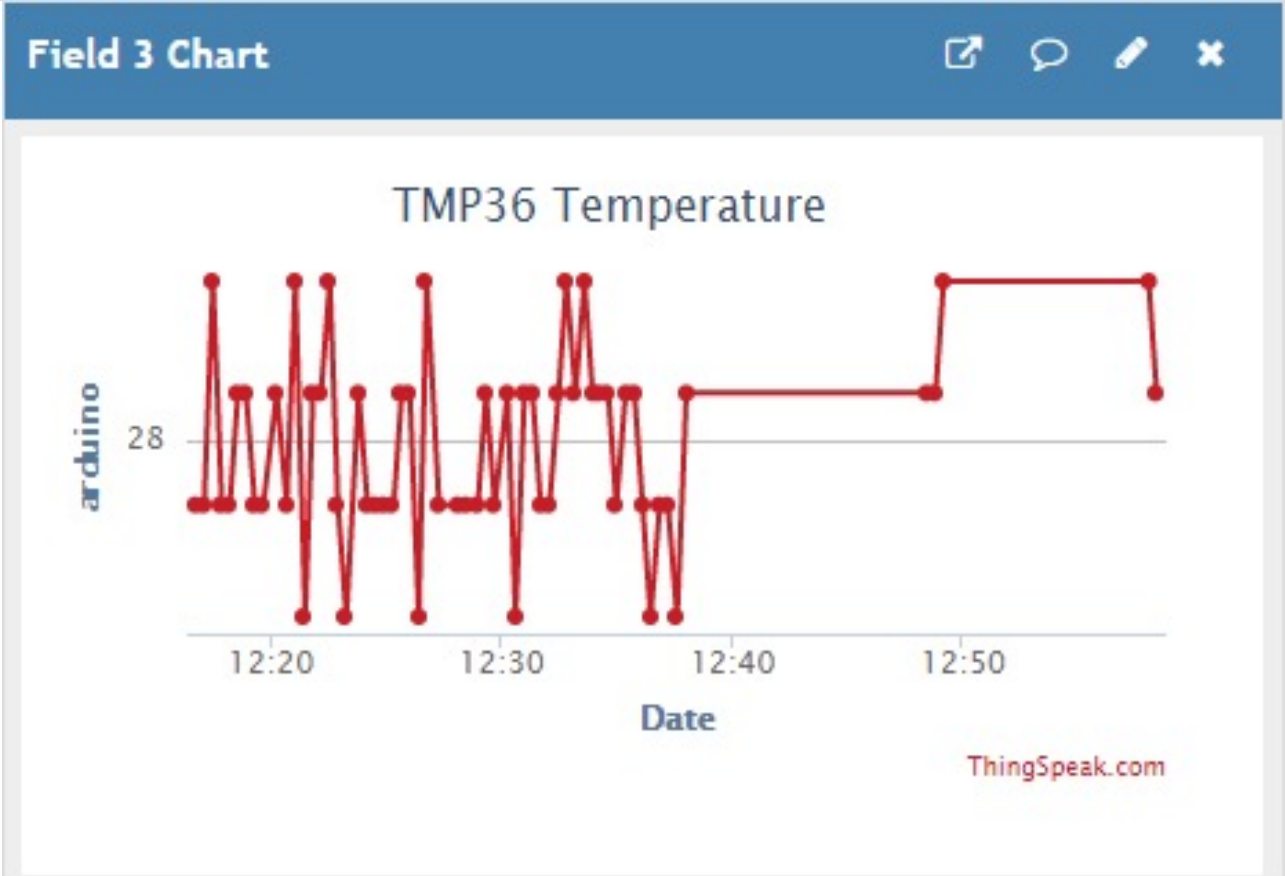
Send

```
28.69
Channel update successful.
28.20
Channel update successful.
28.20
Channel update successful.
28.20
Channel update successful.
27.71
Channel update successful.
28.20
Channel update successful.
28.20
Channel update successful.
27.71
Channel update successful.
```

Autoscroll Show timestamp Newline 9600 baud Clear output

ThingSpeak

We see that the Temperature Data has been successfully written to ThingSpeak



Updated Code

The Code is the same, but it is now structured into different Functions for better readability

secrets.h

```
#define SECRET_SSID « xxxxxx"
#define SECRET_PASS « xxxxxx"

#define SECRET_CH_ID xxxxx

#define SECRET_WRITE_APIKEY "xxxxxx"
```

```
#include "ThingSpeak.h"
#include <WiFiNINA.h>
#include "secrets.h"

WiFiClient  client;
int wait = 20000;
float temperatureValue = 0;

void setup()
{
  Serial.begin(9600);
  CheckWiFi();
  ThingSpeak.begin(client);
}

void loop()
{
  ConnectWiFi();
  ReadTemperature();
  ThingSpeakWrite();
  delay(wait);
}
```

CheckWiFi()

```
void CheckWiFi()
{
  // check for the WiFi module:
  if (WiFi.status() == WL_NO_MODULE) {
    Serial.println("Communication with WiFi module failed!");
    // don't continue
    while (true);
  }

  String fv = WiFi.firmwareVersion();
  if (fv != "1.0.0")
  {
    Serial.println("Please upgrade the firmware");
  }
}
```

