

IF? ... THEN!

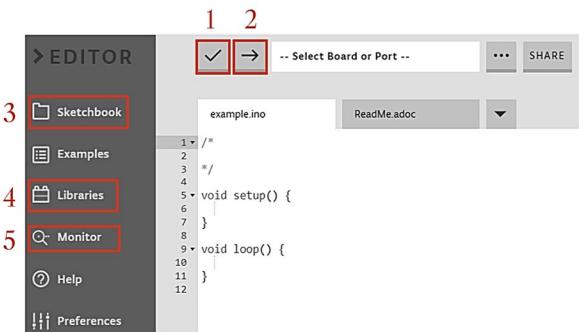
```
LightSensor_exampl.ino
1 #include <EduIntro.h>
2
3 LightSensor ldr(A0);
4
5 void setup() {
6   Serial.begin(9600);
7 }
8
9 void loop() {
10  if(lDr.read() < 20){
11    | Serial.print("It is night");
12  }
13  if(lDr.read() > 50){
14    | Serial.print("It is day");
15  }
16  delay(10);
17 }
```

Condition inside if's parentheses can return only true or false.

When the answer is true code after if, inside {} is executed. When false that code gets skipped.

If ldr connected to the board senses light more than 50 this text is printed to Serial monitor.

WEB EDITOR



- 1 Verify, test if the sketch (code) has errors
- 2 Upload, send the sketch to the board
- 3 Sketchbook, create a new sketch and store them
- 4 Libraries, find EduIntro example sketches
- 5 Serial monitor, read serial data from sketch and board

RESISTORS

A resistor is an electronic component that limits the amount of current in a circuit. But only some of the components in Arduino require them.

Resistance is measured in Ohms (Ω). It can be hard to calculate which resistor should be used. For that, resistor calculators are useful tools for finding the right one.



HOW TO USE MAP() FUNCTION

Map() function re-maps a number from one range to another

```
map(value, fromLow, fromHigh, toLow, toHigh);
```

value: the number to map

fromLow: the lower bound of the value's current range

fromHigh: the upper bound of the value's current range

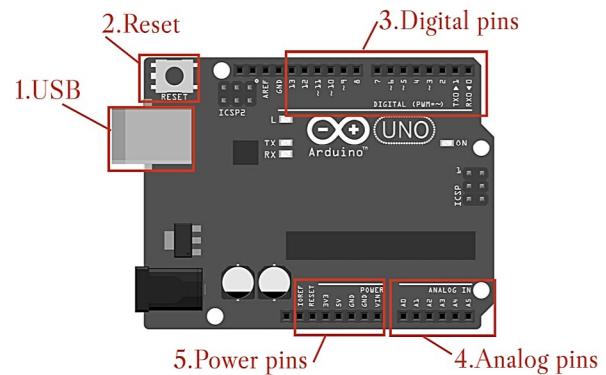
toLow: the lower bound of the value's target range

toHigh: the upper bound of the value's target range

From potentiometer's range to servo's range:

```
map(knobVal, 0, 1023, 0, 180);
```

ARDUINO BOARD



- 1 Power and upload sketches to board
- 2 Starts sketch from the beginning
- 3 13 digital pins, used both as inputs and outputs
- 4 6 analog pins, work only as inputs
- 5 Power and ground

POTENTIOMETER



Simple knob to control outputs

EXAMPLES WHERE TO USE THEM

- Light dimmer
- Control servo motors

```

ExampleLino

1 /*
2 This is an example sketch (1)
3 */
4
5 #include <EduIntro.h> (2)
6
7 Led myLed(D10);
8 int time = 1000; (3)
9
10 void setup() {
11 } (4)
12 }
13
14 void loop() {
15 //turn led on after 1 second (1)
16 delay(time);
17 myLed.on();
18 }
19

