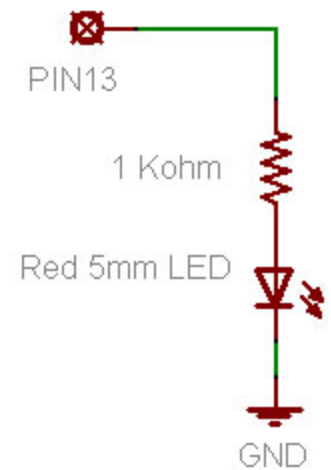
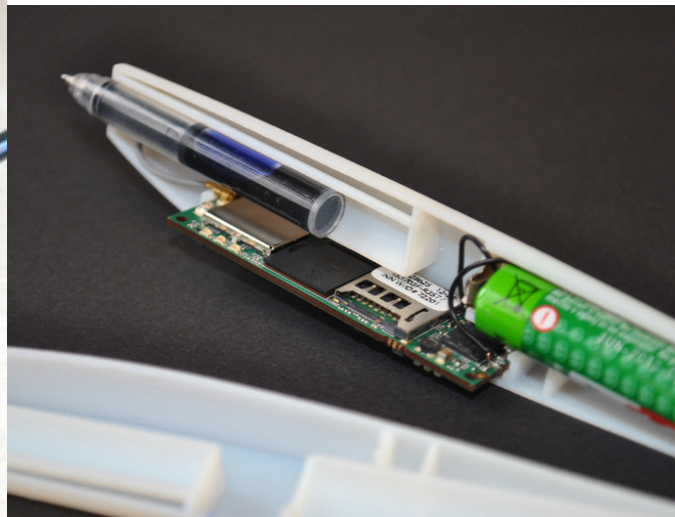
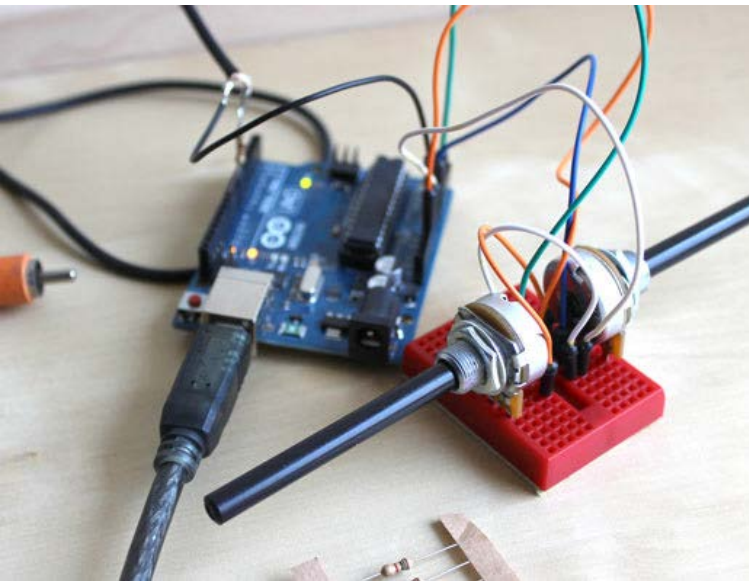


Semaine interdisciplinaire Jour 2-3: arduino et electronique (analogique)

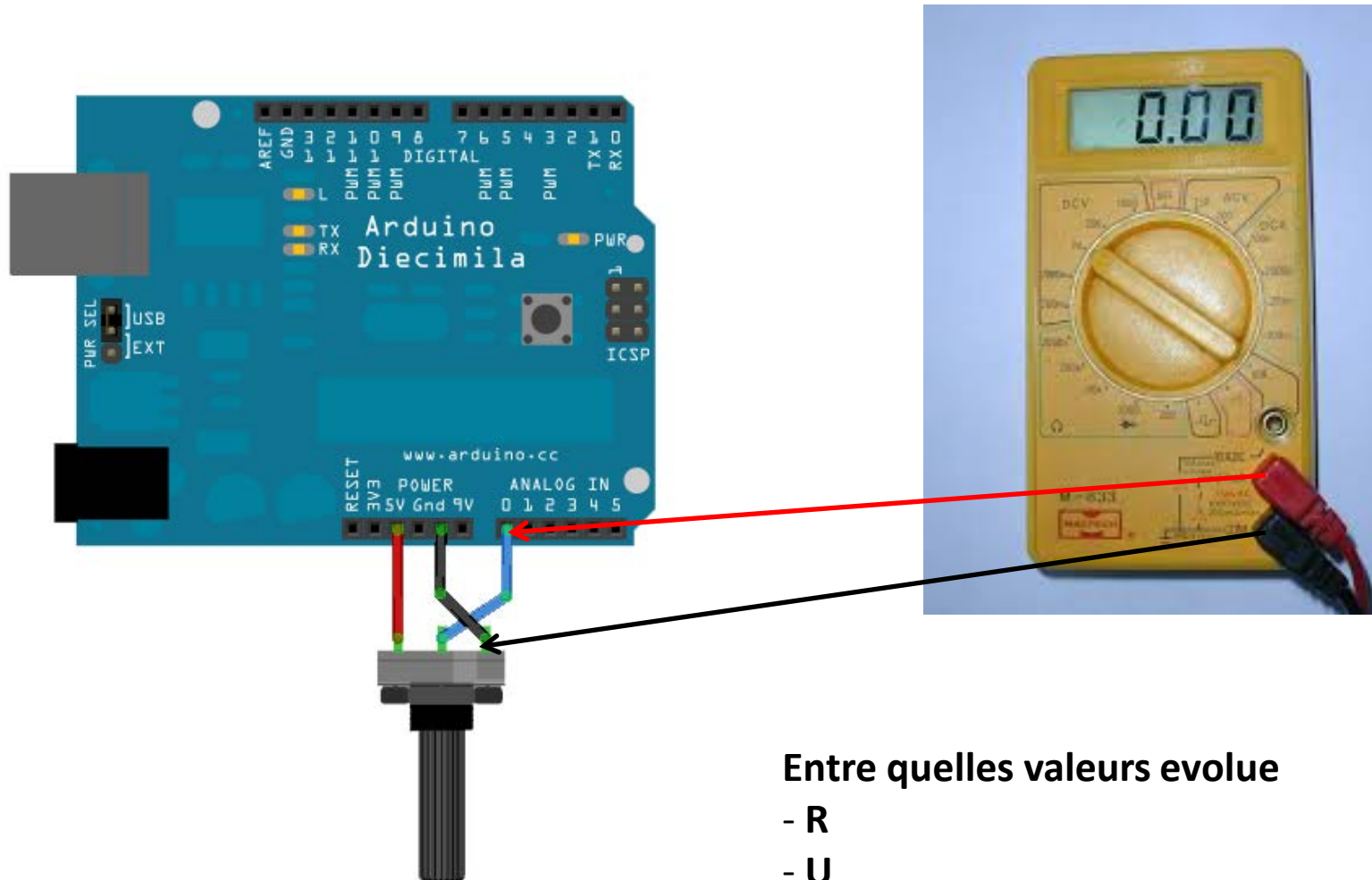


Programme Jour 2

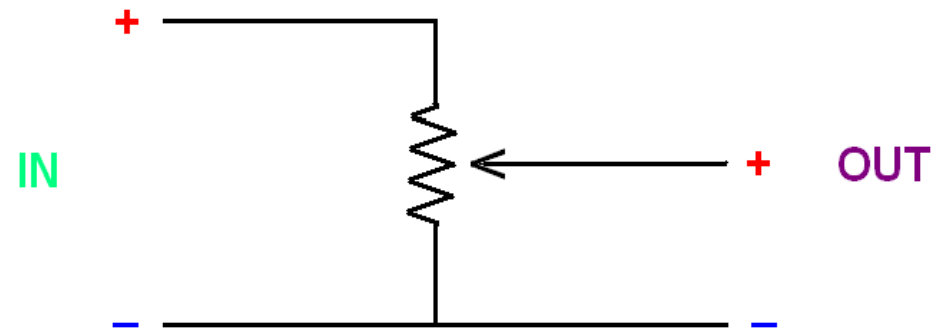
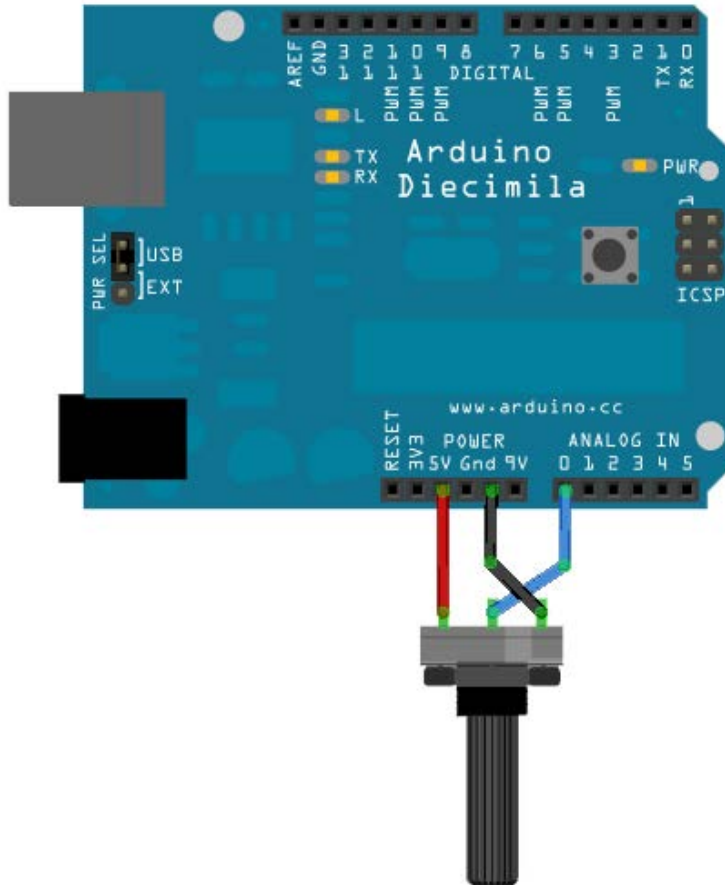
- Comprendre les bases de la programmation arduino (blink)
- Savoir lire un schéma électronique
- Savoir lire une datasheet
- Savoir comment debugger un circuit /programme
- Comprendre les bases de l'électronique (Différence courant /tension)
- Fabrication du device micro / carte sd / et test !