ConnectWiFi()

```
void ConnectWiFi()
{
  char ssid[] = SECRET_SSID;
  char pass[] = SECRET_PASS;

  if(WiFi.status() != WL_CONNECTED)
  {
    Serial.print("Attempting to connect to SSID: ");
    Serial.println(SECRET_SSID);
    while(WiFi.status() != WL_CONNECTED)
    {
      WiFi.begin(ssid, pass);
      Serial.print(".");
      delay(5000);
    }
    Serial.println("\nConnected.");
  }
}
```

ReadTemperature()

```
void ReadTemperature()
{
  int SensorPin = 0;
  float adcValue;
  float voltageValue;

  adcValue = analogRead(SensorPin);
  voltageValue = (adcValue*5)/1023;
  temperatureValue = 100*voltageValue - 50;
  Serial.println(temperatureValue);
}
```

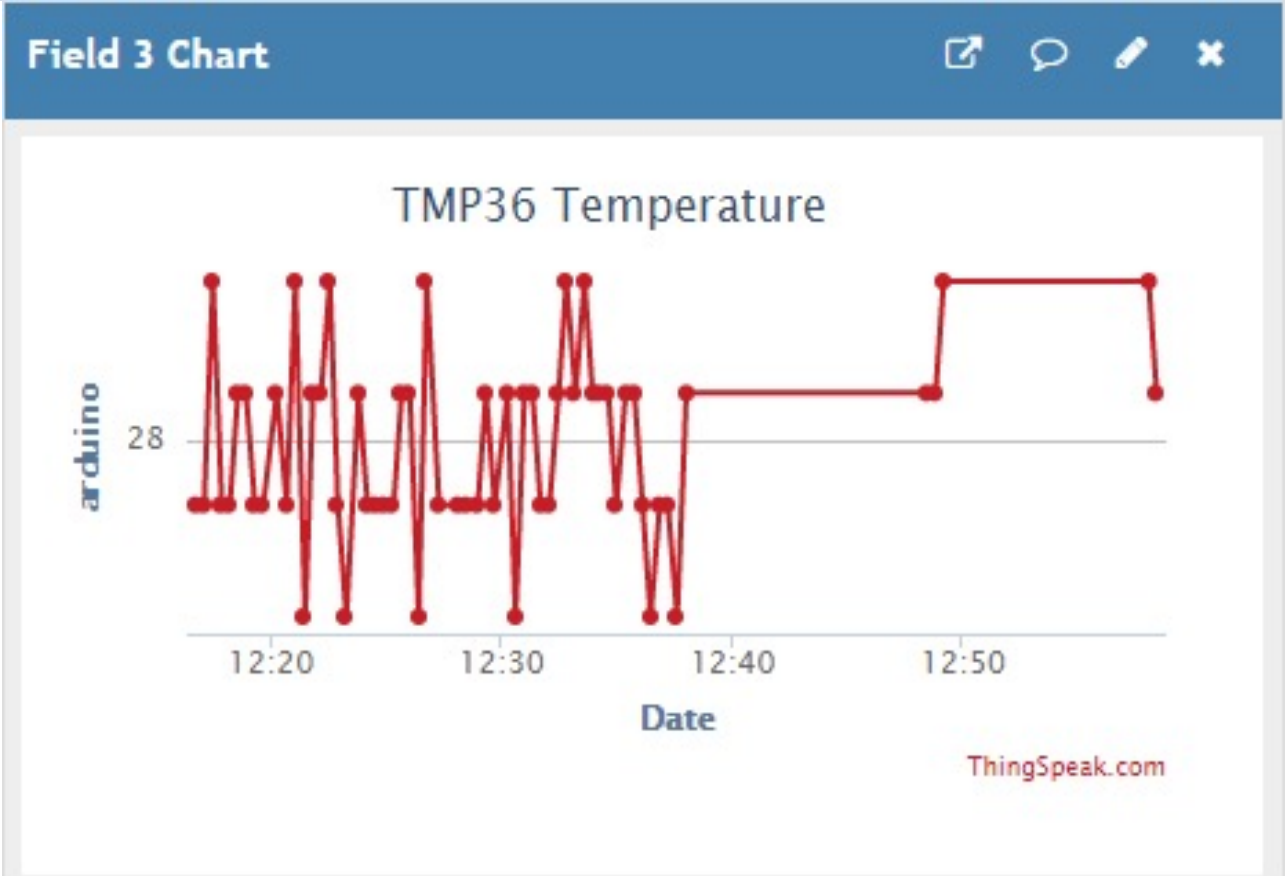
ThingSpeakWrite()

```
void ThingSpeakWrite()
{
  unsigned long myChannelNumber = SECRET_CH_ID;
  const char * myWriteAPIKey = SECRET_WRITE_APIKEY;
  int channelField = 3;

  int x = ThingSpeak.writeField(myChannelNumber, channelField,
        temperatureValue, myWriteAPIKey);
  if(x == 200){
    Serial.println("Channel update successful.");
  }
  else{
    Serial.println("Problem updating channel. HTTP error code " + String(x));
  }
}
```

ThingSpeak

We see that the Temperature Data has been successfully written to ThingSpeak



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