```

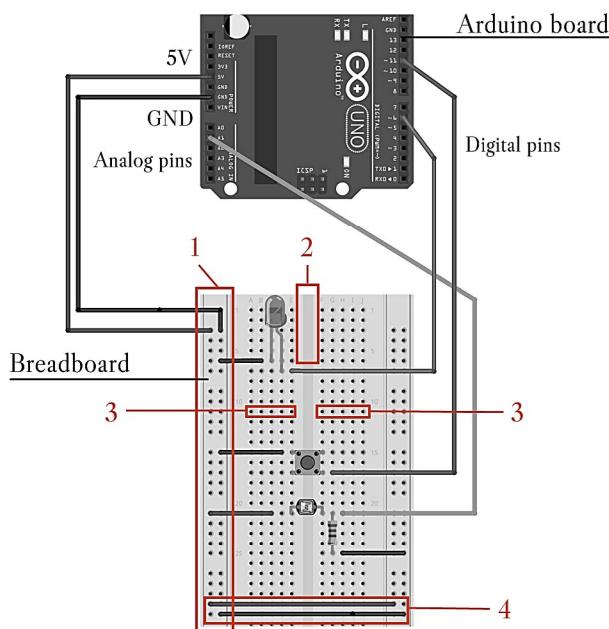
1. /* */ and // are for comments, they are used to explain the code but won't have an affect when uploading the code

2. #include the EduIntro library in the beginning of all your sketches to provide them with extra functionality

3. Declare all the variables that are later used in the sketch

4. Every Arduino sketch requires to have two elements:
void setup() that runs once when sketch is uploaded to the board or reset button is pressed. void loop() repeats code inside the {} as long as the board has power and new sketch is not being uploaded

5. ; will end short functions and declaration of variables
{ } contain the content of a function



1. Power rails

Power rails are vertical rows on both sides of a breadboard. One row is connected all the way from top to bottom. Wire one row to 5V and the other to GND, this will give an easy access to power and grounding on breadboard.

2. Gap

Breadboard has a gap in the middle. This gap is perfect size for components with two parallel rows of pins (button).

3. Terminal strips

Breadboard is full of terminal strips. One strip contains five holes in a horizontal row. When one of them is wired all the holes in that row are electrically connected. !One component leg to one terminal strip (except resistors).

4. Jumpers

Use the same power sources on both sides of breadboard by connecting power rails with jumpers.



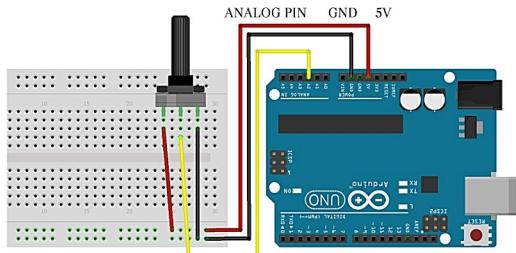
EXAMPLE HOW TO WIRE IT

Value sent from knob is between 0-1023:



When the knob is turned all the way in one direction 0 volts is going to the pin (0 in the code). When in other direction, 5 volts is going to the pin (1023 in the code).

POWER GROUND
ANALOG PIN



EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor
LIBRARIES > EDUINTRO > BY_TOPIC > SERVOKNOB

```

ServoKnob_example.ino
1 #include <EduIntro.h>
2 #include <Servo.h>
3
4 Potentiometer knob(A0); (1)
5 Servo servo;
6
7 int potVal = 0; (2)
8 int angleVal = 0; (2)
9
10 void setup() {
11 servo.attach(9); (3)
12 }
13
14 void loop() {
15 potVal = knob.read(); (4)
16 angleVal = map(potVal, 0, 1023, 0, 180); (4)
17 servo.write(angleVal); (4)
18 delay(100); (4)
19 }

```

Potentiometer needs an analog pin

Declaring two variables for storing values from potentiometer and from map() function

Potentiometer can return values between 0 - 1023 and servo can take values between 0 - 180. That is why the value read from the knob needs to be re-mapped to values that the servo can interpret.