Part 1- Electronics 101

Arduino Potentiometer – Ex 1 mesurer tension et R



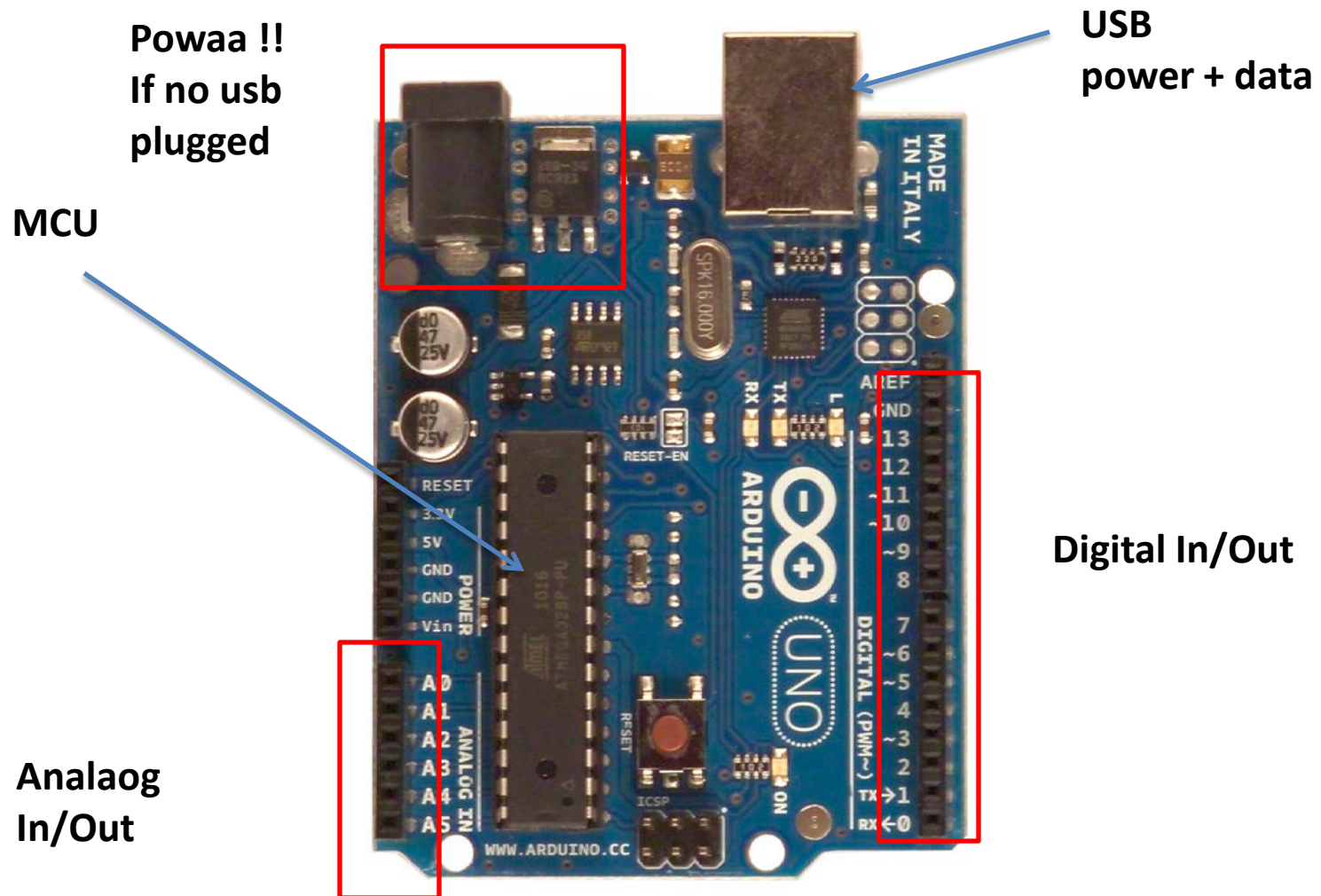
Arduino Ex 1 Potentiometer correction



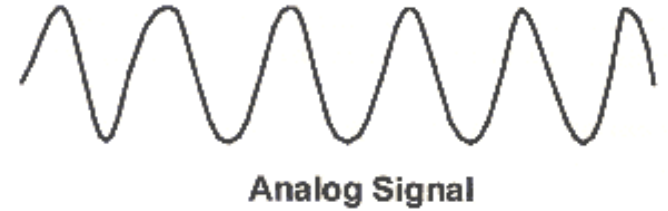
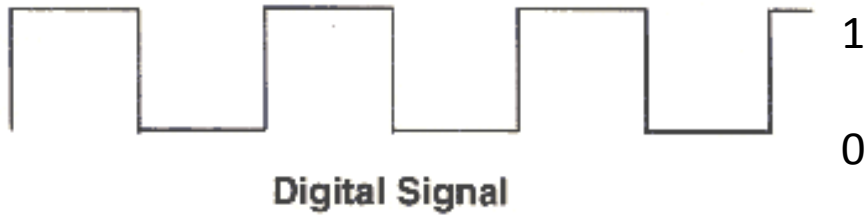
Entre quelles valeurs evolue

- R : 0-10kohms
- U: 0-5V
- valeur A0 : 0-1024

What is the Arduino ?



Analog vs Digital



Output has been
digitalized

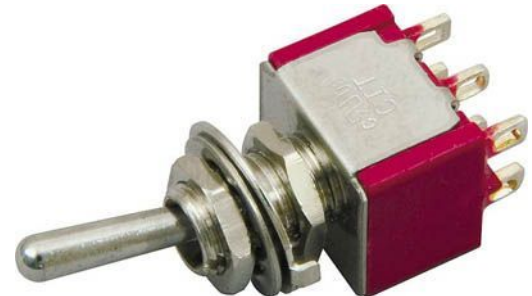


Output directly linked
to the signal

Ex 2 : Analog or digital



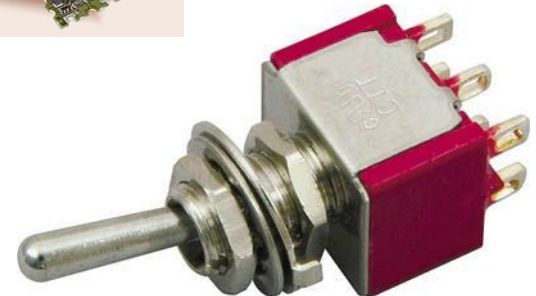
GPS chip



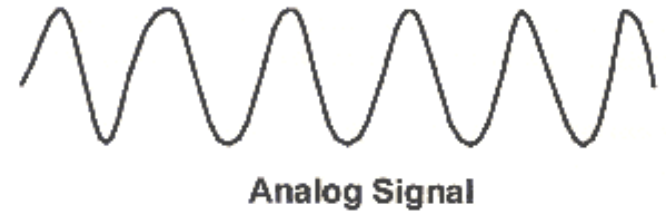
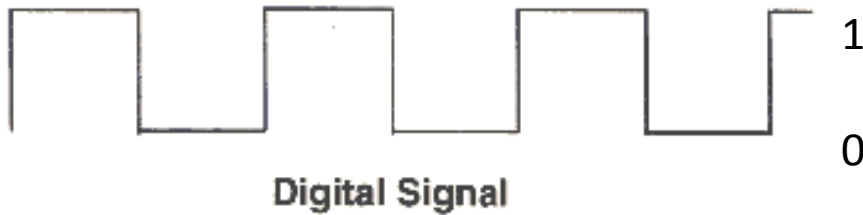
Ex2 correction



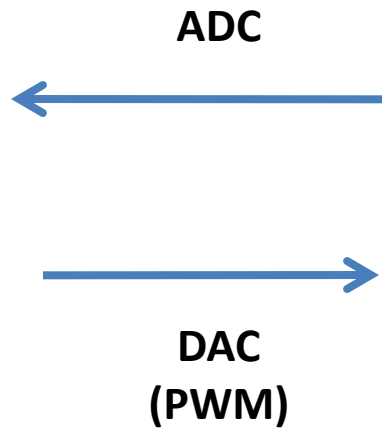
GPS chip



Analog vs Digital



Output has been
digitalized

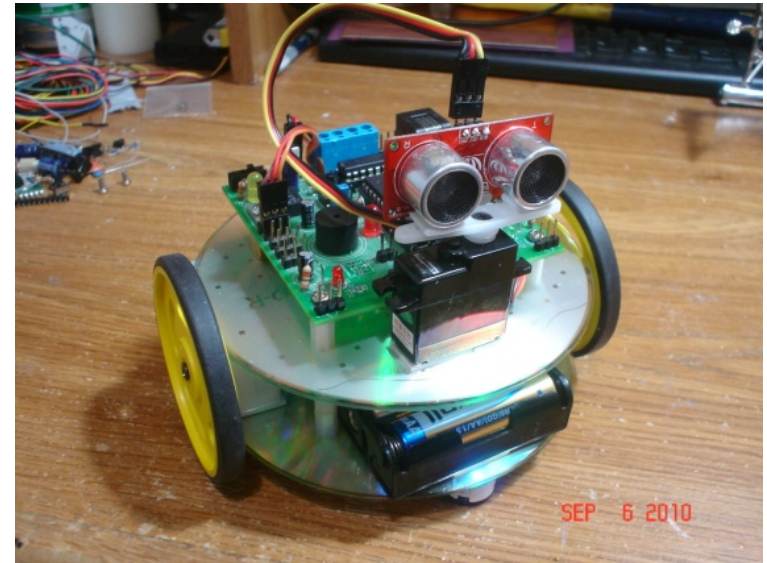


Si encodage :
microprocesseur



Output directly linked
to the signal

Analog vs Digital ex robots

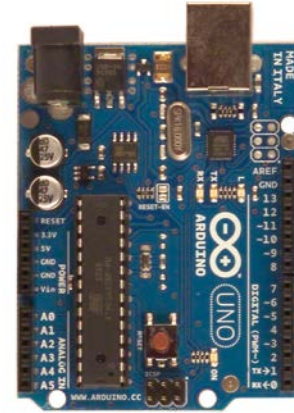


Analog => Digital



0V-5V

=>



0-1023

Why 1023 et pas 53 ,158, 256, 42 ???