LDR

LIGHT DEPENDENT RESISTOR



Light sensor to detect if it's dark or light

EXAMPLES WHERE TO USE THEM

- Automatic night light
- Camera shutter control
- Distance measurement

FUNCTIONS TO USE WITH BUTTONS

TO MAKE BUTTON WORK LIKE A LAMP SWITCH:

```
if(button.readSwitch() == LOW) { True when button is ON  
| led.on();  
}  
if(button.readSwitch() == HIGH) { True when button is OFF  
| led.off();  
}
```

TO MAKE BUTTON WORK LIKE A DOORBELL:

```
if(button.pressed()) { True the first moment  
when button is pressed  
  
if(button.held()) { True when held down  
piezo.play(music);  
}  
  
if(button.released()) { True when released  
}
```

BUTTON



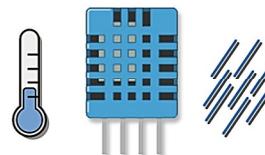
Control what happens when button is pressed

EXAMPLES WHERE TO USE THEM

- Lamp switch
- Remote controller
- Start an engine

DHT11

DIGITAL HUMIDITY/TEMPERATURE SENSOR



Measure humidity and temperature levels

EXAMPLES WHERE TO USE THEM

- Automatic humidifier
- Weather station
- Controlling block heater for a car

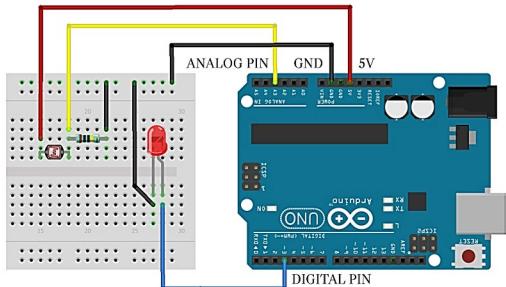


EXAMPLE HOW TO WIRE IT

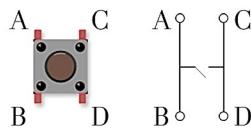


LDR is connected to an analog pin because it doesn't change only from dark to light (LOW/HIGH), it can send values also between those two. A resistor enables voltage in the Arduino input to change when LDR senses different amount of light.

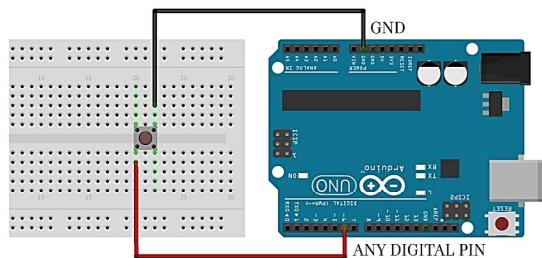
CONTROLLING LED WITH LDR



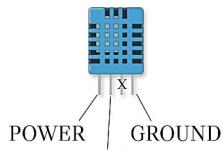
EXAMPLE HOW TO WIRE IT



Pushbutton has four legs, however two of the legs are one piece of metal (A&B, C&D). Meaning that only one leg from each group should be wired (example B and C).

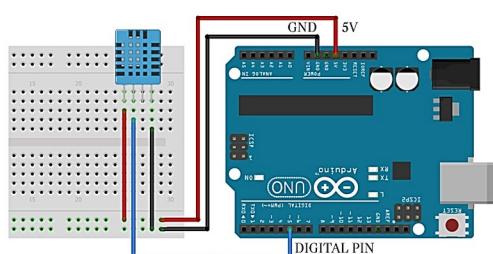


EXAMPLE HOW TO WIRE IT



Every second DHT11 reads a new value:

	Range	Error
Temp	0-50°C	±2°C
Humid	20-80%	±5%



EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor
LIBRARIES > EDUINTRO > BY_TOPIC > LIGHTSENSOR

```
LightSensor.ino
1 #include <EduIntro.h>
2
3 LightSensor myldr(A3);
4 Led redLed(D3);
5
6 void setup() {
7 }
8
9 void loop() {
10 int brightnessVal = myldr.read();
11 redLed.brightness(brightnessVal);
12 delay(10);
13 }
```