There are 10 types
of people in the world:

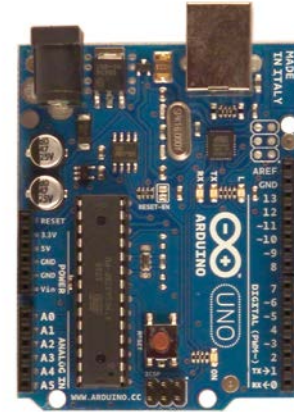
Those who understand binary
and those who don't.

Analog => Digital



0V-5V

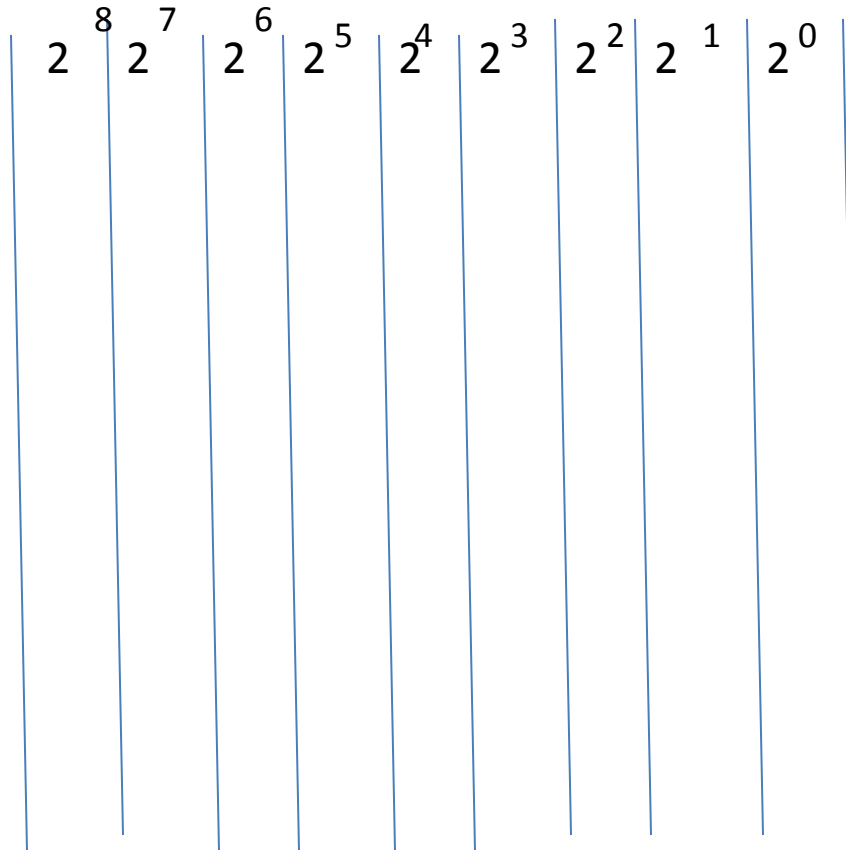
=>



0-1023

$$1023 = 2^{10}$$

Ex 3 ecrire en binaire



bits Vs bytes

MSB vs LSB

Ecrire : 256, 64, 17, 23, 42, 58 en binaire

ADC precision

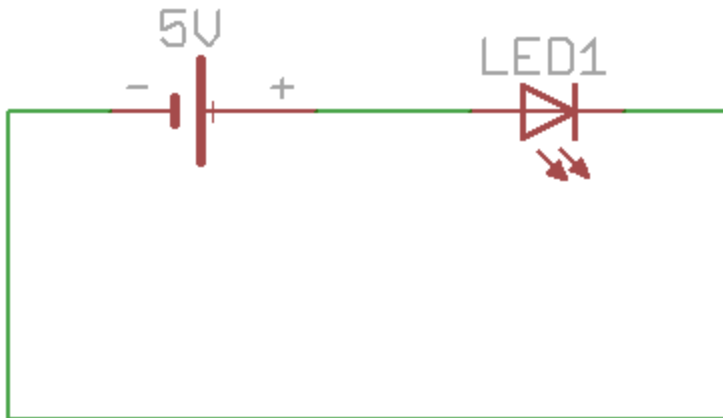
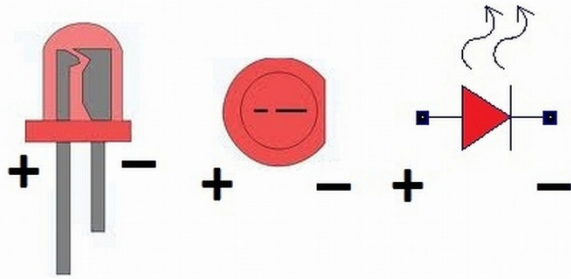


0-1023 - 10 bit

Quel est le plus petit voltage que l'on peut mesurer ??

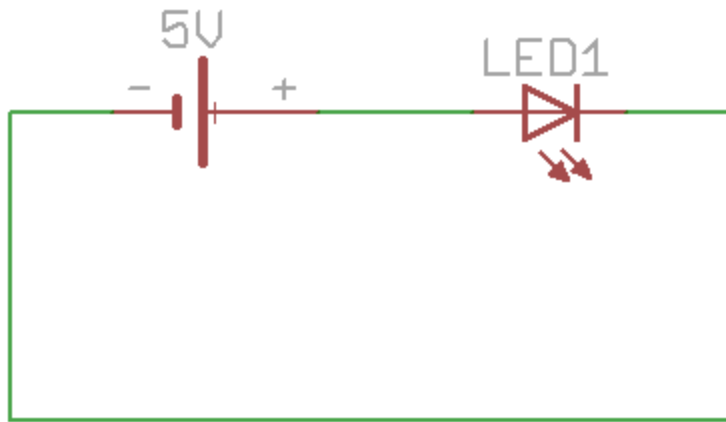
LEDs

LED Pin Out



Loi d'ohms
 $U=RI$

LEDs



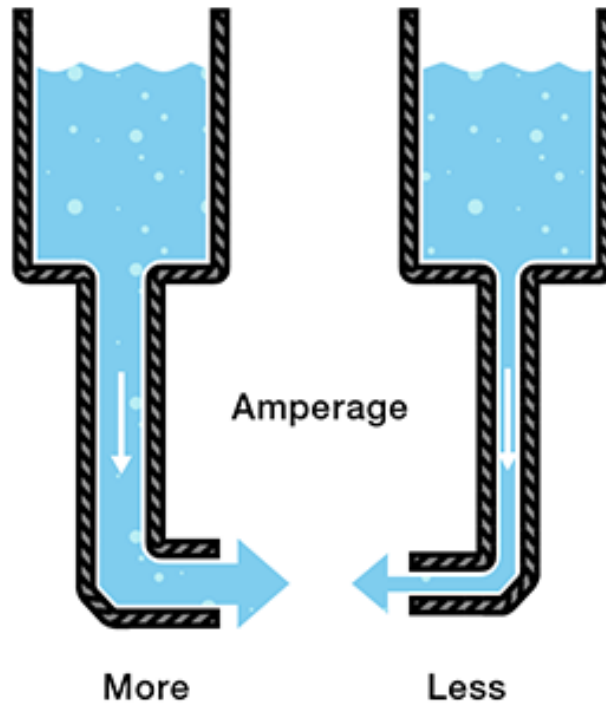
Loi d'ohms
 $U=RI$

$$I = U/R$$

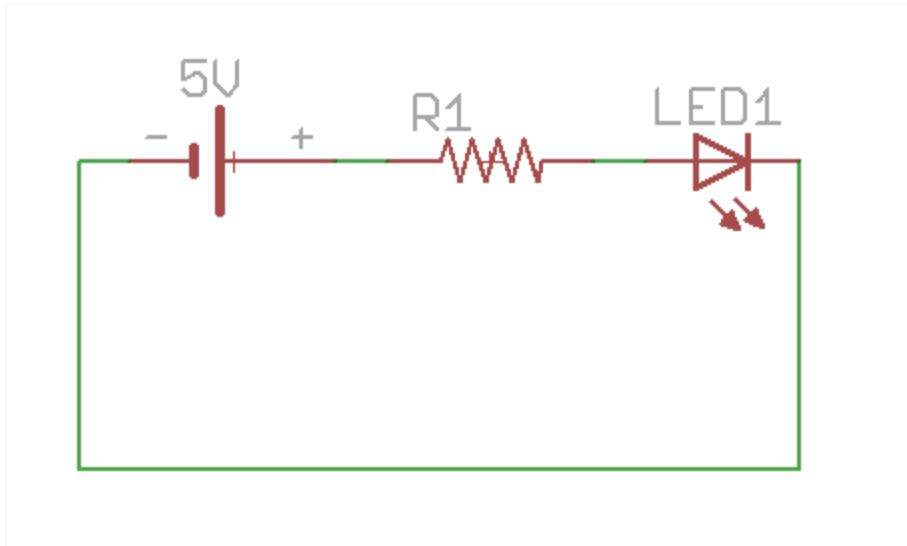
Si $R \sim 0 \Rightarrow I$ enorme \Rightarrow magic smoke



Differences tension/courant



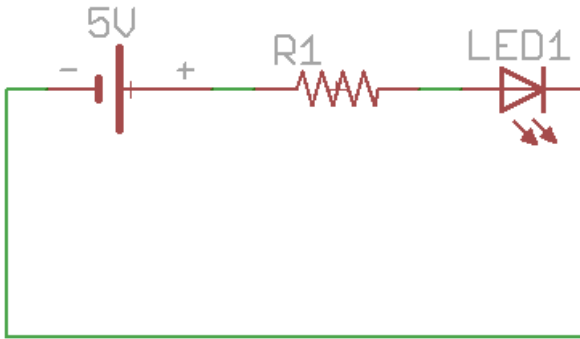
Ex 4 : LEDs - how to choose R



Loi d'ohms
 $U=RI$

Voir la datasheet fournie !

Ex4 : correction



Loi d'ohms
 $U=RI$

$$I=20\text{ma}$$

$$U=5-2.2=2.8$$

$$R=U/I =140$$

Resistance + proche
150

Absolute Maximum Ratings: (Ta=25°C) .

ITEMS	Symbol	Absolute Maximum Rating	Unit
Forward Current	I_F	20	mA
Peak Forward Current	I_{FP}	30	mA
Suggestion Using Current	I_{su}	16-18	mA
Reverse Voltage ($V_R=5V$)	I_R	10	uA
Power Dissipation	P_D	105	mW
Operation Temperature	T_{OPR}	-40 ~ 85	°C
Storage Temperature	T_{STG}	-40 ~ 100	°C
Lead Soldering Temperature	T_{SOL}	Max. 260°C for 3 Sec, Max. (3mm from the base of the epoxy bulb)	

Absolute Maximum Ratings: (Ta=25°C)

ITEMS	Symbol	Test condition	Min	Typ	Max	Unit
Forward Voltage	V_F	$I_F=20\text{mA}$	1.8	---	2.2	V
Wavelength (nm) or TC(k)	$\Delta \lambda$	$I_F=20\text{mA}$	620	---	625	nm
*Luminous intensity	I_v	$I_F=20\text{mA}$	150	---	200	mcd
50% Viewing Angle	$2 \theta 1/2$	$I_F=20\text{mA}$	40	---	60	deg

Ex 4 : triche

<http://led.linear1.org/>

LED center

[LED basics](#) [LED lighting](#) [LED science](#) [Practical LEDs](#) [LED products](#)

LED calculator

This is the new version of the single LED series resistance calculator, good for when you have a single LED and need to know "what resistor should I use with my LED?" This calculator determines that for you.

The **LED series/parallel array wizard** is available for those of you who need to do calculations involving more than one LED. The wizard will help you pick the resistors make the connections for **any number of LEDs**.

LED calculator: current limiting resistor value

5	Source voltage	<input checked="" type="checkbox"/>
2.2	diode forward voltage	<input checked="" type="checkbox"/>
20	diode forward current (mA)	<input checked="" type="checkbox"/>

Find R

The wizard recommends a 1/8W or greater 150 ohm resistor. The color code for 150 ohms is brown green brown.

led.linear1.org

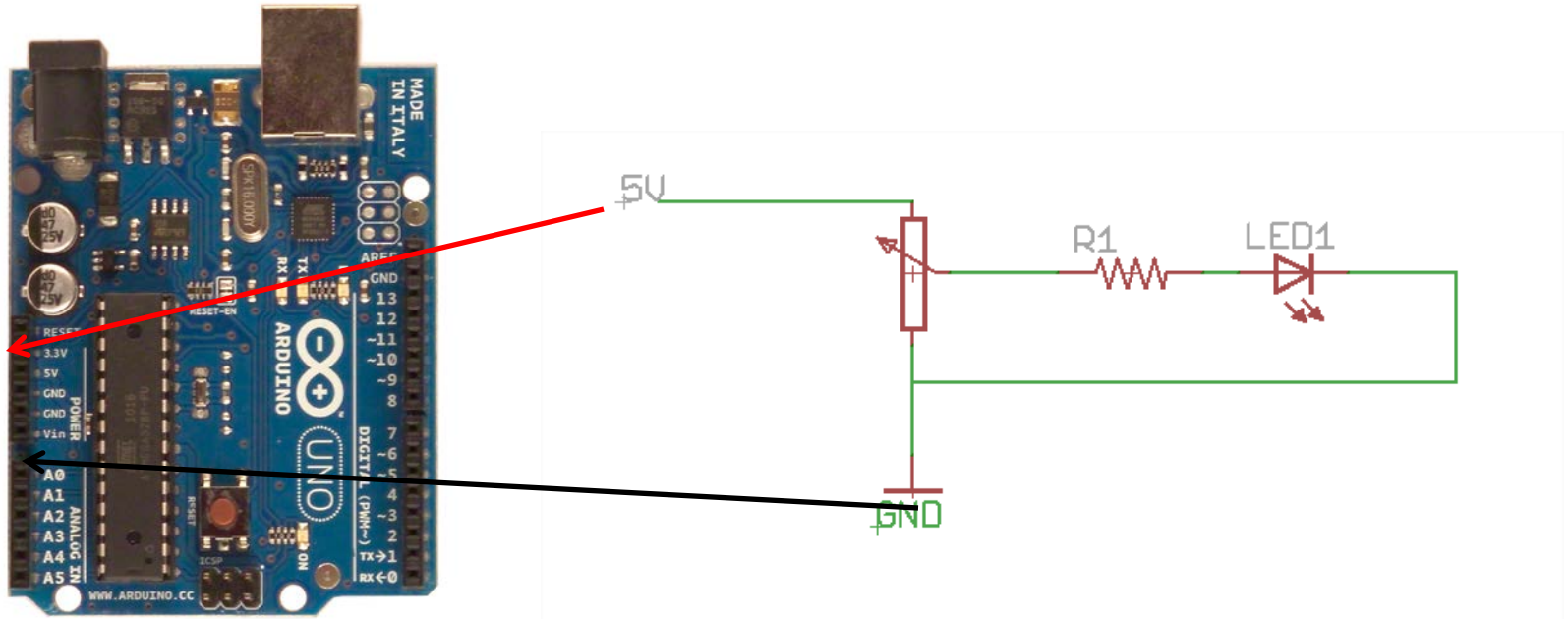
Link to this solution: <http://led.linear1.org/1led.wiz?VS=5;VF=2.2;ID=20>

* This calculator rounds the resistance up to the next standard resistor value. You should actually be able to buy a 5% resistor with the value returned by the calculator.

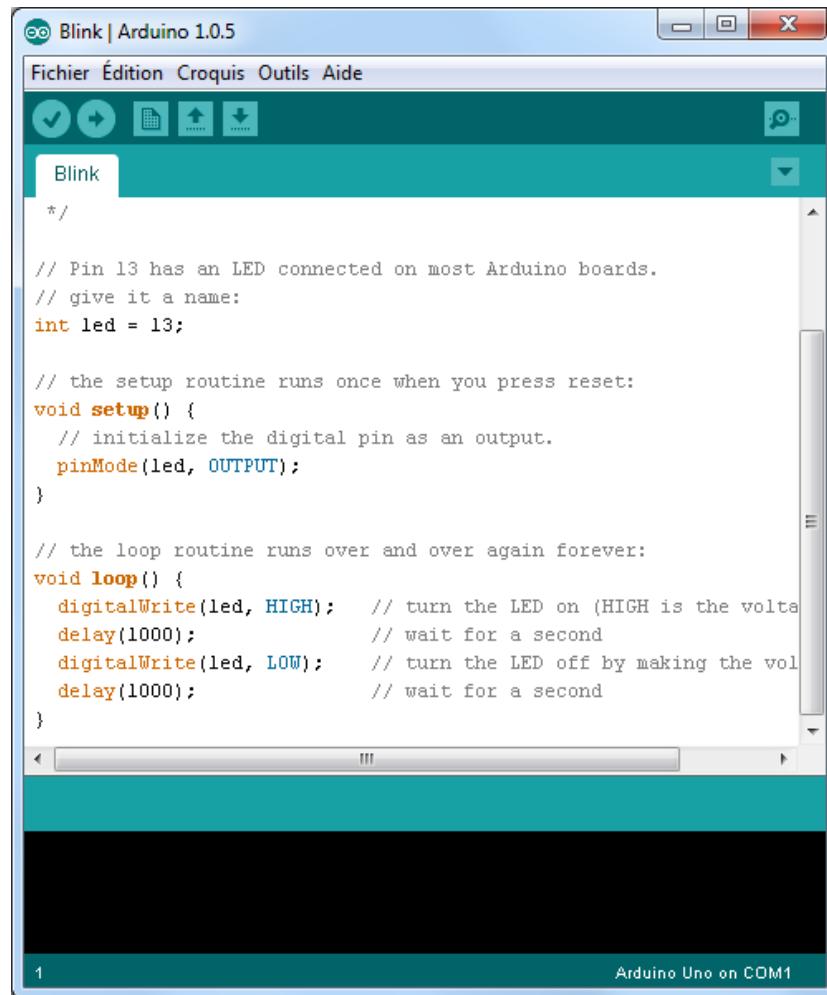
** Power calculations assume use of the standard value current-limiting resistor shown above. Resistor power ratings are chosen based on operating within 60% of the rated value.

LED calculator version 2.0 Copyright 2001-2006, Rob 'linear' Arnold. All rights reserved.