Storing and reading the amount of light LDR senses currently

Controlling LED's brightness with values LDR sends

*Variables are used to label and store data, different types of variables:
int = whole numbers, float = decimal numbers, String = text,
char = characters, boolean = true or false

EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor
LIBRARIES > EDUINTRO > COURSEWARE > BUTTON

```
Button.ino
1 #include <EduIntro.h>
2
3 Button lampButton(D6);
4 Led redLed(D10);
5
6 void setup() {
7 }
8
9 void loop() {
10 if (lampButton.readSwitch() == LOW) {
11 redLed.on();
12 } else {
13 redLed.off();
14 }
15 }
```

if(this condition is true)
{then this is executed}
else {this will be executed}

buttonname.readSwitch()
returns LOW or HIGH

* Logical comparison:
== Equal, != Not equal, < Less than, > More than

EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor
LIBRARIES > EDUINTRO > BY_TOPIC > DHT11

```
DHT11.ino
1 #include <EduIntro.h>
2 DHT11 tempSensor(D5);
3 int cels;
4
5 void setup() {
6 serial.begin(9600);
7 }
8
9 void loop() {
10 tempSensor.update();
11 cels = tempSensor.readCelsius();
12
13 Serial.print("Celsius: ");
14 Serial.print(cels);
15 delay(1000);
16 }
```

Start using serial monitor,
this have to be done inside
void setup() {}

Printing text and
temperature values
to serial monitor

*Serial monitor (Open Monitor frArduino web editor):
To activate the monitor and view data sent from the code or sensor

Print text = Serial.print("Between quote marks write normal language");
Print variable values = Serial.print(nameOfTheVariable no quote marks);

FUNCTIONS TO USE WITH SERVO

With blue servo motor, write() function will set the angle of the shaft, between 0 and 180.

```
servo.write(0);
servo.write(20);
servo.write(180);
```

These same functions work differently with the black servo. It is a continuous rotation servo and write() function will set the speed of the shaft. 0 is full-speed to one direction and 180 is full-speed to the other. 90 degrees will stop it.

FUNCTIONS TO USE WITH LED

These functions will turn led on and off

```
led.on();
delay(1000);
led.off();
```

Set the brightness for led between 0-255

```
led.brightness(50);
```

*delay(1000); = waiting for 1000 milliseconds (1 sec) before the code continues to execute the next row.

HOW TO ACCESS VALUES IN ARRAY

Declare an array

```
int numbers[] = {1, 2, 3};
```

Access an array, 0 is the first value in the array

```
if(numbers[0] == 1)
```

Put a new value to an array

```
numbers[2] = 4;
```

Get a value from an array

```
int x = numbers[1];
```

SERVO MOTOR



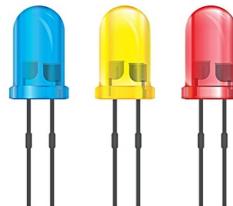
When you want to move something you need a motor

EXAMPLES WHERE TO USE THEM

- Robotic arm
- Open and close a door
- Barometer

!Blue motor turns 0-180 degrees and black 360

LED



Small light that can be turned on and off

EXAMPLES WHERE TO USE THEM

- Traffic lights
- Blinking eyes
- Led panel with scrolling text

PIEZO



Speakers that can play various tones

EXAMPLES WHERE TO USE THEM

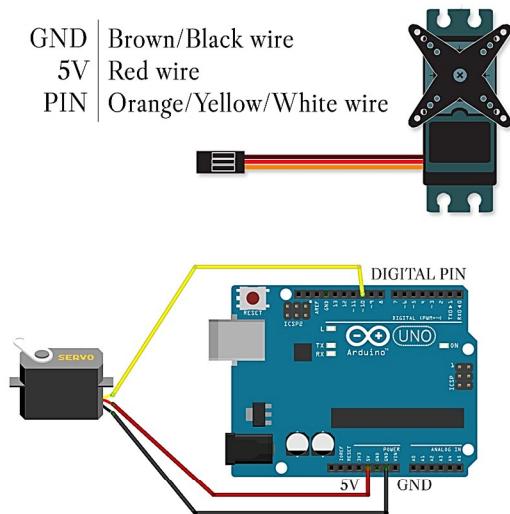
- Sound effects
- Making own music
- Confirmation of user input