Ex 5 : potentiometer led dim



Ex 6 : Blink commande des led numérique

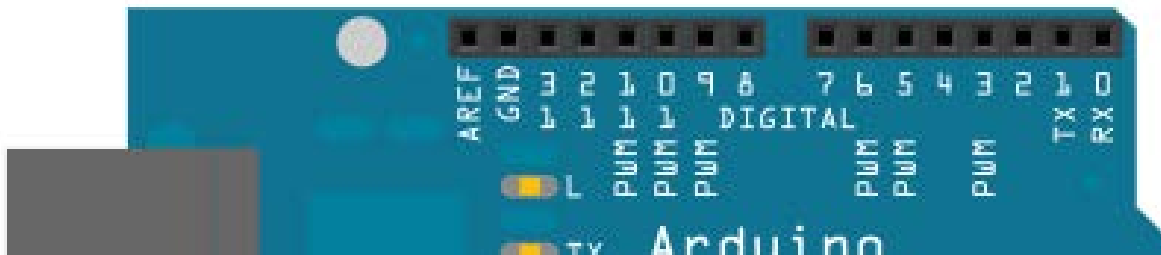
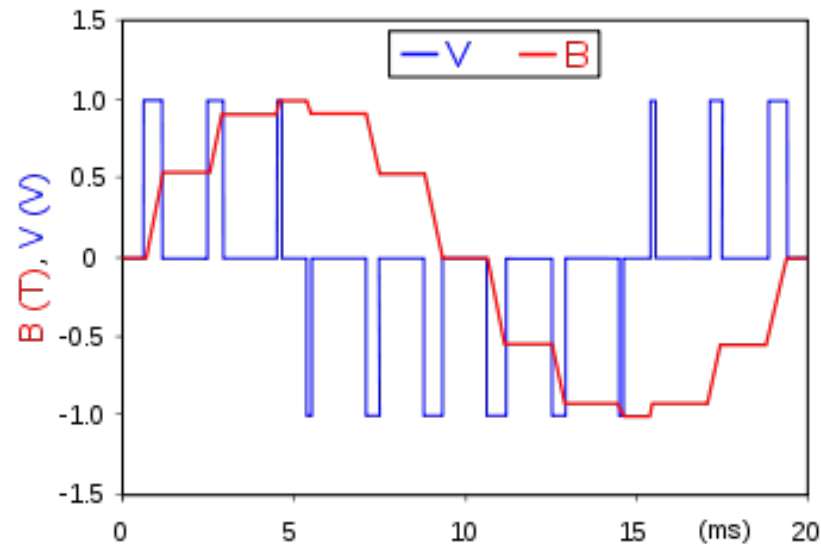
The image shows a screenshot of the Arduino IDE interface. The title bar reads "Blink | Arduino 1.0.5". The menu bar includes "Fichier", "Édition", "Croquis", "Outils", and "Aide". Below the menu bar is a toolbar with icons for opening, saving, and running. The main text area contains the following code:

```
*/  
  
// Pin 13 has an LED connected on most Arduino boards.  
// give it a name:  
int led = 13;  
  
// the setup routine runs once when you press reset:  
void setup() {  
  // initialize the digital pin as an output.  
  pinMode(led, OUTPUT);  
}  
  
// the loop routine runs over and over again forever:  
void loop() {  
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage)  
  delay(1000);             // wait for a second  
  digitalWrite(led, LOW);  // turn the LED off by making the voltage low  
  delay(1000);             // wait for a second  
}
```

The status bar at the bottom indicates "1" on the left and "Arduino Uno on COM1" on the right.

Changer le delay et voir le résultat !

Commande des leds par PWM



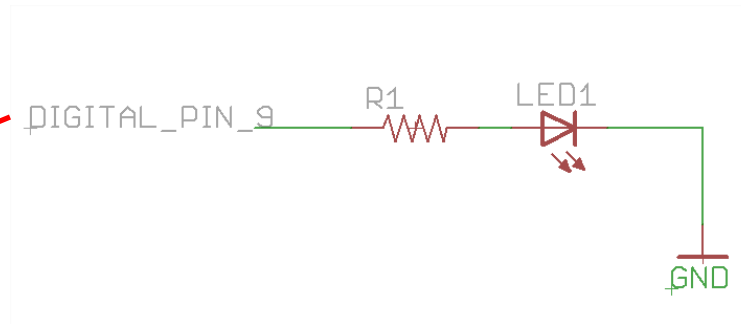
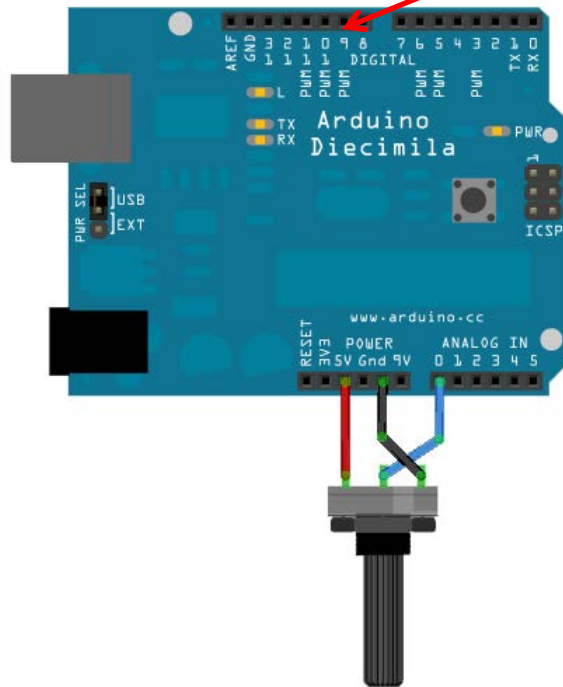
Ex 7: Commande des leds par PWM

**Dans le code du blink changer le
digitalwrite par :**

```
analogWrite(led, brightness);
```

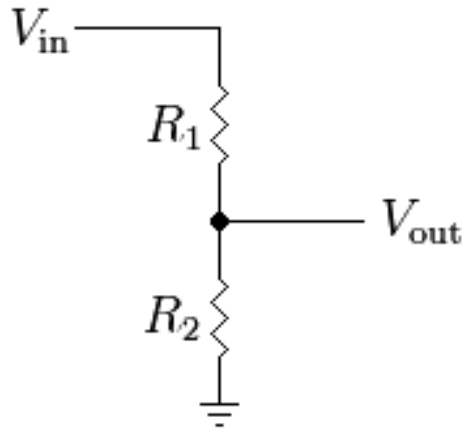
**Et comprendre comment cela peut
marcher**

Ex 8: Commande des leds par PWM et potentiometre





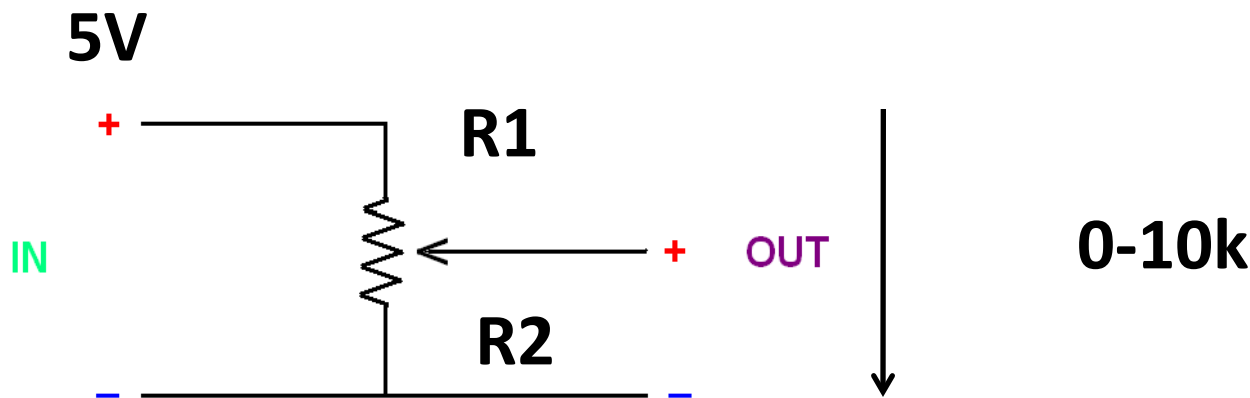
Pont diviseur de tension



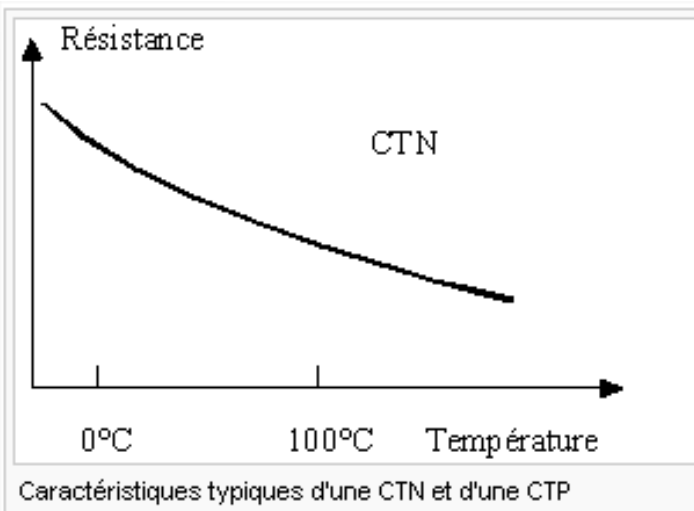
$$V_{\text{out}} = \frac{R_2}{R_1 + R_2} \cdot V_{\text{in}}$$

Ex R1=R2 = 5k = 5000

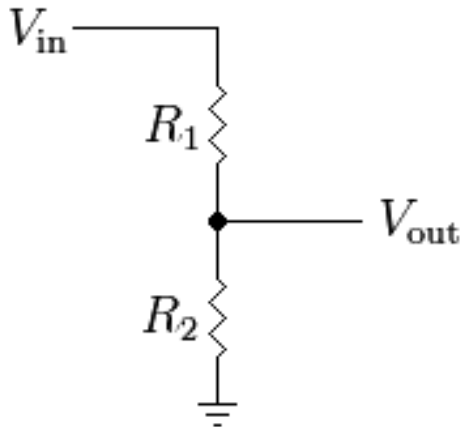
$$V_{\text{out}} = (5000/10000) \cdot 5 = 2.5$$