EXAMPLE HOW TO WIRE IT

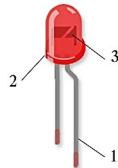
Colors matter when connecting a motor:

GND	Brown/Black wire
5V	Red wire
PIN	Orange/Yellow/White wire



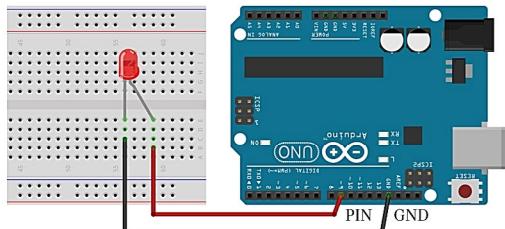
EXAMPLE HOW TO WIRE IT

3 tips how to connect the led right way:



Power (PIN)	Ground (GND)
1 Long leg	Short leg
2 Round side	Flat side
3 Small peg	Big peg

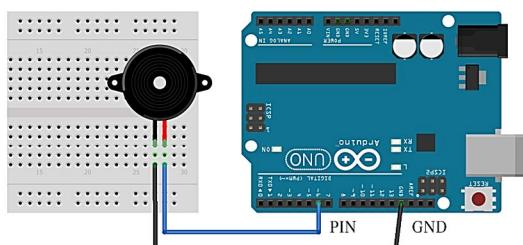
Stick leg to one of the connection holes, then connect wire to the same terminal strip and the other end of the wire to Arduino board. (More about the boards in the red card).



EXAMPLE HOW TO WIRE IT



Piezo has two metal legs, connect one of them to a digital pin and the other to ground



EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor

LIBRARIES > EDUINTRO > COURSEWARE > SERVO

```
Servo_Example.ino
1 #include <Servo.h>
2
3 Servo myservo;
4 int pos = 0;
5
6 void setup() {
7   myservo.attach(10);
8 }
9
10 void loop() {
11   for (pos = 0; pos <= 180; pos += 1) {
12     myservo.write(pos);
13     delay(15);
14   }
15 }
```

*For-loop:
for(initialization; condition; increment)
{ this will be executed in every iteration }

EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor

LIBRARIES > EDUINTRO > COURSEWARE > BLINK

```
Blink.ino
1
2 #include <EduIntro.h>
3
4 Led myLed(D9);
5
6 void setup() {
7 }
8
9 void loop(){
10   myLed.on();
11   delay(1000);
12   myLed.off();
13   delay(1000);
14 }
```

Change this pin (D9) number to match the one where led is connected in your Arduino board

Remember to write the name of the led here exactly the same way as when declaring it

*Declaring a variable = Type + Name + Value + ;
int howManyTimes = 0;
Led redLight(D11);

EXAMPLE HOW TO PROGRAM IT { }

Find this example from Arduino web editor

LIBRARIES > EDUINTRO > COURSEWARE > MELODY

```
Melody_copy_cards.ino
1 #include <EduIntro.h>
2
3 int melody[] = { NOTE_C4, 4,
4   NOTE_G3, 8,
5   NOTE_G3, 8,
6   NULL };
7
8 Piezo myPiezo(D6);
9
10 void setup() {
11 }
12
13 void loop(){
14   myPiezo.play(melody);
15   delay(1000);
16 }
```

Change notes in this array to play the desired tune

This one will play the whole melody.
To access only the first note write melody[0]

*An array is a container that holds values stored in it