Ex 9 : Application thermistor

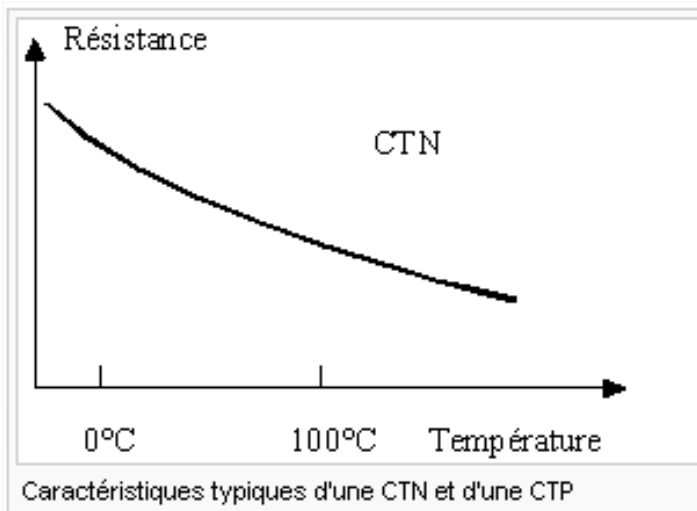


$R_t = 100k @ 25^\circ C$

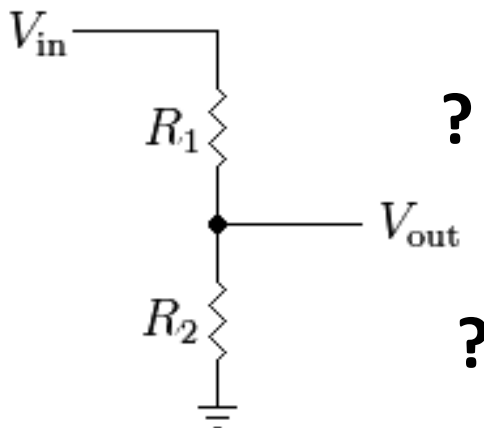


Coefficient thermique = $-4.57\%/^\circ C$

Ex 9 : Application thermistor



$R_t = 100k @ 25^\circ C$

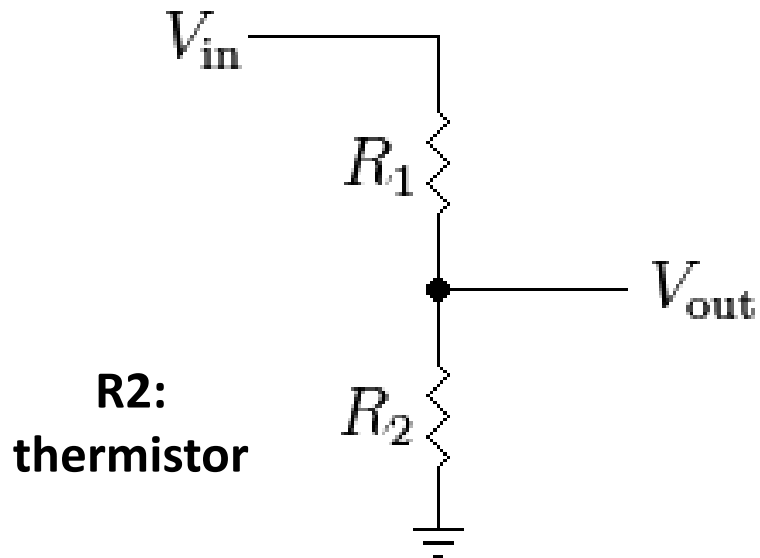
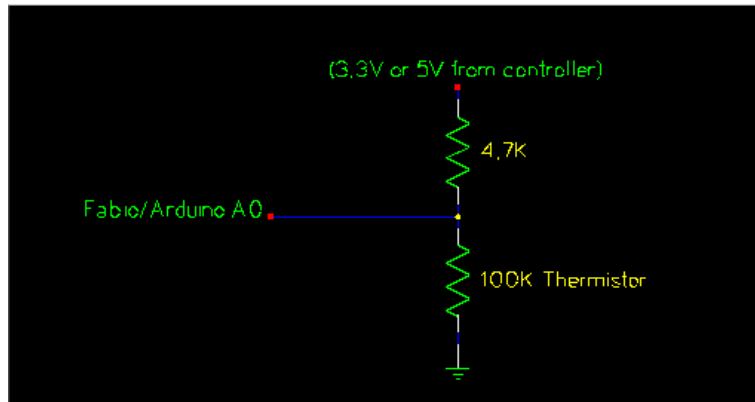


Q1 : R_t R_1 ou R_2 ?

**Q2 : valeur approximative
autre résistance ?**

**Q3: deviner la
temperature
actuelle/sensibilité ?**

Ex 10 : Application thermistor correction



$$V_{out} = \frac{R_2}{R_1 + R_2} \cdot V_{in}$$

Thermistor 100K = 100Kohm@25°C

$V_{out} = (100k/104.7k)5 = 4.75V = 989@25^\circ C$

Arduino ADC: 5V=1024 -> 0.00488 V/step

Value A0 * 0.00488 = voltage
-4.57% de 100kohm/°C = -4.57k Ohm/°C

$26^\circ C = 100k - 4.57k = 95.43 = (95430/100\ 130) * 5 = 4.76V = 992$

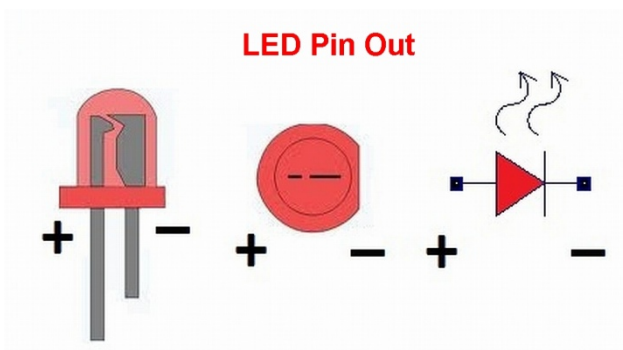
Ex 11 : Application 2 IR phototransistor + IR emitter



Point jaune : IR led

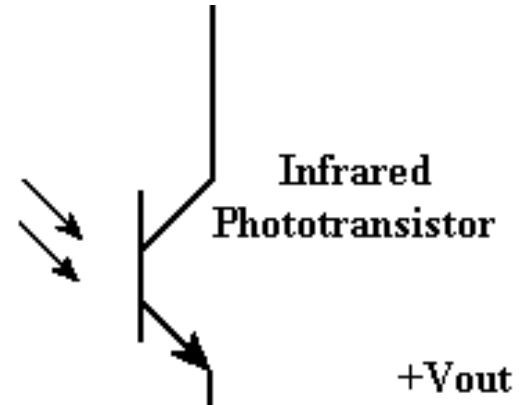
Point rouge : IR phototransistor

Polarité comme les leds



IR led : comme led (voir datasheet fournie)

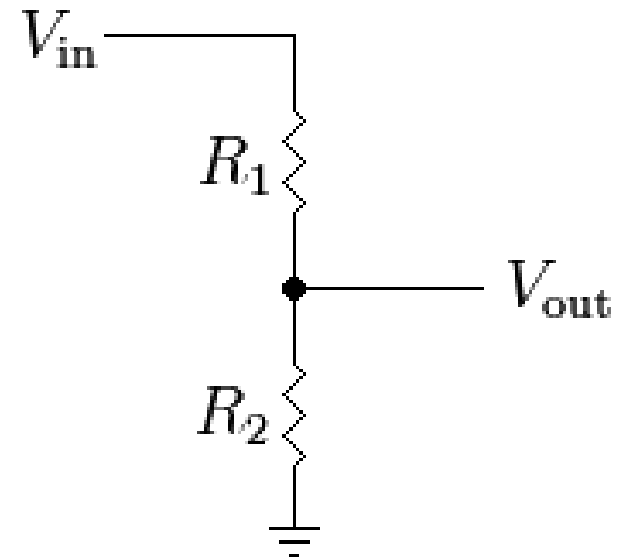
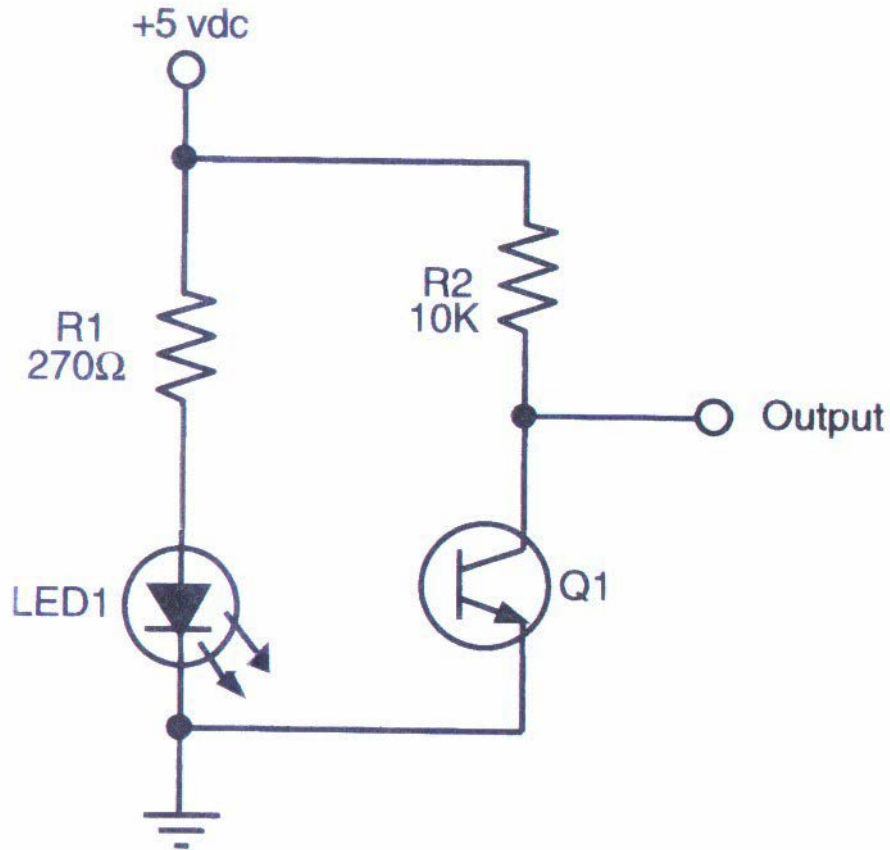
IR phototransistor



Q1 : schéma
phototransistor

Q2 : resistance pour ir led
?

Ex 11 : Application 2 IR phototransistor + IR emitter - correction



Part 2- Montage du device

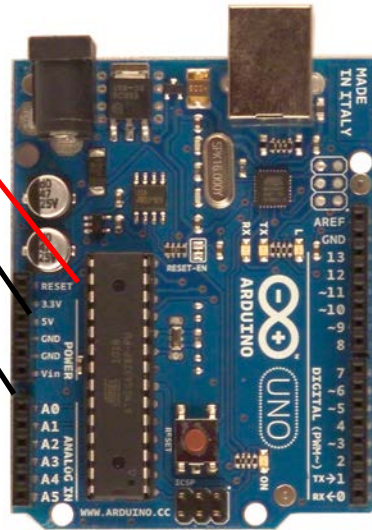
Microphone



Vcc : arduino 5V

GND : GND

AUD : analog pin 0



Souder 3 fils !

Arduino code potentiometer

The screenshot displays the Arduino IDE interface. The main window shows the 'AnalogInOutSerial' sketch, which includes comments about potentiometer wiring and LED connection, creation/modification dates, and the source license. The code defines two pins, reads a sensor value, and outputs it via PWM. The status bar at the bottom indicates the sketch is uploaded to an 'Arduino Uno on COM26'.

AnalogInOutSerial | Arduino 1.0.5

File Edit Sketch Tools Help

AnalogInOutSerial

side pins of the potentiometer go to +5V and ground
* LED connected from digital pin 9 to ground

created 29 Dec. 2008
modified 9 Apr 2012
by Tom Igoe

This example code is in the public domain.

*/

// These constants won't change. They're used to give names
// to the pins used:
`const int analogInPin = A0; // Analog input pin that the potentiometer`
`const int analogOutPin = 9; // Analog output pin that the LED is at`

`int sensorValue = 0; // value read from the pot`
`int outputValue = 0; // value output to the PWM (analog out)`

`void setup() {`

Done uploading.

Binary sketch size: 3,618 bytes (of a 32,256 byte maximum)

1 Arduino Uno on COM26

COM26

Send

sensor = 634	output = 158
sensor = 625	output = 155
sensor = 614	output = 153
sensor = 627	output = 156
sensor = 612	output = 152
sensor = 610	output = 152
sensor = 606	output = 151
sensor = 650	output = 162
sensor = 612	output = 152
sensor = 648	output = 161
sensor = 650	output = 162
sensor = 650	output = 162
sensor = 625	output = 155
sensor = 614	output = 153
sensor = 635	output = 158
sensor = 618	output = 154
sensor = 644	output = 160
sensor = 622	output = 155
sensor = 623	output = 155
sensor = 651	output = 162
sensor = 626	output = 156
sensor = 646	output = 161
sensor = 628	output = 156
sensor = 606	output = 151
sensor = 620	output = 154
sensor = 625	output = 155
sensor = 639	output = 159
sensor = 608	output = 151
sensor = 613	output = 152
sensor = 637	output = 158
sensor = 641	output = 159
sensor = 647	output = 161
sensor = 590	output = 147
sensor = 632	output = 157
sensor = 619	output = 154
sensor = 615	output = 153
sensor = 625	output = 155
sensor = 624	output = 155
sensor = 625	output = 155
sensor = 625	output = 155
sensor = 600	output = 149
sensor = 640	output = 159
sensor = 636	output = 158
sensor = 616	output = 153
sensor = 614	output =

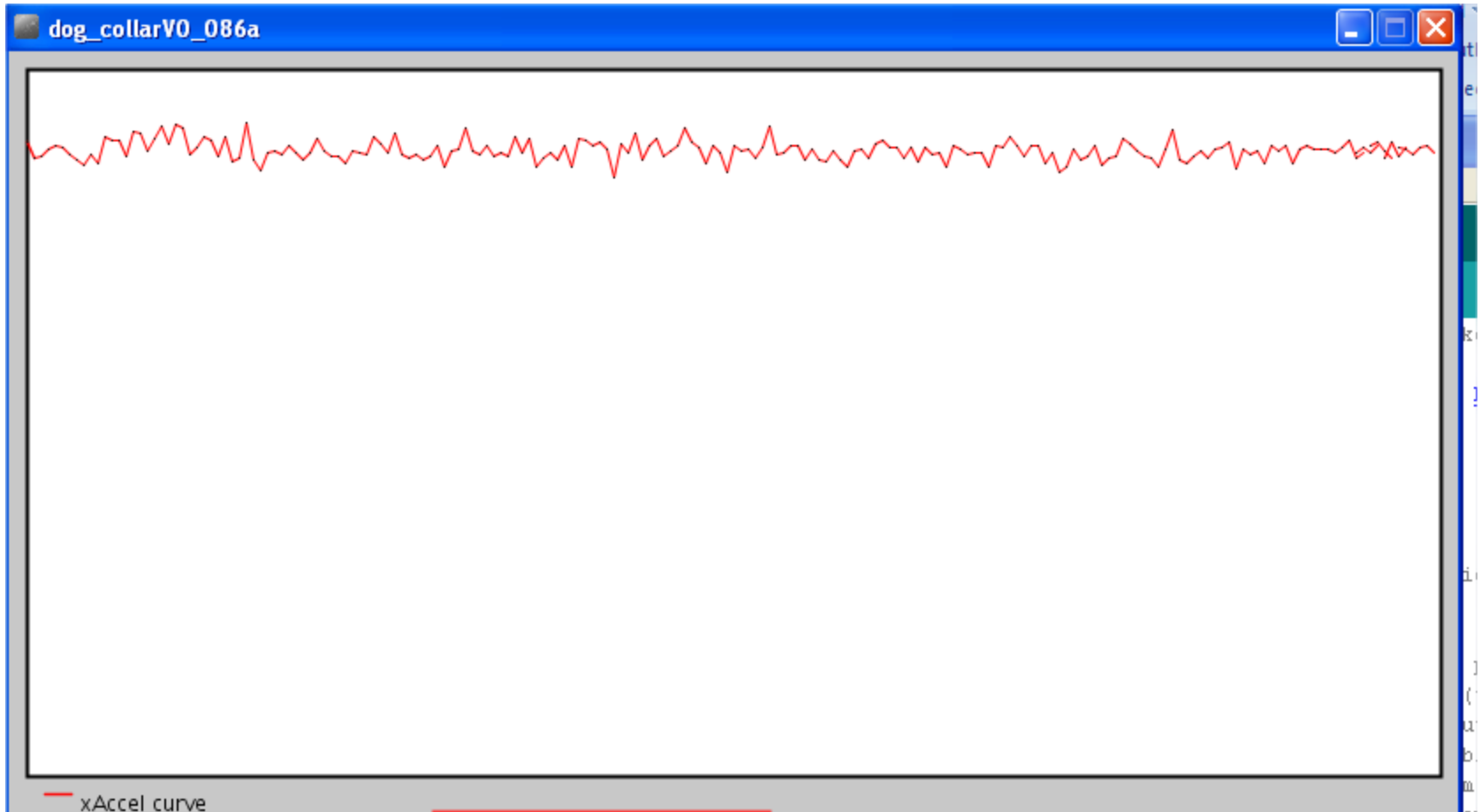
☒ Autoscroll No line ending 9600 baud

Reflechir au sampling rate et à la taille mémoire occupée

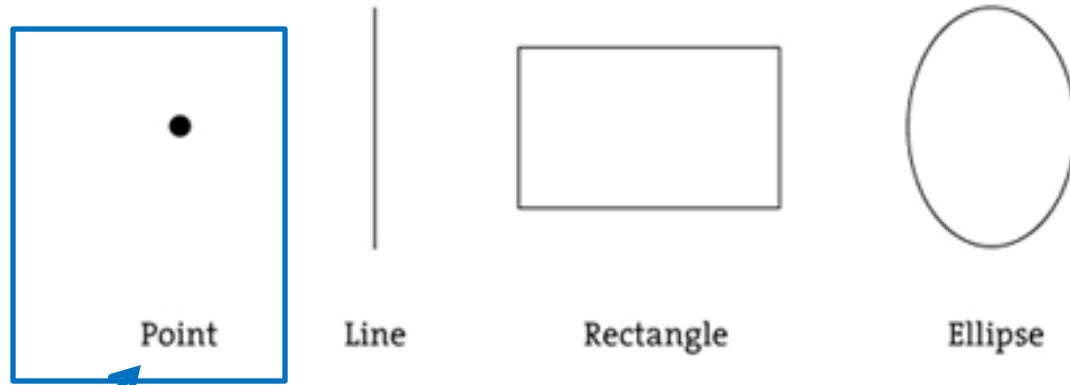
```
unsigned long time0 =0;  
unsigned long time1 =0;  
  
time0=time1;  
time1=micros();  
Serial.println(time1-time0);
```

Code processing oscilloscope ?

```
Int[] dataX;
```



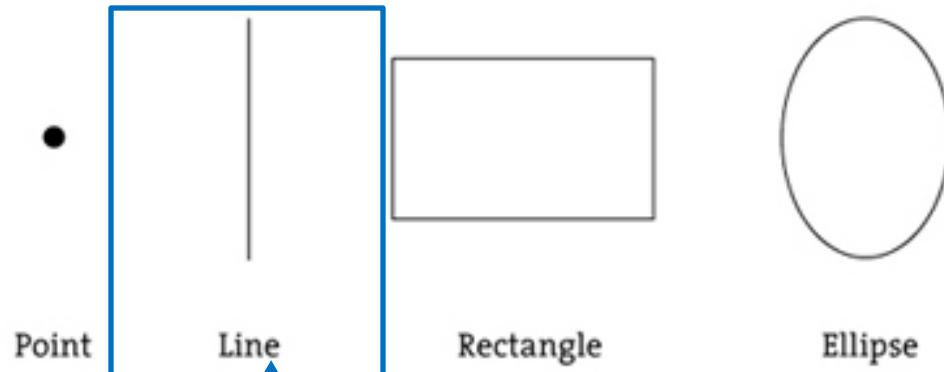
Rappel processing : shapes



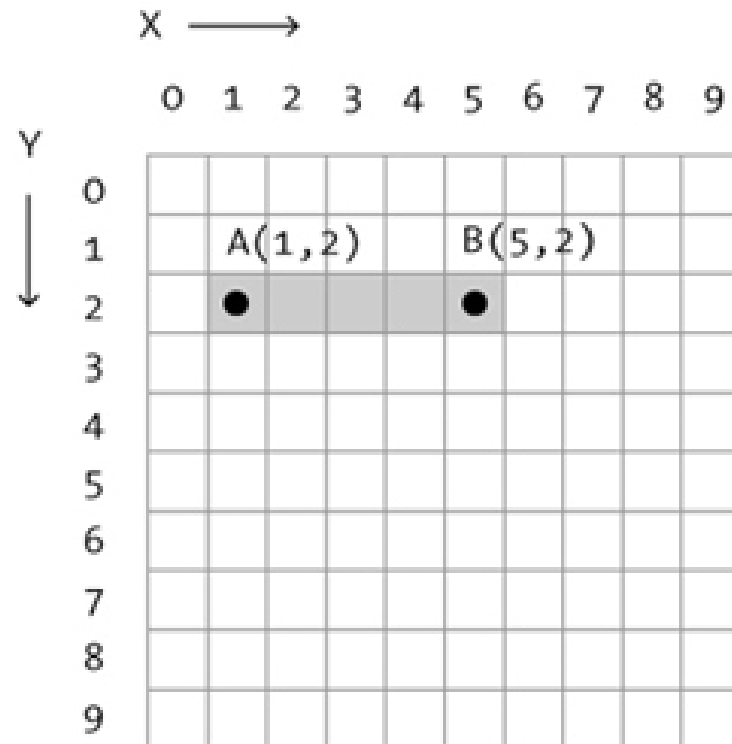
point(x,y) ;

***=> 1 point = 1 pixel =
très petit***

Rappel processing : shapes



line(xa,ya,xb,yb) ;



1:

E:

1:

Installer le shield carte SD



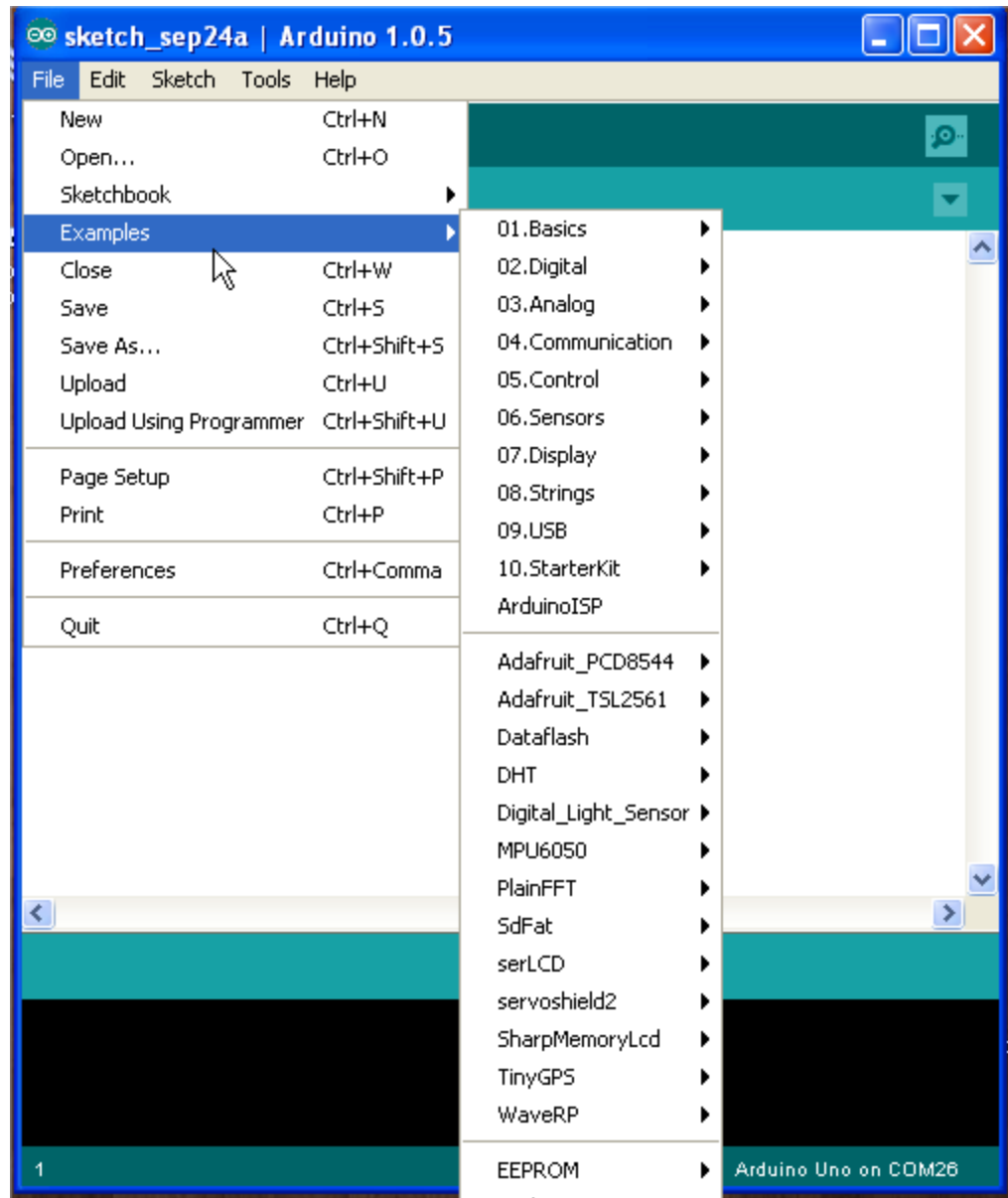
Installer les librairies arduino pour enregistrer des
wave

**Copier le contenu de
day2->arduino_libraries**

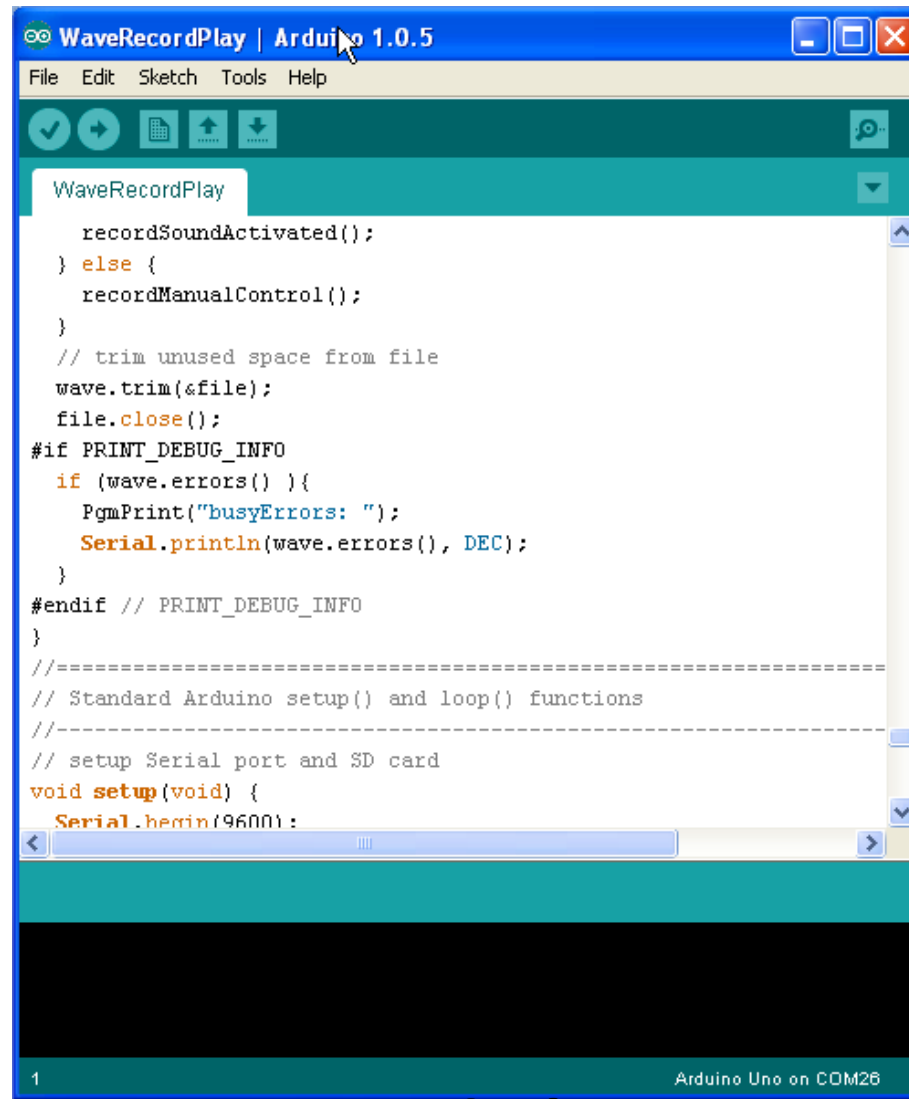
Dans

Arduino-> sketchbook -> libraries

**Si bonne installation on devrait voir dans
la liste d'exemple Sdfat et waveRP**



Arduino -> example -> waveRP -> waverecorPlay



The screenshot shows the Arduino IDE interface with the 'WaveRecordPlay' sketch loaded. The title bar indicates 'WaveRecordPlay | Arduino 1.0.5'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. Below the menu bar is a toolbar with icons for checking, running, uploading, and downloading. The main text area displays the following code:

```
recordSoundActivated();
} else {
  recordManualControl();
}
// trim unused space from file
wave.trim(&file);
file.close();
#if PRINT_DEBUG_INFO
  if (wave.errors() ){
    PgmPrint("busyErrors: ");
    Serial.println(wave.errors(), DEC);
  }
#endif // PRINT_DEBUG_INFO
}
//=====
// Standard Arduino setup() and loop() functions
//=====
// setup Serial port and SD card
void setup(void) {
  Serial.begin(9600);
}
```

The status bar at the bottom shows '1' on the left and 'Arduino Uno on COM26' on the right.

Upload -> ouvrir terminal série

a : liste des commandes

r : record

p : play (mais ne marchera pas car il n'y a pas de spaeaker branché)